Clouds and the Earth's Radiant Energy System (CERES)

Data Management System

Data Products Catalog

Release 2
Version 1

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Preface

The Clouds and the Earth's Radiant Energy System (CERES) Data Management System supports the data processing needs of the CERES Science Team research to increase understanding of the Earth's climate and radiant environment. The CERES Data Management Team works with the CERES Science Team to develop the software necessary to support the science algorithms. This software, being developed to operate at the Langley Distributed Active Archive Center (DAAC), produces an extensive set of science data products.

The Data Management System consists of 12 subsystems; each subsystem represents a stand-alone executable program. Each subsystem executes when all of its required input data sets are available and produces one or more archival science products.

The documentation for each subsystem describes the software design at various significant milestones and includes items such as Software Requirements Documents, Data Products Catalogs, Software Design Documents, Software Test Plans, and User's Guides.

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1.0 Introduction

The Clouds and the Earth's Radiant Energy System (CERES) is a key component of the Earth Observing System (EOS). The CERES instruments are improved models of the Earth Radiation Budget Experiment (ERBE) scanner instruments, which operated from 1984 through 1990 on the National Aeronautics and Space Administration's (NASA) Earth Radiation Budget Satellite (ERBS) and on the National Oceanic and Atmospheric Administration's (NOAA) operational weather satellites NOAA-9 and NOAA-10. The strategy of flying instruments on Sun-synchronous, polar orbiting satellites, such as NOAA-9 and NOAA-10, simultaneously with instruments on satellites that have precessing orbits in lower inclinations, such as ERBS, was successfully developed in ERBE to reduce time sampling errors. CERES will continue that strategy by flying instruments on the polar orbiting EOS platforms simultaneously with an instrument on the Tropical Rainfall Measuring Mission (TRMM) spacecraft, which will have an orbital inclination of 35 degrees. In addition, to reduce the uncertainty in data interpretation and to improve the consistency between the cloud parameters and the radiation fields, CERES will include cloud imager data and other atmospheric parameters. The first CERES instrument is scheduled to be launched on the TRMM spacecraft in 1997. Additional CERES instruments will fly on the EOS-AM platforms, the first of which is scheduled for launch in 1998, and on the EOS-PM platforms, the first of which is scheduled for launch in 2000. The TRMM satellite carries one CERES instrument while the EOS satellites carry two CERES instruments, one operating in a fixed azimuth scanning mode and the other operating in a rotating azimuth scanning mode.

A high-level view of the CERES Data Management System (DMS) is illustrated by the CERES Top Level Data Flow Diagram shown in Figure 1.0-1. Circles in the diagram represent algorithm processes which are called subsystems. Subsystems are a logical collection of algorithms which together convert input data products into output data products. Boxes represent archival data products. Two parallel lines represent data stores which are designated as nonarchival or temporary data products. Boxes or data stores with arrows entering a circle are input data sources for the subsystem, while boxes or data stores with arrows exiting the circles are output data products.

The CERES DMS produces science data products for use by the CERES Science Team, the Data Management Team, and for archival at the Langley Distributed Active Archive Center (DAAC). This document describes the data products that are shown in Figure 1.0-1. There are a variety of conditions which control the production rate of each product. For example, some are produced for each instrument, some are produced for both instruments on a given satellite, and some are produced for the entire CERES mission. Table 1.0-1 lists each of these scenarios and assigns a one-letter key to identify them. The CERES product sizes in this document are based on one of three types of data structures: Hierarchical Data Format (HDF), flat binary format, or HDF-EOS format, which are described in Table 1.0-2 with corresponding one-letter keys. The final file organization of many of the products will not be completed until the next release of this document. All standard data products distributed to external users will be archived in HDF or HDF-EOS. CERES-specific or internal files will be written as flat binary files. Some of the files will be written as flat binary files and converted to HDF when requested by the user.

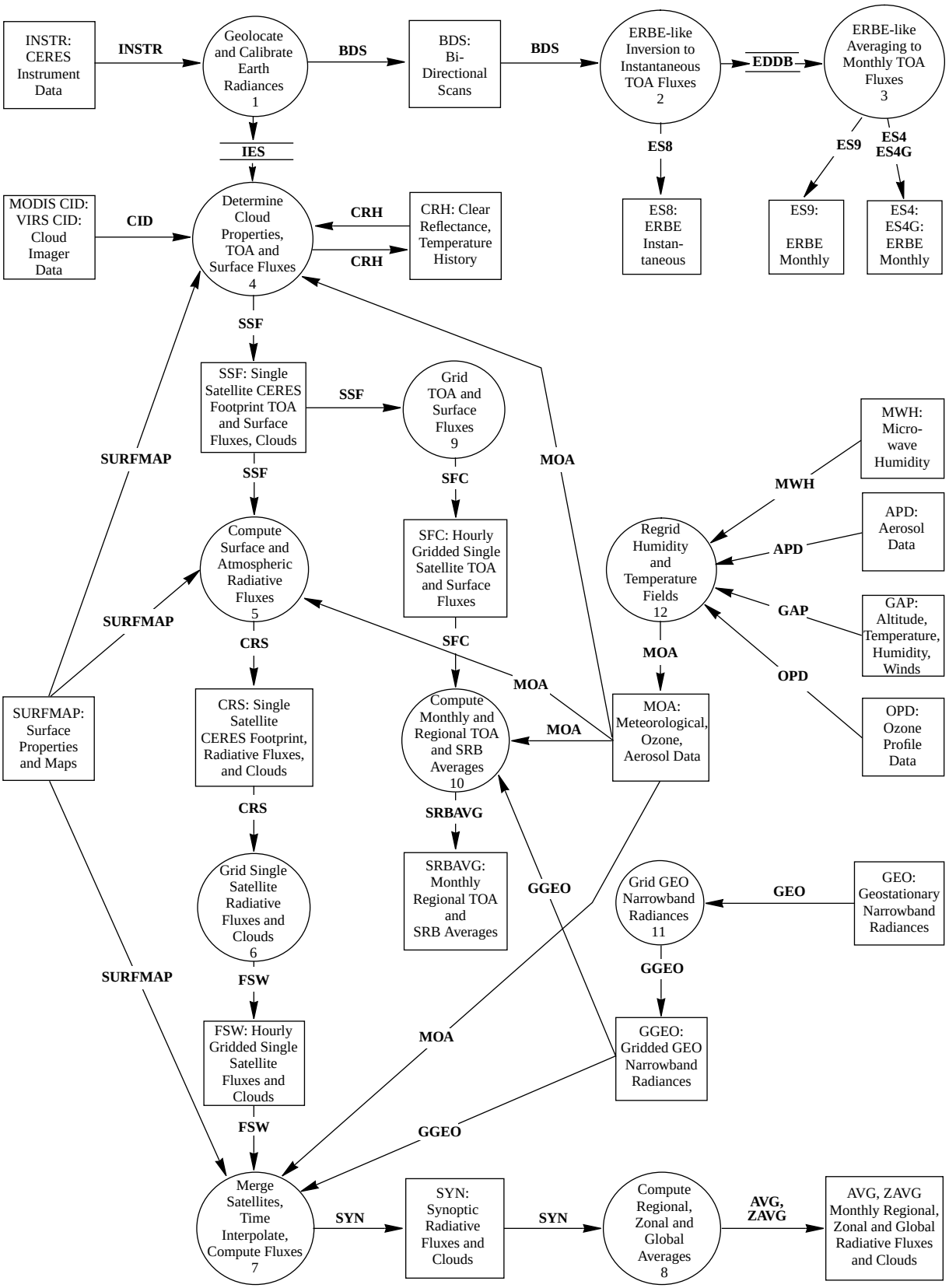


Figure 1.0-1. CERES Top Level Data Flow Diagram

Table 1.0-1. Scenario Key

Key	Scenario (Production Rate)
A	One per each instrument operating in fixed azimuth scan mode
B	One per each instrument operating in either azimuth scan mode (fixed or rotating)
C	One per each satellite (regardless of the number of instruments)
D	One per each instrument in fixed azimuth scan mode plus all instruments combined
E	One per mission (regardless of the number of instruments and satellites)
F	One per TRMM satellite (VIRS imager data)
G	One per EOS satellite (MODIS imager data)

Table 1.0-2. File Format Size Key

Size Key	Description
E	File size estimates for HDF_EOS structures
F	File size estimates for flat file structure
H	File size estimates for HDF structures

There are three categories of products as listed in the summary Tables 1.0-3, 1.0-4 and 1.0-5.

Table 1.0-3: Archival Products: Output products which are permanently stored by the Earth Observing System Data and Information System (EOSDIS)

Table 1.0-4: Internal Products: Output products which are temporarily stored by EOSDIS (the storage duration may range from days to years)

Table 1.0-5: Ancillary Products: Input products which contain non-CERES data needed to interpret the CERES measurements

Each summary table lists the number of the subsystem which produces or uses the product, the CERES and EOSDIS product identification codes, a descriptive product name, the temporal production frequency, the size of one instance of the product, the total size of a full month of one instance of the product, a scenario key as described in Table 1.0-1, and a size key for the current format as described in Table 1.0-2. The total data volume for a given product can be derived from the monthly size and the scenario. These volume estimates will change as the content of each data product is further refined and when the final file format is selected.

The following sections of the catalog describe products from each of the three categories listed above. Each product description consists of a summary narrative followed by a listing of the data requirements for each parameter in the product.

Table 1.0-3. Archival Products Summary

Sub Sys	Product Codes		Name	Frequency	Size, MB	Monthly Size, MB	Key	Size Key
	CERES	EOSDIS						
1	BDS	CER01	Bidirectional Scan	1/Day	710.9	22039	B	H
1	INSTR	CERX00a	Instrument Production Data Set	1/Day	88.9	2757	B	F
2	ES-8	CER02	ERBE-like Instantaneous TOA	1/Day	467.1	14479	B	E
3	ES-9	CER03	ERBE-like Monthly Regional Averages	1/Month	175.2	175	D	F
3	ES-4	CER13	ERBE-like Monthly Geographical Averages	1/Month	16.5	17	D	F
3	ES-4G	CER14	ERBE-like Monthly Gridded Averages	1/Month	18.2	18	D	F
4	SSF	CER11	Single Satellite Footprint, TOA and Surface Flux, Clouds	1/Hour	261.7	194705	B	F
4	CRH	CER16	Clear Reflectance History	3/Month	48.9	152	C	F
5	CRS	CER04	Clouds and Radiative Swath	1/Hour	309.0	229908	B	F
6	FSW	CER05	Monthly Gridded Single Satellite Fluxes and Clouds	1/Month	11480.0	11480	A	H
7	SYN	CER07	Synoptic Radiative Fluxes and Clouds	8/Day	79.9	19819	D	F
8	AVG	CER08	Monthly Regional Radiative Fluxes and Clouds	1/Month	1201.1	1201	D	E
8	ZAVG	CER15	Monthly Zonal and Global Radiative Fluxes and Clouds	1/Month	3.4	3	D	E
9	SFC	CER12	Monthly Gridded Single Satellite TOA and Surface Fluxes/Clouds	1/Month	6210.0	6210	A	H
10	SRBAVG	CER06	Monthly TOA and SRB Aver-ages	1/Month	2224.5	2225	D	E
11	GGEO	CERX14	Gridded GEO Narrowband Radiances	1/Month	816.1	816	E	F
12	MOA	CERX06	Meteorological, Ozone, and Aerosol Data	1/Hour	12.9	9595	E	F

Table 1.0-4. Internal Products Summary

Sub Sys	Product Code		Name	Frequency	Size, MB	Monthly Size, MB	Key	Size Key
	CERES	EOSDIS						
1	IES	CER09	Instrument Earth Scans	1/Hour	32.3	24001	B	H
2	EDDB/ EID6	CERX02	ERBE-like Daily Data Base Data	1/Day	17.2	534	A	F

Table 1.0-5. Ancillary Products Summary

Sub Sys	Product Code		Name	Frequency	Size, MB	Monthly Size, MB	Key	Size Key
	CERES	EOSDIS						
4	CID_MODIS	CERX04	MODIS Cloud Imager Data	1/2.5min	195.3	3,544,013	G	H
4	CID_VIRS	CERX05	VIRS Cloud Imager Data	1/Hour	57.3	42,654	F	H
4	SURFMAP	CERX07	Surface Map	1/Week	16.0	64	E	F
11	GEO	CERX09	Grid GEO Narrowband Radiances	8/Day	30.6	7600	E	F
12	APD	CERX10	Aerosol Profile Data	1/Week	TBD	TBD	E	F
12	GAP	CERX12	Altitude, Temperature, Humidity	4/Day	TBD	TBD	E	F
12	MWH	CERX13	Microwave Humidity	1/Day	TBD	TBD	E	F
12	OPD	CERX11	Ozone Profile Data	Daily to Monthly	TBD	TBD	E	F

2.0 Archival Data Products

This section describes the CERES data products which are permanently archived at the Langley DAAC. Each subsection contains a brief overview of the purpose and content of the data product followed by a table which lists every parameter contained in the product. The following data attributes are described in the overview sections:

- Level - Level of the data
- Type - Data type (Archival, Internal, or Ancillary)
- Frequency - How often the product is received or produced
- Time Interval Covered -
  - File - Time period covered within this file
  - Record - Time period covered within one record of this file
- Portion of Globe Covered -
  - File - Portion of the globe covered within this file
  - Record - Portion of the globe covered with a record of this file
- Portion of Atmosphere Covered -
  - File - Portion of the atmosphere covered within this file (Surface, Top-of-the-Atmosphere (TOA), etc.)

The tables in each subsection contain the following attributes for each parameter:

- Description - A textual description of the parameter
- Parameter Number - Arbitrary number assigned to the parameter
- Units - Units of the parameter value
- Range - Range of values for the parameter
- Elements/Record - Elements per record for this parameter (array definition)
- Bits/Element - Number of bits used to describe this parameter
- Elem Num - Element Number, a numbering of each element in the file/record

The following summary information is provided at the end of each table:

- Total Meta Bits/File - Total number of bits within the file containing metadata
- Total Data Bits/Record - Total number of bits within each data record of the file
- Total Records/File - Total number of records within the file
- Total Data Bits/File - Total number of data bits within the entire file, excludes metadata
- Total Bits/File - Total number of bits in the file including metadata

The bolded entries within the file are names for the group of parameters which follow.

2.1 Bidirectional Scans (BDS)

EOSDIS Product Code: CER01

The Bidirectional Scan (BDS) data product is an archival product containing Level-1b CERES scanner data obtained for a 24-hour period. All science scan modes are in the BDS. This includes the fixed and rotating azimuth scan modes that perform normal Earth scans, internal calibration, and short scan elevation profiles. The BDS product includes samples taken at all scan elevation positions (including space-looks and internal calibration views).

The BDS includes the raw (unconverted) science and instrument data from the Level 0 input file (excluding Level 0 header and footer data) as well as the geolocated converted science and instrument data. The BDS also contains additional data not found in the Level 0 input file, including converted satellite position and velocity data, celestial data, and converted digital status data.

All of the BDS data use Hierarchical Data Format (HDF) structures such as Vdata and Scientific Data Sets (SDSs). See the HDF User's Guide for additional information (Reference1). Metadata for the BDS is implemented using the ECS Toolkit metadata routines (Reference2), which are based on HDF Annotations.

The general composition of a BDS in terms of HDF components is as follows:

Data Structure	HDF Component
1. Metadata	HDF Annotations
2. Unconverted Science Data	HDF SDS(s)
3. Unconverted Instrument Data	HDF Vdata(s)
4. Digital Instrument Data	HDF SDS
5. Converted Science Data	HDF SDS(s)
6. Converted Instrument Data	HDF Vdata(s)
7. Satellite-Celestial Data	HDF Vdata(s)

A more detailed listing of the data parameters for this product can be found in the subsequent tables of this section.

Level: 1b
Type: Archival
Frequency: 1/Day

Portion of Globe Covered
File: Satellite Swath
Record: N/A

Time Interval Covered
File: 24 Hours
Record: Single 6.6-Second Scans

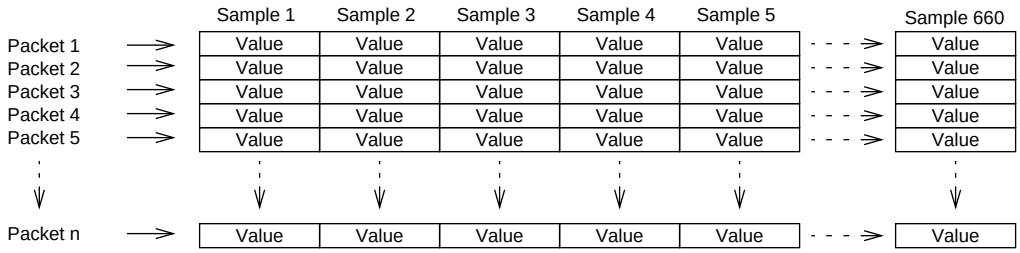
Portion of Atmosphere Covered
File: Satellite Altitude

Bidirectional Scans (BDS) Definition

BDS Metadata - TBD

BDS Scientific Data Sets

Every Scientific Data Set (SDS) in the BDS file represents a time ordered collection of data where each row in the SDS corresponds to a packet of data, and each column corresponds to a single sample within a packet. Most of the SDSs have 660 samples per packet of a single parameter arranged as shown in the following sketch.



(Note: n = the number of packets processed)

Table 2.1-1 summarizes the contents of each SDS contained within the BDS file.

Table 2.1-1. BDS SDS Summary

SDS Name	HDF Rank	Rows	Columns	Data Type	Range	Units	Nominal Size (MB)*
Shortwave Detector Output	2	n	660	U16 Integer	0..4095	count	16.45
Total Detector Output	2	n	660	U16 Integer	0..4095	count	16.45
Window Detector Output	2	n	660	U16 Integer	0..4095	count	16.45
Elevation Position Count	2	n	660	U16 Integer	0..4095	count	16.45
Azimuth Position Count	2	n	660	U16 Integer	0..4095	count	16.45
BDS Raw Digital Status Measurement	2	n	185	U16 Integer	See Table 2.1-3	N/A	4.62
CERES SW Filtered Radiance, Upwards	2	n	660	32-Bit Float	-10.0..510.0	$Wm^{-2}sr^{-1}$	32.96
CERES TOT Filtered Radiance, Upwards	2	n	660	32-Bit Float	0.0..700.0	$Wm^{-2}sr^{-1}$	32.96
CERES WN Filtered Radiance, Upwards	2	n	660	32-Bit Float	0.0..50.0	$Wm^{-2}sr^{-1}$	32.96
Colatitude of CERES FOV at TOA	2	n	660	64-Bit Float	0.0..180.0	deg	65.92
Longitude of CERES FOV at TOA	2	n	660	64-Bit Float	0.0..360.0	deg	65.92
CERES Viewing Zenith at TOA	2	n	660	64-Bit Float	0.0..90.0	deg	65.92
CERES Solar Zenith at TOA	2	n	660	64-Bit Float	0.0..180.0	deg	65.92
CERES Relative Azimuth at TOA	2	n	660	64-Bit Float	0.0..360.0	deg	65.92
Converted Elevation Angles	2	n	660	64-Bit Float	0.0..180.0	deg	65.92
Converted Azimuth Angles	2	n	660	64-Bit Float	0.0..270.0	deg	65.92
BDS Quality Flags	2	n	660	U32 Integer	See Table 2.1-4	N/A	32.96
Julian Date and Time	2	n	2	64-Bit Float	N/A	day	0.20
SDS TOTAL SIZE							**680.35**

* Assumes n = 13091 and does not take into account additional HDF overhead

BDS Vdatas

The BDS contains seven Vdatas which are collections of records similar to records used in conventional database applications (multifield, various data types). Each of the seven Vdatas contains *n* records of packet level data, and there is a one-to-one correspondence of the Vdata record numbers to the row numbers of the BDS SDSs.

Table 2.1-2 summarizes the contents of each Vdata contained within the BDS file.

Table 2.1-2. BDS Vdata Summary

Vdata Name	Description Table	Records	Number of Fields	Nominal Size (MB)
Temperature Counts	2.1-5	n	39	5.62
Voltage and Torque Counts	2.1-6	n	24	2.25
Position Counts	2.1-7	n	12	6.6
Converted Temperatures	2.1-8	n	35	8.84
Converted Voltages and Torques	2.1-9	n	23	4.35
Satellite-Celestial Data	2.1-10	n	12	1.95
Converted Digital Data	2.1-11	n	23	0.94
Vdata TOTAL SIZE				**30.55**

Table 2.1-3. Digital Data Word Definitions (1 of 7)

Word	Parameter Name	Bits
0	Instrument Mode Sequence Number	0..4
	Instrument Previous Mode Sequence Number	5..9
	Mode Sequence Changed By	10..12
	Mode Sequence Has Changed	13..14
	Spare Bit	15
1	Sequence Command Index	0..4
	Sequence Execution Status	5..7
	Sequence Time to Next Command	8..15
2	Spare Word	0..15
3	Spare Word	0..15
4	Spare Word	0..15
5	Spare Word	0..15
6	Spare Word	0..15
7	Instrument Command Counter	0..15
8	Instrument Command Main 1	0..15
9	Instrument Command Parameter 1	0..15
10	Instrument Command Sample Number 1	0..9
	Instrument Command Status 1	10..14
	Instrument Command Source 1	15
11	Instrument Command Main 2	0..15
12	Instrument Command Parameter 2	0..15
13	Instrument Command Sample Number 2	0..9
	Instrument Command Status 2	10..14
	Instrument Command Source 2	15
14	Instrument Command Main 3	0..15
15	Instrument Command Parameter 3	0..15
16	Instrument Command Sample Number 3	0..9
	Instrument Command Status 3	10..14
	Instrument Command Source 3	15
17	Instrument Command Main 4	0..15
18	Instrument Command Parameter 4	0..15
19	Instrument Command Sample Number 4	0..9
	Instrument Command Status 4	10..14
	Instrument Command Source 4	15
20	Instrument Command Main 5	0..15
21	Instrument Command Parameter 5	0..15
22	Instrument Command Sample Number 5	0..9
	Instrument Command Status 5	10..14
	Instrument Command Source 5	15
23	Instrument Command Main 6	0..15
24	Instrument Command Parameter 6	0..15
25	Instrument Command Sample Number 6	0..9
	Instrument Command Status 6	10..14
	Instrument Command Source 6	15
26	Instrument Command Main 7	0..15
27	Instrument Command Parameter 7	0..15
28	Instrument Command Sample Number 7	0..9
	Instrument Command Status 7	10..14
	Instrument Command Source 7	15

Table 2.1-3. Digital Data Word Definitions (2 of 7)

Word	Parameter Name	Bits
29	Instrument Command Main 8	0..15
30	Instrument Command Parameter 8	0..15
31	Instrument Command Sample Number 8	0..9
	Instrument Command Status 8	10..14
	Instrument Command Source 8	15
32	Instrument Error Counter	0..15
33	Instrument Error Sample Number 1	0..9
	Instrument Error Type 1	10..15
34	Instrument Error Sample Number 2	0..9
	Instrument Error Type 2	10..15
35	Instrument Error Sample Number 3	0..9
	Instrument Error Type 3	10..15
36	Instrument Error Sample Number 4	0..9
	Instrument Error Type 4	10..15
37	Instrument Error Sample Number 5	0..9
	Instrument Error Type 5	10..15
38	Instrument Error Sample Number 6	0..9
	Instrument Error Type 6	10..15
39	Instrument Error Sample Number 7	0..9
	Instrument Error Type 7	10..15
40	Instrument Error Sample Number 8	0..9
	Instrument Error Type 8	10..15
41	Spare Word	0..15
42	Spare Word	0..15
43	Spare Word	0..15
44	Spare Word	0..15
45	Spare Word	0..15
46	Total Bridge Balance Control Status	0..2
	Total Bridge Balance DAC Update Status Value	3
	Total Bridge Balance Reset Counter	4..8
	Spare Bits	9..15
47	Total Spacelook Average	0..11
	Spare Bits	12..15
48	Total Bridge Balance DAC Coarse Value	0..11
	Spare Bits	12..15
49	Total Bridge Balance DAC Fine Value	0..11
	Spare Bits	12..15
50	SW Bridge Balance Control Status	0..2
	SW Bridge Balance DAC Update Status Value	3
	SW Bridge Balance Reset Counter	4..8
	Spare Bits	9..15
51	SW Spacelook Average	0..11
	Spare Bits	12..15
52	SW Bridge Balance DAC Coarse Value	0..11
	Spare Bits	12..15
53	SW Bridge Balance DAC Fine Value	0..11
	Spare Bits	12..15

Table 2.1-3. Digital Data Word Definitions (3 of 7)

Word	Parameter Name	Bits
54	LW Bridge Balance Control Status	0..2
	LW Bridge DAC Update Status Value	3
	LW Bridge Balance Reset Counter	4..8
	Spare Bits	9..15
55	LW Spacelook Average	0..11
	Spare Bits	12..15
56	LW Bridge Balance DAC Coarse Value	0..11
	Spare Bits	12..15
57	LW Bridge Balance DAC Fine Value	0..11
	Spare Bits	12..15
58	Bridge Balance Spacelook Start Sample Number	0..9
	Spare Bits	10..15
59	Bridge Balance Spacelook End Sample Number	0..9
	Spare Bits	10..15
60	Bridge Balance DAC Update Sample Number	0..9
	Spare Bits	10..15
61	Bridge Balance Window High Value	0..11
	Spare Bits	12..15
62	Bridge Balance Window Low Value	0..11
	Spare Bits	12..15
63	Bridge Balance Window Setpoint Value	0..11
	Spare Bits	12..15
64	Total Detector Temperature Setpoint	0..11
	Total Detector Temperature Control Status	12
	Spare Bits	13..15
65	SW Detector Temperature Setpoint	0..11
	SW Detector Temperature Control Status	12
	Spare Bits	13..15
66	LW Detector Temperature Setpoint	0..11
	LW Detector Temperature Control Status	12
	Spare Bits	13..15
67	Blackbody Temperature Setpoint	0..11
	Blackbody Temperature Control Status	12
	Spare Bits	13..15
68	SWICS Intensity Level	0..1
	Spare Bits	2..15
69	Spare Word	0..15
70	Elevation Scan Mode	0..4
	Elevation On Deck Scan Mode	5..9
	Elevation Scan Status	10..12
	Elevation Motor Drive	13
	Elevation Encoder LED Intensity	14
	Elevation Stall	15
71	Elevation Offset Correction	0..15
72	Elevation Stall Error Threshold	0..15
73	Elevation Stall Count Threshold	0..9
	Spare Bits	10..15
74	Elevation Position Error Sample 1	0..15
75	Elevation Position Error Sample 2	0..15
76	Elevation Position Error Sample 3	0..15

Table 2.1-3. Digital Data Word Definitions (4 of 7)

Word	Parameter Name	Bits
77	Main Cover Command	0..3
	Main Cover Motion Status	4..7
	Main Cover Position Status	8..11
	Main Cover Sensor Active	12..13
	Spare Bits	14..15
78	Main Cover Commanded Position	0..11
	Spare Bits	12..15
79	Main Cover Accumulated Lag Error Sensor 1	0..7
	Spare Bits	8..15
80	Main Cover Accumulated Lag Error Sensor 2	0..7
	Spare Bits	8..15
81	Main Cover Fixed Step Count	0..15
82	Main Cover Defined Closed Position	0..11
	Spare Bits	12..15
83	Main Cover Defined Open Position	0..11
	Spare Bits	12..15
84	Main Cover Defined Closed Margin	0..11
	Spare Bits	12..15
85	Main Cover Defined Open Margin	0..11
	Spare Bits	12..15
86	MAM Cover Command	0..3
	MAM Cover Motion Status	4..7
	MAM Cover Position Status	8..11
	MAM Cover Sensor Active	12..13
	Spare Bits	14..15
87	MAM Cover Commanded Position	0..11
	Spare Bits	12..15
88	Spare Word	0..15
89	Spare Word	0..15
90	MAM Cover Fixed Step Count	0..15
91	MAM Cover Defined Closed Position	0..11
	Spare Bits	12..15
92	MAM Cover Defined Open Position	0..11
	Spare Bits	12..15
93	MAM Cover Defined Closed Margin	0..11
	Spare Bits	12..15
94	MAM Cover Defined Open Margin	0..11
	Spare Bits	12..15
95	DAP Watchdog Boot Status	0
	DAP Watchdog Enable Status	1
	DAP PROM Power Status	2
	DAP Sample Clock Interrupt Occurred	3..4
	Spare Bits	5..15
96	DAP Processor Scan Period Count	0..15
97	DAP Memory Dump Start Address Offset	0..15
98	DAP Memory Dump Start Address Segment	0..15
99	DAP Memory Dump End Address Offset	0..15
100	DAP Memory Dump End Address Segment	0..15
101	DAP Packet Start Address Offset	0..15
102	DAP Packet Start Address Segment	0..15

Table 2.1-3. Digital Data Word Definitions (5 of 7)

Word	Parameter Name	Bits
103	DAP Address Changes Indicator	0..15
104	DAP Minimum Execution Time	0..15
105	DAP Minimum Sample Number	0..10
	Spare Bits	11..15
106	DAP Maximum Execution Time	0..15
107	DAP Maximum Sample Number	0..10
	Spare Bits	11..15
108	DAP RAM Code Checksum	0..15
109	DAP ROM Code Checksum	0..15
110	Spare Word	0..15
111	Spare Word	0..15
112	Spare Word	0..15
113	Spare Word	0..15
114	Spare Word	0..15
115	Azimuth Mode	0..4
	Azimuth Motion Status	5
	Azimuth Direction Status	6
	Azimuth Position Status	7..10
	Azimuth Motor Drive Status	11
	Azimuth Encoder LED Status	12
	Azimuth Stall	13
	Spare Bits	14..15
116	Azimuth Defined Crosstrack Position	0..15
117	Azimuth Defined Fixed Position A	0..15
118	Azimuth Defined Fixed Position B	0..15
119	Azimuth Defined Fixed Solar Calibration Position	0..15
120	Azimuth Defined Fixed Cage Position	0..15
121	Azimuth Defined Fixed Position Spare 1	0..15
122	Azimuth Defined Fixed Position Spare 2	0..15
123	Azimuth Defined Fixed Position Spare 3	0..15
124	Azimuth Defined Normal Slew Rate	0..15
125	Azimuth Defined Asynchronous Scan Rate	0..15
126	Azimuth Defined Synchronous Scan Rate	0..15
127	Azimuth Offset Correction	0..15
128	Azimuth Stall Error Threshold	0..15
129	Azimuth Stall Count Threshold	0..9
	Spare Bits	10..15
130	Brake Command Status	0..3
	Brake Motion Status	4..7
	Brake Position Status	8..11
	Spare Bits	12..15
131	Brake Commanded Position	0..11
	Spare Bits	12..15
132	Brake Current Position	0..11
	Spare Bits	12..15
133	Brake Position SUBMUX Channel	0..7
	Spare Bits	8..15
134	Brake Step Count	0..15
135	Brake Defined Released Position	0..11
	Spare Bits	12..15

Table 2.1-3. Digital Data Word Definitions (6 of 7)

Word	Parameter Name	Bits
136	Brake Defined Applied Position	0..11
	Spare Bits	12..15
137	Brake Defined Cage Position	0..11
	Spare Bits	12..15
138	Brake Defined Released Margin	0..11
	Spare Bits	12..15
139	Brake Defined Applied Margin	0..11
	Spare Bits	12..15
140	Brake Defined Cage Margin	0..11
	Spare Bits	12..15
141	Azimuth Position Error Value	0..15
142	Safehold Input A Status	0
	Safehold Input B Status	1
	Safehold Response A Status	2..3
	Safehold Response B Status	4..5
	Spare Bits	6..15
143	ICP Watchdog Boot Status	0
	ICP Watchdog Enable Status	1
	ICP PROM Power Status	2
	ICP Sample Clock Interrupt Occurred	3..4
	DMA Communication Status	5..7
	Spare Bits	8..15
144	ICP Scan Period Counter	0..15
145	ICP Memory Dump Start Address Offset	0..15
146	ICP Memory Dump Start Address Segment	0..15
147	ICP Memory Dump End Address Offset	0..15
148	ICP Memory Dump End Address Segment	0..15
149	ICP Packet Start Address Offset	0..15
150	ICP Packet Start Address Segment	0..15
151	ICP Address Changed Indicator	0..15
152	ICP Minimum Execution Time	0..15
153	ICP Minimum Sample Number	0..10
	Spare Bits	11..15
154	ICP Maximum Execution Time	0..15
155	ICP Maximum Sample Number	0..10
	Spare Bits	11..15
156	ICP RAM Code Checksum	0..15
157	ICP ROM Code Checksum	0..15
158	Spare Word	0..15
159	Spare Word	0..15
160	Spare Word	0..15
161	Spare Word	0..15
162	Spare Word	0..15

Table 2.1-3. Digital Data Word Definitions (7 of 7)

Word	Parameter Name	Bits
163	SPS 1 State	0
	SPS 2 State	1
	SPS 1 Response	2
	SPS 2 Response	3
	Solar Warning	4..5
	Scan Timeout Response	6
	Scan Timeout Counting	7..8
	Scan Timeout Occurred	9..10
	Spare Bits	11..15
164	Solar Warning Event Sample Number	0..15
165	Solar Warning Event Scan Period	0..15
166	Scan Timeout Scan Period	0..15
167	SPS 1 Narrow FOV Signal	0..11
	Spare Bits	12..15
168	SPS 1 Wide FOV Signal	0..11
	Spare Bits	12..15
169	SPS 1 Threshold Noise	0..11
	Spare Bits	12..15
170	SPS 1 Threshold Scale Numerator	0..5
	Spare Bits	6..15
171	SPS 1 Solar Detection State	0
	Spare Bits	1..15
172	SPS 1 Solar Detection Count	0..9
	Spare Bits	10..15
173	SPS 1 Solar Detection Count Threshold	0..9
	Spare Bits	10..15
174	SPS 1 Solar Detection Max Count	0..9
	Spare Bits	10..15
175	SPS 2 Narrow FOV Signal	0..11
	Spare Bits	12..15
176	SPS 2 Wide FOV Signal	0..11
	Spare Bits	12..15
177	SPS 2 Threshold Noise	0..11
	Spare Bits	12..15
178	SPS 2 Threshold Scale Numerator	0..5
	Spare Bits	6..15
179	SPS 2 Solar Detection State	0
	Spare Bits	1..15
180	SPS 2 Solar Detection Count	0..9
	Spare Bits	10..15
181	SPS 2 Solar Detection Count Threshold	0..9
	Spare Bits	10..15
182	SPS 2 Solar Detection Max Count	0..9
	Spare Bits	10..15
183	Solar Avoidance Initial Scan Count	0..9
	Spare Bits	10..15
184	Solar Avoidance Current Scan Count	0..9
	Spare Bits	10..15

For additional information on digital parameters, consult DRL 64 (Reference3).

