ICESat (GLAS) Science Processing Software Document Series

Volume

GLAS Standard Data Products Specification - Level 2

Version 8

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Foreword

This document defines the Level Two GLAS standard data products. This Standard Data Products Specification is developed under the structure of the NASA STD-2100-91, a NASA standard defining a four-volume set of documents to cover an entire software life cycle. Under this standard a section of any volume may, if necessary, be rolled out to its own separate document. This document is a roll out of the GLAS ESDIS Software Detailed Design Specification under the Product Specification Volume.

The GEOSCIENCE LASER ALTIMETER SYSTEM (GLAS) is a part of the EOS program. This laser altimetry mission will be carried on the spacecraft designated EOS ICESat (Ice, Cloud and Land Elevation Satellite). The GLAS laser is a frequency-doubled, cavity-pumped, solid state Nd:YAG laser.

This document addresses the data flow, interfaces, record and data formats associated with the GLAS Level 2 standard data products. The term “standard data products” refers to those EOS instrument data products listed in the Earth Science Data and Information System (ESDIS) Project data base that are routinely generated within the EOSDIS Distributed Active Archive Center (DAAC) or Science Computing Facilities (SCFs). Each data product has a unique Product Identification code assigned by the EOS Senior Project Scientist.

The Level 2 Standard Data Products specifically include those derived geophysical data values (i.e., ice sheet elevation, cloud height, vegetation height, etc.). Additionally, the appropriate correction elements used to transform the Level 1A and Level 1B Data Products into Level 2 Data Products are included. The data are packaged with time tags, precision orbit location coordinates, and data quality and usage flags.

This document was prepared by the Cryospheric Sciences Branch at NASA GSFC / WFF, Wallops Island, VA, in support of B. E. Schutz, GLAS Science Team Leader for the GLAS Investigation. This work was performed under the direction of David W. Hancock, III, who may be contacted at (757) 824-1238, David.W.Hancock@nasa.gov (e-mail), or (757) 824-1036 (FAX).

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Section 1

Introduction

1.1 Identification of Document

This document is identified as the GLAS Level 2 Standard Data Products Specification. The unique document identification number within the GLAS Standard Data Software documentation numbering scheme is GLAS-DPS-2641. Progressive editions of this document will be uniquely identified by the cover and page date marks.

1.2 Scope of Document

This document addresses the purpose, usage, and description of the GLAS Level 2 Standard Data Products. The intended audience for this document is the GLAS Science and Instrument Teams, the ESDIS Project and related focus teams, the community of EOS data users and investigators, and the GLAS Standard Data Software Development Team. This document will not address the procedures for obtaining the GLAS Level 2 Standard Data Products from the EOSDIS DAAC.

1.3 Purpose and Objectives of Document

The purpose of the GLAS Level 2 Standard Data Products Specification is to provide a high-level descriptive document for the data products. This document describes the purpose, usage, content, and format of the GLAS Level 2 Data Products. It describes the representation and definition of the GLAS data elements constituting the data product. It further describes the structure, physical storage, organization, and access characteristics of the GLAS Level 2 Data Products. The document additionally describes file transfer methods to support product access, the data flow associated with the data product, and the data storage and generation characteristics of the data product.

1.4 Document Organization

This document outline is assembled in a form similar to those presented in the NASA Software Engineering Program [Applicable Document 2.3a].

1.5 Document Status and Schedule

This document will be updated and released as required.

1.5.1 Document Change History

Document Name: GLAS Standard Data Products Specification - Level 2		
Version Number	**Date**	**Nature of Change**
Preliminary	December 31, 1995	Original Version
Version 1.2	March 1998	Text, Figures, and Tables updated for Level 2 data updates, for the change to GLAS standard data product generation being performed at the GLAS SCF, and change of the spacecraft name to ICESAT.
Version 2.0	January 1999	Updates to the data product contents.
Version 3.0	November 2000	Updated Data Product Contents coincident with the GLAS Science Algorithm Software V1 release.
Version 4.0	November 2001	Updated Data Product Contents coincident with the GLAS Science Algorithm Software V2 release.
Version 5.0	July 2002	Updated Data Product Contents coincident with the GLAS Science Algorithm Software V2.2 release.
Version 6.0	October 2002	Revised for Version 3.0 software.
Version 7.0	August 2004	Revised for Version 4.0 software.
Version 8.0	November 2005	Revised for Version 5.0 software.

Section 2

Related Documentation

2.1 Parent Documents

The GLAS Level 2 Standard Data Products Specification is considered a "roll-out" from the Product Specification as the parent document or volume. Specific topics pertaining to data descriptions are located in the External Interface sections under the Detailed Design document template.

This document is subordinate to any top-level mission or instrument management plan documents, and as such, recognizes these documents as external parent documents in lineage. The recognized external EOSDIS and GLAS parent documents superior to the GLAS Level 2 Standard Data Products Specification are listed below.

a) *NASA Earth Observing System Geoscience Laser Altimeter System GLAS Science Requirements Document,* Version 2.01, October 1997, Center for Space Research, University of Texas at Austin.

b) *GLAS Science Software Management Plan*, NASA / TM-1999-208641 / Version 3 / Volume 1, August 1998, NASA / GSFC Wallops Flight Facility.

2.2 Applicable Documents

The following documents are applicable to, or contain policies or references pertinent to the contents of the GLAS Level 2 Standard Data Products Specification.

a) *Data Production Software, Data Management, and Flight Operations Working Agreement for GLAS*, TBD, NASA Goddard Space Flight Center.

b) *Atmospheric Delay Correction to GLAS Laser Altimeter Ranges,* Algorithm Theoretical Basis Document, March 2001, Massachusetts Institute of Technology.

c) *Algorithm Theoretical Basis Document for the GLAS Atmospheric Channel Observations*, Version 0 (Preliminary), December 1995, Goddard Space Flight Center.

d) *Geoscience Laser Altimeter System: Surface Roughness of Ice Sheets,* Algorithm Theoretical Basis Document, Version 0.3, December 1996, University of Wisconsin.

e) *Determination of Sea Ice Surface Roughness from Laser Altimeter Waveform*, Algorithm Theoretical Basis Document, Version 0 (Preliminary), December 1995, The Ohio State University.

f) *Laser Footprint Location and Surface Profiles*, Algorithm Theoretical Basis Document, Version 3.0, October 2002, Center for Space Research, The University of Texas at Austin.

g) *Precision Orbit Determination (POD),* Algorithm Theoretical Basis Document, Version 2.2, October 2002, Center for Space Research, The University of Texas at Austin.

h) *Precision Attitude Determination (PAD)*, Algorithm Theoretical Basis Document, Version 2.2, October 2002, Center for Space Research, The University of Texas at Austin.

i) *GLAS Atmospheric Data Products*, Algorithm Theoretical Basis Document, Version 4.2, June 2001, Goddard Space Flight Center.

2.3 Information Documents

The following documents are provided as sources of information that provide background or supplemental information that may clarify or amplify material in the GLAS Level 2 Standard Data Products Specification.

a) *NASA Software Documentation Standard Software Engineering Program*, NASA-STD-21000-91, July 29, 1991, NASA.

b) *The Geoscience Laser Altimetry/Ranging System*, IEEE Transactions on Geoscience and Remote Sensing, Vol. GE-25, No. 5, September 1987.

c) *EOS Altimetry/GLAS Phase-A Study*, November 1995, NASA Goddard Space Flight Center.

d) *Memorandum: GLAS Data Products*, December 23, 1993, Center for Space Research, University of Texas at Austin.

e) *GLAS Science Computing Facility (SCF) Plan*, October 1997, NASA Goddard Space Flight Center, Wallops Flight Facility.

Section 3

Purpose and Description of the Data Products

3.1 Purpose of the Data Products

The purpose of the GLAS Level 2 Standard Data Products is to provide time-ordered, processed GLAS data, acceptable for science applications. This GLAS derived data consists of calibrated laser altimeter data supplemented with precision orbit determination, earth-location and precision attitude data from the ancillary data sources. The GLAS Level 2 Standard Data Products are intended for use by the GLAS Science Team, and by the EOSDIS data user community.

3.2 Description of the Data Product

Table 3-1 identifies the Level 2 Data Products and shows the composition of each. The data products are integer-binary format files containing fixed-length records of data. Each data record consists of several data elements. An element is either an Item or an Array of Items. The elements are measurements and associated correction values obtained from specific GLAS science algorithm sets. The data products will be formatted in scaled integer binary format with both attached and unattached metadata containing identification, processing history, and data descriptive information.

Table 3-1 GLAS Level 2 Standard Data Products

Product ID (Identification)	Product Name	Product Level
GLA08	Boundary Layer and Elevated Aerosol Layer Heights File	2
GLA09	Cloud Height for Multiple Layers File	2
GLA10	Aerosol Vertical Structure File	2
GLA11	Thin Cloud/Aerosol Optical Depth File	2
GLA12	Ice Sheet Products File	2
GLA13	Sea Ice Products File	2
GLA14	Land Products File	2
GLA15	Ocean Products File	2

The GLAS Level 2 Standard Data Products are generated as product aggregates or files (i.e., nominally a pass, a half orbit) of GLAS derived geophysical data. The data parameters represent derived geophysical data and associated correction values obtained from specific GLAS science algorithms. These data parameter groups include time tags, data use and quality flags, and precision orbit location data. In

addition to the data products, metadata including identification, processing history, and data content descriptive information is produced for archival.

The GLAS Level 2 Standard Data Products are produced by the GLAS science data processing software which is based on the GLAS Algorithm Theoretical Basis Documents [Applicable Documents 2.2b - 2.2h]. These data products are produced by processing the GLAS Level 1 Data Products to form the Level 2 data. Figure 3-1 illustrates the source data products being processed to generate the Level 2 Data Products.

The specific details of the data product structure, content, format, and data element details will be presented in Section 6. Data sizing and burden, and physical media details are provided in Section 5.

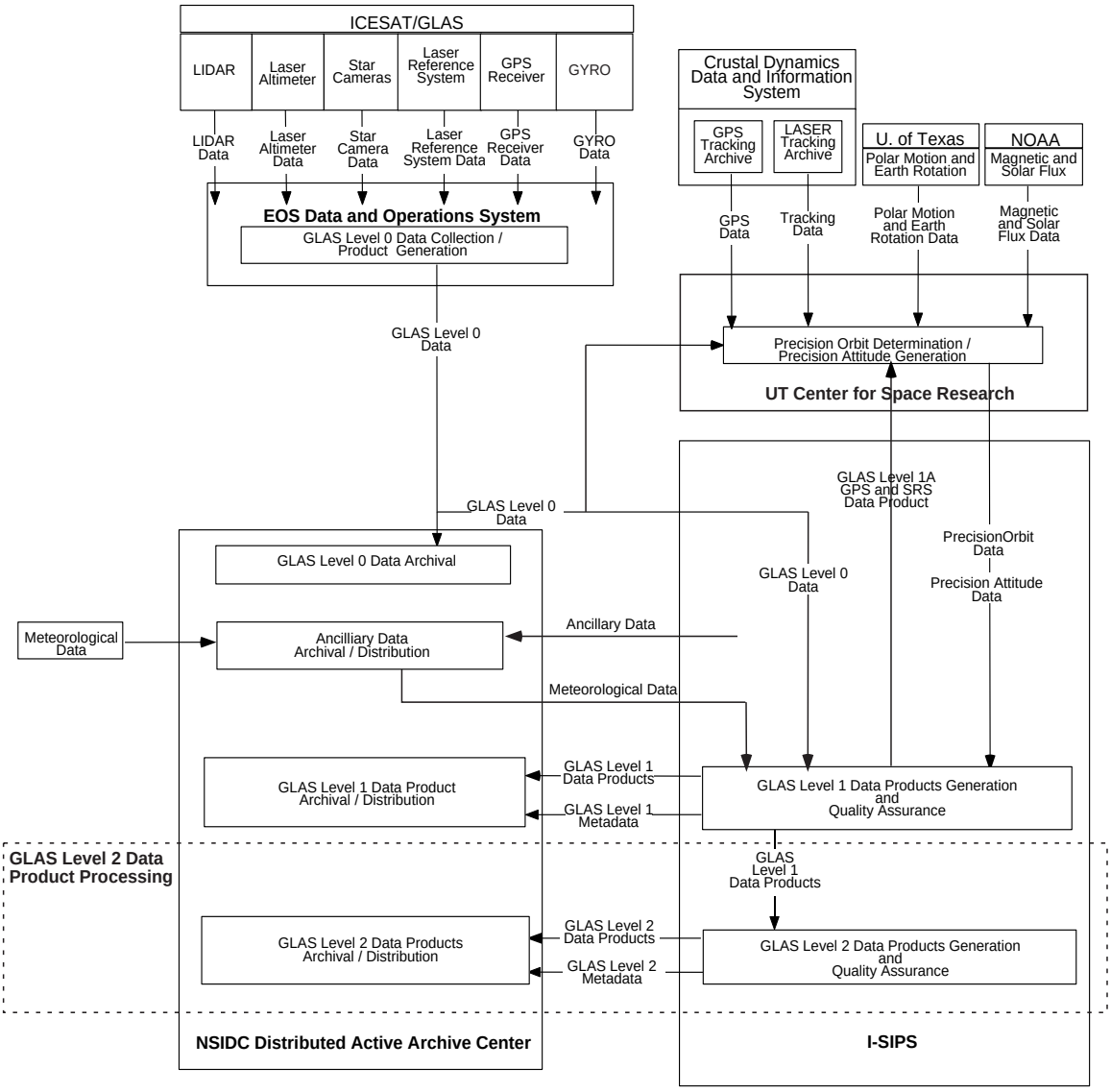

Figure 3-1 GLAS Level 2 Products Within The Data Product Hierarchy

Section 4

Environment

4.1 Hardware Characteristics and Limitations

The GLAS Level 2 Standard Data Products will be generated on the UNIX host processors within the I-SIPS. The input GLAS Level 1 Data Products and ancillary data reside in the I-SIPS storage facilities. Newly-generated Level 2 Data Products are accessed for quality assurance (QA) monitoring through the I-SIPS.

The I-SIPS consists of distributed UNIX operating system-based computers operating under the standard UNIX environment that support the GLAS Science Team operations including the quality monitoring. The GLAS Level 2 Data Products and their metadata (including the QA monitoring data) are delivered to the EOSDIS DAAC archive. The Level 2 metadata (associated data description and support information) are stored in the EOSDIS DAAC to facilitate EOS client inquiry and retrieval activities. The distribution management function of the EOSDIS DAAC allows clients to perform direct search and access of the Level 2 data or to request preparation of Level 2 Data Products.

4.2 Data Product Medium and Characteristics

The Data Products will be archived within the EOSDIS DAAC. The storage system will contain not only the Level 2 Data Products, but will also contain data descriptions and data advertisements (i.e., textual descriptive and abstract information also called metadata). The Level 2 Data Products and their metadata will be part of the Earth Sciences Data Types collection.

The Earth Science data are implemented in the current EOSDIS system through a hierarchical storage manager interface. Physical media supported by the storage system interface will include the disk storage subsystems, magnetic or optical media subsystems, and tiered archive robotics storage subsystems. EOSDIS clients can directly access the GLAS Level 2 data from the DAAC and can copy the data products to their host processors across the EOSDIS Networks.

The Level 2 Data Products will be available to the GLAS Science Team through the GLAS SCF. See Information Document 2.3e for a detailed description of the GLAS SCF.

4.3 Protocol and Conventions

Specific protocols and convention applying to the GLAS SCF will be specified in the SCF Plan [Information Document 2.3e]. When interfacing to the EOSDIS DAAC, the I-SIPS will comply with procedures, conventions, and protocols as defined by the EOSDIS.

Data definition terminology specific to the GLAS Level 2 Data Products and this document is presented in the Glossary at the end of this document. Figure 4-1 “Data Representation” depicts a schematic of the standard data representations used in GLAS Level 2 Data Products. These data structures will be used in the Section 6.0 generic data description and in the Appendix C detailed data description of the GLAS Level 2 Data Product contents.

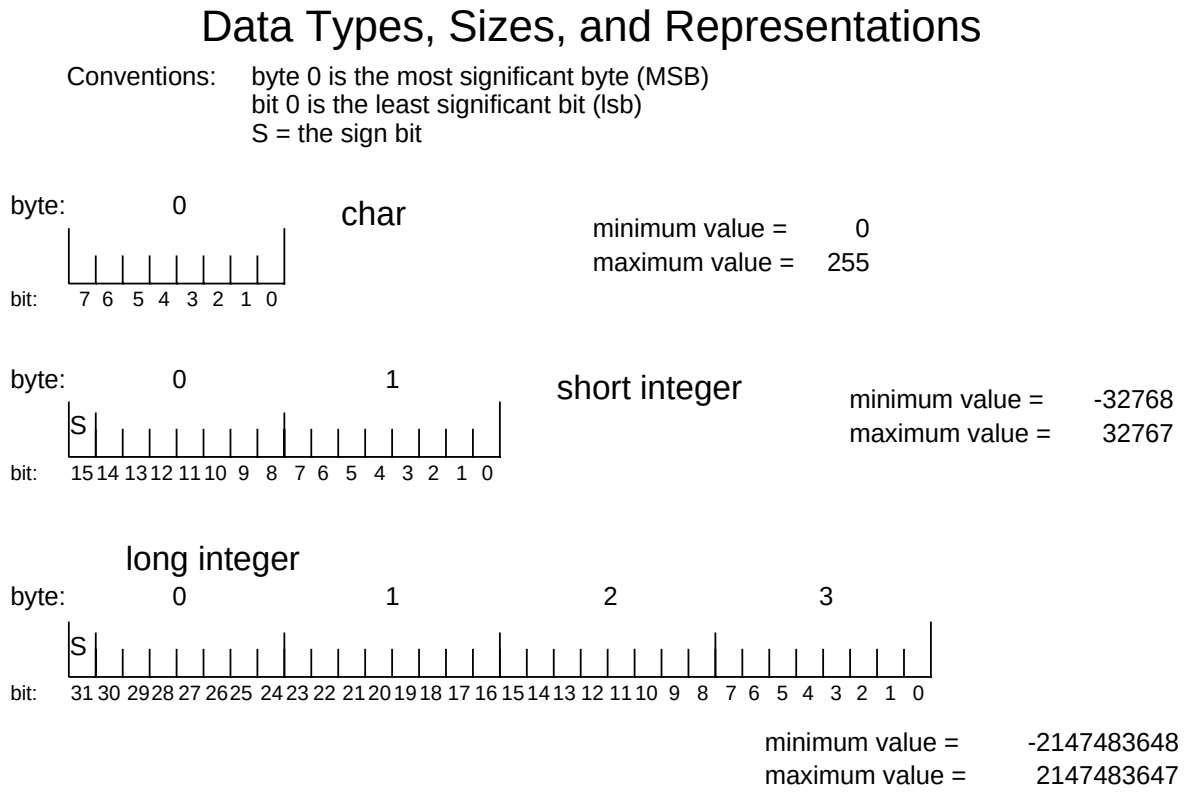

Figure 4-1 Data Representation

4.4 Failure Protection, Detection, and Recovery Features

The team supporting operations at the I-SIPS will be responsible for failure protection, detection, and recovery of the generated GLAS Level 2 Data Products stored on the I-SIPS. Initial GLAS Level 2 Data Products error detection is performed during product generation as part of the product and processing quality assurance activity. The GLAS Level 2 Data Products will be “backed up” under the routine operational functions performed at the I-SIPS. In the event of failure or error detection in the active working or archive storage, recovery would be performed from backup media or from the EOSDIS DAAC archive.

The EOSDIS will be responsible for failure protection, detection, and recovery of the GLAS Level 2 Data Products archived at the EOSDIS DAAC.

Section 5

Data Flow Characteristics

5.1 Volume, Size, and Frequency Estimates

The expected daily data burdens for the GLAS Level 2 Standard Data Products are listed in Appendix B. These estimates are based on the following EOS ICESat (Ice, Cloud, and Land Elevation Satellite) operational assumptions. The spacecraft will orbit the Earth at an inclination of 94 degrees and a nominal altitude of 600 kilometers in a circular orbit. The orbit (groundtrack) repeat cycle is approximately 91 days based on a frozen orbit. The EOS ICESat orbit period is approximately 100 minutes, with a pass period duration of approximately 50 minutes resulting in just under 15 orbits per day.

The daily volumes shown in Appendix B are assuming 24 hours of global coverage for each product. However, the contents of the GLA12, GLA13, GLA14, and GLA15 products will be edited based on location. Therefore the actual daily volume of these products may vary from what is shown in the table.

5.2 Data Transfer and Transmission

The GLAS Science Team will have access to the GLAS Level 2 Data Products through the GLAS SCF using TCP/IP and standard UNIX command operations. GLAS Level 2 Data Products generated within the I-SIPS will be transferred to the DAAC through the EOS Science Network or off-line via storage media.

Data access procedures to retrieve GLAS Level 2 Standard Data Products from the DAAC will be provided by the EOSDIS DAAC.

5.3 Timing and Sequencing Characteristics

The GLAS Level 2 Standard Data Products are generated as product files consisting of processed GLAS Level 1A and Level 1B Standard Data Products data. The basic aggregation of the GLAS Level 2 Data Products is the descriptive information in the header records and GLAS Data Elements in the data record. All data records within the GLAS Level 2 Data Products will be in ascending time order based on the height vector or aerosol measurement time tag. All parameters contained within the record are synchronous. The GLAS instrument and the EOS ICESat spacecraft are expected to operate for at least three years with a goal of five years.

5.4 Recipients and Utilization

The initial recipients of the GLAS Level 2 Data Products will be the GLAS Science Team and the EOSDIS. At the I-SIPS, the GLAS Level 2 Data Products will be used to produce the metadata quantifying and qualifying the products for EOS community usage. The GLAS Science Team will use the Level 2 Data Products for analysis and

research. The subsequent recipients for the GLAS Level 2 Data Products are the scientific, governmental, and educational community sectors which will obtain the data products from the EOSDIS DAAC.

5.5 Access

The GLAS Level 2 Data Products are available to the GLAS Science Team from the GLAS SCF. Access to the GLAS SCF is controlled by the GLAS Science Team.

While EOS is intended to be a globally available and utilized mission program, access to the data is still operated under a security and integrity program to protect the data and data system resources from unauthorized or destructive use. Procedures for data access are provided by the EOSDIS DAAC.

Section 6

Data Products Definitions

6.1 Data Products Structure

The GLAS Level 2 Standard Data Products will be generated as scaled integer binary files. Each file will include appropriate header, labelling, and metadata information.

6.2 Labeling and Identification

Each of the GLAS Level 2 Data Products is uniquely identified by a GLAS standard file name. The form of this file name is

GLAxx_mmm_prkk_ccc_tttt_s_nn_ffff.eee

Specific elements within the file name are described in Table 6-1.

Table 6-1 GLAS File Naming Keys

Key	Description
xx	The GLAS Product ID (01-15)
mmm	release number for process that created the produce (CCB assigned-combination of software and data)
p	repeat ground track phase
r	reference orbit number
kk	instance # incremented every time GLAS enters a different reference orbit
ccc	cycle of reference orbit for this phase
tttt	track within reference orbit
s	segment of orbit. This is 0 on files that contain multiple segments (GLA02, GLA03, GLA04,GLA07-GLA15) and 1,2,3,or 4 on GLA01, GLA05, and GLA06.
nn	granule version number (the number of times this granule is created for a specific release)
ffff	file type (numerical,CCB assigned for multiple files as needed for data of same time period for a specific ANCxx or GLAxx, i.e. multi-file granule)

The structure and contents of the GLAS Level 2 Data Product headers and labels are contained in Appendix A.

6.3 Data Products Substructure Descriptions

Full data product descriptions are provided in Appendix B and online in a hyper-linked format at the WFF GLAS website. The URL for product descriptions is:

http://wffglas.wff.nasa.gov/v50_products/

Table 6-2 lists the fields shown in each data product description entry.

Table 6-2 GLAS Data Product Description Fields

Field	Description
Product ID	GLAS File ID (GLA01, GLA02, etc).
Name	Descriptive name.
Product Level	Product Level (L0,L1A,L1B,L2,L3).
Science Discipline	Primary associated science discipline.
Investigator	Primary investigator.
Archive Site	Location at which this file will be permanently archived.
Source	A flag giving source data system of this file.

Table 6-3 lists the data coverage description fields.

Table 6-3 GLAS Data Coverage Description Fields

Field	Description
Product ID	GLAS File ID (GLA01, GLA02, etc).
Temporal Resolution	Nominal time span, in seconds, of each record of data within a file.
Temporal Coverage	Nominal time span, in minutes, of data contained within a file.
Horiz Res Coverage	Horizontal coverage, in meters, over Earth's surface for each instrument measurement.
Vert Res Coverage	Vertical coverage, in meters, over the Earth's surface for each instrument measurement.
Root/External Flag	A flag signifying whether this file is: **0**: neither of the following. **1**: the head-of-chain (Level 0 data) of an instrument's data stream. **2**: a file from an external source.

Table 6-4 lists the data volume description fields.

Table 6-4 GLAS Data Volume Description of Fields

Field	Description
Product ID	GLAS File ID (GLA01, GLA02, etc).
Frequency (per day)	Number of times processing PGE is executed.
Files per Granule	Number of physical files per each granule.
CPU (min)	Number of processing minutes required to produce a granule of this data.
MB per Day	Estimated amount of this data processed each data.
Record Size (bytes, 0=variable)	Size, in bytes, of a single record of data. 0 indicates a variable sized record.
Granule Size (MB)	Size, in megabytes, of a granule.
Granules per Day	Number of granules normally processed per day.
Revs per Granule	Number of earth revolutions contained in one granule.

6.4 Detailed Data Descriptions

Full detailed data descriptions are available in Appendix C. These descriptions provide details for each value within a product file. Table 6-5 lists the fields shown in each detailed data description entry.

Table 6-5 GLAS Detailed Data Description Fields

Field	Description
Product Var Name	Unique identifying name of the product variable.
Offset (bytes)	Offset in bytes from start of data record (start=0).
Prod Data Type	Product (Unscaled) Variable Type and dimensions (in parens). **i1b** = Integer, 1 byte **i2b** = Integer, 2 bytes **i4b** = Integer, 4 bytes **r4b** = Real, 4 bytes **r8b** = Real, 8 bytes etc...
Total Bytes	Total number of bytes used by variable.
Is Unsigned?	Flag indicating if variable should be treated as unsigned.
Invalid Value/Flag	Indicates what identifies the filed as being invalid. **None** = variable cannot be invalid. **gd_invalid_*xxx*** = datatype-specific value which indicates the variable is not valid. ***[variable name]*** = name of the flag to check in order to determine validity of the variable.

6.5 GLAS Data Dictionary

Detailed variable descriptions are provided in Appendix D. These descriptions provide details for each variable within a product file. Table 6-6 lists the fields shown in each detailed data dictionary entry.

Table 6-6 GLAS Data Dictionary

Field	Description
Product Var Name	Unique identifying name of the product variable.
Is element of:	Corresponding record where variable is located.
Short Description	Descriptive name of the product variable.
Prod Data Type	Product (Unscaled) Variable Type and dimensions (in parens). **i1b** = Integer, 1 byte **i2b** = Integer, 2 bytes **i4b** = Integer, 4 bytes **r4b** = Real, 4 bytes **r8b** = Real, 8 bytes etc...
Total Bytes	Total number of bytes used by variable.
Product Units	Units in which variable is stored on product file.
Total Bytes	Total number of bytes used by variable.
Product Units	Units in which variable is stored on product file.
Invalid Value/Flag	Indicates what identifies the filed as being invalid. **None** = variable cannot be invalid. **gd_invalid_*xxx*** = datatype-specific value which indicates the variable is not valid. ***[variable name]*** = name of the flag to check in order to determine validity of the variable.
Is Correction Flag	Flag indicating if the variable is a correction flag.
Is Unsigned?	Flag indicating if variable should be treated as unsigned.
Product Minimum	Minimum value supported in product variable.
Product Maximum	Maximum value supported in product variable.
Description	Text description.
Comments	Text comments.

6.6 GLAS Flag Description

A detailed description of the flags is available in Appendix E.

Appendix A
Level 2 Data Products - Standard Label Contents & Description

GLAS Products begin with ASCII header records containing information regarding the processing which created the Product and the data contained within. These header records are exactly the same size as a Product data record and contain ASCII information in a slightly modified KEYWORD=VALUE format. In order to conserve space on the product, the header records contain multiple KEYWORD=VALUE entries and entries are delimited by a semi-colon (;) and linefeed (ASCII 10).

By design, the first two header entries are the record length and number of header records. This allows product readers to verify the record length and jump directly to the first data record, if necessary. Most of the remaining information within the headers is directly applicable to the generation of metadata files for EOS ingest.

The following common fields are defined for GLAS Product Headers:

Table A-1 Product Header Elements

Keyword	Content Description
Additional_Attribute	Product-specific additional attributes.
AutomaticQualityFlagExplan	Automatic Quality flag explanation (per parameter).
Cycle	A count of the number of exact repeats of this reference orbit.
EquatorCrossingDate	Date of the equator crossing.
EquatorCrossingLong	Longitude of equator crossing.
EquatorCrossingTime	Time of the equator crossing.
glas_osc_rate	Value that indicates the accuracy rate of the GLAS oscillator.
glas_osc_rate_date	Valid date of the GLAS oscillator rate. (yyyy-mm-dd)
glas_osc_rate_time	Valid time of the GLAS oscillator rate. (hh:mm:ss)
InputPointer	Name of each input product file used to created this product (one instances of this keyword appears in the product header record for each input product file used in creation of this product).
internal_range_delay	Internal range delay for digitizer in meters (from anc33).
internal_range_delay_date	Valid date of corresponding internal range delay. (yyyy-mm-dd)
internal_range_delay_time	Valid time of corresponding internal range delay. (hh:mm:ss)
internal_time_delay	Time delay for digitizer in seconds (from anc33).
internal_time_delay_date	Valid date of internal time delay. (yyyy-mm-dd)
internal_time_delay_time	Valid time of internal time delay. (hh:mm:ss)

Table A-1 Product Header Elements (Continued)

Keyword	Content Description
Instance	The number of times that a specific reference orbit has been returned to during flight.
instrument_short_name	Short name of instrument (GLAS).
Instrument_State	Flag word that indicates which redundant units (laser, detector, oscillator) of the GLAS instrument are in operation.
Instrument_State_Date	The date that corresponds to the Instrument_State. There are a maximum of two per granule.
Instrument_State_Time	The time that corresponds to the Instrument_State. There are a maximum of two per granule.
LocalGranuleID	Filename of the granule.
LocalVersionID	Granule version number (auto-incrementing, nn in filenaming convention).
Numhead	Number of header records preceeding product data records.
OperationalQualityFlagExpl	Operational Quality flag explanation (per parameter).
Orbit Number	Orbit number
OrbitQuality	Status word that states what type of orbit was used during processing of the data for the granule. It specifies the models used in the orbit determination program. This provides an indication of the quality of the orbits being applied to the data.
ParameterName	Name of product specific parameters for which additional information follows.
PercentFullRate	Percent of data for this granule that atmospheric parameters are provided at 40 Hz data rate.
PercentGroundHit	Percent of data for this granule that had a detected ground return of the transmitted laser pulse.
PercentHighRate	Percent of data for this granule that atmospheric parameters are provided at 5 Hz data rate.
PercentLowRate	Percent of data for this granule that atmospheric parameters are provided at 0.25 Hz data rate.
PercentMediumRate	Percent of data for this granule that atmospheric parameters are provided at 1 Hz data rate.
Percent1064to532	Percent atmospheric profiles that use the 1064 nm profile data to provide estimated values for the saturated 532nm profiles.
PGEVersion	Version number of the GSAS software that generated this granule.
platform_short_name	Short name of spacecraft (Icesat).
ProductionDateTime	Creation time of granule.
QAPercentMissingData	Percent of missing data (per parameter)

Table A-1 Product Header Elements (Continued)

Keyword	Content Description
QAPercentOutofBounds	Percent of out-of-bounds data (per parameter)
RangeBeginningDate	Start date of data on the granule.
RangeEndingDate	End data of data on the granule.
RangeBeginningTime	Start time of day for data on this granule.
Range_Bias	The additive calibration correction in millimeters to apply to range based on the science team cal/val activities.
Range_Bias_Date	The date that corresponds to the first valid Range_Bias. There are a maximum of two per granule.
Range_Bias_Time	The time that corresponds to the first valid Range_Bias. There are a maximum of two per granule.
RangeEndingTime	End time of day for data on this granule.
Recl	Record length in bytes.
ReferenceOrbit	Assigned number for which exact orbital elements describe the exact repeat orbit pattern.
ReprocessingPlanned	Planned reprocessing status.
ReprocessingActual	Actual reprocessing status.
sc_osc_rate	Value that indicates the accuracy of the spacecraft oscillator.
sc_osc_rate_date	Valid date of the spacecraft oscillator measurement. (yyyy-mm-dd)
sc_osc_rate_time	Valid time of the spacecraft oscillator measurement. (hh:mm:ss)
sensor_short_name	Short name of sensor (LaserALT).
ScienceQualityFlagExplana	Science Quality flag explanation (per parameter).
ShortName	GSAS Filetype.
size_mb_ecs_data_granule	Size (in MB) of the granule.
SP_ICE_GLAS_EndBlock	Integer SPICE block number within GLAS coverage scheme in which granule data ends.
SP_ICE_PATH_NO	Number which represents the GLAS SPICE path number.
SP_ICE_GLAS_StartBlock	Integer SPICE block number within GLAS coverage scheme in which granule data starts.
time_between_contiguous_records	Time between contiguous data records (in seconds).
Timing_Bias	The time tag error determined by the calibration team that was added to the time tags to compute the true time of data as provided on the granule.
Timing_Bias_Date	The date that corresponds to the Timing_Bias. There are a maximum of two per granule.

Table A-1 Product Header Elements (Continued)

Keyword	Content Description
Timing_Bias_Time	The time of day that corresponds to the Timing_Bias. There are a maximum of two per granule.
Timing_Drift	This is the ratio of the true time for a one second oscillator tick to nominal one.
Timing_Drift_Date	The date that corresponds to the Timing_Drift. There are a maximum of two per granule.
Timing_Drift_Time	The time of day that corresponds to the Timing_Drift. There are a maximum of two per granule.
Track	The unique number assigned for each repeat ground track (one orbit) of the reference orbit.
Track_Segment	Number assigned for the specific latitude segment (1 = +50 to +50, 2 = +50 to -50, 3 = -50 to -50, 4 = -50 to +50) of the track for the data.
VersionID	The ESDT version number that is to be used with this product.
Additional product specific information	(see Table A-2)

In addition to the common information contained in its headers, each product may also contain information specific to the type of data it contains. This type of information is called a product-specific attribute (PSA). The PSAs mostly contain information related to product data quality. The PSAs and their attributes are listed in Table A-2.

Table A-2 Product Specific Elements

Product	Parameter Name		Attribute
GLA08	Aerosol Layer Heights		TBD
GLA08	Planetary Boundary Layer		TBD
GLA09	Cloud Layer Heights		TBD
GLA10	Cloud Backscatter Cross Section Profile		TBD
GLA10	Cloud Extinction Cross Section Profile		TBD
GLA10	Aerosol Backscatter Cross Section Profile		TBD
GLA10	Aerosol Extinction Cross Section Profile		TBD
GLA11	Cloud Optical Depth		TBD

Table A-2 Product Specific Elements (Continued)

Product	Parameter Name		Attribute
GLA11	Aerosol Optical Depth		TBD
GLA11	Planetary Boundary Layer Optical Depth		TBD
GLA12	Surface Elevation	AutomaticQualityFlag	Flag, will fail if surface elevation percent out of bounds is greater than 5%.
		QAPercentOutofBounds	Percent Out of Bounds is the number of invalid divided by number of shots received.
GLA12	Surface Roughness	AutomaticQualityFlag	Flag, will fail if surface roughness percent out of bounds is greater than 5%.
		QAPercentOutofBounds	Percent Out of Bounds is the number of invalid divided by number of shots received.
GLA12	Surface Reflectance	AutomaticQualityFlag	Flag, will fail if surface reflectance percent out of bounds is greater than 5%.
		QAPercentOutofBounds	Percent Out if Bounds is the number of invalid divided by number of shots received.
GLA12	Surface Slope	AutomaticQualityFlag	Flag, will fail of surface slope percent out of bounds is greater than 5%.
		QAPercentOutofBounds	Percent Out of Bounds is the number of invalid divided by number of shots received.
GLA13	Surface Elevation	AutomaticQualityFlag	Flag, will fail if surface elevation percent out of bounds is greater than 5%.
		QAPercentOutofBounds	Percent Out of Bounds is the number of invalid divided by number of shots received.
GLA13	Surface Roughness	AutomaticQualityFlag	Flag, will fail if surface roughness percent out of bounds is greater than 5%.
		QAPercentOutofBounds	Percent Out of Bounds is the number of invalid divided by number of shots received.

Table A-2 Product Specific Elements (Continued)

Product	Parameter Name		Attribute
GLA13	Surface Reflectance	AutomaticQualityFlag	Flag, will fail if surface reflectance percent out of bounds is greater than 5%.
		QAPercentOutofBounds	Percent Out of Bounds is the number of invalid divided by number of shots received.
GLA14	Surface Elevation	AutomaticQualityFlag	Flag, will fail if surface elevation percent out of bounds is greater than 5%.
		QAPercentOutofBounds	Percent Out of Bounds is the number of invalid divided by number of shots received.
GLA14	Surface Roughness	AutomaticQualityFlag	Flag, will fail if surface roughness percent out of bounds is greater than 5%.
		QAPercentOutofBounds	Percent Out of Bounds is the number of invalid divided by number of shots received.
GLA14	Surface Reflectance	AutomaticQualityFlag	Flag, will fail if surface reflectance percent out of bounds is greater than 5%.
		QAPercentOutofBounds	Percent Out of Bounds is the number of invalid divided by number of shots received.
GLA14	Surface Slope	AutomaticQualityFlag	Flag, will fail of surface slope percent out of bounds is greater than 5%.
		QAPercentOutofBounds	Percent Out of Bounds is the number of invalid divided by number of shots received.
GLA15	Surface Elevation	AutomaticQualityFlag	Flag, will fail if surface elevation percent out of bounds is greater than 5%.
		QAPercentOutofBounds	Percent Out of Bounds is the number of invalid divided by number of shots received.

Table A-2 Product Specific Elements (Continued)

Product	Parameter Name		Attribute
GLA15	Surface Roughness	AutomaticQualityFlag	Flag, will fail if surface roughness percent out of bounds is greater than 5%.
		QAPercentOutofBounds	Percent Out of Bounds is the number of invalid divided by number of shots received.
GLA15	Surface Reflectance	AutomaticQualityFlag	Flag, will fail if surface reflectance percent out of bounds is greater than 5%.
		QAPercentOutofBounds	Percent Out of Bounds is the number of invalid divided by number of shots received.

Appendix B
Level 2 Data Products Description

B.1 Data Product Description

Table B-1 Data Product Description

Product ID	Name	Level	Science Discipline	Investigator	Archive Site	Source
GLA08	Boundary Layer height	2	Atmosphere	J. Spinhirne	NSIDC	ISIPS
GLA09	Cloud Height	2	Atmosphere	J. Spinhirne	Icesat SCF	ICESat SCF
GLA10	Aerosol Vertical Structure	2	Atmosphere	J. Spinhirne	Icesat SCF	Icesat SCF
GLA11	Thin Cloud/OD	2	Atmosphere	J. Spinhirne	Icesat SCF	ICESat SCF
GLA12	Ice Sheet Elevation	2	Elevations-Ice Sheet	Jay Zwally	Icesat SCF	ICESat SCF
GLA13	Sea Ice Roughness	2	Elevations-Sea Ice	Bob Thomas	Icesat SCF	ICESat SCF
GLA14	Land/Canopy Elevation	2	Elevations-Land	Jack Bufton	Icesat SCF	ICESat SCF
GLA15	Ocean Elevation	2	Elevations-Ocean	N/A	Icesat SCF	ICESat SCF

B.2 Data Coverage

Table B-2 Data Coverage

Product ID	Temporal Resolution (sec)	Temporal Coverage (min)	Horiz Res Coverage (m)	Vert Rez Coverage (m)	Root/ External Flag
GLA08	8	1380	-90 to 90	-180 to 180	0
GLA09	4	1380	170	76.8	0
GLA10	4	1380	170	76.8	0
GLA11	4	1380	170	76.8	0
GLA12	1	1380	170	0	0
GLA13	1	1380	170	0	0
GLA14	1	1380	170	0	0
GLA15	1	1380	170	0	0

B.3 Data Volume

Table B-3 Data Volume

Product ID	Freq.(per day)	Files per Gran.	CPU (min)	MB per Day	Record Size (0=variable)	Granule Size (MB)	Gran. per Day	Revs per Gran.
GLA08	1	1	80.07	16.31469727	792	16.31469727	1	14
GLA09	1	1	146.57	143.0419922	6944	143.0419922	1	14
GLA10	1	1	214.02	308.4960938	14976	308.4960938	1	14
GLA11	1	1	115.49	62.45727539	3032	62.45727539	1	14
GLA12	1	1	3.21	135.9558105	6600	135.9558105	1	14
GLA13	1	1	2.9	139.251709	6760	139.251709	1	14
GLA14	1	1	3.05	247.1923828	10000	247.1923828	1	14
GLA15	1	1	4.72	362.2192383	6280	362.2192383	1	14

Appendix C
Level 2 Data Product Formats

C.1 Record Formats

C.1.1 Guidelines

The GLAS Data Product record formats were developed under the following guidelines:

1) Record size a multiple of 4.
2) Start elements on a 4 byte boundary; where not possible use pads or group smaller elements together to get to 4 byte boundary. Pad and move elements so that arrays start on 4 byte boundaries.
3) The output structures to build files should be grouped in descending size order, therefore group elements on file logically and in descending size order.
4) Data that occurs occasionally in the file should be put in the header. Specifically, the orbit number and instrument state are changing at a much lower rate than the record rate on the files, therefore the orbit numbers and instrument states encompassed by a file will be put in the header. These elements will not be shown in the record format. Other data in the same category will be put in the header.
5) Add spares.

C.1.2 GLA08

Each record contains 4 seconds of data. Empty aerosol or planetary boundary layers will contain fill data.

Table C-1 GLA08 Record Format

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
Record Type:GLA08_MAIN; % of Granule: 100; Record Duration (seconds):4; Repeats: 1						
Latest : Last Modified : Tue Sep 06 12:21:56 GMT-0400 (EDT) 2005						
i_rec_ndx	0	i4b	4	N/A	No	no
i_UTCTime	4	i4b (2)	8	seconds, microseconds	No	no
i_beam_coelev	12	i4b (4)	16	degrees*100	No	i4b
i_beam_azimuth	28	i4b (4)	16	degrees*100	No	i4b
i_pad_angle	44	i4b (4)	16	microdegrees	No	i4b
i_spare0	60	i1b (40)	40	null	NA	No
i_AttFlg1	100	i2b (4)	8	NA	No	no
i_lat	108	i4b (4)	16	microdegrees	No	i4b

Table C-1 GLA08 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
i_lon	124	i4b (4)	16	microdegrees	No	i4b
i_OrbFlg	140	i1b (2, 4)	8	NA	No	no
i_surfType	148	i1b (4)	4	NA	No	no
i_LidarQF	152	i2b (4)	8	NA	No	no
i_atm_dem	160	i4b (4)	16	meters	No	i4b
i4_aer_bot	176	i2b (5)	10	deka-meters	No	i4_aer_af
i4_aer_top	186	i2b (5)	10	deka-meters	No	i4_aer_af
i20_aer_bot	196	i2b (3)	6	deka-meters	No	i20_aer_af
i20_aer_top	202	i2b (3)	6	deka-meters	No	i20_aer_af
i_LRpbl_ht	208	i2b	2	deka-meters	No	i2b
i_LRpbl_grd	210	i2b	2	deka-meters	No	i2b
i_HRpbl_ht	212	i2b (20)	40	deka-meters	No	i2b
i_HRpbl_grd	252	i2b (20)	40	deka-meters	No	i2b
i4_aer_pct	292	i1b (5)	5	unitless	No	i4_aer_af
i20_aer_pct	297	i1b (3)	3	unitless	No	i20_aer_af
i_LRpbl_pct	300	i1b	1	unitless	No	i1b
i_LayHgt_Flag	301	i1b (32)	32	NA	No	no
i_AttFlg3	333	i1b	1	NA	No	No
i_timecorflg	334	i2b	2	N/A	No	No
i_Solar_Angle	336	i4b (4)	16	micro-degrees	No	i4b
i_Aer_top_b20_temp	352	i2b (5)	10	degrees Celsius * 100	No	i2b
i_Aer_top_b20_pres	362	i2b (5)	10	millibars of mercury * 10	No	i2b
i_Aer_top_b20_relh	372	i2b (5)	10	percentage * 100	No	i2b
i_Aer_bot_b20_temp	382	i2b (5)	10	degrees Celsius * 100	No	i2b
i_Aer_bot_b20_pres	392	i2b (5)	10	millibars of mercury * 10	No	i2b
i_Aer_bot_b20_relh	402	i2b (5)	10	percentage * 100	No	i2b
i_Aer_top_a20_temp	412	i2b (3)	6	degrees Celsius * 100	No	i2b
i_Aer_top_a20_pres	418	i2b (3)	6	millbars of mercury * 10	No	i2b
i_Aer_top_a20_relh	424	i2b (3)	6	percentage * 100	No	i2b
i_Aer_bot_a20_temp	430	i2b (3)	6	degrees Celsius * 100	No	i2b
i_Aer_bot_a20_pres	436	i2b (3)	6	millbars of mercury * 10	No	i2b
i_Aer_bot_a20_relh	442	i2b (3)	6	percentage * 100	No	i2b
i_Aer_PBL_LR_temp	448	i2b	2	degrees Celsius * 100	No	i2b
i_Aer_PBL_LR_pres	450	i2b	2	millibars of mercury * 10	No	i2b
i_Aer_PBL_LR_relh	452	i2b	2	percentage * 100	No	i2b

Table C-1 GLA08 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
i_Aer_ir_top	454	i2b (2)	4	deka-meters	No	i2b
i_Aer_ir_bot	458	i2b (2)	4	deka-meters	No	i2b
i_Aer_ir_layflg	462	i1b (2)	2	N/A	No	No
i_Aer_ir_top_temp	464	i2b (2)	4	degrees Celsius * 100	No	i2b
i_Aer_ir_top_pres	468	i2b (2)	4	millibars of mercury * 10	No	i2b
i_Aer_ir_top_relh	472	i2b (2)	4	percentage * 100	No	i2b
i_Aer_ir_bot_temp	476	i2b (2)	4	degrees Celsius * 100	No	i2b
i_Aer_ir_bot_pres	480	i2b (2)	4	millibars of mercury * 10	No	i2b
i_Aer_ir_bot_relh	484	i2b (2)	4	percentage * 100	No	i2b
i_Surface_temp	488	i2b (4)	8	degrees Celsius * 100	No	i2b
i_Surface_pres	496	i2b (4)	8	millibars of mercury * 10	No	i2b
i_Surface_relh	504	i2b (4)	8	percentage * 100	No	i2b
i_Surface_wind	512	i2b (4)	8	meters/second * 100	No	i2b
i_Surface_wdir	520	i2b (4)	8	degrees * 10	No	i2b
i_spare2	528	i1b (264)	264	NA	No	NA
Total Bytes	792					

C.1.3 GLA09

Each record contains 4 seconds of data. Empty cloud layers will contain fill data.

Table C-2 GLA09 Record Format

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
Record Type:GLA09_MAIN; % of Granule: 100; Record Duration (seconds):4; Repeats: 1						
Latest: Last Modified: Tue Sep 20 08:42:49 GMT-0400 (EDT) 2005						
i_rec_ndx	0	i4b	4	N/A	No	no
i_UTCTime	4	i4b (2)	8	seconds, microseconds	No	no
i_beam_coelev	12	i4b (4)	16	degrees*100	No	i4b
i_beam_azimuth	28	i4b (4)	16	degrees*100	No	i4b
i_pad_angle	44	i4b (4)	16	microdegrees	No	i4b
i_spare0	60	i1b (40)	40	null	NA	No
i_AttFlg1	100	i2b (4)	8	NA	No	no
i_lat	108	i4b (4)	16	microdegrees	No	i4b
i_lon	124	i4b (4)	16	microdegrees	No	i4b
i_OrbFlg	140	i1b (2, 4)	8	NA	No	no
i_surfType	148	i1b (4)	4	NA	No	no
i_LidarQF	152	i2b (4)	8	NA	No	no
i_spare2	160	i1b (8)	8	NA	No	NA
i_topo_elev	168	i4b (4)	16	meters	No	i4b
i_atm_dem	184	i4b (4)	16	meters	No	i4b
i_LRcld_bot	200	i2b (10)	20	deka-meters	No	i_LRC_af
i_LRcld_top	220	i2b (10)	20	deka-meters	No	i_LRC_af
i_LRcld_grd	240	i2b	2	deka-meters	No	i2b
i_spare3	242	i1b (2)	2	NA	No	NA
i_MRcld_bot	244	i2b (10, 4)	80	deka-meters	No	i_MRC_af
i_MRcld_top	324	i2b (10, 4)	80	deka-meters	No	i_MRC_af
i_MRcld_grd	404	i2b (4)	8	deka-meters	No	i2b
i_MRcld_pct	412	i1b (10, 4)	40	unitless	No	i_MRC_af
i_HRcld_bot	452	i2b (10, 20)	400	deka-meters	No	i_HRC_af
i_HRcld_top	852	i2b (10, 20)	400	deka-meters	No	i_HRC_af
i_HRcld_grd	1252	i2b (20)	40	deka-meters	No	i2b
i_FRcld_bot	1292	i2b (160)	320	deka-meters	No	i_FRC_af
i_FRcld_top	1612	i2b (160)	320	deka-meters	No	i_FRC_af
i_FRcld_grd	1932	i2b (160)	320	deka-meters	No	i2b
i_FRg_grd_sig	2252	i4b (160)	640	e9/(m-sr)	No	i4b

Table C-2 GLA09 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
i_FRir_grd_sig	2892	i4b (160)	640	e9/(m-sr)	No	i4b
i_LRCL_Flag	3532	i1b (11)	11	NA	No	no
i_MRCL_Flag	3543	i1b (37)	37	NA	No	no
i_HRCL_Flag	3580	i1b (185)	185	NA	No	no
i_FRCL_Flag	3765	i1b (220)	220	NA	No	no
i_AttFlg3	3985	i1b	1	NA	No	No
i_timecorflg	3986	i2b	2	N/A	No	No
i_FRir_cldtop	3988	i2b (160)	320	deka-meters	No	i2b
i_FRir_qaFlag	4308	i1b (160)	160	NA	No	No
i_FRir_intsig	4468	i2b (160)	320	e7/(m-sr)	No	i2b
i_Solar_Angle	4788	i4b (4)	16	micro-degrees	No	i4b
i_LRir_cld_top	4804	i2b (10)	20	deka-meters	No	i2b
i_LRir_cld_bot	4824	i2b (10)	20	deka-meters	No	i2b
i_LRir_QAflag	4844	i1b (10)	10	NA	No	No
i_LRir_cldtop_temp	4854	i2b (10)	20	degrees Celsius * 100	No	i2b
i_LRir_cldtop_pres	4874	i2b (10)	20	millibars of mercury * 10	No	i2b
i_LRir_cldtop_relh	4894	i2b (10)	20	percentage * 100	No	i2b
i_LRir_cldbot_temp	4914	i2b (10)	20	degrees Celsius * 100	No	i2b
i_LRir_cldbot_pres	4934	i2b (10)	20	millibars of mercury * 10	No	i2b
i_LRir_cldbot_relh	4954	i2b (10)	20	percentage * 100	No	i2b
i_MRir_cld_top	4974	i2b (10, 4)	80	deka-meters	No	i2b
i_MRir_cld_bot	5054	i2b (10, 4)	80	deka-meters	No	i2b
i_MRir_QAflag	5134	i1b (40)	40	NA	No	No
i_MRir_cldtop_temp	5174	i2b (10, 4)	80	degrees Celsius * 100	No	i2b
i_MRir_cldtop_pres	5254	i2b (10, 4)	80	millibars of mercury * 10	No	i2b
i_MRir_cldtop_relh	5334	i2b (10, 4)	80	percentage * 100	No	i2b
i_MRir_cldbot_temp	5414	i2b (10, 4)	80	degrees Celsius * 100	No	i2b
i_MRir_cldbot_pres	5494	i2b (10, 4)	80	millibars of mercury * 10	No	i2b
i_MRir_cldbot_relh	5574	i2b (10, 4)	80	percentage * 100	No	i2b
i_LRg_cldtop_temp	5654	i2b (10)	20	degrees Celsius * 100	No	i2b
i_LRg_cldtop_pres	5674	i2b (10)	20	millibars of mercury * 10	No	i2b
i_LRg_cldtop_relh	5694	i2b (10)	20	percentage * 100	No	i2b
i_LRg_cldbot_temp	5714	i2b (10)	20	degrees Celsius * 100	No	i2b
i_LRg_cldbot_pres	5734	i2b (10)	20	millibars of mercury * 10	No	i2b
i_LRg_cldbot_relh	5754	i2b (10)	20	percentage * 100	No	i2b

Table C-2 GLA09 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
i_MRg_cldtop_temp	5774	i2b (10, 4)	80	degrees Celsius * 100	No	i2b
i_MRg_cldtop_pres	5854	i2b (10, 4)	80	millibars of mercury * 10	No	i2b
i_MRg_cldtop_relh	5934	i2b (10, 4)	80	percentage * 100	No	i2b
i_MRg_cldbot_temp	6014	i2b (10, 4)	80	degrees Celsius * 100	No	i2b
i_MRg_cldbot_pres	6094	i2b (10, 4)	80	millibars of mercury * 10	No	i2b
i_MRg_cldbot_relh	6174	i2b (10, 4)	80	percentage * 100	No	i2b
i_LRg_SourceFt	6254	i2b	2	Unknown	No	i2b
i_MRg_SourceFt	6256	i2b (4)	8	Unknown	No	i2b
i_HRg_SourceFt	6264	i2b (20)	40	Unknown	No	i2b
i_LRir_SourceFt	6304	i2b	2	Unknown	No	i2b
i_MRir_SourceFt	6306	i2b (4)	8	Unknown	No	i2b
i_Surface_temp	6314	i2b (4)	8	degrees Celsius * 100	No	i2b
i_Surface_pres	6322	i2b (4)	8	millibars of mercury * 10	No	i2b
i_Surface_relh	6330	i2b (4)	8	percentage * 100	No	i2b
i_Surface_wind	6338	i2b (4)	8	meters/second * 100	No	i2b
i_Surface_wdir	6346	i2b (4)	8	degrees * 10	No	i2b
i_spare4	6354	i1b (590)	590	NA	No	NA
Total Bytes	6944					

C.1.4 GLA10

Each record contains 4 seconds of data.

