MODIS Level 1B Product User's Guide

For Level 1B Version 2.0

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1. Introduction

1.1. Document Identification

This is the MODIS Level 1B Product User's Guide.

1.2. Scope

This User's Guide provides information about the content, format and use of all files produced by the MODIS Level 1B software.

1.3. Purpose

The purpose of this User's Guide is to provide sufficient information for anyone wishing to use the calibrated MODIS instrument data provided in the Level 1B product to

understand the content
understand the format
determine what data items they need or want
access the data

1.4. Reference Documents

MODIS Level 1B Algorithm Theoretical Basis Document Version 2.0 [ATBMOD-01], MODIS Characterization Support Team

HDF-EOS Library User's Guide for the ECS Project, Volume 1: Overview and Examples, 170-TP-005-002, Technical Paper, Hughes Information Technology Systems, November 1996

Writing HDF-EOS Swath Products for Optimum Subsetting Services, 170-TP-009-001, Technical Paper, Hughes Information Technology Systems, December 1996

1.5. Document Organization

Section 1 is the introduction

Section 2 is the product overview

Section 3 is the description of the data items

Section 4 is a description of the individual files.

Section 5 contains abbreviations and acronyms

Section 6 is the glossary.

Section 7 is notes

Section 8 contains appendices.

2. Product Overview

The MODIS Level 1B 1 data product has been separated into the following four Hierarchical Data Format (HDF) files.

MODIS Level 1B 250M Earth View Data Product which contains Earth View observations in scientific units for MODIS bands 1 and 2, at 250 meter resolution;

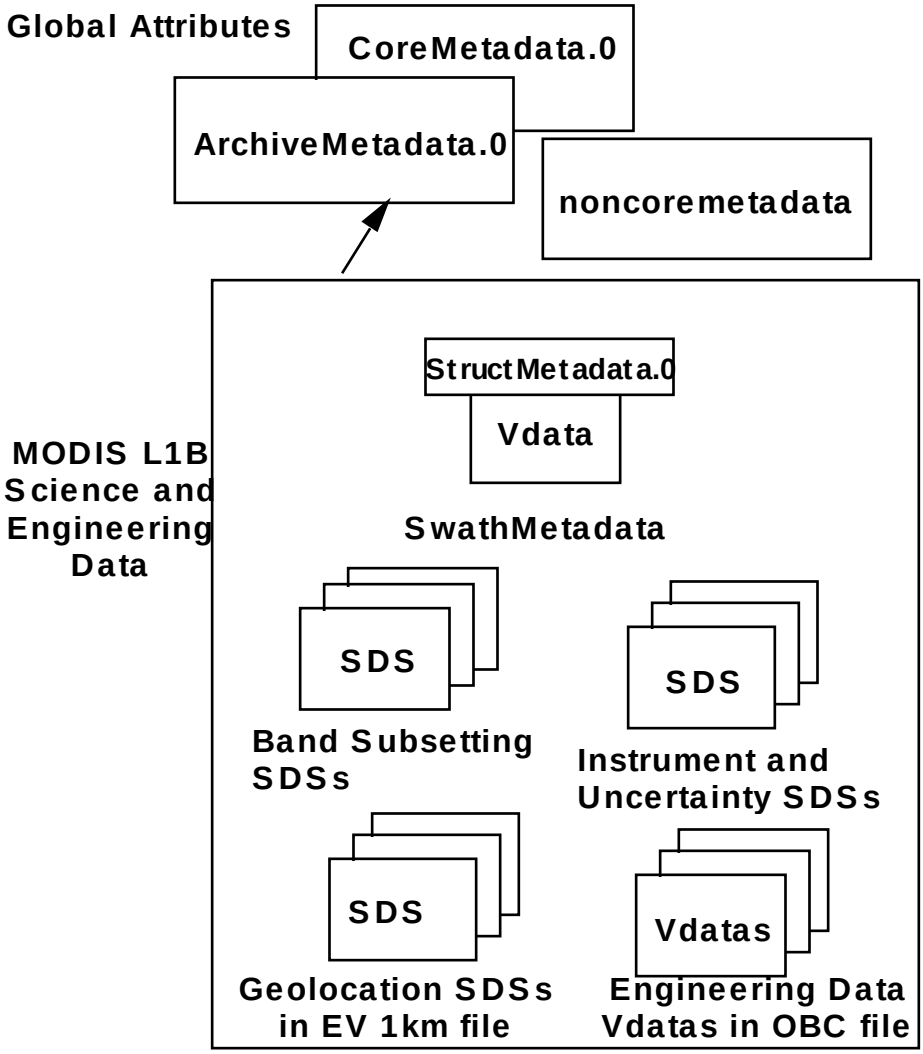
MODIS Level 1B 500M Earth View Data Product which contains Earth View observations in scientific units from MODIS bands 1 and 2, aggregated at 500 meter resolution, plus the Earth View observations from MODIS bands 3 through 7, at 500 meter resolution;

MODIS Level 1B 1KM Earth View Data Product which contains Earth View observations in scientific units from MODIS bands 1 through 7, aggregated at 1 kilometer resolution, plus the Earth View observations from MODIS bands 8 through 36, at 1 kilometer resolution;

MODIS Level 1B OBC/E Product which contains On Board Calibrator observations in scientific units from all MODIS bands, at their original resolution, plus the Engineering data in engineering units.

The 1 km Earth View data file contains a subset of geolocation data to support plotting and visualization.

The aggregation algorithm used in the 500M and 1KM Earth View files is documented in the MODIS Earth Location Algorithm Theoretical Basis document, Version 2.0, April 1995.



Level 1B HDF Format

2.1. Metadata

Metadata is information about data. The Level 1B product contains five types of metadata. These are Core Metadata, Archive Metadata, Product Metadata, Swath Metadata, and SDS Metadata. The Core, Archive and Product metadata are stored as global attributes. The Swath metadata is stored in two forms, as swath attributes for HDF-EOS required swath metadata, and as HDF Vdata for Level 1B specific swath metadata. The SDS metadata is stored as Science Data Set (SDS) attributes.

The ECS required metadata in this file is written with the Science Data Processing Tool Kit (SDPTK) tools, so that it may be read with these tools.

Core metadata satisfies the ECS requirements to provide granule level information for ingesting, cataloging, and searching data products. The content and format of the Core metadata is defined by ECS.

Archive metadata provides granule level information that is archived with the product, but which is not stored in the searchable ECS database.

Product metadata satisfies the MODIS mission's requirement to track MODIS specific data at the granule level. The granule level information is output as global metadata elements stored using the HDF Attribute, in accordance with ECS guidelines

Swath metadata provides HDF-EOS required fields, instrument information, the nadir frame number, the latitude, longitude and sun angles with respect to the nadir frame, processing information and quality information about a particular swath of MODIS data.

SDS metadata contains information that describes the dimensions of the SDS and the data stored in the SDS.

2.2. Science Data

The science data in the Earth View files is instrument data and geolocation data stored as multiple SDSs in HDF-EOS Swath format. External storage of the complete set of geolocation data separated from the swath was approved by ECS for the MODIS project as a means of reducing redundant storage of the geolocation data in every product. The small subset of internal geolocation data stored in the 1 KM Earth View file is for convenience in imaging and visualization.

The dimensions of the SDSs are defined using HDF dimension names. Attributes associated with an HDF dimension are inherited by any SDS using that dimension name. This technique is used to provide multiple SDSs which have a common dimension with information such as band names, units, and scale and offset values.

The indexing is described in terms of C. This means that for a two dimension array, data_array[index_1][index_2], the values in the array are stored with index_2 varying more rapidly. Similarly, for a three dimension array, data_array[index_1][index_2][index_3], the values in the array are stored with index_3 varying most rapidly, index_2 varying next most rapidly, and index_1 varying most slowly.

2.3. Instrument SDSs

The targets observed by the MODIS instrument are the Solar Diffuser, the Spectroradiometric Calibration Assembly, the Black Body, the Space View and the Earth

View. The instrument data in three of the four files described by this User's Guide is MODIS data taken while observing the Earth View (EV) scene. The instrument data for the four calibration targets viewed by MODIS are stored in the OBC/Engineering file. The data at each resolution, for the EV scene, is in an SDS.

In the 1 KM Earth View file are:

reflected solar band calibrated data at 250 M resolution aggregated to 1 km,
reflected solar band calibrated data at 500 M resolution aggregated to 1 km,
reflected solar band calibrated data at 1 km resolution,
emissive thermal band calibrated data at 1 km resolution,
uncertainty indices,
number of samples used in the aggregations.

In the 500 M Earth View file are:

reflected solar band calibrated data at 250 M resolution aggregated to 500 M,
reflected solar band calibrated data at 500 M resolution,
uncertainty indices,
number of samples used in the aggregations.

In the 250 M Earth View file are:

reflected solar band calibrated data at 250 M
uncertainty indices.

In the OBC/Engineering file are:

Solar Diffuser data
SRCA data
Black Body data
Space View data
uncertainty indices
Engineering data

The data in the instrument SDSs are scaled integers. Meaningful geophysical products are derived from these integer data sets through use of scaling factors and offsets provided in the SDS dimension attributes. The scaled integer values map uniquely, throughout the mission, to reflectance for Reflective Solar Bands and to radiance for Emissive Infrared bands

When the MODIS instrument is commanded to operate in night mode, the data taken by the detectors in bands 1 through 19 is not telemetered down from the spacecraft. The SDSs for the data for these bands exist for all granules, but contain no data when the instrument is operating in night mode for the entire granule. The SDSs for the data for bands 1 through 19 contain the missing data indicator in night mode scans when the instrument operations switch between day mode and night mode within the granule. The

instrument cannot change between day mode and night mode during the extent of an Earth View scan.

Dimension names are stored as attributes of the swath in the HDF-EOS swath metadata. The numbers of the bands in each SDS, the units of the calibrated data, and the scale and offset values for converting the integers to calibrated geophysical parameters are provided as SDS dimension attributes. These attributes are described in terms of ncdump output, where x.f represents a float32 value.

