9.0 NESDIS OPERATIONAL PRODUCTS

Please note that this section is outdated. For the latest information and access to NESDIS operational products please go to http://www.nesdis.noaa.gov/.

The following products are generated from the NOAA KLM Level 1b data and are further described in this section:

- Sea Surface Temperature (SST) Products
- Mapped GAC Products
- Radiation Budget Products
- Sounding Products
- CoastWatch Products
- Snow and Ice Products
- Ozone (SBUV/2) Products
- Aerosol/Optical Thickness Products
- Comprehensive Large Array-data Stewardship System (CLASS)

9.1 SEA SURFACE TEMPERATURE (SST) PRODUCTS

NOAA/NESDIS produces and archives two types of SST products, gridded products and geographically organized retrievals. In addition, through an agreement under the NOAA/DOD Shared Processing Program, NESDIS receives and archives global Sea Surface Temperature retrievals from the Naval Oceanographic Office at Stennis Space Center, Mississippi. Both the NESDIS and Navy retrieval Archive cartridges contain eight days of 8-km resolution SST observations from a current operational NOAA polar orbiter (normally the afternoon spacecraft). All gridded products are produced from the 8-km resolution observations. Monthly archives are produced for all the gridded products. They include daily 100-km (Global-Scale Analysis), bi-weekly 50 km (Regional Scale Analysis), and biweekly 14 km (Local Scale) gridded SST fields. Monthly means are also produced from the observations on a 250-km grid (SST Monthly Mean) and archived yearly.

Any queries regarding SST products should be directed to:

National Climatic Data Center
Climate Services Division
151 Patton Avenue
Asheville, NC 28801-5001
email: NCDC.satorder@noaa.gov

The 14-km gridded, 50-km gridded, and 100-km gridded SST fields are generated by NESDIS in the SST Field Format which is described in Section 9.1.1. Section 9.1.2 describes the SST

Observation File and the SST Monthly Mean is described in Section 9.1.3.

Most SST archive cartridges contain a Header File which will usually be the first file on the cartridge. The Header File consists of one 400-byte physical record which contains some of the information shown in Table 9.1-1.

Table 9.1-1. Format of the SST Header File

Word #	# Bytes	Content	Range
1-20	80	Title of data set archived in File 2 of this cartridge	1-80 characters with blank fill
21-27	28	Data set name of disk data set	1-28 characters with blank fill
28-29	8	Original archive cartridge number	1-8 characters with blank fill
Date of earliest data on cartridge:			
30	1	Year	0-99
	1	Month	1-12
	1	Day	1-31
	1	Blank	
Date of most current data on cartridge:			
31	1	Year	0-99
	1	Month	1-12
	1	Day	1-31
	1	Blank	
Date and time when data was archived from disk to cartridge:			
32	4	Year	0-99
33	4	Month	1-12
34	4	Day	1-31
35	4	Hour	0-23

36	4	Minute	0-59
37	4	Second	0-59
38	4	Number of records of data in File 2 of cartridge	n/a
39	4	Number of files of data on the cartridge (not counting Header file)	n/a
40-100	244	Spare	n/a

9.1.1 SST FIELD FORMAT

All of the SST Field products including the 14-km gridded (0.125 degree), 50-km gridded (0.5 degree), and 100-km gridded (1 degree) are derived from the basic 8-km SST observations. An SST Field consists of a specific set of information pertaining to latitude and longitude intersections. The Global-Scale (1 degree resolution) file includes the area from 180W to 179E longitude and from -70S to 70N latitude and is generated daily. The regional scale (0.5 degree) and local scale (0.125 degree) fields are generated twice weekly. All the fields are generated by analyzing all the SST observations obtained during the period since the last analysis.

As mentioned in the previous section, most SST archive cartridges contain a header file which is usually the first file on the cartridge. The remaining files on the cartridge are field accumulation files.

Before September 2001, all field accumulation files (regardless of resolution) consisted of a Directory Record followed by some number of fields. For field data after September 2001, the individual fields are no longer stored in accumulation files. Therefore, the field accumulation Directory Record was eliminated, and multiple field files are no longer bundled into one big file. Field files are now archived as individual fields and thus the rest of the format (field documentation record and field data records) remains the same. Each field consists of a Field Documentation Record, followed by a Field Data Record for each latitude row in the field. The accumulation file Directory Record (which exists prior to September 2001 only) includes, among other things, the starting record number (i.e., the record number of the Field Documentation Record) for each field in the accumulation file. Details of the Directory Record, Field Documentation Record and Field Data Records are contained in Sections 9.1.1.1, 9.1.1.2 and 9.1.1.3, respectively. Data records (latitude rows) in the fields are ordered from south to north.

The fields will generally be arranged in chronological order. A field for a particular time period may be missing or repeated so one should examine the Field Documentation Record for each field in the file to find that field spanning the time of interest. The Field Documentation Record (the first record of each field) should be used in referencing the data records for the field, since it

provides information concerning the organization, size, and time period of the field.

After the Directory Record, there are NFIELDS fields. The first record of each field is a Field Documentation Record which is followed by NRECS Field Data Records, one for each latitudinal row in the field. Each row (logical record) consists of 28 bytes of information for each longitude or column forming a grid intersection, plus 28 bytes at the end of the record (the Latitudinal Row Identifier) containing the row number identification and the date and time of the last analysis made for the field.

The 100-km SST field cartridge is generated monthly (on the second day of the month). The cartridge contains two files: File 1 is the Header File (Table 9.1-1). File 2 is the 100-km SST field accumulation file. In File 2, after the Directory Record, there are 35 fields, 142 logical records per field. These fields are produced daily. Each field contains the Field Documentation Record followed by 141 Field Data Records, one for each 1 degree latitudinal row from -70S to 70N. There are 360 grid intersections in each row, one for each l degree of longitude from -180 W eastward to 179E. Each Field Data Record (logical record) contains 10,108 bytes ((360 x 28) + 28 for row identification).

The 50 km gridded SST field accumulation files are archived to cartridge once a month (on the second day of each month) for the previous month. File 1 is a Header File (Table 9.1-1), while files 2-6 contain the field accumulation files for regions 1 through 5 respectively (one geographic region per file). Each field accumulation file contains 10 fields. These fields are produced twice a week by analyzing all the SST observations obtained since the last analysis. The five regions are defined as follows:

Region 1:	5N through 53N latitude -100W through -52W longitude
Region 2:	15N through 63N latitude -145W through -97W longitude
Region 3:	15N through 63N latitude +170E through -142W longitude
Region 4:	-35S through 20N latitude -150W through -70W longitude
Region 5:	-35S through 20N latitude +155E through -145W longitude

The 14-km (0.125 degree) gridded SST fields (Local-Scale Analyses) are archived monthly on two cartridges. There are eight 0.125 degree resolution fields which cover the following areas:

Region 2:	18N through 31N latitude -98W through -80W longitude
Region 4:	39N through 52N latitude -136W through -123W longitude
Region 5:	28N through 41N latitude +155E through -145W longitude
Region 6:	30N through 36N latitude -82W through -60W longitude
Region 7:	18N through 32N latitude -85W through -70W longitude
Region 10:	50N through 62N latitude (Seasonal) -160W through -126W longitude
Region 11:	50N through 70N latitude (Seasonal) -180W through -157W longitude
Region 12:	20N through 32N latitude -136W through -105W longitude

The first cartridge of the 14-km gridded SST field data contains Regions 2, 4, 5, 6, and 7 which cover the Gulf of Mexico, Northwest Pacific coast, Southwest Pacific coast, Northeast Atlantic coast, and Southeast Atlantic coast, respectively. This cartridge contains six files, the first file being the Header File. Files two through six contain the 14-km field accumulation files for Regions 2,4,5,6, and 7, respectively. Each accumulation file contains twelve fields (2 per week) ordered chronologically.

The second cartridge of the 14-km gridded SST data contains Regions 10, 11 and 12 which cover the Gulf of Alaska, Bering Sea and the Gulf of California, respectively. This cartridge contains four files, the first file being the Header File (Table 9.1-1). The second, third and fourth files contain the 14-km field accumulation files for Regions 10, 11 and 12, respectively. Each accumulation file contains twelve fields (2 per week) ordered chronologically.

Beginning with data from NOAA-16 on February 21, 2001, a new 14-km SST Field encompasses all but Regions 10 and 11, listed above. This is considered the new North American field (14 km NA ETA Field). This region corresponds to the ETA model's grid for North America and should be very useful for modeling and Climatological purposes. The region itself consists of an area that extends from 15N to 60N and 50W to 140W. This field is produced

on odd days of the year by analyzing all the SST observations obtained in the previous two days. The 14 km NA ETA Field contains 18 files organized chronologically. The first physical record of the file is a directory record pointing to the beginning of each of the 18 fields. Each field of the file contains 1+ (18 x 361) = 6499 logical records blocked into 6499 physical records in the file.

The original SST field formats were not Year 2000 (Y2K) compliant, but have been changed to meet the four-digit year requirement. These changes are noted in the appropriate locations in the format records.

Starting with data generated on or about September 2, 2001, all the field accumulation files will be discontinued. They will be replaced by individual field data files (as opposed to bundling several fields' files into accumulation files). Specifically: the 100-km field accumulation file that is archived monthly will be replaced by a 100-km field file archived daily; the 50-km field accumulation Regional files that are archived monthly will be replaced by the new 50-km global field file which will be archived twice weekly; the 14-km field accumulation data for Regions 10 and 11 that are archived monthly will be replaced by 14-km field data including a new Hawaii region (between 10N and 30N latitude and 170W and 150W longitude) archived twice weekly; and the 14-km field accumulation data for Region 12 that are archived monthly will be replaced (encompassed) by 14-km field data archived every 48 hours or on all odd Julian days.

9.1.1.1 Directory Record Format

A Directory Record is always the first record of each SST Field Accumulation File (not counting the Header File and for data generated after September 2001 which are not accumulation files but are individual field files). It has a variable length with zero fill to the logical record size of the type of field, and serves as a pointer to the beginning of each field. Table 9.1.1.1-1 contains the format of the Directory Record.

Table 9.1.1.1-1. Format of the Directory Record for any SST Field Accumulation File.

Full Word #	Content
1	Number of records in the data set
2	Number of records in each field (NRECS)
3	Number of fields in the accumulation file (NFIELDS)
4	Field number of latest field entered in accumulation file
5	Record number of first record of Field #1
6	Record number of first record of Field #2

...	...
4+NFIELDS	Record number of first record of Field #NFIELDS

9.1.1.2 Field Documentation Record Format

The format of the Field Documentation Record is described in this section. There are 158 words of information in the Field Documentation Record with blank fill to the end of the logical record (logical record size is dependent on number of longitude columns in the field). The minimum size is 158 words (632 bytes) and the maximum size is 2,527 words (10,108 bytes). Table 9.1.1.2-1 contains the format (where R or I indicate real or integer words, respectively) of the Field Documentation Record.

Unfortunately, the SST fields were developed when the format for IBM real numbers were thought to be the standard. Many platforms cannot read IBM real numbers and so the following variables in the Field Documentation Record: SMGLAT, AXLAT, SMLONG, ASLONG, RES, SMHOUR, HOURS, TIMGAP, SMREL, AXREL, SORC, OBTYPE, GRDWTS, MKM, H, EXP, FDX, XCLASS, DEL, BDEL and FCWT (defined in Table 9.1.1.2-1) will be unavailable without conversions. The values of the most used parameters for the 14 km NA ETA field are listed specifically in Table 9.1.1.2-1. The general user will not need the rest of the values, but for the advanced user a conversion program from IBM real numbers to IEEE real numbers is included in Appendix N.

Table 9.1.1.2-1. Format of the Field Documentation Record.

Word #	Parameter	R or I	Description
1	LDBGN	I	Record number of the first row of the field (currently 2 for all fields since the documentation record requires only one record).
2	SMGLAT	R	Minimum latitude included in field which is the bottom edge and first row of field (-South; + North). 15.0 for 14 km NA ETA field.
3	AXLAT	R	Maximum latitude included in field which is the top edge and last row of field (-South; + North). 60.0 for 14 km NA ETA field.
4	SMLONG	R	Minimum longitude included in field which is the left edge and first column of field (-West; + East). -140.0 for 14 km NA ETA field.

5	AXLONG	R	Maximum longitude included in field which is the right edge and last column of field (excluding the I.D. column) (-West; +East). -50.0 for 14 km NA ETA field.
6	RES	R	Number of latitude-longitude degrees between each grid point. 0.125 for 14 km NA ETA field.
7	SMHOUR	R	Youngest time, in hours of the year, of observations used during last analysis, which becomes the oldest time allowed for the next analysis.
8	HOURS	R	Oldest time, in hours of the year, of observations used during last analysis.
9	TIMGAP	R	Number of hours between youngest and oldest times of observations used in analysis.
10	MAXDAT	I	Maximum number of hours allowed in time period for observation times to be included in analysis.
11	SMREL	R	Minimum reliability of observations to be used in analysis.
12	AXREL	R	Maximum reliability of observations to be used in analysis.
13-22	SORC(10)	R	List of source codes of observations to be used in analysis. (See Table 9.1.2-5)
23-32	OBTYPE (10)	R	List of observation types allowed to be used in analysis. (See Table 9.1.2-4)
33	NROWS	I	Number of rows (latitudinal parallels) included in field, excluding documentation record.
34	NCOLS	I	Number of columns (longitudinal meridians) in field, including the I.D. column.
35	IBLK	I	Number of rows or logical records per physical block.
36	NWRDS	I	Number of full words (32 bits) allocated to each grid point.
37	ISZ	I	Number of rows to be maintained in an array in core for temperature analysis and calculation of gradients.
38	ICENT	I	Center line within the array of ISZ rows upon which calculations will be performed.

39-41	LWT, LNT, LBT	I	Word number, length in bits, and starting bit location of analysis temperature within a grid intersection information unit of an SST field.
42-44	LWG, LNG,LBG	I	Word number, length in bits, and starting bit location of average gradient.
45-47	LWGXP, LNGXP, LBGXP	I	Word number, length in bits, and starting LBGXP bit location of gradient X+ direction.
48-50	LWGXN, LNGXN, LBGXN	I	Word number, length of bits, and starting LBGXN bit location of gradient X- direction.
51-53	LWGYP, LNGYP, LBGYP	I	Word number, length in bits, and starting LBGYP bit location of gradient Y+ direction.
54-56	LWGYN, LNGYN, LBGYN	I	Word number, length in bits, and starting LBGYN bit location of gradient Y- direction.
57-59	LWPD, LNPD, LBPD	I	Word number, length in bits, and starting LBPD bit location of Physiographic Description.
60-62	LWNO, LNN, OLBNO	I	Word number, length in bits, and starting LBNO bit location of Number Observations.
63-65	LWAGE, LNAGE, LBAGE	I	Word number, length in bits, and starting LBAGE bit location of Age of most Recent Observations.
66-68	LWREL, LNREL, LBREL	I	Word number, length in bits, and starting LBREL bit location of Reliability.
69-71	LWCLS, LNCLS, LBCLS	I	Word number, length in bits, and starting LBCLS bit location of Class 1 coverage.

72-74	LWSXP, LNSXP, LBSXP	I	Word number, length in bits, and starting LBSXP bit location of Spatial Covariance X+.
75-77	LWSXN, LNSXN, LBSXN	I	Word number, length in bits, and starting LBSXN bit location of Spatial Covariance X-.
78-80	LWSYP, LNSYP, LBSYP	I	Word number, length in bits, and starting LBSYP bit location of Spatial Covariance Y+.
81-83	LWSYN, LNSYN, LBSYN	I	Word number, length of bits, and starting LBSYN bit location of Spatial Covariance Y-.
84-86	LWIND, LNIND, LBIND	I	Word number, length in bits, and starting LBIND bit location of Independent Temperature.
87-96	GRDWTS (10)	R	Weight assigned to each grid unit, according to its distance from the grid intersection for which gradients are being calculated.
97	NP	I	Number of grid points to be used in calculation of gradients.
98-117	KMDST (10,2)	I	Look up table of gradient values and corresponding distances to be used in determining the search area for analysis.
118	MKM	R	Number of paired entries in KMDST.
119-138	H(10,2)	R	Look up table of gradient values and corresponding factors to be used in determining the new weight assigned to the observation temperature analysis.
139	MH	I	Number of paired entries in H.
140	EXP	R	Exponent used in temperature analysis.
141	FDX	R	Factor used in determining new weight assigned to the observation temperature for analysis.
142	XCLASS	R	Factor used to place gradients into a class for Gradient Class Summary.

143	DEL	R	Maximum number of degrees centigrade (x 10) that the new analysis temperature may differ from the previous SST field temperature.
144	MF	I	Factor applied to the previous field temperature and reliability to determine the final analysis temperature and its reliability.
145	MSTAR	I	Factor applied to the combined observation temperature and weight in determining the new analysis temperature.
146	MNSRCH	I	Minimum distance in kilometers to be searched for analysis observations.
147	MXSRCH	I	Maximum distance in kilometers to be searched for analysis observations.
148	BDEL	R	Maximum distance in kilometers to be searched for analysis observations. Maximum difference allowed between new analysis temperature and the previous one for Class 1 coverage bit to be set to 1.
149	FCWT	R	Maximum value that can be assigned as the reliability of the new analysis temperature.
150	IYYY	I	Year of youngest time of observation data used (0-99).
151	IYMM	I	Month of youngest time of observation data used (1-12).
152	IYDD	I	Day of youngest time of observation data used (1-31).
153	IYHH	I	Hour of youngest time of observation data used (0-23).
154	IOYY	I	Year of oldest time of observation data used (0-99).
155	IOMM	I	Month of oldest time of observation data used (1-12).
156	IODD	I	Day of oldest time of observation data used (1-31).
157	IOHH	I	Hour of oldest time of observation data used (0-23).
158	ICURTM	I	Last time used in analysis (in Julian days from Jan. 1, 4713 BC).

9.1.1.3 Field Data Record Format

Each Field Data Record (latitudinal row) consists of a series of grid intersection points. These points are 28 bytes in length. Each longitude (column) reflects one grid intersection. At the end

of the data record (i.e., immediately following the last column) is the 28-byte Latitudinal Row Identifier. All parameters in the grid intersection are stored as integer values and have the format shown in Table 9.1.1.3-1.

Table 9.1.1.3-1. Format of the Parameters in the Grid Intersection.

Word #	Byte #	Description	Units	Range
1	1-2	Analysis Temperature	C x 10	-850 to +610
1	3-4	Average Gradient	C/100 km (x 10)	0 to 300
2	5-6	Gradient X+	C/100 km (x 10)	0 to 300
2	7-8	Gradient X-	C/100 km (x 10)	0 to 300
3	9-10	Gradient Y+	C/100 km (x 10)	0 to 300
3	11-12	Gradient Y-	C/100 km (x 10)	0 to 300
4	13	Physiographic Descriptor	0 = sea; 1=land	0 to 15
4	14	Ice Field	Percent sea ice for 50 km SST field, otherwise, undefined.	0 to 100 for 50 km SST field. Set to 100 for all other fields.
4	15	Number of Observations	Integer	0 to 255
4	16	Age of Most Recent Observation	Hours	0 to 255
5	17-18	Reliability	Integer	0 to 32767
5	19-20	Class 1 Coverage	Bits	0 or 1
6	21	Spatial Covariance X+	Grid units	0 to 10
6	22	Spatial Covariance X-	Grid units	0 to 10
6	23	Spatial Covariance Y+	Grid units	0 to 10
6	24	Spatial Covariance Y-	Grid units	0 to 10
7	25-26	Climatological Temperature (for 100 km field file only)	C (x 10)	-850 to +610
7	27-28	Spare	Undefined	Blank

The format of the Latitudinal Row Identifier (last 28 bytes of a row) is contained in Table 9.1.1.3-2. All parameters in the table are stored as integer values.

Table 9.1.1.3-2. Format of the Latitudinal Row Identifier.

Word #	# Bytes	Description	Units	Range
1	4	Row	Integer	1-141
2	4	Spare	Undefined	0 to 32767
3	4	Spare	Undefined	0 to 32767
4	1	Physiographic Descriptor	Integer	Always 255
4	3	Spare	Undefined	0 to 32767
Date and time at which analysis was performed:				
5	4	Hour of Day, Minutes of hour	100 x hours + minutes	100 x (0-23) + (0-59)
6	4	Day of Year	Days	1-366
7	4	Year (2-digits before 3/3/99; 4-digits after 3/3/99)	Years	0-99 (1999-2100 after 3/3/1999)

The terms used to describe the grid intersection points are defined as follows:

ANALYSIS TEMPERATURE - The latest sea surface temperature calculated based on the previous analysis temperature, weighted according to its reliability, combined with a weighted average of current observations within a surrounding area of the grid point. The surrounding area is determined according to the gradient in each direction.

AVERAGE GRADIENT - The average of the gradients in all four directions (N, S, E, and W) from the grid intersection.

GRADIENT IN X+ DIRECTION - Change in temperature between the grid point and neighbor points within the field in the positive direction along the X axis.

GRADIENT IN X- DIRECTION - Change in temperature in the negative direction along the X axis.

GRADIENT IN Y+ DIRECTION - Change in temperature in the positive direction along the Y axis.

GRADIENT IN Y- DIRECTION - Change in temperature in the negative direction along the Y axis.

PHYSIOGRAPHIC DESCRIPTOR - The land/sea tag indicating whether a grid intersection is a land or sea point.

SPARE - Unused parameter.

NUMBER OF OBSERVATIONS - The total number of current observations used in the analysis of the new temperature for the grid intersection.

AGE OF MOST RECENT OBSERVATION - The age, in hours before the time of the analysis, of the most recent observation used to determine the new temperature for a grid intersection.

RELIABILITY - New reliability associated with the new temperature, based on the previous reliability combined with the weighted reliability of all observations used in the last analysis. Larger values are more reliable.

CLASS 1 TEMPORAL COVERAGE - Set of bits (0-15) of which Bit 1 is set to 1 for each analysis which included observations with a reliability greater than or equal to a specific minimum reliability considered as Class 1. Bit 0 always remains a 0, and all bits are shifted right during each analysis leaving Bit 1 to 0 when no Class 1 reliability observations are used for a grid intersection.

SPATIAL COVARIANCE X+ - The distance in grid units from the grid intersection to the nearest land mass in the positive direction along the X axis.

SPATIAL COVARIANCE X- - The distance in grid units from the grid intersection to the nearest land mass in the negative direction along the X axis.

SPATIAL COVARIANCE Y+ - The distance in grid units from the grid intersection to the nearest land mass in the positive direction along the Y axis.
SPATIAL COVARIANCE Y- - The distance in grid units from the grid intersection to the nearest land mass in the negative direction along the Y axis.

CLIMATOLOGICAL GRID TEMPERATURE - The average sea surface temperature of a grid intersection for a particular month over a number of years, taken from the global climatology file (for 100 km field file only).

9.1.2 EIGHT-DAY SST OBSERVATION FILE

The current operational technique for calculating SSTs is a multichannel technique with separate

algorithms for day and night observations. This multichannel technique yields an improved resolution of 8 km. The SST Observation File contains eight days of SST observations, which are organized in 5 x 5 degree blocks. These 5 x 5 degree blocks are further subdivided into 1 x 1 degree subblocks. Global coverage requires 2,592 blocks. The block number IBLOCK for an observation located at ILAT latitude (+N,-S) and ILONG longitude (+E,-W) can be calculated using the following equation:

$$IBLOCK = \frac{(ILATA - LA)}{LAO} \times INBL + \frac{(ILONG - LO)}{LOO} + 1 \qquad 9.1.2\text{-}1$$

The current operational technique for calculating SSTs is a multichannel technique with separate algorithms for day and night observations. This multichannel technique yields an improved resolution of 8 km. The SST Observation File contains eight days of SST observations, which are organized in 5 x 5 degree blocks. These 5 x 5 degree blocks are further subdivided into 1 x 1 degree subblocks. Global coverage requires 2,592 blocks. The block number IBLOCK for an observation located at ILAT latitude (+N,-S) and ILONG longitude (+E,-W) can be calculated using the following equation:

$$SBN = (ILAT - LLA) \times LOO + ILONG - LLL + 1 \qquad 9.1.2\text{-}2$$

where LA is the latitude origin of the file (-90 degrees), LO is the longitude origin of the file (-180 degrees), LAO is the size of the block in the latitudinal direction (5 degrees), LOO is the size of the block in the longitudinal direction (5 degrees), and INBC is the number of column blocks (360 degrees/LOO). Each block includes the minimum whole latitude and longitude, and excludes the maximum whole latitude and longitude which borders the block. For example, the limits of Block 1 are: -90.0S to -85.01S and -180.0W to -175.01W. Since all subblocks are degree boxes, the Subblock number *SBN* for a given latitude and longitude can be defined as: where LLA and LLL are respectively the lower left latitude and longitude of the 5 degree block.

The first record in the Eight Day SST Observation File is the Block Directory which contains 13,024 bytes. The format of the Block Directory is contained in Table 9.1.2-1.

Table 9.1.2-1. Format of the Block Directory record.

Halfword #	Contents
1	LA, the latitude origin of the file (range: -90)
2	LO, the longitude origin of the file (range: -180)
3	LAO, size of block in latitudinal direction (range: +5)

4	LOO, size of block in longitudinal direction (range: +5)
5	First free record pointer (points to record # of first record available as an overflow track, 0 if no more tracks available).
6	Number of records in file (3,100 initially)
7	Start of Block Directory Information in halfwords (11 initially)
8	Day of year of most recent information (range: 1-366)
9	File availability: 0=available, 1=unavailable, update in progress
10	Year of century of last data (range: 0-99)
11	Record number for Block 1 (range: 2-3,100)
12	Record number for Block 2 (0 for no data in block)
...	**...**

Using the block number, the record number can be calculated and found in the portion of the Block Directory which serves as a lookup table. If the record number entry is zero, there is no data for that corresponding block in the file. The record number points to the Observation Data record, of which the first portion is a subdirectory. The file contains 8,446 records of 13,024 bytes each. The Observation Data record has the format shown in Table 9.1.2-2.

Table 9.1.2-2. Format of Observation Data Record.

Halfword #	Contents	Range
1	Record number	2 to 8446
2	Block number	1 to 2592
3	Extent number (number of records removed from primary)	0 (if primary)
4	Pointer to succeeding overflow record. Last overflow record points to primary record.	0 if no overflow
5	Pointer to halfword position of start of Observation Unit	61
6	Pointer to start of Subblock Directory	11

7	Lower left latitude of block LLA (+N,-S) in degrees	-90 to +90
8	Lower left longitude of block LLL (+E,-W) in degrees	-180 to +180
9	Pointer to last halfword containing data	1 to 6512
10	Unused	n/a
11	Halfword of start of data for Subblock #1	0 if no data for subblock 61 otherwise
12	Halfword of end of data for Subblock #1 (other extents may or may not contain data for this subblock).	1 to 6512
13-60	Similar to halfwords 11 and 12 for remaining subblocks	1 to 6512
61-6512	Observation data (observation units are variable length but usually they are 56 bytes each)	n/a

If the block size is changed in the future, a block may contain a different number of subblocks, thus changing the number of subblock pointers and the starting halfword of the Observation Unit. If the observations for a block do not fit on one record then as many records (extents) are allocated as needed. Each additional record will include the subdirectory and Observation Unit. If the subblock contains no information, then the start and end positions contain a zero. Subblocks may cross record boundaries. If an entire subblock cannot fit into one record, it will be split and a new record will be allocated for the remainder of the subblock. Unused portions of records and records containing no data will be zero filled.

The Observation Unit for the Eight Day SST Observation File is of variable length, ranging from a minimum of four 4-byte words to a maximum of 24 words. The length must be an even number of full words with no odd full word (except the first word which is always negative). The first three words of an Observation Unit contain identification information including the type of algorithm used, the satellite, date, time, and location. The fourth word contains the actual SST data and the reliability assigned to the observation. The remainder of the Observation Unit is unique to the type of algorithm used. The format of the Eight Day SST Observation Unit is contained in Table 9.1.2-3. Tables' 9.1.2-4 and 9.1.2-5 contain the SST Observation types and source codes, respectively.

Table 9.1.2-3. Format of the Eight Day SST Observation Unit.			
Halfword#	**Byte #**	**Contents**	**Range**
1	1	Type of Observation (Table 9.1.2-4)	129 to 255
1	2	Source of Observation (Table 9.1.2-5)	0 to 255
2	3	Year	0 to 99
2	4	Month	1 to 12
3	5-6	Latitude (+N,-S) x 100	-9000 to 9000
4	7-8	Longitude (+E,-W) x 100	-18000 to 17999
5	9	Day	1 to 31
5	10	Hour	0 to 23
6	11	Minute	0 to 59
6	12	Second	0 to 59
7	13-14	SST (degrees C x 10)	-20 to 350
8	15-16	Reliability	0 to 32,767
9	17-18	Solar zenith angle (degrees x 10)	0 to 1800
10	19-20	Satellite zenith angle (degrees x 10)	-600 to 600
11	21-22	Analyzed Field SST (degrees C x 10)	-20 to350
12	23-24	Internal Error (RMS x 100)	0 to 1000
13	25-26	Solar azimuth angle (degrees x 10)	0 to 1800
14	27-28	Climatological SST (degrees C x 10)	-20 to 350
15	29	Beginning Row if unit array	1 to 11
15	30	Beginning Column of unit array	1 to 11
16	31-32	AVHRR Ch. 1 average (% x 100)	0 to10,000
17	33-34	AVHRR Ch. 2 average (% x 100)	0 to 10,000
18	35-36	AVHRR Ch. 3 average (K x 100)	0 to 32,767

19	37-38	AVHRR Ch. 4 average (K x 100)	0 to 32,767
20	39-40	AVHRR Ch. 5 average (K x 100)	0 to 32,767
21	41-42	Space View sigma Ch. 1 (% x 100)	0 to 10,000
22	43-44	Space View sigma Ch. 2 (% x 100)	0 to 10,000
23	45-46	Space View sigma Ch. 3 (K x 100)	0 to 32,767
24	47-48	Ch. 4 Blackbody temperature (K x 100)	0 to 32,767
25	49-50	Ch. 5 Blackbody temperature (K x 100)	0 to 32,767
26	51-52	Algorithm number	1 to 32767
27	53-56	Spares	n/a

Table 9.1.2-4. SST Observation Types.

Code	Type
151	AVHRR-only day operational
152	AVHRR-only night operational
153	HIRS-only day operational
154	HIRS-only night operational
155	AVHRR + HIRS day operational
156	AVHRR + HIRS night operational
157	Aerosol Retrieval - (AVHRR-only day operational)
158	Aerosol Retrieval - (AVHRR-only day operational - warm spot mode)
159	AVHRR-only day operational warm spot mode (relaxed visible cloud test)
160	Reserved
161	AVHRR-only day test
162	AVHRR-only night test
163	HIRS-only day test

164	HIRS-only night test
165	AVHRR + HIRS day test
166	AVHRR + HIRS night test
167-168	Reserved
169	AVHRR-only day test - warm spot mode (relaxed visible cloud test)
170-178	Reserved
179	ITOS SST
180-199	Reserved
200	Independent SST (Ship or buoy)
201-254	Reserved
255	Erroneous Data - Do not use this Observation
Note: Codes having values between 151 and 169 (inclusive) indicate a multichannel technique in use at the present time.	

Table 9.1.2-5. SST Observation Source Codes.

Source code	Source
128	No source
129	TIROS-N
130	NOAA-6[1]
131	Not Used
132	NOAA-7
133	Not Used
134	NOAA-8[1]
135,7[2]	NOAA-9
8	NOAA-10[1]
1	NOAA-11

5	NOAA-12
2	NOAA-13[3]
3	NOAA-14
4	NOAA-15
5-20	TBD
21-50	Reserved
51	ITOS NOAA 1 Sensor # 1
52	ITOS NOAA 1 Sensor #2
53	ITOS NOAA 2 Sensor # 1
54	ITOS NOAA 2 Sensor #2
55-58	ITOS NOAA 3 and 4
59-62	ITOS NOAA 5
63-127	Reserved

1. No SSTs were archived for these satellites.
2. NOAA-9 source code was 135 prior to August 4, 1986. NOAA-9 source code was 7 beginning on August 4, 1986.
3. No SSTs were ever generated for this satellite.

9.1.3 SST MONTHLY MEAN ARCHIVE

The SST Monthly Mean Archive contains twelve monthly mean SST fields for one year. NESDIS creates this archive cartridge in January of every year, archiving the monthly mean fields for the previous year. The data on this cartridge were derived exclusively from satellite data. The field has a 2.5 degree latitude-longitude resolution or 250-km resolution. For each 2.5 degree box in the field, there is a count of the number of observations in the box, the mean SST, and the standard deviation about the mean, σ.

The SST Monthly Mean archive cartridge contains two files. The first file is a Header File (previously described in Table 9.1-1) which contains information about the data on cartridge. The second file has 72 physical records, each containing 12 logical records consisting of satellite SST monthly mean data. For each month of the year and for each point of its geographical grid, the data consists of 1) the month's mean temperature, T; 2) the standard deviation of a single measure, sigma sub T; and 3) the number of observations entering into the mean, N. Each of

these quantities is stored as 2-byte integers: T as degrees C x 10, σ_T as degrees C x 100, and N as itself.

The geographical grid establishes a global field of boxes at 2.5 degree resolution. Boxes are bordered by meridians and parallels which are multiples of 2.5 degrees in latitude and longitude. Four of these boxes can be combined to produce boxes centered on intersections of meridians and parallels which are multiples of 5 degrees in latitude and longitude.

The second file contains 12 fields, the first is January, and the last is December. Each field has 72 logical records grouped into 12 logical records per physical record or each field has 6 physical records. Each logical record is 876 bytes long with 10,512 bytes in a physical record. The first logical record in each field contains data for the 2.5 degree latitude band with southern boundary at 90.0S. The 72nd logical record for a field has data for the 2.5 degree latitude band with southern boundary at 87.5N. Within a latitude band, the first grid box has a westernmost boundary of 180W. The 144th grid box has a westernmost boundary of 177.5E. Each grid box requires three 16-bit halfwords. In addition, the first 12 bytes of each logical record contains the year, month, and latitude of the latitude band. A detailed format description of a Monthly Mean Data Field is contained in Table 9.1.3-1.

Table 9.1.3-1. Format of Monthly Mean Data Field.

Logical Record #	Bytes	Content (Integer values indicated)
1	1-4	Year of data (e.g., 1978)
1	5-8	Month of data (e.g., 1)
1	9-12	Latitude of southern edge of this 2.5 degree latitude band (real value)
1	13-14	Number of observations N for 2.5 degree box with southwest corner at 90.0S, 180W.
1	15-16	Monthly mean temperature T (degrees C x10) for same box
1	17-18	σ_T (degrees C x 100) for same box
1	19-20	N for 2.5 degree box with southwest corner at 90.0S, 177.5W.
1	21-22	T for same box
1	23-24	σ_T for same box
...	...	...
1	871-872	N for 2.5 degree box with southwest corner at 90.0S, 177.5E.

1	873-874	T for same box
1	875-876	σ_T for same box
...	...	...
72	10,507-10,508	N for 2.5 degree box with southwest corner at 87.5N, 177.5E.
72	10,509-10,510	T for same box.
72	10,511-10,512	σ_T for same box.

9.2 MAPPED GAC PRODUCTS

The Mapped GAC products consist of mapped mosaics displayed on polar stereographic and Mercator map projections with both forms available on digital media. The Mapped mosaics consist of daytime visible (VIS) and Infrared (IR), and nighttime IR imagery. The Mapped GAC product in polar stereographic form is described in Section 9.2.1, while the Mapped GAC product in Mercator form is described in Section 9.2.2. For a representative sample of Mapped GAC products, users should link to URL: http://www.osdpd.noaa.gov/PSB/IMAGES/mapped.html .

NESDIS/IPD also produces an operational mapped GAC product which is known as the Global Vegetation Index Product. This product provides a means of monitoring the density and vigor of green vegetation over the growing areas of the Earth. Plate Carreé, polar stereographic and Mercator mosaics of the Global Vegetation Index, derived from AVHRR Channels 1, 2, plus coincident channels 4 and 5, and supporting information are produced weekly. For more information, see the *NOAA Global Vegetation Index User's Guide*, which is available from NCDC. For the latest maps of the various Global Vegetation Index Products, link to URL: http://www.osdpd.noaa.gov/PSB/IMAGES/gvi.html.

9.2.1 MAPPED GAC (POLAR STEREOGRAPHIC) PRODUCT

The Mapped GAC (polar stereographic) data are organized as daytime and nighttime for the northern and southern hemispheres. The daytime data contain both visible (Channel 1) and IR (Channel 4) data while the nighttime data contain only the IR data. The data are reported in pairs of files. The first file of each file pair consists of a documentation record for that variable, immediately followed by an EOF and a second file containing the data records for the same variable. All records are 16,384 bytes in length. Both documentation and data records are in binary format and have the same length. A value of zero indicates missing data.

Every day a 3480 cartridge is created which contains one day of data in the polar stereographic projection. Table 9.2.1-1 contains the general file structure of this daily KLM Master map file. Each cartridge contains 12 files arranged as shown in Table 9.2.1-1.

The variables reported in the documentation record are all INTEGER*2 with the exception of the satellite type in the first two bytes of the record, which is CHARACTER*2. Table 9.2.1-2 defines the basic documentation record format.

Each data record (16,384 bytes) consists of four mapped rows, each containing 4096 pixels of data. Each pixel is represented by one byte of data.

Table 9.2.1-1. General structure of the polar stereographic KLM Master Map File.

File, record #	Contents
DAYTIME NORTHERN HEMISPHERE	
	Visible Channels
F1, rec. 1	Channel 1 documentation record. See Table 9.2.1-2 for format
F2, rec. 1-1024	Channel 1 data records. Consists of 16,384 bytes of data or 4 mapped rows of data. Each row contains 4096 pixels of data. Each pixel is one byte. A value of 0 indicates missing data
	IR Channels
F3, rec. 1	Channel 4 documentation record. See Table 9.2.1-2 for format
F4, rec. 1-1024	Channel 4 data records. Same as F2 data records
DAYTIME SOUTHERN HEMISPHERE	
	Visible Channels
F5, rec. 1	Channel 1 documentation record. See Table 9.2.1-2 for format.
F6, rec. 1-1024	Channel 1 data records. Same as F2 data records
	IR Channels
F7, rec. 1	Channel 4 documentation record. See Table 9.2.1-2 for format.
F8, rec. 1-1024	Channel 4 data records. Same as F2 data records.
NIGHTTIME NORTHERN HEMISPHERE	

	IR Channels
F9, rec. 1	Channel 4 documentation record. See Table 9.2.1-2 for format.
F10, rec. 1-1024	Channel 4 data records. Same as F2 data records
NIGHTTIME SOUTHERN HEMISPHERE	
	IR Channels
F11, rec. 1	Channel 4 documentation record. See Table 9.2.1-2 for format.
F12, rec. 1-1024	Channel 4 data records. Same as F2 data records.

Table 9.2.1-2. Format of documentation record for polar stereographic KLM Master Map data.

Byte #s	Contents
1-2	Satellite type, e.g., NH=NOAA-H (CHARACTER*2)
3-4	Satellite ID: 0=morning satellite; 1=afternoon sat.
5-6	Data set type: 1=LAC; 2=GAC; 3=HRPT
7-8	Projection type: 0=unmapped; 1=Mercator; 2=Polar; 3=linear lat/lon
	IMAGE BOUNDARIES
9-10	Beginning latitude x 128; North>0; South<0
11-12	Ending latitude x 128
13-14	Beginning longitude x 128; East>0; West<0
15-16	Ending longitude x 128
17-18	Mapped resolution x 100; km for polar and mercator projections; degree/pixel for linear lat/lon projections; sampling interval for unmapped projection
19-22	Spares
	POLAR PROJECTION DATA
23-24	Polar grid mesh size (grid size that corresponds to resolution, e.g., 64 = 1/64 grid)
25-26	Number of grid points (that correspond to grid size, e.g., 1/64 grid corresponds to 4096 points)

27-28	Hemisphere: 1=Northern; -1=Southern
29-30	Prime longitude; East>0; West<0
	GRID OFFSETS
31-32	IOFF; grid coordinates of top left corner of the image. (not applicable for unmapped projections)
33-34	JOFF
	IMAGE SIZE
35-36	Number of rows
37-38	Number of columns
39-42	Spares
43-44	Composite flag: 0=no composite; 1=composite based on minimum nadir angle; 2=retain average value; 3=retain later value; 4=retain warmer value; 5=retain colder value
45-46	Calibration flag: 0=raw counts; 1=radiances; 2= calibrated to albedos and BTs; 3=calibrated to albedos and GOES counts
47-48	Fill-up options: 0=no fill-up; 1=fill-up using averages; 2=fill-up using adjacent pixel values
49-50	Channel number: 1-5=channel number; 101=scan angle; 102 =satellite zenith angle; 103=solar zenith angle; 104 = relative azimuth angle; 105=scan time; 201=SST split window; 202=SST dual window; 203=SST Triple window
51-52	Data ID: 0=visible; 1=infrared; 2=ancillary
	DATA CORRECTION FLAGS
53-54	Sun normalization: 0=not performed; 1=performed
55-56	Limb correction: 0=not performed; 1=performed
57-58	Nonlinearity correction: 0=not performed; 1=performed
59-60	Number of orbits processed
	CHANNEL IMAGES
61-62	Number of channels produced

63-64	Pixel size: 1=1 byte; 2=2 bytes
65-66	Starting block number
67-68	Ending block number
	ANCILLARY DATA
69-70	Number of ancillary parameters produced
71-72	Pixel size: 1=1 byte; 2=2 bytes
73-74	Starting block number
75-76	Ending block number
77-78	Block size of image files
79-80	Compression flag
81-100	Spares
	ORBIT 1 INFORMATION
101-102	Orbital node over region: -1=asc; 1=desc; 2=both
103-104	Day/night flag: 0=day; 1=night
	IMAGE DATA BOUNDARIES
105-106	Start row
107-108	Start column
109-110	End row
111-112	End column
	ORBIT START TIME
113-114	Year of century
115-116	Day of year
117-118	Month and day of month (month x 100) + day
119-120	Hours and minutes (hours x 100) + minutes
121-122	Seconds

123-124	Milliseconds
	ORBIT END TIME
125-126	Year of century
127-128	Day of year
129-130	Month and day of month (month x 100) + day
131-132	Hours and minutes (hours x 100) + minutes
133-134	Seconds
135-136	Milliseconds
137-138	Processing block ID (orbit number)
	QUALITY FLAGS
139-140	Ramp/auto calibration flag
141-142	Number of data gaps
143-144	Sync errors
145-146	TIP parity errors
147-148	Auxiliary errors
149-150	Calibration parameter ID
151-152	DACS status
	CALIBRATION COEFFICIENTS
153-154	Channel 1 slope x 10,000
155-156	Channel 1 intercept x 1,000
157-158	Channel 2 slope x 10,000
159-160	Channel 2 intercept x 1,000
161-166	Spares
	ORBIT 2 INFORMATION
167-232	Same as bytes 102-166

	ORBIT 3 INFORMATION
233-298	Same as bytes 102-166
...	**...**
	ORBIT n INFORMATION
((n-1) x 66+102) -((n-1)x 66+166)	Same as bytes 102-166

9.2.2 MAPPED GAC (MERCATOR) PRODUCT

The Mapped GAC (Mercator) data are organized as visible (Channel 1), and daytime and nighttime IR (Channel 4). These data are reported in pairs of files, totaling six files. The first file of each file pair consists of a documentation record for that variable, immediately followed by an EOF and a second file containing the data records for the same variable. All records are 4,052 bytes in length. Both documentation and data records are in binary format and have the same length. A value of zero indicates missing data.

Every day a 3480 cartridge is created which contains a day's worth of Mapped GAC data in the mercator projection. Table 9.2.2-1 contains the general file structure of the daily mercator KLM Master Map file. Each file contains 6 files arranged as shown in the table.

The format of the basic documentation record is the same as the polar stereographic KLM Master Map which is contained in Table 9.2.1-2.

Each data record (4,052 bytes) consists of one mapped row, containing 4052 pixels of data. Each pixel is represented by one byte of data.

Table 9.2.2-1. General structure of the Mercator KLM Master Map File.

File, record #	Contents
	Visible Channels
F1, rec. 1	Channel 1 documentation record. See Table 9.2.1-2 for format.
F2, rec. 1-984	Channel 1 data records. Consists of 4,052 bytes of data or 1 mapped row of data. Each row contains 4052 pixels of data. Each pixel is one byte. A value of 0 indicates missing data.
	IR Channels (Daytime)

F3, rec. 1	Channel 4 documentation record. See Table 9.2.1-2 for format.
F4, rec. 1-984	Channel 4 data records. Same as F2 data records
	IR Channels (Nighttime)
F5, rec. 1	Channel 4 documentation record. See Table 9.2.1-2 for format
F6, rec. 1-984	Channel 4 data records. Same as F2 data records.

9.3 RADIATION BUDGET PRODUCTS

After the launch of NOAA-K, NOAA will be generating all the radiation budget products in the new NOAA KLM one degree equal area format. In addition, the older TIROS-N format for radiation budget products will be available through May 1999. This section contains a description of the NOAA KLM radiation budget products as well as a brief overview of the TIROS-N series products**.**

9.3.1 NOAA KLM RADIATION BUDGET PRODUCTS

The Radiation Budget Product Generation System (RBPGS) generates four basic output files: the Primary Components File for daily products (Section 9.3.1.1), the Monthly Mean files (Section 9.3.1.2), the Seasonal Mean files (Section 9.3.1.3) and the Annual Mean files (also in Section 9.3.1.3).

9.3.1.1 Primary Components 37 Day File (PC37DF)

This is the basic output file generated by the RBPGS and is known as the Primary Components 37 Day File (PC37DF). It is a revolving file with, at present, one record for a header plus a set of records for each of 37 day bins. The Primary Components File has a logical record size of 23,476 bytes with one record per block. The file format is ASCII for text information and integer (I*2) for the data. Each day bin contains three sets of maps:

1. Nighttime (22 maps),
2. Daylight longwave (22 maps),
3. Daylight shortwave (24 maps).

Each set of maps occurs in pairs, one map for the Northern Hemisphere and one for the Southern Hemisphere (thus the nighttime maps consist of eleven types). Each of these requires two records. The structure of an individual map is based on the Pathfinder Equal Areas/Equal Aspect (EAA) map. The whole RBPGS is set up to, at any time, either add or subtract data from any day bin within the PC37DF. This is done so as to allow reprocessing of poor data. The file is fully

described in Table 9.3.1.1-1. Note, the tabulated Available Solar Energy (ASE) Day Bin Fields are stored contiguously (all 600) in the header and are allocated to each Day Bin.

Table 9.3.1.1-1. Description of the Primary Components 37 Day File (PC37DF) Header.