Table C-3 GLA10 Record Format

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
Record Type:GLA10_MAIN; % of Granule: 100; Record Duration (seconds):4; Repeats: 1						
Latest : Last Modified : Tue Sep 06 12:20:48 GMT-0400 (EDT) 2005						
i_rec_ndx	0	i4b	4	N/A	No	no
i_UTCTime	4	i4b (2)	8	seconds, microseconds	No	no
i_beam_coelev	12	i4b (4)	16	degrees*100	No	i4b
i_beam_azimuth	28	i4b (4)	16	degrees*100	No	i4b
i_pad_angle	44	i4b (4)	16	microdegrees	No	i4b
i_spare0	60	i1b (40)	40	null	NA	No
i_AttFlg1	100	i2b (4)	8	NA	No	no
i_lat	108	i4b (4)	16	microdegrees	No	i4b

Table C-3 GLA10 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
i_lon	124	i4b (4)	16	microdegrees	No	i4b
i_OrbFlg	140	i1b (2, 4)	8	NA	No	no
i_surfType	148	i1b (4)	4	NA	No	no
i_LidarQF	152	i2b (4)	8	NA	No	no
i_cld1_bs_prof	160	i4b (280, 4)	4480	e10/(m-sr)	No	i4b
i_cld1_ext_prof	4640	i4b (280, 4)	4480	e9/m	No	i4b
i_aer4_bs_prof	9120	i4b (548)	2192	e10/(m-sr)	No	i4b
i_aer4_ext_prof	11312	i4b (548)	2192	e9/m	No	i4b
i_cld1_sval1	13504	i2b (10, 4)	80	100*sr	No	i2b
i_cld1_sval2	13584	i2b (10, 4)	80	100*sr	No	i2b
i_aer4_sval1	13664	i2b (9)	18	100*sr	No	i2b
i_aer4_sval2	13682	i2b (9)	18	100*sr	No	i2b
i_cld1_bot	13700	i2b (10, 4)	80	deka-meters	No	i2b
i_cld1_top	13780	i2b (10, 4)	80	deka-meters	No	i2b
i_cld1_grd_det	13860	i2b (4)	8	deka-meters	No	i2b
i_aer4_bot	13868	i2b (9)	18	deka-meters	No	i2b
i_aer4_top	13886	i2b (9)	18	deka-meters	No	i2b
i_pbl4_grd_det	13904	i2b	2	deka-meters	No	i2b
i_spare2	13906	i1b (2)	2	NA	No	NA
i_cld1_sval_uf	13908	i1b (20)	20	NA	No	no
i_aer4_sval_uf	13928	i1b (5)	5	NA	No	no
i_spare3	13933	i1b (3)	3	NA	No	NA
i_cld1_bs_flag	13936	i1b (40)	40	NA	No	no
i_cld1_ext_flag	13976	i1b (40)	40	NA	No	no
i_aer4_bs_flag	14016	i1b (10)	10	NA	No	no
i_aer4_ext_flag	14026	i1b (10)	10	NA	No	no
i_spare4	14036	i1b	1	null	NA	No
i_AttFlg3	14037	i1b	1	NA	No	No
i_timecorflg	14038	i2b	2	N/A	No	No
i_Solar_Angle	14040	i4b (4)	16	micro-degrees	No	i4b
i_MRg_cldtop_temp	14056	i2b (10, 4)	80	degrees Celsius * 100	No	i2b
i_MRg_cldtop_pres	14136	i2b (10, 4)	80	millibars of mercury * 10	No	i2b
i_MRg_cldtop_relh	14216	i2b (10, 4)	80	percentage * 100	No	i2b
i_MRg_cldbot_temp	14296	i2b (10, 4)	80	degrees Celsius * 100	No	i2b
i_MRg_cldbot_pres	14376	i2b (10, 4)	80	millibars of mercury * 10	No	i2b

Table C-3 GLA10 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
i_MRg_cldbot_relh	14456	i2b (10, 4)	80	percentage * 100	No	i2b
i_Aer_top_temp	14536	i2b (9)	18	degrees Celsius * 100	No	i2b
i_Aer_top_pres	14554	i2b (9)	18	millibars of mercury * 10	No	i2b
i_Aer_top_relh	14572	i2b (9)	18	percentage * 100	No	i2b
i_Aer_bot_temp	14590	i2b (9)	18	degrees Celsius * 100	No	i2b
i_Aer_bot_pres	14608	i2b (9)	18	millibars of mercury * 10	No	i2b
i_Aer_bot_relh	14626	i2b (9)	18	percentage * 100	No	i2b
i_Surface_temp	14644	i2b (4)	8	degrees Celsius * 100	No	i2b
i_Surface_pres	14652	i2b (4)	8	millibars of mercury * 10	No	i2b
i_Surface_relh	14660	i2b (4)	8	percentage * 100	No	i2b
i_Surface_wind	14668	i2b (4)	8	meters/second * 100	No	i2b
i_Surface_wdir	14676	i2b (4)	8	degrees * 10	No	i2b
i_spare5	14684	i1b (292)	292	NA	No	NA
Total Bytes	14976					

C.1.5 GLA11

Each record contains 4 seconds of data.

Table C-4 GLA11 Record Format

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
Record Type:GLA11_MAIN; % of Granule: 100; Record Duration (seconds):4; Repeats: 1						
Latest : Last Modified : Tue Sep 20 08:42:49 GMT-0400 (EDT) 2005						
i_rec_ndx	0	i4b	4	N/A	No	no
i_UTCTime	4	i4b (2)	8	seconds, microseconds	No	no
i_beam_coelev	12	i4b (4)	16	degrees*100	No	i4b
i_beam_azimuth	28	i4b (4)	16	degrees*100	No	i4b
i_pad_angle	44	i4b (4)	16	microdegrees	No	i4b
i_spare0	60	i1b (40)	40	null	NA	No
i_AttFlg1	100	i2b (4)	8	NA	No	no
i_lat	108	i4b (4)	16	microdegrees	No	i4b
i_lon	124	i4b (4)	16	microdegrees	No	i4b
i_OrbFlg	140	i1b (2, 4)	8	NA	No	no
i_surfType	148	i1b (4)	4	NA	No	no
i_LidarQF	152	i2b (4)	8	NA	No	no

Table C-4 GLA11 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
i_cld1_od	160	i2b (10, 4)	80	unitless*1000	No	i2b
i_aer4_od	240	i2b (8)	16	unitless*1000	No	i2b
i_pbl4_od	256	i2b	2	unitless*1000	No	i2b
i_aer4_msf	258	i2b (9)	18	unitless	No	i2b
i_cld1_msf	276	i2b (10, 4)	80	unitless	No	i2b
i_cld1_bot	356	i2b (10, 4)	80	deka-meters	No	i2b
i_cld1_top	436	i2b (10, 4)	80	deka-meters	No	i2b
i_cld1_grd_det	516	i2b (4)	8	deka-meters	No	i2b
i_aer4_bot	524	i2b (8)	16	deka-meters	No	i2b
i_aer4_top	540	i2b (8)	16	deka-meters	No	i2b
i_aer4_ht	556	i2b	2	deka-meters	No	i2b
i_aer4_grd_det	558	i2b	2	deka-meters	No	i2b
i_erd	560	i2b (4)	8	millimeters	No	i2b
i_pse	568	i2b (4)	8	microns	No	i2b
i_cld1_mswf	576	i1b (2)	2	NA	No	no
i_cld1_flag	578	i1b (40)	40	NA	No	no
i_aer4_flag	618	i1b (8)	8	NA	No	no
i_pbl4_flag	626	i1b	1	NA	No	no
i_AttFlg3	627	i1b	1	NA	No	No
i_timecorflg	628	i2b	2	N/A	No	No
i_rdu	630	i2b (4)	8	millimeters	No	i2b
i_spare2	638	i1b (2)	2	NA	No	NA
i_Solar_Angle	640	i4b (4)	16	micro-degrees	No	i4b
i_MRg_cldtop_temp	656	i2b (10, 4)	80	degrees Celsius * 100	No	i2b
i_MRg_cldtop_pres	736	i2b (10, 4)	80	millibars of mercury * 10	No	i2b
i_MRg_cldtop_relh	816	i2b (10, 4)	80	percentage * 100	No	i2b
i_MRg_cldbot_temp	896	i2b (10, 4)	80	degrees Celsius * 100	No	i2b
i_MRg_cldbot_pres	976	i2b (10, 4)	80	millibars of mercury * 10	No	i2b
i_MRg_cldbot_relh	1056	i2b (10, 4)	80	percentage * 100	No	i2b
i_Aer_top_temp	1136	i2b (9)	18	degrees Celsius * 100	No	i2b
i_Aer_top_pres	1154	i2b (9)	18	millibars of mercury * 10	No	i2b
i_Aer_top_relh	1172	i2b (9)	18	percentage * 100	No	i2b
i_Aer_bot_temp	1190	i2b (9)	18	degrees Celsius * 100	No	i2b
i_Aer_bot_pres	1208	i2b (9)	18	millibars of mercury * 10	No	i2b
i_Aer_bot_relh	1226	i2b (9)	18	percentage * 100	No	i2b

Table C-4 GLA11 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
i_Aer_ir_top	1244	i2b (2)	4	deka-meters	No	i2b
i_Aer_ir_bot	1248	i2b (2)	4	deka-meters	No	i2b
i_Aer_ir_top_temp	1252	i2b (2)	4	degrees Celsius * 100	No	i2b
i_Aer_ir_top_pres	1256	i2b (2)	4	millibars of mercury * 10	No	i2b
i_Aer_ir_top_relh	1260	i2b (2)	4	percentage * 100	No	i2b
i_Aer_ir_bot_temp	1264	i2b (2)	4	degrees Celsius * 100	No	i2b
i_Aer_ir_bot_pres	1268	i2b (2)	4	millibars of mercury * 10	No	i2b
i_Aer_ir_bot_relh	1272	i2b (2)	4	percentage * 100	No	i2b
i_MRir_cld_top	1276	i2b (10, 4)	80	deka-meters	No	i2b
i_MRir_cld_bot	1356	i2b (10, 4)	80	deka-meters	No	i2b
i_MRir_cldtop_temp	1436	i2b (10, 4)	80	degrees Celsius * 100	No	i2b
i_MRir_cldtop_pres	1516	i2b (10, 4)	80	millibars of mercury * 10	No	i2b
i_MRir_cldtop_relh	1596	i2b (10, 4)	80	percentage * 100	No	i2b
i_MRir_cldbot_temp	1676	i2b (10, 4)	80	degrees Celsius * 100	No	i2b
i_MRir_cldbot_pres	1756	i2b (10, 4)	80	millibars of mercury * 10	No	i2b
i_MRir_cldbot_relh	1836	i2b (10, 4)	80	percentage * 100	No	i2b
i_MRir_QAflag	1916	i1b (40)	40	NA	No	No
i_Aer_PBL_LR_temp	1956	i2b	2	degrees Celsius * 100	No	i2b
i_Aer_PBL_LR_pres	1958	i2b	2	millibars of mercury * 10	No	i2b
i_Aer_PBL_LR_relh	1960	i2b	2	percentage * 100	No	i2b
i_Surface_temp	1962	i2b (4)	8	degrees Celsius * 100	No	i2b
i_Surface_pres	1970	i2b (4)	8	millibars of mercury * 10	No	i2b
i_Surface_relh	1978	i2b (4)	8	percentage * 100	No	i2b
i_Surface_wind	1986	i2b (4)	8	meters/second * 100	No	i2b
i_Surface_wdir	1994	i2b (4)	8	degrees * 10	No	i2b
i_Aer_ir_OD	2002	i2b (2)	4	Unknown	No	i2b
i_cld_ir_OD	2006	i2b (10, 4)	80	Unknown	No	i2b
i_Aer_ir_ODFlg	2086	i1b (2)	2	N/A	No	No
i_cld_ir_ODFlg	2088	i1b (10, 4)	40	N/A	No	No
i_FRir_ODflg	2128	i1b (160)	160	NA	No	No
i_FRir_qaFlag	2288	i1b (160)	160	NA	No	No
i_FRir_cldtop	2448	i2b (160)	320	deka-meters	No	i2b
i_Aer_b20_prop	2768	i1b (20, 5)	100	Unknown	No	i1b
i_PBL_prop	2868	i1b (20)	20	Unknown	No	i1b
i_spare3	2888	i1b (144)	144	N/A	No	No

Table C-4 GLA11 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
Total Bytes	3032					

C.1.6 GLA12

Each record contains 1 second of data.

Table C-5 GLA12 Record Format

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/ Flag
Record Type:GLA12_MAIN; % of Granule: 25; Record Duration (seconds):1; Repeats: 1						
Latest : Last Modified : Mon Sep 19 09:22:56 GMT-0400 (EDT) 2005						
i_rec_ndx	0	i4b	4	N/A	0	no
i_UTCTime	4	i4b (2)	8	seconds, microseconds	0	no
i_transtime	12	i2b	2	microseconds	0	i2b
i_Spare1	14	i1b (2)	2	N/A	null	No
i_deltagpstmcor	16	i4b	4	nanoseconds	0	gi_invalid_i4b
i_dShotTime	20	i4b (39)	156	microseconds	0	No
i_lat	176	i4b (40)	160	microdeg	-90000000	i4b
i_lon	336	i4b (40)	160	microdeg	0	i4b
i_elev	496	i4b (40)	160	mm	-500000	i4b
i_PADPoint	656	i4b (6, 40)	960	Unitless*1000000	-1000000	i4b
i_PODFixedPos	1616	i4b (6, 40)	960	3 * (m, mm)	-7.00E+10	i4b
i_sigmaatt	2576	i2b (40)	80	Unitless	0	i2b
i_Azimuth	2656	i4b	4	millideg	0	i4b
i_SolAng	2660	i4b	4	microdeg	-90000000	i4b
i_tpintensity_avg	2664	i4b	4	counts	0	i4b
i_tpazimuth_avg	2668	i2b	2	degrees*10	0	i2b
i_tpeccentricity_avg	2670	i2b	2	Unitless*1000	0	i2b
i_tpmajoraxis_avg	2672	i2b	2	cm	0	i2b
i_Spare2	2674	i1b (2)	2	null	null	null
i_gdHt	2676	i2b (2)	4	cm	-20000	i2b
i_erElv	2680	i2b (2)	4	mm	-10000	i2b
i_spElv	2684	i2b (4)	8	mm	-10000	i2b
i_ldElv	2692	i2b (4)	8	mm	-10000	i2b
i_ocElv	2700	i2b (2)	4	mm	-10000	i2b
i_wTrop	2704	i2b (2)	4	mm	-1000	i2b

Table C-5 GLA12 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/ Flag
i_dTrop	2708	i2b (40)	80	mm	-2500	i2b
i_surfType	2788	i1b	1	N/A	1	No
i_Spare3	2789	i1b (3)	3	N/A	null	null
i_DEM_elv	2792	i4b (40)	160	cm	-50000	i4b
i_refRng	2952	i4b (40)	160	mm	400000000	i4b
i_TrshRngOff	3112	i4b (40)	160	mm	-150000	i4b
i_isRngOff	3272	i4b (40)	160	mm	-150000	i4b
i_SigEndOff	3432	i4b (40)	160	mm	-150000	i4b
i_cntRngOff	3592	i4b (40)	160	mm	-150000	i4b
i_reflctUncorr	3752	i4b (40)	160	Unitless*1E06	0	i4b
i_reflCor_atm	3912	i4b	4	Unitless*1E06	0	i4b
i_maxSmAmp	3916	i2b (40)	80	Tenth of millivolts	-300	No
i_SigmaElv	3996	i2b (40)	80	mm	0	i2b
i_numPk	4076	i1b (40)	40	N/A	0	No
i_kurt2	4116	i2b (40)	80	unitless * 100	-1000	i2b
i_skew2	4196	i2b (40)	80	unitless * 100	-10000	i2b
i_IceSheetRuf	4276	i2b (40)	80	cm	0	i2b
i_IsSlopeEmp	4356	i2b (40)	80	millideg	0	i2b
i_IsRngLast	4436	i4b (40)	160	mm	-150000	i4b
i_IsRngFst	4596	i4b (40)	160	mm	-150000	i4b
i_IceSVar	4756	i2b (40)	80	millivolts	0	i2b
i_ElvuseFlg	4836	i1b (5)	5	N/A	-127	No
i_atm_avail	4841	i1b	1	NA	0	No
i_erd	4842	i2b	2	Millimeters	0	i2b
i_rdu	4844	i2b	2	Millimeters	0	i2b
i_cld1_mswf	4846	i1b	1	NA	0	No
i_MRC_af	4847	i1b	1	NA	0	No
i_SurfRuf_slpQF	4848	i1b (40)	40	N/A	0	No
i_ElvFlg	4888	i1b (40)	40	N/A	0	No
i_rng_UQF	4928	i2b (40)	80	N/A	0	No
i_atmQF	5008	i1b (10)	10	N/A	0	No
i_timecorflg	5018	i2b	2	N/A	0	No
i_APID_AvFlg	5020	i1b (8)	8	n/a	-127	No
i_AttFlg2	5028	i1b (20)	20	NA	0	no
i_spare5	5048	i1b	1	NA	0	NA

Table C-5 GLA12 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/ Flag
i_FrameQF	5049	i1b	1	N/A	0	No
i_OrbFlg	5050	i1b (2)	2	NA	0	no
i_rngCorrFlg	5052	i1b (2)	2	N/A	0	No
i_CorrStatFlg	5054	i1b (2)	2	NA	0	no
i_beam_coelev	5056	i4b	4	degrees*100	0	i4b
i_beam_azimuth	5060	i4b	4	degrees*100	0	i4b
i_AttFlg1	5064	i2b	2	N/A	0	No
i_Spare6	5066	i1b (2)	2	N/A	null	null
i_DEM_hires_src	5068	i1b (40)	40	NA	0	No
i_DEM_hires_elv	5108	i2b (40)	80	meters	-500	i2b
i_satNdx	5188	i1b (40)	40	ns	0	i1b
i_satRngCorr	5228	i2b (40)	80	mm	0	i2b
i_satCorrFlg	5308	i1b (40)	40	NA	NA	No
i_satNrgCorr	5348	i2b (40)	80	mm	0	i2b
i_satPwdCorr	5428	i2b (40)	80	mm	0	i2b
i_gval_rcv	5508	i2b (40)	80	counts	0	i2b
i_RecNrgAll	5588	i2b (40)	80	0.01 fJoules	0	i_APID_AvFlg
i_FRir_cldtop	5668	i2b (40)	80	deka-meters	0	i2b
i_FRir_qaFlag	5748	i1b (40)	40	NA	0	No
i_FRir_ODflg	5788	i1b (40)	40	NA	0	No
i_FRir_intsig	5828	i2b (40)	80	e7/(m-sr)	0	i2b
i_msRngCorr	5908	i2b (40)	80	Unknown	0	i2b
i_msCorrFlg	5988	i1b (40)	40	Unknown	0	No
i_Surface_temp	6028	i2b	2	degrees Celsius * 100	-10000	i2b
i_Surface_pres	6030	i2b	2	millibars of mercury * 10	0	i2b
i_Surface_relh	6032	i2b	2	percentage * 100	0	i2b
i_spare7	6034	i1b (566)	566	NA	null	null
Total Bytes	6600					

C.1.7 GLA13

Each record contains 1 second of data.

Table C-6 GLA13 Record Format

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
Record Type:GLA13_MAIN; % of Granule: 25; Record Duration (seconds):1; Repeats: 1						
Latest : Last Modified : Mon Sep 19 09:22:56 GMT-0400 (EDT) 2005						
i_rec_ndx	0	i4b	4	N/A	0	no
i_UTCTime	4	i4b (2)	8	seconds, microseconds	0	no
i_transtime	12	i2b	2	microseconds	0	i2b
i_Spare1	14	i1b (2)	2	N/A	null	No
i_deltagpstmcor	16	i4b	4	nanoseconds	0	gi_invalid_i4b
i_dShotTime	20	i4b (39)	156	microseconds	0	No
i_lat	176	i4b (40)	160	microdeg	-90000000	i4b
i_lon	336	i4b (40)	160	microdeg	0	i4b
i_elev	496	i4b (40)	160	mm	-500000	i4b
i_PADPoint	656	i4b (6, 40)	960	Unitless*1000000	-1000000	i4b
i_PODFixedPos	1616	i4b (6, 40)	960	3 * (m, mm)	-7.00E+10	i4b
i_sigmaatt	2576	i2b (40)	80	Unitless	0	i2b
i_Azimuth	2656	i4b	4	millideg	0	i4b
i_SolAng	2660	i4b	4	microdeg	-90000000	i4b
i_tpintensity_avg	2664	i4b	4	counts	0	i4b
i_tpazimuth_avg	2668	i2b	2	degrees*10	0	i2b
i_tpeccentricity_avg	2670	i2b	2	Unitless*1000	0	i2b
i_tpmajoraxis_avg	2672	i2b	2	cm	0	i2b
i_Spare2	2674	i1b (2)	2	N/A	null	No
i_gdHt	2676	i2b 2)	4	cm	-20000	i2b
i_erElv	2680	i2b 2)	4	mm	-10000	i2b
i_spElv	2684	i2b 4)	8	mm	-10000	i2b
i_ldElv	2692	i2b (4)	8	mm	-10000	i2b
i_ocElv	2700	i2b (2)	4	mm	-10000	i2b
i_wTrop	2704	i2b (2)	4	mm	-1000	i2b
i_dTrop	2708	i2b (40)	80	mm	-2500	i2b
i_surfType	2788	i1b	1	N/A	1	No
i_Spare3	2789	i1b (3)	3	N/A	null	No
i_DEM_elv	2792	i4b (40)	160	cm	-50000	i4b
i_refRng	2952	i4b (40)	160	mm	400000000	i4b

Table C-6 GLA13 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
i_TrshRngOff	3112	i4b (40)	160	mm	-150000	i4b
i_siRngOff	3272	i4b (40)	160	mm	-150000	i4b
i_SigEndOff	3432	i4b (40)	160	mm	-150000	i4b
i_cntRngOff	3592	i4b (40)	160	mm	-150000	i4b
i_reflctUncorr	3752	i4b (40)	160	Unitless*1E06	0	i4b
i_reflCor_atm	3912	i4b	4	Unitless*1E06	0	i4b
i_maxSmAmp	3916	i2b (40)	80	Tenth of millivolts	-300	No
i_SigmaElv	3996	i2b (40)	80	mm	0	i2b
i_numPk	4076	i1b (40)	40	N/A	0	No
i_RufSeaIce	4116	i2b (40)	80	cm	0	i2b
i_skew2	4196	i2b (40)	80	unitless * 100	-10000	i2b
i_SiRufLstPk	4276	i2b (40)	80	cm	0	i2b
I_AvgRuf	4356	i2b (40)	80	cm	0	i4b
i_BergElev	4436	i4b (40)	160	mm	0	i4b
i_Spare7	4596	i2b (40)	80	N/A	null	No
i_SiRufMaxPk	4676	i2b (40)	80	cm	0	i2b
i_SiRngFst	4756	i4b (40)	160	mm	-150000	i4b
i_SeaIceVar	4916	i2b (40)	80	millivolts	0	i2b
i_ElvuseFlg	4996	i1b (5)	5	N/A	-127	No
i_atm_avail	5001	i1b	1	NA	0	No
i_erd	5002	i2b	2	Millimeters	0	i2b
i_rdu	5004	i2b	2	Millimeters	0	i2b
i_cld1_mswf	5006	i1b	1	NA	0	No
i_MRC_af	5007	i1b	1	NA	0	No
i_SiRufQF	5008	i1b (40)	40	N/A	0	No
i_ElvFlg	5048	i1b (40)	40	N/A	0	No
i_rng_UQF	5088	i2b (40)	80	N/A	0	No
i_atmQF	5168	i1b (10)	10	N/A	0	No
i_timecorflg	5178	i2b	2	N/A	0	No
i_APID_AvFlg	5180	i1b (8)	8	n/a	-127	No
i_AttFlg2	5188	i1b (20)	20	NA	0	no
i_spare5	5208	i1b	1	NA	0	NA
i_FrameQF	5209	i1b	1	N/A	0	No
i_OrbFlg	5210	i1b (2)	2	NA	0	no
i_rngCorrFlg	5212	i1b (2)	2	N/A	0	No

Table C-6 GLA13 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
i_CorrStatFlg	5214	i1b (2)	2	NA	0	no
i_beam_coelev	5216	i4b	4	degrees*100	0	i4b
i_beam_azimuth	5220	i4b	4	degrees*100	0	i4b
i_AttFlg1	5224	i2b	2	N/A	0	No
i_Spare6	5226	i1b (2)	2	N/A	null	No
i_DEM_hires_src	5228	i1b (40)	40	NA	0	No
i_DEM_hires_elv	5268	i2b (40)	80	meters	-500	i2b
i_satNdx	5348	i1b (40)	40	ns	0	i1b
i_satRngCorr	5388	i2b (40)	80	mm	0	i2b
i_satCorrFlg	5468	i1b (40)	40	NA	NA	No
i_satNrgCorr	5508	i2b 40)	80	mm	0	i2b
i_satPwdCorr	5588	i2b (40)	80	mm	0	i2b
i_gval_rcv	5668	i2b (40)	80	counts	0	i2b
i_RecNrgAll	5748	i2b (40)	80	0.01 fJoules	0	i_APID_AvFlg
i_FRir_cldtop	5828	i2b (40)	80	deka-meters	0	i2b
i_FRir_qaFlag	5908	i1b (40)	40	NA	0	No
i_FRir_ODflg	5948	i1b (40)	40	NA	0	No
i_FRir_intsig	5988	i2b (40)	80	e7/(m-sr)	0	i2b
i_msRngCorr	6068	i2b (40)	80	Unknown	0	i2b
i_msCorrFlg	6148	i1b (40)	40	Unknown	0	No
i_Surface_temp	6188	i2b	2	degrees Celsius * 100	-10000	i2b
i_Surface_pres	6190	i2b	2	millibars of mercury * 10	0	i2b
i_Surface_relh	6192	i2b	2	percentage * 100	0	i2b
i_spare8	6194	i1b (566)	566	N/A	null	No
Total Bytes	6760					

C.1.8 GLA14

Each record contains 1 second of data.

Table C-7 GLA14 Record Format

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
Record Type:GLA14_MAIN; % of Granule: 30; Record Duration (seconds):1; Repeats: 1						
Latest : Last Modified : Mon Sep 19 09:22:56 GMT-0400 (EDT) 2005						
i_rec_ndx	0	i4b	4	N/A	0	no

Table C-7 GLA14 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
i_UTCTime	4	i4b (2)	8	seconds, microseconds	0	no
i_transtime	12	i2b	2	microseconds	0	i2b
i_Spare1	14	i1b (2)	2	N/A	null	No
i_deltagpstmcor	16	i4b	4	nanoseconds	0	gi_invalid_i4b
i_dShotTime	20	i4b (39)	156	microseconds	0	No
i_lat	176	i4b (40)	160	microdeg	-90000000	i4b
i_lon	336	i4b (40)	160	microdeg	0	i4b
i_elev	496	i4b (40)	160	mm	-500000	i4b
i_PADPoint	656	i4b (6, 40)	960	Unitless*1000000	-1000000	i4b
i_PODFixedPos	1616	i4b (6, 40)	960	3 * (m, mm)	-7.00E+10	i4b
i_sigmaatt	2576	i2b (40)	80	Unitless	0	i2b
i_Azimuth	2656	i4b	4	millideg	0	i4b
i_SolAng	2660	i4b	4	microdeg	-90000000	i4b
i_tpintensity_avg	2664	i4b	4	counts	0	i4b
i_tpazimuth_avg	2668	i2b	2	degrees*10	0	i2b
i_tpeccentricity_avg	2670	i2b	2	Unitless*1000	0	i2b
i_tpmajoraxis_avg	2672	i2b	2	cm	0	i2b
i_Spare2	2674	i1b (2)	2	N/A	null	No
i_gdHt	2676	i2b (2)	4	cm	-20000	i2b
i_erElv	2680	i2b (2)	4	mm	-10000	i2b
i_spElv	2684	i2b (4)	8	mm	-10000	i2b
i_ldElv	2692	i2b (4)	8	mm	-10000	i2b
i_ocElv	2700	i2b (2)	4	mm	-10000	i2b
i_wTrop	2704	i2b (2)	4	mm	-1000	i2b
i_dTrop	2708	i2b (40)	80	mm	-2500	i2b
i_surfType	2788	i1b	1	N/A	1	No
i_Spare3	2789	i1b (3)	3	N/A	null	No
i_DEM_elv	2792	i4b (40)	160	cm	-50000	i4b
i_refRng	2952	i4b (40)	160	mm	400000000	i4b
i_SigBegOff	3112	i4b (40)	160	mm	-150000	i4b
i_ldRngOff	3272	i4b (40)	160	mm	-150000	i4b
i_SigEndOff	3432	i4b (40)	160	mm	-150000	i4b
i_gpCntRngOff	3592	i4b (6, 40)	960	mm	-150000	i4b
i_reflctUncorr	4552	i4b (40)	160	Unitless*1E06	0	i4b
i_reflCor_atm	4712	i4b	4	Unitless*1E06	0	i4b

Table C-7 GLA14 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
i_maxSmAmp	4716	i2b (40)	80	Tenth of millivolts	-300	No
i_SigmaElv	4796	i2b (40)	80	mm	0	i2b
i_numPk	4876	i1b (40)	40	N/A	0	No
i_kurt1	4916	i2b (40)	80	unitless * 100	-1000	i2b
i_skew1	4996	i2b (40)	80	unitless * 100	-10000	i2b
i_LdRufLstPk	5076	i2b (40)	80	cm	0	i2b
i_LandSlopeLast	5156	i2b (40)	80	millideg	0	i2b
i_Gamp	5236	i4b (6, 40)	960	0.01 volts	0	i4b
i_Garea	6196	i4b (6, 40)	960	0.01 volts * ns	0	i4b
i_Gsigma	7156	i4b (6, 40)	960	0.001 ns	0	i4b
i_nPeaks1	8116	i1b (40)	40	NA	0	no
i_LandVar	8156	i2b (40)	80	millivolts	0	i2b
i_ElvuseFlg	8236	i1b (5)	5	N/A	-127	No
i_atm_avail	8241	i1b	1	NA	0	No
i_erd	8242	i2b	2	Millimeters	0	i2b
i_rdu	8244	i2b	2	Millimeters	0	i2b
i_cld1_mswf	8246	i1b	1	NA	0	No
i_MRC_af	8247	i1b	1	NA	0	No
i_SurfRuf_slpQF	8248	i1b (40)	40	N/A	0	No
i_ElvFlg	8288	i1b (40)	40	N/A	0	No
i_rng_UQF	8328	i2b (40)	80	N/A	0	No
i_atmQF	8408	i1b (10)	10	N/A	0	No
i_timecorflg	8418	i2b	2	N/A	0	No
i_APID_AvFlg	8420	i1b (8)	8	n/a	-127	No
i_AttFlg2	8428	i1b (20)	20	NA	0	no
i_spare5	8448	i1b	1	NA	0	NA
i_FrameQF	8449	i1b	1	N/A	0	No
i_OrbFlg	8450	i1b (2)	2	NA	0	no
i_rngCorrFlg	8452	i1b (2)	2	N/A	0	No
i_CorrStatFlg	8454	i1b (2)	2	NA	0	no
i_beam_coelev	8456	i4b	4	degrees*100	0	i4b
i_beam_azimuth	8460	i4b	4	degrees*100	0	i4b
i_AttFlg1	8464	i2b	2	N/A	0	No
i_Spare6	8466	i1b (2)	2	N/A	null	No
i_DEM_hires_src	8468	i1b (40)	40	NA	0	No

Table C-7 GLA14 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
i_DEM_hires_elv	8508	i2b (40)	80	meters	-500	i2b
i_satNdx	8588	i1b (40)	40	ns	0	i1b
i_satRngCorr	8628	i2b (40)	80	mm	0	i2b
i_satCorrFlg	8708	i1b (40)	40	NA	NA	No
i_satNrgCorr	8748	i2b (40)	80	mm	0	i2b
i_satPwdCorr	8828	i2b (40)	80	mm	0	i2b
i_gval_rcv	8908	i2b (40)	80	counts	0	i2b
i_RecNrgAll	8988	i2b (40)	80	0.01 fJoules	0	i_APID_AvFlg
i_FRir_cldtop	9068	i2b (40)	80	deka-meters	0	i2b
i_FRir_qaFlag	9148	i1b (40)	40	NA	0	No
i_FRir_ODflg	9188	i1b (40)	40	NA	0	No
i_FRir_intsig	9228	i2b (40)	80	e7/(m-sr)	0	i2b
i_msRngCorr	9308	i2b (40)	80	Unknown	0	i2b
i_msCorrFlg	9388	i1b (40)	40	Unknown	0	No
i_Surface_temp	9428	i2b	2	degrees Celsius * 100	-10000	i2b
i_Surface_pres	9430	i2b	2	millibars of mercury * 10	0	i2b
i_Surface_relh	9432	i2b	2	percentage * 100	0	i2b
i_Spare7	9434	i1b (566)	566	NA	null	null
Total Bytes	10000					

C.1.9 GLA15

Each record contains 1 second of data.

Table C-8 GLA15 Record Format

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
Record Type:GLA15_MAIN; % of Granule: 70; Record Duration (seconds):1; Repeats: 1						
Latest : Last Modified : Mon Sep 19 09:22:56 GMT-0400 (EDT) 2005						
i_rec_ndx	0	i4b	4	N/A	No	no
i_UTCTime	4	i4b (2)	8	seconds, microseconds	No	no
i_transtime	12	i2b	2	microseconds	No	i2b
i_Spare1	14	i1b (2)	2	N/A	No	No
i_deltagpstmcor	16	i4b	4	nanoseconds	No	gi_invalid_i4b
i_dShotTime	20	i4b (39)	156	microseconds	No	No

Table C-8 GLA15 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
i_lat	176	i4b (40)	160	microdeg	No	i4b
i_lon	336	i4b (40)	160	microdeg	No	i4b
i_elev	496	i4b (40)	160	mm	No	i4b
i_PADPoint	656	i4b (6, 40)	960	Unitless*1000000	No	i4b
i_PODFixedPos	1616	i4b (6, 40)	960	3 * (m, mm)	No	i4b
i_sigmaatt	2576	i2b (40)	80	Unitless	No	i2b
i_Azimuth	2656	i4b	4	millideg	No	i4b
i_SolAng	2660	i4b	4	microdeg	No	i4b
i_tpintensity_avg	2664	i4b	4	counts	No	i4b
i_tpazimuth_avg	2668	i2b	2	degrees*10	No	i2b
i_tpeccentricity_avg	2670	i2b	2	Unitless*1000	No	i2b
i_tpmajoraxis_avg	2672	i2b	2	cm	No	i2b
i_Spare2	2674	i1b (2)	2	N/A	No	No
i_gdHt	2676	i2b (2)	4	cm	No	i2b
i_erElv	2680	i2b (2)	4	mm	No	i2b
i_spElv	2684	i2b (4)	8	mm	No	i2b
i_ldElv	2692	i2b (4)	8	mm	No	i2b
i_ocElv	2700	i2b (2)	4	mm	No	i2b
i_wTrop	2704	i2b (2)	4	mm	No	i2b
i_dTrop	2708	i2b (40)	80	mm	No	i2b
i_surfType	2788	i1b	1	N/A	No	No
i_Spare3	2789	i1b (3)	3	N/A	No	No
i_DEM_elv	2792	i4b (40)	160	cm	No	i4b
i_refRng	2952	i4b (40)	160	mm	No	i4b
i_TrshRngOff	3112	i4b (40)	160	mm	No	i4b
i_ocRngOff	3272	i4b (40)	160	mm	No	i4b
i_SigEndOff	3432	i4b (40)	160	mm	No	i4b
i_cntRngOff	3592	i4b (40)	160	mm	No	i4b
i_reflctUncorr	3752	i4b (40)	160	Unitless*1E06	No	i4b
i_reflCor_atm	3912	i4b	4	Unitless*1E06	No	i4b
i_maxSmAmp	3916	i2b (40)	80	Tenth of millivolts	No	No
i_SigmaElv	3996	i2b (40)	80	mm	No	i2b
i_numPk	4076	i1b (40)	40	N/A	No	No
i_skew2	4116	i2b (40)	80	unitless * 100	No	i2b
i_OcRufRMS	4196	i4b	4	mm	No	i4b

Table C-8 GLA15 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
i_OcMeanElev	4200	i4b	4	mm	No	i4b
i_lowElev	4204	i4b (40)	160	mm	No	i4b
i_highElev	4364	i4b (40)	160	mm	No	i4b
i_OceanVar	4524	i2b (40)	80	millivolts	No	i2b
i_ElvuseFlg	4604	i1b (5)	5	N/A	No	No
i_atm_avail	4609	i1b	1	NA	No	No
i_erd	4610	i2b	2	Millimeters	No	i2b
i_rdu	4612	i2b	2	Millimeters	No	i2b
i_cld1_mswf	4614	i1b	1	NA	No	No
i_MRC_af	4615	i1b	1	NA	No	No
i_OcRMSqf	4616	i1b (40)	40	null	No	N
i_ElvFlg	4656	i1b (40)	40	N/A	No	No
i_rng_UQF	4696	i2b (40)	80	N/A	No	No
i_atmQF	4776	i1b (10)	10	N/A	No	No
i_timecorflg	4786	i2b	2	N/A	No	No
i_APID_AvFlg	4788	i1b (8)	8	n/a	No	No
i_AttFlg2	4796	i1b (20)	20	NA	No	no
i_spare5	4816	i1b	1	NA	No	NA
i_FrameQF	4817	i1b	1	N/A	No	No
i_OrbFlg	4818	i1b (2)	2	NA	No	no
i_rngCorrFlg	4820	i1b (2)	2	N/A	No	No
i_CorrStatFlg	4822	i1b (2)	2	NA	No	no
i_beam_coelev	4824	i4b	4	degrees*100	No	i4b
i_beam_azimuth	4828	i4b	4	degrees*100	No	i4b
i_AttFlg1	4832	i2b	2	N/A	No	No
i_Spare6	4834	i1b (2)	2	N/A	No	No
i_satNdx	4836	i1b (40)	40	ns	Yes	i1b
i_satRngCorr	4876	i2b (40)	80	mm	No	i2b
i_satCorrFlg	4956	i1b (40)	40	NA	NA	No
i_satNrgCorr	4996	i2b (40)	80	mm	No	i2b
i_satPwdCorr	5076	i2b (40)	80	mm	No	i2b
i_gval_rcv	5156	i2b (40)	80	counts	No	i2b
i_RecNrgAll	5236	i2b (40)	80	0.01 fJoules	No	i_APID_AvFlg
i_FRir_cldtop	5316	i2b (40)	80	deka-meters	No	i2b
i_FRir_qaFlag	5396	i1b (40)	40	NA	No	No

Table C-8 GLA15 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
i_FRir_ODflg	5436	i1b (40)	40	NA	No	No
i_FRir_intsig	5476	i2b (40)	80	e7/(m-sr)	No	i2b
i_msRngCorr	5556	i2b (40)	80	Unknown	No	i2b
i_msCorrFlg	5636	i1b (40)	40	Unknown	No	No
i_Surface_temp	5676	i2b	2	degrees Celsius * 100	No	i2b
i_Surface_pres	5678	i2b	2	millibars of mercury * 10	No	i2b
i_Surface_relh	5680	i2b	2	percentage * 100	No	i2b
i_Surface_wind	5682	i2b	2	meters/second * 100	No	i2b
i_Surface_wdir	5684	i2b	2	degrees * 10	No	i2b
i_Spare7	5686	i1b (594)	594	N/A	No	No
Total Bytes	6280					

Appendix D
Data Dictionary

D.1 Data Dictionary

D.1.1 GLA08 Record

```
Product Var Name:     i_rec_ndx
Is element of:        GLA01 Long Waveform Record, GLA01 Main Record ,
GLA01_Short_Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO
Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04
SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record,
GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description:    GLAS Record Index
Product Data Type:    i4b
Total Bytes:          4
Product Units:        N/A
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      2147483647
Description:          Unique index that relates this record to the corresponding
record(s) in each GLAS data product.
Comments:

Product Var Name:     i_UTCTime
Is element of:        GLA01 Long Waveform Record, GLA01 Main Record ,
GLA01_Short_Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO
Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04
SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record,
GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description:    Transmit Time of First Shot in frame in J2000
Product Data Type:    i4b (2)
Total Bytes:          8
Product Units:        seconds, microseconds
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      2147483647
Description:          The transmit time in UTC of the 1st shot in the 1 second frame
referenced to noon on Jan 1, 2000.   The first item is the whole number of seconds ; the
second item is the fractional part in microseconds.
Comments:             This is not the ground bounce time, but the transmit time.

Product Var Name:     i_beam_coelev
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Co-elevation
Product Data Type:    i4b (4)
Total Bytes:          16
Product Units:        degrees*100
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
```

```
Product Minimum:      0
Product Maximum:      36000
Description:          Co-elevation (CE) is direction from vertical of the laser beam as
seen by an observer located at the laser ground spot.
Comments:

Product Var Name:     i_beam_azimuth
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Azimuth
Product Data Type:    i4b (4)
Total Bytes:          16
Product Units:        degrees*100
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      36000
Description:          Azimuth (Az) is the direction clockwise from north of the laser
beam as seen by an observer at the laser ground spot.Comments:

Product Var Name:     i_pad_angle
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    PAD Angle
Product Data Type:    i4b ( 4)
Total Bytes:          16
Product Units:        microdegrees
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      3600000000
Description:          Attitude angle calculated from PAD and POD.Comments:

Product Var Name:     i_spare0
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Spares
Product Data Type:    i1b (40)
Total Bytes:          40
Product Units:        null
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         NA
Product Minimum:      0
Product Maximum:      0
Description:
Comments:

Product Var Name:     i_AttFlg1
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Attitude flag
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      null
Product Maximum:      null
Description:          Composite Flag - see Common Flag Spreadsheet for details
```

```
Please see <a href='flags/i_AttFlg1.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name:     i_lat
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Profile Location, Latitude
Product Data Type:    i4b ( 4)
Total Bytes:          16
Product Units:        microdegrees
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -90000000
Product Maximum:      90000000
Description:          Profile coordinate in the IERS Terrestrial Reference Frame: east
longitude and latitude, at the 1 herz rate.
Comments:

Product Var Name:     i_lon
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Profile Location, Longitude
Product Data Type:    i4b ( 4)
Total Bytes:          16
Product Units:        microdegrees
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      360000000
Description:          Profile coordinate in the IERS Terrestrial Reference Frame: east
longitude and latitude, at the 1 herz rate.
Comments:

Product Var Name:     i_OrbFlg
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Orbit flag
Product Data Type:    i1b (2, 4)
Total Bytes:          8
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      128
Description:          Composite Flag - see Common Flag Spreadsheet for details
Please see <a href='flags/i_OrbFlg.pdf'> the PDF flag description</a> for more details.
There are 4 sets of this flag value, 1/sec for each of the 4 sec covered in the record.
Comments:

Product Var Name:     i_surfType
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Region Type
Product Data Type:    i1b ( 4)
Total Bytes:          4
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      1
```

```
Product Maximum:      15
Description:          Describes the region type or types associated with each shot Ice
Sheet, ocean, sea ice, or Land.
Please see <a href='flags/i_surfType.pdf'> the PDF flag description</a> for more de-
tails.
Comments:

Product Var Name:     i_LidarQF
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Lidar Frame quality flag
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      null
Product Maximum:      null
Description:          Composite Flag - see Common Flag Spreadsheet for details
Please see <a href='flags/i_LidarQF.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name:     i_atm_dem
Is element of:        GLA08 Record
Short Description:    DEM value at current location from 1 km x 1 km grid
Product Data Type:    i4b ( 4)
Total Bytes:          16
Product Units:        meters
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -32768
Product Maximum:      32768
Description:          Surface height value for current location from 1 km x 1 km grid
Comments:

Product Var Name:     i4_aer_bot
Is element of:        GLA08 Record
Short Description:    Below 20 KM Aerosol Layer Bottom at 532 nm
Product Data Type:    i2b (5)
Total Bytes:          10
Product Units:        deka-meters
Invalid Value/Flag:   i4_aer_af
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      2000
Description:          The aerosol layer bottoms (below 20 KM in atmosphere) for up to 5
layers at 1 per 4 sec.
Comments:

Product Var Name:     i4_aer_top
Is element of:        GLA08 Record
Short Description:    Below 20 KM Aerosol Layer Top at 532 nm
Product Data Type:    i2b (5)
Total Bytes:          10
Product Units:        deka-meters
Invalid Value/Flag:   i4_aer_af
Is Correction Flag?:  NA
```

```
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      2000
Description:          The aerosol layer tops (below 20 KM in atmosphere) for up to 5
layers at 1 per 4 sec.
Comments:

Product Var Name:     i20_aer_bot
Is element of:        GLA08 Record
Short Description:    20-40 KM Aerosol Layer Bottom at 532 nm
Product Data Type:    i2b (3)
Total Bytes:          6
Product Units:        deka-meters
Invalid Value/Flag:   i20_aer_af
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      1000
Product Maximum:      4000
Description:          The aerosol layer bottoms (20 - 40 KM in atmosphere) for up to 3
layers at 1 per 4 sec.
Comments:

Product Var Name:     i20_aer_top
Is element of:        GLA08 Record
Short Description:    20-40 KM Aerosol Layer Top at 532 nm
Product Data Type:    i2b (3)
Total Bytes:          6
Product Units:        deka-meters
Invalid Value/Flag:   i20_aer_af
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      1000
Product Maximum:      4000
Description:          The aerosol layer tops (20 - 40 KM in atmosphere) for up to 3 layers
at 1 per 4 sec.
Comments:

Product Var Name:     i_LRpbl_ht
Is element of:        GLA08 Record
Short Description:    Low Resolution PBL Height at 532 nm
Product Data Type:    i2b
Total Bytes:          2
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      700
Description:          Low resolution height of the planetary boundary layer, as derived
from the aerosol structure; the low resolution data is averaged over 4 seconds.
Comments:

Product Var Name:     i_LRpbl_grd
Is element of:        GLA08 Record
Short Description:    Ground Detection for Low Res PBL at 532 nm
Product Data Type:    i2b
Total Bytes:          2
Product Units:        deka-meters
Invalid Value/Flag:   i2b
```

```
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      1000
Description:          The height above the reference ellipsoid of the ground used by the
low res PBL processing algorithms.
Comments:

Product Var Name:     i_HRpbl_ht
Is element of:        GLA08 Record
Short Description:    High Resolution PBL Height at 532 nm
Product Data Type:    i2b ( 20)
Total Bytes:          40
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      700
Description:          High resolution height of the planetary boundary layer, as derived
from the aerosol structure; the high resolution data occurs at the rate of 5 per second.
Comments:

Product Var Name:     i_HRpbl_grd
Is element of:        GLA08 Record
Short Description:    Ground Detection for High Res PBL
Product Data Type:    i2b ( 20)
Total Bytes:          40
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      1000
Description:          The height above the reference ellipsoid of the ground used by the
high res PBL processing algorithms.
Comments:

Product Var Name:     i4_aer_pct
Is element of:        GLA08 Record
Short Description:    Percentage of Saturated Bins in Below 20 KM Aerosol Layers at 532
nm
Product Data Type:    i1b (5)
Total Bytes:          5
Product Units:        unitless
Invalid Value/Flag:   i4_aer_af
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      100
Description:          Percentage of Saturated Bins in Below 20 KM Aerosol Layers at 532
nm
Comments:

Product Var Name:     i20_aer_pct
Is element of:        GLA08 Record
Short Description:    Percentage of Saturated Bins in 20-40 KM Aerosol Layers at 532 nm
Product Data Type:    i1b (3)
Total Bytes:          3
```

```
Product Units:        unitless
Invalid Value/Flag:   i20_aer_af
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      100
Description:          Percentage of Saturated Bins in 20-40 KM Aerosol Layers at 532 nm
Comments:

Product Var Name:     i_LRpbl_pct
Is element of:        GLA08 Record
Short Description:    Percentage of Saturated Bins in Low Resolution PBL Layer at 532 nm
Product Data Type:    i1b
Total Bytes:          1
Product Units:        unitless
Invalid Value/Flag:   i1b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      100
Description:          Percentage of Saturated Bins in Low Resolution PBL Layer at 532 nm
Comments:

Product Var Name:     i_LayHgt_Flag
Is element of:        GLA08 Record
Short Description:    Layer Height Flag
Product Data Type:    i1b ( 32)
Total Bytes:          32
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      15
Description:          Composite Flag - see Breakout for details
Please see <a href='flags/i_LayHgt_Flag.pdf'> the PDF flag description</a> for more de-
tails.Comments:

Product Var Name:     i_AttFlg3
Is element of:        GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11
Record
Short Description:    Attitude Flag 3
Product Data Type:    i1b
Total Bytes:          1
Product Units:        NA
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1
Description:          Please see <a href='flags/i_AttFlg3.pdf'> the PDF flag descrip-
tion</a> for more details.
Comments:

Product Var Name:     i_timecorflg
Is element of:        GLA01 Main Record , GLA02 Record, GLA03 Main Record, GLA04 BST Main
Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS
Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08
Record, GLA09 Record, GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14
```

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Record, GLA15 Record
Short Description:    time correction flag
Product Data Type:    i2b
Total Bytes:          2
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  No
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      32767
Description:          Indicates what instrument or bias corrections were applied to the
times on this record. Please see <a href='flags/i_timecorflg.pdf'> the PDF flag descrip-
tion</a> for more details.
Comments:

Product Var Name:     i_Solar_Angle
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Solar Angle
Product Data Type:    i4b ( 4)
Total Bytes:          16
Product Units:        micro-degrees
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -90000000
Product Maximum:      90000000
Description:          Incident angle of sun from normal.
Comments:

Product Var Name:     i_Aer_top_b20_temp
Is element of:        GLA08 Record
Short Description:    Temperature of Top of Aerosol Layers in Bottom 20km of Atmosphere
at 532 nm
Product Data Type:    i2b ( 5)
Total Bytes:          10
Product Units:        degrees Celsius * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          Temperature of Top of Aerosol Layers in Bottom 20km of Atmosphere
at 532 nm
Comments:

Product Var Name:     i_Aer_top_b20_pres
Is element of:        GLA08 Record
Short Description:    Pressure of Top of Aerosol Layers in Bottom 20km of Atmosphere at
532 nm
Product Data Type:    i2b ( 5)
Total Bytes:          10
Product Units:        millibars of mercury * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Pressure of Top of Aerosol Layers in Bottom 20km of Atmosphere at
532 nm
```

```
Comments:

Product Var Name:     i_Aer_top_b20_relh
Is element of:        GLA08 Record
Short Description:    Relative Humidity of Top of Aerosol Layers in Bottom 20km of Atm
at 532 nm
Product Data Type:    i2b ( 5)
Total Bytes:          10
Product Units:        percentage * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:          Relative Humidity of Top of Aerosol Layers in Bottom 20km of At-
mosphere at 532 nm
Comments:

Product Var Name:     i_Aer_bot_b20_temp
Is element of:        GLA08 Record
Short Description:    Temperature of Bottom of Aerosol Layers in Bottom 20km of Atmo-
sphere at 532 nm
Product Data Type:    i2b ( 5)
Total Bytes:          10
Product Units:        degrees Celsius * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          Temperature of Bottom of Aerosol Layers in Bottom 20km of Atmo-
sphere at 532 nm
Comments:

Product Var Name:     i_Aer_bot_b20_pres
Is element of:        GLA08 Record
Short Description:    Pressure of Bottom of Aerosol Layers in Bottom 20km of Atmosphere
at 532 nm
Product Data Type:    i2b ( 5)
Total Bytes:          10
Product Units:        millibars of mercury * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Pressure of Bottom of Aerosol Layers in Bottom 20km of Atmosphere
at 532 nm
Comments:

Product Var Name:     i_Aer_bot_b20_relh
Is element of:        GLA08 Record
Short Description:    Relative Humidity of Bottom of Aerosol Layers in Bottom 20km of
Atm at 532 nm
Product Data Type:    i2b ( 5)
Total Bytes:          10
Product Units:        percentage * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
```

```
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:          Relative Humidity of Bottom of Aerosol Layers in Bottom 20km of
Atmosphere at 532 nm
Comments:

Product Var Name:     i_Aer_top_a20_temp
Is element of:        GLA08 Record
Short Description:    Temperature of Top oof Aerosol Layers Above 20km of Atmosphere at
532 nm
Product Data Type:    i2b ( 3)
Total Bytes:          6
Product Units:        degrees Celsius * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  No
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          Temperature of Top oof Aerosol Layers Above 20km of Atmosphere at
532 nm
Comments:

Product Var Name:     i_Aer_top_a20_pres
Is element of:        GLA08 Record
Short Description:    Pressure of Top of Aerosol Layers Above 20km of Atmosphere at 532
nm
Product Data Type:    i2b ( 3)
Total Bytes:          6
Product Units:        millbars of mercury * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Pressure of Top of Aerosol Layers Above 20km of Atmosphere at 532
nm
Comments:

Product Var Name:     i_Aer_top_a20_relh
Is element of:        GLA08 Record
Short Description:    Relative Humidity of Top of Aerosol Layers Above 20km of Atmosphere
at 532 nm
Product Data Type:    i2b ( 3)
Total Bytes:          6
Product Units:        percentage * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:          Relative Humidity of Top of Aerosol Layers Above 20km of Atmosphere
at 532 nm
Comments:

Product Var Name:     i_Aer_bot_a20_temp
Is element of:        GLA08 Record
Short Description:    Temperature of Bottom of Aerosol Layers Above 20km of Atmosphere
at 532 nm
```

```
Product Data Type:    i2b ( 3)
Total Bytes:          6
Product Units:        degrees Celsius * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          Temperature of Bottom of Aerosol Layers Above 20km of Atmosphere
at 532 nm
Comments:

Product Var Name:     i_Aer_bot_a20_pres
Is element of:        GLA08 Record
Short Description:    Pressure of Bottom of Aerosol Layers Above 20km of Atmosphere at
532 nm
Product Data Type:    i2b ( 3)
Total Bytes:          6
Product Units:        millbars of mercury * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Pressure of Bottom of Aerosol Layers Above 20km of Atmosphere at
532 nm
Comments:

Product Var Name:     i_Aer_bot_a20_relh
Is element of:        GLA08 Record
Short Description:    Relative Humidity of Bottom of Aerosol Layers Above 20km of Atmo-
sphere at 532 nm
Product Data Type:    i2b ( 3)
Total Bytes:          6
Product Units:        percentage * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:          Relative Humidity of Bottom of Aerosol Layers Above 20km of Atmo-
sphere at 532 nm
Comments:

Product Var Name:     i_Aer_PBL_LR_temp
Is element of:        GLA08 Record, GLA11 Record
Short Description:    Temperature of Low Resolution Planetary Boundary Layer Top at 532
nm
Product Data Type:    i2b
Total Bytes:          2
Product Units:        degrees Celsius * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          Temperature of Low Resolution Planetary Boundary Layer Top at 532
nm
Comments:
```

```
Product Var Name:     i_Aer_PBL_LR_pres
Is element of:        GLA08 Record, GLA11 Record
Short Description:    Pressure of Low Resolution Planetary Boundary Layer Top at 532 nm
Product Data Type:    i2b
Total Bytes:          2
Product Units:        millibars of mercury * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Pressure of Low Resolution Planetary Boundary Layer Top at 532 nm
Comments:

Product Var Name:     i_Aer_PBL_LR_relh
Is element of:        GLA08 Record, GLA11 Record
Short Description:    Relative Humidity of Low Resolution Planetary Boundary Layer Top
at 532 nm
Product Data Type:    i2b
Total Bytes:          2
Product Units:        percentage * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:          Relative Humidity of Low Resolution Planetary Boundary Layer Top
at 532 nm
Comments:

Product Var Name:     i_Aer_ir_top
Is element of:        GLA08 Record, GLA11 Record
Short Description:    Elevation of Top of Aerosol Layers Detected in 1064 nm
Product Data Type:    i2b ( 2)
Total Bytes:          4
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      2200
Description:          Elevation of Top of Aerosol Layers detected in 1064 nm
Comments:

Product Var Name:     i_Aer_ir_bot
Is element of:        GLA08 Record, GLA11 Record
Short Description:    Elevation of Bottom of Aerosol Layers Detected in 1064 nm
Product Data Type:    i2b ( 2)
Total Bytes:          4
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      2200
Description:          Elevation of Bottom of Aerosol Layers Detected in 1064 nm.
Comments:
```

```
Product Var Name:     i_Aer_ir_layflg
Is element of:        GLA08 Record
Short Description:    Layer Flag for 1064 Aerosol
Product Data Type:    i1b ( 2)
Total Bytes:          2
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      null
Product Maximum:      null
Description:          Please see <a href='flags/i_Aer_ir_layflg.pdf'> the PDF flag de-
scription</a> for more details.Comments:

Product Var Name:     i_Aer_ir_top_temp
Is element of:        GLA08 Record, GLA11 Record
Short Description:    Temperature  of Top of Aerosol Layers Detected in 1064 nm
Product Data Type:    i2b ( 2)
Total Bytes:          4
Product Units:        degrees Celsius * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          Temperature of Top of Aerosol Layers Detected in 1064 nm
Comments:

Product Var Name:     i_Aer_ir_top_pres
Is element of:        GLA08 Record, GLA11 Record
Short Description:    Pressure of Top of Aerosol Layers Detected in 1064 nm
Product Data Type:    i2b ( 2)
Total Bytes:          4
Product Units:        millibars of mercury * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Pressure of Top of Aerosol Layers Detected in 1064 nm
Comments:

Product Var Name:     i_Aer_ir_top_relh
Is element of:        GLA08 Record, GLA11 Record
Short Description:    Relative Humidity of Top of Aerosol Layers Detected in 1064 nm
Product Data Type:    i2b ( 2)
Total Bytes:          4
Product Units:        percentage * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:          Relative Humidity of Top of Aerosol Layers Detected in 1064 nm
Comments:

Product Var Name:     i_Aer_ir_bot_temp
Is element of:        GLA08 Record, GLA11 Record
Short Description:    Temperature of Bottom of Aerosol Layers Detected in 1064 nm
```

```
Product Data Type:    i2b ( 2)
Total Bytes:          4
Product Units:        degrees Celsius * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          Temperature of Bottom of Aerosol Layers Detected in 1064 nm
Comments:

Product Var Name:     i_Aer_ir_bot_pres
Is element of:        GLA08 Record, GLA11 Record
Short Description:    Pressure of Bottom of Aerosol Layers Detected in 1064 nm
Product Data Type:    i2b ( 2)
Total Bytes:          4
Product Units:        millibars of mercury * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Pressure of Bottom of Aerosol Layers Detected in 1064 nmComments:

Product Var Name:     i_Aer_ir_bot_relh
Is element of:        GLA08 Record, GLA11 Record
Short Description:    Relative Humidity of Bottom of Aerosol Layers Detected in 1064 nm
Product Data Type:    i2b ( 2)
Total Bytes:          4
Product Units:        percentage * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:          Relative Humidity of Bottom of Aerosol Layers Detected in 1064 nm
Comments:

Product Var Name:     i_Surface_temp
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Surface Temperature
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        degrees Celsius * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          Surface Temperature, 4 of 1-second intervals.
Comments:

Product Var Name:     i_Surface_pres
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Surface Pressure
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        millibars of mercury * 10
Invalid Value/Flag:   i2b
```

```
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Surface Pressure, 4 of 1-second intervals.
Comments:

Product Var Name:     i_Surface_relh
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Surface Relative Humidity
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        percentage * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:          Surface Relative Humidity, 4 of 1-second intervals.
Comments:

Product Var Name:     i_Surface_wind
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Surface Wind Speed
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        meters/second * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Surface Wind Speed, 4 of 1-second intervals.
Comments:

Product Var Name:     i_Surface_wdir
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Surface Wind Direction Azimuth from North
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        degrees * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      3600
Description:          Surface wind direction azimuth from North, 4 of 1-second intervals.
Comments:

Product Var Name:     i_spare2
Is element of:        GLA08 Record
Short Description:    Spares
Product Data Type:    i1b (264)
Total Bytes:          264
Product Units:        NA
Invalid Value/Flag:   NA
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      null
```

```
Product Maximum:      null
Description:          not used
Comments:
```

D.1.2 GLA09 Record

```
Product Var Name:     i_rec_ndx
Is element of:        GLA01 Long Waveform Record, GLA01 Main Record ,
GLA01_Short_Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO
Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04
SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record,
GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description:    GLAS Record Index
Product Data Type:    i4b
Total Bytes:          4
Product Units:        N/A
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      2147483647
Description:          Unique index that relates this record to the corresponding
record(s) in each GLAS data product.
Comments:

Product Var Name:     i_UTCTime
Is element of:        GLA01 Long Waveform Record, GLA01 Main Record ,
GLA01_Short_Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO
Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04
SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record,
GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description:    Transmit Time of First Shot in frame in J2000
Product Data Type:    i4b (2)
Total Bytes:          8
Product Units:        seconds, microseconds
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      2147483647
Description:          The transmit time in UTC of the 1st shot in the 1 second frame
referenced to noon on Jan 1, 2000.   The first item is the whole number of seconds ; the
second item is the fractional part in microseconds.
Comments:             This is not the ground bounce time, but the transmit time.

Product Var Name:     i_beam_coelev
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Co-elevation
Product Data Type:    i4b (4)
Total Bytes:          16
Product Units:        degrees*100
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      36000
Description:          Co-elevation (CE) is direction from vertical of the laser beam as
seen by an observer located at the laser ground spot.
Comments:
```

```
Product Var Name:     i_beam_azimuth
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Azimuth
Product Data Type:    i4b (4)
Total Bytes:          16
Product Units:        degrees*100
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      36000
Description:          Azimuth (Az) is the direction clockwise from north of the laser
beam as seen by an observer at the laser ground spot.Comments:

Product Var Name:     i_pad_angle
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    PAD Angle
Product Data Type:    i4b ( 4)
Total Bytes:          16
Product Units:        microdegrees
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      3600000000
Description:          Attitude angle calculated from PAD and POD.Comments:

Product Var Name:     i_spare0
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Spares
Product Data Type:    i1b (40)
Total Bytes:          40
Product Units:        null
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         NA
Product Minimum:      0
Product Maximum:      0
Description:
Comments:

Product Var Name:     i_AttFlg1
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Attitude flag
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      null
Product Maximum:      null
Description:          Composite Flag - see Common Flag Spreadsheet for details
Please see <a href='flags/i_AttFlg1.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name:     i_lat
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
```

```
Short Description:    Profile Location, Latitude
Product Data Type:    i4b ( 4)
Total Bytes:          16
Product Units:        microdegrees
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -90000000
Product Maximum:      90000000
Description:          Profile coordinate in the IERS Terrestrial Reference Frame: east
longitude and latitude, at the 1 herz rate.
Comments:

Product Var Name:     i_lon
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Profile Location, Longitude
Product Data Type:    i4b ( 4)
Total Bytes:          16
Product Units:        microdegrees
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      360000000
Description:          Profile coordinate in the IERS Terrestrial Reference Frame: east
longitude and latitude, at the 1 herz rate.
Comments:

Product Var Name:     i_OrbFlg
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Orbit flag
Product Data Type:    i1b (2, 4)
Total Bytes:          8
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      128
Description:          Composite Flag - see Common Flag Spreadsheet for details
Please see <a href='flags/i_OrbFlg.pdf'> the PDF flag description</a> for more details.
There are 4 sets of this flag value, 1/sec for each of the 4 sec covered in the record.
Comments:

Product Var Name:     i_surfType
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Region Type
Product Data Type:    i1b ( 4)
Total Bytes:          4
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      1
Product Maximum:      15
Description:          Describes the region type or types associated with each shot Ice
Sheet, ocean, sea ice, or Land.
Please see <a href='flags/i_surfType.pdf'> the PDF flag description</a> for more de-
tails.
```

```
Comments:

Product Var Name:     i_LidarQF
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Lidar Frame quality flag
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      null
Product Maximum:      null
Description:          Composite Flag - see Common Flag Spreadsheet for details
Please see <a href='flags/i_LidarQF.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name:     i_spare2
Is element of:        GLA09 Record
Short Description:    Spares
Product Data Type:    i1b (8)
Total Bytes:          8
Product Units:        NA
Invalid Value/Flag:   NA
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      null
Product Maximum:      null
Description:          not used
Comments:

Product Var Name:     i_topo_elev
Is element of:        GLA09 Record
Short Description:    Topographic elevation of surface above geoid
Product Data Type:    i4b ( 4)
Total Bytes:          16
Product Units:        meters
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -2500
Product Maximum:      32000
Description:          Topographic elevation of surface above geoid based upon POD, PAD,
and geoid
Comments:

Product Var Name:     i_atm_dem
Is element of:        GLA09 Record
Short Description:    DEM value at current location from 1 km x 1 km grid
Product Data Type:    i4b ( 4)
Total Bytes:          16
Product Units:        meters
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -32768
Product Maximum:      32768
Description:          Surface height value for current location from 1 km x 1 km grid
Comments:
```

```
Product Var Name:     i_LRcld_bot
Is element of:        GLA09 Record
Short Description:    Low Resolution Cloud Bottom at 532 nm
Product Data Type:    i2b (10)
Total Bytes:          20
Product Units:        deka-meters
Invalid Value/Flag:   i_LRC_af
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      2000
Description:          Low resolution height above the reference ellipsoid of the bottom
of a cirrus, thin, or dense cloud layer in the atmosphere.  There can be up to 10 cloud
layers in an atmospheric profile.  The low resolution data occurs at the rate of once
per 4 seconds.
Comments:

Product Var Name:     i_LRcld_top
Is element of:        GLA09 Record
Short Description:    Low Resolution Cloud Top at 532 nm
Product Data Type:    i2b (10)
Total Bytes:          20
Product Units:        deka-meters
Invalid Value/Flag:   i_LRC_af
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      2000
Description:          Low resolution height above the reference ellipsoid of the top of
a cirrus, thin, or dense cloud layer in the atmosphere.  There can be up to 10 cloud
layers in an atmospheric profile.  The low resolution data occurs at the rate of once
per 4 seconds.
Comments:

Product Var Name:     i_LRcld_grd
Is element of:        GLA09 Record
Short Description:    Low Resolution Ground Detection at 532 nm
Product Data Type:    i2b
Total Bytes:          2
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      1000
Description:          The height from the reference ellipsoid of the ground as detected
by the low res cloud processing algorithms. A value of -880 indicates that the ground
was searched for, but not detected.
Comments:

Product Var Name:     i_spare3
Is element of:        GLA09 Record
Short Description:    Spares
Product Data Type:    i1b (2)
Total Bytes:          2
Product Units:        NA
Invalid Value/Flag:   NA
Is Correction Flag?:  NA
```

```
Is Unsigned?:         No
Product Minimum:      null
Product Maximum:      null
Description:          not used
Comments:

Product Var Name:     i_MRcld_bot
Is element of:        GLA09 Record
Short Description:    Medium Resolution Cloud Bottom at 532 nm
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        deka-meters
Invalid Value/Flag:   i_MRC_af
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      2000
Description:          Medium resolution height above the reference ellipsoid of the bot-
tom of a cirrus, thin, or dense cloud layer in the atmosphere.  There can be up to 10
cloud layers in an atmospheric profile.  The medium resolution data occurs at the rate
of once per second.
Comments:

Product Var Name:     i_MRcld_top
Is element of:        GLA09 Record
Short Description:    Medium Resolution Cloud Top at 532 nm
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        deka-meters
Invalid Value/Flag:   i_MRC_af
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      2000
Description:          Medium resolution height above the reference ellipsoid of the top
of a cirrus, thin, or dense cloud layer in the atmosphere.  There can be up to 10 cloud
layers in an atmospheric profile.  The medium resolution data occurs at the rate of once
per second.
Comments:

Product Var Name:     i_MRcld_grd
Is element of:        GLA09 Record
Short Description:    Medium Resolution Ground Detection at 532 nm
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      1000
Description:          The height above the reference ellipsoid of the ground as detected
by the med res cloud processing algorithms. A value of -880 indicates that the ground
was searched for, but not detected.
Comments:

Product Var Name:     i_MRcld_pct
Is element of:        GLA09 Record
Short Description:    Percentage of Saturated Bins in Medium Resolution Cloud Layers at
```

```
532 nm
Product Data Type:    i1b (10, 4)
Total Bytes:          40
Product Units:        unitless
Invalid Value/Flag:   i_MRC_af
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      100
Description:          Percentage of saturated bins in medium resolution cloud layers
Comments:

Product Var Name:     i_HRcld_bot
Is element of:        GLA09 Record
Short Description:    High Resolution Cloud Bottom at 532 nm
Product Data Type:    i2b (10, 20)
Total Bytes:          400
Product Units:        deka-meters
Invalid Value/Flag:   i_HRC_af
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      2000
Description:          High resolution height above the reference ellipsoid of the bottom
of a cirrus, thin, or dense cloud layer below 10KM in the atmosphere.  There can be up
to 10 cloud layers in an atmospheric profile.  The high resolution data occurs at the
rate of 5 per second.
Comments:

Product Var Name:     i_HRcld_top
Is element of:        GLA09 Record
Short Description:    High Resolution Cloud Top at 532 nm
Product Data Type:    i2b (10, 20)
Total Bytes:          400
Product Units:        deka-meters
Invalid Value/Flag:   i_HRC_af
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      2000
Description:          High resolution height above the reference ellipsoid of the top of
a cirrus, thin, or dense cloud layer below 10 KM in the atmosphere.  There can be up to
10 cloud layers in an atmospheric profile.  The high resolution data occurs at the rate
of 5 per second.
Comments:

Product Var Name:     i_HRcld_grd
Is element of:        GLA09 Record
Short Description:    High Resolution Ground Detection at 532 nm
Product Data Type:    i2b ( 20)
Total Bytes:          40
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      1000
Description:          The height above the reference ellipsoid of the ground as detected
by the high res cloud processing algorithms. A value of -880 indicates that the ground
```

```
was searched for, but not detected.
Comments:

Product Var Name:     i_FRcld_bot
Is element of:        GLA09 Record
Short Description:    Full Resolution Cloud Bottom at 532 nm
Product Data Type:    i2b ( 160)
Total Bytes:          320
Product Units:        deka-meters
Invalid Value/Flag:   i_FRC_af
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      400
Description:          The height above the reference ellipsoid to the bottom of the full
resolution cloud layer.   The full resolution data occurs at the rate of 40 per second,
however, the full resolution cloud layer will only be processed from high resolution
layers found below 4 KM.  If there are no high resolution layers below 4 KM then the
full resolution data will be marked as invalid on the product.
Comments:

Product Var Name:     i_FRcld_top
Is element of:        GLA09 Record
Short Description:    Full Resolution Cloud Top at 532 nm
Product Data Type:    i2b ( 160)
Total Bytes:          320
Product Units:        deka-meters
Invalid Value/Flag:   i_FRC_af
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      400
Description:          The height above the reference ellipsoid to the top of the full
resolution cloud layer.  The full resolution data occurs at the rate of 40 per second,
however, the full resolution cloud layer will only be processed from high resolution
layers found below 4 KM.  If there are no high resolution layers below 4 KM then the
full resolution data will be marked as invalid on the product.
Comments:

Product Var Name:     i_FRcld_grd
Is element of:        GLA09 Record
Short Description:    Full Resolution Cloud Ground Detection at 532 nm
Product Data Type:    i2b ( 160)
Total Bytes:          320
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      1000
Description:          The height above the reference ellipsoid of the ground as detected
by the full resolution cloud processing algorithms. A value of -880 indicates that the
ground was searched for, but not detected.
Comments:

Product Var Name:     i_FRg_grd_sig
Is element of:        GLA09 Record
Short Description:    Full Resolution Ground Return Signal at 532 nm
Product Data Type:    i4b ( 160)
```

```
Total Bytes:          640
Product Units:        e9/(m-sr)
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      10000
Product Maximum:      10000000
Description:          Ground return signal from the 532 nm backscatter profile at the
height that the ground return is detected.
Comments:

Product Var Name:     i_FRir_grd_sig
Is element of:        GLA09 Record
Short Description:    Full Resolution Ground Return Signal at 1064 nm
Product Data Type:    i4b ( 160)
Total Bytes:          640
Product Units:        e9/(m-sr)
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      100000
Product Maximum:      10000000
Description:          Ground return signal from the 1064 nm backscatter profile at the
height that the ground return is detected.
Comments:

Product Var Name:     i_LRCL_Flag
Is element of:        GLA09 Record
Short Description:    Low Resolution Cloud Layers Flag for 532 nm
Product Data Type:    i1b ( 11)
Total Bytes:          11
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      15
Description:          Composite Flag - see Breakout for details
Please see <a href='flags/i_LRCL_Flag.pdf'> the PDF flag description</a> for more de-
tails.
Comments:

Product Var Name:     i_MRCL_Flag
Is element of:        GLA09 Record
Short Description:    Medium Resolution Cloud Layers Flag for 532 nm
Product Data Type:    i1b ( 37)
Total Bytes:          37
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      15
Description:          Composite Flag - see Breakout for details
Please see <a href='flags/i_MRCL_Flag.pdf'> the PDF flag description</a> for more de-
tails.
Comments:

Product Var Name:     i_HRCL_Flag
```

```
Is element of:        GLA09 Record
Short Description:    High Resolution Cloud Layers Flag for 532 nm
Product Data Type:    i1b ( 185)
Total Bytes:          185
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      15
Description:          Composite Flag - see Breakout for details
Please see <a href='flags/i_HRCL_Flag.pdf'> the PDF flag description</a> for more de-
tails.
Comments:

Product Var Name:     i_FRCL_Flag
Is element of:        GLA09 Record
Short Description:    Full Resolution Cloud Layers Flag for 532 nm
Product Data Type:    i1b ( 220)
Total Bytes:          220
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      15
Description:          Composite Flag - see Breakout for details
Please see <a href='flags/i_FRCL_Flag.pdf'> the PDF flag description</a> for more de-
tails.

Comments:

Product Var Name:     i_AttFlg3
Is element of:        GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11
Record
Short Description:    Attitude Flag 3
Product Data Type:    i1b
Total Bytes:          1
Product Units:        NA
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1
Description:          Please see <a href='flags/i_AttFlg3.pdf'> the PDF flag descrip-
tion</a> for more details.
Comments:

Product Var Name:     i_timecorflg
Is element of:        GLA01 Main Record , GLA02 Record, GLA03 Main Record, GLA04 BST Main
Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS
Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08
Record, GLA09 Record, GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    time correction flag
Product Data Type:    i2b
Total Bytes:          2
Product Units:        N/A
Invalid Value/Flag:   No
```

```
Is Correction Flag?:  No
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      32767
Description:          Indicates what instrument or bias corrections were applied to the
times on this record. Please see <a href='flags/i_timecorflg.pdf'> the PDF flag descrip-
tion</a> for more details.
Comments:

Product Var Name:     i_FRir_cldtop
Is element of:        GLA09 Record, GLA11 Record
Short Description:    Full Resolution 1064 Cloud Top
Product Data Type:    i2b ( 160)
Total Bytes:          320
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1030
Description:          Full resolution (40 Hz) cloud top height obtained from the 1064
atmospheric channel. This parameter is for a 4 second record. Also parameter is in GLA06,
12-15.
Comments:

Product Var Name:     i_FRir_qaFlag
Is element of:        GLA09 Record, GLA11 Record
Short Description:    Full Resolution 1064 Quality Flag
Product Data Type:    i1b ( 160)
Total Bytes:          160
Product Units:        NA
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      15
Description:          Please see <a href='flags/i_FRir_qaFlag.pdf'> the PDF flag de-
scription</a> for more details.
Comments:

Product Var Name:     i_FRir_intsig
Is element of:        GLA09 Record
Short Description:    Full Resolution 1064 Integrated Signal
Product Data Type:    i2b ( 160)
Total Bytes:          320
Product Units:        e7/(m-sr)
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:          Though called 'integrated signal' this is actually an average of
all bins in the above-ground portion of the 1064 40 Hz profile with values above the
threshold of 1.0e-7 (1/(m-sr). This parameter is for a 4 second record. This parameter
is also in GLA06, 12-15.
Comments:

Product Var Name:     i_Solar_Angle
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
```

```
Short Description:    Solar Angle
Product Data Type:    i4b ( 4)
Total Bytes:          16
Product Units:        micro-degrees
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -90000000
Product Maximum:      90000000
Description:          Incident angle of sun from normal.
Comments:

Product Var Name:     i_LRir_cld_top
Is element of:        GLA09 Record
Short Description:    Elevation of Top of Cloud Layers Detected in 1064 nm at Low Reso-
lution
Product Data Type:    i2b ( 10)
Total Bytes:          20
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      2200
Description:          Elevation of top of cloud layers detected in 1064 nm at low reso-
lution data rate (1 per 4 sec).
Comments:

Product Var Name:     i_LRir_cld_bot
Is element of:        GLA09 Record
Short Description:    Elevation of Bottom of Cloud Layers Detected in 1064 nm at Low Res-
olution
Product Data Type:    i2b ( 10)
Total Bytes:          20
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      2200
Description:          Elevation of Bottom of Cloud Layers Detected in 1064 nm at Low Res-
olution data rate (1 per 4 sec).
Comments:

Product Var Name:     i_LRir_QAflag
Is element of:        GLA09 Record
Short Description:    Low Resolution 1064 nm Cloud Layer QA Flag
Product Data Type:    i1b ( 10)
Total Bytes:          10
Product Units:        NA
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      256
Description:          Low Resolution 1064 nm Cloud Layer QA Flag. Composite Flag - see
Breakout for details
Please see <a href='flags/i_LRir_QAflag.pdf'> the PDF flag description</a> for more de-
tails.
```

```
The data is arranged in 10 bytes.  Within the 10 bytes:

byte 1 leaves bits 4-7 as spare, and stores the af availabilty flag in
         bits 0-3; it provides the number of cloud layers determined
         from 1064 nm data, with 0=layers searched for but not
         detected and 15=cloud layers not searched for
bytes 2-5 are spares
bytes 6-10 are 10 flags, each 4 bits in length giving a quality flag;
         15=cloud layers were not searched for, 0=cloud layers searched
         for but not detected, 1= low chance of being a cloud,
         2=moderate, 3=high, 4=no doubt
Comments:

Product Var Name:     i_LRir_cldtop_temp
Is element of:        GLA09 Record
Short Description:    Temperature of Top of Cloud Layers Detected in 1064 nm at Low Res-
olution
Product Data Type:    i2b ( 10)
Total Bytes:          20
Product Units:        degrees Celsius * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          Temperature of Top of Cloud Layers Detected in 1064 nm at Low Res-
olution data rate (1 per 4 sec).
Comments:

Product Var Name:     i_LRir_cldtop_pres
Is element of:        GLA09 Record
Short Description:    Pressure of Top of Cloud Layers Detected in 1064 nm at Low Reso-
lution
Product Data Type:    i2b ( 10)
Total Bytes:          20
Product Units:        millibars of mercury * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Pressure of Top of Cloud Layers Detected in 1064 nm at Low Reso-
lution data rate (1 per 4 sec).
Comments:

Product Var Name:     i_LRir_cldtop_relh
Is element of:        GLA09 Record
Short Description:    Relative Humidity of Top of Cloud Layers Detected in 1064 nm at
Low Resolution
Product Data Type:    i2b ( 10)
Total Bytes:          20
Product Units:        percentage * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:          Relative Humidity of Top of Cloud Layers Detected in 1064 nm at
```

```
Low Resolution data rate (1 per 4 sec).
Comments:

Product Var Name:     i_LRir_cldbot_temp
Is element of:        GLA09 Record
Short Description:    Temperature of Bottom of Cloud Layers Detected in 1064 nm at Low
Resolution
Product Data Type:    i2b ( 10)
Total Bytes:          20
Product Units:        degrees Celsius * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          Temperature of Bottom of Cloud Layers Detected in 1064 nm at Low
Resolution data rate (1 per 4 sec).
Comments:

Product Var Name:     i_LRir_cldbot_pres
Is element of:        GLA09 Record
Short Description:    Pressure of Bottom of Cloud Layers Detected in 1064 nm at Low Res-
olution
Product Data Type:    i2b ( 10)
Total Bytes:          20
Product Units:        millibars of mercury * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Pressure of Bottom of Cloud Layers Detected in 1064 nm at Low Res-
olution data rate (1 per 4 sec).
Comments:

Product Var Name:     i_LRir_cldbot_relh
Is element of:        GLA09 Record
Short Description:    Relative  Humidity of Bottom of Cloud Layers Detected in 1064 nm
Low Resolution
Product Data Type:    i2b ( 10)
Total Bytes:          20
Product Units:        percentage * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:          Relative Humidity of Bottom of Cloud Layers Detected in 1064 nm
Low Resolution data rate (1 per 4 sec).
Comments:

Product Var Name:     i_MRir_cld_top
Is element of:        GLA09 Record, GLA11 Record
Short Description:    Elevation of Top of Cloud Layers Detected in 1064 nm at Medium Res-
olution
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        deka-meters
Invalid Value/Flag:   i2b
```

```
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      2200
Description:          Elevation of Top of Cloud Layers Detected in 1064 nm at Medium Res-
olution data rate.
Comments:

Product Var Name:     i_MRir_cld_bot
Is element of:        GLA09 Record, GLA11 Record
Short Description:    Elevation of Bottom of Cloud Layers Detected in 1064 nm at Medium
Resolution
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      2200
Description:          Elevation of Bottom of Cloud Layers Detected in 1064 nm at Medium
Resolution data rate.
Comments:

Product Var Name:     i_MRir_QAflag
Is element of:        GLA09 Record, GLA11 Record
Short Description:    Medium Resolution 1064 nm Cloud Layer QA Flag
Product Data Type:    i1b ( 40)
Total Bytes:          40
Product Units:        NA
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Medium Resolution 1064 nm Cloud Layer QA Flag. Composite Flag -
see Breakout for details
Please see <a href='flags/i_MRir_QAflag.pdf'> the PDF flag description</a> for more de-
tails.

The data is arranged in 40 bytes.

bytes 1-18 are spares:
bytes 19-20 are af flags: The 4 'af' flags (4 bits each) are concatenated with the QAflag
storage and are contained in bytes 19-20 starting at bit 0 of byte 20.
bytes 21-40 are QAflags: The QAflag portion has been stored such that interval 1 is in
bytes 40-36, interval 2 in bytes 35-31, interval 3 in bytes 30-26, and interval 4 in
bytes 25-21.  Each of the 10 layer flags per interval is 4 bits in length as before,
such that interval 1 layer 1 is in bits 0-3 and interval 1 layer 2 is in bits 4-7 of
byte 40, interval 1 layer 3 is in bits 0-3 and interval 1 layer 4 is in bits 4-7 of byte
39, etc.

         Quality flag value 15=cloud layers were not searched for; 0=cloud layers were
searched but not detected; 1-14 indicate increasing confidence of good cloud retrieval
(value 1=least confidence, value 14=greatest confidence).
        Availability flag value 15=cloud layers not searched for; 0=layers searched for
but not detected.
Comments:
```

```
Product Var Name:     i_MRir_cldtop_temp
Is element of:        GLA09 Record, GLA11 Record
Short Description:    Temperature of Top of Cloud Layers Detected in 1064 nm at Medium
Resolution
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        degrees Celsius * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          Temperature of Top of Cloud Layers Detected in 1064 nm at Medium
Resolution data rate.
Comments:

Product Var Name:     i_MRir_cldtop_pres
Is element of:        GLA09 Record, GLA11 Record
Short Description:    Pressure of Top of Cloud Layers Detected in 1064 nm at Medium Res-
olution
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        millibars of mercury * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Pressure of Top of Cloud Layers Detected in 1064 nm at Medium Res-
olution data rate.
Comments:

Product Var Name:     i_MRir_cldtop_relh
Is element of:        GLA09 Record, GLA11 Record
Short Description:    Relative Humidity of Top of Cloud Layers in 1064 nm at Medium Res-
olution
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        percentage * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:          Relative Humidity of Top of Cloud Layers in 1064 nm at Medium Res-
olution data rate.
Comments:

Product Var Name:     i_MRir_cldbot_temp
Is element of:        GLA09 Record, GLA11 Record
Short Description:    Temperature of Bottom of Cloud Layers Detected in 1064 nm at Medium
Resolution
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        degrees Celsius * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
```

```
Product Maximum:      10000
Description:          Temperature of Bottom of Cloud Layers Detected in 1064 nm at Medium
Resolution data rate.
Comments:

Product Var Name:     i_MRir_cldbot_pres
Is element of:        GLA09 Record, GLA11 Record
Short Description:    Pressure of Bottom of Cloud Layers Detected in 1064 nm at Medium
Resolution
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        millibars of mercury * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Pressure of Bottom of Cloud Layers Detected in 1064 nm at Medium
Resolution data rate.
Comments:

Product Var Name:     i_MRir_cldbot_relh
Is element of:        GLA09 Record, GLA11 Record
Short Description:    Relative Humidity of Bottom of Cloud Layers Detected in 1064 nm at
MR
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        percentage * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:          Relative Humidity of Bottom of Cloud Layers Detected in 1064 nm at
Medium Resolution data rate.
Comments:

Product Var Name:     i_LRg_cldtop_temp
Is element of:        GLA09 Record
Short Description:    Low Resolution 532 nm Cloud Top Temperature
Product Data Type:    i2b ( 10)
Total Bytes:          20
Product Units:        degrees Celsius * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          Low Resolution 532 nm Cloud Top Temperature
Comments:

Product Var Name:     i_LRg_cldtop_pres
Is element of:        GLA09 Record
Short Description:    Low Resolution 532 nm Cloud Top Pressure
Product Data Type:    i2b ( 10)
Total Bytes:          20
Product Units:        millibars of mercury * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
```

```
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Low Resolution 532 nm Cloud Top Pressure
Comments:

Product Var Name:     i_LRg_cldtop_relh
Is element of:        GLA09 Record
Short Description:    Low Resolution 532 nm Cloud Top Relative Humidity
Product Data Type:    i2b ( 10)
Total Bytes:          20
Product Units:        percentage * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:          Low Resolution 532 nm Cloud Top Relative Humidity
Comments:

Product Var Name:     i_LRg_cldbot_temp
Is element of:        GLA09 Record
Short Description:    Low Resolution 532 nm Cloud Bottom Temperature
Product Data Type:    i2b ( 10)
Total Bytes:          20
Product Units:        degrees Celsius * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          Low Resolution 532 nm Cloud Bottom Temperature
Comments:

Product Var Name:     i_LRg_cldbot_pres
Is element of:        GLA09 Record
Short Description:    Low Resolution 532 nm Cloud Bottom Pressure
Product Data Type:    i2b ( 10)
Total Bytes:          20
Product Units:        millibars of mercury * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Low Resolution 532 nm Cloud Bottom Pressure
Comments:

Product Var Name:     i_LRg_cldbot_relh
Is element of:        GLA09 Record
Short Description:    Low Resolution 532 nm Cloud Bottom Relative Humidity
Product Data Type:    i2b ( 10)
Total Bytes:          20
Product Units:        percentage * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
```

```
Description:          Low Resolution 532 nm Cloud Bottom Relative Humidity
Comments:

Product Var Name:     i_MRg_cldtop_temp
Is element of:        GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Medium Resolution 532 nm Cloud Top Temperature
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        degrees Celsius * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          Medium Resolution 532 nm Cloud Top Temperature
Comments:

Product Var Name:     i_MRg_cldtop_pres
Is element of:        GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Medium Resolution 532 nm Cloud Top Pressure
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        millibars of mercury * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Medium Resolution 532 nm Cloud Top Pressure
Comments:

Product Var Name:     i_MRg_cldtop_relh
Is element of:        GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Medium Resolution 532 nm Cloud Top Relative Humidity
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        percentage * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:          Medium Resolution 532 nm Cloud Top Relative Humidity
Comments:

Product Var Name:     i_MRg_cldbot_temp
Is element of:        GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Medium Resolution 532 nm Cloud Bottom Temperature
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        degrees Celsius * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          Medium Resolution 532 nm Cloud Bottom Temperature
Comments:
```

```
Product Var Name:     i_MRg_cldbot_pres
Is element of:        GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Medium Resolution 532 nm Cloud Bottom Pressure
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        millibars of mercury * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Medium Resolution 532 nm Cloud Bottom Pressure
Comments:

Product Var Name:     i_MRg_cldbot_relh
Is element of:        GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Medium Resolution 532 nm Cloud Bottom Relative Humidity
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        percentage * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:          Medium Resolution 532 nm Cloud Bottom Relative Humidity
Comments:

Product Var Name:     i_LRg_SourceFt
Is element of:        GLA09 Record
Short Description:    Low Resolution Data 532 nm Source Function
Product Data Type:    i2b
Total Bytes:          2
Product Units:        Unknown
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      0
Description:          Low Resolution Data 532 nm Source Function
Comments:

Product Var Name:     i_MRg_SourceFt
Is element of:        GLA09 Record
Short Description:    Medium Resolution Data 532 nm Source Function
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        Unknown
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      0
Description:          Medium Resolution Data 532 nm Source Function
Comments:

Product Var Name:     i_HRg_SourceFt
Is element of:        GLA09 Record
Short Description:    High Resolution Data 532 nm Source Function
```

```
Product Data Type:    i2b ( 20)
Total Bytes:          40
Product Units:        Unknown
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      0
Description:          High Resolution Data 532 nm Source Function
Comments:

Product Var Name:     i_LRir_SourceFt
Is element of:        GLA09 Record
Short Description:    Low Resolution Data 1064 nm Source Function
Product Data Type:    i2b
Total Bytes:          2
Product Units:        Unknown
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      0
Description:          Low Resolution Data 1064 nm Source Function
Comments:

Product Var Name:     i_MRir_SourceFt
Is element of:        GLA09 Record
Short Description:    Medium Resolution Data 1064 nm Source Function
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        Unknown
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      0
Description:          Medium Resolution Data 1064 nm Source FunctionComments:

Product Var Name:     i_Surface_temp
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Surface Temperature
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        degrees Celsius * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          Surface Temperature, 4 of 1-second intervals.
Comments:

Product Var Name:     i_Surface_pres
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Surface Pressure
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        millibars of mercury * 10
Invalid Value/Flag:   i2b
```

```
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Surface Pressure, 4 of 1-second intervals.
Comments:

Product Var Name:     i_Surface_relh
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Surface Relative Humidity
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        percentage * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:          Surface Relative Humidity, 4 of 1-second intervals.
Comments:

Product Var Name:     i_Surface_wind
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Surface Wind Speed
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        meters/second * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Surface Wind Speed, 4 of 1-second intervals.
Comments:

Product Var Name:     i_Surface_wdir
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Surface Wind Direction Azimuth from North
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        degrees * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      3600
Description:          Surface wind direction azimuth from North, 4 of 1-second intervals.
Comments:

Product Var Name:     i_spare4
Is element of:        GLA09 Record
Short Description:    Spares
Product Data Type:    i1b ( 590)
Total Bytes:          590
Product Units:        NA
Invalid Value/Flag:   NA
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      null
```

```
Product Maximum:      null
Description:          not used
Comments:
```

D.1.3 GLA10 Record

```
Product Var Name:     i_rec_ndx
Is element of:        GLA01 Long Waveform Record, GLA01 Main Record ,
GLA01_Short_Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO
Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04
SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record,
GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description:    GLAS Record Index
Product Data Type:    i4b
Total Bytes:          4
Product Units:        N/A
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      2147483647
Description:          Unique index that relates this record to the corresponding
record(s) in each GLAS data product.
Comments:

Product Var Name:     i_UTCTime
Is element of:        GLA01 Long Waveform Record, GLA01 Main Record ,
GLA01_Short_Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO
Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04
SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record,
GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description:    Transmit Time of First Shot in frame in J2000
Product Data Type:    i4b (2)
Total Bytes:          8
Product Units:        seconds, microseconds
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      2147483647
Description:          The transmit time in UTC of the 1st shot in the 1 second frame
referenced to noon on Jan 1, 2000.   The first item is the whole number of seconds ; the
second item is the fractional part in microseconds.
Comments:             This is not the ground bounce time, but the transmit time.

Product Var Name:     i_beam_coelev
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Co-elevation
Product Data Type:    i4b (4)
Total Bytes:          16
Product Units:        degrees*100
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      36000
Description:          Co-elevation (CE) is direction from vertical of the laser beam as
seen by an observer located at the laser ground spot.
Comments:
```

```
Product Var Name:     i_beam_azimuth
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Azimuth
Product Data Type:    i4b (4)
Total Bytes:          16
Product Units:        degrees*100
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      36000
Description:          Azimuth (Az) is the direction clockwise from north of the laser
beam as seen by an observer at the laser ground spot.Comments:

Product Var Name:     i_pad_angle
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    PAD Angle
Product Data Type:    i4b ( 4)
Total Bytes:          16
Product Units:        microdegrees
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      3600000000
Description:          Attitude angle calculated from PAD and POD.Comments:

Product Var Name:     i_spare0
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Spares
Product Data Type:    i1b (40)
Total Bytes:          40
Product Units:        null
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         NA
Product Minimum:      0
Product Maximum:      0
Description:
Comments:

Product Var Name:     i_AttFlg1
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Attitude flag
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      null
Product Maximum:      null
Description:          Composite Flag - see Common Flag Spreadsheet for details
Please see <a href='flags/i_AttFlg1.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name:     i_lat
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
```

```
Short Description:    Profile Location, Latitude
Product Data Type:    i4b ( 4)
Total Bytes:          16
Product Units:        microdegrees
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -90000000
Product Maximum:      90000000
Description:          Profile coordinate in the IERS Terrestrial Reference Frame: east
longitude and latitude, at the 1 herz rate.
Comments:

Product Var Name:     i_lon
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Profile Location, Longitude
Product Data Type:    i4b ( 4)
Total Bytes:          16
Product Units:        microdegrees
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      360000000
Description:          Profile coordinate in the IERS Terrestrial Reference Frame: east
longitude and latitude, at the 1 herz rate.
Comments:

Product Var Name:     i_OrbFlg
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Orbit flag
Product Data Type:    i1b (2, 4)
Total Bytes:          8
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      128
Description:          Composite Flag - see Common Flag Spreadsheet for details
Please see <a href='flags/i_OrbFlg.pdf'> the PDF flag description</a> for more details.
There are 4 sets of this flag value, 1/sec for each of the 4 sec covered in the record.
Comments:

Product Var Name:     i_surfType
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Region Type
Product Data Type:    i1b ( 4)
Total Bytes:          4
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      1
Product Maximum:      15
Description:          Describes the region type or types associated with each shot Ice
Sheet, ocean, sea ice, or Land.
Please see <a href='flags/i_surfType.pdf'> the PDF flag description</a> for more de-
tails.
```

```
Comments:

Product Var Name:     i_LidarQF
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Lidar Frame quality flag
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      null
Product Maximum:      null
Description:          Composite Flag - see Common Flag Spreadsheet for details
Please see <a href='flags/i_LidarQF.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name:     i_cld1_bs_prof
Is element of:        GLA10 record
Short Description:    Cloud Backscatter Cross Section Profile at 532 nm
Product Data Type:    i4b (280, 4)
Total Bytes:          4480
Product Units:        e10/(m-sr)
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -1000000
Product Maximum:      100000000
Description:          532 nm cloud backscatter cross section corrected for attenuation,
from 20 to -1km at 1hz. The first 4*280 bytes refer to the profile at  the first second.
Comments:

Product Var Name:     i_cld1_ext_prof
Is element of:        GLA10 record
Short Description:    Cloud Extinction Cross Section Profile at 32 nm
Product Data Type:    i4b (280, 4)
Total Bytes:          4480
Product Units:        e9/m
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000000
Product Maximum:      1000000000
Description:          Cloud extinction cross section profile from 20 to -1km at 1hz cal-
culated from the 532 nm data. The first 4*280 bytes refer to the profile at  the first
second.
Comments:

Product Var Name:     i_aer4_bs_prof
Is element of:        GLA10 record
Short Description:    Aerosol Backscatter Cross Section Profile at 532nm
Product Data Type:    i4b (548)
Total Bytes:          2192
Product Units:        e10/(m-sr)
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -1000000
Product Maximum:      100000000
```

```
Description:          532 nm aerosol backscatter cross section from 40 to -1km at 0.25hz.
The 4*548 bytes refer to the profile at  the four second interval.
Comments:

Product Var Name:     i_aer4_ext_prof
Is element of:        GLA10 record
Short Description:    Aerosol Extinction Cross Section Profile at 532 nm
Product Data Type:    i4b (548)
Total Bytes:          2192
Product Units:        e9/m
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000000
Product Maximum:      1000000000
Description:          Aerosol extinction cross section profile for 40 to -1km calculated
from the 532 nm data at 0.25hz. The 4*548 bytes refer to the profile at  the four second
interval.
Comments:

Product Var Name:     i_cld1_sval1
Is element of:        GLA10 record
Short Description:    Cloud true S values from table
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        100*sr
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      100
Product Maximum:      20000
Description:          Cloud true extinction to backscatter ratios calculated from mete-
orological and feographic data. The first set of 2*10  bytes refers to the 10 possible
layers at the first second.
Comments:

Product Var Name:     i_cld1_sval2
Is element of:        GLA10 record
Short Description:    Cloud true S values from equation calc.
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        100*sr
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      100
Product Maximum:      20000
Description:          Cloud true extinction to backscatter ratios calculated from opti-
cally thin layer considerations. The first set of 2*10  bytes refers to the 10 possible
layers at the first second.
Comments:

Product Var Name:     i_aer4_sval1
Is element of:        GLA10 record
Short Description:    Aerosol true S Values from table
Product Data Type:    i2b (9)
Total Bytes:          18
Product Units:        100*sr
Invalid Value/Flag:   i2b
```

```
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      100
Product Maximum:      20000
Description:          Aerosol true extinction tom backscatter ratios calculated from me-
teorological and geographic data
Comments:

Product Var Name:     i_aer4_sval2
Is element of:        GLA10 record
Short Description:    Aerosol true S Values from equation calc.
Product Data Type:    i2b (9)
Total Bytes:          18
Product Units:        100*sr
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      100
Product Maximum:      20000
Description:          Aerosol true extinction to backscatter ratios calculated from op-
tically thin layer considerations
Comments:

Product Var Name:     i_cld1_bot
Is element of:        GLA10 record, GLA11 Record
Short Description:    Medium Resolution Cloud Bottom at 532 nm
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      2000
Description:          Medium resolution cloud bottom heights for layers which were se-
lected for optical processing at 1hz, 1 per layer, 10 layers
Comments:

Product Var Name:     i_cld1_top
Is element of:        GLA10 record, GLA11 Record
Short Description:    Medium Resolution Cloud Top at 532 nm
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      2000
Description:          Medium resolution cloud top heights for layers which were selected
for optical processing at 1hz, 1 per layer, 10 layers
Comments:

Product Var Name:     i_cld1_grd_det
Is element of:        GLA10 record, GLA11 Record
Short Description:    Medium Resolution Ground Detection at 532 nm
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        deka-meters
```

```
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      2000
Description:          Medium resolution processed ground height at 1hz, 1 per profile
Comments:

Product Var Name:     i_aer4_bot
Is element of:        GLA10 record
Short Description:    Low Resolution Aerosol Layer Bottom at 532 nm
Product Data Type:    i2b (9)
Total Bytes:          18
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      4000
Description:          Low resolution aerosol layer bottom heights for layers which were
selected for optical processing at 0.25hz, 1 per layer, 9 layers including the planetary
boundary layer and PSC
Comments:

Product Var Name:     i_aer4_top
Is element of:        GLA10 record
Short Description:    Low Resolution Aerosol Layer Top at 532 nm
Product Data Type:    i2b (9)
Total Bytes:          18
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      4000
Description:          Low resolution aerosol layer top heights for layers which were se-
lected for optical processing at 0.25hz, 1 per layer, 9 layers including the planetary
boundary layer and PSC
Comments:

Product Var Name:     i_pbl4_grd_det
Is element of:        GLA10 record
Short Description:    Low Resolution Aerosol Layer Ground Detection
Product Data Type:    i2b
Total Bytes:          2
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      1000
Description:          Low resolution processed ground detection height at 0.25hz, 1 per
profile
Comments:

Product Var Name:     i_spare2
Is element of:        GLA10 record
Short Description:    Spares
Product Data Type:    i1b ( 2)
```

```
Total Bytes:          2
Product Units:        NA
Invalid Value/Flag:   NA
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      null
Product Maximum:      null
Description:          not used
Comments:

Product Var Name:     i_cld1_sval_uf
Is element of:        GLA10 record
Short Description:    Cloud true S values use flag
Product Data Type:    i1b ( 20)
Total Bytes:          20
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      15
Description:          Cloud true S values use flag for 10 layers at 1 Hz for 4 sec. First
40 bits are for 10 layers of first second, last 40 bits are for 10 layers of 4th second.
Please see <a href='flags/i_cld1_sval_uf.pdf'> the PDF flag description</a> for more de-
tails.
Comments:

Product Var Name:     i_aer4_sval_uf
Is element of:        GLA10 record
Short Description:    Aerosol true S Values use flag
Product Data Type:    i1b ( 5)
Total Bytes:          5
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      15
Description:          Aerosol true S values use flag for 9 layers at 1 per 4 sec. First
4 bits are for first layer, last 4 bits are for 9th layer. Bits 36-39 are spares needed
to make 5 bytes.
Please see <a href='flags/i_aer4_sval_uf.pdf'> the PDF flag description</a> for more de-
tails.
Comments:

Product Var Name:     i_spare3
Is element of:        GLA10 record
Short Description:    Spares
Product Data Type:    i1b (3)
Total Bytes:          3
Product Units:        NA
Invalid Value/Flag:   NA
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      null
Product Maximum:      null
Description:          not used
Comments:
```

```
Product Var Name:     i_cld1_bs_flag
Is element of:        GLA10 record
Short Description:    Cloud backscatter flag for 532 nm
Product Data Type:    i1b ( 40)
Total Bytes:          40
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      15
Description:          Composite Flag - see Breakout for details
Please see <a href='flags/i_cld1_bs_flag.pdf'> the PDF flag description</a> for more de-
tails.
Comments:

Product Var Name:     i_cld1_ext_flag
Is element of:        GLA10 record
Short Description:    Cloud extinction flag at 532 nm
Product Data Type:    i1b ( 40)
Total Bytes:          40
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      15
Description:          Composite Flag - see Breakout for details
Please see <a href='flags/i_cld1_ext_flag.pdf'> the PDF flag description</a> for more
details.
Comments:

Product Var Name:     i_aer4_bs_flag
Is element of:        GLA10 record
Short Description:    Aerosol backscatter flag for 532 nm
Product Data Type:    i1b ( 10)
Total Bytes:          10
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      15
Description:          Composite Flag - see Breakout for details
Please see <a href='flags/i_aer4_bs_flag.pdf'> the PDF flag description</a> for more de-
tails.
Comments:

Product Var Name:     i_aer4_ext_flag
Is element of:        GLA10 record
Short Description:    Aerosol extinction flag for 532 nm
Product Data Type:    i1b ( 10)
Total Bytes:          10
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      15
```

```
Description:          Composite Flag - see Breakout for details
Please see <a href='flags/i_aer4_ext_flag.pdf'> the PDF flag description</a> for more
details.
Comments:

Product Var Name:     i_spare4
Is element of:        GLA10 record
Short Description:    Spares
Product Data Type:    i1b
Total Bytes:          1
Product Units:        null
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         NA
Product Minimum:      0
Product Maximum:      0
Description:
Comments:

Product Var Name:     i_AttFlg3
Is element of:        GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11
Record
Short Description:    Attitude Flag 3
Product Data Type:    i1b
Total Bytes:          1
Product Units:        NA
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1
Description:          Please see <a href='flags/i_AttFlg3.pdf'> the PDF flag descrip-
tion</a> for more details.
Comments:

Product Var Name:     i_timecorflg
Is element of:        GLA01 Main Record , GLA02 Record, GLA03 Main Record, GLA04 BST Main
Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS
Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08
Record, GLA09 Record, GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    time correction flag
Product Data Type:    i2b
Total Bytes:          2
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  No
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      32767
Description:          Indicates what instrument or bias corrections were applied to the
times on this record. Please see <a href='flags/i_timecorflg.pdf'> the PDF flag descrip-
tion</a> for more details.
Comments:

Product Var Name:     i_Solar_Angle
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Solar Angle
Product Data Type:    i4b ( 4)
```

```
Total Bytes:          16
Product Units:        micro-degrees
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -90000000
Product Maximum:      90000000
Description:          Incident angle of sun from normal.
Comments:

Product Var Name:     i_MRg_cldtop_temp
Is element of:        GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Medium Resolution 532 nm Cloud Top Temperature
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        degrees Celsius * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          Medium Resolution 532 nm Cloud Top Temperature
Comments:

Product Var Name:     i_MRg_cldtop_pres
Is element of:        GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Medium Resolution 532 nm Cloud Top Pressure
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        millibars of mercury * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Medium Resolution 532 nm Cloud Top Pressure
Comments:

Product Var Name:     i_MRg_cldtop_relh
Is element of:        GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Medium Resolution 532 nm Cloud Top Relative Humidity
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        percentage * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:          Medium Resolution 532 nm Cloud Top Relative Humidity
Comments:

Product Var Name:     i_MRg_cldbot_temp
Is element of:        GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Medium Resolution 532 nm Cloud Bottom Temperature
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        degrees Celsius * 100
Invalid Value/Flag:   i2b
```

```
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          Medium Resolution 532 nm Cloud Bottom Temperature
Comments:

Product Var Name:     i_MRg_cldbot_pres
Is element of:        GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Medium Resolution 532 nm Cloud Bottom Pressure
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        millibars of mercury * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Medium Resolution 532 nm Cloud Bottom Pressure
Comments:

Product Var Name:     i_MRg_cldbot_relh
Is element of:        GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Medium Resolution 532 nm Cloud Bottom Relative Humidity
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        percentage * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:          Medium Resolution 532 nm Cloud Bottom Relative Humidity
Comments:

Product Var Name:     i_Aer_top_temp
Is element of:        GLA10 record, GLA11 Record
Short Description:    Aerosol Layers Temperature at Top of Layer at 532 nm
Product Data Type:    i2b ( 9)
Total Bytes:          18
Product Units:        degrees Celsius * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          Aerosol Layers Temperature at Top of Layer at 532 nm
Comments:

Product Var Name:     i_Aer_top_pres
Is element of:        GLA10 record, GLA11 Record
Short Description:    Aerosol Layers Pressure at Top of Layer at 532 nm
Product Data Type:    i2b ( 9)
Total Bytes:          18
Product Units:        millibars of mercury * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
```

```
Product Maximum:      20000
Description:          Aerosol Layers Pressure at Top of Layer at 532 nm
Comments:

Product Var Name:     i_Aer_top_relh
Is element of:        GLA10 record, GLA11 Record
Short Description:    Aerosol Layers Relative Humidity at Top of Layer at 532 nm
Product Data Type:    i2b ( 9)
Total Bytes:          18
Product Units:        percentage * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:          Aerosol Layers Relative Humidity at Top of Layer at 532 nm
Comments:

Product Var Name:     i_Aer_bot_temp
Is element of:        GLA10 record, GLA11 Record
Short Description:    Aerosol Layers Temperature at Bottom of Layer at 532 nm
Product Data Type:    i2b ( 9)
Total Bytes:          18
Product Units:        degrees Celsius * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          Aerosol Layers Temperature at Bottom of Layer at 532 nm
Comments:

Product Var Name:     i_Aer_bot_pres
Is element of:        GLA10 record, GLA11 Record
Short Description:    Aerosol Layers Pressure at Bottom of Layer at 532 nm
Product Data Type:    i2b ( 9)
Total Bytes:          18
Product Units:        millibars of mercury * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Aerosol Layers Pressure at Bottom of Layer at 532 nm
Comments:

Product Var Name:     i_Aer_bot_relh
Is element of:        GLA10 record, GLA11 Record
Short Description:    Aerosol Layers Relative Humidity at Bottom of Layer at 532 nm
Product Data Type:    i2b ( 9)
Total Bytes:          18
Product Units:        percentage * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:          Aerosol Layers Relative Humidity at Bottom of Layer at 532 nm
Comments:
```

```
Product Var Name:     i_Surface_temp
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Surface Temperature
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        degrees Celsius * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          Surface Temperature, 4 of 1-second intervals.
Comments:

Product Var Name:     i_Surface_pres
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Surface Pressure
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        millibars of mercury * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Surface Pressure, 4 of 1-second intervals.
Comments:

Product Var Name:     i_Surface_relh
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Surface Relative Humidity
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        percentage * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:          Surface Relative Humidity, 4 of 1-second intervals.
Comments:

Product Var Name:     i_Surface_wind
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Surface Wind Speed
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        meters/second * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Surface Wind Speed, 4 of 1-second intervals.
Comments:

Product Var Name:     i_Surface_wdir
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
```

```
Short Description:    Surface Wind Direction Azimuth from North
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        degrees * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      3600
Description:          Surface wind direction azimuth from North, 4 of 1-second intervals.
Comments:

Product Var Name:     i_spare5
Is element of:        GLA10 record
Short Description:    Spares
Product Data Type:    i1b (292)
Total Bytes:          292
Product Units:        NA
Invalid Value/Flag:   NA
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      0
Description:          not used
Comments:
```

D.1.4 GLA11 Record

```
Product Var Name:     i_rec_ndx
Is element of:        GLA01 Long Waveform Record, GLA01 Main Record ,
GLA01_Short_Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO
Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04
SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record,
GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description:    GLAS Record Index
Product Data Type:    i4b
Total Bytes:          4
Product Units:        N/A
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      2147483647
Description:          Unique index that relates this record to the corresponding
record(s) in each GLAS data product.
Comments:

Product Var Name:     i_UTCTime
Is element of:        GLA01 Long Waveform Record, GLA01 Main Record ,
GLA01_Short_Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO
Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04
SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record,
GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description:    Transmit Time of First Shot in frame in J2000
Product Data Type:    i4b (2)
Total Bytes:          8
Product Units:        seconds, microseconds
Invalid Value/Flag:   no
Is Correction Flag?:  NA
```

```
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      2147483647
Description:          The transmit time in UTC of the 1st shot in the 1 second frame
referenced to noon on Jan 1, 2000.   The first item is the whole number of seconds ; the
second item is the fractional part in microseconds.
Comments:             This is not the ground bounce time, but the transmit time.