There is one scale and offset pair which provides the corrected raw counts, DN*, for each detector, and two pairs of scale and offset values which provide radiance or reflectance related values, for each band. The emissive bands are reported as radiance products only. After multiplying by the scale and adding the offset to the integer values to restore them to calibrated geophysical quantities, the corrected counts will be in units of counts, the radiances will be in units of Watts/m^2/μm/steradian; the reflectance related values [(EV BRF) ∗ (cosine of the Solar Zenith Angle)] will be in units of per steradian. Thus, radiance (Watts/m^2/μm/steradian)=radiance scale(band#) * unsigned integer values + radiance offset (band#). The band dependent scales and offsets are determined as $scale = 1.1\left[\frac{L_{MAX_{band}}}{2^{15}-1}\right]$, and $offset = -0.1\left[\frac{L_{MAX_{band}}}{2^{15}-1}\right]$, where $L_{MAX_{band}}$ is the maximum radiance value for a band, and is defined to be 90% of the possible range.

In terms of the reflectance related product, the band dependent scales and offsets are

$$scale = 1.1\left[\frac{(\rho\cos\theta)_{MAX_{band}}}{2^{15}-1}\right], \quad offset = -0.1\left[\frac{(\rho\cos\theta)_{MAX_{band}}}{2^{15}-1}\right],$$

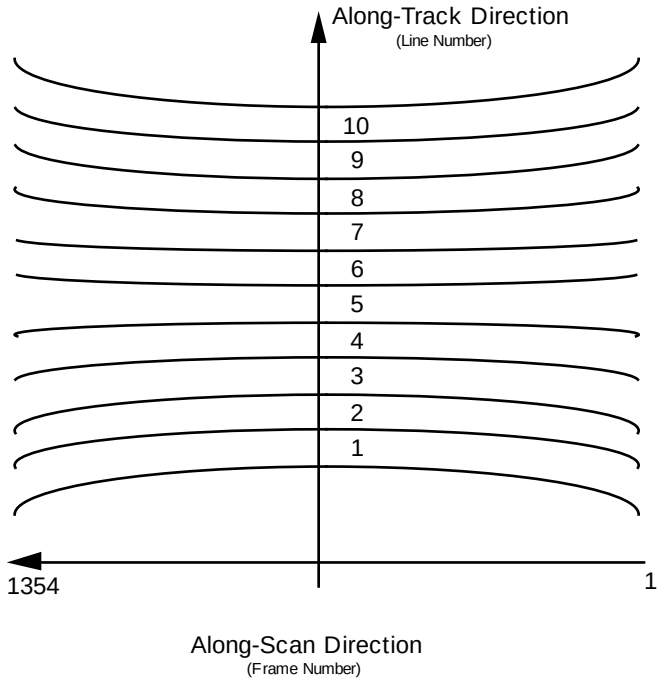
where $\left(\rho\cos\Theta_{MAX_{band}}\right) = \frac{\pi}{E_{SUN_{nd}}} L_{MAX_{band}}$.

The relationship between reflectance (ρ_{EV}) and radiance (L_{EV}) is given by the equation $\rho_{EV}\cos\left(\Theta_{EV}\right) = \frac{\pi L_{EV,B,D}}{E_{Sun,B}}$, and is determined at the top of the atmosphere. See the MODIS Level 1B Algorithm Theoretical Basis Document, Version 2.0.

The scale and offset values that restore the unsigned integer values to corrected counts are needed for each detector in each band. These are stored as though indexed [band][detector], i.e., the corrected counts scales for all detectors in a band are contiguous, and the corrected counts offsets for all detectors in a band are contiguous.

The numbers assigned by the hardware engineers to the detectors on the instrument are the reverse of the data storage numbering. The lines of data within a swath or scan in the Level 1A, Geolocation and Level 1B files are stored by increasing index, 1 to 10, 1 to 20 and 1 to 40, in increasing along-track direction. The pixel data within a band are stored

this way so that consecutive swaths or scans can be "laid down" directly onto a map and have the correct continuity across each swath.



Invalid data fields are identified by having the high order bit set to 1. The data in a field is marked as invalid for the following reasons:

it was flagged as missing from the Level 1A dataset;
the detector is dead;
the value was saturated;
there was a calibration failure;
the radiance was too low to calculate;
there was coherent Space View (SV) noise;
the number of outliers in the SV data exceeded the maximum;
there was a mirror side difference in the SV data.

Thus any data value larger than 32767 should be interpreted as invalid data.

The values in data fields that are flagged as missing from the Level 1A dataset are copied into the Level 1B file exactly as they are stored in the Level 1A file. In the Level 1A file these values are -1, stored as signed 16 bit integers. In the Level 1B file these values are 65535, stored as unsigned 16 bit integers.

For invalid data not flagged as missing from the Level 1A dataset, the actual values stored in the file are the values calculated by the algorithm, altered by having the high order bit set to 1.

The specific cause of all invalid data is reported in the QA log message file.

2.4. Other SDSs

2.4.1. Uncertainties SDSs

NOTE: At this point MCST is not yet certain that we have the optimum design for the Uncertainty Index and the Scene Contrast Index so that they are of optimal use to the science user. Any user who plans to start using these indexes before the Version 2.1 release of the Level 1B software should contact MCST directly.

Level 1B Uncertainty Index

The Uncertainty Index is carried as a multiplicative factor to be applied to the instrument spectral radiance specifications. The instrument specifications are provided below, and will be stored in the Collect Level metadata, which is TBD. The uncertainty is recorded as an index which includes MCST's complete and best understanding of the flat-field uncertainties for that pixel. The index translates to an uncertainty value by use of the formula

exp(Uncertainty Index/2) = $\pm$Uncertainty Range Multiplier Value.

The uncertainty is carried in the one-sigma sense. This index can be considered a Risk Index describing the use of the Level 1B data. An Uncertainty Index of 7 indicates that the uncertainty has not been computed.

2.4.1.1.Using the Uncertainty Index Stored in the L1B File

As an example, for Band 9, the accuracy requirement of one sigma is 5%. If the uncertainty index has a value of 3, the maximum magnitude of the uncertainty for Band 9 is $e^{3/2}(.05)$, or (4.5)(.05) = 0.225, or 22.5%.

Uncertainty Index Value	Multiplier Range (1 Sigma)
0	$\pm$1
1	$\pm$1.6
2	$\pm$2.7
3	$\pm$4.5
4	$\pm$7.4
5	$\pm$12
6	$\pm$20
7	greater than 20, index not computed

2.4.1.2.Calculating the Uncertainty Index in the L1B Software

Initialize to 7 the uncertainty index for the pixel

Calculate the uncertainty for the pixel as described in the ATBD $\left(\frac{\Delta L}{L}\right)$.

Find the desired band number in the table of accuracy requirements for the MODIS bands.
Extract the accuracy requirement for that band.
Divide the calculated uncertainty by the accuracy requirement for the band.
Multiply by two the natural logarithm of the quantity calculated in the previous step.
Round to the next highest integer and store as the uncertainty index for the pixel.

Band	Accuracy Requirement	Band	Accuracy Requirement	Band	Accuracy Requirement
1	5%	13hi	5%	25	1%
2	5%	14lo	5%	26	5%
3	5%	14hi	5%	27	1%
4	5%	15	5%	28	1%
5	5%	16	5%	29	1%
6	5%	17	5%	30	1%
7	5%	18	5%	31	0.50%
8	5%	19	5%	32	0.50%
9	5%	20	0.75%	33	1%
10	5%	21	1%	34	1%
11	5%	22	1%	35	1%
12	5%	23	1%	36	1%
13lo	5%	24	1%		

2.5. Geolocation SDSs

The Geolocation SDSs stored in the 1km file contain a subset of the MODIS Geolocation file used to generate this file. In each scan, starting with the third frame of the Earth View sector and for every fifth frame after that, Geolocation fields for the third and eighth lines of data, corresponding to 1 km resolution bands, are copied directly from the Geolocation file. The Geolocation fields are latitude, longitude, height, sensor zenith, sensor azimuth, range, solar zenith, and solar azimuth. Refer to the MODIS Geolocation Product Specification for a complete description. Interpolating over these locations to approximate geolocation values for the intervening frames or lines of data will not provide the accuracy available in the MODIS Geolocation file.

2.6. Band Subsetting SDSs

The Band Subsetting SDSs support ECS subsetting of the band dimensions.

3. Individual Files

3.1. MODIS Level 1B 1km Earth View Data

ECS Standard Core Granule Metadata **Stored as One ECS PVL String in :coremetadata.0=Global Attribute**	
Description	**Example**
SHORTNAME	"MOD021KM"
VERSIONID	"2.0"
SIZEMBECSDATAGRANULE	400. (Obtained from system at runtime)
EASTBOUNDINGCOORDINATE	40.000000
WESTBOUNDINGCOORDINATE	15.000000
NORTHBOUNDINGCOORDINATE	25.000000
SOUTHBOUNDINGCOORDINATE	10.000000
EXCLUSIONGRINGFLAG.1	"N"
GRINGPOINTLATITUDE.1	(25.000000, 20.000000, 10.000000, 15.000000)
GRINGPOINTLONGITUDE.1	(20.000000, 40.000000, 35.000000, 15.000000)
GRINGPOINTSEQUENCENO.1	(1, 2, 3, 4)
ORBITNUMBER	1234
RANGEBEGINNINGDATETIME	"2002-02-23T11:02:27.987654Z"
RANGEENDINGDATETIME	"2002-02-23T11:04:57.987654Z"
QAPERCENTINTERPOLATEDDATA	0
QAPERCENTOUTOFBOUNDSDATA	0
QAPERCENTMISSINGDATA	0
AUTOMATICQUALITYFLAG	"passed"
OPERATIONALQUALITYFLAG	"not being investigated"
SCIENCEQUALITYFLAG	" uncertainty and QA for each pixel, no validation data yet applied "
QUALITYFLAGEXPLANATION	"not being investigated"
REPROCESSINGACTUAL	"processed once"
REPROCESSINGPLANNED	"no further update anticipated"
INPUTPOINTER	"L1A and Geolocation file name(s), Reflective.LUT, Emissive.LUT, sd.coeff.trend "
OPERATIONMODE	"day"

MODIS Level 1B Archive Granule Metadata **Stored as HDF ECS PVL in :archivemetadata.0=Global Attribute**	
Description	**Example**
PROCESSINGDATETIME	"2002-02-23T11:04:57.987654Z"
SPSOPARAMETERS	"The SPSO parameters (see database) for all data contained in this file"
ALGORITHMPACKAGEACCEPTANCEDATE	"1997-01-01"
ALGORITHMPACKAGEMATURITYCODE	"pre-launch"