Field	Bytes	Type	Description
HEADER	1-100	A100	ASCII Header "NOAA/NESDIS RADIATION BUDGET ARCHIVED 37-DAY PRIMARY COMPONENTS FILE PRD.RADBUD.NOAAXX.ARC.DAY37CMP" where XX indicates the satellite used.
TYPE	101-102	I*2	The type of file (0 for Primary components file).
VER	103-104	I*2	The version number of the file (0 for this version).
SATID	105-106	I*2	The satellite ID.
PCOY	107-108	I*2	The year of the oldest data contained in the file.
PCOM	109-110	I*2	The month of the oldest data contained in the file.
PCOD	111-112	I*2	The day of the month of the oldest data contained in the file.
PCYY	113-114	I*2	The 4 digit year of the youngest (most current) data in the file.
PCYM	115-116	I*2	The month of the youngest (most current) data in the file.
PCYD	117-118	I*2	The day of the month of the youngest (most current) data in the file.
PCDBO	119-120	I*2	The day bin reflecting the oldest data in the file.
PCDBY	121-122	I*2	The day bin reflecting the youngest (most current) data in the file.
PCDBSR	123-124	I*2	The first physical record on this file that contains Primary Components map data for day bin number 1.
PCDBBL	125-126	I*2	The total number of physical records in this file that are required by each day bin.
IDATE	127-132	3 I*2	The creation date of this file (YYYYMMDD).

RECTYP	133-134	I*2	The record type of this (header) record (=1).
EPOCHY	135-136	I*2	The satellite epoch year (launch year).
EPOCHD	137-138	I*2	The satellite epoch day-in-year (launch day).
MAPTYP	139-140	I*2	The map type (0=PSG maps, 1=EAA maps).
ASPECT	141-142	I*2	EAA map aspect ratio x 1000.
AREA	143-144	I*2	EAA map nominal element area (square degrees x 1000).
CSCALE	145-148	I*4	Polar Stereographic (PSG) map scale (grid points x 1000 between pole and equator).
LRC	149-150	I*2	Longitude Rotation Convention (LRC).
PRIMEL	151-152	I*2	PSG map Prime Longitude x 100 (interpreted via the LRC).
PACK	153-154	I*2	Is the map to be packed? If yes, then PACK=1. Note that EAA maps are packed.
NPROWS	155-156	I*2	If so, then number of rows per stored column.
SBOUND (1-5)	157-166	5I*2	GAC 5 shortwave class boundary fluxes for the GAC histograms. These values have to be the same as those held in SF/RF 18 and in the RDAF header (the sixth value is immaterial).
LBOUND (1-5)	167-176	5I*2	GAC 5 longwave class boundary fluxes for the GAC histograms. These values have to be the same as those held in SF/RF 18 and in the RDAF header (the sixth value is immaterial).
TSTAMP	177-188	6I*2	Time stamp written at the end of ANLRET/SUMFRM as YYYYMMDDHHMMSS.
NDHELD	189-190	I*2	Number of days in the 37(!) Day files. This is to be the same as RADANL: DBNX.
PRL	191-194	I*4	Primary Components 37 Day File physical record length (23,476 bytes for this version).
	195-276		Spare.

Tabulated ASE Day Bin Fields			
ABDN	277+ (ADBN-1)*600:278+ (ADBN-1)*600	I*2	Permanent Day Bin label. Values 1 to 37 (or RADANL: DBNX the number of day bins in the 37(!) day files).
NCDAY	279+ (ADBN-1)*600:280+ (ADBN-1)*600	I*2	Actual Day Number of the contained data relative to the Satellite Epoch.
NARUNS	281+ (ADBN-1)*600:282+ (ADBN-1)*600	I*2	Number of RADRET runs involved in the ASETAB average.
IDATIM (1-6)	283+ (ADBN-1)*600:294+ (ADBN-1)*600	6 I*2	Time Stamp YYMMDDHHMMSS
ASETAB (1-91)	295+ (ADBN-1)*600:476+ (ADBN-1)*600		Contains the Biased Sum of Average Available Solar Energy (ASE) Table for the actual day currently occupying the day bin. There are 91 values (two bytes each) in each field starting at the North Pole and then given at intervals of two degrees. Each value should be divided by the number of pixels in a target (currently 121). Then add the shortwave bias value (currently 270) to retrieve the average unbiased ASE value for each latitude.

	477+ (ADBN-1)*600:876+ (ADBN-1)*600		Spare.
	22077-23476		Spare.

The first map data containing record on the Primary Components file is the first data record of Day Bin 1 and is Record Number PCDBSR (see Table 9.3.1.1-1). If PCDBSR is set higher than 2, then an extended header may be constructed running from record 2 to PCDBSR-1.

Day Bin 1 runs from Record PCDBSR through Record PCDBBL + PCDBSR - 1 , i.e., there are PCDBBL records allocated to day bin 1 and, thereafter, to every day bin. The records in each day bin are constructed in exactly the same manner with the only difference being the Permanent Day Bin label, DBN, located in bytes one and two of each record, allocated to the given day bin. Day Bin 2, etc. is structured exactly the same as Day Bin 1 (apart from the value of DBN) and immediately follows Day Bin 1.

In a Day Bin, the records occur in groups of four, all pertaining to the same kind of map field (e.g., GAC OLR at night); two records for the Northern Hemisphere followed directly by two records for the Southern Hemisphere. The format of the first record of a hemisphere pair is described in Table 9.3.1.1-2, while the second record of a hemisphere pair is contained in Table 9.3.1.1-3.

Table 9.3.1.1-2. Format of Record 1 of a Hemisphere Pair in a Day Bin.

Field	Bytes	Type	Description
DBN	1-2	I*2	Permanent Day Bin label.
BCDAY	3-4	I*2	Actual Day Number, relative to the Satellite Epoch, of the data that is currently stored in the day bin.
YEAR	5-6	I*2	Actual four digit year.
MONTH	7-8	I*2	Actual month.
DAY	9-10	I*2	Actual day of month.

PURGET	11-12	I*2	Last purge date (=100 x month + day, with month and day being the real-time month and day of the first writing of the BCDAY data).
RCTYPE	13-14	I*2	'02' 1st record of a Northern Hemisphere map. '04' 1st record of a Southern Hemisphere map.
DBSECN	15-16	I*2	Day Bin Section Number: 1= Night; 2= Longwave Day; 3= Shortwave Day.
FIELD	17-18	I*2	Field mnemonic. (See Table 9.3.1.1-4).
NORS	19-20	I*2	Hemisphere: North=0, South=1.
TSTAMP	21-32	6 I*2	Time Stamp as 'YYYYMMDDHHMMSS' of most recent data addition or subtraction.
NARUNS	33-34	I*2	Showing the number of RADRET runs contributing to the tabulated Available Solar Energy (ASE). Copied from the PC37DF header.
ASEBYT	35-216		Showing the Biased Sum of Tabulated ASE for the (1-91) actual day, starting at the North Pole and then given for every two degrees latitude. Copied from the PC37DF header.
SPARE	217-276		Spare
I*2MAP	277-23,476		Showing the first 11,600 I*2 elements of the Equal Areas/Equal Aspect Pathfinder Map (of total size 20,626 elements) for the hemisphere. The first set of elements (3) is for the pole. The second latitude band of elements (9) is for -89 in the Southern Hemisphere and 89 for the Northern Hemisphere. This continues toward the equator, where the number of elements in each latitude band is determined by the array NCELL (see second hemisphere pair). The first element in a latitude set is the eastward most longitude (beginning at the Greenwich Meridian). Each element after that is west of the previous element in the latitude set.

Table 9.3.1.1-3. Format of Record 2 of a Hemisphere Pair of a Day Bin.			
Field	**Bytes**	**Type**	**Description**
DBN	1-2	I*2	Permanent Day Bin label.
FIELD	3-4	I*2	Field mnemonic (see Table 9.3.1.1-4).
NORS	5-6	I*2	Hemisphere: North=0; South=1.
NCELL (1-90)	7-186	90 I*2	Each succeeding value represents the number of longitude bins in each of 90 latitude bands of the (current) Equal Areas/Equal Aspect Pathfinder Maps starting at the pole and abutting (to the west) the Greenwich Meridian.
I2MAP	277-18,328		Showing the remaining 9,026 elements (11,601-20,626) of the EAA map stored as 20,626 I*2 integers.
	18,329-22,036		Spare
E2MAP	22,037-23,476		Showing the 720 I*2 elements of the equatorial band data for the hemisphere. Each element is for use with the old-style 144 by 72 LatLon maps, and is of size 1.25 degrees in latitude and 0.5 degrees in longitude with each element abutting the equator and the first element centered on the dateline. Subsequent elements are recorded eastwards.

Table 9.3.1.1-4. Field Mnemonic for radiation budget monthly mean data.	
Data Field	**Description**
HCN=1	HIRS Count Nighttime
HN=2	HIRS OLR Nighttime
GCN=3	GAC Count Nighttime
GLN=4	GAC Longwave Nighttime
GQN=5	GAC OLR Variance Nighttime

G1N=6	GAC OLR Class 1 Pixel Count
G2N=7	GAC OLR Class 2 Pixel Count
G3N=8	GAC OLR Class 3 Pixel Count
G4N=9	GAC OLR Class 4 Pixel Count
G5N=10	GAC OLR Class 5 Pixel Count
G6N=11	GAC OLR Class 6 Pixel Count
HCD=12	HIRS Count Daytime
HD=13	HIRS OLR Daytime
GCD=14	GAC Count Daytime
GLD=15	GAC OLR Daytime
GQD=16	GAC Variance Daytime
G1D=17	GAC OLR Daytime Class 1 Pixel Count
G2D=18M	GAC OLR Daytime Class 2 Pixel Count
G3D=19	GAC OLR Daytime Class 3 Pixel Count
G4D=20	GAC OLR Daytime Class 4 Pixel Count
G5D=21	GAC OLR Daytime Class 5 Pixel Count
G6D=22	GAC OLR Daytime Class 6 Pixel Count
TC=23	Target Count in Daylight (good retrievals only)
AS=24	Average Available Solar Energy Flux
GC=25	GAC Pixel Count in Daylight
GS=26	Average GAC Absorbed SW Flux
GQ=27	Average GAC Absorbed SW Variance
G1=28	GAC Absorbed SW Class 1 Pixel Count
G2=29	GAC Absorbed SW Class 2 Pixel Count
G3=30	GAC Absorbed SW Class 3 Pixel Count

G4=31	GAC Absorbed SW Class 4 Pixel Count
G5=32	GAC Absorbed SW Class 5 Pixel Count
G6=33	GAC Absorbed SW Class 6 Pixel Count
CP=34	Experimental Cloud Product

9.3.1.2 Monthly Mean Radiation Budget Product

This file contains one month of current monthly mean data. It contains 25 records. The first record is the header. It contains six types of data: HIRS Night OLR, HIRS Day OLR, AVHRR Night OLR, AVHRR Day OLR, Available Solar Energy, and AVHRR SW Absorbed Radiation. Each type of data is associated with four records (The Northern Hemisphere pair and the Southern Hemisphere pair).

The format of the header record for the Monthly Means (and also the Seasonal and Annual Means) data is shown in Table 9.3.1.2-1.

Table 9.3.1.2-1. Format of Header Record for Monthly/Seasonal/Annual Mean Data.

Field	Bytes	Type	Description
HEADER	1-100	ASCII	Text header
SATID	101-102	I*2	The satellite ID
RPTREQ	103-104	I*2	The type of mean: 0=Monthly; 1=Winter; 2=Spring; 3=Summer; 4=Fall; 5=Annual.
RPTYR	105-106	I*2	The four digit year of the initial data.
RPTMO	107-108	I*2	The month of the initial data.
VER	109-110	I*2	Version number of this file format.
RPTOY	111-112	I*2	The four digit year of the latest data contained in the file.

RPTOM	113-114	I*2	The month of the latest data contained in the file.
RPTOD	115-116	I*2	The day of the month of the latest data contained in the file.
SPARES	117-122	I*2	SPARES
MAXCNT	123-124	I*2	The number of records in the file.
SPARE	125- 126	I*2	SPARE
EPOCHY	127-128	I*2	The four digit satellite epoch year (launch year).
EPOCHD	129-130	I*2	The satellite epoch day-in-year (launch day).
EPOCHT	131-132	I*2	The time of day of the satellite launch: 1=morning 2=afternoon.
TYPREC	133-134	I*2	The record type of this (header) record (=1).
NUMTYPS	135-136	I*2	The number of data types in the file. The maximum number of data types is 35. The current number supported is 6.
NUMRECS	137-138	I*2	The number of records per data type is 4.
TYPENAM	139-208	32 I*2	The names of the number of data types currently supported in the file. There is one name for each of the NUMTYPS supported. 2=HN, 3=GLN, 13=HD, 15=GLD, 24=AS, 26=GS (See Note 1)
SPARES	209-6447	I*2	The spare bytes in the header record.

Tables' 9.3.1.2-2 and 9.3.1.2-3 contain the format for Records 1 and 2 of the Monthly Mean Data, respectively.

Table 9.3.1.2-2. Format of Monthly Mean Data Record 1 of a Hemisphere Pair.

Field	Bytes	Type	Description
SPARE	1-2	I*2	SPARE

BCDDAY	3-4	I*2	The actual day number, relative to the satellite Epoch, of the first day in the period covered in the file. (i.e. for monthly means the day is relative to the first day of the month)
SPARES	5-12	I*2	SPARES
RCTYPE1	13-14	I*2	The indicator for the first record of the hemisphere: 02 = Record 1 for the Northern Hemisphere; 04 = Record 1 for the Southern Hemisphere.
SPARE	15-16	I*2	SPARE
FIELD	17-18	I*2	The Field mnemonic. (See Table 9.3.1.1-4)
NORS	19-20	I*2	The hemisphere indicator: 0= North; 1= South
BEGINDATE	21-24	2 I*2	The start time as YYYYMM of the data in the record.
SPARE	25-26	I*2	SPARE
ENDDATEF	27-30	2I*2	The end time as YYYYMM of the data in the record.
SPARES	31-276	I*2	SPARES
I2MAP	277-23476	I*2	The mean values of the first 11600 I*2 elements of the 20626 elements of the Equal Areas/Equal Aspect Map

Table 9.3.1.2-3. Format of Monthly Mean Data Record 2 of a Hemisphere Pair..

Field	Bytes	Type	Description
RECTYP2	1-2	I*2	The indicator for the second record of the hemisphere: 03=Record 2 for the Northern Hemisphere; 05=Record 2 for the Southern Hemisphere.
FIELD	3-4	I*2	The Field mnemonic. (See Note 1)

NORS	5-6	I*2	The hemisphere indicator: 0=North; 1= South.
NCELL	7-186	90 I*2	The number of longitude bins in each of 90 latitude bands of the (current) Equal Areas/Equal Aspect Pathfinder Maps starting at the pole and abutting (to the west) the Greenwich Meridian.
SPARES	187-276	I*2	SPARES
I2MAP	277- 18328	I*2	The mean values of the last 9026 I*2 elements of the 20,626 elements of the Equal Areas/Equal Aspect Map
SPARE	18329-22036	I*2	SPARE
E2MAP	22037-23476	I*2	The 720 I*2 mean elements of the equatorial band data for the hemisphere

9.3.1.3 Seasonal/Annual Mean Radiation Budget Product

This file contains one season or one year of mean radiation budget data. It contains 25 records. The first record is the header. It contains six types of data: HIRS Night OLR, HIRS Day OLR, AVHRR Night OLR, AVHRR Day OLR, Available Solar Energy, and AVHRR SW Absorbed Radiation. Each type of data is associated with four records (the Northern Hemisphere pair and the Southern Hemisphere pair). The format of the header record has already been described in Table 9.3.1.2-1. The first data record of a hemisphere pair is described in Table 9.3.1.3-1, while data record 2 of a hemisphere pair is shown in Table 9.3.1.3-2.

Table 9.3.1.3-1. Format of Seasonal/Annual Mean Data Record 1 of a Hemisphere Pair.

Field	Bytes	Type	Description
SPARE	1-2	I*2	SPARE
BCDDAY	3-4	I*2	The actual day number, relative to the satellite Epoch, of the first day in the period covered in file l (i.e. for monthly means the day is the relative to the first day of the month).
SPARES	5-12	I*2	SPARES

RCTYPE1	13-14	I*2	The indicator for the first record of the hemisphere: 02 = Record 1 for the Northern Hemisphere; 04 = Record 1 for the Southern Hemisphere.
SPARE	15-16	I*2	SPARE
FIELD	17-18	I*2	The Field mnemonic. (See Table 9.3.1.1-4).
NORS	19-20	I*2	The hemisphere indicator: 0= North; 1= South.
BEGINDATE	21-24	2 I*2	The start time as YYYYMM of the data in the record.
SPARE	25-26	I*2	SPARE
ENDDATEF	27-30	2 I*2	The end time as YYYYMM of the data in the record.
SPARES	31-276	I*2	SPARES
I2MAP	277-23,476	I*2	The mean values of the first 11,600 I*2 elements of the 20,626 elements of the Equal Areas/Equal Aspect Map

Table 9.3.1.3-2. Format of Seasonal/Annual Mean Data Record 2 of a Hemisphere Pair.

Field	Bytes	Type	Description
RECTYP2	1-2	I*2	The indicator for the second record of the hemisphere: 03=Record 2 for the Northern Hemisphere; 05=Record 2 for the Southern Hemisphere.
FIELD	3-4	I*2	The Field mnemonic. (See Table 9.3.1.1-4).
NORS	5-6	I*2	The hemisphere indicator: 0= North; 1= South.

NCELL	7-186	90I*2	The number of longitude bins in each of 90 latitude bands of the (current) Equal Areas/Equal Aspect Pathfinder Maps starting at the pole and abutting (to the west) the Greenwich Meridian.
SPARES	187-276	I*2	SPARES
I2MAP	277-18,328	I*2	The mean values of the last 9026 I*2 elements of the 20626 elements of the Equal Areas/Equal Aspect Map
SPARE	18,329-22,036	I*2	SPARE
E2MAP	22,037-23,476	I*2	The 720 I*2 mean elements of the equatorial band data for the hemisphere

9.3.2 TIROS-N SERIES RADIATION BUDGET PRODUCTS

There are six types of digital Radiation Budget products archived by NOAA/NCDC. All radiation budget products are produced by the NOAA/NESDIS Office of Satellite Data Processing and Distribution's Product Systems Branch (OSDPD/PSB). The six types of Radiation Budget products are: 37 Day file, monthly radiation, seasonal radiation, monthly mean radiation, seasonal mean radiation and annual mean radiation budget products. These are described in the *NOAA Polar Orbiter Data Users Guide*, Section 5.4, which is available online at: http://www.ncdc.noaa.gov/oa/pod-guide/ncdc/docs/podug/html/c5/sec5-4.htm. There are seven months of these TIROS-N style products archived for NOAA-K (November 1998 through April 1999) which are available concurrently with the NOAA KLM style products for comparison/continuity purposes.

9.4 SOUNDING PRODUCTS (ATOVS AND AMSU-B)

Beginning with the NOAA-15 satellite, the sounding instrument suite was dramatically changed. The four-channel MSU instrument was replaced with a 20-channel AMSU instrument suite, AMSU-A for temperature and AMSU-B for moisture. The SSU instrument was dropped but AMSU-A essentially replaces its function. The HIRS, AMSU-A and AMSU-B instruments are described in Sections 3.2, 3.3 and 3.4, respectively. The ATOVS system is the 'TOVS' system for NOAA-15 and subsequent satellites. ATOVS uses the HIRS and AMSU-A to generate the retrieved profiles. The AVHRR instrument is used for cloud detection along with the HIRS and AMSU-A. The AMSU-B instrument is currently not part of the ATOVS system, primarily because of resource limitations in the development of the system. Therefore, the AMSU-B is processed independently of ATOVS using a slightly modified version of software developed and used to process the SSM/T-2 on the DMSP satellites. The AMSU-B system became operational

about one year after ATOVS because of satellite antenna interference in the AMSU-B data. NESDIS has expended a great deal of effort to reduce the interference and accurately account for the constant interference which remains. Refer to Appendix M for more details about the AMSU-B Bias Correction Algorithm.

NESDIS currently has the capability of producing a maximum of 370,000 soundings every 24 hours from two operational spacecraft. ATOVS from NOAA-15 generates about 300,000 retrievals every 24 hours with a 60 km resolution (40 km at nadir). AMSU-B from NOAA-15 generates about 1,400,000 moisture retrievals every 24 hours with a 15 km resolution and 15 km spacing between retrievals; the data are sampled to reduce the data volume by half. Section 9.4.1 describes the ATOVS format, while Section 9.4.2 describes the AMSU-B format.

9.4.1 ATOVS SOUNDING PRODUCT (APRIL 27, 1999 - PRESENT

The ATOVS archive (NOAA KLM series) is substantially different from the TOVS archive (TIROS-N, NOAA-6 through NOAA-14 series). Users that need a description of the format used for the TOVS Sounding Product between January 1979 and March 8, 1992, should refer to Section 5.1 of the *NOAA Polar Orbiter Data User's Guide*. ATOVS retrievals are made at 40 km spacing at nadir and up to 80 km at the limb. The ATOVS archive is actually four separate archive products. The first is the retrieval archive which is the full resolution archive of the ATOVS products, processed orbitally. The second archive is the metadata archive which consists of weekly statistics comparing the ATOVS retrievals to radiosonde data. The third archive is the Radiosonde Match Archive which contains radiosonde and retrieval data collocated in time and space. The final ATOVS archive product is the coefficient data base (CDB). The CDB contains the primary coefficients used in the generation of the ATOVS retrievals. Some coefficients are constants, others are satellite dependent and another set is updated on a weekly basis. The CDB is a very complex file and is not described in this section. Documentation about the CDB will be provided with any CDB product requested.

9.4.1.1 ATOVS Sounding Retrieval Archive Data File

The ATOVS retrieval archive data file contains complete sounding data, retrieval products and data quality flags. The Retrieval Archive Data File is in all integer format with data values scaled by values such as 64 or 128. The file contains records of length 1,000 bytes with a block size of 9,000 bytes. The first record in each file is the header record which is the same size as the data records and is described in Table 9.4.1.1-1. Records 2 through N (the number of records) contain the retrieval records, in that the data frame record N+1 contains the data frame header for the next data frame. A typical orbit has 28 data frames. The format of each ATOVS retrieval data record is described in Table 9.4.1.1-2. The archive product has been filtered for super adiabatic retrievals. Even though there is a super adiabatic flag it will always return no super adiabatic data. Precipitation contaminated data is included in the archive. However it is not advisable to use this data with the same weight as the rest of the product for temperature or moisture retrieval analysis. The ATOVS archive contains parameters that were not archived in TOVS or RTOVS. These are

cloud information (cloud top pressure and temperature, cloud amount) and radiation budget information (outgoing longwave radiation, layer cooling rates), and the sulfur dioxide content. These terms should be used with caution, even though they are archived as part of the ATOVS product, they are very new products and not fully proven for accuracy. The fill value for this file is -32768, missing is typically all I*2 bits set.

Table 9.4.1.1-1. Format of header record for ATOVS retrieval data file.

Starting Byte	I*4 Location	Length	# of values	Description
1	1	4	1	Number of data records in the file
5	2	4	1	First data record written in file (2)
9	3	4	1	Last data record written
13	4	4	1	Logical record length
17	5	4	1	Spacecraft ID
21	n/a	3	1	File type (RET)
25	n/a	8	1	Satellite name (e.g. NOAA 15)
34	n/a	44	1	File name
79	n/a	10	1	File creation data (YYYYMMDDHH)
89	23	4	1	Beginning orbit number
93	24	4	1	Ending orbit number
97	25	4	1	Time of first retrieval (YYYYMM)
101	26	4	1	Time of first retrieval (DDHH)
105	27	4	1	Time of first retrieval (mmss)
109	28	4	1	Time of last retrieval (YYYYMM)
113	29	4	1	Time of last retrieval (DDHH)
117	30	4	1	Time of last retrieval (mmss)
121	31-67	4	37	Spares

Table 9.4.1.1-2. Format of ATOVS Retrieval Data Record.					
Byte #	**Integer Index**	**# of Values**	**Length**	**Scale**	**Description**
1	1	1	2	n/a	Record type (2=data record)
3	2	1	2	n/a	Satellite number (XX from "NOAA-XX")
5	3	1	2	n/a	Data frame number from beginning of Level 1b data
7	4	1	2	n/a	Beginning orbit number
9	5	1	2	n/a	Ending orbit number
11	6	5	2	n/a	Spare
21	11	1	2	n/a	Surface elevation (m)
23	12	7	2	n/a	Spare
37	19	1	2	n/a	4-digit retrieval year
39	20	2	2	n/a	Valid forecast date/time (YYMM, DDHH)
43	22	1	2	n/a	Spare
45	23	1	2	n/a	Retrieval grid point number (counter over the retrieval grid of 28 spots by 20 lines)
47	24	1	2	128	Retrieval latitude (-90 to +90 degrees)
49	25	1	2	128	Retrieval longitude (-180 to +180 degrees)
51	26	3	2	n/a	Retrieval time (YYMM, DDHH, mmss)
57	29	1	2	n/a	Precipitation flag: 0=no precipitation; 1=precipitation

59	30	1	2	n/a	Terrain flag: 0=sea; 1=land; 2=coast; 10=sea ice; 11=snow
61	31	1	2	n/a	Day/Night flag: 0=night; 1=day.
63	32	1	2	n/a	Test or production version number
65	33	1	2	n/a	Processing flag: 0=unsuccessful; 1=successfully processed
67	34	1	2	128	Solar zenith angle (degrees)
69	35	1	2	128	Satellite (local) zenith angle (degrees)
71	36	1	2	n/a	Geographical index (bin number 1-23). (See Table 9.4.1.1-3.)
73	37	1	2	128	Solar azimuth angle (degrees)
75	38	1	2	n/a	HIRS spot number (1-56)
77	39	1	2	n/a	Orbital node: 1=ascending; 2=descending
79	40	1	2	n/a	Super adiabatic flag: 0=not super adiabatic; 1=super adiabatic between 700 mb and 1000 mb; 2=super adiabatic between 500 mb and 700 mb; 3=super adiabatic between 100 mb and 500 mb; 4=super adiabatic above 100 mb

81	41	1	2	n/a	Observation quality flag: 0=good; 2=failed gross temperature limits for HIRS and AMSU-A or is polar redundant or is super adiabatic, do not use for distribution, tuning or evaluation)
83	42	1	2	n/a	Retrieval flag: 0=clear; 32=cloudy; 48=no-HIRS (one or more HIRS channel is missing or out of bounds)
85	43	1	2	n/a	Spare
87	44	1	2	n/a	Spare
89	45	42	2	64	Retrieved temperature profile (K). See note 1.
173	87	40	2	64	Adjusted brightness temperatures (limb-corrected and cloud-detection performed) (K). See note 2.
253	127	35	2	64	Bias corrected, limb-corrected, cloud-detection performed brightness temperatures (K). See note 2.
323	162	35	2	64	Non-limb corrected, cloud-detection performed brightness temps (K). See note 2.
393	197	42	2	n/a	Geopotential heights (m). See note 1.
477	239	19	2	1024	Water vapor mixing ratios, ln (g/kg). See note 3.
515	258	1	2	64	Tropopause temperature (K)
517	259	1	2	n/a	Tropopause pressure (mb)
519	260	1	2	128	Total precipitable water (mm)
521	261	15	2	128	Layer precipitable water (mm). See note 4.

551	276	15	2	64	Layer mean virtual temperature (K). See note 4.
581	291	20	2	n/a	Layer thicknesses (m). See note 5.
621	311	1	2	n/a	Spare
623	312	1	2	n/a	Spare
625	313	1	2	n/a	Spare
627	314	9	2	n/a	Spare
645	323	1	2	64	Sea surface temperature from internal map (K) (set to missing when SST map has land but terrain map has sea).
647	324	1	2	64	Derived skin temperature value (K)
649	325	1	2		Surface model level (ATOVS pressure level which is the closest retrieval pressure level to the surface pressure. Always level 40 over sea.)
651	326	1	2	64	Retrieved surface temperature (Bt) (K)
653	327	1	2	64	Water Vapor corrected HIRS channel 8 (Bt) (K)
655	328	1	2	64	Surface temperature estimate for HIRS channel 8 (K)
657	329	1	2	64	Surface temperature estimate for HIRS channel 18 (K)
659	330	1	2	64	Surface temperature estimate for HIRS channel 19 (K)
661	331	42	2	64	First Guess temperature profile (K). See note 1.
743	373	19	2	1024	First Guess water vapor mixing ratio, ln (g/kg). See note 3.
783	392	35	2	64	First Guess radiance temperatures (K). See note 2.

853	427	1	2	64	NCEP forecast potential temperature (K)
855	428	1	2	256	NCEP forecast relative humidity (%)
857	429	1	2	64	NCEP forecast surface temperature (K)
859	430	1	2	10	Adjusted NCEP forecast surface pressure (mb)
861	431	1	2	10	Forecast pressure (mb)
863	432	1	2	100	Potential temperature time minus NCEP forecast time
865	433	1	2	512	Stability departure
867	434	1	2	512	Lower departure
869	435	1	2	512	Upper departure
871	436	1	2	n/a	Time difference (satellite minus forecast)
873	437	1	2	n/a	Stability forecast increment
875	438	1	2	n/a	Cloud liquid water (mm)
877	439	1	2	64	Cloud top temperature (K): 0=clear; -777=missing.
879	440	1	2	n/a	Cloud top pressure (mb): 1250=clear; -777=missing.
881	441	1	2	100	Cloud amount: 0=clear; -777=missing.
883	442	1	2	n/a	Total ozone (dobson units)
885	443	1	2	128	Total precipitable water from 300 mb to 500 mb (mm)
887	444	1	2	128	Total precipitable water from 500 mb to 700 mb (mm)

889	445	1	2	128	Total precipitable water from 700 mb to 1000 mb (mm)
891	446	1	2	n/a	Sulfur Dioxide (ppm or ppb)
893	447	1	2	n/a	Polar redundancy flag: -1=not redundant; 1=redundant.
895	448	1	2	10	Outgoing longwave radiation (W/m^2)
897	449	1	2	1000	Layer cooling rate (240 mb to 10 mb) (W/m^2)
899	450	1	2	1000	Layer cooling rate (500 mb to 240 mb) (W/m^2)
901	451	1	2	1000	Layer cooling rate (700 mb to 500 mb) (W/m^2)
903	452	1	2	1000	Layer cooling rate (1000 to 700 mb) (W/m^2)
905	453	1	2	n/a	Cloud comparison flag (cloud detection vs. cloud products): 0 (good) =clear retrieval + clear cloud algorithm 0 (good) = cloudy retrieval + cloudy cloud algorithm 1 (bad) = clear retrieval +cloudy cloud algorithm 2 (so-so)= cloudy retrieval + clear cloud algorithm
907	454	1	2	n/a	Library search closeness (pho) value
909	455	1	2	n/a	Super adiabatic level (1-42) (level where profile became super adiabatic - set to missing if no super adiabatic levels are found)
911	456	1	2	n/a	HIRS/AMSU-A gross temperature flag: 0=all temperatures within limits; 1=temperatures out of bounds.
913	457	44	2	n/a	Spare

Notes:

1. ATOVS Temperature Levels 1-40 in millibars (0.1, 0.2, 0.5, 1.0, 1.5, 2, 3, 4, 5, 7, 10, 15, 20, 25, 30, 50, 60, 70, 85, 100, 115, 135, 150, 200, 250, 300, 350, 400, 430, 475, 500, 570, 620, 700, 780, 850, 920, 950, 1000,1012, 1030). Geopotential heights are represented in meters from 115 to 1030 mb, and in decimeters from 0.1 through 100mb. Currently, the parameters for the 1012 and 1030 mb levels are not computed, but are planned for the future.

2. Channel ordering - HIRS channels 1-20 are stored first, then AMSU-A 1-15.

3. ATOVS Water Vapor levels 1-19 in millibars (200, 250, 300, 350, 400, 430, 475, 500, 570, 620, 700, 780, 850, 920, 950, 1000, 1012, and 1030). Currently, the parameters for the 1012 and 1030 mb levels are not computed, but are planned for the future.

4. ATOVS Layer temperature and moisture values 1-15 in millibars (7-10, 10-20, 20-30, 30-50, 50-70, 70-100, 100-150, 150-200, 200-250, 250-300, 300-400, 400-500, 500-700, 700-850, 850-1000). Although the moisture array goes to 7mb, moisture is computed to 200 mb, early ATOVS data goes to 300 mb.

5. Layer thicknesses 1-20 in millibars (100-115, 115-135, 135-150, 150-200, 200-250, 250-300, 300-350, 350-400, 400-470, 470-500, 500-570, 570-620, 620-700, 700-780, 780-850, 850-920, 920-950, 950-1000, 1000-1012, 1012-1030). The thickness below 1000mb is not currently computed but is planned for the future.

Table 9.4.1.1-3. Geographical Bins for ATOVS.

Class Number	Latitude Zone	Terrain	Day/Night
1	90N to 60N	Sea	Day/Night
2	60N to 45N	Sea	Day/Night
3	45N to 30N	Sea	Day/Night
4	30N to 15N	Sea	Day/Night
5	15N to 15S	Land/Sea	Day/Night
6	15S to 30S	Sea	Day/Night
7	30S to 45S	Sea	Day/Night
8	45S to 60S	Land/Sea	Day/Night

9	60S to 90S	Sea	Day/Night
10	90N to 60N	Land	Day
11	60N to 45N	Land	Day
12	45N to 30N	Land	Day
13	30N to15N	Land	Day
14	15S to 30S	Land	Day
15	30S to 45S	Land	Day
16	60S to 90S	Land	Day
17	90N to 60N	Land	Night
18	60N to 45N	Land	Night
19	45N to 30N	Land	Night
20	30N to 15N	Land	Night
21	15S to 30S	Land	Night
22	30S to 45S	Land	Night
23	60S to 90S	Land	Night

9.4.1.2 ATOVS Sounding Quality Information (Metadata Archive) File

This section describes the format for the ATOVS quality information file. Each week, one record of data is written to this file. The data records contain 3380 Integer*2 words. Each record contains data for six latitude zones: 90N to 60N, 60N to 30N, 30N to 0, 0 to 30S, 30S to 60S, and 60S to 90S. The file is a rotating file; the first record (header record) is updated each week and contains the start date (year, month, and date of the next week's data, the next available record and the maximum records on the file). There are four data files for each week of Metadata Statistics: 1) Level Temperature statistics; 2) Layer Temperature statistics; 3) Mixing Ratio statistics; and 4) Brightness Temperature statistics. Table 9.4.1.2-1 contains the format for the header record which is the first record in the metadata archive file. Table's 9.4.1.2-2, 9.4.1.2-3, 9.4.1.2-4 and 9.4.1.2-5 contain the formats of the data records.

Table 9.4.1.2-1. Format of Metadata Archive Header Record.					
Start Byte	**Data Type**	**# of Values**	**Length (bytes)**	**Scale**	**Description**
1	Char	1	2	n/a	Spare
3	Char	1	4	I*4	Next beginning year
7	Char	1	2	I*2	Next beginning month
9	Char	1	2	I*2	Next beginning day
11	Char	1	6	I*6	Spare
17	Char	1	2	I*2	Next record on file to write to
19	Char	1	6	I*6	Spare
25	Char	1	2	I*2	Maximum record on file to write to
27	Char	n/a	3853	n/a	Spares

Table 9.4.1.2-2. Format of Data Record 1 of Metadata archive file.

Data Record 1 - ATOVS Level temperature (40,4,6)
- 40 - levels
- 4 - statistics (1-mean, 2-root mean square, 3-standard deviation, and 4-sample size)
- 6 - zones

Start Byte	# of Values	Length (bytes)	Scale	Description
1	1	8	I*8	File record number
11	1	4	I*4	Beginning year of data
15	1	2	I*2	Beginning month of data
17	1	2	I*2	Beginning day of data (total of 7 days of data)
19	1	22	A*22	Information Character (i.e. ATOVS LEVEL TEMP STATS)
41	960	3840	(1..40,1..4,1..6)	Level temperatures statistics

41	240	960	(1..40,1,1..6)	Level temps Mean Difference from RAOB
1001	240	960	(1..40,2,1..6)	Root Mean Square
1961	240	960	(1..40,3,1..6)	Standard Deviation
2921	240	959	(1..40,4,1..6)	Sample Size

Table 9.4.1.2-3. Format of Data Record 2 of Metadata archive file.

Data Record 2 - Layer Thickness temperatures (20,4,6)
20 - layers
4 - statistics (1-mean, 2-root mean square, 3-standard deviation, and 4-sample size)
6 - zones

Start Byte	# of Values	Length (bytes)	Scale	Description
1	1	8	I*8	File record number
11	1	4	I*4	Beginning year of data
15	1	2	I*2	Beginning month of data
17	1	2	I*2	Beginning day of data (total of 7 days of data)
19	1	22	A*22	Information Character (i.e. LAYER THICK STATS)
41	480	1920	(1..20,1..4,1..6)	Layer Thickness Statistics
41	120	480	(1..20,1,1..6)	Layer Thickness Mean
521	120	480	(1..20,2,1..6)	Root Mean Square
1001	120	480	(1..20,3,1..6)	Standard Deviation
1481	120	480	(1..20,4,1..6)	Sample Size
1961	n/a	1919	n/a	Spares

Table 9.4.1.2-4. Format of Data Record 3 of Metadata archive file.				
Data Record 3 - Level Mixing Ratios (19,4,6) 19 - channels 4 - statistics (1-mean, 2-root mean square, 3-standard deviation, and 4-sample size) 6 - zones				
Start Byte	# of Values	Length (bytes)	Scale	Description
1	1	8	I*8	File record number
11	1	4	I*4	Beginning year of data
15	1	2	I*2	Beginning month of data
17	1	2	I*2	Beginning day of data (total of 7 days of data)
19	1	22	A*22	Information Character (i.e. LEVEL MIXING RATIOS)
41	456	1824	(1..19,1..4,1..6)	Level Mixing Ratios statistics
41	114	456	(1..19,1,1..6)	Level Mixing Ratios
497	114	456	(1..19,2,1..6)	Root Mean Square
953	114	456	(1..19,3,1..6)	Standard Deviation
1409	114	456	(1..19,4,1..6)	Sample Size
1865	n/a	2015	n/a	Spares

Table 9.4.1.2-5. Format of Data Record 4 of Metadata archive file.				
Data Record 4 - Brightness temperatures RAOB - Derived (35,4,6) 35 - 20 HIRS & 15 AMSU-A channels 4 - statistics (1-mean, 2-root mean square, 3-standard deviation, and 4-sample size) 6 - zones				
Start Byte	**# of Values**	**Length (bytes)**	**Scale**	**Description**
1	1	8	I*8	File record number

11	1	4	I*4	Beginning year of data
15	1	2	I*2	Beginning month of data
17	1	2	I*2	Beginning day of data (total of 7 days of data)
19	1	22	A*22	Information Character (i.e. BRI TEMP DER STATS)
41	840	3360	(1..35,1..4,1..6)	Layer Thickness Statistics
41	210	840	(1..35,1,1..6)	Layer Thickness Mean
881	210	840	(1..35,2,1..6)	Root Mean Square
1721	210	840	(1..35,3,1..6)	Standard Deviation
2661	210	840	(1..35,4,1..6)	Sample Size
3601	n/a	279	n/a	Spares

9.4.1.3 ATOVS Radiosonde Matchup Archive File

The ATOVS data matched to radiosondes will be added to the suite of archived sounding products. The matchups of retrieval and radiosonde have gone through an extensive screening process. Thus, both profiles in the file are considered as 'good' and used as input to the retrieval process. The records in this file are 3,000 bytes in length. Table 9.4.1.3-1 contains the format of the header record for the radiosonde matchup file. Each bin or class also has a header record which is described in Table 9.4.1.3-2. The radiosonde standard levels (in millibars) are: 5, 7, 10, 20, 30, 50, 70, 100, 150, 200, 250, 300, 400, 500, 700, 850 and 1000.

Table 9.4.1.3-1. Format of Header Record for Radiosonde Matchup File.

Byte	Integer Index	Data Type	# of Values	Length	Scale	Description
1	1	Int	1	4	n/a	Date of last file update (YYYYMMDD)
5	2	Int	1	4	n/a	Number of records in the file
9	3	Int	1	4	n/a	Last record containing valid data

13	4	Int	1	4	n/a	Data of most recent data (YYYYMMDD)
17	5	Int	1	4	n/a	File Type: 1=clear; 2=cloudy
21	6	Int	1	4	n/a	Satellite ID (i.e., 15 for NOAA-15)
25	7	Int	3	4	n/a	Spare
37	10	Int	1	4	n/a	Number of classes in the file
41	11	Int	1	4	n/a	First record for class 1
45	12	Int	1	4	n/a	First record for class 2
49	13	Int	1	4	n/a	First record for class 3
53	14	Int	1	4	n/a	First record for class 4
57	15	Int	1	4	n/a	First record for class 5
61	16	Int	1	4	n/a	First record for class 6
65	17	Int	1	4	n/a	First record for class 7
69	18	Int	1	4	n/a	First record for class 8
73	19	Int	1	4	n/a	First record for class 9
77	20	Int	1	4	n/a	First record for class 10
81	21	Int	1	4	n/a	First record for class 11
85	22	Int	1	4	n/a	First record for class 12
89	23	Int	1	4	n/a	First record for class 13
93	24	Int	1	4	n/a	First record for class 14
97	25	Int	1	4	n/a	First record for class 15
101	26	Int	1	4	n/a	First record for class 16
105	27	Int	1	4	n/a	First record for class 17
109	28	Int	1	4	n/a	First record for class 18

113	29	Int	1	4	n/a	First record for class 19
117	30	Int	1	4	n/a	First record for class 20
121	31	Int	1	4	n/a	First record for class 21
125	32	Int	1	4	n/a	First record for class 22
129	33	Int	1	4	n/a	First record for class 23
133	34	Int	716	4	n/a	Spare

Table 9.4.1.3-2. Format of Class Header Record for Radiosonde Matchup File.

Byte	Int Index	Data Type	# of Values	Length (bytes)	Scale	Description
1	1	Int	1	2	n/a	Record type (1=class header record)
3	2	Int	1	2	n/a	Class number
5	3	Int	1	2	n/a	Maximum number of matchups in this class
7	4	Int	1	2	n/a	Actual number of matchups in this class
9	5	Int	1	2	n/a	First data record within this class
11	6	Int	1	2	n/a	Last data record within this class
13	7	Int	1493	2	n/a	Spare

Table 9.4.1.3-3 contains the format of the data records in the radiosonde matchup file.

Table 9.4.1.3-3. Format of Data Records for the Radiosonde Matchup File.

Start Byte	Int Index	# of Values	Length	Scale	Description
Retrieved Data					

1	1	1	2	n/a	Record type (2=data record)
3	2	1	2	n/a	Satellite number (XX from "NOAA-XX")
5	3	1	2	n/a	Data frame number from beginning of Level 1b data
7	4	1	2	n/a	Beginning orbit number
9	5	1	2	n/a	Ending orbit number
11	6	5	2	n/a	Spares
21	11	1	2	n/a	Surface elevation (m)
23	12	7	2	n/a	Spares
37	19	1	2	n/a	4-digit retrieval year
39	20	2	2	n/a	Valid forecast date/time (YYMM, DDHH)
43	22	1	2	n/a	Spare
45	23	1	2	n/a	Retrieval grid point number (counter over the retrieval grid of 28 spots by 20 lines)
47	24	1	2	128	Retrieval latitude (-90 to +90 degrees)
49	25	1	2	128	Retrieval longitude (-180 to +180 degrees)
51	26	3	2	n/a	Retrieval time (YYMM, DDHH, mmss)
57	29	1	2	n/a	Precipitation flag: 0=no precip; 1=precip
59	30	1	2	n/a	Terrain flag: 0=sea; 1=land; 2=coast; 10= sea ice; 11=snow.

61	31	1	2	n/a	Day/Night flag: 0=night; 1=day.
63	32	1	2	n/a	Test or production version number
65	33	1	2	n/a	Processing flag: 0=unsuccessful; 1=successfully processed.
67	34	1	2	128	Solar zenith angle (degrees)
69	35	1	2	128	Satellite (local) zenith angle (degrees)
71	36	1	2	n/a	Geographical index (bin number 1-23) See Table 9.4.3-2a.
73	37	1	2	128	Solar azimuth angle (degrees)
75	38	1	2	n/a	HIRS spot number (1-56)
77	39	1	2	n/a	Orbital node: 1=ascending; 2=descending.
79	40	1	2	n/a	Super adiabatic flag: 0=not super adiabatic; 1=super adiabatic between 700mb and 1000mb; 2=super adiabatic between 500mb and 700mb; 3=super adiabatic between 100mb and 500mb; 4=super adiabatic above 100mb.
81	41	1	2	n/a	Observation quality flag: 0=good; 2=failed gross temperature limits for HIRS and AMSU-A or is polar redundant or is super adiabatic.