Product Var Name:     i_beam_coelev
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Co-elevation
Product Data Type:    i4b (4)
Total Bytes:          16
Product Units:        degrees*100
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      36000
Description:          Co-elevation (CE) is direction from vertical of the laser beam as
seen by an observer located at the laser ground spot.
Comments:

Product Var Name:     i_beam_azimuth
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Azimuth
Product Data Type:    i4b (4)
Total Bytes:          16
Product Units:        degrees*100
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      36000
Description:          Azimuth (Az) is the direction clockwise from north of the laser
beam as seen by an observer at the laser ground spot.Comments:

Product Var Name:     i_pad_angle
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    PAD Angle
Product Data Type:    i4b ( 4)
Total Bytes:          16
Product Units:        microdegrees
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      3600000000
Description:          Attitude angle calculated from PAD and POD.Comments:

Product Var Name:     i_spare0
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Spares
Product Data Type:    i1b (40)
Total Bytes:          40
Product Units:        null
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         NA
```

```
Product Minimum:      0
Product Maximum:      0
Description:
Comments:

Product Var Name:     i_AttFlg1
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Attitude flag
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      null
Product Maximum:      null
Description:          Composite Flag - see Common Flag Spreadsheet for details
Please see <a href='flags/i_AttFlg1.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name:     i_lat
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Profile Location, Latitude
Product Data Type:    i4b ( 4)
Total Bytes:          16
Product Units:        microdegrees
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -90000000
Product Maximum:      90000000
Description:          Profile coordinate in the IERS Terrestrial Reference Frame: east
longitude and latitude, at the 1 herz rate.
Comments:

Product Var Name:     i_lon
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Profile Location, Longitude
Product Data Type:    i4b ( 4)
Total Bytes:          16
Product Units:        microdegrees
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      360000000
Description:          Profile coordinate in the IERS Terrestrial Reference Frame: east
longitude and latitude, at the 1 herz rate.
Comments:

Product Var Name:     i_OrbFlg
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Orbit flag
Product Data Type:    i1b (2, 4)
Total Bytes:          8
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
```

```
Product Minimum:      0
Product Maximum:      128
Description:          Composite Flag - see Common Flag Spreadsheet for details
Please see <a href='flags/i_OrbFlg.pdf'> the PDF flag description</a> for more details.
There are 4 sets of this flag value, 1/sec for each of the 4 sec covered in the record.
Comments:

Product Var Name:     i_surfType
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Region Type
Product Data Type:    i1b ( 4)
Total Bytes:          4
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      1
Product Maximum:      15
Description:          Describes the region type or types associated with each shot Ice
Sheet, ocean, sea ice, or Land.
Please see <a href='flags/i_surfType.pdf'> the PDF flag description</a> for more de-
tails.
Comments:

Product Var Name:     i_LidarQF
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Lidar Frame quality flag
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      null
Product Maximum:      null
Description:          Composite Flag - see Common Flag Spreadsheet for details
Please see <a href='flags/i_LidarQF.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name:     i_cld1_od
Is element of:        GLA11 Record
Short Description:    Cloud Optical Depth at 532 nm
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        unitless*1000
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      5000
Description:          532 nm cloud optical depth, corrected for multiple scattering, at
1hz, 1 per layer, 10 layers
Comments:

Product Var Name:     i_aer4_od
Is element of:        GLA11 Record
Short Description:    Aerosol Optical Depth at 532 nm
Product Data Type:    i2b (8)
Total Bytes:          16
```

```
Product Units:        unitless*1000
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      5000
Description:          532 nm elevated aerosol optical depth, corrected for multiple scat-
tering, at 0.25hz, 1 per layer, 8 layers
Comments:

Product Var Name:     i_pbl4_od
Is element of:        GLA11 Record
Short Description:    PBL Optical Depth at 532 nm
Product Data Type:    i2b
Total Bytes:          2
Product Units:        unitless*1000
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      5000
Description:          532 nm Planetary Boundary Layer aerosol optical depth, corrected
for multiple scattering at 0.25hz, 1 per layer, 1 layer
Comments:

Product Var Name:     i_aer4_msf
Is element of:        GLA11 Record
Short Description:    Aerosol Multiple Scattering Factor
Product Data Type:    i2b (9)
Total Bytes:          18
Product Units:        unitless
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1000
Description:          Aerosol multiple scattering coefficient used at 0.25hz, 1 per lay-
er, 9 layers (including PSC)
Comments:

Product Var Name:     i_cld1_msf
Is element of:        GLA11 Record
Short Description:    Cloud Multiple Scattering Factor
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        unitless
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1000
Description:          Cloud multiple scattering coefficient at 1 hz, 1 per layer, 10 lay-
ers
Comments:

Product Var Name:     i_cld1_bot
Is element of:        GLA10 record, GLA11 Record
Short Description:    Medium Resolution Cloud Bottom at 532 nm
Product Data Type:    i2b (10, 4)
```

```
Total Bytes:          80
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      2000
Description:          Medium resolution cloud bottom heights for layers which were se-
lected for optical processing at 1hz, 1 per layer, 10 layers
Comments:

Product Var Name:     i_cld1_top
Is element of:        GLA10 record, GLA11 Record
Short Description:    Medium Resolution Cloud Top at 532 nm
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      2000
Description:          Medium resolution cloud top heights for layers which were selected
for optical processing at 1hz, 1 per layer, 10 layers
Comments:

Product Var Name:     i_cld1_grd_det
Is element of:        GLA10 record, GLA11 Record
Short Description:    Medium Resolution Ground Detection at 532 nm
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      2000
Description:          Medium resolution processed ground height at 1hz, 1 per profile
Comments:

Product Var Name:     i_aer4_bot
Is element of:        GLA11 Record
Short Description:    Low Resolution Aerosol Layer Bottom at 532 nm
Product Data Type:    i2b (8)
Total Bytes:          16
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      4000
Description:          Low resolution elevated aerosol layer (including PSC) bottom
height for layers which were selected for optical processing at 0.25hz, 1 per layer, 8
layers
Comments:

Product Var Name:     i_aer4_top
Is element of:        GLA11 Record
Short Description:    Low Resolution Aerosol Layer Top at 532 nm
```

```
Product Data Type:    i2b (8)
Total Bytes:          16
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      4000
Description:          Low resolution elevated aerosol layer (including PSC) top height
for layers which were selected for optical processing at 0.25hz, 1 per layer, 8 layers
Comments:

Product Var Name:     i_aer4_ht
Is element of:        GLA11 Record
Short Description:    Low Resolution PBL Height at 532 nm
Product Data Type:    i2b
Total Bytes:          2
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      700
Description:          Low resolution Planetary Boundary Layer height at 0.25hz, 1 per
profile
Comments:

Product Var Name:     i_aer4_grd_det
Is element of:        GLA11 Record
Short Description:    Low Resolution Ground Detection at 532 nm
Product Data Type:    i2b
Total Bytes:          2
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      1000
Description:          Low resolution processed ground detection height at 0.25hz, 1 per
profile
Comments:

Product Var Name:     i_erd
Is element of:        GLA11 Record
Short Description:    Estimated Range Delay
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        millimeters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1000
Description:          Estimated Range (Altimetry) Delay 1 per second
Comments:

Product Var Name:     i_pse
Is element of:        GLA11 Record
Short Description:    Particle Size Estimate
```

```
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        microns
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1000
Description:          Particle size estimate used to calculate warning flag and range
delay, 1 per second
Comments:

Product Var Name:     i_cld1_mswf
Is element of:        GLA11 Record
Short Description:    Cloud Multiple Scattering Warning Flag
Product Data Type:    i1b ( 2)
Total Bytes:          2
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      15
Description:          Cloud Multiple Scattering Warning Flag at 1 Hz for 4 sec. First 4
bits are for first second, last 4 bits are for 4th second.
Please see <a href='flags/i_cld1_mswf.pdf'> the PDF flag description</a> for more de-
tails.
The multiple scattering warning flag (MSWF) is based on the total column optical depth
(aerosol plus cloud) calculated in GLA11 using 532nm. It is intended as a way to quickly
obtain information about the potential severity of multiple scattering with regards to
the range-to-surface calculated by the altimetry processing software. It will be output
on the GLA11 product for use by the altimetry group. The multiple scattering warning
flag will have values ranging from 0-14, based on the total column optical depth as
detailed in the PDF.
A warning flag value of 15 will signify ?invalid?. An invalid will be encoded if an
optical depth in any of the layers in the 1-second column could not be calculated. This
usually occurs in a very optically ?thick? cloud which extinguishes the signal. It could
also occur if the extinction-to-backscatter ratio assignment is set too high, causing
the transmission calculations in the lidar inversion to go out-of-range.
Comments:

Product Var Name:     i_cld1_flag
Is element of:        GLA11 Record
Short Description:    Cloud optical depth  flag for 532 nm
Product Data Type:    i1b ( 40)
Total Bytes:          40
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      15
Description:          Composite Flag - see Breakout for details
Please see <a href='flags/i_cld1_flag.pdf'> the PDF flag description</a> for more de-
tails.
Comments:

Product Var Name:     i_aer4_flag
Is element of:        GLA11 Record
```

```
Short Description:    Aerosol optical depth  flag for 532 nm
Product Data Type:    i1b ( 8)
Total Bytes:          8
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      15
Description:          Composite Flag - see Breakout for details
Please see <a href='flags/i_aer4_flag.pdf'> the PDF flag description</a> for more de-
tails.
Comments:

Product Var Name:     i_pbl4_flag
Is element of:        GLA11 Record
Short Description:    PBL optical depth  flag for 532 nm
Product Data Type:    i1b
Total Bytes:          1
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      15
Description:          Composite Flag - see Breakout for details
Please see <a href='flags/i_pbl4_flag.pdf'> the PDF flag description</a> for more de-
tails.
Comments:

Product Var Name:     i_AttFlg3
Is element of:        GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11
Record
Short Description:    Attitude Flag 3
Product Data Type:    i1b
Total Bytes:          1
Product Units:        NA
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1
Description:          Please see <a href='flags/i_AttFlg3.pdf'> the PDF flag descrip-
tion</a> for more details.
Comments:

Product Var Name:     i_timecorflg
Is element of:        GLA01 Main Record , GLA02 Record, GLA03 Main Record, GLA04 BST Main
Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS
Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08
Record, GLA09 Record, GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    time correction flag
Product Data Type:    i2b
Total Bytes:          2
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  No
Is Unsigned?:         No
```

```
Product Minimum:      0
Product Maximum:      32767
Description:          Indicates what instrument or bias corrections were applied to the
times on this record. Please see <a href='flags/i_timecorflg.pdf'> the PDF flag descrip-
tion</a> for more details.
Comments:

Product Var Name:     i_rdu
Is element of:        GLA11 Record
Short Description:     Range Delay Uncertainty
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        millimeters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:
Comments:

Product Var Name:     i_spare2
Is element of:        GLA11 Record
Short Description:    Spares
Product Data Type:    i1b ( 2)
Total Bytes:          2
Product Units:        NA
Invalid Value/Flag:   NA
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      null
Product Maximum:      null
Description:          not used
Comments:

Product Var Name:     i_Solar_Angle
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Solar Angle
Product Data Type:    i4b ( 4)
Total Bytes:          16
Product Units:        micro-degrees
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -90000000
Product Maximum:      90000000
Description:          Incident angle of sun from normal.
Comments:

Product Var Name:     i_MRg_cldtop_temp
Is element of:        GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Medium Resolution 532 nm Cloud Top Temperature
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        degrees Celsius * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
```

```
Product Maximum:     10000
Description:         Medium Resolution 532 nm Cloud Top Temperature
Comments:

Product Var Name:    i_MRg_cldtop_pres
Is element of:       GLA09 Record, GLA10 record, GLA11 Record
Short Description:   Medium Resolution 532 nm Cloud Top Pressure
Product Data Type:   i2b (10, 4)
Total Bytes:         80
Product Units:       millibars of mercury * 10
Invalid Value/Flag:  i2b
Is Correction Flag?: NA
Is Unsigned?:        No
Product Minimum:     0
Product Maximum:     20000
Description:         Medium Resolution 532 nm Cloud Top Pressure
Comments:

Product Var Name:    i_MRg_cldtop_relh
Is element of:       GLA09 Record, GLA10 record, GLA11 Record
Short Description:   Medium Resolution 532 nm Cloud Top Relative Humidity
Product Data Type:   i2b (10, 4)
Total Bytes:         80
Product Units:       percentage * 100
Invalid Value/Flag:  i2b
Is Correction Flag?: NA
Is Unsigned?:        No
Product Minimum:     0
Product Maximum:     10000
Description:         Medium Resolution 532 nm Cloud Top Relative Humidity
Comments:

Product Var Name:    i_MRg_cldbot_temp
Is element of:       GLA09 Record, GLA10 record, GLA11 Record
Short Description:   Medium Resolution 532 nm Cloud Bottom Temperature
Product Data Type:   i2b (10, 4)
Total Bytes:         80
Product Units:       degrees Celsius * 100
Invalid Value/Flag:  i2b
Is Correction Flag?: NA
Is Unsigned?:        No
Product Minimum:     -10000
Product Maximum:     10000
Description:         Medium Resolution 532 nm Cloud Bottom Temperature
Comments:

Product Var Name:    i_MRg_cldbot_pres
Is element of:       GLA09 Record, GLA10 record, GLA11 Record
Short Description:   Medium Resolution 532 nm Cloud Bottom Pressure
Product Data Type:   i2b (10, 4)
Total Bytes:         80
Product Units:       millibars of mercury * 10
Invalid Value/Flag:  i2b
Is Correction Flag?: NA
Is Unsigned?:        No
Product Minimum:     0
Product Maximum:     20000
Description:         Medium Resolution 532 nm Cloud Bottom Pressure
Comments:
```

```
Product Var Name:     i_MRg_cldbot_relh
Is element of:        GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Medium Resolution 532 nm Cloud Bottom Relative Humidity
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        percentage * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:          Medium Resolution 532 nm Cloud Bottom Relative Humidity
Comments:

Product Var Name:     i_Aer_top_temp
Is element of:        GLA10 record, GLA11 Record
Short Description:    Aerosol Layers Temperature at Top of Layer at 532 nm
Product Data Type:    i2b ( 9)
Total Bytes:          18
Product Units:        degrees Celsius * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          Aerosol Layers Temperature at Top of Layer at 532 nm
Comments:

Product Var Name:     i_Aer_top_pres
Is element of:        GLA10 record, GLA11 Record
Short Description:    Aerosol Layers Pressure at Top of Layer at 532 nm
Product Data Type:    i2b ( 9)
Total Bytes:          18
Product Units:        millibars of mercury * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Aerosol Layers Pressure at Top of Layer at 532 nm
Comments:

Product Var Name:     i_Aer_top_relh
Is element of:        GLA10 record, GLA11 Record
Short Description:    Aerosol Layers Relative Humidity at Top of Layer at 532 nm
Product Data Type:    i2b ( 9)
Total Bytes:          18
Product Units:        percentage * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:          Aerosol Layers Relative Humidity at Top of Layer at 532 nm
Comments:

Product Var Name:     i_Aer_bot_temp
Is element of:        GLA10 record, GLA11 Record
```

```
Short Description:    Aerosol Layers Temperature at Bottom of Layer at 532 nm
Product Data Type:    i2b ( 9)
Total Bytes:          18
Product Units:        degrees Celsius * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          Aerosol Layers Temperature at Bottom of Layer at 532 nm
Comments:

Product Var Name:     i_Aer_bot_pres
Is element of:        GLA10 record, GLA11 Record
Short Description:    Aerosol Layers Pressure at Bottom of Layer at 532 nm
Product Data Type:    i2b ( 9)
Total Bytes:          18
Product Units:        millibars of mercury * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Aerosol Layers Pressure at Bottom of Layer at 532 nm
Comments:

Product Var Name:     i_Aer_bot_relh
Is element of:        GLA10 record, GLA11 Record
Short Description:    Aerosol Layers Relative Humidity at Bottom of Layer at 532 nm
Product Data Type:    i2b ( 9)
Total Bytes:          18
Product Units:        percentage * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:          Aerosol Layers Relative Humidity at Bottom of Layer at 532 nm
Comments:

Product Var Name:     i_Aer_ir_top
Is element of:        GLA08 Record, GLA11 Record
Short Description:    Elevation of Top of Aerosol Layers Detected in 1064 nm
Product Data Type:    i2b ( 2)
Total Bytes:          4
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      2200
Description:          Elevation of Top of Aerosol Layers detected in 1064 nm
Comments:

Product Var Name:     i_Aer_ir_bot
Is element of:        GLA08 Record, GLA11 Record
Short Description:    Elevation of Bottom of Aerosol Layers Detected in 1064 nm
Product Data Type:    i2b ( 2)
Total Bytes:          4
```

```
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      2200
Description:          Elevation of Bottom of Aerosol Layers Detected in 1064 nm.
Comments:

Product Var Name:     i_Aer_ir_top_temp
Is element of:        GLA08 Record, GLA11 Record
Short Description:    Temperature  of Top of Aerosol Layers Detected in 1064 nm
Product Data Type:    i2b ( 2)
Total Bytes:          4
Product Units:        degrees Celsius * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          Temperature of Top of Aerosol Layers Detected in 1064 nm
Comments:

Product Var Name:     i_Aer_ir_top_pres
Is element of:        GLA08 Record, GLA11 Record
Short Description:    Pressure of Top of Aerosol Layers Detected in 1064 nm
Product Data Type:    i2b ( 2)
Total Bytes:          4
Product Units:        millibars of mercury * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Pressure of Top of Aerosol Layers Detected in 1064 nm
Comments:

Product Var Name:     i_Aer_ir_top_relh
Is element of:        GLA08 Record, GLA11 Record
Short Description:    Relative Humidity of Top of Aerosol Layers Detected in 1064 nm
Product Data Type:    i2b ( 2)
Total Bytes:          4
Product Units:        percentage * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:          Relative Humidity of Top of Aerosol Layers Detected in 1064 nm
Comments:

Product Var Name:     i_Aer_ir_bot_temp
Is element of:        GLA08 Record, GLA11 Record
Short Description:    Temperature of Bottom of Aerosol Layers Detected in 1064 nm
Product Data Type:    i2b ( 2)
Total Bytes:          4
Product Units:        degrees Celsius * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
```

```
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          Temperature of Bottom of Aerosol Layers Detected in 1064 nm
Comments:

Product Var Name:     i_Aer_ir_bot_pres
Is element of:        GLA08 Record, GLA11 Record
Short Description:    Pressure of Bottom of Aerosol Layers Detected in 1064 nm
Product Data Type:    i2b ( 2)
Total Bytes:          4
Product Units:        millibars of mercury * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Pressure of Bottom of Aerosol Layers Detected in 1064 nmComments:

Product Var Name:     i_Aer_ir_bot_relh
Is element of:        GLA08 Record, GLA11 Record
Short Description:    Relative Humidity of Bottom of Aerosol Layers Detected in 1064 nm
Product Data Type:    i2b ( 2)
Total Bytes:          4
Product Units:        percentage * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:          Relative Humidity of Bottom of Aerosol Layers Detected in 1064 nm
Comments:

Product Var Name:     i_MRir_cld_top
Is element of:        GLA09 Record, GLA11 Record
Short Description:    Elevation of Top of Cloud Layers Detected in 1064 nm at Medium Res-
olution
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -100
Product Maximum:      2200
Description:          Elevation of Top of Cloud Layers Detected in 1064 nm at Medium Res-
olution data rate.
Comments:

Product Var Name:     i_MRir_cld_bot
Is element of:        GLA09 Record, GLA11 Record
Short Description:    Elevation of Bottom of Cloud Layers Detected in 1064 nm at Medium
Resolution
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
```

```
Product Minimum:      -100
Product Maximum:      2200
Description:          Elevation of Bottom of Cloud Layers Detected in 1064 nm at Medium
Resolution data rate.
Comments:

Product Var Name:     i_MRir_cldtop_temp
Is element of:        GLA09 Record, GLA11 Record
Short Description:    Temperature of Top of Cloud Layers Detected in 1064 nm at Medium
Resolution
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        degrees Celsius * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          Temperature of Top of Cloud Layers Detected in 1064 nm at Medium
Resolution data rate.
Comments:

Product Var Name:     i_MRir_cldtop_pres
Is element of:        GLA09 Record, GLA11 Record
Short Description:    Pressure of Top of Cloud Layers Detected in 1064 nm at Medium Res-
olution
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        millibars of mercury * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Pressure of Top of Cloud Layers Detected in 1064 nm at Medium Res-
olution data rate.
Comments:

Product Var Name:     i_MRir_cldtop_relh
Is element of:        GLA09 Record, GLA11 Record
Short Description:    Relative Humidity of Top of Cloud Layers in 1064 nm at Medium Res-
olution
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        percentage * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:          Relative Humidity of Top of Cloud Layers in 1064 nm at Medium Res-
olution data rate.
Comments:

Product Var Name:     i_MRir_cldbot_temp
Is element of:        GLA09 Record, GLA11 Record
Short Description:    Temperature of Bottom of Cloud Layers Detected in 1064 nm at Medium
Resolution
Product Data Type:    i2b (10, 4)
```

```
Total Bytes:          80
Product Units:        degrees Celsius * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          Temperature of Bottom of Cloud Layers Detected in 1064 nm at Medium
Resolution data rate.
Comments:

Product Var Name:     i_MRir_cldbot_pres
Is element of:        GLA09 Record, GLA11 Record
Short Description:    Pressure of Bottom of Cloud Layers Detected in 1064 nm at Medium
Resolution
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        millibars of mercury * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Pressure of Bottom of Cloud Layers Detected in 1064 nm at Medium
Resolution data rate.
Comments:

Product Var Name:     i_MRir_cldbot_relh
Is element of:        GLA09 Record, GLA11 Record
Short Description:    Relative Humidity of Bottom of Cloud Layers Detected in 1064 nm at
MR
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        percentage * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:          Relative Humidity of Bottom of Cloud Layers Detected in 1064 nm at
Medium Resolution data rate.
Comments:

Product Var Name:     i_MRir_QAflag
Is element of:        GLA09 Record, GLA11 Record
Short Description:    Medium Resolution 1064 nm Cloud Layer QA Flag
Product Data Type:    i1b ( 40)
Total Bytes:          40
Product Units:        NA
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Medium Resolution 1064 nm Cloud Layer QA Flag. Composite Flag -
see Breakout for details
Please see <a href='flags/i_MRir_QAflag.pdf'> the PDF flag description</a> for more de-
tails.
The data is arranged in 40 bytes.
```

bytes 1-18 are spares:
bytes 19-20 are af flags: The 4 ‘af’ flags (4 bits each) are concatenated with the QAflag storage and are contained in bytes 19-20 starting at bit 0 of byte 20.
bytes 21-40 are QAflags: The QAflag portion has been stored such that interval 1 is in bytes 40-36, interval 2 in bytes 35-31, interval 3 in bytes 30-26, and interval 4 in bytes 25-21. Each of the 10 layer flags per interval is 4 bits in length as before, such that interval 1 layer 1 is in bits 0-3 and interval 1 layer 2 is in bits 4-7 of byte 40, interval 1 layer 3 is in bits 0-3 and interval 1 layer 4 is in bits 4-7 of byte 39, etc.

Quality flag value 15=cloud layers were not searched for; 0=cloud layers were searched but not detected; 1-14 indicate increasing confidence of good cloud retrieval (value 1=least confidence, value 14=greatest confidence).
Availability flag value 15=cloud layers not searched for; 0=layers searched for but not detected.
Comments:

Product Var Name: i_Aer_PBL_LR_temp
Is element of: GLA08 Record, GLA11 Record
Short Description: Temperature of Low Resolution Planetary Boundary Layer Top at 532 nm
Product Data Type: i2b
Total Bytes: 2
Product Units: degrees Celsius * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -10000
Product Maximum: 10000
Description: Temperature of Low Resolution Planetary Boundary Layer Top at 532 nm
Comments:

Product Var Name: i_Aer_PBL_LR_pres
Is element of: GLA08 Record, GLA11 Record
Short Description: Pressure of Low Resolution Planetary Boundary Layer Top at 532 nm
Product Data Type: i2b
Total Bytes: 2
Product Units: millibars of mercury * 10
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 20000
Description: Pressure of Low Resolution Planetary Boundary Layer Top at 532 nm
Comments:

Product Var Name: i_Aer_PBL_LR_relh
Is element of: GLA08 Record, GLA11 Record
Short Description: Relative Humidity of Low Resolution Planetary Boundary Layer Top at 532 nm
Product Data Type: i2b
Total Bytes: 2
Product Units: percentage * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000

```
Description:          Relative Humidity of Low Resolution Planetary Boundary Layer Top
at 532 nm
Comments:

Product Var Name:     i_Surface_temp
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Surface Temperature
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        degrees Celsius * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          Surface Temperature, 4 of 1-second intervals.
Comments:

Product Var Name:     i_Surface_pres
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Surface Pressure
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        millibars of mercury * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Surface Pressure, 4 of 1-second intervals.
Comments:

Product Var Name:     i_Surface_relh
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Surface Relative Humidity
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        percentage * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:          Surface Relative Humidity, 4 of 1-second intervals.
Comments:

Product Var Name:     i_Surface_wind
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Surface Wind Speed
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        meters/second * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:          Surface Wind Speed, 4 of 1-second intervals.
Comments:
```

```
Product Var Name:     i_Surface_wdir
Is element of:        GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description:    Surface Wind Direction Azimuth from North
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        degrees * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      3600
Description:          Surface wind direction azimuth from North, 4 of 1-second intervals.
Comments:

Product Var Name:     i_Aer_ir_OD
Is element of:        GLA11 Record
Short Description:    Aerosol Optical Depth at 1064 nm
Product Data Type:    i2b ( 2)
Total Bytes:          4
Product Units:        Unknown
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      0
Description:          Aerosol Optical Depth at 1064 nm
Comments:

Product Var Name:     i_cld_ir_OD
Is element of:        GLA11 Record
Short Description:    Cloud Optical Depth at 1064 nm
Product Data Type:    i2b (10, 4)
Total Bytes:          80
Product Units:        Unknown
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      0
Description:          Cloud Optical Depth at 1064 nm
Comments:

Product Var Name:     i_Aer_ir_ODFlg
Is element of:        GLA11 Record
Short Description:    Aerosol Optical Depth at 1064 nm Flag
Product Data Type:    i1b ( 2)
Total Bytes:          2
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      null
Product Maximum:      null
Description:
Comments:

Product Var Name:     i_cld_ir_ODFlg
Is element of:        GLA11 Record
```

```
Short Description:    Cloud Optical Depth at 1064 nm Flag
Product Data Type:    i1b (10, 4)
Total Bytes:          40
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      null
Product Maximum:      null
Description:
Comments:

Product Var Name:     i_FRir_ODflg
Is element of:        GLA11 Record
Short Description:    Full Resolution 1064 Optical Depth Flag
Product Data Type:    i1b ( 160)
Total Bytes:          160
Product Units:        NA
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      0
Description:          This parameter is for a 4 second record. This parameter is also in
GLA06, 12-15.
Comments:

Product Var Name:     i_FRir_qaFlag
Is element of:        GLA09 Record, GLA11 Record
Short Description:    Full Resolution 1064 Quality Flag
Product Data Type:    i1b ( 160)
Total Bytes:          160
Product Units:        NA
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      15
Description:          Please see <a href='flags/i_FRir_qaFlag.pdf'> the PDF flag de-
scription</a> for more details.
Comments:

Product Var Name:     i_FRir_cldtop
Is element of:        GLA09 Record, GLA11 Record
Short Description:    Full Resolution 1064 Cloud Top
Product Data Type:    i2b ( 160)
Total Bytes:          320
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1030
Description:          Full resolution (40 Hz) cloud top height obtained from the 1064
atmospheric channel. This parameter is for a 4 second record. Also parameter is in GLA06,
12-15.
Comments:

Product Var Name:     i_Aer_b20_prop
```

```
Is element of:        GLA11 Record
Short Description:    Aerosol Below 20 Properties
Product Data Type:    i1b (20, 5)
Total Bytes:          100
Product Units:        Unknown
Invalid Value/Flag:   i1b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      0
Description:
Comments:

Product Var Name:     i_PBL_prop
Is element of:        GLA11 Record
Short Description:    Aerosol Properties
Product Data Type:    i1b ( 20)
Total Bytes:          20
Product Units:        Unknown
Invalid Value/Flag:   i1b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      0
Description:
Comments:

Product Var Name:     i_spare3
Is element of:        GLA11 Record
Short Description:    Spares
Product Data Type:    i1b ( 144)
Total Bytes:          144
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      null
Product Maximum:      null
Description:
Comments:
```

D.1.5 GLA12 Record

```
Product Var Name:     i_rec_ndx
Is element of:        GLA01 Long Waveform Record, GLA01 Main Record ,
GLA01_Short_Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO
Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04
SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record,
GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description:    GLAS Record Index
Product Data Type:    i4b
Total Bytes:          4
Product Units:        N/A
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      2147483647
Description:          Unique index that relates this record to the corresponding
```

record(s) in each GLAS data product.
Comments:

Product Var Name: i_UTCTime
Is element of: GLA01 Long Waveform Record, GLA01 Main Record , GLA01_Short_Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Transmit Time of First Shot in frame in J2000
Product Data Type: i4b (2)
Total Bytes: 8
Product Units: seconds, microseconds
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 2147483647
Description: The transmit time in UTC of the 1st shot in the 1 second frame referenced to noon on Jan 1, 2000. The first item is the whole number of seconds ; the second item is the fractional part in microseconds.
Comments: This is not the ground bounce time, but the transmit time.

Product Var Name: i_transtime
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: One way transit time
Product Data Type: i2b
Total Bytes: 2
Product Units: microseconds
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 4000
Description: One way transit time calculated using the preliminary range offset. This is added to the UTC time tag to get the ground bounce times at which to calculate the orbit
Comments:

Product Var Name: i_Spare1
Is element of: GLA12 Record
Short Description: Spare
Product Data Type: i1b (2)
Total Bytes: 2
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: null
Product Maximum: null
Description:
Comments:

Product Var Name: i_deltagpstmcor
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Delta GPS time correction
Product Data Type: i4b

```
Total Bytes:          4
Product Units:        nanoseconds
Invalid Value/Flag:   gi_invalid_i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1000000
Description:          The high frequency delta GPS time correction calculated during the
precision orbit processing step.
Comments:

Product Var Name:     i_dShotTime
Is element of:        GLA01 Main Record , GLA04 LPA Main Record, GLA05 record, GLA06
record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description:    Laser Shot Time Deltas (shots 2-40)
Product Data Type:    i4b (39)
Total Bytes:          156
Product Units:        microseconds
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1200000
Description:          The time deltas of pulses 2 through 40 to i_UTCTime, the UTC time
tag of the first pulse in the 1-second data frame. Adding the deltas to i_UTCTime will
give the user the time of each individual shot in the frame.
Comments:             To calculate the time for shots 2-40, add these deltas to the time
of the first shot.

Product Var Name:     i_lat
Is element of:        GLA12 Record
Short Description:    Coordinate Data, Latitude, specific to ice sheet range
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        microdeg
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -90000000
Product Maximum:      90000000
Description:          The geodetic latitude of the 40 laser spots in the 1 second time
frame, computed from the Precision orbit determined GLAS laser antenna ground nadir co-
ordinates, precision attitude, and ice sheet-specific range after all instrument cor-
rections, atmospheric delays and tides have been applied. The values are in degrees
North.
Comments:

Product Var Name:     i_lon
Is element of:        GLA12 Record
Short Description:    Coordinate Data, Longitude, specific to ice sheet range
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        microdeg
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      360000000
Description:          The longitude of the 40 laser spots in the 1 second time frame,
```

computed from the Precision orbit determined GLAS laser antenna ground nadir coordinates, precision attitude, and ice sheet-specific range after all instrument corrections, atmospheric delays and tides have been applied. The values are in east longitude.
Comments:

Product Var Name: i_elev
Is element of: GLA12 Record
Short Description: Ice Sheet Surface elevation
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: mm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -500000
Product Maximum: 10000000
Description: Surface elevation with respect to the ellipsoid at the spot location determined by range using the ice sheet specific algorithm after instrument corrections, atmospheric delays and tides have been applied.
Comments:

Product Var Name: i_PADPoint
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: PAD Pointing unit Vector in ICRF
Product Data Type: i4b (6, 40)
Total Bytes: 960
Product Units: Unitless*1000000
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -1000000
Product Maximum: 1000000
Description: Unit vectors giving the pointing direction of the laser with respect to the GLAS optical bench axes in the ICRF reference frame, one vector for each of the 40 shots, at the shot (transmit) time. Each component is composed of 2 4-byte items.
Comments:

Product Var Name: i_PODFixedPos
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Position orbit vector in ICRF
Product Data Type: i4b (6, 40)
Total Bytes: 960
Product Units: 3 * (m, mm)
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -7.0E+10
Product Maximum: 7.0E+10
Description: Spacecraft position vectors in ICRF of the laser point of reference on the spacecraft, one vector for each of the 40 shots, at the bounce (transmit plus transit) time. Each element is composed of 2 4-byte items. The first is m and the second is millimeters.
Comments:

Product Var Name: i_sigmaatt
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14

```
Record, GLA15 Record
Short Description:    Attitude Quality Indicator
Product Data Type:    i2b (40)
Total Bytes:          80
Product Units:        Unitless
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      6000
Description:          Attitude quality indicator. Values: 0=good; 50=warning; 100=bad.
Comments:             This indicator currently has only 3 values: 0, 50, and 100, leaving
open the opportunity to use numbers in between for further resolution of the degradation
as our knowledge improves.

Product Var Name:     i_Azimuth
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Local Azimuth
Product Data Type:    i4b
Total Bytes:          4
Product Units:        millideg
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      360000
Description:          Azimuth of the footprint path.
Comments:

Product Var Name:     i_SolAng
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Solar Incidence Angle
Product Data Type:    i4b
Total Bytes:          4
Product Units:        microdeg
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -90000000
Product Maximum:      90000000
Description:          The solar incidence angle determined during Precision Orbit Deter-
mination processing; it provides the operational sun angle estimate.
Comments:

Product Var Name:     i_tpintensity_avg
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Transmit Pulse intensity - frame avg
Product Data Type:    i4b
Total Bytes:          4
Product Units:        counts
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      25500
Description:
```

```
Comments:

Product Var Name:     i_tpazimuth_avg
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Transmit Pulse azimuth - frame avg
Product Data Type:    i2b
Total Bytes:          2
Product Units:        degrees*10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      3600
Description:
Comments:

Product Var Name:     i_tpeccentricity_avg
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Transmit Pulse eccentricity - frame avg
Product Data Type:    i2b
Total Bytes:          2
Product Units:        Unitless*1000
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1000
Description:
Comments:

Product Var Name:     i_tpmajoraxis_avg
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Tramsit Pulse major axis - frame avg
Product Data Type:    i2b
Total Bytes:          2
Product Units:        cm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:
Comments:

Product Var Name:     i_Spare2
Is element of:        GLA12 Record
Short Description:    Spare
Product Data Type:    i1b (2)
Total Bytes:          2
Product Units:        null
Invalid Value/Flag:   null
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      null
Product Maximum:      null
Description:
```

```
Comments:

Product Var Name:     i_gdHt
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Geoid
Product Data Type:    i2b ( 2)
Total Bytes:          4
Product Units:        cm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -20000
Product Maximum:      20000
Description:          The height of the geoid above the ellipsoid for the first and last
shot in the record.
Comments:

Product Var Name:     i_erElv
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description:    Solid Earth Tide Elevation (at first & last shot)
Product Data Type:    i2b ( 2)
Total Bytes:          4
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          The solid earth tide elevation for the first & last shot in the
record.
Comments:

Product Var Name:     i_spElv
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Tide Elevations, Specific
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          A tide elevation calculated from alternate tide models for specific
regions for shots 1, 11, 21, and 31.
Comments:

Product Var Name:     i_ldElv
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Load Tide Elevation
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
```

```
Product Minimum:      -10000
Product Maximum:      10000
Description:          The load tide elevation applied to each shot. Elements 1-4 of the
load tide vector are applied to shots 1-10, 11-20, 21-30, and 31-40, respectively.Com-
ments:                The load tide is NOT NECESSARILY the load tide for shots
1,11,21,31. It is calculated for the first valid shot in each group of 10 and applied
to all valid shots in the group.

Product Var Name:     i_ocElv
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Ocean Tide Elevation (at first & last shot)
Product Data Type:    i2b ( 2)
Total Bytes:          4
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          The ocean tide elevation at first & last shot
Comments:

Product Var Name:     i_wTrop
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Range Correction_Wet Troposphere
Product Data Type:    i2b ( 2)
Total Bytes:          4
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -1000
Product Maximum:      0
Description:          The range correction due to the wet troposphere at first & last
shot.
Comments:

Product Var Name:     i_dTrop
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description:    Range Correction, Dry Troposphere
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -2500
Product Maximum:      0
Description:          The range correction due to the dry troposphere; one correction
for each shot.
Comments:

Product Var Name:     i_surfType
Is element of:        GLA06 record, GLA07 Record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Region Type
Product Data Type:    i1b
```

```
Total Bytes:          1
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      1
Product Maximum:      15
Description:          Describes the region type or types associated with each shot Ice
Sheet, ocean, sea ice, or Land.
Please see <a href='flags/i_surfType.pdf'> the PDF flag description</a> for more de-
tails.
Comments:

Product Var Name:     i_Spare3
Is element of:        GLA12 Record
Short Description:    Spare
Product Data Type:    i1b (3)
Total Bytes:          3
Product Units:        N/A
Invalid Value/Flag:   null
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      null
Product Maximum:      null
Description:
Comments:

Product Var Name:     i_DEM_elv
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    DEM Elevation
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        cm
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -50000
Product Maximum:      1000000
Description:          Elevation with respect to sea level as interpolated from a Digital
Elevation Map (DEM) at each footprint location.
Comments:

Product Var Name:     i_refRng
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description:    Reference Range
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        mm
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      400000000
Product Maximum:      1000000000
Description:          Range in distance calculated from the time between the peak of the
transmit pulse and the farthest gate from the spacecraft of the received pulse. See the
rngcorrflg to determine any corrections that have been applied.
Comments:
```

```
Product Var Name:     i_TrshRngOff
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description:    Threshold Retracker Range Offset
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        mm
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -150000
Product Maximum:      0
Description:          Offset to be added to i_refRng to give the range in distance to
the threshold retracker location on the received echo using standard parameters.
Comments:

Product Var Name:     i_isRngOff
Is element of:        GLA06 record, GLA12 Record
Short Description:    Ice Sheet Range Offset
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        mm
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -150000
Product Maximum:      0
Description:          Range offset to be added to i_refRng to calculate the range using
the algorithm deemed appropriate for ice sheets.
Comments:

Product Var Name:     i_SigEndOff
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description:    Signal End Range Offset
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        mm
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -150000
Product Maximum:      0
Description:          Offset to be added to i_refRng to give the range in distance to
the location on the received echo calculated as the end of signal (farthest from the
spacecraft) using standard parameters.Comments:

Product Var Name:     i_cntRngOff
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description:    Centroid Range Offset
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        mm
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -150000
Product Maximum:      0
Description:          Offset to be added to i_refRng to give the range in distance to
the location of the centroid of the received echo from signal begin through signal end
defined by the standard parameters.
```

```
Comments:

Product Var Name:     i_reflctUncorr
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Reflectivity not corrected for Atmospheric Effects
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        Unitless*1E06
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1000000
Description:          The reflectance (not corrected for atmospheric effects) is calcu-
lated as the ratio of the received energy after it has been scaled for range, and the
transmitted energy.  The corrected reflectance may be calculated from this uncorrected
reflectance by dividing  by e^(-2(tc+ta+tm)), where tc is the cloud (column) integrated
optical depth, ta is the aerosol (column) integrated optical depth, and tm is the mo-
lecular optical depth.
Comments:             This uses all signal between signal begin and signal end.

Product Var Name:     i_reflCor_atm
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Reflectivity Corrected Atmospheric Effects
Product Data Type:    i4b
Total Bytes:          4
Product Units:        Unitless*1E06
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1000000
Description:          This corrected reflectance is calculated from the uncorrected re-
flectance by dividing by e^(-2(tc+ta+tm)), where tc is the cloud (column) integrated
optical depth, ta is the aerosol (column) integrated optical depth, and tm is the mo-
lecular optical depth.
Comments:

Product Var Name:     i_maxSmAmp
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Peak Amplitude of Smoothed Received Echo
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        Tenth of millivolts
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -300
Product Maximum:      30000
Description:          The peak amplitude of the received echo after it has been smoothed
to remove high frequency noise (see ATBD).
Comments:             This is calculated after converting the return to voltage.

Product Var Name:     i_SigmaElv
Is element of:        GLA06 record, GLA12 Record
Short Description:    Sigma of Elevation
```

```
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      32000
Description:          Elevation error estimates, the error from the Gaussian fit to the
received echo associated with the centroid of the last peak using standard parameters.
Comments:

Product Var Name:     i_numPk
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description:    Number of Peaks found in the Return
Product Data Type:    i1b ( 40)
Total Bytes:          40
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      6
Description:          The number of peaks in the return echo found by the Gaussian fit-
ting procedure, using standard parameters.
Comments:

Product Var Name:     i_kurt2
Is element of:        GLA05 record, GLA06 record, GLA12 Record
Short Description:    Kurtosis of the Received Echo (standard)
Product Data Type:    i2b (40)
Total Bytes:          80
Product Units:        unitless * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -1000
Product Maximum:      1000
Description:          Kurtosis of the received echo from signal begin to signal end using
standard parameters
Comments:             Note that the received echo was calibrated and converted to voltage
before calculation.

Product Var Name:     i_skew2
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA15
Record
Short Description:    Skewness
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        unitless * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          The skewness of the received echo from signal begin to signal end
using standard  parameters.
Comments:             Note that the received echo was calibrated and converted to voltage
before calculation.
```

```
Product Var Name:     i_IceSheetRuf
Is element of:        GLA12 Record
Short Description:    Ice Sheet Roughness
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        cm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      12000
Description:          The surface roughness over the footprint calculated empirically
from the transmitted pulse and received echo assuming no slope.
Comments:

Product Var Name:     i_IsSlopeEmp
Is element of:        GLA12 Record
Short Description:    Ice Sheet Slope - echo
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        millideg
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      32000
Description:          The surface slope over the footprint calculated empirically from
the transmitted pulse and received echo assuming no roughness.
Comments:

Product Var Name:     i_IsRngLast
Is element of:        GLA12 Record
Short Description:    Ice Sheet Range offset using last peak
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        mm
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -150000
Product Maximum:      0
Description:          Range offset to be added to i_refRng to calculate ice sheet spe-
cific range from centroid of last peak in standard Gaussian fit.
Comments:

Product Var Name:     i_IsRngFst
Is element of:        GLA12 Record
Short Description:    Ice Sheet Range Offset using first peak
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        mm
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -150000
Product Maximum:      0
Description:          Range offset to be added to i_refRng to calculate ice sheet spe-
cific range from centroid of first peak in standard Gaussian fit
```

```
Comments:

Product Var Name:     i_IceSVar
Is element of:        GLA12 Record
Short Description:    Standard Deviation of the ice sheet Gaussian Fit
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        millivolts
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      25500
Description:          The Standard deviation of the difference between the functional
fit and the received echo using standard parameters. It is directly taken from GLA05
parameter d_wfFitSDev_2 (standard).
Comments:

Product Var Name:     i_ElvuseFlg
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Elevation use flag
Product Data Type:    i1b ( 5)
Total Bytes:          5
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -127
Product Maximum:      127
Description:          Flag indicating whether the elevations on this record should be
used or not (1 bit set/shot). See the <a href='flags/i_ElvuseFlg.pdf'>PDF file</A> for
more information.
Comments:

Product Var Name:     i_atm_avail
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Atmosphere Availability Flag
Product Data Type:    i1b
Total Bytes:          1
Product Units:        NA
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      15
Description:          Please see <a href='flags/i_atm_avail.pdf'> the PDF flag descrip-
tion</a> for more details.
Comments:

Product Var Name:     i_erd
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Estimated Range Delay
Product Data Type:    i2b
Total Bytes:          2
Product Units:        Millimeters
Invalid Value/Flag:   i2b
```

Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1000
Description:
Comments:

Product Var Name: i_rdu
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Range Delay Uncertainty
Product Data Type: i2b
Total Bytes: 2
Product Units: Millimeters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description:
Comments:

Product Var Name: i_cld1_mswf
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Cloud Multiple Scattering Warning Flag
Product Data Type: i1b
Total Bytes: 1
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: The multiple scattering warning flag (MSWF) is based on the total column optical depth (aerosol plus cloud) calculated in GLA11 using 532nm. It is intended as a way to quickly obtain information about the potential severity of multiple scattering with regards to the range-to-surface calculated by the altimetry processing software. It will be output on the GLA11 product for use by the altimetry group. The multiple scattering warning flag will have values ranging from 0-14, based on the total column optical depth as detailedin the PDF.
A warning flag value of 15 will signify ?invalid?. An invalid will be encoded if an optical depth in any of the layers in the 1-second column could not be calculated. This usually occurs in a very optically ?thick? cloud which extinguishes the signal. It could also occur if the extinction-to-backscatter ratio assignment is set too high, causing the transmission calculations in the lidar inversion to go out-of-range.Please see the PDF flag description for more details.
Comments:

Product Var Name: i_MRC_af
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Medium Resolution Cloud Availability Flag
Product Data Type: i1b
Total Bytes: 1
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No

```
Product Minimum:      0
Product Maximum:      15
Description:          Please see <a href='flags/i_MRC_af.pdf'> the PDF flag descrip-
tion</a> for more details.
Comments:

Product Var Name:     i_SurfRuf_slpQF
Is element of:        GLA06 record, GLA12 Record, GLA14 Record
Short Description:    Surface Roughness & Slope Quality Flag
Product Data Type:    i1b ( 40)
Total Bytes:          40
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      127
Description:          Per-shot data quality flags indicating quality of i_srf_slope and
i_srf_ruf on this record.
Please see <a href='flags/i_SurfRuf_slpQF.pdf'> the PDF flag description</a> for more
details. For GLA06 and 12-15, bits are set to reflect Standard Fitting.
For GLA14, bits are set to reflect Alternate Fitting. Although defined as a pass-thru,
the values are different on GLA06/12-15 and GLA14.'
Comments:

Product Var Name:     i_ElvFlg
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Elevation Definition Flag
Product Data Type:    i1b ( 40)
Total Bytes:          40
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      127
Description:          Indicates which location on the received echo was used to calculate
the elevation on the record.
Please see <a href='flags/i_ElvFlg.pdf'> the PDF flag description</a> for more details.
'For GLA06 and 12-15, bits are set to reflect Standard Fitting. For GLA14, bits are set
to reflect Alternate Fitting. Although defined as a pass-thru, the values are different
on GLA06/12-15 and GLA14.'
Comments:

Product Var Name:     i_rng_UQF
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Range Offset Quality/Use Flag
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      32767
Description:          Data quality flag for the range offsets on this record.
Please see <a href='flags/i_rng_UQF.pdf'> the PDF flag description</a> for more details.
```

Comments:

Product Var Name: i_atmQF
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Atmosphere Flag
Product Data Type: i1b (10)
Total Bytes: 10
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1
Description: Indicates from LIDAR channel if conditions for forward scattering were favorable.
Please see the PDF flag description for more details.
Comments: If forward scattering occurs, it may map to an error in the elevation measurement. Users may want to delete data with forward scattering.

Product Var Name: i_timecorflg
Is element of: GLA01 Main Record , GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: time correction flag
Product Data Type: i2b
Total Bytes: 2
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: No
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 32767
Description: Indicates what instrument or bias corrections were applied to the times on this record. Please see the PDF flag description for more details.
Comments:

Product Var Name: i_APID_AvFlg
Is element of: GLA01 Main Record , GLA02 Record, GLA04 BST Main Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: APID Data Availability Flag
Product Data Type: i1b (8)
Total Bytes: 8
Product Units: n/a
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -127
Product Maximum: 127
Description: Flag indicating which packets (APIDs) for each second are available missing, or filled. APID 19 is broken down further into Altimeter Digitizer, Photon Counter, Cloud Digitizer, GPS/DEM, and C&T sections.
Please see the PDF flag description for more details.