ALGORITHMPACKAGENAME	"MOD02V2.0"
ALGORITHMPACKAGEVERSION	"version 2.0"
INSTRUMENTNAME	"Moderate-Resolution Imaging SpectroRadiometer"
PLATFORMSHORTNAME	"EOS AM1"
PROCESSINGCENTER	"GSFC"
ROUTINEINSTRUMENTOPERATIONS	"Y" or "N"
CALIBRATIONDATAQUALITY	"good", "marginal" OR "bad"
NADIRPOINTING	"Y" or "N"
MISSIONPHASE	"A&E" OR "post A&E"

MODIS Level 1B Product Granule Metadata Stored as Native HDF Global Attributes		
Description	**Format**	**Example**
"Number of Scans"	Int32	203
"Number of Day mode scans"	Int32	203
"Number of Night mode scans"	Int32	0
"Incomplete Scans"	Int32	14
"Max Earth View Frames"	Int32	1354
"%Valid EV Observations"	float32[38]	98.2,..., 87.1,..,46.0,...
"%Saturated EV Observations"	float32[38]	1.4,..., 0.2,...,7.9,...
"Post Processing Indicates Bad data"	Int32[38]	1=True; 0=False
"Electronics Redundancy Vector"	uint32[2]	One bit set to 0 for Side A or 1 for Side B, for each programmable component
"Reflective LUT Last Change Date"	string	"1997-02-28T00:00:00"
"Emissive LUT Last Change Date"	string	"1997-02-28T00:00:00"
"Focal Plane Set Point State"	Int8[4]	0=Running open loop 1=Set Point is 83 degrees 2=Set Point is 85 degrees 3=Set Point is 88 degrees

Level 1B HDF-EOS Swath Metadata Stored as HDF ECS PVL in :StructMetadata.0=Global Attribute
GROUP=SwathStructure GROUP=SWATH_1 SwathName="MODIS_Swath_Type_L1B" GROUP=Dimension Dimension_1, "Band_250M", Size=2 Dimension_2, "Band_500M", Size=5 Dimension_3, "Band_1KM_RefSB", Size=15 Dimension_4, "Band_1KM_Emissive, Size=16 Dimension_5, "10*nscans", Size=10*nscans Dimension_6, "Max_EV_frames", Size=Max_EV_frames Dimension_7, "2*nscans", Size=2*nscans

```
    Dimension_8, ”Max_EV_frames/5”, Size=Max_EV_frames/5
  GROUP=DimensionMap
    DimensionMap_1, GeoDimension=“2*nscans”,
                                        DataDimension=“10*nscans”, Offset=2, Increment=5
    DimensionMap_2, GeoDimension=“ Max_EV_frames/5”,
                                    DataDimension=“ Max_EV_frames”, Offset=2, Increment=5
  GROUP=GeoField
    GeoField_1, “Latitude”,  DFNT_FLOAT32,
                                                        (“2*nscans”,”Max_EV_frames/5”)
    GeoField_2, “Longitude”,  DFNT_FLOAT32,
                                                        (“2*nscans”,”Max_EV_frames/5”)
  GROUP=DataField

    DataField_1, “EV_250_Aggr1km_RefSB”, DFNT_UINT16,
                                          (“Band-250M”, “10*nscans”, “Max_EV_frames”)
    DataField_2, “EV_250M_Aggr1km_RefSB_Uncert_Indexes”,
                                  DFNT_UINT8,  (“Band_250M”, “10*nscans”, “Max_EV_frames”)
    DataField_3, “EV_500_Aggr1km_RefSB”, DFNT_UINT16,
                                          (“Band_500M”, “10*nscans”, “Max_EV_frames”)
    DataField_4, “EV_500M_Aggr1km_RefSB_Uncert_Indexes”,
                                  DFNT_UINT8,  (“Band_500M”, “10*nscans”, “Max_EV_frames”)
    DataField_5, “EV_1KM_RefSB”, DFNT_UINT16,
                                        (“Band_1KM_RefSB”, “10*nscans”, “Max_EV_frames”)
    DataField_6, “EV_1KM_RefSB_Uncert_Indexes”, DFNT_UINT8,
                                        (“Band_1KM_RefSB”, “10*nscans”, “Max_EV_frames”)
    DataField_7, “EV_1KM_Emissive”, DFNT_UINT16,
                                      (“Band_1KM_Emissive”, “10*nscans”, “Max_EV_frames”)
    DataField_8, “EV_1KM_Emissive_Uncert_Indexes”, DFNT_UINT8,
                                      (“Band_1KM_Emissive”, “10*nscans”, “Max_EV_frames”)
    DataField_9, “Height”, DFNT_INT16, (“2*nscans”, “Max_EV_frames/5”)
    DataField_10, “SensorZenith”, DFNT_INT16,
                                                        (“2*nscans”, “Max_EV_frames/5”)
    DataField_11, “SensorAzimuth”, DFNT_INT16,
                                                        (“2*nscans”, “Max_EV_frames/5”)
    DataField_12, “Range”, DFNT_INT16, (“2*nscans”, “Max_EV_frames/5”)
    DataField_13, “SolarZenith”, DFNT_INT16,
                                                        (“2*nscans”, “Max_EV_frames/5”)
    DataField_14, “SolarAzimuth”, DFNT_INT16,
                                                        (“2*nscans”, “Max_EV_frames/5”)
    DataField_15, “gflags”, DFNT_INT8,
                                                        (“2*nscans”, “Max_EV_frames/5”)
    DataField_16, “EV_250_Aggr1km_RefSB_Samples_Used”, DFNT_INT8,
                                        (“Band_250M”, “10*nscans”, “Max_EV_frames”)
    DataField_16, “EV_500_Aggr1km_RefSB_Samples_Used”, DFNT_INT8,
                                        (“Band_500M”, “10*nscans”, “Max_EV_frames”)
```

"Level 1B Specific Swath Metadata" Written as Vdata with the Following Fields		
Field	**Type**	**Typical value**
Scan Number	int32	Range 1 to 100
Complete Scan Flag	int32	Complete=1, Incomplete=0
Scan Type	char8[4]	"D "=day, "N "=night, "M "=mixed, "O "=other
Mirror Side	int32	Mirror Side 1 = 0; Mirror Side 2 = 1
EV Sector Start Time	float64	TAI: Sec. since midnight 1/1/93
Programmed_EV_Frames	int32	1514
EV_Frames	int32	1354
Nadir_Frame_Number	int32	677
Latitude of Nadir Frame	float32	-90.0 to 90.0 in degrees
Longitude of Nadir Frame	float32	-180.0 to 180.0 in degrees
Solar Azimuth of Nadir Frame	float32	-180 to 180 degrees
Solar Zenith of Nadir Frame	float32	0.0 to 180.0 in degrees
No. thermistor outliers	int32	Range 0 to 12
Bit QA Flags	int32	1=True; 0=False
Moon in SV Port	bit 0	
Spacecraft Maneuver	bit 1	
Sector Rotation	bit 2	
Negative Radiance Beyond Noise Level	bit 3	
PC Ecal on	bit 4	
PV Ecal on	bit 5	
SD Door Open	bit 6	
SD Screen Down	bit 7	
SRCA On	bit 8	
SDSM On	bit 9	
Outgassing	bit 10	
Instrument Standby Mode	bit 11	
Linear Emissive Calibration	bit 12	
DC Restore Change	bit 13	
BB/Cavity Temperature Differential	bit 14	
BB Heater On	bit 15	
Missing Previous Granule	bit 16	
Missing Subsequent Granule	bit 17	
Remaining 14 bits reserved for future use	bits 18 - 31	

Band Subsetting SDSs		
SDS Name	**Data Type**	**HDF Dimension Names**
"Band_250M"	float32	floating point array of dimension (Band_250M)
Band_250M SDS Attributes: long_name ="250M Band Numbers for Subsetting" Note: The values stored in this array are 1.0 and 2.0 Band_250M Dimension Attributes: band_names = "1, 2" radiance_scales = x.f, x.f radiance_offsets = x.f, x.f radiance_units = "Watts/m^2/μm/steradian" reflectance_scales = x.f, x.f reflectance_offsets = x.f, x.f reflectance_units = "1/steradian" corrected_counts_scales = x.f, x.f, x.f,...80 values, one for each detector in each band. corrected_counts_offsets = x.f, x.f, x.f,...80 values, one for each detector in each band. corrected_counts_units = "counts"		
"Band_500M"	float32	floating point array of dimension (Band_250M)
Band_500M SDS Attributes: long_name ="500M Band Numbers for Subsetting" Note: The values stored in this array are 3.0, 4.0, 5.0, 6.0, and 7.0 Band_500M Dimension Attributes: band_names = "3, 4, 5, 6, 7" radiance_scales = x.f, x.f, x.f, x.f, x.f radiance_offsets = x.f, x.f, x.f, x.f, x.f radiance_units = "Watts/m^2/μm/steradian" reflectance_scales = x.f, x.f, x.f, x.f, x.f reflectance_offsets = x.f, x.f, x.f, x.f, x.f reflectance_units = "1/steradian" corrected_counts_scales = x.f, x.f, x.f,...100 values, one for each detector in each band. corrected_counts_offsets = x.f, x.f, x.f,...100 values, one for each detector in each band. corrected_counts_units = "counts"		
"Band_1KM_RefSB "	float32	floating point array of dimension (Band_1KM_RefSB)

Band_1KM_RefSB SDS Attributes: long_name ="1KM Reflective Solar Band Numbers for Subsetting" Note: The values stored in this array are 8.0, 9.0, 10.0, 11.0, 12.0, 13.0, 13.5, 14.0, 14.5, 15.0, 16.0, 17.0, 18.0, 19.0 and 26.0 Band_1KM_RefSB Dimension Attributes: band_names = "8, 9, 10, 11, 12, 13lo, 13hi, 14lo, 14hi, 15, 16, 17, 18, 19, 26" radiance_scales = x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f radiance_offsets x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f radiance_units = "Watts/m^2/μm/steradian" reflectance_scales = x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f reflectance_offsets = x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f reflectance_units = "1/steradian" corrected_counts_scales = x.f, x.f, x.f,...160 values, one for each detector in each band. corrected_counts_offsets = x.f, x.f, x.f,...160 values, one for each detector in each band. corrected_counts_units = "counts"		
"Band_1KM_Emissive "	float32	floating point array of dimension (Band_1KM_Emissive)
Band_1KM_Emissive SDS Attributes: long_name ="1KM Emissive Band Numbers for Subsetting" Note: The values stored in this array are 20.0, 21.0, 22.0, 23.0, 24.0, 25.0, 27.0, 28.0, 29.0, 30.0, 31.0, 32.0, 33.0, 34.0, 35.0, 36.0 Band_1KM_Emissive Dimension Attributes: band_names = "20, 21, 22, 23, 24, 25, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36" radiance_scales = x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f radiance_offsets = x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f radiance_units = "Watts/m^2/μm/steradian" corrected_counts_scales = x.f, x.f, x.f,...150 values, one for each detector in each band. corrected_counts_offsets x.f, x.f, x.f,...150 values, one for each detector in each band. corrected_counts_units = "counts"		