83	42	1	2	n/a	Retrieval flag: 0=clear; 32=cloudy; 48=no HIRS (one or more HIRS channels missing or out of bounds).
85	43	1	2	n/a	Spare
87	44	1	2	n/a	Spare
89	45	42	2	64	Retrieved temperature profile (K)
173	87	40	2	64	Adjusted brightness temperatures (limb-corrected and cloud-detection performed) (K)
253	127	35	2	64	Bias corrected, Limb-corrected, cloud detection performed brightness temperatures (K)
323	162	35	2	64	Non-limb corrected, cloud detection performed brightness temperatures (K)
393	197	42	2	n/a	Geopotential heights (m)
477	239	19	2	1024	Water vapor mixing ratios, ln (g/kg)
515	258	1	2	64	Tropopause temperature (K)
517	259	1	2	n/a	Tropopause pressure (mb)
519	260	1	2	128	Total precipitable water (mm)
521	261	15	2	128	Layer precipitable water (mm)
551	276	15	2	64	Layer mean virtual temperature (K)
581	291	20	2	n/a	Layer thicknesses (m)
621	311	1	2	n/a	Spare
623	312	1	2	n/a	Spare
625	313	1	2	n/a	Spare
627	314	9	2	n/a	Spare

645	323	1	2	64	Sea surface temperature from internal map (K) (Set to missing when SST map has land but terrain map has sea.)
647	324	1	2	64	Derived skin temperature value (K)
649	325	1	2	n/a	Surface model level (ATOVS level closest to surface elevation)
651	326	1	2	64	Retrieved surface temperature (Bt) (K)
653	327	1	2	64	Water Vapor corrected HIRS channel 8 (Bt) (K)
655	328	1	2	64	Surface temperature estimate for HIRS channel 8 (K)
657	329	1	2	64	Surface temperature estimate for HIRS channel 18 (K)
659	330	1	2	64	Surface temperature estimate for HIRS channel 19 (K)
661	331	42	2	64	First Guess temperature profile (K)
745	373	19	2	1024	First Guess water vapor mixing ratio, ln (g/kg)
783	392	35	2	64	First Guess radiance temperatures (K)
853	427	1	2	64	NCEP forecast potential temperature (K)
855	428	1	2	256	NCEP forecast relative humidity (%)
857	429	1	2	64	NCEP forecast surface temperature (K)
859	430	1	2	10	Adjusted NCEP forecast surface pressure (mb)
861	431	1	2	10	Forecast pressure (mb)
863	432	1	2	100	Potential temperature time minus NCEP forecast time
865	433	1	2	512	Stability departure

867	434	1	2	512	Lower departure
869	435	1	2	512	Upper departure
871	436	1	2	n/a	Time difference (satellite minus forecast)
873	437	1	2	n/a	Stability forecast increment
875	438	1	2	n/a	Cloud liquid water (mm)
877	439	1	2	64	Cloud top temperature (K): 0=clear; -777=missing.
879	440	1	2	n/a	Cloud top pressure (mb): 1250=clear; -777 = missing.
881	441	1	2	100	Cloud amount: 0=clear; -777 = missing.
883	442	1	2	n/a	Total ozone (dobson)
885	443	1	2	128	Total precipitable water from 300 to 500mb (mm)
887	444	1	2	128	Total precipitable water from 500 to 700mb (mm)
889	445	1	2	128	Total precipitable water from 700 to 1000mb (mm)
891	446	1	2	n/a	Sulfur Dioxide (ppm or ppb)
893	447	1	2	n/a	Polar redundancy flag: -1=not redundant; 1=redundant.
895	448	1	2	10	Outgoing longwave radiation (W/m^2)
897	449	1	2	1000	Layer cooling rate from 240mb to 10mb (W/m^2)
899	450	1	2	1000	Layer cooling rate from 500mb to 240mb (W/m^2)

901	451	1	2	1000	Layer cooling rate from 700mb to 500mb (W/m^2)
903	452	1	2	1000	Layer cooling rate from 1000mb to 700mb (W/m^2)
905	453	1	2	n/a	Cloud comparison flag (cloud detection vs. cloud products): Clear retrieval + Clear cloud algorithm =0 (good); Cloudy retrieval + cloudy cloud algorithm = 0 (good); Clear retrieval + cloudy cloud algorithm = 1 (bad); Cloudy retrieval + clear cloud algorithm = 2 (so-so).
907	454	1	2	n/a	Library search closeness (pho) value
909	455	1	2	n/a	Super adiabatic level (1-42)
911	456	1	2	n/a	HIRS/AMSU-A gross temperature flag: 0= all temperatures within limits; 1 = one or more temperatures out of bounds.
913	457	44	2	n/a	Spares
Matchup Information					
1001	501	1	2	n/a	Matchup test pass/fail flag: 0=pass; 1=fail.
1003	502	8	2	n/a	Matchup test flags
1019	510	13	2	n/a	Spares
1045	523	1	2	n/a	Archive Flag: 1 = record has been written to Archive (Matchup Database Holding and Archive files only).
1047	524	1	2	n/a	Library flag: 0=not used in library; 1=used in library.

1049	525	1	2	n/a	Difference in time (hours) between RAOB/Retrieval
1051	526	1	2	n/a	Difference in distance (km) between RAOB/Retrieval
1053	527	1	2	64	Closeness parameter
1055	528	1	2	n/a	Matchup Utility Index
Radiosonde Data					
1057	529	1	2	n/a	Radiosonde station ID (ASCII(1st char)*100 + (ASCII(2nd char))
1059	530	1	2	n/a	Radiosonde station ID (ASCII(3rd char)*100 + (ASCII(4th char))
1061	531	1	2	n/a	Radiosonde station ID (ASCII(5th char)*100 + (ASCII(6th char))
1063	532	3	2	n/a	Radiosonde day of synoptic report (YY, MM, DD)
1069	535	3	2	n/a	Radiosonde balloon release date (YY, MM, DD)
1075	538	1	2	100	Radiosonde observation time (hours in UTC)
1077	539	1	2	128	Radiosonde latitude (-90 to +90 degrees)
1079	540	1	2	128	Radiosonde longitude (-180 to +180 degrees)
1081	541	1	2	n/a	Radiosonde station elevation (m)
1083	542	1	2	n/a	Radiosonde instrument type
1085	543	1	2	n/a	Radiosonde report type
1087	544	1	2	n/a	Radiosonde terrain : 0=sea; 1 =land; 2=coast.

1089	545	1	2	64	Lowest reported pressure (mb)
1091	546	1	2	64	Highest reported pressure (mb)
Radiosonde test flags (0=pass, 1=fail)					
1093	547	1	2	n/a	Radiosonde pass/fail flag
1095	548	1	2	n/a	Vertical extent flag
1097	549	1	2	n/a	Data gap flag
1099	550	1	2	n/a	Profile super adiabatic flag
1101	551	1	2	n/a	Profile inversion flag
1103	552	1	2	n/a	Spare
1105	553	1	2	n/a	Profile climatological limits flag
1107	554	1	2	n/a	Spare
Radiosonde quality flags (0=pass, 1=fail)					
1109	555	1	2	n/a	Standard level relative humidity not within limits flag
1111	556	1	2	n/a	Standard level relative humidity missing flag
1113	557	1	2	n/a	Standard level temperature not within limits flag
1115	558	1	2	n/a	Tropopause temperature not within limits flag
1117	559	1	2	n/a	Standard level temperature inaccurate flag
1119	560	1	2	n/a	Tropopause temperature inaccurate flag
1121	561	1	2	n/a	Data gaps in temperature data flag
1123	562	1	2	n/a	Radiosonde vertical extent failure flag
1125	563	1	2	n/a	Standard level relative humidity inaccurate flag

1127	564	1	2	n/a	Significant level relative humidity missing flag
1129	565	1	2	n/a	Significant level relative humidity vertical extent flag
1131	566	1	2	n/a	Tropopause pressure limits flag
1133	567	1	2	n/a	Super adiabatic layers flag
1135	568	1	2	n/a	Temperature inversions flag
1137	569	1	2	n/a	Tropopause data missing flag
1139	570	1	2	n/a	Surface inversion flag
1141	571-612	42	2	64	Radiosonde temperatures (C)
1225	613-631	19	2	1024	Radiosonde water vapor mixing ratios (ln g/kg)
1263	632	1	2	n/a	Radiosonde tropopause temperature (C)
1265	633	1	2	n/a	Radiosonde tropopause pressure (mb)
1267	634	1	2	n/a	Radiosonde surface pressure (mb)
1269	635	1	2	n/a	Radiosonde surface temperature (C)
1271	636	1	2	1024	Radiosonde surface water vapor mixing ratio (ln g/kg)
1273	637	1	2	1024	Water vapor mixing ratio at lowest reported level (ln g/kg)
1275	638	1	2	1024	Water vapor mixing ratio at highest reported level (ln g/kg)
1277	639	3	2	100	Layer precipitable water from reported Radiosonde data (mm)
1283	642	1	2	100	Total precipitable water from reported Radiosonde data (mm)
1285	643	18	2	100	Layer precipitable water from extrapolated RAOB data (mm)

1321	661	16	2	n/a	Spares
Category 1 Radiosonde Data (standard levels)					
1353	677	17	2	n/a	Standard level geopotential heights (m)
1387	694	17	2	10	Standard level temperatures (C)
1421	711	17	2	10	Standard level dewpoint depressions (C)
1455	728	17	2	n/a	Standard level wind direction (degrees)
1489	745	17	2	n/a	Standard level wind speed (knots)
1523	762	17	2	n/a	Standard level geopotential height QC flags (ASCII)
1557	779	17	2	n/a	Standard level temperature QC flags (ASCII)
1591	796	17	2	n/a	Standard level dewpoint depression QC flags (ASCII)
1625	813	17	2	n/a	Standard level wind QC flags (ASCII)
1659	830	17	2	n/a	Standard level "missing" flags (ASCII)
Category 2 Radiosonde Data (significant levels)					
1693	847	1	2	n/a	Number of significant levels
1695	848	50	2	10	Significant level pressure (mb)
1795	898	50	2	10	Significant level temperature (C)
1895	948	50	2	10	Significant level dewpoint depression (C)
1995	998	50	2	n/a	Significant level pressure QC flags (ASCII)
2095	1048	50	2	n/a	Significant level temperature QC flags (ASCII)
2195	1098	50	2	n/a	Significant level dewpoint depression QC flags (ASCII)

2295	1148	50	2	n/a	Significant level spare QC flags (ASCII)
2395	1198	50	2	n/a	Significant level "missing" flags (ASCII)
Category 3 Radiosonde Data (wind data)					
2495	1248	1	2	n/a	Number of wind levels
2497	1249	25	2	10	Wind level pressure (mb)
2547	1274	25	2	n/a	Wind direction (degrees)
2597	1299	25	2	n/a	Wind speed (knots)
2647	1324	25	2	n/a	Wind level pressure QC flags (ASCII)
2697	1349	25	2	n/a	Wind level wind QC flags (ACSII)
2747	1374	25	2	n/a	Wind level spare QC flags (ASCII)
2797	1399	25	2	n/a	Wind level spare QC flags (ASCII)
Category 5 Radiosonde Data (tropopause data)					
2847	1424	2	2	10	Tropopause pressure (mb)
2851	1426	2	2	10	Tropopause temperature (C)
2855	1428	2	2	10	Tropopause dewpoint depression (C)
2859	1430	2	2	n/a	Tropopause wind direction (degrees)
2863	1432	2	2	n/a	Tropopause wind speed (knots)
2867	1434	2	2	n/a	Tropopause level pressure QC flags (ASCII)
2871	1436	2	2	n/a	Tropopause level temperature QC flags (ASCII)
2875	1438	2	2	n/a	Tropopause level dewpoint depression QC flags (ASCII)
2879	1440	2	2	n/a	Tropopause level wind QC flags (ASCII)

2883	1442	2	2	n/a	Tropopause "missing" flags (ASCII)
Category 7 Radiosonde Data (cloud cover)					
2887	1444	1	2	n/a	Number of cloud levels (0 or 1)
2889	1445	1	2	10	Pressure at bottom of clouds (mb)
2891	1446	1	2	n/a	Cloud cover percentage increments of 5, (less than 5% reported as 0)
2893	1447-1500	54	2	n/a	Spares

9.4.2 AMSU-B SOUNDING PRODUCTS

In addition to the ATOVS products, NOAA KLM also generates AMSU-B data from which moisture products are generated. The AMSU-B instrument has a FOV of 15 km. The data generated from the AMSU-B instrument is sampled by skipping every other FOV. This generates a product of about 30 km spacing with a maximum of 100,000 retrievals per orbit.

Each archive file consists of all valid sounding data extracted from the original retrieval file for the most recent AMSU-B orbit. Except for the header record, an orbit archive file has all integer terms with data values scaled by numbers such as 64 and 128. The archive file has a block size of 10,720 bytes with record lengths of 268 bytes. The first record of the database is the header (see Table 9.4.2-1) which provides information such as the last record written and the number of records. The header record uses I*4 words and is the same size as the data records (268 bytes).

Table 9.4.2-1. Header Record Format of Orbit Archive File.

Starting Byte	I*4 Location	Length (bytes)	# of values	Description
1	1	4	1	Number of data records in the file
5	2	4	1	First data record written in file (2)
9	3	4	1	Last data record written
13	4	4	1	Logical record length
17	5	4	1	Spacecraft ID
21	n/a	3	1	File type (RET)

25	n/a	8	1	Satellite name (NOAA-xx)
34	n/a	44	1	File name
79	n/a	10	1	File creation date (YYYYMMDDHH)
89	23	4	1	Beginning orbit number
93	24	4	1	Ending orbit number
97	25	4	1	Time of first retrieval (YYYYMM)
101	26	4	1	Time of first retrieval (DDHH)
105	27	4	1	Time of first retrieval (mmss)
109	28	4	1	Time of last retrieval (YYYYMM)
113	29	4	1	Time of last retrieval (DDHH)
117	30	4	1	Time of last retrieval (mmss)
121	31-67	4	1	Spares

Records 2 through N (the number of records) contain the retrieval records. Table 9.4.2-2 contains the format of the retrieval data records.

Table 9.4.2-2. Format of Orbit Archive File Retrieval Data Records.

Starting Byte	I*2 Location	Length (bytes)	# of Values	Scaling Factor	Description
1	1	2	1	1	Record type (2=data record)
3	2	2	1	1	FOV number in the scan line
5	3	2	1	1	Spare
7	4	2	1	1	Orbit number
9	5	2	1	1	FOV time (YYMM)
11	6	2	1	1	FOV (DDHH)
13	7	2	1	1	FOV (mmss)
15	8	2	1	128	FOV latitude (degrees)

17	9	2	1	128	FOV longitude (degrees)
19	10	2	1	128	Solar zenith angle (degrees)
21	11	2	1	128	Satellite zenith angle (degrees)
23	12	2	1	1	Terrain type 0=sea; 1=land; 2=coast; 16=ice; 17=snow.
25	13	2	1	1	Surface elevation (m)
27	14	2	1	1	Surface pressure (mb)
29	15	2	1	64	Skin temperature (K)
31	16	2	1	1	Day/Night indicator 0=night, 1=day.
33	17	2	3	1	Channel combination flag
39	20	2	1	1	Observation quality flag
41	21	2	15	1024	Natural log of AMSU-B water vapor mixing ratios (g/kg)
71	36	2	5	64	Limb corrected AMSU-B temperatures (K)
81	41	2	5	64	Bias Corrected observed AMSU-B temperatures (K)
91	46	2	5	64	First Guess bias corrected AMSU-B temperatures (K)
101	51	2	15	1024	Natural log of first guess water vapor mixing ratios (g/kg)
131	66	2	1	1	First Guess temperature profile flag
133	67	2	40	64	First Guess temperature profile
213	107	2	7	64	Spares

227	114	2	1	1	Forecast increment
229	115	2	1	64	Forecast potential temperature (K)
231	116	2	1	64	Forecast surface air temperature (K)
233	117	2	1	10	Forecast surface pressure (mb)
235	118	2	1	1	Forecast relative humidity (%)
237	119	2	1	1	Retrieval - forecast time difference
239	120	2	1	100	Cloud liquid water (cm)
241	121	2	3	100	Layer precipitable water (cm)
247	124	2	1	64	First Guess skin temperature (K)
249	125	2	1	64	First Guess surface temperature (K)
251	126	2	1	10	First Guess surface pressure (mb)
253	127	2	1	1	First Guess relative humidity (%)
255	128	2	1	1	Scan number
257	129	2	5	64	AMSU-B antenna temperature (K)
267	134	2	1	100	Total precipitable water (cm)

9.4.2.1 AMSU-B Metadata Archive File

The AMSU-B Metadata Archive File is a rotating file. The first record is updated each week and contains the start date (year, month, and day of the next week's data, the next available record and the maximum records on the file). The metadata archive file consists of a header record (1,000 bytes), followed by two data files for each week of metadata statistics: one file contains mixing ratio statistics, the other file contains brightness temperature statistics. Table 9.4.2.1-1 contains the format for the header record of the AMSU-B metadata archive file. Tables' 9.4.2.1-2 and 9.4.2.1-3 contain the formats of the data files.

Table 9.4.2.1-1. Format of the Header Record of the AMSU-B Metadata Archive File.

Start Byte	Data Type	# of values	Length (bytes)	Dimension	Description
1	C	1	1	n/a	Spare

2	C	1	10	I10	Next beginning year
11	C	1	10	I10	Next beginning month
21	C	1	10	I10	Next beginning day
31	C	1	10	I10	Next record on file to write to
41	C	1	10	I10	Maximum record on file to write to
51	C	n/a	950	n/a	Spares

Table 9.4.2.1-2. Format of AMSU-B Metadata Archive File, Data Record A (Mixing Ratios) (15, 4, and 6).

15 levels (300, 350, 400, 430, 475, 500, 570, 620, 670, 700, 780, 850, 920, 950, 1000 mb)
4 statistics (1 - mean, 2 - root mean square, 3 - standard deviation, 4 - sample size)
6 zones (90.0 to 60.0, 60.0 to 30.0, 30.0 to 0.0, 0.0 to -30.0, -30.0 to -60.0 and -60.0 to-90.0 degrees latitude)

Start Byte	# of values	Length (bytes)	Dimension	Description
1	1	6	I*6	File record number
7	1	6	I*6	Beginning year of data
13	1	6	I*6	Beginning month of data
19	1	6	I*6	Beginning day of data (total of 7 days of data)
25	1	36	A*36	Information Character (i.e., MIXING RATIO STATISTICS)
61	360	780	(15,4,6)	Mixing Ratio Statistics
	90	180	(1,1,1)	Mixing ratio mean difference from RAOB
	90	180	(1,2,1)	Root mean square
	90	180	(1,3,1)	Standard Deviation
	90	180	(1,4,1)	Sample Size
781	n/a	220	n/a	Spares

Table 9.4.2.1-3. Format of AMSU-B Metadata Archive File, Data Record B (Brightness Temperatures) (5,4,6).				
5 channels (channels 1 through 5) 4 statistics (1 - mean, 2 - root mean square, 3 - standard deviation, 4 - sample size) 6 zones (90.0 to 60.0, 60.0 to 30.0, 30.0 to 0.0, 0.0 to -30.0, -30.0 to -60.0 and -60.0 to-90.0 degrees latitude)				
Start Byte	**# of values**	**Length (bytes)**	**Dimension**	**Description**
1	1	6	I*6	File record number
7	1	6	I*6	Beginning year of data
13	1	6	I*6	Beginning month of data
19	1	6	I6	Beginning day of data (total of 7 days of data)
25	1	36	A*36	Information Character (i.e., BRIGHTNESS TEMP STATISTICS)
61	120	300	(5,4,6)	Brightness Temperature Statistics
	30	60	(1,1,1)	Brightness Temperature Mean difference from RAOB derived
	30	60	(1,2,1)	Root mean square
	30	60	(1,3,1)	Standard Deviation
	30	60	(1,4,1)	Sample Size
301	n/a	700	n/a	Spares

9.4.2.2 AMSU-B Radiosonde Match Archive

A new radiosonde match archive file is created once a month. Each archive file consists of all valid retrieval-radiosonde matches extracted from the AMSU-B Match Archive for the previous month. Except for the header record, the radiosonde match archive file is in all integer format with data values either unscaled or scaled by values from 64 to 1024. The header record provides information such as the last record written and the number of records. All integer values in the header are four bytes long. The records are 2,484 bytes in length with a block size of 27,324 bytes. Table 9.4.2.2-1 contains the format of the header record and Table 9.4.2.2-2 contains the format of the data records for the radiosonde match archive file. In the data records, real values have been stored in I*2 format after first multiplying the real value by the scaling factor.

Table 9.4.2.2-1. Format of Header record for AMSU-B Radiosonde Match Archive File.				
Starting Byte	**I*4 Location**	**Length (bytes)**	**# of values**	**Description**
1	1	4	1	Number of data records in the file
5	2	4	1	First data record written in file (2)
9	3	4	1	Last data record written
13	4	4	1	Logical record length
17	5	4	1	Spacecraft ID
21	n/a	3	1	File type (‘ARC’)
25	n/a	6	1	Satellite name (‘NOAA xx’)
31	n/a	1	3	Spares
34	n/a	24	1	File name
58	n/a	1	3	Spares
61	n/a	8	1	File creating date (YYYYMMDD)
69	n/a	20	1	Spare
89	23	4	1	Time of first retrieval (YYYYMM)
93	24	4	1	Time of first retrieval (DDHH)
97	25	4	1	Time of first retrieval (mmss)
101	26	4	1	Time of last retrieval (YYYYMM)
105	27	4	1	Time of last retrieval (DDHH)
109	28	4	1	Time of last retrieval (mmss)
113	29-621	4	2368	Spare

Table 9.4.2.2-2. Format of Data record for AMSU-B Radiosonde Match Archive File.					
Start Byte	**Integer Location**	**Length (bytes)**	**# of values**	**Scale**	**Description**

1	n/a	6	1	1	Radiosonde station ID
7	4	2	1	128	Station latitude (-90 to 90 degrees)
9	5	2	1	128	Station longitude (-180 to 180 degrees)
11	6	2	1	1	Station elevation (m)
13	n/a	8	1	1	Satellite ID (‘NOAA xx’)
21	11	2	1	128	Retrieval latitude (-90 to 90 degrees)
23	12	2	1	128	Retrieval longitude (-180 to 180 degrees)
25	13	2	3	1	Retrieval time [1]
31	16	2	1	1	Orbit Number
33	17	2	1	1	Beam position
35	18	2	1	1	Archive flag (1=archived)
37	n/a	1	2	1	Spare
Satellite Observations:					
39	20	2	1	128	Solar Zenith angle (degrees)
41	21	2	1	128	Satellite Zenith angle (degrees)
43	n/a	1	1	1	Terrain flag 0=sea, 1=land, 2=coast, 10=sea ice, 11=snow
44	n/a	1	1	1	Spare
45	23	2	1	1	Surface Elevation (m)
47	24	2	1	1	Surface Pressure (mb)
49	25	2	1	64	Mapped skin temp (NCEP SST) (K)
51	n/a	1	1	1	Day/night flag 0=night, 1=day

52	n/a	1	6	1	Channel combination
58	n/a	1	1	1	Observation quality flag [2]
59	30	2	15	1024	Retrieved water vapor mix ratios [3] (g/kg)
89	45	2	5	64	Limb corrected brightness temperatures (K)
99	50	2	5	64	Bias corrected brightness temperatures (K)
109	55	2	5	64	First Guess brightness temperatures (K)
119	60	2	15	1024	First Guess mixing ratios [3] (g/kg)
149	75	1	1	1	First Guess temperature profile flag
150	n/a	1	1	1	Spare
151	76	2	40	64	First Guess atmospheric temperatures (K) (set to missing)
231	116	2	7	1	Spares
245	123	1	1	1	Forecast increment
246	n/a	1	1	1	Extrapolation flag (set to ‘0')
247	124	2	1	64	Forecast potential temperature (K)
249	125	2	1	64	Forecast surface air temperature (K)
251	126	2	1	10	Forecast surface pressure (mb)
253	127	2	1	1	Forecast relative humidity (%)
255	128	2	1	1	Retrieval-Forecast time difference
257	129	2	1	100	Cloud liquid water (g/cm^2)
259	130	2	3	512	Layer precipitable water (cm)
265	133	2	1	64	First Guess potential temperature/surface air temperature (K)
267	134	2	1	1	First Guess humidity (%)
269	135	2	1	64	First Guess skin temperature (K)
Interpolated Radiosonde Profile:					

271	136	2	40	64	Interpolated atmospheric temperatures (K)
351	176	2	15	1024	Interpolated water vapor mixing ratios [3] (g/kg)
381	191	2	1	64	Interpolated tropopause temperatures (K)
383	192	2	1	1	Interpolated tropopause pressure (mb)
385	193	2	1	1	Interpolated surface pressure (mb)
387	194	2	1	64	Interpolated surface temperature (K)
389	195	2	1	1024	Interpolated surface mixing ratio [3] (g/kg)
391	196	2	1	100	RAOB profile used: 0=preceding RAOB used 1=succeeding RAOB used
393	197	2	5	64	Simulated RAOB brightness temperatures (K)
403	202	2	1	1	Highest level reached by RAOB
405	203	2	1	1	Lowest level reached by RAOB
407	n/a	1	1	1	Primary/secondary matchup flag: 1=primary; 2=secondary.
408	n/a	1	12	1	Screening flags
420	n/a	1	1	1	Spare
421	211	2	3	100	Layer Precipitable Water (cm)
427	214	2	1	100	Total Precipitable Water (cm)
429	n/a	1	8	1	Spare
Preceding Radiosonde Station Report:					
437	n/a	6	1	1	Radiosonde station ID
443	n/a	2	3	1	Day of synoptic report [4]
449	n/a	2	3	1	Balloon release date [5]
455	228	2	1	100	Observation time (UTC hours)

457	229	2	1	128	Latitude (-90 to 90 degrees)
459	230	2	1	128	Longitude (-180 to 180 degrees)
461	231	2	1	1	Station elevation (m)
463	232	2	1	1	Instrument type
465	233	2	1	1	Report type
Preceding Radiosonde Station Report Category 1 Data (Standard Levels):					
17 successive levels from 1000 mb of the following information: starting byte = 466 + 14 x (level-1) + starting byte integer position = 233 +7(level-1) + integer location xx = 01 to 17					
1	n/a	2	1	1	Geopotential height (m)
3	n/a	2	1	10	Temperature (C)
5	n/a	2	1	10	Dewpoint depression (C)
7	n/a	2	1	1	Wind direction (degrees)
9	n/a	2	1	1	Wind speed (knots)
11	n/a	1	1	1	Geopotential height QC flag
12	n/a	1	1	1	NCEP temperature QC flag
13	n/a	1	1	1	NCEP dewpoint QC flag
14	n/a	1	1	1	NCEP wind QC flag
Preceding Radiosonde Station Report Category 2 Data (Significant Levels):					
705	353	2	1	1	Number of significant levels
50 successive levels from the surface of the following information: starting byte = 706 + 10 x (level-1) + starting byte integer position = 353 + 5 x (level-1) + integer location xx = 01 to 50					
1	1	2	1	10	Pressure (mb)
3	2	2	1	10	Temperature (C)

5	3	2	1	10	Dewpoint depression (C)
7	n/a	1	1	1	NCEP Pressure QC flag
8	n/a	1	1	1	NCEP temperature QC flag
9	n/a	1	1	1	NCEP dewpoint QC flag
10	n/a	1	1	1	Spare flag
Preceding Radiosonde Station Report Category 3 Data (Winds):					
1,207	604	2	1	1	Number of significant wind levels
25 successive levels from the surface of the following information: starting byte = 1,208 + 8 x (level -1) + starting byte integer position = 604 + 4 x (level-1) + integer location xx = 01 to 25					
1	1	2	1	10	Pressure (mb)
3	2	2	1	1	Wind direction (degrees)
5	3	2	1	1	Wind speed (knots)
7	n/a	1	1	1	NCEP pressure QC flag
8	n/a	1	1	1	NCEP wind QC flag
Preceding Radiosonde Station Report Category 5 Data (Tropopause):					
2 levels of the following information: starting byte = 1,408 +14 x (level - 1) + starting byte integer position = 704 + 7 x (level-1) + integer location xx = 01 to 02					
1	1	2	1	10	Pressure (mb)
3	2	2	1	10	Temperature (C)
5	3	2	1	10	Dewpoint depression (C)
7	4	2	1	1	Wind direction (degrees)
9	5	2	1	1	Wind speed (knots)
11	n/a	1	1	1	NCEP pressure QC flag

12	n/a	1	1	1	NCEP temperature QC flag
13	n/a	1	1	1	NCEP dewpoint depression QC flag
14	n/a	1	1	1	NCEP wind QC flag
Reconstructed Profile Flags for Preceding Radiosonde:					
1,437	n/a	151	1	1	Reconstructed RAOB report flags
1,452	n/a	3	1	1	Matchup usefulness flags
1,455	n/a	1	1	1	Surface inversion
1,456	n/a	1	1	1	Terrain type
1,457	n/a	1	1	1	Co-location time window
1,458	n/a	3	1	1	Reserved for future use
Succeeding Radiosonde Station Report:					
1,461	n/a	6	1	1	Radiosonde station ID
1,467	n/a	2	3	1	Day of synoptic report [4]
1,473	n/a	2	3	1	Balloon release date [5]
1,479	740	2	1	100	Observation time in hours (UTC)
1,481	741	2	1	128	Latitude (-90 to 90 degrees)
1,483	742	2	1	128	Longitude (-180 to 180 degrees)
1,485	743	2	1	1	Station elevation (m)
1,487	744	2	1	1	Instrument type
1,489	745	2	1	1	Report type
Succeeding Radiosonde Station Report Category 1 Data (Standard Levels):					
17 successive levels from 1000 mb of the following information: starting byte = 1,490 + 14 x (level-1) + starting byte integer position = 745 + 7 x (level-1) + integer location xx = 01 to 17					
1	1	2	1	1	Geopotential height (m)

3	2	2	1	10	Temperature (C)
5	3	2	1	10	Dewpoint depression (C)
7	4	2	1	1	Wind direction (degrees)
9	5	2	1	1	Wind speed (knots)
11	n/a	1	1	1	Geopotential height QC flag
12	n/a	1	1	1	NCEP temperature QC flag
13	n/a	1	1	1	NCEP dewpoint QC flag
14	n/a	1	1	1	NCEP wind QC flag
Succeeding Radiosonde Station Report Category 2 Data (Significant Levels):					
1,729	865	2	1	1	Number of significant levels
50 successive levels from the surface of the following information: starting byte = 1,730 + 10 x (level-1) + starting byte integer position = 865 + 5 x (level-1) + integer location xx = 01 to 50					
1	1	2	1	10	Pressure (mb)
3	2	2	1	10	Temperature (C)
5	3	2	1	10	Dewpoint depression (C)
7	n/a	1	1	1	NCEP pressure QC flag
8	n/a	1	1	1	NCEP temperature QC flag
9	n/a	1	1	1	NCEP dewpoint QC flag
10	n/a	1	1	1	Spare flag
Succeeding Radiosonde Station Report Category 3 Data (Winds):					
2,231	1,116	2	1	1	Number of significant wind levels
25 successive levels from the surface of the following information: starting byte = 2,232 + 8 x (level-1) + starting byte integer position = 1,116 + 4 x (level-1) + integer location xx = 01 to 25					

1	1	2	1	10	Pressure (mb)
3	2	2	1	1	Wind direction (degrees)
5	3	2	1	1	Wind speed (knots)
7	n/a	1	1	1	NCEP pressure QC flag
8	n/a	1	1	1	NCEP wind QC flag
Succeeding Radiosonde Station Report Category 5 Data (Tropopause):					
2 levels of the following information: starting byte = 2,432 + 14 x (level-1) + starting byte integer position = 1,216 + 7 x (level-1) + integer location xx = 01 to 02					
1	1	2	1	10	Pressure (mb)
3	2	2	1	10	Temperature (C)
5	3	2	1	10	Dewpoint depression (C)
7	4	2	1	1	Wind direction (degrees)
9	5	2	1	1	Wind speed (knots)
11	n/a	1	1	1	NCEP pressure QC flag
12	n/a	1	1	1	NCEP temperature QC flag
13	n/a	1	1	1	NCEP dewpoint depression QC flag
14	n/a	1	1	1	NCEP wind QC flag
Reconstructed Profile Flags for Succeeding Radiosonde:					
2,461	n/a	15	1	1	Reconstructed RAOB report flags [6]
2,476	n/a	3	1	1	Matchup usefulness flags [6]
2,479	n/a	1	1	1	Surface inversion
2,480	n/a	1	1	1	Terrain type
2,481	n/a	1	1	1	Co-location time window
2,482	n/a	3	1	1	Reserved for future use

Notes:
1. YYMM DDHH mmss, where YY is the year, MM is the month, DD is the day, HH is the hour, mm is the minute, and ss is the number of seconds (UTC).
2. 0=good; 1=good, but redundant; 2=questionable; 3=bad; 4=experimental flag; 5= precipitating.
3. Mixing ratios are converted to their natural logs before being scaled.
4. The synoptic day for which the observation was made (YYMMDD).
5. The day that the balloon was actually released (YYMMDD). For observations at 0000z, the balloon is actually released at approximately 2330z. The balloon release time is frequently reported as the observation time, although the synoptic time is more commonly reported. In order to sort observations into chronological order, the balloon release date and time should be used.
6. Each byte represents a different flag, set to a character value "0" if FALSE and to the character value "1", if TRUE.

9.5 COASTWATCH PRODUCTS

The CoastWatch Program mission is to provide and ensure timely access to near real-time satellite data to protect, restore, and manage U.S. coastal ocean resources, and understand climate variability and change to further enhance society's quality of life. Primary users include Federal, State, and local marine scientists, coastal resource managers, and the general public. CoastWatch is comprised of two components: Central Operations and Regional Nodes. Central Operations, managed by NOAA's National Environmental Satellite, Data, and Information Service (NESDIS) coordinates the processing, delivery, quality control and storage of data products. The six regional nodes are made up of other NOAA line offices that participate in the CoastWatch Program. They are located around the country, hosting equipment and personnel to provide near real-time data distribution and regional scientific expertise to the local user community. Together, central operations and the regional nodes provide for the distribution pathway for CoastWatch data products (see Section 9.5.1 for further information on central operations and the regional nodes).

CoastWatch started with only POES/AVHRR SST data for the East Coast in 1987, but now provides a variety of imagery and data from several different platforms covering all U.S. coastal waters. All products are available through the CoastWatch website product search: http://coastwatch.noaa.gov/interface/interface.html Note: since this User's Guide deals exclusively with POES data, emphasis will be placed on the POES CoastWatch products. Use this link for additional information on CoastWatch POES/AVHRR data http://coastwatch.noaa.gov/poes_sst_overview.html.

The images displayed on the NOAA CoastWatch website are created from satellite datasets. For many uses, these images provide enough information and are easily viewed over the Internet. However, the datasets are not viewable by Internet browsers and may require specialized

software to view, manipulate, and extract the information as needed. CoastWatch provides software utilities and data primers to assist in using these data products. http://coastwatch.noaa.gov/cw_software.html

Retrospective availability of CoastWatch POES data products are provided through a remotely accessible system at the Comprehensive Large Array-data Stewardship System (CLASS) website: http://www.class.noaa.gov/nsaa/products/welcome. CLASS replaces the Satellite Active Archive and their website provides users with data formats and details pertinent to the type of CoastWatch data the user chooses to download.

CoastWatch data products utilize five receiving stations around the country that collect data from the AVHRR sensor on the NOAA KLM polar orbiting spacecrafts. They include Gilmore Creek, AK for the four Alaska regions; Monterey, CA for the West Coast; Miami, FL for the Caribbean and Gulf of Mexico waters; Ewa Beach, HI for Central Pacific; and Wallops Island, VA for the East Coast and Great Lakes. Data are processed on NOAA computers in Suitland, MD using a set of NOAA developed multi-channel atmospherically corrected algorithms for determination of sea surface temperature. Data are then mapped to predefined coordinates specified for each of the CoastWatch regions.

Table 9.5-1. CoastWatch Region Specifications.

Region Code	Region Name	Latitude	Longitude	Res. (km)	Size		Map Projection
					Rows	Cols	
aa	Alaska Sitka	45.949	-179.07	5.0	512	512	Polar Stereographic
ax	Alaska South	55.0	-132.5	1.47	1200	1400	Polar Stereographic
ay	Alaska West	58.0	-159.0	1.47	1200	1400	Polar Stereographic
az	Alaska North	69.5	-159.0	1.47	1024	1024	Polar Stereographic
ce	Caribbean East	15.5	-68.0	1.47	1180	1400	Mercator
cw	Caribbean West	15.5	-85.0	1.47	1180	1400	Mercator
er	East Coast North	39.0	-70.5	1.47	1401	1302	Mercator
gr	Great Lakes	45.04	-84.14	1.8	1024	1024	Mercator
hr	Hawaii	19.808	-157.05	1.47	1394	1394	Mercator
mr	Gulf of Mexico	24.6	-89.0	1.47	1101	1401	Mercator
sb	East Coast Bermuda	27.0	-68.0	1.47	1200	1200	Mercator
sl	Great Salt Lake	41.54	-112.83	1.47	512	512	Mercator
sr	East Coast South	30.0	-80.32	1.47	1248	1140	Mercator
wa	West Coast Acapulco	17.0	-102.0	1.47	1180	1400	Mercator
wj	West Coast Baja	27.25	-113.60	1.47	1024	1024	Mercator

wn	West Coast North	45.0	-128.25	1.47	1024	1024	Mercator
ws	West Coast South	36.5	-121.50	1.47	1024	1024	Mercator
*Note: the Latitude/Longitude coordinates are for the center point of the region.							

Variable Naming Conventions

Each HDF data file contains multiple data variables stored using the HDF Scientific Data Sets (SDS) model. Each variable is named according to the data that it represents as follows:

avhrr_ch1
    AVHRR channel 1 albedo (%)
avhrr_ch2
    AVHRR channel 2 albedo (%)
avhrr_ch3a
    AVHRR channel 3a albedo (%)
avhrr_ch3
    AVHRR channel 3 brightness temperature (deg C)
avhrr_ch4
    AVHRR channel 4 brightness temperature (deg C)
avhrr_ch5
    AVHRR channel 5 brightness temperature (deg C)
sst
    Moisture corrected sea-surface-temperature (deg C)
cloud
    8-bit CLAVR ocean cloud mask:
    Daytime
    Bit 1: Reflective Gross Cloud Test
    Bit 2: Reflectance Uniformity Test
    Bit 3: Reflectance Ratio Cloud Test
    Bit 4: Channel 3 Albedo Test
    Bit 5: Thermal Uniformity Test
    Bit 6: Four Minus Five Test
    Bit 7: Thermal Gross Cloud Test
    Nighttime
    Bit 1: Thermal Gross Cloud Test
    Bit 2: Thermal Uniformity Test
    Bit 3: Uniform Low Stratus Test
    Bit 4: Four Minus Five Test
    Bit 5: Cirrus Test
    Bit 6: Channel 3B Albedo Test
    Bit 7: Channel 3B Albedo Uniformity Test
sat_zenith

Satellite zenith angle (degrees)

sun_zenith

Solar zenith angle (degrees)

rel_azimuth

Relative azimuth angle (degrees)

graphics

8-bit graphics layers:
Bit 1: Fill flag
Bit 2: Latitude/longitude grid
Bit 3: Coastline and political geography lines
Bit 4: Land/water flag
Bits 5-8: Unused

*Note: AVHRR channels 1 and 2, solar zenith, and relative azimuth angles are only useful for daytime data; therefore these variables are omitted from the nighttime data files.

9.5.1 HOW TO OBTAIN COASTWATCH DATA

9.5.1.1 CoastWatch Regional Nodes

Alaska - Gary Hufford
NOAA/NWS - Alaska Region
222 W. 7th Avenue #23, Room 517
Anchorage, AK 99513-7575
Phone: (907) 271-3886
Fax: (907) 271-3711
E-mail: Gary.Hufford@noaa.gov
URL: http://cwatch.arh.noaa.gov

Caribbean/Gulf of Mexico – Thomas Leming
NOAA/NMFS Southeast Fisheries Science Center
Bldg. 1103, Room 218
Stennis Space Center, MS 39529-6000
Phone: (228) 688-1214
Fax: (228) 688-1151
E-mail: Thomas.D.Leming@noaa.gov
URL: http://cwcaribbean.aoml.noaa.gov

Central Pacific (Hawaii) - Dr. Jeffrey J. Polovina
NOAA/NMFS Southwest Fisheries Science Center
Honolulu Laboratory
2570 Dole Street
Honolulu, HI 96822-2396
Phone: (808) 983-5390

Fax: (808) 983-2902
E-mail: Jeffrey.Polovina@noaa.gov
URL: http://oceanwatch.pifsc.noaa.gov

East Coast Node
410 Severn Avenue
Annapolis, MD 21403
Phone: (410) 267-5660
Fax: (410) 267-5666
URL http://coastwatch.chesapeakebay.noaa.gov

Great Lakes – George A. Leshkevich
NOAA/OAR/Great Lakes Environmental Laboratory
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Ann Arbor, MI 48105-1593
Phone: (734) 741-2265
Fax: (734) 741-2055
E-mail: George.Leshkevich@noaa.gov
URL: http://coastwatch.glerl.noaa.gov

West Coast - Dr. Cara Wilson
NOAA/NMFS Southwest Fisheries Science Center
8604 La Jolla Shores Drive (P.O. Box 271)
La Jolla, Ca 92038-0271
Phone: (831) 648-5337
Fax: (831) 648-8440
E-mail: Cara.Wilson@noaa.gov
URL: http://coastwatch.pfel.noaa.gov/

9.5.1.2 CoastWatch Central Operations

Program Manager - Kent H. Hughes
NOAA/NESDIS/ Office of Research and Applications
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URL: http://coastwatch.noaa.gov

CoastWatch Help Desk -
SP Systems, Inc. for NOAA/NESDIS/ Office of Research and Applications
Phone: (301) 763-8102 X349
Fax: (301) 763-8572
Email: Shawna.Karlson@noaa.gov
URL: http://coastwatch.noaa.gov

Central Support:
Central Processing- John Sapper
NOAA/NESDIS/ Office of Satellite Data Processing and Distribution
Phone: (301) 763-8142 ex 103
Fax: (301) 899-9196
E-mail: John.Sapper@noaa.gov
URL: http://www.osdpd.noaa.gov/PSB/EPS/EPS.html

POES SST Validation – William Pichel
NOAA/NESDIS/ Office of Research and Applications
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Fax: (301) 763-8020
E-mail: William.G.Pichel@noaa.gov
URL: http://www.orbit.nesdis.noaa.gov/sod/orad/sod/

Comprehensive Large Array-data Stewardship System (CLASS)
NOAA/NESDIS
Phone: (301) 763-8598 X349
Fax: (301) 763-8838
URL: http://www.class.noaa.gov

9.6 INTEGRATED SURFACE AND PRECIPITATION PRODUCTS

The following sections describe the newest operational products using a variety of sensors flown on NOAA's satellites. Many of the products are created by integrating data from several sensors, which creates instrument/spectrum-independent, parameter-independent, and platform-independent timely products to help meteorologists and climatologists monitor and forecast changes in surface and atmospheric conditions.

NESDIS has an extensive history of monitoring snow and ice coverage. Accurate monitoring of global snow/ice cover is a key component in the study of climate and global change as well as daily weather forecasting. NESDIS has been creating maps showing the extent of snow and ice cover for the Northern Hemisphere since 1966. The snow and ice maps were produced weekly at a spatial resolution of 190 km from 1966 to 1999.. The Interactive Multisensor Snow and Ice Mapping System (IMS) replaced the weekly mapping process in June 1999 and improved the snow and ice map by producing daily maps at 23 km resolution, using a consolidated array of new as well as existing satellite and surface imagery products. Another large resolution improvement began in early 2004, when improved technology allowed the creation of a daily 4 km (6144x6144) chart. These charts can be ordered from the National Climatic Data Center.

The Microwave Surface and Precipitation Products System (MSPPS) produced near real-time operational surface and precipitation products from the AMSU-A, AMSU-B and MHS

instruments aboard NOAA and METOP satellites. The operational products included Antenna Temperatures, Total Precipitable Water, Cloud Liquid Water, Sea Ice Concentration, Land Surface Temperature, Land Surface Emissivity at 23.8, 31.4 and 50.3 GHz, Snow Cover, Rain Rate, Snow Water Equivalent and Ice-Water Path. Both Level-II (orbital) and Level-III (grid) products are available. The MSPPS grid products include Snow Cover, Rain Rate and Snow-Water Equivalent from AMSU-B/MHS and Sea Ice Concentration from AMSU-A. These level 3 geophysical products are mapped with the 1/16th-mesh Polar Stereographic projection and updated daily. They are available in HDF-EOS format for the period from 1998 to 2007 in CLASS.

The MSPPS was replaced by the Microwave Integrated Retrieval System (MIRS) in August 2007. The MIRS has an end to end capability of calibrating and characterizing the radiances measured from satellite-based microwave instruments, and retrieving the environmental data records with state-of-the-art algorithm science. It is a one-stop resource for microwave-derived products from various polar-orbiting satellite instrument configurations The MIRS strength is derived from being instrument/spectrum-independent, parameter-independent, and platform-independent.

9.6.1 WEEKLY SNOW AND ICE MAPPING

During the 1966 to 1999 weekly snow and ice mapping era, the primary data source was Advanced Very High Resolution Radiometer (AVHRR) hardcopy visible imagery acquired from NOAA Polar Operational Environmental Satellite (POES, United States). Secondary data sources included on-line visible imagery from Geostationary Operational Environmental Satellite (GOES, U.S.), Geostationary Meteorological Satellite (GMS, Japan), and European Meteorological Satellite (METEOSAT, European Organization for the Exploitation of Meteorological Satellites), hardcopy National Ice Center (NIC, U.S.) sea ice edge maps, the United States Air Force (USAF) three-dimensional (3-D) Nephanalysis snow product, and surface observations. These products became available at various times in subsequent years. The two crucial problems with the weekly product when used for short-term forecasting were its temporal and spatial resolution. The infrequency of the weekly product created significant errors in the near surface temperature forecasts when the map was used for initialization of the National Weather Service's (NWS) Numerical Weather Prediction (NWP) models, and the grid used in the models had a higher resolution than the weekly snow and ice map.

Snow and ice cover identification was made by the manual inspection of hardcopy polar orbiting satellite imagery and graphics products, on-line video loops of multiple geostationary satellite images, and the previous week's analysis. The former process was largely manual and time consuming, and took up to ten hours to produce a map during the snow season. Map quality was dependent upon the availability of clear sky visible satellite imagery and the meteorologist's experience. The analysis from the previous week was carried forward when cloud cover obstructed the view of the snow/ice boundary during the entire week. The final hardcopy 190 kilometer resolution snow and ice chart was prepared by the analyst by manually transferring the

observed boundary lines to the map after all snow and ice boundaries were identified. The polar stereographic base map displayed coastlines, seas and large lakes, international and U.S. state political boundaries, and a latitude-longitude grid. Snow cover was indicated by the irregular solid black lines contiguous with the stippling. Ice cover was delineated by the base map's coastlines and contiguous open circles. The map's key listed the satellites from which imagery was used in preparing the final map. Each week the analyst drew a new map by hand, then digitized the extent of snow and ice cover through the use of an 89x89 line grid overlaid on a polar stereographic map of the Northern Hemisphere which created an electronic version for archival storage at the National Climate Data Center (NCDC). Quality control was either self-imposed by the meteorologist performing the analysis or by the focal point meteorologist. Upon completion, the hardcopy snow and ice chart was faxed to users in the NWS National Centers for Environmental Prediction (NCEP) which included the Environmental Modeling Center and the Climate Prediction Center, the U.S. Department of Agriculture, universities, foreign governments, and other customers.

9.6.2 INTERACTIVE MULTISENSOR SNOW AND ICE MAPPING SYSTEM: 1999 - PRESENT

The Interactive Multisensor Snow and Ice Mapping System (IMS) was designed and built to improve the previously produced weekly snow and ice map by producing a more accurate, timely product. Clear sky imagery from both the NOAA POES and GOES show the snow line very well. The problem is that current visible and infrared analysis techniques suffer from persistent cloud cover near the snow boundary. This makes daily observations difficult and infrequent. Microwave snow products are generally independent of cloud cover. However, snow and ice analyses based on visible, infrared, or microwave satellite imagery have varying accuracies under certain environmental conditions or over specific types of terrain. It's therefore advantageous to allow a meteorologist to assess satellite imagery and derived snow maps from multiple remote sensing instruments and data sources, and from them interactively produce a composite that is more accurate than the individual snow cover maps.

IMS is a UNIX-based workstation application. It provides the capability for an analyst to create, save, edit, and distribute maps showing the extent of snow and ice cover over the Earth’s Northern Hemisphere with a resolution of 23 kilometers. Snow and ice mapping is performed daily in approximately one to two hours. New data sources available on the workstation, in addition to the data sets used in producing the former weekly snow and ice map (see Section 9.6.1), include the Special Sensor Microwave/Imager (SSM/I) snow map from Defense Meteorological Satellite Program (DMSP) satellites, daily snow maps from the NWS National Operational Hydrologic Remote Sensing Center (NOHRSC), and NOAA-15's Advanced Microwave Sounding Unit (AMSU) snow cover map. Imagery from the AVHRR/3 1.6 micron channel, selected for its ability to discriminate snow cover from clouds, will be provided by NOAA-16. Data overlays of elevation contours, coastlines and rivers, and geopolitical boundaries are also available. IMS editing features allow toggling between two or more snow maps and other mapped data sets, such as land cover maps. The software produces a final snow map with appropriate header information and with an ancillary map containing information about

data sources and quality flags.

