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

Data Products Catalog

Release 4
Version 8
September 2004

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Primary Authors

Thomas E. Caldwell, Lisa H. Coleman, Denise L. Cooper, Joey Escuadra, Alice Fan, Carla B. Franklin, Jason A. Halvorson, Phillip C. Hess, Edward A. Kizer, Nichele C. McKoy, Timothy D. Murray, Le Trang Nguyen, Sandra K. Nolan, Rajalekshmy Raju, John L. Robbins, Joseph C. Stassi, Sunny Sun-Mack, Carol J. Tolson

Science Applications International Corporation (SAIC)
One Enterprise Parkway
Hampton, VA 23666

P. Kay Costulis, Erika B. Geier, Jim F. Kibler, Maria V. Mitchum

NASA Langley Research Center
Radiation and Aerosols Branch
Atmospheric Sciences Competency
Hampton, VA 23681-2199

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Document Revision Record

The Document Revision Record contains information for approved and implemented changes to the entire Data Products Catalog (DPC). The table lists the date that the revised DPC was created and a short description of the revision.

Revision Date	Release Number	Description of Revision
08/94	R1V1	TRMM Pre-launch Version
01/97	R2V1	TRMM Launch Version
07/98	R3V1	TRMM Launch Version including HDF organization
03/00	R3V2	Updated for product parameter and/or format changes. Supports all launches.
10/02	R3V3	Updated format to comply with standards.
07/03	R4V1	Updated the following sections: SSF, CRS, FSW, SFC, SRBAVG, and INSTR.
08/03	R4V2	Updated the SSF section.
10/03	R4V3	Updated the CRS section.
11/03	R4V4	Updated the FSW and SFC sections.
03/04	R4V5	Updated the BDS, CRS, ES-4, ES-8, ES-9, and SRBAVG sections.
04/15	R4V6	Updated the FSW section.
08/04	R4V7	Updated the SSF section.
09/04	R4V8	Updated the FSW, SFC, and SSF sections.

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 one or more stand-alone executable programs. Each subsystem executes when all of its required input data sets are available and produces one or more primary science products.

This Data Products Catalog is intended to give an overview of the primary, internal, and ancillary data products which are used or produced by the Data Management System. All CERES products are permanently stored by the Langley TRMM and Terra Information System (LATIS) DAAC. Primary data products are those that become available for distribution to the scientific community upon verification by the CERES Science Team. Internal and ancillary data products are available to the CERES Data Management System for use in producing the primary products. Additional details are given in the Collection Guide for each primary data product.

Acknowledgment is given to Joanne Saunders of Science Applications International Corporation for her support in preparing this document.

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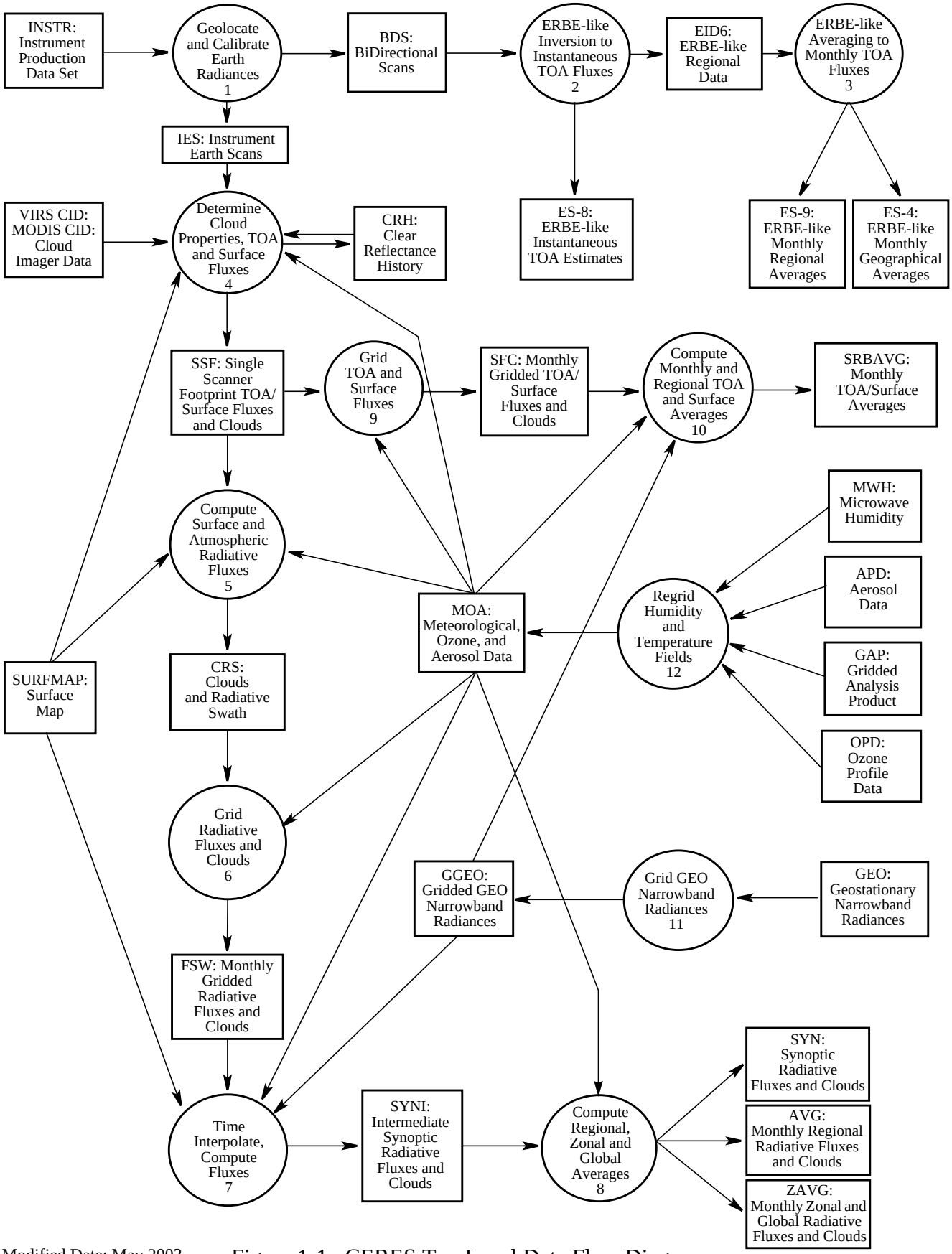
1.0 Introduction

The Clouds and the Earth's Radiant Energy System (CERES) is a key component of the Earth Observing System (EOS) program. The CERES instrument provides radiometric measurements of the Earth's atmosphere from three broadband channels: a shortwave channel (0.3 - 5 µm), a total channel (0.3 - 200 µm), and an infrared window channel (8 - 12 µm). 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 continues that strategy by flying instruments on the polar orbiting EOS platforms simultaneously with an instrument on the Tropical Rainfall Measuring Mission (TRMM) spacecraft, which has 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 includes cloud imager data and other atmospheric parameters. The TRMM satellite carries one CERES instrument while the EOS satellites carry two CERES instruments, one operating in a fixed azimuth plane scanning mode (FAPS) for continuous Earth sampling and the other operating in a rotating azimuth plane scan mode (RAPS) for improved angular sampling.

A high-level view of the CERES Data Management System (DMS) is illustrated by the CERES Top Level Data Flow Diagram shown in Figure 1-1. Circles in the diagram represent algorithm processes called subsystems. Subsystems are a logical collection of algorithms which together convert input data products into output data products. Boxes represent primary (archival), internal, or ancillary data products. Boxes with arrows entering a circle are input data sources for the subsystem, while boxes 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 1-1. Various conditions 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. Figure 1-1 lists each of these scenarios and assigns a one-letter key to identify them. The CERES products are written using one of three types of data structures: Hierarchical Data Format (HDF), binary format, or Hierarchical Data Format-Earth Observing System (HDF-EOS) format, which are described in Figure 1-1 with corresponding one-letter keys. All data products distributed to external users are archived in HDF or HDF-EOS. The binary files are used within the CERES DMS and are not distributed.



Modified Date: May 2003

Figure 1-1. CERES Top Level Data Flow Diagram

Table 1.0-1. Scenario Key

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

Table 1.0-2. File Format Key

Format Key	Description
B	File written using binary file structure
E	File written using HDF-EOS structures
H	File written using HDF structures

There are three categories of products as listed in the summary Table 1.0-3 through Table 1.0-5.

Table 1.0-3: Primary Products: Output products which are permanently stored by the Langley TRMM and Terra Information System (LATIS) DAAC, are formatted in HDF or HDF-EOS format, and are available for distribution to the scientific community.

Table 1.0-4: Internal Products: CERES Level 0 input data and output products which are produced and used by the Data Management System, are stored by the LATIS DAAC, and are not available for distribution.

Table 1.0-5: Ancillary Products: Input products which contain non-CERES data needed to interpret the CERES measurements and are not available for distribution.

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 format key 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.

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 parameters in the product. Appendix A provides a list of Acronyms and Unit Definitions; Appendix B describes the metadata that are written to all CERES products.

Table 1.0-3. Primary Archival Products Summary

Sub Sys	Product Codes		Name	Frequency	Size, MB	Monthly Size, MB	Key	
	CERES	EOSDIS					Scenario	Format
1	BDS	CER01	Bidirectional Scans	1/Day	844.7	26186	A	H
2	ES-8	CER02	ERBE-like Instantaneous TOA Estimates	1/Day	480.2	14886	A	E
3	ES-9	CER03	ERBE-like Monthly Regional Averages	1/Month	1099.1	1099	C	H
3	ES-4	CER13	ERBE-like Monthly Geographical Averages	1/Month	27.1	27	C	H
4	SSF	CER11	Single Scanner Footprint TOA/Surface Fluxes and Clouds	1/Hour	257.6	191677	A	H
5	CRS	CER04	Clouds and Radiative Swath	1/Hour	353.9	263308	A	H
6	FSW	CER05	Monthly Gridded Radiative Fluxes and Clouds	1/Month	20349.4	20349	C	H
7	SYN	CER07	Synoptic Radiative Fluxes and Clouds	1/Day	1920.2	59526	C	E
8	AVG	CER08	Monthly Regional Radiative Fluxes and Clouds	1/Month	1188.5	1189	C	E
8	ZAVG	CER15	Monthly Zonal and Global Radiative Fluxes and Clouds	1/Month	3.3	3	C	E
9	SFC	CER12	Monthly Gridded TOA/Surface Fluxes and Clouds	1/Month	11068.7	11069	C	H
10	SRBAVG	CER06	Monthly TOA/Surface Averages	1/Month	4722.2	4722	C	E

Table 1.0-4. Internal Products Summary

Sub Sys	Product Code		Name	Frequency	Size, MB	Monthly Size, MB	Key	
	CERES	EOSDIS					Scenario	Format
1	INSTR	CERX00	Instrument Production Data Set	1/Day	89.0	2759	A	B
1	IES	CER09	Instrument Earth Scans	1/Hour	33.8	25148	A	H
2	EID-6	CERX02	ERBE-like Regional Data	1/Day	17.2	533	A	B
4	CRH	CER16	Clear Reflectance History	1/Day	17.8	552	B	B
11	GGEO	CERX14	Gridded GEO Narrowband Radiances	1/Month	472.8	479	D	B
12	MOA	CERX06	Meteorological, Ozone, and Aerosol Data	1/Hour	43.8	5431.2	D	B

Table 1.0-5. Ancillary Products Summary

Sub Sys	Product Code		Name	Frequency	Size, MB	Monthly Size, MB	Key	
	CERES	EOSDIS					Scenario	Format
4	CID_VIRS	CERX05	VIRS Cloud Imager Data	1/Hour	57.4	42706	E	H
4	CID_MODIS	CERX04	MODIS Cloud Imager Data	1/5mins	338.1	3018378	F	H
4	SURFMAP	CERX07	Surface Map	Variable	28.8	162	D	B
1	GEO	CERX09	Geostationary Narrowband Radiances	8/Day/ Satellite	7.7	7600	D	B
2	APD	CERX10	Aerosol Data	1/Month	.4	.4	D	B
2	GAP	CERX12	Gridded Analysis Product	4-8/Day	103.6	128495	D	B
2	MWH	CERX13	Microwave Humidity	1/Day	2.1	65	D	B
2	OPD	CERX11	Ozone Profile Data	1/Day	2.4	74	D	B

Introduction Revision Record

The product Revision Record contains information pertaining to approved section changes. The table lists the date the Software Configuration Change Request (SCCR) was approved, the Release and Version Number, the SCCR number, a short description of the revision, and the revised sections. The authors are listed on the document cover.

Introduction Revision Record

SCCR Approval Date	Release/ Version Number	SCCR Number	Description of Revision	Section(s) Affected
N/A	R3V1	N/A	• Updated format to comply with standards.	All

2.0 Primary Archival Data Products

This section describes the CERES primary output data products that are permanently stored by the Langley TRMM and Terra Information System (LATIS) DAAC and are available for distribution to the scientific community. Each subsection contains a brief overview of the purpose and content of the data product followed by one or more tables which list every parameter contained in the product. The following data attributes are described in the overview sections:

- Level - The EOS data products are defined in terms of "levels"[1]
- Frequency - How often the product is received or produced
- Configuration Code - Unique identifier that defines the software and input file vesions used to produce the products
- 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 within 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.)

Additional tables may 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

Total file sizes are also provided. The bolded entries within the file are names for the group of parameters which follow.

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1. **Level 0:** raw instrument data at full sensor resolution.
Level 1A: raw instrument data at full sensor resolution, time-referenced, and annotated with ancillary information (including radiometric calibration coefficients and geolocation parameters such as platform ephemeris) computed and appended but not applied to the Level 0 data.
Level 1B: Level 1A data processed to sensor units and geolocated.
Level 2: derived geophysical variables at the same resolution and location as the Level 1 source data.
Level 3: geophysical variables mapped on uniform space-time grids, usually with some completeness and consistency.
Level 4: model output or results from analyses of lower level data, e.g., variables derived from multiple measurements.

Primary Archival Data Products Revision Record

The product Revision Record contains information pertaining to approved section changes. The table lists the date the Software Configuration Change Request (SCCR) was approved, the Release and Version Number, the SCCR number, a short description of the revision, and the revised sections. The authors are listed on the document cover.

Primary Archival Data Products Revision Record

SCCR Approval Date	Release/ Version Number	SCCR Number	Description of Revision	Section(s) Affected
N/A	R3V1	N/A	• Updated format to comply with standards.	All

2.1 Bidirectional Scans (BDS)

EOSDIS Product Code: CER01

The BiDirectional Scans (BDS) product contains 24 hours of instantaneous Level-1b CERES data for a single scanner instrument. The BDS contains instantaneous radiance measurements recorded every 0.01-second for views of space, internal calibration, solar calibration and Earth. It contains all elevation scan modes which include the normal Earth scan and the short Earth scan modes and both the fixed and rotating azimuth plane scan modes.

The BDS product includes:

- Filtered broadband radiances for the total, shortwave, and window channels for each 0.01 second measurement
- Geolocation and viewing geometry for every Earth-viewing measurement
- Instrument status, engineering temperatures and voltages for each 6.6 second scan
- Sun geometry, satellite position and velocity for each scan
- All raw engineering and status data from the instrument

A more detailed listing of the data parameters for this product can be found in the BDS Collection Guide: http://asd-www.larc.nasa.gov/ceres/collect_guide/list.html (Reference 3).

Level: 1B
Frequency: 1/Day
Portion of Atmosphere Covered: Satellite Altitude

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

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

Product Version:
TRMM: N/A
Terra: Edition1, Edition2 ++ see NOTE
Aqua: Edition1, Edition2 ++ see NOTE

NOTE: The Slow Mode and Drift Corrected Counts SDSs are only available on Edition1 BDS products with a configuration code of 027025 or greater and Edition2 BDS products with a configuration code of 028028 or greater.

Bidirection Scans (BDS) Definition

Table 2.1-1 summarizes the contents and estimated product size of each data structure type contained within an BDS file. Each BDS product contains three metadata structures, 35 SDS structures, and eight VData structures.

Table 2.1-1. BDS HDF Structure Summary

Name	Description Table	Records	Number of Fields	Nominal Size (Bytes)
CERES Baseline Header Metadata	Table B-1	1	36	~25907
CERES_metadata Vdata	Table B-2	1	14	~1024
BDS Product-specific Metadata	Table 2.1-2	1	11	~66
BDS SDS Summary	Table 2.1-3	1 .. 13091	43	1,111,326,670
BDS Vdata Summary	Table 2.1-4	1 .. 13091	178	31,811,250
Total Size (Bytes):				**1,143,164,917**
Total Size (MBytes, including ~0.2% HDF overhead; 1MByte = 1024^2Bytes):				**1,090.41**

BDS Metadata

The BDS product includes three data structures. These include the CERES Baseline Header Metadata and the CERES_metadata Vdata parameters, which are listed in Appendix B. The BDS-specific metadata parameters are listed in Table 2.1-2.

Table 2.1-2. BDS Product-Specific Metadata

Item	Parameter Name	Units	Range	Data Type
1	ScanMode	N/A	XtrkOnly, RapsOnly, FapsOnly, Raps/Faps, Xtrk/Raps, Xtrk/Faps, Xtrk/Raps/Faps	s(14)
2	Second Time Constant Mode	N/A	Off, On	s(3)
3	Ephemeris Data Used	N/A	Real, Pred, Sim	s(4)
4	Attitude Data Used	N/A	Real, Sim	s(4)
5	Percent Total Channel Bad	N/A	0.0 .. 100.0	F11.6
6	Percent Window Channel Bad	N/A	0.0 .. 100.0	F11.6
7	Percent Short Wave Channel Bad	N/A	0.0 .. 100.0	F11.6
8	Percent FAPS	N/A	0.0 .. 100.0	F11.6
9	Percent RAPS	N/A	0.0 .. 100.0	F11.6
10	Percent Transitional	N/A	0.0 .. 100.0	F11.6
11	Percent Crosstrack	N/A	0.0 .. 100.0	F11.6
12	TOA_Model_Used	N/A	CERES-TOA or WGS 84	s(9)
13	Number Input Files	N/A	1 .. n	uint32

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 Figure 2.1-1.

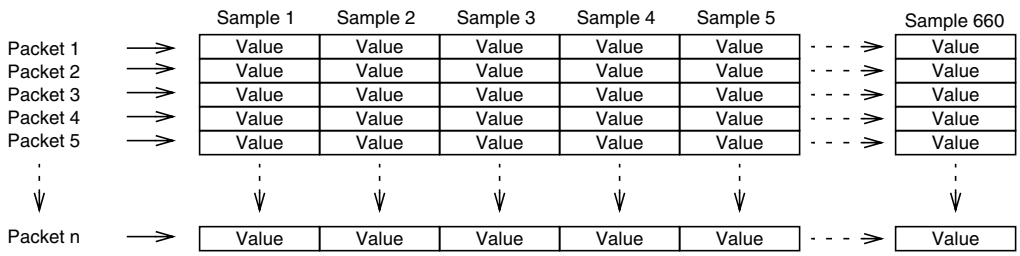

Figure 2.1-1. BDS SDS Schematic

Table 2.1-3 summarizes the contents of each SDS structure contained within the BDS file (listed in alphabetical order by their SDS structure name). All SDS parameters have an HDF Rank = 2 and the maximum number of SDS elements corresponds to the number of rows by the number of columns. Data types are referenced by their HDF classification (e.g. char8, float32, float64, int8, uint8, int16, uint16, int32, uint32, int64, uint64).

Table 2.1-3. BDS SDS Summary (1 of 2)

SDS Name	Maximum SDS Elements	Data Type	Range	Units	Maximum Size (Bytes)
Raw Instrument Status Data	13091x185	uint16	Reference 3	N/A	4,843,670
Julian Date and Time	13091x2	float64	2449353.0 .. 2458500.0	day	209,456
Azimuth Position Count	13091x660	uint16	0 .. 4095	count	17,280,120
Elevation Position Count	13091x660	uint16	0 .. 4095	count	17,280,120
Radiance and Mode Flags	13091x660	uint32	Table 3.2-1	N/A	34,560,240
Secondary Sample Level QA Flags	13091x660	uint32	Reference 3	N/A	34,560,240
Primary Scan Level QA Flags	13091x660	uint32	Reference 3	N/A	34,560,240
Secondary Scan Level QA Flags	13091x660	uint32	Reference 3	N/A	34,560,240
Converted Azimuth Angles	13091x660	float32	0.0 .. 360.0	deg	34,560,240
Converted Elevation Angles	13091x660	float32	0.0 .. 260.0	deg	34,560,240
CERES Viewing Zenith at Surface	13091x660	float32	0.0 .. 90.0	deg	34,560,240
CERES Solar Zenith at Surface	13091x660	float32	0.0 .. 180.0	deg	34,560,240
CERES Relative Azimuth at Surface	13091x660	float32	0.0 .. 360.0	deg	34,560,240
Colatitude of CERES FOV at Surface	13091x660	float32	0.0 .. 180.0	deg	34,560,240
Longitude of CERES FOV at Surface	13091x660	float32	0.0 .. 360.0	deg	34,560,240
Cone Angles	13091x660	float32	0.0 .. 90.0	deg	34,560,240
Clock Angles	13091x660	float32	0.0 .. 360.0	deg	34,560,240
Cone Angle Rates	13091x660	float32	-100.0 .. 100.0	deg sec^{-1}	34,560,240

Table 2.1-3. BDS SDS Summary (2 of 2)

SDS Name	Maximum SDS Elements	Data Type	Range	Units	Maximum Size (Bytes)
Clock Angle Rates	13091x660	float32	-10.0 .. 10.0	deg sec^{-1}	34,560,240
Colatitude of CERES FOV at TOA	13091x660	float32	0.0 .. 180.0	deg	34,560,240
Longitude of CERES FOV at TOA	13091x660	float32	0.0 .. 360.0	deg	34,560,240
CERES Viewing Zenith at TOA - Geocentric	13091x660	float32	0.0 .. 90.0	deg	34,560,240
CERES Solar Zenith at TOA - Geocentric	13091x660	float32	0.0 .. 180.0	deg	34,560,240
CERES Relative Azimuth at TOA - Geocentric	13091x660	float32	0.0 .. 360.0	deg	34,560,240
Sample Aligned Analog Data	13091x660	uint16	0 ..4095	count	17,280,120
Drift Corrected SW Counts	13091x660	float32	0.0 .. 4095.0	count	34,560,240
Drift Corrected WN Counts	13091x660	float32	0.0 .. 4095.0	count	34,560,240
Drift Corrected TOT Counts	13091x660	float32	0.0 .. 4095.0	count	34,560,240
Shortwave Detector Output	13091x660	uint16	0 .. 4095	count	17,280,120
Window Detector Output	13091x660	uint16	0 .. 4095	count	17,280,120
Total Detector Output	13091x660	uint16	0 .. 4095	count	17,280,120
CERES SW Filtered Radiance Upwards	13091x660	float32	-10.0 .. 510.0	W m-2sr^{-1}	34,560,240
CERES WN Filtered Radiance Upwards	13091x660	float32	0.0 .. 50.0	W m-2sr^{-1}	34,560,240
CERES TOT Filtered Radiance Upwards	13091x660	float32	0.0 .. 700.0	W m-2sr^{-1}	34,560,240
Count Conversion SW Sample Offsets	4x660	float32	N/A	count	10,560
Count Conversion WN Sample Offsets	4x660	float32	N/A	count	10,560
Count Conversion TOT Sample Offsets	4x660	float32	N/A	count	10,560
SW Spaceclamp Values	13091x2	float32	N/A	count	104,728
WN Spaceclamp Values	13091x2	float32	N/A	count	104,728
TOT Spaceclamp Values	13091x2	float32	N/A	count	104,728
SW Slow Mode and Drift Corrected Counts[1]	13091x660	float32	0.0 .. 4095.0	count	34,560,240
WN Slow Mode and Drift Corrected Counts[1]	13091x660	float32	0.0 .. 4095.0	count	34,560,240
TOT Slow Mode and Drift Corrected Counts[1]	13091x660	float32	0.0 .. 4095.0	count	34,560,240
SDS Total Size (Bytes)					1,111,326,670
SDS Total Size (MBytes, plus a small HDF overhead percentage)					1060.06

[1] These SDSs are available on Aqua and Terra Edition1 BDSs beginning with CC-Code 027025 and Aqua and Terra Edition2 BDSs beginning with CC-Code 028028.

BDS Vdata

The BDS contains eight Vdatas which are collections of records containing one or more fields. Each of the eight Vdatas contains *n* (1..10391) records of packet level data, and there is a one-to-one correspondence of the Vdatas record numbers to the BDS SDSs row numbers. Table 2.1-4 summarizes each of the BDS Vdatas. Reference 3 provides detailed descriptions of the parameters.

Table 2.1-4. BDS Vdata Summary

Vdata Name	Number of Fields	Maximum Records	Number Bytes per Record	Maximum Size (Bytes)
Satellite-Celestial Data	11	13091	128	1,675,648
Converted Instrument Status Data	25	13091	88	1,152,008
Position Counts	12	13091	528	6,912,048
Temperature Counts	39	13091	450	5,890,950
Voltage and Torque Counts	24	13091	180	2,356,380
Converted Temperatures	35	13091	708	9,268,428
Converted Voltages and Torques	23	13091	348	4,555,668
Count Conversion Constants	9	1	120	120
Vdata Total Size (Bytes)				31,811,250
Vdata Total Size (MBytes, plus a small HDF overhead percentage)				30.36

BDS Revision Record

The product Revision Record contains information pertaining to approved section changes. The table lists the date the Software Configuration Change Request (SCCR) was approved, the Release and Version Number, the SCCR number, a short description of the revision, and the revised sections. The authors are listed on the document cover.

BDS Revision Record

SCCR Approval Date	Release/ Version Number	SCCR Number	Description of Revision	Section(s) Affected
N/A	R3V1	N/A	• Updated format to comply with standards.	All
1/16/04	R4V1	497	• Updated to add newly added SDSs. Also reordered the tables to match the order on the BDS. • Updated format to comply with standards.	All All

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

EOSDIS Product Code: CER02

The ERBE-like Instantaneous TOA Estimates (ES-8) product contains 24 hours of instantaneous Clouds and the Earth's Radiant Energy System (CERES) data for a single scanner instrument. The ES-8 contains filtered radiances recorded every 0.01-second for the total (TOT), shortwave (SW), and window (WN) channels and the unfiltered SW, longwave (LW), and WN radiances. The SW and LW radiances at spacecraft altitude are converted to Top-of-the-Atmosphere (TOA) fluxes with a scene identification algorithm and Angular Distribution Models (ADMs) which are "like" those used for the Earth Radiation Budget Experiment (ERBE). The TOA fluxes, scene identification, and angular geometry are included on the ES-8. Complete listings of metadata and science parameters are listed in Tables 2.2-1 through 2.2-4.

A detailed listing of the data parameters for this product can be found in the ES-8 Collection Guide: http://asd-www.larc.nasa.gov/ceres/collect_guide/list.html (Reference 3).

Level: 2
Frequency: 1/Day
Portion of Atmosphere Covered: Satellite Altitude and TOA

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

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

Product Version:
TRMM: Transient-Ops2, Edition2 ++ see NOTE
Terra: Edition1 ++ see NOTE, Edition2
Aqua: Edition1, Edition2

NOTE: The Spectral Response Functions Vdata is only available on ES-8 products with a configuration code greater than 021018.

ES-8 Metadata

Table 2.2-1 gives an overview of the ES-8 product. The metadata structures contain information which need only be recorded once per daily product. The CERES Baseline Header Metadata and the CERES_metadata Vdata are listed in Appendix B. As explained in Appendix B, the CERES Baseline Header Metadata includes either the bounding rectangle or GRing attributes. The spatial boundaries of the ES-8 are defined with the bounding rectangle. The ES-8 also contains Product Specific Metadata, which are shown in Table 2.2-2.

Table 2.2-1. ES-8 Product Summary

HDF Name	Description	Number of Parameters	Nominal Size (MB)
CERES Baseline Header Metadata	See Table B-1	36	
CERES_metadata Vdata	See Table B-2	14	
ES-8 Product Specific Metadata	See Table 2.2-2	1	
ES-8 Vdata Summary	See Table 2.2-3	21	1.117
ES-8 SDS Summary	See Table 2.2-4	20	467.108
ES-8 Data Size (MB/Day)			468.225
ES-8 Meta Data Size (MB/Day)			0.880
ES-8 Total Product Size (MB/Day)			**469.105**
ES-8 Total Product Size with HDF Data Compression			**293.5**[a]

a. GZIP Compression, Level 1

Table 2.2-2. ES-8 Product Specific Metadata

Item	Parameter Name	Records	Units	Range	Data Type
1	ES8_ProductionDate	1	N/A	N/A	ASCII string
2	NumOfCrosstrackRecords	1	N/A	0 .. 13092	Integer
3	NumOfRAPSRecords	1	N/A	0 .. 13092	Integer
4	NumOfAlongtrackRecords	1	N/A	0 .. 13092	Integer
5	NumOfTransitionalRecords	1	N/A	0 .. 13092	Integer
6	Software_SCCR_Number	1	N/A	N/A	ASCII string
7	Data_SCCR_Number	1	N/A	N/A	ASCII string

ES-8 Vdata Structures

The ES-8 contains 20 record-level parameters and one product-level parameter written by HDF-EOS as HDF Vdata structures. The record-level structures may be thought of as one-dimensional arrays dimensioned according to the number of 6.6-second records contained in the data-day; the maximum number of these records is 13,092 (since the time length of a record may vary, the maximum number of records on the ES-8 can be 13,092). The product-level parameter, Spectral Response Functions, structure contains six arrays, two arrays each for the shortwave, total, and window channels.