Quality Flag Definition

The status flag used for the BDS is a 32-bit word where a single bit or slice corresponds to a particular quality assurance or status flag. Every sample contained in the BDS has an associated status flag. The bit ordering of the the status word is shown below. The individual flags are defined in Table 2.1-4. This is also the IES Quality Flag definition, which is included in the IES, SSF, and CRS products.

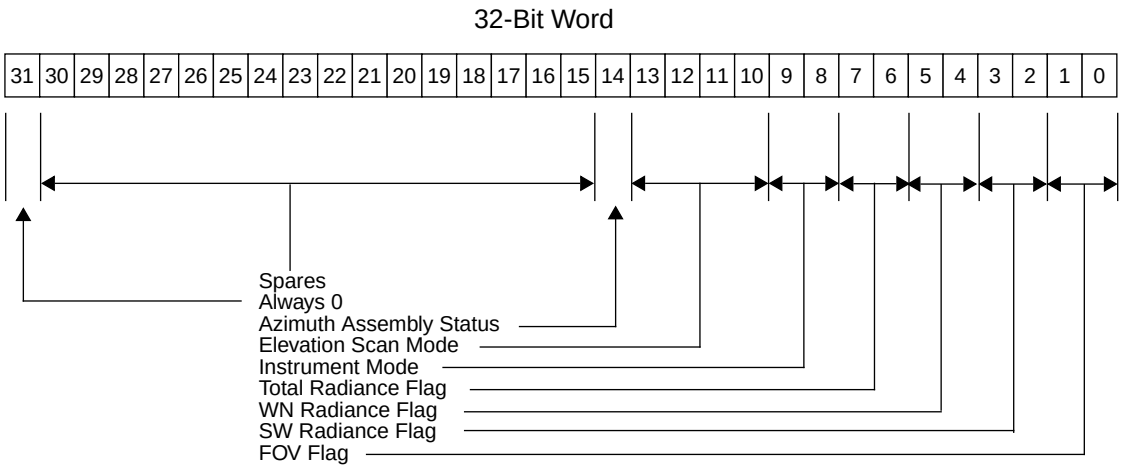


Table 2.1-4. BDS Quality Flag Definition

Bits	Flag Parameter	Definition
0..1	FOV Flag	00 = Hit Earth 01 = Hit TOA, Missed Earth 10, 11 = Missed TOA, Earth
2..3	SW Radiance Flag	00 = Good 01 = Suspect 10, 11 = Bad
4..5	WN Radiance Flag	00 = Good 01 = Suspect 10, 11 = Bad
6..7	Total Radiance Flag	00 = Good 01 = Suspect 10, 11 = Bad
8..9	Instrument Mode	00 = FAPS 01 = RAPS 10, 11 = Transitional / Other
10..13	Elevation Scan Mode	0000 = Normal Earth Scan 0001 = Short Earth Scan 0010 = MAM Scan 0011 = NADIR Scan 0100 = Stowed Profile All others = Other Profile
14	Azimuth Assembly Status	0 = Fixed 1 = In Motion
15..30	Spares	TBD
31	N/A	Always 0

BDS Vdatas

Table 2.1-5. Temperature Counts Record

Field No.	Field Name / Parameter	Data Type	Units	Range	No. of Components
1	Total Channel Heater DAC Value	U16 Integer	N/A	N/A	12
2	SW Channel Heater DAC Value	U16 Integer	N/A	N/A	12
3	LW Channel Heater DAC Value	U16 Integer	N/A	N/A	12
4	Blackbody Heater DAC Value	U16 Integer	N/A	N/A	12
5	Total Detector Control Temperature	U16 Integer	count	0..4095	12
6	Total Detector Monitor Temperature	U16 Integer	count	0..4095	12
7	SW Detector Control Temperature	U16 Integer	count	0..4095	12
8	SW Detector Monitor Temperature	U16 Integer	count	0..4095	12
9	LW Detector Control Temperature	U16 Integer	count	0..4095	12
10	LW Detector Monitor Temperature	U16 Integer	count	0..4095	12
11	Total Blackbody Temperature	U16 Integer	count	0..4095	12
12	LW Blackbody Temperature	U16 Integer	count	0..4095	12
13	Elevation Spindle Temperature (Motor)	U16 Integer	count	0..4095	3
14	Elevation Spindle Temperature (Cable Wrap)	U16 Integer	count	0..4095	3
15	Elevation Bearing Temperature (Motor)	U16 Integer	count	0..4095	3
16	Elevation Bearing Temperature (Cable Wrap)	U16 Integer	count	0..4095	3
17	SWICS Photodiode Temperature	U16 Integer	count	0..4095	3
18	Sensor Module Temperature	U16 Integer	count	0..4095	3
19	Sensor Electronics Temperature	U16 Integer	count	0..4095	3
20	Main Cover Motor Temperature	U16 Integer	count	0..4095	3
21	MAM Total Baffle Temperature 1	U16 Integer	count	0..4095	3
22	MAM Total Baffle Temperature 2	U16 Integer	count	0..4095	3
23	MAM Assembly SW Temperature	U16 Integer	count	0..4095	3
24	MAM Assembly Total Temperature	U16 Integer	count	0..4095	3
25	DAA Radiator Temperature	U16 Integer	count	0..4095	3
26	DAA Processor Electronics Temperature	U16 Integer	count	0..4095	3
27	DAA ADC Electronics Temperature	U16 Integer	count	0..4095	3
28	ECA Radiator Temperature	U16 Integer	count	0..4095	3
29	ECA Electronics Temperature	U16 Integer	count	0..4095	3
30	ACA Electronics Temperature	U16 Integer	count	0..4095	3
31	Azimuth Lower Bearing Temperature	U16 Integer	count	0..4095	3
32	Azimuth Upper Bearing Temperature	U16 Integer	count	0..4095	3
33	ICA Radiator Temperature	U16 Integer	count	0..4095	3
34	ICA Processor Electronics Temperature	U16 Integer	count	0..4095	3
35	ICA ADC Electronics Temperature	U16 Integer	count	0..4095	3
36	PCA Radiator Temperature	U16 Integer	count	0..4095	3
37	PCA Electronics Temperature	U16 Integer	count	0..4095	3
38	Pedestal Temperature 1 (Brake Housing)	U16 Integer	count	0..4095	3
39	Pedestal Temperature 2 (Isolator)	U16 Integer	count	0..4095	3

Table 2.1-6. Voltage and Torque Counts Record

Field No.	Field Name / Parameter	Data Type	Units	Range	No. of Components
1	Detector +120V Bias	U16 Integer	count	0..4095	3
2	Detector -120V Bias	U16 Integer	count	0..4095	3
3	SWICS Photodiode Output	U16 Integer	count	0..4095	3
4	SWICS Lamp Current	U16 Integer	count	0..4095	3
5	ICA +5V Digital	U16 Integer	count	0..4095	3
6	ICA +15V to ECA/ACA	U16 Integer	count	0..4095	3
7	ICA -15V to ECA/ACA	U16 Integer	count	0..4095	3
8	ICA + 5V Analog	U16 Integer	count	0..4095	3
9	ICA +10V Bias	U16 Integer	count	0..4095	3
10	ICA +15V Internal	U16 Integer	count	0..4095	3
11	ICA -15V Internal	U16 Integer	count	0..4095	3
12	DAA Ground Reference 1	U16 Integer	count	0..4095	3
13	DAA Ground Reference 2	U16 Integer	count	0..4095	3
14	DAA -10V Reference	U16 Integer	count	0..4095	3
15	DAA +130V	U16 Integer	count	0..4095	3
16	DAA -130V	U16 Integer	count	0..4095	3
17	DAA +12V	U16 Integer	count	0..4095	3
18	DAA -12V	U16 Integer	count	0..4095	3
19	DAA +15V	U16 Integer	count	0..4095	3
20	DAA -15V	U16 Integer	count	0..4095	3
21	DAA +5V	U16 Integer	count	0..4095	3
22	DAA +10V Reference	U16 Integer	count	0..4095	3
23	ECA Torque Output	U16 Integer	count	0..4095	12
24	ACA Torque Output	U16 Integer	count	0..4095	12

Table 2.1-7. Position Counts Record

Field No.	Field Name / Parameter	Data Type	Units	Range	No. of Components
1	ACA Encoder Clear Track A	U16 Integer	count	0..4095	3
2	ACA Encoder Clear Track B	U16 Integer	count	0..4095	3
3	ECA Encoder Clear Track A	U16 Integer	count	0..4095	3
4	ECA Encoder Clear Track B	U16 Integer	count	0..4095	3
5	Main Cover Position 1	U16 Integer	count	0..4095	3
6	Main Cover Position 2	U16 Integer	count	0..4095	3
7	MAM Cover Position	U16 Integer	count	0..4095	3
8	Azimuth Brake Position	U16 Integer	count	0..4095	3
9	SPS 1 Narrow FOV	U16 Integer	count	0..4095	60
10	SPS 1 Wide FOV	U16 Integer	count	0..4095	60
11	SPS 2 Narrow FOV	U16 Integer	count	0..4095	60
12	SPS 2 Wide FOV	U16 Integer	count	0..4095	60

Table 2.1-8. Converted Temperatures Record

Field No.	Field Name / Parameter	Data Type	Units	Range	No. of Components
1	Total Detector Control Temperature	32-Bit Float	^{o}C	36.0..40.0	12
2	Total Detector Monitor Temperature	32-Bit Float	^{o}C	36.0..40.0	12
3	SW Detector Control Temperature	32-Bit Float	^{o}C	36.0..40.0	12
4	SW Detector Monitor Temperature	32-Bit Float	^{o}C	36.0..40.0	12
5	LW Detector Control Temperature	32-Bit Float	^{o}C	36.0..40.0	12
6	LW Detector Monitor Temperature	32-Bit Float	^{o}C	36.0..40.0	12
7	Total Blackbody Temperature	32-Bit Float	^{o}C	-15.0..60.0	12
8	LW Blackbody Temperature	32-Bit Float	^{o}C	-15.0..60.0	12
9	Elevation Spindle Temperature (Motor)	32-Bit Float	^{o}C	-30.0..70.0	3
10	Elevation Spindle Temperature (Cable Wrap)	32-Bit Float	^{o}C	-30.0..70.0	3
11	Elevation Bearing Temperature (Motor)	32-Bit Float	^{o}C	-30.0..70.0	3
12	Elevation Bearing Temperature (Cable Wrap)	32-Bit Float	^{o}C	-30.0..70.0	3
13	SWICS Photodiode Temperature	32-Bit Float	^{o}C	-30.0..70.0	3
14	Sensor Module Temperature	32-Bit Float	^{o}C	-30.0..70.0	3
15	Sensor Electronics Temperature	32-Bit Float	^{o}C	-30.0..70.0	3
16	Main Cover Motor Temperature	32-Bit Float	^{o}C	-30.0..70.0	3
17	MAM Total Baffle Temperature 1	32-Bit Float	^{o}C	-30.0..70.0	3
18	MAM Total Baffle Temperature 2	32-Bit Float	^{o}C	-30.0..70.0	3
19	MAM Assembly SW Temperature	32-Bit Float	^{o}C	-30.0..70.0	3
20	MAM Assembly Total Temperature	32-Bit Float	^{o}C	-30.0..70.0	3
21	DAA Radiator Temperature	32-Bit Float	^{o}C	-30.0..70.0	3
22	DAA Processor Electronics Temperature	32-Bit Float	^{o}C	-30.0..70.0	3
23	DAA ADC Electronics Temperature	32-Bit Float	^{o}C	-30.0..70.0	3
24	ECA Radiator Temperature	32-Bit Float	^{o}C	-30.0..70.0	3
25	ECA Electronics Temperature	32-Bit Float	^{o}C	-30.0..70.0	3
26	ACA Electronics Temperature	32-Bit Float	^{o}C	-30.0..70.0	3
27	Azimuth Lower Bearing Temperature	32-Bit Float	^{o}C	-30.0..70.0	3
28	Azimuth Upper Bearing Temperature	32-Bit Float	^{o}C	-30.0..70.0	3
29	ICA Radiator Temperature	32-Bit Float	^{o}C	-30.0..70.0	3
30	ICA Processor Electronics Temperature	32-Bit Float	^{o}C	-30.0..70.0	3
31	ICA ADC Electronics Temperature	32-Bit Float	^{o}C	-30.0..70.0	3
32	PCA Radiator Temperature	32-Bit Float	^{o}C	-30.0..70.0	3
33	PCA Electronics Temperature	32-Bit Float	^{o}C	-30.0..70.0	3
34	Pedestal Temperature 1 (Brake Housing)	32-Bit Float	^{o}C	-30.0..70.0	3
35	Pedestal Temperature 2 (Isolator)	32-Bit Float	^{o}C	-30.0..70.0	3

Table 2.1-9. Converted Voltages and Torques Record

Field No.	Field Name / Parameter	Data Type	Units	Range	No. of Components
1	Sensor +120V Bias	32-Bit Float	volt	115.0..125.0	3
2	Sensor -120V Bias	32-Bit Float	volt	-125.0..-115.0	3
3	SWICS Lamp Current	32-Bit Float	mA	0.0..100.0	3
4	ICA +5V Digital	32-Bit Float	volt	0.0..8.0	3
5	ICA +15V to ECA/ICA	32-Bit Float	volt	0.0..20.0	3
6	ICA -15V to ECA/ICA	32-Bit Float	volt	-20.0..0.0	3
7	ICA +18V	32-Bit Float	volt	0.0..20.0	3
8	ICA -18V	32-Bit Float	volt	-20.0..0.0	3
9	ICA +15V Internal	32-Bit Float	volt	0.0..30.0	3
10	ICA -15V Internal	32-Bit Float	volt	-30.0..0.0	3
11	DAA Ground Reference 1	32-Bit Float	volt	0.0..10.0	3
12	DAA Ground Reference 2	32-Bit Float	volt	0.0..10.0	3
13	DAA -10V Reference	32-Bit Float	volt	-20.0..0.0	3
14	DAA +130V	32-Bit Float	volt	90.0..170.0	3
15	DAA -130V	32-Bit Float	volt	-224.0..-36.0	3
16	DAA +12V	32-Bit Float	volt	0.0..20.0	3
17	DAA -12V	32-Bit Float	volt	-20.0..0.0	3
18	DAA +15V	32-Bit Float	volt	0.0..20.0	3
19	DAA -15V	32-Bit Float	volt	-20.0..0.0	3
20	DAA +18V	32-Bit Float	volt	0.0..20.0	3
21	DAA -18V	32-Bit Float	volt	-20.0..0.0	3
22	Elevation Torque Output	32-Bit Float	in-oz	-20.0..20.0	12
23	Azimuth Torque	32-Bit Float	in-oz	-20.0..20.0	12

Table 2.1-10. Satellite-Celestial Data Record

Field No.	Field Names / Parameters	Data Type	Units	Range	No. of Components
1	Satellite Position at record start	64-Bit Float	km	-8000..8000	3 (x, y, z)
2	Satellite Position at record end	64-Bit Float	km	-8000..8000	3 (x, y, z)
3	Satellite Velocity at record start	64-Bit Float	km sec^{-1}	-10.0..10.0	3 (x, y, z)
4	Satellite Velocity at record end	64-Bit Float	km sec^{-1}	-10.0..10.0	3 (x, y, z)
5	Colatitude of satellite at record start	64-Bit Float	deg	0.0..180.0	1
6	Longitude of satellite at record start	64-Bit Float	deg	0.0..360.0	1
7	Colatitude of satellite at record end	64-Bit Float	deg	0.0..180.0	1
8	Longitude of satellite at record end	64-Bit Float	deg	0.0..360.0	1
9	Earth-Sun Distance	64-Bit Float	AU	0.98..1.02	1
10	Number of Orbits	U32 Integer	N/A	TBD	1
11	Colatitude of Sun at observation	64-Bit Float	deg	0.0..180.0	1
12	Longitude of Sun ar observation	64-Bit Float	deg	0.0..360.0	1

Table 2.1-11. Converted Digital Data

Field No.	Field Names / Parameters	Data Type	Units	Range	No. of Components
1	Elevation Offset Correction	32-Bit Float	deg	0..360	1
2	Azimuth Offset Correction	32-Bit Float	deg	0..360	1
3	Azimuth Defined Crosstrack Position	32-Bit Float	deg	0..360	1
4	Azimuth Defined Fixed Position A	32-Bit Float	deg	0..360	1
5	Azimuth Defined Fixed Position B	32-Bit Float	deg	0..360	1
6	Azimuth Defined Fixed Solar Cal Position	32-Bit Float	deg	0..360	1
7	Azimuth Defined Fixed Cage Position	32-Bit Float	deg	0..360	1
8	Azimuth Defined Fixed Position Spare 1	32-Bit Float	deg	0..360	1
9	Azimuth Defined Fixed Position Spare 2	32-Bit Float	deg	0..360	1
10	Azimuth Defined Fixed Position Spare 3	32-Bit Float	deg	0..360	1
11	Azimuth Defined Normal Slew Rate	32-Bit Float	deg sec^{-1}	4.0..6.0	1
12	Azimuth Defined Asynchronous Scan Rate	32-Bit Float	deg sec^{-1}	4.0..6.0	1
13	Azimuth Defined Synchronous Scan Rate	32-Bit Float	deg sec^{-1}	4.0..6.0	1
14	DAP Minimum Execution Time	32-Bit Float	msec	0.0..10.0	1
15	DAP Maximum Execution Time	32-Bit Float	msec	0.0..10.0	1
16	ICP Minimum Execution Time	32-Bit Float	msec	0.0..10.0	1
17	ICP Maximum Execution Time	32-Bit Float	msec	0.0..10.0	1
18	Instrument ID Number	U8 Integer	N/A	0..31	1
19	Packet Data Indicator	U8 Integer	N/A	0..6	1
20	Packet Data Version	U8 Integer	N/A	0..31	1
21	Science Packet Quick Look Flag Status	U8 Integer	N/A	0..1	1
22	Packet Timecode Indicator	U8 Integer	N/A	0..1	1
23	Packet Counter	U16 Integer	N/A	0..65536	1

2.2 Instrument Production Data Set (INSTR)

EOSDIS Product Code: CERX00a

The Instrument Production Data Set (INSTR) is the Level 0 raw data from the CERES instrument as structured by the instrument itself and is programmed by the instrument developer, TRW. All CERES instrument output is formatted into a Consultative Committee for Space Data Systems (CCSDS) packet. CERES instrument packets contain the same data output formatting options, although some instrument data packets contain data unique to a particular spacecraft. There are seven basic pieces of information contained in a normal CERES data packet (i.e., science output format):

1. Packet Header - Same format for all instruments
2. Time (secondary header) - formats specified by platform's selected CCSDS option
3. Radiometric Detector Outputs
4. Instrument Elevation and Azimuth Position Data
5. Instrument Analog Engineering Data (e.g., Temperatures and Voltages)
6. Instrument Digital Engineering Data

There are five types of packets currently defined for the CERES instrument - Science, Diagnostic Memory, Diagnostic Processor, Diagnostic Gimbal, and Diagnostic Fixed Pattern. Each of these packet types corresponds to a particular operation of the CERES instrument.

For processing purposes, packets are grouped into Level 0 files which typically represent data collected from the CERES instrument over a 24-hour period. The types of Level 0 file formats for the Instrument Production Data Set are illustrated in Figure 2.2-1. Table 2.2-1 lists the parameters for each packet type.

Level: 0
Type: Archival
Frequency: 1/Day

Portion of Globe Covered
File: Satellite Swath
Record: N/A

Time Interval Covered
File: 1 Day
Record: Single 6.6-Second Scans

Portion of Atmosphere Covered
File: N/A

Level 0 File Definitions

TRMM Level 0 File

File Header (48 to 52 Bytes)
Instrument Data Packets (Number of Packets x 7132 Bytes)
File Footer (QAC) (Total = Length of QAC Footer (4) +[Number of Entries x 5] Bytes)
File Footer (MDUL) (Total = Length of MDUL Footer (4) + [Number of Entries x 5] Bytes)

(Minimum number of QAC entries is always = 1)

QAC - List of packet IDs known to be corrupted or unusable;
MDUL - List of packet IDs missing;

EOS Level 0 File

File Header (TBD Bytes)
Instrument Data Packets (Number of Packets x TBD Bytes)

Figure 2.2-1. TRMM and EOS Level 0 File Formats

Table 2.2-1. Instrument Production Data Set (INSTR) (1 of 3)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
INSTR_PDS						
INSTR_PDS File Header (TRMM)						
Spacecraft ID		N/A	N/A	1	16	
Spacecraft Clock (first packet)		N/A	N/A	1	72	
Spare		N/A	N/A	1	8	
Spacecraft Clock (last packet)		N/A	N/A	1	72	
Spare		N/A	N/A	1	8	
Number of Packets in file		N/A	N/A	1	32	
Processing Options		N/A	N/A	1	8	
Data Type Flag		N/A	N/A	1	8	
Time of Receipt at Originating Node		N/A	N/A	1	56	
Spare		N/A	N/A	1	24	
Select Options		N/A	N/A	1	8	
Number of APIDs		N/A	N/A	1	8	
APIDs		N/A	N/A	1 to 3	16	
Spare		N/A	N/A	1	8	
Number of QAC lists in file		N/A	N/A	1	8	
Offset to QAC List		N/A	N/A	1	32	
INSTR_PDS File Header (EOS)		N/A	N/A		TBD	
Contents TBD						
INSTR_PDS Data is Array[13091] of:						
INSTR_PDS_Data_Packet						
INSTR_PDS_Data_Packet_Header is selection of						
INSTR_Packet_Hdr (TRMM)						
INSTR_Packet_Header_Data						
Version Number	1	N/A	N/A	1	3	1
Type	2	N/A	N/A	1	1	2
Secondary Header Flag	3	N/A	N/A	1	1	3
APID	4	N/A	N/A	1	11	4
Sequence Flags	5	N/A	N/A	1	2	5
Packet Sequence Count	6	N/A	N/A	1	14	6
Packet Length	7	N/A	N/A	1	16	7
INSTR_Packet_Secondary_Hdr (TRMM)						
Time Data	8	N/A	N/A	1	64	8
INSTR_Packet_Hdr (EOS)						
INSTR_Packet_Header_Data						
Version Number	1	N/A	N/A	1	3	1
Type	2	N/A	N/A	1	1	2
Secondary Header Flag	3	N/A	N/A	1	1	3
APID	4	N/A	N/A	1	11	4
Segment Flags	5	N/A	N/A	1	2	5
Source Sequence Count	6	N/A	N/A	1	14	6
Packet Length	7	N/A	N/A	1	16	7
EOS_Secondary_Hdr (EOS)						
Time Data	9	N/A	N/A	1	72	8
Quick Look Flag	10	N/A	N/A	1	8	9

Table 2.2-1 Instrument Production Data Set (INSTR) (2 of 3)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
INSTR_Measurement_Data is selection of						
INSTR_Science_Data is Array[660] of:						
INSTR_Science_Record						
Azimuth Position Count	11	count	0..65535	660	16	13
Elevation Position Count	12	count	0..65535	660	16	673
Total Detector Output	13	count	0..4095	660	12	1333
SW Detector Output	14	count	0..4095	660	12	1993
Window Detector Output	15	count	0..4095	660	12	2653
Instrument Analog Data - see DRL64, Rev. D (TRW) for details	16	-	-	660	12	3313
INSTR_Diagnostic_Memory_Data is Array[660] of:						
INSTR_Memory_Record						
Azimuth Position Count	11	count	0..65535	660	16	13
Elevation Position Count	12	count	0..65535	660	16	673
DAP Memory Dump Data	13	N/A	0..65535	660	16	1333
ICP Memory Dump Data	14	N/A	0..65535	660	16	1993
Fill Data	15	N/A	0..15	660	4	2653
Instrument Analog Data - see DRL64, Rev. D (TRW) for details	16	-	-	660	12	3313
INSTR_Diagnostic_Gimbal_Operation_Data is Array[660] of:						
INSTR_Gimbal_Record						
Azimuth Position Count	11	count	0..65535	660	16	13
Elevation Position Count	12	count	0..65535	660	16	673
Elevation Error	13	count	0..55535	660	16	1333
Azimuth Error	14	count	0..65535	660	16	1993
Fill Data	15	N/A	0..15	660	4	2653
Instrument Analog Data - see DRL64, Rev. D (TRW) for details	16	-	-	660	12	3313
INSTR_Diagnostic_Processor_Operation_Data is Array[660] of:						
INSTR_Processor_Op_Record						
Azimuth Position Count	11	count	0..65535	660	16	13
Elevation Position Count	12	count	0..65535	660	16	673
DAP Timing	13	N/A	0..65535	660	16	1333
ICP Timing	14	N/A	0..65535	660	16	1993
Fill Data	15	N/A	0..15	660	4	2653
Instrument Analog Data - see DRL64, Rev. D (TRW) for details	16	-	-	660	12	3313
INSTR_Diagnostic_Fixed_Pattern_Data is Array[660] of:						
INSTR_Fixed_Record						
Fixed Pattern in Elevation Field	11	N/A	0..65535	660	16	13
Fixed Pattern for Azimuth Field	12	N/A	0..65535	660	16	673
Fixed Pattern for Total Channel Field	13	N/A	0..4095	660	12	1333
Fixed Pattern for Window Channel Field	14	N/A	0..4095	660	12	1993
Fixed Pattern for Shortwave Channel Field	15	N/A	0..4095	660	12	2653
Fixed Pattern for Analog Field	16	N/A	0..4095	660	12	3313
INSTR_Data						
INSTR_Digital_Status_Block is						
Instrument Digital Status - see DRL64, Rev D. (TRW) for details	17	-	-	1	2960	3314
INSTR_Ancillary_Data is selection of						
INSTR-EOS_Ancillary_Data						
Ancillary Time Stamp	18	count	$0..1.84x10^{19}$	1	64	3315
GPS/UTC Time Conversion	19	count	$0..4.29x10^{9}$	1	32	3316

Table 2.2-1. Instrument Production Data Set (INSTR) (3 of 3)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
Solar Array Current	20	count	0..255	1	8	3317
Mag Coil Current X	21	count	0..255	1	8	3318
Mag Coil Current Y	22	count	0..255	1	8	3319
Mag Coil Current Z	23	count	0..255	1	8	3320
Satellite Position (X) Count	24	count	$0..4.29x10^9$	1	32	3321
Satellite Position (Y) Count	25	count	$0..4.29x10^9$	1	32	3322
Satellite Position (Z) Count	26	count	$0..4.29x10^9$	1	32	3323
Satellite Velocity (X) Count	27	count	$0..4.29x10^9$	1	32	3324
Satellite Velocity (Y) Count	28	count	$0..4.29x10^9$	1	32	3325
Satellite Velocity (Z) Count	29	count	$0..4.29x10^9$	1	32	3326
Satellite Attitude (Roll) Count	30	count	0..65535	1	16	3327
Satellite Attitude (Pitch) Count	31	count	0..65535	1	16	3328
Satellite Attitude (Yaw) Count	32	count	0..65535	1	16	3329
Satellite Attitude Rate (Roll) Count	33	count	0..65535	1	16	3330
Satellite Attitude Rate (Pitch) Count	34	count	0..65535	1	16	3331
Satellite Attitude Rate (Yaw) Count	35	count	0..65535	1	16	3332
Solar X Position	36	count	0..255	1	8	3333
Solar Y Position	37	count	0..255	1	8	3334
Solar Z Position	38	count	0..255	1	8	3335
Lunar X Position	39	count	0..255	1	8	3336
Lunar Y Position	40	count	0..255	1	8	3337
Lunar Z Position	41	count	0..255	1	8	3338
INSTR_Fill_Data is selection of						
TRMM	42	N/A	N/A	1	1104	3378
EOS	42	N/A	N/A	1	592	3378
INSTR_PDS File Footer (TRMM Only)						
INSTR_PDS_File_Footer is						
QAC List	N/A	N/A	N/A	1	32	
QAC Entries	N/A	N/A	N/A	variable	16	
MDUL	N/A	N/A	N/A	1	32	
MDU	N/A	N/A	N/A	variable	16	
Total Header Bits/File:	416					
Total Data Bits/Record:	57056					
Total Records/File:	13091					
Total Data Bits/File:	746920096					
Total Bits/File:	745873296					

2.3 ERBE-like Instantaneous TOA Estimates (ES-8)

EOSDIS Product Code: CER02

The ES-8 data product contains a 24-hour, single-satellite, instantaneous view of scanner fluxes at the top-of-atmosphere reduced from spacecraft altitude unfiltered radiances using the ERBE scanner Inversion algorithms and the ERBE shortwave (SW) and longwave (LW) angular distribution models (ADMs). The ES-8 also includes the SW, LW, and window (WN) channel radiometric data; SW, LW, and WN unfiltered radiance values; and the ERBE scene identification for each measurement. These data are organized according to the CERES 3.3-sec scan into 6.6-sec records. As long as there is one valid scanner measurement within a record, the ES-8 record will be generated.

Specifically, the ES-8 contains the following kinds of information:

1. Scan-Level Data
   a) Julian date and time
   b) Earth-Sun distance
   c) Satellite position and velocity and Sun position
   d) Orbit number

2. Measurement-Level Data
   a) Satellite instrument FOV data
   b) Radiometric data
   c) Satellite and Sun geometry data
   d) Unfiltered radiances
   e) TOA fluxes
   f) ERBE scene identification

(1) clear ocean	(5) clear coastal	(9) mostly cloudy ocean
(2) clear land	(6) partly cloudy ocean	(10) mostly cloudy land-desert
(3) clear snow	(7) partly cloudy land-desert	(11) mostly cloudy coastal
(4) clear desert	(8) partly cloudy coastal	(12) overcast

The ES-8 will be produced starting at launch and will be externally archived for use by the global scientific community. A complete listing of parameters for this data product can be found in Table 2.3-1.