The IMS workstation's graphical user interface (GUI) is able to display an entire Northern Hemisphere daily snow and ice map or portions thereof. The snow and ice map depicts snow in white, ice in yellow, land in beige, and water in dark blue. The GUI provides pull down menus in the upper left corner of the screen for file retrieval and storage, access to editing tools, image display, annotation of images, and access to help text. A tool palette of draw and edit icons is located on the upper right side of the screen. These icons provide the means for map rotation in 90 degree units, undoing the last action taken, the exclusive drawing and erasure of snow and ice, zooming in on a given area, reversion from zoom mode to a normal view (a 1024x1024 pixel matrix), clearing the screen of snow or ice, and fine detail addition or deletion of snow or ice in non-contiguous snow or ice areas. Static overlay buttons provide data layers consisting of coastlines, elevation at 500 meter intervals, land use, latitude-longitude grid, international boundaries, U.S. state and Canadian provincial political boundaries, rivers and lakes, climatological snow maps and vegetation indices. Other available functions include the option to clear the overlays or imagery from the screen as well as toggling between two images or maps. The command line of buttons at the bottom of the GUI provides access to a variety of imagery and derived products including visible imagery from AVHRR, GOES, GMS, and METEOSAT, microwave products derived from SSM/I and AMSU data, snow and ice maps from NOHRSC, NIC, and USAF daily snow analyses, as well as surface observations from manual and automated weather stations. Production of a daily Northern Hemisphere experimental product began in February 1997. Operational implementation of IMS was completed in November 1997 and formally replaced the weekly product in June 1999. The current daily digital product is in ASCII format and archived at the National Snow and Ice Data Center (NSIDC: http://nsidc.org/index.html). A 15 month validation, funded by NOAA's Office of Global Programs, was conducted over two snow seasons in which the weekly and daily products were produced in parallel. A digital weekly snow and ice map will be derived from the daily digital products for comparison with the current weekly product and for continuation into the future of the satellite derived weekly snow and ice map climatological record begun in 1966. The results of the validation will be published. Feedback from the snow and ice community on the IMS daily product is welcome and encouraged. It is routinely posted on the NOAA/NESDIS Office of Satellite Data Processing and Distribution's (OSDPD) home page (http://www.osdpd.noaa.gov) and on the NOAA/NESDIS/OSDPD Satellite Services Division's home page at (http://www.ssd.noaa.gov/).

In summary, digital snow and ice map products archived at NSIDC (http://nsidc.org/noaa/) consist or will consist of the following:

- 1024x1024 daily snow and ice map
- 1024x1024 weekly snow and ice map (to be derived from the daily product)
- 89x89 weekly snow and ice map (derived from the weekly snow and ice map)

9.6.3 Microwave Surface and Precipitation Products System (MSPPS) Day-2 System

The first AMSU-A and -B instruments were launched on NOAA-15 on May 13, 1998. These instruments provided a new opportunity to produce microwave surface and precipitation products from NOAA polar orbiter satellites similar to the microwave surface and precipitation products [known as Environmental Data Records (EDRs)] produced by Fleet Numerical Meteorology and Oceanography Center (FNMOC) from the Defense Meteorological Satellite Program's (DMSP) Special Sensor Microwave/Imager (SSM/I) instrument. The Special Sensor Microwave/ Temperature (SSM/T) and Special Sensor Microwave/moisture (SSM/T-2) sounders (both cross-track instruments), along with the SSM/I (conical scanner), provided valuable data to expedite both sounding and MSPPS algorithm development. The commonality of the AMSU-A and -B instrument suite with the current DMSP SSM/T/I/T-2 suite of instruments, as well as the future DMSP Special Sensor Microwave/Imager-Sounder (SSM-IS) (conical scanner) is illustrated in Table 9.6.3-1. AMSU-A is a 15-channel cross-track scanning passive microwave radiometer. An AMSU-A scan takes eight seconds and is comprised of 30 Earth views. AMSU-B is a five channel cross-track scanning passive microwave radiometer. An AMSU-B scan takes 8/3 seconds and is comprised of 90 Earth views.

Table 9.6.3-1. Comparison of Microwave Sensors

AMSU-A/B		**SSM/I/T/T2**		**SSM-IS**	
Frequency (MHz)	**Footprint (km)**	**Frequency (MHz/ Polarization - see note 1)**	**Footprint (km)**	**Frequency (MHz/ Polarization - see note 1)**	**Footprint (km)**
		19,350 / H & V	43 x 69	19,350 / H & V	73 x 47
23,800	45 x 45 - 86 x 172	22,235 / V	40 x 60	22,235 / V	73 x 47
31,400	45 x 45 - 86 x 172	37,000 / H & V	28 x 37	37,000 / H & V	41 x 31
50,300	45 x 45 - 86 x 172	50,500 / H	175 x 175 - 305 x 313	50,300 / H	38 x 38
52,800	45 x 45 - 86 x 172	53,200 / H	175 x 175 - 305 x 313	52,800 / H	38 x 38
53,596 ± 115	45 x 45 - 86 x 172			53,596 / H	38 x 38
54,400	45 x 45 - 86 x 172	54,350 / H	175 x 175 - 305 x 313	54,400 / H	38 x 38
54,940	45 x 45 - 86 x 172	54,900 / H	175 x 175 - 305 x 313		
55,500	45 x 45 - 86 x 172			55,500 / H	38 x 38
57,900.344 (f_{lo})	45 x 45 - 86 x 172			57,290 / See Note 2	38 x 38

f_{lo} ± 217	45 x 45 - 86 x 172				
f_{lo} ± 322.2 ± 48	45 x 45 - 86 x 172			59,400 / See Note 2	38 x 38
f_{lo} ± 322.2 ± 22	45 x 45 - 86 x 172	58,400 / V	175 x 175 - 305 x 313		
f_{lo} ± 322.2 ± 10	45 x 45 - 86 x 172	58,825 / V	175 x 175 - 305 x 313		
f_{lo} ± 322.2 ±4.5	45 x 45 - 86 x 172	59,400 / V	175 x 175 - 305 x 313		
89,000	45 x 45 - 86 x 172	85,500 / H & V	13 x 15	91,655 / V	14 x 13 (imager)
89,000	15 x 15 - 26 x 52	91,655 / V	84 x 84	91,655 / H	14 x 13 (imager)
15,700	15 x 15 - 26 x 52	150,000 / V	54 x 54	150,000 / H	14 x 13 (imager)
183,310 ± 1,000	15 x 15 - 26 x 52	183,310 ± 1000 / V	48 x 48	183,310 ± 1,000/H	14 x 13 (imager)
183,310 ± 3,000	15 x 15 - 26 x 52	183,310 ± 3000 / V	48 x 48	183,310 ± 3,000/H	14 x 13 (imager)
183,310 ± 7,000	15 x 15 - 26 x 52	183,310 ± 7000 / V	48 x 48	183,310 ± 7,000/H	14 x 13 (imager)
				See Note 3	75 x 75

Notes:

1. H and V refer to horizontal and vertical polarization, respectively.
2. These SSM-IS channels are not polarization dependent.
3. SSM-IS has 6 additional narrow band channels in the frequency range of 60,000 to 63,000 MHz.

The lineage of MSPPS at NOAA/NESDIS includes the generation of orbital and gridded (Mastermap) products from SSM/I "raw" data transmitted via the Shared Processing Network (SPN) from Air Force Global Weather Central (AFGWC). Both of these systems were intended to produce experimental products until FNMOC was ready to begin transmission of the official SSM/I operational products over SPN. In 1992, FNMOC began transmitting Temperature Data Records (TDR), Sensor Data Records (SDR), and Environmental Data Records (EDRs) to NESDIS via SPN. NESDIS processed the SDRs and EDRs into 30-orbit files and mapped the EDRs and SDRs into Mastermap files (eighth-mesh polar stereographic maps). Under the auspices of the NOAA Climate and Global Change Program, a prototype Microwave Climate System (MCS) was developed. MCS entailed the production of orbital Brightness Temperatures (BTs) from the seven SSM/I channels as well as total precipitable water and rain rate products from the EDRs and from the BTs using experimental algorithms. Besides the orbital files, daily,

pentad (five-day), and monthly climate products were generated and archived. The design and development of MCS provided the foundation and fundamental "building blocks" for the design of MSPPS.

The design philosophy of MSPPS is to maintain commonality with MCS to the extent possible realizing that the generation of real-time and climate products have much in common, as do the generation of products from different microwave instruments such as SSM/I, AMSU-A and AMSU-B.

MSPPS produces near real-time operational surface and precipitation products from the AMSU-A and AMSU-B instruments. The products are listed in Table 9.6.3-2.

Table 9.6.3-2. AMSU-A and -B Products.

Product	AMSU-A	AMSU-B
Antenna Temperatures (AT)	X	X
Total Precipitable Water (TPW)	X	
Cloud Liquid Water (CLW)	X	
Sea Ice Concentration	X	
Surface Emissivity at 23.8 GHz	X	
Surface Emissivity at 31.4 GHz	X	
Surface Emissivity at 50.3 GHz	X	
Surface (skin) Temperature	X	
Snow Cover (Yes or No)		X
Rain Rate		X
Ice Water Path		X

Operational MSPPS includes three integrated subsystems:

1) AMSU-A Orbital Products Generation (OPG);
2) AMSU-B OPG; and
3) AMSU-A/B Mapped Orbital Products (MOP).

AMSU-A OPG processing is initiated by converting the Level 1b* AMSU-A data (Level 1b* is a centralized database which contains the basic elements of the Level 1b and the associated supporting ancillary data) from IBM MVS to IEEE format; then antenna temperatures and geophysical products are computed and stored in HDF-EOS Swath files (with compression). The MSU-A OPG data are available on an orbital basis. An AMSU-A Snow Cover Product can be computed but is not currently being done since the AMSU-B product is available and improved with respect to the AMSU-A product. Likewise, the AMSU-A Rain Rate Product is

not computed since the superior AMSU-B product is available. The AMSU-A products would be turned on for output if the AMSU-B processing stream fails. The AMSU-A Swath output is available as NPR.AAOP.

AMSU-B OPG processing first converts the AMSU-B Level 1b* data from IBM MVS to IEEE format, then computes the AMSU-B antenna temperatures (ATs), and stores the AMSU-B antenna temperatures and ancillary data in AMSU-B HDF-EOS Swath files (with compression). Then, the relevant AMSU-A ATs and geophysical products from the AMSU-A Swath file and the AMSU-B Swath file from the previous step are read; the AMSU-B geophysical products are computed and appended to AMSU-B HDF-EOS Swath files (with compression). The AMSU-B OPG data are available on an orbital basis. The AMSU-B Swath output is available as NPR.ABOP.

AMSU-B MOP processing generates mapped geophysical products on an orbit-by-orbit basis. These mapped AMSU surface and precipitation products are written into a rotating file so that portions of the file are overwritten orbitally. In this manner, the MOP satisfies the requirements that necessitate the mapped products to be updated orbitally. The output from the AMSU-A OPG and the AMSU-B OPG serve as the input to the AMSU-B product mapping. Currently, sea-ice, snow and the rain rate products are written to a $1/16^{th}$-mesh Polar Stereographic (1024x1024) projection. For a complete description of the mapping algorithm see the NOAA KLM User's Guide - Appendix C (URL:

http://www.ncdc.noaa.gov/oa/pod-guide/ncdc/docs/klm/html/c/app-c.htm).

The rain rate was added to the MOP file on January 10, 2002. The snow and sea ice products are composited from descending orbital data only, while the rain rate is composited from both descending and ascending data. The AMSU-B MOP output files, NPR.ABMP, are in HDF-EOS Grid format (with compression).

As part of Product Validation on the Research System version of MSPPS, selected Mapped Daily Products (MDP) are created. The MSPPS has been extended to meet climate requirements, climate subsystems for Daily, Pentad, and Monthly product generation have been created.

HDF-EOS was chosen as the standard output format for MSPPS for a variety of reasons. First, there are the inherent attributes of HDF-EOS forming the basis for its selection as the standard format for EOS. Some of these are: support for multiple data objects; coupling of geolocation with the data, resulting in subsetting capabilities; self defining (self documented); supports internal compression; portable; non-proprietary; and widespread use. Second, because of its widespread use and being a standard, an extremely large suite of tools for HDF-EOS and applications that support HDF-EOS are anticipated

MSPPS Level-2 and Level-3 data are stored in the HDF-EOS format, an extension of National Center for Supercomputing Application's (NCSA) HDF (URL: http://www.hdfgroup.org/)

developed by NASA to support its Earth Observing System (EOS). Among other attributes, the multi-object HDF-EOS format that supports compression is portable, flexible, and self-defining. For an overview of HDF and HDF-EOS, refer to the excellent Primer at URL: http://edhs1.gsfc.nasa.gov/waisdata/sdp/pdf/wp1750102.pdf. HDF-EOS enhances the flexibility of HDF by permitting temporal and spatial subsetting. Traditionally, product files have been in a fixed format requiring up-to-date external documentation describing the format. To accommodate changes in format, spares are often included. If additional changes in format are required, users must rewrite their data-read modules. The self-defining nature of HDF-EOS greatly reduces the impact of any change in format on the user. The HDF_EOS tools can be downloaded from the library found at URL: http://www.hdfgroup.org/hdftools.html

Currently, MSPPS files "NPR.AAOP", "NPR.ABOP", and "NPR.ABMP" are archived at NCDC and are available from the CLASS at URL: http://www.class.noaa.gov. Although the MSPPS Day-2 files have the same type of naming convention as the Day-1 files, the formats are slightly different. The change-over to Day-2 files for archive occurred in August 2001.

The major differences between the Day-1 and Day-2 file are parameter names. Several parameters appear in the Day-1 Data Sets that should not be used and were only included as either potential parameters or spare fields. These include a QC field and a surface elevation field. In the Day-1 AMSU-A Swath file the surface type parameter is not valid; whereas the surface type is valid for the Day-1 AMSU-B swath data. The major differences between the Day-1 and Day-2 file are delineated in Table 9.6.3-3.

Table 9.6.3-3. Difference between Day-1 and Day-2 Files.

Day-1	Day-2
AMSU-A and AMSU-B Swath Files	
Surface_type (not a valid parameter - AMSU-A only)	Sfc_type (valid)
Antenna Temperatures assigned to variable - Chan_xBT (x is channel number) Note: incorrectly named variable	Antenna Temperatures - Chanx_AT (x is channel number)
AMSU-A Swath Files	
Full set of products	As listed in Table 9.6.3-2
AMSU-B Swath Files	
Channel Temperatures only	As listed in Table 9.6.3-2
Mapped Data File	

1/8th mesh (512 x 512) Polar Stereographic	1/16th mesh (1024 x 1024) Polar Stereographic
TPW, CLW, Sea Ice, Snow Cover and Rain Rate	Snow and Sea Ice (rain rate added January 2002)

Access routines for the HDF-EOS AMSU-A and AMSU-B swath files and the HDF-EOS MSPPS Polar Stereographic Mapped file are available for download at URL: ftp://ftp2.ncdc.noaa.gov/pub/doc/klmguide/meta/. There are three directories called: AMSU-A, AMSU-B, and PSmap. Each of these directories contains three sub-directories: input, output, and src. Refer to the "README" file in the "src" sub-directory for instructions about retrieving data from the designated file type.

For general information about the Microwave Surface and Precipitation Products System, see the MSPPS home page at URL: http://www.orbit.nesdis.noaa.gov/corp/scsb/mspps/main.html. There are links to discussions of the product algorithms, case studies, product monitoring, presentations, MSPPS documentation, and more.

Tables 9.6.3-3 and 9.6.3-4 contain the format of AMSU-A HDF-EOS swath for NPR.AAOP files and attributes, respectively. Tables 9.6.3-5, 9.6.3-6 and 9.6.3-7 contain the format of AMSU-B HDF-EOS swath for NPR.ABOP files, attributes and polar stereographic grid for NPR.ABMP files.

Table 9.6.3-4. AMSU-A HDF-EOS Swath: NPR.AAOP files on DDS.

Parameter Name	Data Type	Missing Data	Scale	Explanation
ScanTime_year	I*2	0 (See Note 1)	1	Four digit calendar year (e.g., 1999)
ScanTime_month	I*1	0 (See Note 1)	1	Month of year (e.g., 1-12)
ScanTime_dom	I*1	0 (See Note 1)	1	Day of month (e.g., 1-31)
ScanTime_hour	I*1	0 (See Note 1)	1	Hour of day (e.g., 0-23)
ScanTime_minute	I*1	0 (See Note 1)	1	Minute of hour (e.g., 0-59)
ScanTime_second	I*1	0 (See Note 1)	1	Second of minute (e.g., 0-59)
ScanTime_doy	I*2	0 (See Note 1)	1	Day of year (e.g., 1-366)
Latitude	R*4	0 (See Note 1)	1	Latitude (degrees, e.g., -90 to 90)
Longitude	R*4	0 (See Note 1)	1	Longitude (degrees, e.g., -180 to 180)
Time	R*8	0 (See Note 1)	1	Number of seconds and fractions since 0000 UTC Jan. 1, 1993 (TAI93)
Sfc_type	I*1	255	1	Surface Type: 0=ocean; 1=land; 2=coast.

Orbit_mode	I*1	0 (See Note 1)	1	Orbit direction: 1=ascending; 2=descending.
LZ_angle	R*4	0 (See Note 1)	1	Local zenith angle range (degrees) range 0 - 57
SZ_ angle	R*4	0 (See Note 1)	1	Solar zenith angle range (degrees) range 1 - 180
Chan1_AT	I*2	-99	100	Channel 1 Antenna Temperature (K) range 125.0-310.0
Chan2_AT	I*2	-99	100	Channel 2 Antenna Temperature (K) range 125.0-310.0
Chan3_AT	I*2	-99	100	Channel 3 Antenna Temperature (K) range 150.0-310.0
Chan4_AT	I*2	-99	100	Channel 4 Antenna Temperature (K) range 170.0-295.0
Chan5_AT	I*2	-99	100	Channel 5 Antenna Temperature (K) range 190.0-280.0
Chan6_AT	I*2	-99	100	Channel 6 Antenna Temperature (K) range 190.0-260.0
Chan7_ AT	I*2	-99	100	Channel 7 Antenna Temperature (K) range 190.0-250.0
Chan8_AT	I*2	-99	100	Channel 8 Antenna Temperature (K) range 180.0-245.0
Chan9_AT	I*2	-99	100	Channel 9 Antenna Temperature (K) range 175.0-250.0
Chan10_AT	I*2	-99	100	Channel 10 Antenna Temperature (K) range 170.0-250.0
Chan11_AT	I*2	-99	100	Channel 11 Antenna Temperature (K) range 175.0-255.0
Chan12_AT	I*2	-99	100	Channel 12 Antenna Temperature (K) range 180.0- 265.0
Chan13_AT	I*2	-99	100	Channel 13 Antenna Temperature (K) range 190.0- 280.0
Chan14_AT	I*2	-99	100	Channel 14 Antenna Temperature (K) range 195.0-290.0
Chan15_AT	I*2	-99	100	Channel 15 Antenna Temperature (K) range 130.0- 315.0
TPW	I*2	See Table 9.6.3.1-9	10	Total Precipitable Water (mm x 10) range 0.0 - 75.0

CLW	I*2	See Table 9.6.3.1-9	100	Cloud Liquid Water (mm x 100) range 0.0 - 6.0
SIce	I*2	See Table 9.6.3.1-9	1	Sea Ice Concentration (%) range 0.0 - 100.0
T_sfc	I*2	See Table 9.6.3.1-9	100	Surface Temperature (K) range 150.0 - 350.0
Emis_23	I*2	See Table 9.6.3.1-9	100	Emissivity at 23.8 GHz (unit less) range 0.3 - 1.0
Emis_31	I*2	See Table 9.6.3.1-9	100	Emissivity at 31.4 GHz (unit less) range 0.3 - 1.0
Emis_50	I*2	See Table 9.6.3.1-9	100	Emissivity at 50.3 GHz (unit less) range 0.3 - 1.0

Note:

1. The initialization value is zero. No missing scan lines should be encountered, but verification can be made by using product parameters.

Table 9.6.3-5. AMSU-A HDF-EOS Swath Attributes.

Parameter Name	Data Type	Explanation
AT_Limits	R*4	Lower and upper limits of AMSU-A antenna temperatures (K)
TPW_Limits	R*4	Lower and upper limits of total precipitable water (mm)
CLW_Limits	R*4	Lower and upper limits of cloud liquid water (mm)
SIce_Limits	R*4	Lower and upper limits of sea ice concentration (%)
TS_Limits	R*4	Lower and upper limits of surface temperature (K)
EM23_Limits	R*4	Lower and upper limits of emissivity at 23.8 GHz (unit less)
EM31_Limits	R*4	Lower and upper limits of emissivity at 31.4 GHz (unit less)
EM50_Limits	R*4	Lower and upper limits of emissivity at 50.3 GHz (unit less)
Rain_Limits	R*4	Lower and upper limits of rain rate (mm/hr)
SNowC_Limits	R*4	Lower and upper limits of snow cover (unit less)
AT_SCAL	R*4	Scaling factor of antenna temperature
TPW_SCAL	R*4	Scaling factor of total precipitable water
CLW_SCAL	R*4	Scaling factor of cloud liquid water
SICE_SCAL	R*4	Scaling factor of sea ice concentration
TS_SCAL	R*4	Scaling factor of surface temperature

EM_SCAL	R*4	Scaling factor of emissivity
RR_SCAL	R*4	Scaling factor of rain rate
SNOWC_SCAL	R*4	Scaling factor of snow cover
Epoch_year	I*2	Epoch Year for Orbit Vector (e.g., 2003)
Epoch_day	I*2	Day of Epoch Year for Orbit Vector (e.g., 365)
Epoch_time	I*4	Epoch UTC Time of Day for Orbit Vector (milliseconds)
semimajor_axis	R*4	Semi-major Axis (kilometers)
eccentricity	R*4	Eccentricity (unit less)
inclination	R*4	Inclination (degrees)
argument_of_perigee	R*4	Argument of Perigee (degrees)
right_ascension	R*4	Right Ascension of the Ascending Node (degrees)
mean_anomaly	R*4	Mean Anomaly (degrees)

Table 9.6.3-6. Format of AMSU-B HDF-EOS Swath: NPR.ABOP files on DDS.

Parameter Name	Data Type	Missing Data	Scale	Explanation
ScanTime_year	I*2	0 (See Note 1)	1	Four digit calendar year (e.g., 1999)
ScanTime_month	I*1	0 (See Note 1)	1	Month of year (e.g., 1-12)
ScanTime_dom	I*1	0 (See Note 1)	1	Day of month (e.g., 1-31)
ScanTime_hour	I*1	0 (See Note 1)	1	Hour of day (e.g., 0-23)
ScanTime_minute	I*1	0 (See Note 1)	1	Minute of hour (e.g., 0-59)
ScanTime_second	I*1	0 (See Note 1)	1	Second of minute (e.g., 0-59)
ScanTime_doy	I*2	0 (See Note 1)	1	Day of year (e.g., 1-366)
Latitude	R*4	0 (See Note 1)	1	Latitude (degrees, range: -90.0 to 90.0)
Longitude	R*4	0 (See Note 1)	1	Longitude (degrees, range: -180.0 to 180.0)
Time	R*8	0 (See Note 1)	1	Number of seconds and fractions since 0000 UTC Jan. 1, 1993 (TAI93)
Sfc_type	I*1	255	1	Surface Type: 0=ocean; 1=land; 2=coast.
Orbit_mode	I*1	0 (See Note 1)	1	Orbit direction: 1=ascending; 2=descending.

LZ_angle	R*4	0 (See Note 1)	1	Local zenith angle range (degrees)
SZ_ angle	R*4	0 (See Note 1)	1	Solar zenith angle range (degrees)
Chan1_AT	I*2	-99	100	Channel 1 Antenna Temperature (K) range 75.0 - 325.0
Chan2_AT	I*2	-99	100	Channel 2 Antenna Temperature (K) range 75.0 - 325.0
Chan3_AT	I*2	-99	100	Channel 3 Antenna Temperature (K) range 75.0 - 325.0
Chan4_AT	I*2	-99	100	Channel 4 Antenna Temperature (K) range 75.0 - 325.0
Chan5_AT	I*2	-99	100	Channel 5 Antenna Temperature (K) range 75.0 - 325.0
RR	I*2	See Table 9.6.3.1-9	100	Rain Rate (mm/hr) range 0.0 - 30.0
Snow	I*2	See Table 9.6.3.1-9	1	Snow Cover (0 or 100; 100 = snow) range 0.0 -100.0
IWP	I*2	See Table 9.6.3.1-9	100	Ice Water Path (kg/m^2) range 0.0 - 2.0

Note:
1. The initialization value is zero. No missing scan lines should be encountered, but verification can be made by using product parameters.

Table 9.6.3-7. AMSU-B HDF-EOS Swath Attributes.

Parameter Name	Data Type	Explanation
AT_Limits	R*4	Lower and upper limits of AMSU-B antenna temperatures (K)
RR_Limits	R*4	Lower and upper limits of rain rate (mm/hr)
SNOW_Limits	R*4	Lower and upper limits of snow cover (percent)
IWP_Limits	R*4	Lower and upper limits of ice water path (kg/m^2)
AT_SCAL	R*4	Scaling factor of antenna temperature
RR_SCAL	R*4	Scaling factor of rain rate
SNOW_SCAL	R*4	Scaling factor of snow cover
IWP_SCAL	R*4	Scaling factor of ice water path
Epoch_year	I*2	Epoch Year for Orbit Vector (e.g., 1999)
Epoch_day	I*2	Day of Epoch Year for Orbit Vector (e.g., 365)

Epoch_time	I*4	Epoch UTC Time of Day in Milliseconds for Orbit Vector
semimajor_axis	R*4	Semi-major Axis (kilometers)
eccentricity	R*4	Eccentricity (unit less)
inclination	R*4	Inclination (degrees)
argument_of_perigee	R*4	Argument of Perigee (degrees)
right_ascension	R*4	Right Ascension of the Ascending Node (degrees)
mean_anomaly	R*4	Mean Anomaly (degrees)

Table 9.6.3-8. AMSU-B HDF-EOS PS Grid: NPR.ABMP files on DDS.

Parameter Name	Data Type	Missing Data	Explanation
Northern Hemisphere			
North_year	I*2	-99	Four digit calendar year (e.g., 1999)
North_moy	I*1	255	Month of year (e.g., 1-12)
North_dom	I*1	255	Day of month (e.g., 1-31)
North_hour	I*1	255	Hour of day (e.g., 1-24)
North_minute	I*1	255	Minute of hour (e.g., 1-60)
North_second	I*1	255	Second of minute (e.g., 1-60)
North_doy	I*2	-99	Day of year (e.g., 1-366)
North_lat	R*4	-999.0	Latitude (degrees, 0 to 90)
North_lon	R*4	-999.0	Longitude (degrees, -180 to 180)
North_RR	I*2	See Table 9.6.3.1-9	Rain Rate (mm/hr; 0.0 - 30.0 with a scaling factor of 10, negative values are flags)
North_Snow	I*2	See Table 9.6.3.1-9	Snow Cover (%; 0 or 100; 100 = snow, negative values are flags)
North_Sice	I*2	See Table 9.6.3.1-9	Sea ice concentration (%; 0 -100)
Southern Hemisphere			
South_year	I*2	-99	Four digit calendar year 4 digits (e.g., 1999)
South_moy	I*1	255	Month of year (e.g., 1-12)
South_dom	I*1	255	Day of month (e.g., 1-31)

South_hour	I*1	255	Hour of day (e.g., 1-24)
South_minute	I*1	255	Minute of hour (e.g., 1-60)
South_second	I*1	255	Second of minute (e.g., 1-60)
South_doy	I*2	-99	Day of year (e.g., 1-366)
South_lat	R*4	-999.0	Latitude (degrees, -90 to 0)
South_lon	R*4	-999.0	Longitude (degrees, -180 to 180)
South_RR	I*2	See Table 9.6.3.1-9	Rain Rate (mm/hr; 0.0 - 30.0 with a scaling factor of 10, negative values are flags)
South_Snow	I*2	See Table 9.6.3.1-9	Snow Cover (%; 0 or 100; 100 = snow, negative values are flags)
South_Sice	I*2	See Table 9.6.3.1-9	Sea ice concentration (%; 0 -100, negative values are flags)

Table 9.6.3-9 contains an explanation of the product error flags used for MSPPS data.

Table 9.6.3-9. Product Error Flags.

Flag Value	Explanation
-1	Calculated product value larger than its upper limit.
-2	Calculated product value less than its lower limit.
-3	Calculated antenna temperature larger than its upper limit.
-4	Calculated antenna temperature less than its lower limit.
-5	Undetermined because of undetermined cloud liquid water.
-6	Undetermined because of possible rain.
-7	Undetermined because of possible snow.
-8	Undetermined because of possible sea ice.
-9	Undetermined because of coast.
-10	Undetermined because of unknown reasons.
-11	Undetermined because of possible desert.

-12	Undetermined because of elevation (> 3000 m).

9.6.4 Microwave Integrated Retrieval System Products

The Microwave Integrated Retrieval System (MIRS) was developed with an end to end capability of calibrating and characterizing the radiances measured from satellite-based microwave instruments, and retrieving the environmental data records with state-of-the-art algorithm science. The MIRS replaced the MSPPS on August 30, 2007. There are currently no plans to reprocess the MSPPS data into the MIRS format. This system is an upgrade from the NESDIS operational MSPPS and is a one-stop resource for microwave-derived products from various polar-orbiting satellite instrument configurations. The MIRS is capable of optimally retrieving atmospheric and surface state parameters and provides physical-based retrievals/products in a consistent fashion. The MIRS is also designed to be instrument/spectrum-independent, parameter-independent, and platform-independent. MIRS produces advanced near-real-time operational surface and precipitation products in all-weather and over all-surface conditions using brightness temperatures from multiple microwave instruments.

These instruments include the Advanced Microwave Sounding Unit-A (AMSU-A) and Microwave Humidity Sounder (MHS) on board the Initial Joint Polar-orbiting Operational Satellite (IJPS) System (NOAA-N, -N', MetOp-1, -2, -3), the Special Sensor Microwave Imager/Sounder (SSMIS) on Defense Meteorological Satellite Program (DMSP) F-16, F-17, F-18, F-19 and F-20 polar satellites, and the Advanced Technology Microwave Sounder (ATMS) that will fly on National Polar-orbiting Operational Environmental Satellite System (NPOESS) and on NPOESS Preparatory Project (NPP).

Operational products currently and will include: vertical profiles of temperature, moisture and hydrometeors, and also rain rate, total precipitable water, cloud liquid water, falling snow, snow cover, snow water equivalent, sea ice concentration, ice water path, surface emissivity spectra and land surface temperature.

The following table shows the current delivery schedule to CLASS and the available operational products from each version.

Table 9.6.4-1 POES and MetOp Deliverables

POES & MetOp Deliverables	**Delivery Time/MIRS version**
- Temperature Profiles (T(z)) (over ocean) - Moisture Profiles (q(z)) (over ocean) - Total Precipitable Water (TPW) (over ocean) - Land Surface Emissivity (LSE) - Land Surface Temperature (LST)	Version 1.0 August/September 2007

- Cloud Liquid Water (CLW) (over ocean) - Snow Water Equivalent (SWE) - Snow Cover - Sea Ice Concentration - T(z) (extension to non-oceanic surfaces) - q(z) (extension to non-oceanic surfaces) - TPW (extension to non-oceanic surfaces)	Version 2.0 February 2008
- Hydrometeor Profiles (Hy(z)) (includes profiles of mixing ratio of cloud, rain, graupel, snow and ice particles) from NOAA-18 and MetOp-A - Ice Water Path (IWP)	Version 3.0 August 2008
- Rainfall Rate (RR)	Version 4.0 February 2009

Additional products will be added as they become operational.

9.6.4.1 MIRS File Naming Convention

The MIRS file naming convention is similar to the standard Level 1b file naming convention. There are significant differences. The filename has the following format:

<***PROCESSING-CENTER***>.<***PROJECT-ID***>.< ***VERSION***>.<***PRODUCT-TYPE***>.<***SENEOR-ID***>.<***SPACECRAFT_ID***>.<***YEAR-DAY***>.<***START-TIME***>.<***STOP-TIME***>.<***PROCESSING-BLOCK-ID***>.<***SOURCE***>.<***FILE-TYPE***>

Where:

PROCESSING-CENTER = Processing-Center where the data were created. **Length**: 3 char. **Domain**:
"NPR" = NOAA/NESDIS Product – Suitland, Maryland, USA

PROJECT-ID = Identifies the project name. **Length**: 4 char. **Domain**:
"MIRS" = Microwave Integrated Retrieval System (fixed)

VERSION = The product's algorithm version number **Length**: 2 char. **Domain**: "V1"

PRODUCT-TYPE = Identifies the type of product. **Length**: 3 char. **Domain**:
"SND" = 3-dimentional sounding-type products.
"IMG" = 2-dimensional surface and precipitation type products.

Note that the filename convention covers two types of products, and each type includes a suite of individual products. For example, the “SND” file will contain three sounding profiles: T(z), Q(z) and hydrometeor(Z), and the “IMG” file will contain 9 integrated precipitation and surface products: TPW, CLW, RR, SWE, Snow Cover, Sea Ice, LSE, LST and IWP. This approach allows one file to store duplicate geolocation and other auxiliary data for each individual product type.

SENSOR-ID = Short name for the instrument used to derive the product. **Length**: 4 to 5 char. **Domain**:

“AAMH”= derived from combined AMSU-A and MHS data on POES/MetOp spacecraft.
“SSMIS” = derived from SSMIS data on DMSP.
“ATMS”= derived from ATMS data on NPP

SPACECRAFT_ID = Spacecraft-Unique-ID. **Length**: 2 char. **Domain**:

“NN” = NOAA-18 (NOAA-N)
“SA” = DMSP Air Force F16
“SB” = DMSP Air Force F17
“M2” = MetOp-2

YEAR-DAY = Year-Day. E.g. “D79104”, where “D” identifies this group as a Julian day delimiter, “79” identifies the year in which the spacecraft began recording the data set and “104” identifies the Julian day on which the spacecraft began recording the data set. **Length**: 6 char. (5 characters for the date string, plus one for the “D” at the beginning). **Domain**: “D”+”YYJJJ”

START-TIME = e.g. “S1355”, where “S” identifies this group as a start time delimiter. “1355” denotes 13 hours 55 minutes UTC (to the nearest minute) and represents the time at which spacecraft recording began. **Length**: 5 char. (4 characters for the time string, plus one for the “S” at the beginning). **Domain**: “S”+”HHMM”

STOP-TIME = e.g. “E1456”, where “E” identifies this group as an end time delimiter. “1456” denotes 14 hours 56 minutes UTC (to the nearest minute) and denotes the time of spacecraft recording of the last usable data in the data set. **Length**: 5 char. (4 characters for the time string, plus one for the “E” at the beginning). **Domain**: “E”+”HHMM”

PROCESSING-BLOCK-ID = e.g. “B0016465”, where “B” identifies this group as a processing block ID delimiter. “0016465” is a seven digit number identifying the spacecraft revolution (orbit) in which recording of this data set began and the revolution in which the recording of the data set ended (the first five digits identifying the beginning revolution and the last two being the two least significant digits of the ending revolution). **Length**: 8 char. (7 characters for the orbit number, plus one for the “B” at the beginning). **Domain**: “B”+”XXXXXXX”

SOURCE = Identifies the data acquisition source. **Length**: 2 char. **Domain**:

“NS” = Fixed field designating No Station.

FILE-TYPE = File extension that indicates file type. **Length**: variable. **Domain**: “hdf”, “he4”, “netcdf”, “bin”, etc.

Filename example:
NPR.MIRS.V0.SND.AAMH.NN.D07077.S0855.E1030.B0940405.NS.he4

9.6.4.2 Dynamic Metadata to be Captured

This section identifies the subset of granule (dynamic) metadata attributes to be used by the Archive and the valid range of values that will be used for validation of these attributes. Listed below are the metadata items to be utilized by the Archive. The “Source” column indicates the location of a particular metadata element. The “Use” column indicates how the metadata item will be utilized within the Archive: “S” for searching; “D” for displaying in the search results; or “SD” for both searching and displaying.

Table 9.6.4.2-1 Dynamic Metadata					
Field Name	**Source**	**Data Type**	**Description**	**Range of Values**	**Use**
Data Type	Filename	String	The MIRS product type refers to whether the product file contains 3-dimensoinal sounding-type products or 2-dimensional surface/precip-type products. This is determined from three characters in the filename. The MIRS products suite contains the following products: Temperature profiles, moisture profiles, hydrometeor profiles, Rain Rate, Total Precipitable Water or TPW, Cloud Liquid Water or CLW, Snow Cover, Sea Ice, Snow Water Equivalent or SWE, Skin Temperature or LST, Land Surface Emissivity or LSE. All products are 2-dimensional surface/precip-type products except Temperature, Moisture and Hydrometeor profiles, which are 3-dimensional sounding-type products.	Product type: "SND", "IMG" Sensor: “AAMH”, “SSMIS”, and “ATMS”	SD
MIRS Version	Filename	String	The product’s algorithm version number.	Currently "V1"	SD
Sensor	Filename	String	The instrument used to derive the product	Sensors: "AAMH", "SSMIS", "ATMS"	SD

Spacecraft-Unique-Id	Filename	String	Two characters identifying the platform.	"NN"= NOAA-18 "SA" = DMSP Air Force F16 "SB" = DMSP Air Force F17 "M2" = MetOp-2	SD
Start / Stop Time delimiter	Filename	String	Denotes to the nearest minute the time at which instrument recording began and ended.	"S"+"HHMM" "E"+"HHMM"	SD
Orbit / Processing Block ID	Filename	String	A seven digit number, preceded by "B", identifying the spacecraft revolution (orbit) in which recording of this data set began and the revolution in which the recording of the data set ended (the first five digits identifying the beginning revolution and the last two being the two least significant digits of the ending revolution).	N/A	D
File Format	Filename	String	Note that initial format will be HDF-EOS 4, yet BUFR and NetCDF formats should be available later during the FY09 time frame when the full suite of MIRS products is available. This may occur earlier if there is a strong user request.	"he4", for HDF-EOS 4	SD

9.6.4.3 MIRS Swath Data Fields and Attributes

Tables 9.6.4.3-1 and 9.6.4.3-2 list the attributes and Tables 9.6.4.3-3 and 9.6.4.3-4 list the retrieved products in the HDF_EOS data files that will be archived at CLASS in the first phase.

Table 9.6.4.3-1. MIRS HDF-EOS Sounding Swath Attributes

Parameter Name	Data Type	Explanation
Temp_Limits	R*4	Lower and upper limits of temperatures (K)
PTemp_SCAL	R*4	Scaling factor of layer temperature
PLayer_SCAL	R*4	Scaling factor for layer pressure
PVapor_SCAL	R*4	Scaling factor of layer water vapor amount
PCloud_SCAL	R*4	Scaling factor of cloud amount
PRain_SCAL	R*4	Scaling factor of rain amount
PSnow_SCAL	R*4	Scaling factor of snow amount
PIce_SCAL	R*4	Scaling factor of ice amount
PGrpl_SCAL	R*4	Scaling factor of graupel amount
SurfP_SCAL	R*4	Scaling factor of surface pressure
Level_pres	R*4 (1:101)	Pressures of the levels between the products profile layers
Total_scan	I*2	Total number of scans in the data
Num_fov	I*2	Number of FOVs in the orbit data
Num_layer	I*2	Number of layers for profiles
Num_qcatm	I*2	Number of atmosphere QC parameters
Num_qcsfc	I*2	Number of surface QC parameters

Table 9.6.4.3-2. MIRS HDF-EOS Sounding Swath Data Fields

Parameter Name	Data Type and (Dimension)	Missing Data Value	Scale	Explanation
ScanTime_year	I*2 (1)	-999	1	Four digit calendar year (e.g., 1999)
ScanTime_doy	I*2 (1)	-999	1	Day of year (e.g., 1-366)
Latitude	R*4 (2)	-999	1	Latitude (degrees, e.g., -90 to 90)
Longitude	R*4 (2)	-999	1	Longitude (degrees, e.g., -180 to 180)
TimeUTC	R*8 (1)	-999	1	Number of seconds and fractions since 0000 UTC Jan. 1, 1993 (TAI93)
Atm_type	I*2 (2)	-999	1	Atmosphere type: 1=global
Sfc_type	I*2 (2)	-999	1	Surface Type: 0=ocean, 1=sea-ice, 2=land and 3 =snow cover.

Qc_atm	I*2 (2)	-999	1	Quality flag for retrievals: 0=retrieval; 1=no retrieval (default to background value).
Qc_sfc	I*2 (2)	-999	1	Quality flag for retrievals: 0=retrieval; 1=no retrieval (default to background value).
Chisqr	R*4 (2)	-999	1	Convergence rate: good retrievals with Chisqr <= 3; less reliable retrievals with 3< Chisqr <=10; unreliable retrieval with Chisqr > 10.
Orbit_mode	I*2 (1)	-999	1	Orbit direction: 0=ascending; 1=descending.
LZ_angle	R*4 (2)	-999	1	Local zenith angle range (degrees) Ranges from -59 to 59
PLayer	R*4(1)	N/A	1	Pressure of profile products layers in mbar
PTemp	R*4 (3)	bkv	1	Temperature profiles containing layer temperature in Kelvin
PVapor	R*4 (3)	bkv	1	Water Vapor profiles containing mixing ratio of absorbents for each layer in g/kg
PClw**	R*4 (3)	bkv	1	Cloud profiles containing mixing ratio of cloud particles for each layer in g/kg.
PRain**	R*4 (3)	bkv	1	Cloud profiles containing mixing ratio of rain particles for each layer in g/kg.
PGraupel**	R*4 (3)	bkv	1	Cloud profiles containing: mixing ratio of graupel particles for each layer in g/kg.
PSnow**	R*4 (3)	bkv	1	Cloud profiles containing: mixing ratio of snow particles for each layer in g/kg.
PIce**	R*4 (3)	bkv	1	Cloud profiles containing: mixing ratio of ice particles for each layer in g/kg.
SurfP***	I*2(2)	bkv	10	Surface Pressure in mbar
Note 1 : For Dimensions 1 : scan (retrieval layers for Player) ; 2: scan*spot ; 3: scan*spot*layer				

Note 2: Error Flags

Flag Value	Explanation
-999	Missing product
-888	Products not available
bkv	Background values used when no retrievals available

**: The arrays are only place holders at the Version 1, and the actual values will be filled in and available to users following the timeline listed in Table 1 & 2.

***: Any values for pressure layers below the reported surface pressure should not be used.

Table 9.6.4.3-3: MIRS Image Swath Attributes

Parameter Name	Data Type	Explanation
Total_scan	I*2	Total number of scans in the data
Num_fov	I*2	Number of FOVs in the orbit data
Num_qcatm	I*2	Number of atmosphere QC parameters
Num_qcsfc	I*2	Number of surface QC parameters
BT_SCAL	R*4	Scale of Brightness Temperature
TPW_SCAL	R*4	Scale of TPW(Total Precipitable Water)
CLW_SCAL	R*4	Scale of CLW(Cloud Liquid Water)
RWP_SCAL	R*4	Scale of RWP(Rain Water Path)
SWP_SCAL	R*4	Scale of SWP(Snow Water Path)
IWP_SCAL	R*4	Scale of IWP(Ice Water Path)
GWP_SCAL	R*4	Scale of GWP(Graupel Water Path)
CLDTOP_SCAL	R*4	Scale of Cloud Top
CLDBASE_SCAL	R*4	Scale of Cloud Base
CLDTHICK_SCAL	R*4	Scale of Cloud Thickness
RR_SCAL	R*4	Scale of Rain Rate
SFR_SCAL	R*4	Scale of SFR (Snow Falling Rate)
SWE_SCAL	R*4	Scale of Snow Water Equivalent
SNOW_SCAL	R*4	Scale of Snow Cover
SICE_SCAL	R*4	Scale of Sea Ice
SURFM_SCAL	R*4	Scale of Surface Moisture
WINDSP_SCAL	R*4	Scale of Wind Speed
WINDDIR_SCAL	R*4	Scale of Wind Vector
WINDU_SCAL	R*4	Scale of Wind Speed in U direction
WINDV_SCAL	R*4	Scale of Wind Speed in V direction
TSKIN_SCAL	R*4	Scale of Skin Temperature
SURFP_SCAL	R*4	Scale of Surface Pressure

EMIS_SCAL	R*4	Scale of Emissivity

Table 9.6.4.3-4: MIRS Image Swath Data Fields

Parameter Name	Data Type and (Dimension)	Missing Data Value	Scale	Explanation
ScanTime_year	I*2 (1)	-999	1	Four digit calendar year (e.g., 1999)
ScanTime_doy	I*2 (1)	-999	1	Day of year (e.g., 1-366)
Latitude	R*4 (2)	-999	1	Latitude (degrees, e.g., -90 to 90)
Longitude	R*4 (2)	-999	1	Longitude (degrees, e.g., -180 to 180)
TimeUTC	R*8 (1)	-999	1	Number of seconds and fractions since 0000 UTC Jan. 1, 1993 (TAI93)
Atm_type	I*2 (2)	-999	1	Atmosphere type: 1=global
Sfc_type	I*2 (2)	-999	1	Surface Type: 0=ocean, 1=sea-ice, 2=land and 3 =snow cover.
Qc_atm	I*2 (2)	-999	1	Quality flag for retrievals: 0=retrieval; 1=no retrieval (default to background value).
Qc_sfc	I*2 (2)	-999	1	Quality flag for retrievals: 0=retrieval; 1=no retrieval (default to background value).
Chisqr	R*4 (2)	-999	1	Convergence rate: good retrievals with Chisqr <= 3; less reliable retrievals with 3< Chisqr <=10; unreliable retrieval with Chisqr > 10.
Orbit_mode	I*2 (1)	-999	1	Orbit direction: 0=ascending; 1=descending.
LZ_angle	R*4 (2)	-999	1	Local zenith angle range (degrees) Ranges from -59 to 59
BT	I*2(3)	-999	100	Brightness temperatures in K at each frequency channels
TPW	I*2 (2)	bkv	10	Total Precipitable Water (in mm)
CLW**	I*2 (2)	bkv	100	Cloud Liquid Water (in mm)
RWP**	I*2 (2)	bkv	100	Integrated Rain Water Path (in

				mm)
SWP**	I*2 (2)	bkv	100	Integrated Snow Water Path (in mm)
IWP**	I*2 (2)	bkv	100	Integrated Ice Water Path (in mm)
GWP**	I*2 (2)	bkv	100	Integrated Graupel Water Path (in mm)
CldTop**	I*2 (2)	bkv	100	Cloud Top (in mbar)
CldBase**	I*2(2)	bkv	100	Cloud Base (in mbar)
CldThick**	I*2(2)	bkv	100	Cloud Thick (in mbar)
RR**	I*2(2)	bkv	10	Rain Rate (in mm/hr)
Rflag**	I*2(2)	bkv	1	Rain Flag (0/1)
SFR**	I*2(2)	bkv	10	Snow Falling Rate (in mm/hr)
PrecipType**	I*2(2)	bkv	1	Precipitation type
Snow**	I*2(2)	bkv	1	Snow Cover (0/1)
SWE**	I*2(2)	bkv	100	Snow Water Equivalent (cm)
SIce**	I*2(2)	bkv	1	Sea Ice Concentration (%)
SurfM**	I*2(2)	bkv	100	Surface Soil Moisture (mm)
WindSP**	I*2(2)	bkv	100	Wind Speed (in m/s)
WindDir**	I*2(2)	bkv	100	Wind Direction (in degree)
WindU**	I*2(2)	bkv	100	Wind Speed in U direction (m/s)
WindV**	I*2(2)	bkv	100	Wind Speed in V direction (m/s)
TSkin	I*2(2)	bkv	100	Skin Temperature (in Kelvin)
SurfP	I*2(2)	bkv	100	Surface Pressure (in mbar)
Emis	I*2(3)	bkv	100	Emissivity Vector

Note 1 : For Dimensions

1 : scan ; 2: scan*spot ; 3: scan*spot*channel

Note 2: Error Flags

Flag Value	Explanation
-999	Missing product
-888	Operational products not available
bkv	Background values used when no retrievals available

**: The arrays are only place holders at the Version 1, and the actual values will be filled in and available to users following the MIRS operational delivery timeline. Some of them will be only available as experimental products. Operational products can be referred to MIRS deliverables in

Section 1.2.