```
Comments:

Product Var Name:     i_AttFlg2
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Attitude Flag 2
Product Data Type:    i1b (20)
Total Bytes:          20
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      15
Description:          Denotes at 40/sec rate whether precision attitude was used to de-
termine spot location, and if problems with LPA, etc.
Please see <a href='flags/i_AttFlg2.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name:     i_spare5
Is element of:        GLA12 Record
Short Description:    Spares
Product Data Type:    i1b
Total Bytes:          1
Product Units:        NA
Invalid Value/Flag:   NA
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      0
Description:
Comments:

Product Var Name:     i_FrameQF
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Altimeter Frame Quality Flag
Product Data Type:    i1b
Total Bytes:          1
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1
Description:          Denotes all bad data (no signal in whole frame), or all data good
and all science team recommended corrections applied
Please see <a href='flags/i_FrameQF.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name:     i_OrbFlg
Is element of:        GLA01 Main Record , GLA02 Record, GLA05 record, GLA06 record, GLA07
Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description:    POD flag (Orbit Flag)
Product Data Type:    i1b (2)
Total Bytes:          2
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
```

```
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      128
Description:          Denotes quality of orbit, whether predicted or precision, loss of
GPS data, maneuver-degraded, etc.
Please see <a href='flags/i_OrbFlg.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name:     i_rngCorrFlg
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Range Correction Flag
Product Data Type:    i1b (2)
Total Bytes:          2
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      32767
Description:          Denotes which geophysical or instrument corrections have been ap-
plied to the range in the calculation of the elevation on this record.
Please see <a href='flags/i_rngCorrFlg.pdf'> the PDF flag description</a> for more de-
tails.
Comments:

Product Var Name:     i_CorrStatFlg
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Correction Status Flag
Product Data Type:    i1b (2)
Total Bytes:          2
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      32767
Description:          For each geophysical correction that has multiple values denotes
which algorithm or model was used.
Please see <a href='flags/i_CorrStatFlg.pdf'> the PDF flag description</a> for more de-
tails.
Comments:

Product Var Name:     i_beam_coelev
Is element of:        GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13
Record, GLA14 Record, GLA15 Record
Short Description:    Co-elevation
Product Data Type:    i4b
Total Bytes:          4
Product Units:        degrees*100
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      36000
Description:          Co-elevation (CE) is direction from vertical of the laser beam as
seen by an observer located at the laser ground spot.Comments:
```

```
Product Var Name:     i_beam_azimuth
Is element of:        GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13
Record, GLA14 Record, GLA15 Record
Short Description:    Azimuth
Product Data Type:    i4b
Total Bytes:          4
Product Units:        degrees*100
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      36000
Description:          Az is the direction clockwise from north of the laser beam vector
as seen by an observer at the laser ground spot viewing toward the spacecraft (i.e., the
vector from the ground to the spacecraft).Comments:

Product Var Name:     i_AttFlg1
Is element of:        GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13
Record, GLA14 Record, GLA15 Record
Short Description:    Attitude Flag 1
Product Data Type:    i2b
Total Bytes:          2
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      32767
Description:          At 1/sec denotes large off-nadir angle, ocn sweep, target of op-
portunity, steering to reference track.
Please see <a href='flags/i_AttFlg1.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name:     i_Spare6
Is element of:        GLA12 Record
Short Description:    Spare
Product Data Type:    i1b ( 2)
Total Bytes:          2
Product Units:        N/A
Invalid Value/Flag:   null
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      null
Product Maximum:      null
Description:
Comments:

Product Var Name:     i_DEM_hires_src
Is element of:        GLA06 record, GLA12 Record, GLA13 Record
Short Description:    High Resolution Source Flag
Product Data Type:    i1b ( 40)
Total Bytes:          40
Product Units:        NA
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      128
Description:          Please see <a href='flags/i_DEM_hires_src.pdf'> the PDF flag de-
```

```
scription</a> for more details.
Comments:

Product Var Name:     i_DEM_hires_elv
Is element of:        GLA06 record, GLA12 Record, GLA13 Record
Short Description:    High Resolution Elevation
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -500
Product Maximum:      13000
Description:
Comments:

Product Var Name:     i_satNdx
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Saturation Index
Product Data Type:    i1b (40)
Total Bytes:          40
Product Units:        ns
Invalid Value/Flag:   i1b
Is Correction Flag?:  NA
Is Unsigned?:         Yes
Product Minimum:      0
Product Maximum:      255
Description:          The count of the number of gates in a waveform which have an am-
plitude greater than or equal to i_satNdxTh (set in anc07_0004). The value 255 means 255
or more gates are above the saturation index threshold (i_satNdxth).
Comments:

Product Var Name:     i_satRngCorr
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Saturation Range Correction
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  No
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      100
Description:
Comments:

Product Var Name:     i_satCorrFlg
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Saturation Correction Flag
Product Data Type:    i1b ( 40)
Total Bytes:          40
Product Units:        NA
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         NA
```

```
Product Minimum:      NA
Product Maximum:      NA
Description:          This is a flag for i_satRngCorr, i_satNrgCorr & i_satPwdCorr.
Comments:

Product Var Name:     i_satNrgCorr
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Saturation Energy Correction
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      100
Description:
Comments:

Product Var Name:     i_satPwdCorr
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Saturation Pulse Width Correction
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      100
Description:
Comments:

Product Var Name:     i_gval_rcv
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Gain Value used for Received Pulse
Product Data Type:    i2b (40)
Total Bytes:          80
Product Units:        counts
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      200
Description:          Gain value used for received pulse - uncalibrated.
Comments:             This value is in counts and needs to be calibrated before calcu-
lating energy from it. Same as variable in GLA01_Long/i_gainSet1064.

Product Var Name:     i_RecNrgAll
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Received Energy signal begin to signal end
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:         0.01 fJoules
Invalid Value/Flag:   i_APID_AvFlg
```

```
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      32000
Description:
Comments:

Product Var Name:     i_FRir_cldtop
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Full Resolution 1064 Cloud Top
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1030
Description:          Full resolution (40 Hz) cloud top height obtained from the 1064
atmospheric channel. This parameter is for a 1 second record. This parameter is in GLA09.
Comments:

Product Var Name:     i_FRir_qaFlag
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Full Resolution 1064 Quality Flag
Product Data Type:    i1b ( 40)
Total Bytes:          40
Product Units:        NA
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      15
Description:          Please see <a href='flags/i_FRir_qaFlag.pdf'> the PDF flag de-
scription</a> for more details.
Comments:

Product Var Name:     i_FRir_ODflg
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Full Resolution 1064 Optical Depth Flag
Product Data Type:    i1b ( 40)
Total Bytes:          40
Product Units:        NA
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      0
Description:          This parameter is for a 1 second record. This parameter is also in
GLA11.Comments:

Product Var Name:     i_FRir_intsig
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Full Resolution 1064 Integrated Signal
Product Data Type:    i2b ( 40)
```

```
Total Bytes:          80
Product Units:        e7/(m-sr)
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:          Though called ‘integrated signal’ this is actually an average of
all bins in the above-ground portion of the 1064 40 Hz profile with values above the
threshold of 1.0e-7 (1/(m-sr) units). This parameter is for a 1 second record. This pa-
rameter is also in GLA09.
Comments:

Product Var Name:     i_msRngCorr
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Multi-Scatter Range Correction
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        Unknown
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      0
Description:
Comments:

Product Var Name:     i_msCorrFlg
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Multi-Scatter Range Correction
Product Data Type:    i1b ( 40)
Total Bytes:          40
Product Units:        Unknown
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      0
Description:
Comments:

Product Var Name:     i_Surface_temp
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Surface Temperature
Product Data Type:    i2b
Total Bytes:          2
Product Units:        degrees Celsius * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:
Comments:

Product Var Name:     i_Surface_pres
```

```
Is element of:       GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:   Surface Pressure
Product Data Type:   i2b
Total Bytes:         2
Product Units:       millibars of mercury * 10
Invalid Value/Flag:  i2b
Is Correction Flag?: NA
Is Unsigned?:        No
Product Minimum:     0
Product Maximum:     20000
Description:
Comments:

Product Var Name:    i_Surface_relh
Is element of:       GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:   Relative Humidity
Product Data Type:   i2b
Total Bytes:         2
Product Units:       percentage * 100
Invalid Value/Flag:  i2b
Is Correction Flag?: NA
Is Unsigned?:        No
Product Minimum:     0
Product Maximum:     10000
Description:
Comments:

Product Var Name:    i_spare7
Is element of:       GLA12 Record
Short Description:   Spares
Product Data Type:   i1b ( 566)
Total Bytes:         566
Product Units:       NA
Invalid Value/Flag:  null
Is Correction Flag?: NA
Is Unsigned?:        No
Product Minimum:     null
Product Maximum:     null
Description:
Comments:
```

D.1.6 GLA13 Record

```
Product Var Name:    i_rec_ndx
Is element of:       GLA01 Long Waveform Record, GLA01 Main Record ,
GLA01_Short_Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO
Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04
SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record,
GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description:   GLAS Record Index
Product Data Type:   i4b
Total Bytes:         4
Product Units:       N/A
Invalid Value/Flag:  no
Is Correction Flag?: NA
Is Unsigned?:        No
Product Minimum:     0
```

Product Maximum: 2147483647
Description: Unique index that relates this record to the corresponding record(s) in each GLAS data product.
Comments:

Product Var Name: i_UTCTime
Is element of: GLA01 Long Waveform Record, GLA01 Main Record , GLA01_Short_Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Transmit Time of First Shot in frame in J2000
Product Data Type: i4b (2)
Total Bytes: 8
Product Units: seconds, microseconds
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 2147483647
Description: The transmit time in UTC of the 1st shot in the 1 second frame referenced to noon on Jan 1, 2000. The first item is the whole number of seconds ; the second item is the fractional part in microseconds.
Comments: This is not the ground bounce time, but the transmit time.

Product Var Name: i_transtime
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: One way transit time
Product Data Type: i2b
Total Bytes: 2
Product Units: microseconds
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 4000
Description: One way transit time calculated using the preliminary range offset. This is added to the UTC time tag to get the ground bounce times at which to calculate the orbit
Comments:

Product Var Name: i_Spare1
Is element of: GLA13 Record
Short Description: Spare
Product Data Type: i1b (2)
Total Bytes: 2
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: null
Product Maximum: null
Description:
Comments:

Product Var Name: i_deltagpstmcor
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record

```
Short Description:    Delta GPS time correction
Product Data Type:    i4b
Total Bytes:          4
Product Units:        nanoseconds
Invalid Value/Flag:   gi_invalid_i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1000000
Description:          The high frequency delta GPS time correction calculated during the
precision orbit processing step.
Comments:

Product Var Name:     i_dShotTime
Is element of:        GLA01 Main Record , GLA04 LPA Main Record, GLA05 record, GLA06
record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description:    Laser Shot Time Deltas (shots 2-40)
Product Data Type:    i4b (39)
Total Bytes:          156
Product Units:        microseconds
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1200000
Description:          The time deltas of pulses 2 through 40 to i_UTCTime, the UTC time
tag of the first pulse in the 1-second data frame. Adding the deltas to i_UTCTime will
give the user the time of each individual shot in the frame.
Comments:             To calculate the time for shots 2-40, add these deltas to the time
of the first shot.

Product Var Name:     i_lat
Is element of:        GLA13 Record
Short Description:    Coordinate Data, Latitude, specific to sea ice range
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        microdeg
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -90000000
Product Maximum:      90000000
Description:          The geodetic latitude of the 40 laser spots in the 1 second time
frame, computed from the Precision orbit determined GLAS laser antenna ground nadir co-
ordinates, PAD, and sea ice specific range after all atmospheric corrections and tides
have been applied.
Comments:

Product Var Name:     i_lon
Is element of:        GLA13 Record
Short Description:    Coordinate Data, Longitude, specific to sea ice range
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        microdeg
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      360000000
```

Description: The longitude of the 40 laser spots in the 1 second time frame, computed from the Precision orbit determined GLAS laser antenna ground nadir coordinates, PAD, and sea ice specific range after all atmospheric corrections and tides have been applied. The values are in east longitude.
Comments:

Product Var Name: i_elev
Is element of: GLA13 Record
Short Description: Sea Ice Surface Elevation
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: mm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -500000
Product Maximum: 10000000
Description: Surface elevation wrt ellipsoid at the spot location determined by range using the sea ice specific fitting procedure after atmospheric delays and tides have been applied.
Comments:

Product Var Name: i_PADPoint
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: PAD Pointing unit Vector in ICRF
Product Data Type: i4b (6, 40)
Total Bytes: 960
Product Units: Unitless*1000000
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -1000000
Product Maximum: 1000000
Description: Unit vectors giving the pointing direction of the laser with respect to the GLAS optical bench axes in the ICRF reference frame, one vector for each of the 40 shots, at the shot (transmit) time. Each component is composed of 2 4-byte items.
Comments:

Product Var Name: i_PODFixedPos
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Position orbit vector in ICRF
Product Data Type: i4b (6, 40)
Total Bytes: 960
Product Units: 3 * (m, mm)
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -7.0E+10
Product Maximum: 7.0E+10
Description: Spacecraft position vectors in ICRF of the laser point of reference on the spacecraft, one vector for each of the 40 shots, at the bounce (transmit plus transit) time. Each element is composed of 2 4-byte items. The first is m and the second is millimeters.
Comments:

Product Var Name: i_sigmaatt

```
Is element of:       GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:   Attitude Quality Indicator
Product Data Type:   i2b (40)
Total Bytes:         80
Product Units:       Unitless
Invalid Value/Flag:  i2b
Is Correction Flag?: NA
Is Unsigned?:        No
Product Minimum:     0
Product Maximum:     6000
Description:         Attitude quality indicator. Values: 0=good; 50=warning; 100=bad.
Comments:            This indicator currently has only 3 values: 0, 50, and 100, leaving
open the opportunity to use numbers in between for further resolution of the degradation
as our knowledge improves.

Product Var Name:    i_Azimuth
Is element of:       GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:   Local Azimuth
Product Data Type:   i4b
Total Bytes:         4
Product Units:       millideg
Invalid Value/Flag:  i4b
Is Correction Flag?: NA
Is Unsigned?:        No
Product Minimum:     0
Product Maximum:     360000
Description:         Azimuth of the footprint path.
Comments:

Product Var Name:    i_SolAng
Is element of:       GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:   Solar Incidence Angle
Product Data Type:   i4b
Total Bytes:         4
Product Units:       microdeg
Invalid Value/Flag:  i4b
Is Correction Flag?: NA
Is Unsigned?:        No
Product Minimum:     -90000000
Product Maximum:     90000000
Description:         The solar incidence angle determined during Precision Orbit Deter-
mination processing; it provides the operational sun angle estimate.
Comments:

Product Var Name:    i_tpintensity_avg
Is element of:       GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:   Transmit Pulse intensity - frame avg
Product Data Type:   i4b
Total Bytes:         4
Product Units:       counts
Invalid Value/Flag:  i4b
Is Correction Flag?: NA
Is Unsigned?:        No
Product Minimum:     0
Product Maximum:     25500
```

```
Description:
Comments:

Product Var Name:     i_tpazimuth_avg
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Transmit Pulse azimuth - frame avg
Product Data Type:    i2b
Total Bytes:          2
Product Units:        degrees*10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      3600
Description:
Comments:

Product Var Name:     i_tpeccentricity_avg
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Transmit Pulse eccentricity - frame avg
Product Data Type:    i2b
Total Bytes:          2
Product Units:        Unitless*1000
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1000
Description:
Comments:

Product Var Name:     i_tpmajoraxis_avg
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Tramsit Pulse major axis - frame avg
Product Data Type:    i2b
Total Bytes:          2
Product Units:        cm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:
Comments:

Product Var Name:     i_Spare2
Is element of:        GLA13 Record
Short Description:    Spare
Product Data Type:    i1b (2)
Total Bytes:          2
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      null
Product Maximum:      null
```

```
Description:
Comments:

Product Var Name:     i_gdHt
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Geoid
Product Data Type:    i2b ( 2)
Total Bytes:          4
Product Units:        cm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -20000
Product Maximum:      20000
Description:          The height of the geoid above the ellipsoid for the first and last
shot in the record.
Comments:

Product Var Name:     i_erElv
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description:    Solid Earth Tide Elevation (at first & last shot)
Product Data Type:    i2b ( 2)
Total Bytes:          4
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          The solid earth tide elevation for the first & last shot in the
record.
Comments:

Product Var Name:     i_spElv
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Tide Elevations, Specific
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          A tide elevation calculated from alternate tide models for specific
regions for shots 1, 11, 21, and 31.
Comments:

Product Var Name:     i_ldElv
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Load Tide Elevation
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
```

```
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          The load tide elevation applied to each shot. Elements 1-4 of the
load tide vector are applied to shots 1-10, 11-20, 21-30, and 31-40, respectively.Com-
ments:                The load tide is NOT NECESSARILY the load tide for shots
1,11,21,31. It is calculated for the first valid shot in each group of 10 and applied
to all valid shots in the group.
Product Var Name:     i_ocElv
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Ocean Tide Elevation (at first & last shot)
Product Data Type:    i2b ( 2)
Total Bytes:          4
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          The ocean tide elevation at first & last shot
Comments:

Product Var Name:     i_wTrop
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Range Correction_Wet Troposphere
Product Data Type:    i2b ( 2)
Total Bytes:          4
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -1000
Product Maximum:      0
Description:          The range correction due to the wet troposphere at first & last
shot.
Comments:

Product Var Name:     i_dTrop
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description:    Range Correction, Dry Troposphere
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -2500
Product Maximum:      0
Description:          The range correction due to the dry troposphere; one correction
for each shot.
Comments:

Product Var Name:     i_surfType
Is element of:        GLA06 record, GLA07 Record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Region Type
Product Data Type:    i1b
```

```
Total Bytes:          1
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      1
Product Maximum:      15
Description:          Describes the region type or types associated with each shot Ice
Sheet, ocean, sea ice, or Land.
Please see <a href='flags/i_surfType.pdf'> the PDF flag description</a> for more de-
tails.
Comments:

Product Var Name:     i_Spare3
Is element of:        GLA13 Record
Short Description:    Spare
Product Data Type:    i1b (3)
Total Bytes:          3
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      null
Product Maximum:      null
Description:
Comments:

Product Var Name:     i_DEM_elv
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    DEM Elevation
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        cm
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -50000
Product Maximum:      1000000
Description:          Elevation with respect to sea level as interpolated from a Digital
Elevation Map (DEM) at each footprint location.
Comments:

Product Var Name:     i_refRng
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description:    Reference Range
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        mm
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      400000000
Product Maximum:      1000000000
Description:          Range in distance calculated from the time between the peak of the
transmit pulse and the farthest gate from the spacecraft of the received pulse. See the
rngcorrflg to determine any corrections that have been applied.
Comments:
```

```
Product Var Name:     i_TrshRngOff
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description:    Threshold Retracker Range Offset
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        mm
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -150000
Product Maximum:      0
Description:          Offset to be added to i_refRng to give the range in distance to
the threshold retracker location on the received echo using standard parameters.
Comments:

Product Var Name:     i_siRngOff
Is element of:        GLA06 record, GLA13 Record
Short Description:    Sea Ice Range Offset
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        mm
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -150000
Product Maximum:      0
Description:          Range offset to be added to i_refRng to calculate the range using
the algorithm deemed appropriate for sea ice.
Comments:

Product Var Name:     i_SigEndOff
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description:    Signal End Range Offset
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        mm
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -150000
Product Maximum:      0
Description:          Offset to be added to i_refRng to give the range in distance to
the location on the received echo calculated as the end of signal (farthest from the
spacecraft) using standard parameters.Comments:

Product Var Name:     i_cntRngOff
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description:    Centroid Range Offset
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        mm
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -150000
Product Maximum:      0
Description:          Offset to be added to i_refRng to give the range in distance to
the location of the centroid of the received echo from signal begin through signal end
defined by the standard parameters.
```

```
Comments:

Product Var Name:     i_reflctUncorr
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Reflectivity not corrected for Atmospheric Effects
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        Unitless*1E06
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1000000
Description:          The reflectance (not corrected for atmospheric effects) is calcu-
lated as the ratio of the received energy after it has been scaled for range, and the
transmitted energy.  The corrected reflectance may be calculated from this uncorrected
reflectance by dividing  by e^(-2(tc+ta+tm)), where tc is the cloud (column) integrated
optical depth, ta is the aerosol (column) integrated optical depth, and tm is the mo-
lecular optical depth.
Comments:             This uses all signal between signal begin and signal end.

Product Var Name:     i_reflCor_atm
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Reflectivity Corrected Atmospheric Effects
Product Data Type:    i4b
Total Bytes:          4
Product Units:        Unitless*1E06
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1000000
Description:          This corrected reflectance is calculated from the uncorrected re-
flectance by dividing by e^(-2(tc+ta+tm)), where tc is the cloud (column) integrated
optical depth, ta is the aerosol (column) integrated optical depth, and tm is the mo-
lecular optical depth.
Comments:

Product Var Name:     i_maxSmAmp
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Peak Amplitude of Smoothed Received Echo
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        Tenth of millivolts
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -300
Product Maximum:      30000
Description:          The peak amplitude of the received echo after it has been smoothed
to remove high frequency noise (see ATBD).
Comments:             This is calculated after converting the return to voltage.

Product Var Name:     i_SigmaElv
Is element of:        GLA13 Record
Short Description:    Sigma of Elevation
```

```
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      32000
Description:          Elevation error estimates, the error from the Gaussian fit to the
received echo associated with the centroid of the last peak using standard parame-
ters.Comments:

Product Var Name:     i_numPk
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description:    Number of Peaks found in the Return
Product Data Type:    i1b ( 40)
Total Bytes:          40
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      6
Description:          The number of peaks in the return echo found by the Gaussian fit-
ting procedure, using standard parameters.
Comments:

Product Var Name:     i_RufSeaIce
Is element of:        GLA13 Record
Short Description:    Sea Ice Surface Roughness
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        cm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      12400
Description:          The surface slope over the footprint calculated empirically from
the transmitted and received waveforms using the RMS width of the entire waveform
Comments:

Product Var Name:     i_skew2
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA15
Record
Short Description:    Skewness
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        unitless * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          The skewness of the received echo from signal begin to signal end
using standard  parameters.
Comments:             Note that the received echo was calibrated and converted to voltage
before calculation.
```

```
Product Var Name:     i_SiRufLstPk
Is element of:        GLA13 Record
Short Description:    Surface  Roughness - last peak
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        cm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      12400
Description:          The surface roughness over the footprint calculated empirically
from the transmitted and received waveforms using the RMS width of the last peak.
Comments:

Product Var Name:     I_AvgRuf
Is element of:        GLA13 Record
Short Description:    Avg Roughness
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        cm
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      12000
Description:          The surface roughness of the entire footprint calculated from the
RMS width of the entire waveform.
Comments:

Product Var Name:     i_BergElev
Is element of:        GLA13 Record
Short Description:    Iceberg Elevation
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        mm
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      200000
Description:          For waveforms with more than 1 peak, 'iceberg' elevation is cal-
culated using the difference between the range offset of the maximum amplitude peak and
the range offset of the first peak. Computations are made after atmospheric and tide
corrections have been applied. The elevation computed is relative to the ellipsoid.
Comments:             Users should be wary that this parameter is computed for all mul-
tiple-peak GLA13 records, even if the elevation is too high to be sea-ice.

Product Var Name:     i_Spare7
Is element of:        GLA13 Record
Short Description:    Spares
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         NA
Product Minimum:      null
Product Maximum:      null
```

```
Description:
Comments:

Product Var Name:     i_SiRufMaxPk
Is element of:        GLA13 Record
Short Description:    Maximum Amplitutde Peak Sea Ice Surface Roughness
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        cm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      12400
Description:          The surface slope over the footprint calculated empirically from
the transmitted and received waveforms using the gaussian width of the maximum amplitude
peak.Comments:

Product Var Name:     i_SiRngFst
Is element of:        GLA13 Record
Short Description:    Sea ice range increment to first peak
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        mm
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -150000
Product Maximum:      0
Description:          Range increment to be added to reference range to compute the sea
ice specific range. This was determined from centroid of first peak in sea ice Gaussian
fit
Comments:

Product Var Name:     i_SeaIceVar
Is element of:        GLA13 Record
Short Description:    Standard Deviation of the sea ice Gaussian fit
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        millivolts
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      25500
Description:          The Standard deviation of the difference between the functional
fit and the received echo using standard parameters. It is directly taken from GLA05
parameter d_wfFitSDev_2 (standard).
Comments:

Product Var Name:     i_ElvuseFlg
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Elevation use flag
Product Data Type:    i1b ( 5)
Total Bytes:          5
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
```

```
Is Unsigned?:         No
Product Minimum:      -127
Product Maximum:      127
Description:          Flag indicating whether the elevations on this record should be
used or not (1 bit set/shot). See the <a href='flags/i_ElvuseFlg.pdf'>PDF file</A> for
more information.
Comments:

Product Var Name:     i_atm_avail
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Atmosphere Availability Flag
Product Data Type:    i1b
Total Bytes:          1
Product Units:        NA
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      15
Description:          Please see <a href='flags/i_atm_avail.pdf'> the PDF flag descrip-
tion</a> for more details.
Comments:

Product Var Name:     i_erd
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Estimated Range Delay
Product Data Type:    i2b
Total Bytes:          2
Product Units:        Millimeters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1000
Description:
Comments:

Product Var Name:     i_rdu
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Range Delay Uncertainty
Product Data Type:    i2b
Total Bytes:          2
Product Units:        Millimeters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:
Comments:

Product Var Name:     i_cld1_mswf
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Cloud Multiple Scattering Warning Flag
Product Data Type:    i1b
```

Total Bytes: 1
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: The multiple scattering warning flag (MSWF) is based on the total column optical depth (aerosol plus cloud) calculated in GLA11 using 532nm. It is intended as a way to quickly obtain information about the potential severity of multiple scattering with regards to the range-to-surface calculated by the altimetry processing software. It will be output on the GLA11 product for use by the altimetry group. The multiple scattering warning flag will have values ranging from 0-14, based on the total column optical depth as detailedin the PDF.
A warning flag value of 15 will signify ?invalid?. An invalid will be encoded if an optical depth in any of the layers in the 1-second column could not be calculated. This usually occurs in a very optically ?thick? cloud which extinguishes the signal. It could also occur if the extinction-to-backscatter ratio assignment is set too high, causing the transmission calculations in the lidar inversion to go out-of-range.Please see the PDF flag description for more details.
Comments:

Product Var Name: i_MRC_af
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Medium Resolution Cloud Availability Flag
Product Data Type: i1b
Total Bytes: 1
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: Please see the PDF flag description for more details.
Comments:

Product Var Name: i_SiRufQF
Is element of: GLA13 Record
Short Description: Sea ice Roughness Quality Flag
Product Data Type: i1b (40)
Total Bytes: 40
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1
Description: Data quality flag for the sea ice roughness indicates quality based on good vs. bad criteria.
Please see the PDF flag description for more details.
Comments:

Product Var Name: i_ElvFlg
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Elevation Definition Flag
Product Data Type: i1b (40)

```
Total Bytes:          40
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      127
Description:          Indicates which location on the received echo was used to calculate
the elevation on the record.
Please see <a href='flags/i_ElvFlg.pdf'> the PDF flag description</a> for more details.
'For GLA06 and 12-15, bits are set to reflect Standard Fitting. For GLA14, bits are set
to reflect Alternate Fitting. Although defined as a pass-thru, the values are different
on GLA06/12-15 and GLA14.'
Comments:

Product Var Name:     i_rng_UQF
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Range Offset Quality/Use Flag
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      32767
Description:          Data quality flag for the range offsets on this record.
Please see <a href='flags/i_rng_UQF.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name:     i_atmQF
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Atmosphere Flag
Product Data Type:    i1b ( 10)
Total Bytes:          10
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1
Description:          Indicates from LIDAR channel if conditions for forward scattering
were favorable.
Please see <a href='flags/i_atmQF.pdf'> the PDF flag description</a> for more details.
Comments:             If forward scattering occurs, it may map to an error in the ele-
vation measurement. Users may want to delete data with forward scattering.

Product Var Name:     i_timecorflg
Is element of:        GLA01 Main Record , GLA02 Record, GLA03 Main Record, GLA04 BST Main
Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS
Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08
Record, GLA09 Record, GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    time correction flag
Product Data Type:    i2b
Total Bytes:          2
Product Units:        N/A
```

```
Invalid Value/Flag:   No
Is Correction Flag?:  No
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      32767
Description:          Indicates what instrument or bias corrections were applied to the
times on this record. Please see <a href='flags/i_timecorflg.pdf'> the PDF flag descrip-
tion</a> for more details.
Comments:

Product Var Name:     i_APID_AvFlg
Is element of:        GLA01 Main Record , GLA02 Record, GLA04 BST Main Record, GLA04 GYRO
Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04
SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13 Record,
GLA14 Record, GLA15 Record
Short Description:    APID Data Availability Flag
Product Data Type:    i1b (8)
Total Bytes:          8
Product Units:        n/a
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -127
Product Maximum:      127
Description:          Flag indicating which packets (APIDs) for each second are available
missing, or filled.  APID 19 is broken down further into Altimeter Digitizer, Photon
Counter, Cloud Digitizer, GPS/DEM, and C&T sections.
Please see <a href='flags/i_APID_AvFlg.pdf'> the PDF flag description</a> for more de-
tails.
Comments:

Product Var Name:     i_AttFlg2
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Attitude Flag 2
Product Data Type:    i1b (20)
Total Bytes:          20
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      15
Description:          Denotes at 40/sec rate whether precision attitude was used to de-
termine spot location, and if problems with LPA, etc.
Please see <a href='flags/i_AttFlg2.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name:     i_spare5
Is element of:        GLA13 Record
Short Description:    Spares
Product Data Type:    i1b
Total Bytes:          1
Product Units:        NA
Invalid Value/Flag:   NA
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      0
```

```
Description:
Comments:

Product Var Name:     i_FrameQF
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Altimeter Frame Quality Flag
Product Data Type:    i1b
Total Bytes:          1
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1
Description:          Denotes all bad data (no signal in whole frame), or all data good
and all science team recommended corrections applied
Please see <a href='flags/i_FrameQF.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name:     i_OrbFlg
Is element of:        GLA01 Main Record , GLA02 Record, GLA05 record, GLA06 record, GLA07
Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description:    POD flag (Orbit Flag)
Product Data Type:    i1b (2)
Total Bytes:          2
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      128
Description:          Denotes quality of orbit, whether predicted or precision, loss of
GPS data, maneuver-degraded, etc.
Please see <a href='flags/i_OrbFlg.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name:     i_rngCorrFlg
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Range Correction Flag
Product Data Type:    i1b (2)
Total Bytes:          2
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      32767
Description:          Denotes which geophysical or instrument corrections have been ap-
plied to the range in the calculation of the elevation on this record.
Please see <a href='flags/i_rngCorrFlg.pdf'> the PDF flag description</a> for more de-
tails.
Comments:

Product Var Name:     i_CorrStatFlg
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Correction Status Flag
```

```
Product Data Type:    i1b (2)
Total Bytes:          2
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      32767
Description:          For each geophysical correction that has multiple values denotes
which algorithm or model was used.
Please see <a href='flags/i_CorrStatFlg.pdf'> the PDF flag description</a> for more de-
tails.
Comments:

Product Var Name:     i_beam_coelev
Is element of:        GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13
Record, GLA14 Record, GLA15 Record
Short Description:    Co-elevation
Product Data Type:    i4b
Total Bytes:          4
Product Units:        degrees*100
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      36000
Description:          Co-elevation (CE) is direction from vertical of the laser beam as
seen by an observer located at the laser ground spot.Comments:

Product Var Name:     i_beam_azimuth
Is element of:        GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13
Record, GLA14 Record, GLA15 Record
Short Description:    Azimuth
Product Data Type:    i4b
Total Bytes:          4
Product Units:        degrees*100
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      36000
Description:          Az is the direction clockwise from north of the laser beam vector
as seen by an observer at the laser ground spot viewing toward the spacecraft (i.e., the
vector from the ground to the spacecraft).Comments:

Product Var Name:     i_AttFlg1
Is element of:        GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13
Record, GLA14 Record, GLA15 Record
Short Description:    Attitude Flag 1
Product Data Type:    i2b
Total Bytes:          2
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      32767
Description:          At 1/sec denotes large off-nadir angle, ocn sweep, target of op-
portunity, steering to reference track.
```

```
Please see <a href='flags/i_AttFlg1.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name:     i_Spare6
Is element of:        GLA13 Record
Short Description:    Spares
Product Data Type:    i1b (2)
Total Bytes:          2
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         NA
Product Minimum:      null
Product Maximum:      null
Description:
Comments:

Product Var Name:     i_DEM_hires_src
Is element of:        GLA06 record, GLA12 Record, GLA13 Record
Short Description:    High Resolution Source Flag
Product Data Type:    i1b ( 40)
Total Bytes:          40
Product Units:        NA
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      128
Description:          Please see <a href='flags/i_DEM_hires_src.pdf'> the PDF flag de-
scription</a> for more details.
Comments:

Product Var Name:     i_DEM_hires_elv
Is element of:        GLA06 record, GLA12 Record, GLA13 Record
Short Description:    High Resolution Elevation
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -500
Product Maximum:      13000
Description:
Comments:

Product Var Name:     i_satNdx
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Saturation Index
Product Data Type:    i1b (40)
Total Bytes:          40
Product Units:        ns
Invalid Value/Flag:   i1b
Is Correction Flag?:  NA
Is Unsigned?:         Yes
Product Minimum:      0
Product Maximum:      255
Description:          The count of the number of gates in a waveform which have an am-
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plitude greater than or equal to i_satNdxTh (set in anc07_0004). The value 255 means 255 or more gates are above the saturation index threshold (i_satNdxth).
Comments:

Product Var Name: i_satRngCorr
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Saturation Range Correction
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: mm
Invalid Value/Flag: i2b
Is Correction Flag?: No
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 100
Description:
Comments:

Product Var Name: i_satCorrFlg
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Saturation Correction Flag
Product Data Type: i1b (40)
Total Bytes: 40
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: NA
Product Minimum: NA
Product Maximum: NA
Description: This is a flag for i_satRngCorr, i_satNrgCorr & i_satPwdCorr.
Comments:

Product Var Name: i_satNrgCorr
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Saturation Energy Correction
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: mm
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 100
Description:
Comments:

Product Var Name: i_satPwdCorr
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Saturation Pulse Width Correction
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: mm
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No

```
Product Minimum:      0
Product Maximum:      100
Description:
Comments:

Product Var Name:     i_gval_rcv
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Gain Value used for Received Pulse
Product Data Type:    i2b (40)
Total Bytes:          80
Product Units:        counts
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      200
Description:          Gain value used for received pulse - uncalibrated.
Comments:             This value is in counts and needs to be calibrated before calcu-
lating energy from it. Same as variable in GLA01_Long/i_gainSet1064.

Product Var Name:     i_RecNrgAll
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Received Energy signal begin to signal end
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:         0.01 fJoules
Invalid Value/Flag:   i_APID_AvFlg
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      32000
Description:
Comments:

Product Var Name:     i_FRir_cldtop
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Full Resolution 1064 Cloud Top
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1030
Description:          Full resolution (40 Hz) cloud top height obtained from the 1064
atmospheric channel. This parameter is for a 1 second record. This parameter is in GLA09.
Comments:

Product Var Name:     i_FRir_qaFlag
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Full Resolution 1064 Quality Flag
Product Data Type:    i1b ( 40)
Total Bytes:          40
Product Units:        NA
```

```
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      15
Description:          Please see <a href='flags/i_FRir_qaFlag.pdf'> the PDF flag de-
scription</a> for more details.
Comments:

Product Var Name:     i_FRir_ODflg
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Full Resolution 1064 Optical Depth Flag
Product Data Type:    i1b ( 40)
Total Bytes:          40
Product Units:        NA
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      0
Description:          This parameter is for a 1 second record. This parameter is also in
GLA11.Comments:

Product Var Name:     i_FRir_intsig
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Full Resolution 1064 Integrated Signal
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        e7/(m-sr)
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:          Though called 'integrated signal' this is actually an average of
all bins in the above-ground portion of the 1064 40 Hz profile with values above the
threshold of 1.0e-7 (1/(m-sr) units). This parameter is for a 1 second record. This pa-
rameter is also in GLA09.
Comments:

Product Var Name:     i_msRngCorr
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Multi-Scatter Range Correction
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        Unknown
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      0
Description:
Comments:

Product Var Name:     i_msCorrFlg
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
```

```
Record
Short Description:    Multi-Scatter Range Correction
Product Data Type:    i1b ( 40)
Total Bytes:          40
Product Units:        Unknown
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      0
Description:
Comments:

Product Var Name:     i_Surface_temp
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Surface Temperature
Product Data Type:    i2b
Total Bytes:          2
Product Units:        degrees Celsius * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:
Comments:

Product Var Name:     i_Surface_pres
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Surface Pressure
Product Data Type:    i2b
Total Bytes:          2
Product Units:        millibars of mercury * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:
Comments:

Product Var Name:     i_Surface_relh
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Relative Humidity
Product Data Type:    i2b
Total Bytes:          2
Product Units:        percentage * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:
Comments:

Product Var Name:     i_spare8
```

```
Is element of:        GLA13 Record
Short Description:    Spares
Product Data Type:    i1b ( 566)
Total Bytes:          566
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         NA
Product Minimum:      null
Product Maximum:      null
Description:
Comments:
```

D.1.7 GLA14 Record

```
Product Var Name:     i_rec_ndx
Is element of:        GLA01 Long Waveform Record, GLA01 Main Record ,
GLA01_Short_Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO
Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04
SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record,
GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description:    GLAS Record Index
Product Data Type:    i4b
Total Bytes:          4
Product Units:        N/A
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      2147483647
Description:          Unique index that relates this record to the corresponding
record(s) in each GLAS data product.
Comments:

Product Var Name:     i_UTCTime
Is element of:        GLA01 Long Waveform Record, GLA01 Main Record ,
GLA01_Short_Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO
Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04
SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record,
GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description:    Transmit Time of First Shot in frame in J2000
Product Data Type:    i4b (2)
Total Bytes:          8
Product Units:        seconds, microseconds
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      2147483647
Description:          The transmit time in UTC of the 1st shot in the 1 second frame
referenced to noon on Jan 1, 2000.   The first item is the whole number of seconds ; the
second item is the fractional part in microseconds.
Comments:             This is not the ground bounce time, but the transmit time.

Product Var Name:     i_transtime
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    One way transit time
Product Data Type:    i2b
```

Total Bytes: 2
Product Units: microseconds
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 4000
Description: One way transit time calculated using the preliminary range offset. This is added to the UTC time tag to get the ground bounce times at which to calculate the orbit
Comments:

Product Var Name: i_Spare1
Is element of: GLA14 Record
Short Description: Spare
Product Data Type: i1b (2)
Total Bytes: 2
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: null
Product Maximum: null
Description:
Comments:

Product Var Name: i_deltagpstmcor
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Delta GPS time correction
Product Data Type: i4b
Total Bytes: 4
Product Units: nanoseconds
Invalid Value/Flag: gi_invalid_i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1000000
Description: The high frequency delta GPS time correction calculated during the precision orbit processing step.
Comments:

Product Var Name: i_dShotTime
Is element of: GLA01 Main Record , GLA04 LPA Main Record, GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Laser Shot Time Deltas (shots 2-40)
Product Data Type: i4b (39)
Total Bytes: 156
Product Units: microseconds
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1200000
Description: The time deltas of pulses 2 through 40 to i_UTCTime, the UTC time tag of the first pulse in the 1-second data frame. Adding the deltas to i_UTCTime will give the user the time of each individual shot in the frame.
Comments: To calculate the time for shots 2-40, add these deltas to the time of the first shot.

```
Product Var Name:     i_lat
Is element of:        GLA14 Record
Short Description:    Coordinate Data, Latitude, specific to land range
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        microdeg
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -90000000
Product Maximum:      90000000
Description:          The geodetic latitude of the forty laser spots in the 1 second time
frame, computed from the Precision orbit determined GLAS laser antenna ground nadir co-
ordinates, precision attitude, and land-specific range after all instrument corrections,
atmospheric delays and tides have been applied. The values are in degrees North.
Comments:

Product Var Name:     i_lon
Is element of:        GLA14 Record
Short Description:    Coordinate Data, Longitude, specific to land range
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        microdeg
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      360000000
Description:          The longitude of the forty laser spots in the 1 second time frame,
computed from the Precision orbit determined GLAS laser antenna ground nadir coordinates,
precision attitude, and land-specific range after all instrument corrections, atmospher-
ic delays and tides have been applied.   The values are in east longitude.
Comments:

Product Var Name:     i_elev
Is element of:        GLA14 Record
Short Description:    Land surface Elevation
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        mm
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -500000
Product Maximum:      10000000
Description:          Surface elevation with respect to the ellipsoid at the spot loca-
tion determined by range using the land-specific fitting procedure after all instrument
corrections, atmospheric delays and tides have been applied.
Comments:

Product Var Name:     i_PADPoint
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    PAD Pointing unit Vector in ICRF
Product Data Type:    i4b (6, 40)
Total Bytes:          960
Product Units:        Unitless*1000000
Invalid Value/Flag:   i4b
```

```
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -1000000
Product Maximum:      1000000
Description:          Unit vectors giving the pointing direction of the laser with re-
spect to the GLAS optical bench axes in the ICRF reference frame, one vector for each
of the 40 shots, at the shot (transmit) time. Each component is composed of 2 4-byte
items.
Comments:

Product Var Name:     i_PODFixedPos
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Position orbit vector in ICRF
Product Data Type:    i4b (6, 40)
Total Bytes:          960
Product Units:        3 * (m, mm)
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -7.0E+10
Product Maximum:      7.0E+10
Description:          Spacecraft position vectors in ICRF of the laser point of reference
on the spacecraft, one vector for each of the 40 shots, at the bounce (transmit plus
transit) time.  Each element is composed of 2 4-byte items. The first is m and the second
is millimeters.
Comments:

Product Var Name:     i_sigmaatt
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Attitude Quality Indicator
Product Data Type:    i2b (40)
Total Bytes:          80
Product Units:        Unitless
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      6000
Description:          Attitude quality indicator. Values: 0=good; 50=warning; 100=bad.
Comments:             This indicator currently has only 3 values: 0, 50, and 100, leaving
open the opportunity to use numbers in between for further resolution of the degradation
as our knowledge improves.

Product Var Name:     i_Azimuth
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Local Azimuth
Product Data Type:    i4b
Total Bytes:          4
Product Units:        millideg
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      360000
Description:          Azimuth of the footprint path.
Comments:
```

```
Product Var Name:     i_SolAng
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Solar Incidence Angle
Product Data Type:    i4b
Total Bytes:          4
Product Units:        microdeg
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -90000000
Product Maximum:      90000000
Description:          The solar incidence angle determined during Precision Orbit Deter-
mination processing; it provides the operational sun angle estimate.
Comments:

Product Var Name:     i_tpintensity_avg
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Transmit Pulse intensity - frame avg
Product Data Type:    i4b
Total Bytes:          4
Product Units:        counts
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      25500
Description:
Comments:

Product Var Name:     i_tpazimuth_avg
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Transmit Pulse azimuth - frame avg
Product Data Type:    i2b
Total Bytes:          2
Product Units:        degrees*10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      3600
Description:
Comments:

Product Var Name:     i_tpeccentricity_avg
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Transmit Pulse eccentricity - frame avg
Product Data Type:    i2b
Total Bytes:          2
Product Units:        Unitless*1000
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1000
```

```
Description:
Comments:

Product Var Name:     i_tpmajoraxis_avg
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Tramsit Pulse major axis - frame avg
Product Data Type:    i2b
Total Bytes:          2
Product Units:        cm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:
Comments:

Product Var Name:     i_Spare2
Is element of:        GLA14 Record
Short Description:    Spares
Product Data Type:    i1b (2)
Total Bytes:          2
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      null
Product Maximum:      null
Description:
Comments:

Product Var Name:     i_gdHt
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Geoid
Product Data Type:    i2b ( 2)
Total Bytes:          4
Product Units:        cm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -20000
Product Maximum:      20000
Description:          The height of the geoid above the ellipsoid for the first and last
shot in the record.
Comments:

Product Var Name:     i_erElv
Is element of:        GLA14 Record
Short Description:    Earth Tide Elevation
Product Data Type:    i2b ( 2)
Total Bytes:          4
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
```

```
Description:          Solid earth tide elevation (first and last shot)
Comments:

Product Var Name:     i_spElv
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Tide Elevations, Specific
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          A tide elevation calculated from alternate tide models for specific
regions for shots 1, 11, 21, and 31.
Comments:

Product Var Name:     i_ldElv
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Load Tide Elevation
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          The load tide elevation applied to each shot. Elements 1-4 of the
load tide vector are applied to shots 1-10, 11-20, 21-30, and 31-40, respectively.Com-
ments:                The load tide is NOT NECESSARILY the load tide for shots
1,11,21,31. It is calculated for the first valid shot in each group of 10 and applied
to all valid shots in the group.
Product Var Name:     i_ocElv
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Ocean Tide Elevation (at first & last shot)
Product Data Type:    i2b ( 2)
Total Bytes:          4
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          The ocean tide elevation at first & last shot
Comments:

Product Var Name:     i_wTrop
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Range Correction_Wet Troposphere
Product Data Type:    i2b ( 2)
Total Bytes:          4
Product Units:        mm
Invalid Value/Flag:   i2b
```

```
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -1000
Product Maximum:      0
Description:          The range correction due to the wet troposphere at first & last
shot.
Comments:

Product Var Name:     i_dTrop
Is element of:        GLA14 Record
Short Description:    Range Correction, Dry Troposphere
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -2500
Product Maximum:      0
Description:          Atmospheric dry tropospheric delay correction added to the eleva-
tion
Comments:

Product Var Name:     i_surfType
Is element of:        GLA06 record, GLA07 Record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Region Type
Product Data Type:    i1b
Total Bytes:          1
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      1
Product Maximum:      15
Description:          Describes the region type or types associated with each shot Ice
Sheet, ocean, sea ice, or Land.
Please see <a href='flags/i_surfType.pdf'> the PDF flag description</a> for more de-
tails.

Comments:

Product Var Name:     i_Spare3
Is element of:        GLA14 Record
Short Description:    Spare
Product Data Type:    i1b (3)
Total Bytes:          3
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      null
Product Maximum:      null
Description:
Comments:

Product Var Name:     i_DEM_elv
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
```

```
Short Description:    DEM Elevation
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        cm
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -50000
Product Maximum:      1000000
Description:          Elevation with respect to sea level as interpolated from a Digital
Elevation Map (DEM) at each footprint location.
Comments:

Product Var Name:     i_refRng
Is element of:        GLA14 Record
Short Description:    Reference Range
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        mm
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      400000000
Product Maximum:      1000000000
Description:          Range calculated from the time between the peak of the transmit
pulse and the farthest gate from the spacecraft of the received pulse.
Comments:

Product Var Name:     i_SigBegOff
Is element of:        GLA14 Record
Short Description:    Signal Begin Range Increment
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        mm
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -150000
Product Maximum:      0
Description:          Range increment to be added to reference range to obtain signal
begin as computed in ground process using the alternate parameterization.
Comments:

Product Var Name:     i_ldRngOff
Is element of:        GLA06 record, GLA14 Record
Short Description:    Land Range Offset
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        mm
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -150000
Product Maximum:      0
Description:          Range offset to be added to i_refRng to calculate the range using
the algorithm deemed appropriate for land.
Comments:

Product Var Name:     i_SigEndOff
```

```
Is element of:        GLA14 Record
Short Description:    Signal End Range Increment
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        mm
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -150000
Product Maximum:      0
Description:          Range increment to be added to reference range to signal end as
computed in ground process using the alternate parameterization.Comments:

Product Var Name:     i_gpCntRngOff
Is element of:        GLA14 Record
Short Description:    Centroid Range Increment for all 6 peaks
Product Data Type:    i4b (6, 40)
Total Bytes:          960
Product Units:        mm
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -150000
Product Maximum:      0
Description:
Comments:

Product Var Name:     i_reflctUncorr
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Reflectivity not corrected for Atmospheric Effects
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        Unitless*1E06
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1000000
Description:          The reflectance (not corrected for atmospheric effects) is calcu-
lated as the ratio of the received energy after it has been scaled for range, and the
transmitted energy.  The corrected reflectance may be calculated from this uncorrected
reflectance by dividing  by e^(-2(tc+ta+tm)), where tc is the cloud (column) integrated
optical depth, ta is the aerosol (column) integrated optical depth, and tm is the mo-
lecular optical depth.
Comments:             This uses all signal between signal begin and signal end.

Product Var Name:     i_reflCor_atm
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Reflectivity Corrected Atmospheric Effects
Product Data Type:    i4b
Total Bytes:          4
Product Units:        Unitless*1E06
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1000000
```

```
Description:          This corrected reflectance is calculated from the uncorrected re-
flectance by dividing by e^(-2(tc+ta+tm)), where tc is the cloud (column) integrated
optical depth, ta is the aerosol (column) integrated optical depth, and tm is the mo-
lecular optical depth.
Comments:

Product Var Name:     i_maxSmAmp
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Peak Amplitude of Smoothed Received Echo
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        Tenth of millivolts
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -300
Product Maximum:      30000
Description:          The peak amplitude of the received echo after it has been smoothed
to remove high frequency noise (see ATBD).
Comments:             This is calculated after converting the return to voltage.

Product Var Name:     i_SigmaElv
Is element of:        GLA14 Record
Short Description:    Sigma of Elevation - TBD
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      32000
Description:          The algorithm for calculating this is TBD.Comments:

Product Var Name:     i_numPk
Is element of:        GLA14 Record
Short Description:    Number of Peaks found in the Return
Product Data Type:    i1b ( 40)
Total Bytes:          40
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      6
Description:          The number of peaks in the waveform producted by the Gaussian fil-
tering, using alternate parameters.
Comments:

Product Var Name:     i_kurt1
Is element of:        GLA05 record, GLA14 Record
Short Description:    Kurtosis of Received Echo (alternative)
Product Data Type:    i2b (40)
Total Bytes:          80
Product Units:        unitless * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
```

```
Product Minimum:      -1000
Product Maximum:      1000
Description:          Kurtosis of the received echo from signal begin to signal end using
alternative parameters
Comments:             Note that the received echo was calibrated and converted to voltage
before calculation.

Product Var Name:     i_skew1
Is element of:        GLA05 record, GLA14 Record
Short Description:    Skewness of Received Echo (alternative)
Product Data Type:    i2b (40)
Total Bytes:          80
Product Units:        unitless * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          Skewness of the received echo from signal begin to signal end using
alternative parameters
Comments:             Note that the received echo was calibrated and converted to voltage
before calculation.

Product Var Name:     i_LdRufLstPk
Is element of:        GLA14 Record
Short Description:    Land  Roughness - last
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        cm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      12000
Description:          The surface roughness over the footprint calculated empirically
from the transmitted pulse and received echo assuming no slope using alternate parame-
ters.
Comments:

Product Var Name:     i_LandSlopeLast
Is element of:        GLA14 Record
Short Description:    Land Slope - echo - last
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        millideg
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      32000
Description:          The surface slope over the footprint calculated empirically from
the transmitted pulse and received echo assuming no slope using alternate parameters.
Comments:

Product Var Name:     i_Gamp
Is element of:        GLA14 Record
Short Description:    Amplitudes of Gaussians
Product Data Type:    i4b (6, 40)
Total Bytes:          960
```

```
Product Units:        0.01 volts
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      300
Description:          Amplitude of each Gaussian solved for (up to six), using the al-
ternate parameters.
Comments:

Product Var Name:     i_Garea
Is element of:        GLA14 Record
Short Description:    Area under Gaussian
Product Data Type:    i4b (6, 40)
Total Bytes:          960
Product Units:        0.01 volts * ns
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      348457
Description:          Area under each of the Gaussians solved for (up to six), using al-
ternate parameters.
Comments:

Product Var Name:     i_Gsigma
Is element of:        GLA14 Record
Short Description:    Sigma of Gaussians
Product Data Type:    i4b (6, 40)
Total Bytes:          960
Product Units:        0.001 ns
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      327660
Description:          Width (sigma) of each Gaussian solved for (up to six), using al-
ternate parameters.
Comments:

Product Var Name:     i_nPeaks1
Is element of:        GLA05 record, GLA06 record, GLA14 Record
Short Description:    Initial Number of Peaks in received echo (alternate)
Product Data Type:    i1b (40)
Total Bytes:          40
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      50
Description:          The initial number of peaks of the received echo; determined from
the smoothed waveform, using alternative parameters
Comments:

Product Var Name:     i_LandVar
Is element of:        GLA14 Record
Short Description:    Standard Deviation of the land Gaussian Fit
Product Data Type:    i2b ( 40)
```

```
Total Bytes:          80
Product Units:        millivolts
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      25500
Description:          The Standard deviation of the difference between the functional
fit and the received echo using alternative parameters. It is directly taken from GLA05
parameter d_wfFitSDev_1 (alternative).
Comments:

Product Var Name:     i_ElvuseFlg
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Elevation use flag
Product Data Type:    i1b ( 5)
Total Bytes:          5
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -127
Product Maximum:      127
Description:          Flag indicating whether the elevations on this record should be
used or not (1 bit set/shot). See the <a href='flags/i_ElvuseFlg.pdf'>PDF file</A> for
more information.
Comments:

Product Var Name:     i_atm_avail
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Atmosphere Availability Flag
Product Data Type:    i1b
Total Bytes:          1
Product Units:        NA
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      15
Description:          Please see <a href='flags/i_atm_avail.pdf'> the PDF flag descrip-
tion</a> for more details.
Comments:

Product Var Name:     i_erd
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Estimated Range Delay
Product Data Type:    i2b
Total Bytes:          2
Product Units:        Millimeters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1000
Description:
Comments:
```