The parameters detailed in Table 2.2-3 are:

a) Time of Observation (Julian date and time)
b) Earth-Sun distance
c) Satellite position and velocity
d) Satellite nadir position
e) Sun position
f) Spectral Response Functions

Table 2.2-3. ES-8 Vdata Summary (1 of 2)

Parameter Name (Vdata Name)	Units	Range	Maximum Number of Vdata Elements	Data Type	Maximum Vdata Size (KB)
Time of Observation	day	2440000 .. 2480000	13092	64 bit real	102.27
Earth-Sun distance at record start	AU	0.98 .. 1.02	13092	64 bit real	102.27
X component of satellite position at record start	m	$-8x10^6$ .. $8x10^6$	13092	32 bit real	51.14
X component of satellite position at record end	m	$-8x10^6$ .. $8x10^6$	13092	32 bit real	51.14
Y component of satellite position at record start	m	$-8x10^6$ .. $8x10^6$	13092	32 bit real	51.14
Y component of satellite position at record end	m	$-8x10^6$ .. $8x10^6$	13092	32 bit real	51.14
Z component of satellite position at record start	m	$-8x10^6$ .. $8x10^6$	13092	32 bit real	51.14
Z component of satellite position at record end	m	$-8x10^6$ .. $8x10^6$	13092	32 bit real	51.14
X component of satellite velocity at record start	m sec^{-1}	$-1x10^4$ .. $1x10^4$	13092	32 bit real	51.14
X component of satellite velocity at record end	m sec^{-1}	$-1x10^4$ .. $1x10^4$	13092	32 bit real	51.14
Y component of satellite velocity at record start	m sec^{-1}	$-1x10^4$ .. $1x10^4$	13092	32 bit real	51.14
Y component of satellite velocity at record end	m sec^{-1}	$-1x10^4$ .. $1x10^4$	13092	32 bit real	51.14
Z component of satellite velocity at record start	m sec^{-1}	$-1x10^4$ .. $1x10^4$	13092	32bit real	51.14

Table 2.2-3. ES-8 Vdata Summary (2 of 2)

Parameter Name (Vdata Name)	Units	Range	Maximum Number of Vdata Elements	Data Type	Maximum Vdata Size (KB)
Z component of satellite velocity at record end	m sec^{-1}	$-1x10^4$ .. $1x10^4$	13092	32 bit real	51.14
Colatitude of satellite nadir at record start	deg	0 .. 180	13092	32 bit real	51.14
Colatitude of satellite nadir at record end	deg	0 .. 180	13092	32 bit real	51.14
Longitude of satellite nadir at record start	deg	0 .. 360	13092	32 bit real	51.14
Longitude of satellite nadir at record end	deg	0 .. 360	13092	32 bit real	51.14
Colatitude of Sun at observation	deg	0 .. 180	13092	32 bit real	51.14
Longitude of Sun at observation	deg	0 .. 360	13092	32 bit real	51.14
Spectral Response Functions: [a]					
SW channel wavelengths	µm	0 .. 200	632	32 bit real	0.002
SW spectral response values	N/A	-1 .. 1	632	32 bit real	0.002
TOT channel wavelengths	µm	0 .. 200	1051	32 bit real	0.004
TOT spectral response values	N/A	-1 .. 1	1051	32 bit real	0.004
WN channel wavelengths	µm	0 .. 200	871	32 bit real	0.003
WN spectral response values	N/A	-1 .. 1	871	32 bit real	0.003
Total Vdata Size (KB)					1125.08
Total Vdata Size (MB)					**1.117**

a. NOTE: The Spectral Response Functions Vdata is only available on ES-8 products with a configuration code greater than 021018.

ES-8 Scientific Data Sets

The ES-8 contains 20 SDSs which are 2-dimensional arrays of time ordered records where the first dimension corresponds to the number of 6.6-second data records contained in the data-day; the maximum is 13,092 (since the time length of a record may vary, the maximum number of records on the ES-8 can be 13,092). For the measurement-level data, other than flag words, the second dimension corresponds to the number of measurements or footprints contained on a 6.6-second data record (660). There are 22 measurement-level, 32-bit flag words that contain a flag value in each of the right-most 30 bits (22 words x 30 bits/word = 660 bits). For these measurement-level flag words, the second dimension is 22. Table 2.2-4 summarizes the content and size of each SDS contained within the ES-8 file.

The SDSs detailed in Table 2.2-4 are:

a) Instrument Field-of-View (colatitude and longitude)
b) Radiometric data (total, shortwave, and window channels)
c) Satellite and Sun geometry (viewing zenith, solar zenith, and relative azimuth)
d) Unfiltered radiances (shortwave, longwave, and window)
e) TOA fluxes (shortwave and longwave)
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

g) Flag words

.

Table 2.2-4. ES-8 SDS Summary (1 of 2)

Parameter Name (SDS Name)	Units	Range	Maximum Number of SDS Elements	Data Type	Maximum SDS Size (KB)
Colatitude of CERES FOV at TOA	deg	0 .. 180	13092x660	32 bit real	33752.81
Longitude of CERES FOV at TOA	deg	0 .. 360	13092x660	32 bit real	33752.81
CERES TOT filtered radiance	$W\ m^{-2}\ sr^{-1}$	-2 .. 700	13092x660	32 bit real	33752.81
CERES SW filtered radiance	$W\ m^{-2}\ sr^{-1}$	-4 .. 510	13092x660	32 bit real	33752.81
CERES WN filtered radiance	$W\ m^{-2}\ sr^{-1}\mu m^{-1}$	-1 .. 15	13092x660	32 bit real	33752.81
CERES viewing zenith at TOA	deg	0 .. 90	13092x660	32 bit real	33752.81
CERES solar zenith at TOA	deg	0 .. 180	13092x660	32 bit real	33752.81
CERES relative azimuth at TOA	deg	0 .. 360	13092x660	32 bit real	33752.81
CERES SW unfiltered radiance	$W\ m^{-2}\ sr^{-1}$	-10 .. 510	13092x660	32 bit real	33752.81
CERES LW unfiltered radiance	$W\ m^{-2}\ sr^{-1}$	0 .. 200	13092x660	32 bit real	33752.81
CERES WN unfiltered radiance	$W\ m^{-2}\ sr^{-1}\mu m^{-1}$	0 .. 15	13092x660	32 bit real	33752.81
CERES SW flux at TOA	$W\ m^{-2}$	0 .. 1400	13092x660	32 bit real	33752.81

Table 2.2-4. ES-8 SDS Summary (2 of 2)

Parameter Name (SDS Name)	Units	Range	Maximum Number of SDS Elements	Data Type	Maximum SDS Size (KB)
CERES LW flux at TOA	W m^{-2}	50 .. 450	13092x660	32 bit real	33752.81
ERBE scene identification at observation	N/A	0 .. 12.4	13092x660	32 bit real	33752.81
TOT channel flag words	N/A	N/A	13092x22	32 bit integer	1125.09
SW channel flag words	N/A	N/A	13092x22	32 bit integer	1125.09
WN channel flag words	N/A	N/A	13092x22	32 bit integer	1125.09
Scanner FOV flag words	N/A	N/A	13092x22	32 bit integer	1125.09
Rapid retrace flag words	N/A	N/A	13092x22	32 bit integer	1125.09
Scanner operations flag word	N/A	N/A	13092x3	32 bit integer	153.42
Total SDS Size (KB)					478318.21
Total SDS Size (MB)					**467.108**

Maximum Data Bits*: **3927600000**
Maximum Data Size (MB)*: **468.2**

* Note: Maximum sizes are based on 13,092 total 6.6-sec data records.

ES-8 Revision Record

The product Revision Record contains information pertaining to approved section changes. The table lists the date the Software Configuration Change Request (SCCR) was approved, the Release and Version Number, the SCCR number, a short description of the revision, and the revised sections. The authors are listed on the document cover.

ES-8 Revision Record

SCCR Approval Date	Release/ Version Number	SCCR Number	Description of Revision	Section(s) Affected
N/A	R3V1	N/A	• Updated document to reflect new formats and to comply with standards.	All
04/26/02	R3V2	341	• Updated LW Flux range from [0 .. 500] to [50 .. 450]. • Added the ES-8 Spectral Response Functions Vdata Summary table. • Moved Vdata parameter list from front page to ES-8 Vdata Structures section. • Moved SDS data listing from front page to ES-8 Scientific Data Sets section. • Updated format to comply with standards.	Table 2.2-4 Table 2.2-3 Vdata SDS All
02/23/04	R4V1	503	• Updated product versions for Aqua Edition1 to include Edition2. • Supplied footnote for availability of Spectral Response Functions Vdata. • Updated format to comply with standards.	Section 2.2 Table 2.2-3 All

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

EOSDIS Product Code: CER03

The ERBE-like Monthly Regional Averages (ES-9) product contains a month of space and time averaged Clouds and the Earth's Radiant Energy System (CERES) data for a single scanner instrument. The ES-9 is also produced for combinations of scanner instruments. All instantaneous shortwave and longwave fluxes at the Top-of-the-Atmosphere (TOA) from the CERES ES-8 product for a month are sorted by 2.5-degree spatial regions, by day number, and by the local hour of observation. The mean of the instantaneous fluxes for a given region-day-hour bin is determined and recorded on the ES-9 along with other flux statistics and scene information. For each region, the daily average flux is estimated from an algorithm that uses the available hourly data, scene identification data, and diurnal models. This algorithm is "like" the algorithm used for the Earth Radiation Budget Experiment (ERBE). The ES-9 also contains hourly average fluxes for the month and an overall monthly average for each region. These average fluxes are given for both clear-sky and total-sky scenes.

The ES-9 archival data product is created as an HDF file with six Vgroups and contains data for each 2.5-degree region observed during a month. There are 10,368 regions in the ERBE-Like data; therefore, there is a maximum of 10,368 records in the ES-9 data set. A summary of the contents of this data product can be found in Table 2.3-1. The ES-9 product size shown in this table assumes that all 2.5-degree regions and all hourboxes contain data. Since the hourboxes are sparsely populated, sizing estimates per platform are 95 MB (TRMM), 260 MB (Terra), and 260 MB (Aqua). The sizing estimate for the ES-9 in the "Archival Products Summary" table is for Aqua. A more detailed listing of the data parameters for this product can be found in the ES-9 Collection Guide: http://asd-www.larc.nasa.gov/ceres/collect_guide/list.html (Reference 3).

Level: 3
Frequency: 1/Month
Portion of Atmosphere Covered: TOA

Time Interval Covered:
- **File:** 1 Month
- **Record:** Hourbox Data

Portion of Global Covered:
- **File:** Global
- **Record**: Regional

Product Version:
- **TRMM:** Edition1, Edition2
- **Terra:** Edition1, Edition2
- **Aqua:** Edition1, Edition2

ES-9 Metadata

The content of the ES-9 is summarized in Table 2.3-1. The metadata structures contain information which need only be recorded once per monthly product. The CERES Metadata are listed in Appendix B. The ES-9 Product-specific Metadata are shown in Table 2.3-2.

Table 2.3-1. ES-9 Product Summary

HDF Name	Description	Records	Number of Fields	Nominal Size (MB)
CERES Baseline Header Metadata	See Table B-1	1	35	
CERES_metadata Vdata	See Table B-2	1	14	
ES-9 Product Specific Metadata	See Table 2.3-2	1	1	
ES-9 Vgroup Summary	See Table 2.3-3	1	6	1099.115
ES-9 TOTAL SIZE (MB/Month)				**1099.115**

Table 2.3-2. ES-9 Product Specific Metadata

Item	Parameter Name	Records	Units	Range	Data Type
1	ES9BinaryProductionDate	1	N/A	N/A	ASCII string

ES-9 Scientific Data Sets

The ES-9 contains science parameters written as HDF Scientific Data Sets (SDSs) which are 1- or 2-dimensional arrays of spatially ordered records that are organized by Vgroups. An overview of each of these Vgroups is given in Table 2.3-3. Detailed definitions of each parameter on the ES-9 may be found in the ES-9 Collection Guide (Reference 3).

Table 2.3-3. ES-9 Vgroup Summary

Vgroup Number	Vgroup Name	Description	Number of Records	Maximum SDS Size (MB)
1	Regional Summary Data	See Table 2.3-4	$10368^a \times 10^b$	0.396
2	Monthly (Day) Averages	See Table 2.3-5	$10368^a \times 28^b$	1.107
3	Monthly (Hour) Averages	See Table 2.3-5	$10368^a \times 28^b$	1.107
4	Daily Averages	See Table 2.3-5	$10368^a \times 31 \times 28^b$	34.330
5	Monthly Hourly Averages	See Table 2.3-5	$10368^a \times 24 \times 34^b$	32.273
6	Hourbox Data	See Table 2.3-6	$(10368 \times 744)^c \times 34^b$	1029.902
Total SDS size (MB)				**1,099.115**

a. The first dimension of the SDS will equal the number of 2.5-degree regions contained on the ES-9.
b. This dimension represents the number of SDS parameters contained in the Vgroup.

c. The first dimension of this SDS is equal to the sum of the number of hourboxes per region over all the regions actually contained on this ES-9, or it is equal to the sum of all "Number of hourboxes" from the Regional Summary Data Vgroup. 10,368 is the maximum number of 2.5-degree regions, and 744 is the maximum number of hourboxes per region, so the maximum size of the first dimension for this SDS is 10,368 x 744 = 7,713,792.

Table 2.3-4 lists the SDSs contained in the Regional Summary Data Vgroup.

Table 2.3-4. Regional Summary Data

Parameter Name
See Table 5-4 in ES-9 Collection Guide
Region number
Longitude
Colatitude
Geographic scene type
Scene fraction histogram (1)
Scene fraction histogram (2)
Scene fraction histogram (3)
Scene fraction histogram (4)
Number of hourboxes
Start position of hourbox data

Table 2.3-5 lists the SDSs contained in the Temporal Vgroups for each 2.5-deg region

Table 2.3-5. Temporal Vgroups for 2.5-deg Regions (1 of 2)

Parameter Name	Temporal Vgroups							
	Monthly (Day) Averages		Monthly (Hour) Averages		Daily Averages		Monthly Hourly Averages	
Sky (Cloud Cover) Vgroup	Total	Clear	Total	Clear	Total	Clear	Total	Clear
Table in ES-9 Collection Guide	5-5	5-6	5-7	5-8	5-9	5-10	5-11	5-12
Region number	X	X	X	X	X	X	X	X
Solar constant, distance corrected					X	X		
Solar incidence	X	X	X	X	X	X	X	X
Net radiant flux	X	X	X	X				
Longwave flux	X	X	X	X	X	X	X	X
Longwave flux minimum value	X	X	X	X	X	X	X	X
Longwave flux maximum value	X	X	X	X	X	X	X	X
Longwave flux standard deviation	X	X	X	X	X	X	X	X
Number of hours of longwave flux			X	X	X	X		
Number of days of longwave flux	X	X					X	X
Longwave sum of estimates							X	X
Longwave sum of estimates squared							X	X
Shortwave flux	X	X	X	X	X	X	X	X
Shortwave flux minimum value	X	X	X	X	X	X	X	X

Table 2.3-5. Temporal Vgroups for 2.5-deg Regions (2 of 2)

Parameter Name	Temporal Vgroups							
	Monthly (Day) Averages		Monthly (Hour) Averages		Daily Averages		Monthly Hourly Averages	
Sky (Cloud Cover) Vgroup	**Total**	**Clear**	**Total**	**Clear**	**Total**	**Clear**	**Total**	**Clear**
Table in ES-9 Collection Guide	**5-5**	**5-6**	**5-7**	**5-8**	**5-9**	**5-10**	**5-11**	**5-12**
Shortwave flux maximum value	X	X	X	X	X	X	X	X
Shortwave flux standard deviation	X	X	X	X	X	X	X	X
Number of hours of shortwave flux			X	X	X	X		
Number of days of shortwave flux	X	X					X	X
Shortwave sum of estimates							X	X
Shortwave sum of estimates squared							X	X
Albedo	X	X	X	X	X	X	X	X

Table 2.3-6 lists the SDSs contained in the Hourbox Data Vgroup.

Table 2.3-6. Hourbox Data

Parameter Name	Parameter Name
See Table 5-13 in ES-9 Collection Guide	
Region number	Longwave flux minimum value
Number of hourboxes	Longwave flux maximum value
Hourbox number	Longwave flux standard deviation
Time of observation	Number of longwave flux estimates
Scene fraction (1)	Longwave flux maximum difference
Scene fraction (2)	Shortwave flux
Scene fraction (3)	Shortwave flux minimum value
Scene fraction (4)	Shortwave flux maximum value
Albedo factor (1)	Shortwave flux standard deviation
Albedo factor (2)	Number of shortwave flux estimates
Albedo factor (3)	Shortwave flux maximum difference
Albedo factor (4)	Clear-sky longwave flux
Cosine of the solar zenith angle	Clear-sky longwave flux standard deviation
Satellite zenith angle	Number of clear-sky longwave flux estimates
Azimuth angle	Clear-sky albedo standard deviation
Solar incidence	Longitude
Longwave flux	Colatitude

ES-9 Revision Record

The product Revision Record contains information pertaining to approved section changes. The table lists the date the Software Configuration Change Request (SCCR) was approved, the Release and Version Number, the SCCR number, a short description of the revision, and the revised sections. The authors are listed on the document cover.

ES-9 Revision Record

SCCR Approval Date	Release/ Version Number	SCCR Number	Description of Revision	Section(s) Affected
N/A	R3V1	N/A	• Updated format to comply with standards.	All
2/23/04	R4V1	503	• Updated product versions for Aqua Edition1 to include Edition2. • Updated format to comply with standards.	All All

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

EOSDIS Product Code: CER13

The ERBE-like Monthly Geographical Averages (ES-4) product contains a month of space and time averaged Clouds and the Earth's Radiant Energy System (CERES) data for a single scanner instrument. The ES-4 is also produced for combinations of scanner instruments. For each observed 2.5-degree spatial region, the daily average, the hourly average over the month, and the overall monthly average of shortwave and longwave fluxes at the Top-of-the-Atmosphere (TOA) from the CERES ES-9 product are spatially nested up from 2.5-degree regions to 5- and 10-degree regions, to 2.5-, 5-, and 10-degree zonal averages, and to global monthly averages. For each nested area, the albedo and net flux are given. For each region, the daily average flux is estimated from an algorithm that uses the available hourly data, scene identification data, and diurnal models. This algorithm is "like" the algorithm used for the Earth Radiation Budget Experiment (ERBE).

The ES-4 archival data product is created as an HDF file which contains nine HDF Vgroups corresponding to regional, nested regional, zonal, and global averages (see Table 2.4-3). There are 10,368 2.5-degree regions for the ERBE-like data; therefore, there is a maximum of 10,368 records in the 2.5-degree regional data set. The second set of data is the 2.5-degree nested to 5-degree regional data, which constitutes a maximum of 2,592 records. The third set of data is the 5-degree nested to 10-degree regional data, which constitutes up to 648 records. The fourth, fifth, and sixth sets of data are the 2.5-, 5-, and 10-degree zonally averaged data which constitute 72, 36, and 18 records, respectively. The seventh, eighth, and ninth sets of data are the 2.5-, 5-, and 10-degree globally averaged data which constitutes 1 record each. A summary of the contents of this data product can be found in Table 2.4-1.

A more detailed listing of the data parameters for this product can be found in the ES-4 Collection Guide: http://asd-www.larc.nasa.gov/ceres/collect_guide/list.html (Reference 3).

Level: 3
Frequency: 1/Month
Portion of Atmosphere Covered: TOA

Time Interval Covered:
- **File:** Month
- **Record:** Month

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

Product Version:
- **TRMM:** Edition1, Edition2
- **Terra:** Edition1, Edition2
- **Aqua:** Edition1, Edition2

ES-4 Metadata

The content of the ES-4 product is summarized in Table 2.4-1. The metadata structures contain information which need only be recorded once per monthly product. The CERES Baseline Header Metadata and the CERES_metadata Vdata are listed in Appendix B. The ES-4 Product-specific Metadata are shown in Table 2.4-2.

Table 2.4-1. ES-4 Product Summary

HDF Name	Description Table	Number of Parameters	Nominal Size (MBytes)
CERES Baseline Header Metadata	See Table B-1	35	
CERES_metadata Vdata	See Table B-2	14	
ES-4 Product Specific Metadata	See Table 2.4-2	1	
ES-4 Vgroup Summary	See Table 2.4-3	9	25.482
ES-4 Data Size (MB/Month)			**25.5**
ES-4 Metadata Size (MB/Month)			**1.5**
ES-4 TOTAL SIZE (MB/Month)			**27.0**

Table 2.4-2. ES-4 Product Specific Metadata

Item	Parameter Name	Records	Units	Range	Data Type
1	ES4BinaryProductionDate	1	N/A	N/A	ASCII string

Table 2.4-3. ES-4 Vgroup Summary

Vgroup Number	Vgroup Name	Description	Number of Records	Total Size (MB)
1	2.5 Degree Regional	See Table 2.4-4	10368 (72 x 144)	19.232
2	5.0 Degree Nested Regional	See Table 2.4-5	2592 (36 x 72)	4.808
3	10.0 Degree Nested Regional	See Table 2.4-6	648 (18 x 36)	1.202
4	2.5 Degree Zonal	See Table 2.4-7	72	0.134
5	5.0 Degree Zonal	See Table 2.4-8	36	.067
6	10.0 Degree Zonal	See Table 2.4-9	18	.033
7	2.5 Degree Global	See Table 2.4-10	1	.002
8	5.0 Degree Global	See Table 2.4-11	1	.002
9	10.0 Degree Global	See Table 2.4-12	1	.002
Total Product Size (MB)				**25.482**

ES-4 Scientific Data Sets

The ES-4 contains science parameters written as HDF Scientific Data Sets (SDSs) which are 2- or 3-dimensional arrays of time ordered records. The ES-4 Collection Guide (Reference 3) gives a detailed description of the parameters contained on the ES-4 product.

Table 2.4-4 lists the SDSs contained in the 2.5-degree Regional Vgroup.

Table 2.4-4. 2.5 Degree Regional

Parameter Name	Temporal Vgroups							
	Monthly (Day) Averages		Monthly (Hour) Averages		Daily Averages		Monthly Hourly Averages	
Sky (Cloud Cover) Vgroup	Total	Clear	Total	Clear	Total	Clear	Total	Clear
Table in ES-4 Collection Guide	5-4	5-5	5-6	5-7	5-8	5-9	5-10	5-11
Solar incidence	X	X	X	X	X		X	X
Net radiant flux	X	X	X	X				
Longwave flux	X	X	X	X	X	X	X	X
Number of days of longwave flux							X	X
Number of hours of longwave flux					X	X		
Shortwave flux	X	X	X	X	X	X	X	X
Number of days of shortwave flux							X	X
Number of hours of shortwave flux					X	X		
Albedo	X	X	X	X	X	X	X	X
Geographic scene type	X	X	X	X	X	X	X	X
Longitude	X	X	X	X	X	X	X	X
Colatitude	X	X	X	X	X	X	X	X

Table 2.4-5 lists the SDSs contained in the 5.0 Degree Nested Regional Vgroup.

Table 2.4-5. 5.0 Degree Nested Regional (1 of 2)

Parameter Name	Temporal Vgroups							
	Monthly (Day) Averages		Monthly (Hour) Averages		Daily Averages		Monthly Hourly Averages	
Sky (Cloud Cover) Vgroup	Total	Clear	Total	Clear	Total	Clear	Total	Clear
Table in ES-4 Collection Guide	5-12	5-13	5-14	5-15	5-16	5-17	5-18	5-19
Solar incidence	X	X	X	X	X		X	X
Net radiant flux	X	X	X	X				
Longwave flux	X	X	X	X	X	X	X	X
Number of days of longwave flux							X	X
Number of hours of longwave flux					X	X		
Shortwave flux	X	X	X	X	X	X	X	X

Table 2.4-5. 5.0 Degree Nested Regional (2 of 2)

Parameter Name	Temporal Vgroups							
	Monthly (Day) Averages		Monthly (Hour) Averages		Daily Averages		Monthly Hourly Averages	
Sky (Cloud Cover) Vgroup	**Total**	**Clear**	**Total**	**Clear**	**Total**	**Clear**	**Total**	**Clear**
Table in ES-4 Collection Guide	**5-12**	**5-13**	**5-14**	**5-15**	**5-16**	**5-17**	**5-18**	**5-19**
Number of days of shortwave flux							X	X
Number of hours of shortwave flux					X	X		
Albedo	X	X	X	X	X	X	X	X
Geographic scene type	X	X	X	X	X	X	X	X
Longitude	X	X	X	X	X	X	X	X
Colatitude	X	X	X	X	X	X	X	X

Table 2.4-6 lists the SDSs contained in the 10.0 Degree Nested Regional Vgroup.

Table 2.4-6. 10.0 Degree Nested Regional

Parameter Name	Temporal Vgroups							
	Monthly (Day) Averages		Monthly (Hour) Averages		Daily Averages		Monthly Hourly Averages	
Sky (Cloud Cover) Vgroup	**Total**	**Clear**	**Total**	**Clear**	**Total**	**Clear**	**Total**	**Clear**
Table in ES-4 Collection Guide	**5-20**	**5-21**	**5-22**	**5-23**	**5-24**	**5-25**	**5-26**	**5-27**
Solar incidence	X	X	X	X	X		X	X
Net radiant flux	X	X	X	X				
Longwave flux	X	X	X	X	X	X	X	X
Number of days of longwave flux							X	X
Number of hours of longwave flux					X	X		
Shortwave flux	X	X	X	X	X	X	X	X
Number of days of shortwave flux							X	X
Number of hours of shortwave flux					X	X		
Albedo	X	X	X	X	X	X	X	X
Geographic scene type	X	X	X	X	X	X	X	X
Longitude	X	X	X	X	X	X	X	X
Colatitude	X	X	X	X	X	X	X	X

Table 2.4-7 lists the SDSs contained in the 2.5-Degree Zonal Vgroup.

Table 2.4-7. 2.5-Degree Zonal

Parameter Name	Temporal Vgroups							
	Monthly (Day) Averages		Monthly (Hour) Averages		Daily Averages		Monthly Hourly Averages	
Sky (Cloud Cover) Vgroup	Total	Clear	Total	Clear	Total	Clear	Total	Clear
Table in ES-4 Collection Guide	5-28	5-29	5-30	5-31	5-32	5-33	5-34	5-35
Solar incidence	X	X	X	X	X		X	X
Net radiant flux	X	X	X	X				
Longwave flux	X	X	X	X	X	X	X	X
Number of days of longwave flux							X	X
Number of hours of longwave flux					X	X		
Shortwave flux	X	X	X	X	X	X	X	X
Number of days of shortwave flux							X	X
Number of hours of shortwave flux					X	X		
Albedo	X	X	X	X	X	X	X	X
Geographic scene type	X	X	X	X	X	X	X	X
Longitude	X	X	X	X	X	X	X	X
Colatitude	X	X	X	X	X	X	X	X

Table 2.4-8 lists the SDSs contained in the 5.0-Degree Zonal Vgroup.

Table 2.4-8. 5.0-Degree Zonal

Parameter Name	Temporal Vgroups							
	Monthly (Day) Averages		Monthly (Hour) Averages		Daily Averages		Monthly Hourly Averages	
Sky (Cloud Cover) Vgroup	Total	Clear	Total	Clear	Total	Clear	Total	Clear
Table in ES-4 Collection Guide	5-36	5-37	5-38	5-39	5-40	5-41	5-42	5-43
Solar incidence	X	X	X	X	X		X	X
Net radiant flux	X	X	X	X				
Longwave flux	X	X	X	X	X	X	X	X
Number of days of longwave flux							X	X
Number of hours of longwave flux					X	X		
Shortwave flux	X	X	X	X	X	X	X	X
Number of days of shortwave flux							X	X
Number of hours of shortwave flux					X	X		
Albedo	X	X	X	X	X	X	X	X
Geographic scene type	X	X	X	X	X	X	X	X
Longitude	X	X	X	X	X	X	X	X
Colatitude	X	X	X	X	X	X	X	X

Table 2.4-9 lists the SDSs contained in the 10.0-Degree Zonal Vgroup.

Table 2.4-9. 10.0-Degree Zonal

Parameter Name	Temporal Vgroups							
	Monthly (Day) Averages		Monthly (Hour) Averages		Daily Averages		Monthly Hourly Averages	
Sky (Cloud Cover) Vgroup	**Total**	**Clear**	**Total**	**Clear**	**Total**	**Clear**	**Total**	**Clear**
Table in ES-4 Collection Guide	**5-44**	**5-45**	**5-46**	**5-47**	**5-48**	**5-49**	**5-50**	**5-51**
Solar incidence	X	X	X	X	X		X	X
Net radiant flux	X	X	X	X				
Longwave flux	X	X	X	X	X	X	X	X
Number of days of longwave flux							X	X
Number of hours of longwave flux					X	X		
Shortwave flux	X	X	X	X	X	X	X	X
Number of days of shortwave flux							X	X
Number of hours of shortwave flux					X	X		
Albedo	X	X	X	X	X	X	X	X
Geographic scene type	X	X	X	X	X	X	X	X
Longitude	X	X	X	X	X	X	X	X
Colatitude	X	X	X	X	X	X	X	X

Table 2.4-10 lists the SDSs contained in the 2.5-Degree Global Vgroup.