9.6.4.4 Data Access

The MIRS data sets are able to be accessed via class. The URLs to access the data are listed below:

http://www.class.noaa.gov
http://www.class.ncdc.noaa.gov
http://www.class.ngdc.noaa.gov

9.7 OZONE PRODUCTS

This section describes in detail the three operational ozone products based on the data collected from the SBUV/2 instrument. The three products are:

- o 1b Data Set
- o Product Master File - Original Format and BUFR Format

9.7.1 1b DATA SET

The 1b dataset is an operational product of the SBUV/2 instrument and should not be confused with the Level 1b database described in Section 8. (The SBUV/2 1b dataset does not meet the Level 1b definition.)

9.7.1.1 Overview

The 1b data set contains:

(1) All SBUV/2 sensor data (except boost mode data [first several minutes after launch]; data with unreasonable year, day or time of day; and data within an orbit that is not time ascending) and support data necessary for the derivation of atmospheric ozone and solar flux;

(2) Instrument in-flight calibration data and housekeeping functions for monitoring post-launch instrument changes; and

(3) Prelaunch calibration factors, computed current-day instrument calibration and albedo correction factors to adjust the ozone algorithm for actual instrument performance. Initially, only prelaunch calibration adjustments will be made until the Instrument Support Subsystem is implemented.

The SBUV/2 sensor data consists of radiance and irradiance measurements taken in both the discrete mode (12 wavelengths) and the sweepmode (1680 wavelengths) at approximately 2 Angstrom (Δ) intervals. The support data includes earth location data derived from predictive ephemeris, cloud and temperature from TOVS, ancillary data to initialize the algorithm, surface pressure data, and (to be added at a later date) snow/ice data.

9.7.1.2 Contents

The following subsections describe the contents of the 1b data set:

- · Raw SBUV/2 data
- · Cloud and temperature data from TOVS
- · Surface pressure data
- · Ancillary data set

- Instrument calibration and albedo correction data
- Instrument status and quality flags
- Earth location data
- Fill values on the 1b data set

9.7.1.2.1 Raw SBUV/2 Data

Each major frame (32 seconds) of raw SBUV/2 data received from the satellite results in one discrete or two sweep data records on the 1b data set. Each discrete data record contains SBUV/2 instrument data collected from 12 discrete wavelengths by the monochromator (one wavelength if it is in the position mode) and one wavelength by the CCR plus electronic calibration data. The instrument may be in discrete, sweep, position, wavelength calibration or diffuser decontamination mode and viewing either the Earth, wavelength calibration lamp or diffuser plate. Each sweep data record contains SBUV/2 instrument data collected in the instrument sweep mode. In this mode the instrument will usually be viewing the diffuser plate in order to take solar measurements, however other viewing scenes are possible. For a complete set of 1680 wavelength measurements, twelve 16 second sweep data records are required. These correspond to six 32 second major frames.

All SBUV/2 data are preserved as raw counts on the 1b data set. The only conversions to engineering units are done for the orbital and daily statistics.

The data on the 1b data set are arranged in terms of SBUV/2 orbits. The SBUV/2 orbit definition is different from the standard TIROS-N series (NOAA/NESDIS) orbit definition. Each SBUV/2 orbit begins when the center of the SBUV/2 instrument field of view (FOV) transits the equator on the dark viewing side of the Earth and continues through one satellite revolution about the Earth. Earth location data is used to ascertain equator crossing but is only given for the start time of each TIP major frame's worth of data. Thus, the SBUV/2 orbital designation of each TIP major frame's worth of information is based on the earth location at the start of each major frame.

The orbit definition used on the TIROS-N series satellite has the orbital boundary occurring at northbound equator crossing regardless of the time the satellite views the Earth. By this definition an afternoon satellite's (northbound equator crossing on the sunlit side of the Earth) orbits begin during daylight viewing times (i.e. about 50 minutes out of phase with SBUV/2 orbits). SBUV/2 will fly only on afternoon satellites. The change in the orbit definition is to provide continuity with that used for Nimbus-7 SBUV.

9.7.1.2.2 Major Frame Synchronization

Each major frame contains 32 channels, or groups of 10 minor frames, with each channel containing one second's worth of data. Some of the data stored in a particular channel is data that was actually sampled during the previous second and thus belongs to the previous channel. Data items belonging to the previous channel are synchronized (placed in the proper channel)

before being written to the daily 1b data set on either discrete sweep data records. This means that some of the data arriving in the first channel of a given major frame is placed in the last channel of the previous major frame before being processed.

The following items need synchronization.

- Grating position
- CCR and PMT data
- Status Word 1 of Digital A data - all items
- Status Word 2 of Digital A data - all items

9.7.1.2.3 Cloud and Temperature Data from TOVS

Meteorological data is provided to the SBUV/2 Data Set from the TIROS Operational Vertical Sounder (TOVS) carried aboard the same satellite as the SBUV/2 instrument. When available, the total ozone algorithm uses cloud information to estimate the ozone hidden from the satellite sensor below the clouds. The TOVS utilizes three instruments for the satellites prior to NOAA-K:

1) A High Resolution Infrared Radiometric Sounder (HIRS/2),
2) A Microwave Sounding Unit (MSU), and
3) A Stratospheric Sounding Unit (SSU).

The TOVS products used by SBUV/2 are: cloud amounts, cloud top temperatures, and vertical profiles of atmospheric temperatures.

The vertical temperature profiles are given for up to forty specified pressure levels ranging from 1000 mb (or surface level) to 0.1 mb. These profiles represent one "box" in the current operational TOVS processing system (formerly a "box" in the old TOVS processing system). A "minibox" consists of 63 HIRS/2 fields of view (called spots) from 7 HIRS/2 scan lines (a "box" consisted of 9 spots from 3 scan lines). Certain quality checks are made during TOVS processing to assure the reasonableness of the temperature profiles. If any of these checks indicate a bad sounding, or the data is unavailable the profile is rejected during the SBUV/2 processing and replaced with fill values.

Cloud amounts and cloud top temperatures are provided on a spot by spot basis. The current operational TOVS processing system provides SBUV/2 with cloud data for boxes which are adjacent to nadir. Miniboxes are constructed by selection of the appropriate spots in a box. Cloud top pressures (analogous to cloud top height) are computed for each spot by linear interpolation of the cloud top temperature between adjacent levels in the temperature profile.

Averages of cloud amount, cloud top temperature, and atmospheric temperature profiles are computed to represent the area sampled by those SBUV/2 fields of view (the four longest wavelengths fields of view in the discrete mode) used in the total ozone computation. This area

is equivalent to 30 HIRS/2 spots. Cloud averages are computed using all spots (except fills) lying within the composite SBUV/2 field of view area. Temperature profile averages include only those from miniboxes with two or three HIRS/2 scan lines lying within this composite SBUV/2 field of view area.

Temperatures of 20 pressure levels (more than needed by the ozone algorithms) have been saved on the 1b Data Set for future implementation of temperature dependency of the ozone absorption coefficients.

Meteorological data is collected only when the instrument is in the discrete mode (normal mode for ozone determination), the position mode (rarely if ever used), and wavelength calibration mode. These three modes have in common the same record format, i.e. the discrete data record. As the ancillary data is not time dependent, this data will be written once for each Daily 1b data set. It is not saved for sweep mode data.

9.7.1.2.4 Surface Pressure Data

The source of this data is the same as that used for Nimbus SBUV processing. It was originally derived from a terrain height data set obtained from NOAA. Terrain heights in kilometers (km) were converted to millibars (mb) using the following equation:

$$P = 1013.25(1 - 0.0257H)^{5.256}$$

where H is the terrain height in km.

The entire globe is divided into 2.5 x 2.5 degree latitude and longitude cells with terrain pressure given for each cell. A total of 10,585 values are given. A two-dimensional interpolation procedure using the four closest grid points is used to find the value of terrain pressure at the start of each major frame. Surface pressure is supplied for discrete mode data only.

9.7.1.2.5 Ancillary Data

The Ancillary Data Set contains the thirteen SBUV/2 bandcenter wavelengths, their associated ozone absorption and Rayleigh scattering coefficients, total ozone and multiple scattering correction lookup tables, and the a priori profiling information. This is the data required to initialize the ozone algorithm.

The Multiple Scattering Coefficients data records contain 1700 values (10 solar zenith Angles, 23 standard ozone profiles, five wavelengths and two surface pressures) of Log Q, 1700 values of Log Q (single scattered), 1700 values of reflected fraction and 170 values (for 23 standard ozone profiles, five wavelengths and two surface pressures) of atmospheric-surface backscatter fraction). The Total Ozone Tables data records contain 1700 values of Log I_o, 1700 values of

reflected fraction, and 170 values of atmospheric-surface backscatter fraction. The A-Priori Profile Information data records will contain 180 values of a priori profile coefficients and 144 values for the a priori covariance matrix elements.

As the ancillary data is not time dependent, this data will be written one for each Daily 1b Data set.

9.7.1.2.6 Instrument Calibration and Albedo Correction Data

The Instrument Calibration and Albedo Correction Data contains four sets of values:

i) Prelaunch radiance and irradiance calibrations
ii) Day 1 solar irradiance calibrations
iii) Monochromator interrange ratios
iv) Albedo Correction Factors

Initially, only prelaunch radiance and irradiance calibrations will be on the 1b Data Set until the Instrument Support Subsystem is implemented. Three sets of prelaunch calibration values are required:

i) Radiance calibrations - count to W/cm^3 conversion constants
ii) Irradiance calibrations - count to $W/cm^3/sr$ conversion constants
iii) Prelaunch diffuser check flux ratios

The radiance and irradiance calibrations each consist of 37 constants: one value for the CCR at 3786.2 Å and 12 values for each of the three monochromator gain ranges at the 12 discrete wavelengths. The ratios of the radiance and irradiance calibrations are used in the computation of I/F ratios in the ozone computation. The prelaunch flux ratios will be used to perform the diffuser calibration in the instrument support subsystem. There will be one ratio for each mercury line chosen which is to be specified.

The monochromator interrange ratios and albedo correction factors are derived from the previous N (to be specified) day's instrument outputs for the current day 1b and ozone processing. There are two interrange ratios for the monochromator, one between gain ranges 1 and 2 (IRR_{21}) and one between gain ranges 2 and 3 (IRR_{32}).

The albedo corrections account for solar flux and instrument changes and are used to adjust the I/F ratios in the ozone processing; there are 13 values for a day, one for the CCR wavelength (3786.2 Å) and twelve for the monochromator discrete wavelengths.

9.7.1.2.7 Instrument Status and Quality Flags

The 1b Data Set contains a comprehensive set of flags that provide instrument status and data quality information. Table 9.7.1.2.7-1 summarizes the types of flags, where in the processing

system they are set and what ranges of data they cover. The flags are defined in the Data Dictionary (Section 9.7.4).

Table 9.7.1.2.7-1. 1b Data Set Instrument Status and Data Quality Flags.		
Data Quality Flags	**Where Set***	**Data Range Covered**
Minor Frame Quality Flags	Decommutation	Channel
Major Frame Quality Flags	Raw TIP/ Decommutation Immediate	Major Frame
Final Channel Quality Flags	1b	Channel
Channel Fill Flags	1b	Channel
Channel Error Flags	1b	Channel
Sample Status Flags	1b	1 discrete sample 10 sweep samples
Summary Status Flags		
Summary Grating Mode	1b	Major Frame**
Summary Grating Memory Mode	1b	Major Frame**
Scene Mode	1b	Major Frame**
Instrument Data Quality Flag	1b	Major Frame**
Channel=10 minor frames=1 second		
Major frame=320 minor frames=32 seconds		
Discrete sample=2 second interval		
10 Sweep samples=1 second interval		
*Refer to Section 1.5 for a discussion of the step for the Operational Ozone Product System **Based on major frames where ECAL/Retrace is off.		

9.7.1.2.8 Earth Location Data

For the start time of each TIP Major Frame (every 32 seconds), using as input the ephemeris (i.e. spacecraft position and velocity vectors) data from GTDS, the following earth location parameters are derived.

- Subsatellite Latitude
- Subsatellite Longitude
- FOV Latitude
- FOV Longitude
- Solar Zenith Angle at FOV
- Solar Azimuth Angle at FOV
- Solar Right Ascension
- Solar Declination
- Spacecraft-centered Solar Elevation Angle
- Spacecraft-centered Solar Azimuth Angle
- Altitude of Satellite

9.7.1.2.9 Fill Values on the 1b Data Set

A fill value may be inserted into an individual data item on the 1b Data Set to indicate that the original data in the input data stream was missing. The Daily Headers and Ancillary Data contain no fill values. The only record types which contain fill values in the Daily Data Records files of the 1b Data Set are the Discrete and Sweep Data Records. Fill values for data items or groups of data items are given in Table 9.7.1.2.9-1.

Table 9.7.1.2.9-1. Fill Values on Data Records.

Data Items or Group of Data Items	Fill Values	Comment
Attitude Data	-32,767 (Hex Code 8001)	Reason for fill given by Major Frame Quality Dwell Mode, Data Fill or Missing Attitude Flags
Earth Location Data	-32,767	Reason for fill is no Earth Location Data Found by Decommutation Program (Indicated by Major Frame Quality Flag For No Earth Location Data)

Digital B Telemetry & Data and Analog	All Bits set to 1	Reason for fill given in this frame's and possibly next frame's Major Frame Quality Flag: Dwell Mode, or Data Fill Flags
Digital A Instrument Data except Recommended Monochromator Range I. D.		Reason for fill given by Major Frame Quality Flags: Data Fill Flags
Meteorological and Geographical Support Data except for FOV Snow/Ice Flag, Cloud Amount/Cloud Albedo and Cloud Amount for Spots 1-9	-7777	Cloud top pressure set to -7777 when no clouds present in 8 second SBUV/2 FOV (i.e. cloud amount = 0)
Cloud Amount/Cloud Albedo	-1028	
Cloud Amount for Spots 1-9	-8	
FOV Snow/Ice Flag Digital A	-1	
Digital A Analog Housekeeping Data	All bits set to 1	Reason for fill given by Major Frame Quality Flags: Dwell Mode or Data Fill Flags
Total Ozone and Profile	-77.0	Reason given by corresponding Ozone Data Error Flag
Note: this table includes some data items not found in the 1b Data Set.		

9.7.1.3 Data Organization

Each 1b Data Set consists of a file containing a calendar month of data. A data set standard header (the OOPS Standard Header Records for the monthly product) describes the data contained on the tape. This is followed by a series of Daily 1b Data Sets, one for each day of the month. Once a calendar month is completed, the complete monthly data set is made available to CLASS on the second day of the following month.

Each Daily 1b Data Set as described in Table 9.7.1.3-1 begins with OOPS Standard Header Records that describe the current day's data set and all the input data sets used to create it. This includes the ancillary data, the instrument calibration and albedo correction data, each SBUV/2 orbit in the correct day, and the daily statistical summary. All data for an orbit that begins the current day is included in the current day. The contents of these data files are described in Section 9.7.1.4. The organization of the Daily 1b Data Set header records is described in Table

9.7.1.4-1. A schematic overview of the 1b Data Set is shown in Figure 9.7.1.3-1. Data is in time ascending order.

The 1b Data Set has a logical record length (LRECL) of 720 bytes and a physical blocksize (BLKSIZE) of 25,920 bytes (36 logical records/block).

Table 9.7.1.3-1. Daily 1b Standard Header Record Data Set Order.	
Output:	
1.	Daily 1b Data Set
Direct Inputs:	
2.	Ancillary Data Set
3.	Instrument Calibration and Albedo Correction Data Set
4.	Daily Intermediate Data Set
5.	Daily Meteorology and Geographic Data Set
Indirect Inputs:	
6.	Spectral Information Data Set
7.	Bass Coefficients Data Set
8.	Absorption Coefficients Data Set
9.	Ancillary Intermediate Data Set (Oldest)
10.	Ancillary Intermediate Data Set (Latest)
11.	A Priori Data Set
12.	Prelaunch Calibration Data Set
13.	Day 1 Solar Flux Data Set
14.	Interrange Ratios Data Set
15.	Albedo Correction Factor Data Set
16.	Surface Pressure File

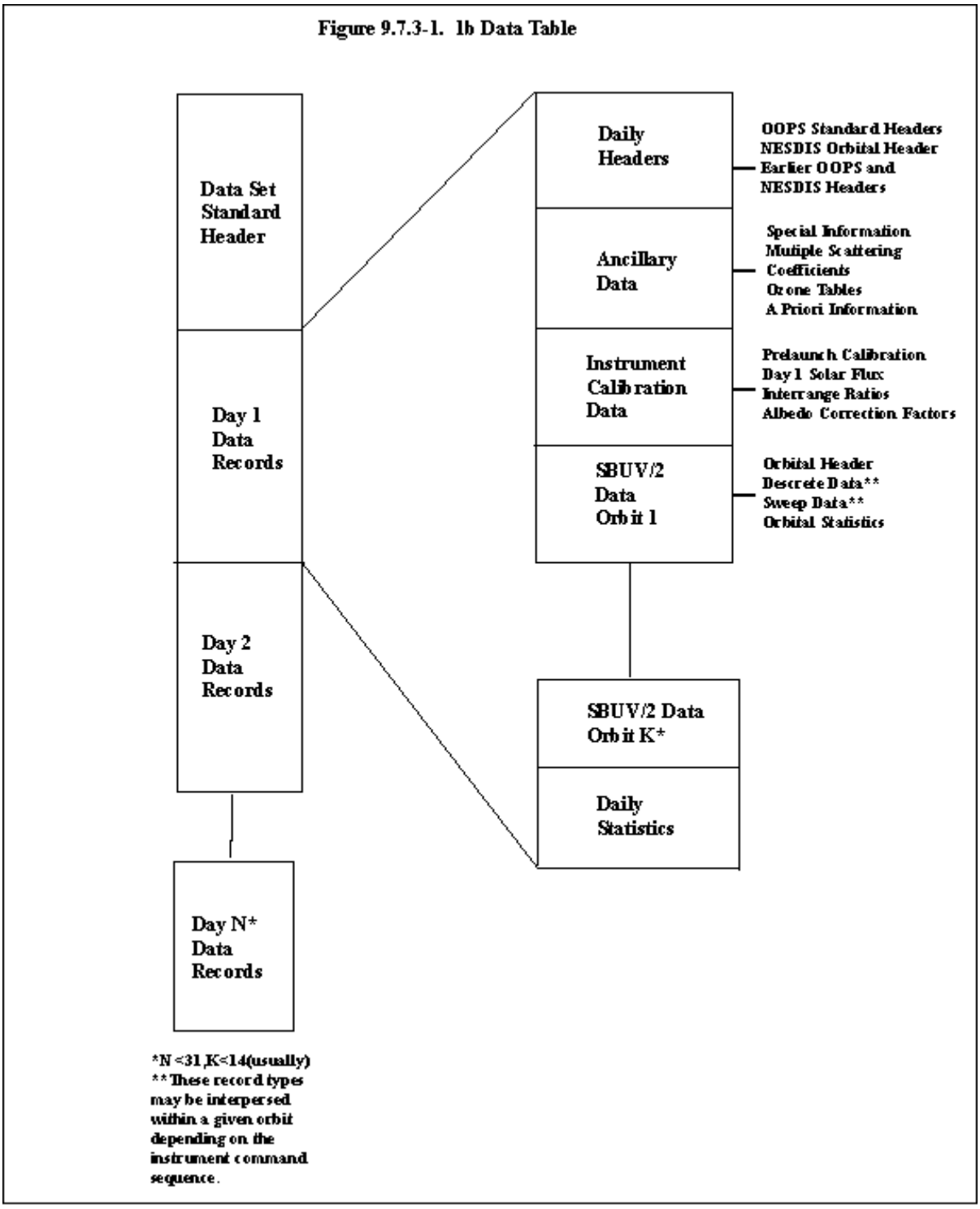

Figure 9.7.1.3-1. 1b Data Table

9.7.1.4 Record Layouts

The following pages describe the layout of each record in the 1b Data Set. The OOPS Standard Header record is shown in Section 9.7.3. Individual data items are described in the Data Dictionary (Section 9.7.4). Records appear on the 1b Data Set in the order shown below:

Table 9.7.1.4-0. List of Tables in 1b Data Set		
Standard Record Layout		
9.7.1.3-1	Data Set Standard Header	2/ Data Set (Month)
Daily Headers		
9.7.3-1 and 9.7.3-2	OOPS Standard Header Records NESDIS Orbital Header Records	32/Day Variable
Ancillary Data		
9.7.1.4-3	Spectral Information Data Record (DR)	1/Day
9.7.1.4-4	Multiple Scattering Coefficients DR	40/Day
9.7.1.4-5	Total Ozone Tables DR	33/Day
9.7.1.4-6	A Priori Information DR	2/Day
Calibration Data		
9.7.1.4-7	Prelaunch Calibration DR	1/Day
9.7.1.4-8	Day 1 Solar Flux DR	1/Day
9.7.1.4-9	Interrange Ratios DR	1/Day
9.7.1.4-10	Albedo Correction Factor DR	1/Day
SBUV/2 Data		
9.7.1.4-11	SBUV/2 Orbital Header Record	1/Orbit
9.7.1.4-12	Discrete DR	Variable
9.7.1.4-13	Sweep DR	Variable
9.7.1.4-19	SBUV/2 Orbital Statistical Record	1/Orbit
9.7.1.4-20	Daily SBUV/2 Statistical Record	1/Day

Except where noted in the record layouts, data is stored in signed full word integer (I*4), signed half-word integer (I*2), or unsigned individual byte integers (all 8 bits are used in computing the integer value). All data are stored in UNIX IEEE data type conventions. For flag fields consisting of several individual bit flags, a byte/bit breakdown is included following the record format.

Table 9.7.1.4-1 contains a list of each record type found in the 1b Data Set. Figure 9.7.1.4-1 shows the layout of the 1b Data Set Record.

Figure 9.7.1.4-1. SBUV 1b Data Set Record IDs.

Record ID	Record Description
Data Set Headers	
241	OOPS Standard Header Record I
242	OOPS Standard Header Record II
250	NESDIS Orbital Header Record
Ancillary Data	
465	Spectral Information Data Record
475	Multiple Scattering coefficients Data Record
485	Total Ozone Tables Data Record
495	A Priori Information Data Record
Instrument Calibration Data	
525	Prelaunch Calibration Data Record
565	Day 1 Solar Flux Data Record
575	Interrange Ratios Data Record
585	Albedo Correction Factor Data Record
SBUV/2 Data	
651	SBUV/2 Orbital Header Record
661	Discrete Mode Data Record (Discrete Record Format)

662	Wavelength Calibration Mode Data Record (Discrete Record Format)
663	Position Mode Data Record (Discrete Record Format)
664	Diffuser Decontamination Data Record
671	Sweep Mode Data Record (Sweep record Format)
681	Conflicting Modes* Record (Discrete Record Format)
682	Conflicting Modes* Record (Sweep Record Format)
691	SBUV/2 Orbital Statistical Record
695	Daily SBUV/2 Statistical Record

Note:
The data format (discrete or sweep) and grating mode (discrete, sweep, wavelength calibration, position, or diffuser decontamination) of a Discrete or Sweep Data Record are determined from each of the 32 channels of the corresponding Major Frame Data Record. If any channel data of a Major Frame Record indicates a record format or grating mode that is different from previous channel data within that major frame, the corresponding Discrete or Sweep Data Record is labeled as an Inconsistent Discrete or Inconsistent Sweep Data Record. If the data format is inconsistent the record is written as an Inconsistent Sweep data Record, regardless of whether or not the grating mode is inconsistent. If only the grating mode is inconsistent, the record is written as an Inconsistent Discrete Data Record if the record format is discrete and as an Inconsistent Sweep Data Record if the record format is sweep.

Table 9.7.1.4-1. SBUV Level 1b Data Set Record Layouts.

NESDIS Orbital Header Record

	Byte 1	**Byte 2**	**Byte 3**	**Byte 4**
Word	**Description**			
1	Record ID			
2	S/C ID	Data Type	Start Time	
3				
4	Number of Major Frames		End Time	
5				

6	Processing	Block ID		
7				Spare
8	Number of Data Gaps		DACS Quality	
9				
10	Spare		DACS Status	Spare
11-180	Spare			

Note:
The Start/End Time, Data Type, and DACS Quality, DACS Status of the NESDIS Orbital Header Record are broken down further in Table 9.7.1.4-2.
Processing Block ID: 7 byte field stored in character code (ASCII)

Table 9.7.1.4-2. Byte/bit Breakdown of NESDIS Orbital Header Data.

	Starting			**Ending**		
Data Item	**Word**	**Byte**	**Bit***	**Word**	**Byte**	**Bit**
Data Type:						
Type of Data	2	2	1	-	-	4
TIP Source	2	2	5	-	-	8
Start Time:						
Year	2	3	1	-	-	7
Day of Year	2	3	8	-	4	8
Spare	3	1	1	-	-	5
Milliseconds of Day	3	1	6	-	4	8
End Time:						
Year	4	3	1	-	-	7
Day of Year	4	3	8	-	4	8
Spare	5	1	1	-	-	5
Milliseconds of Day	5	1	6	-	4	8

DACS Quality:						
No Frame Synch word Counter	8	3	1	-	4	8
TIP Parity Error Counter	9	1	1	-	2	8
Aux Synch Error Counter	9	3	1	-	4	8
DACS Status:						
P/N Flag	10	3	1	-	-	-
Data Source	10	3	2	-	-	3
Tape Direction	10	3	4	-	-	-
Data Mode	10	3	5	-	-	-
Spare	10	3	6	-	-	8

Notes:
*Most Significant bit (MSB) = bit 1, Least significant bit (LSB) = bit 8.
** A dash indicates no change from starting value

Table 9.7.1.4-3. Ancillary Data Spectral Information Data Record.

	Byte 1	**Byte 2**	**Byte 3**	**Byte 4**
Word	**Description**			
1	Record ID			
2	Bandcenter Wavelength of Discrete Channel 1			
3-13	Same as word 2 but for Discrete Channels 2-12			
14	Same as word 2 but for CCR Channel			
15	Effective Ozone Absorption coefficients for Discrete Channel 1			
16-26	Same as word 15 but Discrete Channels 2 12			
27	Same as word 15 but for CCR Channel			
28	Rayleigh Scattering Coefficients for Discrete Channel 1			
29-39	Same as word 28 but for Discrete Channels 2 - 12			
40	Same as word 28 but for CCR Channel			

41-180	Spare
Note: Words 2-40 are stored in floating point (R*4).	

Table 9.7.1.4-4. Ancillary Data Multiple Scattering Coefficients Data Record.				
	Byte 1	**Byte 2**	**Byte 3**	**Byte 4**
Word	**Description**			
1	Record ID			
2-180	179 entries of Multiple Scattering Coefficients Containing:			
	Values of Log Q			
	Values of Log Q (Single Scattered)			
	Values of Log Reflected Fraction			
	Values of Atmosphere Surface Backscatter Fraction			
	(See Section 9.7.1.2.4 for further breakdown)			
Note: Words 2 - 180 are stored in floating point (R*4).				

Table 9.7.1.4-5. Ancillary Data Total Ozone Tables Data Record.				
	Byte 1	**Byte 2**	**Byte 3**	**Byte 4**
Word	**Description**			
1	Record ID			
2-180	179 Entries of Total Ozone Lookup Table containing:			
	Values of Log I_o			
	Values of Reflected Fractions and			
	Values of Atmosphere Surface Backscatter Fraction			
	(See Section 9.7.1.2.4 for further breakdown)			
Note: Words 2-180 Are Stored in Floating Point (R*4).				

Table 9.7.1.4-6. Ancillary Data *A Priori* Information Data Record.				
	Byte 1	**Byte 2**	**Byte 3**	**Byte 4**
Word	**Description**			

1	Record ID
2-180	179 Entries of *A Priori* information containing:
	Values of *A Priori* profile coefficients
	Values of *A Priori* covariance matrix elements
	(See Section 9.7.1.2.4 for further breakdown)
Note: Words 2-180 are stored in floating point (R*4).	

Table 9.7.1.4-7. Prelaunch Calibration Data Record.

	Byte 1	**Byte 2**	**Byte 3**	**Byte 4**
Word	**Description**			
1	Record ID			
2	Prelaunch Radiance Calibration for CCR Channel			
3	Prelaunch Radiance Calibration for Discrete Channel 1, PMT Range 1			
4-14	Same as word 3 but for Channels 2-12, PMT Range 1			
15-26	Same as words 3-14 but for PMT Range 2			
27-38	Same as words 3-14 but for PMT Range 3			
39-75	Same as words 3-28 but for Prelaunch Irradiance Calibrations			
76-87	Prelaunch Diffuser Flux Ratios at 12 Possible Mercury Wavelengths			
88	Prelaunch Diffuser Flux Ratios at CCR Wavelength			
89-180	Spare			
Note: Words 2-75 are stored in floating point (R*4).				

Table 9.7.1.4-8. Day 1 Solar Flux Data Record.

	Byte 1	**Byte 2**	**Byte 3**	**Byte 4**
Word	**Description**			
1	Record ID			

2	Day 1 Solar Irradiance for Discrete Channel 1
3-13	Same as word 2 but for Channels 2-12
14	Same as word 2 but for CCR Channel
15-180	Spare
Note: Words 2-14 are stored in floating point (R*4).	

Table 9.7.1.4-9. Interrange Ratios Data Record.				
	Byte 1	**Byte 2**	**Byte 3**	**Byte 4**
Word	**Description**			
1	Record ID			
2	Number of Coefficients for Interrange Ratios between Monochromator Range 1 and 2 (IRR_{21})			
3	First Coefficient for IRR_{21}			
4-14	Same as Word 3 but for Second through possible Twelfth Coefficient			
15	Number of Coefficients for Interrange Ratios between Monochromator Range 2 and Range 3 (IRR_{23})			
16	First Coefficient for IRR_{23}			
17-27	Same as word 16 but for Second through possible Twelfth Coefficient			
28-180	Spare			
Note: Words 3-14 and 16-25 are stored in floating point (R*4). Words 2 and 15 are I*4.				

Table 9.7.1.4-10. Albedo Correction Factor Data Record.				
	Byte 1	**Byte 2**	**Byte 3**	**Byte 4**
Word	**Description**			
1	Record ID			
2	Albedo Correction Factor for Discrete Channel 1			
3-13	Same as word 2 but for Channels 2-12			

14	Same as word 2 but for CCR Channel
15-180	Spare
Note: Words 2-14 are stored in floating point (R*4).	

Table 9.7.1.4-11. SBUV/2 Orbital Header Record.				
	Byte 1	**Byte 2**	**Byte 3**	**Byte 4**
Word	**Description**			
1	Record ID			
2	SBUV/2 Orbit Number			
3	SBUV/2 Day Number			
4	Year of first Major Frame in SBUV/2 Orbit			
5	Day of Year of First Major Frame in SBUV/2 Orbit			
6	Seconds of Day at Start of First Major Frame in SBUV/2 Orbit			
7	FOV Latitude at Start of First Major Frame in SBUV/2 Orbit			
8	FOV Longitude at Start of First Major Frame in SBUV/2 Orbit			
9	Year of Last Major Frame in SBUV/2 Orbit			
10	Day of Year at Last Major Frame in SBUV/2 orbit			
11	Seconds of Day at Start of Last Major Frame in SBUV/2 Orbit			
12	FOV Latitude at Start of Last Major Frame in SBUV/2 Orbit			
13	FOV Longitude at Start of Last Major Frame in SBUV/2 Orbit			
14	NESDIS Orbit Number at Start of SBUV/2 Orbit			
15	NESDIS Orbit Number at End of SBUV/2 Orbit			
16-180	Spare			

Table 9.7.1.4-12. Discrete Data Record.
Data Identifiers

	Byte 1	Byte 2	Byte 3	Byte 4
Word	**Description**			
1	Record I.D.			
2	Major Frame Counter		Discrete/Sweep Indicator Record	
3	Year		Day of Year	
4	Seconds of day (T_0)			
5	SBUV/2 Orbit Number			
6	SBUV/2 Day Number			
7	Major Frame Quality Flags			
8	Minor Frame Quality Flags			
9-10	Spare			
Attitude Data				
11	Yaw Euler Error Angle within 1st Second		Yaw Euler Error Angle within 9th Second	
12	Yaw Euler Error Angle within 17th Second		Yaw Euler Error Angle within 25th Second	
13-14	Same as 11-12 but for 4 Roll Euler Error Angles			
15-16	Same as 11-12 but for 4 Pitch Euler Error Angles			
Earth Location Data				
17	Spare		Spacecraft altitude	
18	Solar Right Ascension		Solar declination	
19	Subsatellite latitude		Subsatellite longitude	
20	FOV latitude @ T_0		FOV latitude @ T_0 + 32 seconds	
21	FOV longitude @ T_0		FOV longitude @ T_0 + 32 seconds	
22	Solar Zenith Angle (SZA) @ FOV @ T_0		SZA @ FOV @ T_0 + 32 seconds	

23	Solar Azimuth Angle (SAA) @ FOV @ T_0		SAA @ FOV @ T_0 + 32 seconds	
24	Spacecraft (S/C) centered Solar Elevation Angle (SEA) @ T_0		S/C centered SEA @ T_0 + 32 seconds	
25	S/C centered SAA @ T_0		S/C centered SAA @ T_0 + 32 seconds	
26-30	Spare			
Digital B Telemetry				
31-32	Digital B Telemetry			
Status Flags				
33	Instrument Data Quality Flags	Summary Grating Mode	Scene Mode	Summary Grating Memory Mode
34	Channel Fill Flags			
35	Channel Error Flags			
36	Final Channel Quality Flags			
37	Spare			
38	Sample Status Flag #1	Sample Status Flag #2	Sample Status Flag #3	Sample Status Flag #4
Digital A Instrument Data				
39	Monochromator Grating Position		Radiometric DC level	Grating Position Error
40	Memory Verify		CCR and Monochromator Overrange Flags	
41	CCR Data		Monochromator Range 1 Data	
42	Monochromator Range 2 Data		Monochromator Range 3 Data	
43	Recommended Monochromator Range Data		Recommended Monochromator Range ID	
44-133	Same as Words 38-43 for next 15 samples.			

134-137	Spare			
Meteorological and Geographic Support Data				
138	FOV Surface Pressure		FOV Snow/Ice Flag	
139	FOV Average Cloud Amount		FOV Average Cloud Top Pressure	
140	FOV Average Temperature @ 0.5 mb		FOV Average Temperature @ 1.0 mb	
141-149	Same as word 140 but for FOV Average Temperatures at 1.5, 2, 3, 4, 5, 7, 10, 15, 20, 25, 30, 50, 60, 70, 85, 100, 200, and 400 mb			
150-154	Spare			
Housekeeping Data				
155	Digital A Analog Housekeeping Channel 1A	Digital A Analog Housekeeping Channel 1B	Digital A Analog Housekeeping Channel 2A	Digital A Analog Housekeeping Channel 2B
156-162	Same as Word 155 for Digital A Analog Housekeeping Channels 3A/3B through 16A/16B			
163	Analog Telemetry Point #1	Analog Telemetry Point #2	Analog Telemetry Point #3	Analog Telemetry Point #4
164-167	Same as Word 163 but for Analog Telemetry Points 5-17			
167	Analog Telemetry Point #17	Spare		
168-180	Same as Words 155-167 but for the second 16 second interval			

Notes:
T_0 = Time (seconds) at start of Major Frame
Major Frame Quality Flags: See Byte/Bit Breakdown
*Words 33-36, 38 are individual bit data. For Instrument Data Quality Flag and Sample Status Flags see Byte/bit breakdown. For CCR and Monochromator Overrange Flags: See Byte/Bit Breakdown.

Table 9.7.1.4-13. Sweep Data Record Data Identification, Attitude, Earth Location Data, Digital B and Status Flags.

	Byte 1	Byte 2	Byte 3	Byte 4
Word	**Description**			
1-38	Same as Words 1-38 of Discrete Data Record			
Digital A Instrument Record				
39	CCR and Monochromator Overrange Flags		Monochromator Range ID	
40	Monochromator Grating Position		CCR Data	
41	Monochromator Data: sample #1		Monochromator Data: sample #2	
42-45	Same as Word 41 but for samples 3-10			
46-165	Same as Words 38-45 but for next 15 one second intervals			
166-167	Spare			
Housekeeping Data				
168-180	Same as words 155-167 of Discrete Data Record but covering appropriate 16 second sweep data record interval.			
Note: CCR and Monochromator Overrange Flags, and Monochromator ID: See byte/bit breakdown.				

Table 9.7.1.4-14. Byte/bit Breakdown of Discrete Data.

	Starting			Ending**		
Data Item	**Word**	**Byte**	**Bit***	**Word**	**Byte**	**Bit**
Monochromator Grating Position:						
Grating Position	39	1	1	-	2	5
Segment Being Read	39	2	6	-	-	7
Digital lock	39	2	8	-	-	-
CCR and Monochromator Overrange Flags:						
CCR Overrange Flag	40	3	1	-	-	4

Monochromator Range Number 1 Overrange Flag	40	3	5	-	-	8
Monochromator Range Number 2 Overrange Flag	40	4	1	-	-	4
Monochromator Range Number 3 Overrange Flag	40	4	5	-	-	8

Table 9.7.1.4-15. Byte/bit Breakdown of Discrete/Sweep Data.

	Starting			Ending**		
Data Item	**Word**	**Byte**	**Bit***	**Word**	**Byte**	**Bit**
Major Frame Quality Flags:						
Bad Quality Major Frame Flag	7	1	1	-	-	-
Time Error Flag	7	1	2	-	-	-
Dwell Mode Flag	7	1	3	-	-	-
Boost Mode Flag	7	1	4	-	-	-
Data Fill Flag	7	1	5	-	-	-
Spare	7	1	6	-	-	-
Missing Attitude Data Flag	7	1	7	-	-	-
No SBUV/2 Earth Location Data Flag	7	1	8	-	-	-
Spare	7	2	1	7	3	8
Unreasonable Date or Time Flag	7	4	1	-	-	-
Non-time Ascending Data Flag	7	4	2	-	-	-
Out of Range Attitude Data Flag	7	4	3	-	-	-
Out of Range Analog Telemetry Data Flag	7	4	4	-	-	-
Out of Range Earth Location Data Flag	7	4	5	-	-	-
Major/Minor Frame Inconsistency Flag	7	4	6	-	-	-
Spare	7	4	7	-	-	8

Table 9.7.1.4-16. Byte/bit Breakdown of Discrete Data.						
	Starting			Ending**		
DIGITAL B TELEMETRY:	**Word**	**Byte**	**Bit***	**Word**	**Byte**	**Bit**
1st 3.2 second interval						
Telemetry Point 1	31	2	3	-	-	-
Telemetry Point 2	31	2	4	-	-	-
...					-	-
Telemetry Point 22	31	4	8	-	-	-
6th 3.2 second interval						
Telemetry Point 1	32	2	3	-	-	-
Telemetry Point 2	32	2	4	-	-	-
...						
Telemetry Point 22	32	4	8	-	-	-
Instrument Data Quality Flag:						
Master Power ON/OFF	33	1	1	-	-	2
High Voltage ON/OFF	33	1	3	-	-	4
Frame Sync Flag	33	1	5	-	-	6
Data Communications	33	1	7	-	-	8
Sample Status Flag Number 1:						
Discrete/Sweep Flag	38	1	1	-	-	-
Retrace ON/OFF	38	1	2	-	-	-
ECAL Step Number	38	1	3	-	-	5
Grating Mode	38	1	6	-	-	8
Sample Status Flag Number 2:						
Grating Memory	38	2	1	-	-	-

Grating Index	38	2	2	-	-	-
Frame Sync Code	38	2	3	-	-	-
Automated Command	38	2	4	-	-	5
Command Sequence State	38	2	6	-	-	8

* Most significant bit (MSB) = bit 1, Least significant bit (LSB) = bit 8.
** A dash indicates no change from starting value

Table 9.7.1.4-17. Byte/bit Breakdown of Discrete/Sweep Data.

	Starting			Ending**		
Data Item	**Word**	**Byte**	**Bit***	**Word**	**Byte**	**Bit**
Sample Status Flag Number 3:						
Master Power On/Off	38	3	1	-	-	-
Calibration Lamp Timer	38	3	2	-	-	-
Calibration Lamp Position	38	3	3	-	-	4
Diffuser Timer	38	3	5	-	-	-
Diffuser Position	38	3	6	-	-	8
Sample Status Flag Number 4:						
Code Address	38	4	1	-	-	2
Code Data Bits 1 through 6	38	4	3	-	-	8

* Most significant bit (MSB) = bit 1, Least significant bit (LSB) = bit 8.
** A dash indicates no change from starting value.

Table 9.7.1.4-18. Byte/bit Breakdown of Sweep Data.

	Starting			Ending**		
Data Item	**Word**	**Byte**	**Bit***	**Word**	**Byte**	**Bit**
CCR and Monochromator Overrange Flags:						
Spare	39	1	1	-	-	-

CCR Overrange Flag	39	1	2	-	-	-
Monochromator Overrange Flag for Sample 10	39	1	3	-	-	-
One Bit Monochromator Overrange (Flags for Sample 9 through Sample 1)	39	1	4	-	2	4
Monochromator Range for ID:						
Monochromator Range for ID for Sample 10	39	2	5	-	-	6
Two bit Monochromator Range ID for Samples 9 through Sample 1	39	2	7	-	4	8
Monochromator Grating Position:						
Grating Position	40	1	1	-	2	5
Segment Being Read	40	2	6	-	-	7
Digital Lock	40	2	8	-	-	-
* Most significant bit (MSB) = bit 1, Least significant bit (LSB) = bit 8. ** A dash indicates no change from starting value.						

Table 9.7.1.4-19. SBUV/2 Orbital Statistical Record..

	Byte 1	**Byte 2**	**Byte 3**	**Byte 4**
Word	**Description**			
1	Record ID			
2-15	Same as words 2-15 of SBUV/2 Orbital Record Header			
16	Number of Discrete Records			
17	Number of Discrete Records with Master Power Off			
18	Number of Discrete Records with High Voltage Off			
19	Number of Discrete Records with Bad Tip Data Quality/Frame Sync Flag Set			
20	Number of Discrete Records with Data Contaminated by Automated Command Sequence			
21	Number of Discrete Records in Earth Scene Mode			

22	Number of Discrete Records in Sun Scene Mode	
23	Number of Discrete Records in Direct Hg Lamp Scene Mode	
24	Number of Discrete Records in Indirect Hg Lamp Scene Mode	
25	Number of Discrete Records in Mixed/Contaminated Scene Modes	
26	Number of Discrete Records with Diffuser Decontamination Data	
27	Number of Discrete Records with Non-Standard Wavelengths	
28	Number of Discrete Records in Discrete Grating Mode	
29	Number of Discrete Records in Wavelength Calibration Mode	
30	Number of Discrete Records in Position Mode	
31	Number of Discrete Records with Grating Mode Indeterminate	
Sweep Record Counters		
32-45	Same as words 16 to 28 and word 31, but for sweep records.	
46-55	Spare	
Digital A Analog Housekeeping Orbital Summary		
56	Orbital Average of Digital A Analog Housekeeping Channel 1A	Orbital Average of Digital A Analog Housekeeping Channel 1B
57-71	Same as word 56 but contains Channels 2A/2B through 16A/16B	
72-87	Same as words 56 to 71 but contains orbital maxima	
88-103	Same as words 56 to 71 but contains orbital minima	
104-119	Same as words 56 to 71 but contains orbital standard deviations	
120-135	Same as words 56 to 71 but contains number of data samples for each housekeeping channel in orbit	
Analog Telemetry Orbital Summary		
136	Orbital Average of Analog Telemetry # 1	Orbital Average of Analog Telemetry Point #2
137-144	Same as word 136 for Points #3 through 17	
144	Orbital Average of Analog Telemetry # 17	Spare

145-153	Same as words 136 through 144 but for orbital maxima
154-162	Same as words 136 through 144 but for orbital minima
163-171	Same as words 136 though 144 but for orbital standard deviations
172-180	Same as words 136 through 144 but contains number of data samples for each point number in orbit.
Note: For scaling factors, see Section 9.7.1.5	

Table 9.7.1.4-20. SBUV/2 Daily Statistical Record.

	Byte 1	Byte 2	Byte 3	Byte 4
Word	**Description**			
1	Record ID			
2	SBUV/2 day number			
3	SBUV/2 start orbit number of day			
4	SBUV/2 end orbit number of day			
5	Year of first Major Frame in first SBUV/2 orbit of day			
6	Day of first Major Frame in First SBUV/2 orbit of day			
7	Seconds of day at start of first Major Frame in first SBUV/2 orbit of day			
8	Year of last Major Frame in last SBUV/2 orbit of day			
9	Day of last Major Frame in last SBUV/2 orbit of day			
10	Seconds of day at start of last Major Frame in last SBUV/2 orbit of day			
11-15	Spare			
16-180	Same as SBUV/2 orbital statistical record except for day instead of orbit			

9.7.1.5 Housekeeping Data Ranges and Conversions

The SBUV/2 instrument provides a variety of housekeeping data to monitor the health of the instrument itself. These data are contained in the Digital A Subcom Analog Housekeeping and the Analog Telemetry. On the 1b Data Set these data are stored in the individual data records as raw counts. However, in the orbital and daily statistics records these data have been converted to

engineering units. For discrete data, there are two sets (of 16 seconds each) of Digital A (Subcom) Analog Housekeeping data and two sets of Analog Housekeeping data for each major frame (one record). For sweep data, where one major frame requires 2 data records, both Digital A Subcom and Analog Telemetry data are present for each 16 second interval (i.e. each data record).