Level: 2
Type: Archival
Frequency: 1/Day

Portion of Globe Covered
File: Satellite Swath
Record: N/A

Time Interval Covered
File: 24 Hours
Record: 6.6-Seconds

Portion of Atmosphere Covered
File: Satellite Altitude and TOA

Table 2.3-1. ERBE-like Instantaneous TOA Estimates (ES-8)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
ES-8						
ES-8_File_Header						
ES-8 File header		N/A		TBD	TBD	
ES-8_Data_Record						
Scan_Level_Data						
Julian day	1	day	2449353 .. 2458500	1	32	1
Julian time	2	10^{-9} day	0 .. 999999999	1	32	2
Earth-Sun distance	3	10^{-9} AU	$98*10^6$ ..$102*10^6$	1	32	3
X component of satellite position	4	km	-8000 .. 8000	2	32	4
Y component of satellite position	5	km	-8000 .. 8000	2	32	6
Z component of satellite position	6	km	-8000 .. 8000	2	32	8
X component of satellite inertial velocity	7	km sec^{-1}	-10 .. 10	2	32	10
Y component of satellite inertial velocity	8	km sec^{-1}	-10 .. 10	2	32	12
Z component of satellite inertial velocity	9	km sec^{-1}	-10 .. 10	2	32	14
Colatitude of satellite at observation	10	deg	0 .. 180	2	32	16
Longitude of satellite at observation	11	deg	0 .. 360	2	32	18
Colatitude of Sun at observation	12	deg	0 .. 180	1	32	20
Longitude of Sun at observation	13	deg	0 .. 360	1	32	21
Satellite orbit number	14	N/A	0 .. 54000	1	32	22
Scanner operations flag word	15	N/A	N/A	3	32	23
Measurement_Level_Flag_Words						
Quality flag for total radiance value	16	N/A	N/A	22	32	26
Quality flag for shortwave radiance value	17	N/A	N/A	22	32	48
Quality flag for window radiance value	18	N/A	N/A	22	32	70
Quality flag for FOV	19	N/A	N/A	22	32	92
Measurement_Level_Data						
Colatitude of FOV at TOA	20	deg	0 .. 180	660	32	114
Longitude of FOV at TOA	21	deg	0 .. 360	660	32	774
Total filtered radiance, upwards	22	W $m^{-2}sr^{-1}$	0 .. 700	660	32	1434
Shortwave filtered radiance, upwards	23	W $m^{-2}sr^{-1}$	-10 .. 510	660	32	2094
Window filtered radiance, upwards	24	W $m^{-2}sr^{-1}$	0 .. 50	660	32	2754
Viewing zenith at TOA	25	deg	0 .. 90	660	32	3414
Solar zenith at TOA	26	deg	0 .. 180	660	32	4074
Relative azimuth at TOA	27	deg	0 .. 360	660	32	4734
Shortwave unfiltered radiance, upwards	28	W m^{-2}	-10 .. 510	660	32	5394
Longwave unfiltered radiance, upwards	29	W m^{-2}	0 .. 200	660	32	6054
Window unfiltered radiance, upwards	30	W m^{-2}	0 .. 50	660	32	6714
Shortwave flux at TOA, upwards	31	W m^{-2}	0 .. 1400	660	32	7374
Longwave flux at TOA, upwards	32	W m^{-2}	50 .. 400	660	32	8034
ERBE scene type	33	N/A	0 .. 12.4	660	32	8694

Total Meta Bits/File:	TBD
Total Data Bits/Record:	299296
Total Records/File:	13091
Total Data Bits/File:	3918083936
Total Bits/File:	3918083936

Note: Product size is independent of platform.
Product size: 467.1 MB

2.4 ERBE-like Monthly Regional Averages (ES-9)

EOSDIS Product Code: CER03

The ES-9 stores data for each 2.5-degree region observed during a month. There are 10368 possible regions; a given region is viewed by the scanner several times as the spacecraft passes overhead. For each region, data is stored by the hour for each hour of each day in the month. Stored data includes the mean estimates of shortwave and longwave radiant flux at the TOA, the standard deviations of these estimates, the maximum and minimum estimate, and scene information or cloud condition. Similar parameters are determined for those scanner measurements that are identified as viewing clear-sky areas. Daily, monthly hourly, and monthly averages are also stored. A complete listing of parameters for this data product can be found in Table 2.4-1.

Level: 3
Type: Archival
Frequency: 1/Month

Portion of Globe Covered
File: Global
Record: Regional

Time Interval Covered
File: 1 Month
Record: Hourbox Data

Portion of Atmosphere Covered
File: TOA

Table 2.4-1. ERBE-like Monthly Regional Averages (ES-9) (1 of 3)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
ES-9						
ES-9_File_Header						
File header		N/A		TBD	TBD	
ES-9_Record_Level_Data_Scale_Factors						
Scale factors		N/A		93	16	
ES-9_Data_Records						
Region number	1	N/A	1..10368	1	16	1
Geographic scene type	2	N/A	1 .. 5	1	16	2
Sene fraction histogram	3	N/A	N/A	4	16	3
Monthly_Averages_Day						
SW flux	4	W m^{-2}	0 .. 1400	1	16	7
SW flux minimum value	5	W m^{-2}	0 .. 1400	1	16	8
SW flux maximum value	6	W m^{-2}	0 .. 1400	1	16	9
SW flux standard deviation	7	W m^{-2}	0 .. 1400	1	16	10
SW flux number of days with at least one sample	8	day	0 .. 31	1	16	11
LW flux	9	W m^{-2}	50 .. 400	1	16	12
LW flux minimum value	10	W m^{-2}	50 .. 400	1	16	13
LW flux maximum value	11	W m^{-2}	50 .. 400	1	16	14
LW flux standard deviation	12	W m^{-2}	0 .. 350	1	16	15
LW flux number of days with at least 1 sample	13	day	0 .. 31	1	16	16
Albedo	14	N/A	0 .. 1	1	16	17
Net flux	15	W m^{-2}	-200 .. 200	1	16	18
Monthly total integrated solar incidence	16	N/A	0 .. 500000	2	16	19
Clear sky SW flux	17	W m^{-2}	0 .. 1400	1	16	21
Clear sky SW flux minimum value	18	W m^{-2}	0 .. 1400	1	16	22
Clear sky SW flux maximum value	19	W m^{-2}	0 .. 1400	1	16	23
Clear sky SW flux standard deviation	20	W m^{-2}	0 .. 1400	1	16	24
Clear sky SW flux number of days with at least 1 sample	21	day	0 .. 31	1	16	25
Clear sky LW flux average flux	22	W m^{-2}	50 .. 400	1	16	26
Clear sky LW flux minimum value	23	W m^{-2}	50 .. 400	1	16	27
Clear sky LW flux maximum value	24	W m^{-2}	50 .. 400	1	16	28
Clear sky LW flux standard deviation	25	W m^{-2}	0 .. 350	1	16	29
Clear sky LW flux number of days with at least 1 sample	26	day	0 .. 31	1	16	30
Clear sky albedo	27	N/A	0 .. 1	1	16	31
Clear sky net radiant flux	28	W m^{-2}	-200 .. 200	1	16	32
Clear sky solar incidence	29	N/A	0 .. 500000	2	16	33
Monthly_Averages_Hour						
SW flux	30	W m^{-2}	0 .. 1400	1	16	35
SW flux minimum value	31	W m^{-2}	0 .. 1400	1	16	36
SW flux maximum value	32	W m^{-2}	0 .. 1400	1	16	37
SW flux standard deviation	33	W m^{-2}	0 .. 1400	1	16	38
SW flux number of hours with at least 1 sample	34	hour	0 .. 24	1	16	39
LW flux	35	W m^{-2}	50 .. 400	1	16	40
LW flux minimum value	36	W m^{-2}	50 .. 400	1	16	41
LW flux maximum value	37	W m^{-2}	50 .. 400	1	16	42
LW flux standard deviation	38	W m^{-2}	0 .. 350	1	16	43
LW flux number of hours with at least 1 sample	39	hour	0 .. 24	1	16	44
Albedo	40	N/A	0 .. 1	1	16	45
Net flux	41	W m^{-2}	-200 .. 200	1	16	46
Solar incidence	42	W h m^{-2}	0 .. 500000	2	16	47
Clear sky SW flux	43	W m^{-2}	0 .. 1400	1	16	49
Clear sky SW flux minimum value	44	W m^{-2}	0 .. 1400	1	16	50
Clear sky SW flux maximum value	45	W m^{-2}	0 .. 1400	1	16	51
Clear sky SW flux standard deviation	46	W m^{-2}	0 .. 1400	1	16	52
Clear sky SW flux number of hours with at least 1 sample	47	hour	0 .. 24	1	16	53

Table 2.4-1. ERBE-like Monthly Regional Averages (ES-9) (2 of 3)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
Clear sky LW flux	48	W m^{-2}	50 .. 400	1	16	54
Clear sky LW flux minimum value	49	W m^{-2}	50 .. 400	1	16	55
Clear sky LW flux maximum value	50	W m^{-2}	50 .. 400	1	16	56
Clear sky LW flux standard deviation	51	W m^{-2}	0 .. 350	1	16	57
Clear sky LW flux number of hours with at least 1 sample	52	hour	0 .. 24	1	16	58
Clear sky albedo	53	N/A	0 .. 1	1	16	59
Clear sky net flux	54	W m^{-2}	-200 .. 200	1	16	60
Clear sky solar incidence	55	W m^{-2}	0 .. 500000	2	16	61
Monthly_Averages_Daily						
Solar constant, distance corrected	56	W m^{-2}	1300 .. 1450	31	16	63
SW flux	57	W m^{-2}	0 .. 1400	31	16	94
SW flux minimum value	58	W m^{-2}	0 .. 1400	31	16	125
SW flux maximum value	59	W m^{-2}	0 .. 1400	31	16	156
SW flux standard deviation	60	W m^{-2}	0 .. 1400	31	16	187
SW flux number of hours with at least 1 sample	61	hour	0 .. 24	31	16	218
LW flux	62	W m^{-2}	50 .. 400	31	16	249
LW flux minimum value	63	W m^{-2}	50 .. 400	31	16	280
LW flux maximum value	64	W m^{-2}	50 .. 400	31	16	311
LW flux standard deviation	65	W m^{-2}	0 .. 350	31	16	342
LW flux number of hours with at least 1 sample	66	hour	0 .. 24	31	16	373
Albedo	67	N/A	0 .. 1	31	16	404
Solar incidence	68	W m^{-2}	0 .. 20000	62	16	435
Clear sky SW flux	69	W m^{-2}	0 .. 1400	31	16	497
Clear sky SW flux minimum value	70	W m^{-2}	0 .. 1400	31	16	528
Clear sky SW flux maximum value	71	W m^{-2}	0 .. 1400	31	16	559
Clear sky SW flux standard deviation	72	W m^{-2}	0 .. 1400	31	16	590
Clear sky SW flux number of hours with at least 1 sample	73	hour	0 .. 24	31	16	621
Clear sky LW flux	74	W m^{-2}	50 .. 400	31	16	652
Clear sky LW flux minimum value	75	W m^{-2}	50 .. 400	31	16	683
Clear sky LW flux maximum value	76	W m^{-2}	50 .. 400	31	16	714
Clear sky LW flux standard deviation	77	W m^{-2}	0 .. 350	31	16	745
Clear sky LW flux number of hours with at least 1 sample	78	hour	0 .. 24	31	16	776
Clear sky albedo	79	N/A	0 .. 1	31	16	807
Monthly_Averages_Hourly						
SW flux	80	W m^{-2}	0 .. 1400	24	16	838
SW flux minimum value	81	W m^{-2}	0 .. 1400	24	16	862
SW flux maximum value	82	W m^{-2}	0 .. 1400	24	16	886
SW flux standard deviation	83	W m^{-2}	0 .. 1400	24	16	910
SW flux number of days with at least 1 sample	84	day	0 .. 31	24	16	934
SW sum of estimates	85	W m^{-2}	0 .. 45000	48	16	958
SW sum of estimates squared	86	W^2 m^{-4}	0 .. 50000000	48	16	1006
LW flux	87	W m^{-2}	50 .. 400	24	16	1054
LW flux minimum value	88	W m^{-2}	50 .. 400	24	16	1078
LW flux maximum value	89	W m^{-2}	50 .. 400	24	16	1102
LW flux standard deviation	90	W m^{-2}	0 .. 350	24	16	1126
LW flux number of days with at least 1 sample	91	day	0 .. 31	24	16	1150
LW flux sum of estimates	92	W m^{-2}	0 .. 15000	48	16	1174
LW sum of estimates squared	93	W^2 m^{-4}	0 .. 5000000	48	16	1222
Albedo	94	N/A	0 .. 1	24	16	1270
Solar incidence	95	W m^{-2}	0 .. 1450	48	16	1294
Clear sky SW flux	96	W m^{-2}	0 .. 1400	24	16	1342
Clear sky SW flux minimum value	97	W m^{-2}	0 .. 1400	24	16	1366
Clear sky SW flux maximum value	98	W m^{-2}	0 .. 1400	24	16	1390

Table 2.4-1. ERBE-like Monthly Regional Averages (ES-9) (3 of 3)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
Clear sky SW flux standard deviation	99	W m^{-2}	0 .. 1400	24	16	1414
Clear sky SW flux number of days with at least 1 sample	100	day	0 .. 31	24	16	1438
Clear sky SW sum of estimates	101	W m^{-2}	0..45000	48	16	1462
Clear sky SW sum of estimates squared	102	W^2 m^{-4}	0 .. 50000000	48	16	1510
Clear sky LW flux	103	W m^{-2}	50 .. 400	24	16	1558
Clear sky LW flux minimum value	104	W m^{-2}	50 .. 400	24	16	1582
Clear sky LW flux maximum value	105	W m^{-2}	50 .. 400	24	16	1606
Clear sky LW flux standard deviation	106	W m^{-2}	0 .. 350	24	16	1630
Clear sky LW flux number of days with at least 1 sample	107	day	0 .. 31	24	16	1654
Clear sky LW sum of estimates	108	W m^{-2}	0 .. 15000	48	16	1678
Clear sky LW sum of estimates squared	109	W^2 m^{-4}	0 .. 5000000	48	16	1726
Clear sky albedo	110	W m^{-2}	0 .. 1	24	16	1774
Clear sky solar incidence	111	W m^{-2}	0 .. 1450	48	16	1798
Number_of_Monthly_Hour_boxes						
Number of hourboxes	112	N/A	1 .. 744	1	16	1846
Monthly_Hourly_Daily						
Hourbox number	113	N/A	1 .. 744	744	16	1847
Whole part of Julian date	114	day	2449353..2458500	1488	16	2591
Fractional part of Julian day	115	day	0 .. 1	744	16	4079
Scene fraction	116	N/A	0 .. 1	2976	16	4823
Albedo vector	117	N/A	0 .. 1	2976	16	7799
Cosine of the solar zenith angle	118	N/A	0 .. 1	744	16	10775
Satellite zenith angle	119	deg	0 .. 90	744	16	11519
Azimuth angle	120	deg	0 .. 360	744	16	12263
Solar incidence	121	W m^{-2}	0 .. 1450	744	16	13007
SW flux	122	W m^{-2}	0 .. 1400	744	16	13751
SW flux minimum value	123	W m^{-2}	0 .. 1400	744	16	14495
SW flux maximum value	124	W m^{-2}	0 .. 1400	744	16	15239
SW flux standard deviation	125	W m^{-2}	0 .. 1400	744	16	15983
SW flux number	126	N/A	TBD	744	16	16727
LW flux	127	W m^{-2}	50 .. 400	744	16	17471
LW flux minimum value	128	W m^{-2}	50 .. 400	744	16	18215
LW flux maximum value	129	W m^{-2}	50 .. 400	744	16	18959
LW flux standard deviation	130	W m^{-2}	0 .. 350	744	16	19703
LW flux number	131	N/A	TBD	744	16	20447
SW flux maximum difference	132	W m^{-2}	TBD	744	16	21191
LW flux maximum difference	133	W m^{-2}	TBD	744	16	21935
Clear sky albedo	134	N/A	0 .. 1	744	16	22679
Clear sky LW flux	135	W m^{-2}	50 .. 400	744	16	23423
Clear sky LW flux standard deviation	136	W m^{-2}	0 .. 350	744	16	24167
Clear sky LW flux number	137	N/A	TBD	744	16	24911

Total Meta Bits/File:	TBD
Total Data Bits/Record:	410464
Total Records/File:	10368
Total Data Bits/File:	4255690752
Total Bits/File :	4255692240

Note: Sizing estimates shown in this table assume that all 2.5-deg regions and all hourboxes contain data. The sizing estimates per platform are

Product Size (TRMM):	66.0 MB
Product Size (EOS-AM):	170.0 MB
Product Size (EOS-PM):	175.2 MB

The sizing estimate for the ES-9 in the “Archival Products Summary” Table is for EOS-PM.

2.5 ERBE-like Monthly Geographical Averages (ES-4)

EOSDIS Product Code: CER13

The ES-4 data is a regional, zonal, and global averages product. The instantaneous scanner estimates at the TOA are arranged temporally to hours, days, and the month. They are averaged spatially to regions, latitude zones, and the globe. The ES-4 product contains a header record, a record of file address map, a record of data scale factors, and seven sets of data records. Each record data set corresponds to a regional, nested regional, zonal, or global average. There are 10368 2.5-degree regions for the ERBE-like data. Therefore, there is a maximum of 10368 records in the 2.5-degree regional record set. The second set of data records is the 2.5-degree nested to 5.0-degree regional data, which constitutes a maximum of 2592 records. The third set of data records is the 5.0-degree nested to 10.0-degree regional data, which constitutes up to 648 records. The fourth, fifth, and sixth sets of records are the 2.5-, 5.0-, and 10.0-degree zonally averaged data which constitute 72, 36, and 18 records, respectively. The last set is the global data, which constitutes 3 records. A complete listing of parameters for this data product can be found in Table 2.5-1.

Level: 3
Type: Archival
Frequency: 1/Month

Time Interval Covered
File: Month
Record: Month

Portion of Globe Covered
File: Regional, Zonal, Global
Record: Regional, Zonal, Global

Portion of Atmosphere Covered
File: TOA

Table 2.5-1. ERBE-like Monthly Geographical Averages (ES-4) (1 of 3)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
ES-4						
ES-4_Header:						
File header		N/A	N/A	TBD	TBD	
ES-4_Record_Mapping_Matrix (1 record)						
10 X 2 mapping matrix for spatial boundaries		N/A	N/A	20	32	
ES-4_Record_Data_Scaling (1 record)						
Scale factors for 32-bits Data		N/A	N/A	90	32	
Scale factors for 16-bits Data		N/A	N/A	345	16	
Scale factors for 8-bits Data		N/A	N/A	240	8	
ES-4_2.5-deg Regional Data Record (10368 records)						
32-bit_Data						
File ID	1	N/A	N/A	1	32	1
Solar Incidence for Monthly Averages by Day	2	W h m^{-2}	0 .. 500000	1	32	2
Monthly net radiant flux by day	3	W m^{-2}	-200 .. 200	1	32	3
Clear sky net radiant flux, monthly by day	4	W m^{-2}	-200 .. 200	1	32	4
Clear sky solar incidence, monthly by day	5	W m^{-2}	0 .. 500000	1	32	5
Monthly net radiant flux by hour	6	W m^{-2}	-200 .. 200	1	32	6
Solar incidence, monthly by hour	7	W h m^{-2}	0 .. 500000	1	32	7
Clear sky net radiant flux, monthly by hour	8	W m^{-2}	-200 .. 200	1	32	8
Clear sky solar incidence, monthly by hour	9	W h m^{-2}	0 .. 500000	1	32	9
Daily solar incidence	10	W h m^{-2}	0 .. 500000	31	32	10
Hourly solar incidence	11	W h m^{-2}	0 .. 500000	24	32	41
Clear sky solar incidence	12	W h m^{-2}	0 .. 500000	24	32	65
32-bit Spares	13	N/A	N/A	2	32	89
16-bit_Data						
Region number	14	N/A	1 .. 144	1	16	91
Year and month (YYMM) of data processed	15	N/A	N/A	1	16	92
Spacecraft code (TBD)	16	N/A	TBD	1	16	93
Longwave flux	17	W m^{-2}	50 .. 400	1	16	94
Shortwave flux	18	W m^{-2}	0 .. 1400	1	16	95
Monthly mean albedo	19	N/A	0 .. 1	1	16	96
Clear sky longwave flux	20	W m^{-2}	50 .. 400	1	16	97
Clear sky shortwave flux	21	W m^{-2}	0 .. 1400	1	16	98
Monthly mean clear sky albedo	22	N/A	0 .. 1	1	16	99
Longwave flux by the hour	23	W m^{-2}	50 .. 400	1	16	100
Shortwave flux by the hour	24	W m^{-2}	0 .. 1400	1	16	101
Monthly average albedo by the hour	25	N/A	0 .. 1	1	16	102
Clear sky longwave flux by the hour	26	W m^{-2}	50 .. 400	1	16	103
Clear sky shortwave flux by the hour	27	W m^{-2}	0 .. 1400	1	16	104
Clear sky Monthly averaged albedo by the hour	28	N/A	0 .. 1	1	16	105
Longwave flux, daily	29	W m^{-2}	50 .. 400	31	16	106
Short wave flux, daily	30	W m^{-2}	0 .. 1200	31	16	137
Monthly mean albedo, daily	31	N/A	0 .. 1	31	16	168
Clear sky longwave flux, daily	32	W m^{-2}	50 .. 400	31	16	199
Clear sky shortwave flux, daily	33	W m^{-2}	0 .. 1400	31	16	230
Monthly mean clear sky albedo, daily	34	N/A	0 .. 1	31	16	261
Longwave flux, hourly	35	W m^{-2}	50 .. 400	24	16	285
Shortwave flux, hourly	36	W m^{-2}	0 .. 1400	24	16	309
Monthly average albedo, hourly	37	N/A	0 .. 1	24	16	333
Clear sky longwave flux, hourly	38	W m^{-2}	50 .. 400	24	16	357
Clear sky shortwave flux, hourly	39	W m^{-2}	0 .. 1400	24	16	381
Clear sky Monthly averaged albedo, hourly	40	N/A	0 .. 1	24	16	405
8-bit_Data						
Number of observations for LW, daily	41	hour	0 .. 24	31	8	436

Table 2.5-1. ERBE-like Monthly Geographical Averages (ES-4) (2 of 3)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
Number of observations SW, daily	42	hour	0 .. 24	31	8	467
Number of observations for clear sky LW, daily	43	hour	0 .. 24	31	8	498
Number of observations for clear sky SW, daily	44	hour	0 .. 24	31	8	529
Number of observations for LW, hourly	45	day	0 .. 31	24	8	560
Number of observations for SW, hourly	46	day	0 .. 31	24	8	584
Number of observations for clear sky LW, hourly	47	day	0 .. 31	24	8	608
Number of observations for clear sky SW, hourly	48	day	0 .. 31	24	8	632
Spares	49	N/A	N/A	20	8	656
ES-4_5.0-deg Nested Regional Data Record (2592 records)						
32-bit_Data						
Same parameters as in 2.5-deg Regional Data Record	1	N/A	N/A	90	32	1
16-bit_Data						
Same parameters as in 2.5-deg Regional Data Record	14	N/A	N/A	345	16	91
8-bit_Data						
Same parameters as in 2.5-deg Regional Data Record	41	N/A	N/A	240	8	436
ES-4_10.0-deg Nested Regional Data Record (648 records)						
32-bit_Data						
Same parameters as in 2.5-deg Regional Data Record	1	N/A	N/A	90	32	1
16-bit_Data						
Same parameters as in 2.5-deg Regional Data Record	14	N/A	N/A	345	16	91
8-bit_Data						
Same parameters as in 2.5-deg Regional Data Record	41	N/A	N/A	240	8	436
ES-4_2.5-deg Zonal Data Record (72 records)						
32-bit_Data						
Same parameters as in 2.5-deg Regional Data Record	1	N/A	N/A	90	32	1
16-bit_Data						
Same parameters as in 2.5-deg Regional Data Record	14	N/A	N/A	345	16	91
8-bit_Data						
Same parameters as in 2.5-deg Regional Data Record	41	N/A	N/A	240	8	436
ES-4_5.0-deg Zonal Data Record (36 records)						
32-bit_Data						
Same parameters as in 2.5-deg Regional Data Record	1	N/A	N/A	90	32	1
16-bit_Data						
Same parameters as in 2.5-deg Regional Data Record	14	N/A	N/A	345	16	91
8-bit_Data						
Same parameters as in 2.5-deg Regional Data Record	41	N/A	N/A	240	8	436
ES-4_10.0-deg Zonal Data Record (18 records)						
32-bit_Data						
Same parameters as in 2.5-deg Regional Data Record	1	N/A	N/A	90	32	1
16-bit_Data						
Same parameters as in 2.5-deg Regional Data Record	14	N/A	N/A	345	16	91
8-bit_Data						
Same parameters as in 2.5-deg Regional Data Record	41	N/A	N/A	240	8	436
ES-4_Global Zonal Data Record (3 records)						
32-bit_Data						
Same parameters as in 2.5-deg Regional Data Record	1	N/A	N/A	90	32	1
16-bit_Data						
Same parameters as in 2.5-deg Regional Data Record	14	N/A	N/A	345	16	91
8-bit_Data						
Same parameters as in 2.5-deg Regional Data Record	41	N/A	N/A	240	8	436

Table 2.5-1. ERBE-like Monthly Geographical Averages (ES-4) (3 of 3)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
Total Meta Bits/File:	TBD					
Total Data Bits/Record:	10320					
Total Records/File:	13739					
Total Data Bits/File:	141786480					
Total Bits/File:	141786480					

Note: Sizing estimates shown above assume that all 2.5-deg regions contain data. The sizing estimates per platform are

Product Size (TRMM):	11.3 MB
Product Size (EOS-AM):	16.5 MB
Product Size (EOS-PM):	16.5 MB

The sizing estimate for the ES-4 in the “Archival Products Summary” Table is for EOS-AM and EOS-PM.

2.6 ERBE-like Monthly Gridded Averages (ES-4G)

EOSDIS Product Code: CER14

The ES-4G data product stores the same time and space averages as the ES-4 science data product, with the difference being the arrangement of the data. While the ES-4 is arranged by region, the ES-4G files present a gridded data product with all regions for a given data parameter grouped together. The regional presentation of the data is in the same order as that described for the ES-4 product. The 2.5-degree regional parameters are presented as 10368-element vectors, the 2.5 nested to 5.0-degree data is presented as 2592-element vectors, and the 5.0 nested to 10.0-degree data is presented as 648-element vectors. The 2.5-, 5.0-, and 10.0-degree zonal data is presented as 72-, 36-, and 18-element vectors respectively. The global data are presented as 3-element vectors.

The ES-4G data product is written on four output files. The first three files contain 2.5-degree regional data, 32-, 16-, and 8-bit data. The fourth file contains nested regional data, all zonal data, and global data. A complete listing of parameters for this data product can be found in Table 2.6-1.

Level: 3
Type: Archival
Frequency: 1/Month

Time Interval Covered
File: Month
Record: Month

Portion of Globe Covered
File: Global, Zonal, Regional
Record: Global, Zonal, Regional

Portion of Atmosphere Covered
File: TOA

Table 2.6-1. ERBE-like Monthly Gridded Averages (ES-4G) (1 of 8)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
ES_4G_2.5-deg_Regional_32-bit_Data (File 1)						
Monthly_Averages_Day						
Solar Incidence						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	32	2
Monthly Averages	3	W h m^{-2}	0 .. 500000	10368	32	3
Spares	4	N/A	N/A	420	8	10371
Net Flux						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	32	2
Monthly Averages	3	W m^{-2}	-200 .. 200	10368	32	3
Spares	4	N/A	N/A	420	8	10371
Clear Sky Net Flux						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	32	2
Monthly Average	3	W m^{-2}	-200 .. 200	10368	32	3
Spares	4	N/A	N/A	420	8	10371
Clear Sky Solar Incidence						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	32	2
Monthly Averages	3	W h m^{-2}	0 .. 500000	10368	32	3
Spares	4	N/A	N/A	420	8	10371
Monthly_Averages_Hour						
Net Flux						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	32	2
Monthly Averages	3	W m^{-2}	-200 .. 200	10368	32	3
Spares	4	N/A	N/A	420	8	10371
Solar Incidence						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	32	2
Monthly Averages	3	W h m^{-2}	0 .. 500000	10368	32	3
Spares	4	N/A	N/A	420	8	10371
Clear Sky Net Flux						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	32	2
Monthly Averages	3	W m^{-2}	-200 .. 200	10368	32	3
Spares	4	N/A	N/A	420	8	10371
Clear Sky Solar Incidence						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	32	2
Monthly Averages	3	W h m^{-2}	0 .. 500000	10368	32	3
Spares	4	N/A	N/A	420	8	10371
Monthly_Averages_Daily						
Solar Incidence (31 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	32	2
Monthly Averages	3	W h m^{-2}	0 .. 500000	10368	32	3
Spares	4	N/A	N/A	420	8	10371
Monthly_Averages_Hourly						
Solar Incidence (24 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	32	2
Monthly Averages	3	W h m^{-2}	0 .. 500000	10368	32	3

Table 2.6-1. ERBE-like Monthly Gridded Averages (ES-4G) (2 of 8)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
Spares	4	N/A	N/A	420	8	10371
Clear Sky Solar Incidence (24 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	32	2
Monthly Averages	3	W h m^{-2}	0 .. 500000	10368	32	3
Spares	4	N/A	N/A	420	8	10371

Total Meta Bits/File:	TBD
Total Data Bits/Record:	335872
Total Records/File 1:	87
Total Data Bits/File 1:	29220864
Total Bits/File 1:	29220864

Table 2.6-1. ERBE-like Monthly Gridded Averages (ES-4G) (3 of 8)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
ES_4G_2.5-deg_Regional_16-bit_Data (File 2)						
Monthly_Averages_Day						
LW Flux						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	16	2
Monthly Averages	3	W m^{-2}	50 .. 400	10368	16	3
Spares	4	N/A	N/A	166	8	10371
SW Flux						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	16	2
Monthly Averages	3	W m^{-2}	0 .. 1400	10368	16	3
Spares	4	N/A	N/A	166	8	10371
Albedo						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	16	2
Monthly Averages	3	N/A	0 .. 1	10368	16	3
Spares	4	N/A	N/A	166	8	10371
Clear Sky LW Flux						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	16	2
Monthly Averages	3	W m^{-2}	0 .. 1400	10368	16	3
Spares	4	N/A	N/A	166	8	10371
Clear Sky SW Flux						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	16	2
Monthly Averages	3	W m^{-2}	0 .. 400	10368	16	3
Spares	4	N/A	N/A	166	8	10371
Clear Sky Albedo						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	16	2
Monthly Averages	3	N/A	0 .. 1	10368	16	3
Spares	4	N/A	N/A	166	8	10371
Monthly_Averages_Hour						
LW Flux						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	16	2
Monthly Averages	3	W m^{-2}	50 .. 400	10368	16	3
Spares	4	N/A	N/A	166	8	10371
SW Flux						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	16	2
Monthly Averages	3	W m^{-2}	0 .. 1400	10368	16	3
Spares	4	N/A	N/A	166	8	10371
Albedo						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	16	2
Monthly Averages	3	N/A	0 .. 1	10368	16	3
Spares	4	N/A	N/A	166	8	10371
Clear Sky LW Flux						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	16	2
Monthly Averages	3	W m^{-2}	50 .. 400	10368	16	3
Spares	4	N/A	N/A	166	8	10371
Clear Sky SW Flux						
Data Description	1	N/A	N/A	1	640	1

Table 2.6-1. ERBE-like Monthly Gridded Averages (ES-4G) (4 of 8)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
Scale Factor	2	N/A	N/A	1	16	2
Monthly Averages	3	W m^{-2}	0 .. 1400	10368	16	3
Spares	4	N/A	N/A	166	8	10371
Clear Sky Albedo						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	16	2
Monthly Averages	3	N/A	0 .. 1	10368	16	3
Spares	4	N/A	N/A	166	8	10371
Monthly_Averages_Daily						
LW Flux (31 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	16	2
Monthly Averages	3	W m^{-2}	50 .. 400	10368	16	3
Spares	4	N/A	N/A	166	8	10371
SW Flux (31 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	16	2
Monthly Averages	3	W m^{-2}	50 .. 1400	10368	16	3
Spares	4	N/A	N/A	166	8	10371
Albedo (31 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	16	2
Monthly Averages	3	N/A	0 .. 1	10368	16	3
Spares	4	N/A	N/A	166	8	10371
Clear Sky LW Flux (31 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	16	2
Monthly Averages	3	W m^{-2}	50 .. 400	10368	16	3
Spares	4	N/A	N/A	166	8	10371
Clear Sky SW Flux (31 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	16	2
Monthly Averages	3	W m^{-2}	0 .. 1400	10368	16	3
Spares	4	N/A	N/A	166	8	10371
Clear Sky Albedo (31 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	16	2
Monthly Averages	3	N/A	0 .. 1	10368	16	3
Spares	4	N/A	N/A	166	8	10371
Monthly_Averages_Hourly						
LW Flux (24 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	16	2
Monthly Averages	3	W m^{-2}	50 .. 400	10368	16	3
Spares	4	N/A	N/A	166	8	10371
SW Flux (24 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	16	2
Monthly Averages	3	W m^{-2}	0 .. 1400	10368	16	3
Spares	4	N/A	N/A	166	8	10371
Albedo (24 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	16	2
Monthly Averages	3	N/A	0 .. 1	10368	16	3

Table 2.6-1. ERBE-like Monthly Gridded Averages (ES-4G) (5 of 8)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
Spares	4	N/A	N/A	166	8	10371
Clear Sky LW Flux (24 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	16	2
Monthly Averages	3	W m^{-2}	50 .. 400	10368	16	3
Spares	4	N/A	N/A	166	8	10371
Clear Sky SW Flux (24 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	16	2
Monthly Averages	3	W m^{-2}	0 .. 1400	10368	16	3
Spares	4	N/A	N/A	166	8	10371
Clear Sky Albedo (24 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	16	2
Monthly Averages	3	N/A	0 .. 1	10368	16	3
Spares	4	N/A	N/A	166	8	10371

Total Meta Bits/File:	TBD
Total Data Bits/Record:	167936
Total Records/File 2:	342
Total Data Bits/File 2:	57434112
Total Bits/File 2:	57434112