Instrument and Uncertainty SDSs		
SDS Name	**Data Type**	**HDF Dimension Names**
"EV_250_Aggr1km_RefSB "	uint16	16 bit scaled integer array of dimension (Band_250M, 10*nscans, Max_EV_frames)

EV_250_Aggr1km_RefSB SDS Attributes: long_name ="Earth View 250M Aggregated 1km Reflected Solar Bands Scaled Integers" Band_250M Dimension Attributes: band_names = "1, 2" radiance_scales = x.f, x.f radiance_offsets = x.f, x.f radiance_units = "Watts/m^2/μm/steradian" reflectance_scales = x.f, x.f reflectance_offsets = x.f, x.f reflectance_units = "1/steradian" corrected_counts_scales = x.f, x.f, x.f,...80 values, one for each detector in each band. corrected_counts_offsets = x.f, x.f, x.f,...80 values, one for each detector in each band. corrected_counts_units = "counts"		
"EV_250_Aggr1km_RefSB_Uncert_Indexes"	uint8	8 bit integer array of dimension (Band_250M, 10*nscans, Max_EV_frames)
EV_250_Aggr1km_RefSB_Uncert_Indexes SDS Attributes: long_name ="Earth View 250M Aggregated 1km Reflected Solar Bands Uncertainty Indexes"		
"EV_250_Aggr1km_RefSB_Samples_Used"	int8	8 bit integer array of dimension (Band_250M, 10*nscans, Max_EV_frames)
EV_250_Aggr1km_RefSB_Samples_Used SDS Attributes: long_name ="Earth View 250M Aggregated 1km Reflected Solar Bands Number of Samples Used in Aggregation"		
"EV_500_Aggr1km_RefSB"	uint16	16 bit scaled integer array of dimension (Band_500M, 10*nscans, Max_EV_frames)
EV_500_RefSB SDS Attributes: long_name ="Earth View 500M Aggregated 1km Reflected Solar Bands Scaled Integers" Band_500M Dimension Attributes: band_names = "3, 4, 5, 6, 7" radiance_scales = x.f, x.f, x.f, x.f, x.f radiance_offsets = x.f, x.f, x.f, x.f, x.f radiance_units = "Watts/m^2/μm/steradian" reflectance_scales = x.f, x.f, x.f, x.f, x.f reflectance_offsets = x.f, x.f, x.f, x.f, x.f reflectance_units = "1/steradian" corrected_counts_scales = x.f, x.f, x.f,...100 values, one for each detector in each band. corrected_counts_offsets = x.f, x.f, x.f,...100 values, one for each detector in each band. corrected_counts_units = "counts"		
"EV_500_Aggr1km_RefSB_Uncert_Indexes"	uint8	8 bit integer array of dimension (Band_500M, 10*nscans, Max_EV_frames)
EV_500_RefSB_Uncert_Indexes SDS Attributes: long_name ="Earth View 500M Aggregated 1km Reflected Solar Bands Uncertainty Indexes"		
"EV_500_Aggr1km_RefSB_Samples_Used"	int8	8 bit integer array of dimension (Band_500M, 10*nscans, Max_EV_frames)

EV_500_Aggr1km_RefSB_Samples_Used SDS Attributes: long_name ="Earth View 500M Aggregated 1km Reflected Solar Bands Number of Samples Used in Aggregation"		
"EV_1KM_RefSB"	uint16	16 bit scaled integer array of dimension (Band_1KM_RefSB,10*nscans,Max_EV_frames)
EV_1KM_RefSB SDS Attributes: long_name ="Earth View 1KM Reflected Solar Bands Scaled Integers" Band_1KM_RefSB Dimension Attributes: band_names = "8, 9, 10, 11, 12, 13lo, 13hi, 14lo, 14hi, 15, 16, 17, 18, 19, 26" radiance_scales = x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f radiance_offsets x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f radiance_units = "Watts/m^2/μm/steradian" reflectance_scales = x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f reflectance_offsets = x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f reflectance_units = "1/steradian" corrected_counts_scales = x.f, x.f, x.f,...150 values, one for each detector in each band. corrected_counts_offsets = x.f, x.f, x.f,...150 values, one for each detector in each band. corrected_counts_units = "counts"		
"EV_1KM_RefSB_Uncert_ Indexes"	uint8	8 bit integer array of dimension (Band_1KM_RefSB,10*nscans,Max_EV_frames)
EV_1KM_RefSB_Uncert_Indexes SDS Attributes: long_name ="Earth View 1KM Reflected Solar Bands Uncertainty Indexes"		
"EV_1KM_Emissive"	uint16	16 bit scaled integer array of dimension (Band_1KM_Emissive, 10*nscans, Max_EV_frames,)
EV_1KM_Emissive SDS Attributes: long_name ="Earth View 1KM Emissive Bands Scaled Integers" Band_1KM_Emissive Dimension Attributes: band_names = "20, 21, 22, 23, 24, 25, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36" radiance_scales = x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f radiance_offsets = x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f radiance_units = "Watts/m^2/μm/steradian" corrected_counts_scales = x.f, x.f, x.f,...160 values, one for each detector in each band. corrected_counts_offsets x.f, x.f, x.f,...160 values, one for each detector in each band. corrected_counts_units = "counts"		
"EV_1KM_Emissive_Unce rt_Indexes"	uint8	8 bit integer array of dimension (Band_1KM_Emissive, 10*nscans, Max_EV_frames,)
EV_1KM_Emissive_Uncert_Indexes SDS Attributes: long_name ="Earth View 1KM Emissive Bands Uncertainty Indexes"		

Geolocation SDSs

SDS Name	Data Type	HDF Dimension Names
"Latitude"	float32	32 bit floating point array of dimension (2*nscans, Max_EV_frames/5)
Latitude SDS Attributes: units = degrees valid_range = -180.0, 180.0 _FillValue = -999.9 line_numbers = [3, 8] frame_numbers = [3, 8, 13,...]		
"Longitude"	float32	32 bit floating point array of dimension (2*nscans, Max_EV_frames/5)
Longitude SDS Attributes: units = degrees valid_range = -90.0, 90.0 _FillValue = -999.9 line_numbers = [3, 8] frame_numbers = [3, 8, 13,...]		
"Height"	int16	16 bit integer array of dimension (2*nscans, Max_EV_frames/5)
Height SDS Attributes: units = meters valid_range = 0, 10000 _FillValue = -32767 line_numbers = [3, 8] frame_numbers = [3, 8, 13,...] scale_factor = 0.01		
"SensorZenith"	int16	16 bit integer array of dimension (2*nscans, Max_EV_frames/5)
SensorZenith SDS Attributes: units = degrees valid_range = 0, 15730 _FillValue = -32767 line_numbers = 3, 8 frame_numbers = 3, 8, 13,... scale_factor = 0.01		
"SensorAzimuth"	int16	16 bit integer array of dimension (2*nscans, Max_EV_frames/5)
SensorAzimuth SDS Attributes: units = degrees valid_range = -3146 line_numbers = [3, 8] frame_numbers = [3, 8, 13,...] scale_factor = 0.01		
"Range"	uint16	16 bit unsigned integer array of dimension (2*nscans, Max_EV_frames/5)

Range SDS Attributes: units = meters valid_range = 27000,65535 _FillValue = 0 line_numbers = [3, 8] frame_numbers = [3, 8, 13,...] scale_factor = 50		
"SolarZenith"	int16	16 bit integer array of dimension (2*nscans, Max_EV_frames/5)
SolarZenith SDS Attributes: units = degrees valid_range = 0, 31460 _FillValue = -32767 line_numbers = [3, 8] frame_numbers = [3, 8, 13,...] scale_factor = 0.01		
"SolarAzimuth"	int16	16 bit integer array of dimension (2*nscans, Max_EV_frames/5)
SolarAzimuth SDS Attributes: units = degrees valid_range = -31460, 31460 _FillValue = -32767 line_numbers = [3, 8] frame_numbers = [3, 8, 13,...] scale_factor = 0.01		
"gflags"	int8	8 bit integer array of dimension (2*nscans, Max_EV_frames/5)
gflags SDS Attributes: Bit 0: 1 = invalid input data Bit 1: 1 = no ellipsoid intersection Bit 2: 1 = no valid terrain data Bit 3: 1 = invalid sensor angles Bit 4: 1 = invalid solar angles		

3.2. MODIS Level 1B 500M Earth View Data

ECS Standard Core Granule Metadata **Stored as One ECS PVL String in :coremetadata.0=Global Attribute**	
Description	**Example**
SHORTNAME	"MOD02HKM"
VERSIONID	"2.0"
SIZEMBECSDATAGRANULE	400. (Obtained from system at runtime)
EASTBOUNDINGCOORDINATE	40.000000
WESTBOUNDINGCOORDINATE	15.000000
NORTHBOUNDINGCOORDINATE	25.000000

SOUTHBOUNDINGCOORDINATE	10.000000
EXCLUSIONGRINGFLAG.1	"N"
GRINGPOINTLATITUDE.1	(25.000000, 20.000000, 10.000000, 15.000000)
GRINGPOINTLONGITUDE.1	(20.000000, 40.000000, 35.000000, 15.000000)
GRINGPOINTSEQUENCENO.1	(1, 2, 3, 4)
ORBITNUMBER	1234
RANGEBEGINNINGDATETIME	"2002-02-23T11:02:27.987654Z"
RANGEENDINGDATETIME	"2002-02-23T11:04:57.987654Z"
QAPERCENTINTERPOLATEDDATA	0
QAPERCENTOUTOFBOUNDSDATA	0
QAPERCENTMISSINGDATA	0
AUTOMATICQUALITYFLAG	"passed"
OPERATIONALQUALITYFLAG	"not being investigated"
SCIENCEQUALITYFLAG	" uncertainty and QA for each pixel, no validation data yet applied "
QUALITYFLAGEXPLANATION	"not being investigated"
REPROCESSINGACTUAL	"processed once"
REPROCESSINGPLANNED	"no further update anticipated"
INPUTPOINTER	"L1A and Geolocation file name(s), Reflective.LUT, Emissive.LUT, sd.coeff.trend "
OPERATIONMODE	"day" or "night"