Tables 9.7.1.5-1 and 9.7.1.5-2 on the following pages contain the housekeeping data ranges, counts to engineering units conversion methods and, for orbital and daily statistics, the scaling factors of the stored data (e.g., a stored value of 4316 with a scaling factor of 10^2 is really 43.16). The source of this information is the TIROS-N Unique Instrument Interface for SBUV/2. Data ranges are not used in computing orbital and daily statistics (i.e. no data are excluded).

Three conversion methods are used to go from raw counts to Engineering Units (E.U.), depending on the type of housekeeping data:

1. Linear interpolation

$$E.U. = (A \times counts) + B$$

where A and B are given in Table 9.7.1.5-1 or 9.7.1.5-2.

2 SPTEMP: Convert single point temperature to degrees Centigrade using cubic spline interpolation.
   a. Convert count to voltage in volts.
   b. Select appropriate temperature-voltage curve for interpolation
   c. Select closest four points on given curve for interpolation
   d. Perform cubic spline interpolation/extrapolation

3. DFTEMP: convert differential count to differential temperature.

   a. Compute Thermistor A count from differential count and reference count
   b. Obtain Thermistor A temperature in degrees Centigrade (use SPTEMP)
   c. Compute differential temperature from Thermistor A temperature and reference temperature.

Table 9.7.1.5-1. Digital A Subcom Housing Channels.

	Range*			
Channel Function	**Counts**	**Engineering Units**	**Conversion Method**	**Statistical Record Scaling Factor**

1A Chopper Motor Current	0-255	0-0.15A	A = .002 N	10^4
1B Spare	spare	spare	A = .002 N	1.0
2A Diffuser Motor Current	0-255	0-1.02 A	A=.004 N	10^4
2B Diffuser Plate Temp.	0-255	0-80^o C	SPTEMP	10^2
3A HVPS volts	0-255	0-1530	V=6 N	10^1
3B Baseplate Temp.	0-255	-15 to 45^o C	SPTEMP	10^2
4A Thermistor Bias (+10V REF)	135-165	9-11 V	V=.0667 N	10^3
4B +25V Power-Volts	113-139	22.5-27.5 V	V=.198 N	10^2
5A Cal Lamp Temp.	0-255	0-80^o C	SPTEMP	10^2
5B +15V Servo-Volts	135-165	13.5-16.5 V	V=.1 N	10^3
6A ECAL Ref. Voltage	145-175	5.8-7 V	V=.04 N	10^3
6B -15V Servo-Volts	147-153	-16.5 to -13.5	V=.5076 N-91.4	10^3
7A +15V Sensors-Volts	135-165	13.5-16.5 V	V=.1 N	10^3
7B CCR Diode Temp.	0-255	-5 to 35^o C	SPTEMP	10^2
8A -15V Sensors-Volts	147-153	-16.5 to -13.5	V=.5076 N-91.4	10^3
8B SM differential Temp. Y	0-255	-5 to 5^o C	DFTEMP	10^3
9A +24V Motor-Volts	95-147	19 to 29 V	V=.198 N	10^3
9B SM Differential Temp. Z	0-255	-5 to 5^o C	DFTEMP	10^2
10A +5V LED-Volts	120-180	4-6 V	V=.0333 N	10^3
10B Differential Ref. Temp Z	57-179	-15 to 45^o C	SPTEMP	10^2
11A +10V Logic-Volts	135-165	9-11 V	V=. 0667 N	10^3

11B Differential Ref. Temp Y	57-179	-15 to 45^{o} C	SPTEMP	10^{2}
12A CAL Lamp Current	0-255	0-1331.1 μ A	A=5.22X10^{-6} N	10^{8}
12B PMT Cathode Temp.	0-255	-5 to 35^{o} C	SPTEMP	10^{2}
13A Spare	spare	spare	--	1.0
13B Spare	spare	spare	--	1.0
14A Grating Coarse Error(1)	0-255	24 to -25 steps	Step=-.1935 N+24	10^{3}
14BChopper Phase Error	0-255	0-25.12 V	V=.0985 N	10^{3}
15A Grating Motor Current(1)	0-255	.73 to -.392 A	A=-.0044 N+.73	10^{4}
15B Spare	spare	spare	SPTEMP	1.0
16A Lamp Motor Current	0-255	0-1.02 A	A=.004 N	10^{4}
16B Spare	spare	spare	SPTEMP	1.0

Notes:
°C = degrees Centigrade, A = Amperes, V = Volts, μA = microamperes, N = Actual count
* Ranges are normal ranges for voltages. For other items, these are maximum ranges.
(1) Grating Coarse Error and Grating Motor Current are expected to read 0 to 10 counts for Flight Model #1. These telemetry points were grounded out before launch.

Table 9.7.1.5-2. Analog Telemetry Points.

	Range*			
Channel Function	**Counts**	**Engineering Units**	**Conversion Method**	**Statistical Record Scaling Factor**
1 SM Baseplate Temp. #2 (1)	0-255	-15 to 45^{o} C	SPTEMP	100
2 SM Shroud Temp.	0-255	-30 to 80^{o} C	SPTEMP	100

3 Depolarizer Housing Temp.	0-255	-15 to 45^{o} C	SPTEMP	100
4 HVPS Temp.	0-255	-15 to 45^{o} C	SPTEMP	100
5 Diffuser Plate Temp #2(1)	0-255	0 to 80^{o} C	SPTEMP	100
6 Chopper Motor Temp.	0-255	-15 to 45^{o} C	SPTEMP	100
7 Grating Motor Temp.	0-255	-15 to 45^{o} C	SPTEMP	100
8 Diffuser Motor Temp	0-255	-15 to 45^{o} C	SPTEMP	100
9 Cal Lamp Motor Temp.	0-255	-15 to 45^{o} C	SPTEMP	100
10 Electrometer Temp.	0-255	-15 to 45^{o} C	SPTEMP	100
11 Cal Lamp Power Supply Temp.	0-255	-15 to 45^{o} C	SPTEMP	100
12 Diffuser Radiator Temp.	0-255	-15 to 45^{o} C	SPTEMP	100
13 ELM Temp.	0-255	-15 to 45^{o} C	SPTEMP	100
14 LVPS Temp.	0-255	-15 to 45^{o} C	SPTEMP	100
15 Diffuser Heater Current	0-255	0-.459 A	A=.0018 N	10^4
16 Baseplate Heater Current	0-255	0-.459 A	A=.0018 N	10^4
17 28 V Main Power	120-160	24-32 V	V=.2 N	100
Notes: ^{o}C = degrees Centigrade, A = Amperes, V = Volts, N = Actual Count * Ranges are normal ranges for voltages. For other items, these are maximum ranges. (1) Powered from the 28 V Analog TM BUS				

9.7.2 PRODUCT MASTER FILE

9.7.2.1 Overview

The Product Master File (PMF) contains the ozone information derived by the ozone algorithm, located in space and time, other meteorological information developed in support of the ozone computation, parameters indicating the validity of the individual ozone retrievals and the radiance information derived from the SBUV/2 measurements.

9.7.2.2 Data Organization

The operational monthly PMF contains one month of data comprised of whole orbits (delimited by night time equator crossing). The last orbit in the file may contain some data from the next day. The information on the file is grouped logically by orbit and by scan. Header and summary information is provided for each orbital group of scan by scan ozone data as well as daily summary information. The orbital group contains the OOPS Standard Header, ancillary data and instrument calibration data.

Figure 9.7.2.2-1 and Table 9.7.2.2-1 provide detailed descriptions of the arrangement of records on the PMF monthly operational file. Each daily record consists of the OOPS standard headers and the daily PMF records. The daily group indicated in the table is repeated for each day of the month. The file has a Logical Record Length (LRECL) of 828 bytes and is blocked at 16560 bytes (20 records). The SBUV/2 algorithm used prior to 2007 was called Version 6. Beginning in 2007, a revised SBUV/2 algorithm was implemented, called Version 8. For a detailed description of the Version 8 algorithm, refer to the Algorithm Theoretical Basis Document located at ftp://www.orbit.nesdis.noaa.gov/pub/smcd/spb/ozone/docs/SBUV2_V8_ATBD_020207.pdf. At that time, the Version 6 monthly PMF file described here became solely an intermediate file, not for distribution. Users were provided only with daily PMFs. The format for Version 8 daily files is shown in Table 9.7.2.2-9 through 9.7.2.2.-12. Since the Version 6 product is an intermediate step in the production of the Version 8 product, users can note the full original Version 6 data record is reproduced at the end of the Version 8 records, in words 1794-2000.

The archive original PMF (Version 6, available for years prior to 2007), available through CLASS, consists of daily files with only PMF data records (see Table 9.7.2.2-5**).** All other record types have been removed. The daily files are tarred together at the end of the month and available through CLASS on the second day of the next month. For Version 8, the archive format is exactly like the daily operational binary file format. Each daily file has two header records (Tables 9.7.2.2-9 and 9.7.2.2-10), followed by a variable number of data records (Table 9.7.2.2-11), ending with a trailer record (Table 9.7.2.2-12).

Table 9.7.2.2-2 and Table 9.7.2.2-3 lists the pressure layers and levels at which the ozone data is reported. With Version 8, there are 21 layers, instead of 12. In atmospheres, the Layer bottoms are: 1.0, 0.631, 0.398, 0.251, 0.158, 0.100, 0.0631, 0.040, 0.0251, 0.0158, 0.0100, 0.0063, 0.0040, 0.00251, 0.00158, 0.0010, 0.00063, 0.00040, 0.00025, 0.000158, and 0.0001, with top layer extending to infinity.

The PMF is also available in BUFR format (a WMO International format for observed data.).

See Table 9.7.2.2-8 for the PMF BUFR words (Version 6) and Table 9.7.2.2-13 for Version 8. Not all words are included in the Version 8 BUFR files. Including only a subset of words, with modified units, allowed the product to be created in a World Meteorological Organization (WMO) compatible format. Reading the BUFR files requires an input BUFR table that describes the layout of the BUFR subsets. These subsets are combined into BUFR messages of up to 10,000 bytes. Table 9.7.2.2-13 contains the BUFR input table, made up of three sections: Table A, Table B, and Table D.

Table 9.7.2.2-1. PMF Record Layout for Day. (Version 6)

Record Type	# of Records
OOPS Standard Headers I & II ○ Product Master File ○ Daily 1b Data Set	2
Orbital Header Record	1
Data Records	100 (Nominal)
Repeat last three items each orbit of day	1400 (Nominal)

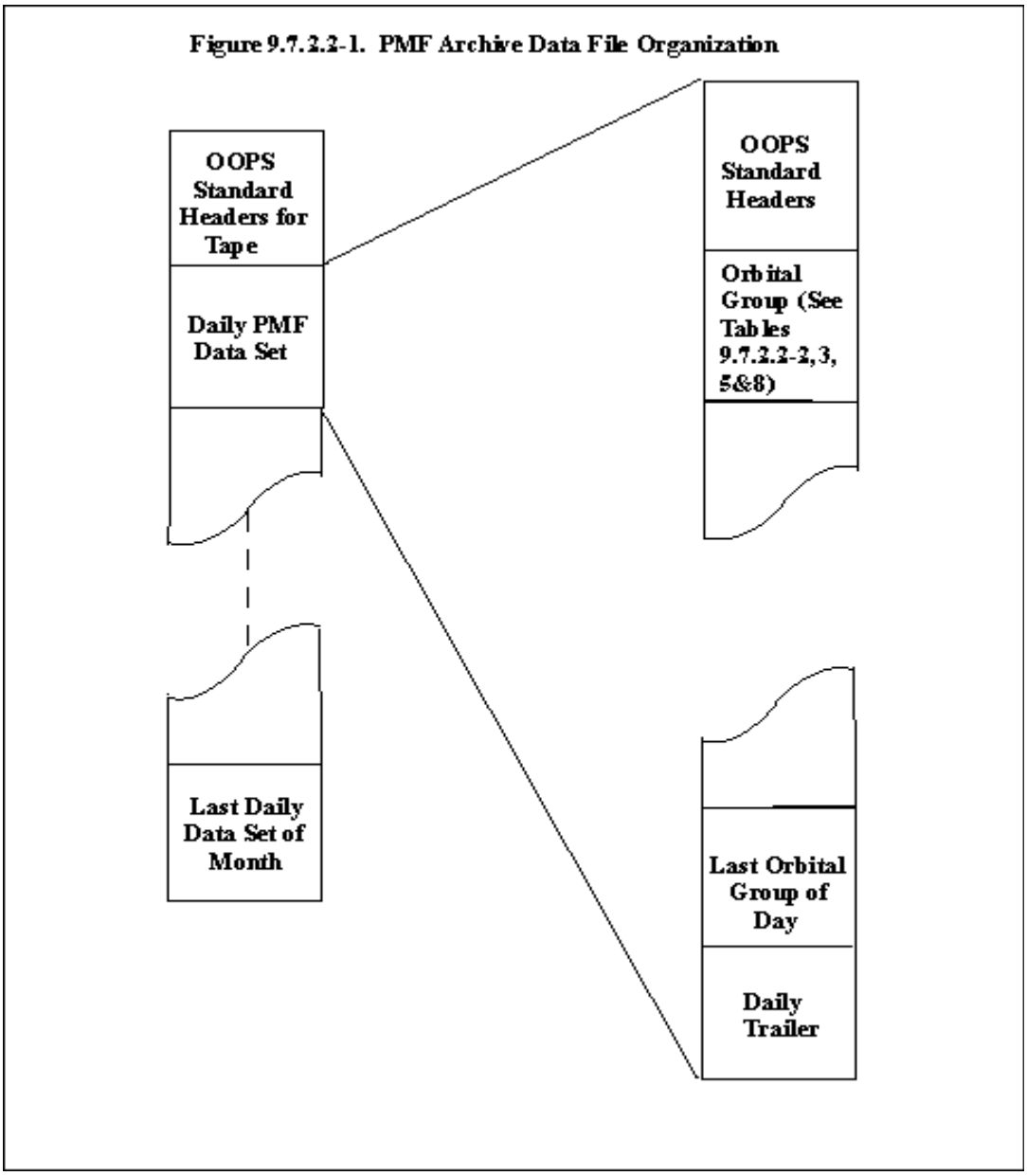

Figure 9.7.2.2-1. PMF Archive Tape Data Set Organization

Table 9.7.2.2-2. Ozone Pressure Levels.					
Kilometers	**Feet**	**Miles**	**Pressure**	**Level**	**Layer**
63.5	209000	39.6	0.12		-----
					12
58.5	192000	36.4	0.25		-----
57.0	187500	35.5	0.30	1	11
55.0	180500	34.2	0.40	2	
53.5	175000	33.1	0.49		-----
53.0	174500	33.0	0.50	3	10
51.5	166000	31.4	0.70	4	
48.0	157000	29.7	0.99		-----
47.8	156500	29.6	1.00	5	9
44.6	146500	27.7	1.50	6	
42.4	139500	26.4	1.98		-----
42.6	139000	26.3	2.00	7	8
39.4	129500	24.5	3.00	8	
37.4	123000	23.3	3.96		-----
37.2	122500	23.2	4.00	9	
35.6	117500	22.2	5.00	10	7
33.4	110000	20.8	7.00	11	
32.6	107000	20.3	7.92		-----
31.0	101800	19.3	10.00	12	6
28.4	93000	17.6	15.00	13	
28.0	91800	17.4	15.83		-----
26.5	86800	16.4	20.00	14	5

23.8	78200	14.8	30.00	15	
23.5	77200	14.6	31.66		-----
22.0	72200	13.7	40.00	16	4
20.6	67400	12.8	50.00	17	
19.1	62600	11.9	63.33		-----
18.4	60400	11.4	70.00	18	3
16.1	53000	10.0	100.00	19	
14.7	48200	9.1	126.66		-----
13.6	44600	8.5	150.00		2
11.8	38600	7.3	200.00		
10.3	33700	6.4	253.31		------
9.2	30000	5.7	300.00		
7.2	23500	4.6	400.00		
5.6	18200	3.5	500.00		
4.2	13800	2.6	600.00		
3.0	9900	1.9	700.00		1
2.0	6400	1.2	800.00		
1.5	4800	0.9	850.00		
1.0	3200	0.6	900.00		
.1	400	0.1	1000.00		
0.0	0	0.0	1013.25		-----

Table 9.7.2.2-3. Ozone Pressure Layers (Version 6) and Levels			
PMF Word (V6)	**UMKEHR**	**Pressure (Atm)**	**Pressure (mb)**
132	12	.0002-.0001	0.25 - 0.12
133	11	.0005-.0002	0.49 – 0.25
134	10	.0010-.0005	0.99 – 0.49
135	9	.0020-.0010	1.98 – 0.99
136	8	.0039-.0020	3.96 – 1.98
137	7	.0078-.0039	7.92 – 3.96
138	6	.0156-.0078	15.83 - 7.92
139	5	.0313-.0156	31.66 - 15.83
140	4	.0625-.0313	63.33 - 31.66
141	3	.1250-.0625	126.66 - 63.33
142	2	.2500-.1250	253.31- 126.66
143	1	1.0000-.2500	1013.25 – 253.31
Levels			
PMF Word (V6)	**Level (mb)**	**PMF Word (V6)**	**Level (mb)**
160	0.3	169	5.0
161	0.4	170	7.0
162	0.5	171	10.0
163	0.7	172	15.0
164	1.0	173	20.0
165	1.5	174	30.0
166	2.0	175	40.0
167	3.0	176	50.0
168	4.0	177	70.0

-	-	178	100.0
Version 8 Layers			
PMF Word (V8)	Layer Number	Pressure (ATM)	Pressure (mb)
163	21	.0001 – top of atmo	< .1
162	20	.000158-.0001	.16-.1
161	19	.00025-.000158	.25-.16
160	18	.00040-.00025	.41-.25
159	17	.00063-.00040	.64-.41
158	16	.0010-.00063	1.0-.64
157	15	.00158-.0010	1.6-1.0
156	14	.00251-.00158	2.5-1.6
155	13	.0040-.00251	4-2.5
154	12	.0063-.0040	6-4
153	11	.010-.0063	10-6
152	10	.0158-.010	16-10
151	9	.0251-.0158	25-16
150	8	.040-.0251	41-25
149	7	.0631-.040	64-41
148	6	.10-.0631	101-64
147	5	.158-.10	160-101
146	4	.251-.158	255-160
145	3	.398-251	404-255
144	2	.631-.398	640-404
143	1	1.0-.631	1013-640

Table 9.7.2.2-4. PMF Orbital Header Record. (Version 6)				
.	**Byte 1**	**Byte 2**	**Byte 3**	**Byte 4**
Word	**Description**			
1	Record ID (Integer)			
2	Logical sequence number (1)			
3	SBUV/2 orbit number			
4-7	Date of job run (EBCDIC)			
8	Julian day of first good scan			
9	Seconds of day of first good scan (seconds)			
10	Year of first good scan (yyy)			
11	Subsatellite latitude of first good scan (degrees)			
12	Subsatellite longitude of first good scan (degrees)			
13	Spare (-77.0)			
14-16	Processing parameters			
17	Spare (-77.0)			
18-30	Day 1 solar irradiance			
31-67	Radiance calibration factors			
68-80	Band center wavelengths			
81-93	Effective ozone absorption coefficients			
94-106	Rayleigh scattering coefficient			
107-126	Processing options 0.0 = false, 1.0 = true			
127-207	Spare (-77.0)			

Table 9.7.2.2-5. PMF Data Record. (Version 6)				
	Byte 1	**Byte 2**	**Byte 3**	**Byte 4**
Word	**Description**			
1	Record ID (integer)			
2	Logical Sequence Number			
3	SBUV/2 Orbit Number			
4	Year at Start of Scan x 1000 + Day of Year at Start of Scan			
5	Seconds of Day			
6	Subsatellite Latitude at the Beginning of Scan (Degrees)			
7	Subsatellite Longitude at the Beginning of Scan (Degrees)			
Total - Ozone Output				
8	View Latitude - Average for Total Ozone Wavelengths (Degrees)			
9	View Longitude - Average for Total Ozone Wavelengths (Degrees)			
10	Solar Zenith Angle - Average for Total Ozone Wavelengths (Degrees)			
11-14	N-Values (CCR Coincident with 339.8, 331.2, 317.5, 312.5 nm)			
15-18	N-Values (Monochromator 339.8, 331.2, 317.5, 312.5, 305 nm)			
19	Gain Selection code for each of five wavelengths (339.8, 331.2, 317.5, 312.5, 305 nm) (Ex: Integer #33322)			
20	Grating Position Error Offsets for wavelength's 1-6.			
21	Total Ozone - Best Estimate based on TOVS Cloud Height. (m-atm-cm)			
22	FOV Average Cloud Top Pressure (atm) (Reported by TOVS)			
23	Pressure of Reflective Surface (atm) (Estimated using TOVS)			
24	Reflectivity-Average (Estimated using TOVS)			
25	Percent Cloud from CCR			
26	Ozone Error Flag for TOVS Total Ozone			
27	Total A-Pair Ozone (m-atm-cm)			

28	Ozone A-Pair sensitivity (N-Value/m-atm-cm)
29	Reflectivity average for A-Pair
30	Ozone Weight A-Pair
31	Total Ozone B-Pair (m-atm-cm)
32	Ozone Sensitivity B-Pair (N-Value/m-atm-cm)
33	Reflectivity average for B-Pair
34	Ozone Weight B-Pair
35	Total Ozone-Best Estimate Based on Climatological Cloud Height (m-atm-cm)
36	Total Ozone C-Pair (m-atm-cm)
37	Pressure of reflecting Surface (Estimated Without TOVS) (atm)
38	Reflectivity Average
39	Ozone Sensitivity C-Pair (N-Value/m-atm-cm)
40	Ozone Error Flag for Best Ozone
41	FOV Snow Flag * 10 + Table Selection Index 1=Snow 1 = Low Latitude; 0=No Snow 2 = Mid Latitude; -1=No Info. 3 = High Latitude.
42	Grating Position Error Offset for wavelength's 7-12
43	Reflectivity difference (Photometer/monochromator)
44	Terrain Surface Pressure (atm)
45	Total Ozone D-Pair (m-atm-cm)
46	SOI Index
47	Total Ozone B′-Pair (m-atm-cm)
Profile Output	
48	View latitude - Average for profile (degrees)
49	View longitude - Average for profile (degrees)
50	Solar Zenith Angle - Average for profile (degrees)

51-58	N-Values (CCR coincident with Profile wavelengths 252.2, 275.3, 283.0, 287.6, 292.2, 297.5, 301.9, and 305.8 nm)
59-66	N-Values (monochromator profile wavelengths)
67-68	Gain Selection Flags for Each of Eight Wavelengths
69-80	Layer Ozone-first Guess Amounts in 12 Pressure Layers (m-atm-cm)
81	Total Ozone for A Priori profile (m-atm-cm)
82-91	Q-Values Corrected for Multiple Scattering and Surface Reflectivity (252.2 through 317.5 nm)
92-101	Initial Residues (252.2 through 317.5 nm) (%)
102-106	Multiple-Scattering correction to Q for Five Longer Wavelengths Channels (297.5 through 317.5 nm)
107-111	Reflectivities for Five Longer Wavelengths (297.5 through 317.5 nm)
112-116	Multiple-Scattering Sensitivity for Five Longer Wavelengths (297.5 through 317.5 nm) (Q-Value/m-atm-cm)
117-121	Multiple-Scattering Mixing Fraction for Five Longer Wavelengths (297.5 through 317.5 nm)
122-131	Final Residues (252.2 through 317.5 nm) (%)
132-143	Layer Ozone Amounts for Solution Profile in 12 Pressure Layers (m-atm-cm)
144-155	Layer Ozone Standard Deviations for Solution Profile in 12 Pressure Layers (%)
156	Total Ozone for solution profile (m-atm-cm)
157	Ozone Error Flag for Profile
158-159	Upper Level Profile parameters C (m-atm-cm) and Sigma
160-178	Ozone Mixing Ratio at 19 Pressure Levels (micro gm/gm)
179-190	Layer Ozone Standard Deviations for First Guess in 12 Pressure Layers (%)
191-200	Standard Deviations of Q-Values Corrected for Multiple Scattering and Reflectivity (252.2 through 317.5 nm) (%)
201	Number of Iterations for Profile Solution
202	VCI (Volcano Contamination Index)

203	Spare (-77.0) or Solar Azimuth Angle at Field of View at start of scan (degrees)
204	Ozone Sensitivity D-Pair (N_value/m-atm-cm)
205	Ozone Sensitivity B′-Pair (N_value/m-atm-cm)
206	Solar Zenith Angle at Start of Scan (Radians x 10^4)
207	Solar Zenith Angle at End of Scan (Radians x 10^4)

Table 9.7.2.2-6. PMF Orbital Trailer Record. (Version 6)

	Byte 1	Byte 2	Byte 3	Byte 4
Word	**Description**			
1	Record ID (Integer)			
2	Logical sequence number -(N+2); N = number of data records			
3	SBUV/2 orbit number			
4	Day of year of last good scan of orbit			
5	Seconds of day of last good scan of orbit			
6	Subsatellite latitude at the end of orbit (degrees)			
7	Subsatellite longitude at the end of orbit (degrees)			
8	View latitude - Average for total ozone on last scan (degrees)			
9	View Longitude - Average for total ozone on last scan (degrees)			
10-39	Processing counters (orbital sub-totals)			
40-207	Spares			

Table 9.7.2.2-7. PMF Daily Trailer Record. (Version 6)

	Byte 1	Byte 2	Byte 3	Byte 4
Word	**Description**			
1	Record ID (Integer)			
2	Daily Trailer Identifier (-1.0)			

3	SBUV/2 Orbit Number of Last Orbit of Day
4	Day of Year of Last Scan of Day
5	Seconds of Day of Last Scan of Day
6	Subsatellite Latitude of Last Scan (Degrees)
7	Subsatellite Longitude of Last Scan (Degrees)
8-27	Processing Counters (Daily Totals)
28-207	Spares

Table 9.7.2.2-8. SBUV/2 Ozone - Product Master File (PMF) BUFR Words. (Version 6)

Word #	Description	Units	Decimal Places	Range of Values	Fill Value
1	Record ID (Integer)	N/A	0	761	N/A
2	Logical Sequence Number	N/A	0	1 to 200	N/A
3	SBUV/2 Orbit Number	N/A	0	1 to 99999	N/A
4	Start of Scan Year	Year	0	96001 to ?????	N/A
5	Day of Year	Day	0	1 to 366	N/A
6	Hour	Hour	0	00 to 24	N/A
7	Minute	Minute	0	00 to 60	N/A
8	Second	Second	0	00 to 60	N/A
9	Subsatellite Latitude	Degrees	2	-90S to 90N	N/A
10	Subsatellite Longitude	Degrees	2	-180W to 180E	N/A
11	View Latitude Total Ozone	Degrees	2	-90S to 90N	N/A
12	View Longitude Total Ozone	Degrees	2	-180W to 180E	N/A
13	Solar Zenith Angle - Average for Total Ozone	Degrees	2	0 to 180	N/A

14	N-value CCR 339.8 nm	N/A	0	0 to 1000	-77
15	N-value CCR 331.2 nm	N/A	0	0 to 1000	-77
16	N-value CCR 317.5 nm	N/A	0	0 to 1000	-77
17	N-value CCR 312.5	N/A	0	0 to 1000	-77
18	N-value Monochromator 339.8 nm	N/A	0	0 to 1000	-77
19	N-value CCR 331.2 nm	N/A	0	0 to 1000	-77
20	N-value CCR 317.5 nm	N/A	0	0 to 1000	-77
21	N-value CCR 312.5 nm	N/A	0	0 to 1000	-77
22	Gain Selection Code for 4 Wavelengths + 305 nm	N/A	0	11111 to 33333	NA
23	Total Ozone Best Estimate TOVS Cloud Height	m-atm-cm	2	0 to 1000	-77
24	FOV Average Cloud Top Pressure	atm	2	0 to 1	-77
25	Pressure of Reflective Surface Estimating Using TOVS	atm	2	0 to 1	-77
26	Reflectivity Avg. For TOVS	N/A	2	0 to 1	-77
27	% Cloud from CCR	%	0	0 to 100	-77
28	Ozone Error Flag for TOVS Total Ozone	N/A	0	0 to 19	NA
29	Total A-pair Ozone	m-atm-cm	2	0 to 1000	-77
30	Ozone A-pair Sensitivity	1/(m-atm-cm)	2	0 to 1	-77
31	Reflectivity Average For A-pair	N/A	2	0 to 1	-77
32	Ozone Weight A-pair	N/A	2	0 to 1	-77
33	Total B-pair Ozone	m-atm-cm	2	0 to 1000	-77

34	Ozone B-Pair Sensitivity	1/(m-atm-cm)	2	0 to 1	-77
35	Reflectivity Average for B-pair	N/A	2	0 to 1	-77
36	Ozone Weight B-pair	N/A	2	0 to 1	-77
37	Total Ozone Best Estimate Based on Climatology Cloud Height	m-atm-cm	2	0 to 1000	-77
38	Total C-pair Ozone	m-atm-cm	2	0 to 1000	-77
39	Pressure of Reflective Surface Estimating Without TOVS	atm	2	0 to 1	-77
40	Reflectivity Average	N/A	2	0 to 1	-77
41	Ozone C-pair Sensitivity	1/(m-atm-cm)	2	0 to 1	-77
42	Ozone Error Flag for Best Ozone	N/A	0	0 to 19	N/A
43	Table Selection Index	N/A	0	1 to 3	N/A
44	FOV Snow Flag	N/A	0	-1 to 1	N/A
45	Reflectivity Difference (Photo/mono)	N/A	2	-10 to 10	-77
46	Terrain Surface Pressure	atm	2	0 to 1	-77
47	Total D-pair Ozone	m-atm-cm	2	0 to 1000	-77
48	Soil Index	N/A	2	-1000 to 1000	-77
49	Total B'-pair Ozone	m-atm-cm	2	0 to 1000	-77
50	View Latitude Profile Ozone	Degrees	2	-90S to 90N	N/A
51	View Longitude Profile Ozone	Degrees	2	-180W to 180E	N/A
52	Solar Zenith Angle - Average for Profile Ozone	Degrees	2	0 to 180	N/A

53	N-value CCR 252.2 nm	N/A	0	0 to 1000	-77
54	N-value CCR 275.3 nm	N/A	0	0 to 1000	-77
55	N-value CCR 283.0 nm	N/A	0	0 to 1000	-77
56	N-value CCR 287.6 nm	N/A	0	0 to 1000	-77
57	N-value CCR 292.2 nm	N/A	0	0 to 1000	-77
58	N-value CCR 297.5 nm	N/A	0	0 to 1000	-77
59	N-value CCR 301.9 nm	N/A	0	0 to 1000	-77
60	N-value CCR 305.8 nm	N/A	0	0 to 1000	-77
61	N-value Monochromator 252.2 nm	N/A	0	0 to 1000	-77
62	N-value Monochromator 275.3 nm	N/A	0	0 to 1000	-77
63	N-value Monochromator 283.0 nm	N/A	0	0 to 1000	-77
64	N-value Monochromator 287.6 nm	N/A	0	0 to 1000	-77
65	N-value Monochromator 292.2 nm	N/A	0	0 to 1000	-77
66	N-value Monochromator 297.5 nm	N/A	0	0 to 1000	-77
67	N-value Monochromator 301.9 nm	N/A	0	0 to 1000	-77
68	N-value Monochromator 305.8 nm	N/A	0	0 to 1000	-77
69	Gain Selection Code for First 4 Wavelengths	N/A	0	1111 to 3333	N/A
70	Gain Selection Code for Last 4 Wavelengths	N/A	0	1111 to 3333	N/A
71	First Guess Layer Ozone 12 .25-.12 mb	m-atm-cm	2	0 to 500	-77

72	First Guess Layer Ozone 11 .5-.25 mb	m-atm-cm	2	0 to 500	-77
73	First Guess Layer Ozone 10 1-.5 mb	m-atm-cm	2	0 to 500	-77
74	First Guess Layer Ozone 9 2-1 mb	m-atm-cm	2	0 to 500	-77
75	First Guess Layer Ozone 8 4-2 mb	m-atm-cm	2	0 to 500	-77
76	First Guess Layer Ozone 7 8-4 mb	m-atm-cm	2	0 to 500	-77
77	First Guess Layer Ozone 6 16-8 mb	m-atm-cm	2	0 to 500	-77
78	First Guess Layer Ozone 5 32-16 mb	m-atm-cm	2	0 to 500	-77
79	First Guess Layer Ozone 4 64-32 mb	m-atm-cm	2	0 to 500	-77
80	First Guess Layer Ozone 3 127-64 mb	m-atm-cm	2	0 to 500	-77
81	First Guess Layer Ozone 2 250-127 mb	m-atm-cm	2	0 to 500	-77
82	First Guess Layer Ozone 1 1013-250 mb	m-atm-cm	2	0 to 500	-77
83	Total Ozone for A-priori Profile	m-atm-cm	2	0 to 1000	-77
84	Q-Values Corrected for Multiple-scattering and Reflectivity. 252.2 nm	N/A	2	0 to 100000	-77
85	Q-values Corrected for Multi-scat. and Reflect. 275.3 nm	N/A	2	0 to 100000	-77
86	Q-values Corrected for Multi-scat. and Reflect. 283.0 nm	N/A	2	0 to 100000	-77

87	Q-values Corrected for Multi-scat. and Reflect. 287.6 nm	N/A	2	0 to 100000	-77
88	Q-values Corrected for Multi-scat. and Reflect. 292.2 nm	N/A	2	0 to 100000	-77
89	Q-values Corrected for Multi-scat. and Reflect. 297.5 nm	N/A	2	0 to 100000	-77
90	Q-values Corrected for Multi-scat. and Reflect. 301.9 nm	N/A	2	0 to 100000	-77
91	Q-values Corrected for Multi-scat. and Reflect. 305.8 nm	N/A	2	0 to 100000	-77
92	Q-values Corrected for Multi-scat. and Reflect. 312.5 nm	N/A	2	0 to 100000	-77
93	Q-values Corrected for Multi-scat. and Reflect. 317.5 nm	N/A	2	0 to 100000	-77
94	Initial Residue 252.2 nm	%	0	0 to 100	-77
95	Initial Residue 275.3 nm	%	0	0 to 100	-77
96	Initial Residue 283.0 nm	%	0	0 to 100	-77
97	Initial Residue 287.6 nm	%	0	0 to 100	-77
98	Initial Residue 292.2 nm	%	0	0 to 100	-77
99	Initial Residue 297.5 nm	%	0	0 to 100	-77
100	Initial Residue 301.9 nm	%	0	0 to 100	-77
101	Initial Residue 305.8 nm	%	0	0 to 100	-77
102	Initial Residue 312.5 nm	%	0	0 to 100	-77
103	Initial Residue 317.5 nm	%	0	0 to 100	-77
104	Multiple Scattering Correction to Q 297.5 nm	N/A	2	0 to 1	-77
105	Multiple Scattering Correction to Q 301.9 nm	N/A	2	0 to 1	-77
106	Multiple Scattering Correction to Q 305.8 nm	N/A	2	0 to 1	-77

107	Multiple Scattering Correction to Q 312.5 nm	N/A	2	0 to 1	-77
108	Multiple Scattering Correction to Q 317.5 nm	N/A	2	0 to 1	-77
109	Reflectivities 297.5 nm	N/A	2	0 to 1	-77
110	Reflectivities 301.9 nm	N/A	2	0 to 1	-77
111	Reflectivities 305.8 nm	N/A	2	0 to 1	-77
112	Reflectivities 312.5 nm	N/A	2	0 to 1	-77
113	Reflectivities 317.5 nm	N/A	2	0 to 1	-77
114	Multiple Scattering Sensitivity 297.5 nm	1/(m-atm-cm)	2	0 to 1	-77
115	Multiple Scattering Sensitivity 301.9 nm	1/(m-atm-cm)	2	0 to 1	-77
116	Multiple Scattering Sensitivity 305.8 nm	1/(m-atm-cm)	2	0 to 1	-77
117	Multiple Scattering Sensitivity 312.5 nm	1/(m-atm-cm)	2	0 to 1	-77
118	Multiple Scattering Sensitivity 317.5 nm	1/(m-atm-cm)	2	0 to 1	-77
119	Multiple Scattering Mixing Fraction 297.5 nm	N/A	2	0 to 100	-77
120	Multiple Scattering Mixing Fraction 301.9 nm	N/A	2	0 to 100	-77
121	Multiple Scattering Mixing Fraction 305.8 nm	N/A	2	0 to 100	-77
122	Multiple Scattering Mixing Fraction 312.5 nm	N/A	2	0 to 100	-77
123	Multiple Scattering Mixing Fraction 317.5 nm	N/A	2	0 to 100	-77
124	Final Residues 252.2 nm	%	0	0 to 100	-77

125	Final Residues 275.3 nm	%	0	0 to 100	-77
126	Final Residues 283.0 nm	%	0	0 to 100	-77
127	Final Residues 287.6 nm	%	0	0 to 100	-77
128	Final Residues 292.2 nm	%	0	0 to 100	-77
129	Final Residues 297.5 nm	%	0	0 to 100	-77
130	Final Residues 301.9 nm	%	0	0 to 100	-77
131	Final Residues 305.8 nm	%	0	0 to 100	-77
132	Final Residues 312.5 nm	%	0	0 to 100	-77
133	Final Residues 317.5 nm	%	0	0 to 100	-77
134	Solution Profile Layer Ozone 12 .25-.12 mb	m-atm-cm	2	0 to 500	-77
135	Solution Profile Layer Ozone 11 .5-.25 mb	m-atm-cm	2	0 to 500	-77
136	Solution Profile Layer Ozone 10 1-.5 mb	m-atm-cm	2	0 to 500	-77
137	Solution Profile Layer Ozone 9 2-1 mb	m-atm-cm	2	0 to 500	-77
138	Solution Profile Layer 8 4-2 mb	m-atm-cm	2	0 to 500	-77
139	Solution Profile Layer Ozone 7 8-4 mb	m-atm-cm	2	0 to 500	-77
140	Solution Profile Layer Ozone 6 16-8 mb	m-atm-cm	2	0 to 500	-77
141	Solution Profile Layer Ozone 5 32-16 mb	m-atm-cm	2	0 to 500	-77
142	Solution Profile Layer Ozone 4 64-32 mb	m-atm-cm	2	0 to 500	-77
143	Solution Profile Layer Ozone 3 127-64 mb	m-atm-cm	2	0 to 500	-77

144	Solution Profile Layer Ozone 2 250-127 mb	m-atm-cm	2	0 to 500	-77
145	Solution Profile Layer Ozone 1 1013-250 mb	m-atm-cm	2	0 to 500	-77
146	Solution Profile Standard Deviation Layer Ozone 12 .25-.12 mb	%	0	0 to 100	-77
147	Solution Profile Standard Deviation Layer Ozone 11 .5-.25 mb	%	0	0 to 100	-77
148	Solution Profile Standard Deviation Layer Ozone 10 1-.5 mb	%	0	0 to 100	-77
149	Solution Profile Standard Deviation Layer Ozone 9 2-1 mb	%	0	0 to 100	-77
150	Solution Profile Standard Deviation Layer Ozone 8 4-2 mb	%	0	0 to 100	-77
151	Solution Profile Standard Deviation Layer Ozone 7 8-4 mb	%	0	0 to 100	-77
152	Solution Profile Standard Deviation Layer Ozone 6 16-8 mb	%	0	0 to 100	-77
153	Solution Profile Standard Deviation Layer Ozone 5 32-16 mb	%	0	0 to 100	-77
154	Solution Profile Standard Deviation Layer Ozone 4 64-32 mb	%	0	0 to 100	-77
155	Solution Profile Standard Deviation Layer Ozone 3 127-64 mb	%	0	0 to 100	-77

156	Solution Profile Standard Deviation Layer Ozone 2 250-127 mb	%	0	0 to 100	-77
157	Solution Profile Standard Deviation Layer Ozone 1 1013-250 mb	%	0	0 to 100	-77
158	Total Ozone for Solution Profile	m-atm-cm	2	0 to 1000	-77
159	Ozone Error Flag for Profile	N/A	0	0 to 9	N/A
160	Upper Level Profile Parameter C	m-atm-cm	2	0 to 1000	-77
161	Upper Level Profile Parameter Sigma	m-atm-cm	2	0 to 1000	-77
162	Ozone Mixing Ratio Level 1 .3 mb	micro-grams /gram	2	0 to 50	-77
163	Ozone Mixing Ratio Level 2 .4 mb	micro-grams /gram	2	0 to 50	-77
164	Ozone Mixing Ratio Level 3 .5 mb	micro-grams /gram	2	0 to 50	-77
165	Ozone Mixing Ratio Level 4 .7 mb	micro-grams /gram	2	0 to 50	-77
166	Ozone Mixing Ratio Level 5 1.0 mb	micro-grams /gram	2	0 to 50	-77
167	Ozone Mixing Ratio Level 6 1.5 mb	micro-grams /gram	2	0 to 50	-77
168	Ozone Mixing Ratio Level 7 2.0 mb	micro-grams /gram	2	0 to 50	-77

169	Ozone Mixing Ratio Level 8 3.0 mb	micro-grams /gram	2	0 to 50	-77
170	Ozone Mixing Ratio Level 9 4.0 mb	micro-grams /gram	2	0 to 50	-77
171	Ozone Mixing Ratio Level 10 5.0 mb	micro-grams /gram	2	0 to 50	-77
172	Ozone Mixing Ratio Level 11 7.0 mb	micro-grams /gram	2	0 to 50	-77
173	Ozone Mixing Ratio Level 12 10.0 mb	micro-grams /gram	2	0 to 50	-77
174	Ozone Mixing Ratio Level 13 15.0 mb	micro-grams /gram	2	0 to 50	-77
175	Ozone Mixing Ratio Level 14 20.0 mb	micro-grams /gram	2	0 to 50	-77
176	Ozone Mixing Ratio Level 15 30.0 mb	micro-grams /gram	2	0 to 50	-77
177	Ozone Mixing Ratio Level 16 40.0 mb	micro-grams /gram	2	0 to 50	-77
178	Ozone Mixing Ratio Level 17 50.0 mb	micro-grams /gram	2	0 to 50	-77
179	Ozone Mixing Ratio Level 18 70.0 mb	micro-grams /gram	2	0 to 50	-77

180	Ozone Mixing Ratio Level 19 100.0 mb	micro-grams /gram	2	0 to 50	-77
181	Layer Ozone Standard Deviations for 1st Guess Layer 12	%	0	0 to 100	-77
182	Layer Ozone Standard Deviations for 1st Guess Layer 11	%	0	0 to 100	-77
183	Layer Ozone Standard Deviations for 1st Guess Layer 10	%	0	0 to 100	-77
184	Layer Ozone Standard Deviations for 1st Guess Layer 9	%	0	0 to 100	-77
185	Layer Ozone Standard Deviations for 1st Guess Layer 8	%	0	0 to 100	-77
186	Layer Ozone Standard Deviations for 1st Guess Layer 7	%	0	0 to 100	-77
187	Layer Ozone Standard Deviations for 1st Guess Layer 6	%	0	0 to 100	-77
188	Layer Ozone Standard Deviations for 1st Guess Layer 5	%	0	0 to 100	-77
189	Layer Ozone Standard Deviations for 1st Guess Layer 4	%	0	0 to 100	-77
190	Layer Ozone Standard Deviations for 1st Guess Layer 3	%	0	0 to 100	-77

191	Layer Ozone Standard Deviations for 1st Guess Layer 2	%	0	0 to 100	-77
192	Layer Ozone Standard Deviations for 1st Guess Layer 1	%	0	0 to 100	-77
193	Standard Deviation of Q-values Corrected for Multiple Scattering and Reflectivity 252.2 nm	%	0	0 to 100	-77
194	Standard Deviation of Q-values Corrected for Multiple Scattering and Reflectivity 275.3 nm	%	0	0 to 100	-77
195	Standard Deviation of Q-values Corrected for Multiple Scattering and Reflectivity 283.0 nm	%	0	0 to 100	-77
196	Standard Deviation of Q-values Corrected for Multiple Scattering and Reflectivity 287.6 nm	%	0	0 to 100	-77
197	Standard Deviation of Q-values Corrected for Multiple Scattering and Reflectivity 292.2 nm	%	0	0 to 100	-77
198	Standard Deviation of Q-values Corrected for Multiple Scattering and Reflectivity 297.5 nm	%	0	0 to 100	-77
199	Standard Deviation of Q-values Corrected for Multiple Scattering and Reflectivity 301.9 nm	%	0	0 to 100	-77

200	Standard Dev. of Q-values Corrected for Multiple Scattering and Reflectivity 305.8 nm	%	0	0 to 100	-77
201	Standard Dev. of Q-values Corrected for Multiple Scattering and Reflectivity 312.5 nm	%	0	0 to 100	-77
202	Standard Deviation of Q-values Corrected for Multiple Scattering and Reflectivity 317.5 nm	%	0	0 to 100	-77
203	Number of Iterations for Profile Solution	N/A	0	0 to 1000	-77
204	Volcano Contamination Index	N/A	2	-10 to 20	-77
205	Solar Azimuth Angle at FOV at Start of Scan	Degrees	2	-180 to 180	-77
206	Ozone Sensitivity D-pair	1/(m-atm-cm)	2	0 to 1	-77
207	Ozone Sensitivity B'-pair	1/(m-atm-cm)	2	0 to 1	-77
208	Solar Zenith Angle at Start of Scan	Radians	4	0 to 30000	-77
209	Solar Zenith Angle at End of Scan	Radians	4	0 to 30000	-77

Table 9.7.2.2-9 Version 8 Header Record I Layout

Byte	Description	Sample
1-5	Spare	
6-13	Satellite name and flight model identifier	'SBUV-N18'
14	Spare	
15-21	Data Level	'LEVEL-2'
22-33	Algorithm	'BY V8SBUV '
34	Spare	
35-47	Version	'VERSION 8.100'
48	Spare	

49-62	Program date	‘Feb, 26 2004 ’
63	Spare	
64-86	Operating system	‘ON OSUNIX GEN’
87	Spare	
88-90	Month of data processing	‘APR’
91	Spare	
92-93	Day of data processing	‘12’
94	Spare	
95-98	Year of data processing	‘2006’
99	Spare	
100-101	Hour of data processing	‘16’
102-103	Minute of data processing	‘29’
104-105	Second of data processing	‘48’
106	Spare	
107-114	‘DATA FOR’	
115-116	Spare	
117-119	Month of data	‘APR’
120	Spare	
121-122	Day of data	‘11’
123	Spare	
124-127	Year of data	‘2006’
128	Spare	
129-130	Hour of data	‘00’
131-132	Minute of data	‘55’
133-134	Second of data	‘02’
135-140	Spare	
141-1980	Input Control File (80 characters per input line)	
1981-8000	Spare	