Table 2.4-10. 2.5-Degree Global

Parameter Name	Temporal Vgroups							
	Monthly (Day) Averages		Monthly (Hour) Averages		Daily Averages		Monthly Hourly Averages	
Sky (Cloud Cover) Vgroup	**Total**	**Clear**	**Total**	**Clear**	**Total**	**Clear**	**Total**	**Clear**
Table in ES-4 Collection Guide	**5-52**	**5-53**	**5-54**	**5-55**	**5-56**	**5-57**	**5-58**	**5-59**
Solar incidence	X	X	X	X	X		X	X
Net radiant flux	X	X	X	X				
Longwave flux	X	X	X	X	X	X	X	X
Number of days of longwave flux							X	X
Number of hours of longwave flux					X	X		
Shortwave flux	X	X	X	X	X	X	X	X
Number of days of shortwave flux							X	X
Number of hours of shortwave flux					X	X		
Albedo	X	X	X	X	X	X	X	X
Geographic scene type	X	X	X	X	X	X	X	X
Longitude	X	X	X	X	X	X	X	X
Colatitude	X	X	X	X	X	X	X	X

Table 2.4-11 lists the SDSs contained in the 5.0-Degree Global Vgroup.

Table 2.4-11. 5.0-Degree Global

Parameter Name	Temporal Vgroups							
	Monthly (Day) Averages		Monthly (Hour) Averages		Daily Averages		Monthly Hourly Averages	
Sky (Cloud Cover) Vgroup	**Total**	**Clear**	**Total**	**Clear**	**Total**	**Clear**	**Total**	**Clear**
Table in ES-4 Collection Guide	**5-60**	**5-61**	**5-62**	**5-63**	**5-64**	**5-65**	**5-66**	**5-67**
Solar incidence	X	X	X	X	X		X	X
Net radiant flux	X	X	X	X				
Longwave flux	X	X	X	X	X	X	X	X
Number of days of longwave flux							X	X
Number of hours of longwave flux					X	X		
Shortwave flux	X	X	X	X	X	X	X	X
Number of days of shortwave flux							X	X
Number of hours of shortwave flux					X	X		
Albedo	X	X	X	X	X	X	X	X
Geographic scene type	X	X	X	X	X	X	X	X
Longitude	X	X	X	X	X	X	X	X
Colatitude	X	X	X	X	X	X	X	X

Table 2.4-12 lists the SDSs contained in the 10.0-Degree Global Vgroup.

Table 2.4-12. 10.0-Degree Global

Parameter Name	Temporal Vgroups							
	Monthly (Day) Averages		Monthly (Hour) Averages		Daily Averages		Monthly Hourly Averages	
Sky (Cloud Cover) Vgroup	**Total**	**Clear**	**Total**	**Clear**	**Total**	**Clear**	**Total**	**Clear**
Table in ES-4 Collection Guide	**5-68**	**5-69**	**5-70**	**5-71**	**5-72**	**5-73**	**5-74**	**5-75**
Solar incidence	X	X	X	X	X		X	X
Net radiant flux	X	X	X	X				
Longwave flux	X	X	X	X	X	X	X	X
Number of days of longwave flux							X	X
Number of hours of longwave flux					X	X		
Shortwave flux	X	X	X	X	X	X	X	X
Number of days of shortwave flux							X	X
Number of hours of shortwave flux					X	X		
Albedo	X	X	X	X	X	X	X	X
Geographic scene type	X	X	X	X	X	X	X	X
Longitude	X	X	X	X	X	X	X	X
Colatitude	X	X	X	X	X	X	X	X

ES-4 Revision Record

The product Revision Record contains information pertaining to approved section changes. The table lists the date the Software Configuration Change Request (SCCR) was approved, the Release and Version Number, the SCCR number, a short description of the revision, and the revised sections. The authors are listed on the document cover.

ES-4 Revision Record

SCCR Approval Date	Release/ Version Number	SCCR Number	Description of Revision	Section(s) Affected
N/A	R3V1	N/A	• Updated format to comply with standards.	All
2/23/04	R4V1	503	• Updated product versions for Aqua Edition1 to include Edition2. • Updated format to comply with standards.	All All

2.5 Single Scanner Footprint TOA/Surface Fluxes and Clouds (SSF)

EOSDIS Product Code: CER11

The Single Scanner Footprint TOA/Surface Fluxes and Clouds (SSF) product contains one hour of instantaneous Clouds and the Earth's Radiant Energy System (CERES) data for a single scanner instrument. The SSF combines instantaneous CERES data with scene information from a higher-resolution imager such as Visible/Infrared Scanner (VIRS) on TRMM or Moderate-Resolution Imaging Spectroradiometer (MODIS) on Terra and Aqua. Scene identification and cloud properties are defined at the higher imager resolution and these data are averaged over the larger CERES footprint. For each CERES footprint, the SSF contains the number of cloud layers and for each layer the cloud amount, height, temperature, pressure, optical depth, emissivity, ice and liquid water path, and water particle size. The SSF also contains the CERES filtered radiances for the total, shortwave (SW), and window (WN) channels and the unfiltered SW, longwave (LW), and WN radiances. The SW, LW, and WN radiances at spacecraft altitude are converted to Top-of-the-Atmosphere (TOA) fluxes based on the imager defined scene. These TOA fluxes are used to estimate surface fluxes.

Only footprints with imager coverage are included on the SSF which is much less than the full set of footprints on the CERES ES-8 product. The number of possible footprints on an SSF depends on the elevation scan mode, azimuth scan mode, and height of the satellite. Since elevation and azimuth scan modes are programmable, the range on the number of footprints in an SSF product has been set to the largest possible range, namely 0 .. 360000 as shown in Table 2.5-2. A smaller number of footprints is used in SSF sizing estimates, namely the estimated maximum number of TRMM full Earth-view footprints per hour given a normal elevation scan and an along-track azimuth scan. Accounting for the need for imager coverage, the actual number of footprints is expected to be even smaller. This reduction of footprints due to lack of imager coverage is very evident when CERES is operating in a cross-track azimuth scan mode. A complete listing of parameters for this data product can be found in Tables 2.5-3 to Table 2.5-15.

A more detailed listing of the data parameters for this product can be found in the SSF Collection Guide: http://asd-www.larc.nasa.gov/ceres/collect_guide/list.html (Reference 3).

Level: 2
Frequency: 1/Hour
Portion of Atmosphere Covered: Surface to TOA

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

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

Product Version:
- **TRMM:** Edition2B
- **Terra:** Edition2B
- **Aqua:** Edition1A

SSF Metadata

SSF metadata includes the CERES Baseline Header Metadata and CERES_metadata Vdata, which are listed in Appendix B. The SSF product-specific metadata parameters are listed in Table 2.5-1 and the SSF_Header parameters are listed in Table 2.5-2. For TRMM SSF products, the SSF ID (SSF-H1) will be set to 117 and will contain 131 SDS parameters (SSF-1 through SSF-131). For Terra and Aqua SSF products, the SSF ID will be set to 1117 and these products will contain an additional 29 MODIS aerosol SDS parameters (SSF-132 through SSF-160).

Table 2.5-1. SSF Product-specific Metadata

Item	Parameter Name	Units	Range	Data Type
1	PercentCrosstrackFOV	N/A	0.0 .. 100.0	32-bit real
2	PercentRapsFOV	N/A	0.0 .. 100.0	32-bit real
3	PercentOtherFOV	N/A	0.0 .. 100.0	32-bit real

Table 2.5-2. SSF_Header (1 of 2)

Item	Description	Units	Range	Elements	Bytes/ Elem
SSF-H1	SSF ID	N/A	117 or 1117	1	4
SSF-H2	Character name of CERES instrument	N/A	ASCII string	1	4
SSF-H3	Day and time at hour start	N/A	ASCII string	1	28
SSF-H4	Character name of satellite	N/A	ASCII string	1	4
SSF-H5	Character name of high resolution imager instrument	N/A	ASCII string	1	8
SSF-H6	Number of imager channels	N/A	1 .. 20	1	4
SSF-H7	Central wavelengths of imager channels	µm	0.4 .. 15.0	20	4
SSF-H8	Earth-Sun distance at hour start	AU	0.98 .. 1.02	1	4
SSF-H9	Beta angle	deg	-90 .. 90	1	4
SSF-H10	Colatitude of subsatellite point at surface at hour start	deg	0 .. 180	1	4
SSF-H11	Longitude of subsatellite point at surface at hour start	deg	0 .. 360	1	4
SSF-H12	Colatitude of subsatellite point at surface at hour end	deg	0 .. 180	1	4
SSF-H13	Longitude of subsatellite point at surface at hour end	deg	0 .. 360	1	4
SSF-H14	Along-track angle of satellite at hour end	deg	0 .. 330	1	4
SSF-H15	Number of footprints in SSF product	N/A	0 .. 360000	1	4
SSF-H16	Subsystem 4.1 identification string	N/A	ASCII string	1	128
SSF-H17	Subsystem 4.2 identification string	N/A	ASCII string	1	128

Table 2.5-2. SSF_Header (2 of 2)

Item	Description	Units	Range	Elements	Bytes/ Elem
SSF-H18	Subsystem 4.3 identification string	N/A	ASCII string	1	128
SSF-H19	Subsystem 4.4 identification string	N/A	ASCII string	1	128
SSF-H20	Subsystem 4.5 identification string	N/A	ASCII string	1	128
SSF-H21	Subsystem 4.6 identification string	N/A	ASCII string	1	128
SSF-H22	IES production date and time	N/A	ASCII string	1	24
SSF-H23	MOA production date and time	N/A	ASCII string	1	24
SSF-H24	SSF production date and time	N/A	ASCII string	1	24

SSF Scientific Data Sets

The SSF contains Scientific Data Sets (SDS) which are parameter collections of along-track ordered footprints where the first dimension corresponds to the number of footprints; the last dimension corresponds to the number of parameters; and the middle dimension, if rank 3, corresponds to the number of elements in each parameter array. This ordering is used by the C programming language and most HDF viewers. In Fortran, the dimensions are reversed such that the number of footprints becomes the last dimension and the first dimension is the number of parameters in the SDS. The SDSs are divided into tables which map to Vgroups of the same name. Table 2.5-3 to Table 2.5-15 summarize the contents of each Vgroup and SDS contained within the SSF file. The MODIS land and ocean aerosol data (SDS parameters, SSF-132 through SSF-160) described in Table 2.5-14 and Table 2.5-15 are available only on Terra and Aqua SSF products.

(Note: the dimension n in the following tables is the number of footprints processed: Assuming n = 245475 for sizing)

Table 2.5-3. Time and Position (1 of 2)

Item	SDS Name (Parameter Name)	Units	Range	Dimen-sions	Data Type	Maximum Hourly Size (MB)
SSF-1	Time of observation	day	2440000 .. 2480000	n	64-bit real	1.87
SSF-2	Radius of satellite from center of Earth at observation	km	6000 .. 8000	n	64-bit real	1.87
SSF-3	X component of satellite inertial velocity	km sec^{-1}	-10 .. 10	n	64-bit real	1.87
SSF-4	Y component of satellite inertial velocity	km sec^{-1}	-10 .. 10	n	64-bit real	1.87
SSF-5	Z component of satellite inertial velocity	km sec^{-1}	-10 .. 10	n	64-bit real	1.87
SSF-6	Colatitude of subsatellite point at surface at observation	deg	0 .. 180	n	32-bit real	0.94
SSF-7	Longitude of subsatellite point at surface at observation	deg	0 .. 360	n	32-bit real	0.94

Table 2.5-3. Time and Position (2 of 2)

Item	SDS Name (Parameter Name)	Units	Range	Dimen-sions	Data Type	Maximum Hourly Size (MB)
SSF-8	Colatitude of subsolar point at surface at observation	deg	0 .. 180	n	32-bit real	0.94
SSF-9	Longitude of subsolar point at surface at observation	deg	0 .. 360	n	32-bit real	0.94
SSF-10	Colatitude of CERES FOV at surface	deg	0 .. 180	n	32-bit real	0.94
SSF-11	Longitude of CERES FOV at surface	deg	0 .. 360	n	32-bit real	0.94
SSF-12	Scan sample number	N/A	1 .. 660	n	16-bit integer	0.47
SSF-13	Packet number	N/A	0 .. 13100	n	16-bit integer	0.47
SSF-14	Cone angle of CERES FOV at satellite	deg	0 .. 90	n	32-bit real	0.94
SSF-15	Clock angle of CERES FOV at satellite wrt inertial velocity	deg	0 .. 360	n	32-bit real	0.94
SSF-16	Rate of change of cone angle	deg sec^{-1}	-300 .. 300	n	32-bit real	0.94
SSF-17	Rate of change of clock angle	deg sec^{-1}	-20 .. 20	n	32-bit real	0.94
SSF-18	Along-track angle of CERES FOV at surface	deg	-30 .. 330	n	32-bit real	0.94
SSF-19	Cross-track angle of CERES FOV at surface	deg	-90 .. 90	n	32-bit real	0.94

Table 2.5-4. Viewing Angles

Item	SDS Name (Parameter Name)	Units	Range	Dimen-sions	Data Type	Maximum Hourly Size (MB)
SSF-20	CERES viewing zenith at surface	deg	0 .. 90	n	32-bit real	0.94
SSF-21	CERES solar zenith at surface	deg	0 .. 180	n	32-bit real	0.94
SSF-22	CERES relative azimuth at surface	deg	0 .. 360	n	32-bit real	0.94
SSF-23	CERES viewing azimuth at surface wrt North	deg	0 .. 360	n	32-bit real	0.94

Table 2.5-5. Surface Map

Item	SDS Name (Parameter Name)	Units	Range	Dimen-sions	Data Type	Maximum Hourly Size (MB)
SSF-24	Altitude of surface above sea level	m	-1000 .. 10000	n	32-bit real	0.94
SSF-25	Surface type index	N/A	1 .. 20	n x 8	16-bit integer	3.75
SSF-26	Surface type percent coverage	N/A	0 .. 100	n x 8	16-bit integer	3.75

Table 2.5-6. Scene Type

Item	SDS Name (Parameter Name)	Units	Range	Dimen-sions	Data Type	Maximum Hourly Size (MB)
SSF-27	CERES SW ADM type for inversion process	N/A	0 .. 5000	n	16-bit integer	0.47
SSF-28	CERES LW ADM type for inversion pro-cess	N/A	0 .. 5000	n	16-bit integer	0.47
SSF-29	Cloud Classification	N/A	0 .. 5000	n	16-bit integer	0.47
SSF-30	Snow/ice percent coverage clear-sky overhead-sun vis albedo	N/A	0 .. 9999	n	16-bit integer	0.47

Table 2.5-7. Filtered Radiances

Item	SDS Name (Parameter Name)	Units	Range	Dimen-sions	Data Type	Maximum Hourly Size (MB)
SSF-31	CERES TOT filtered radiance - upwards	$W\ m^{-2}\ sr^{-1}$	0 .. 700	n	32-bit real	0.94
SSF-32	CERES SW filtered radiance - upwards	$W\ m^{-2}\ sr^{-1}$	-10 .. 510	n	32-bit real	0.94
SSF-33	CERES WN filtered radiance - upwards	$W\ m^{-2}\ sr^{-1}\mu m^{-1}$	0 .. 15	n	32-bit real	0.94
SSF-34	Radiance and Mode flags	N/A	0 .. $(2^{31}-1)$	n	32-bit integer	0.94

Table 2.5-8. Unfiltered Radiances

Item	SDS Name (Parameter Name)	Units	Range	Dimen-sions	Data Type	Maximum Hourly Size (MB)
SSF-35	CERES SW radiance - upwards	W m^{-2} sr^{-1}	-10 ..510	n	32-bit real	0.94
SSF-36	CERES LW radiance - upwards	W m^{-2} sr^{-1}	0 .. 200	n	32-bit real	0.94
SSF-37	CERES WN radiance - upwards	W m^{-2} sr^{-1}	0 .. 60	n	32-bit real	0.94

Table 2.5-9. TOA and Surface Fluxes

Item	SDS Name (Parameter Name)	Units	Range	Dimen-sions	Data Type	Maximum Hourly Size (MB)
SSF-38	CERES SW TOA flux - upwards	W m^{-2}	0 .. 1400	n	32-bit real	0.94
SSF-39	CERES LW TOA flux - upwards	W m^{-2}	0 .. 500	n	32-bit real	0.94
SSF-40	CERES WN TOA flux - upwards	W m^{-2}	0 .. 200	n	32-bit real	0.94
SSF-41	CERES downward SW surface flux - Model A	W m^{-2}	0 .. 1400	n	32-bit real	0.94
SSF-42	CERES downward LW surface flux - Model A	W m^{-2}	0 .. 700	n	32-bit real	0.94
SSF-43	CERES downward WN surface flux - Model A	W m^{-2}	0 .. 250	n	32-bit real	0.94
SSF-44	CERES net SW surface flux - Model A	W m^{-2}	0 .. 1400	n	32-bit real	0.94
SSF-45	CERES net LW surface flux - Model A	W m^{-2}	-250 .. 50	n	32-bit real	0.94
SSF-46	CERES downward SW surface flux - Model B	W m^{-2}	0 .. 1400	n	32-bit real	0.94
SSF-47	CERES downward LW surface flux - Model B	W m^{-2}	0 .. 700	n	32-bit real	0.94
SSF-48	CERES net SW surface flux - Model B	W m^{-2}	0 .. 1400	n	32-bit real	0.94
SSF-49	CERES net LW surface flux - Model B	W m^{-2}	-250 .. 50	n	32-bit real	0.94
SSF-50	CERES broadband surface albedo	N/A	0 .. 1	n	32-bit real	0.94
SSF-51	CERES LW surface emissivity	N/A	0 .. 1	n	32-bit real	0.94
SSF-52	CERES WN surface emissivity	N/A	0 .. 1	n	32-bit real	0.94

Table 2.5-10. Full Footprint Area

Item	SDS Name (Parameter Name)	Units	Range	Dimen-sions	Data Type	Maximum Hourly Size (MB)
SSF-53	Number of imager pixels in CERES FOV	N/A	0 .. 32766	n	16-bit integer	0.47
SSF-54	Imager percent coverage	N/A	0 .. 100	n	16-bit integer	0.47
SSF-55	Imager viewing zenith over CERES FOV	deg	0 .. 90	n	32-bit real	0.94
SSF-56	Imager relative azimuth over CERES FOV	deg	0 .. 360	n	32-bit real	0.94
SSF-57	Surface wind - U-vector	m sec^{-1}	-100 .. 100	n	32-bit real	0.94
SSF-58	Surface wind - V-vector	m sec^{-1}	-100 .. 100	n	32-bit real	0.94
SSF-59	Surface skin temperature	K	175 .. 375	n	32-bit real	0.94
SSF-60	Column averaged relative humidity	N/A	0 .. 100	n	32-bit real	0.94
SSF-61	Precipitable water	cm	0.001 .. 10	n	32-bit real	0.94
SSF-62	Flag - Source of precipitable water	N/A	0 .. 120	n	16-bit integer	0.47
SSF-63	Cloud property extrapolation over cloudy area	N/A	0 .. 100	n	16-bit integer	0.47
SSF-64	Notes on general procedure	N/A	0 .. 32766	n	16-bit integer	0.47
SSF-65	Notes on cloud algorithms	N/A	0 .. 32766	n	16-bit integer	0.47

Table 2.5-11. Clear Footprint Area (1 of 2)

Item	SDS Name (Parameter Name)	Units	Range	Dimen-sions	Data Type	Maximum Hourly Size (MB)
SSF-66	Clear area percent coverage at subpixel resolution	N/A	0 .. 100	n	32-bit real	0.94
SSF-67	Cloud-mask clear-strong percent coverage	N/A	0 .. 100	n	16-bit integer	0.47
SSF-68	Cloud-mask clear-weak percent coverage	N/A	0 .. 100	n	16-bit integer	0.47
SSF-69	Cloud-mask snow/ice percent coverage	N/A	0 .. 100	n	16-bit integer	0.47
SSF-70	Cloud-mask aerosol B percent coverage	N/A	0 .. 100	n	16-bit integer	0.47
SSF-71	Flag - Type of aerosol B	N/A	0 .. 9999	n	16-bit integer	0.47

Table 2.5-11. Clear Footprint Area (2 of 2)

Item	SDS Name (Parameter Name)	Units	Range	Dimen-sions	Data Type	Maximum Hourly Size (MB)
SSF-72	Cloud-mask percent coverage supplement	N/A	0 .. 32766	n	16-bit integer	0.47
SSF-73	Total aerosol A optical depth - visible	N/A	-1 .. 5	n	32-bit real	0.94
SSF-74	Total aerosol A optical depth - near IR	N/A	-1 .. 5	n	32-bit real	0.94
SSF-75	Aerosol A supplement 1	N/A	-1000 .. 1000	n	32-bit real	0.94
SSF-76	Aerosol A supplement 2	N/A	-1000 .. 1000	n	32-bit real	0.94
SSF-77	Aerosol A supplement 3	N/A	-1000 .. 1000	n	32-bit real	0.94
SSF-78	Aerosol A supplement 4	N/A	-1000 .. 1000	n	32-bit real	0.94
SSF-79	Imager-based surface skin temperature	K	175 .. 375	n	32-bit real	0.94
SSF-80	Vertical temperature change	K	-30 .. 90	n	32-bit real	0.94

Table 2.5-12. Cloudy Footprint Area (1 of 3)

Item	SDS Name (Parameter Name)	Units	Range	Dimen-sions	Data Type	Maximum Hourly Size (MB)
SSF-81	Clear/layer/overlap percent coverages	N/A	0 .. 100	n x 4	32-bit real	3.74
SSF-82	Note for cloud layer	N/A	0 .. $(2^{31}-1)$	n x 2	32-bit integer	1.87
SSF-83	Mean visible optical depth for cloud layer	N/A	0 .. 400	n x 2	32-bit real	1.87
SSF-84	Stddev of visible optical depth for cloud layer	N/A	0 .. 300	n x 2	32-bit real	1.87
SSF-85	Mean logarithm of visible optical depth for cloud layer	N/A	-6 .. 6	n x 2	32-bit real	1.87
SSF-86	Stddev of logarithm of visible optical depth for cloud layer	N/A	0 .. 6	n x 2	32-bit real	1.87
SSF-87	Mean cloud infrared emissivity for cloud layer	N/A	0 .. 2	n x 2	32-bit real	1.87
SSF-88	Stddev of cloud infrared emissivity for cloud layer	N/A	0 .. 2	n x 2	32-bit real	1.87
SSF-89	Mean liquid water path for cloud layer (3.7)	$g\ m^{-2}$	0 .. 10000	n x 2	32-bit real	1.87
SSF-90	Stddev of liquid water path for cloud layer (3.7)	$g\ m^{-2}$	0 .. 8000	n x 2	32-bit real	1.87

Table 2.5-12. Cloudy Footprint Area (2 of 3)

Item	SDS Name (Parameter Name)	Units	Range	Dimen-sions	Data Type	Maximum Hourly Size (MB)
SSF-91	Mean ice water path for cloud layer (3.7)	$g\ m^{-2}$	0 .. 10000	n x 2	32-bit real	1.87
SSF-92	Stddev of ice water path for cloud layer (3.7)	$g\ m^{-2}$	0 .. 8000	n x 2	32-bit real	1.87
SSF-93	Mean cloud top pressure for cloud layer	hPa	0 .. 1100	n x 2	32-bit real	1.87
SSF-94	Stddev of cloud top pressure for cloud layer	hPa	0 .. 600	n x 2	32-bit real	1.87
SSF-95	Mean cloud effective pressure for cloud layer	hPa	0 .. 1100	n x 2	32-bit real	1.87
SSF-96	Stddev of cloud effective pressure for cloud layer	hPa	0 .. 500	n x 2	32-bit real	1.87
SSF-97	Mean cloud effective temperature for cloud layer	K	100 .. 350	n x 2	32-bit real	1.87
SSF-98	Stddev of cloud effective temperature for cloud layer	K	0 .. 150	n x 2	32-bit real	1.87
SSF-99	Mean cloud effective height for cloud layer	km	0 .. 20	n x 2	32-bit real	1.87
SSF-100	Stddev of cloud effective height for cloud layer	km	0 .. 12	n x 2	32-bit real	1.87
SSF-101	Mean cloud base pressure for cloud layer	hPa	0 .. 1100	n x 2	32-bit real	1.87
SSF-102	Stddev of cloud base pressure for cloud layer	hPa	0 .. 600	n x 2	32-bit real	1.87
SSF-103	Mean water particle radius for cloud layer (3.7)	µm	0 .. 40	n x 2	32-bit real	1.87
SSF-104	Stddev of water particle radius for cloud layer (3.7)	µm	0 .. 20	n x 2	32-bit real	1.87
SSF-105	Mean ice particle effective diameter for cloud layer (3.7)	µm	0 .. 300	n x 2	32-bit real	1.87
SSF-106	Stddev of ice particle effective diameter for cloud layer (3.7)	µm	0 .. 200	n x 2	32-bit real	1.87
SSF-107	Mean cloud particle phase for cloud layer (3.7)	N/A	1 .. 2	n x 2	32-bit real	1.87
SSF-108	Mean water particle radius for cloud layer (1.6)	µm	0 .. 40	n x 2	32-bit real	1.87
SSF-109	Mean ice particle effective diameter for cloud layer (1.6)	µm	0 .. 300	n x 2	32-bit real	1.87

Table 2.5-12. Cloudy Footprint Area (3 of 3)

Item	SDS Name (Parameter Name)	Units	Range	Dimen-sions	Data Type	Maximum Hourly Size (MB)
SSF-110	Mean cloud particle phase for cloud layer (1.6)	N/A	1 .. 2	n x 2	32-bit real	1.87
SSF-111	Mean vertical aspect ratio for cloud layer (TBD)	N/A	0 .. 20	n x 2	32-bit real	1.87
SSF-112	Stddev of vertical aspect ratio for cloud layer (TBD)	N/A	0 .. 15	n x 2	32-bit real	1.87
SSF-113	Percentiles of visible optical depth for cloud layer	N/A	0 .. 400	n x 13 x 2	32-bit real	24.35
SSF-114	Percentiles of IR emissivity for cloud layer	N/A	0 .. 2	n x 13 x 2	32-bit real	24.35

Table 2.5-13. Footprint Imager Radiance Statistics (1 of 2)

Item	SDS Name (Parameter Name)	Units	Range	Dimen-sions	Data Type	Maximum Hourly Size (MB)
SSF-115	Imager channel central wavelength	μm	0.4 .. 15.0	n x 5	32-bit real	4.68
SSF-116	All subpixel clear area percent coverage	N/A	0 .. 100	n	32-bit real	0.94
SSF-117	All subpixel overcast cloud area percent coverage	N/A	0 ..100	n	32-bit real	0.94
SSF-118	Mean imager radiances over clear area	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	-1000 .. 1000	n x 5	32-bit real	4.68
SSF-119	Stddev of imager radiances over clear area	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	0 .. 1000	n x 5	32-bit real	4.68
SSF-120	Mean imager radiances over over-cast cloud area	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	-1000 .. 1000	n x 5	32-bit real	4.68
SSF-121	Stddev of imager radiances over overcast cloud area	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	0 .. 1000	n x 5	32-bit real	4.68
SSF-122	Mean imager radiances over full CERES FOV	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	-1000 .. 1000	n x 5	32-bit real	4.68
SSF-123	Stddev of imager radiances over full CERES FOV	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	0 .. 1000	n x 5	32-bit real	4.68
SSF-124	5th percentile of imager radiances over full CERES FOV	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	-1000 .. 1000	n x 5	32-bit real	4.68
SSF-125	95th percentile of imager radiances over full CERES FOV	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	-1000 .. 1000	n x 5	32-bit real	4.68

Table 2.5-13. Footprint Imager Radiance Statistics (2 of 2)

Item	SDS Name (Parameter Name)	Units	Range	Dimen-sions	Data Type	Maximum Hourly Size (MB)
SSF-126	Mean imager radiances over cloud layer 1 (no overlap)	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	-1000 .. 1000	n x 5	32-bit real	4.68
SSF-127	Stddev of imager radiances over cloud layer 1 (no overlap)	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	0 .. 1000	n x 5	32-bit real	4.68
SSF-128	Mean imager radiances over cloud layer 2 (no overlap)	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	-1000 .. 1000	n x 5	32-bit real	4.68
SSF-129	Stddev of imager radiances over cloud layer 2 (no overlap)	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	0 .. 1000	n x 5	32-bit real	4.68
SSF-130	Mean imager radiances over cloud layer 1 and 2 overlap	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	-1000 .. 1000	n x 5	32-bit real	4.68
SSF-131	Stddev of imager radiances over cloud layer 1 and 2 overlap	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	0 .. 1000	n x 5	32-bit real	4.68

The MODIS land aerosol parameters described in Table 2.5-14 are only available on Terra and Aqua SSF products.