MODIS Level 1B Archive Granule Metadata Stored as HDF ECS PVL in :archivemetadata.0=Global Attribute	
Description	**Example**
PROCESSINGDATETIME	"2002-02-23T11:04:57.987654Z"
SPSOPARAMETERS	"The SPSO parameters (see database) for all data contained in this file"
ALGORITHMPACKAGEACCEPTANCEDATE	"1997-01-01"
ALGORITHMPACKAGEMATURITYCODE	"pre-launch"
ALGORITHMPACKAGENAME	"MOD02V2"
ALGORITHMPACKAGEVERSION	"version 2"
INSTRUMENTNAME	"Moderate-Resolution Imaging SpectroRadiometer"
PLATFORMSHORTNAME	"EOS AM1"
PROCESSINGCENTER	"GSFC"
ROUTINEINSTRUMENTOPERATIONS	"Y" or "N"
CALIBRATIONDATAQUALITY	"good", "marginal" OR "bad"
NADIRPOINTING	"Y" or "N"
MISSIONPHASE	"A&E" OR "post A&E"

MODIS Level 1B Product Granule Metadata Stored as Native HDF Global Attributes		
Description	**Format**	**Example**
"Number of Scans"	Int32	203
"Number of Day mode scans"	Int32	203
"Number of Night mode scans"	Int32	0
"Incomplete Scans"	Int32	14
"Max Earth View Frames"	Int32	1354
"%Valid EV Observations"	float32[38]	98.2,..., 87.1,..,46.0,...
"%Saturated EV Observations"	float32[38]	1.4,..., 0.2,...,7.9,...
"Post Processing Indicates Bad data"	Int32[38]	1=True; 0=False
"Electronics Redundancy Vector"	uint32[2]	One bit set to 0 for Side A or 1 for Side B, for each programmable component
"Reflective LUT Last Change Date"	string	"1997-02-28T00:00:00"
"Emissive LUT Last Change Date"	string	"1997-02-28T00:00:00"
"Focal Plane Set Point State"	Int8[4]	0=Running open loop 1=Set Point is 83 degrees 2=Set Point is 85 degrees 3=Set Point is 88 degrees

Level 1B HDF-EOS Swath Metadata Stored as HDF ECS PVL in :StructMetadata.0=Global Attribute
GROUP=SwathStructure GROUP=SWATH_1 SwathName="MODIS_Swath_Type_L1B"

```
GROUP=Dimension
  Dimension_1, “Band_250M”, Size=2
  Dimension_2, “Band_500M”, Size=5
  Dimension_3, “10*nscans”, Size=10*nscans
  Dimension_4, “20*nscans”, Size=20*nscans
  Dimension_5, ”Max_EV_frames”, Size=Max_EV_frames
  Dimension_6, ”2*Max_EV_frames”, Size=2*Max_EV_frames
GROUP=DimensionMap
  DimensionMap_1, GeoDimension=“10*nscans”,
                                DataDimension=“20*nscans”, Offset=0, Increment=2
  DimensionMap_2, GeoDimension=“ Max_EV_frames”,
                              DataDimension=“ 2*Max_EV_frames”, Offset=0, Increment=2
GROUP=GeoField
  GeoField_1, “Latitude”,  DFNT_FLOAT32,
                                                (“10*nscans”,”Max_EV_frames”)
  GeoField_2, “Longitude”,  DFNT_FLOAT32,
                                                (“10*nscans”,”Max_EV_frames”)
GROUP=DataField
  DataField_1, “EV_250_Aggr500_RefSB”, DFNT_UINT16,
                                    (“Band-250M”, “20*nscans”, “2*Max_EV_frames”)
  DataField_2, “EV_250M_Aggr500_RefSB_Uncert_Indexes”,
                        DFNT_UINT8,  (“Band_250M”, “20*nscans”, “2*Max_EV_frames”)
  DataField_3, “EV_500 _RefSB”, DFNT_UINT16,
                                    (“Band_500M”, “20*nscans”, “2*Max_EV_frames”)
  DataField_4, “EV_500M_RefSB_Uncert_Indexes”,
                        DFNT_UINT8,  (“Band_500M”, “20*nscans”, “2*Max_EV_frames”)
  DataField_5, “EV_250_Aggr500_RefSB_Samples_Used”,
                         DFNT_INT8,  (“Band_250M”, “20*nscans”, “2*Max_EV_frames”)
```

"Level 1B Swath Metadata" Written as Vdata with the Following Fields		
Field	**Type**	**Typical value**
Scan Number	int32	Range 1 to 100
Complete Scan Flag	int32	Complete=1, Incomplete=0
Scan Type	char8[4]	"D "=day, "N "=night, "M "=mixed, "O "=other
Mirror Side	int32	Mirror side 1 = 0; Mirror side 2 = 1
EV Sector Start Time	float64	TAI: Sec. since midnight 1/1/93
Programmed_EV_Frames	int32	1514
EV_Frames	int32	1354
Nadir_Frame_Number	int32	677
Latitude of Nadir Frame	float32	-90.0 to 90.0 in degrees
Longitude of Nadir Frame	float32	-180.0 to 180.0 in degrees
Solar Azimuth of Nadir Frame	float32	-180 to 180 degrees
Solar Zenith of Nadir Frame	float32	0.0 to 180.0 in degrees

No. thermistor outliers	int32	Range 0 to 12
Bit QA Flags	int32	1=True; 0=False
Moon in SV Port	bit 0	
Spacecraft Maneuver	bit 1	
Sector Rotation	bit 2	
Negative Radiance Beyond Noise Level	bit 3	
PC Ecal on	bit 4	
PV Ecal on	bit 5	
SD Door Open	bit 6	
SD Screen Down	bit 7	
SRCA On	bit 8	
SDSM On	bit 9	
Outgassing	bit 10	
Instrument Standby Mode	bit 11	
Linear Emissive Calibration	bit 12	
DC Restore Change	bit 13	
BB/Cavity Temperature Differential	bit 14	
BB Heater On	bit 15	
Missing Previous Granule	bit 16	
Missing Subsequent Granule	bit 17	
Remaining 14 bits reserved for future use	bits 18 - 31	

Band Subsetting SDSs		
SDS Name	**Data Type**	**HDF Dimension Names**
"Band_250M"	float32	floating point array of dimension (Band_250M)
Band_250M SDS Attributes: long_name ="250M Band Numbers for Subsetting" Note: The values stored in this array are 1.0 and 2.0 Band_250M Dimension Attributes: band_names = "1, 2" radiance_scales = x.f, x.f radiance_offsets = x.f, x.f radiance_units = "Watts/m^2/μm/steradian" reflectance_scales = x.f, x.f reflectance_offsets = x.f, x.f reflectance_units = "1/steradian" corrected_counts_scales = x.f, x.f, x.f,...80 values, one for each detector in each band. corrected_counts_offsets = x.f, x.f, x.f,...80 values, one for each detector in each band. corrected_counts_units = "counts"		
"Band_500M"	float32	floating point array of dimension (Band_250M)

Band_500M SDS Attributes:
long_name ="500M Band Numbers for Subsetting"
Note: The values stored in this array are 3.0, 4.0, 5.0, 6.0, and 7.0
Band_500M Dimension Attributes:
band_names = "3, 4, 5, 6, 7"
radiance_scales = x.f, x.f, x.f, x.f, x.f
radiance_offsets = x.f, x.f, x.f, x.f, x.f
radiance_units = "Watts/m^2/μm/steradian"
reflectance_scales = x.f, x.f, x.f, x.f, x.f
reflectance_offsets = x.f, x.f, x.f, x.f, x.f
reflectance_units = "1/steradian"
corrected_counts_scales = x.f, x.f, x.f,...100 values, one for each detector in each band.
corrected_counts_offsets = x.f, x.f, x.f,...100 values, one for each detector in each band.
corrected_counts_units = "counts"

Instrument and Uncertainty SDSs		
"EV_250_Aggr500_RefSB "	uint16	16 bit scaled integer array of dimension (Band_250M, 20*nscans, 2*Max_EV_frames)
EV_250_Aggr500_RefSB SDS Attributes: long_name ="Earth View 250M Aggregate 500M Reflected Solar Bands Scaled Integers" Band_250M Dimension Attributes: band_names = "1, 2" radiance_scales = x.f, x.f radiance_offsets = x.f, x.f radiance_units = "Watts/m^2/μm/steradian" reflectance_scales = x.f, x.f reflectance_offsets = x.f, x.f reflectance_units = "1/steradian" corrected_counts_scales = x.f, x.f, x.f,...80 values, one for each detector in each band. corrected_counts_offsets = x.f, x.f, x.f,...80 values, one for each detector in each band. corrected_counts_units = "counts"		
"EV_250_Aggr500_RefSB _Uncert_Indexes"	uint8	8 bit integer array of dimension (Band_250M, 20*nscans, 2*Max_EV_frames)
EV_250_Aggr500_RefSB_Uncert_Indexes SDS Attributes: long_name ="Earth View 250M Aggregate 500M Reflected Solar Bands Uncertainty Indexes"		
"EV_250_Aggr500_RefSB _Samples_Used"	int8	(Band_250M, 20*nscans, 2*Max_EV_frames)
long_name = "Earth View 250M Aggregated 500M Reflected Solar Bands Number of Samples Used in Aggregation"		
"EV_500_RefSB"	uint16	16 bit scaled integer array of dimension (Band_500M, 20*nscans, 2*Max_EV_frames)
EV_500_RefSB SDS Attributes: long_name ="Earth View 500M Reflected Solar Bands Scaled Integers" Band_500M Dimension Attributes: band_names = "3, 4, 5, 6, 7" radiance_scales = x.f, x.f, x.f, x.f, x.f radiance_offsets = x.f, x.f, x.f, x.f, x.f radiance_units = "Watts/m^2/μm/steradian" reflectance_scales = x.f, x.f, x.f, x.f, x.f reflectance_offsets = x.f, x.f, x.f, x.f, x.f reflectance_units = "1/steradian" corrected_counts_scales = x.f, x.f, x.f,...100 values, one for each detector in each band. corrected_counts_offsets = x.f, x.f, x.f,...100 values, one for each detector in each band. corrected_counts_units = "counts"		
"EV_500_RefSB_Uncert_ Indexes"	uint8	8 bit integer array of dimension (Band_500M, 20*nscans, 2*Max_EV_frames)
EV_500_RefSB _Uncert_Indexes SDS Attributes: long_name ="Earth View 500M Reflected Solar Bands Uncertainty Indexes"		