Table 2.6-1. ERBE-like Monthly Gridded Averages (ES-4G) (6 of 8)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
ES_4G_2.5-deg_Regional_8-bit_Data (File 3)						
Number of Observations_Daily						
LW Flux (31 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	8	2
Number of Observations	3	hour	0..24	10368	8	3
Spares	4	N/A	N/A	295	8	10371
SW Flux (31 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	8	2
Number of Observations	3	hour	0..24	10368	8	3
Spares	4	N/A	N/A	295	8	10371
Clear Sky LW Flux (31 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	8	2
Number of Observations	3	hour	0..24	10368	8	3
Spares	4	N/A	N/A	295	8	10371
Clear Sky SW Flux (31 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	8	2
Number of Observations	3	hour	0..24	10368	8	3
Spares	4	N/A	N/A	295	8	10371
Number of Observations_Hourly						
LW Flux (24 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	8	2
Number of Observations	3	day	0..31	10368	8	3
Spares	4	N/A	N/A	295	8	10371
SW Flux (24 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	8	2
Number of Observations	3	day	0..31	10368	8	3
Spares	4	N/A	N/A	295	8	10371
Clear Sky LW Flux (24 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	8	2
Number of Observations	3	day	0..31	10368	8	3
Spares	4	N/A	N/A	295	8	10371
Clear Sky SW Flux (24 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	8	2
Number of Observations	3	day	0..31	10368	8	3
Spares	4	N/A	N/A	295	8	10371
Geotype						
Geotype_Instances						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	8	2
Geotype of Region	3	N/A	0 .. 5	10368	8	3
Spares	4	N/A	N/A	295	8	10371

Total Meta Bits/File:	TBD
Total Data Bits/Record:	86016
Total Records/File 3:	221
Total Data Bits/File 3:	19009536
Total Bits/File 3:	19009536

Table 2.6-1. ERBE-like Monthly Gridded Averages (ES-4G) (7 of 8)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
ES_4G_Nested_Zonal_Global_data (File 4)						
(Same parameters as in 2.5-deg Regional Data Record)						
Nested_5.0-deg_Regional_Data						
32-bit_Data (87 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	32	2
Monthly Averages	3	N/A	N/A	2592	32	3
Spares	4	N/A	N/A	292	8	2595
16-bit_Data (342 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	16	2
Monthly Averages	3	N/A	N/A	2592	16	3
Spares	4	N/A	N/A	358	8	2595
8-bit_Data (221 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	8	2
Monthly Averages	3	N/A	N/A	2592	8	3
Spares	4	N/A	N/A	391	8	2595
Nested_10.0-deg_Regional_Data						
32-bit_Data (87 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	32	2
Monthly Averages	3	N/A	N/A	648	32	3
Spares	4	N/A	N/A	388	8	651
16-bit_Data (342 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	16	2
Monthly Averages	3	N/A	N/A	648	16	3
Spares	4	N/A	N/A	150	8	651
8-bit_Data (221 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	8	2
Monthly Averages	3	N/A	N/A	648	8	3
Spares	4	N/A	N/A	287	8	651
2.5-deg_Zonal_Data						
32-bit_Data (87 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	32	2
Monthly Averages	3	N/A	N/A	72	32	3
Spares	4	N/A	N/A	132	8	75
16-bit_Data (342 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	16	2
Monthly Averages	3	N/A	N/A	72	16	3
Spares	4	N/A	N/A	278	8	75
8-bit_Data (221 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	8	2
Monthly Averages	3	N/A	N/A	72	8	3
Spares	4	N/A	N/A	351	8	75
5.0-deg_Zonal_Data						
32-bit_Data (87 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	32	2
Monthly Averages	3	N/A	N/A	36	32	3
Spares	4	N/A	N/A	276	8	39

Table 2.6-1. ERBE-like Monthly Gridded Averages (ES-4G) (8 of 8)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
16-bit_Data (342 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	16	2
Monthly Averages	3	N/A	N/A	36	16	3
Spares	4	N/A	N/A	350	8	39
8-bit_Data (221 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	8	2
Monthly Averages	3	N/A	N/A	36	8	3
Spares	4	N/A	N/A	387	8	39
10.0-deg_Zonal_Data						
32-bit_Data (87 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	32	2
Monthly Averages	3	N/A	N/A	18	32	3
Spares	4	N/A	N/A	348	8	21
16-bit_Data (342 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	16	2
Monthly Averages	3	N/A	N/A	18	16	3
Spares	4	N/A	N/A	386	8	21
8-bit_Data (221 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	8	2
Monthly Averages	3	N/A	N/A	18	8	3
Spares	4	N/A	N/A	405	8	21
Global_Data						
32-bit_Data (87 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	32	2
Monthly Averages	3	N/A	N/A	3	32	3
Spares	4	N/A	N/A	408	8	6
16-bit_Data (342 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	16	2
Monthly Averages	3	N/A	N/A	3	16	3
Spares	4	N/A	N/A	416	8	6
8-bit_Data (221 records)						
Data Description	1	N/A	N/A	1	640	1
Scale Factor	2	N/A	N/A	1	8	2
Monthly Averages	3	N/A	N/A	3	8	3
Spares	4	N/A	N/A	420	8	6

Total Meta Bits/File:	TBD
Maximum Data Bits/Record:	86016
Total Records/File 4:	3900
Total Data Bits/File 4:	47124480
Total Bits/File 4:	47124480
Total Bits on ES-4G	152788992

Note: Product size is independent of platform.
Product size: 18.2 MB

2.7 Single Satellite Footprint, TOA and Surface Flux, Clouds (SSF)

EOSDIS Product Code: CER11

The Single Satellite CERES Footprint TOA and Surface Fluxes, Clouds (SSF) product is produced from the cloud identification, convolution, inversion, and surface processing for CERES. Each SSF covers footprints, or CERES Fields-of-View (FOV), from a single hour and a single CERES scanner (3 channels) mounted on one satellite.

The major categories of data output on the SSF are

- CERES footprint geometry and CERES viewing angles
- CERES footprint radiance and flux (TOA and Surface)
- CERES footprint area statistics and imager viewing angles
- CERES footprint clear area statistics
- CERES footprint cloudy area statistics for two cloud height categories
- CERES footprint cloud overlap conditions (4 conditions)
- Footprint imager radiance statistics (5 imager channels)

The SSF product will be produced daily starting with the TRMM launch. The SSF provides data needed to produce a production quality set of CERES Angular Distribution Models (CADMs). At a later time, the archival SSF product will be reproduced using the production CADMs.

The current SSF sizing of 245475 footprints per hour is a maximum and is based on the number of Earth-viewing CERES footprints recorded in an hour. For a CERES footprint to be recorded on the SSF, however, it must have adequate imager coverage. Therefore, when operating in a cross-track scan, the expected number of footprints on an SSF is reduced. For TRMM, this results in approximately 37% fewer footprints per hour. For EOS, the reduction is approximately 23%. When operating in Rotating Azimuth Plane Scan (RAPS) mode, the expected number of footprints per hour is also reduced, but not to the same extent as in cross-track. A complete listing of parameters for this data product can be found in Table 2.7-1.

Level: 2
Type: Archival
Frequency: 1/Hour

Portion of Globe Covered
File: Satellite Swath
Record: 1 CERES Footprint

Time Interval Covered
File: 1 Hour
Record: 1/100-Second

Portion of Atmosphere Covered
File: Surface to TOA

Table 2.7-1. Single Satellite Footprint, TOA and Sfc Flux, Clouds (SSF) (1 of 3)

Product Code Key:			
	A:	Archival Parameter	Parameters of interest to the general user community
	I:	Internal Parameter	Parameters required by subsequent subsystems or reprocessing
	V:	Validation Parameter	Parameters used for validation

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Product Code
SSF						
SSF_Header						
1 Product ID		N/A	TBD	1	16	A
2 Day and Time at hour start		N/A	ASCII string	1	216	A
3 Character name of satellite		N/A	ASCII string	1	64	A
4 Character name of CERES instrument		N/A	ASCII string	1	32	A
5 Character name of high resolution imager instrument		N/A	ASCII string	1	64	A
6 Number of imager channels used		N/A	1 .. 20	1	16	A
7 Central wavelengths of imager channels		µm	0.4 .. 15.0	20	32	A
8 Earth-Sun distance		AU	0.98 .. 1.02	1	32	A
9 Azimuth scan mode		N/A	ASCII string	1	32	A
10 Instrument software version number used to produce IES (SS1.0)		N/A	TBD	1	16	A
11 Cloud properties software version number (SS4-1 - 4.3)		N/A	TBD	1	16	A
12 Convolution of imager with CERES software version number (SS4.4)		N/A	TBD	1	16	A
13 TOA and Surface Estimation software version number (SS4.5 - 4.6)		N/A	TBD	1	16	A
14 Day and Time SSF created		N/A	ASCII string	1	152	A
15 Number of Footprints in SSF product		N/A	0.. 245475	1	32	A
SSF_Record						
Footprint Geometry						
Time and Position						
1 Time of observation	1	day	-0.01 .. 1.01	1	64	A
2 Radius of satellite from center of Earth at observation	2	km	6000 .. 8000	1	64	A
3 Colatitude of satellite at observation	3	deg	0 .. 180	1	32	A
4 Longitude of satellite at observation	4	deg	0 .. 360	1	32	A
5 Colatitude of Sun at observation	5	deg	0 .. 180	1	32	A
6 Longitude of Sun at observation	6	deg	0 .. 360	1	32	A
7 Colatitude of CERES FOV at TOA	7	deg	0 .. 180	1	32	A
8 Longitude of CERES FOV at TOA	8	deg	0 .. 360	1	32	A
9 Colatitude of CERES FOV at surface	9	deg	0 .. 180	1	32	A
10 Longitude of CERES FOV at surface	10	deg	0 . .360	1	32	A
11 Scan sample number	11	N/A	1 .. 660	1	16	A
12 Packet number	12	N/A	0 .. 32767	1	16	A
13 Cone angle of CERES FOV at satellite	13	deg	0 .. 90	1	32	A
14 Clock angle of CERES FOV at satellite wrt inertial velocity	14	deg	0 .. 360	1	32	A
15 Rate of change of cone angle	15	deg sec^{-1}	-100 .. 100	1	32	A
16 Rate of change of clock angle	16	deg sec^{-1}	-10 .. 10	1	32	A
17 Along-track angle of CERES FOV at TOA	17	deg	-20 .. 360	1	32	A
18 Cross-track angle of CERES FOV at TOA	18	deg	-90 .. 90	1	32	A
19 X component of satellite inertial velocity	19	km sec^{-1}	-10 .. 10	1	64	A
20 Y component of satellite inertial velocity	20	km sec^{-1}	-10 .. 10	1	64	A
21 Z component of satellite inertial velocity	21	km sec^{-1}	-10 .. 10	1	64	A
CERES Viewing Angles						
22 CERES viewing zenith at TOA	22	deg	0 .. 90	1	32	A
23 CERES solar zenith at TOA	23	deg	0 .. 180	1	32	A
24 CERES relative azimuth at TOA	24	deg	0 .. 360	1	32	A
25 CERES viewing azimuth at TOA wrt North	25	deg	0 .. 360	1	32	V
Surface_Map Parameters26						
26 Altitude of surface above sea level	26	m	-1000 .. 10000	1	32	A
27 Surface type index	27	N/A	1 .. 20	8	16	A
28 Surface type percent coverage	28	N/A	0 .. 100	8	16	A
Scene_Type						
29 CERES SW ADM type for inversion process	29	N/A	TBD	1	16	A
30 CERES LW ADM type for inversion process	30	N/A	TBD	1	16	A
31 CERES WN ADM type for inversion process	31	N/A	TBD	1	16	A

Table 2.7-1. Single Satellite Footprint, TOA and Sfc Flux, Clouds (SSF) (2 of 3)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Product Code
Footprint Radiation						
CERES Filtered Radiances						
32 CERES TOT filtered radiance, upwards	32	W m^{-2} sr^{-1}	0 .. 700	1	32	I
33 CERES SW filtered radiance, upwards	33	W m^{-2} sr^{-1}	-10 .. 510	1	32	I
34 CERES WN filtered radiance, upwards	34	W m^{-2} sr^{-1}	0 .. 50	1	32	I
35 IES quality flags	35	N/A	see Table 2.1-4	1	32	A
CERES Unfiltered Radiances						
36 CERES SW radiance, upwards	36	W m^{-2} sr^{-1}	-10 .. 510	1	32	A
37 CERES LW radiance, upwards	37	W m^{-2} sr^{-1}	0 .. 200	1	32	A
38 CERES WN radiance, upwards	38	W m^{-2} sr^{-1}	0 .. 50	1	32	A
TOA and Surface Flux						
39 CERES SW flux at TOA, upwards	39	W m^{-2}	0 .. 1400	1	32	A
40 CERES LW flux at TOA, upwards	40	W m^{-2}	0 .. 500	1	32	A
41 CERES WN flux at TOA, upwards	41	W m^{-2}	10 .. 400	1	32	A
42 CERES downward SW surface flux, Model A	42	W m^{-2}	0 .. 1400	1	32	A
43 CERES downward LW surface flux, Model A	43	W m^{-2}	0 .. 700	1	32	A
44 CERES downward WN surface flux, Model A	44	W m^{-2}	0 .. 250	1	32	A
45 CERES net SW surface flux, Model A	45	W m^{-2}	0 .. 1400	1	32	A
46 CERES net LW surface flux, Model A	46	W m^{-2}	-250 .. 50	1	32	A
47 CERES downward SW surface flux, Model B (TBD)	47	W m^{-2}	0 .. 1400	1	32	A
48 CERES downward LW surface flux, Model B	48	W m^{-2}	0 .. 700	1	32	A
49 CERES net SW surface flux, Model B (TBD)	49	W m^{-2}	0 .. 1400	1	32	A
50 CERES net LW surface flux, Model B	50	W m^{-2}	-250 .. 50	1	32	A
51 CERES spectral albedo	51	N/A	0 .. 1	6	32	I
52 CERES broadband surface albedo	52	N/A	0 .. 1	1	32	I
53 CERES LW surface emissivity	53	N/A	0 .. 1	1	32	I
54 CERES WN surface emissivity	54	N/A	0 .. 1	1	32	I
Full Footprint Area						
55 Number of imager pixels in CERES FOV	55	N/A	0 .. 9000	1	16	A
56 Imager percent coverage	56	N/A	0 .. 100	1	16	A
57 Precipitable water	57	cm	0.001 .. 10	1	32	A
58 Flag, Source of precipitable water	58	N/A	TBD	1	16	A
59 Shadowed pixels percent coverage (TBD)	59	N/A	0 .. 100	1	16	A
60 Notes on general procedure	60	N/A	TBD	1	16	A
61 Notes on Cloud Algorithms	61	N/A	TBD	1	16	A
62 Mean imager viewing zenith over CERES FOV	62	deg	0 .. 90	1	32	A
63 Mean imager relative azimuth over CERES FOV	63	deg	0 .. 360	1	32	A
Clear Footprint Area						
64 Clear area percent coverage	64	N/A	0 .. 100	1	16	A
65 Sunglint percent coverage	65	N/A	0 .. 100	1	16	A
66 Snow/Ice percent coverage	66	N/A	0 .. 100	1	16	A
67 Fire percent coverage	67	N/A	0 .. 100	1	16	A
68 Aerosol percent coverage	68	N/A	0 .. 100	1	16	A
69 Flag, Type of aerosol	69	N/A	0 .. 9999	1	16	A
70 Total aerosol visible optical depth in clear area	70	N/A	0 .. 2	1	32	A
71 Total aerosol effective radius in clear area	71	µm	0 .. 20	1	32	A
72 Imager-based surface skin temperature	72	K	175 .. 375	1	32	I
Cloudy Footprint Area						
Cloud Category Arrays is Array[2] of:						
73 Cloud category area percent coverage	73	N/A	0 .. 100	2	16	A
74 Mean cloud visible optical depth for cloud category	74	N/A	0 .. 400	2	32	A
75 Stddev of visible optical depth for cloud category	75	N/A	TBD	2	32	A
76 Mean logarithm of cloud visible optical depth for cloud category	76	N/A	0 .. 6	2	32	A
77 Stddev of logarithm of visible optical depth for cloud category	77	N/A	TBD	2	32	A
78 Mean cloud infrared emissivity for cloud category	78	N/A	0 .. 1	2	32	A
79 Stddev of cloud infrared emissivity for cloud category	79	N/A	TBD	2	32	A
80 Mean liquid water path for cloud category	80	g m^{-2}	TBD	2	32	A

Table 2.7-1. Single Satellite Footprint, TOA and Sfc Flux, Clouds (SSF) (3 of 3)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Product Code
Cloudy Footprint Area (Continued)						
Cloud Category Arrays (Continued) is Array[2] of:						
81 Stddev of liquid water path for cloud category	81	g m^{-2}	TBD	2	32	V
82 Mean ice water path for cloud category	82	g m^{-2}	TBD	2	32	A
83 Stddev of ice water path for cloud category	83	g m^{-2}	TBD	2	32	V
84 Mean cloud top pressure for cloud category	84	hPa	0 .. 1100	2	32	A
85 Stddev of cloud top pressure for cloud category	85	hPa	TBD	2	32	V
86 Mean cloud effective pressure for cloud category	86	hPa	0 .. 1100	2	32	A
87 Stddev of cloud effective pressure for cloud category	87	hPa	TBD	2	32	A
88 Mean cloud effective temperature for cloud category	88	K	100 .. 350	2	32	A
89 Stddev of cloud effective temperature for cloud category	89	K	TBD	2	32	A
90 Mean cloud effective height for cloud category	90	km	0 .. 20	2	32	A
91 Stddev of cloud effective height for cloud category	91	km	TBD	2	32	V
92 Mean cloud bottom pressure for cloud category	92	hPa	0 .. 1100	2	32	A
93 Stddev of cloud bottom pressure for cloud category	93	hPa	TBD	2	32	V
94 Mean water particle radius for cloud category	94	µm	TBD	2	32	A
95 Stddev of water particle radius for cloud category	95	µm	TBD	2	32	A
96 Mean ice particle effective diameter for cloud category	96	µm	TBD	2	32	A
97 Stddev of ice particle effective diameter for cloud category	97	µm	TBD	2	32	A
98 Mean cloud particle phase for cloud category	98	N/A	1 .. 2	2	32	A
99 Stddev of cloud particle phase for cloud category	99	N/A	0 .. 1	2	32	V
100 Mean vertical aspect ratio for cloud category (TBD)	100	N/A	0 .. 20	2	32	A
101 Stddev of vertical aspect ratio for cloud category (TBD)	101	N/A	TBD	2	32	V
102 Percentiles of visible optical depth for cloud category	102	N/A	TBD	2 x 13	32	I
103 Percentiles of IR emissivity for cloud category	103	N/A	TBD	2 x 13	32	I
Overlap Footprint Area						
104 Overlap condition weighted area percentage	104	N/A	0 .. 100	4	16	A
Footprint Imager Radiance Statistics						
105 Imager channel central wavelength	105	µm	0.4 .. 15.0	5	32	I
106 Clear area percent coverage at imager resolution	106	N/A	0 .. 100	1	16	I
107 Mean of imager radiances over clear area	107	W m^{-2} sr^{-1} μm^{-1}	TBD	5	32	I
108 Stddev of imager radiances over clear area	108	W m^{-2} sr^{-1} μm^{-1}	TBD	5	32	I
109 Overcast cloud area percent coverage at imager resolution	109	N/A	0 .. 100	1	16	I
110 Mean of imager radiances over overcast cloud area	110	W m^{-2} sr^{-1} μm^{-1}	TBD	5	32	I
111 Stddev of imager radiances over overcast cloud area	111	W m^{-2} sr^{-1} μm^{-1}	TBD	5	32	I
112 Mean of imager radiances over full CERES FOV	112	W m^{-2} sr^{-1} μm^{-1}	TBD	5	32	I
113 Stddev of imager radiances over full CERES FOV	113	W m^{-2} sr^{-1} μm^{-1}	TBD	5	32	I
114 5th percentile of imager radiances over full CERES FOV	114	W m^{-2} sr^{-1} μm^{-1}	TBD	5	32	I
115 95th percentile of imager radiances over full CERES FOV	115	W m^{-2} sr^{-1} μm^{-1}	TBD	5	32	I
116 Mean of imager radiances over cloud layer 1 (no overlap)	116	W m^{-2} sr^{-1} μm^{-1}	TBD	5	32	I
117 Stddev of imager radiances over cloud layer 1 (no overlap)	117	W m^{-2} sr^{-1} μm^{-1}	TBD	5	32	I
118 Mean of imager radiances over cloud layer 2 (no overlap)	118	W m^{-2} sr^{-1} μm^{-1}	TBD	5	32	I
119 Stddev of imager radiances over cloud layer 2 (no overlap)	119	W m^{-2} sr^{-1} μm^{-1}	TBD	5	32	I
120 Mean of imager radiances over cloud layer 1 and 2 overlap	120	W m^{-2} sr^{-1} μm^{-1}	TBD	5	32	I
121 Stddev of imager radiances over cloud layer 1 and 2 overlap	121	W m^{-2} sr^{-1} μm^{-1}	TBD	5	32	I

Total Meta Bits/File:	1360
Total Data Bits/Record:	8528
Total Records/File:	245475
Total Data Bits/File:	2093410800

Total MegaBytes / Hour	261.7
Total GigaBytes / Day	6.3

SSF parameter distribution is as follows: (See Product Code Key)

Archival Parameters	2.6/Giga Bytes/Day (41.5%)
Internal Parameters	3.3/Giga Bytes/Day (52.9%)
Validation Parameters	0.4/Giga Bytes/Day (5.6%)

2.8 Clear Reflectance History (CRH)

EOSDIS Product Code: CER16

The Clear Reflectance/Temperature History (CRH) data are organized on a global equal-area grid that is approximately 1/6-degree by 1/6-degree. The data coverage is 24 hours and is updated every 10 days. The data product consists of a product header followed by fixed-length records organized according to the grid pattern. Each record has:

- Visible albedo
- Temperature
- Viewing angles

The parameters are derived from cloud imager measurements by Subsystem 4. The CRH product is the same structure for both Moderate Resolution Imaging Spectrometer (MODIS) values and Visible Infrared Scanner (VIRS) values. There is a source indication on the header record.

The CRH is archived because the product is needed for reprocessing. A complete listing of parameters for this data product can be found in Table 2.8-1.

Level: 3
Type: Archival
Frequency: Every 10 Days

Portion of Globe Covered
File: Entire Globe
Record: 1/6-Deg by 1/6-Deg

Time Interval Covered
File: Life of Mission
Record: Every 10 Days

Portion of Atmosphere Covered
File: Surface Reference

Table 2.8-1. Clear Reflectance History (CRH)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
CRH						
CRH header record		N/A	N/A	1	2048	
Record_CRH is Array[2332800] of:						
Grid_CRH						
Day of observation	1	day	Mission Life	1	32	1
Time of observation	2	day	0 .. 1	1	32	2
Visible albedo for collimated, overhead sun illumination	3	N/A	0 .. 1	1	16	3
Temperature derived from 3.7 µm imager channel	4	K	TBD	1	16	4
Temperature derived from 11 µm imager channel	5	K	TBD	1	16	5
Solar zenith angle from imager	6	deg	0 .. 90	1	16	6
Mean imager viewing zenith over CERES FOV	7	deg	0 .. 90	1	16	7
Mean imager relative azimuth angle over CERES FOV	8	deg	0 .. 360	1	16	8
Narrowband ADM Type	9	N/A	TBD	1	16	9

Total Meta Bits/File:	2048
Total Data Bits/Record:	176
Total Records/File:	2332800
Total Data Bits/File:	410,572,800
Total Bits/File:	410,574,848

2.9 Clouds and Radiative Swath (CRS)

EOSDIS Product Code: CER04

The Clouds and Radiative Swath (CRS) product is produced by the CERES Instantaneous Surface and Atmospheric Radiation Budget (SARB) Subsystem. Each CRS record contains instantaneous data for one hour from one CERES instrument. The CRS contains the same data as the SSF, with the addition of longwave and shortwave vertical flux profile data.

Each CERES record contains:

- CERES FOV geometry, time, and scene data
- CERES FOV satellite altitude radiance data
- CERES FOV estimated TOA flux data
- CERES FOV surface flux data
- CERES FOV total-sky area data
- CERES FOV clear-sky area data
- Cloud category properties for two of four cloud height categories (low (L), lower middle (LM), upper middle (UM), and high (H)) over the CERES FOV
- CERES FOV Data for four cloud overlap conditions
- FOV imager radiance statistics for five imager channels
- CERES FOV surface radiative parameters
- Atmospheric flux profiles for both clear-sky and total-sky at the surface, 500hPa, the tropopause, and the TOA over the CERES FOV
- Flux adjustments (tuned-untuned) for clear-sky and total-sky at the surface and TOA over the CERES FOV
- Adjustment parameters for clear-sky (note that these are calculated for both clear-sky and total-sky FOV)
- Adjustment parameters for the two cloud categories over the CERES FOV

A complete listing of parameters for this data product can be found in Table 2.9-1.

Level: 2
Type: Archival
Frequency: 1/ Hour

Time Interval Covered
File: 1 Hour
Record: 1/100-Second

Portion of Globe Covered
File: Satellite Swath
Record: 1 CERES FOV

Portion of Atmosphere Covered
File: Surface to TOA

Table 2.9-1. Clouds and Radiative Swath (CRS) (1 of 4)

Product Code Key:			
	A:	Archival Parameter	Parameters of interest to the general user community
	I:	Internal Parameter	Parameters required by subsequent subsystems or reprocessing
	V:	Validation Parameter	Parameters used for validation

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Product Code
CRS Header (Meta Data)						
Product ID		N/A	TBD	1	16	A
Day and time at hour start		N/A	ASCII string	1	216	A
Character name of satellite		N/A	ASCII string	1	64	A
Character name of CERES instrument		N/A	ASCII string	1	32	A
Character name of high resolution imager instrument		N/A	ASCII string	1	64	A
Number of imager channels used		N/A	1 .. 20	1	16	A
Central wavelengths of imager channels		µm	0.4 .. 15.0	20	32	A
Earth-Sun distance		AU	.98 .. 1.02	1	32	A
Azimuth scan mode		N/A	ASCII string	1	32	A
Instrument software version number used to produce IES (SS 1.0)		N/A	TBD	1	16	A
Cloud properties software version number (SS 4.1- 4.3)		N/A	TBD	1	16	A
Convolution of imager with CERES software version number (SS 4.4)		N/A	TBD	1	16	A
TOA and Surface Estimation software version number (SS 4.5 - 4.6)		N/A	TBD	1	16	A
Compute SARB software version number (SS 5.0)		N/A	TBD	1	16	A
Day and time CRS generated		N/A	ASCII string	1	152	A
Number of FOVs in CRS product		N/A	0 .. 245275	1	32	A
CERES FOV Geometry, Time, and Scene						
Time of observation	1	day	-0.01 .. 1.01	1	64	A
Radius of satellite from center of Earth at observation	2	km	6000 .. 8000	1	64	A
Colatitude of satellite at observation	3	deg	0 .. 180	1	32	A
Longitude of satellite at observation	4	deg	0 .. 360	1	32	A
Colatitude of Sun at observation	5	deg	0 .. 180	1	32	A
Longitude of Sun at observation	6	deg	0 .. 360	1	32	A
Colatitude of CERES FOV at TOA	7	deg	0 .. 180	1	32	A
Longitude of CERES FOV at TOA	8	deg	0 .. 360	1	32	A
Colatitude of CERES FOV at surface	9	deg	0 .. 180	1	32	A
Longitude of CERES FOV at surface	10	deg	0 .. 360	1	32	A
Scan sample number	11	N/A	1 .. 660	1	16	A
Packet number	12	N/A	0 .. 32767	1	16	A
Cone angle of CERES FOV at satellite	13	deg	0 .. 90	1	32	A
Clock angle of CERES FOV at satellite wrt inertial velocity	14	deg	0 .. 360	1	32	A
Rate of change of cone angle	15	deg sec^{-1}	-100 .. 100	1	32	A
Rate of change of clock angle	16	deg sec^{-1}	-10 .. 10	1	32	A
Along-track angle of CERES FOV at TOA	17	deg	-20 .. 360	1	32	A
Cross-track angle of CERES FOV at TOA	18	deg	-90 .. 90	1	32	A
X component of satellite inertial velocity vector	19	km sec^{-1}	-10 .. 10	1	64	A
Y component of satellite inertial velocity vector	20	km sec^{-1}	-10 .. 10	1	64	A
Z component of satellite inertial velocity vector	21	km sec^{-1}	-10 .. 10	1	64	A
CERES viewing zenith angle at TOA	22	deg	0 .. 90	1	32	A
CERES solar zenith angle at TOA	23	deg	0 .. 180	1	32	A
CERES relative azimuth angle at TOA	24	deg	0 .. 360	1	32	A
CERES viewing azimuth angle at TOA wrt North	25	deg	0 .. 360	1	32	V
Surface altitude above sea level	26	m	-1000 .. 10000	1	32	A
Surface type index	27	N/A	1 .. 20	8	16	A
Surface type percent coverage	28	N/A	0 .. 100	8	16	A
CERES SW ADM type for inversion process	29	N/A	TBD	1	16	A
CERES LW ADM type for inversion process	30	N/A	TBD	1	16	A
CERES WN ADM type for inversion process	31	N/A	TBD	1	16	A
CERES FOV Satellite Altitude Radiance Data						
CERES TOT filtered radiance, satellite altitude, upwards	32	W $m^{-2}sr^{-1}$	0 .. 700	1	32	I
CERES SW filtered radiance, satellite altitude, upwards	33	W $m^{-2}sr^{-1}$	-10 .. 510	1	32	I
CERES WN filtered radiance, satellite altitude, upwards	34	W $m^{-2}sr^{-1}$	0 .. 50	1	32	I
IES quality flags	35	N/A	see Table 2.1-4	1	32	A
CERES SW unfiltered radiance, satellite altitude, upwards	36	W $m^{-2}sr^{-1}$	-10 .. 510	1	32	A
CERES LW unfiltered radiance, satellite altitude, upwards	37	W $m^{-2}sr^{-1}$	0 .. 200	1	32	A
CERES WN unfiltered radiance, satellite altitude, upwards	38	W $m^{-2}sr^{-1}$	0 .. 50	1	32	A

Table 2.9-1. Clouds and Radiative Swath (CRS) (2 of 4)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Product Code
CERES FOV Estimated TOA Flux Data						
CERES SW flux, TOA, upwards	39	W m^{-2}	0 .. 1400	1	32	A
CERES LW flux, TOA, upwards	40	W m^{-2}	0 .. 500	1	32	A
CERES WN flux, TOA, upwards	41	W m^{-2}	10 .. 400	1	32	A
CERES FOV Surface Flux Data						
CERES SW flux, surface, downwards, Model A	42	W m^{-2}	0 .. 1400	1	32	A
CERES LW flux, surface, downwards, Model A	43	W m^{-2}	0 .. 700	1	32	A
CERES WN flux, surface, downwards, Model A	44	W m^{-2}	0 .. 250	1	32	A
CERES SW flux, surface, net, Model A	45	W m^{-2}	0 .. 1400	1	32	A
CERES LW flux, surface, net, Model A	46	W m^{-2}	-250 .. 50	1	32	A
CERES SW flux, surface, downwards, Model B (TBD)	47	W m^{-2}	0 .. 1400	1	32	A
CERES LW flux, surface, downwards, Model B	48	W m^{-2}	0 .. 700	1	32	A
CERES SW flux, surface, net, Model B (TBD)	49	W m^{-2}	0 .. 1400	1	32	A
CERES LW flux, surface, net, Model B	50	W m^{-2}	-250 .. 50	1	32	A
CERES spectral albedo	51	N/A	0 .. 1	6	32	I
CERES broadband surface albedo (uncorrected)	52	N/A	0 .. 1	1	32	I
CERES LW surface emissivity	53	N/A	0 .. 1	1	32	I
CERES WN surface emissivity	54	N/A	0 .. 1	1	32	I
CERES FOV Total-Sky Area Data						
Number of imager pixels in CERES FOV	55	N/A	0 .. 9000	1	16	A
Imager percent coverage	56	N/A	0 .. 100	1	16	A
Precipitable water	57	cm	0.001 .. 10.000	1	32	A
Flag, Source precipitable water	58	N/A	TBD	1	16	A
Shadowed pixels percent coverage (TBD)	59	N/A	0 .. 100	1	16	A
Notes on general procedures	60	N/A	TBD	1	16	A
Notes on cloud algorithms	61	N/A	TBD	1	16	A
Imager viewing zenith angle over CERES FOV, mean	62	deg	0 .. 90	1	32	A
Imager relative azimuth angle over CERES FOV, mean	63	deg	0 .. 360	1	32	A
CERES FOV Clear-Sky Area Data						
Clear area percent coverage	64	N/A	0 .. 100	1	16	A
Sunglint percent coverage	65	N/A	0 .. 100	1	16	A
Snow/Ice percent coverage	66	N/A	0 .. 100	1	16	A
Fire percent coverage	67	N/A	0 .. 100	1	16	A
Aerosol percent coverage	68	N/A	0 .. 100	1	16	A
Flag, Aerosol type	69	N/A	0 .. 9999	1	16	A
Total aerosol visible optical depth, clear-sky area	70	N/A	0 .. 2	1	32	A
Total aerosol effective radius, clear-sky area	71	µm	0 .. 20	1	32	A
Imager-based surface skin temperature	72	K	175 .. 375	1	32	I
Cloud Properties for Two of Four Cloud Layers (Cloud layers are Low (L), Lower Middle (LM), Upper Middle (UM), and High (H))						
Area percent coverage	73	N/A	0 .. 100	2	16	A
Cloud visible optical depth, linear, mean	74	N/A	0 .. 400	2	32	A
Cloud visible optical depth, linear, std	75	N/A	TBD	2	32	A
Cloud visible optical depth, logarithmic, mean	76	N/A	0 .. 6	2	32	A
Cloud visible optical depth, logarithmic, std	77	N/A	TBD	2	32	A
Cloud infrared emissivity, mean	78	N/A	0 .. 1	2	32	A
Cloud infrared emissivity, std	79	N/A	TBD	2	32	A
Liquid water path, mean	80	g m^{-2}	TBD	2	32	A
Liquid water path, std	81	g m^{-2}	TBD	2	32	V
Ice water path, mean	82	g m^{-2}	TBD	2	32	A
Ice water path, std	83	g m^{-2}	TBD	2	32	V
Cloud top pressure, mean	84	hPa	0 .. 1100	2	32	A
Cloud top pressure, std	85	hPa	TBD	2	32	V
Cloud effective pressure, mean	86	hPa	0 .. 1100	2	32	A
Cloud effective pressure, std	87	hPa	TBD	2	32	A
Cloud effective temperature, mean	88	K	100 .. 350	2	32	A
Cloud effective temperature, std	89	K	TBD	2	32	A
Cloud effective height, mean	90	km	0 .. 20	2	32	A
Cloud effective height, std	91	km	TBD	2	32	V
Cloud bottom pressure, mean	92	hPa	0 .. 1100	2	32	A
Cloud bottom pressure, std	93	hPa	TBD	2	32	V