Product Var Name: i_rdu
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Range Delay Uncertainty
Product Data Type: i2b
Total Bytes: 2
Product Units: Millimeters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description:
Comments:

Product Var Name: i_cld1_mswf
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Cloud Multiple Scattering Warning Flag
Product Data Type: i1b
Total Bytes: 1
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: The multiple scattering warning flag (MSWF) is based on the total column optical depth (aerosol plus cloud) calculated in GLA11 using 532nm. It is intended as a way to quickly obtain information about the potential severity of multiple scattering with regards to the range-to-surface calculated by the altimetry processing software. It will be output on the GLA11 product for use by the altimetry group. The multiple scattering warning flag will have values ranging from 0-14, based on the total column optical depth as detailedin the PDF.
A warning flag value of 15 will signify ?invalid?. An invalid will be encoded if an optical depth in any of the layers in the 1-second column could not be calculated. This usually occurs in a very optically ?thick? cloud which extinguishes the signal. It could also occur if the extinction-to-backscatter ratio assignment is set too high, causing the transmission calculations in the lidar inversion to go out-of-range.Please see the PDF flag description for more details.
Comments:

Product Var Name: i_MRC_af
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Medium Resolution Cloud Availability Flag
Product Data Type: i1b
Total Bytes: 1
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: Please see the PDF flag description for more details.
Comments:

```
Product Var Name:     i_SurfRuf_slpQF
Is element of:        GLA06 record, GLA12 Record, GLA14 Record
Short Description:    Surface Roughness & Slope Quality Flag
Product Data Type:    i1b ( 40)
Total Bytes:          40
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      127
Description:          Per-shot data quality flags indicating quality of i_srf_slope and
i_srf_ruf on this record.
Please see <a href='flags/i_SurfRuf_slpQF.pdf'> the PDF flag description</a> for more
details. For GLA06 and 12-15, bits are set to reflect Standard Fitting.
For GLA14, bits are set to reflect Alternate Fitting. Although defined as a pass-thru,
the values are different on GLA06/12-15 and GLA14.'
Comments:

Product Var Name:     i_ElvFlg
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Elevation Definition Flag
Product Data Type:    i1b ( 40)
Total Bytes:          40
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      127
Description:          Indicates which location on the received echo was used to calculate
the elevation on the record.
Please see <a href='flags/i_ElvFlg.pdf'> the PDF flag description</a> for more details.
'For GLA06 and 12-15, bits are set to reflect Standard Fitting. For GLA14, bits are set
to reflect Alternate Fitting. Although defined as a pass-thru, the values are different
on GLA06/12-15 and GLA14.'
Comments:

Product Var Name:     i_rng_UQF
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Range Offset Quality/Use Flag
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      32767
Description:          Data quality flag for the range offsets on this record.
Please see <a href='flags/i_rng_UQF.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name:     i_atmQF
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Atmosphere Flag
```

```
Product Data Type:    i1b ( 10)
Total Bytes:          10
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1
Description:          Indicates from LIDAR channel if conditions for forward scattering
were favorable.
Please see <a href='flags/i_atmQF.pdf'> the PDF flag description</a> for more details.
Comments:             If forward scattering occurs, it may map to an error in the ele-
vation measurement. Users may want to delete data with forward scattering.

Product Var Name:     i_timecorflg
Is element of:        GLA01 Main Record , GLA02 Record, GLA03 Main Record, GLA04 BST Main
Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS
Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08
Record, GLA09 Record, GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    time correction flag
Product Data Type:    i2b
Total Bytes:          2
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  No
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      32767
Description:          Indicates what instrument or bias corrections were applied to the
times on this record. Please see <a href='flags/i_timecorflg.pdf'> the PDF flag descrip-
tion</a> for more details.
Comments:

Product Var Name:     i_APID_AvFlg
Is element of:        GLA01 Main Record , GLA02 Record, GLA04 BST Main Record, GLA04 GYRO
Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04
SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13 Record,
GLA14 Record, GLA15 Record
Short Description:    APID Data Availability Flag
Product Data Type:    i1b (8)
Total Bytes:          8
Product Units:        n/a
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -127
Product Maximum:      127
Description:          Flag indicating which packets (APIDs) for each second are available
missing, or filled.  APID 19 is broken down further into Altimeter Digitizer, Photon
Counter, Cloud Digitizer, GPS/DEM, and C&T sections.
Please see <a href='flags/i_APID_AvFlg.pdf'> the PDF flag description</a> for more de-
tails.
Comments:

Product Var Name:     i_AttFlg2
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Attitude Flag 2
```

```
Product Data Type:    i1b (20)
Total Bytes:          20
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      15
Description:          Denotes at 40/sec rate whether precision attitude was used to de-
termine spot location, and if problems with LPA, etc.
Please see <a href='flags/i_AttFlg2.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name:     i_spare5
Is element of:        GLA14 Record
Short Description:    Spares
Product Data Type:    i1b
Total Bytes:          1
Product Units:        NA
Invalid Value/Flag:   NA
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      0
Description:
Comments:

Product Var Name:     i_FrameQF
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Altimeter Frame Quality Flag
Product Data Type:    i1b
Total Bytes:          1
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1
Description:          Denotes all bad data (no signal in whole frame), or all data good
and all science team recommended corrections applied
Please see <a href='flags/i_FrameQF.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name:     i_OrbFlg
Is element of:        GLA01 Main Record , GLA02 Record, GLA05 record, GLA06 record, GLA07
Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description:    POD flag (Orbit Flag)
Product Data Type:    i1b (2)
Total Bytes:          2
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      128
Description:          Denotes quality of orbit, whether predicted or precision, loss of
GPS data, maneuver-degraded, etc.
Please see <a href='flags/i_OrbFlg.pdf'> the PDF flag description</a> for more details.
```

```
Comments:

Product Var Name:     i_rngCorrFlg
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Range Correction Flag
Product Data Type:    i1b (2)
Total Bytes:          2
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      32767
Description:          Denotes which geophysical or instrument corrections have been ap-
plied to the range in the calculation of the elevation on this record.
Please see <a href='flags/i_rngCorrFlg.pdf'> the PDF flag description</a> for more de-
tails.
Comments:

Product Var Name:     i_CorrStatFlg
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Correction Status Flag
Product Data Type:    i1b (2)
Total Bytes:          2
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      32767
Description:          For each geophysical correction that has multiple values denotes
which algorithm or model was used.
Please see <a href='flags/i_CorrStatFlg.pdf'> the PDF flag description</a> for more de-
tails.
Comments:

Product Var Name:     i_beam_coelev
Is element of:        GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13
Record, GLA14 Record, GLA15 Record
Short Description:    Co-elevation
Product Data Type:    i4b
Total Bytes:          4
Product Units:        degrees*100
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      36000
Description:          Co-elevation (CE) is direction from vertical of the laser beam as
seen by an observer located at the laser ground spot.Comments:

Product Var Name:     i_beam_azimuth
Is element of:        GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13
Record, GLA14 Record, GLA15 Record
Short Description:    Azimuth
Product Data Type:    i4b
Total Bytes:          4
```

```
Product Units:        degrees*100
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      36000
Description:          Az is the direction clockwise from north of the laser beam vector
as seen by an observer at the laser ground spot viewing toward the spacecraft (i.e., the
vector from the ground to the spacecraft).Comments:

Product Var Name:     i_AttFlg1
Is element of:        GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13
Record, GLA14 Record, GLA15 Record
Short Description:    Attitude Flag 1
Product Data Type:    i2b
Total Bytes:          2
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      32767
Description:          At 1/sec denotes large off-nadir angle, ocn sweep, target of op-
portunity, steering to reference track.
Please see <a href='flags/i_AttFlg1.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name:     i_Spare6
Is element of:        GLA14 Record
Short Description:    Spares
Product Data Type:    i1b (2)
Total Bytes:          2
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      null
Product Maximum:      null
Description:
Comments:

Product Var Name:     i_DEM_hires_src
Is element of:        GLA14 Record
Short Description:    High Resolution Source Flag
Product Data Type:    i1b ( 40)
Total Bytes:          40
Product Units:        NA
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      127
Description:          Please see <a href='flags/i_DEM_hires_src.pdf'> the PDF flag de-
scription</a> for more details.
Comments:

Product Var Name:     i_DEM_hires_elv
Is element of:        GLA14 Record
Short Description:    High Resolution Elevation
```

```
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -500
Product Maximum:      13000
Description:
Comments:

Product Var Name:     i_satNdx
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Saturation Index
Product Data Type:    i1b (40)
Total Bytes:          40
Product Units:        ns
Invalid Value/Flag:   i1b
Is Correction Flag?:  NA
Is Unsigned?:         Yes
Product Minimum:      0
Product Maximum:      255
Description:          The count of the number of gates in a waveform which have an am-
plitude greater than or equal to i_satNdxTh (set in anc07_0004). The value 255 means 255
or more gates are above the saturation index threshold (i_satNdxth).
Comments:

Product Var Name:     i_satRngCorr
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Saturation Range Correction
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  No
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      100
Description:
Comments:

Product Var Name:     i_satCorrFlg
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Saturation Correction Flag
Product Data Type:    i1b ( 40)
Total Bytes:          40
Product Units:        NA
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         NA
Product Minimum:      NA
Product Maximum:      NA
Description:          This is a flag for i_satRngCorr, i_satNrgCorr & i_satPwdCorr.
Comments:

Product Var Name:     i_satNrgCorr
```

```
Is element of:       GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:   Saturation Energy Correction
Product Data Type:   i2b ( 40)
Total Bytes:         80
Product Units:       mm
Invalid Value/Flag:  i2b
Is Correction Flag?: NA
Is Unsigned?:        No
Product Minimum:     0
Product Maximum:     100
Description:
Comments:

Product Var Name:    i_satPwdCorr
Is element of:       GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:   Saturation Pulse Width Correction
Product Data Type:   i2b ( 40)
Total Bytes:         80
Product Units:       mm
Invalid Value/Flag:  i2b
Is Correction Flag?: NA
Is Unsigned?:        No
Product Minimum:     0
Product Maximum:     100
Description:
Comments:

Product Var Name:    i_gval_rcv
Is element of:       GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:   Gain Value used for Received Pulse
Product Data Type:   i2b (40)
Total Bytes:         80
Product Units:       counts
Invalid Value/Flag:  i2b
Is Correction Flag?: NA
Is Unsigned?:        No
Product Minimum:     0
Product Maximum:     200
Description:         Gain value used for received pulse - uncalibrated.
Comments:            This value is in counts and needs to be calibrated before calcu-
lating energy from it. Same as variable in GLA01_Long/i_gainSet1064.

Product Var Name:    i_RecNrgAll
Is element of:       GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:   Received Energy signal begin to signal end
Product Data Type:   i2b ( 40)
Total Bytes:         80
Product Units:        0.01 fJoules
Invalid Value/Flag:  i_APID_AvFlg
Is Correction Flag?: NA
Is Unsigned?:        No
Product Minimum:     0
Product Maximum:     32000
Description:
Comments:
```

```
Product Var Name:     i_FRir_cldtop
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Full Resolution 1064 Cloud Top
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1030
Description:          Full resolution (40 Hz) cloud top height obtained from the 1064
atmospheric channel. This parameter is for a 1 second record. This parameter is in GLA09.
Comments:

Product Var Name:     i_FRir_qaFlag
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Full Resolution 1064 Quality Flag
Product Data Type:    i1b ( 40)
Total Bytes:          40
Product Units:        NA
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      15
Description:          Please see <a href='flags/i_FRir_qaFlag.pdf'> the PDF flag de-
scription</a> for more details.
Comments:

Product Var Name:     i_FRir_ODflg
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Full Resolution 1064 Optical Depth Flag
Product Data Type:    i1b ( 40)
Total Bytes:          40
Product Units:        NA
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      0
Description:          This parameter is for a 1 second record. This parameter is also in
GLA11.Comments:

Product Var Name:     i_FRir_intsig
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Full Resolution 1064 Integrated Signal
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        e7/(m-sr)
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
```

```
Product Maximum:     10000
Description:         Though called ‘integrated signal’ this is actually an average of
all bins in the above-ground portion of the 1064 40 Hz profile with values above the
threshold of 1.0e-7 (1/(m-sr) units). This parameter is for a 1 second record. This pa-
rameter is also in GLA09.
Comments:

Product Var Name:    i_msRngCorr
Is element of:       GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:   Multi-Scatter Range Correction
Product Data Type:   i2b ( 40)
Total Bytes:         80
Product Units:       Unknown
Invalid Value/Flag:  i2b
Is Correction Flag?: NA
Is Unsigned?:        No
Product Minimum:     0
Product Maximum:     0
Description:
Comments:

Product Var Name:    i_msCorrFlg
Is element of:       GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:   Multi-Scatter Range Correction
Product Data Type:   i1b ( 40)
Total Bytes:         40
Product Units:       Unknown
Invalid Value/Flag:  No
Is Correction Flag?: NA
Is Unsigned?:        No
Product Minimum:     0
Product Maximum:     0
Description:
Comments:

Product Var Name:    i_Surface_temp
Is element of:       GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:   Surface Temperature
Product Data Type:   i2b
Total Bytes:         2
Product Units:       degrees Celsius * 100
Invalid Value/Flag:  i2b
Is Correction Flag?: NA
Is Unsigned?:        No
Product Minimum:     -10000
Product Maximum:     10000
Description:
Comments:

Product Var Name:    i_Surface_pres
Is element of:       GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:   Surface Pressure
Product Data Type:   i2b
Total Bytes:         2
Product Units:       millibars of mercury * 10
```

```
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:
Comments:

Product Var Name:     i_Surface_relh
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Relative Humidity
Product Data Type:    i2b
Total Bytes:          2
Product Units:        percentage * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:
Comments:

Product Var Name:     i_Spare7
Is element of:        GLA14 Record
Short Description:    spares
Product Data Type:    i1b ( 566)
Total Bytes:          566
Product Units:        NA
Invalid Value/Flag:   null
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      null
Product Maximum:      null
Description:
Comments:
```

D.1.8 GLA15 Record

```
Product Var Name:     i_rec_ndx
Is element of:        GLA01 Long Waveform Record, GLA01 Main Record ,
GLA01_Short_Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO
Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04
SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record,
GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description:    GLAS Record Index
Product Data Type:    i4b
Total Bytes:          4
Product Units:        N/A
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      2147483647
Description:          Unique index that relates this record to the corresponding
record(s) in each GLAS data product.
Comments:

Product Var Name:     i_UTCTime
```

```
Is element of:       GLA01 Long Waveform Record, GLA01 Main Record ,
GLA01_Short_Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO
Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04
SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record,
GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description:   Transmit Time of First Shot in frame in J2000
Product Data Type:   i4b (2)
Total Bytes:         8
Product Units:       seconds, microseconds
Invalid Value/Flag:  no
Is Correction Flag?: NA
Is Unsigned?:        No
Product Minimum:     0
Product Maximum:     2147483647
Description:         The transmit time in UTC of the 1st shot in the 1 second frame
referenced to noon on Jan 1, 2000.   The first item is the whole number of seconds ; the
second item is the fractional part in microseconds.
Comments:            This is not the ground bounce time, but the transmit time.

Product Var Name:    i_transtime
Is element of:       GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:   One way transit time
Product Data Type:   i2b
Total Bytes:         2
Product Units:       microseconds
Invalid Value/Flag:  i2b
Is Correction Flag?: NA
Is Unsigned?:        No
Product Minimum:     0
Product Maximum:     4000
Description:         One way transit time calculated using the preliminary range offset.
This is added to the UTC time tag to get the ground bounce times at which to calculate
the orbit
Comments:

Product Var Name:    i_Spare1
Is element of:       GLA15 Record
Short Description:   Spare
Product Data Type:   i1b (2)
Total Bytes:         2
Product Units:       N/A
Invalid Value/Flag:  No
Is Correction Flag?: NA
Is Unsigned?:        No
Product Minimum:     null
Product Maximum:     null
Description:
Comments:

Product Var Name:    i_deltagpstmcor
Is element of:       GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:   Delta GPS time correction
Product Data Type:   i4b
Total Bytes:         4
Product Units:       nanoseconds
Invalid Value/Flag:  gi_invalid_i4b
Is Correction Flag?: NA
```

Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1000000
Description: The high frequency delta GPS time correction calculated during the precision orbit processing step.
Comments:

Product Var Name: i_dShotTime
Is element of: GLA01 Main Record , GLA04 LPA Main Record, GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Laser Shot Time Deltas (shots 2-40)
Product Data Type: i4b (39)
Total Bytes: 156
Product Units: microseconds
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1200000
Description: The time deltas of pulses 2 through 40 to i_UTCTime, the UTC time tag of the first pulse in the 1-second data frame. Adding the deltas to i_UTCTime will give the user the time of each individual shot in the frame.
Comments: To calculate the time for shots 2-40, add these deltas to the time of the first shot.

Product Var Name: i_lat
Is element of: GLA15 Record
Short Description: Coordinate Data, Latitude, specific to ocean range
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: microdeg
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -90000000
Product Maximum: 90000000
Description: The geodetic latitude of the forty laser spots in the 1 second time frame, computed from the Precision orbit determined GLAS laser antenna ground nadir coordinates, precision attitude, and ocean-specific range after all instrument corrections, atmospheric delays and tides have been applied. The values are in degress North.
Comments:

Product Var Name: i_lon
Is element of: GLA15 Record
Short Description: Coordinate Data, Longitude, specific to ocean range
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: microdeg
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 360000000
Description: The longitude of the forty laser spots in the 1 second time frame, computed from the Precision orbit determined GLAS laser antenna ground nadir coordinates, precision attitude, and ocean-specific range after all instrument corrections, atmospheric delays and tides have been applied. The values are in east longitude.
Comments:

```
Product Var Name:     i_elev
Is element of:        GLA15 Record
Short Description:    Ocean Surface Elevation
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        mm
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -500000
Product Maximum:      10000000
Description:          Surface elevation with respect to the ellipsoid at the spot loca-
tion determined by range using the fitting algorithm after instrument corrections, at-
mospheric delays and tides have been applied.
Comments:

Product Var Name:     i_PADPoint
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    PAD Pointing unit Vector in ICRF
Product Data Type:    i4b (6, 40)
Total Bytes:          960
Product Units:        Unitless*1000000
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -1000000
Product Maximum:      1000000
Description:          Unit vectors giving the pointing direction of the laser with re-
spect to the GLAS optical bench axes in the ICRF reference frame, one vector for each
of the 40 shots, at the shot (transmit) time. Each component is composed of 2 4-byte
items.
Comments:

Product Var Name:     i_PODFixedPos
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Position orbit vector in ICRF
Product Data Type:    i4b (6, 40)
Total Bytes:          960
Product Units:        3 * (m, mm)
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -7.0E+10
Product Maximum:      7.0E+10
Description:          Spacecraft position vectors in ICRF of the laser point of reference
on the spacecraft, one vector for each of the 40 shots, at the bounce (transmit plus
transit) time.  Each element is composed of 2 4-byte items. The first is m and the second
is millimeters.
Comments:

Product Var Name:     i_sigmaatt
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Attitude Quality Indicator
Product Data Type:    i2b (40)
Total Bytes:          80
Product Units:        Unitless
```

```
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      6000
Description:          Attitude quality indicator. Values: 0=good; 50=warning; 100=bad.
Comments:             This indicator currently has only 3 values: 0, 50, and 100, leaving
open the opportunity to use numbers in between for further resolution of the degradation
as our knowledge improves.

Product Var Name:     i_Azimuth
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Local Azimuth
Product Data Type:    i4b
Total Bytes:          4
Product Units:        millideg
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      360000
Description:          Azimuth of the footprint path.
Comments:

Product Var Name:     i_SolAng
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Solar Incidence Angle
Product Data Type:    i4b
Total Bytes:          4
Product Units:        microdeg
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -90000000
Product Maximum:      90000000
Description:          The solar incidence angle determined during Precision Orbit Deter-
mination processing; it provides the operational sun angle estimate.
Comments:

Product Var Name:     i_tpintensity_avg
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Transmit Pulse intensity - frame avg
Product Data Type:    i4b
Total Bytes:          4
Product Units:        counts
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      25500
Description:
Comments:

Product Var Name:     i_tpazimuth_avg
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
```

```
Short Description:    Transmit Pulse azimuth - frame avg
Product Data Type:    i2b
Total Bytes:          2
Product Units:        degrees*10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      3600
Description:
Comments:

Product Var Name:     i_tpeccentricity_avg
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Transmit Pulse eccentricity - frame avg
Product Data Type:    i2b
Total Bytes:          2
Product Units:        Unitless*1000
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1000
Description:
Comments:

Product Var Name:     i_tpmajoraxis_avg
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Tramsit Pulse major axis - frame avg
Product Data Type:    i2b
Total Bytes:          2
Product Units:        cm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:
Comments:

Product Var Name:     i_Spare2
Is element of:        GLA15 Record
Short Description:    Spare
Product Data Type:    i1b (2)
Total Bytes:          2
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      null
Product Maximum:      null
Description:
Comments:

Product Var Name:     i_gdHt
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
```

```
Short Description:    Geoid
Product Data Type:    i2b ( 2)
Total Bytes:          4
Product Units:        cm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -20000
Product Maximum:      20000
Description:          The height of the geoid above the ellipsoid for the first and last
shot in the record.
Comments:

Product Var Name:     i_erElv
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description:    Solid Earth Tide Elevation (at first & last shot)
Product Data Type:    i2b ( 2)
Total Bytes:          4
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          The solid earth tide elevation for the first & last shot in the
record.
Comments:

Product Var Name:     i_spElv
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Tide Elevations, Specific
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          A tide elevation calculated from alternate tide models for specific
regions for shots 1, 11, 21, and 31.
Comments:

Product Var Name:     i_ldElv
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Load Tide Elevation
Product Data Type:    i2b ( 4)
Total Bytes:          8
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          The load tide elevation applied to each shot. Elements 1-4 of the
load tide vector are applied to shots 1-10, 11-20, 21-30, and 31-40, respectively.Com-
ments:                The load tide is NOT NECESSARILY the load tide for shots
```

```
1,11,21,31. It is calculated for the first valid shot in each group of 10 and applied
to all valid shots in the group.
Product Var Name:     i_ocElv
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Ocean Tide Elevation (at first & last shot)
Product Data Type:    i2b ( 2)
Total Bytes:          4
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          The ocean tide elevation at first & last shot
Comments:

Product Var Name:     i_wTrop
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Range Correction_Wet Troposphere
Product Data Type:    i2b ( 2)
Total Bytes:          4
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -1000
Product Maximum:      0
Description:          The range correction due to the wet troposphere at first & last
shot.
Comments:

Product Var Name:     i_dTrop
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description:    Range Correction, Dry Troposphere
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -2500
Product Maximum:      0
Description:          The range correction due to the dry troposphere; one correction
for each shot.
Comments:

Product Var Name:     i_surfType
Is element of:        GLA06 record, GLA07 Record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Region Type
Product Data Type:    i1b
Total Bytes:          1
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      1
```

```
Product Maximum:      15
Description:          Describes the region type or types associated with each shot Ice
Sheet, ocean, sea ice, or Land.
Please see <a href='flags/i_surfType.pdf'> the PDF flag description</a> for more de-
tails.
Comments:

Product Var Name:     i_Spare3
Is element of:        GLA15 Record
Short Description:    Spares
Product Data Type:    i1b (3)
Total Bytes:          3
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      null
Product Maximum:      null
Description:
Comments:

Product Var Name:     i_DEM_elv
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    DEM Elevation
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        cm
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -50000
Product Maximum:      1000000
Description:          Elevation with respect to sea level as interpolated from a Digital
Elevation Map (DEM) at each footprint location.
Comments:

Product Var Name:     i_refRng
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description:    Reference Range
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        mm
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      400000000
Product Maximum:      1000000000
Description:          Range in distance calculated from the time between the peak of the
transmit pulse and the farthest gate from the spacecraft of the received pulse. See the
rngcorrflg to determine any corrections that have been applied.
Comments:

Product Var Name:     i_TrshRngOff
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description:    Threshold Retracker Range Offset
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        mm
```

```
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -150000
Product Maximum:      0
Description:          Offset to be added to i_refRng to give the range in distance to
the threshold retracker location on the received echo using standard parameters.
Comments:

Product Var Name:     i_ocRngOff
Is element of:        GLA06 record, GLA15 Record
Short Description:    Ocean Range Offset
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        mm
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -150000
Product Maximum:      0
Description:          Range offset to be added to i_refRng to calculate the range using
the algorithm deemed appropriate for oceans.
Comments:

Product Var Name:     i_SigEndOff
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description:    Signal End Range Offset
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        mm
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -150000
Product Maximum:      0
Description:          Offset to be added to i_refRng to give the range in distance to
the location on the received echo calculated as the end of signal (farthest from the
spacecraft) using standard parameters.Comments:

Product Var Name:     i_cntRngOff
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description:    Centroid Range Offset
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        mm
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -150000
Product Maximum:      0
Description:          Offset to be added to i_refRng to give the range in distance to
the location of the centroid of the received echo from signal begin through signal end
defined by the standard parameters.
Comments:

Product Var Name:     i_reflctUncorr
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Reflectivity not corrected for Atmospheric Effects
```

```
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        Unitless*1E06
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1000000
Description:          The reflectance (not corrected for atmospheric effects) is calcu-
lated as the ratio of the received energy after it has been scaled for range, and the
transmitted energy.  The corrected reflectance may be calculated from this uncorrected
reflectance by dividing  by e^(-2(tc+ta+tm)), where tc is the cloud (column) integrated
optical depth, ta is the aerosol (column) integrated optical depth, and tm is the mo-
lecular optical depth.
Comments:             This uses all signal between signal begin and signal end.

Product Var Name:     i_reflCor_atm
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Reflectivity Corrected Atmospheric Effects
Product Data Type:    i4b
Total Bytes:          4
Product Units:        Unitless*1E06
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1000000
Description:          This corrected reflectance is calculated from the uncorrected re-
flectance by dividing by e^(-2(tc+ta+tm)), where tc is the cloud (column) integrated
optical depth, ta is the aerosol (column) integrated optical depth, and tm is the mo-
lecular optical depth.
Comments:

Product Var Name:     i_maxSmAmp
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Peak Amplitude of Smoothed Received Echo
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        Tenth of millivolts
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -300
Product Maximum:      30000
Description:          The peak amplitude of the received echo after it has been smoothed
to remove high frequency noise (see ATBD).
Comments:             This is calculated after converting the return to voltage.

Product Var Name:     i_SigmaElv
Is element of:        GLA15 Record
Short Description:    Sigma of Elevation
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
```

```
Product Minimum:      0
Product Maximum:      32000
Description:          Elevation error estimates, the error from the Gaussian fit to the
received echo associated with the centroid of the last peak using standard parame-
ters.Comments:

Product Var Name:     i_numPk
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description:    Number of Peaks found in the Return
Product Data Type:    i1b ( 40)
Total Bytes:          40
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      6
Description:          The number of peaks in the return echo found by the Gaussian fit-
ting procedure, using standard parameters.
Comments:

Product Var Name:     i_skew2
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA15
Record
Short Description:    Skewness
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        unitless * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:          The skewness of the received echo from signal begin to signal end
using standard  parameters.
Comments:             Note that the received echo was calibrated and converted to voltage
before calculation.

Product Var Name:     i_OcRufRMS
Is element of:        GLA15 Record
Short Description:    RMS of elevations used for 1-sec mean elevation
Product Data Type:    i4b
Total Bytes:          4
Product Units:        mm
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      120000
Description:
Comments:

Product Var Name:     i_OcMeanElev
Is element of:        GLA15 Record
Short Description:    Mean elevation over 1 sec
Product Data Type:    i4b
Total Bytes:          4
Product Units:        mm
Invalid Value/Flag:   i4b
```

```
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -500000
Product Maximum:      10000000
Description:          1 -sec mean elevation
Comments:

Product Var Name:     i_lowElev
Is element of:        GLA15 Record
Short Description:    Lowest Elevation
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        mm
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -500000
Product Maximum:      10000000
Description:          Lowest elevation in footprint, with all corrections applied (cor-
responds to signal end) using standard parameters.
Comments:

Product Var Name:     i_highElev
Is element of:        GLA15 Record
Short Description:    Highest Elevation
Product Data Type:    i4b ( 40)
Total Bytes:          160
Product Units:        mm
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -500000
Product Maximum:      10000000
Description:          Highest elevation in footprint, with all corrections applied (cor-
responds to signal begin) using standard parameters.
Comments:

Product Var Name:     i_OceanVar
Is element of:        GLA15 Record
Short Description:    Standard Deviation of the ocean Gaussian Fit
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        millivolts
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      25500
Description:          The Standard deviation of the difference between the functional
fit and the received echo using standard parameters. It is directly taken from GLA05
parameter d_wfFitSDev_2 (standard).
Comments:

Product Var Name:     i_ElvuseFlg
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Elevation use flag
Product Data Type:    i1b ( 5)
Total Bytes:          5
```

```
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -127
Product Maximum:      127
Description:          Flag indicating whether the elevations on this record should be
used or not (1 bit set/shot). See the <a href='flags/i_ElvuseFlg.pdf'>PDF file</A> for
more information.
Comments:

Product Var Name:     i_atm_avail
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Atmosphere Availability Flag
Product Data Type:    i1b
Total Bytes:          1
Product Units:        NA
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      15
Description:          Please see <a href='flags/i_atm_avail.pdf'> the PDF flag descrip-
tion</a> for more details.
Comments:

Product Var Name:     i_erd
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Estimated Range Delay
Product Data Type:    i2b
Total Bytes:          2
Product Units:        Millimeters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1000
Description:
Comments:

Product Var Name:     i_rdu
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Range Delay Uncertainty
Product Data Type:    i2b
Total Bytes:          2
Product Units:        Millimeters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:
Comments:

Product Var Name:     i_cld1_mswf
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
```

Record
Short Description: Cloud Multiple Scattering Warning Flag
Product Data Type: i1b
Total Bytes: 1
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: The multiple scattering warning flag (MSWF) is based on the total column optical depth (aerosol plus cloud) calculated in GLA11 using 532nm. It is intended as a way to quickly obtain information about the potential severity of multiple scattering with regards to the range-to-surface calculated by the altimetry processing software. It will be output on the GLA11 product for use by the altimetry group. The multiple scattering warning flag will have values ranging from 0-14, based on the total column optical depth as detailedin the PDF.
A warning flag value of 15 will signify ?invalid?. An invalid will be encoded if an optical depth in any of the layers in the 1-second column could not be calculated. This usually occurs in a very optically ?thick? cloud which extinguishes the signal. It could also occur if the extinction-to-backscatter ratio assignment is set too high, causing the transmission calculations in the lidar inversion to go out-of-range.Please see the PDF flag description for more details.
Comments:

Product Var Name: i_MRC_af
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Medium Resolution Cloud Availability Flag
Product Data Type: i1b
Total Bytes: 1
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: Please see the PDF flag description for more details.
Comments:

Product Var Name: i_OcRMSqf
Is element of: GLA15 Record
Short Description: Ocean RMS Roughness Quality Flag
Product Data Type: i1b (40)
Total Bytes: 40
Product Units: null
Invalid Value/Flag: N
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1
Description: Data quality flag for the ocean roughness.
Please see the PDF flag description for more details.
Comments:

Product Var Name: i_ElvFlg
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record

```
Short Description:    Elevation Definition Flag
Product Data Type:    i1b ( 40)
Total Bytes:          40
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      127
Description:          Indicates which location on the received echo was used to calculate
the elevation on the record.
Please see <a href='flags/i_ElvFlg.pdf'> the PDF flag description</a> for more details.
'For GLA06 and 12-15, bits are set to reflect Standard Fitting. For GLA14, bits are set
to reflect Alternate Fitting. Although defined as a pass-thru, the values are different
on GLA06/12-15 and GLA14.'
Comments:

Product Var Name:     i_rng_UQF
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Range Offset Quality/Use Flag
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      32767
Description:          Data quality flag for the range offsets on this record.
Please see <a href='flags/i_rng_UQF.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name:     i_atmQF
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Atmosphere Flag
Product Data Type:    i1b ( 10)
Total Bytes:          10
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1
Description:          Indicates from LIDAR channel if conditions for forward scattering
were favorable.
Please see <a href='flags/i_atmQF.pdf'> the PDF flag description</a> for more details.
Comments:             If forward scattering occurs, it may map to an error in the ele-
vation measurement. Users may want to delete data with forward scattering.

Product Var Name:     i_timecorflg
Is element of:        GLA01 Main Record , GLA02 Record, GLA03 Main Record, GLA04 BST Main
Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS
Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08
Record, GLA09 Record, GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    time correction flag
Product Data Type:    i2b
```

```
Total Bytes:          2
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  No
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      32767
Description:          Indicates what instrument or bias corrections were applied to the
times on this record. Please see <a href='flags/i_timecorflg.pdf'> the PDF flag descrip-
tion</a> for more details.
Comments:

Product Var Name:     i_APID_AvFlg
Is element of:        GLA01 Main Record , GLA02 Record, GLA04 BST Main Record, GLA04 GYRO
Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04
SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13 Record,
GLA14 Record, GLA15 Record
Short Description:    APID Data Availability Flag
Product Data Type:    i1b (8)
Total Bytes:          8
Product Units:        n/a
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -127
Product Maximum:      127
Description:          Flag indicating which packets (APIDs) for each second are available
missing, or filled.  APID 19 is broken down further into Altimeter Digitizer, Photon
Counter, Cloud Digitizer, GPS/DEM, and C&T sections.
Please see <a href='flags/i_APID_AvFlg.pdf'> the PDF flag description</a> for more de-
tails.
Comments:

Product Var Name:     i_AttFlg2
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Attitude Flag 2
Product Data Type:    i1b (20)
Total Bytes:          20
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      15
Description:          Denotes at 40/sec rate whether precision attitude was used to de-
termine spot location, and if problems with LPA, etc.
Please see <a href='flags/i_AttFlg2.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name:     i_spare5
Is element of:        GLA15 Record
Short Description:    Spares
Product Data Type:    i1b
Total Bytes:          1
Product Units:        NA
Invalid Value/Flag:   NA
Is Correction Flag?:  NA
Is Unsigned?:         No
```

```
Product Minimum:      0
Product Maximum:      0
Description:
Comments:

Product Var Name:     i_FrameQF
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Altimeter Frame Quality Flag
Product Data Type:    i1b
Total Bytes:          1
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1
Description:          Denotes all bad data (no signal in whole frame), or all data good
and all science team recommended corrections applied
Please see <a href='flags/i_FrameQF.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name:     i_OrbFlg
Is element of:        GLA01 Main Record , GLA02 Record, GLA05 record, GLA06 record, GLA07
Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description:    POD flag (Orbit Flag)
Product Data Type:    i1b (2)
Total Bytes:          2
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      128
Description:          Denotes quality of orbit, whether predicted or precision, loss of
GPS data, maneuver-degraded, etc.
Please see <a href='flags/i_OrbFlg.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name:     i_rngCorrFlg
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Range Correction Flag
Product Data Type:    i1b (2)
Total Bytes:          2
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      32767
Description:          Denotes which geophysical or instrument corrections have been ap-
plied to the range in the calculation of the elevation on this record.
Please see <a href='flags/i_rngCorrFlg.pdf'> the PDF flag description</a> for more de-
tails.
Comments:

Product Var Name:     i_CorrStatFlg
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
```

```
Record
Short Description:    Correction Status Flag
Product Data Type:    i1b (2)
Total Bytes:          2
Product Units:        NA
Invalid Value/Flag:   no
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      32767
Description:          For each geophysical correction that has multiple values denotes
which algorithm or model was used.
Please see <a href='flags/i_CorrStatFlg.pdf'> the PDF flag description</a> for more de-
tails.
Comments:

Product Var Name:     i_beam_coelev
Is element of:        GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13
Record, GLA14 Record, GLA15 Record
Short Description:    Co-elevation
Product Data Type:    i4b
Total Bytes:          4
Product Units:        degrees*100
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      36000
Description:          Co-elevation (CE) is direction from vertical of the laser beam as
seen by an observer located at the laser ground spot.Comments:

Product Var Name:     i_beam_azimuth
Is element of:        GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13
Record, GLA14 Record, GLA15 Record
Short Description:    Azimuth
Product Data Type:    i4b
Total Bytes:          4
Product Units:        degrees*100
Invalid Value/Flag:   i4b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      36000
Description:          Az is the direction clockwise from north of the laser beam vector
as seen by an observer at the laser ground spot viewing toward the spacecraft (i.e., the
vector from the ground to the spacecraft).Comments:

Product Var Name:     i_AttFlg1
Is element of:        GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13
Record, GLA14 Record, GLA15 Record
Short Description:    Attitude Flag 1
Product Data Type:    i2b
Total Bytes:          2
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      32767
```

```
Description:          At 1/sec denotes large off-nadir angle, ocn sweep, target of op-
portunity, steering to reference track.
Please see <a href='flags/i_AttFlg1.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name:     i_Spare6
Is element of:        GLA15 Record
Short Description:    spares
Product Data Type:    i1b ( 2)
Total Bytes:          2
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      null
Product Maximum:      null
Description:
Comments:

Product Var Name:     i_satNdx
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Saturation Index
Product Data Type:    i1b (40)
Total Bytes:          40
Product Units:        ns
Invalid Value/Flag:   i1b
Is Correction Flag?:  NA
Is Unsigned?:         Yes
Product Minimum:      0
Product Maximum:      255
Description:          The count of the number of gates in a waveform which have an am-
plitude greater than or equal to i_satNdxTh (set in anc07_0004). The value 255 means 255
or more gates are above the saturation index threshold (i_satNdxth).
Comments:

Product Var Name:     i_satRngCorr
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Saturation Range Correction
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  No
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      100
Description:
Comments:

Product Var Name:     i_satCorrFlg
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Saturation Correction Flag
Product Data Type:    i1b ( 40)
Total Bytes:          40
Product Units:        NA
Invalid Value/Flag:   No
```

```
Is Correction Flag?:  NA
Is Unsigned?:         NA
Product Minimum:      NA
Product Maximum:      NA
Description:          This is a flag for i_satRngCorr, i_satNrgCorr & i_satPwdCorr.
Comments:

Product Var Name:     i_satNrgCorr
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Saturation Energy Correction
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      100
Description:
Comments:

Product Var Name:     i_satPwdCorr
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Saturation Pulse Width Correction
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        mm
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      100
Description:
Comments:

Product Var Name:     i_gval_rcv
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Gain Value used for Received Pulse
Product Data Type:    i2b (40)
Total Bytes:          80
Product Units:        counts
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      200
Description:          Gain value used for received pulse - uncalibrated.
Comments:             This value is in counts and needs to be calibrated before calcu-
lating energy from it. Same as variable in GLA01_Long/i_gainSet1064.

Product Var Name:     i_RecNrgAll
Is element of:        GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description:    Received Energy signal begin to signal end
Product Data Type:    i2b ( 40)
Total Bytes:          80
```

```
Product Units:         0.01 fJoules
Invalid Value/Flag:   i_APID_AvFlg
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      32000
Description:
Comments:

Product Var Name:     i_FRir_cldtop
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Full Resolution 1064 Cloud Top
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        deka-meters
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      1030
Description:          Full resolution (40 Hz) cloud top height obtained from the 1064
atmospheric channel. This parameter is for a 1 second record. This parameter is in GLA09.
Comments:

Product Var Name:     i_FRir_qaFlag
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Full Resolution 1064 Quality Flag
Product Data Type:    i1b ( 40)
Total Bytes:          40
Product Units:        NA
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      15
Description:          Please see <a href='flags/i_FRir_qaFlag.pdf'> the PDF flag de-
scription</a> for more details.
Comments:

Product Var Name:     i_FRir_ODflg
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Full Resolution 1064 Optical Depth Flag
Product Data Type:    i1b ( 40)
Total Bytes:          40
Product Units:        NA
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      0
Description:          This parameter is for a 1 second record. This parameter is also in
GLA11.Comments:

Product Var Name:     i_FRir_intsig
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
```

```
Short Description:    Full Resolution 1064 Integrated Signal
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        e7/(m-sr)
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:          Though called ‘integrated signal’ this is actually an average of
all bins in the above-ground portion of the 1064 40 Hz profile with values above the
threshold of 1.0e-7 (1/(m-sr) units). This parameter is for a 1 second record. This pa-
rameter is also in GLA09.
Comments:

Product Var Name:     i_msRngCorr
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Multi-Scatter Range Correction
Product Data Type:    i2b ( 40)
Total Bytes:          80
Product Units:        Unknown
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      0
Description:
Comments:

Product Var Name:     i_msCorrFlg
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Multi-Scatter Range Correction
Product Data Type:    i1b ( 40)
Total Bytes:          40
Product Units:        Unknown
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      0
Description:
Comments:

Product Var Name:     i_Surface_temp
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Surface Temperature
Product Data Type:    i2b
Total Bytes:          2
Product Units:        degrees Celsius * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      -10000
Product Maximum:      10000
Description:
Comments:
```

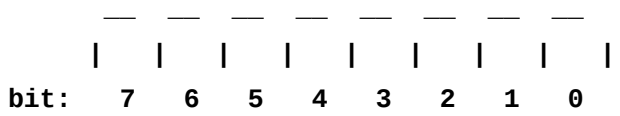
```
Product Var Name:     i_Surface_pres
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Surface Pressure
Product Data Type:    i2b
Total Bytes:          2
Product Units:        millibars of mercury * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:
Comments:

Product Var Name:     i_Surface_relh
Is element of:        GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description:    Relative Humidity
Product Data Type:    i2b
Total Bytes:          2
Product Units:        percentage * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      10000
Description:
Comments:

Product Var Name:     i_Surface_wind
Is element of:        GLA07 Record, GLA15 Record
Short Description:    Surface Wind Speed
Product Data Type:    i2b
Total Bytes:          2
Product Units:        meters/second * 100
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      20000
Description:
Comments:

Product Var Name:     i_Surface_wdir
Is element of:        GLA07 Record, GLA15 Record
Short Description:    Surface Wind Direction Azimuth from North
Product Data Type:    i2b
Total Bytes:          2
Product Units:        degrees * 10
Invalid Value/Flag:   i2b
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      0
Product Maximum:      3600
Description:
Comments:
```

```
Product Var Name:     i_Spare7
Is element of:        GLA15 Record
Short Description:    spares
Product Data Type:    i1b ( 594)
Total Bytes:          594
Product Units:        N/A
Invalid Value/Flag:   No
Is Correction Flag?:  NA
Is Unsigned?:         No
Product Minimum:      null
Product Maximum:      null
Description:
Comments:
```

Appendix E
Flags

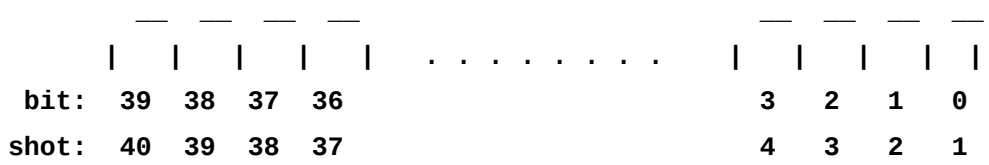
E.1 Design Philosophy

GSAS flag design is governed by a consistent philosophy. Per HP documentation, bits are numbered right to left starting at 0. Eg, a byte has the following bit numbers:

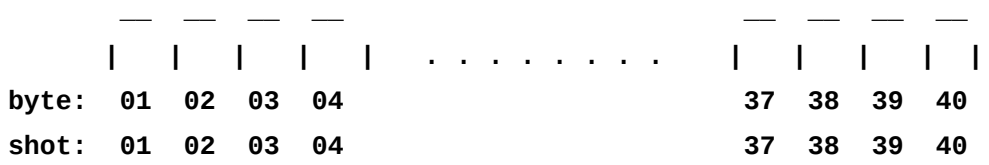


However, arrays of bytes are numbered left to right starting at 1. The direction from which shots are incremented depend if the flag is a byte flag or bit flag. Byte flags increment from left to right, bit flags increment from right to left. This follows the "natural" big endian ordering scheme. Eg:

BIT flags increment from right to left:



BYTE flags increment from left to right:



The following section contains detailed descriptions of each flag found in the GSAS Level 2 products. The descriptions are ordered alphabetically.

E.2 Flag Descriptions

i_Aer_ir_layflg [GLA08]: Layer Flag for 1064 Aerosol

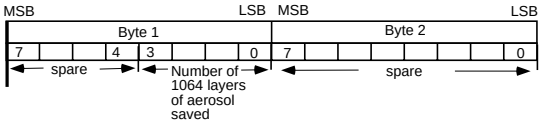


Figure E-1 Layer Flag for 1064 Aerosol

i_LayHgt_Flag [GLA08]: Layer Height Flag

i_pscf: value 0 = not a PSC; value 1 = low likely; value 2 = medium likely; value 3 = high likely

i20_aer_qf = quality flag at 1 per sec: value 0 = aerosol layers were searched for, but not detected; values 1 to 13 = increasing goodness; value 14 = bad; value 15 = upper (>20 km) aerosol layers were not searched for

i20_aer_af = availability flag at 1 per 20 sec: value 0 = aerosol layers were searched for, but not detected; value 15 = aerosol layers were not searched for

i20_aer_uf = use flag at 1 per 20 sec: value 0 = no saturated bins present in layer; value 1 = saturated bins present in layer and replaced with 1064 data; value 2 = saturated bins present in layer and not replaced with 1064 data

i4_aer_qf = quality flag at 1 per 4 sec: value 0 = aerosol layers were searched for, but not detected; values 1 to 13 = increasing goodness; value 14 = bad; value 15 = lower (<20 km) aerosol layers were not searched for

i4_aer_af = availability flag at 1 per 4 sec: value 0 = aerosol layers were searched for, but not detected; value 15 = aerosol layers were not searched for

i4_aer_uf = use flag at 1 per 4 sec: value 0 = no saturated bins present in layer; value 1 = saturated bins present in layer and replaced with 1064 data; value 2 = saturated bins present in layer and not replaced with 1064 data

i_HRpbl_qf = quality flag at 5Hz for 4 sec: value 0 = PBL was searched for, but not detected; values 1 to 13 = increasing goodness; value 14 = bad; value 15 = PBL not searched for

i_HRpbl_uf = use flag at 5Hz for 4 sec: value 0 = no saturated bins present in layer; value 1 = saturated bins present in layer and replaced with 1064 data; value 2 = saturated bins present in layer and not replaced with 1064 data

i_HRpbl_ccf = clear/cloudy flag at 5Hz for 4 sec: value 0 = clear; value 1 = cloudy

i_LRpbl_qf = quality flag at 1 per 4 sec: value 0 = PBL was searched for, but not detected; values 1 to 13 = increasing goodness; value 14 = bad; value 15 = PBL not searched for

i_LRpbl_uf = use flag at 1 per 4 sec: value 0 = no saturated bins present in layer; value 1 = saturated bins present in layer and replaced with 1064 data; value 2 = saturated bins present in layer and not replaced with 1064 data

i_LRpbl_ccf = clear/cloudy flag at 1 per 4 sec: value 0 = clear; value 1 = cloudy

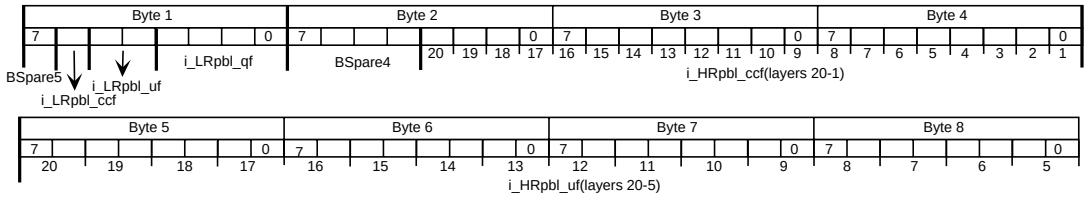


Figure E-2 Layer Height Flag

i_LayHgt_Flag [GLA08]: Layer Height Flag (continued)

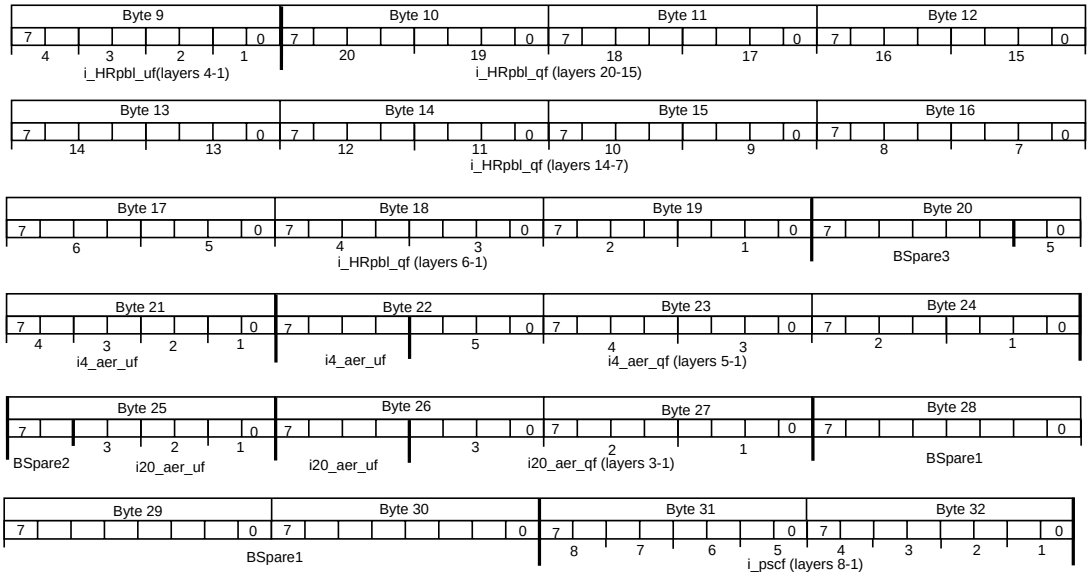


Figure E-2 Layer Height Flag (Continued)

i_FRCL_Flag [GLA09]: Full Resolution Cloud Layer Flag (4 seconds per record, 40 per second rate) Page 1 of 4

af = availability flag: Tells how many cloud layers were found (from the 532 channel) at this resolution.
value 15 = cloud layers were not searched for; value 0 = cloud layers were searched for, but not detected

qf = quality flag: value 15 = cloud layers were not searched for; value 0 = cloud layers were searched for but not detected; value 1 = low chance of being a cloud; value 2 = moderate; value 3 = high; value 4 = no doubt

uf = use flag: not used at this time

df = diurnal flag: This tells whether a given layer would be detected during normal daylight conditions. value 0 = layer would not have been detected in typical daytime background; value 1 = layer would have been detected in daylight

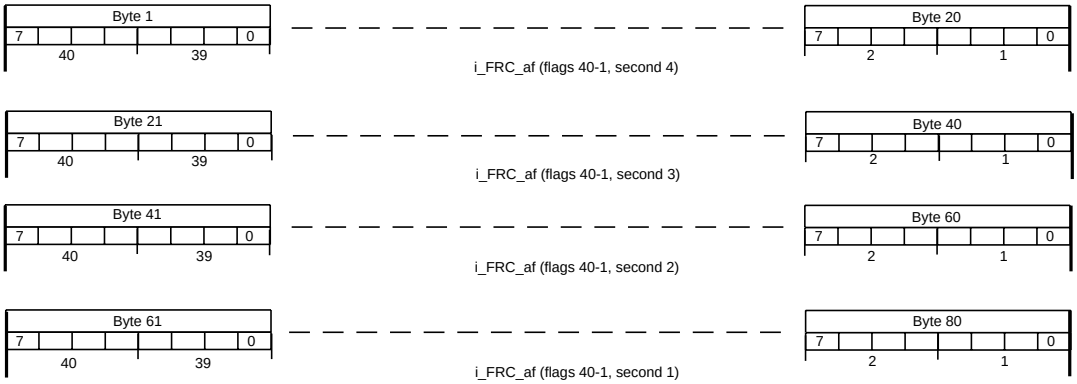


Figure E-3 Full Resolution Cloud Layer Flag

i_FRCL_Flag [GLA09]: Full Resolution Cloud Layer Flag (4 seconds per record, 40 per second rate) Page 2 of 4

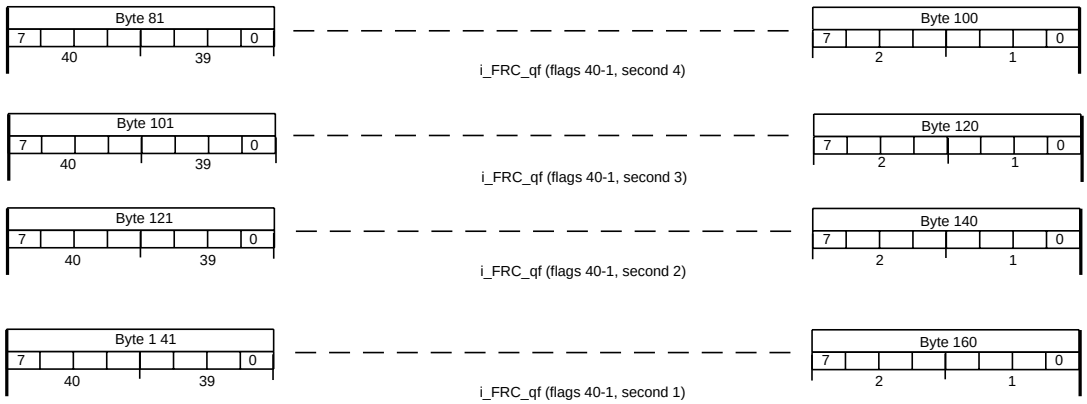


Figure E-3 Full Resolution Cloud Layer Flag (Continued)

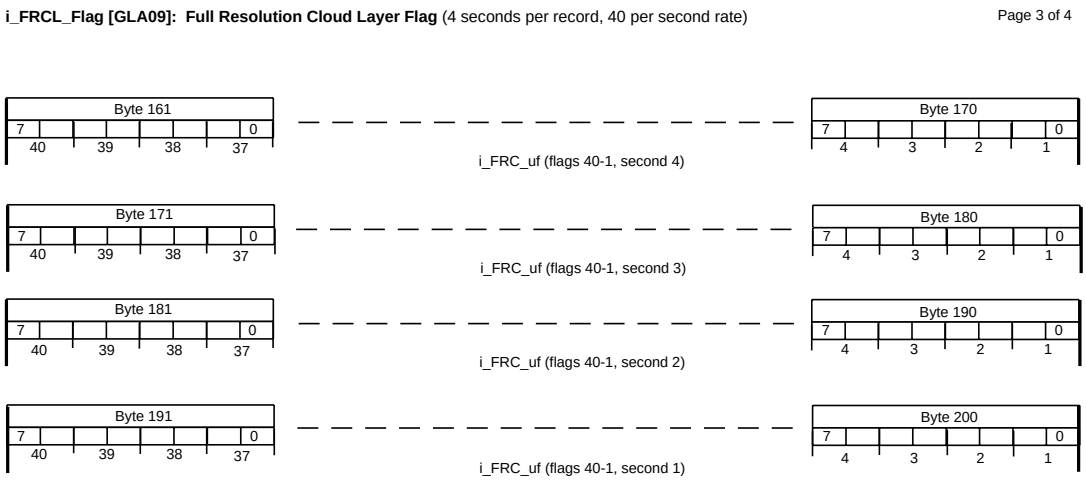


Figure E-3 Full Resolution Cloud Layer Flag (Continued)

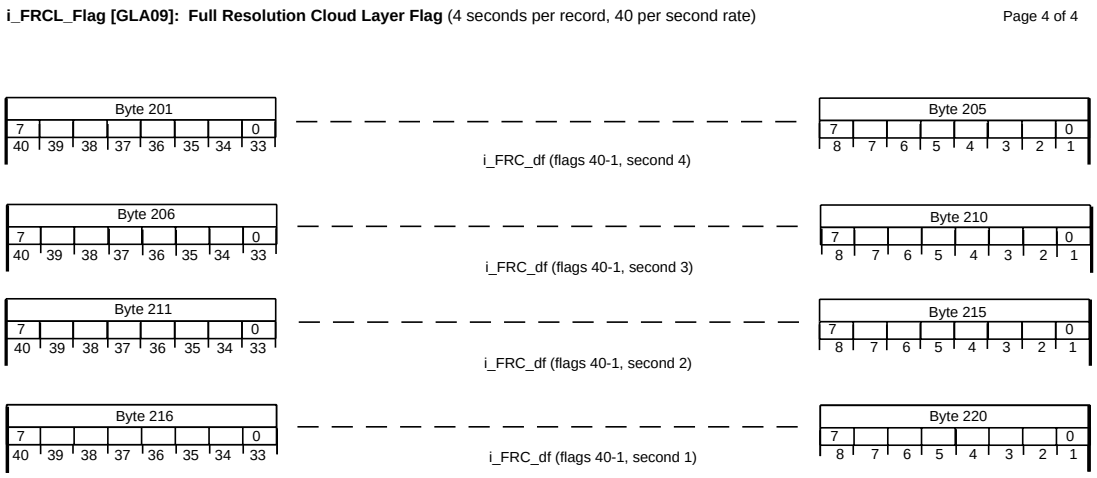


Figure E-3 Full Resolution Cloud Layer Flag (Continued)

i_FRir_qaFlag [GLA09, 11]: Full Resolution 1064 Quality Flag (i1b(160): 4 seconds per record, 40 per second rate)

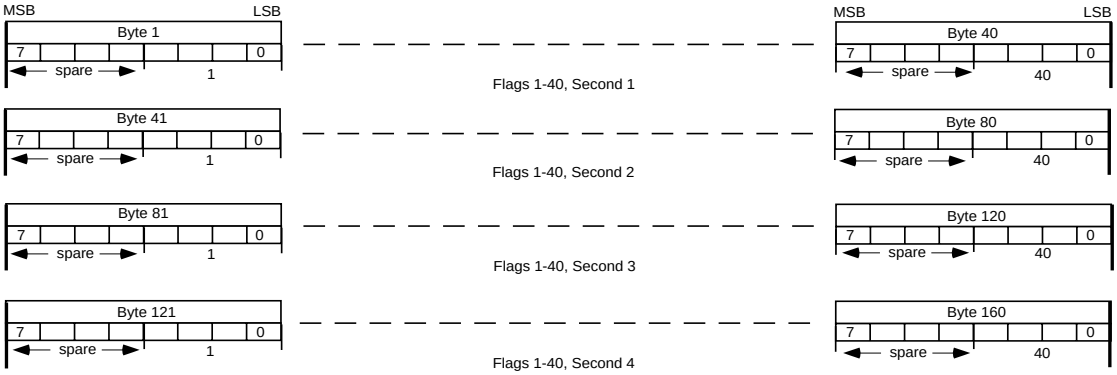
One byte per data quality flag

Value 15 = No clouds.