3.3. MODIS Level 1B 250M Earth View Data

ECS Standard Core Granule Metadata **Stored as One ECS PVL String in :coremetadata.0=Global Attribute**	
Description	**Example**
SHORTNAME	"MOD02QKM"
VERSIONID	"2.0"
SIZEMBECSDATAGRANULE	400. (Obtained from system at runtime)
EASTBOUNDINGCOORDINATE	40.000000
WESTBOUNDINGCOORDINATE	15.000000
NORTHBOUNDINGCOORDINATE	25.000000
SOUTHBOUNDINGCOORDINATE	10.000000
EXCLUSIONGRINGFLAG.1	"N"
GRINGPOINTLATITUDE.1	(25.000000, 20.000000, 10.000000, 15.000000)
GRINGPOINTLONGITUDE.1	(20.000000, 40.000000, 35.000000, 15.000000)
GRINGPOINTSEQUENCENO.1	(1, 2, 3, 4)
ORBITNUMBER	1234
RANGEBEGINNINGDATETIME	"2002-02-23T11:02:27.987654Z"
RANGEENDINGDATETIME	"2002-02-23T11:04:57.987654Z"
QAPERCENTINTERPOLATEDDATA	0
QAPERCENTOUTOFBOUNDSDATA	0
QAPERCENTMISSINGDATA	0
AUTOMATICQUALITYFLAG	"passed"
OPERATIONALQUALITYFLAG	"not being investigated"
SCIENCEQUALITYFLAG	" uncertainty and QA for each pixel, no validation data yet applied "
QUALITYFLAGEXPLANATION	"not being investigated"
REPROCESSINGACTUAL	"processed once"
REPROCESSINGPLANNED	"no further update anticipated"
INPUTPOINTER	"L1A and Geolocation file name(s), Reflective.LUT, Emissive.LUT, sd.coeff.trend "
OPERATIONMODE	"day" or "night"

MODIS Level 1B Archive Granule Metadata **Stored as HDF ECS PVL in :archivemetadata.0=Global Attribute**	
Description	**Example**
PROCESSINGDATETIME	"2002-02-23T11:04:57.987654Z"
SPSOPARAMETERS	"The SPSO parameters (see database) for all data contained in this file"
ALGORITHMPACKAGEACCEPTANCEDATE	"1997-01-01"
ALGORITHMPACKAGEMATURITYCODE	"pre-launch"
ALGORITHMPACKAGENAME	"MOD02V2"
ALGORITHMPACKAGEVERSION	"version 2"
INSTRUMENTNAME	"Moderate-Resolution Imaging SpectroRadiometer"

PLATFORMSHORTNAME	"EOS AM1"
PROCESSINGCENTER	"GSFC"
ROUTINEINSTRUMENTOPERATIONS	"Y" or "N"
CALIBRATIONDATAQUALITY	"good", "marginal" OR "bad"
NADIRPOINTING	"Y" or "N"
MISSIONPHASE	"A&E" OR "post A&E"

MODIS Level 1B Product Granule Metadata Stored as Native HDF Global Attributes		
Description	**Format**	**Example**
"Number of Scans"	Int32	203
"Number of Day mode scans"	Int32	203
"Number of Night mode scans"	Int32	0
"Incomplete Scans"	Int32	14
"Max Earth View Frames"	Int32	1354
"%Valid EV Observations"	float32[38]	98.2,..., 87.1,..,46.0,...
"%Saturated EV Observations"	float32[38]	1.4,..., 0.2,...,7.9,...
"Post Processing Indicates Bad data"	Int32[38]	1=True; 0=False
"Electronics Redundancy Vector"	uint32[2]	One bit set to 0 for Side A or 1 for Side B, for each programmable component
"Reflective LUT Last Change Date"	string	"1997-02-28T00:00:00"
"Emissive LUT Last Change Date"	string	"1997-02-28T00:00:00"
"Focal Plane Set Point State"	Int8[4]	0=Running open loop 1=Set Point is 83 degrees 2=Set Point is 85 degrees 3=Set Point is 88 degrees

Level 1B HDF-EOS Swath Metadata
Stored as HDF ECS PVL in :StructMetadata.0=Global Attribute

```
GROUP=SwathStructure
    GROUP=SWATH_1
      SwathName="MODIS_Swath_Type_L1B"
      GROUP=Dimension
        Dimension_1, "Band_250M", Size=2
        Dimension_2, "10*nscans", Size=10*nscans
        Dimension_3, "40*nscans", Size=40*nscans
        Dimension_4, "Max_EV_frames", Size=Max_EV_frames
        Dimension_5, "4*Max_EV_frames", Size=4*Max_EV_frames
      GROUP=DimensionMap
        DimensionMap_1, GeoDimension="10*nscans",
                                    DataDimension="40*nscans", Offset=3, Increment=4
        DimensionMap_2, GeoDimension=" Max_EV_frames",
                                DataDimension=" 4*Max_EV_frames", Offset=1, Increment=4
```

```
GROUP=GeoField
  GeoField_1, “Latitude”,  DFNT_FLOAT32,
                                        (“10*nscans”,”Max_EV_frames”)
  GeoField_2, “Longitude”,  DFNT_FLOAT32,
                                        (“10*nscans”,”Max_EV_frames”)
GROUP=DataField
  DataField_1, “EV_250 _RefSB”, DFNT_UINT16,
                                  (“Band-250M”, “40*nscans”, “4*Max_EV_frames”)
  DataField_2, “EV_250M_RefSB_Uncert_Indexes”,
                        DFNT_UINT8, (“Band_250M”, “40*nscans”, “4*Max_EV_frames”)
```

"Level 1B Swath Metadata" Written as Vdata with the Following Fields		
Field	**Type**	**Typical value**
Scan Number	int32	Range 1 to 100
Complete Scan Flag	int32	Complete=1, Incomplete=0
Scan Type	char 32	"D"=day, "N"=night, "M"=mixed, "O"=other
Mirror Side	int32	Mirror side 1 = 0; Mirror side 2 = 1
EV Sector Start Time	float 64	TAI: Sec. since midnight 1/1/93
Programmed_EV_Frames	int32	1514
EV_Frames	int32	1354
Nadir_Frame_Number	int32	677
Latitude of Nadir Frame	float32	-90.0 to 90.0 in degrees
Longitude of Nadir Frame	float32	-180.0 to 180.0 in degrees
Solar Azimuth of Nadir Frame	float32	-180 to 180 degrees
Solar Zenith of Nadir Frame	float32	0.0 to 180.0 in degrees
No. thermistor outliers	int32	Range 0 to 12
Bit QA Flags	int32	1=True; 0=False
Moon in SV Port	bit 0	
Spacecraft Maneuver	bit 1	
Sector Rotation	bit 2	
Negative Radiance Beyond Noise Level	bit 3	
PC Ecal on	bit 4	
PV Ecal on	bit 5	
SD Door Open	bit 6	
SD Screen Down	bit 7	
SRCA On	bit 8	
SDSM On	bit 9	
Outgassing	bit 10	
Instrument Standby Mode	bit 11	
Linear Emissive Calibration	bit 12	
DC Restore Change	bit 13	

BB/Cavity Temperature Differential	bit 14	
BB Heater On	bit 15	
Missing Previous Granule	bit 16	
Missing Subsequent Granule	bit 17	
Remaining 14 bits reserved for future use	bits 18 - 31	

Band Subsetting SDS		
"Band_250M(Band_250M)"	int16	Band_250M = 2
Band_250M SDS Attributes: long_name ="250M Band Numbers for Subsetting" Note: The values stored in this array are 1.0 and 2.0 Band_250M Dimension Attributes: band_names = "1, 2" radiance_scales = x.f, x.f radiance_offsets = x.f, x.f radiance_units = "Watts/m^2/μm/steradian" reflectance_scales = x.f, x.f reflectance _offsets = x.f, x.f reflectance _units = "1/steradian" corrected_counts_scales = x.f, x.f, x.f,...80 values, one for each detector in each band. corrected_counts_offsets = x.f, x.f, x.f,...80 values, one for each detector in each band. corrected_counts_units = "counts"		

Instrument and Uncertainty SDSs		
"EV_250_RefSB "	Unsigned Integer (16 bits)	16 bit scaled integer array of dimension (Band_250M, 40*nscans, 4*Max_EV_frames)
EV_250_RefSB SDS Attributes: long_name ="Earth View 250M Reflected Solar Bands Scaled Integers" Band_250M Dimension Attributes: band_names = "1, 2" radiance_scales = x.f, x.f radiance_offsets = x.f, x.f radiance_units = "Watts/m^2/μm/steradian" reflectance_scales = x.f, x.f reflectance _offsets = x.f, x.f reflectance _units = "1/steradian" corrected_counts_scales = x.f, x.f, x.f,...80 values, one for each detector in each band. corrected_counts_offsets = x.f, x.f, x.f,...80 values, one for each detector in each band. corrected_counts_units = "counts"		
"EV_250_RefSB _Uncert_Indexes"	uint8	8 bit integer array of dimension (Band_250M, 40*nscans, 4*Max_EV_frames)
EV_250_RefSB _Uncert_Indexes SDS Attributes: long_name ="Earth View 250M Reflected Solar Bands Uncertainty Indexes"		

3.4. MODIS Level 1B OBC/Engineering Data

ECS Standard Core Granule Metadata **Stored as One ECS PVL String in :coremetadata.0=Global Attribute**	
Description	**Example**
SHORTNAME	"MOD02OBC"
VERSIONID	"2.0"
SIZEMBECSDATAGRANULE	400. (Obtained from system at runtime)
EASTBOUNDINGCOORDINATE	40.000000
WESTBOUNDINGCOORDINATE	15.000000
NORTHBOUNDINGCOORDINATE	25.000000
SOUTHBOUNDINGCOORDINATE	10.000000
EXCLUSIONGRINGFLAG	"N"
GRINGPOINTLATITUDE	(25.000000, 20.000000, 10.000000, 15.000000)
GRINGPOINTLONGITUDE	(20.000000, 40.000000, 35.000000, 15.000000)
GRINGPOINTSEQUENCENO	(1, 2, 3, 4)
ORBITNUMBER	1234
RANGEBEGINNINGDATETIME	"2002-02-23T11:02:27.987654Z"
RANGEENDINGDATETIME	"2002-02-23T11:04:57.987654Z"
QAPERCENTINTERPOLATEDDATA	0
QAPERCENTOUTOFBOUNDSDATA	0
QAPERCENTMISSINGDATA	0
AUTOMATICQUALITYFLAG	"passed"
OPERATIONALQUALITYFLAG	"not being investigated"
SCIENCEQUALITYFLAG	" uncertainty and QA for each pixel, no validation data yet applied "
QUALITYFLAGEXPLANATION	"not being investigated"
REPROCESSINGACTUAL	"processed once"
REPROCESSINGPLANNED	"no further update anticipated"
INPUTPOINTER	"L1A and Geolocation file name(s), Reflective.LUT, Emissive.LUT, sd.coeff.trend "
OPERATIONMODE	"day" or "night"