Table 2.5-14. MODIS Land Aerosols (1 of 2)

Item	SDS Name (Parameter Name)	Units	Range	Dimen-sions	Data Type	Maximum Hourly Size (MB)
SSF-132	Percentage of CERES FOV with MODIS land aerosol	N/A	0 .. 100	n	16-bit integer	0.47
SSF-133	PSF-wtd MOD04 cloud fraction land	N/A	0 .. 100	n	16-bit integer	0.47
SSF-134	PSF-wtd MOD04 aerosol types land	N/A	0 .. 9999	n	32-bit integer	0.94
SSF-135	PSF-wtd MOD04 dust weighting factor land	N/A	0.0 .. 1.0	n	32-bit real	0.94
SSF-136	PSF-wtd MOD04 corrected optical depth land (0.470)	N/A	0.0 .. 5.0	n	32-bit real	0.94
SSF-137	PSF-wtd MOD04 corrected optical depth land (0.550)	N/A	0.0 .. 5.0	n	32-bit real	0.94
SSF-138	PSF-wtd MOD04 corrected optical depth land (0.659)	N/A	0.0 .. 5.0	n	32-bit real	0.94
SSF-139	MOD04 number pixels percentile land (0.659) in CERES FOV	N/A	0 .. $(2^{31}-1)$	n	32-bit integer	0.94
SSF-140	PSF-wtd MOD04 mean reflectance land (0.470)	N/A	0.0 .. 1.0	n	32-bit real	0.94

Table 2.5-14. MODIS Land Aerosols (2 of 2)

Item	SDS Name (Parameter Name)	Units	Range	Dimen-sions	Data Type	Maximum Hourly Size (MB)
SSF-141	PSF-wtd MOD04 mean reflectance land (0.659)	N/A	0.0 .. 1.0	n	32-bit real	0.94
SSF-142	PSF-wtd MOD04 mean reflectance land (0.865)	N/A	0.0 .. 1.0	n	32-bit real	0.94
SSF-143	PSF-wtd MOD04 mean reflectance land (2.130)	N/A	0.0 .. 1.0	n	32-bit real	0.94
SSF-144	PSF-wtd MOD04 mean reflectance land (3.750)	N/A	0.0 .. 1.0	n	32-bit real	0.94
SSF-145	PSF-wtd MOD04 std reflectance land (0.470)	N/A	0.0 .. 2.0	n	32-bit real	0.94

The MODIS ocean aerosol parameters described in Table 2.5-15 are only available on Terra and Aqua SSF products.

Table 2.5-15. MODIS Ocean Aerosols (1 of 2)

Item	SDS Name (Parameter Name)	Units	Range	Dimen-sions	Data Type	Maximum Hourly Size (MB)
SSF-146	Percentage of CERES FOV with MODIS ocean aerosol	N/A	0 .. 100	n	16-bit integer	0.47
SSF-147	PSF-wtd MOD04 cloud fraction ocean	N/A	0 .. 100	n	16-bit integer	0.47
SSF-148	PSF-wtd MOD04 solution indices ocean small, average	N/A	0 .. 99999	n	32-bit integer	0.94
SSF-149	PSF-wtd MOD04 solution indices ocean large, average	N/A	0 .. 99999	n	32-bit integer	0.94
SSF-150	PSF-wtd MOD04 effective optical depth average ocean (0.470)	N/A	0.0 .. 5.0	n	32-bit real	0.94
SSF-151	PSF-wtd MOD04 effective optical depth average ocean (0.550)	N/A	0.0 .. 5.0	n	32-bit real	0.94
SSF-152	PSF-wtd MOD04 effective optical depth average ocean (0.659)	N/A	0.0 .. 5.0	n	32-bit real	0.94
SSF-153	PSF-wtd MOD04 effective optical depth average ocean (0.865)	N/A	0.0 .. 5.0	n	32-bit real	0.94
SSF-154	PSF-wtd MOD04 effective optical depth average ocean (1.240)	N/A	0.0 .. 5.0	n	32-bit real	0.94

Table 2.5-15. MODIS Ocean Aerosols (2 of 2)

Item	SDS Name (Parameter Name)	Units	Range	Dimen-sions	Data Type	Maximum Hourly Size (MB)
SSF-155	PSF-wtd MOD04 effective optical depth average ocean (1.640)	N/A	0.0 .. 5.0	n	32-bit real	0.94
SSF-156	PSF-wtd MOD04 effective optical depth average ocean (2.130)	N/A	0.0 .. 5.0	n	32-bit real	0.94
SSF-157	PSF-wtd MOD04 optical depth small average ocean (0.550)	N/A	0.0 .. 5.0	n	32-bit real	0.94
SSF-158	PSF-wtd MOD04 optical depth small average ocean (0.865)	N/A	0.0 .. 5.0	n	32-bit real	0.94
SSF-159	PSF-wtd MOD04 optical depth small average ocean (2.130)	N/A	0.0 .. 5.0	n	32-bit real	0.94
SSF-160	PSF-wtd MOD04 cloud condensa-tion nuclei ocean, average	CCN cm^{-2}	0.0 .. $1*10^{10}$	n	32-bit real	0.94

Estimated GigaBytes / Day: 6.8

SSF Revision Record

The product Revision Record contains information pertaining to approved section changes. The table lists the date the Software Configuration Change Request (SCCR) was approved, the Release and Version Number, the SCCR number, a short description of the revision, and the revised sections. The authors are listed on the document cover.

SSF Revision Record

SCCR Approval Date	Release/ Version Number	SCCR Number	Description of Revision	Section(s) Affected
N/A	R3V1	N/A	• Updated document to reflect new formats and to comply with standards.	All
6/21/02	R3V2	367	• Changed range of SSF ID in SSF_Header. • Added 2 tables for data available on Terra and Aqua products. • Added explanation about differences between TRMM products and the Terra and Aqua products. • Modified cover page to add information for all CERES satellites. • Added Revision Record page. • Updated format to comply with standards.	SSF Metadata Tables 2.5-14 & 2.5-15 SSF Scientific Data Sets Cover page SSF Revision Record All
5/21/03	R3V3	438	• Changed range of PSF-wtd MOD04 effective optical depths (SSF-136 to SSF-138; SSF-150 to SSF-159) from 0.0 .. 3.0 to 0.0 .. 5.0 based on changes to v003 MOD04 inputs starting with data date 01.Apr.2002. • Added Beta1 data set for Aqua satellite. • Updated format to comply with standards.	Tables 2.5-14 & 2.5-15 Cover page All
8/27/03	R3V4	463	• Changed range for ADM geo (SSF-30) and removed the '(TBD)' in the parameter name. • Updated format to comply with standards.	Table 2.5-6 All
6/04/04	R4V1	533	• Changed (SSF-30) SDS name from "ADM geo" to "Snow/ice percent coverage clear-sky overhead-sun vis albedo." • Changed (SSF-29) SDS name from "CERES WN ADM type for inversion process" to "Cloud Classification." • Updated format to comply with standards.	Table 2.5-6 Table 2.5-6 All

2.6 Clouds and Radiative Swath (CRS)

EOSDIS Product Code: CER04

The Clouds and Radiative Swath (CRS) product contains one hour of instantaneous Clouds and the Earth's Radiant Energy System (CERES) data for a single scanner instrument. The CRS contains all of the CERES SSF product data. For each CERES FOV on the SSF, the CRS also contains vertical flux profiles evaluated at five levels in the atmosphere: the surface, 500 hPa, 200 hPa, 70 hPa, and the TOA. After an initial pass through the radiative transfer model, the input parameters to the model are adjusted and a constrained pass through the model is made for both clear sky and total sky. If the FOV is overcast, clear sky fluxes are still calculated.

For the longwave, shortwave, and window channels, the CRS contains the upward and downward constrained vertical flux profiles for clear sky and total sky conditions evaluated at the five levels, along with pristine (no aerosols or clouds) and aerosol-free total sky fluxes evaluated at the surface and the TOA.

The initial flux profiles are not contained on the CRS unless constrained values are unavailable; however, the adjustments between the constrained and initial profiles for the following are included for clear sky, total sky, pristine, and aerosol-free total sky conditions:

- Longwave, shortwave, and window channel upward at the surface and the TOA.
- Longwave, shortwave, and window channel downward at the surface.

The adjustments to the model input parameters between the initial and the constrained passes are also contained on the CRS. The adjustable parameters include:

- Surface albedo and skin temperature.
- Total column precipitable water and upper tropospheric relative humidity.
- Aerosol optical depth.
- Cloud optical depth, fractional area, and effective temperature.

Level: 2
Frequency: 1/Hour
Portion of Atmosphere Covered: Surface to the TOA

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

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

Product Version:
TRMM: Edition2B
Terra: Beta4
Aqua: N/A

CRS Metadata

The types of CRS metadata are summarized in Table 2.6-1 and contain information which need only be recorded once per hour. The CERES metadata are listed in Appendix B. Table B-1 lists the CERES Baseline Header Metadata and Table B-2 lists the parameters in the CERES_metadata Vdata Table. Note that the CERES_metadata Vdata is a subset of the CERES Baseline Header Metadata. The CRS product-specific metadata parameters are listed in Table 2.6-1 and the CRS_Header_Vdata parameters are listed in Table 2.6-2.

Table 2.6-1. CRS Metadata Summary

HDF Name	Description Table	Records	Number of Fields
CERES Baseline Header Metadata	Table B-1	1	36
CERES_metadata Vdata	Table B-2	1	14
CRS Product-specific Metadata	Table 2.6-2	1	3
CRS_Header Vdata	Table 2.6-2	1	25

Table 2.6-2. CRS_Header_Vdata

Item	Description	Units	Range	Elements	Bytes/Elem
CRS-H1	SSF ID	N/A	112 .. 200	1	4
CRS-H2	Character name of CERES instrument	N/A	ASCII string	1	4
CRS-H3	Day and Time at hour start	N/A	ASCII string	1	28
CRS-H4	Character name of satellite	N/A	ASCII string	1	4
CRS-H5	Character name of high resolution imager instrument	N/A	ASCII string	1	8
CRS-H6	Number of imager channels	N/A	1 .. 20	1	4
CRS-H7	Central wavelengths of imager channels	µm	0.4 .. 15.0	20	4
CRS-H8	Earth-Sun distance at hour start	AU	0.98 .. 1.02	1	4
CRS-H9	Beta Angle	deg	-90 .. 90	1	4
CRS-H10	Colatitude of subsatellite point at surface at hour start	deg	0 .. 180	1	4
CRS-H11	Longitude of subsatellite point at surface at hour start	deg	0 .. 360	1	4
CRS-H12	Colatitude of subsatellite point at surface at hour end	deg	0 .. 180	1	4
CRS-H13	Longitude of subsatellite point at surface at hour end	deg	0 .. 360	1	4
CRS-H14	Along-track angle of satellite at hour end	deg	0 .. 330	1	4
CRS-H15	Number of Footprints in SSF product	N/A	0 .. 360000	1	4
CRS-H16	Subsystem 4.1 identification string	N/A	ASCII string	1	128
CRS-H17	Subsystem 4.2 identification string	N/A	ASCII string	1	128
CRS-H18	Subsystem 4.3 identification string	N/A	ASCII string	1	128
CRS-H19	Subsystem 4.4 identification string	N/A	ASCII string	1	128
CRS-H20	Subsystem 4.5 identification string	N/A	ASCII string	1	128
CRS-H21	Subsystem 4.6 identification string	N/A	ASCII string	1	128
CRS-H22	IES production date and time	N/A	ASCII string	1	24
CRS-H23	MOA production date and time	N/A	ASCII string	1	24
CRS-H24	SSF production date and time	N/A	ASCII string	1	24
CRS-H25	Instantaneous SARB Version number	N/A	1 .. 26	1	2
CRS-H26	CRS production date and time	N/A	ASCII string	1	19

CRS Scientific Data Sets

For the TRMM satellite, the CRS contains 206 Scientific Data Sets (SDS). For the Terra satellite, the CRS contains 250 SDSs. The first 131 SDSs (160 SDSs for Terra) are also contained on the SSF. (For a list of these SDSs, see Table 2.5-3 through Table 2.5-15.) The remaining SDSs are generated by the CERES Surface and Atmospheric Radiation Budget (SARB) production software and are unique to the CRS product.

These SDSs are parameter collections of along-track ordered FOVs where the first dimension corresponds to the number of FOVs, and the last dimension corresponds to the number of parameters. The middle dimension, if rank 3, corresponds to the number of elements in each parameter array. This ordering is used by the C programming language and most HDF viewers. In Fortran, the dimensions are reversed such that the number of FOVs becomes the last dimension and the first dimension is the number of parameters in the SDS.

The SDSs are divided into tables which map to Vgroups of the same name. Table 2.6-3 through Table 2.6-16 summarize the contents of each Vgroup and SDS contained within the CRS file. Product sizing information for the maximum number of possible FOVs is given in Table 2.6-17. (Note: the dimension n in the following tables is the number of FOVs processed: Assuming n = 245475 for sizing). Maximum SDS hourly sizes for the different dimensions are given in Table 2.6-18.

Table 2.6-3. Surface Radiative Properties

SARB SDS	TRMM CRS SDS Number[a]	Terra CRS SDS Number[b]	SDS Name	Units	Range	Dim	Data Type
1	TRMM-132	Terra-161	Photosynthetically active radiation over surface	W m^{-2}	0 .. 780	n	32 bit real
2	TRMM-133	Terra-162	Direct/diffuse surface ratio	N/A	0 .. 30	n	32 bit real
3	TRMM-134	Terra-163	Corrected initial broadband surface albedo	N/A	0 .. 1	n	32 bit real

a. The first 131 TRMM CRS SDSs are listed in the corresponding TRMM SSF DPC pages. TRMM SSF and CRS granules contain fewer SDSs than Terra SSF and CRS granules.
b. The first 160 Terra CRS SDSs are listed in the corresponding Terra SSF DPC pages.

Table 2.6-4. Vertical Profile Description

SARB SDS	TRMM CRS SDS Number[a]	Terra CRS SDS Number[b]	SDS Name	Units	Range	Dim	Data Type
4	TRMM-135	Terra-164	Number of atmospheric levels	N/A	0 .. 5	n	32 bit integer
5	TRMM-136	Terra-165	Pressure levels	hPa	0 .. 1100	n x 5	32 bit real

a. The first 131 TRMM CRS SDSs are listed in the corresponding TRMM SSF DPC pages. TRMM SSF and CRS granules contain fewer SDSs than Terra SSF and CRS granules.
b. The first 160 Terra CRS SDSs are listed in the corresponding Terra SSF DPC pages.

Table 2.6-5. Pristine Vertical Flux Profiles

SARB SDS	TRMM CRS SDS Number[a]	Terra CRS SDS Number[b]	SDS Name	Units	Range	Dim	Data Type
6	TRMM-137	Terra-166	SW flux - upward - pristine	W m^{-2}	0 .. 1400	n x 2	32 bit real
7	TRMM-138	Terra-167	SW flux - downward - pristine	W m^{-2}	0 .. 1400	n x 2	32 bit real
8	TRMM-139	Terra-168	LW flux - upward - pristine	W m^{-2}	0 .. 850	n x 2	32 bit real
9	TRMM-140	Terra-169	LW flux - downward - pristine	W m^{-2}	0 .. 700	n x 2	32 bit real
10	TRMM-141	Terra-170	WN flux - upward - pristine	W m^{-2}	0 .. 370	n x 2	32 bit real
11	TRMM-142	Terra-171	WN flux - downward - pristine	W m^{-2}	0 .. 370	n x 2	32 bit real

a. The first 131 TRMM CRS SDSs are listed in the corresponding TRMM SSF DPC pages. TRMM SSF and CRS granules contain fewer SDSs than Terra SSF and CRS granules.
b. The first 160 Terra CRS SDSs are listed in the corresponding Terra SSF DPC pages.

Table 2.6-6. Constrained Clear Sky Profiles

SARB SDS	TRMM CRS SDS Number[a]	Terra CRS SDS Number[b]	SDS Name	Units	Range	Dim	Data Type
12	TRMM-143	Terra-172	SW flux - upward for clear-sky	W m^{-2}	0 .. 1400	n x 5	32 bit real
13	TRMM-144	Terra-173	SW flux - downward for clear-sky	W m^{-2}	0 .. 1400	n x 5	32 bit real
14	TRMM-145	Terra-174	LW flux - upward for clear-sky	W m^{-2}	0 .. 850	n x 5	32 bit real
15	TRMM-146	Terra-175	LW flux - downward for clear-sky	W m^{-2}	0 .. 700	n x 5	32 bit real
16	TRMM-147	Terra-176	WN flux - upward for clear-sky	W m^{-2}	0 .. 370	n x 5	32 bit real
17	TRMM-148	Terra-177	WN flux - downward for clear-sky	W m^{-2}	0 .. 370	n x 5	32 bit real

a. The first 131 TRMM CRS SDSs are listed in the corresponding TRMM SSF DPC pages. TRMM SSF and CRS granules contain fewer SDSs than Terra SSF and CRS granules.
b. The first 160 Terra CRS SDSs are listed in the corresponding Terra SSF DPC pages.

Table 2.6-7. Constrained Total Sky Profiles

SARB SDS	TRMM CRS SDS Number[a]	Terra CRS SDS Number[b]	SDS Name	Units	Range	Dim	Data Type
18	TRMM-149	Terra-178	SW flux - upward for total-sky	W m^{-2}	0 .. 1400	n x 5	32 bit real
19	TRMM-150	Terra-179	SW flux - downward for total-sky	W m^{-2}	0 .. 1400	n x 5	32 bit real
20	TRMM-151	Terra-180	LW flux - upward for total-sky	W m^{-2}	0 .. 850	n x 5	32 bit real
21	TRMM-152	Terra-181	LW flux - downward for total-sky	W m^{-2}	0 .. 700	n x 5	32 bit real
22	TRMM-153	Terra-182	WN flux - upward for total-sky	W m^{-2}	0 .. 370	n x 5	32 bit real
23	TRMM-154	Terra-183	WN flux - downward for total-sky	W m^{-2}	0 .. 370	n x 5	32 bit real

a. The first 131 TRMM CRS SDSs are listed in the corresponding TRMM SSF DPC pages. TRMM SSF and CRS granules contain fewer SDSs than Terra SSF and CRS granules.
b. The first 160 Terra CRS SDSs are listed in the corresponding Terra SSF DPC pages.

Table 2.6-8. Pristine Constrainment-Initial Flux Deltas

SARB SDS	TRMM CRS SDS Number[a]	Terra CRS SDS Number[b]	SDS Name	Units	Range	Dim	Data Type
24	TRMM-155	Terra-184	SW flux adjustment at surface - upward - pristine	W m^{-2}	-1400 .. 1400	n	32 bit real
25	TRMM-156	Terra-185	SW flux adjustment at TOA - upward - pristine	W m^{-2}	-1400 .. 1400	n	32 bit real
26	TRMM-157	Terra-186	SW flux adjustment at surface - downward - pristine	W m^{-2}	-1400 .. 1400	n	32 bit real
27	TRMM-158	Terra-187	LW flux adjustment at surface - upward - pristine	W m^{-2}	-600 .. 600	n	32 bit real
28	TRMM-159	Terra-188	LW flux adjustment at surface - downward - pristine	W m^{-2}	-700 .. 700	n	32 bit real
29	TRMM-160	Terra-189	LW flux adjustment at TOA - upward - pristine	W m^{-2}	-700 .. 700	n	32 bit real
30	TRMM-161	Terra-190	WN flux adjustment at surface - upward - pristine	W m^{-2}	-50 .. 50	n	32 bit real
31	TRMM-162	Terra-191	WN flux adjustment at surface - downward - pristine	W m^{-2}	-50 .. 50	n	32 bit real
32	TRMM-163	Terra-192	WN flux adjustment at TOA - upward - pristine	W m^{-2}	-50 .. 50	n	32 bit real

a. The first 131 TRMM CRS SDSs are listed in the corresponding TRMM SSF DPC pages. TRMM SSF and CRS granules contain fewer SDSs than Terra SSF and CRS granules.
b. The first 160 Terra CRS SDSs are listed in the corresponding Terra SSF DPC pages.

Table 2.6-9. Clear Sky Constrainment-Initial Flux Deltas

SARB SDS	TRMM CRS SDS Number[a]	Terra CRS SDS Number[b]	SDS Name	Units	Range	Dim	Data Type
33	TRMM-164	Terra-193	SW flux adjustment at surface - upward for clear-sky	W m^{-2}	-1400 .. 1400	n	32 bit real
34	TRMM-165	Terra-194	SW flux adjustment at TOA - upward for clear-sky	W m^{-2}	-1400 .. 1400	n	32 bit real
35	TRMM-166	Terra-195	SW flux adjustment at surface - downward for clear-sky	W m^{-2}	-1400 .. 1400	n	32 bit real
36	TRMM-167	Terra-196	LW flux adjustment at surface - upward for clear-sky	W m^{-2}	-600 .. 600	n	32 bit real
37	TRMM-168	Terra-197	LW flux adjustment at surface - downward for clear-sky	W m^{-2}	-700 .. 700	n	32 bit real
38	TRMM-169	Terra-198	LW flux adjustment at TOA - upward for clear-sky	W m^{-2}	-700 .. 700	n	32 bit real
39	TRMM-170	Terra-199	WN flux adjustment at surface - upward for clear-sky	W m^{-2}	-50 .. 50	n	32 bit real
40	TRMM-171	Terra-200	WN flux adjustment at surface - downward for clear-sky	W m^{-2}	-50 .. 50	n	32 bit real
41	TRMM-172	Terra-201	WN flux adjustment at TOA - upward for clear-sky	W m^{-2}	-50 .. 50	n	32 bit real

a. The first 131 TRMM CRS SDSs are listed in the corresponding TRMM SSF DPC pages. TRMM SSF and CRS granules contain fewer SDSs than Terra SSF and CRS granules.
b. The first 160 Terra CRS SDSs are listed in the corresponding Terra SSF DPC pages.

Table 2.6-10. Total Sky Constrainment-Initial Flux Deltas (1 of 2)

SARB SDS	TRMM CRS SDS Number[a]	Terra CRS SDS Number[b]	SDS Name	Units	Range	Dim	Data Type
42	TRMM-173	Terra-202	SW flux adjustment at surface - upward for total-sky	W m^{-2}	-1400 .. 1400	n	32 bit real
43	TRMM-174	Terra-203	SW flux adjustment at TOA - upward for total-sky	W m^{-2}	-1400 .. 1400	n	32 bit real
44	TRMM-175	Terra-204	SW flux adjustment at surface - downward for total-sky	W m^{-2}	-1400 .. 1400	n	32 bit real
45	TRMM-176	Terra-205	LW flux adjustment at surface - upward for total-sky	W m^{-2}	-600 .. 600	n	32 bit real

Table 2.6-10. Total Sky Constrainment-Initial Flux Deltas (2 of 2)

SARB SDS	TRMM CRS SDS Number[a]	Terra CRS SDS Number[b]	SDS Name	Units	Range	Dim	Data Type
46	TRMM-177	Terra-206	LW flux adjustment at surface - downward for total-sky	W m^{-2}	-700 .. 700	n	32 bit real
47	TRMM-178	Terra-207	LW flux adjustment at TOA - upward for total-sky	W m^{-2}	-700 .. 700	n	32 bit real
48	TRMM-179	Terra-208	WN flux adjustment at surface - upward for total-sky	W m^{-2}	-50 .. 50	n	32 bit real
49	TRMM-180	Terra-209	WN flux adjustment at surface - downward for total-sky	W m^{-2}	-50 .. 50	n	32 bit real
50	TRMM-181	Terra-210	WN flux adjustment at TOA - upward for total-sky	W m^{-2}	-50 .. 50	n	32 bit real

a. The first 131 TRMM CRS SDSs are listed in the corresponding TRMM SSF DPC pages. TRMM SSF and CRS granules contain fewer SDSs than Terra SSF and CRS granules.
b. The first 160 Terra CRS SDSs are listed in the corresponding Terra SSF DPC pages.

Table 2.6-11. Satellite Emulated Window Channel

SARB SDS	TRMM CRS SDS Number[a]	Terra CRS SDS Number[b]	SDS Name	Units	Range	Dim	Data Type
51	TRMM-182	Terra-211	WN filtered radiance -satellite emulated	W $m^{-2}sr^{-1}$	0 .. 50	n	32 bit real
52	TRMM-183	Terra-212	WN filtered radiance adjustment-satellite emulated	W $m^{-2}sr^{-1}$	0 .. 50	n	32 bit real
53	TRMM-184	Terra-213	WN flux - satellite emulated - TOA	W m^{-2}	2 .. 50	n	32 bit real
54	TRMM-185	Terra-214	WN flux adjustment - satellite emulated - TOA	W m^{-2}	2 .. 50	n	32 bit real

a. The first 131 TRMM CRS SDSs are listed in the corresponding TRMM SSF DPC pages. TRMM SSF and CRS granules contain fewer SDSs than Terra SSF and CRS granules.
b. The first 160 Terra CRS SDSs are listed in the corresponding Terra SSF DPC pages.

Table 2.6-12. Unfiltered Total Longwave

SARB SDS	TRMM CRS SDS Number[a]	Terra CRS SDS Number[b]	SDS Name	Units	Range	Dim	Data Type
55	TRMM-186	Terra-215	Total LW unfiltered radiance - satellite emulated	W $m^{-2}sr^{-1}$	0 .. 200	n	32 bit real
56	TRMM-187	Terra-216	Total LW unfiltered radiance adjustment - satellite emulated	W $m^{-2}sr^{-1}$	0 .. 200	n	32 bit real

a. The first 131 TRMM CRS SDSs are listed in the corresponding TRMM SSF DPC pages. TRMM SSF and CRS granules contain fewer SDSs than Terra SSF and CRS granules.
b. The first 160 Terra CRS SDSs are listed in the corresponding Terra SSF DPC pages.

Table 2.6-13. Constrainment Adjustments (1 of 2)

SARB SDS	TRMM CRS SDS Number[a]	Terra CRS SDS Number[b]	SDS Name	Units	Range	Dim	Data Type
57	TRMM-188	Terra-217	Total column precipitable water - initial	cm	0 .. 10	n	32 bit real
58	TRMM-189	Terra-218	Total column precipitable water - adjustment	cm	-10 .. 10	n	32 bit real
59	TRMM-190	Terra-219	Upper tropospheric precipitable water - initial	cm	0 .. 10	n	32 bit real
60	TRMM-191	Terra-220	Upper tropospheric precipitable water - adjustment	cm	-10 .. 10	n	32 bit real
61	TRMM-192	Terra-221	Upper tropospheric humidity - initial	N/A	0.0 .. 100.0	n	32 bit real
62	TRMM-193	Terra-222	Upper tropospheric humidity - adjustment	N/A	0.0 .. 100.0	n	32 bit real
63	TRMM-194	Terra-223	Surface albedo - adjustment	N/A	-1 ..1	n	32 bit real

Table 2.6-13. Constrainment Adjustments (2 of 2)

SARB SDS	TRMM CRS SDS Number[a]	Terra CRS SDS Number[b]	SDS Name	Units	Range	Dim	Data Type
64	TRMM-195	Terra-224	Aerosol optical depth - initial	N/A	0 .. 2	n	32 bit real
65	TRMM-196	Terra-225	Aerosol optical depth - adjustment	N/A	-2 .. 2	n	32 bit real
66	TRMM-197	Terra-226	Skin temperature - initial	K	TBD	n	32 bit real
67	TRMM-198	Terra-227	Skin temperature - adjustment	K	TBD	n	32 bit real
68	TRMM-199	Terra-228	Mean visible optical depth- adjustment	N/A	-400 .. 400	n x 2	32 bit real
69	TRMM-200	Terra-229	Mean cloud fractional area - adjustment	N/A	-1 .. 1	n x 2	32 bit real
70	TRMM-201	Terra-230	Mean cloud effective temperature - adjustment	K	TBD	n x 2	32 bit real

a. The first 131 TRMM CRS SDSs are listed in the corresponding TRMM SSF DPC pages. TRMM SSF and CRS granules contain fewer SDSs than Terra SSF and CRS granules.
b. The first 160 Terra CRS SDSs are listed in the corresponding Terra SSF DPC pages.

Table 2.6-14. Aerosol Constituency Information

SARB SDS	TRMM CRS SDS Number[a]	Terra CRS SDS Number[b]	SDS Name	Units	Range	Dim	Data Type
71	TRMM-202	Terra-231	Aerosol constituency flags	N/A	01000000 .. 18999999	n x 7	32 bit integer
72	TRMM-203	Terra-232	Aerosol and surface albedo sources flag	N/A	100 - 303	n	32 bit integer

a. The first 131 TRMM CRS SDSs are listed in the corresponding TRMM SSF DPC pages. TRMM SSF and CRS granules contain fewer SDSs than Terra SSF and CRS granules.
b. The first 160 Terra CRS SDSs are listed in the corresponding Terra SSF DPC pages.

Table 2.6-15. Constrainment Status

SARB SDS	TRMM CRS SDS Number[a]	Terra CRS SDS Number[b]	SDS Name	Units	Range	Dim	Data Type
73	TRMM-204	Terra-233	Number of tuning iterations	N/A	0 .. 1	n	32 bit integer
74	TRMM-205	Terra-234	Constrainment status flag	N/A	0 .. 600	n	32 bit integer
75	TRMM-206	Terra-235	FuLiou model error code	N/A	1 .. 3000	n	32 bit integer

a. The first 131 TRMM CRS SDSs are listed in the corresponding TRMM SSF DPC pages. TRMM SSF and CRS granules contain fewer SDSs than Terra SSF and CRS granules.
b. The first 160 Terra CRS SDSs are listed in the corresponding Terra SSF DPC pages.