Value 14 = Indicates the likely presence of low clouds (< 150 m) based on elevated signal from the two bins above the ground return bin that were not detected directly by the cloud search algorithm. When this occurs, the 40 Hz cloud top height (i_Frir_cldtop) is set to a value of 0.10 km.

Value 13 = Indicates the possible presence of a cloud based on the value of the integrated signal parameter (i_FRir_intsig) that was not detected directly by the cloud search algorithm. When this occurs, the 40 Hz cloud top height (i_Frir_cldtop) is set to a value of 10.0 km.

Value 0 - 12 = Cloud detected by cloud search algorithm with higher numbers indicating a stronger average signal from the region starting at cloud top and extending 500 m below cloud top height.



i_FRir_qaFlag [GLA06, 12-15]: Full Resolution 1064 Quality Flag (i1b(40): 40 per second rate)

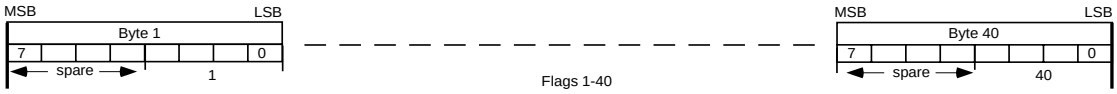


Figure E-4 Full Resolution 1064 Quality Flag

i_HRCL_Flag [GLA09]: High Resolution Cloud Layer Flag (4 seconds per record, 5 per second rate)

af = availability flag: Tells how many cloud layers were found (from the 532 channel) at this resolution.
value 15 = cloud layers were not searched for; value 0 = cloud layers were searched for, but not detected

qf = quality flag: value 15 = cloud layers were not searched for; value 0 = cloud layers were searched for but not detected; value 1 = low chance of being a cloud; value 2 = moderate; value 3 = high; value 4 = no doubt

uf = use flag: not used at this time

df = diurnal flag: This tells whether a given layer would be detected during normal daylight conditions. value 0 = layer would not have been detected in typical daytime background; value 1 = layer would have been detected in daylight

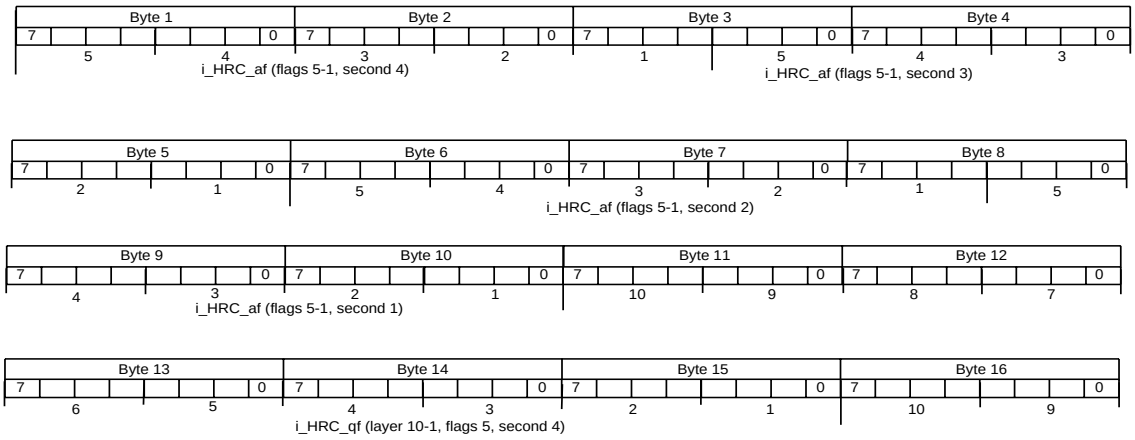


Figure E-5 High Resolution Cloud Layer Flag

i_HRCL_Flag [GLA09]: High Resolution Cloud Layer Flag (4 seconds per record, 5 per second rate)

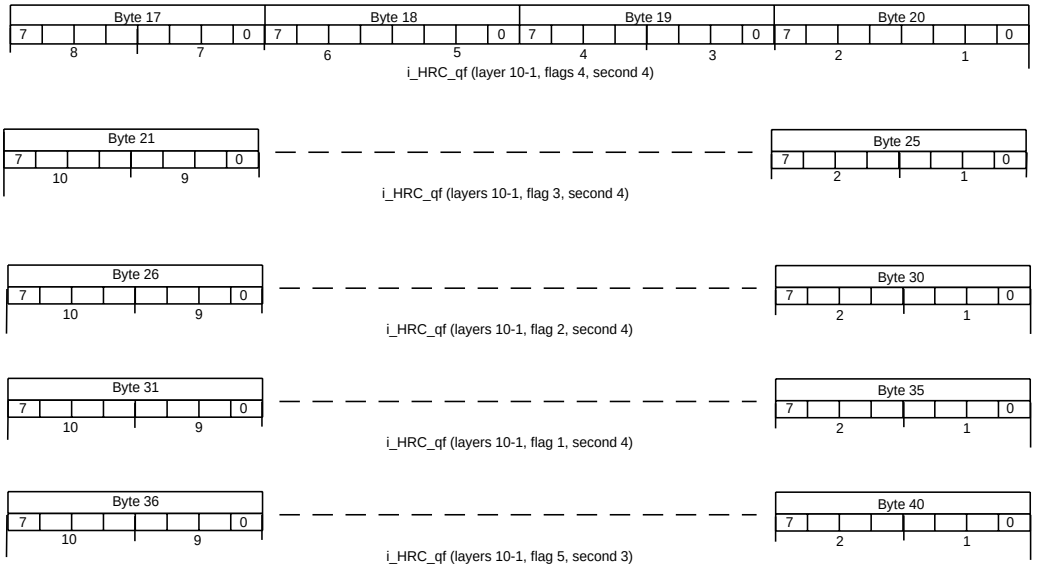


Figure E-5 High Resolution Cloud Layer Flag (Continued)

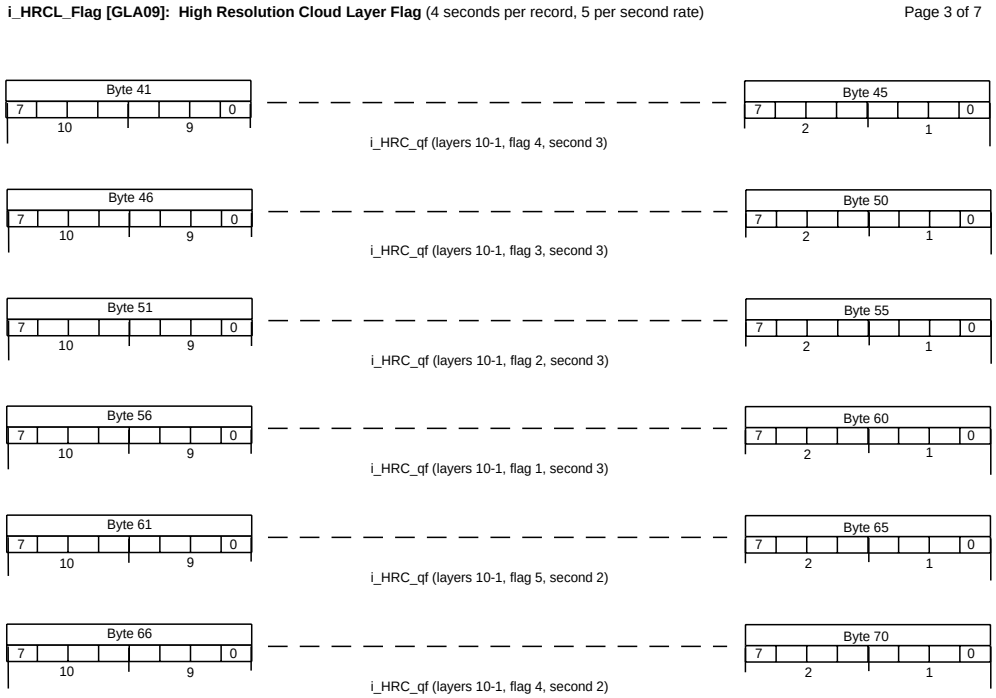


Figure E-5 High Resolution Cloud Layer Flag (Continued)

i_HRCL_Flag [GLA09]: High Resolution Cloud Layer Flag (4 seconds per record, 5 per second rate)

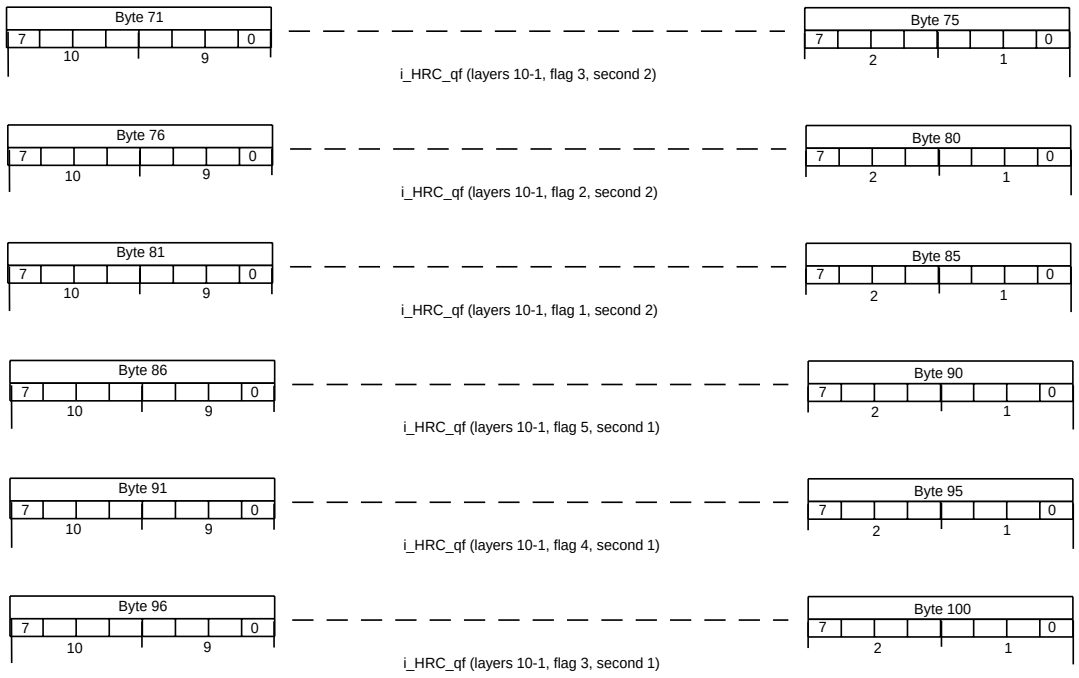


Figure E-5 High Resolution Cloud Layer Flag (Continued)

i_HRCL_Flag [GLA09]: High Resolution Cloud Layer Flag (4 seconds per record, 5 per second rate)

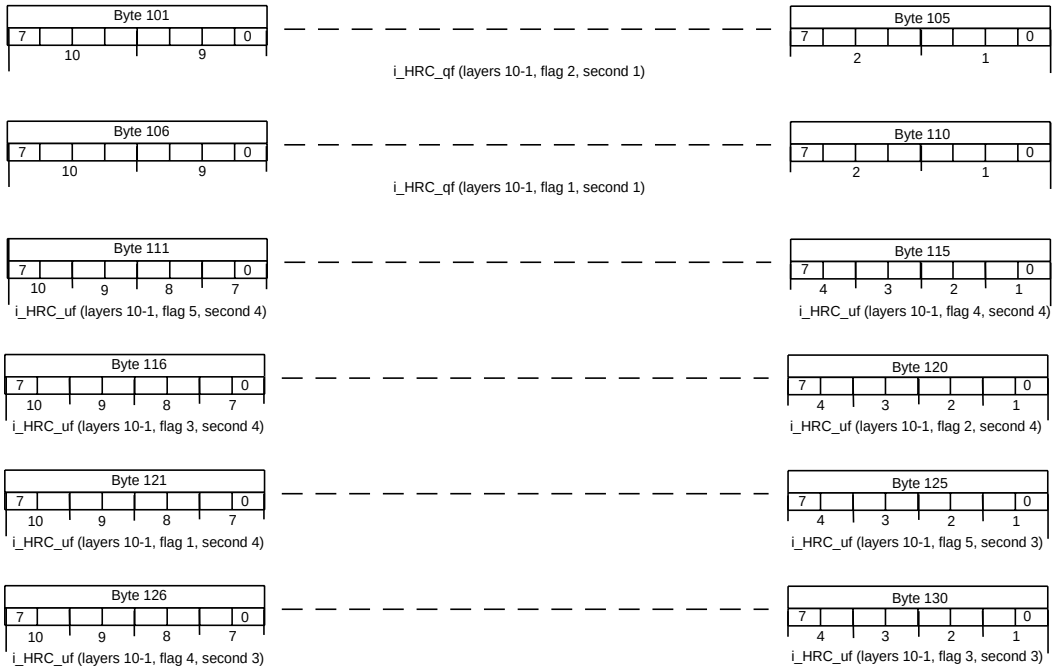


Figure E-5 High Resolution Cloud Layer Flag (Continued)

i_HRCL_Flag [GLA09]: High Resolution Cloud Layer Flag (4 seconds per record, 5 per second rate)

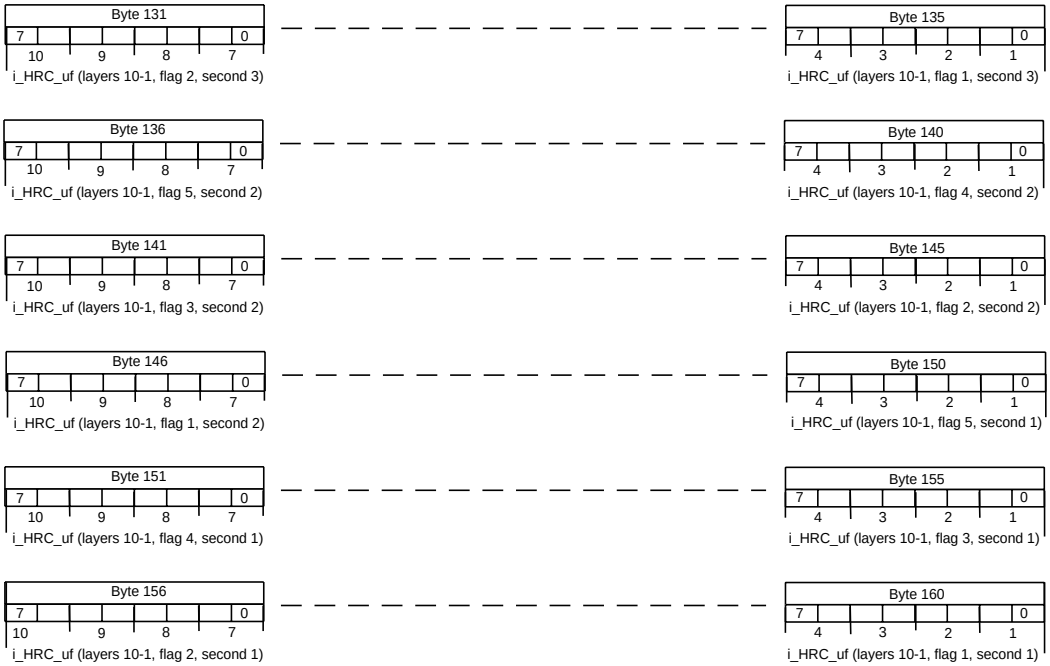


Figure E-5 High Resolution Cloud Layer Flag (Continued)

i_HRCL_Flag [GLA09]: High Resolution Cloud Layer Flag (4 seconds per record, 5 per second rate)

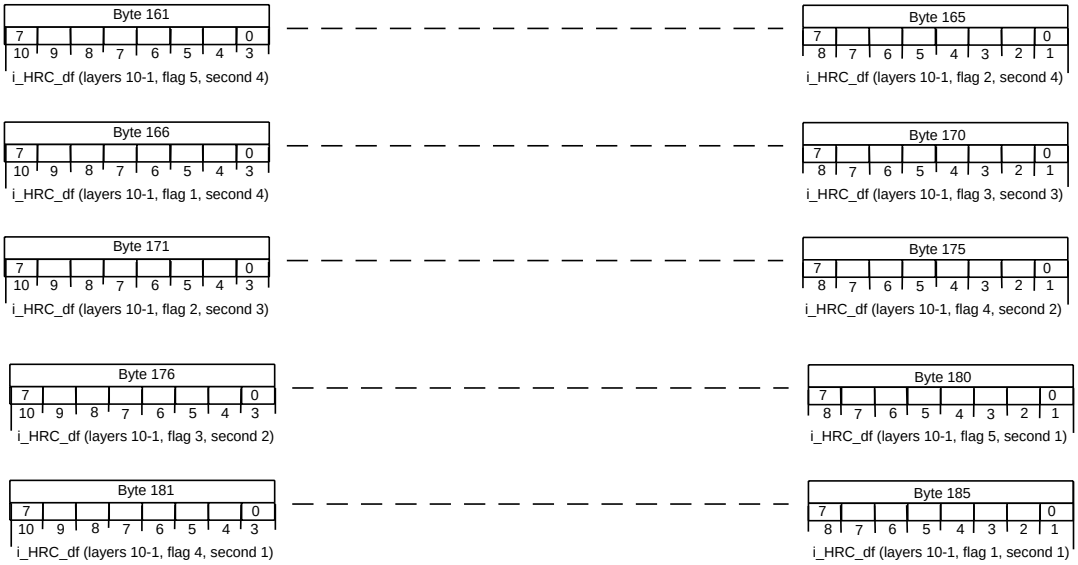


Figure E-5 High Resolution Cloud Layer Flag (Continued)

i_LRCL_Flag [GLA09]: Low Resolution Cloud Layer Flag (4 seconds per record, at once per 4 second rate)

af = availability flag: Tells how many cloud layers were found at this resolution. The total number of layers found is the sum of those found using the 532 channel and the 1064 channel (thus, this number will generally be larger than the actual number of layers present). value 15 = cloud layers were not searched for; value 0 = cloud layers were searched for, but not detected

qf = quality flag: value 15 = cloud layers were not searched for; value 0 = cloud layers were searched for but not detected; value 1 = low chance of being a cloud; value 2 = moderate; value 3 = high; value 4 = no doubt

uf = use flag: Tells which channel was used to detect the layer; value 0 = cloud layer was derived from 532 channel data; value 2 = cloud layer was derived from the 1064 channel data

df = diurnal flag: This tells whether a given layer would be detected during normal daylight conditions. value 0 = layer would not have been detected in typical daytime background; value 1 = layer would have been detected in daylight

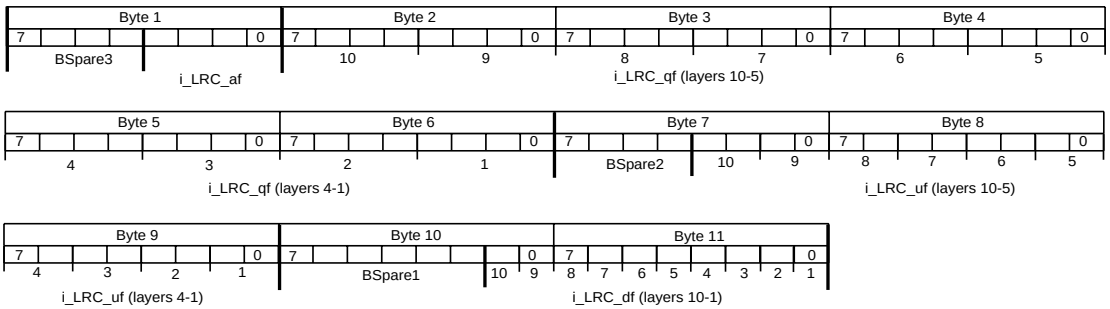


Figure E-6 Low Resolution Cloud Layer Flag

i_LRir_QAflag [GLA09]: Low Resolution 1064 Quality Flag (once per 4 seconds rate)

af = availability flag: It provides the number of cloud layers determined from the 1064 nm data.
value 0 = layers searched for but not detected; value 15 = cloud layers not searched for.

QAflag = quality flag: value 15 = cloud layers were not searched for; value 0 = cloud layers were searched for but not detected; values 1-14 indicate increasing confidence of good cloud retrieval (value 1 = least confidence, value 14 = greatest confidence).

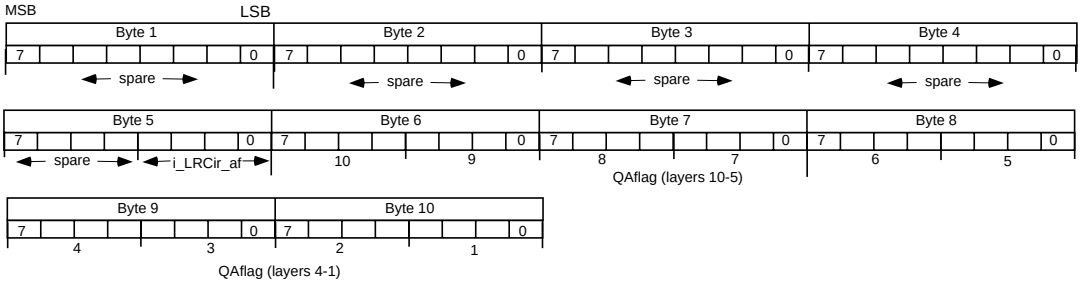


Figure E-7 Low Resolution 1064 Quality Flag

i_MRCL_Flag [GLA09]: Medium Resolution Cloud Layer Flag (4 seconds per record, at once per second rate)

af = availability flag: Tells how many cloud layers were found at this resolution. The total number of layers found is the sum of those found using the 532 channel and the 1064 channel (thus, this number will generally be larger than the actual number of layers present). value 15 = cloud layers were not searched for; value 0 = cloud layers were searched for, but not detected

qf = quality flag: value 15 = cloud layers were not searched for; value 0 = cloud layers were searched for but not detected; value 1 = low chance of being a cloud; value 2 = moderate; value 3 = high; value 4 = no doubt

uf = use flag: Tells which channel was used to detect the layer; value 0 = cloud layer was derived from 532 channel data; value 2 = cloud layer was derived from the 1064 channel data

df = diurnal flag: This tells whether a given layer would be detected during normal daylight conditions. value 0 = layer would not have been detected in typical daytime background; value 1 = layer would have been detected in daylight

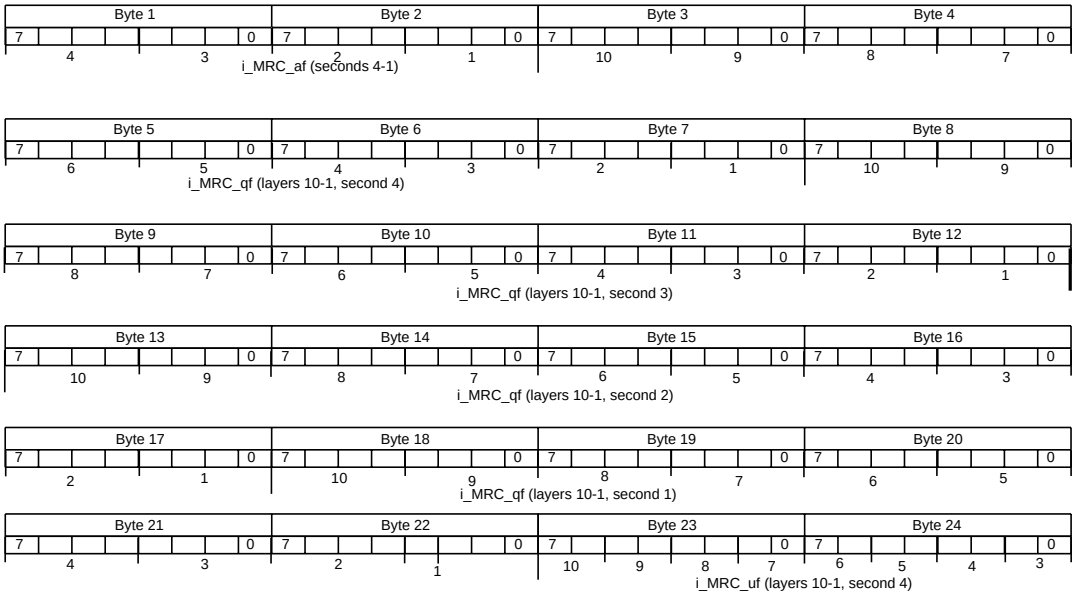


Figure E-8 Medium Resolution Cloud Layer Flag

i_MRCL_Flag [GLA09]: Medium Resolution Cloud Layer Flag (4 seconds per record, at once per second rate)

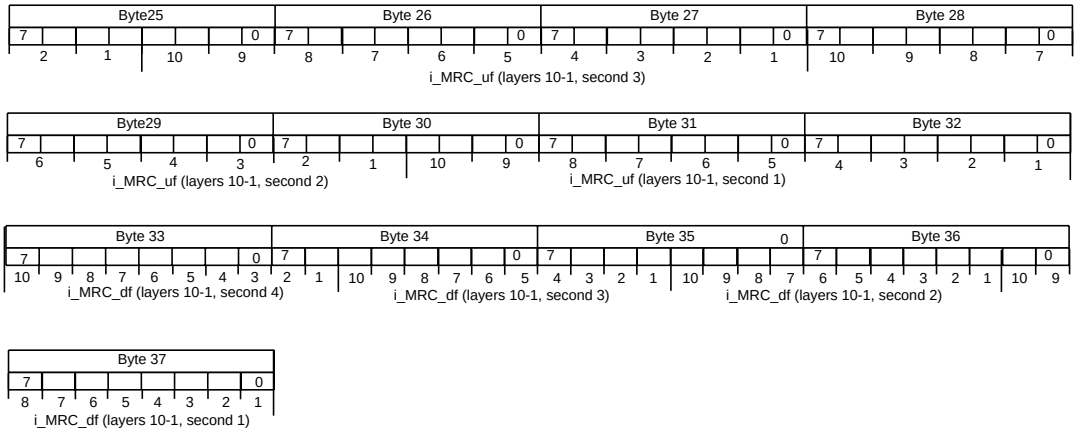


Figure E-8 Medium Resolution Cloud Layer Flag (Continued)

i_MRir_QAflag [GLA09, 11]: Medium Resolution 1064 Quality Flag (4 seconds per record, at once per second rate)

af = availability flag: It provides the number of cloud layers determined from the 1064 nm data.
value 0 = layers searched for but not detected; value 15 = cloud layers not searched for.

QAflag = quality flag: value 15 = cloud layers were not searched for; value 0 = cloud layers were searched for but not detected; values 1-14 indicate increasing confidence of good cloud retrieval (value 1 = least confidence, value 14 = greatest confidence).

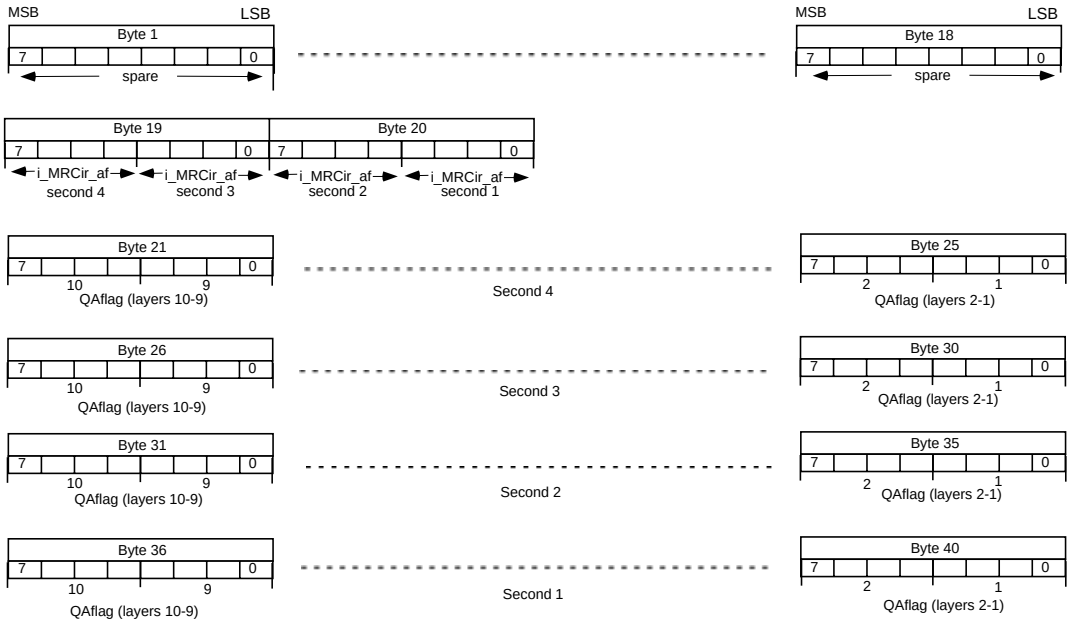


Figure E-9 Medium Resolution 1064 Quality Flag

i_aer4_bs_flag [GLA10]: Aerosol Backscatter Flag (once per 4 sec., up to 9 layers/record)

(QF = Quality Flag; UF = Use Flag)

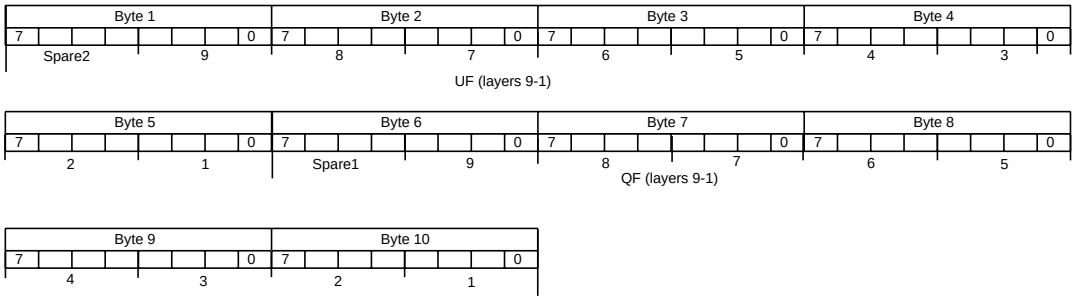


Figure E-10 Aerosol Backscatter Flag

i_aer4_ext_flag [GLA10]: Aerosol Extinction Flag (once per 4 sec., up to 9 layers/record)

(QF = Quality Flag; UF = Use Flag)

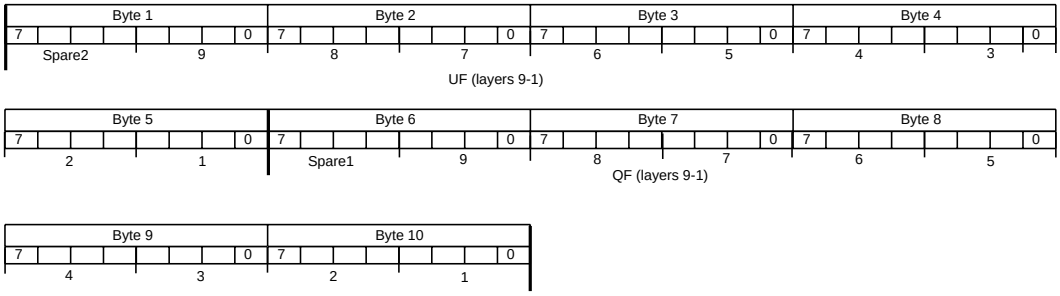


Figure E-11 Aerosol Extinction Flag

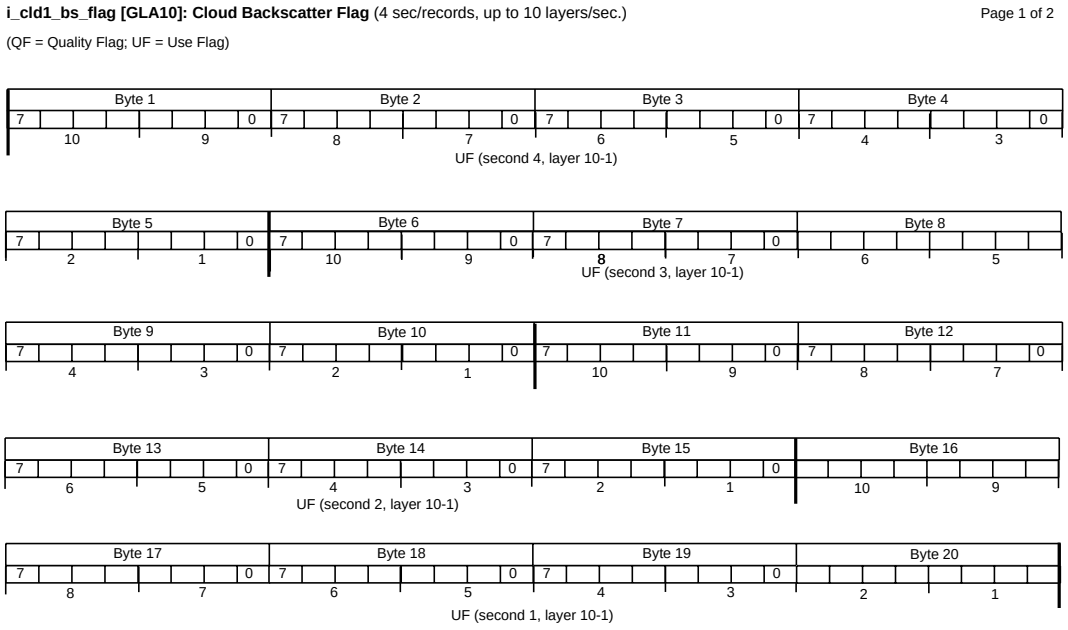


Figure E-12 Cloud Backscatter Flag

i_cld1_bs_flag [GLA10]: Cloud Backscatter Flag (4 sec/records, up to 10 layers/sec.) Page 2 of 2

(QF = Quality Flag; UF = Use Flag)

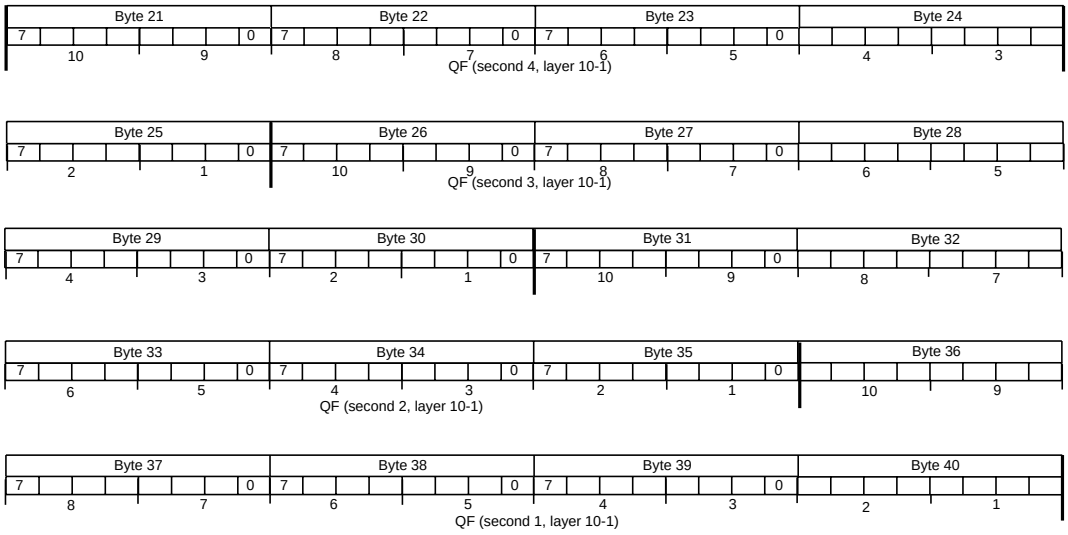


Figure E-12 Cloud Backscatter Flag (Continued)

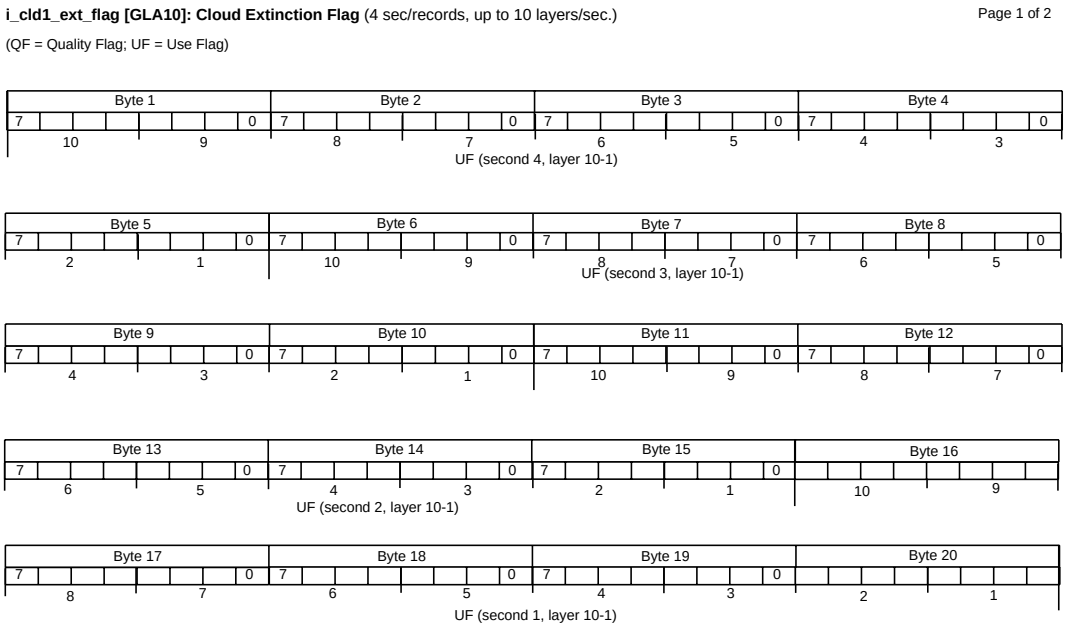


Figure E-13 Cloud Extinction Flag

i_cld1_ext_flag [GLA10]: Cloud Extinction Flag (4 sec/records, up to 10 layers/sec.) Page 2 of 2

(QF = Quality Flag; UF = Use Flag)

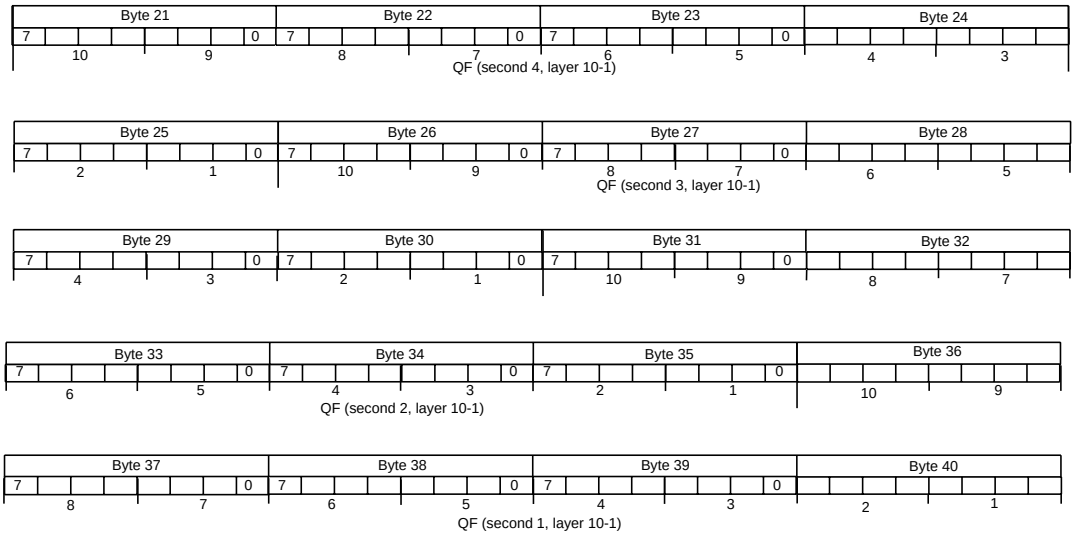


Figure E-13 Cloud Extinction Flag (Continued)

i_aer4_sval_uf [GLA10]: Aerosol True S Values Use Flag (once per 4 sec., up to 9 layers/record)

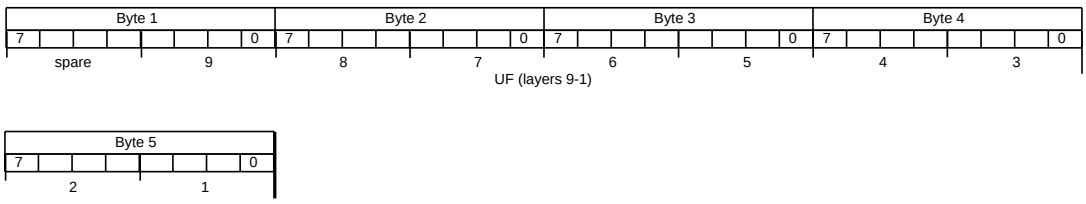


Figure E-14 Aerosol True S Values Use Flag

i_cld1_sval_uf [GLA10]: Cloud True S Values Use Flag (4 sec/records, up to 10 layers/sec.)