MODIS Level 1B Archive Granule Metadata **Stored as HDF ECS PVL in :archivemetadata.0=Global Attribute**	
Description	**Example**
PROCESSINGDATETIME	"2002-02-23T11:04:57.987654Z"
SPSOPARAMETERS	"The SPSO parameters (see database) for all data contained in this file"
ALGORITHMPACKAGEACCEPTANCEDATE	"1997-01-01"

ALGORITHMPACKAGEMATURITYCODE	"pre-launch"
ALGORITHMPACKAGENAME	"MOD02V2"
ALGORITHMPACKAGEVERSION	"version 2.0"
INSTRUMENTNAME	"Moderate-Resolution Imaging SpectroRadiometer"
PLATFORMSHORTNAME	"EOS AM1"
PROCESSINGCENTER	"GSFC"
ROUTINEINSTRUMENTOPERATIONS	"Y" or "N"
CALIBRATIONDATAQUALITY	"good", "marginal" OR "bad"
NADIRPOINTING	"Y" or "N"
MISSIONPHASE	"A&E" OR "post A&E"

MODIS Level 1B Product Granule Metadata Stored as Native HDF Global Attributes		
Description	**Format**	**Example**
"Number of Scans"	Int32	203
"Number of Day mode scans"	Int32	203
"Number of Night mode scans"	Int32	0
"Incomplete Scans"	Int32	14
"Max Earth View Frames"	Int32	1354
"%Valid EV Observations"	float32[38]	98.2,..., 87.1,..,46.0,...
"%Saturated EV Observations"	float32[38]	1.4,..., 0.2,...,7.9,...
"Post Processing Indicates Bad data"	Int32[38]	1=True; 0=False
"Electronics Redundancy Vector"	Int64	One bit set to 0 for Side A or 1 for Side B, for each programmable component
"Reflective LUT Last Change Date"	string	"1997-02-28T00:00:00"
"Emissive LUT Last Change Date"	string	"1997-02-28T00:00:00"
"Focal Plane Set Point State"	Int8[4]	0=Running open loop 1=Set Point is 83 degrees 2=Set Point is 85 degrees 3=Set Point is 88 degrees

"Level 1B Specific Swath Metadata" Written as Vdata with the Following Fields		
Field	**Type**	**Typical value**
Scan Number	int32	Range 1 to 100
Complete Scan Flag	int32	Complete=1, Incomplete=0
Scan Type	char8[4]	"D "=day, "N "=night, "M "=mixed, "O "=other
Mirror Side	int32	Mirror side 1 = 0; Mirror side 2 = 1
SD Sector Start Time	float64	TAI: Sec. since midnight 1/1/93
SRCA Sector Start Time	float64	TAI: Sec. since midnight 1/1/93
BB Sector Start Time	float64	TAI: Sec. since midnight 1/1/93

SV Sector Start Time	float64	TAI: Sec. since midnight 1/1/93
Programmed_SD_Frames	int32	50
SD_Frames	int32	40
Programmed_SRCA_Frames	int32	20
SRCA_Frames	int32	10
Programmed_BB_Frames	int32	50
BB_Frames	int32	40
Programmed_SV_Frames	int32	1514
SV_Frames	int32	1354
No. thermistor outliers	int32	Range 0 to 12
Bit QA Flags	int32	1=True; 0=False
Moon in SV Port	bit 0	
Spacecraft Maneuver	bit 1	
Sector Rotation	bit 2	
Negative Radiance Beyond Noise Level	bit 3	
PC Ecal on	bit 4	
PV Ecal on	bit 5	
SD Door Open	bit 6	
SD Screen Down	bit 7	
SRCA On	bit 8	
SDSM On	bit 9	
Outgassing	bit 10	
Instrument Standby Mode	bit 11	
Linear Emissive Calibration	bit 12	
DC Restore Change	bit 13	
BB/Cavity Temperature Differential	bit 14	
BB Heater On	bit 15	
Missing Previous Granule	bit 16	
Missing Subsequent Granule	bit 17	
Remaining 14 bits reserved for future use	bits 18 - 31	

Band Subsetting SDSs		
SDS Name	**Data Type**	**HDF Dimension Names**
"Band_250M"	float32	floating point array of dimension (Band_250M)

Band_250M SDS Attributes: long_name ="250M Band Numbers for Subsetting" Note: The values stored in this array are 1.0 and 2.0 Band_250M Dimension Attributes: band_names = "1, 2" radiance_scales = x.f, x.f radiance_offsets = x.f, x.f radiance_units = "Watts/m^2/μm/steradian" reflectance_scales = x.f, x.f reflectance _offsets = x.f, x.f reflectance _units = "1/steradian" corrected_counts_scales = x.f, x.f, x.f,...80 values, one for each detector in each band. corrected_counts_offsets = x.f, x.f, x.f,...80 values, one for each detector in each band. corrected_counts_units = "counts"		
"Band_500M"	float32	floating point array of dimension (Band_250M)
Band_500M SDS Attributes: long_name ="500M Band Numbers for Subsetting" Note: The values stored in this array are 3.0, 4.0, 5.0, 6.0, and 7.0 Band_500M Dimension Attributes: band_names = "3, 4, 5, 6, 7" radiance_scales = x.f, x.f, x.f, x.f, x.f radiance_offsets = x.f, x.f, x.f, x.f, x.f radiance_units = "Watts/m^2/μm/steradian" reflectance_scales = x.f, x.f, x.f, x.f, x.f reflectance _offsets = x.f, x.f, x.f, x.f, x.f reflectance _units = "1/steradian" corrected_counts_scales = x.f, x.f, x.f,...100 values, one for each detector in each band. corrected_counts_offsets = x.f, x.f, x.f,...100 values, one for each detector in each band. corrected_counts_units = "counts"		
"Band_1KM_RefSB "	float32	floating point array of dimension (Band_1KM_RefSB)

Band_1KM_RefSB SDS Attributes:
long_name ="1KM Reflective Solar Band Numbers for Subsetting"
Note: The values stored in this array are 8.0, 9.0, 10.0, 11.0, 12.0, 13.0, 13.5, 14.0, 14.5, 15.0, 16.0, 17.0, 18.0, 19.0 and 26.0
Band_1KM_RefSB Dimension Attributes:
band_names = "8, 9, 10, 11, 12, 13lo, 13hi, 14lo, 14hi, 15, 16, 17, 18, 19, 26"
radiance_scales = x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f
radiance_offsets x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f
radiance_units = "Watts/m^2/μm/steradian"
reflectance_scales = x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f
reflectance _offsets = x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f
reflectance _units = "1/steradian"
corrected_counts_scales = x.f, x.f, x.f,...150 values, one for each detector in each band.
corrected_counts_offsets = x.f, x.f, x.f,...150 values, one for each detector in each band.
corrected_counts_units = "counts"

"Band_1KM_Emissive "	float32	floating point array of dimension (Band_1KM_Emissive)

Band_1KM_Emissive SDS Attributes:
long_name ="1KM Emissive Band Numbers for Subsetting""
Note: The values stored in this array are 20.0, 21.0, 22.0, 23.0, 24.0, 25.0, 27.0, 28.0, 29.0, 30.0, 31.0, 32.0, 33.0, 34.0, 35.0, 36.0
Band_1KM_Emissive Dimension Attributes:
band_names = "20, 21, 22, 23, 24, 25, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36"
radiance_scales = x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f
radiance_offsets = x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f, x.f
radiance_units = "Watts/m^2/μm/steradian"
corrected_counts_scales = x.f, x.f, x.f,...160 values, one for each detector in each band.
corrected_counts_offsets = x.f, x.f, x.f,...160 values, one for each detector in each band.
corrected_counts_units = "counts"

250 Meter SDSs		
SDS Name	**Data Type**	**HDF Dimension Names**
"BB_250_RefSB "	uint16	16 bit scaled integer array of dimension (Band_250M, 40*nscans, 4*BB_frames)
BB_250_RefSB SDS Attributes: long_name ="Black Body 250M Reflected Solar Bands Scaled Integers"		
"BB_250_RefSB_Uncert_Indexes"	uint8	16 bit scaled integer array of dimension (Band_250M, 40*nscans, 4*BB_frames)
BB_250_RefSB_Uncert SDS Attributes: long_name ="Black Body 250M Reflected Solar Bands Scaled Integer Uncertainty Indexes"		
"SD_250_RefSB "	uint16	16 bit scaled integer array of dimension (Band_250M, 40*nscans, 4*SD_frames)
SD_250_RefSB SDS Attributes: long_name ="Solar Diffuser 250M Reflected Solar Bands Scaled Integers"		
"SD_250_RefSB_Uncert_Indexes"	uint8	16 bit scaled integer array of dimension (Band_250M, 40*nscans, 4*SD_frames)
SD_250_RefSB_Uncert SDS Attributes: long_name ="Solar Diffuser 250M Reflected Solar Bands Scaled Integer Uncertainty Indexes"		
"SRCA_250_RefSB"	uint16	16 bit scaled integer array of dimension (Band_250M, 40*nscans, 4*SRCA_frames)
SRCA_250_RefSB SDS Attributes: long_name ="Solar Diffuser 250M Reflected Solar Bands Scaled Integers"		
"SRCA_250_RefSB_Uncert_Indexes"	uint8	16 bit scaled integer array of dimension (Band_250M, 40*nscans, 4*SRCA_frames)
SRCA_250_RefSB _Uncert_Indexes SDS Attributes: long_name ="Solar Diffuser 250M Reflected Solar Bands Scaled Integer Uncertainty Indexes"		
"SV_250_RefSB "	uint16	16 bit scaled integer array of dimension (Band_250M, 40*nscans, 4*SV_frames)
SV_250_RefSB SDS Attributes: long_name ="Space View 250M Reflected Solar Bands Scaled Integers"		
"SV_250_RefSB_Uncert_Indexes"	uint8	16 bit scaled integer array of dimension (Band_250M, 40*nscans, 4*SV_frames)
SV_250_RefSB _Uncert_Indexes Attributes: long_name ="Space View 250M Reflected Solar Bands Scaled Integer Radiance Uncertainty"		