Table 2.6-16. Cloudy Skies with No Aerosol Information (1 of 2)

SARB SDS	TRMM CRS SDS Number[a]	Terra CRS SDS Number[b]	SDS Name	Units	Range	Dim	Data Type
76	N/A	Terra-236	SW flux - upward - cloudy skies with no aerosol	$W\ m^{-2}$	0 .. 1400	n	32 bit real
77	N/A	Terra-237	SW flux - downward - cloudy skies with no aerosol	$W\ m^{-2}$	0 .. 1400	n	32 bit real
78	N/A	Terra-238	LW flux - upward - cloudy skies with no aerosol	$W\ m^{-2}$	0 .. 850	n	32 bit real
79	N/A	Terra-239	LW flux - downward - cloudy skies with no aerosol	$W\ m^{-2}$	0 .. 700	n	32 bit real
80	N/A	Terra-240	WN flux - upward - cloudy skies with no aerosol	$W\ m^{-2}$	0 .. 370	n	32 bit real
81	N/A	Terra-241	WN flux - downward - cloudy skies with no aerosol	$W\ m^{-2}$	0 .. 370	n	32 bit real

Table 2.6-16. Cloudy Skies with No Aerosol Information (2 of 2)

SARB SDS	TRMM CRS SDS Number[a]	Terra CRS SDS Number[b]	SDS Name	Units	Range	Dim	Data Type
82	N/A	Terra-242	SW flux adjustment at surface - upward - cloudy skies with no aerosol	W m^{-2}	-1400 .. 1400	n	32 bit real
83	N/A	Terra-243	SW flux adjustment at TOA - upward - cloudy skies with no aerosol	W m^{-2}	-1400 .. 1400	n	32 bit real
84	N/A	Terra-244	SW flux adjustment at surface - downward - cloudy skies with no aerosol	W m^{-2}	-1400 .. 1400	n	32 bit real
85	N/A	Terra-245	LW flux adjustment at surface - upward - cloudy skies with no aerosol	W m^{-2}	-600 .. 600	n	32 bit real
86	N/A	Terra-246	LW flux adjustment at surface - downward - cloudy skies with no aerosol	W m^{-2}	-700 .. 700	n	32 bit real
87	N/A	Terra-247	LW flux adjustment at TOA - upward - cloudy skies with no aerosol	W m^{-2}	-700 .. 700	n	32 bit real
88	N/A	Terra-248	WN flux adjustment at surface - upward - cloudy skies with no aerosol	W m^{-2}	-50 .. 50	n	32 bit real
89	N/A	Terra-249	WN flux adjustment at surface - downward - cloudy skies with no aerosol	W m^{-2}	-50 .. 50	n	32 bit real
90	N/A	Terra-250	WN flux adjustment at TOA - upward - cloudy skies with no aerosol	W m^{-2}	-50 .. 50	n	32 bit real

a. The first 131 TRMM CRS SDSs are listed in the corresponding TRMM SSF DPC pages. TRMM SSF and CRS granules contain fewer SDSs than Terra SSF and CRS granules.
b. The first 160 Terra CRS SDSs are listed in the corresponding Terra SSF DPC pages.

Table 2.6-17. Sizing Information[a]

SATELLITE	HOURLY SSF SDS TOTAL SIZE (MAXIMUM)	HOURLY CRS-ONLY SDS SIZE (MAXIMUM)	HOURLY CRS TOTAL SDS SIZE (MAXIMUM)	DAILY CRS TOTAL SIZE (MAXIMUM)
TRMM SATELLITE	260.27 MB	132.97 MB	391.42	9.15 GB
TERRA SATELLITES	283.73MB	147.02 MB	430.75	10.10 GB

a. Sizing data in this table are based solely on binary versions of the products, and do not account for HDF compression.

Table 2.6-18. Maximum Hourly SDS Sizes

Dimension	Maximum Hourly Size (MB)
n	0.94
n x 2	1.87
n x 5	4.68
n x 7	6.55

CRS Revision Record

The product Revision Record contains information pertaining to approved section changes. The table lists the date the Software Configuration Change Request (SCCR) was approved, the Release and Version Number, the SCCR number, a short description of the revision, and the revised sections. The authors are listed on the document cover.

CRS Revision Record (1 of 2)

SCCR Approval Date	Release/ Version Number	SCCR Number	Description of Revision	Section(s) Affected
N/A	R3V1	N/A	• Updated format to comply with standards.	All
12/20/02	R3V2	408	• Added text to indicate a different number of SDSs for the different satellites. • Updated table to include sizing information for the different satellites. • Updated summary information to include the Product Version section and eliminated the references to the CERES Configuration Codes. • Corrected references to the height used as the TOA by SARB to 0.1 hPa. • Updated format to comply with standards.	2.6 Table 2.6-16 2.6 2.6 All
12/20/02	R3V3	408	• Replaced references to the 0.1 hPa height with the term TOA and defined pristine skies as containing no clouds or aerosols. • Removed column containing individual SDS hourly size information from VGroup tables and added Table 2.6-17. • Replaced single Item Number column in VGroup Tables with three columns to distinguish the Item Number between satellites. • Updated format to comply with standards.	2.6 Tables 2.6-3 through 2.6-17 Tables 2.6-3 through 2.6-16 All
7/30/03	R3V4	458	• Updated introduction to discuss the aerosol-free total sky additions to the CRS. • Added new table to contain the aerosol-free total sky information. • Updated sizing table to reflect the additional data. • Updated format to comply with standards.	2.6 Table 2.6-16 Table 2.6-17 All

CRS Revision Record (2 of 2)

SCCR Approval Date	Release/ Version Number	SCCR Number	Description of Revision	Section(s) Affected
1/16/04	R3V5	498	• The revisions to the document are the updating of Table 2.6-15 to reflect the renaming of the SDS Sigma table version number SDS to FuLiou model error code, and the updating of that SDS's range. • Corrected name shown for SARB SDS 1. • Updated format to comply with standards.	Table 2-6.15 Table 2.6-3 All

2.7 Monthly Gridded Radiative 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 is written in HDF and contains metadata as well as gridded science data. The HDF product for TRMM consists of eight files, each containing data for ten 1.0-degree equal-angle zones. The HDF product for Terra and Aqua consists of 60 files, each containing data for three 1.0-degree equal-angle zones. Each record contains spatially averaged data for an individual region.

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

- Region data
- Imager Radiances Statistics
- Angular model scene classes
- Radiative fluxes for both Clear-sky and Total-sky at TOA
- Atmospheric flux profiles for Pristine-sky, Clear-sky and Total-sky
- Flux Adjustments for Pristine-sky, Clear-sky and Total-sky
- Surface Emissivity
- Overlap data for eleven cloud conditions
- Cloud category properties for four cloud layers
- Adjustment parameters for four cloud layers
- Adjustment parameters for clear-skies

A complete listing of parameters for this data product can be found in Tables 2.7-4 through Table 2.7-27.

Level: 3
Frequency: 1/Month
Portion of Atmosphere Covered: TOA, Surface, and Atmospheric Pressure Levels

Time Interval Covered:
File: Month
Record: Hour

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

Product Version:
TRMM:
Terra: Edition2B
Aqua: Edition1A

FSW Metadata

The types of FSW metadata are summarized in Table 2.7-1 and contain information which need only be recorded once per product. The CERES metadata are listed in Appendix B. The FSW product-specific metadata parameters are listed in Table 2.7-2.

Table 2.7-1. FSW Metadata Summary

HDF Name	Description Table	Records	Number of Fields
CERES Baseline Header Metadata	Table B-1	1	36
CERES_metadata Vdata	Table B-2	1	14
FSW Product Specific Metadata	Table 2.7-2	1	2

Table 2.7-2. FSW Product-specific Metadata

Item	Parameter Name	Description	DataType	Units	Range
1	ZoneBeginning	Beginning zone number	I4	N/A	1 .. 180
2	ZoneEnding	Ending zone number	I4	N/A	1 .. 180

All of the FSW science data are organized into the Vdata structures summarized in Table 2.7-3. The TRMM FSW product parameter lists are summarized in Table 2.7-4 through Table 2.7-13 and Table 2.7-18 through Table 2.7-24 including the SDS number, the SDS name, the data type, the units, the range, and the number of elements within each field. The Terra and Aqua FSW product parameter lists are summarized in Table 2.7-4 through Table 2.7-9 and Table 2.7-14 through Table 2.7-27 including the SDS number, the SDS name, the data type, the units, the range, and the number of elements within each field. Terra and Aqua FSW products contain additional MODIS aerosol SDSs which are summarized in Table 2.7-25 through Table 2.7-27. The profile flux SDS names are defined differently between TRMM and Terra FSW products, therefore the profile flux SDSs are summarized in separate tables for TRMM and Terra products. The number of records per Vdata is defined as n where n varies for each file. Sizing estimates are based on anticipated Terra sampling.

Table 2.7-3. FSW Vdata Summary (1 of 2)

Vdata Name	Description Table	Records	Number of Fields	VData Size (MB)
Time and Position Data	Table 2.7-4	n	6	311.04
Regional Identification Data	Table 2.7-5	n	5	115.20
Surface Map And Clear Area Data	Table 2.7-6	n	11	1555.20
Imager Radiances Statistics	Table 2.7-7	n	5	276.48
Angular Model Scene Type Data	Table 2.7-8	n	7	5235.84

Table 2.7-3. FSW Vdata Summary (2 of 2)

Vdata Name	Description Table	Records	Number of Fields	VData Size (MB)
TOA Fluxes	Table 2.7-9	n	12	1866.24
Pristine Vertical Flux Profiles - TRMM	Table 2.7-10	n	12	1866.24
Constrained Clear Sky Profiles - TRMM	Table 2.7-11	n	30	1555.20
Constrained Total Sky Profiles - TRMM	Table 2.7-12	n	30	1555.20
Constrainment - Initial Flux Deltas - TRMM	Table 2.7-13	n	27	1399.68
Pristine Vertical Flux Profiles - Terra/Aqua	Table 2.7-14	n	12	1866.24
Constrained Clear Sky Profiles - Terra/Aqua	Table 2.7-15	n	30	1555.20
Constrained Total Sky Profiles - Terra/Aqua	Table 2.7-16	n	30	1555.20
Constrainment - Initial Flux Deltas - Terra/Aqua	Table 2.7-17	n	27	1399.68
Surface Emissivity	Table 2.7-18	n	7	362.88
Cloud Overlap Conditions	Table 2.7-19	n	11	570.24
Cloud Layer - High	Table 2.7-20	n	18	2799.36
Cloud Layer - UpperMid	Table 2.7-21	n	18	2799.36
Cloud Layer - LowerMid	Table 2.7-22	n	18	2799.36
Cloud Layer - Low	Table 2.7-23	n	18	2799.36
Constrainment - Adjustments	Table 2.7-24	n	7	362.88
Aerosol LAND	Table 2.7-25	n	3	155.52
Aerosol OCEAN	Table 2.7-26	n	7	362.88
Cloudy Skies With No Aerosols	Table 2.7-27	n	21	1088.64
TOTAL SIZE				29856.80

Table 2.7-4. Time and Position Data

TRMM/ Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-0	Julian Time	day	2 440 000.0 .. 2 480 000.0	3	64-Bit Float[a]	1
FSW-1	Sun Colatitude	deg	0.0 .. 180.0	3	32-Bit Float	1
FSW-2	Sun Longitude	deg	0.0 .. 360.0	3	32-Bit Float	1
FSW-3	Relative Azimuth Angle	deg	0.0 .. 360.0	3	32-Bit Float	1
FSW-4	Cos. Solar Zenith Angle	N/A	0.0 .. 1.0	3	32-Bit Float	1
FSW-5	Spacecraft Zenith Angle	deg	0.0 .. 90.0	3	32-Bit Float	1

a. Julian Time SDS Data Type is set to 32-Bit Float on TRMM products.

Table 2.7-5. Regional Identification Data

TRMM/ Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-6	Region Number	N/A	1 .. 64800	3	32-Bit Float	1
FSW-7	Hour Box Number	N/A	1 .. 744	3	32-Bit Float	1
FSW-8	Num. Footprints in Region	N/A	1 .. 500	3	32-Bit Float	1
FSW-9	Colatitude	N/A	1 - 180	3	32-Bit Float	1
FSW-10	Longitude	N/A	1 - 360	3	32-Bit Float	1

Table 2.7-6. Surface Map And Clear Area Data (1 of 2)

TRMM/ Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-11	Alt. of Srf. above Sea	m	-1000 .. 10000	3	32-Bit Float	1
FSW-12	Surface Type Percentage	percent	0.0 .. 100.0	4	32-Bit Float	20
FSW-13	Snow/Ice Percentage	percent	0.0 .. 100.0	3	32-Bit Float	1
FSW-14	Smoke Percentage	percent	0.0 .. 100.0	3	32-Bit Float	1
FSW-15	Aerosol Percentage	percent	0.0 .. 100.0	3	32-Bit Float	1
FSW-16	Flag - Aerosol Type	N/A	0.0 .. 9999.0	3	32-Bit Float	1

Table 2.7-6. Surface Map And Clear Area Data (2 of 2)

TRMM/ Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-17	Aerosol Opt. Depth at 0.63 µm in clr	µm	-1.0 .. 5.0	3	32-Bit Float	1
FSW-18	Aerosol Opt. Depth at 1.6 µm in clr	µm	-1.0 .. 5.0	3	32-Bit Float	1
FSW-19	Precipitable Water	cm	0.001 .. 10.0	3	32-Bit Float	1
FSW-20	Flag - Source Precip. H2O	N/A	0 .. 120	3	32-Bit Float	1
FSW-21	MOA - Relative Column Avg. Humidity	N/A	0.0 .. 100.0	3	32-Bit Float	1

Table 2.7-7. Imager Radiances Statistics

TRMM/ Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-22	Imager Viewing Zenith Angle	deg	0.0 .. 90.0	3	32-Bit Float	1
FSW-23	Imager Relative Azimuth Angle	deg	0.0 .. 360.0	3	32-Bit Float	1
FSW-24	Imager Channel Central Wave-length	µm	0.4 .. 15.0	4	32-Bit Float	5
FSW-25	Imager Radiance	$W\ m^{-2} sr^{-1} \mu m^{-1}$	-1000.0 .. 1000.0	4	32-Bit Float	5
FSW-26	Imager Radiance Clr-sky	$W\ m^{-2} sr^{-1} \mu m^{-1}$	-1000.0 .. 1000.0	4	32-Bit Float	5

Table 2.7-8. Angular Model Scene Type Data (1 of 2)

TRMM/ Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-27	Incident Solar Flux	N/A	0.0 .. 1400.0	3	32-Bit Float	1
FSW-28	Area Coverage	percent	0.0 .. 100.0	4	32-Bit Float	20
FSW-29	SW Scene ID	N/A	0 .. 5000	4	32-Bit Float	20
FSW-30	Albedo (mean)	N/A	0.0 .. 1.0	4	32-Bit Float	20
FSW-31	Albedo (std)	N/A	0.0 .. 1.0	4	32-Bit Float	20
FSW-32	LW (mean)	$W\ m^{-2}$	0.0 .. 400.0	4	32-Bit Float	20

Table 2.7-8. Angular Model Scene Type Data (2 of 2)

TRMM/ Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-33	LW (std)	W m^{-2}	0.0 .. 400.0	4	32-Bit Float	20

Table 2.7-9. TOA Fluxes

TRMM/ Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-34	SW TOA Clear-Sky	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-35	LW TOA Clear-Sky	W m^{-2}	0.0 .. 500.0	4	32-Bit Float	3
FSW-36	WN TOA Clear-Sky	W m^{-2}	0.0 .. 200.0	4	32-Bit Float	3
FSW-37	ALB TOA Clear-Sky	N/A	0.0 .. 1.0	4	32-Bit Float	3
FSW-38	SW TOA DOWNWARD Clear-Sky[a]	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-39	SW TOA UPWARD Clear-Sky[a]	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-40	LW TOA UPWARD Clear-Sky[a]	W m^{-2}	0.0 .. 850.0	4	32-Bit Float	3
FSW-41	WN TOA UPWARD Clear-Sky[a]	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-42	SW TOA Total-Sky	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-43	LW TOA Total-Sky	W m^{-2}	0.0 .. 500.0	4	32-Bit Float	3
FSW-44	WN TOA Total-Sky	W m^{-2}	0.0 .. 200.0	4	32-Bit Float	3
FSW-45	ALB TOA Total-Sky	N/A	0.0 .. 1.0	4	32-Bit Float	3

a. TOA Clear Sky SW, LW, WN upward & SW downward data is sorted according to the CERES Clear Sky definitions and the mean values are written in an additional set of SDSs.

Table 2.7-10. Pristine Vertical Flux Profiles (TRMM) (1 of 2)

TRMM SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-46	SW Upward Prestine Sky (TOA)	W m^{-2}	0.0 - 1400.0	4	32-Bit Float	3
FSW-47	SW Downward Prestine Sky (TOA)	W m^{-2}	0.0 - 1400.0	4	32-Bit Float	3
FSW-48	LW Upward Prestine Sky (TOA)	W m^{-2}	0.0 - 850.0	4	32-Bit Float	3

Table 2.7-10. Pristine Vertical Flux Profiles (TRMM) (2 of 2)

TRMM SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-49	LW Downward Prestine Sky (TOA)	W m^{-2}	0.0 - 700.0	4	32-Bit Float	3
FSW-50	WN Upward Prestine Sky (TOA)	W m^{-2}	0.0 - 370.0	4	32-Bit Float	3
FSW-51	WN Downward Prestine Sky (TOA)	W m^{-2}	0.0 - 370.0	4	32-Bit Float	3
FSW-52	SW Upward Prestine Sky (SRF)	W m^{-2}	0.0 - 1400.0	4	32-Bit Float	3
FSW-53	SW Downward Prestine Sky (SRF)	W m^{-2}	0.0 - 1400.0	4	32-Bit Float	3
FSW-54	LW Upward Prestine Sky (SRF)	W m^{-2}	0.0 - 850.0	4	32-Bit Float	3
FSW-55	LW Downward Prestine Sky (SRF)	W m^{-2}	0.0 - 700.0	4	32-Bit Float	3
FSW-56	WN Upward Prestine Sky (SRF)	W m^{-2}	0.0 - 370.0	4	32-Bit Float	3
FSW-57	WN Downward Prestine Sky (SRF)	W m^{-2}	0.0 - 370.0	4	32-Bit Float	3

Table 2.7-11. Constrained Clear Sky Profiles (TRMM) (1 of 2)

TRMM SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-58	SW Upward Clear Sky (TOA)	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-59	SW Downward Clear Sky (TOA)	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-60	LW Upward Clear Sky (TOA)	W m^{-2}	0.0 .. 850.0	4	32-Bit Float	3
FSW-61	LW Downward Clear Sky (TOA)	W m^{-2}	0.0 .. 700.0	4	32-Bit Float	3
FSW-62	WN Upward Clear Sky (TOA)	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-63	WN Downward Clear Sky (TOA)	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-64	SW Upward Clear Sky (70hPa)	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-65	SW Downward Clear Sky (70hPa)	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-66	LW Upward Clear Sky (70hPa)	W m^{-2}	0.0 .. 850.0	4	32-Bit Float	3

Table 2.7-11. Constrained Clear Sky Profiles (TRMM) (2 of 2)

TRMM SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-67	LW Downward Clear Sky (70hPa)	W m^{-2}	0.0 .. 700.0	4	32-Bit Float	3
FSW-68	WN Upward Clear Sky (70hPa)	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-69	WN Downward Clear Sky (70hPa)	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-70	SW Upward Clear Sky (200hPa)	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-71	SW Downward Clear Sky (200hPa)	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-72	LW Upward Clear Sky (200hPa)	W m^{-2}	0.0 .. 850.0	4	32-Bit Float	3
FSW-73	LW Downward Clear Sky (200hPa)	W m^{-2}	0.0 .. 700.0	4	32-Bit Float	3
FSW-74	WN Upward Clear Sky (200hPa)	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-75	WN Downward Clear Sk (200hPa)	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-76	SW Upward Clear Sky (500hPa)	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-77	SW Downward Clear Sky (500hPa)	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-78	LW Upward Clear Sky (500hPa)	W m^{-2}	0.0 .. 850.0	4	32-Bit Float	3
FSW-79	LW Downward Clear Sky (500hPa)	W m^{-2}	0.0 .. 700.0	4	32-Bit Float	3
FSW-80	WN Upward Clear Sky (500hPa)	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-81	WN Downward Clear Sky (500hPa)	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-82	SW Upward Clear Sky (SFC)	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-83	SW Downward Clear Sky (SFC)	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-84	LW Upward Clear Sky (SFC)	W m^{-2}	0.0 .. 850.0	4	32-Bit Float	3
FSW-85	LW Downward Clear Sky (SFC)	W m^{-2}	0.0 .. 700.0	4	32-Bit Float	3
FSW-86	WN Upward Clear Sky (SFC)	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-87	WN Downward Clear Sky (SFC)	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3

Table 2.7-12. Constrained Total Sky Profiles (TRMM) (1 of 2)

TRMM SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-88	SW Upward Total Sky (TOA)	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-89	SW Downward Total Sky (TOA)	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-90	LW Upward Total Sky (TOA)	W m^{-2}	0.0 .. 850.0	4	32-Bit Float	3
FSW-91	LW Downward Total Sky (TOA)	W m^{-2}	0.0 .. 700.0	4	32-Bit Float	3
FSW-92	WN Upward Total Sky (TOA)	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-93	WN Downward Total Sky (TOA)	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-94	SW Upward Total Sky (70hPa)	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-95	SW Downward Total Sky (70hPa)	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-96	LW Upward Total Sky (70hPa)	W m^{-2}	0.0 .. 850.0	4	32-Bit Float	3
FSW-97	LW Downward Total Sky (70hPa)	W m^{-2}	0.0 .. 700.0	4	32-Bit Float	3
FSW-98	WN Upward Total Sky (70hPa)	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-99	WN Downward Total Sky (70hPa)	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-100	SW Upward Total Sky (200hPa)	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-101	SW Downward Total Sky (200hPa)	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-102	LW Upward Total Sky (200hPa)	W m^{-2}	0.0 .. 850.0	4	32-Bit Float	3
FSW-103	LW Downward Total Sky (200hPa)	W m^{-2}	0.0 .. 700.0	4	32-Bit Float	3
FSW-104	WN Upward Total Sky (200hPa)	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-105	WN Downward Total Sky (200hPa)	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-106	SW Upward Total Sky (500hPa)	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-107	SW Downward Total Sky (500hPa)	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-108	LW Upward Total Sky (500hPa)	W m^{-2}	0.0 .. 850.0	4	32-Bit Float	3

Table 2.7-12. Constrained Total Sky Profiles (TRMM) (2 of 2)

TRMM SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-109	LW Downward Total Sky (500hPa)	W m^{-2}	0.0 .. 700.0	4	32-Bit Float	3
FSW-110	WN Upward Total Sky (500hPa)	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-111	WN Downward Total Sky (500hPa)	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-112	SW Upward Total Sky (SFC)	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-113	SW Downward Total Sky (SFC)	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-114	LW Upward Total Sky (SFC)	W m^{-2}	0.0 .. 850.0	4	32-Bit Float	3
FSW-115	LW Downward Total Sky (SFC)	W m^{-2}	0.0 .. 700.0	4	32-Bit Float	3
FSW-116	WN Upward Total Sky (SFC)	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-117	WN Downward Total Sky (SFC)	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3

Table 2.7-13. Constrainment - Initial Flux Deltas (TRMM) (1 of 2)

TRMM SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-118	SW Upward Prestine Sky (TOA)	W m^{-2}	-1400.0 .. 1400.0	4	32-Bit Float	3
FSW-119	LW Upward Prestine Sky (TOA)	W m^{-2}	-700.0 .. 700.0	4	32-Bit Float	3
FSW-120	WN Upward Prestine Sky (TOA)	W m^{-2}	-50.0 .. 50.0	4	32-Bit Float	3
FSW-121	SW Upward Prestine Sky (SFC)	W m^{-2}	-1400.0 .. 1400.0	4	32-Bit Float	3
FSW-122	SW Downward Prestine Sky (SFC)	W m^{-2}	-1400.0 .. 1400.0	4	32-Bit Float	3
FSW-123	LW Upward Prestine Sky (SFC)	W m^{-2}	-700.0 .. 700.0	4	32-Bit Float	3
FSW-124	LW Downward Prestine Sky (SFC)	W m^{-2}	-600.0 .. 600.0	4	32-Bit Float	3
FSW-125	WN Upward Prestine Sky (SFC)	W m^{-2}	-50.0 .. 50.0	4	32-Bit Float	3
FSW-126	WN Downward Prestine Sky (SFC)	W m^{-2}	-50.0 .. 50.0	4	32-Bit Float	3

Table 2.7-13. Constrainment - Initial Flux Deltas (TRMM) (2 of 2)

TRMM SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-127	SW Upward Clear Sky (TOA)	W m^{-2}	-1400.0 .. 1400.0	4	32-Bit Float	3
FSW-128	LW Upward Clear Sky (TOA)	W m^{-2}	-700.0 .. 700.0	4	32-Bit Float	3
FSW-129	WN Upward Clear Sky (TOA)	W m^{-2}	-50.0 .. 50.0	4	32-Bit Float	3
FSW-130	SW Upward Clear Sky (SFC)	W m^{-2}	-1400.0 .. 1400.0	4	32-Bit Float	3
FSW-131	SW Downward Clear Sky (SFC)	W m^{-2}	-1400.0 .. 1400.0	4	32-Bit Float	3
FSW-132	LW Upward Clear Sky (SFC)	W m^{-2}	-700.0 .. 700.0	4	32-Bit Float	3
FSW-133	LW Downward Clear Sky (SFC)	W m^{-2}	-600.0 .. 600.0	4	32-Bit Float	3
FSW-134	WN Upward Clear Sky (SFC)	W m^{-2}	-50.0 .. 50.0	4	32-Bit Float	3
FSW-135	WN Downward Clear Sky (SFC)	W m^{-2}	-50.0 .. 50.0	4	32-Bit Float	3
FSW-136	SW Upward Total Sky (TOA)	W m^{-2}	-1400.0 .. 1400.0	4	32-Bit Float	3
FSW-137	LW Upward Total Sky (TOA)	W m^{-2}	-700.0 .. 700.0	4	32-Bit Float	3
FSW-138	WN Upward Total Sky (TOA)	W m^{-2}	-50.0 .. 50.0	4	32-Bit Float	3
FSW-139	SW Upward Total Sky (SFC)	W m^{-2}	-1400.0 .. 1400.0	4	32-Bit Float	3
FSW-140	SW Downward Total Sky (SFC)	W m^{-2}	-1400.0 .. 1400.0	4	32-Bit Float	3
FSW-141	LW Upward Total-Sky (SFC)	W m^{-2}	-700.0 .. 700.0	4	32-Bit Float	3
FSW-142	LW Downward Total-Sky (SFC)	W m^{-2}	-600.0 .. 600.0	4	32-Bit Float	3
FSW-143	WN Upward Total-Sky (SFC)	W m^{-2}	-50.0 .. 50.0	4	32-Bit Float	3
FSW-144	WN Downward Total-Sky (SFC)	W m^{-2}	-50.0 .. 50.0	4	32-Bit Float	3

Table 2.7-14. Pristine Vertical Flux Profiles (Terra/Aqua)

Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-46	SW flux - upward - pristine - TOA	W m^{-2}	0.0 - 1400.0	4	32-Bit Float	3
FSW-47	SW flux - upward - pristine - surfa	W m^{-2}	0.0 - 1400.0	4	32-Bit Float	3
FSW-48	SW flux - downward - pristine - TOA	W m^{-2}	0.0 - 1400.0	4	32-Bit Float	3
FSW-49	SW flux - downward - pristine - sur	W m^{-2}	0.0 - 1400.0	4	32-Bit Float	3
FSW-50	LW flux - upward - pristine - TOA	W m^{-2}	0.0 - 850.0	4	32-Bit Float	3
FSW-51	LW flux - upward - pristine - surfa	W m^{-2}	0.0 - 850.0	4	32-Bit Float	3
FSW-52	LW flux - downward - pristine - TOA	W m^{-2}	0.0 - 700.0	4	32-Bit Float	3
FSW-53	LW flux - downward - pristine - sur	W m^{-2}	0.0 - 700.0	4	32-Bit Float	3
FSW-54	WN flux - upward - pristine - TOA	W m^{-2}	0.0 - 370.0	4	32-Bit Float	3
FSW-55	WN flux - upward - pristine - surfa	W m^{-2}	0.0 - 370.0	4	32-Bit Float	3
FSW-56	WN flux - downward - pristine - TOA	W m^{-2}	0.0 - 370.0	4	32-Bit Float	3
FSW-57	WN flux - downward - pristine - sur	W m^{-2}	0.0 - 370.0	4	32-Bit Float	3

Table 2.7-15. Constrained Clear Sky Profiles (Terra/Aqua) (1 of 3)

Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-58	SW flux - upward - clear-sky - TOA	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-59	SW flux - upward - clear-sky - 70hPA	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-60	SW flux - upward - clear-sky - 200hPa	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-61	SW flux - upward - clear-sky - 500hPa	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-62	SW flux - upward - clear-sky - SFC	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-63	SW flux - downward - clear-sky - TOA	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3

Table 2.7-15. Constrained Clear Sky Profiles (Terra/Aqua) (2 of 3)

Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-64	SW flux - downward - clear-sky - 70hPA	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-65	SW flux - downward - clear-sky - 200hPa	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-66	SW flux - downward - clear-sky - 500hPa	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-67	SW flux - downward - clear-sky - SFC	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-68	LW flux - upward - clear-sky - TOA	W m^{-2}	0.0 .. 850.0	4	32-Bit Float	3
FSW-69	LW flux - upward - clear-sky - 70hPA	W m^{-2}	0.0 .. 850.0	4	32-Bit Float	3
FSW-70	LW flux - upward - clear-sky - 200hPa	W m^{-2}	0.0 .. 850.0	4	32-Bit Float	3
FSW-71	LW flux - upward - clear-sky - 500hPa	W m^{-2}	0.0 .. 850.0	4	32-Bit Float	3
FSW-72	LW flux - upward - clear-sky - SFC	W m^{-2}	0.0 .. 850.0	4	32-Bit Float	3
FSW-73	LW flux - downward - clear-sky - TOA	W m^{-2}	0.0 .. 700.0	4	32-Bit Float	3
FSW-74	LW flux - downward - clear-sky - 70hPA	W m^{-2}	0.0 .. 700.0	4	32-Bit Float	3
FSW-75	LW flux - downward - clear-sky - 200hPa	W m^{-2}	0.0 .. 700.0	4	32-Bit Float	3
FSW-76	LW flux - downward - clear-sky - 500hPa	W m^{-2}	0.0 .. 700.0	4	32-Bit Float	3
FSW-77	LW flux - downward - clear-sky - SFC	W m^{-2}	0.0 .. 700.0	4	32-Bit Float	3
FSW-78	WN flux - upward - clear-sky - TOA	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-79	WN flux - upward - clear-sky - 70hPa	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-80	WN flux - upward - clear-sky - 200hPa	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-81	WN flux - upward - clear-sky - 500hPa	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-82	WN flux - upward - clear-sky - SFC	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-83	WN flux - downward - clear-sky - TOA	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-84	WN flux - downward - clear-sky - 70hPa	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3

Table 2.7-15. Constrained Clear Sky Profiles (Terra/Aqua) (3 of 3)

Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-85	WN flux - downward - clear-sky - 200hPa	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-86	WN flux - downward - clear-sky - 500hPa	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-87	WN flux - upward - clear-sky - SFC	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3

Table 2.7-16. Constrained Total Sky Profiles (Terra/Aqua) (1 of 2)

Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-88	SW flux - upward - total-sky - TOA	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-89	SW flux - upward - total-sky - 70hPA	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-90	SW flux - upward - total-sky - 200hPa	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-91	SW flux - upward - total-sky - 500hPa	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-92	SW flux - upward - total-sky - SFC	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-93	SW flux - downward - total-sky - TOA	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-94	SW flux - downward - total-sky - 70hPA	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-95	SW flux - downward - total-sky - 200hPa	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-96	SW flux - downward - total-sky - 500hPa	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-97	SW flux - downward - total-sky - SFC	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
FSW-98	LW flux - upward - total-sky - TOA	W m^{-2}	0.0 .. 850.0	4	32-Bit Float	3
FSW-99	LW flux - upward - total-sky - 70hPA	W m^{-2}	0.0 .. 850.0	4	32-Bit Float	3
FSW-100	LW flux - upward - total-sky - 200hPa	W m^{-2}	0.0 .. 850.0	4	32-Bit Float	3
FSW-101	LW flux - upward - total-sky - 500hPa	W m^{-2}	0.0 .. 850.0	4	32-Bit Float	3
FSW-102	LW flux - upward - total-sky - SFC	W m^{-2}	0.0 .. 850.0	4	32-Bit Float	3

Table 2.7-16. Constrained Total Sky Profiles (Terra/Aqua) (2 of 2)

Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-103	LW flux - downward - total-sky - TOA	W m^{-2}	0.0 .. 700.0	4	32-Bit Float	3
FSW-104	LW flux - downward - total-sky - 70hPA	W m^{-2}	0.0 .. 700.0	4	32-Bit Float	3
FSW-105	LW flux - downward - total-sky - 200hPa	W m^{-2}	0.0 .. 700.0	4	32-Bit Float	3
FSW-106	LW flux - downward - total-sky - 500hPa	W m^{-2}	0.0 .. 700.0	4	32-Bit Float	3
FSW-107	LW flux - downward - total-sky - SFC	W m^{-2}	0.0 .. 700.0	4	32-Bit Float	3
FSW-108	WN flux - upward - total-sky - TOA	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-109	WN flux - upward - total-sky - 70hPa	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-110	WN flux - upward - total-sky - 200hPa	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-111	WN flux - upward - total-sky - 500hPa	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-112	WN flux - upward - total-sky - SFC	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-113	WN flux - downward - total-sky - TOA	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-114	WN flux - downward - total-sky - 70hPa	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-115	WN flux - downward - total-sky - 200hPa	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-116	WN flux - downward - total-sky - 500hPa	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3
FSW-117	WN flux - upward - total-sky - SFC	W m^{-2}	0.0 .. 370.0	4	32-Bit Float	3

Table 2.7-17. Constrainment - Initial Flux Deltas (Terra/Aqua) (1 of 3)

Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-118	SW flux adjustment at surface upward - pristine	W m^{-2}	-1400.0 .. 1400.0	4	32-Bit Float	3
FSW-119	SW flux adjustment at TOA - upward - pristine	W m^{-2}	-1400.0 .. 1400.0	4	32-Bit Float	3
FSW-120	SW flux adjustment at surface - downward - pristine	W m^{-2}	-1400.0 .. 1400.0	4	32-Bit Float	3

Table 2.7-17. Constrainment - Initial Flux Deltas (Terra/Aqua) (2 of 3)

Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-121	LW flux adjustment at surface - upward - pristine	W m^{-2}	-700.0 .. 700.0	4	32-Bit Float	3
FSW-122	LW flux adjustment at surface - downward - pristine	W m^{-2}	-600.0 .. 600.0	4	32-Bit Float	3
FSW-123	LW flux adjustment at TOA - upward - pristine	W m^{-2}	-700.0 .. 700.0	4	32-Bit Float	3
FSW-124	WN flux adjustment at surface - upward - pristine	W m^{-2}	-50.0 .. 50.0	4	32-Bit Float	3
FSW-125	WN flux adjustment at surface - downward - pristine	W m^{-2}	-50.0 .. 50.0	4	32-Bit Float	3
FSW-126	WN flux adjustment at TOA - upward - pristine	W m^{-2}	-50.0 .. 50.0	4	32-Bit Float	3
FSW-127	SW flux adjustment at surface upward - clear-sky	W m^{-2}	-1400.0 .. 1400.0	4	32-Bit Float	3
FSW-128	SW flux adjustment at TOA - upward - clear-sky	W m^{-2}	-1400.0 .. 1400.0	4	32-Bit Float	3
FSW-129	SW flux adjustment at surface - downward - clear-sky	W m^{-2}	-1400.0 .. 1400.0	4	32-Bit Float	3
FSW-130	LW flux adjustment at surface - upward - clear-sky	W m^{-2}	-700.0 .. 700.0	4	32-Bit Float	3
FSW-131	LW flux adjustment at surface - downward - clear-sky	W m^{-2}	-600.0 .. 600.0	4	32-Bit Float	3
FSW-132	LW flux adjustment at TOA - upward - clear-sky	W m^{-2}	-700.0 .. 700.0	4	32-Bit Float	3
FSW-133	WN flux adjustment at surface - upward - clear-sky	W m^{-2}	-50.0 .. 50.0	4	32-Bit Float	3
FSW-134	WN flux adjustment at surface - downward - clear-sky	W m^{-2}	-50.0 .. 50.0	4	32-Bit Float	3
FSW-135	WN flux adjustment at TOA - upward - clear-sky	W m^{-2}	-50.0 .. 50.0	4	32-Bit Float	3
FSW-136	SW flux adjustment at surface upward - total-sky	W m^{-2}	-1400.0 .. 1400.0	4	32-Bit Float	3
FSW-137	SW flux adjustment at TOA - upward - total-sky	W m^{-2}	-1400.0 .. 1400.0	4	32-Bit Float	3
FSW-138	SW flux adjustment at surface - downward - total-sky	W m^{-2}	-1400.0 .. 1400.0	4	32-Bit Float	3
FSW-139	LW flux adjustment at surface - upward - total-sky	W m^{-2}	-700.0 .. 700.0	4	32-Bit Float	3
FSW-140	LW flux adjustment at surface - downward - total-sky	W m^{-2}	-600.0 .. 600.0	4	32-Bit Float	3
FSW-141	LW flux adjustment at TOA - upward - total-sky	W m^{-2}	-700.0 .. 700.0	4	32-Bit Float	3

Table 2.7-17. Constrainment - Initial Flux Deltas (Terra/Aqua) (3 of 3)

Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-142	WN flux adjustment at surface - upward - total-sky	W m^{-2}	-50.0 .. 50.0	4	32-Bit Float	3
FSW-143	WN flux adjustment at surface - downward - total-sky	W m^{-2}	-50.0 .. 50.0	4	32-Bit Float	3
FSW-144	WN flux adjustment at TOA - upward - total-sky	W m^{-2}	-50.0 .. 50.0	4	32-Bit Float	3

Table 2.7-18. Surface Emissivity

TRMM/ Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-145	LW Surface Emissivity	N/A	0.0 .. 1.0	3	32-Bit Float	1
FSW-146	WN Surface Emissivity	N/A	0.0 .. 1.0	3	32-Bit Float	1
FSW-147	Photo. Syn. Radiation	W m^{-2}	0.0 .. 780.0	3	32-Bit Float	1
FSW-148	Direct/Diffuse	N/A	0.0 .. 30.0	3	32-Bit Float	1
FSW-149	Initial Broadband Albedo	N/A	0.0 .. 1.0	3	32-Bit Float	1
FSW-150	Surface Albedo	N/A	0.0 .. 1.0	3	32-Bit Float	1
FSW-151	Skin Temperature	K	175.0 .. 375.0	3	32-Bit Float	1

Table 2.7-19. Cloud Overlap Conditions

TRMM/ Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-152	Clear	percent	0.0 .. 100.0	3	32-Bit Float	1
FSW-153	Low	percent	0.0 .. 100.0	3	32-Bit Float	1
FSW-154	Lowermid	percent	0.0 .. 100.0	3	32-Bit Float	1
FSW-155	Uppermid	percent	0.0 .. 100.0	3	32-Bit Float	1
FSW-156	High	percent	0.0 .. 100.0	3	32-Bit Float	1
FSW-157	High Uppermid	percent	0.0 .. 100.0	3	32-Bit Float	1
FSW-158	High Lowermid	percent	0.0 .. 100.0	3	32-Bit Float	1
FSW-159	High Low	percent	0.0 .. 100.0	3	32-Bit Float	1
FSW-160	Uppermid - Lowermid	percent	0.0 .. 100.0	3	32-Bit Float	1
FSW-161	Uppermid - Low	percent	0.0 .. 100.0	3	32-Bit Float	1
FSW-162	Lowermid - Low	percent	0.0 .. 100.0	3	32-Bit Float	1

Table 2.7-20. Cloud Layer - High (mean std num_obs)

TRMM/ Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-163	Area Fraction Percentage	percent	0.0 .. 100.0	3	32-Bit Float	1
FSW-164	Effective Pressure	hPa	0.0 .. 1100.0	4	32-Bit Float	3
FSW-165	Effective Temperature	K	100.0 .. 350.0	4	32-Bit Float	3
FSW-166	Effective Height	km	0.0 .. 20.0	4	32-Bit Float	3
FSW-167	Top Pressure	hPa	0.0 .. 1100.0	4	32-Bit Float	3
FSW-168	Bottom Pressure	hPa	0.0 .. 1100.0	4	32-Bit Float	3
FSW-169	Particle Phase	N/A	1.0 .. 2.0	4	32-Bit Float	3
FSW-170	Liquid Water Path	gm^{-2}	0.0 .. 10000.0	4	32-Bit Float	3
FSW-171	Ice Water Path	gm^{-2}	0.0 .. 10000.0	4	32-Bit Float	3
FSW-172	Liquid Particle Radius	µm	0.0 .. 40.0	4	32-Bit Float	3
FSW-173	Ice Particle Diameter	µm	0.0 .. 300.0	4	32-Bit Float	3
FSW-174	Vis. Opt. Depth (linear)	N/A	0.0 .. 400.0	4	32-Bit Float	3
FSW-175	Vis. Opt. Depth (log)	N/A	-6.0 .. 6.0	4	32-Bit Float	3
FSW-176	Infrared Emissivity	N/A	0.0 .. 2.0	4	32-Bit Float	3
FSW-177	Vertical Aspect Ratio	N/A	0.0 .. 20.0	4	32-Bit Float	3
FSW-178	Adj. Vis. Opt. Depth	N/A	-400.0 .. 400.0	3	32-Bit Float	1
FSW-179	Adj. Fractional Area	N/A	-1 ..1	3	32-Bit Float	1
FSW-180	Adj. Effective Temp.	K	TBD	3	32-Bit Float	1

Table 2.7-21. Cloud Layer - UpperMid (mean std num_obs) (1 of 2)

TRMM/ Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-181	Area Fraction Percentage	percent	0.0 .. 100.0	3	32-Bit Float	1
FSW-182	Effective Pressure	hPa	0.0 .. 1100.0	4	32-Bit Float	3
FSW-183	Effective Temperature	K	100.0 .. 350.0	4	32-Bit Float	3
FSW-184	Effective Height	km	0.0 .. 20.0	4	32-Bit Float	3
FSW-185	Top Pressure	hPa	0.0 .. 1100.0	4	32-Bit Float	3
FSW-186	Bottom Pressure	hPa	0.0 .. 1100.0	4	32-Bit Float	3
FSW-187	Particle Phase	N/A	1.0 .. 2.0	4	32-Bit Float	3
FSW-188	Liquid Water Path	gm^{-2}	0.0 .. 10000.0	4	32-Bit Float	3
FSW-189	Ice Water Path	gm^{-2}	0.0 .. 10000.0	4	32-Bit Float	3
FSW-190	Liquid Particle Radius	µm	0.0 .. 40.0	4	32-Bit Float	3
FSW-191	Ice Particle Diameter	µm	0.0 .. 300.0	4	32-Bit Float	3
FSW-192	Vis. Opt. Depth (linear)	N/A	0.0 .. 400.0	4	32-Bit Float	3

Table 2.7-21. Cloud Layer - UpperMid (mean std num_obs) (2 of 2)

TRMM/ Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-193	Vis. Opt. Depth (log)	N/A	-6.0 .. 6.0	4	32-Bit Float	3
FSW-194	Infrared Emissivity	N/A	0.0 .. 2.0	4	32-Bit Float	3
FSW-195	Vertical Aspect Ratio	N/A	0.0 .. 20.0	4	32-Bit Float	3
FSW-196	Adj. Vis. Opt. Depth	N/A	-400.0 .. 400.0	3	32-Bit Float	1
FSW-197	Adj. Fractional Area	N/A	-1 ..1	3	32-Bit Float	1
FSW-198	Adj. Effective Temp.	K	TBD	3	32-Bit Float	1

Table 2.7-22. Cloud Layer - LowerMid (mean std num_obs)

TRMM/ Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-199	Area Fraction Percentage	percent	0.0 .. 100.0	3	32-Bit Float	1
FSW-200	Effective Pressure	hPa	0.0 .. 1100.0	4	32-Bit Float	3
FSW-201	Effective Temperature	K	100.0 .. 350.0	4	32-Bit Float	3
FSW-202	Effective Height	km	0.0 .. 20.0	4	32-Bit Float	3
FSW-203	Top Pressure	hPa	0.0 .. 1100.0	4	32-Bit Float	3
FSW-204	Bottom Pressure	hPa	0.0 .. 1100.0	4	32-Bit Float	3
FSW-205	Particle Phase	N/A	1.0 .. 2.0	4	32-Bit Float	3
FSW-206	Liquid Water Path	gm^{-2}	0.0 .. 10000.0	4	32-Bit Float	3
FSW-207	Ice Water Path	gm^{-2}	0.0 .. 10000.0	4	32-Bit Float	3
FSW-208	Liquid Particle Radius	µm	0.0 .. 40.0	4	32-Bit Float	3
FSW-209	Ice Particle Diameter	µm	0.0 .. 300.0	4	32-Bit Float	3
FSW-210	Vis. Opt. Depth (linear)	N/A	0.0 .. 400.0	4	32-Bit Float	3
FSW-211	Vis. Opt. Depth (log)	N/A	-6.0 .. 6.0	4	32-Bit Float	3
FSW-212	Infrared Emissivity	N/A	0.0 .. 2.0	4	32-Bit Float	3
FSW-213	Vertical Aspect Ratio	N/A	0.0 .. 20.0	4	32-Bit Float	3
FSW-214	Adj. Vis. Opt. Depth	N/A	-400.0 .. 400.0	3	32-Bit Float	1
FSW-215	Adj. Fractional Area	N/A	-1 .. 1	3	32-Bit Float	1
FSW-216	Adj. Effective Temp.	K	TBD	3	32-Bit Float	1

Table 2.7-23. Cloud Layer - Low (mean std num_obs)

TRMM/ Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-217	Area Fraction Percentage	percent	0.0 .. 100.0	3	32-Bit Float	1
FSW-218	Effective Pressure	hPa	0.0 .. 1100.0	4	32-Bit Float	3
FSW-219	Effective Temperature	K	100.0 .. 350.0	4	32-Bit Float	3
FSW-220	Effective Height	km	0.0 .. 20.0	4	32-Bit Float	3
FSW-221	Top Pressure	hPa	0.0 .. 1100.0	4	32-Bit Float	3
FSW-222	Bottom Pressure	hPa	0.0 .. 1100.0	4	32-Bit Float	3
FSW-223	Particle Phase	N/A	1.0 .. 2.0	4	32-Bit Float	3
FSW-224	Liquid Water Path	gm^{-2}	0.0 .. 10000.0	4	32-Bit Float	3
FSW-225	Ice Water Path	gm^{-2}	0.0 .. 10000.0	4	32-Bit Float	3
FSW-226	Liquid Particle Radius	µm	0.0 .. 40.0	4	32-Bit Float	3
FSW-227	Ice Particle Diameter	µm	0.0 .. 300.0	4	32-Bit Float	3
FSW-228	Vis. Opt. Depth (linear)	N/A	0.0 .. 400.0	4	32-Bit Float	3
FSW-229	Vis. Opt. Depth (log)	N/A	-6.0 .. 6.0	4	32-Bit Float	3
FSW-230	Infrared Emissivity	N/A	0.0 .. 2.0	4	32-Bit Float	3
FSW-231	Vertical Aspect Ratio	N/A	0.0 .. 20.0	4	32-Bit Float	3
FSW-232	Adj. Vis. Opt. Depth	N/A	-400.0 .. 400.0	3	32-Bit Float	1
FSW-233	Adj. Fractional Area	N/A	-1 .. 1	3	32-Bit Float	1
FSW-234	Adj. Effective Temp.	K	TBD	3	32-Bit Float	1

Table 2.7-24. Constrainment - Adjustments (mean)

TRMM/ Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-235	Init. Precipitable H2O	cm	0 .. 10	3	32-Bit Float	1
FSW-236	Adj. Precipitable H2O	cm	-10 .. 10	3	32-Bit Float	1
FSW-237	Adj. Surface Albedo	N/A	-1 .. 1	3	32-Bit Float	1
FSW-238	Init. Aerosol Opt. Dep.	N/A	0 .. 2	3	32-Bit Float	1
FSW-239	Adj. Aerosol Opt. Dep.	N/A	-2 .. 2	3	32-Bit Float	1
FSW-240	Init. Skin Temperature	K	TBD	3	32-Bit Float	1
FSW-241	Adj. Skin Temperature	K	TBD	3	32-Bit Float	1

Table 2.7-25. Aerosol LAND

Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-242	cor_optdepth047_land	N/A	0.0..5.0	3	32-Bit Float	1
FSW-243	cor_optdepth055_land	N/A	0.0..5.0	3	32-Bit Float	1
FSW-244	cor_optdepth066_land	N/A	0.0..5.0	3	32-Bit Float	1

Table 2.7-26. Aerosol OCEAN

Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-245	eff_optdepth047_ocean	N/A	0.0..5.0	3	32-Bit Float	1
FSW-246	eff_optdepth055_ocean	N/A	0.0..5.0	3	32-Bit Float	1
FSW-247	eff_optdepth066_ocean	N/A	0.0..5.0	3	32-Bit Float	1
FSW-248	eff_optdepth087_ocean	N/A	0.0..5.0	3	32-Bit Float	1
FSW-249	eff_optdepth124_ocean	N/A	0.0..5.0	3	32-Bit Float	1
FSW-250	eff_optdepth164_ocean	N/A	0.0..5.0	3	32-Bit Float	1
FSW-251	eff_optdepth213_ocean	N/A	0.0..5.0	3	32-Bit Float	1

Table 2.7-27. Cloudy Skies with No Aerosols (1 of 2)

Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-252	SW flux - upward cloudy skies with no aerosol - TOA	$W\ m^{-2}$	0.0 .. 1400.0	4	32-Bit Float	3
FSW-253	SW flux - upward cloudy skies with no aerosol - surface	$W\ m^{-2}$	0.0 .. 1400.0	4	32-Bit Float	3
FSW-254	SW flux - downward cloudy skies with no aerosol - TOA	$W\ m^{-2}$	0.0 .. 1400.0	4	32-Bit Float	3
FSW-255	SW flux - downward cloudy skies with no aerosol - surface	$W\ m^{-2}$	0.0 .. 1400.0	4	32-Bit Float	3
FSW-256	LW flux - upward cloudy skies with no aerosol - TOA	$W\ m^{-2}$	0.0 .. 850.0	4	32-Bit Float	3
FSW-257	LW flux - upward cloudy skies with no aerosol - surface	$W\ m^{-2}$	0.0 .. 850.0	4	32-Bit Float	3
FSW-258	LW flux - downward cloudy skies with no aerosol - TOA	$W\ m^{-2}$	0.0 .. 700.0	4	32-Bit Float	3

Table 2.7-27. Cloudy Skies with No Aerosols (2 of 2)

Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele-ments
FSW-259	LW flux - downward cloudy skies with no aerosol - surface	$W\ m^{-2}$	0.0 .. 700.0	4	32-Bit Float	3
FSW-260	WN flux - upward cloudy skies with no aerosol - TOA	$W\ m^{-2}$	0.0 .. 370.0	4	32-Bit Float	3
FSW-261	WN flux - upward cloudy skies with no aerosol - surface	$W\ m^{-2}$	0.0 .. 370.0	4	32-Bit Float	3
FSW-262	WN flux - downward cloudy skies with no aerosol - TOA	$W\ m^{-2}$	0.0 .. 370.0	4	32-Bit Float	3
FSW-263	WN flux - downward cloudy skies with no aerosol - surface	$W\ m^{-2}$	0.0 .. 370.0	4	32-Bit Float	3
FSW-264	SW flux adjustments at surface-upward-cloudy skies/no aerosol	$W\ m^{-2}$	-1400.0 .. 1400.0	4	32-Bit Float	3
FSW-265	SW flux adjustments at TOA-upward-cloudy skies/no aerosol	$W\ m^{-2}$	-1400.0 .. 1400.0	4	32-Bit Float	3
FSW-266	SW flux adjustments at surface-downward-cloudy skies/no aero-sol	$W\ m^{-2}$	-1400.0 .. 1400.0	4	32-Bit Float	3
FSW-267	LW flux adjustments at surface-upward-cloudy skies/no aerosol	$W\ m^{-2}$	-600.0 .. 600.0	4	32-Bit Float	3
FSW-268	LW flux adjustments at surface-downward-cloudy skies/no aero-sol	$W\ m^{-2}$	-700.0 .. 700.0	4	32-Bit Float	3
FSW-269	LW flux adjustments at TOA-upward-cloudy skies/no aerosol	$W\ m^{-2}$	-700.0 .. 700.0	4	32-Bit Float	3
FSW-270	WN flux adjustments at surface-upward-cloudy skies/no aerosol	$W\ m^{-2}$	-50.0 .. 50.0	4	32-Bit Float	3
FSW-271	WN flux adjustments at surface-downward- cloudy skies/no aero-sol	$W\ m^{-2}$	-50.0 .. 50.0	4	32-Bit Float	3
FSW-272	WN flux adjustments at TOA-upward-cloudy skies/ no aerosol	$W\ m^{-2}$	-50.0 .. 50.0	4	32-Bit Float	3

FSW Revision Record

The product Revision Record contains information pertaining to approved section changes. The table lists the date the Software Configuration Change Request (SCCR) was approved, the Release and Version Number, the SCCR number, a short description of the revision, and the revised sections. The authors are listed on the document cover.

FSW Revision Record (1 of 2)

SCCR Approval Date	Release/ Version Number	SCCR Number	Description of Revision	Section(s) Affected
N/A	R3V1	N/A	• Updated format to comply with standards.	All
02/07/03	R3V2	424	• Updated parameters in Regional Identification Data, Regional Imager Data. • Updated Angular model scene category • Updated vdata sizes. • Added MODIS aerosols for land and Ocean. • Updated format to comply with standards.	Tables 2.11-5, 2.11-7 Table 2.7-8 Table 2.7-3 Tables 2.7-21, 2.7-22 All
10/23/03	R3V3	476	• Added cloudy skies with no Aerosols. • Updated flux profile parameters. • Added Snow/Ice Percentage from Imager History parameter to Angular Model Scene type. • Updated format to comply with standards.	Tables 2.7.3, 2.7-23 Tables 2.7-11 - 2.7-13 Table 2.7.8 All
10/23/03 01/28/04	R3V4	476 499	• Added two new columns to include SDS index numbers for TRMM & Terra. • Julian Time SDS data type is set to 64-bit. Added a note. • Added new tables for TRMM profile flux SDSs, since these names are defined differently for TRMM and Terra. • Updated units and range values. • Updated format to comply with standards.	All Tables 2.7.4 Tables 2.7.10 - 2.7.13 Tables 2.7.19 - 2.7.23 & 2.7.25-2.7.26 All

FSW Revision Record (2 of 2)

SCCR Approval Date	Release/ Version Number	SCCR Number	Description of Revision	Section(s) Affected
06/04/04	R4V1	530	• Deleted Snow/Ice Percentage from Imager History parameter to Angular Model Scene type. • Updated SDS Indices. • Deleted Terra SDS Index columns where ever SDS Indices are the same for TRMM, Terra and Aqua. Updated Column Titles. • Updated Terra SDS Indices. • Added product name in front of SDS index in the first column of the table. • Updated format to comply with standards.	Table 2.7.8 Tables 2.7.9, 2.7.14 - 2.7.27 Tables 2.7.9, 2.7.8, 2.7.18 - 2.7.24 Tables 2.7.15 - 2.7.17, 2.7.25 - 2.7.27 Tables 2.7.4 - 2.7.27 All

2.8 Monthly Gridded TOA/Surface Fluxes and Clouds (SFC)

EOSDIS Product Code: CER12

The Monthly Gridded TOA/Surface 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 Scanner Footprint TOA/Surface Fluxes and Clouds (SSF) archival data product. Each SFC covers a single month swath from a single CERES instrument mounted on one satellite. The product is written in HDF and contains metadata as well as gridded science data. For TRMM, data will be organized onto eight SFC HDF files, each containing data for ten 1.0-degree equal-angle zones. For Terra and Aqua, data will be organized onto 36 SFC HDF files, each containing data for five 1.0-degree equal-angle zones. Each record contains spatially averaged data for an individual region. The science data are Vdata with 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
- Imager Radiances Statistics
- Angular model scene classes
- Total-sky radiative fluxes at TOA and Surface
- Clear-sky radiative fluxes at TOA and Surface
- Surface Emissivity
- Cloud category properties for four cloud layers

A complete listing of metadata and science parameters for this data product can be found in Tables 2.8-1 through Table 2.8-17.

Level: 3
Frequency: 1/Month
Portion of Atmosphere Covered: TOA and Surface

Time Interval Covered:
File: Month
Record: Hour

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

Product Version:
TRMM:
Terra: Edition2B
Aqua: Edition1A

SFC Metadata

The CERES Baseline Header Metadata and the CERES_metadata Vdata are listed in Appendix B. The SFC product-specific metadata parameters are listed in Table 2.8-2.

Table 2.8-1. SFC Metadata Summary

HDF Name	Description Table	Records	Number of Fields
CERES Baseline Header Metadata	Table B-1	1	36
CERES_metadata Vdata	Table B-2	1	14
SFC Product Specific Metadata	Table 2.8-2	1	2

Table 2.8-2. SFC Product-specific Metadata

Item	Parameter Name	Description	DataType	Units	Range
1	ZoneBeginning	Beginning zone number	I4	N/A	1 .. 180
2	ZoneEnding	Ending zone number	I4	N/A	1 .. 180

SFC Science Data

All of the SFC science data are organized into various Vdata Structures, summarized in Table 2.8-3. The TRMM SFC product parameter lists are summarized in Table 2.8-4 through Table 2.8-15 including the SDS number, the SDS name, the data type, the units, the range, and the number of Elements within each field. Terra and Aqua SFC science data contain an additional 10 MODIS aerosol SDS parameters, summarized in Table 2.8-16 through Table 2.8-17. The number of records per Vdata is defined as n where n varies for each file. Sizing estimates are based on TERRA sampling.