Table 2.9-1. Clouds and Radiative Swath (CRS) (3 of 4)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Product Code
Cloud Properties (Continued)						
Water particle radius, mean	94	µm	TBD	2	32	A
Water particle radius, std	95	µm	TBD	2	32	A
Ice particle effective diameter, mean	96	µm	TBD	2	32	A
Ice particle effective diameter, std	97	µm	TBD	2	32	A
Cloud particle phase, mean	98	N/A	1 .. 2	2	32	A
Cloud particle phase, std	99	N/A	0 .. 1	2	32	V
Vertical aspect ratio, mean (TBD)	100	N/A	0 .. 20	2	32	A
Vertical aspect ratio, std (TBD)	101	N/A	TBD	2	32	V
Visible optical depth, 13 percentiles	102	N/A	TBD	26	32	I
IR emissivity, 13 percentiles	103	N/A	TBD	26	32	I
CERES FOV Data for 4 Cloud Overlap Conditions						
Overlap condition weighted area percentage	104	N/A	0 .. 100	4	16	A
FOV Imager Radiance Statistics						
Imager channel central wavelength (5 channels)	105	µm	0.4 .. 15.0	5	32	I
Clear area percent coverage at imager resolution	106	N/A	0 .. 100	1	16	I
Imager radiance, clear-sky area, mean	107	$W\ m^{-2}sr^{-1}\mu m^{-1}$	TBD	5	32	I
Imager radiance, clear-sky area, std	108	$W\ m^{-2}sr^{-1}\mu m^{-1}$	TBD	5	32	I
Overcast area percent coverage at imager resolution	109	N/A	0 .. 100	1	16	I
Imager radiance, overcast area, mean	110	$W\ m^{-2}sr^{-1}\mu m^{-1}$	TBD	5	32	I
Imager radiance, overcast area, std	111	$W\ m^{-2}sr^{-1}\mu m^{-1}$	TBD	5	32	I
Imager radiance over full CERES FOV, mean	112	$W\ m^{-2}sr^{-1}\mu m^{-1}$	TBD	5	32	I
Imager radiance over full CERES FOV, std	113	$W\ m^{-2}sr^{-1}\mu m^{-1}$	TBD	5	32	I
Imager radiance over full CERES FOV, 5th percentile	114	$W\ m^{-2}sr^{-1}\mu m^{-1}$	TBD	5	32	I
Imager radiance over full CERES FOV, 95th percentile	115	$W\ m^{-2}sr^{-1}\mu m^{-1}$	TBD	5	32	I
Imager radiance over cloud layer 1, no overlap, mean	116	$W\ m^{-2}sr^{-1}\mu m^{-1}$	TBD	5	32	I
Imager radiance over cloud layer 1, no overlap, std	117	$W\ m^{-2}sr^{-1}\mu m^{-1}$	TBD	5	32	I
Imager radiance over cloud layer 2, no overlap, mean	118	$W\ m^{-2}sr^{-1}\mu m^{-1}$	TBD	5	32	I
Imager radiance over cloud layer 2, no overlap, std	119	$W\ m^{-2}sr^{-1}\mu m^{-1}$	TBD	5	32	I
Imager radiance over cloud layers 1 and 2, overlap, mean	120	$W\ m^{-2}sr^{-1}\mu m^{-1}$	TBD	5	32	I
Imager radiance over cloud layers 1 and 2, overlap, std	121	$W\ m^{-2}sr^{-1}\mu m^{-1}$	TBD	5	32	I
Surface Radiative Parameters						
Photosynthetically active radiation, surface (TBD)	122	$W\ m^{-2}$	0 .. 780	1	32	A
Direct/diffuse ratio, surface (TBD)	123	N/A	0 .. 30	1	32	A
Corrected initial broadband surface albedo	124	N/A	0 .. 1	1	32	A
Atmospheric Flux Profile for Clear-sky and Total-sky (Atmospheric levels in profile are surface, 500 hPa, tropopause and TOA)						
Number atmospheric levels	125	N/A	0 .. 4	1	16	A
Level pressures	126	hPa	0 .. 1100	4	32	A
SW flux, atmospheric level, upwards, tuned	127	$W\ m^{-2}$	0 .. 1400	8	32	A
SW flux, atmospheric level, downwards, tuned	128	$W\ m^{-2}$	0 .. 1400	8	32	A
LW flux, atmospheric level, upwards, tuned	129	$W\ m^{-2}$	0 .. 700	8	32	A
LW flux, atmospheric level, downwards, tuned	130	$W\ m^{-2}$	0 .. 600	8	32	A
Flux Adjustments (Tuned - Untuned) for Clear-sky and Total-sky						
SW flux, surface, downwards, delta	131	$W\ m^{-2}$	-1400 .. 1400	2	32	A
SW flux, surface, upwards, delta	132	$W\ m^{-2}$	-1400 .. 1400	2	32	A
SW flux, TOA, upwards, delta	133	$W\ m^{-2}$	-1400 .. 1400	2	32	A
LW flux, surface, downwards, delta	134	$W\ m^{-2}$	-500 .. 500	2	32	A
LW flux, surface, upwards, delta	135	$W\ m^{-2}$	-500 .. 500	2	32	A
LW flux, TOA, upwards, delta	136	$W\ m^{-2}$	-500 .. 500	2	32	A
Adjustment Parameters for Clear Skies						
Adjusted precipitable water, delta	137	cm	-10 .. 10	1	32	A
Adjusted surface albedo, delta	138	N/A	-1 .. 1	1	32	A
Adjusted aerosol optical depth, delta	139	N/A	-2 .. 2	1	32	A
Adjusted skin temperature, delta	140	K	TBD	1	32	A
Adjustment Parameters for Two Cloud Layers						
Adjusted mean visible optical depth (logarithmic), delta	141	N/A	-400 .. 400	2	32	A
Adjusted mean cloud fractional area, delta	142	N/A	-1 .. 1	2	32	A
Adjusted mean cloud effective temperature, delta	143	K	TBD	2	32	A

Table 2.9-1. Clouds and Radiative Swath (CRS) (4 of 4)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Product Code
Auxiliary Adjustment Quality Control Flags						
Constrainment status flag	144	N/A	TBD	1	32	A
Sigma table configuration flag	145	N/A	TBD	1	32	A

Total Meta Bits/File:	1376
Total Data Bits/Record:	10560
Total Records/File:	245475
Total Data Bits/File:	2592216000
Total Bits/File:	2592217376

2.10 Monthly Gridded Single Satellite Fluxes and Clouds (FSW)

EOSDIS Product Code: CER05

The Monthly Gridded Single Satellite Fluxes and Clouds (FSW) archival data product contains hourly single satellite flux and cloud parameters averaged over 1.0-degree regions. Input to the FSW Subsystem is the Clouds and Radiative Swath (CRS) archival data product. Each FSW covers a single month swath from a single CERES instrument mounted on one satellite. The product has a product header and multiple records; each record contains spatially averaged data for an individual region.

The major categories of data output on the FSW are as follows:

- Region data
- Total-sky radiative fluxes at TOA, surface, and atmospheric levels
- Clear-sky radiative fluxes at TOA, surface, and atmospheric levels
- Cloud overlap conditions
- Cloud category properties
- Column-averaged cloud properties
- Angular model scene classes
- Surface-only data
- Adjustment parameters

FSW is an archival product generated on a monthly basis. Initially, at the launch of the TRMM spacecraft, this product will be produced in validation mode once every 3 months, or for 4 data months a year. During the first 18 months after the launch of TRMM, the CERES Science Team will derive a production quality set of ADMs, which are needed to produce the SW and LW instantaneous fluxes. Eighteen months after the launch of TRMM, this product will be archived and will contain SW and LW fluxes at the tropopause and at the 500 hPa pressure level, in addition to fluxes at TOA and at the surface. A complete listing of parameters for this data product can be found in Table 2.10-1.

Level: 3
Type: Archival
Frequency: 1/Month

Time Interval Covered
File: Month
Record: Hour

Portion of Globe Covered
File: Gridded Satellite Swath
Record: 1.0-Deg Equal-angle Regions

Portion of Atmosphere Covered
File: TOA, Surface, and Atmospheric Pressure Levels

Table 2.10-1. Monthly Gridded Single Satellite Fluxes and Clouds (FSW) (1 of 3)

Description	Parameter Num	Unit	Range	Elements/ Record	Bits/ Elem	Elem Num
FSW Header						
CERES Data Product Code		N/A	N/A	1	32	
CERES Spacecraft Identification Code		N/A	N/A	1	32	
CERES Instrument Identification code		N/A	N/A	1	32	
Zone Number		N/A	1 .. 180	1	32	
Data Year		N/A	1996 .. 2099	1	32	
Data Month		N/A	1 .. 12	1	32	
Number of hours per region		N/A	0 .. 744	360	32	
Data Date Processed		N/A	N/A	1	136	
FSW Record						
Spatially Averaged Region Parameters						
Time and Position Data						
Key Footprint Parameters						
Julian Time	1	day	-0.01 .. 1.0	1	32	1
Sun colatitude	2	deg	0.0 .. 180.0	1	32	2
Sun longitude	3	deg	0.0 .. 360.0	1	32	3
Relative azimuth angle at TOA	4	deg	0.0 .. 360.0	1	32	4
Cosine of solar zenith angle at TOA	5	N/A	0.0 .. 1.0	1	32	5
Spacecraft zenith angle	6	deg	0.0 .. 90.0	1	32	6
Region ID						
Region number	7	N/A	1 .. 64800	1	32	7
Hourbox number	8	N/A	1 .. 744	1	32	8
Number of Footprints in region	9	N/A	1 .. 40	1	32	9
Other Regional Parameters						
Altitude of surface above sea level	10	m	-1000 .. 10000	1	32	10
Surface type percentage	11	percent	0.0 .. 100.0	20	32	11
Sunglint percent coverage	12	percent	0.0 .. 100.0	1	32	31
Snow/Ice percent coverage	13	percent	0.0 .. 100.0	1	32	32
Smoke percent coverage	14	percent	0.0 .. 100.0	1	32	33
Fire percent coverage	15	percent	0.0 .. 100.0	1	32	34
Aerosol percent coverage	16	percent	0.0 .. 100.0	1	32	35
Flag, Aerosol type	17	N/A	0.0-9999.0	1	32	36
Imager radiance, clear-sky area	18	$W\ m^{-2}sr^{-1}\mu m^{-1}$	TBD	5	32	37
Total aerosol visible optical depth, clear-sky area	19	N/A	0.0 .. 2.0	1	32	42
Total aerosol effective radius, clear-sky area	20	µm	0.0 .. 20.0	1	32	43
Imager percent coverage	21	percent	0.0 .. 100.0	1	32	44
Precipitable Water	22	cm	0.0001 .. 10.0	1	32	45
Flag, Source precipitable water	23	N/A	TBD	1	32	46
Shadowed pixels percent coverage (TBD)	24	percent	0.0 .. 100.0	1	32	47
Imager viewing zenith angle over CERES FOV	25	deg	0.0 .. 90.0	1	32	48
Imager relative azimuth angle over CERES FOV	26	deg	0.0 .. 360.0	1	32	49
Imager channel identifier	27	N/A	1 .. 20	5	32	50
Imager radiance over CERES FOV, 5th percentile	28	$W\ m^{-2}sr^{-1}\mu m^{-1}$	TBD	5	32	55
Imager radiance over CERES FOV	29	$W\ m^{-2}sr^{-1}\mu m^{-1}$	TBD	5	32	60
Imager radiance over CERES FOV, 95th percentile	30	$W\ m^{-2}sr^{-1}\mu m^{-1}$	TBD	5	32	65
Spatially Averaged Radiative Flux Parameters						
TOA Clear-Sky Fluxes is Array[3] of:						
Upward SW flux at TOA: mean, std, num obs	31	$W\ m^{-2}$	0.0 .. 1400.0	3	32	70
Upward LW flux at TOA: mean, std, num obs	32	$W\ m^{-2}$	100.0 .. 500.0	3	32	73
Upward LW window flux at TOA: mean, std, num obs	33	$W\ m^{-2}$	0.0 .. 800.0	3	32	76
Albedo: mean, std, num obs	34	N/A	0.0 .. 1.0	3	32	79
TOA Total-Sky Fluxes is Array[3] of:						
Upward SW flux at TOA: mean, std, num obs	35	$W\ m^{-2}$	0.0 .. 1400.0	3	32	82
Upward LW flux at TOA: mean, std, num obs	36	$W\ m^{-2}$	100.0 .. 500.0	3	32	85
Upward LW window flux at TOA: mean, std, num obs	37	$W\ m^{-2}$	0.0 .. 800.0	3	32	88
Albedo: mean, std, num obs	38	N/A	0.0 .. 1.0	3	32	91

Table 2.10-1. Monthly Gridded Single Satellite Fluxes and Clouds (FSW) (2 of 3)

Description	Parameter Num	Unit	Range	Elements/ Record	Bits/ Elem	Elem Num
Atmospheric Clear-Sky Flux Profiles for 4 Layers						
(Layers: sfc, 500hPa, tropopause, and TOA AVG) is Array[3] of:						
Downward SW flux: mean, std, num obs	39	W m^{-2}	0.0 .. 1400.0	12	32	94
Upward SW flux: mean, std, num obs	40	W m^{-2}	0.0 .. 1400.0	12	32	106
Downward LW flux: mean, std, num obs	41	W m^{-2}	0.0 .. 600.0	12	32	118
Upward LW flux: mean, std, num obs	42	W m^{-2}	0.0 .. 700.0	12	32	130
Atmospheric Total-Sky Flux Profiles for 4 Layers						
(Layers: sfc, 500hPa, tropopause, and TOA AVG) is Array[3] of:						
Downward SW flux: mean, std, num obs	43	W m^{-2}	0.0 .. 1400.0	12	32	142
Upward SW flux: mean, std, num obs	44	W m^{-2}	0.0 .. 1400.0	12	32	154
Downward LW flux: mean, std, num obs	45	W m^{-2}	0.0 .. 600.0	12	32	166
Upward LW flux: mean, std, num obs	46	W m^{-2}	0.0 .. 700.0	12	32	178
Clear-Sky Flux_Adjustments (Tuned-Untuned) is Array[3] of:						
Surface Layer:						
Downward SW flux: mean, std, num obs	47	W m^{-2}	-1400.0 .. 1400.0	3	32	190
Upward SW flux: mean, std, num obs	48	W m^{-2}	-1400.0 .. 1400.0	3	32	193
Downward LW flux: mean, std, num obs	49	W m^{-2}	-500.0 .. 500.0	3	32	196
Upward LW flux: mean, std, num obs	50	W m^{-2}	-500.0 .. 500.0	3	32	199
TOA Layer:						
Upward Sw flux: mean, std, num obs	51	W m^{-2}	-1400.0 .. 1400.0	3	32	202
Upward LW flux: mean, std, num obs	52	W m^{-2}	-500.0 .. 500.0	3	32	205
Total-Sky Flux_Adjustments (Tuned-Untuned) is Array[3] of:						
Surface Layer:						
Downward SW flux: mean, std, num obs	53	W m^{-2}	-1400.0 .. 1400.0	3	32	208
Upward SW flux: mean, std, num obs	54	W m^{-2}	-1400.0 .. 1400.0	3	32	211
Downward LW flux: mean, std, num obs	55	W m^{-2}	-500.0 .. 500.0	3	32	214
Upward LW flux: mean, std, num obs	56	W m^{-2}	-500.0 .. 500.0	3	32	217
TOA Layer:						
Upward Sw flux: mean, std, num obs	57	W m^{-2}	-1400.0 .. 1400.0	3	32	220
Upward LW flux: mean, std, num obs	58	W m^{-2}	-500.0 .. 500.0	3	32	223
Emissivity						
LW surface emissivity	59	N/A	0.0 .. 1.0	1	32	226
WN surface emissivity	60	N/A	0.0 .. 1.0	1	32	227
Spatially Average Surface Data						
Spectral Albedo	61	N/A	0.0 .. 1.0	6	32	228
Broadband Surface Albedo (uncorrected)	62	N/A	0.0 .. 1.0	1	32	234
Surface Skin Temperature	63	K	175.0 .. 375.0	1	32	235
Surface Only Data						
Photosynthetically active radiation	64	W m^{-2}	0.0 .. 780.0	1	32	236
Direct/Diffuse	65	N/A	0.0 .. 30.0	1	32	237
Corrected initial broadband albedo	66	N/A	0.0 .. 1.0	1	32	238
Spatially Averaged Cloud Parameters						
Spatially Averaged Cloud Overlap Conditions						
Overlap condition weighted area percentage	67	percent	0.0 .. 100.0	11	32	239
Spatially Averaged Cloud Category Data for 4 Layers						
(High, Upper Middle, Lower Middle, and Low)						
Spatially Averaged Cloud Area Fractions						
Overcast percent coverage	68	percent	0.0 .. 100.0	4	32	250
Total percent coverage	69	percent	0.0 .. 100.0	4	32	254
Spatially Averaged Cloud Properties is Array[3] of:						
Cloud effective pressure: mean, std, num obs	70	hPa	0.0 .. 1100.0	12	32	258
Cloud effective temperature: mean, std, num obs	71	K	100.0 .. 350.0	12	32	270
Cloud effective altitude: mean, std, num obs	72	km	0.0 .. 20.0	12	32	282
Cloud top pressure: mean, std, num obs	73	hPa	0.0 .. 1100.0	12	32	294
Cloud bottom pressure: mean, std, num obs	74	hPa	0.0 .. 1100.0	12	32	306
Cloud particle phase: mean, std, num obs	75	fraction	1.0 .. 2.0	12	32	318
Liquid water path: mean, std, num obs	76	g m^{-2}	TBD	12	32	330
Ice water path: mean, std, num obs	77	g m^{-2}	TBD	12	32	342
Liquid particle radius: mean, std, num obs	78	micron	TBD	12	32	354
Ice particle effective diameter: mean, std, num obs	79	micron	TBD	12	32	366
Visible optical depth (linear): mean, std, num obs	80	N/A	0.0 .. 100.0	12	32	378
Visible optical depth (logarithmic): mean, std, num obs	81	N/A	0.0 .. 100.0	12	32	390
Infrared emissivity: mean, std, num obs	82	N/A	0.0 .. 2.0	12	32	402

Table 2.10-1. Monthly Gridded Single Satellite Fluxes and Clouds (FSW) (3 of 3)

Description	Parameter Num	Unit	Range	Elements/ Record	Bits/ Elem	Elem Num
C*loud vertical aspect ratio: mean, std, num obs	83	N/A	TBD	12	32	414
Spatially Averaged Adjustment Parameters						
Adjusted visible optical depth	84	N/A	0.0 .. 400.0	4	32	426
Adjusted cloud fractional area	85	N/A	0.0 .. 100.0	4	32	430
Adjusted cloud effective temperature	86	K	0.0 .. 250.0	4	32	434
Spatially Averaged Weighted Column						
Averaged Cloud Properties for 5 Weightings						
(Five Weightings: SW, LW TOA, SFC LW, LWP, IWP)						
Spatially Averaged Cloud Area Fractions						
Overcast percent coverage	87	percent	0.0 .. 100.0	5	32	438
Total percent coverage	88	percent	0.0 .. 100.0	5	32	443
Spatially Averaged Cloud Properties is Array[3] of:						
Cloud effective pressure: mean, std, num obs	89	hPa	0.0 .. 1100.0	15	32	448
Cloud effective temperature: mean, std, num obs	90	K	100.0 .. 350.0	15	32	463
Cloud effective altitude: mean, std, num obs	91	km	0.0 .. 20.0	15	32	478
Cloud top pressure: mean, std, num obs	92	hPa	0.0 .. 1100.0	15	32	493
Cloud bottom pressure: mean, std, num obs	93	hPa	0.0 .. 1100.0	15	32	508
Cloud particle phase: mean, std, num obs	94	fraction	1.0 .. 2.0	15	32	523
Liquid water path: mean, std, num obs	95	g m^{-2}	TBD	15	32	538
Ice water path: mean, std, num obs	96	g m^{-2}	TBD	15	32	553
Liquid particle radius: mean, std, num obs	97	micron	TBD	15	32	568
Ice particle effective diameter: mean, std, num obs	98	micron	TBD	15	32	583
Visible optical depth (linear): mean, std, num obs	99	N/A	0.0 .. 100.0	15	32	598
Visible optical depth (logarithmic): mean, std, num obs	100	N/A	0.0 .. 100.0	15	32	613
Infrared emissivity: mean, std, num obs	101	N/A	0.0 .. 2.0	15	32	628
Cloud vertical aspect ratio: mean, std, num obs	102	N/A	TBD	15	32	643
Spatially Averaged Angular Model Scene Type Parameters						
Incident Solar Flux	103	N/A	0.0 .. 1400.0	1	32	658
Angular Model Scene Type Parameters for 12 Scene Types						
Fractional area coverage	104	percent	0.0 .. 100.0	12	32	659
Angular Model Scene Type Statistical Data is Array[2] of:						
Albedo: mean, std	105	N/A	0.0 .. 1.0	24	32	671
LW flux: mean, std	106	W m^{-2}	0.0 .. 400.0	24	32	695
Spatially Averaged Clear Sky Adjustment Parameters						
Adjustment Parameters for Clear Skies						
Adjusted precipitable water: mean, std	107	cm	0.001 .. 8.0	2	32	719
Adjusted surface albedo: mean, std	108	N/A	0.0 .. 1.0	2	32	721
Adjusted aerosol optical depth: mean, std	109	N/A	0.0 .. 2.0	2	32	723
Adjusted skin temperature: mean, std	110	K	TBD	2	32	725

Total Meta Bits/File:	11848
Total Data Bits/Record:	23232
Total Records/File:	23572
Total Data Bits/File:	547624704
Total Bits/File:	547636552

Total Files/Product:	180
Total Meta Bits/Product:	2132640
Total Data Bits/Product:	98572446720
Total Bits/Product:	98574579360
Total MegaBytes/File:	65.28
Total GigaBytes/Product:	11.48

Note: Sizing estimates in this table are based on sampling estimates expected by the TRMM spacecraft.

2.11 Synoptic Radiative Fluxes and Clouds (SYN)

EOSDIS Product Code: CER07

The Synoptic Radiative Fluxes and Clouds (SYN), a CERES archival product, is produced by the CERES Merge Satellites, Time Interpolate, Compute Fluxes Subsystem. Each SYN file contains regional longwave and shortwave radiative fluxes for the surface, internal atmosphere and TOA. The data are computed at 3-hour intervals on the CERES grid, and are based on measurements from multiple EOS CERES instruments. In addition to being an archival product, the SYN is used by the CERES Subsystem, Compute Regional, Zonal and Global Averages.

The SYN contains averaged:

- Regional data
- Clear-sky area scene data
- Observed CERES TOA data
- Cloud category properties for four (low, lower middle, upper middle and high) cloud height categories
- Column averaged cloud properties for five (TOA SW, TOA LW, SFC LW, Liquid Water Content (LWC) and Ice Water Content (IWC)) weighting schemes
- Overlap data for eleven (clear, low (L), lower middle (LM), upper middle (UM), high (H), H/UM, H/LM, H/L, UM/LM, UM/L, LM/L) cloud overlap conditions
- Angular model scene classes for the twelve ERBE scene types
- Surface radiative parameters
- Untuned radiative fluxes for both clear skies and total scene at the surface and the TOA
- Tuned radiative fluxes for both clear skies and total scene at the surface, 500hPa, the tropopause and the TOA
- Adjustment parameters for clear skies
- Adjustment parameters for four (low, lower middle, upper middle and high) cloud height categories
- Auxiliary adjustment quality control flags

A complete listing of parameters for this data product can be found in Table 2.11-1.

Level: 3
Type: Archival
Frequency: Every 3 Hours

Time Interval Covered
File: 3 Hours
Record: 3 Hours

Portion of Globe Covered
File: Global
Record: 1 CERES Region

Portion of Atmosphere Covered
File: Surface, Internal and TOA

Table 2.11-1. Synoptic Radiative Fluxes and Clouds (SYN) (1 of 3)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
Meta Data						
SYN Header FIle		N/A		1	380	
Regional Data						
Julian date at hour start	1	day	2449395 .. 2456000	1	32	1
Julian time at hour start	2	day	-0.01 .. 1.01	1	32	2
Region number	3	N/A	1 .. 44012	1	32	3
Hour-box number	4	N/A	1 .. 744	1	32	4
Surface altitude above sea level, mean	5	m	-1000 .. 10000	1	32	5
Cosine of solar zenith angle	6	deg	0 .. 1	1	32	6
Surface type percent coverage	7	N/A	0 .. 100	20	32	7
Clear-sky Area Data						
Snow/ice percent coverage	8	N/A	0 .. 100	1	32	27
Smoke percent coverage	9	N/A	0 .. 100	1	32	28
Fire percent coverage	10	N/A	0 .. 100	1	32	29
Total aerosol visible optical depth, clear area	11	N/A	0 .. 2	1	32	30
Total aerosol effective radius, clear area	12	N/A	0 .. 20	1	32	31
Aerosol percent coverage	13	N/A	0 .. 100	1	32	32
Observed CERES TOA Data for Clear-sky and Total-sky						
CERES SW flux, TOA, upwards, mean	14	W m^{-2}	0 .. 1400	2	32	33
CERES SW flux, TOA, upwards, std	15	W m^{-2}	TBD	2	32	35
CERES LW flux, TOA, upwards, mean	16	W m^{-2}	0 .. 500	2	32	37
CERES LW flux, TOA, upwards, std	17	W m^{-2}	TBD	2	32	39
CERES WN flux, TOA, upwards, mean	18	W m^{-2}	10 .. 400	2	32	41
CERES WN flux, TOA, upwards, std	19	W m^{-2}	TBD	2	32	43
Albedo, TOA, mean	20	N/A	0 .. 1	2	32	45
Albedo, TOA, std	21	N/A	0 .. 1	2	32	47
Cloud Properties for Four Cloud Height Categories (Cloud height categories are low (L), lower middle (LM), upper middle (UM), and high (H))						
Overcast cloud area percentage	22	N/A	0 .. 100	4	32	49
Total cloud area percentage	23	N/A	0 .. 100	4	32	53
Cloud visible optical depth, linear, mean	24	N/A	0 .. 400	4	32	57
Cloud vsible optical depth, linear, std	25	N/A	TBD	4	32	61
Cloud visible optical depth, logarithmic, mean	26	N/A	0 .. 6	4	32	65
Cloud vsible optical depth, logarithmic, std	27	N/A	TBD	4	32	69
Cloud infrared emissivity, mean	28	N/A	0 .. 1	4	32	73
Cloud infrared emissivity, std	29	N/A	TBD	4	32	77
Cloud liquid water path, mean	30	g m^{-2}	TBD	4	32	81
Cloud liquid water path, std	31	g m^{-2}	TBD	4	32	85
Cloud ice water path, mean	32	g m^{-2}	TBD	4	32	89
Cloud ice water path, std	33	g m^{-2}	TBD	4	32	93
Cloud top pressure, mean	34	hPa	0 .. 1100	4	32	97
Cloud top pressure, std	35	hPa	TBD	4	32	101
Cloud effective pressure, mean	36	hPa	0 .. 1100	4	32	105
Cloud effective pressure, std	37	hPa	TBD	4	32	109
Cloud effective temperature, mean	38	K	100 .. 350	4	32	113
Cloud effective temperature, std	39	K	TBD	4	32	117
Cloud effective height, mean	40	km	0 .. 20	4	32	121
Cloud effective height, std	41	km	TBD	4	32	125
Cloud bottom pressure, mean	42	hPa	0 .. 1100	4	32	129
Cloud bottom pressure, std	43	hPa	TBD	4	32	133
Cloud liquid particle radius, mean	44	µm	TBD	4	32	137
Cloud liquid particle radius, std	45	µm	TBD	4	32	141
Cloud ice particle effective diameter, mean	46	µm	TBD	4	32	145
Cloud ice particle effective diameter, std	47	µm	TBD	4	32	149
Cloud particle phase, mean	48	N/A	1 .. 2	4	32	153
Cloud particle phase, std	49	N/A	TBD	4	32	157
Vertical aspect ratio, mean (TBD)	50	N/A	0 .. 20	4	32	161
Vertical aspect ratio, std (TBD)	51	N/A	TBD	4	32	165

Table 2.11-1. Synoptic Radiative Fluxes and Clouds (SYN) (2 of 3)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
Column Averaged Cloud Properties for TOA-SW, TOA-LW, SFC-LW, LWC and IWC Weighting Schemes						
Overcast cloud area percentage	52	N/A	0 .. 100	5	32	169
Total cloud area percentage	53	N/A	0 .. 100	5	32	174
Cloud visible optical depth, linear, mean	54	N/A	0 .. 400	5	32	179
Cloud vsible optical depth, linear, std	55	N/A	TBD	5	32	184
Cloud visible optical depth, logarithmic, mean	56	N/A	0 .. 6	5	32	189
Cloud vsible optical depth, logarithmic, std	57	N/A	TBD	5	32	194
Cloud infrared emissivity, mean	58	N/A	0 .. 1	5	32	199
Cloud infrared emissivity, std	59	N/A	TBD	5	32	204
Cloud liquid water path, mean	60	g m^{-2}	TBD	5	32	209
Cloud liquid water path, std	61	g m^{-2}	TBD	5	32	214
Cloud ice water path, mean	62	g m^{-2}	TBD	5	32	219
Cloud ice water path, std	63	g m^{-2}	TBD	5	32	224
Cloud top pressure, mean	64	hPa	0 .. 1100	5	32	229
Cloud top pressure, std	65	hPa	TBD	5	32	234
Cloud effective pressure, mean	66	hPa	0 .. 1100	5	32	239
Cloud effective pressure, std	67	hPa	TBD	5	32	244
Cloud effective temperature, mean	68	K	100 .. 350	5	32	249
Cloud effective temperature, std	69	K	TBD	5	32	254
Cloud effective height, mean	70	km	0 .. 20	5	32	259
Cloud effective height, std	71	km	TBD	5	32	264
Cloud bottom pressure, mean	72	hPa	0 .. 1100	5	32	269
Cloud bottom pressure, std	73	hPa	TBD	5	32	274
Cloud liquid particle radius, mean	74	µm	TBD	5	32	279
Cloud liquid particle radius, std	75	µm	TBD	5	32	284
Cloud ice particle effective diameter, mean	76	µm	TBD	5	32	289
Cloud ice particle effective diameter, std	77	µm	TBD	5	32	294
Cloud particle phase, mean	78	N/A	1 .. 2	5	32	299
Cloud particle phase, std	79	N/A	TBD	5	32	304
Vertical aspect ratio, mean (TBD)	80	N/A	0 .. 20	5	32	309
Vertical aspect ratio, std (TBD)	81	N/A	TBD	5	32	314
Overlap Footprint Data for 11 Cloud Overlap Conditions (Cloud classes are clear, L, LM, UM, H, H/UM, H/LM, H/L, UM/LM, UM/L, and LM/L)						
Overlap condition weighted area percentage	82	N/A	0 .. 100	11	32	319
Angular Model Scene Classes for 12 ERBE Scene Types						
Incident solar flux	83	W m^{-2}	TBD	1	32	330
Area percent coverage	84	N/A	0 .. 100	12	32	331
Albedo, mean	85	N/A	0 .. 1	12	32	343
Albedo, std	86	N/A	0 .. 1	12	32	355
LW flux, mean	87	W m^{-2}	TBD	12	32	367
LW flux, std	88	W m^{-2}	TBD	12	32	379
Surface Radiative Parameters						
Spectral albedo	89	N/A	0 .. 1	6	32	391
Broadband surface albedo (uncorrected)	90	N/A	0 .. 1	1	32	397
LW surface emissivity	91	N/A	0 .. 1	1	32	398
WN surface emissivity	92	N/A	0 .. 1	1	32	399
Imager-based surface skin temperature	93	K	175 .. 375	1	32	400
Photosynthetically active radiation (TBD)	94	W m^{-2}	0 .. 780	1	32	401
DIrect/diffuse ratio (TBD)	95	N/A	0 .. 30	1	32	402
Corrected initial broadband surface albedo	96	N/A	0 .. 1	1	32	403
Atmospheric Flux Profile for Clear-sky and Total-sky (Atmospheric levels in profile are surface, 500hPa, tropopause and TOA)						
Number atmospheric levels	97	N/A	0 .. 4	1	32	404
Pressure, atmospheric levels	98	hPa	0 .. 1100	4	32	405
SW flux, atmospheric level, upwards, tuned	99	W m^{-2}	0 .. 1400	8	32	409
SW flux, atmospheric level, downwards, tuned	100	W m^{-2}	0 .. 1400	8	32	417
LW flux, atmospheric level, upwards, tuned	101	W m^{-2}	0 .. 700	8	32	425
LW flux, atmospheric level, downwards, tuned	102	W m^{-2}	0 .. 600	8	32	433

Table 2.11-1. Synoptic Radiative Fluxes and Clouds (SYN) (3 of 3)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
Flux Adjustments (Tuned - Untuned) for Clear-sky and Total-sky at Surface and TOA						
SW flux, surface, downwards, delta	103	W m^{-2}	-1400 .. 1400	2	32	441
SW flux, surface, upwards, delta	104	W m^{-2}	-1400 .. 1400	2	32	443
SW flux, TOA, upwards, delta	105	W m^{-2}	-1400 .. 1400	2	32	445
LW flux, surface, downwards, delta	106	W m^{-2}	-500 .. 500	2	32	447
LW flux, surface, upwards, delta	107	W m^{-2}	-500 .. 500	2	32	449
LW flux, TOA, upwards, delta	108	W m^{-2}	-500 .. 500	2	32	451
Adjustment Parameters for Clear Skies						
Adjusted precipitable water, delta	109	cm	-10 .. 10	1	32	453
Adjusted surface albedo, delta	110	N/A	-1 ..1	1	32	454
Adjusted aerosol optical depth, delta	111	N/A	-2 .. 2	1	32	455
Adjusted skin temperature, delta	112	K	TBD	1	32	456
Adjustment Parameters for Four Cloud Height Categories						
Adjusted mean visible optical depth (logarithmic), delta	113	N/A	-400 .. 400	4	32	457
Adjusted mean cloud fractional area, delta	114	N/A	-1 .. 1	4	32	461
Adjusted mean cloud effective temperature, delta	115	K	TBD	4	32	465
Auxiliary Adjustment Quality Control Flags						
Constrainment status flag	116	N/A	TBD	1	32	469
Sigma table configuration flag	117	N/A	TBD	1	32	470

Total Meta Bits/File:	380
Total Data Bits/Record:	15232
Total Records/File:	44012
Total Data Bits/File:	670390784
Total Bits/File:	670391164

2.12 Monthly Regional Radiative Fluxes and Clouds (AVG)

EOSDIS Product Code: CER08

The Monthly Regional Radiative Fluxes and Clouds (AVG/ZAVG) product contains monthly and monthly hourly averages of the Top-of-the-Atmosphere (TOA) and surface longwave (LW) and shortwave (SW) radiative fluxes, together with LW and SW fluxes at standard pressure levels in between. This final product also contains observed cloud and clear-sky properties at the standard one-degree horizontal resolution.