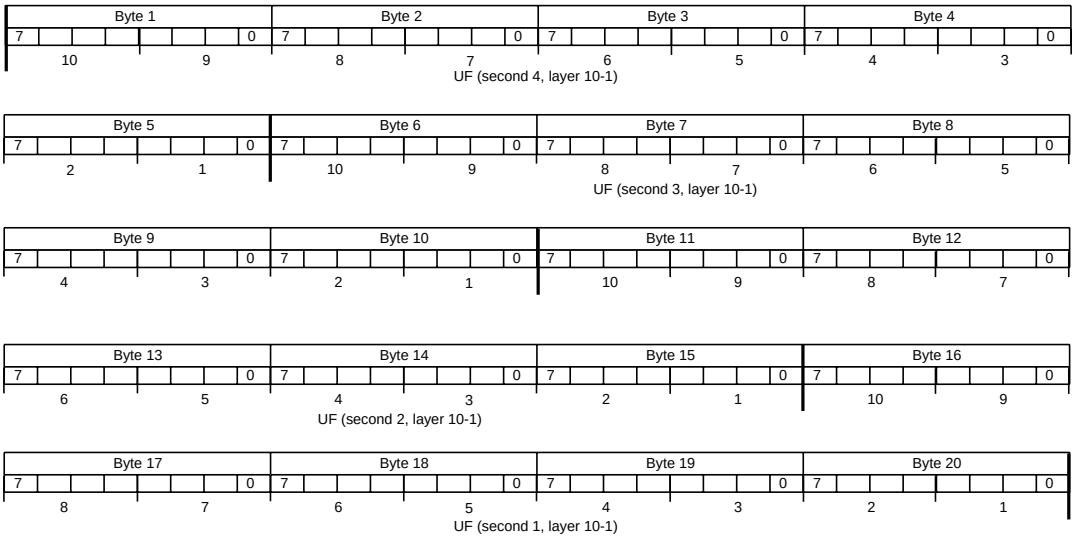


Figure E-15 Cloud True S Values Use Flag

i_aer4_flag [GLA11]: Aerosol Optical Depth (4 sec. per record, at once per 4 second rate)

(QF = Quality Flag; UF = Use Flag)

Byte 1								Byte 2								Byte 3								Byte 4							
7							0	7							0	7							0	7							0
UF (layer 8)				UF (layer 7)				UF (layer 6)				UF (layer 5)				UF (layer 4)				UF (layer 3)				UF (layer 2)				UF (layer 1)			

Byte 5								Byte 6								Byte 7								Byte 8							
7							0	7							0	7							0	7							0
QF (layer 8)				QF (layer 7)				QF (layer 6)				QF (layer 5)				QF (layer 4)				QF (layer 3)				QF (layer 2)				QF (layer 1)			

Layer Use Flag Values

a) For backscatter cross section, the use flag gives saturation status as follows:

Use FLAG SATURATION STATUS
0 = no saturation detected
1 = one or two bins were saturated with 1064 nm conversion performed
2 = at least three bins were saturated with 1064 nm conversion performed
3 = at least one but less than four bins were saturated with no conversion performed
4 = four or more bins were saturated with no conversion performed
15 = invalid

b) for extinction cross section and layer optical depth, the use flag designates layer type category as follows:

Aerosol: {based on S ratio default index, PSC flag, and tropopause height}
Use Flag Meaning
00 = PBL generic (all PBL indices not mentioned below)
01 = PBL maritime (index 4)
02 = PBL continental ice (index 7)
03 = PBL continental haze (index 11)
04 = PBL Saharan dust (index 12)
05 = PBL desert (index 13)
06 = PBL smoke (indices 15,3)
07 = TROP generic (all TROP indices not mentioned below)
08 = TROP volcanic (index 3)
09 = TROP continental haze (index 11)
10 = TROP Saharan dust (index 12)
11 = TROP smoke (index 15)
12 = STRATO aerosol (any non-PSC layer whose top is > tropopause
13 = PSC type I (PSC with rh less than or equal to 95%)
14 = PSC type II (PSC with rh greater than 95%)
15 = invalid

Cloud: {based on average cloud temperature, water cloud is warmer than –13 C}

Use Flag Meaning
00 = less than or equal to –75.0 C
01 = -75.0 through –68.5
02 = -68.5 through –62.0
03 = -62.0 through –55.5
04 = -55.5 through –49.0
05 = -49.0 through –32.5
06 = -32.5 through –26.0
07 = -26.0 through –19.5
08 = -19.5 through –13.0
09 = -13.0 through –6.5
10 = -6.5 through 0.0
11 = 0.0 through 6.5
12 = 6.5 through 13.0
13 = 13.0 through 19.5
14 = greater than 19.5 C
15 = invalid

Quality Flag Values

0 = 0-5 % Error
1 = 5-10 % Error
2 = 10-15 % Error
3 = 15-20 % Error
4 = 20-25 % Error
5 = 25-30 % Error
6 = 30-35 % Error
7 = 35-40 % Error
8 = 40-45 % Error
9 = 45-50 % Error
10 = 50-55 % Error
11 = 55-60 % Error
12 = 60-65 % Error
13 = 65-70 % Error
14 = 70 and greater % Error
15 = Unable to process

Figure E-16 Aerosol Optical Depth

i_cld1_flag [GLA11]: Cloud Optical Depth (4 sec. per record, at once per second rate) Page 1 of 3

(QF = Quality Flag; UF = Use Flag; see Page 3 for Value Descriptions)

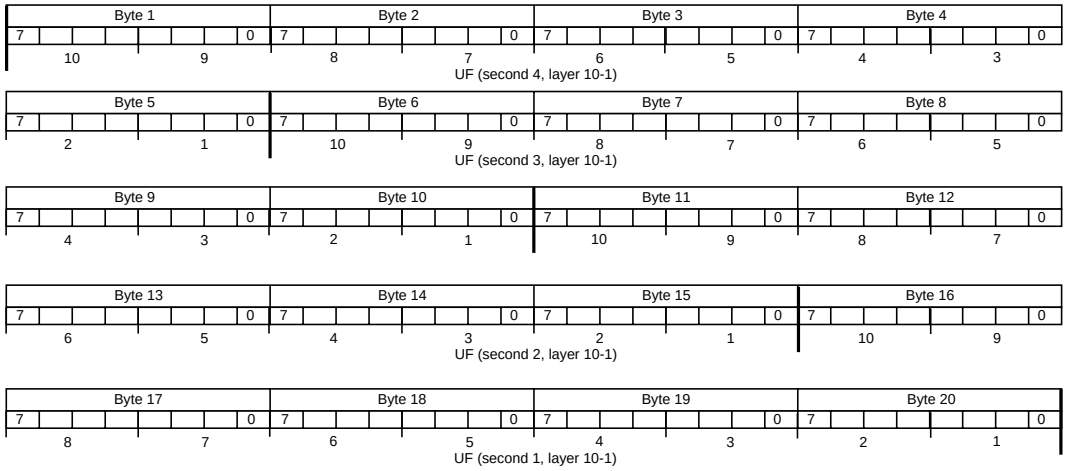


Figure E-17 Cloud Optical Depth

i_cld1_flag [GLA11]: Cloud Optical Depth (4 sec. per record, at once per second rate) Page 2 of 3

(QF = Quality Flag; UF = Use Flag; see Page 3 for Value Descriptions)

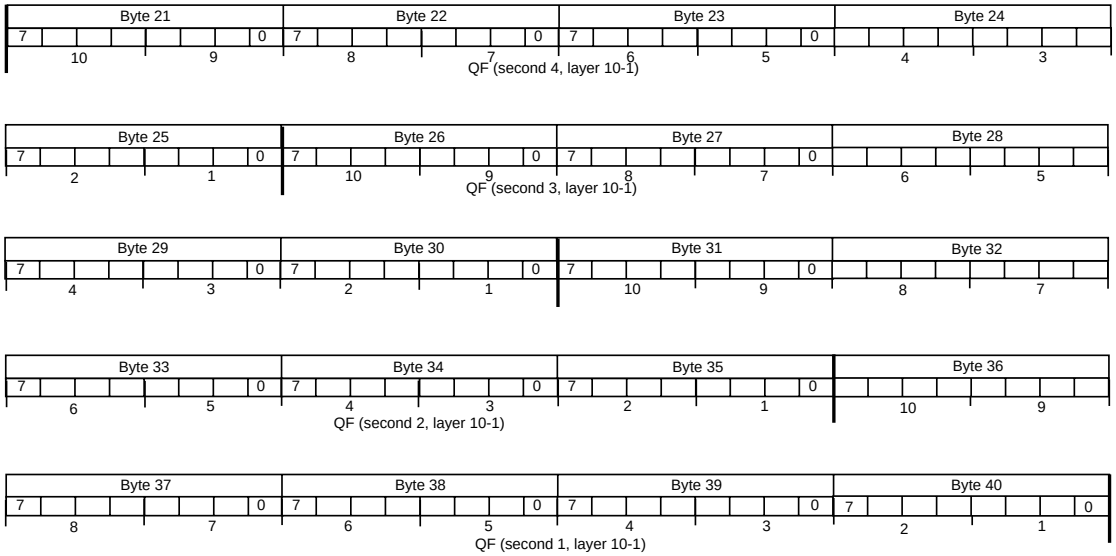


Figure E-17 Cloud Optical Depth (Continued)

i_cld1_flag [GLA11]: Cloud Optical Depth (4 sec. per record, at once per second rate)

(QF = Quality Flag; UF = Use Flag)

Layer Use Flag Values

a) For backscatter cross section, the use flag gives saturation status as follows:

Use FLAG SATURATION STATUS
0 = no saturation detected
1 = one or two bins were saturated with 1064 nm conversion performed
2 = at least three bins were saturated with 1064 nm conversion performed
3 = at least one but less than four bins were saturated with no conversion performed
4 = four or more bins were saturated with no conversion performed
15 = invalid

b) for extinction cross section and layer optical depth, the use flag designates layer type category as follows:

Aerosol: {based on S ratio default index, PSC flag, and tropopause height}
Use Flag Meaning
00 = PBL generic (all PBL indices not mentioned below)
01 = PBL maritime (index 4)
02 = PBL continental ice (index 7)
03 = PBL continental haze (index 11)
04 = PBL Saharan dust (index 12)
05 = PBL desert (index 13)
06 = PBL smoke (indices 15,3)
07 = TROP generic (all TROP indices not mentioned below)
08 = TROP volcanic (index 3)
09 = TROP continental haze (index 11)
10 = TROP Saharan dust (index 12)
11 = TROP smoke (index 15)
12 = STRATO aerosol (any non-PSC layer whose top is > tropopause
13 = PSC type I (PSC with rh less than or equal to 95%)
14 = PSC type II (PSC with rh greater than 95%)
15 = invalid

Cloud: {based on average cloud temperature, water cloud is warmer than –13 C}

Use Flag Meaning
00 = less than or equal to –75.0 C
01 = -75.0 through –68.5
02 = -68.5 through –62.0
03 = -62.0 through –55.5
04 = -55.5 through –49.0
05 = -49.0 through –32.5
06 = -32.5 through –26.0
07 = -26.0 through –19.5
08 = -19.5 through –13.0
09 = -13.0 through –6.5
10 = -6.5 through 0.0
11 = 0.0 through 6.5
12 = 6.5 through 13.0
13 = 13.0 through 19.5
14 = greater than 19.5 C
15 = invalid

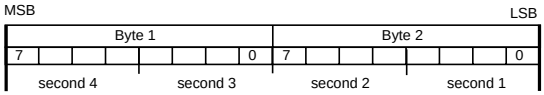
Quality Flag Values

0 = 0-5 % Error
1 = 5-10 % Error
2 = 10-15 % Error
3 = 15-20 % Error
4 = 20-25 % Error
5 = 25-30 % Error
6 = 30-35 % Error
7 = 35-40 % Error
8 = 40-45 % Error
9 = 45-50 % Error
10 = 50-55 % Error
11 = 55-60 % Error
12 = 60-65 % Error
13 = 65-70 % Error
14 = 70 and greater % Error
15 = Unable to process

Figure E-17 Cloud Optical Depth (Continued)

i_cld1_mswf [GLA11]: Multiple Scattering Warning Flag (4 sec. per record, at once per second rate)

4 bit set of values;
0 = < 0.010
1 = 0.010 - 0.030
2 = 0.030 - 0.060
3 = 0.060 - 0.100
4 = 0.100 - 0.150
5 = 0.150 - 0.225
6 = 0.225 - 0.300
7 = 0.300 - 0.400
8 = 0.400 - 0.500
9 = 0.500 - 0.670
10 = 0.670 - 0.900
11 = 0.900 - 1.200
12 = 1.200 - 1.600
13 = 1.600 - 2.000
14 = > 2.000
15 = Invalid



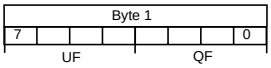
Note: A warning flag value of 15 will be the default whenever no 532nm signal is available (as when the 532 laser energy is < 4 mJ during daytime). To distinguish this case from that of optically thick clouds, one must check the number of layers. If there were zero layers reported, but the MSWF is 15, then the cause is the lack of useable 532 data. If the number of layers is > 0 and the MSWF is 15, then the cause is total extinction of the lidar beam (this happens for clouds of optical depth > about 3).

A warning flag of '0' is a very good indicator of no layers or a layer so thin it won't cause any altimetry range delays.

Figure E-18 Multiple Scattering Warning Flag

i_pbl4_flag [GLA11]: PBL Optical Depth (4 sec. per record, at once per 4 second rate)

(QF = Quality Flag; UF = Use Flag)



Layer Use Flag Values

a) For backscatter cross section, the use flag gives saturation status as follows:

Use FLAG SATURATION STATUS
0 = no saturation detected
1 = one or two bins were saturated with 1064 nm conversion performed
2 = at least three bins were saturated with 1064 nm conversion performed
3 = at least one but less than four bins were saturated with no conversion performed
4 = four or more bins were saturated with no conversion performed
15 = invalid

b) for extinction cross section and layer optical depth, the use flag designates layer type category as follows:

Aerosol: {based on S ratio default index, PSC flag, and tropopause height}
Use Flag Meaning
00 = PBL generic (all PBL indices not mentioned below)
01 = PBL maritime (index 4)
02 = PBL continental ice (index 7)
03 = PBL continental haze (index 11)
04 = PBL Saharan dust (index 12)
05 = PBL desert (index 13)
06 = PBL smoke (indices 15,3)
07 = TROP generic (all TROP indices not mentioned below)
08 = TROP volcanic (index 3)
09 = TROP continental haze (index 11)
10 = TROP Saharan dust (index 12)
11 = TROP smoke (index 15)
12 = STRATO aerosol (any non-PSC layer whose top is > tropopause
13 = PSC type I (PSC with rh less than or equal to 95%)
14 = PSC type II (PSC with rh greater than 95%)
15 = invalid

Cloud: {based on average cloud temperature, water cloud is warmer than –13 C}

Use Flag Meaning
00 = less than or equal to –75.0 C
01 = -75.0 through –68.5
02 = -68.5 through –62.0
03 = -62.0 through –55.5
04 = -55.5 through –49.0
05 = -49.0 through –32.5
06 = -32.5 through –26.0
07 = -26.0 through –19.5
08 = -19.5 through –13.0
09 = -13.0 through –6.5
10 = -6.5 through 0.0
11 = 0.0 through 6.5
12 = 6.5 through 13.0
13 = 13.0 through 19.5
14 = greater than 19.5 C
15 = invalid

Quality Flag Values

0 = 0-5 % Error
1 = 5-10 % Error
2 = 10-15 % Error
3 = 15-20 % Error
4 = 20-25 % Error
5 = 25-30 % Error
6 = 30-35 % Error
7 = 35-40 % Error
8 = 40-45 % Error
9 = 45-50 % Error
10 = 50-55 % Error
11 = 55-60 % Error
12 = 60-65 % Error
13 = 65-70 % Error
14 = 70 and greater % Error
15 = Unable to process

Figure E-19 PBL Optical Depth

i_SiRufQF [1/sec for GLA13]: Sea Ice Roughness Quality Flag; One byte per shot data quality flag

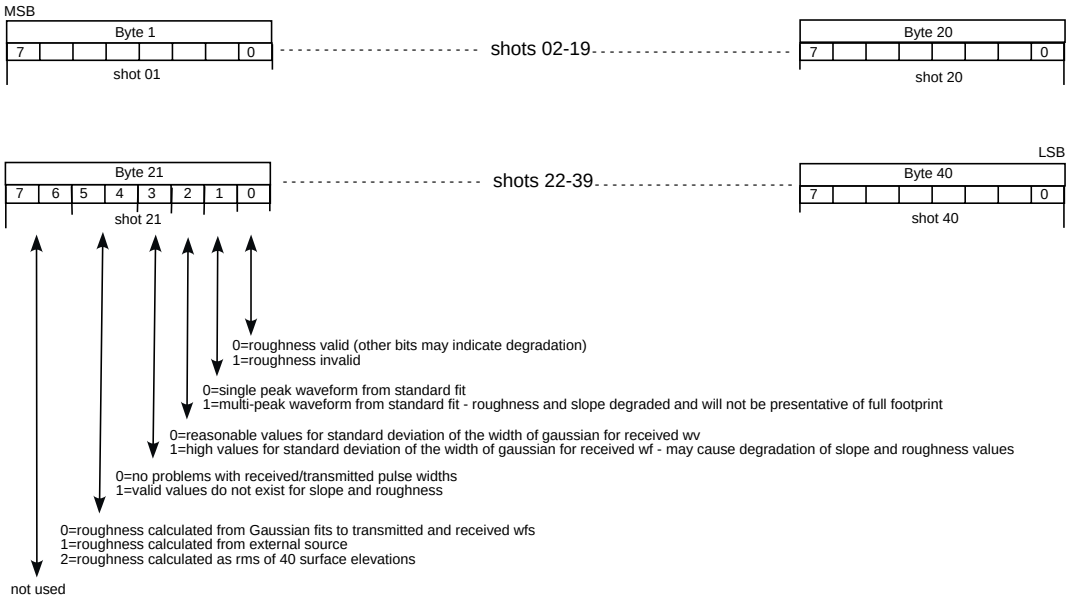


Figure E-20 Sea Ice Roughness Quality Flag

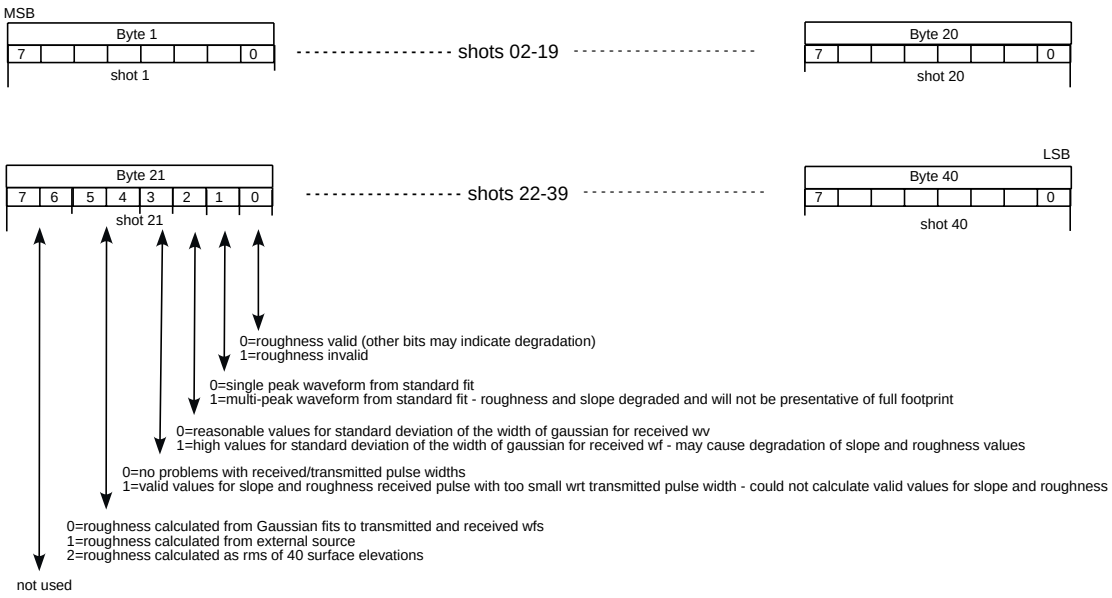


Figure E-21 Ocean RMS Roughness Quality Flag

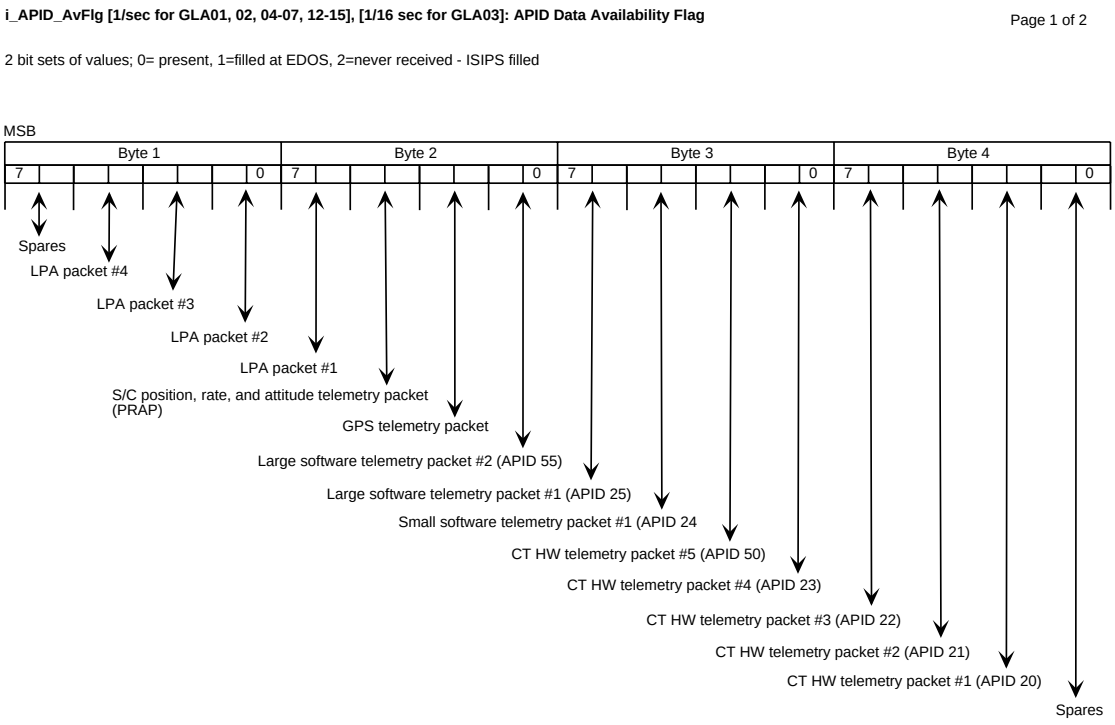


Figure E-22 APID Data Availability Flag

i_APID_AvFlg [1/sec for GLA01, 02, 04-07, 12-15], [1/16 sec for GLA03]: APID Data Availability Flag (continued)

2 bit sets of values; 0= present, 1=filled at EDOS, 2=never received - ISIPS filled

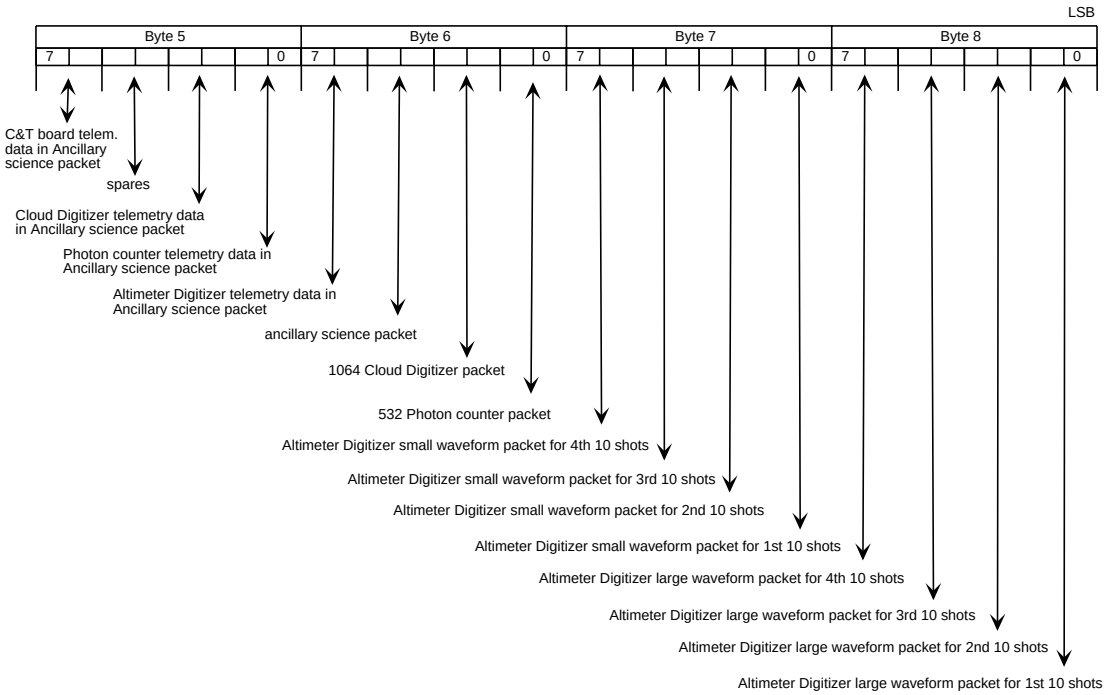


Figure E-22 APID Data Availability Flag (Continued)

i_OrbFlg [1/sec for GLA01, 02, 05-15]: Orbit Flag

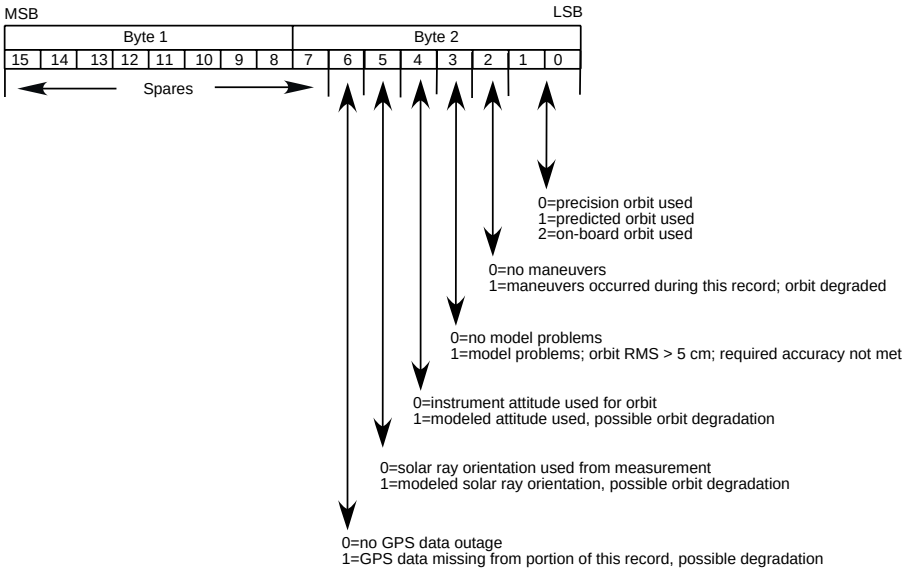


Figure E-23 Orbit Flag

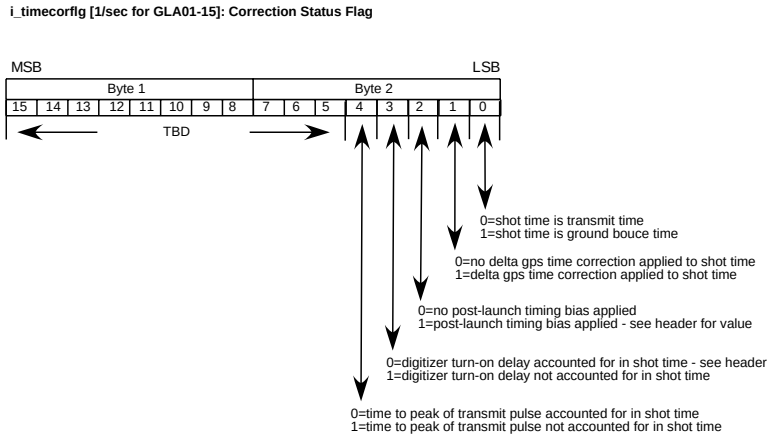


Figure E-24 Correction Status Flag

i_atmQF [1/sec for GLA05, 06, 12-15]: Atmosphere Flag

2 bit flags, 40/second

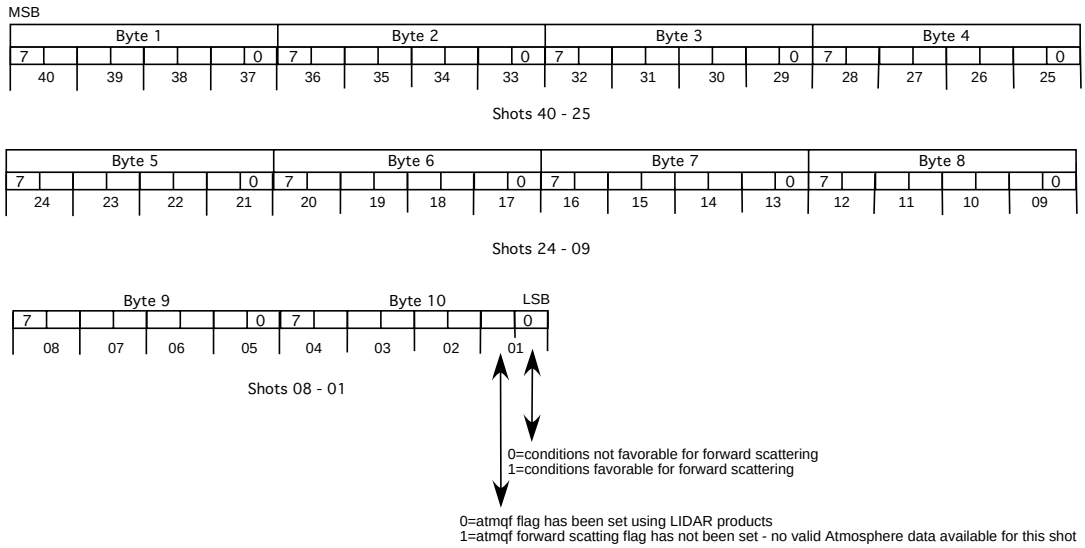


Figure E-25 Atmosphere Flag

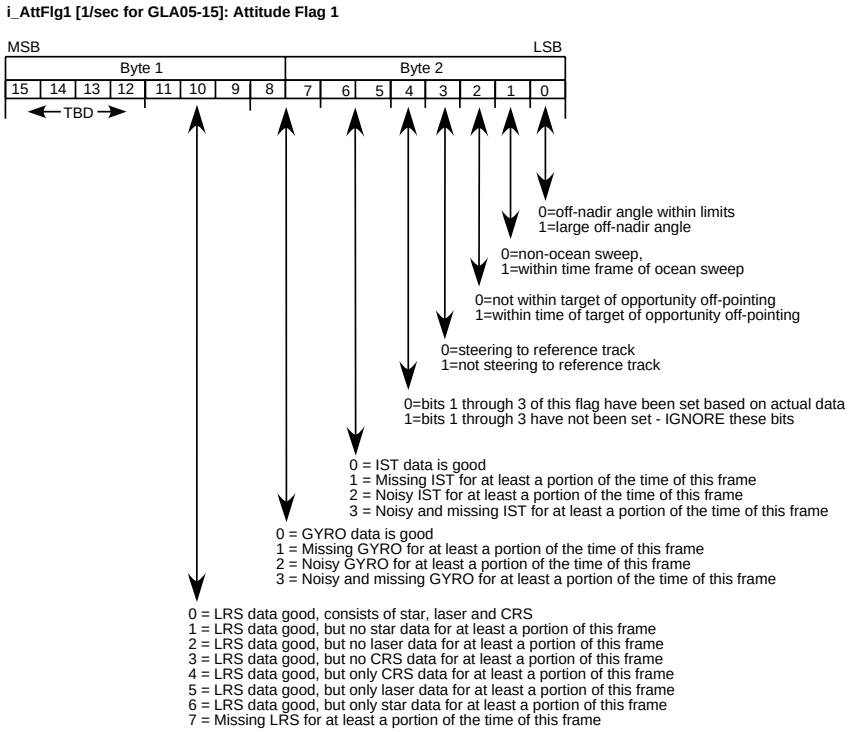


Figure E-26 Attitude Flag 1

i_AttFlg2 [1/sec for GLA05,06,12-15]: Attitude Flag 2

Bytes 1-5, PAD Use Flag: 1 bit/shot values; 0 = PAD used to determine spot location, 1 = PAD not used to determine spot location
Bytes 6-10, Calc PAD Use Flag: 1 bit/shot values; 0 = new PAD used to determine orbit, 1 = pass-thru PAD not used to determine orbit
Bytes 11-20, LPA Problem Flag: 2 bit/shot values; 0 = no problems with LPA, 1 = missing LPA, 2 = noisy LPA

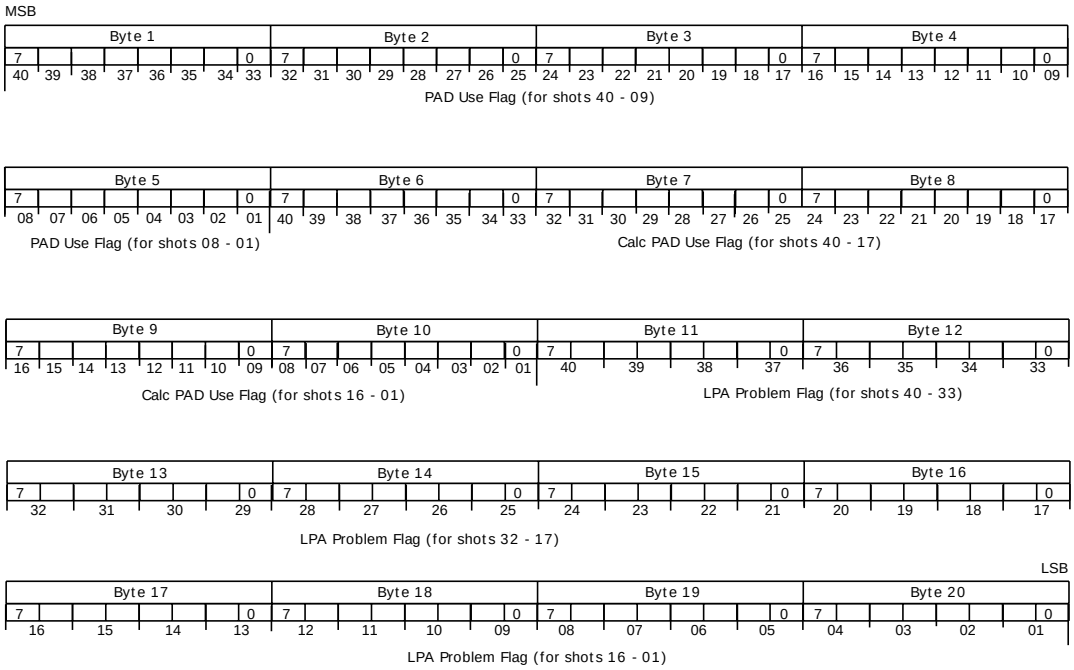


Figure E-27 Attitude Flag 2

i_AttFlg3 [1/sec for GLA07-11]: Attitude Flag 3

0=PAD used for geolocation
1=PAD not used for geolocation

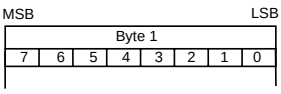


Figure E-28 Attitude Flag 3

i_ElvFlg [1/sec GLA05, 06, 12-15]: Elevation Definition Flag; Indicates which location on the received echo was used to calculate the elevation on the record.

1-byte flags, 40/second.

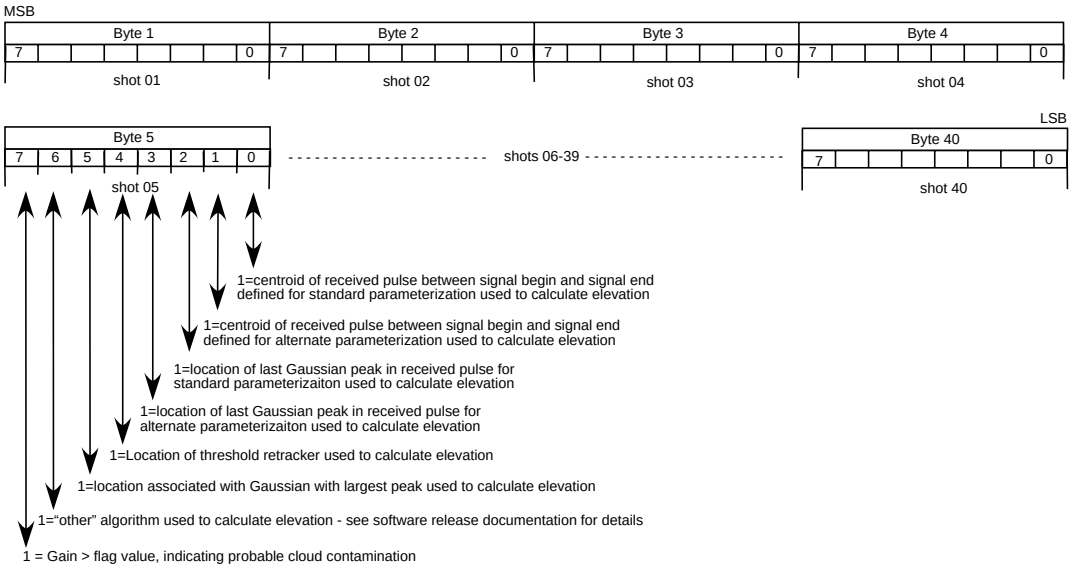


Figure E-29 Elevation Definition Flag

i_ElvuseFlg [1/sec for GLA05, 06, 12-15]: Elevation Use Flag; One flag per shot; indicates quality to use based on valid or invalid criteria
1-bit flags, 40/ second.

0=elevation is valid
1=elevation is invalid

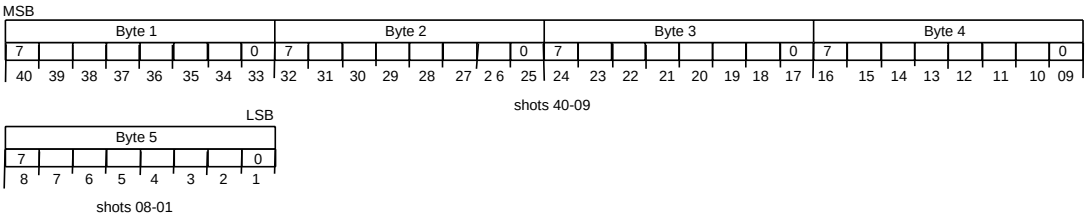


Figure E-30 Elevation Use Flag

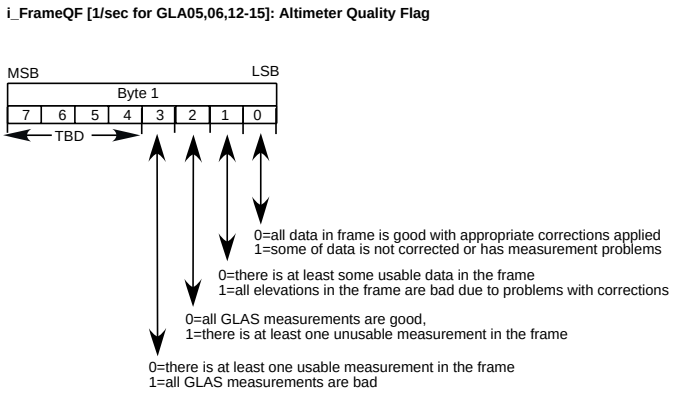


Figure E-31 Altimeter Quality Flag

i_rngCorrFlg [1/sec for GLA05, 06, 12-15]: Range Correction Flag

2 byte set of 1 bit values: 0=used, 1=not used

Note: This is a range correction flag. Some of the corrections are applied to the reference range, i_refrng on the data record, and some of them are used in the calculation of the elevation but are not applied to the reference range.

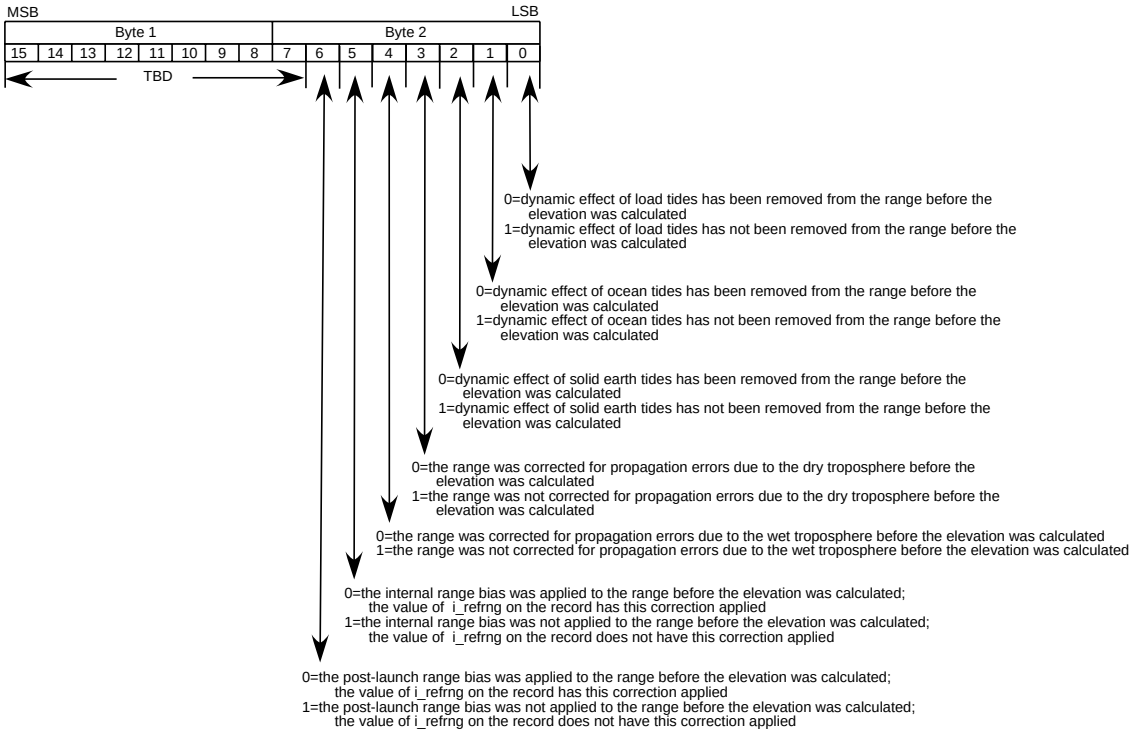


Figure E-32 Range Correction Flag

i_atm_avail [1/sec for GLA06, 12-15]: Atmosphere Availability Flag

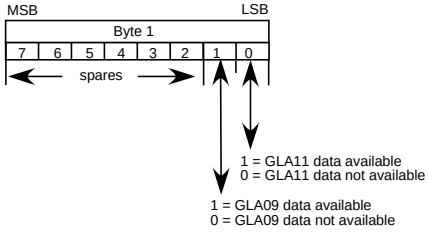
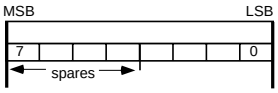


Figure E-33 Atmosphere Availability Flag

i_cld1_mswf [GLA06, 12-15]: Multiple Scattering Warning Flag

4 bit set of values;
0 = < 0.010
1 = 0.010 - 0.030
2 = 0.030 - 0.060
3 = 0.060 - 0.100
4 = 0.100 - 0.150
5 = 0.150 - 0.225
6 = 0.225 - 0.300
7 = 0.300 - 0.400
8 = 0.400 - 0.500
9 = 0.500 - 0.670
10 = 0.670 - 0.900
11 = 0.900 - 1.200
12 = 1.200 - 1.600
13 = 1.600 - 2.000
14 = > 2.000
15 = Invalid



Note: A warning flag value of 15 will be the default whenever no 532nm signal is available (as when the 532 laser energy is < 4 mJ during daytime). To distinguish this case from that of optically thick clouds, one must check the number of layers. If there were zero layers reported, but the MSWF is 15, then the cause is the lack of useable 532 data. If the number of layers is > 0 and the MSWF is 15, then the cause is total extinction of the lidar beam (this happens for clouds of optical depth > about 3).

A warning flag of '0' is a very good indicator of no layers or a layer so thin it won't cause any altimetry range delays.

Figure E-34 Multiple Scattering Warning Flag

i_CorrStatFlg [1/sec for GLA06, 12-15]: Correction Status Flag

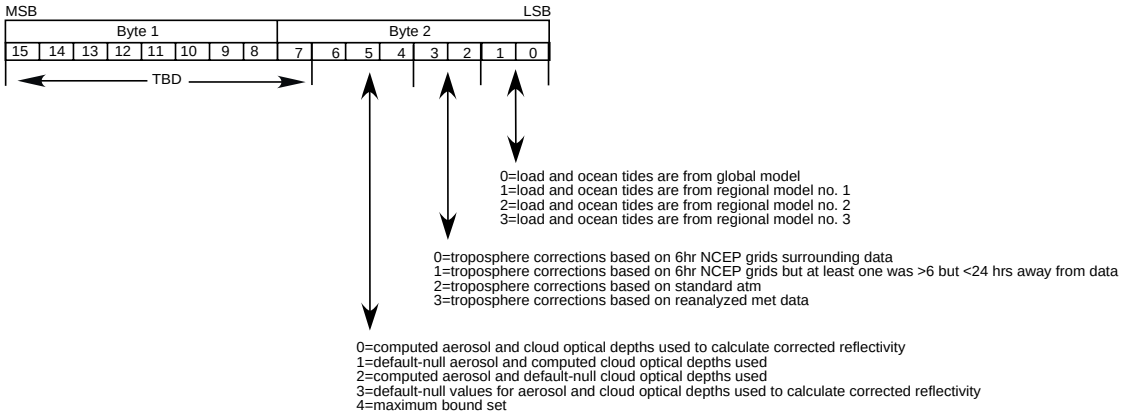
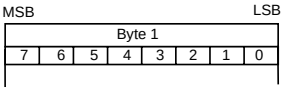


Figure E-35 Correction Status Flag

i_DEM_hires_src [1/sec for GLA06,14]: High Resolution Source Flag

1-byte flag, 40/second



Values:
0 = no high res source available
1 = "unfinished research" Shuttle Radar Topography Mission (SRTM) C-band 90 m DEM produced by JPL
2 = "finished" SRTM C-band 90 m DEM produced by NGA

Figure E-36 High Resolution Source Flag

i_MRC_af [GLA06, 12-15]: Medium Resolution Cloud Availability Flag

Tells how many cloud layers were found at this resolution. The total number of layers found is the sum of those found using the 532 channel and the 1064 channel (thus, this number will generally be larger than the actual number of layers present). value 15 = cloud layers were not searched for; value 0 = cloud layers were searched for, but not detected

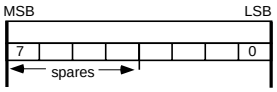


Figure E-37 Medium Resolution Cloud Availability Flag

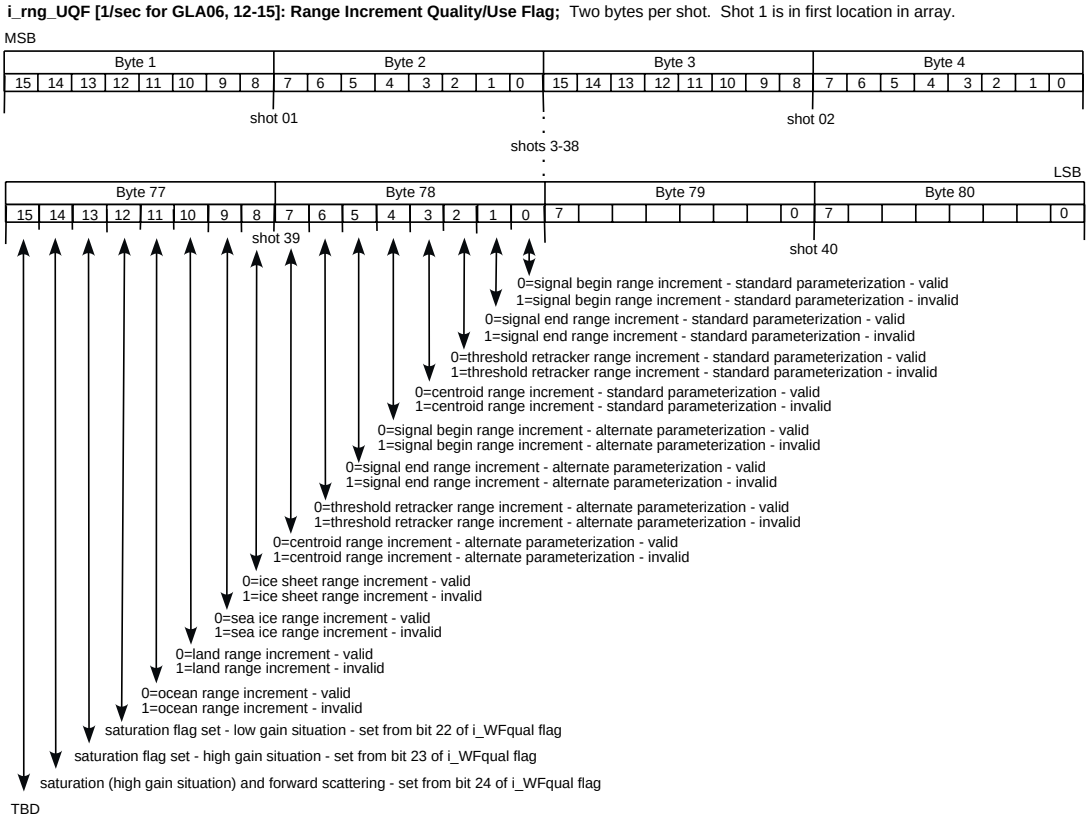


Figure E-38 Range Increment Quality/Use Flag

i_SurfRuf_slpQF [1/sec for GLA06, 12,14]: Surface Roughness and Slope Quality Flag; One byte per shot data quality flag.

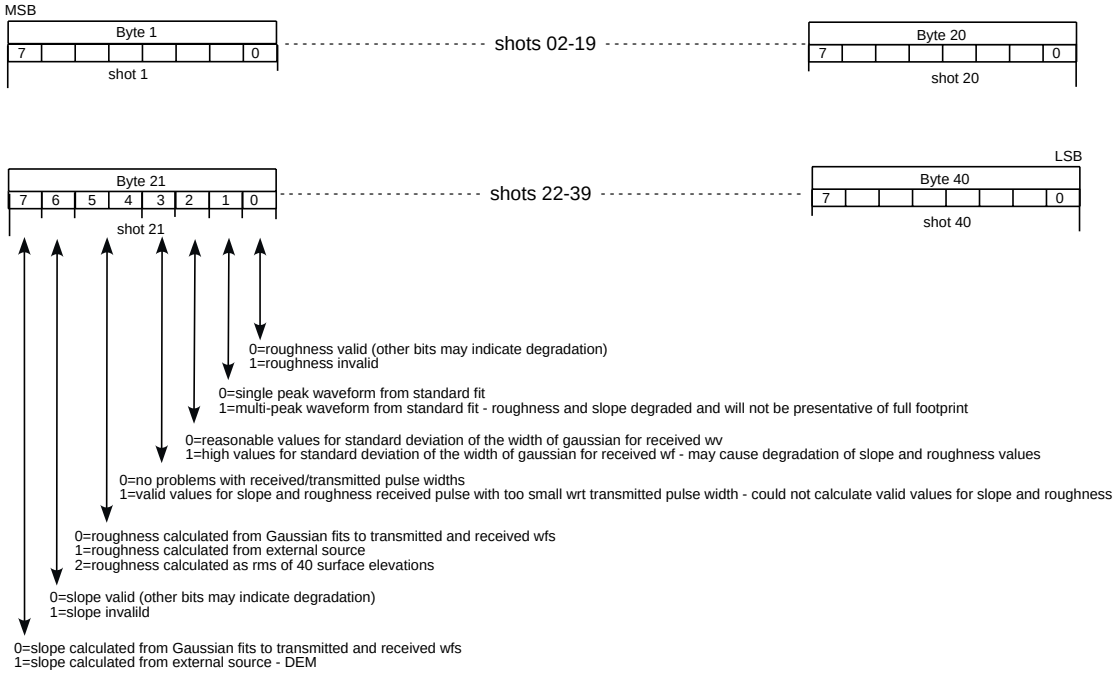


Figure E-39 Surface Roughness and Slope Quality Flag

i_surfType [GLA06, 12-15]: Region Type

1 byte of 1 bit values

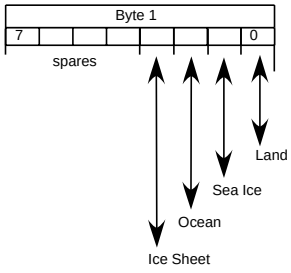


Figure E-40 Region Type

i_LidarQF [1/sec for GLA07], [1/4 sec for GLA08-11]: Lidar Frame Quality Flag

0=good data
1=data unsuitable for L2 processing due to weak 532 laser energy or high background
2=either SPCMs not turned on or bad background

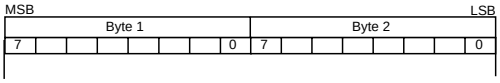


Figure E-41 Lidar Frame Quality Flag

Abbreviations & Acronyms

A2P	Algorithm-to-Product Conversion
ALT	Altimeter or Altimetry, also designation for the EOS-Altimeter spacecraft series
ANCxx	GLAS Ancillary Data Files
APID	GLAS Level-0 Data file
ATBD	Algorithm Theoretical Basis Document
ATM	Atmosphere
CCB	Change Control Board
ClearCase	GSAS version tracking software
CR	Change Request
DAAC	Distributed Active Archive Center
DEM	Digital Elevation Model
DFD	Data Flow Diagram
DLT	Digital Linear Tape
EDOS	EOS Data and Operations System
EDS	Expedited Data Set
ELEV	Elevation
EOC	EOS Operating Center
EOS	NASA Earth Observing System Mission Program
EOSDIS	Earth Observing System Data and Information System
GB	Gigabyte
GDS	GLAS Ground Data System
GLAS	Geoscience Laser Altimeter System instrument or investigation
GLAxx	GLAS Science Data Product Files
GLOP	GLAS Level-0 PGE (correctly called GLAS_L0proc)
GPS	Global Positioning System
GSAS	GLAS Science Algorithm Software
GSFC	NASA Goddard Space Flight Center at Greenbelt, Maryland
GSFC/WFF	NASA Goddard Space Flight Center/Wallops Flight Facility at Wallops Island, Virginia
TBD	to be determined, to be done, or to be developed

Glossary

aggregate	A collection, assemblage, or grouping of distinct data parts together to make a whole. It is generally used to indicate the grouping of GLAS data items, arrays, elements, and EOS parameters into a data record. For example, the collection of Level 1B EOS Data Parameters gathered to form a one-second Level 1B data record. It could be used to represent groupings of various GLAS data entities such as data items aggregated as an array, data items and arrays aggregated into a GLAS Data Element, GLAS Data Elements aggregated as an EOS Data Parameter, or EOS Data Parameters aggregated into a Data Product record.
array	An ordered arrangement of homogenous data items that may either be synchronous or asynchronous. An array of data items usually implies the ability to access individual data items or members of the array by an index. An array of GLAS data items might represent the three coordinates of a georeference location, a collection of values at a rate, or a collection of values describing an altimeter waveform.
file	A collection of data stored as records and terminated by a physical or logical end-of-file (EOF) marker. The term usually applies to the collection within a storage device or storage media such as a disk file or a tape file.
header	A text and/or binary label or information record, record set, or block, prefacing a data record, record set, or a file. A header usually contains identifying or descriptive information, and may sometimes be embedded within a record rather than attached as a prefix.
item	Specifically, a data item. A discrete, non-decomposable unit of data, usually a single word or value in a data record, or a single value from a data array. The representation of a single GLAS data value within a data array or a GLAS Data Element.
label	The text and/or binary information records, record set, block, header, or headers prefacing a data file or linked to a data file sufficient to form a labeled data product. A label may consist of a single header as well as multiple headers and markers depending on the defining authority.
Level 0	The level designation applied to an EOS data product that consists of raw instrument data, recorded at the original resolution, in time order, with any duplicate or redundant data packets removed.
Level 1A	The level designation applied to an EOS data product that consists of reconstructed, unprocessed Level 0 instrument data, recorded at the full resolution with time referenced data records, in time order. The data are annotated with ancillary information including radiometric and geometric calibration coefficients, and georeferencing parameter data (i.e., ephemeris data). The included, computed coefficients and parameter data have not however been applied to correct the Level 0 instrument data contents.
Level 1B	The level designation applied to an EOS data product that consists of Level 1A data that have been radiometrically corrected, processed from raw data into sensor data units, and have been geolocated according to applied georeferencing data.

Level 2	The level designation applied to an EOS data product that consists of derived geophysical data values, recorded at the same resolution, time order, and georeference location as the Level 1A or Level 1B data.
Level 3	The level designation applied to an EOS data product that consists of geophysical data values derived from Level 1 or Level 2 data, recorded at a temporally or spatially resampled resolution.
Level 4	The level designation applied to an EOS data product that consists of data from modeled output or resultant analysis of lower level data that are not directly derived by the GLAS instrument and supplemental sensors.
metadata	The textual information supplied as supplemental, descriptive information to a data product. It may consist of fixed or variable length records of ASCII data describing files, records, parameters, elements, items, formats, etc., that may serve as catalog, data base, keyword/value, header, or label data. This data may be parsable and searchable by some tool or utility program.
orbit revolution	The passage of time and spacecraft travel signifying a complete journey around a celestial or terrestrial body. For GLAS and the EOS ICESat spacecraft each orbit revolution count starts at the time when the spacecraft is on the equator traveling toward the North Pole, continues through the equator crossing as the spacecraft ground track moves toward the South Pole, and terminates when the spacecraft has reached the equator moving northward from the South Polar region.
parameter	Specifically, an EOS Data Parameter. This is a defining, controlling, or constraining data unit associated with a EOS science community approved algorithm. It is identified by an EOS Parameter Number and Parameter Name. An EOS Data Parameter within the GLAS Data Product is composed of one or more GLAS Data Elements
pass	A sub-segment of an orbit, it may consist of the ascending or descending portion of an orbit (e.g., a descending pass would consist of the ground track segment beginning with the northernmost point of travel through the following southernmost point of travel), or the segment above or below the equator (e.g., either the northern or southern hemisphere portion of the ground track on any orbit).
product	Specifically, the Data Product or the EOS Data Product. This is implicitly the labeled data product or the data product as produced by software on the DAAC or SCF. A GLAS data product refers to the data file or record collection either prefaced with a product label or standard formatted data label or linked to a product label or standard formatted data label file. Loosely used, it may indicate the entire set of product files contained in a data repository.
record	A specific organization or aggregate of data items. It represents the collection of EOS Data Parameters within a given time interval, such as a one-second data record. It is the first level decomposition of a product file.
Standard Data Product	Specifically, a GLAS Standard Data Product. It represents an EOS ICESat/GLAS Data Product produced on the DAAC or on the SCF. It is routinely produced and is intended to be archived in the EOSDIS data repository for EOS user community-wide access and retrieval.
variable	Usually a reference in a computer program to a storage location.