Table 2.8-3. SFC Vdata Summary (1 of 2)

Vdata Name	Description Table	Records	Number of Fields	Vdata Size (MB)
Time and Position Data	Table 2.8-4	n	6	311.04
Regional Identification Data	Table 2.8-5	n	5	115.20
Surface Map and Full-Clear area Data	Table 2.8-6	n	6	777.6
Imager Radiances Statistics	Table 2.8-7	n	5	881.28
Angular Model Scene Type	Table 2.8-8	n	7	5235.84
TOA Fluxes (mean std num_obs)	Table 2.8-9	n	8	1244.16
Surface Fluxes (mean std num_obs)	Table 2.8-10	n	18	2799.36
Surface Emissivity	Table 2.8-11	n	2	103.68
Layer Cloud - HIGH (mean std num_obs)	Table 2.8-12	n	15	2332.80
Layer Cloud - UPPERMID (mean std num_obs)	Table 2.8-13	n	15	2332.80
Layer Cloud - LOWERMID (mean std num_obs)	Table 2.8-14	n	15	2332.80

Table 2.8-3. SFC Vdata Summary (2 of 2)

Vdata Name	Description Table	Records	Number of Fields	Vdata Size (MB)
Layer Cloud - LOW (mean std num_obs)	Table 2.8-15	n	15	2332.80
Aerosol LAND	Table 2.8-16	n	3	155.52
Aerosol OCEAN	Table 2.8-17	n	7	362.88
Vdata TOTAL SIZE				**21817.76**

Table 2.8-4. Time and Position Data

TRMM Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Elements
SFC-0	Julian Time	date	2 440 000.0 .. 2 480 000.0	3	32-Bit Float	1
SFC-1	Sun Colatitude	deg	0.0 .. 180.0	3	32-Bit Float	1
SFC-2	Sun Longitude	deg	0.0 .. 360.0	3	32-Bit Float	1
SFC-3	Relative Azimuth Angle	deg	0.0 .. 360.0	3	32-Bit Float	1
SFC-4	Cos. Solar Zenith Angle	N/A	0.0 .. 1.0	3	32-Bit Float	1
SFC-5	Spacecraft Zenith Angle	deg	0.0 .. 90.0	3	32-Bit Float	1

Table 2.8-5. Regional Identification Data

TRMM/ Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Elements
SFC-6	Region Number	N/A	1 .. 64800	3	32-Bit Float	1
SFC-7	Hour Box Number	N/A	1 .. 744	3	32-Bit Float	1
SFC-8	Num. Footprints in Region	N/A	1 .. 450	3	32-Bit Float	1
SFC-9	Colatitude	deg	1 .. 180	3	32-Bit Float	1
SFC-10	Longitude	deg	1 .. 360	3	32-Bit Float	1

Table 2.8-6. Surface Map and Full-Clear area Data

TRMM/ Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Elements
SFC-11	Alt. of Srf. above Sea	m	-1000.0 .. 10000.0	3	32-Bit Float	1
SFC-12	Surface Type Percentage	N/A	0.0 .. 100.0	4	32-Bit Float	20

Table 2.8-6. Surface Map and Full-Clear area Data

TRMM/ Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Elements
SFC-13	Precipitable Water	cm	0.001 .. 10.0	3	32-Bit Float	1
SFC-14	Snow/Ice Percentage	N/A	0.0 .. 100.0	3	32-Bit Float	1
SFC-15	Aerosol Opt. Depth at 0.63um in clr	μm	-1.0 .. 5.0	3	32-Bit Float	1
SFC-16	Aerosol Opt. Depth at 1.6um in clr	μm	-1.0 .. 5.0	3	32-Bit Float	1

Table 2.8-7. Imager Radiances Statistics

TRMM/ Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Elements
SFC-17	Imager Viewing Zenith Angle	deg	0 .. 360	3	32-Bit Float	1
SFC-18	Imager Relative Azimuth. Angle	deg	0 .. 360	3	32-Bit Float	1
SFC-19	Imager Channel Central Wave-length	μm	0.4 .. 15.0	4	32-Bit Float	5
SFC-20	Imager Mean Radiances	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	-1000 .. 1000	4	32-Bit Float	5
SFC-21	Imager Radiances over clear area	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	-1000 .. 1000	4	32-Bit Float	5

Table 2.8-8. Angular Model Scene Type

TRMM/ Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Elements
SFC-22	Incident Solar Flux	N/A	0.0 .. 1400.0	3	32-Bit Float	1
SFC-23	Area Coverage	N/A	0.0 .. 100.0	4	32-Bit Float	20
SFC-24	SW Scene ID	N/A	0 .. 5000	4	32-Bit Float	20
SFC-25	Albedo (mean)	N/A	0.0 .. 1.0	4	32-Bit Float	20
SFC-26	Albedo (std)	N/A	0.0 .. 1.0	4	32-Bit Float	20
SFC-27	LW (mean)	$W\ m^{-2}$	0.0 .. 400.0	4	32-Bit Float	20
SFC-28	LW (std)	$W\ m^{-2}$	0.0 .. 400.0	4	32-Bit Float	20

Table 2.8-9. TOA Fluxes (mean std num_obs)

TRMM/ Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Elements
SFC-29	SW TOA Clear-sky	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
SFC-30	LW TOA Clear-sky	W m^{-2}	0.0 .. 500.0	4	32-Bit Float	3
SFC-31	WN TOA Clear-sky	W m^{-2}	0.0 .. 200.0	4	32-Bit Float	3
SFC-32	ALB TOA Clear-sky	N/A	0.0 .. 1.0	4	32-Bit Float	3
SFC-33	SW TOA Total-Sky	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
SFC-34	LW TOA Total-Sky	W m^{-2}	0.0 .. 500.0	4	32-Bit Float	3
SFC-35	WN TOA Total-Sky	W m^{-2}	0.0 .. 200.0	4	32-Bit Float	3
SFC-36	ALB TOA Total-Sky	N/A	0.0 .. 1.0	4	32-Bit Float	3

Table 2.8-10. Surface Fluxes (mean std num_obs)

TRMM/ Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Elements
SFC-37	SW SRF Model A Clear-Sky	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
SFC-38	LW SRF Model A Clear-Sky	W m^{-2}	0.0 .. 700.0	4	32-Bit Float	3
SFC-39	WN SRF Model A Clear-Sky	W m^{-2}	0.0 .. 250.0	4	32-Bit Float	3
SFC-40	Net. SW SRF Model A Clear-Sky	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
SFC-41	Net. LW SRF Model A Clear-Sky	W m^{-2}	-250.0 .. 50.0	4	32-Bit Float	3
SFC-42	SW SRF Model B Clear-Sky	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
SFC-43	LW SRF Model B Clear-Sky	W m^{-2}	0.0 .. 700.0	4	32-Bit Float	3
SFC-44	Net. SW SRF Model B Clear-Sky	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
SFC-45	Net. LW SRF Model B Clear-Sky	W m^{-2}	-250.0 .. 50.0	4	32-Bit Float	3
SFC-46	SW SRF Model A Total-Sky	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
SFC-47	LW SRF Model A Total-Sky	W m^{-2}	0.0 .. 700.0	4	32-Bit Float	3
SFC-48	WN SRF Model A Total-Sky	W m^{-2}	0.0 .. 250.0	4	32-Bit Float	3
SFC-49	Net. SW SRF Model A Total-Sky	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
SFC-50	Net. LW SRF Model A Total-Sky	W m^{-2}	-250.0 .. 50.0	4	32-Bit Float	3
SFC-51	SW SRF Model B Total-Sky	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
SFC-52	LW SRF Model B Total-Sky	W m^{-2}	0.0 .. 700.0	4	32-Bit Float	3
SFC-53	Net. SW SRF Model B Total-Sky	W m^{-2}	0.0 .. 1400.0	4	32-Bit Float	3
SFC-54	Net. LW SRF Model B Total-Sky	W m^{-2}	-250.0 .. 50.0	4	32-Bit Float	3

Table 2.8-11. Surface Emissivity

TRMM/ Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Elements
SFC-55	LW Surface	N/A	0.0 .. 1.0	3	32-Bit Float	1
SFC-56	WN Surface	N/A	0.0 .. 1.0	3	32-Bit Float	1

Table 2.8-12. Layer Cloud - HIGH (mean std num_obs)

TRMM/ Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Elements
SFC-57	Area Fraction Percentage	percent	0.0 .. 100.0	3	32-Bit Float	1
SFC-58	Effective Pressure	hPa	0.0 .. 1100.0	4	32-Bit Float	3
SFC-59	Effective Temperature	K	100.0 .. 350.0	4	32-Bit Float	3
SFC-60	Effective Height	km	0.0 .. 20.0	4	32-Bit Float	3
SFC-61	Top Pressure	hPa	0.0 .. 1100.0	4	32-Bit Float	3
SFC-62	Bottom Pressure	hPa	0.0 .. 1100.0	4	32-Bit Float	3
SFC-63	Particle Phase	N/A	1.0 .. 2.0	4	32-Bit Float	3
SFC-64	Liquid Water Path	$g\ m^{-2}$	0.0 .. 10000.0	4	32-Bit Float	3
SFC-65	Ice Water Path	$g\ m^{-2}$	0.0 .. 10000.0	4	32-Bit Float	3
SFC-66	Liquid Particle Radius	µm	0.0 .. 40.0	4	32-Bit Float	3
SFC-67	Ice Particle Diameter	µm	0.0 .. 300.0	4	32-Bit Float	3
SFC-68	Vis. Opt. Depth (linear)	N/A	0.0 .. 400.0	4	32-Bit Float	3
SFC-69	Vis. Opt. Depth (log)	N/A	-6.0 .. 6.0	4	32-Bit Float	3
SFC-70	Infrared Emissivity	N/A	0.0 .. 2.0	4	32-Bit Float	3
SFC-71	Vertical Aspect Ratio	N/A	0.0 .. 20.0	4	32-Bit Float	3

Table 2.8-13. Layer Cloud - UPPERMID (mean std num_obs) (1 of 2)

TRMM/ Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Elements
SFC-72	Area Fraction Percentage	N/A	0.0 .. 100.0	3	32-Bit Float	1
SFC-73	Effective Pressure	hPa	0.0 .. 1100.0	4	32-Bit Float	3
SFC-74	Effective Temperature	K	100.0 .. 350.0	4	32-Bit Float	3
SFC-75	Effective Height	km	0.0 .. 20.0	4	32-Bit Float	3
SFC-76	Top Pressure	hPa	0.0 .. 1100.0	4	32-Bit Float	3
SFC-77	Bottom Pressure	hPa	0.0 .. 1100.0	4	32-Bit Float	3
SFC-78	Particle Phase	N/A	1.0 .. 2.0	4	32-Bit Float	3

Table 2.8-13. Layer Cloud - UPPERMID (mean std num_obs) (2 of 2)

TRMM/ Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Elements
SFC-79	Liquid Water Path	g m^{-2}	0.0 .. 10000.0	4	32-Bit Float	3
SFC-80	Ice Water Path	g m^{-2}	0.0 .. 10000.0	4	32-Bit Float	3
SFC-81	Liquid Particle Radius	µm	0.0 .. 40.0	4	32-Bit Float	3
SFC-82	Ice Particle Effective Diameter	µm	0.0 .. 300.0	4	32-Bit Float	3
SFC-83	Vis. Opt. Depth (linear)	N/A	0.0 .. 400.0	4	32-Bit Float	3
SFC-84	Vis. Opt. Depth (log)	N/A	-6.0 .. 6.0	4	32-Bit Float	3
SFC-85	Infrared Emissivity	N/A	0.0 .. 2.0	4	32-Bit Float	3
SFC-86	Vertical Aspect Ratio	N/A	0.0 .. 20.0	4	32-Bit Float	3

Table 2.8-14. Layer Cloud - LOWERMID (mean std num_obs)

TRMM/ Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Elements
SFC-87	Area Fraction Percentage	N/A	0.0 .. 100.0	3	32-Bit Float	1
SFC-88	Effective Pressure	hPa	0.0 .. 1100.0	4	32-Bit Float	3
SFC-89	Effective Temperature	K	100.0 .. 350.0	4	32-Bit Float	3
SFC-90	Effective Height	km	0.0 .. 20.0	4	32-Bit Float	3
SFC-91	Top Pressure	hPa	0.0 .. 1100.0	4	32-Bit Float	3
SFC-92	Cloud Base Pressure	hPa	0.0 .. 1100.0	4	32-Bit Float	3
SFC-93	Particle Phase	N/A	1.0 .. 2.0	4	32-Bit Float	3
SFC-94	Liquid Water Path	g m^{-2}	0.0 .. 10000.0	4	32-Bit Float	3
SFC-95	Ice Water Path	g m^{-2}	0.0 .. 10000.0	4	32-Bit Float	3
SFC-96	Liquid Particle Radius	µm	0.0 .. 40.0	4	32-Bit Float	3
SFC-97	Ice Particle Effective Diameter	µm	0.0 .. 300.0	4	32-Bit Float	3
SFC-98	Vis. Opt. Depth (linear)	N/A	0.0 .. 400.0	4	32-Bit Float	3
SFC-99	Vis. Opt. Depth (log)	N/A	-6.0 .. 6.0	4	32-Bit Float	3
SFC100	Infrared Emissivity	N/A	0.0 .. 2.0	4	32-Bit Float	3
SFC-101	Vertical Aspect Ratio	N/A	0.0 .. 20.0	4	32-Bit Float	3

Table 2.8-15. Layer Cloud - LOW (mean std num_obs) (1 of 2)

TRMM/ Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Elements
SFC-102	Area Fraction Percentage	N/A	0.0 .. 100.0	3	32-Bit Float	1
SFC-103	Effective Pressure	hPa	0.0 .. 1100.0	4	32-Bit Float	3
SFC-104	Effective Temperature	K	100.0 .. 350.0	4	32-Bit Float	3

Table 2.8-15. Layer Cloud - LOW (mean std num_obs) (2 of 2)

TRMM/ Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Elements
SFC-105	Effective Height	km	0.0 .. 20.0	4	32-Bit Float	3
SFC-106	Top Pressure	hPa	0.0 .. 1100.0	4	32-Bit Float	3
SFC-107	Bottom Pressure	hPa	0.0 .. 1100.0	4	32-Bit Float	3
SFC-108	Particle Phase	N/A	1.0 .. 2.0	4	32-Bit Float	3
SFC-109	Liquid Water Path	$g\ m^{-2}$	0.0 .. 10000.0	4	32-Bit Float	3
SFC-110	Ice Water Path	$g\ m^{-2}$	0.0 .. 10000.0	4	32-Bit Float	3
SFC-111	Liquid Particle Radius	µm	0.0 .. 40.0	4	32-Bit Float	3
SFC-112	Ice Particle Effective Diameter	µm	0.0 .. 300.0	4	32-Bit Float	3
SFC-113	Vis. Opt. Depth (linear)	N/A	0.0 .. 400.0	4	32-Bit Float	3
SFC-114	Vis. Opt. Depth (log)	N/A	-6.0 .. 6.0	4	32-Bit Float	3
SFC-115	Infrared Emissivity	N/A	0.0 .. 2.0	4	32-Bit Float	3
SFC-116	Vertical Aspect Ratio	N/A	0.0 .. 20.0	4	32-Bit Float	3

Table 2.8-16. Aerosol LAND

Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Elements
SFC-117	cor_optdepth047_land	N/A	0.0 .. 5.0	3	32-Bit Float	1
SFC-118	cor_optdepth055_land	N/A	0.0 .. 5.0	3	32-Bit Float	1
SFC-119	cor_optdepth066_land	N/A	0.0 .. 5.0	3	32-Bit Float	1

Table 2.8-17. Aerosol OCEAN

Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Elements
SFC-120	eff_optdepth047_ocean	N/A	0.0 .. 5.0	3	32-Bit Float	1
SFC-121	eff_optdepth055_ocean	N/A	0.0 .. 5.0	3	32-Bit Float	1
SFC-122	eff_optdepth066_ocean	N/A	0.0 .. 5.0	3	32-Bit Float	1
SFC-123	eff_optdepth087_ocean	N/A	0.0 .. 5.0	3	32-Bit Float	1
SFC-124	eff_optdepth124_ocean	N/A	0.0 .. 5.0	3	32-Bit Float	1
SFC-125	eff_optdepth164_ocean	N/A	0.0 .. 5.0	3	32-Bit Float	1
SFC-126	eff_optdepth213_ocean	N/A	0.0 .. 5.0	3	32-Bit Float	1

SFC Revision Record

The product Revision Record contains information pertaining to approved section changes. The table lists the date the Software Configuration Change Request (SCCR) was approved, the Release and Version Number, the SCCR number, a short description of the revision, and the revised sections. The authors are listed on the document cover.

SFC Revision Record

SCCR Approval Date	Release/ Version Number	SCCR Number	Description of Revision	Section(s) Affected
5/29/02	R3V2	365	• Updated parameters in Regional Identification Data, Regional Imager Data. • Updated format to comply with standards.	Tables 2.11-5 & 2.11-7 All
02/03/03	R3V3	388	• Updated vdata sizes. • Added MODIS aerosols for land and Ocean. • Updated format to comply with standards.	Table 2.11-3 Tables 2.11-16 & 2.11-17 All
02/03/03	R3V4 R4V1	388	• Changed range of MOD04 effective optical depths from 0.0 .. 3.0 to 0.0 .. 5.0 based on changes to v003 MOD04 inputs starting with data date 01.Apr.2002. • Changed units of 10 ,11 in Layer Cloud category from mm to μm. • Updated format to comply with standards. • The revision and version numbers were changed at this time.	Tables 2.11-16 & 2.11-17 Tables 2.11-12, 2.11-13, 2.11-14, 2.11-15 All All
10/29/03	R4V2	476	• Added Snow/Ice Percentage from Imager History parameter to Angular Model Scene type. • Updated format to comply with standards	Table 2.8.8 All
06/04/04	R4V3	530	• Deleted Snow/Ice Percentage from Imager History parameter to Angular Model Scene type. • Added product name in front of SDS index in the first column of the table. • Updated format to comply with standards	Table 2.8.8 Tables 2.8.4 - 2.8.17 All

2.9 Synoptic Radiative Fluxes and Clouds (SYN)

EOSDIS Product Code: CER07

This is a planned data product. Data are not yet available.

The Synoptic Radiative Fluxes and Clouds (SYN) product contains a day of space and time averaged Clouds and the Earth's Radiant Energy System (CERES) data for a single scanner instrument. The SYN is also produced for combinations of scanner instruments. The 1-degree regional flux at the hour of observation from the CERES FSW product and concurrent diurnal data from geostationary satellites are used to estimate the regional flux at 3-hour intervals. Also at 3-hour intervals are estimates of the adjusted fluxes at the four atmospheric levels as defined by the CERES CRS product for both clear-sky and total-sky scenes, estimates of the average cloud parameters in four cloud height categories, and column averaged cloud parameters.

The SYN contains the following constrained vertical flux profiles for both clear sky and total sky conditions evaluated at the surface, 500-, 70-, and 1-hPa:

- Longwave, Shortwave, and Window channels upward and downward.

The initial flux profiles are not contained on the SYN; however, the adjustments between the constrained and initial profiles for the following are included for both clear sky and total sky conditions:

- Longwave upward at the surface and 1 hPa.
- Longwave downward at the surface.
- Shortwave upward at the surface and 1 hPa.
- Shortwave downward at the surface.
- Window channel upward at the surface and 1 hPa.
- Window channel downward at the surface.

The adjustments to the radiative transfer model input parameters between the initial and the constrained passes are also contained on the SYN. These parameters include:

- Surface albedo and skin temperature
- Total column precipitable water and upper tropospheric relative humidity
- Aerosol optical depth
- Cloud optical depth, fractional area, and effective temperature

Level: 3
Frequency: Every 3 Hours
Portion of Atmosphere Covered: Surface, Internal and TOA

Time Interval Covered:
File: 3 Hours
Record: 3 Hours

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

Product Version:
TRMM:
Terra:
Aqua:

SYN Metadata

The types of SYN metadata are summarized in Table 2.9-1 and contain information which need only be recorded once per hour. The CERES metadata are listed in Appendix B. The SYN product-specific metadata parameters are listed in Table 2.9-1 and the CRS_Header_Vdata parameters are listed in Table 2.9-2.

Table 2.9-1. SYN Metadata Summary

HDF Name	Description Table	Records	Number of Fields
CERES Baseline Header Metadata	Table B-1	1	36
CERES_metadata Vdata	Table B-2	1	14
SYN_Header Vdata	Table 2.9-2	1	25

Table 2.9-2. SYN_Header_Vdata

Item	Description	Units	Range	Elements	Bytes/ Elem
SYN-H1	SYN ID	N/A	112 .. 200	1	4
SYN-H2	Julian Day	N/A	ASCII string	1	28
SYN-H3	MOA production date and time	N/A	ASCII string	1	24
SYN-H4	Synoptic SARB Version number	N/A	1 .. 26	1	2
SYN-H5	SYN production date and time	N/A	ASCII string	1	19

SYN Scientific Data Sets

The SYN contains 156 Scientific Data Sets (SDS) which are parameter collections of one-degree regional data where the first dimension corresponds to the number of global regions, the last dimension corresponds to the number of parameters; and the middle dimension, if rank 3, corresponds to the number of elements in each parameter array. This ordering is used by the C programming language and most HDF viewers. In FORTRAN, the dimensions are reversed such that the number of regions becomes the last dimension and the first dimension is the number of parameters in the SDS. The SDSs are divided into tables which map to Vgroups of the same name. Tables 2.9-3 to Table 2.9-19 summarize the contents of each Vgroup and SDS contained within the SYN file. Product sizing information for the number of CERES regions, 64800, is given in Table 2.9-20.

Table 2.9-3. Regional Data (1 of 2)

Item	SDS Name	Units	Range	Dimen-sions	DataType	Hourly Size (MB)
SYN-1	Julian date at hour start	day	2440000 .. 2480000	n	64-bit real	0.49

Table 2.9-3. Regional Data (2 of 2)

Item	SDS Name	Units	Range	Dimen-sions	DataType	Hourly Size (MB)
SYN-2	Region number	N/A	1 .. 64800	n	32-bit integer	0.25
SYN-3	Hour-box number	N/A	1 .. 744	n	32-bit integer	0.25
SYN-4	Surface altitude above sea level - mean	m	-1000 .. 10000	n	32-bit real	0.25
SYN-5	Cosine of solar zenith angle	N/A	0 .. 1	n	32-bit real	0.25
SYN-6	Surface type percent coverage	N/A	0 .. 100	n x 20	32-bit integer	4.94

Table 2.9-4. Clear-sky Area Data

Item	SDS Name	Units	Range	Dimen-sions	DataType	Hourly Size (MB)
SYN-7	Snow/ice percent coverage	N/A	0 .. 100	n	32-bit real	0.25
SYN-8	Smoke percent coverage	N/A	0 .. 100	n	32-bit real	0.25
SYN-9	Fire percent coverage	N/A	0 .. 100	n	32-bit real	0.25
SYN-10	Aerosol visible optical depth - 0.63 mm	N/A	-1 .. 5	n	32-bit real	0.25
SYN-11	Aerosol visible optical depth - 1.6 mm	N/A	-1 .. 5	n	32-bit real	0.25
SYN-12	Aerosol percent coverage	N/A	0 .. 100	n	32-bit real	0.25
SYN-13	Sunglint percentage	N/A	0 .. 100	n	32-bit real	0.25

Table 2.9-5. Observed TOA Flux (1 of 2)

Item	SDS Name	Units	Range	Dimen-sions	DataType	Hourly Size (MB)
SYN-14	SW TOA Flux - total skies - mean	$W\ m^{-2}$	0 .. 1400	n	32-bit real	0.25
SYN-15	SW TOA Flux - total skies - std	$W\ m^{-2}$	0 .. 1400	n	32-bit real	0.25
SYN-16	LW TOA Flux - total skies - mean	$W\ m^{-2}$	0 .. 500	n	32-bit real	0.25
SYN-17	LW TOA Flux - total skies - std	$W\ m^{-2}$	0 .. 500	n	32-bit real	0.25
SYN-18	TOA Albedo - total skies - mean	N/A	0 .. 1	n	32-bit real	0.25
SYN-19	TOA Albedo - total skies - std	N/A	0 .. 1	n	32-bit real	0.25
SYN-20	WN TOA Flux - total skies - mean	$W\ m^{-2}\ \mu m^{-1}$	2 .. 50	n	32-bit real	0.25
SYN-21	WN TOA Flux - total skies - std	$W\ m^{-2}\ \mu m^{-1}$	2 .. 50	n	32-bit real	0.25
SYN-22	SW TOA Flux - clear skies - mean	$W\ m^{-2}$	0 .. 1400	n	32-bit real	0.25

Table 2.9-5. Observed TOA Flux (2 of 2)

Item	SDS Name	Units	Range	Dimen-sions	DataType	Hourly Size (MB)
SYN-23	SW TOA Flux - clear skies - std	W m^{-2}	0 .. 1400	n	32-bit real	0.25
SYN-24	LW TOA Flux - clear skies - mean	W m^{-2}	0 .. 500	n	32-bit real	0.25
SYN-25	LW TOA Flux - clear skies - std	W m^{-2}	0 .. 500	n	32-bit real	0.25
SYN-26	TOA Albedo - clear skies - mean	N/A	0 .. 1	n	32-bit real	0.25
SYN-27	TOA Albedo - clear skies - std	N/A	0 .. 1	n	32-bit real	0.25
SYN-28	WN TOA Flux - clear skies - mean	W m^{-2} μm^{-1}	2 .. 50	n	32-bit real	0.25
SYN-29	WN TOA Flux - clear skies - std	W m^{-2} μm^{-1}	2 .. 50	n	32-bit real	0.25

Table 2.9-6. Cloud Properties for Four Cloud Layers (1 of 2)

Item	SDS Name	Units	Range	Dimen-sions	DataType	Hourly Size (MB)
SYN-30	Area percent coverage	N/A	0 .. 100	n x 4	32-bit real	0.99
SYN-31	Cloud visible optical depth - linear - mean	N/A	0 .. 400	n x 4	32-bit real	0.99
SYN-32	Cloud vsible optical depth - linear - std	N/A	0 .. 300	n x 4	32-bit real	0.99
SYN-33	Cloud visible optical depth - logarithmic - mean	N/A	-6 .. 6	n x 4	32-bit real	0.99
SYN-34	Cloud vsible optical depth - logarithmic - std	N/A	0 .. 6	n x 4	32-bit real	0.99
SYN-35	Cloud infrared emissivity - mean	N/A	0 .. 1	n x 4	32-bit real	0.99
SYN-36	Cloud infrared emissivity - std	N/A	0 .. 1	n x 4	32-bit real	0.99
SYN-37	Cloud liquid water path - mean	g m^{-2}	0 .. 10000	n x 4	32-bit real	0.99
SYN-38	Cloud liquid water path - std	g m^{-2}	0 .. 8000	n x 4	32-bit real	0.99
SYN-39	Cloud ice water path - mean	g m^{-2}	0 .. 10000	n x 4	32-bit real	0.99
SYN-40	Cloud ice water path - std	g m^{-2}	0 .. 8000	n x 4	32-bit real	0.99
SYN-41	Cloud top pressure - mean	hPa	0 .. 1100	n x 4	32-bit real	0.99
SYN-42	Cloud top pressure - std	hPa	0 .. 600	n x 4	32-bit real	0.99
SYN-43	Cloud effective pressure - mean	hPa	0 .. 1100	n x 4	32-bit real	0.99

Table 2.9-6. Cloud Properties for Four Cloud Layers (2 of 2)

Item	SDS Name	Units	Range	Dimen-sions	DataType	Hourly Size (MB)
SYN-44	Cloud effective pressure - std	hPa	0 .. 350	n x 4	32-bit real	0.99
SYN-45	Cloud effective temperature - mean	K	100 .. 350	n x 4	32-bit real	0.99
SYN-46	Cloud effective temperature - std	K	0 .. 150	n x 4	32-bit real	0.99
SYN-47	Cloud effective height - mean	km	0 .. 20	n x 4	32-bit real	0.99
SYN-48	Cloud effective height - std	km	0 .. 12	n x 4	32-bit real	0.99
SYN-49	Cloud base pressure - mean	hPa	0 .. 1100	n x 4	32-bit real	0.99
SYN-50	Cloud base pressure - std	hPa	0 .. 600	n x 4	32-bit real	0.99
SYN-51	Cloud liquid particle radius - 3.7 μm - mean	μm	0 .. 40	n x 4	32-bit real	0.99
SYN-52	Cloud liquid particle radius - 3.7 μm - std	μm	0 .. 20	n x 4	32-bit real	0.99
SYN-53	Cloud ice particle effective diameter - 3.7 μm - mean	μm	0 .. 300	n x 4	32-bit real	0.99
SYN-54	Cloud ice particle effective diameter - 3.7 μm - std	μm	0 .. 200	n x 4	32-bit real	0.99
SYN-55	Cloud particle phase - 3.7 μm - mean	N/A	1 .. 2	n x 4	32-bit real	0.99
SYN-56	Cloud liquid particle radius - 1.6 μm - mean	μm	0 .. 40	n x 4	32-bit real	0.99
SYN-57	Cloud ice particle effective diameter - 3.7 μm - mean	μm	0 .. 300	n x 4	32-bit real	0.99
SYN-58	Cloud particle phase - 1.6 μm - mean	N/A	1 .. 2	n x 4	32-bit real	0.99
SYN-59	Vertical aspect ratio - mean (TBD)	N/A	0 .. 20	n x 4	32-bit real	0.99
SYN-60	Vertical aspect ratio - std (TBD)	N/A	0 .. 15	n x 4	32-bit real	0.99

Table 2.9-7. Column Averaged Cloud Properties - Weighted by TOA SW, TOA LW, SFC LW, LWP, and IWP (1 of 3)

Item	SDS Name	Units	Range	Dimen-sions	DataType	Hourly Size (MB)
SYN-61	Area percent coverage	N/A	0 .. 100	n x 4 x 5	32-bit real	4.94
SYN-62	Cloud visible optical depth - linear - mean	N/A	0 .. 400	n x 4 x 5	32-bit real	4.94

Table 2.9-7. Column Averaged Cloud Properties - Weighted by TOA SW, TOA LW, SFC LW, LWP, and IWP (2 of 3)