500 Meter SDSs		
SDS Name	**Data Type**	**HDF Dimension Names**
"BB_500_RefSB"	uint16	16 bit scaled integer array of dimension (Band_500M, 20*nscans, 2*BB_frames)
BB_500_RefSB SDS Attributes: long_name ="Black Body 500M Reflected Solar Bands Scaled Integers"		
"BB_500_RefSB_Uncert_Indexes"	uint8	16 bit scaled integer array of dimension (Band_500M, 20*nscans, 2*BB_frames)
BB_500_RefSB_Rad_Uncert_Indexes SDS Attributes: long_name ="Black Body 500M Reflected Solar Bands Scaled Integer Radiance Uncertainty Indexes"		
"SD_500_RefSB "	uint16	16 bit scaled integer array of dimension (Band_500M, 20*nscans, 2*SD_frames)
SD_500_RefSB SDS Attributes: long_name ="Solar Diffuser 500M Reflected Solar Bands Scaled Integers"		
"SD_500_RefSB_Uncert_Indexes"	uint8	16 bit scaled integer array of dimension (Band_500M, 20*nscans, 2*SD_frames)
SD_500_RefSB_Rad_Uncert SDS Attributes: long_name ="Solar Diffuser 500M Reflected Solar Bands Scaled Integer Uncertainty Indexes"		
"SRCA_500_RefSB"	uint16	16 bit scaled integer array of dimension (Band_500M, 20*nscans, 2*SRCA_frames)
SRCA_500_RefSB SDS Attributes: long_name ="SRCA 500M Reflected Solar Bands Scaled Integers"		
"SRCA_500_RefSB_Uncert_Indexes"	uint8	16 bit scaled integer array of dimension (Band_500M, 20*nscans, 2*SRCA_frames)
SRCA_500_RefSB_Rad_Uncert SDS Attributes: long_name ="SRCA 500M Reflected Solar Bands Scaled Integer Uncertainty Indexes"		
"SV_500_RefSB"	uint16	16 bit scaled integer array of dimension (Band_500M, 20*nscans, 2*SV_frames)
SV_500_RefSB SDS Attribute: long_name ="Space View 500M Reflected Solar Bands Scaled Integers"		
"SV_500_RefSB_Uncert_Indexes"	uint8	16 bit scaled integer array of dimension (Band_500M, 20*nscans, 2*SV_frames)
SV_500_RefSB_Uncert_Indexes SDS Attributes: long_name ="Space View 500M Reflected Solar Bands Scaled Integer Uncertainty Indexes"		

1000 Meter Radiance SDSs		
SDS Name	**Data Type**	**HDF Dimension Names**
"BB_1000_RefSB "	uint16	16 bit scaled integer array of dimension (Band_1KM_RefSB, 10*nscans, BB_frames)

BB_1000_RefSB SDS Attributes: long_name ="Black Body 1KM Reflected Solar Bands Scaled Integers"		
"BB_1000_RefSB_Uncert_ Indexes"	uint8	16 bit scaled integer array of dimension (Band_1KM_RefSB, 10*nscans, BB_frames)
BB_1000_RefSB_Uncert_Indexes SDS Attributes: long_name ="Black Body 1KM Reflected Solar Bands Scaled Integer Uncertainty Indexes"		
"BB_1000_Emissive "	uint16	16 bit scaled integer array of dimension (Band_1KM_Emissive, 10*nscans, BB_frames)
BB_1000_Emissive SDS Attributes: long_name ="Black Body 1KM Emissive Bands Scaled Integers"		
"BB_1000_Emissive_Uncert_Indexes"	uint8	16 bit scaled integer array of dimension (Band_1KM_Emissive, 10*nscans, BB_frames)
BB_1000_Emissive_Uncert_Indexes SDS Attributes: long_name ="Black Body 1KM Emissive Bands Scaled Integer Uncertainty Indexes"		
"SD_1000_RefSB "	uint16	16 bit scaled integer array of dimension (Band_1KM_RefSB, 10*nscans, SD_frames)
SD_1000_RefSB SDS Attributes: long_name ="Solar Diffuser 1KM Reflected Solar Bands Scaled Integers"		
"SD_1000_RefSB_Uncert_ Indexes"	uint8	16 bit scaled integer array of dimension (Band_1KM_RefSB, 10*nscans, SD_frames)
SD_1000_RefSB_Uncert_Indexes SDS Attributes: long_name ="Solar Diffuser 1KM Reflected Solar Bands Scaled Integer Uncertainty Indexes"		
"SD_1000_Emissive"	uint16	16 bit scaled integer array of dimension (Band_1KM_Emissive, 10*nscans, SD_frames)
SD_1000_Emissive SDS Attributes: long_name ="Solar Diffuser 1KM Emissive Bands Scaled Integers"		
"SD_1000_Emmissive_Uncert_Indexes"	uint8	16 bit scaled integer array of dimension (Band_1KM_Emissive, 10*nscans, SD_frames)
SD_1000_Emissive_Uncert_Indexes SDS Attributes: long_name ="Solar Diffuser 1KM Emissive Bands Scaled Integer Uncertainty Indexes"		
"SRCA_1000_RefSB"	uint16	16 bit scaled integer array of dimension (Band_1KM_RefSB, 10*nscans, SRCA_frames)
SRCA_1000_RefSB SDS Attributes: long_name ="SRCA 1KM Reflected Solar Bands Scaled Integers"		
"SRCA_1000_RefSB_Uncert_Indexes"	uint8	16 bit scaled integer array of dimension (Band_1KM_RefSB, 10*nscans, SRCA_frames)
SRCA_1000_RefSB _Uncert_Indexes SDS Attributes: long_name ="SRCA 1KM Reflected Solar Bands Scaled Integer Uncertainty Indexes"		

"SRCA_1000_Emissive"	uint16	16 bit scaled integer array of dimension (Band_1KM_Emissive, 10*nscans, SRCA_frames)
SRCA_1000_Emissive SDS Attributes: long_name ="SRCA 1KM Emissive Bands Scaled Integers"		
"SRCA_1000_Emissive_Uncert_Indexes"	uint8	16 bit scaled integer array of dimension (Band_1KM_Emissive, 10*nscans, SRCA_frames)
SRCA_1000_Emissive _Uncert SDS Attributes: long_name ="SRCA 1KM Emissive Bands Scaled Integer Uncertainty Indexes"		
"SV_1000_RefSB"	uin16	16 bit scaled integer array of dimension (Band_1KM_RefSB, 10*nscans, SV_frames)
SV_1000_RefSB SDS Attributes: long_name ="Space View 1KM Reflected Solar Bands Scaled Integer Radiance"		
"SV_1000_RefSB_Uncert_Indexes"	uint8	16 bit scaled integer array of dimension (Band_1KM_RefSB, 10*nscans, SV_frames)
SV_1000_RefS_Uncert_Indexes SDS Attributes: long_name ="Space View 1KM Reflected Solar Bands Scaled Integer Uncertainty Indexes"		
"SV_1000_Emissive "	uint16	16 bit scaled integer array of dimension (Band_1KM_Emissive, 10*nscans, SV_frames)
SV_1000_Emissive SDS Attributes: long_name ="Space View 1KM Emissive Bands Scaled Integers"		
"SV_1000_Emissive_Uncert_Indexes"	uint8	16 bit scaled integer array of dimension (Band_1KM_Emissive, 10*nscans, SV_frames)
SV_1000_Emissive_Uncert_Indexes SDS Attributes: long_name ="Space View 1KM Emissive Bands Scaled Integer Uncertainty Indexes"		

Engineering Data Stored as Science Data Sets NOTE: This has changed with the Protoflight Model and we do not yet have final updates.		
fpa_dcr_offset	int8	dimension(nscans,550)
fam_samp_delay	int8	dimension(nscans,6)
raw_mir_enc	int16	dimension(nscans,78)
raw_hk_telem	int8	dimension(nscans,128)
raw_sci_eng	int8	dimension(nscans,216
raw_param	int8	dimension(nscans,30)
raw_vs_start	int16	dimension(nscans,40)
raw_cp_event	int8	dimension(nscans,32, 2)
raw_fr_event	int8	dimension(nscans,32, 2)
raw_sc_ancil	int16	dimension(nscans,64)
fpa_aem_config	int16	dimension(nscans, 10)
science_state	int8	dimension(nscans)

fam_af0x_mux_dcr	int16	dimension(nscans,6, 10)
sdsm_det_samples	int16	dimension(nscans,9, 3)

Instrument Telemetry Vdatas NOTE: This has changed with the Protoflight Model and we do not yet have final updates.		
NIR measures	**Format**	**Size**
SMIR measures	**Format**	**Size**
LWIR measures	**Format**	**Size**
VIS measures	**Format**	**Size**
PC measures	**Format**	**Size**
PC Voltages	**Format**	**Size**
PV measures	**Format**	**Size**
CP measures	**Format**	**Size**
CP times	**Format**	**Size**
CP status	**Format**	**Size**
AO measures	**Format**	**Size**
Cal. electronics measures	**Format**	**Size**
Nadir Aperture measures	**Format**	**Size**
Solar Diffuser measures	**Format**	**Size**
SDSM measures	**Format**	**Size**
Space View measures	**Format**	**Size**
FDDI measures	**Format**	**Size**
FIFO measures	**Format**	**Size**
FR measures	**Format**	**Size**
Earth View measures	**Format**	**Size**
SRCA measures	**Format**	**Size**
SRCA grating measures	**Format**	**Size**
SRCA lamp measures	**Format**	**Size**
SRCA slit measures	**Format**	**Size**
SRCA SIS measures	**Format**	**Size**
MEM View measures	**Format**	**Size**
MF measures	**Format**	**Size**
PS measures	**Format**	**Size**
PS voltages	**Format**	**Size**
RC measures	**Format**	**Size**
Scan Assy measures	**Format**	**Size**
Temp Cntlr measures	**Format**	**Size**
Telescope measures	**Format**	**Size**
Timing Gen measures	**Format**	**Size**
TM measures	**Format**	**Size**

4. Abbreviations and Acronyms

5. Glossary

6. Notes

7. Appendices

7.1. Appendix A. Components Commandable to A-side Electronics or B-side Electronics

7.2. File Read Routines in C

7.3. File Read Routines in FORTRAN