Table 9.7.2.2-10 Version 8 Header Record II Layout

Byte	Description	Sample
1-5	Spare	
6-13	Satellite name and flight model identifier	‘SBUV-N18’
14	Spare	
15-21	Level	‘LEVEL-2’
22-33	Algorithm	‘BY V8SBUV ’
34	Spare	
35-47	Version	‘VERSION 8.100’
48-60	Spare	
61-1900	Input constant file (80 characters per input line)	

1901-1968	Spare or the first 68 characters of the V6 PMF standard header record I	
1969-8000	Spare	

Table 9.7.2.2-11 Version 8 Data Record Layout		
Word (V6 Word No.)	**Content**	**Sample**
1	Orbit Number	4590.000000
2	Greenwich Mean Time seconds	4870.000000
3	Logical sequence number	50.00000000
4	Satellite ID	18.00000000
5	Day of year	101.0000000
6	Year	2006.000000
7	Latitude for Total Ozone (318 nm)	21.90064812
8	Longitude for Total Ozone (318 nm)	-177.2539978
9	Solar zenith angle	25.69408035
10	Solar zenith angle at start of scan	25.51954079
11	Solar zenith angle at end of scan	26.11541557
12-23	N252, N274, N283, N288, N292, N298, N302, N306, N313, N318, N331, N340 (Measured n-values from the monochromator)	353.0212097
24-35	N252, N274, N283, N288, N292, N298, N302, N306, N313, N318, N331, N340 (Measured n-values from the photometer)	112.6623688
36	Total Ozone	285.4809875
37	Error flag	0.0000000000E+00
38	Reflectivity	0.1248972490
39	Algorithm flag	1.000000000
40	Step one ozone	283.8000183
41	Step two ozone	284.5615845
42-49	(dN/dΩ)292, (dN/dΩ)298, (dN/dΩ)302, (dN/dΩ)306, (dN/dΩ)313, (dN/dΩ)318, (dN/dΩ)331, (dN/dΩ)340	0.9698080976E-04
50-57	(dN/dR)292, (dN/dR)298, (dN/dR)302, (dN/dR)306, (dN/dR)313, (dN/dR)318, (dN/dR)331, (dN/dR)340	-0.6654153112E-03
58	(dN/dR)CCR (at 331 nm monochromator channel)	-119.6416702
59-66	Res(N292), Res(N298), Res(N302), Res(N306),Res(N313), Res(N318), Res(N331), Res(N340)	-2.646954060
67	Photometer Residual (CCR) at N331	0.3035485744
68	Terrain Pressure (atm)	1.000000000
69	Cloud top pressure (atm)	0.5330700874
70	Effective cloud fraction	0.0000000000E+00
71	Ozone below cloud	0.0000000000E+00
72	Surface category	0.0000000000E+00
73-75	Gain12-9, Gain8-5, Gain4-1	33332.00000 0.0000000000E+00 0.0000000000E+00
76	Aerosol Index	-0.3035485744
77-86	Total ozone *a priori* profile layer 0-9 Ozone	19.70327759
87	Total ozone *a priori* profile for layer 10 and above	1.284301281
88-97	Total ozone algorithmic efficiency Layer 0-9	0.6234209538
98	Total ozone algorithmic efficiency for layer 10 and above	1.102117181

99	Latitude for Profile Ozone (292 nm)	21.31681824
100	Longitude for Profile Ozone (292 nm)	-177.1071472
101-121	21 layer A-priori ozone profile (DU)(Layer bottoms are: 1.0,0.631,0.398,0.251,0.158,0.100,0.0631,0.040,0.0251,0.0158,0.0100,0.0063,0.0040,0.00251,0.00158,0.0010,0.00063,0.00040,0.00025,0.000158,0.0001, with top layer extending to infinity)	13.76889515
122-142	21 layer First guess ozone profile (DU)	10.63301754
143-163	21 layer Retrieved ozone profile (DU)	13.92403889
164-183	Estimated error of retrieved profile (%) (top layer not included)	6.871080875
184	Profile total ozone (DU)	285.6116943
185	Estimated error of profile total ozone (%)	1.000248790
186-200	Ozone mixing ratio in prescribed levels (ppmv) (0.5, 0.7, 1.0, 1.5, 2.0, 3.0, 4.0, 5.0, 7.0, 10.0, 15.0, 20.0, 30.0, 40.0, 50.0)	1.507388115
201-215	Estimated errors in mixing ratio (%)	8.611349106
216-225	Initial residuals (n-value: short to long wavelength)	-3.654667854
226-235	Final residuals (n-value: short to long wavelength)	-0.4110307395
236-435	10 x 20 Total scattering kernel (top layer not included)	0.0000000000E+00
436-445	Computed single-scattering n-values (short to long wavelength)	353.5621033
446-458	Input temperature profile in Umkehr layers 12 - 0	240.9932098
459	Number of iterations for solution convergence	3.000000000
460	Reflectivity Correction	0.3565867373E-03
461-472	Grating drive position for wavelengths of 252, 274, 283, 288, 292, 298, 302, 306, 313, 318, 331, 340	4.000000000
473-480	Photometer reflectivity for wavelengths of 292, 298, 302, 306, 313, 318, 331, 340	0.1403288096
481	Sigma	0.5608523488
482	Error code for profile ozone	0.0000000000E+00
483	Index of longest profile channel used	7.000000000
484	TOVS Cloud Pressure (SBUV2 Only)	-77.00000000
485-492	Cloud fraction for wavelengths of 292, 298, 302, 306, 313, 318, 331, 340	0.0000000000E+00
493	Quality of Fit Parameter (Average final residual)	0.2619659156E-01
494	Dark Current Flag (Nimbus-04 only)	0.0000000000E+00
495	Snow/Ice Indicator	0.0000000000E+00
496-499	Photometer reflectivity for wavelengths of 252, 274, 283, 288	0.1389459223
500	Spare	99999.00000
501-900	20 layer averaging kernel	0.2918600850E-01
901	fractional error in radiance/flux	0.9999999776E-02
902	fractional error in profile	0.5000000000
903-1793	Spare	99999.00000
1794 (1)	Record ID (integer)	0.1066388131E-41 (761)
1795 (2)	Logical Sequence Number	55.00000000
1796 (3)	SBUV/2 Orbit Number	4590.000000
1797 (4)	Year at Start of Scan x 1000 + Day of Year at Start of Scan	2006101.000
1798 (5)	Seconds of Day	4870.000000
1799 (6)	Subsatellite Latitude at the Beginning of Scan (Degrees)	20.76972771
1800 (7)	Subsatellite Longitude at the Beginning of Scan (Degrees)	-176.9695282
1801 (8)	View Latitude - Average for Total Ozone Wavelengths (Degrees)	21.90064812
1802 (9)	View Longitude - Average for Total Ozone Wavelengths (Degrees)	-177.2539978
1803 (10)	Solar Zenith Angle - Average for Total Ozone Wavelengths (Degrees)	25.88033295

1804-1807 (11-14)	N-Values (CCR Coincident with 339.8, 331.2, 317.5, 312.5 nm)	114.7022018
1808-1811 (15-18)	N-Values (Monochromator 339.8, 331.2, 317.5, 312.5, 305 nm)	104.7198639
1812 (19)	Gain Selection code for each of five wavelengths (339.8, 331.2, 317.5, 312.5, 305 nm) (Ex: Integer #33322)	33332.00000
1813 (20)	Grating Position Error Offsets for wavelengths 1-6	444444.0000
1814 (21)	Total Ozone - Best Estimate based on TOVS Cloud Height. (m-atm-cm)	-77.00000000
1815 (22)	FOV Average Cloud Top Pressure (atm) (Reported by TOVS)	-77.00000000
1816 (23)	Pressure of Reflective Surface (atm) (Estimated using TOVS)	-77.00000000
1817 (24)	Reflectivity-Average(Estimated using TOVS)	-77.00000000
1818 (25)	Percent Cloud from CCR	-77.00000000
1819(26)	Ozone Error Flag for TOVS Total Ozone	-77.00000000
1820(27)	Total A-Pair Ozone (m-atm-cm)	281.7537842
1821 (28)	Ozone A-Pair sensitivity (N-Value/m-atm-cm)	0.1266763657
1822 (29)	Reflectivity average for A-Pair	0.1436941475
1823 (30)	Ozone Weight A-Pair	0.6520434618
1824 (31)	Total Ozone B-Pair (m-atm-cm)	289.5964661
1825 (32)	Ozone Sensitivity B-Pair (N-Value/m-atm-cm)	0.6523291767E-01
1826 (33)	Reflectivity average for B-Pair	0.1426741332
1827 (34)	Ozone Weight B-Pair	0.3479565382
1828 (35)	Total Ozone-Best Estimate Based on Climatological Cloud Height (m-atm-cm)	282.6184998
1829 (36)	Total Ozone C-Pair (m-atm-cm)	-77.00000000
1830 (37)	Pressure of reflecting Surface (Estimated Without TOVS) (atm)	0.8969467282
1831 (38)	Reflectivity Average	0.1431841403
1832 (39)	Ozone Sensitivity C-Pair (N-Value/m-atm-cm)	-77.00000000
1833 (40)	Ozone Error Flag for Best Ozone	0.0000000000E+00
1834 (41)	FOV Snow Flag * 10 + Table Selection Index 1 = Snow 1=Low Latitude 0 = No Snow 2 = Mid Latitude -1=No Info. 3 = High Latitude	1.230021596
1835 (42)	Grating Position Error Offset for wavelength's 7-12	444444.0000
1836 (43)	Reflectivity difference (Photometer/monochromator)	-0.8263364434E-02
1837 (44)	Terrain Surface Pressure (atm)	1.000000000
1838 (45)	Total Ozone D-Pair (m-atm-cm)	288.6121521
1839 (46)	SOI Index	3.594287157
1840 (47)	Total Ozone B'-Pair (m-atm-cm)	283.5286865
1841 (48)	View latitude – Average for profile (degrees)	21.31681824
1842 (49)	View longitude - Average for profile (degrees)	-177.1071472
1843 (50)	Solar Zenith Angle - Average for profile (degrees)	25.69408035
1844-1851 (51-58)	N-Values (CCR coincident with Profile wavelengths 252.2, 275.3, 283.0, 287.6, 292.2, 297.5, 301.9, and 305.8 nm)	112.6623688
1852-1859 (59-66)	N-Values (monochromator profile wavelengths)	353.0212097
1860-1861 (67-68)	Gain Selection Flags for Each of Eight Wavelengths	15.32454681
1862-1873 (69-80	Layer Ozone-first Guess Amounts in 12 Pressure Layers (m-atm-cm)	0.9603615850E-01
1874 (81)	Total Ozone for A Priori profile (m-atm-cm)	282.6184998
1875-1884	Q-Values Corrected for Multiple Scattering and Surface Reflectivity	0.1054719673E-02

(82-91)	(252.2 through 317.5 nm)	
1885-1894 (92-101)	Initial Residues (252.2 through 317.5 nm) (%)	-2.375382423
1895-1899 (102-106)	Multiple-Scattering Correction to Q for Five Longer Wavelengths Channels (297.5 through 317.5 nm)	0.2912611817E-03
1900-1904 (107-111)	Reflectivities for Five Longer Wavelengths (297.5 through 317.5 nm)	0.1532480419
1905-1909 (112-116)	Multiple-Scattering Sensitivity for Five Longer Wavelengths (297.5 through 317.5 nm) (Q-Value/m-atm-cm)	-0.3800403094E-02
1910-1914 (117-121)	Multiple-Scattering Mixing Fraction for Five Longer Wavelengths (297.5 through 317.5 nm)	1.873179913
1915-1924 (122-131)	Final Residues (252.2 through 317.5 nm) (%)	-0.1078700796
1925-1936 (132-143)	Layer Ozone Amounts for Solution Profile in 12 Pressure Layers (m-atm-cm)	0.9808807075E-01
1937-1948 (144-155)	Layer Ozone Standard Deviations for Solution Profile in 12 Pressure Layers (%)	11.56864834
1949 (156)	Total Ozone for solution profile (m-atm-cm)	280.3361206
1950 (157)	Ozone Error Flag for Profile	0.0000000000E+00
1951-1952 (158-159)	Upper Level Profile parameters C (m-atm-cm) and Sigma	1.130160093 0.5665833950
1953-1971 (160-178)	Ozone Mixing Ratio at 19 Pressure Levels (micro gm/gm)	1.708832741
1972-1983 (179-190)	Layer Ozone Standard Deviations for First Guess in 12 Pressure Layers (%)	11.99999905
1984-1993 (191-200)	Standard Deviations of Q-Values Corrected for Multiple Scattering and Reflectivity (252.2 through 317.5 nm) (%)	1.039469957
1994 (201)	Number of Iterations for Profile Solution	2.000000000
1995 (202)	VCI (Volcano Contamination Index)	0.2916399837
1996 (203)	Spare (-77.0) or Solar Azimuth Angle at Field of View at start of scan (degrees)	-20265.00000
1997 (204)	Ozone Sensitivity D-Pair (N_value/m-atm-cm)	0.1641995311
1998 (205)	Ozone Sensitivity B'-Pair (N_value/m-atm-cm)	0.7568971068E-01
1999 (206)	Solar Zenith Angle at Start of Scan (Radians x 10^4)	4454.000000
2000 (207)	Solar Zenith Angle at End of Scan (Radians x 10^4)	4558.000000

Table 9.7.2.2.12 Version 8 Trailer record layout

Word	Description	Sample
1	Orbit number	4603.000000
2	GMT of first scan	3302.000000
3	Logical sequence number (negative)	-1206.000000
4	Day of year of first scan	101.0000000
5	GMT of first scan	3302.000000
6	Nadir view latitude of first scan	-68.95317078
7	Nadir view longitude of first scan	-143.5602875
8	Day of year of last scan	101.0000000
9	GMT of last scan	85862.00000
10	Latitude of last scan	76.30832672

11	Longitude of last scan	68.10655975
12	Local equator crossing time	-77.00000000
13	Local day of year at equator crossing	0.0000000000E+00
14	Local year at equator crossing	0.0000000000E+00
15	not used	-77.00000000
16	not used	0.0000000000E+00
17	not used	0.0000000000E+00
18	not used	-77777.00000
19	Ozone minimum for orbit	233.4052734
20	Ozone maximum for orbit	518.6837158
21-41	Daily processing counters	1112.000000
42-60	Spare	99999.00000
61-73	Instrument wavelengths	252.0399933
74-86	N-Value adjustment factors	0.0000000000E+00
87-98	Interpolation factor	0.4289999977E-01
99-152	Raman scattering correction factors	0.5600000173E-01
153	Reflectivity wavelength index	11.00000000
154	Reflectivity wavelength index for hi SZA	12.00000000
155	Ozone wavelength index	10.00000000
156	Ozone wavelength index for high SZA	11.00000000
157	Profile mixing wavelength index	9.000000000
158	F313 coefficient	-8.000000000
159-161	F360 coefficients	4.223000050
162-164	Flag 3 limit	10.00000000
165-167	Flag 4 limit	3.500000000
168	Fractional error in radiance/flux	0.9999999776E-02
169	Fractional error in profile	0.5000000000
170	Correlation length of *a priori* covariance	12.00000000
171	Ozone interpolation tolerance value	0.1000000047E-02
172-2000	Spare	99999.00000

Table 9.7.2.2-13 BUFR input table

MNEMONIC	NUMBER	DESCRIPTION
USER DEFINITIONS FOR TABLE A, TABLE B, AND TABLE D		
NC012201	A10019	SBUV/2 OZONE
SAID	001007	SATELLITE IDENTIFIER
SIID	002019	SATELLITE INSTRUMENT 624=SBUV/2
DATE	301011	DATE
TIME	301013	TIME
C08	352015	REPEAT EIGHT TIMES
C15	352016	REPEAT FIFTEEN TIMES
C20	352017	REPEAT TWENTY TIMES
C21	352018	REPEAT TWENTY ONE TIMES
CLAT	005002	LATITUDE (COARSE ACCURACY) FOR TOTAL OZONE
CLON	006002	LONGITUDE
LTLONC	001023	LATITUDE (COARSE ACCURACY) FOR TOTAL OZONE
		LONGITUDE (COARSE ACCURACY) FOR TOTAL OZONE
SOZA	007025	SOLAR ZENITH ANGLE
		SOLAR ZENITH ANGLE AT START OF SCAN
		SOLAR ZENITH ANGEL AT END OF SCAN
TSIG	008021	TIME SIGNIFICANCE
RSST	008029	SURFACE CATEGORY
ORBN	005040	ORBIT NUMBER
STKO	008075	ASCENDING/DESCENDING ORBIT QUALIFIER
OZON	015001	TOTAL OZONE
SBUVTOQ	033070	ERROR CODE FOR PROFILE OZONE
PRES	010004	TERRAIN PRESSURE (PA)
VSAT	008003	VERTICAL SIGNIFICANCE 0=SURFACE
ACIDX	015030	AEROSOL CONTAMINATION INDEX
CLDMNT	020081	CLOUD FRACTION FOR WAVELENGTHS 292,298,302,306,313,318,
		331,340
		EFFECTIVE CLOUD FRACTION
		OZONE BELOW CLOUD - SAME AS TOTAL OZONE
TLRFV	033042	TYPE OF LIMIT REPRESENTED
PRLC	007004	CLOUD TOP PRESSURE (PA)
OZOP	015005	21 LAYER A-PRIORI OZONE PROFILE (DU) (21 VALUES)
		21 LAYER RETRIEVED OZONE PROFILE (DU) (21 VALUES)
MTXSIG	008026	MATRIX SIGNIFICANCE
LINCOF	025143	20 LAYER AVERAGING KERNEL (400 VALUES)
ATCT	008043	ATMOSPHERIC CHEMICAL TYPE
DSFTV	008090	DECIMAL SCALE
MIXRV	015008	OZONE MIXING RATIO IN PRESCRIBED LEVELS (PPMV) (15 VALUE
SBUVPOQ	033071	SBUV PROFILE OZONE QUALITY
PCCF	033007	ESTIMATED ERRORS IN MIXING RATIO (15 VALUES)
WAVL	002071	FINAL RESIDUALS (N-VALUE: SHORT TO LONG WAVELENGTH)
YEAR	004001	YEAR
MNTH	004002	MONTH
DAYS	004003	DAYS
HOUR	004004	HOUR
MINU	004005	MINUTE
SECO	004006	SECOND

MNEMONIC	SEQUENCE
DEFINITION OF OZONE BUFR FILE	
NC012201	SAID SIID DATE TIME CLAT CLON SOZA TSIG SOZA TSIG SOZA TSIG
NC012201	RSST ORBN STKO VSAT PRES VSAT 207002 OZON 207000 SBUVTOQ
NC012201	ACIDX 207002 CLDMNT 207000 VSAT TLRFV PRLC 207002 OZON 207000
NC012201	VSAT "C21"21 ATCT "C15"15 ATCT SBUVPOQ "C08"8

C21	PRLC PRLC 207002 TSIG OZOP TSIG OZOP PCCF 207000 MTXSIG "C20"20
C21	MTXSIG
C20	LINCOF
C15	PRLC DSFTV 207006 MIXRV 207000 DSFTV 207002 PCCF 207000
C08	202124 201107 WAVL 201000 202000 207002 CLDMNT 207000
DATE	YEAR MNTH DAYS
TIME	HOUR MINU SECO

MNEMONIC	SCAL	REFERENCE	BIT	UNITS
SAID	0	0	10	CODE TABLE
SIID	0	0	11	CODE TABLE
CLAT	2	-9000	15	DEGREE
CLON	2	-18000	16	DEGREE
LTLONC	2	-18000	16	DEGREE
SOZA	2	-9000	15	DEGREE
RSST	0	0	8	CODE TABLE
ORBN	0	0	24	NUMERIC
STKO	0	0	2	CODE TABLE
OZON	0	0	10	DU
SBUVTOQ	0	0	4	CODE TABLE
PRES	-1	0	14	PA
ACIDX	2	-1000	12	NUMERIC
CLDMNT	0	0	7	%
VSAT	0	0	6	CODE TABLE
PRLC	-1	0	14	PA
OZOP	0	0	10	DU
PCCF	0	0	7	%
LINCOF	6	-5000000	24	NUMERIC
MIXRV	0	0	10	PT/PT BY VOL
SBUVPOQ	0	0	4	CODE TABLE
WAVL	13	0	30	M
YEAR	0	0	12	YEAR
MNTH	0	0	4	MONTH
DAYS	0	0	6	DAYS
HOUR	0	0	5	HOUR
MINU	0	0	6	MINUTES
SECO	0	0	6	SECONDS
TSIG	0	0	5	CODE TABLE
TLRFV	0	0	3	CODE TABLE
MTXSIG	0	0	6	CODE TABLE
ATCT	0	0	8	CODE TABLE
DSFTV	0	-127	8	NUMERIC

9.7.3 OOPS STANDARD HEADER

Each monthly and daily SBUV/2 product has a pair of standard header records at the beginning of the data set that describes the contents of that data set. The standard headers include information such as the range of data coverage and the version number of the data set (for those situations where the data is recreated, e.g., due to changes in instrument calibration).

The 1b data set also contains standard headers describing each input data set (e.g. meteorological) used to build the 1b. The Product Master File will have the 1b standard header records in addition to its own standard headers. Starting with Version 8 PMFs in 2007, the 1B datasets is the only externally distributed dataset that will contain the OOPS Standard Header Records.

The format of the OOPS standard header is given on the following pages. Definitions of individual items can be found in the Data Dictionary, Section 9.7.4.

Table 9.7.3-1. OOPS Standard Header Record I.

	Byte 1	**Byte 2**	**Byte 3**	**Byte 4**
Word	**Description**			
1	Record ID		Integer number	
2-3	Spacecraft Name		‘NOAA - xx’	
4-5	Instrument Name		‘SBUV/2‘	
6-9	Data Set name		16 character data set name	
10	Data Version Identifier		‘VER’	
11-12	Data Version		‘␣␣xxa‘	
13	Data Generation Identifier		‘GEN␣‘	
14-15	Data Generation Date		(‘yy␣mm␣dd’)	
16-17	Data Generation Time		(‘hhmmss␣‘)	
18-19	Program Identifier		(‘PROGRAM:’)	
20-21	Program name		(‘aaaaaa‘)	
22	Program Version Identifier		(‘VER‘)	
23-24	Program Version		(‘␣xx.xx␣␣‘)	

25-26	Program Version Date	(‘yyb̸mmb̸dd’)
27-28	Spare	(8 ASCII blanks)
29-30	Data Coverage identifier	(‘DATA:‘)
31-32	Data Start Date	(‘19yyb̸ddd’)
33-34	Data Start Time	(‘sss<m-kono@tv-asahi.co.jp> sss‘)
35	‘To’ Character	(‘b̸TOb̸‘)
36-37	Data End Date	(‘19yyb̸ddd’)
38-39	Data End Time	(‘ssssssb̸‘)
40	Standard/Non-standard Wavelength Flag	(4 ASCII blanks or ‘STND’ or ‘SPEC’)
41-180	Spares (ASCII blanks)	
For Data Sets containing a time span of data (e.g. Daily 1b); Otherwise spare words (all ASCII blanks) b̸ = blank, x = numeric character, a = alphabetic character. Note: all words are ASCII characters except word 1.		

Table 9.7.3-2. OOPS Standard Header Record II.

	Byte 1	**Byte 2**	**Byte 3**	**Byte 4**
Word	**Description**			
1	Record ID			
2-40	Data or Program Version Change Description			
41-180	Spare (ASCII blanks)			
Note: all words are ASCII characters except word 1				

9.7.4 DATA DICTIONARY

The data dictionary contains an entry for each lowest level data item, and in some cases, group items, found in each of the OOPS data sets. Where the same information occurs on more than

one data set, even if stored in different units (e.g., radians vs. degree), it has been given a common name and only occurs once in the data dictionary. Individual byte/bit breakdowns (e.g. series of 1 bit flags) of these items will not be listed as separate entries in the data dictionary.

The data set name abbreviations used in the data dictionary are given below for reference:

Data Set	Abbreviation in Data Dictionary
Product Master File	PMF
1b	1b

There the data set name given is All-OOPS which means that the associated data occurs on all four of the data products. These data items are part of the OOPS Standard Header (Section 9.7.4).

<table>
<tr><th colspan="4">Data Dictionary</th></tr>
<tr><th>Data Item</th><th>Data Sets</th><th colspan="2">Description</th></tr>
<tr><td rowspan="10">Analog Telemetry</td><td rowspan="10">1b</td><td colspan="2">Seventeen SBUV/2 analog telemetry points, sampled at 16 second intervals. Analog telemetry data are found in word 13 of the TIP minor frames. For all but orbital and daily statistical records on the 1b data set, these data are given in terms of counts. On orbital and daily statistical records these are given in engineering units. For ranges and scaling factors see Section 9.7.1.5.</td></tr>
<tr><td>No.</td><td>Telemetry Point Name</td></tr>
<tr><td>1.</td><td>SM Baseplate Temp. #2 (1)</td></tr>
<tr><td>2.</td><td>SM Shroud Temp.</td></tr>
<tr><td>3.</td><td>Depolarizer Housing Temp.</td></tr>
<tr><td>4.</td><td>HVPS Temp.</td></tr>
<tr><td>5.</td><td>Diffuser Plate Temp #2 (1)</td></tr>
<tr><td>6.</td><td>Chopper Motor Temp.</td></tr>
<tr><td>7.</td><td>Grating Motor Temp.</td></tr>
<tr><td>8.</td><td>Diffuser Motor Temp.</td></tr>
</table>

		9	Cal Lamp Motor Temp.
		10.	Electrometer Temp.
		11.	Cal Lamp Power Supply Temp.
		12.	Diffuser Radiator Temp.
		13.	ELM Temp.
		14.	LVPS Temp.
		15.	Diffuser Heater Current or not applicable (2)
		16.	Baseplate Heater Current or Cal Lamp Heater Current (2)
		17.	28 V Main Power
		Notes: (1) powered from the 28 V analog TM BUS (2) First choice is for NOAA- F and G, second for NOAA- H, I, J, K, L and M	
A priori covariance Matrix	1b	144 elements of covariance matrix	
A priori Profile Coefficients	1b	180 coefficients for computing first guess ozone profiles	
Atmosphere Surface Backscatter Fraction	1b	Ratio used in multiple scattering correction and ozone inversion scheme (170 values)	
Averaging Kernel	PMF	The theoretical responses in the retrieval layer amounts to changes in the true atmospheric profiles. In the Version 8 product, this is a 20x20 array, associated with the 20 layers output in the product.	
Bad Quality Major Frame Flag	1b	Flag indicating one or more of the major frame quality flags has been set to true (i.e. = 1) thereby indicating a problem in the data. Bit set to 0 = no problem, 1 = problem.	
Band Center Wavelengths	1b, PMF	13 standard SBUV/2 wavelengths (Angstroms) ordered from shortest to longest range: 2500-4000 Angstroms	

Boost Mode Flag	1b	Flag indicating spacecraft in boost mode, usually the first 5 minutes following launch, during one or more TIP minor frames, therefore the data should not be used. Bit set to 0 = not boost mode, 1 = boost mode.
CCR Data	1b	Same as Monochromator Range Data, but for Cloud Cover Radiometer
CCR and Mono-chromator overrange Flags	1b	0 = not overrange
		1 = overrange; increase corresponding monochromator range or CCR data by 2^{16}.
		In Discrete Mode, for each monochromator range (1, 2, 3) and CCR.
		For Sweep Mode, flags for selected monochromator range for each of 10 samples, plus CCR.
		WARNING: Flags not set properly by the instrument, thus not to be used in any calculations using range counts.
Channel Error Flags	1b	**32 one bit flags set if inconsistent data encountered in a particular channel. Flag set if:**
		a) More or less than one grating mode flag is set or
		b) Inconsistent Hg lamp position given or invalid lamp position or
		c) more or less than one diffuser position given or invalid diffuser position or
		d) more than one automated sequence, given MSB represents first channel (second), LSB represents last channel (second) in 32 second major frame.
		Flag settings are:
		0 = no inconsistent data this channel
		1 = inconsistent data this channel
Channel Fill Flags	1b	**32 one bit flags set if certain errors encountered in a particular channel.**
		0 = no errors encountered
		1 = error encountered this channel.

		Error encountered is:
		a) data gap (all channel fill flags set in this case) or
		b) channel frame sync error or
		c) minor frame quality flag set for this channel.
		MSB represents first channel (second), LSB represents last channel (second) in 32 second major frame.
DACS Quality	1b	**DACS quality for a NESDIS Orbit, containing:**
		a) A count of input TIP minor frames that contain no frame sync word errors,
		b) A count of the DACS detected TIP parity errors (for embedded TIP, this is the count of minor frames with parity errors. For stored TIP this is the number of minor frame word groups with parity errors).
		c) A count of all auxiliary synch errors detected.
DACS Status	1b	**DACS status information for a NESDIS Orbit, containing:**
		a) P/N Flag
		0 = Normal Data
		1 = P/N Data
		b) Data Source
		0 = Unused
		1 = Gilmore
		2 = Wallops
		3 = SOCC
		c) Tape Direction
		0 = FWD (Time incrementing)
		1 = REV (Time decrementing)
		d) Data Mode

		0 = Test Data
		1 = Flight Data
Data End Date And Time	All-OOPS	Year, Julian day, and second of day of last data in the data set. This data is placed in the OOPS standard header.
Data Fill Flag	1b	Flag indicating one or more minor frames of the TIP major frame contain fill data. The data should not be used. Bit set to 0 = no data fill, 1 = contains data fill.
Data Generation Date and Time	All-OOPS	Year, month, day, hour, minute and second for the creation of data in the data set. This data placed in OOPS standard header.
Data or Program Version Change Description	All-OOPS	Explanation of change(s) from previous to current version of data due to data version and/or program version change. This is placed in OOPS standard header.
Data Records Read	PMF	Number of data records from 1b data
Data Records Written	PMF	Number of data records written to PMF
Data Set Name	All-OOPS	Name of data set in OOPS standard header (e.g. Daily 1b Data Set)
Data Start Date and Time	All-OOPS	Year, Julian day, and second of day of first data in the data set. This data is placed in the OOPS standard header.
Data Type	1b	**Type of data where:**
		1 = LAC
		2 = GAC
		3 = HRPT
		4 = TIP

		5 = HIRS/2
		6 = MSU
		7 = SSU
		8 = DCS
		9 = SEM
		For SBUV/2 data, the source of data can only be 1, 2, or 3.
		TIP Source:
		1 = Embedded TIP
		2 = Stored Tip
		3 = Third CDA TIP
Data Version	All-OOPS	**Version number, given by *xxa*, for data/data set. Given in OOPS standard header (e.g. 01A). Number *xx* is incremented by 1 for:**
		a) a change in the format of this data set either in the type of logical record types on the data set or the definition or arrangement of the data in a logical record type or
		b) a change in an algorithm used to generate data on the data set such that the data set generated with this new algorithm is not identical to the previous data version.
		c) a change in any input data set used to create it. The change may be caused by either an algorithm change in the program that created it or inclusion of updated data into an existing reference data set (e.g., for new ancillary coefficients).
		Letter *a* would change when the data set was regenerated with new data replacing old data or data being subtracted from the original data set but the process by which the data is calculated and placed on the data set has not changed. An example of this would be regenerating a data set by replacing missing data with good data. Any change to number *xx* would cause letter *a* to be reset to *A.*
Date of Job Run	PMF	Date of data file production (e.g., MON DEC 10, 1984)

<table>
<tr><td>Day 1 Solar Irradiance</td><td>1b, PMF</td><td colspan="2">Baseline Solar Irradiance values for each discrete monochromator channel and CCR.</td></tr>
<tr><td>Day of Year</td><td>All-OOPS</td><td colspan="2">Julian day of year. Range: 1-366</td></tr>
<tr><td>Day of Year of First/Last Major Frame in SBUV Orbit</td><td>1b</td><td colspan="2">Day of year of first/last available major frame in SBUV/2 orbit. Range: 1-366</td></tr>
<tr><td>Digital A (Subcom) Analog House-keeping</td><td>1b</td><td colspan="2">Contains the SBUV/2 housekeeping information identified. Each channel sampled twice per major frame (32 seconds). For ranges and scaling factors see Section 9.7.1.5. For all but orbital and daily statistical records on the 1b data set, these data are given in terms of counts. On orbital and daily statistical records these are given in engineering units.
<table>
<tr><th>Channel</th><th>Function</th></tr>
<tr><td>1A</td><td>Chopper Motor Current</td></tr>
<tr><td>2A</td><td>Diffuser Motor Current</td></tr>
<tr><td>3A</td><td>HVPS Volts</td></tr>
<tr><td>4A</td><td>Thermistor Bias (+10 V REF)</td></tr>
<tr><td>5A</td><td>CAL Lamp Temp.</td></tr>
<tr><td>6A</td><td>ECAL Ref. Voltage</td></tr>
<tr><td>7A</td><td>+15 V Sensors-volts</td></tr>
<tr><td>8A</td><td>-15 V Sensors -volts</td></tr>
<tr><td>9A</td><td>+24 V Motor-volts</td></tr>
<tr><td>10A</td><td>+5 V LED-volts</td></tr>
<tr><td>11A</td><td>+10 V Logic-volts</td></tr>
<tr><td>12A</td><td>CAL Lamp Current</td></tr>
<tr><td>13A</td><td>Spare</td></tr>
<tr><td>14A</td><td>Grating Coarse Error</td></tr>
</table></td></tr>
</table>

		15A	Grating Motor Current
		16A	Lamp Motor Current
		1B	Spare
		2B	Diffuser Plate Temp.
		3B	Baseplate Temp.
		4B	+25V Power (volts)
		5B	+15 V Servo (volts)
		6B	-15 V Servo (volts)
		7B	CCR Diode Temp.
		8B	SM Differential Temp. Y
		9B	SM Differential Temp. Z
		10B	Differential Reference Temperature Y
		11B	Differential Reference Temperature Z
		12B	PMT Cathode Temperature
		13B	Spare
		14B	Chopper Phase Error
		15B	Spare
		16B	Spare

Digital B Telemetry	1b	Twenty-two Digital B telemetry points which echo the SBUV/2 specific commands sent to the spacecraft. Each point is sampled at 3.2 second intervals. Digital B telemetry data specified to the SBUV/2 instrument are found in word 12 of the TIP minor frames. In order to conserve space on the 1b, only the first and sixth 3.2 second intervals are retained in the 22 least significant bits of the words. The telemetry points comprising Digital B are as follows:		
		No.	**Telemetry Point Name**	**Logic State(1/0)**
		1	Instrument Power	On/Off

		2	Discrete Command	Yes/No
		3	Sweep Command	Yes/No
		4	Wavelength Calibrate Command	Yes/No
		5	Position command	Yes/No
		6	High Voltage	Yes/No
		7	Motor Power	On/Off
		8	Lamp	On/Off
		9	Lamp	Enable/Disable
		10	Lamp assembly command	Open Cmd. /Closed Cmd
		11	High voltage	Enable/Disable
		12	Diffuser Stow command	Yes/No
		13	Diffuser Monitor command	Yes/No
		14	Diffuser Sun Command	Yes/No
		15	Diffuser Decontaminate Command	Yes/No
		16	Chopper Encoder Sensors	Primary/Backup
		17	Grating Encoder Sensors	Primary/Backup
		18	Diffuser Position Sensors	Primary/Backup
		19	Lamp Position Sensors	Primary/Backup
		20	Grating Drive Fix/Flex	Fix/Flex
		21	Baseplate Heater (NOAA- F & G) or Cal Lamp (NOAA-HIJKL&M)	On/Off
		22	Diffuser Heater	On/Off

Discrete/ Sweep Record	1b	0: Discrete format indicator
		1-12: Sweep record format. A complete sweep cycle is 6 major frames (2 records per frame, e.g., code 2 = second record of first frame).
		-1: either a) inconsistent data format (discrete or sweep) within major frame or b) inconsistent sweep grating position within major frame.
Dwell Mode Flag	1b	Flag indicating TIP in Dwell mode during one or more minor frames of the TIP major frame. Data in that minor frame(s) has a specific analog channel data and not the normal SBUV/2 data, therefore the data is incorrect. Bit set to 0 = not in dwell mode, 1 = TIP in dwell mode.
Effective Ozone Absorption Coefficients	1b, PMF	Computed (12 discrete + CCR) coefficients corresponding to 13 standard SBUV/2 wavelengths (shortest to longest), range 300-0 (atm-cm^{-1}).
End time	1b	TIP time code giving year, day and milliseconds of day from the last TIP major frame of data appearing in a given TIROS-N Series orbit.
Final Channel Quality Flags	1b	32 one bit flags, set if any errors encountered for this channel
		0 = No errors
		1 = errors encountered:
		a) channel error flag set this channel or
		b) channel fill flag set this channel or
		c) channel fill flag of next channel set. If current channel is last channel of current major frame, final channel quality flag is set if fill flag of first channel of next major frame is set.
		MSB refers to first two channels (first 2 seconds of major frame 0, LSB refers to last channel (second) of this major frame and first channel (second) of next major frame.

Final Residues	PMF	Computed as: $\frac{(Q_{obs} - Q_{msr} - Q_{ss})}{Q_{ss}}$ where, Q_{obs} = Q-value obtained from the observed radiance; Q_{mar} = Q-value that refers only to the multi-scattered and reflected component of the total intensity (obtained from a lookup table). Q_{ss} = Q-value that refers to the single scattered component of the total intensity (calculated within the program).
FOV Average Cloud Amount	1b	Average cloud amount in percent for the four longest wavelength SBUV/2 FOVs.
FOV Average Cloud Top Pressure	1b, PMF	Averaged cloud top pressure in millibars for the four longest wavelength SBUV/2 FOVs.
FOV Average Cloud Temperature	1b	Averaged temperature profile in Kelvin x 64 for given pressure levels for the four longest wavelength SBUV/2 FOVs. Set to 0 if the Edit Flag indicates a bad sounding.
FOV Latitude	1b	FOV latitude is the geodetic latitude of the FOV at the start of the major frame. Expressed in degrees x 10^2. Northward latitudes are positive. Latitude range: -90 to 90 degrees
FOV Longitude at Start of First/Last Major Frame in SBUV/2 Orbit	1b	Longitude at start of first/last available major frame in SBUV/2 orbit expressed in degrees x 100. Positive longitudes are eastward. Range: -180 to 180 degrees.
FOV Snow/Ice Flag	1b, PMF	Surface condition flag indicating a frozen surface cover (i.e. snow and/or ice) for the SBUV/2 FOV.
		1 = frozen surface
		0 = non-frozen surface

<table>
<tr><td></td><td></td><td colspan="3">-1 = missing</td></tr>
<tr><td>FOV Surface Pressure</td><td>1b</td><td colspan="3">Surface pressure interpolated from surface pressure data set for the center of the SBUV/2 FOV halfway into the major frame (i.e., 16 seconds from TIP time). This time represents the beginning of the data collection for the four longest wavelengths used in the total ozone computation. Pressure given in mb.</td></tr>
<tr><td>Gain Selection Code</td><td>PMF</td><td colspan="3">Indicates recommended gain range for each wavelength.</td></tr>
<tr><td>Grating Position Error</td><td></td><td colspan="3">Note: for flight Model #1 the count value will range between 0 and 10 counts since the telemetry point was grounded out.</td></tr>
<tr><td>Initial Residues</td><td>PMF</td><td colspan="3">Same as final residues except that first guess ozone is used to compute Q_{ss} and Q_{msr}</td></tr>
<tr><td rowspan="9">Instrument Data Quality Flag</td><td rowspan="9">1b</td><td colspan="3">A compilation of 4 quality flags for the time covered by this record.</td></tr>
<tr><td>Flag</td><td>0</td><td>1</td></tr>
<tr><td>Master Power</td><td>On</td><td>Off</td></tr>
<tr><td>High Voltage</td><td>On</td><td>Off</td></tr>
<tr><td>Frame Sync</td><td>In Sync</td><td>Not in Sync</td></tr>
<tr><td>Data Contamination due to automated command sequence taking place</td><td>Not Contaminated</td><td>Contaminated</td></tr>
<tr><td colspan="3">For each flag, 2 = data unavailable for determination due to fill.</td></tr>
<tr><td colspan="3">For each flag, 3 = Inconsistent status during the 32 seconds.</td></tr>
<tr><td colspan="3">This information pertains to all non-filled 32 seconds of data during both discrete and sweep modes except when E-CAL/ Retrace is on (last 8 seconds during discrete mode or last 24 seconds at the end of a six major frame sweep cycle).</td></tr>
</table>

Instrument Name	All-OOPS	Name of instrument (i.e., SBUV/2) in OOPS standard header.		
Interrange Ratio Coefficient Ranges	1b	Ratio of counts minus offset between monochromator gain		
Julian Day	1b, PMF	Day number counted from first day of current year.		
Layer Ozone	PMF	Individual ozone amounts (m-atm-cm) in 12 pressure layers.		
		UMKEHR	**LAYER #**	**mb**
		12	.0002-.0001	0.25 - 0.12
		11	.0005-.0002	0.49 - 0.25
		10	.0010-.0005	0.99 - 0.49
		9	.0020-.0010	1.98 - 0.99
		8	.0039-.0020	3.96 - 1.98
		7	.0078-.0039	7.92 - 3.96
		6	.0156-.0078	15.83 - 7.92
		5	.0313-.0156	31.66 - 15.83
		4	.0625-.0313	63.33 - 31.66
		3	.1250-.0625	126.66 - 63.33
			.2500-.1250	253.31 - 126.66
		1	1.0000-.2500	1013.25 - 253.31
Layer Ozone Standard	PMF	Standard deviation for solution profile individual ozone amounts (%) in 12 pressure layers.		
Level Ozone	PMF	**Individual ozone amounts at 19 pressure levels.**		
		Level #	**Level Pressure (mb)**	
		1	0.3	
		2	0.4	

		3	0.5
		4	0.7
		5	1.0
		6	1.5
		7	2.0
		8	3.0
		9	4.0
		10	5.0
		11	7.0
		12	10.0
		13	15.0
		14	20.0
		15	30.0
		16	40.0
		17	50.0
		18	70.0
		19	100.0
Log I_o	1b	From total ozone tables, 1700 tabularized values of the natural log of the intensity of atmospheric backscattered radiation	
Log Q (Single Scattered)	1b	From multiple scattering correction tables, 1700 values of the natural log of the single scattered Q-value.	
Logical Sequence Number	PMF	Sequential record number reset to 1 at the beginning of each orbit.	
Major Frame Counter	1b	Counter of available major frames in an orbit, starting with 1.	

Major Frame Quality	1b	Single bit quality flags. Flags covering the duration (32 records) of the major frame.
		0 = no error or given circumstances has not occurred
		1 = Error or given circumstance has occurred.
		See also definitions of the individual major frame quality flags:
		Bad Quality Major Frame Flag
		Time Error Flag
		Dwell Mode Flag
		Boost Mode Flag
		Data Fill Flag
		Missing Attitude Error Flag
		No SBUV/2 Earth Location Flag
		Unreasonable Date or Time Flag
		Non-time Ascending Flag
		Out of Range Attitude Data Flag
		Out of Range Analog telemetry Data Flag
		Out of Range Earth Location Data Flag
		Major/Minor Frame Inconsistency Flag
		Note: The MSB (leftmost bit) of the word contains the Quality Summary Flag. It is set to 1 if any other flag is 1; otherwise it is 0.
Major/Minor Frame Inconsisten-cy Flag	1b	(1) One or more minor frame quality flags are set to 1 (error condition) but the associated major frame quality flags (time error, dwell mode, boost mode, data fill) are not set to 1; or (2) the reverse is true: one or more of these major frame quality flags is set to 1 but no minor frame quality flag is on.
Memory Verify	1b	See TIROS-N Unique Instrument Interface for SBUV/2.

Minor Frame Quality Flags	1b	**32 one bit flags, each covering one channel or ten minor frames of the current major frame.**
		0 = no error has occurred this channel
		1 = error occurred this channel
		Minor frame quality flags are set during decommutation and indicate one or more of the following occurred in the channel:
		Time error
		Dwell mode
		Boost Mode
		Data Fill
Missing Attitude Data Flag	1b	One or more of roll, pitch or yaw is missing in the major frame (Bit set to 0 = All data present, 1 = missing data).
Monochro-mator Data	1b	Same as Monochromator Range Data but for Sweep Mode.
Monochro-mator Grating Position	1b	Item contains position, segment being read and digital lock indicator. Grating position: 13 bit (see byte/bit breakdown) signed integer given in counts. Count range: -4095 to 4095. (Negative numbers given as 2's complement). Note: In sweep mode, samples are taken at 10 grating positions, corresponding to 10 wavelengths, per second. The grating position that is stored in sweep mode corresponds to the last wavelength sampled in this second. See Major Frame Synchronization in Section 9.7.1.2.2 for more details.
		Segment being read: 2 bits indicating which of the four flex mode segments (memories) is being used.
		0 = segment 0 being read
		1 = segment 1 being read
		2 = segment 2 being read
		3 = segment 3 being read

		Digital Lock: 1 bit flag indicating whether the grating position was in its locked position, bit set to 1 or unlocked position bit set to 0. Data collection is valid only when the grating position is locked.
Monochro-mator Range Data	1b	Discrete Radiance/Irradiance counts measured by the monochromator. Range = 0 to 65,535 counts. If the corresponding Monochromator Overrange Flag is set to on (1) then add 2^{16} to this value. WARNING: Monochromator Overrange Flags are not set properly by the instrument. They should not be used in any calculation using range counts. If the Retrace/ECAL Flag (see Sample Status Flag #1) is on (1), this is electronic calibration data.
Monochro-mator Range ID	1b	**Corresponds to one of the three monochromator ranges.**
		1 = Range 2 (0-10 na, discrete mode; 0-125 na, sweep mode)
		2 = Range 1 (0-100 pa, discrete mode; 0-1.25 na, sweep mode)
		3 = Range 3 (0-1μa, discrete mode; 0-12.5 μa sweep mode)
Multiple Scattering Correction	PMF	Multiple scattering and reflectivity correction to Q-value for five longer profile wavelength channels.
Multiple Scattering Mixing Fraction	PMF	Multiple-scattering mixing fraction for five longer profile wavelength channels.
Multiple Scattering Sensitivity	PMF	Sensitivity of multiple-scattering and reflectivity correction to total ozone for five longer profile wavelength channels.
N-value	PMF	Attenuation number computed as: $N = -100 \log_{10} (I/F)$ where I = Backscattered radiance and F = Incident solar flux
NESDIS Orbit Number	1b	The NESDIS orbit number is assigned by NESDIS for one revolution starting/ending at the ascending node equator crossing. For the SBUV/2 borne afternoon satellite the NESDIS orbit number at the start of the SBUV/2 orbit will be the same as the SBUV/2 orbit number. The NESDIS orbit number at the end of the SBUV/2 orbit will be one greater than the SBUV/2 orbit number.