AVG/ZAVG is an archival product produced for each spacecraft and for each combination of spacecraft. Initially at the Tropical Rainfall Measuring Mission (TRMM) launch, this product is produced in a validation mode every 3 months, or for 4 months a year. During these 18 months, the CERES Science Team will derive a production quality set of Angular Distribution Models, which are needed to produce the LW and SW instantaneous fluxes. Eighteen months after the TRMM launch, this product is archived and contains LW and SW fluxes at the tropopause and at 500 hPa pressure levels, in addition to fluxes at TOA and at the surface.

The major categories of data on the AVG/ZAVG are

1. Regional data
2. Radiative fluxes for both clear-sky and total-sky at TOA
3. Cloud category properties for four (low, lower middle, upper middle and high) cloud layers
4. Adjustment parameters for four cloud layers
5. Column-averaged cloud properties for five (TOA SW, TOA LW, Hourly Gridded Single Satellite TOA and Surface Fluxes and Clouds (SFC) LW, Liquid Water Path (LWP), and Ice Water Path (IWP)) weighting schemes
6. Adjustment parameters for five weighting schemes
7. Overlap data for eleven (clear, low (L), lower middle (LM), upper middle (UM), high (H), H/UM, H/LM, H/L, UM/LM, UM/L, LM/L) cloud conditions
8. Angular model scene classes
9. Atmospheric flux profile for clear-sky and total-sky
10. Flux adjustments for clear-sky and total-sky
11. Adjustment parameters for clear-skies
12. Surface data

A complete listing of parameters for this data product can be found in Table 2.12-1.

Level: 3
Type: Archival
Frequency: 1/Month

Time Interval Covered
File: 1 Month
Record: 1 Month

Portion of Globe Covered
File: Entire Globe
Record: 1-Deg Regions

Portion of Atmosphere Covered
File: Surface to TOA

Table 2.12-1. Monthly Regional Radiative Fluxes and Clouds (AVG) (1 of 3)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
AVG						
AVG File Header		N/A	N/A			
AVG Data						
REGIONAL DATA is Array[64800] of:						
Regional Parameters						
Region Number	1	N/A	1 .. 64800	1	32	1
Surface altitude	2	m	-1000 .. 10000	1	32	2
Surface type percent coverage	3	N/A	0.0 .. 100.0	20	32	3
Clear-sky Area Scene Data						
Snow/Ice percent coverage	4	N/A	0.0 .. 100.0	1	32	23
Smoke percent coverage	5	N/A	0.0 .. 100.0	1	32	24
Fire percent coverage	6	N/A	0.0 .. 100.0	1	32	25
Total aerosol visible optical depth, clear area	7	N/A	0.0 .. 2.0	1	32	26
Total aerosol effective radius, clear area	8	N/A	0.0 .. 20.0	1	32	27
Aerosol percent coverage	9	N/A	0.0 .. 100.0	1	32	28
TOA Fluxes for 2 Scene Classes						
Monthly-Hourly and Monthly TOA Fluxes is Array[9] of:						
(TOA hourly data are in elements 1-8, monthly data is in element 9)						
TOA flux is Array[3] of:						
Clear-Sky TOA Fluxes						
SW Flux at TOA: mean, std, num vals	10	W m^{-2}	0.0 .. 1400.0	27	32	29
LW flux at TOA: mean, std, num vals	11	W m^{-2}	0.0 .. 1000.0	27	32	56
Window flux: mean, std, num vals	12	W m^{-2}	10.0 .. 400.0	27	32	83
Total albedo: mean, std, num vals	13	N/A	0.0 .. 1.0	27	32	110
Total-Sky TOA Fluxes						
SW Flux at TOA: mean, std, num vals	14	W m^{-2}	0.0 .. 1400.0	27	32	137
LW flux at TOA: mean, std, num vals	15	W m^{-2}	0.0 .. 1000.0	27	32	164
Window flux: mean, std, num vals	16	W m^{-2}	10.0 .. 400.0	27	32	191
Total albedo: mean, std, num vals	17	N/A	0.0 .. 1.0	27	32	218
Fluxes levels						
Flux Levels Monthly-Hourly and Monthly Data is Array[9] of:						
(Flux monthly-hourly data are in elements 1-8, monthly data is in element 9)						
Atmospheric Flux Profile for 2 Scene Classes and 4 Layers						
Scene classes: clear-sky & total-sky, Layers: sfc, 500hPa, tropopause, & TOA is Array[24] of:						
Upward SW flux: mean, std, num vals	18	W m^{-2}	0.0 .. 1400.0	216	32	245
Downward SW Flux: mean, std, num vals	19	W m^{-2}	0.0 .. 1400.0	216	32	461
Upward LW flux: mean, std, num vals	20	W m^{-2}	0.0 .. 700.0	216	32	677
Downward LW flux: mean, std, num vals	21	W m^{-2}	0.0 .. 600.0	216	32	893
Number of Atmospheric Layers	22	N/A	0 .. 4	9	32	1109
Pressure, atmospheric layer	23	hPa	0 .. 1100	36	32	1118
Flux Adjustments (Tuned..Untuned) for 2 Scene Classes and 2 Layers						
Scene classes,adj: clear-sky & total-sky is Array[2] of:						
Layer..surface is Array[3] of:						
Downward SW flux, delta : mean, std, num vals	24	W m^{-2}	-1400.0 .. 1400.0	54	32	1154
Downward LW flux, delta : mean, std, num vals	25	W m^{-2}	-500.0 .. 500.0	54	32	1208
Upward SW flux, delta : mean, std, num vals	26	W m^{-2}	-1400.0 .. 1400.0	54	32	1262
Upward LW flux, delta : mean, std, num vals	27	W m^{-2}	-500.0 .. 500.0	54	32	1316
Layer..TOA is Array[3] of:						
Upward SW flux, delta : mean, std, num vals	28	W m^{-2}	-1400.0 .. 1400.0	54	32	1370
Upward LW flux, delta : mean, std, num vals	29	W m^{-2}	-500.0 .. 500.0	54	32	1424

Table 2.12-1. Monthly Regional Radiative Fluxes and Clouds (AVG) (2 of 3)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
Clear-sky Adjustment Parameters						
Clear-sky Adj. Monthly and Monthly-Hourly Data is Array[9] of:						
(Clear-sky monthly-hourly data are in elements 1-8, monthly data is in element 9)						
Adjusted precipitable water, delta : mean, std, num vals	30	cm	-10.0 .. 10.0	27	32	1478
Adjusted surface albedo, delta : mean, std, num vals	31	N/A	-1.0 .. 1.0	27	32	1505
Adjusted aerosol optical depth, delta : mean, std, num vals	32	N/A	-2.0 .. 2.0	27	32	1532
Adjusted skin temperature, delta : mean, std, num vals	33	K	TBD	27	32	1559
Surface Data						
Surface Monthly-Hourly and Monthly Data is Array[9] of:						
(Surface monthly-hourly data are in elements 1-8, monthly data is in element 9)						
Spectral albedo	34	N/A	0.0 .. 1.0	54	32	1586
Broadband surface albedo (uncorrected)	35	N/A	0.0 .. 1.0	9	32	1640
LW Surface Emissivity	36	N/A	0.0 .. 1.0	9	32	1649
WN Surface Emissivity	37	N/A	0.0 .. 1.0	9	32	1658
Imager-based surface skin temperature	38	K	175 .. 375	9	32	1667
Photosynthetically active radiation	39	W m^{-2}	0.0 .. 780.0	9	32	1676
Direct/Diffuse ratio at surface: mean	40	N/A	0.0 .. 30.0	9	32	1685
Corrected initial broadband surface albedo	41	N/A	0.0 .. 1.0	9	32	1694
Monthly-Hourly and Monthly Cloud Information						
Monthly-Hourly data are in elements 1-8, Monthly data is in element 9 is Array[9] of:						
Angular Model Scene Types						
Incident solar flux	42	N/A	0.0 .. 1400.0	9	32	1703
Angular Model Scene_Classes is Array[12] of:						
Fractional area coverage	43	percent	0.0 .. 100.0	108	32	1712
Albedo: mean, std	44	N/A	0.0 .. 1.0	216	32	1820
LW flux: mean, std	45	W m^{-2}	0.0 .. 400.0	216	32	2036
Column Averaged Cloud Properties						
Five weightings:TOA SW,TOA LW,SFC LW,LWP,and IWP is Array[5] of:						
Cloud Properties						
Overcast cloud area fraction	46	percent	0.0 .. 100.0	45	32	2252
Total cloud area fraction	47	percent	0.0 .. 100.0	45	32	2297
Cloud Property Stats is Array[3] of:						
Cloud effective pressure: mean, std, num vals	48	hPa	0.0 .. 1100.0	135	32	2342
Cloud effective temperature: mean, std, num vals	49	K	100.0 .. 350.0	135	32	2477
Cloud effective height: mean, std, num vals	50	km	0.0 .. 20.0	135	32	2612
Cloud top pressure: mean, std, num vals	51	hPa	0.0 .. 1100.0	135	32	2747
Cloud bottom pressure: mean, std, num vals	52	hPa	0.0 .. 1100.0	135	32	2882
Cloud particle phase: mean, std, num vals	53	N/A	1.0 .. 2.0	135	32	3017
Liquid water path: mean, std, num vals	54	g m^{-2}	TBD	135	32	3152
Ice water path: mean, std, num vals	55	g m^{-2}	TBD	135	32	3287
Liquid particle radius: mean, std, num vals	56	µm	TBD	135	32	3422
Ice particle effective diameter: mean, std, num vals	57	µm	TBD	135	32	3557
Cloud visible optical depth, linear : mean, std, num vals	58	N/A	0.0 .. 100.0	135	32	3692
Cloud visible optical depth, logarthmic : mean, std, num vals	59	N/A	0.0 .. 100.0	135	32	3827
Infrared emissivity: mean, std, num vals	60	N/A	0.0 .. 2.0	135	32	3962
Cloud vertical aspect ratio: mean, std, num vals	61	N/A	0.0 .. 20.0	135	32	4097
Adjustment Parameters for Column Averaged Data						
Five weights: TOA SW, TOA LW, SFC LW, LWP, AND IWP is Array[5] of:						
Adjusted optical depth (logarithmic), delta : mean, std, num vals	62	N/A	-400.0 .. 400.0	135	32	4232
Adjusted cloud fractional area, delta: mean, std, num vals	63	N/A	-1.0 .. 1.0	135	32	4367
Adjusted cloud effective temperature: mean, std, num vals	64	K	TBD	135	32	4502
Monthly Only Cloud Information						
Cloud Category Properties						
Cloud Layers: H,UM,LM, & L is Array[4] of:						
Cloud Properties						
Overcast cloud area fraction	65	percent	0.0 .. 100.0	4	32	4637
Total cloud area fraction	66	percent	0.0 .. 100.0	4	32	4641

Table 2.12-1. Monthly Regional Radiative Fluxes and Clouds (AVG) (3 of 3)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
Cloud Property Stats is Array[3] of:						
Cloud effective pressure: mean, std, num vals	67	hPa	0.0 .. 1100.0	12	32	4645
Cloud effective temperature: mean, std, num vals	68	K	100.0 .. 350.0	12	32	4657
Cloud effective height: mean, std, num vals	69	km	0.0 .. 20.0	12	32	4669
Cloud top pressure: mean, std, num vals	70	hPa	0.0 .. 1100.0	12	32	4681
Cloud bottom pressure: mean, std, num vals	71	hPa	0.0 .. 1100.0	12	32	4693
Cloud particle phase: mean, std, num vals	72	N/A	1.0 .. 2.0	12	32	4705
Liquid water path: mean, std, num vals	73	$g\ m^{-2}$	TBD	12	32	4717
Ice water path: mean, std, num vals	74	$g\ m^{-2}$	TBD	12	32	4729
Liquid particle radius: mean, std, num vals	75	µm	TBD	12	32	4741
Ice particle effective diameter: mean, std, num vals	76	µm	TBD	12	32	4753
Cloud visible optical depth, linear: mean, std, num vals	77	N/A	0.0 .. 100.0	12	32	4765
Cloud visible optical depth, logarthmic: mean, std, num vals	78	N/A	0.0 .. 100.0	12	32	4777
Infrared emissivity: mean, std, num vals	79	N/A	0.0 .. 2.0	12	32	4789
Cloud vertical aspect ratio: mean, std, num vals	80	N/A	0.0 .. 20.0	12	32	4801
Adjustment Parameters for 4 Cloud Layers						
Layers: H,UM,LM, & L is Array[4] of:						
Adjusted optical depth (logarithmic), delta : mean, std, num vals	81	N/A	-400.0 .. 400.0	12	32	4813
Adjusted cloud fractional area, delta: mean, std, num vals	82	N/A	-1.0 .. 1.0	12	32	4825
Adjusted cloud effective temperature, delta : mean, std, num vals	83	K	TBD	12	32	4837
Eleven Cloud Overlap Conditions						
Overlap condition weighted area fraction	84	percent	0.0 .. 100.0	11	32	4849

Total Meta Bits/File:	0
Total Bits/Record:	155488
Total Records/File:	64800
Total Bits/File:	10075622400
Total Bytes/Record:	19436
Total Bytes/File:	1259452800

2.13 Monthly Zonal and Global Radiative Fluxes and Clouds (ZAVG)

EOSDIS Product Code: CER15

The Monthly Zonal and Global Radiative Fluxes and Clouds (ZAVG) product is a summary of the zonal and global averages of the radiative fluxes and cloud properties, probably most suitable for inclusion in the Earth Observing System Data and Information System (EOSDIS) Information Management System (IMS) as a browse product. This product is the CERES equivalent to the zonal averages and global averages in the ERBE S-4 product.

ZAVG is an archival product produced by the Time Interpolation and Spatial Averaging Subsystem for each instrument and for each combination of instruments. Initially at the TRMM launch, this product is produced in a validation mode every 3 months, or for 4 months a year. During the first 18 months, the CERES Science Team will derive a production quality set of Angular Distribution Models, which are needed to produce the LW and SW instantaneous fluxes. Eighteen months after the TRMM launch, this product is archived and contains LW and SW fluxes at the tropopause, and at 500 hPa pressure levels, in addition to fluxes at TOA and at the surface. ZAVG contains one record of monthly and monthly hourly averages for each of the 180 latitudinal zones and one record of global averages. A complete listing of parameters for this data product can be found in Table 2.13-1.

The major categories of data on the ZAVG are

- Regional data
- Radiative fluxes for both clear-sky and total-sky at TOA
- Cloud category properties for four cloud layers
- Column-averaged cloud properties for five weighting schemes
- Overlap data for eleven cloud conditions
- Angular model scene classes
- Adjustment parameters for four cloud layers
- Atmospheric profile for clear-sky and total-sky
- Flux adjustments for clear-sky and total-sky
- Surface data
- Adjustment parameters for clear-skies

Level: 3
Type: Archival
Frequency: Monthly

Portion of Globe Covered
File: Entire Globe
Record: Zonal or Global

Time Interval Covered
File: 1 Month
Record: 1 Month

Portion of Atmosphere Covered
File: Surface to TOA

Table 2.13-1. Monthly Zonal and Global Radiative Fluxes and Clouds (ZAVG) (1 of 3)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
ZAVG						
ZAVG File Header		N/A	N/A	1	201440	
ZAVG Data						
ZONAL and GLOBAL DATA is Array[181] of:						
ZAVG Zone/Globe Parameters						
Zone/Globe Number	1	N/A	1..181	1	32	1
Surface type percent coverage	2	N/A	0.0 .. 100.0	20	32	2
Clear-sky Area Scene Data						
Snow/Ice percent coverage	3	N/A	0.0 .. 100.0	1	32	22
Smoke percent coverage	4	N/A	0.0 .. 100.0	1	32	23
Fire percent coverage	5	N/A	0.0 .. 100.0	1	32	24
Total aerosol visible optical depth, clear area	6	N/A	0.0 .. 2.0	1	32	25
Total aerosol effective radius, clear area	7	N/A	0.0 .. 20.0	1	32	26
Aerosol percent coverage	8	N/A	0.0 .. 100.0	1	32	27
TOA Fluxes for 2 Scene Classes						
Monthly-Hourly and Monthly TOA Fluxes is Array[9] of:						
(TOA hourly data are in elements 1-8, monthly data is in element 9)						
TOA flux is Array[3] of:						
Clear-Sky TOA Fluxes						
SW Flux at TOA: mean, std, num vals	9	W m^{-2}	0.0 .. 1400.0	27	32	28
LW flux at TOA: mean, std, num vals	10	W m^{-2}	0.0 .. 1000.0	27	32	55
Window flux: mean, std, num vals	11	W m^{-2}	10.0 .. 400.0	27	32	82
Total albedo: mean, std, num vals	12	N/A	0.0 .. 1.0	27	32	109
Total-Sky TOA Fluxes						
SW Flux at TOA: mean, std, num vals	13	W m^{-2}	0.0 .. 1400.0	27	32	136
LW flux at TOA: mean, std, num vals	14	W m^{-2}	0.0 .. 1000.0	27	32	163
Window flux: mean, std, num vals	15	W m^{-2}	10.0 .. 400.0	27	32	190
Total albedo: mean, std, num vals	16	N/A	0.0 .. 1.0	27	32	217
Fluxes levels						
Flux Levels Monthly-Hourly and Monthly Data is Array[9] of:						
(Flux monthly-hourly data are in elements 1-8, monthly data is in element 9)						
Atmospheric Flux Profile for 2 Scene Classes and 4 Layers						
Scene classes: clear-sky & total-sky, Layers: sfc, 500hPa, tropopause, & TOA is Array[24] of:						
Upward SW flux: mean, std, num vals	17	W m^{-2}	0.0 .. 1400.0	216	32	244
Downward SW Flux: mean, std, num vals	18	W m^{-2}	0.0 .. 1400.0	216	32	460
Upward LW flux: mean, std, num vals	19	W m^{-2}	0.0 .. 700.0	216	32	676
Downward LW flux: mean, std, num vals	20	W m^{-2}	0.0 .. 600.0	216	32	892
Number of Atmospheric Layers	21	N/A	0 .. 4	9	32	1108
Pressure, atmospheric layer	22	hPa	0 .. 1100	36	32	1117
Flux Adjustments (Tuned..Untuned) for 2 Scene Classes and 2 Layers						
Scene classes,adj: clear-sky & total-sky is Array[2] of:						
Layer..surface is Array[3] of:						
Downward SW flux, delta : mean, std, num vals	23	W m^{-2}	-1400.0 .. 1400.0	54	32	1153
Downward LW flux, delta : mean, std, num vals	24	W m^{-2}	-500.0 .. 500.0	54	32	1207
Upward SW flux, delta : mean, std, num vals	25	W m^{-2}	-1400.0 .. 1400.0	54	32	1261
Upward LW flux, delta : mean, std, num vals	26	W m^{-2}	-500.0 .. 500.0	54	32	1315
Layer..TOA is Array[3] of:						
Upward SW flux, delta : mean, std, num vals	27	W m^{-2}	-1400.0 .. 1400.0	54	32	1369
Upward LW flux, delta : mean, std, num vals	28	W m^{-2}	-500.0 .. 500.0	54	32	1423

Table 2.13-1. Monthly Zonal and Global Radiative Fluxes and Clouds (ZAVG) (2 of 3)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
Clear-sky Adjustment Parameters						
Clear-sky Adj. Monthly and Monthly-Hourly Data is Array[9] of:						
(Clear-sky monthly-hourly data are in elements 1-8, monthly data is in element 9)						
Adjusted precipitable water, delta : mean, std, num vals	29	cm	-10.0 .. 10.0	27	32	1477
Adjusted surface albedo, delta : mean, std, num vals	30	N/A	-1.0 .. 1.0	27	32	1504
Adjusted aerosol optical depth, delta : mean, std, num vals	31	N/A	-2.0 .. 2.0	27	32	1531
Adjusted skin temperature, delta : mean, std, num vals	32	K	TBD	27	32	1558
Surface Data						
Surface Monthly-Hourly and Monthly Data is Array[9] of:						
(Surface monthly-hourly data are in elements 1-8, monthly data is in element 9)						
Spectral albedo	33	N/A	0.0 .. 1.0	54	32	1585
Broadband surface albedo (uncorrected)	34	N/A	0.0 .. 1.0	9	32	1639
LW Surface Emissivity	35	N/A	0.0 .. 1.0	9	32	1648
WN Surface Emissivity	36	N/A	0.0 .. 1.0	9	32	1657
Imager-based surface skin temperature	37	K	175 .. 375	9	32	1666
Photosynthetically active radiation	38	W m^{-2}	0.0 .. 780.0	9	32	1675
Direct/Diffuse ratio at surface: mean	39	N/A	0.0 .. 30.0	9	32	1684
Corrected initial broadband surface albedo	40	N/A	0.0 .. 1.0	9	32	1693
Monthly-Hourly and Monthly Cloud Information						
Monthly-Hourly data are in elements 1-8, Monthly data is in element 9 is Array[9] of:						
Angular Model Scene Types						
Incident solar flux	41	N/A	0.0 .. 1400.0	9	32	1702
Angular Model Scene_Classes is Array[12] of:						
Fractional area coverage	42	percent	0.0 .. 100.0	108	32	1711
Albedo: mean, std	43	N/A	0.0 .. 1.0	216	32	1819
LW flux: mean, std	44	W m^{-2}	0.0 .. 400.0	216	32	2035
Column Averaged Cloud Properties						
Five weightings:TOA SW,TOA LW,SFC LW,LWP,and IWP is Array[5] of:						
Cloud Properties						
Overcast cloud area fraction	45	percent	0.0 .. 100.0	45	32	2251
Total cloud area fraction	46	percent	0.0 .. 100.0	45	32	2296
Cloud Property Stats is Array[3] of:						
Cloud effective pressure: mean, std, num vals	47	hPa	0.0 .. 1100.0	135	32	2341
Cloud effective temperature: mean, std, num vals	48	K	100.0 .. 350.0	135	32	2476
Cloud effective height: mean, std, num vals	49	km	0.0 .. 20.0	135	32	2611
Cloud top pressure: mean, std, num vals	50	hPa	0.0 .. 1100.0	135	32	2746
Cloud bottom pressure: mean, std, num vals	51	hPa	0.0 .. 1100.0	135	32	2881
Cloud particle phase: mean, std, num vals	52	N/A	1.0 .. 2.0	135	32	3016
Liquid water path: mean, std, num vals	53	g m^{-2}	TBD	135	32	3151
Ice water path: mean, std, num vals	54	g m^{-2}	TBD	135	32	3286
Liquid particle radius: mean, std, num vals	55	µm	TBD	135	32	3421
Ice particle effective diameter: mean, std, num vals	56	µm	TBD	135	32	3556
Cloud visible optical depth, linear : mean, std, num vals	57	N/A	0.0 .. 100.0	135	32	3691
Cloud visible optical depth, logarthmic : mean, std, num vals	58	N/A	0.0 .. 100.0	135	32	3826
Infrared emissivity: mean, std, num vals	59	N/A	0.0 .. 2.0	135	32	3961
Cloud vertical aspect ratio: mean, std, num vals	60	N/A	0.0 .. 20.0	135	32	4096
Adjustment Parameters for Column Averaged Data						
Five weights: TOA SW, TOA LW, SFC LW, LWP, AND IWP is Array[5] of:						
Adjusted optical depth (logarithmic), delta : mean, std, num vals	61	N/A	-400.0 .. 400.0	135	32	4231
Adjusted cloud fractional area, delta: mean, std, num vals	62	N/A	-1.0 .. 1.0	135	32	4366
Adjusted cloud effective temperature: mean, std, num vals	63	K	TBD	135	32	4501
Monthly Only Cloud Information						
Cloud Category Properties						
Cloud Layers: H,UM,LM, & L is Array[4] of:						
Cloud Properties						
Overcast cloud area fraction	64	percent	0.0 .. 100.0	4	32	4636
Total cloud area fraction	65	percent	0.0 .. 100.0	4	32	4640

Table 2.13-1. Monthly Zonal and Global Radiative Fluxes and Clouds (ZAVG) (3 of 3)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
Cloud Property Stats is Array[3] of:						
Cloud effective pressure: mean, std, num vals	66	hPa	0.0 .. 1100.0	12	32	4644
Cloud effective temperature: mean, std, num vals	67	K	100.0 .. 350.0	12	32	4656
Cloud effective height: mean, std, num vals	68	km	0.0 .. 20.0	12	32	4668
Cloud top pressure: mean, std, num vals	69	hPa	0.0 .. 1100.0	12	32	4680
Cloud bottom pressure: mean, std, num vals	70	hPa	0.0 .. 1100.0	12	32	4692
Cloud particle phase: mean, std, num vals	71	N/A	1.0 .. 2.0	12	32	4704
Liquid water path: mean, std, num vals	72	g m^{-2}	TBD	12	32	4716
Ice water path: mean, std, num vals	73	g m^{-2}	TBD	12	32	4728
Liquid particle radius: mean, std, num vals	74	µm	TBD	12	32	4740
Ice particle effective diameter: mean, std, num vals	75	µm	TBD	12	32	4752
Cloud visible optical depth, linear : mean, std, num vals	76	N/A	0.0 .. 100.0	12	32	4764
Cloud visible optical depth, logarthmic : mean, std, num vals	77	N/A	0.0 .. 100.0	12	32	4776
Infrared emissivity: mean, std, num vals	78	N/A	0.0 .. 2.0	12	32	4788
Cloud vertical aspect ratio: mean, std, num vals	79	N/A	0.0 .. 20.0	12	32	4800
Adjustment Parameters for 4 Cloud Layers						
Layers: H,UM,LM, & L is Array[4] of:						
Adjusted optical depth (logarithmic), delta : mean, std, num vals	80	N/A	-400.0 .. 400.0	12	32	4812
Adjusted cloud fractional area, delta: mean, std, num vals	81	N/A	-1.0 .. 1.0	12	32	4824
Adjusted cloud effective temperature: mean, std, num vals	82	K	TBD	12	32	4836
Eleven Cloud Overlap Conditions						
Overlap condition weighted area fraction	83	percent	0.0 .. 100.0	11	32	4848

Total Meta Bits/File:	0
Total Bits/Record:	155456
Total Records/File:	181
Total Bits/File:	28137536
Total Bytes/Record:	19432
Total Bytes/File:	3517192

2.14 Monthly Gridded Single Satellite TOA and Surface Fluxes/Clouds (SFC)

EOSDIS Product Code: CER12

The Monthly Gridded Single Satellite Fluxes and Clouds (SFC) archival data product contains hourly single satellite flux and cloud parameters averaged over 1.0-degree regions. Input to the SFC Subsystem is the Single Satellite CERES Footprint TOA and Surface Fluxes, Clouds (SSF) archival data product. Each SFC covers a single month swath from a single CERES instrument mounted on one satellite. The product has a product header and multiple records; each record contains spatially averaged data for an individual region.

The major categories of data output on the SFC are as follows:

- Region data
- Total-sky radiative fluxes at TOA and surface
- Clear-sky radiative fluxes at TOA and surface
- Column-averaged cloud properties
- Angular model scene classes
- Surface-only data

A complete listing of parameters for this data product can be found in Table 2.14-1.

Level: 3
Type: Archival
Frequency: 1/Month

Time Interval Covered
File: Month
Record: Hour

Portion of Globe Covered
File: Gridded Satellite Swath
Record: 1.0-Deg Equal-angle Region

Portion of Atmosphere Covered
File: TOA and Surface

Table 2.14-1. Gridded Single Satellite TOA and Surface Fluxes and Clouds (SFC) (1 of 2)

Description	Parameter Num	Unit	Range	Elements/ Record	Bits/ Elem	Elem Num
SFC Header						
CERES Data Product Code		N/A	N/A	1	32	
CERES Spacecraft Identification Code		N/A	N/A	1	32	
CERES Instrument Identification code		N/A	N/A	1	32	
Zone Number		N/A	1 .. 180	1	32	
Data Year		N/A	1996 .. 2099	1	32	
Data Month		N/A	1 .. 12	1	32	
Number of hours per region		N/A	0 .. 744	360	32	
Data Process Date		N/A	N/A	1	136	
SFC Record						
Spatially Averaged Region Parameters						
Time and Position Data						
Key Footprint Parameters						
Julian Time	1	day	-0.1 .. 1.0	1	32	1
Sun colatitude	2	deg	0.0 .. 180.0	1	32	2
Sun longitude	3	deg	0.0 .. 360.0	1	32	3
Relative azimuth angle at TOA	4	deg	0.0 .. 360.0	1	32	4
Cosine of solar zenith angle at TOA	5	N/A	0.0 .. 1.0	1	32	5
Spacecraft zenith angle	6	deg	0.0 .. 90.0	1	32	6
Region ID						
Region number	7	N/A	1 .. 64800	1	32	7
Hourbox number	8	N/A	1 .. 744	1	32	8
Number of Footprints in region	9	N/A	1 .. 40	1	32	9
Other Regional Parameters						
Altitude of surface above sea level	10	m	-1000 .. 10000	1	32	10
Surface type percentage	11	percent	0.0 .. 100.0	20	32	11
Snow/Ice percent coverage	12	percent	0.0 .. 100.0	1	32	31
Precipitable Water	13	cm	0.0001 .. 10.0	1	32	32
Spatially Averaged Radiative Flux Parameters						
TOA Clear-Sky Fluxes is Array[3] of:						
Upward SW flux at TOA: mean, std, num obs	14	W m^{-2}	0.0 .. 1400.0	3	32	33
Upward LW flux at TOA: mean, std, num obs	15	W m^{-2}	100.0 .. 500.0	3	32	36
Upward LW window flux at TOA: mean, std, num obs	16	W m^{-2}	0.0 .. 800.0	3	32	39
Albedo: mean, std, num obs	17	N/A	0.0 .. 1.0	3	32	42
TOA Total-Sky Fluxes is Array[3] of:						
Upward SW flux at TOA: mean, std, num obs	18	W m^{-2}	0.0 .. 1400.0	3	32	45
Upward LW flux at TOA: mean, std, num obs	19	W m^{-2}	100.0 .. 500.0	3	32	48
Upward LW window flux at TOA: mean, std, num obs	20	W m^{-2}	0.0 .. 800.0	3	32	51
Albedo: mean, std, num obs	21	N/A	0.0 .. 1.0	3	32	54
Surface Clear-Sky Flux is Array[3] of:						
Downward SW flux, Model A: mean, std, num obs	22	W m^{-2}	0.0 .. 1400.0	3	32	57
Downward LW flux, Model A: mean, std, num obs	23	W m^{-2}	0.0 .. 700.0	3	32	60
SW net flux, Model A: mean, std, num obs	24	W m^{-2}	0.0 .. 1400.0	3	32	63
LW net flux, Model A: mean, std, num obs	25	W m^{-2}	-250.0 .. 50.0	3	32	66
Downward WN flux, Model A, mean, std, num obs	26	W m^{-2}	0.0 - 700.0	3	32	69
Downward SW flux, Model B: mean, std, num obs	27	W m^{-2}	0.0 .. 1400.0	3	32	72
Downward LW flux, Model B: mean, std, num obs	28	W m^{-2}	0.0 .. 700.0	3	32	75
SW net flux, Model B: mean, std, num obs	29	W m^{-2}	0.0 .. 1400.0	3	32	78
LW net flux, Model B: mean, std, num obs	30	W m^{-2}	-250.0 .. 50.0	3	32	81
Surface Total-Sky Flux is Array[3] of:						
Downward SW flux, Model A: mean, std, num obs	31	W m^{-2}	0.0 .. 1400.0	3	32	84
Downward LW flux, Model A: mean, std, num obs	32	W m^{-2}	0.0 .. 700.0	3	32	87
SW net flux, Model A: mean, std, num obs	33	W m^{-2}	0.0 .. 1400.0	3	32	90
LW net flux, Model A: mean, std, num obs	34	W m^{-2}	-250.0 .. 50.0	3	32	93
Downward WN flux, Model A, mean, std, num obs	35	W m^{-2}	0.0 - 700.0	3	32	96
Downward SW flux, Model B: mean, std, num obs	36	W m^{-2}	0.0 .. 1400.0	3	32	99
Downward LW flux, Model B: mean, std, num obs	37	W m^{-2}	0.0 .. 700.0	3	32	102
SW net flux, Model B: mean, std, num obs	38	W m^{-2}	0.0 .. 1400.0	3	32	105
LW net flux, Model B: mean, std, num obs	39	W m^{-2}	-250.0 .. 50.0	3	32	108

Table 2.14-1. Gridded Single Satellite TOA and Surface Fluxes and Clouds (SFC) (2 of 2)

Description	Parameter Num	Unit	Range	Elements/ Record	Bits/ Elem	Elem Num
Emissivity						
LW surface emissivity	40	N/A	0 .. 1	1	32	111
WN surface emissivity	41	N/A	0 .. 1	1	32	112
Spatially Averaged Cloud Parameters						
Spatially Averaged Weighted Column						
Averaged Cloud Properties for 5 Weightings						
(Five Weightings: SW, LW TOA, SFC LW, LWP, IWP)						
Spatially Averaged Cloud Area Fractions						
Overcast percent coverage	42	percent	0.0 .. 100.0	5	32	113
Total percent coverage	43	percent	0.0 .. 100.0	5	32	118
Spatially Averaged Cloud Properties is Array[3] of:						
Cloud effective pressure: mean, std, num obs	44	hPa	0.0 .. 1100.0	15	32	123
Cloud effective temperature: mean, std, num obs	45	K	100.0 .. 350.0	15	32	138
Cloud effective altitude: mean, std, num obs	46	km	0.0 .. 20.0	15	32	153
Cloud top pressure: mean, std, num obs	47	hPa	0.0 .. 1100.0	15	32	168
Cloud bottom pressure: mean, std, num obs	48	hPa	0.0 .. 1100.0	15	32	183
Cloud particle phase: mean, std, num obs	49	fraction	1.0 .. 2.0	15	32	198
Liquid water path: mean, std, num obs	50	g m^{-2}	TBD	15	32	213
Ice water path: mean, std, num obs	51	g m^{-2}	TBD	15	32	228
Liquid particle radius: mean, std, num obs	52	micron	TBD	15	32	243
Ice particle effective diameter: mean, std, num obs	53	micron	TBD	15	32	258
Visible optical depth (linear): mean, std, num obs	54	N/A	0.0 .. 100.0	15	32	273
Visible optical depth (logarithmic): mean, std, num obs	55	N/A	0.0 .. 100.0	15	32	288
Infrared emissivity: mean, std, num obs	56	N/A	0.0 .. 2.0	15	32	303
Cloud vertical aspect ratio: mean, std, num obs	57	N/A	TBD	15	32	318
Spatially Averaged Angular Model Scene Type Parameters						
Incident Solar Flux: mean, std	58	N/A	0.0 .. 1400.0	1	32	333
Angular Model Scene Type Parameters for 12 Scene Types						
Fractional area coverage	59	percent	0.0 .. 100.0	12	32	334
Angular Model Scene Type Statistical Data is Array[2] of:						
Albedo: mean, std	60	N/A	0.0 .. 1.0	24	32	346
LW flux: mean, std	61	W m^{-2}	0.0 .. 400.0	24	32	370

Total Meta Bits/File:	11848
Total Data Bits/Record:	12576
Total Records/File:	23572
Total Data Bits/File:	296441472
Total Bits/File:	296453320

Total Files/Product:	180
Total Meta Bits/Product:	2132640
Total Data Bits/Product:	53359464960
Total Bits/Product:	53361597600
Total MegaBytes/File:	35.34
Total GigaBytes/Product:	6.21

2.15 Monthly TOA and SRB Averages (SRBAVG)

EOSDIS Product Code: CER06

The SRBAVG product contains monthly and monthly hourly regional, zonal, and global averages of the TOA and surface LW and SW fluxes and the observed cloud conditions for each 1-degree equal-angle region. This product differs from the AVG product in three ways. First, the surface fluxes have been calculated from the TOA fluxes using parameterizations provided by the science team, instead of using the models provided by the SARB Subsystem. Secondly, no flux fields are calculated at levels between TOA and the surface. Lastly, the regional TOA fluxes are calculated using two methods.

SRBAVG is an archival product produced by Subsystem 10. There is one produced for each spacecraft and one for each combination of spacecraft. At the TRMM launch, this product will be produced in a validation mode for the first 18 months. During these 18 months, the CERES Science Team will derive a production quality set of Angular Distribution Models which are needed to produce the LW and SW instantaneous fluxes.

SRBAVG is composed of the following structures:

On a Regional, Zonal, and Global Basis:

- Regional parameters
- Total-sky radiative fluxes at TOA and surface
- Clear-sky radiative fluxes at TOA and surface
- Angular model scene types
- Column-averaged cloud properties for five weighting schemes:
  TOA SW, TOA LW, SFC LW, LWP and IWP
- Surface data

A complete listing of parameters for this data product can be found in Table 2.15-1.

Level: 3
Type: Archival
Frequency: 1/Month

Portion of Globe Covered
File: Entire Globe
Record: 1-Deg Regions

Time Interval Covered
File: Month
Record: Month

Portion of Atmosphere Covered
File: Surface and TOA

Table 2.15-1. Monthly TOA and SRB Averages (SRBAVG) (1 of 4)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
SRBAVG						
SRBAVG File Header		N/A	N/A	1		
SRBAVG Data						
REGIONAL DATA is Array[64800] of:						
SRBAVG Region Parameters..Table 2-15. Monthly TOA and SRB Averages (SRBAVG) (2 of 4)						
SRBAVG Region Parameters						
Region Number	1	N/A	1..64800	1	32	1
Altitude of surface above sea level	2	km	-1000..10000	1	32	2
Surface type percent coverage	3	percent	0.0..100.0	20	32	3
Snow/Ice Percent Coverage	4	percent	0.0..100.0	1	32	23
Precipitable Water	5	cm	0.0001..10.0	1	32	24
SRBAVG_RECORD						
SRBAVG TOA Fluxes						
Monthly-Hourly and Monthly TOA Fluxes is Array[25] of:						
(TOA hourly data are in elements 1-24, monthly data is in element 25)						
TOA Flux Record is Array[3] of:						
Total-Sky TOA Fluxes - ERBE method						
SW flux: mean, std, num obs	6	W m^{-2}	0.0..800.0	75	32	25
LW flux: mean, std, num obs	7	W m^{-2}	0.0..400.0	75	32	100
Window flux: mean, std, num obs	8	W m^{-2}	0.0..800.0	75	32	175
Albedo: mean, std, num obs	9	N/A	0.0..1.0	75	32	250
Total-Sky TOA Fluxes - GEO method						
SW flux: mean, std, num obs	10	W m^{-2}	0.0..800.0	75	32	325
LW flux: mean, std, num obs	11	W m^{-2}	0.0..400.0	75	32	400
Window flux: mean, std, num obs	12	W m^{-2}	0.0..800.0	75	32	475
Albedo: mean, std, num obs	13	N/A	0.0..1.0	75	32	550
Clear-Sky TOA Fluxes						
SW flux: mean, std, num obs	14	W m^{-2}	0.0..800.0	75	32	625
LW flux: mean, std, num obs	15	W m^{-2}	0.0..400.0	75	32	700
Window flux: mean, std, num obs	16	W m^{-2}	0.0..800.0	75	32	775
Albedo: mean, std, num obs	17	N/A	0.0..1.0	75	32	850
SRBAVG Surface Fluxes						
Monthly-Hourly and Monthly Surface Fluxes is Array[25] of:						
(Surface flux hourly data are in elements 1-24, monthly data is in element 25)						
Surface Fluxes Record is Array[3] of:						
Sfc_Down Total_Sky						
SW flux, Model A: mean, std, num obs	18	W m^{-2}	0.0..1400.0	75	32	925
LW flux, Model A: mean, std, num obs	19	W m^{-2}	0.0..700.0	75	32	1000
SW flux, Model B: mean, std, num obs	20	W m^{-2}	0.0..1400.0	75	32	1075
LW flux, Model B: mean, std, num obs	21	W m^{-2}	0.0..700.0	75	32	1150
WN flux, Model A: mean, std, num obs	22	W m^{-2}	0.0..700.0	75	32	1225
Sfc_Net Total_Sky						
SW flux, Model A: mean, std, num obs	23	W m^{-2}	0.0..1400.0	75	32	1300
LW flux, Model A: mean, std, num obs	24	W m^{-2}	-250.0..50.0	75	32	1375
SW flux, Model B: mean, std, num obs	25	W m^{-2}	0.0..1400.0	75	32	1450
LW flux, Model B: mean, std, num obs	26	W m^{-2}	-250.0..50.0	75	32	1525
Sfc_Down Clear_Sky						
SW flux, Model A: mean, std, num obs	27	W m^{-2}	0.0..1400.0	75	32	1600
LW flux, Model A: mean, std, num obs	28	W m^{-2}	0.0..700.0	75	32	1675
SW flux, Model B: mean, std, num obs	29	W m^{-2}	0.0..1400.0	75	32	1750
LW flux, Model B: mean, std, num obs	30	W m^{-2}	0.0..700.0	75	32	1825
WN flux, Model A: mean, std, num obs	31	W m^{-2}	0.0..700.0	75	32	1900

Table 2.15-1. Monthly TOA and SRB Averages (SRBAVG) (2 of 4)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
Sfc_Net Clear_Sky						
SW flux, Model A: mean, std, num obs	32	W m^{-2}	0.0 .. 1400.0	75	32	1975
LW flux, Model A: mean, std, num obs	33	W m^{-2}	-250.0 .. 50.0	75	32	2050
SW flux, Model B: mean, std, num obs	34	W m^{-2}	0.0 .. 1400.0	75	32	2125
LW flux, Model B: mean, std, num obs	35	W m^{-2}	-250.0 .. 50.0	75	32	2200
SRBAVG Surface Data						
Monthly-Hourly and Monthly Data is Array[25] of:						
(Surface hourly data are in elements 1-24, monthly data is in element 25)						
LW surface emissivity	36	N/A	0.0..1.0	25	32	2275
WN surface emissivity	37	N/A	0.0..1.0	25	32	2300
SRBAVG Cloud Properties						
Monthly-Hourly and Monthly Cloud Properties is Array[25] of:						
(Cloud hourly data are in elements 1-24, monthly data is in element 25)						
SRBAVG Angular_Model Scene_Types						
Incident solar flux	38	N/A	0.0 .. 1400.0	25	32	2325
SRBAVG Angular_Model Scene_Types Record is Array[12] of:						
Fractional area coverage	39	percent	0.0 .. 100.0	300	32	2350
Albedo: mean, stdev	40	N/A	0.0 .. 1.0	600	32	2650
LW flux: mean, stdev	41	W m^{-2}	0.0 .. 400.0	600	32	3250
SRBAVG Weighted_Cloud Properties Record is Array[5] of:						
(Five weightings: TOA SW, TOA LW, SFC LW, LWP, & IWP)						
Cloud Area Fractions						
Overcast Cloud Area Fraction	42	N/A	0.0 .. 100.0	125	32	3850
Total Cloud Area Fraction	43	N/A	0.0 .. 100.0	125	32	3975
SRBAVG Column_Averaged Properties Record is Array[3] of:						
Mean, st dev, and num obs of effective pressure	44	hPa	0.0 .. 1100.0	375	32	4100
Mean, st dev, and num obs of effective temperature	45	K	100.0 .. 350.0	375	32	4475
Mean, st dev, and num obs of effective altitude	46	km	0.0 .. 20.0	375	32	4850
Mean, st dev, and num obs of cloud top pressure	47	hPa	0.0 .. 1100.0	375	32	5225
Mean, st dev, and num obs of cloud bottom pressure	48	hPa	0.0 .. 1100.0	375	32	5600
Mean, st dev, and num obs of particle phase	49	fraction	1.0 .. 2.0	375	32	5975
Mean, st dev, and num obs of liquid water path	50	g m^{-2}	TBD	375	32	6350
Mean, st dev, and num obs of ice water path	51	g m^{-2}	TBD	375	32	6725
Mean, st dev, and num obs of liquid particle radius	52	micron	TBD	375	32	7100
Mean, st dev, and num obs of ice particle effective diameter	53	micron	TBD	375	32	7475
Mean, st dev, and num obs of VIS optical depth	54	N/A	0.0 .. 100.0	375	32	7850
Mean, st dev, and num obs of infrared emissivity	55	N/A	0.0 .. 2.0	375	32	8225
Mean, st dev, and num obs of vertical aspect ratio	56	N/A	TBD	375	32	8600

(END of REGIONAL DATA)

Table 2.15-1. Monthly TOA and SRB Averages (SRBAVG) (3 of 4)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
ZONAL AND GLOBAL DATA is Array[181] of:						
(Zonal data elements in elements 1-180, Global data in element 181)						
SRBAVG Zone Parameters						
Zone Number	57	N/A	1 .. 181	1	32	8975
Surface type percent coverage	58	percent	0.0 .. 100.0	20	32	8976
Snow/Ice Percent Coverage	59	percent	0.0 .. 100.0	1	32	8996
SRBAVG_RECORD						
SRBAVG TOA Fluxes						
Monthly-Hourly and Monthly TOA Fluxes is Array[25] of:						
(TOA hourly data are in elements 1-24, monthly data is in element 25)						
TOA Flux Record is Array[3] of:						
Total-Sky TOA Fluxes - ERBE method						
SW flux: mean, std, num obs	60	W m^{-2}	0.0 .. 1400.0	75	32	8997
LW flux: mean, std, num obs	61	W m^{-2}	0.0 .. 400.0	75	32	9072
Window flux: mean, std, num obs	62	W m^{-2}	0.0 .. 800.0	75	32	9147
Albedo: mean, std, num obs	63	N/A	0.0 .. 1.0	75	32	9222
Total-Sky TOA Fluxes - GEO method						
SW flux: mean, std, num obs	64	W m^{-2}	0.0 .. 1400.0	75	32	9297
LW flux: mean, std, num obs	65	W m^{-2}	0.0 .. 400.0	75	32	9372
Window flux: mean, std, num obs	66	W m^{-2}	0.0 .. 800.0	75	32	9447
Albedo: mean, std, num obs	67	N/A	0.0 .. 1.0	75	32	9522
Clear-Sky TOA Fluxes						
SW flux: mean, std, num obs	68	W m^{-2}	0.0 .. 1400.0	75	32	9597
LW flux: mean, std, num obs	69	W m^{-2}	0.0 .. 400.0	75	32	9672
Window flux: mean, std, num obs	70	W m^{-2}	0.0 .. 800.0	75	32	9747
Albedo: mean, std, num obs	71	N/A	0.0 .. 1.0	75	32	9822
SRBAVG Surface Fluxes						
Monthly-Hourly and Monthly Surface Fluxes is Array[25] of:						
(Surface flux hourly data are in elements 1-24, monthly data is in element 25)						
Surface Fluxes Record is Array[3] of:						
Sfc_Down Total_Sky						
SW flux, Model A: mean, std, num obs	72	W m^{-2}	0.0 .. 1400.0	75	32	9897
LW flux, Model A: mean, std, num obs	73	W m^{-2}	0.0 .. 700.0	75	32	9972
SW flux, Model B: mean, std, num obs	74	W m^{-2}	0.0 .. 1400.0	75	32	10047
LW flux, Model B: mean, std, num obs	75	W m^{-2}	0.0 .. 700.0	75	32	10122
WN flux, Model A: mean, std, num obs	76	W m^{-2}	0.0 .. 700.0	75	32	10197
Sfc_Net Total_Sky						
SW flux, Model A: mean, std, num obs	77	W m^{-2}	0.0 .. 1400.0	75	32	10272
LW flux, Model A: mean, std, num obs	78	W m^{-2}	-250.0 .. 50.0	75	32	10347
SW flux, Model B: mean, std, num obs	79	W m^{-2}	0.0 .. 1400.0	75	32	10422
LW flux, Model B: mean, std, num obs	80	W m^{-2}	-250.0 .. 50.0	75	32	10497
Sfc_Down Clear_Sky						
SW flux, Model A: mean, std, num obs	81	W m^{-2}	0.0 .. 1400.0	75	32	10572
LW flux, Model A: mean, std, num obs	82	W m^{-2}	0.0 .. 700.0	75	32	10647
SW flux, Model B: mean, std, num obs	83	W m^{-2}	0.0 .. 1400.0	75	32	10722
LW flux, Model B: mean, std, num obs	84	W m^{-2}	0.0 .. 700.0	75	32	10797
WN flux, Model A: mean, std, num obs	85	W m^{-2}	0.0 .. 700.0	75	32	10872
Sfc_Net Clear_Sky						
SW flux, Model A: mean, std, num obs	86	W m^{-2}	0.0 .. 1400.0	75	32	10947
LW flux, Model A: mean, std, num obs	87	W m^{-2}	-250.0 .. 50.0	75	32	11022
SW flux, Model B: mean, std, num obs	88	W m^{-2}	0.0 .. 1400.0	75	32	11097
LW flux, Model B: mean, std, num obs	89	W m^{-2}	-250.0 .. 50.0	75	32	11172

Table 2.15-1. Monthly TOA and SRB Averages (SRBAVG) (4 of 4)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
SRBAVG Surface Data						
Monthly-Hourly and Monthly Data is Array[25] of:						
(Surface hourly data are in elements 1-24, monthly data is in element 25)						
LW surface emissivity	90	N/A	0.0..1.0	25	32	11247
WN surface emissivity	91	N/A	0.0..1.0	25	32	11272
SRBAVG Cloud Properties						
Monthly-Hourly and Monthly Cloud Properties is Array[25] of:						
(Cloud hourly data are in elements 1-24, monthly data is in element 25)						
SRBAVG Angular_Model Scene_Types						
Incident solar flux	92	N/A	0.0 .. 1400.0	25	32	11297
SRBAVG Angular_Model Scene_Types Record is Array[12] of:						
Fractional area coverage	93	percent	0.0 .. 100.0	300	32	11322
Albedo: mean, stdev	94	N/A	0.0 .. 1.0	600	32	11622
LW flux: mean, stdev	95	W m^{-2}	0.0 .. 400.0	600	32	12222
SRBAVG Weighted_Cloud Properties Record is Array[5] of:						
(Five weightings: TOA SW, TOA LW, SFC LW, LWP, & IWP)						
Cloud Area Fractions						
Overcast Cloud Area Fraction	96	N/A	0.0 .. 100.0	125	32	12822
Total Cloud Area Fraction	97	N/A	0.0 .. 100.0	125	32	12947
SRBAVG Column_Averaged Properties Record is Array[3] of:						
Mean, st dev, and num obs of effective pressure	98	hPa	0.0 .. 1100.0	375	32	13072
Mean, st dev, and num obs of effective temperature	99	K	100.0 .. 350.0	375	32	13447
Mean, st dev, and num obs of effective altitude	100	km	0.0 .. 20.0	375	32	13822
Mean, st dev, and num obs of cloud top pressure	101	hPa	0.0 .. 1100.0	375	32	14197
Mean, st dev, and num obs of cloud bottom pressure	102	hPa	0.0 .. 1100.0	375	32	14572
Mean, st dev, and num obs of particle phase	103	fraction	1.0 .. 2.0	375	32	14947
Mean, st dev, and num obs of liquid water path	104	g m^{-2}	TBD	375	32	15322
Mean, st dev, and num obs of ice water path	105	g m^{-2}	TBD	375	32	15697
Mean, st dev, and num obs of liquid particle radius	106	micron	TBD	375	32	16072
Mean, st dev, and num obs of ice particle effective diameter	107	micron	TBD	375	32	16447
Mean, st dev, and num obs of VIS optical depth	108	N/A	0.0 .. 100.0	375	32	16822
Mean, st dev, and num obs of infrared emissivity	109	N/A	0.0 .. 2.0	375	32	17197
Mean, st dev, and num obs of vertical aspect ratio	110	N/A	TBD	375	32	17572

(END of ZONAL DATA)

Total Meta Bits/File:	0
Total Bits/Record:	287168
Total Records/File:	64981
Total Bits/File:	18660463808
Total Bytes/Record:	35896
Total Bytes/File:	2332557976
Total Megabytes/File:	2224.5

2.16 Gridded GEO Narrowband Radiances (GGEO)

EOSDIS Product Code: CERX14

The GGEO product is a single file containing a header record followed by multiple data records. The header record contains information to identify the product contents and version. These data are the CERES Data Product Code, the Data Starting and Ending Date, and the Product Creation Date and Time.

Each data record, called an hourbox, contains data particular to a single grid region and hour. The number of hourboxes on the file is constant and is determined by the number of data hours per day, the maximum number of days per month, and the number of regions in the grid (8 hours per day x 31 days per month x 64800 regions on globe = 16,070,400 hourboxes). Hourboxes for which there are no ISCCP data are filled with default values.

The data record (hourbox) contains three categories of data: Satellite and Hourbox ID information, Key Pixel Parameters, and Radiance Statistics.

- The **Satellite and Hourbox ID** information, as the name implies, identifies the hourbox as well as the satellite which collected the data within the hourbox. Although there are many grid regions on the Earth that are observed by more than one geostationary satellite, each hourbox contains only data from the closest observing satellite.
- The **Key Pixel Parameters** are data associated with the key pixel, the pixel which falls closest to the centroid of the region. These data are the time of the pixel and three angle measurements associated with the pixel: the cosine of the satellite zenith angle, the cosine of the solar zenith angle, and the relative azimuth angle.
- The primary data on the GGEO product are **Radiance Statistics**. These are visible and infrared radiance values averaged over a grid region every 3rd hour of each month. The statistics contain, in order, the calculated mean and variance and the number of pixels used for the calculations.

A complete listing of parameters for this data product can be found in Table 2.16-1.

Level: 3
Type: Ancillary
Frequency: Monthly

Time Interval Covered
File: Monthly
Record: Every Third Hour

Portion of Globe Covered
File: Entire Globe
Record: 1-Deg Equal-angle Regions

Portion of Atmosphere Covered
File: TOA

Table 2.16-1. Gridded GEO Narrowband Radiances (GGEO)

Description	Parameter Num	Unit	Range	Elements/ Record	Bits/ Elem	Elem Num	Bits/ Rec
GGEO							
GGEO Header							
CERES Data Product Code		N/A	N/A	1	32		32
Data Starting Date		N/A	N/A	1	32		32
Data Ending Date		N/A	N/A	1	32		32
Product Creation Date		N/A	N/A	1	32		32
Product Creation Time		N/A	N/A	1	32		32
GGEO Record							
Satellite and Hourbox ID							
Satellite Number	1	N/A	N/A	1	32	1	32
Region Number	2	N/A	1 .. 64800	1	32	2	32
Hour Number	3	N/A	1 .. 744	1	32	3	32
Key Pixel Parameters							
Time	4	hhmmss	0 .. 235959	1	32	4	32
Cos of Satellite Zenith Angle	5	N/A	-1.0 .. 1.0	1	32	5	32
Cos of Solar Zenith Angle	6	N/A	-1.0 .. 1.0	1	32	6	32
Relative Azimuth Angle	7	deg	0.0 .. 180.0	1	32	7	32
Radiance Statistics							
visible radiance: mean, var, num obs	8	$W\ m^{-2}sr^{-1}$	0.0 .. 20.0	3	32	8	96
infrared radiance: mean, var, num obs	9	$W\ m^{-2}sr^{-1}\mu m^{-1}$	0.0 .. 600.0	3	32	11	96

Total Meta Bits/File:	160
Total Data Bits/Record:	416
Total Records/File:	16070400
Total Data Bits/File:	6685286400
Total Bits/File:	6685286560
Total Data Bytes/Record:	52
Total Data Bytes/File:	835660800
Total Files/Product:	1

2.17 Meteorological, Ozone, and Aerosol Data (MOA)

EOSDIS Product Code: CERX06

The CERES archival product Meteorological, Ozone, and Aerosol Data (MOA) is produced by the CERES Regrid MOA Subsystem. Each MOA file contains meteorological, ozone, and aerosol data for one hour and is used by several of the CERES subsystems. Data on the MOA are derived from several data sources external to the CERES system, such as the Data Assimilation Office (DAO), NOAA, and various other meteorological satellites. These data arrive anywhere from four times daily to once a month, and have various horizontal resolutions. The Regrid MOA Subsystem interpolates the aerosol and ozone data horizontally to conform with the horizontal resolution of the meteorological data. Profile data are interpolated vertically to conform with CERES requirements. The MOA also contains column perceptible water data measured by microwave instruments, such as TRMM Microwave Imager (TMI) or Special Sensor Microwave/Imager (SSM/I), on their native grid (0.5-degree x 0.5–degree). For a MOA region of 2-degree x 2.5-degree, there are 10 microwave humidity regions. All data are temporally interpolated to provide data to the CERES processing system on an hourly basis.

The MOA contains:

- Surface pressure, geopotential height, skin temperature, and sea surface state
- Vertical profiles of temperature and humidity for 58 atmospheric levels
- Vertical profiles for 18 atmospheric levels below the tropopause of wind u-vector and v-vector data
- Tropospheric height
- Air mass index
- Column perceptible water based on humidity profiles
- Column perceptible water based on microwave measurements
- Column averaged relative humidity
- Vertical profile of ozone mixing ratios for 58 atmospheric levels
- Column ozone
- Aerosol optical depth

A complete listing of parameters for this data product can be found in Table 2.17-1.

Level: 3
Type: Archival
Frequency: 1/Hour

Time Interval Covered
File: 1 Hour
Record: 1 Hour

Portion of Globe Covered
File: Global
Record: 1 Region

Portion of Atmosphere Covered
File: Surface to TOA

Table 2.17-1. Meteorological, Ozone, and Aerosol (MOA)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
Header						
Date and Hour		N/A	ASCII string	1	216	
MOA Processing Date		N/A	ASCII string	1	216	
MOA Grid Index		N/A	1 .. 1	1	16	
Number of MOA Regions		N/A	13104 .. 13104	1	32	
Temperature, Humidity, and Ozone Profile Fixed Pressure Levels		hPa	0 .. 1100	55	32	
Wind Speed Profile Pressure levels		hPa	0 .. 1100	18	32	
Surface Data						
MOA Region Number	1	N/A	1 .. 13104	1	32	1
Surface Pressure	2	hPa	0 .. 1100	1	32	2
Surface Geopotential Height	3	m	-100 .. 10000	1	32	3
Surface Skin Temperature	4	K	175 .. 375	1	32	4
Flag, Sea Surface State	5	N/A	0 .. 9	1	32	5
Flag, Source Surface Data	6	N/A	TBD	1	32	6
Meteorological Profiles						
Temperature Profiles	7	K	175 .. 375	58	32	7
Specific Humidity Profiles	8	g kg^{-1}	.001 .. 30.0	58	32	65
Wind Profile, U-Vector	9	m sec^{-1}	-100 .. 100	18	32	123
Wind Profile, V-Vector	10	m sec^{-1}	-100 .. 100	18	32	141
Flag, Source Meteorological Profiles	11	N/A	TBD	1	32	159
Meteorological Column Data						
Tropospheric Height	12	hPa	150 .. 300	1	32	160
Air Mass Index	13	N/A	0 .. 10	1	32	161
Precipitable Water	14	cm	0.001 .. 10.000	1	32	162
Column Averaged Relative Humidity	15	N/A	0 .. 100	1	32	163
Microwave Precipitable Water	16	cm	0.001 .. 10.000	10	32	164
Microwave Precipitable Water, std	17	cm	TBD	10	32	165
Flag, Source Microwave Column Precipitable Water	18	N/A	TBD	10	32	166
Ozone Profile Data						
Ozone Mixing Ratio Profiles	19	g kg^{-1}	0.00002 .. 0.02	58	32	167
Flag, Source Ozone Profile Data	20	N/A	TBD	1	32	225
Column Ozone						
Column Ozone	21	du	0 .. 500	1	32	226
Flag, Source Column Ozone	22	N/A	TBD	1	32	227
Total Column Aerosol						
Optical Depth, Total Column	23	g m^{-2}	0 .. 2	1	32	228
Flag, Source Optical Depth, Total Column	24	N/A	TBD	1	32	229
Spares	25	N/A	TBD	2	32	230

Total Header Bits/File:	544
Total Data Bits/Record:	8256
Total Records/File:	13104
Total Data Bits/File:	108186624
Total Bits/File:	108187168

3.0 Internal Data Products

This section describes the CERES nonarchival data products which are produced and used within the CERES processing stream. These data products are temporarily stored for periods from days to years. Each subsection contains a brief overview of the purpose and content of the data product followed by a table which lists every parameter contained in the product. The following data attributes are described in the overview sections:

- Level - Level of the data
- Type - Data type (Archival, Internal or Ancillary)
- Frequency - How often the product is received or produced
- Time Interval Covered -
  - File - Time period covered within this file
  - Record - Time period covered within one record of this file
- Portion of Globe Covered -
  - File - Portion of the globe covered within this file
  - Record - Portion of the globe covered with a record of this file
- Portion of Atmosphere Covered -
  - File - Portion of the atmosphere covered within this file (Surface, TOA, etc.)

The tables in each subsection contain the following attributes for each parameter:

- Description - A textual description of the parameter
- Parameter Number - Number assigned to the parameter
- Units - Units of the parameter value
- Range - Range of values for the parameter
- Elements/Record - Elements per record for this parameter (array definition)
- Bits/Element - Number of bits used to describe this parameter
- Elem Num - Element Number, a numbering of each element in the file/record

The following summary information is provided at the end of each table:

- Total Meta Bits/File - Total number of bits within the file containing metadata
- Total Data Bits/Record - Total number of bits within each record of the file
- Total Records/File - Total number of records within the file
- Total Data Bits/File - Total number of data bits within the entire file, excludes metadata
- Total Bits/File - Total number of bits in the file including metadata

The bolded entries within the file are names for the group of parameters which follow.

3.1 Instrument Earth Scans (IES)

EOSDIS Product Code: CER09

The IES data product contains 1-hour of data from a single CERES scanner. The data records are ordered in time with a separate index that sorts the records by along-track angle relating each footprint position to the spacecraft's suborbital point at the start of the hour. The spatial ordering of records using this index will ease the comparison of CERES data with cloud imager data in Subsystem 4. The footprint record is the basic data structure for this data product. This record contains the following kinds of information:

1) Time of Observation
2) Geolocation data (at both the Top-of-Atmosphere (TOA) and at Earth's surface)
3) Filtered radiances (at satellite altitude), with associated quality measures
4) Spacecraft orbital data
5) Footprint viewing geometric data

The IES data product contains only measurements that view the Earth. For the Tropical Rainfall Measuring Mission (TRMM) mission, this means that approximately 225 Earth-viewing footprints (records) are stored on the IES from each 3.3-second half-scan. We have used an estimate of the number of 3.3-second half-scans per hour (approximately 1091) times the number of Earth-viewing measurements in a half-scan (TRMM estimate is 225, EOS estimate is 195) to arrive at our IES product sizing. For TRMM, this is estimated as 245475 measurements per IES data product, and for EOS the estimate is 212745 measurements. The larger of these two measures is used to determine product sizing. The complete listings of parameters for this data product can be found in Tables 3.1-1 and 3.1-2.