No SBUV/2 Earth Location Data Flag	1b	Flag indicating no Earth location data is available for either the start or end of the TIP major frame data. Bit set to 0 = Earth location present, 1 = missing Earth location data.
Non-Time Ascending Data Flag	1b	Flag indicating major frame date or time precedes previous major frame. Bit set to 0 = no problem, 1 = non-time ascending data.
Number of Coefficients for Interrange Ratios	1b	Number of discrete monochromator channels for which interrange ratios are given.
Number of Data Gaps	1b	Number of data gaps occurring in a given TIROS-N series (NESDIS) Orbit. A data gap that covers one or more consecutive TIP major frames is counted as one data gap. NESDIS orbits, as transmitted, may include some overlap with the previous or subsequent orbit. Data gaps that occur in the overlap will be included in the counters for both NESDIS orbits.
Number of Major Frames	1b	Total number of TIP major frames in a given TIROS-N (NESDIS) Orbit. NESDIS orbits, as transmitted, may include some overlap with the previous or subsequent orbit. Major Frames in the overlap will be included in the counters for both NESDIS orbits.
Number of Iterations	PMF	Number of iterations used by the profiling algorithm in a given retrieval.
OOPS Standard Header	ALL-OOPS	Audit trail information at the beginning of each OOPS data set.
		Required:
		Record ID
		Spacecraft ID
		Instrument name
		Data set name
		Data version
		Data generation date & time
		Program name

		Program version and data
		Optional (when applicable):
		Data start date and time
		Data end date and time
		Version Change description
		Standard/Non-standard
		Wavelength Flag
Out of Range Analog	1b	Flag indicating one or more Telemetry data Flag analog telemetry points is outside the range given in Data Dictionary. Bit set to 0 = all data in range, 1 = one or more points out of range.
Out of Range Attitude Data Flag	1b	Flag indicating one or more attitude quantities (roll, pitch, and yaw) in major frame is outside the range given in the Data Dictionary. Bit set to 0 = all attitude data in range, 1 = values out of range.
Out of Range Earth Location Data Flag	1b	Flag indicating one or more Earth location values is outside the range given in the Data Dictionary. Bit set to 0 = all Earth location data in range, 1 = value(s) out of range.
Ozone Error Flags	PMF	**Total Ozone**
		0 - Low path length, good scan
		1 - High path length, good scan
		2 - Very high path, good scan
		3 - Spare
		4 - Inconsistency between best ozone and the largest weighted ozone pair
		5 - Difference between best ozone and total ozone for profile greater than three sigma
		6 - Spare
		7 - Photometer Reflectivity and monochromator reflectivity differ by more than 0.15

		8 - Best Reflectivity out of range (less than - 0.05 or greater than 1.05)
		9 - A-pair, B-pair or C-pair ozone exceeds the dynamic range of the tables. The dynamic ranges are:
		Latitude less than 15^0 : 180 to 350 Dobson Unit (DU)
		Latitude 15^o to 45^o :180 to 600 DU
		Latitude greater than 45^0 : 180 to 650 DU
		10-19 Same as above except the data taken in descending mode.
		Profile:
		0 - No error
		1 - Lower level anomaly
		2 - Inconsistency between best ozone and profile total ozone
		3 - Final residue greater than three sigma
		4 - Measured Q-value calculated with a priori profile and multiple-scattering/Reflectivity correction
		5 - C greater than 3.0 DU or less than 0.5
		6 - Sigma greater than 0.8 or less than 0.3
		7 - Reflectivity is less than -0.05, greater than 1.05, or changes by more than 0.05 from wavelength to wavelength
		8 - Total ozone not available or in-band stray light contamination
		9 - Bad radiance or eclipse contamination
		10-19 Same as above except the data taken in descending mode.
Ozone Mixing Ratios	PMF	Solution mixing ratio (micro-gm/gm) at 19 pressure levels
Ozone Sensitivity	PMF	Sensitivity of a pair of wavelengths is defined as dN_p/dO, where N_p is the difference in the N-value of pair wavelengths and O is the total ozone

Percent Cloud	PMF	Percent cloud cover computed by Product Processor using CCR and snow/ice information (0 - 100).
Pitch Euler Error Angle	1b	Pitch Euler error angle of the spacecraft given in radians x 8,192. Expected range: -0.2 to 0.2 degrees (3 sigma).
Prelaunch Radiance /Irradiance Calibration	1b	Instrument specific prelaunch radiance or irradiance counts to engineering units conversion constants for each of 12 discrete wavelengths at each of 3 PMT gain ranges, plus 1 value for CCR. (Irradiance: W/cm^3, radiance: $W/cm^3/sr$).
Pressure of Reflecting Surface	PMF	Effective surface pressure (mb).
Processing Block Identification	1b	Seven digit (ASCII) number identifying the spacecraft revolution (NESDIS orbit number) in which recording of this data set began and the revolution (NESDIS orbit number) in which it terminates (the first 5-digits identify the beginning revolution and the last two identify the concluding revolution).
Processing Counters	PMF	**The following counters have been defined for total ozone processing:**
		1 - not used (0)
		2 - data records read
		3 - data records written
		4 - output records unprocessed (5+7)
		5 - solar zenith angle greater than limit
		6 - not used (0)
		7 - bad counts and solar eclipse data
		8 - Non-zero total ozone error flag (sum of 9-14)
		9-18 - total ozone error flags 9-0 (reverse order)
		19 - bad radiance (profile wavelength only)
		20 - no total ozone available
		21 - records with profile ozone error flag greater than 2

		22-28- profile ozone error flags 3-9
Processing Options	PMF	**There are 20 possible processing options, only four of which are currently implemented (false - disabled, true - enabled):**
		6 - Profile processing
		7 - Do not use seventh channel in profile processing
		8 - Do not use first channel in profile processing
		9 - Do not use ninth channel in profile processing
Processing Parameters	PMF	**Limiting values used to edit input 1b data. They include:**
		Maximum SZA 0-90 degrees
		Minimum latitude -90 to +90 degrees
		Maximum latitude -90 to +90 degrees
		Minimum latitude must be less than maximum latitude (under normal processing conditions, max. SZA = 92°, min. latitude = -90, max. latitude = +90).
Program Name	All-OOPS	Name of program that generated the data. Name in OOPS standard header.
Program Version	All-OOPS	Version number given as xx.yy, for program. This is given in OOPS standard header (e.g., 01.01) Number xx is incremented by 1 when a change in the program alters the format of the output data set(s) or the contents of the output data set(s) other than generation run time, such that if the program was rerun with the same input data sets, it would not generate an identical (except for generation run time) output data set. Number yy is incremented by 1 when a change in the program does not alter the format or content of the output data set. Such changes might be enhancements to printed output, insertion of additional comments to the program, etc. Any change to number xx would cause number yy to be reset to 01.
Program Version Date	All-OOPS	Year, month and day that generating program version was made operational.
Q-Value	PMF	Normalized radiance - irradiance ratio. Given for each profile wavelength.

Radiance Calibration	PMF	Counts to radiance conversion factors used in ozone computation ($W/cm^3/sr/count$).
Radiometric DC Level	1b	TIROS-N Unique Instrument Interface for SBUV/2.
Rayleigh Scattering Coefficients	1b, PMF	Rayleigh scattering coefficients computed for each of the 13 (12 discrete + CCR) SBUV/2 wavelengths, in order from short to long.
Recom-mended Monochro-mator Range Data	1b	Actual counts obtained for the recommended monochromator range.
Recom-mended Monochro-mator Range ID	1b	One of the three monochromator range ID's, it is chosen as follows:
		If Range 3 data is greater than or equal to 719 counts then Range ID = 3.
		If Range 2 data is greater than or equal to 719 counts and Range 3 data is less than 719 counts the Range ID = 2
		If Range 2 and 3 are less than 719 counts then range ID =1
Record ID	All-OOPS	Unique record identification number for each record type in the 1b Data Set. See Table 9.7.1.4-1.
Reflected Fraction	1b	1700 values of this ratio used in the multiple scattering correction and ozone inversion scheme.
Reflectivity	PMF	Effective surface reflectivity computed by total ozone algorithm (fraction).
Reflectivity Difference	PMF	Difference between the reflectivity computed using the photometer and that using the monochromator.
Roll Euler Error Angle	1b	Roll Euler error angle of the spacecraft given in radians x 8192. Expected range -0.2 to 0.2 degrees (3 sigma)
SBUV/2 Day Number	1b	The day number of the first major frame of the current SBUV/2 orbit, counted from day of launch.

SBUV/2 Orbit Number	1b, PMF	An SBUV/2 orbit is defined as data collected from one revolution of the Earth starting/ending at the dark side of Earth equator crossing. For an afternoon satellite (the SBUV/2 instrument will only be carried on an afternoon satellite), the dark side equator crossing occurs on the descending node. The SBUV/2 orbit number is based on the NESDIS orbit number in that it will be the same as the NESDIS orbit number for the first half of the SBUV/2 orbit (i.e. from descending node equator crossing to ascending node equator crossing). For the second half of the SBUV/2 orbit the NESDIS orbit number would be one greater.
Sample Status Flag #1	1b	**A series of status flags:**
		Data format: discrete/Sweep (0/1)
		Retrace (ECAL) Off/On (0/1);
		ECAL Step #A-E (0-7) where:
		Step A = 1 to 4
		B = 5
		C = 6
		D = 7
		E = 0
		Grating Mode:
		0 = Discrete
		1 = Wavelength Calibration
		2 = Position
		3 = Sweep
		4 = Diffuser Decontamination
		7 = Inconsistent (i.e., more than one mode set)
		(Differs from Ball Brothers convention) Information pertains to 2 second interval (one discrete sample) in discrete mode; pertains to one second interval for sweep mode (ten sweep samples).

Sample Status Flag #2	1b	A series of status flags: Grating Memory Mode: Fix/Flex(1/0) Grating Index: Found/Not Found(1/0) Frame Sync Code: In Sync/Not in Sync(0/1) Automated Command: 0 = None enabled 1 = Discrete sun enable 2 = Sweep sun enable 3 = Wavelength-calibration enable Command Sequence state: Step number for one of three Automated Command Sequences, three series of SBUV/2 commands designed to provide for execution of a number of commands with only a single command being sent. These three set sequences, namely Discrete Sun Enable, Sweep Sun Enable and Wavelength Calibration Enable, each have up to eight command sequence states. In each command sequence, a particular SBUV/2 command is executed. Information pertains to two second interval (one discrete sample) in discrete mode; pertains to one second interval for sweep mode (ten sweep samples).
Sample Status Flag #3	1b	**A series of status flags:**
		Master Power On/Off (0/1)
		Calibration Lamp timer: Not Time Out/Time Out (0/1)
		Cal-Lamp Position: Open(0); Closed (1); Inconsistent or Invalid (3)
		Diffuser Timer: Not Time Out/Time Out (0/1)
		Diffuser Position:
		0 - Stowed
		1 – Sun
		2 - Monitor
		3 - Decontaminate
		7 - Invalid
		Information pertains to two second interval (one discrete sample)

		in discrete mode; pertains to one second interval for sweep mode (ten sweep samples).
Sample Status Flag #4	1b	**A series of status flags:**
		Code Address A
		Code Address B
		Code Data Bit 1 to 6 (LSB) information pertains to two second interval (one discrete sample) in discrete mode; pertains to one second interval for sweep mode (ten sweep samples).
Scene Mode	1b	**Radiance Source to the SBUV/2 instrument**
		0 = Earth Scene
		1 = Same as above except for diffuser sun scene.
		2 = Same as above except for direct Hg lamp scene
		3 = Same as above except for diffuser-Hg lamp scene.
		7 = Scene mode unavailable for determination (all channel fill flags set)
		9 = Inconsistent/changing scene mode
		This information pertains to all non-filled 32 seconds of data during both discrete and sweep modes except when E-CAL/ Retrace is on (last 8 seconds during discrete mode or last 24 seconds at the end of a six major frame sweep cycle) or fill encountered.
Seconds of Day	All-OOPS	Seconds of day. Range: 0-86,399.
Seconds of Day at Start of First/Last Major Frame in SBUV/2 Orbit	1b	Seconds of day at start of first/last available major frame in SBUV/2 orbit. Range: 0-86,399.

Solar Azimuth Angle at FOV	1b	Solar azimuth angle measured in the tangent plane from a line through the FOV due north to the projection of the sun line into the tangent plane. Measured clockwise as seen from the zenith. Expressed in degrees x 100. Range: -180 to 180 degrees.
Solar Declination	1b	Solar declination (celestial latitude) angle at the start of the major frame. This is an angle between the sun and the inertial equator measured in a plane normal to the inertial equator (meridian) containing the sun. North of the equator is positive. Expressed in degrees x 100. Range: -90 to 90 degrees
Solar Right Ascension	1b, PMF	Solar right ascension (Celestial longitude) angle at the start of the major frame. This angle is measured in the plane of the equator from a fixed inertial axis in space (Vernal Equinox) to a plane normal to the equator (meridian) containing the sun. Eastward from the Vernal Equinox is positive. Expressed in degrees x 100. Range: -180 to 180 degrees.
Solar Zenith Angle at FOV	1b, PMF	Solar zenith angle, measured at the FOV between the zenith normal to the tangent plane (horizon) at the FOV and the sun. Expressed in degrees x 100. Range: 0 to 180 degrees.
Spacecraft Altitude	1b	The spacecraft altitude, in integer kilometers at the start of the major frame. Range: 833 ± 90 km.
Spacecraft Centered Solar Azimuth Angle	1b	Solar azimuth angle in spacecraft centered coordinate system. Expressed in degrees x 100. Range: -180 to 180 degrees.
Spacecraft Centered Solar Elevation Angle	1b	Solar elevation angle in spacecraft centered coordinate system. Expressed in degrees x 100. Range: -180 to 180 degrees.
Spacecraft Identification	1b	**The identifier of the spacecraft from which the data was obtained where:**
		0 – Spare
		1 - TIROS-N NOAA-H (N-11)
		2 - NOAA-A (N-6) NOAA-I (N-13)

		3 - NOAA -B NOAA-J (N-14)
		4 - NOAA - C(N-7) NOAA-K (N-15)
		5 - NOAA -D (N-12)
		6 - NOAA -E (N-8)
		7 - NOAA -F (N-9)
		8 - NOAA- G (N-10)
Spacecraft Name	All-OOPS	TIROS-N series spacecraft name (e.g., NOAA-8) in OOPS standard header.
Standard/ Non-standard Wavelength Flag	1b	Indicates that (1) one or more of the 12 discrete wavelengths in one or more major frames (determined from grating mode position) does not match the wavelengths in the Ancillary Data Set, and/or (2) the start sweep mode wavelength in one or more scans does not match the preassigned value. This condition is expected to occur when wavelengths are changed using FLEX mode for special scientific studies:
		STND = All wavelengths standard,
		SPEC = One or more non-standard wavelengths detected in this Daily 1b Data Set
Start Time	1b	TIP time code given in year, day, and milliseconds of day from the first TIP major frame of data appearing in a given TIROS-N (NESDIS) orbit.
Subsatellite Latitude	1b, PMF	Subsatellite geodetic latitude at the start of the major frame as expressed as degrees x 100. Positive latitudes are northward, Range: -90 to 90 degrees (expressed as decimal degrees on PMF).
Subsatellite Longitude	1b, PMF	Subsatellite longitude at the start of the major frame expressed as degrees x 100. Positive longitudes are eastward. Range: -180 to 180 degrees (expressed as decimal degrees on PMF).
Summary Grating Memory Wavelength	1b	0 = fix mode; standard wavelength
		1 = flex mode; standard wavelength
		2 = fix mode, non-standard wavelength
		3 = flex mode, non-standard wavelength

		7 = mode unavailable for determination (all channel fill flags set)
		9 = inconsistent/changing mode
		This information pertains to all non-filled 32 seconds of data during both discrete and sweep modes except when E-CAL/Retrace is on (last 8 seconds during discrete mode or last 24 seconds at the end of a six major frame sweep cycle)
Summary Grating Mode	1b	**Monochromator Grating Mode:**
		0 = Discrete Mode
		1 = Wavelength Calibration Mode
		2 = Position Mode
		3 = Sweep Mode
		4 = Diffuser Decontamination Mode-(based on diffuser position only)
		7 = Grating mode unavailable for determination (all channel fill flags set)
		9 = Inconsistent/changing modes
		This information pertains to all non-filled 32 seconds of data during both discrete and sweep modes except when E-CAL/Retrace is on (last 8 seconds during discrete mode or last 24 seconds at the end of a six major frame sweep cycle).
Table Selection Index	PMF	Indicates standard profile used in profiling algorithm (1-3)
Terrain Surface Pressure	PMF	Terrain surface pressure (atm)
Time Error Flag	1b	Flag indicating a time error has occurred in one or more of the minor frames of the TIP major frame, thus the data is not correctly time matched and should not be used. Bit set to 0 = no time error, 1 = time error.
Total Ozone	PMF	Total ozone (m-atm-cm)

UMKEHR		Procedure to get a vertical ozone profile from the ground up using a Dobson Spectral Photometer
Unreasonable Date or Time Flag	1b	Flag indicating unreasonable major frame year, day of year, or seconds of day, i.e., year less than 0 or greater than 99, day of year less than 0 or greater than 366, seconds of day less than 0 or greater than 86,399. Bit set to 0 = data in range, 1 = data out of range
Upper Profile Parameters	PMF	Parameters C and s determined by assuming an ozone profile of the form: $X(p) = Cp^{1/s}$ where p = pressure in mb, X= cumulative ozone at pressure level p, s = ratio of the atmospheric scale height and ozone scale height, C = ozone at 1 mb (DU).
View Latitude	PMF	Latitude interpreted to the time of measurement of selected wavelengths (-90.0 to 90.0).
View Longitude	PMF	Longitude interpreted to the time of measurement of selected wavelengths (-180.0 to 180.0).
Volcano Contamina-tion Index	PMF	A measure of the amount of aerosols. Ranges from approximately -10 to +20. Uncontaminated data should be approximately zero. +20 represents maximum contamination. Negative numbers are due to noise in the measurements.
Yaw Euler Error Angle	1b	Yaw Euler error angle of the spacecraft given in radians x 8,192. Expected range: -0.2 to 0.2 degrees (3 sigma).
Year	All-OOPS	Year of First/Last Major Frame in SBUV/2 Orbit. Two digit year (e.g., 84) except digit year in PMF.
Year of First/Last Major Frame in SBUV/2 Orbit	1b	2 digit year of first/last available major frame in SBUV/2 orbit.

9.8 AEROSOL/OPTICAL THICKNESS PRODUCTS

NOAA/NESDIS currently produces Aerosol products from NOAA-14 AVHRR data on a weekly basis, using a revised (Phase 2) single channel algorithm for aerosol optical thickness retrieval over oceans from radiances in Channel 1. This algorithm scales the upward satellite radiances in

cloud-free conditions to aerosol optical thickness using an updated radiative transfer model of the ocean and atmosphere. The primary products are a global one degree map of Aerosol Optical Thickness based on a composite of one week's worth of data and the monthly mean product.

These products are archived at the National Climatic Data Center in both hardcopy chart and digital dataset form.

9.8.1 AEROSOL DAILY SUMMARY FILE

The Aerosol Daily Summary File contains statistical information pertaining to aerosol observations in each of the earth's 648 (10 degrees x 10 degrees) Lat/Long boxes.

9.8.1.1 File Structure Description

The first record is a directory record and all other records are data records. There are 41 records in the file.

9.8.1.2 Directory Record Format

The directory record contains information about the time of the data in the file and pointers to the data records for particular Julian Days. Table 9.8.2.2-1 contains the directory record format.

Table 9.8.1.2-1. Aerosol Daily Summary Directory Record Format.

Halfword	Quantity	Range
1	# of records in the file	41 (initially)
2	Year of most recent data in the file	0-32767
3	Record number updated most recently	1-41
4	Julian day of data in first data record	1-366
5	Julian day of data in second data record	1-366
6 to N + 3	Julian day of data in the 3rd through Nth data record	1-366

9.8.1.3 Data Record Format

Each data record contains all data for a particular day. There are 648 blocks of information (1 block for each 10 degrees x 10 degrees Lat/Long box on the globe). Each block is 20 bytes long and thus each record is 20 x 648 or 12,960 bytes in length. The blocks are organized within each data record sequentially from West to East with the first block containing statistics from the box

enclosed by -90.00 to -80.01 degrees latitude (-S, +N) and -180.00 to -170.01 degrees longitude (-W, -E). The second block has statistics from the next box to the east or the box bounded by -170.00 to -160.01 degrees longitude and -90.00 to -80.01 degrees latitude. The 37th block therefore contains statistics for the box -180.00 to -170.01 degrees longitude and -80.00 to -70.01 degrees latitude.

To calculate the starting byte number for the 20-byte block of statistics for a particular (10 degree x 10 degree) box within a data record, the following formula can be used:

$$StartingByteNo. = \left(36 \times \frac{(LLLA - OLA)}{10} + \frac{(LLLO - OLO)}{10} \right) \times 20 + 1$$

where:

LLLA = Lower left latitude of desired (10 x 10 degrees) box,
LLLO = Lower left longitude of desired box,
OLA = Latitude of file origin = -90.00 and
OLO = Longitude of file origin = -180.00.

The documentation record is contained in a 20-byte block as shown in Table 9.8.2.2-1.

Table 9.8.1.3-1. Aerosol Daily Summary File Documentation Record Format.

Halfword	# of Bytes	Quantity	Range
1	2	Number of observations in the box	0-32767
2	1	Maximum optical thickness (O.T.) for the box (x 100).	0-244
2	1	Minimum O.T. for the box (x 100)	0-244
3-4	4	UTC of maximum O.T. value. (Hours x 10,000) + (minutes x 100) + seconds.	0-235959
5	2	Latitude of observation with maximum O.T. value. (Degrees x 100)	-9000 to 9000
6	2	Longitude of observation with maximum O.T. value. (Degrees x 100)	-18000 to 18000
7	1	Spare	n/a
7	1	Mean optical thickness for box (x100).	0-244

8	2	# of observations with O.T. above extreme event threshold	0-32767
9-10	4	Spare	n/a

9.8.2 AEROSOL WEEKLY 100 KM ANALYZED FIELD FILE

An aerosol optical thickness 100 km analyzed field file consists of a specific set of information pertaining to global latitude and longitude intersections. The one degree resolution file, includes the area from -180 degrees to +179 degrees longitude and from -70 degrees to +70 degrees latitude.

9.8.2.1 File Structure Description

The file consists of one documentation record (record number one), followed by one record for each latitude or row of the field. Record 2 or the first latitude row is the southernmost row or the 70 degrees South row. Each row consists of seven words (28 bytes) of information for each longitude column forming a grid intersection plus one seven-word unit containing the row number identification and the date and time of the last analysis made for the field. The first grid intersection of each row is the 180 degree west meridian or the date line. Grid points proceed to the east across the record from left to right ending with the 179 degree East meridian. The documentation record is created from a name list dataset and is displayed in name list format, although it is stored as a binary record. The record size is 10,108 bytes.

9.8.2.2 Documentation Record Format

Table 9.8.2.2-1 contains the format for the documentation record of the Aerosol Weekly 100 km analyzed field file.

Table 9.8.2.2-1. Documentation Record Format for Aerosol Weekly 100 km Field File.

Word #	Parameter	Description
1	LDBGN	Record number of the first row of the field (currently 2 for all fields since the documentation record requires only one record).
2	SMGLAT	Minimum latitude included in field which is the bottom edge and first row of field
3	AXLAT	Maximum latitude included in field which is the top edge and last row of field.
4	SMLONG	Minimum longitude included in field which is the left edge and first column of field.

5	AXLONG	Maximum longitude included in field which is the right edge and last column of field (excluding the I.D. column).
6	RES	Number of latitude/longitude degrees between each grid point
7	SMHOUR	Youngest time, in hours of the year, of observations used during last analysis, which becomes the oldest time allowed for the next analysis. If the difference between this time and time of next analysis is greater than the maximum time gap allowed, SMHOUR for the beginning of the next analysis is reduced to make the difference equal to the maximum time gap.
8	HOURS	Oldest time, in hours of the year, of observations used during last analysis.
9	TIMGAP	Number of hours between youngest and oldest times of observations used in analysis.
10	MAXDAT	Maximum number of hours allowed in time period for observation times to be included in analysis.
11	SMREL	Minimum reliability of observations to be used in analysis.
12	AXREL	Maximum reliability of observations to be used in analysis.
13-22	SORC(10)	List of source codes of observations to be used in analysis.
23-32	OBTYPE (10)	List of observation types allowed to be used in analysis.
33	NROWS	Number of rows (latitudinal parallels) included in field, excluding documentation record.
34	NCOLS	Number of columns (longitudinal meridians) in field, including the I.D. column.
35	IBLK	Number of rows or logical records per physical block.
36	NWRDS	Number of full words (32 bits) allocated to each grid point.
37	ISZ	Number of rows to be maintained in an array in core for optical thickness and analysis and calculation of gradients.
38	ICENT	Center line within the array upon which calculations will be performed.

39-41	LWT, LNT, LBT	Word number, length in bits, and starting bit location of optical thickness within a grid intersection information unit of an SST Field.
42-44	LWG, LNG, LBG	Word number, length in bits, and starting bit location of Average Gradient.
45-47	LWGXP, LNGXP, LBGXP	Word number, length in bits, and starting bit location of Gradient X+direction.
48-50	LWGXN, WNGXN, LBGXN	Word number, length in bits, and starting bit location of Gradient X+direction.
51-53	LWGYP, LNGYP, LBGYP	Word number, length in bits, and starting bit location of Gradient Y+direction.
54-56	LWGYN, LNGYN, LBGYN	Word number, length in bits, and starting bit location of Gradient Y-direction.
57-59	LWPD, LNPD, LBPD	Word number, length in bits, and starting bit location of Physiographic Descriptor.
60-62	LWNO, LNNO, LBNO	Word number, length in bits, and starting bit location of Number Observations.
63-65	LWAGE, LNAGE, LBAGE	Word number, length in bits, and starting bit location of Age Recent Observation
66-68	LWREL, LNREL, LBREL	Word number, length in bits, and starting bit location of Reliability.
69-71	LWCLS, LNCLS, LBCLS	Word number, length in bits, and starting bit location of Class 1 Coverage.
72-74	LWSXP, LNSXP, LBSXP	Word number, length in bits, and starting bit location of Spatial Covariance in the positive X direction.

75-77	LWSXN, LNSXN, LBSXN	Word number, length in bits, and starting bit location of Spatial Covariance in the negative X direction
78-80	LWSYP, LNSYP, LBSYP	Word number, length in bits, and starting bit location of Spatial Covariance in the positive Y direction.
81-83	LWSYN, LNSYN, LBSYN	Word number, length in bits, and starting bit location of Spatial Covariance in the negative Y direction.
84-86	LWIND, LNIND, LBIND	Word number, length in bits, and starting bit location of Independent Temperature.
87-96	GRDWTS (10).	Weight assigned to each grid unit, according to its distance from the grid intersection for which gradients are being calculated
97	NP	Number of grid points to be used in calculation of gradients.
98-117	KMDST (10,2)	Look up table of gradient values and corresponding distances to be used in determining the search area for analysis.
118	MKM	Number of paired entries in KMDST.
119-138	H(10,2)	Look up table of gradient values and corresponding factors to be used in determining the new weight assigned to the observation temperature for analysis.
139	MH	Number of paired entries in H.
140	EXP	Exponent used in temperature analysis.
141	FDX	Factor used in determining new weight assigned to the optical thickness observation for analysis.
142	XCLASS	Factor used to place gradients into a class for Gradient Class Summary
143	DEL	Maximum number of optical thickness units that the new analysis temperature may differ from the previous optical thickness field value.
144	MF	Factor applied to the previous optical thickness and reliability to determine the final optical thickness and its reliability.

145	MSTAR	Factor applied to the combined observations temperature and weight in determining the new analysis optical thickness
146	MNSRCH	Minimum distance in kilometers to be searched for analysis observations.
47	MXSRCH	Maximum distance in kilometers to be searched for analysis observations.
148	BDEL	Maximum difference allowed between new analysis optical thickness and the previous one for the Class 1 Coverage Bit to be set to 1.
149	FCWT	Maximum value that can be assigned as the reliability of the new analysis optical thickness.
150	IYYY	Year of youngest time of observation data used (0-99).
151	IYMM	Month of youngest time of observation data used (1-12).
152	IYDD	Day of youngest time of observation data used (1-31).
153	IYHH	Hour of youngest time of observation data used (0-23).
154	IOYY	Year of oldest time of observation data used (0-99).
155	IOMM	Month of oldest time of observation data used (1-12).
156	IODD	Day of oldest time of observation data used (1-31).
157	IOHH	Hour of oldest time of observation data used (0-23).
158	ICURTM	Last time used in analysis

Values are stored as real (IBM floating-point) or integer according to the format implied by the first letter of their label. (Parameters beginning with I, J, K, L, M and N are integer values.)

9.8.2.3 Data Record Format

Each data record (latitudinal row) consists of a series of grid intersection points. These points are 28 bytes in length. Each longitude (column) reflects one grid intersection. At the end of the data record (i.e., immediately following the last column) is a 28 byte row identifier. All parameters are stored as integer values.

Table 9.8.2.3-1. Format of Grid Intersection in Data Record.

Word #	Length (bytes)	Description	Units	Comments
1	2	Optical Thickness	x 1000	0 to 2440
1	2	Average Gradient	units/100 km (x 1000)	0 to 300
2	2	Gradient X+	units/100 km (x 1000)	0 to 300
2	2	Gradient X-	units/100 km (x 1000)	0 to 300
3	2	Gradient Y+	units/100 km (x 1000)	0 to 300
3	2	Gradient Y-	units/100 km (x 1000)	0 to 300
4	1	Physiographic Descriptor	0=sea 1=land	0 to 15
4	1	Spare	Undefined	0 to 255
4	1	Number observations	Integer	0 to 255
4	1	Age Recent Observation	Hours	0 to 255
5	2	(Weight) Wxy	Integer	0 to 32767
5	2	Class 1 Coverage	Bits	0 to 1
6	1	Spatial Covariance X+	Grid Units	0 to 10
6	1	Spatial Covariance X-	Grid Units	0 to 10
6	1	Spatial Covariance Y+	Grid Units	0 to 10
6	1	Spatial Covariance Y-	Grid Units	0 to 10
7	2	Climatological Temperature	degrees C (x 10)	-850 to +610
7	2	Spare	Undefined	0 to 32767

DEFINITION OF TERMS IN GRID INTERSECTION

Optical Thickness - The latest Aerosol Optical Thickness calculated based on the previous analysis optical thickness, weighted according to its reliability, combined with a weighted average of current observations within a surrounding area which is determined according to the grid point's gradient.

Average Gradient - The average of the gradients in all four directions (N, S, E, W) from the grid intersection.

Gradient in X+ Direction - Change in optical thickness between the grid point and neighbor points within the field in the positive direction along the X axis.

Gradient in X- Direction - Change in optical thickness in the negative direction along the X axis.

Gradient in Y+ Direction - Change in optical thickness in the positive direction along the Y axis.

Gradient in Y- Direction - Change in optical thickness in the negative direction along the Y axis.

Physiographic Descriptor - The land/sea tag indicating whether a grid intersection is a land or sea point.

Spare - Unused parameter.

Number of Observations - The total number of current observations used in the analysis of the new optical thickness for the grid intersection.

Age of Most Recent Observation - The age, in hours from the time of last analysis, of the most recent observation used to determine the new optical thickness for a grid intersection.

Reliability - New reliability associated with the new optical thickness, based on the previous reliability combined with the weighted reliability of all observations used in the last analysis.

Class 1 Temporal Coverage - Set of bits (0-15) of which bit 1 is set to 1 for each analysis which included observations with a reliability greater than or equal to a specific minimum reliability considered as class 1. Bit 0 always remains a 0, and all bits are shifted right during each analysis leaving bit 1 a 0 when no class 1 reliability observations are used for a grid intersection.

Spatial Covariance X+ - The distance in grid units from the grid intersection to the nearest land mass in the positive direction along the X axis.
Spatial Covariance X- - The distance in grid units from the grid intersection to the nearest land mass in the negative direction along the X axis.

Spatial Covariance Y+ - The distance in grid units from the grid intersection to the nearest land mass in the positive direction along the Y axis.

Spatial Covariance Y- - The distance in grid units from the grid intersection to the nearest land mass in the negative direction along the Y axis.

Independent Grid Temperature - The average sea surface temperature of a grid intersection for a particular month over a number of years, taken from the global climatology file.

Table 9.8.2.2-2 gives the row identification information. NOTE: All parameters are stored as integer values. Words 5 to 7 are the date and time at which analysis was performed.

Table 9.8.2.3-2. Row Identification Information.

Full Word	Length (bytes)	Description	Units	Comments
1	4	Row	Integer	1-141
2	4	Spare	Undefined	n/a
3	4	Spare	Undefined	n/a
4	1	Marker	Integer	Always 255
4	3	Spare	Undefined	n/a
5	4	Hour of Day, Minutes of Hour	(100 x Hours) + Minutes	0-2359
6	4	Day of Year	Days	1-366
7	4	Year	Years	????

9.8.3 AEROSOL MONTHLY MEAN FIELD FILE

The Aerosol Monthly Mean Field File is a gridded file of optical thicknesses and other information. The optical thickness at each grid point is the average of the optical thicknesses calculated for each week within the month at that grid point. If an analyzed field was updated during the month, then it will be used in the calculation of the monthly mean.

9.8.3.1 File Structure Description

The first record is a header which contains satellite ID, the month, the year, and the number of fields used in the computation of the mean. The remaining records are data records. Each data record contains all data for one latitudinal row. The latitude range is from -70 to 70 degree. The first data record will contain data from the -70 degree latitude row and the second will contain data from the -69 degree row and so on. Each row will begin with information from the -180 degree meridian and progress eastward to the 179 degree meridian. Each grid point will contain 10 bytes of information thus each record will contain 3600 bytes.

9.8.3.2 Header Record Format

The format of the header record is contained in Table 9.8.3.2-1.

Table 9.8.3.2-1. Header Record Format.

Halfword	Description	Comments
1	Month	1-12
2	Year	1988 - ?
3	Satellite ID	1-8
4	Number of fields used in mean calculation	1-5
5-1800	Spares	n/a

9.8.3.3 Data Record Format

Each data record represents one row of latitude with each 5 halfwords representing a specific grid point or intersection with a meridian. Table 9.8.3.2-2 shows the format of the grid intersections in the data record.

Table 9.8.3.3-1. Grid intersection format.

Halfword	Description	Comments
1	Average Optical Thickness	0 to2440, -999=land
2	Maximum Weekly Optical Thickness for the Month	0 to2440, 0=land
3	Minimum Weekly Optical Thickness for the Month	0 to2440, 0=land
4	Number of weekly field values which were analyzed from at least 1 retrieval which was less than 8 days old.	0 to 5, 0=land
5	Spare	n/a

9.8.4 AEROSOL OPTICAL THICKNESS 8-DAY OBSERVATION FILE

The Aerosol Observation File contains eight days of Sea Surface Temperature (SST) retrievals containing a single-channel (AVHRR Channel 1) optical thickness parameter τ^{A}. The SSTs in these retrievals are "aerosol-corrected" SSTs, but the uncorrected SSTs are also contained within the observation. The layout of the file is identical to the SST 8-day observation file with the

exception that the 2-bytes used to store a water vapor parameter in the SST retrieval are used for an aerosol optical thickness value and a spare area is used for the uncorrected SST. This data file consists of 4,002 physical records each with a length of 13,024 bytes.

9.8.4.1 File Structure Description

The organization of the file is as follows: earth is divided into 5 degree by 5 degree blocks and by 1 degree by 1 degree subblocks within each block. The blocks are numbered from 1 to 2592 with the origin or first block at 180 degrees West (or -180) and 90 degrees South (or -90). Block numbers increase by 1 to the east and by 72 to the north. To locate information in an area, the block number is found which corresponds to the block encompassing the area. A table in the directory record points to the record which contains the desired block. After locating the record containing the block, another table at the beginning of the record locates the proper location of the desired subblock.

The file has overflow records and as such expands and contracts as data are available.

The first record is the directory record containing the block directory and other information. All other records are data records, each containing a subblock directory followed by observations.

9.8.4.2 Directory Record Format

This record describes the size, origin and location of the blocks making up the file. To calculate the block number of a location (ILAT, ILON) use the following formula:

$$IBLOCK = \left(\frac{ILAT - LA}{LAO} \times INBC \right) + \left(\frac{ILON - LO}{LOO} \right) + 1$$

where,

INBC = Number of Column Blocks = 360/LOO,
LA = Latitude origin of file = -90,
LO = Longitude origin of file = -180,
LAO = Size of block in latitudinal direction in degrees = 5,
LOO = Size of block in longitudinal direction in degrees = 5,
ILAT = Latitude (+N, -S) and
ILON = Longitude (+E, -W).

To find INTEGER ILAT and ILON, round up if positive and down if negative. Each block includes the minimum whole latitude and longitude and excludes the maximum whole latitude and longitude which border the block. For example: The limits of block 1 are -90.0 to -85.01 and -180.0 to -175.01.

Table 9.8.4.2-1 contains the format of the directory record.

Table 9.8.4.2-1. Format of Directory Record.		
Halfword	**Description**	**Comments**
1	Latitude Origin	-90
2	Longitude Origin	-180
3	Size of block in latitudinal direction	in degrees (currently 5)
4	Size of block in longitudinal direction	in degrees (currently 5)
5	First free record pointer	Points to first available record
6	Number of records in file	Currently 4002
7	Halfword number of start of block directory table	Currently 11
8	Day of year of latest data	1-366
9	File availability	0=available 1=unavailable update in progress
10	Year of century of latest data	0-99
11	Record number for block 1	2-4002
12	Record number for block 2	0 if no data in block

9.8.4.3 Data Record Format

Table 9.8.4.3-1 contains the format of the data record.

Table 9.8.4.3-1. Data Record Format.		
Halfword	**Description**	**Comments**
1	Record number	2 to 4002
2	Block number	1 to 2592
3	Extent number (# of records) removed from primary	0 if primary

4	Pointer to succeeding overflow record. Last overflow record points to primary.	0 if no overflow.
5	Pointer to halfword position of start of observation data	currently 61
6	Pointer to start of subblock directory	currently 11
7	Lower left latitude of block	degrees
8	Lower left longitude of block	degrees
9	Pointer to last halfword containing data	If no data in the record, this pointer points to the start position of observation data -1
10	Unused	
11	Halfword of start of data for subblock #1	0 if no data for this subblock in this record
12	Halfword of end of data for subblock #1	0 if no data for this subblock in this record. Other extents may or may not contain data for this subblock.
13-60	Similar to halfwords 11 and 12 for remaining subblocks.	Similar to halfwords 11 and 12 for remaining subblocks.
61-6512	Observation data	n/a

If the observations for a block cannot fit in one record, as many additional records (extents) are allocated as needed. Each additional record having the subdirectory and subdocumentation is included. If the subblock is known to be empty for the current record, the start and end position contain a zero. Subblocks may cross record boundaries. If an entire subblock cannot fit into one record, it will be split and a new record is allocated for the remainder of the subblock. Unused portions of the records containing no data are zero filled.

Given IX longitude and IY latitude, the subblock number (SBN) can be calculated as follows:

$$SBN = (IY - LLA) \times LOO + IX - LLL + 1$$

This assumes all subblocks are one degree boxes. Here LLA and LLL are respectively the lower left latitude and longitude for the 5 degree blocks.

Simplifying the above equation:

$$SBN = (IY \times LOO) + IX + C$$

where,

$$C = (-LLA \times LOO) - LLL + 1$$

and has been previously determined.

9.8.4.4 Satellite Aerosol/SST Observation Format

Satellite Aerosol/SST Observations are of variable lengths with a minimum length of 28 halfwords (2-byte integer) and a maximum of 48 halfwords. The observation length must be an even number of halfwords with no odd halfword except the first halfword being negative (i.e. the sign bit is 1). The first odd halfword of an observation is always negative. Table 9.8.4.4-1 gives the format for the observations.

Table 9.8.4.4-1. Satellite Aerosol/SST Observation Format.

Halfword #	Byte	Quantity	Range
1	1	Type of Observation (see Table 9.8.4.4-2)	129 to 255
1	2	Source of Observation (see Table 9.8.4.4-3)	0 to 255
2	3	Year of Century	0 to 99
2	4	Month of Year	1 to 12
3	5-6	Latitude (+N,-S) x 100	-9000 to 9000
4	7-8	Longitude (+E,-W) x 100	-18000 to 17900
5	9	Day of Month	1 to 31
5	10	Hour of Day	0 to 23
6	11	Minute of Hour	0 to 59
6	12	Second of Minute	0 to 59
7	13-14	Aerosol-corrected SST (degrees C x 10)	-20 to 350
8	15-16	Reliability	0 to 32767
9	17-18	Solar Zenith Angle (degrees x 10)	0 to 1800

10	19-20	Satellite Zenith Angle (degrees x 100) (Negative to left of spacecraft track, positive to right.)	-6000 to 6000
11	21-22	Analyzed Field SST (degrees C x 10)	-20 to 350
12	23-24	Internal Error (RMS x 100)	0 to 1000
13	25-26	Relative Azimuth Angle (degrees x 10)	0 to 1800
14	27-28	Climatological SST (degrees C x 10)	-20 to 350
15	29	Beginning Row of Unit Array	1 to 11
15	30	Beginning column of Unit Array	1 to 11
16	31-32	AVHRR Channel 1 Average (% x 100)	0 to 10000
17	33-34	AVHRR Channel 2 Average (% x 100)	0 to 10000
18	35-36	AVHRR Channel 3 Average (K x 100)	0 to 32767
19	37-38	AVHRR Channel 4 Average (K x 100)	0 to 32767
20	39-40	AVHRR Channel 5 Average (K x 100)	0 to 32767
21	41-42	Space View SDEV Channel 1 (% x 100)	0 to 10000
22	43-44	Space View SDEV Channel 2 (% x 100)	0 to 10000
23	45-46	Space View SDEV Channel 3 (K x 100)	0 to 32767
24	47-48	Channel 4 Blackbody Temperature (K x 100)	0 to 32767
25	49-50	Channel 5 Blackbody Temperature (K x 100)	0 to 32767
26	51-52	Algorithm Number	1011 to ?
27	53-54	Aerosol Optical Thickness x 1000	0 to 2440
28	55-56	Uncorrected SST (K x 100)	27116 to 30816
If HIRS Data is appended:			
29	57-58	HIRS Channel 1 Temperature (K x 100)	0 to 32767
30	59-60	HIRS Channel 2 Temperature (K x 100)	0 to 32767
31	61-62	HIRS Channel 3 Temperature (K x 100)	0 to 32767
32	63-64	HIRS Channel 4 Temperature (K x 100)	0 to 32767

33	65-66	HIRS Channel 5 Temperature (K x 100)	0 to 32767
34	67-68	HIRS Channel 6 Temperature (K x 100)	0 to 32767
35	69-70	HIRS Channel 7 Temperature (K x 100)	0 to 32767
36	71-72	HIRS Channel 8 Temperature (K x 100)	0 to 32767
37	73-74	HIRS Channel 9 Temperature (K x 100)	0 to 32767
38	75-76	HIRS Channel 10 Temperature (K x 100)	0 to 32767
39	77-78	HIRS Channel 11 Temperature (K x 100)	0 to 32767
40	79-80	HIRS Channel 12 Temperature (K x 100)	0 to 32767
41	81-82	HIRS Channel 13 Temperature (K x 100)	0 to 32767
42	83-84	HIRS Channel 14 Temperature (K x 100)	0 to 32767
43	85-86	HIRS Channel 15 Temperature (K x 100)	0 to 32767
44	87-88	HIRS Channel 16 Temperature (K x 100)	0 to 32767
45	89-90	HIRS Channel 17 Temperature (K x 100)	0 to 32767
46	91-92	HIRS Channel 18 Temperature (K x 100)	0 to 32767
47	93-94	HIRS Channel 19 Temperature (K x 100)	0 to 32767
48	95-96	HIRS Channel 20 Temperature (% x 100)	0 to 1000

Table 9.8.4.4-2. Aerosol/SST Observation Type Codes.

Code	Type
157	Day Operational Algorithm
158	Day Operational Algorithm in relaxed cloud mode
167	Day Test Algorithm
168	Day Test Algorithm in relaxed cloud mode

Table 9.8.4.4-3. Aerosol/SST Observation Source Codes.

Code	Source

1	NOAA-11 AVHRR
3	NOAA-14 AVHRR
100	Ship data from Navy (FNOC)
101	Buoy data from TIROS collection system
102	Fixed Weather Ship (from NMC)
103	Moving Ship with Name (from NMC)
104	Moving Ship without Name (from NMC)
105	Fixed Buoy (from NMC)
106	Drifting Buoy (from NMC)
107	XBT (from NMC)

9.8.5 AEROSOL OPTICAL THICKNESS 100-KM ANALYZED FIELD ACCUMULATION FILE

Each field accumulation file consists of an archive of one specific type of field (i.e., 100-km aerosol optical thickness). The number of fields archived at any one time depends on the size of the dataset and is given in the directory. In September 2001, the aerosol optical thickness 100-km analyzed field accumulation file which was archived monthly was replaced with an aerosol optical thickness 100-km field file archived weekly. This means that the individual field files are archived and not bundled into an accumulation file for a full month. The format of the individual fields remains the same.

9.8.5.1 File Structure Description

The first record is a directory which points the user to the position of the first record for each field archived. A pointer to the latest field entered in the file is also provided, the user must check each field to find the field for the time period of interest. The fields are concatenated together in one large file after the directory record.

9.8.5.2 Directory Record Format

Table 9.8.5.2-1 contains the format of the Directory Record.

Table 9.8.5.2-1. Directory Record Format.

Full Word #	Quantity

1	# of records in the dataset
2	# of records in each field (NRECS)
3	# of fields in the accumulation file (NFIELDS)
4	Field number of latest field entered in accumulation file
5	Record # of first record of field #1
6	Record # of first record of field #2
4+NFIELDS	Record # of first record of field # NFIELDS

9.8.5.3 Data Record Format

The first field in the accumulation file begins at record 2. Consult the dataset format description for the aerosol optical thickness 100 km analyzed field to find the format of the field documentation record and data records. The field documentation record (the first record of each field) should be used in referencing the data records for the field since the field documentation record provides information concerning the organization, size and time period of the field. The logical record size for a field is 10,108 bytes.

9.9 COMPREHENSIVE LARGE ARRAY-DATA STEWARDSHIP SYSTEM (CLASS)

The Comprehensive Large Array-data Stewardship System (CLASS) is an electronic library of environmental satellite data. CLASS is NOAA's premiere on-line facility for the distribution of NOAA and US Department of Defense (DoD) Polar-orbiting Operational Environmental Satellite (POES) data and derived data products. In addition, CLASS archives and distributes data from NOAA's Geostationary Operational Environmental Satellite (GOES). Note: CLASS has replaced NOAA's Satellite Active Archive (SAA).

The CLASS User Interface is located at: http://www.class.noaa.gov