Level: 1b
Type: Internal
Frequency: 1/Hour

Time Interval Covered
File: 1 Hour
Record: 1/100-Second

Portion of Globe Covered
File: Satellite Swath
Record: 1 CERES Footprint

Portion of Atmosphere Covered
File: Satellite Altitude

Instrument Earth Scans (IES) Definition

IES Metadata - TBD

IES Vdatas

Vdata Name: IES Hour XX
Number of Records: Variable

Number of Fields: 29
Parameter(s): Table 3.1-1

Table 3.1-1. IES Record

Field No.	Field Name / Parameter	Data Type	Units	Range	No. of Components
1	Colatitude of CERES FOV at TOA	32-Bit Float	deg	0.0 ..180.0	1
2	Longitude of CERES FOV at TOA	32-Bit Float	deg	0.0 .. 360.0	1
3	Colatitude of CERES FOV at Surface	32-Bit Float	deg	0.0 ..180.0	1
4	Longitude of CERES FOV at Surface	32-Bit Float	deg	0.0 .. 360.0	1
5	CERES Viewing Zenith at TOA	32-Bit Float	deg	0.0 .. 90.0	1
6	CERES Solar Zenith at TOA	32-Bit Float	deg	0.0 .. 180.0	1
7	CERES Relative Azimuth at TOA	32-Bit Float	deg	0.0..360.0	1
8	CERES Viewing Azimuth at TOA wrt North	32-Bit Float	deg	0.0 .. 360.0	1
9	Cross-track Angle of CERES FOV at TOA	32-Bit Float	deg	-90.0 .. 90.0	1
10	Along-track Angle of CERES FOV at TOA	32-Bit Float	deg	-20.0 .. 360.0	1
11	Cone Angle of CERES FOV at Satellite	32-Bit Float	deg	0.0 .. 90.0	1
12	Clock Angle of CERES FOV at Satellite wrt Inertial Velocity	32-Bit Float	deg	0.0..360.0	1
13	Rate of Change of Cone Angle	32-Bit Float	deg sec^{-1}	-100.0 .. 100.0	1
14	Rate of Change of Clock Angle	32-Bit Float	deg sec^{-1}	-10.0 .. 10.0	1
15	X Component of Satellite Inertial Velocity	64-Bit Float	km sec^{-1}	-10.0 .. 10.0	1
16	Y Component of Satellite Inertial Velocity	64-Bit Float	km sec^{-1}	-10.0 .. 10.0	1
17	Z Component of Satellite Inertial Velocity	64-Bit Float	km sec^{-1}	-10.0 .. 10.0	1
18	Radius of Satellite from Center of Earth at Observation	64-Bit Float	km	6000.0 .. 8000.0	1
19	CERES TOT Filtered Radiance, Upwards	32-Bit Float	W $m^{-2}sr^{-1}$	0.0 .. 700.0	1
20	CERES SW Filtered Radiance, Upwards	32-Bit Float	W $m^{-2}sr^{-1}$	-10.0 .. 510.0	1
21	CERES WN Filtered Radiance, Upwards	32-Bit Float	W $m^{-2}sr^{-1}$	0.0 .. 50.0	1
22	Colatitude of Satellite at Observation	32-Bit Float	deg	0.0 .. 180.0	1
23	Longitude of Satellite at Observation	32-Bit Float	deg	0.0 .. 360.0	1
24	Colatitude of Sun at Observation	32-Bit Float	deg	0.0 .. 180.0	1
25	Longitude of Sun at Observation	32-Bit Float	deg	0.0 .. 360.0	1
26	Scan Sample Number	U16 Integer	N/A	1 .. 660	1
27	IES Quality Flags	U32 Integer	N/A	see Table 2.1-4	1
28	Packet Number	U16 Integer	N/A	0 .. 32767	1
29	Time of Observation	64-Bit Float	day	-0.01 .. 1.01	1

Vdata Name: Along Track Sort Index
Number of Records: Number of IES Records

Number of Fields: 2
Parameter(s): Table 3.1-2

Table 3.1-2. Along-track Angle Sort Index

Field No.	Field Name	Data Type	Units	Range	No. of Components
1	Footprint Index	U32 Integer	N/A	0 .. n - 1	1
2	Along Track Angle	32-Bit Float	N/A	-20.0 .. 360.0	1

3.2 ERBE-like Daily Data Base (EDDB/EID-6)

EOSDIS Product Code: CERX02

The EID-6 product is generated daily by the ERBE-like Inversion Subsystem (2.0). It contains regional averages of several parameters on the ERBE 2.5-degree equal-angle grid. Table 3.2-1 shows each parameter passed from the ERBE-like Inversion to Instantaneous TOA Subsystem (2.0) on the EID-6 to the ERBE-like Averaging to Monthly TOA Fluxes Subsystem (3.0).

Level: 2
Type: Internal
Frequency: 1/Day

Time Interval Covered
File: Day
Record: N/A

Portion of Globe Covered
File: Regional
Record: Individual Region

Portion of Atmosphere Covered
File: TOA

Table 3.2-1. ERBE-like Daily Regional Averages (EDDB/EID-6) (1 of 2)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
EDDB						
EDDB_File_Header						
EDDB File Header		N/A		TBD	TBD	
EDDB_Regional_Data_Records						
Region number	1	N/A	1..10368	1	64	1
Julian day	2	day	2449353..2458500	1	64	2
Julian time	3	day	0..1	1	64	3
Regional_Average_Estimates						
SW flux average value	4	W m^{-2}	0..1400	1	64	4
LW flux average value	5	W m^{-2}	0..400	1	64	5
Retional_SW_Statistics						
SW flux number of values	6	N/A	0..500	1	64	6
SW flux standard deviation	7	W m^{-2}	0..1400	1	64	7
SW flux minimum value	8	W m^{-2}	0..1400	1	64	8
SW flux maximum value	9	W m^{-2}	0..1400	1	64	9
Regional_LW_Statistics						
LW flux number of values	10	N/A	0..500	1	64	10
LW flux standard deviation	11	W m^{-2}	0..400	1	64	11
LW flux minumum value	12	W m^{-2}	0..400	1	64	12
LW flux maximum value	13	W m^{-2}	0..400	1	64	13
Geo_Scene						
Geographic Scene Type	14	N/A	1..5	1	64	14
Clear-sky fraction	15	N/A	0..1	1	64	15
Partly-cloudy fraction	16	N/A	0..1	1	64	16
Mostly-cloudy Fraction	17	N/A	0..1	1	64	17
Overcast Fraction	18	N/A	0..1	1	64	18
Albedos						
Albedo for clear-sky	19	N/A	0..1	1	64	19
Albedo for partly-cloudy	20	N/A	0..1	1	64	20
Albedo for mostly-cloudy	21	N/A	0..1	1	64	21
Albedo for overcast	22	N/A	0..1	1	64	22
Angular_Averages						
Average of cosines of solar zenith angles	23	N/A	0..1	1	64	23
Average of spacecraft zenith angles	24	deg	0..90	1	64	24
Average of relative azimuth angles	25	deg	0..180	1	64	25
Clear-Sky_Statistics						
Clear-sky albedo standard deviation	26	N/A	0..1	1	64	26
Clear-sky LW flux average value	27	W m^{-2}	0..400	1	64	27
Clear-sky LW flux standard deviation	28	W m^{-2}	0..400	1	64	28
Clear-sky LW flux number of values	29	N/A	0..500	1	64	29
Spares						
Spare	30	N/A	N/A	1	64	30
Spare	31	N/A	N/A	1	64	31

Total Meta Bits/File:	TBD
Total Data Bits/Record:	1984
Total Records/File (TRMM):	27597
Total Data Bits/File:	54752448
Total Bits/File:	54752448
Total Data Bits/Record:	1984
Total Records/File (EOS-AM):	72845
Total Data Bits/File:	144524480

Table 3.2-1. ERBE-like Daily Regional Averages (EDDB/EID-6) (2 of 2)

Total Data Bits/Record:	1984
Records/File (EOS-PM):	72597
Total Data Bits/File:	141423488
Total Bits/File:	141423488

Note: The sizing estimate for the EDDB/EID6 in the “Internal Products Summary” Table is for EOS-AM.

4.0 Ancillary Data Products

This section describes the non-CERES input data products which are used by CERES to interpret CERES measurements. Each subsection contains a brief overview of the purpose and content of the data product followed by a table which lists every parameter contained in the product. The following data attributes are described in the overview sections:

- Level - Level of the data
- Type - Data type (Archival, Internal or Ancillary)
- Frequency - How often the product is received or produced
- Time Interval Covered -
  - File - Time period covered within this file
  - Record - Time period covered within one record of this file
- Portion of Globe Covered -
  - File - Portion of the globe covered within this file
  - Record - Portion of the globe covered with a record of this file
- Portion of Atmosphere Covered -
  - File - Portion of the atmosphere covered within this file (Surface, TOA, etc.)

The tables in each subsection contain the following attributes for each parameter:

- Description - A textual description of the parameter
- Parameter Number - Number assigned to the parameter
- Units - Units of the parameter value
- Range - Range of values for the parameter
- Elements/Record - Elements per record for this parameter (array definition)
- Bits/Element - Number of bits used to describe this parameter
- Elem Num - Element Number, a numbering of each element in the file/record

The following summary information is provided at the end of each table:

- Total Meta Bits/File - Total number of bits within the file containing metadata
- Total Data Bits/Record - Total number of bits within each record of the file
- Total Records/File - Total number of records within the file
- Total Data Bits/File - Total number of data bits within the entire file, excludes metadata
- Total Bits/File - Total number of bits in the file including metadata

The bolded entries within the file are names for the group of parameters which follow.

4.1 MODIS Cloud Imager Data (CID_MODIS)

EOSDIS Product Code: CERX04

CID_MODIS (MODIS Cloud Imager Data) from the EOS spacecraft is a Level-1B data set with nineteen of the MODIS channels. The MODIS Team produces a Level-1A Geolocation data set in addition to the Level-1B data set. The files are in Hierarchical Data Format (HDF). At this time, the organizational and content details of this product are not finalized. It is assumed that only Earth-viewing radiances and uncertainties from the Level-1B product will be sent to the LaRC DAAC. The parameters requested are

Earth-viewing radiances
Geodetic latitude
Geodetic longitude
Earth-viewing radiance uncertainties
Geolocation flags

The channels currently requested by the CERES Science Team are

Channels	Micron	Resolution (km)	Channels	Micron	Resolution (km)
Channel 1	0.645	0.25 & 1	Channel 26	1.38	1
Channel 6	1.64	1	Channel 27	6.7	1
Channel 7	2.13	1	Channel 29	8.55	1
Channel 17	0.91	1	Channel 31	11.0	1
Channel 18	0.93	1	Channel 32	12.0	1
Channel 19	0.94	1	Channel 33	13.3	1
Channel 20	3.75	1	Channel 34	13.6	1
Channel 23	4.0	1	Channel 35	13.9	1
Channel 24	4.46	1	Channel 36	14.2	1
Channel 25	4.52	1			

The CERES Science Team has requested data averaged from the 1/4-km resolution channel to the 1 km resolution. It is unclear who will perform this averaging.

The CID_MODIS product is external to the CERES processing and is released after CERES processing is completed. It is assumed that the responsible EOSDIS DAAC will retain a copy of this product should it be needed by CERES for a rerun.

A complete listing of parameters for this data product can be found in Table 4.1-1.

Level: 1-B
Type: Ancillary
Frequency: 1 per 2.5-Min

Portion of Globe Covered
File: Satellite Swath
Record: .25- - 1.0-km by .25- - 1.0-km

Time Interval Covered
File: 2.5-Min
Record: Instantaneous

Portion of Atmosphere Covered
File: Satellite Altitude

Table 4.1-1. MODIS Cloud Imager Data (CID_MODIS)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem
CID_MODIS (Level-IB)					
MODIS HDF Header					
ECS Standard Granule Metadata		N/A	N/A	1	TBD
MODIS Level 1B Specific Granule Metadata		N/A	N/A	1	TBD
MODIS Level 1B Non-core Granule Metadata		N/A	N/A	1	TBD
Level 1B Instrument Data: Dimensions		N/A	N/A	1	1,440
Level 1B Instrument Data: Slopes and Offsets		N/A	N/A	1	9,728
Pixel Quality Science Data Sets		TBD	TBD	1,504,000	16
Level 1B Swath Metadata		N/A	N/A	100	544
MODIS HDF Data					
250 M SDS (40 * 100 scanlines * 1 Channel * 4 * Earth View Frames)					
EarthView_250_RefSB_Rad	1	N/A	N/A	21,664,000	16
EarthView_250_RefSB_Rad_Uncert	2	N/A	N/A	21,664,000	16
1000 M SDS (10 * 100 scanlines * 19 Channels * Earth View Frames)					
EarthView_1000_RefSB_Rad	3	N/A	N/A	25,726,000	16
EarthView_1000_RefSB_Rad_Uncert	4	N/A	N/A	25,726,000	16
Total Meta Bits/File:	24,129,568				
Total Data Bits/File:	1,516,480,000				
Total Bits/File :	1,540,609,568				
Total Mbytes/File:	183.7				
Total Mbytes/Hour:	4,480				
Total Mbytes/Day:	107,520				

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem
CID_MODIS (Geolocation)					
MODIS HDF Header					
ECS Standard Granule Metadata		N/A	N/A	1	TBD
MODIS Geolocation Specific Granule Metadata		N/A	N/A	1	TBD
Processing and Geometric Parameters		N/A	N/A	1	TBD
Scan-level Metadata and Navigation Data		N/A	N/A	100	TBD
MODIS HDF Data					
Geodetic Longitude	1	rad	$-\pi$ .. π	1,354,000	32
Geodetic Latitude	2	rad	$-\pi/2$ .. $\pi/2$	1,354,000	32
Geolocation Flags	3	N/A	N/A	1,354,000	8
Total Meta Bits/File:	TBD				
Total Data Bits/File:	97,488,000				
Total Bits/File:	97,488,000				
Total Mbytes/File:	11.63				
Total Mbytes/Hour:	283.5				
Total Mbytes/Day:	6,803				

CID_MODIS Total Data volume	
Total Mbytes/Granule:	195.3
Total Mbytes/Hour:	4763.5
Total Mbytes/Day:	114,323

4.2 VIRS Cloud Imager Data (CID_VIRS)

EOSDIS Product Code: CERX05

The VIRS Cloud Imager Data (CID_VIRS) are Level 1-B data from the five VIRS channels on the TRMM spacecraft. The data coverage is one orbit; however, the orbit files will be processed on an hourly basis. The sizes listed in the following data description reflect the number of scan line records in 1 hour (11,808). The product is in Hierarchical Data Format (HDF). The product contains metadata and various HDF structures which hold the geolocation data, spacecraft navigation data, local direction angles to the Sun and the spacecraft, scan status data, imager calibration data, and imager radiance data for all of the scan line records. All radiance values for a single channel for all scan lines are together in the same HDF structure. It is assumed that the data are organized in scan lines that appear to scan in the same direction for each scan.

The VIRS product contains the following types of data:

Metadata	Spacecraft navigation data
HDF swath structure	Calibration data
Scan time	Local direction angles to Sun and satellite
Pixel geolocation	VIRS imager pixel data
Scan status flags	

The VIRS channels are

Channels	Micron	Resolution
Channel 1	0.63	2-km
Channel 2	1.60	2-km
Channel 3	3.75	2-km
Channel 4	10.80	2-km
Channel 5	12.00	2-km

CID_VIRS products are external to the CERES processing and are released after CERES processing is completed. It is assumed that the responsible EOSDIS DAAC would retain a copy of this product should it be needed by CERES. A complete listing of parameters for this data product can be found in Table 4.2-1.

Level: 1-B
Type: Ancillary
Frequency: 1/Hour

Portion of Globe Covered
File: Satellite Swath
Record: 2-km by 2-km

Time Interval Covered
File: 1 Hour
Record: Instantaneous

Portion of Atmosphere Covered
File: Satellite Altitude

Table 4.2-1. VIRS Cloud Imager Data (CID_VIRS)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem
CID_VIRS					
VIRS Metadata					
ECS Core Metadata		N/A	N/A	1	80000
Product Specific Metadata		N/A	N/A	1	80000
VIRS Swath Data					
Swath Structure for HDF					
HDF information for decoding the product	1	N/A	TBD	1	40000
Scan Time is Array[11808] of:					
UTC seconds of day	2	sec	TBD	11808	64
Geolocation is Array[11808] of:					
Pixel Location is Array[261] of:					
Latitude of imager pixel	3	deg	-90 .. 90	3081888	32
Longitude of imager pixel	4	deg	0..360	3081888	32
Scan Status is Array[11808] of:					
Scan status	5	N/A	TBD	11808	152
Navigation is Array[11808] of:					
Spacecraft Geocentric Position is					
x component	6	m	TBD	11808	32
y component	7	m	TBD	11808	32
z component	8	m	TBD	11808	32
Spacecraft Geocentric Velocity is					
xdot component	9	m sec^{-1}	TBD	11808	32
ydot component	10	m sec^{-1}	TBD	11808	32
zdot component	11	m sec^{-1}	TBD	11808	32
Spacecraft Geodetic Position is					
Latitude	12	deg	-90 .. 90	11808	32
Longitude	13	deg	0..360	11808	32
Altitude	14	m	TBD	11808	32
Spacecraft Geocentric Attitude is Array[3] of:					
yaw, pitch, roll	15	deg	TBD	35424	32
Sensor Orientation Matrix is Array[9] of:					
Instrument coordinate rotation to Geocentric Inertial Coordinates	16	N/A	TBD	106272	32
Greenwich Hour Angle	17	deg	TBD	11808	32
Calibration Counts is Array[11808] of:					
Channel Number/Data Word is Array[5,2] of:					
Blackbody	18	count	TBD	118080	16
Spaceview	19	count	TBD	118080	16
Solar Diffuser	20	count	TBD	118080	16
Local Direction is Array[11808] of:					
Pixel Number is Array[27] of:					
Zenith angles to the satellite	21	deg	0 .. 90	318816	16
Zenith angles to the sun	22	deg	0 .. 90	318816	16
Azimuth angles to the satellite	23	deg	0 .. 90	318816	16
Azimuth angles to the sun	24	deg	0 .. 90	318816	16
Image Data is Array[11808] of:					
Channel Data is Array[261] of:					
Channel 1, .63 micrometers (visible), day only	25	mW $cm^{-2}sr^{-1}\mu m^{-1}$	TBD	3081888	16
Channel 2, 1.6 micrometers (near infrared), day only	26	mW $cm^{-2}sr^{-1}\mu m^{-1}$	TBD	3081888	16
Channel 3, 3.75 micrometers (infrared), day and night	27	mW $cm^{-2}sr^{-1}\mu m^{-1}$	TBD	3081888	16
Channel 4, 10.7 micrometers (infrared, clouds), day and night	28	mW $cm^{-2}sr^{-1}\mu m^{-1}$	TBD	3081888	16
Channel 5, 12.0 micrometers (infrared, moisture), day and night	29	mW $cm^{-2}sr^{-1}\mu m^{-1}$	TBD	3081888	16

Total Metadata Bits/File:	160 000
Total HDF Swath Structure Bits/File:	40 000
Total Data Bits/File:	480 727 296
Total Bits/File:	480 927 296
Total Megabytes/File:	57.33

4.3 Surface Map (SURFMAP)

EOSDIS Product Code: CERX07

The Surface Map (SURFMAP) product is a composite product of different types of surface conditions, arranged on a global 1/6-degree by 1/6-degree equal-angle grid. The individual products received from different non-EOS sources are

SURFMAP(ICE)	Ice map
SURFMAP(SNOW)	Snow map
SURFMAP(DEM)	Digital elevation map
SURFMAP(ECO)	Ecosystem map
SURFMAP(H2O)	Percent water content map
SURFMAP(ERBE)	ERBE scene id map

The surface type indicator specifies which of the surface conditions best describes the grid cell (land, water, snow, or ice). Snow/ice takes precedence over land/water.

The SURFMAP products are updated at different frequencies, depending on the type of data. For example, the snow and ice map are updated weekly, whereas the elevation map may be used for the life of the mission. EOSDIS will provide the data for some of the required surface conditions. Upon availability and suitability, the CERES software will access these data sets through the Toolkit. A complete listing of parameters for this data product can be found in Table 4.3-1.

Level: 3
Type: Ancillary
Frequency: Weekly

Portion of Globe Covered
File: Entire Globe
Record: 1/6-Deg by 1/6-Deg

Time Interval Covered
File: 1 Week
Record: 1 Week

Portion of Atmosphere Covered
File: Surface

Table 4.3-1. Surface Map (SURFMAP)

Description	Parameter Number	Units	Range	Elements/ Record	Bits/ Elem
SURFMAP					
ICE					
Record_ICE is Array[2332800] of:					
Ice map	1	percent	0 .. 100	1	8
SNOW					
Record_SNOW is Array[2332800] of:					
Snow map	2	percent	0 .. 100	1	8
DEM					
Record_DEM is Array[2332800] of:					
Digital Elevation Model	3	km	-12..10	1	16
ECO					
Record_ECO is Array[2332800] of:					
Ecosystem map	4	N/A	0..13	1	8
H2O					
Record_H2O is Array[2332800] of:					
Water map	5	percent	0 .. 100	1	8
ERBE					
Record_IGBP is Array[2332800] of:					
IGBP Scene ID map	6	N/A	1 .. 20	1	8

Total Data Bits/Record:	18,662,400 / 37,324,800
Total Records/File:	6
Total Bits/File:	130,636,800
Total MBytes/File:	16

4.4 Geostationary Narrowband Radiances (GEO)

EOSDIS Product Code:CERX09

Currently, CERES will use geostationary satellite data collected by the International Satellite Cloud Climatology Project (ISCCP).

The ISCCP B1 dataset consists of a narrowband infrared channel radiance (near 10.8 micrometer) and a narrowband visible channel radiance (near 0.68 micrometer). The radiances are sampled at about 10-km resolution every 3 hours. These data are in the form of eight- or ten-bit counts that can be converted to radiances using either nominal, normalized, or updated calibration formulae.

There are four sets of B1 data currently available. Others may be added in the future as other satellites are launched. The four sets currently available are

1) GMS in GMS format
2) METEOSAT in METEOSAT format
3) GOES-8 in Canadian format
4) GOES-9 in McIDAS format

These data will be provided by EOSDIS which will acquire them from NOAA, the designated archive center for ISCCP B1 data. The data volume is as follows:

1) GMS: eight 3480 cartridges
2) METEOSAT: eight 3480 cartridges
3) GOES-8: fifteen 3480 cartridges
4) GOES-9: seven 3480 cartridges

Each 3480 cartridge holds about 200 MB, so the data volume will be about 7.6 GB per month. NOAA will package these data in 8-millimeter tape format.

Level: 1B
Type: Ancillary
Frequency: Every Third Hour

Portion of Globe Covered
File: 1 Hemisphere
Record: 10-km Pixel

Time Interval Covered
File: 1 Hour
Record: Instantaneous

Portion of Atmosphere Covered
File: TOA

NOTE: Geostationary products are produced by the International Satellite Cloud Climatology Project(ISCCP). They are used by, but are not archived by, the CERES Project. Please contact the ISCCP Project for product information.

4.5 Aerosol Profile Data (APD)

EOSDIS Product Code: CERX10

The external ancillary data product, Aerosol Profile Data (APD), is input to the CERES Regrid Meteorological, Ozone, and Aerosol Data Subsystem. The APD is the source of the total column aerosol optical depth data. These data may be derived daily from the MODIS instrument for the EOS-AM and EOS-PM platforms, while for TRMM the aerosol optical depth data may be derived from monthly climatologies based on weekly NOAA-AVHRR data for ocean and 3-hourly Pinker data for land. AVHRR data may also be used for the EOS-AM and EOS-PM platforms. MODIS data will have a horizontal resolution of either 50-km ×-50-km or 5-km × 5-km for ocean, and 50-km × 50-km for nondesert land. AVHRR data have a horizontal resolution of 1-degree x 1-degree. MISR aerosol data may be used as a backup source. It will provide full global coverage every 10 to 15 days. Stratospheric aerosol data may be obtained from climatologies based on SAGE data. The Regrid Meteorological, Ozone, and Aerosol Data Subsystem interpolates these data temporally and horizontally to conform with CERES processing requirements. ADP file sizes are shown in Table 4.5-1.

Level: 3
Type: Ancillary
Frequency: Daily, Weekly

Portion of Globe Covered
File: Global
Record: 1 Region

Time Interval Covered
File: 1 Day for MODIS,
1 Week for AVHRR
Record: 1 Day for MODIS,
1 Week for AVHRR

Portion of Atmosphere Covered
File: Total Column

Table 4.5-1. APD File Sizes

Platform	Source	Monthly Size
EOS-AM EOS-PM	MODIS	TBD
	SAGE	TBD
TRMM	NOAA	0.29 MB
	Pinker	0.03 MB

4.6 Gridded Analysis Product (GAP)

EOSDIS Product Code: CERX12

The external ancillary data product, Gridded Analysis Product (GAP), is input to the CERES Regrid Meteorological, Ozone, and Aerosol Data Subsystem. The GAP contains vertical profiles of temperature and specific humidity as a function of pressure, along with surface temperature and pressure. These data will be available every 6 hours from the Data Assimilation Office (DAO) on a 2-degree latitude x 2.5–degree longitude grid. The Regrid Meteorological, Ozone, and Aerosol Data Subsystem interpolates these data temporally and vertically to conform with CERES processing requirements. DAO input products are shown in Table 4.6-1.

Level: 3
Type: Ancillary
Frequency: Every 3 or 6 Hours

Portion of Globe Covered
File: Global
Record: 2-Deg x 2.5-Deg Region

Time Interval Covered
File: Every 3 or 6 Hours
Record: Every 3 or 6 Hours

Portion of Atmosphere Covered
File: Surface to TOA

Table 4.6-1. DAO Input Products

DAO File Name	DAO File Size (Monthly)	Products Used by CERES
e0054A.prs.sfcprog.byymmdd.eyymmdd	55.79 MB	Instantaneous surface pressure, temperature, and geopotential height
e0054A.prs.sphu.byymmdd.eyymmdd	11.59 MB	Instantaneous vertical profiles of specific humidity
e0054A.prs.tmpu.byymmdd.eyymmdd	11.59 MB	Instantaneous vertical profiles of temperature
e0054A.prs.uwnd.byymmdd.eyymmdd	11.59 MB	Instantaneous vertical profiles of wind speed u-vectors
e0054A.prs.vwnd.byymmdd.eyymmdd	11.59 MB	Instantaneous vertical profiles of wind speed v-vectors
e0054A.prs.diag4.byymmdd.eyymmdd	161.18 MB	Temperature and specific humidity at two meters averaged over the previous three hours
TOTAL SIZE	**263.33 MB**	

4.7 Microwave Humidity (MWH)

EOSDIS Product Code: CERX13

The external ancillary data product, Microwave Humidity (MWH), is input to the CERES Regrid Meteorological, Ozone, and Aerosol Data Subsystem. The MWH is the source of the column precipitable water vapor burden as measured by a microwave instrument. These data may be derived daily from the SSM/I instrument, which has a 0.5-degree x 0.5-degree horizontal resolution. The Regrid Meteorological, Ozone, and Aerosol Data Subsystem interpolates these data temporally to conform with CERES processing requirements.

Level: 3
Type: Ancillary
Frequency: Daily

Time Interval Covered
File: Daily
Record: Daily

Portion of Globe Covered
File: Global
Record: 1 Region

Portion of Atmosphere Covered
File: Total Column

4.8 Ozone Profile Data (OPD)

EOSDIS Product Code: CERX11

The external ancillary data product, Ozone Profile Data (OPD), is input to the CERES Regrid Meteorological, Ozone, and Aerosol Data Subsystem. The OPD is the source of total column ozone data. These data may be derived weekly from SBUV-2 and are horizontally organized according to a 10-degree x 10-degree grid. The Regrid Meteorological, Ozone, and Aerosol Data Subsystem interpolates these data temporally, horizontally, and vertically to conform with CERES processing requirements.

Level: 3
Type: Ancillary
Frequency: Weekly

Time Interval Covered
File: 1 Week
Record: 1 Week

Portion of Globe Covered
File: Global
Record: 1 Region

Portion of Atmosphere Covered
File: Total Column

References

1. HDF User's Guide, Version 4.0, February 1996 (from NCSA)
2. PGS Toolkit User's Guide for the ECS Project, Version 1 Final, May 1994
3. TRW DRL 64, 55067.300.0080D; In-flight Measurement Analysis (Revision D); 12 September 1995

APPENDIX A

Acronyms and Unit Definitions

Appendix A
Acronyms

ADM	Angular Distribution Model
APD	Aerosol Profile Data
AVG	Monthly Regional Radiative Fluxes and Clouds
AVHRR	Advanced Very High Resolution Radiometer
BDS	Bidirectional Scan
CADM	CERES Angular Distribution Model
CERES	Clouds and the Earth's Radiant Energy System
CID	Cloud Imager Data
CRH	Clear Reflectance History
CRS	Clouds and Radiative Swath
DAAC	Distributed Active Archive Center
DAO	Data Assimilation Office
DMS	Data Management System
EDDB	ERBE-Like Daily Database Product
EOS	Earth Observing System
EOS-AM	EOS Morning Crossing (Ascending) Mission
EOS-PM	EOS Afternoon Crossing (Descending) Mission
EOSDIS	Earth Observing System Data and Information System
ERBE	Earth Radiation Budget Experiment
ERBS	Earth Radiation Budget Satellite
FOV	Field-of-View
FSW	Monthly Single Satellite Fluxes and Clouds
GAP	Gridded Analysis Product
GB	Giga Byte
GEO	Geostationary Narrowband Radiances
GGEO	Gridded GEO Narrowband Radiances
GMS	Geostationary Meteorological Satellite
GOES	Geostationary Operational Environmental Satellite
H	High
HDF	Hierarchical Data Format
IES	Instrument Earth Scans
IGBP	International Geosphere Biosphere Programme
IMS	Information Management System
INSTR	Instrument
ISCCP	International Satellite Cloud Climatology Project
IWC	Ice Water Content
LaRC	Langley Research Center
L	Low
LM	Lower Middle
LW	Longwave
LWC	Liquid Water Content
MB	Mega Byte
METEOSAT	Meteorological Satellite

MISR	Multi-angle Imaging SpectroRadiometer
MOA	Meteorological, Ozone, and Aerosols
MODIS	Moderate Resolution Imaging Spectrometer
MWH	Microwave Humidity
NASA	National Aeronautics and Space Administration
NOAA	National Oceanic and Atmospheric Administration
OPD	Ozone Profile Data
RAPS	Rotating Azimuth Plane Scan
SARB	Surface and Atmospheric Radiation Budget
SBUV-2	Solar Backscatter Ultraviolet/Version 2
SFC	Monthly Gridded Single Satellite TOA and Surface Fluxes and Clouds
SRB	Surface Radiation Budget
SRBAVG	Monthly Averages for Top-of-Atmosphere and Surface Radiation Budget
SSF	Single Satellite CERES Footprint TOA and Surface Fluxes, Clouds
SSM/I	Special Sensor Microwave/Imager
SURFMAP	Surface Map
SW	Shortwave
SYN	Synoptic Radiative Fluxes and Clouds
TBD	To be determined
TISA	Time Interpolation and Spatial Averaging
TMI	TRMM Microwave Imager
TOA	Top-of-the-Atmosphere
TRMM	Tropical Rainfall Measuring Mission
UM	Upper Middle
VIRS	Visible Infrared Scanner
WN	Window
ZAVG	Monthly Zonal and Global Radiative Fluxes and Clouds

Unit Definitions

Units	Definition
AU	Astronomical Unit
cm	centimeter
count	count, counts
day	day, Julian date
deg	degree
deg sec^{-1}	degrees per second
du	Dobson units
fraction	fraction 0..1
g kg^{-1}	gram per kilogram
g m^{-2}	gram per square meter
hhmmss	hour, minute, second
hour	hour
hPa	hectoPascals
in-oz	inch-ounce
K	Kelvin
km	kilometer, kilometers
km sec^{-1}	kilometers per second
m	meter
mA	milliamp, milliamps
micron	micrometer, micron
msec	millisecond
mW $cm^{-2}sr^{-1}\mu m^{-1}$	milliWatts per sware centimeter per steradian per micron
m sec^{-1}	meter per second
N/A	not applicable, none, unitless, dimensionless
percent	percent, percentage 0..100
rad	radian
sec	second
volt	volt, volts

Units	**Definition**
$W\ h\ m^{-2}$	Watt hour per square meter
$W^2\ m^4$	square Watt per meter to the 4th
$W\ m^{-2}$	Watt per square meter
$W\ m^{-2} sr^{-1}$	Watt per square meter per steradian
$W\ m^{-2} sr^{-1} \mu m^{-1}$	Watt per square meter per steradian per micron
°C	degrees centigrade
μm	micrometer, micron