Item	SDS Name	Units	Range	Dimen-sions	DataType	Hourly Size (MB)
SYN-63	Cloud vsible optical depth - linear - std	N/A	0 .. 300	n x 4 x 5	32-bit real	4.94
SYN-64	Cloud visible optical depth - logarithmic - mean	N/A	-6 .. 6	n x 4 x 5	32-bit real	4.94
SYN-65	Cloud vsible optical depth - logarithmic - std	N/A	0 .. 6	n x 4 x 5	32-bit real	4.94
SYN-66	Cloud infrared emissivity - mean	N/A	0 .. 1	n x 4 x 5	32-bit real	4.94
SYN-67	Cloud infrared emissivity - std	N/A	0 .. 1	n x 4 x 5	32-bit real	4.94
SYN-68	Cloud liquid water path - mean	$g\ m^{-2}$	0 .. 10000	n x 4 x 5	32-bit real	4.94
SYN-69	Cloud liquid water path - std	$g\ m^{-2}$	0 .. 8000	n x 4 x 5	32-bit real	4.94
SYN-70	Cloud ice water path - mean	$g\ m^{-2}$	0 .. 10000	n x 4 x 5	32-bit real	4.94
SYN-71	Cloud ice water path - std	$g\ m^{-2}$	0 .. 8000	n x 4 x 5	32-bit real	4.94
SYN-72	Cloud top pressure - mean	hPa	0 .. 1100	n x 4 x 5	32-bit real	4.94
SYN-73	Cloud top pressure - std	hPa	0 .. 600	n x 4 x 5	32-bit real	4.94
SYN-74	Cloud effective pressure - mean	hPa	0 .. 1100	n x 4 x 5	32-bit real	4.94
SYN-75	Cloud effective pressure - std	hPa	0 .. 350	n x 4 x 5	32-bit real	4.94
SYN-76	Cloud effective temperature - mean	K	100 .. 350	n x 4 x 5	32-bit real	4.94
SYN-77	Cloud effective temperature - std	K	0 .. 150	n x 4 x 5	32-bit real	4.94
SYN-78	Cloud effective height - mean	km	0 .. 20	n x 4 x 5	32-bit real	4.94
SYN-79	Cloud effective height - std	km	0 .. 12	n x 4 x 5	32-bit real	4.94
SYN-80	Cloud bottom pressure - mean	hPa	0 .. 1100	n x 4 x 5	32-bit real	4.94
SYN-81	Cloud bottom pressure - std	hPa	0 .. 600	n x 4 x 5	32-bit real	4.94
SYN-82	Cloud liquid particle radius - 3.7 µm - mean	µm	0 .. 40	n x 4	32-bit real	4.94
SYN-83	Cloud liquid particle radius - 3.7 µm - std	µm	0 .. 20	n x 4	32-bit real	4.94
SYN-84	Cloud ice particle effective diameter - 3.7 µm - mean	µm	0 .. 300	n x 4	32-bit real	4.94
SYN-85	Cloud ice particle effective diameter - 3.7 µm - std	µm	0 .. 200	n x 4	32-bit real	4.94

Table 2.9-7. Column Averaged Cloud Properties - Weighted by TOA SW, TOA LW, SFC LW, LWP, and IWP (3 of 3)

Item	SDS Name	Units	Range	Dimen-sions	DataType	Hourly Size (MB)
SYN-86	Cloud particle phase - 3.7 µm - mean	N/A	1 .. 2	n x 4	32-bit real	4.94
SYN-87	Cloud liquid particle radius - 1.6 µm - mean	µm	0 .. 40	n x 4	32-bit real	4.94
SYN-88	Cloud ice particle effective diameter - 3.7 µm - mean	µm	0 .. 300	n x 4	32-bit real	4.94
SYN-89	Cloud particle phase - 1.6 µm - mean	N/A	1 .. 2	n x 4	32-bit real	4.94
SYN-90	Vertical aspect ratio - mean (TBD)	N/A	0 .. 20	n x 4 x 5	32-bit real	4.94
SYN-91	Vertical aspect ratio - std (TBD)	N/A	0 .. 15	n x 4 x 5	32-bit real	4.94

Table 2.9-8. Cloud Overlap Statistics

Item	SDS Name	Units	Range	Dimen-sions	DataType	Hourly Size (MB)
SYN-92	Overlap area fraction	N/A	0 .. 100	n x 11	32-bit real	2.72

Table 2.9-9. Angular Model Scene Data

Item	SDS Name	Units	Range	Dimen-sions	DataType	Hourly Size (MB)
SYN-93	Incident solar flux	$W\ m^{-2}$	0 .. 1400	n	32-bit real	0.25
SYN-94	Area percent coverage	N/A	0 .. 100	n x 12	32-bit real	2.97
SYN-95	Albedo - mean	N/A	0 .. 1	n x 12	32-bit real	2.97
SYN-96	Albedo - std	N/A	0 .. 1	n x 12	32-bit real	2.97
SYN-97	LW flux - mean	$W\ m^{-2}$	0 .. 400	n x 12	32-bit real	2.97
SYN-98	LW flux - std	$W\ m^{-2}$	0 .. 400	n x 12	32-bit real	2.97

Table 2.9-10. Surface Radiative Properties (1 of 2)

Item	SDS Name	Units	Range	Dimen-sions	DataType	Hourly Size (MB)
SYN-99	Photosynthetically active radiation over surface (TBD)	$W\ m^{-2}$	0 .. 780	n	32-bit real	0.25
SYN-100	Direct/diffuse surface ratio	N/A	0 .. 30	n	32-bit real	0.25

Table 2.9-10. Surface Radiative Properties (2 of 2)

Item	SDS Name	Units	Range	Dimen-sions	DataType	Hourly Size (MB)
SYN-101	Corrected initial broadband surface albedo	N/A	0 .. 1	n	32-bit real	0.25

Table 2.9-11. Vertical Profile Description

Item	SDS Name	Units	Range	Dimen-sions	DataType	Hourly Size (MB)
SYN-102	Number of atmospheric levels	N/A	0 .. 4	n	32-bit integer	0.25
SYN-103	Pressure levels	hPa	0 .. 1100	n x 4	32-bit real	0.99

Table 2.9-12. Constrained Clear Sky Profiles

Item	SDS Name	Units	Range	Dimen-sions	DataType	Hourly Size (MB)
SYN-104	SW flux - upward for clear-sky	$W\ m^{-2}$	0 .. 1400	n x 4	32-bit real	0.99
SYN-105	SW flux - downward for clear-sky	$W\ m^{-2}$	0 .. 1400	n x 4	32-bit real	0.99
SYN-106	LW flux - upward for clear-sky	$W\ m^{-2}$	0 .. 850	n x 4	32-bit real	0.99
SYN-107	LW flux - downward for clear-sky	$W\ m^{-2}$	0 .. 700	n x 4	32-bit real	0.99
SYN-108	WN flux - upward for clear-sky	$W\ m^{-2}$	0 .. 370	n x 4	32-bit real	0.99
SYN-109	WN flux - downward for clear-sky	$W\ m^{-2}$	0 .. 370	n x 4	32-bit real	0.99

Table 2.9-13. Constrained Total Sky Profiles

Item	SDS Name	Units	Range	Dimen-sions	DataType	Hourly Size (MB)
SYN-110	SW flux - upward for total-sky	$W\ m^{-2}$	0 .. 1400	n x 4	32-bit real	0.99
SYN-111	SW flux - downward for total-sky	$W\ m^{-2}$	0 .. 1400	n x 4	32-bit real	0.99
SYN-112	LW flux - upward for total-sky	$W\ m^{-2}$	0 .. 850	n x 4	32-bit real	0.99
SYN-113	LW flux - downward for total-sky	$W\ m^{-2}$	0 .. 700	n x 4	32-bit real	0.99
SYN-114	WN flux - upward for total-sky	$W\ m^{-2}$	0 .. 370	n x 4	32-bit real	0.99
SYN-115	WN flux - downward for total-sky	$W\ m^{-2}$	0 .. 370	n x 4	32-bit real	0.99

Table 2.9-14. Clear Sky Constrainment-Initial Flux Deltas

Item	SDS Name	Units	Range	Dimen-sions	DataType	Hourly Size (MB)
SYN-116	SW flux adjustment at surface - upward for clear-sky	W m^{-2}	-1400 .. 1400	n	32-bit real	0.25
SYN-117	SW flux adjustment at TOA - upward for clear-sky	W m^{-2}	-1400 .. 1400	n	32-bit real	0.25
SYN-118	SW flux adjustment at surface - downward for clear-sky	W m^{-2}	-1400 .. 1400	n	32-bit real	0.25
SYN-119	LW flux adjustment at surface - upward for clear-sky	W m^{-2}	-600 .. 600	n	32-bit real	0.25
SYN-120	LW flux adjustment at surface - downward for clear-sky	W m^{-2}	-700 .. 700	n	32-bit real	0.25
SYN-121	LW flux adjustment at TOA - upward for clear-sky	W m^{-2}	-700 .. 700	n	32-bit real	0.25
SYN-122	WN flux adjustment at surface - upward for clear-sky	W m^{-2}	-50 .. 50	n	32-bit real	0.25
SYN-123	WN flux adjustment at surface - downward for clear-sky	W m^{-2}	-50 .. 50	n	32-bit real	0.25
SYN-124	WN flux adjustment at TOA - upward for clear-sky	W m^{-2}	-50 .. 50	n	32-bit real	0.25

Table 2.9-15. Total Sky Constrainment-Initial Flux Deltas (1 of 2)

Item	SDS Name	Units	Range	Dimen-sions	DataType	Hourly Size (MB)
SYN-125	SW flux adjustment at surface - upward for total-sky	W m^{-2}	-1400 .. 1400	n	32-bit real	0.25
SYN-126	SW flux adjustment at TOA - upward for total-sky	W m^{-2}	-1400 .. 1400	n	32-bit real	0.25
SYN-127	SW flux adjustment at surface - downward for total-sky	W m^{-2}	-1400 .. 1400	n	32-bit real	0.25
SYN-128	LW flux adjustment at surface - upward for total-sky	W m^{-2}	-600 .. 600	n	32-bit real	0.25
SYN-129	LW flux adjustment at surface - downward for total-sky	W m^{-2}	-700 .. 700	n	32-bit real	0.25
SYN-130	LW flux adjustment at TOA - upward for total-sky	W m^{-2}	-700 .. 700	n	32-bit real	0.25
SYN-131	WN flux adjustment at surface - upward for total-sky	W m^{-2}	-50 .. 50	n	32-bit real	0.25

Table 2.9-15. Total Sky Constrainment-Initial Flux Deltas (2 of 2)

Item	SDS Name	Units	Range	Dimen-sions	DataType	Hourly Size (MB)
SYN-132	WN flux adjustment at surface - downward for total-sky	W m^{-2}	-50 .. 50	n	32-bit real	0.25
SYN-133	WN flux adjustment at TOA - upward for total-sky	W m^{-2}	-50 .. 50	n	32-bit real	0.25

Table 2.9-16. Satellite Emulated Window Channel

Item	SDS Name	Units	Range	Dimen-sions	DataType	Hourly Size (MB)
SYN-134	WN filtered radiance -satellite emulated	W $m^{-2}sr^{-1}$	0 .. 50	n	32-bit real	0.25
SYN-135	WN filtered radiance adjustment-satellite emulated	W $m^{-2}sr^{-1}$	0 .. 50	n	32-bit real	0.25
SYN-136	WN flux - satellite emulated - TOA	W m^{-2}	2 .. 50	n	32-bit real	0.25
SYN-137	WN flux adjustment - satellite emulated - TOA	W m^{-2}	2 .. 50	n	32-bit real	0.25

Table 2.9-17. Unfiltered Total Longwave

Item	SDS Name	Units	Range	Dimen-sions	DataType	Hourly Size (MB)
SYN-138	Total LW unfiltered radiance - satellite emulated	W $m^{-2}sr^{-1}$	0 .. 200	n	32-bit real	0.25
SYN-139	Total LW unfiltered radiance adjustment - satellite emulated	W $m^{-2}sr^{-1}$	0 .. 200	n	32-bit real	0.25

Table 2.9-18. Constrainment Adjustments (1 of 2)

Item	SDS Name	Units	Range	Dimen-sions	DataType	Hourly Size (MB)
SYN-140	Total column precipitable water - initial	cm	0 .. 10	n	32-bit real	0.25
SYN-141	Total column precipitable water - adjustment	cm	-10 .. 10	n	32-bit real	0.25
SYN-142	Upper tropospheric precipitable water - initial	cm	0 .. 10	n	32-bit real	0.25
SYN-143	Upper tropospheric precipitable water - adjustment	cm	-10 .. 10	n	32-bit real	0.25

Table 2.9-18. Constrainment Adjustments (2 of 2)

Item	SDS Name	Units	Range	Dimen-sions	DataType	Hourly Size (MB)
SYN-144	Upper tropospheric humidity - initial	N/A	0.0 .. 100.0	n	32-bit real	0.25
SYN-145	Upper tropospheric humidity - adjustment	N/A	0.0 .. 100.0	n	32-bit real	0.25
SYN-146	Surface albedo - adjustment	N/A	-1 .. 1	n	32-bit real	0.25
SYN-147	Aerosol optical depth - initial	N/A	0 .. 2	n	32-bit real	0.25
SYN-148	Aerosol optical depth - adjustment	N/A	-2 .. 2	n	32-bit real	0.25
SYN-149	Skin temperature - initial	K	175 .. 375	n	32-bit real	0.25
SYN-150	Skin temperature - adjustment	K	TBD	n	32-bit real	0.25
SYN-151	Mean visible optical depth-adjustment	N/A	-400 .. 400	n x 4	32-bit real	0.99
SYN-152	Mean cloud fractional area - adjustment	N/A	-1 .. 1	n x 4	32-bit real	0.99
SYN-153	Mean cloud effective temperature - adjustment	K	TBD	n x 4	32-bit real	0.99

Table 2.9-19. Constrainment Status

Item	SDS Name	Units	Range	Dimen-sions	DataType	Hourly Size (MB)
SYN-154	Number of tuning iterations	N/A	0 .. 1	n	32-bit integer	0.25
SYN-155	Constrainment status flag	N/A	0 .. 600	n	32-bit integer	0.25
SYN-156	Sigma table version number	N/A	1 .. 20	n	32-bit integer	0.25

Table 2.9-20. Sizing Information

Data Quantity	Size (MB)
Hourly TOTAL SYN Size	240.02
Daily TOTAL SYN Size	1920.19
Monthly TOTAL SYN Size	59525.90

SYN Revision Record

The product Revision Record contains information pertaining to approved section changes. The table lists the date the Software Configuration Change Request (SCCR) was approved, the Release and Version Number, the SCCR number, a short description of the revision, and the revised sections. The authors are listed on the document cover.

SYN Revision Record

SCCR Approval Date	Release/ Version Number	SCCR Number	Description of Revision	Section(s) Affected
N/A	R3V1	N/A	• Updated format to comply with standards.	All

2.10 Monthly Regional Radiative Fluxes and Clouds (AVG)

EOSDIS Product Code: CER08

The Monthly Regional Radiative Fluxes and Clouds (AVG) 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. The product is written in HDF-EOS and contains metadata as well as gridded science data.

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

- Regional data
- Radiative fluxes for both clear-sky and total-sky at TOA
- Cloud category properties for four (low, lower middle, upper middle and high) cloud layers
- Adjustment parameters for four cloud layers
- Column-averaged cloud properties for five (TOASW, TOALW, Hourly Gridded Single Satellite TOA and Surface Fluxes and Clouds (SFC) LW, Liquid Water Path (LWP), and Ice Water Path (IWP)) weighting schemes
- Adjustment parameters for five 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 conditions
- Angular model scene classes
- Atmospheric flux profile for clear-sky and total-sky
- Flux adjustments for clear-sky and total-sky
- Adjustment parameters for clear-skies
- Surface data

A complete listing of metadata and science parameters for this data product can be found in Tables 2.10-1 and Table 2.10-2.

Level: 3
Frequency: 1/Month
Portion of Atmosphere Covered: Surface to TOA

Time Interval Covered:
File: 1 Month
Record: 1 Month

Portion of Globe Covered:
File: Global
Record: 1.0-Deg Regions

Product Version:
TRMM:
Terra:
Aqua:

AVG Metadata

The types of AVG metadata are summarized in Table 2.10-1 and contain information which need only be recorded once per product. The CERES metadata are listed in Appendix B.

Table 2.10-1. AVG Metadata Summary

HDF Name	Description Table	Records	Number of Fields
CERES Baseline Header Metadata	Table B-1	1	36
CERES_metadata gridded data	Table B-2	1	14

AVG Science Data

All of the AVG science data are organized into the HDF-EOS Grid data type, which is shown in Table 2.10-2 below. This table contains a list of the parameters within each grid, including the field number, the field name, the data type, the units, the range, and the number of elements within each field.

Table 2.10-2. AVG Grid Data (1 of 4)

Field No.	Field Name	Data Type	Units	Range	No. of Elements
	Region Parameters				
1	Surface Type Percent Coverage	32-Bit Float	percent	0.0 .. 100.0	20
2	Surface Altitude	32-Bit Float	m	-1000 .. 10000	1
3	Snow/Ice Percent Coverage	32-Bit Float	percent	0.0 .. 100.0	1
4	Fire Percent Coverage	32-Bit Float	percent	0.0 .. 100.0	1
5	Total Aerosol Visible Optical Depth @ 0.63 microns	32-Bit Float	mm	-1 .. 5	1
6	Total Aerosol Visible Optical Depth @ 1.6 microns	32-Bit Float	mm	-1 .. 5	1
7	Aerosol Percent Coverage	32-Bit Float	percent	0.0 .. 20.0	1
	Clear-sky TOA Fluxes (mean, stdev, num obs)				
8	Clear-sky TOA SW Flux	32-Bit Float	Wm^{-2}	0.0 .. 800.0	27
9	Clear-sky TOA LW Flux	32-Bit Float	Wm^{-2}	0.0 .. 400.0	27
10	Clear-sky TOA WN Flux	32-Bit Float	Wm^{-2}	0.0 .. 800.0	27
11	Clear-sky TOA Albedo	32-Bit Float	N/A	0.0 .. 1.0	27
	Total-sky TOA Fluxes (mean, stdev, num obs)				
12	Total-sky TOA SW Flux	32-Bit Float	Wm^{-2}	0.0 .. 800.0	27
13	Total-sky TOA LW Flux	32-Bit Float	Wm^{-2}	0.0 .. 400.0	27
14	Total-sky TOA WN Flux	32-Bit Float	Wm^{-2}	0.0 .. 800.0	27
15	Total-sky TOA Albedo	32-Bit Float	N/A	0.0 .. 1.0	27

Table 2.10-2. AVG Grid Data (2 of 4)

Field No.	Field Name	Data Type	Units	Range	No. of Elements
	Atmospheric Flux Profile for Clear-sky for 4 Layers - sfc, 500hpa, 70hpa, & TOA (mean, stdev, num obs))				
16	Clear-sky Upward SW Flux Profile	32-Bit Float	Wm^{-2}	0.0 .. 1400.0	108
17	Clear-sky Downward SW Flux Profile	32-Bit Float	Wm^{-2}	0.0 .. 1400.0	108
18	Clear-sky Upward LW Flux Profile	32-Bit Float	Wm^{-2}	0.0 .. 700.0	108
19	Clear-sky Downward LW Flux Profile	32-Bit Float	Wm^{-2}	0.0 .. 600.0	108
	Atmospheric Flux Profile for Total-sky for 4 Layers - sfc, 500hpa, 70hpa, & TOA (mean, stdev, num obs)				
20	Total-sky Upward SW Flux Profile	32-Bit Float	Wm^{-2}	0.0 .. 1400.0	108
21	Total-sky Downward SW Flux Profile	32-Bit Float	Wm^{-2}	0.0 .. 1400.0	108
22	Total-sky Upward LW Flux Profile	32-Bit Float	Wm^{-2}	0.0 .. 700.0	108
23	Total-sky Downward LW Flux Profile	32-Bit Float	Wm^{-2}	0.0 .. 600.0	108
24	Number of Atmospheric Layers	32-Bit Float	N/A	0 .. 4	9
25	Pressure - Atmospheric Layer	32-Bit Float	hPa	0 .. 1100	36
	Flux Adjustments Clear-sky - sfc, TOA (mean, stdev, num obs)				
26	Clear-sky Downward Sfc SW Flux Adj	32-Bit Float	Wm^{-2}	-1400.0 .. 1400.0	27
27	Clear-sky Downward Sfc LW Flux Adj	32-Bit Float	Wm^{-2}	-500.0 .. 500.0	27
28	Clear-sky Upward Sfc SW Flux Adj	32-Bit Float	Wm^{-2}	-1400.0 .. 1400.0	27
29	Clear-sky Upward Sfc LW Flux Adj	32-Bit Float	Wm^{-2}	-500.0 .. 500.0	27
30	Clear-sky Upward TOA SW Flux Adj	32-Bit Float	Wm^{-2}	-1400.0 .. 1400.0	27
31	Clear-sky Upward TOA LW Flux Adj	32-Bit Float	Wm^{-2}	-500.0 .. 500.0	27
	Flux Adjustments Total-sky - sfc, TOA (mean, stdev, num obs)				
32	Total-sky Downward Sfc SW Flux Adj	32-Bit Float	Wm^{-2}	-1400.0 .. 1400.0	27
33	Total-sky Downward Sfc LW Flux Adj	32-Bit Float	Wm^{-2}	-500.0 .. 500.0	27
34	Total-sky Upward Sfc SW Flux Adj	32-Bit Float	Wm^{-2}	-1400.0 .. 1400.0	27
35	Total-sky Upward Sfc LW Flux Adj	32-Bit Float	Wm^{-2}	-500.0 .. 500.0	27
36	Total-sky Upward TOA SW Flux Adj	32-Bit Float	Wm^{-2}	-1400.0 .. 1400.0	27
37	Total-sky Upward TOA LW Flux Adj	32-Bit Float	Wm^{-2}	-500.0 .. 500.0	27
	Clear-sky Adjustment Parameters (mean, stdev, num obs)				
38	Clear-sky Adj Precipitable Water	32-Bit Float	cm	-10.0 .. 10.0	27
39	Clear-sky Adj Suface Albedo	32-Bit Float	N/A	-1.0 .. 1.0	27
40	Clear-sky Adj Aerosol Optical Depth	32-Bit Float	N/A	-2.0 .. 2.0	27
41	Clear-sky Adj Skin Temperature	32-Bit Float	k	175 .. 375	27
	Surface Data				
42	Spectral Albedo	32-Bit Float	N/A	0.0 .. 1.0	54
43	Broadband Surface Albedo	32-Bit Float	N/A	0.0 .. 1.0	9
44	LW Surface Emissivity	32-Bit Float	N/A	0.0 .. 1.0	9
45	WN Surface Emissivity	32-Bit Float	N/A	0.0 .. 1.0	9
46	Imager_based Surf Skin Temp	32-Bit Float	k	175.0 .. 375.0	9
47	Photosynthetically Active Radiation	32-Bit Float	Wm^{-2}	0.0 .. 780.0	9
48	Direct/Diffuse Ratio at Surface, mean	32-Bit Float	N/A	0.0 .. 30.0	9
49	Corrected Initial Broadband Surf Albedo	32-Bit Float	N/A	0.0 .. 1.0	9

Table 2.10-2. AVG Grid Data (3 of 4)

Field No.	Field Name	Data Type	Units	Range	No. of Elements
	Angular Model Scene Types				
50	Angular Model Incident Solar Flux	32-Bit Float	N/A	0.0 .. 1400.0	9
51	Angular Model Fractional Area Coverage	32-Bit Float	percent	0.0 .. 100	108
52	Angular Model Albedo, mean, stdev	32-Bit Float	N/A	0.0 .. 1.0	216
53	Angular Model LW Flux, mean, stdev	32-Bit Float	Wm^{-2}	0.0 .. 400.0	216
	Column Averaged Cloud Properties for 5 Weightings - TOA SW, TOA LW, SFC LW, LWP, & IWP (mean, stdev, num obs)				
54	Col Wtd Total Cld Area Fraction	32-Bit Float	percent	0.0 .. 100.0	45
55	Col Wtd Cld Effective Pressure	32-Bit Float	hPa	0.0 .. 1100.0	135
56	Col Wtd Cld Effective Temperature	32-Bit Float	K	100.0 .. 350.0	135
57	Col Wtd Cld Effective Height	32-Bit Float	km	0.0 .. 20.0	135
58	Col Wtd Cld Top Pressure	32-Bit Float	hPa	0.0 .. 1100.0	135
59	Col Wtd Cld Bottom Pressure	32-Bit Float	hPa	0.0 .. 1100.0	135
60	Col Wtd Cld Particle Phase	32-Bit Float	N/A	1.0 .. 2.0	135
61	Col Wtd Liquid Water Path	32-Bit Float	gm^{-2}	0.0 .. 10000.0	135
62	Col Wtd Ice Water Path	32-Bit Float	gm^{-2}	0.0 .. 10000.0	135
63	Col Wtd Water Particle Radius	32-Bit Float	mm	0.0 .. 40.0	135
64	Col Wtd Ice Particle Effective Diam	32-Bit Float	mm	0.0 .. 300.0	135
65	Col Wtd Cld Visible Optical Depth - lin	32-Bit Float	N/A	0.0 .. 100.0	135
66	Col Wtd Cld Visible Optical Depth - log	32-Bit Float	N/A	0.0 .. 100.0	135
67	Col Wtd Infrared Emissivity	32-Bit Float	N/A	0.0 .. 2.0	135
68	Col Wtd Cld Vertical Aspect Ratio	32-Bit Float	N/A	0.0 .. 20.0	135
	Adjustment Parameters for Column-Averaged Data for 5 Weightings - TOA SW, TOA LW, SFC LW, LWP, & IWP (mean, stdev, num obs)				
69	Col Wtd Adj Optical Depth - log	2-Bit Float	N/A	-400.0 .. 400.0	135
70	Col Wtd Adj Cld Fractional Area	32-Bit Float	N/A	-1.0 .. 1.0	135
71	Col Wtd Adj Cld Effective Temperature	32-Bit Float	K	100.0 .. 350.0	135
	Cloud Properties for 4 Layers - H, UM, LM, & L (mean, stdev, num obs)				
72	Cld Layer Total Cld Area Fraction	32-Bit Float	percent	0.0 .. 100.0	4
73	Cld Layer Effective Pressure	32-Bit Float	hPa	0.0 .. 1100.0	12
74	Cld Layer Effective Temperature	32-Bit Float	K	100.0 .. 350.0	12
75	Cld Layer Effective Height	32-Bit Float	km	0.0 .. 20.0	12
76	Cld Layer Top Pressure	32-Bit Float	hPa	0.0 .. 1100.0	12
77	Cld Layer Bottom Pressure	32-Bit Float	hPa	0.0 .. 1100.0	12
78	Cld Layer Particle Phase	32-Bit Float	N/A	1.0 .. 2.0	12
79	Cld Layer Liquid Water Path	32-Bit Float	gm^{-2}	0.0 .. 10000.0	12
80	Cld Layer Ice Water Path	32-Bit Float	gm^{-2}	0.0 .. 10000.0	12
81	Cld Layer Water Particle Radius	32-Bit Float	mm	0.0 .. 40.0	12
82	Cld Layer Ice Particle Effective Diam	32-Bit Float	mm	0.0 .. 300.0	12
83	Cld Layer Visible Optical Depth - lin	32-Bit Float	N/A	0.0 .. 100.0	12
84	Cld Layer Visible Optical Depth - log	32-Bit Float	N/A	0.0 .. 100.0	12
85	Cld Layer Infrared Emissivity	32-Bit Float	N/A	0.0 .. 2.0	12
86	Cld Layer Vertical Aspect Ratio	32-Bit Float	N/A	0.0 .. 20.0	12

Table 2.10-2. AVG Grid Data (4 of 4)

Field No.	Field Name	Data Type	Units	Range	No. of Elements
	Adjustment Parameters for 4 Layers - H, UM, LM, & L (mean, stdev, num obs)				
87	Adj Cld Layer Optical Depth	32-Bit Float	N/A	-400.0 .. 400.0	12
88	Adj Cld Layer Fractional Area	32-Bit Float	N/A	-1.0 .. 1.0	12
89	Adj Cld Layer Effective Temperature	32-Bit Float	K	100.0 .. 350.0	12
	Overlap Data for 11 Cloud Conditions - clear, L, LM, UM, H, H/UM, H/LM, H/L, UM/LM, UM/L, LM/L (mean, stdev, num obs)				
90	Overlap Condition Weighted Area Fraction	32-Bit Float	percent	0.0 .. 100.0	11

Total Bits / Record: **153856**
Total Bytes / Record: **19232**
Total Records / File: **64800**
Total Bytes / File: **1246233600**
Total MBytes/File: **1188.5**

AVG Revision Record

The product Revision Record contains information pertaining to approved section changes. The table lists the date the Software Configuration Change Request (SCCR) was approved, the Release and Version Number, the SCCR number, a short description of the revision, and the revised sections. The authors are listed on the document cover.

AVG Revision Record

SCCR Approval Date	Release/ Version Number	SCCR Number	Description of Revision	Section(s) Affected
N/A	R3V1	N/A	• Updated format to comply with standards.	All

2.11 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 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. This product is written in HDF-EOS and contains metadata as well as gridded science data.

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

- Zonal/Global 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 flux profile for Clear-sky and total-sky
- Flux adjustments for Clear-sky and total-sky
- Surface data
- Adjustment parameters for clear-skies

A complete listing of metadata and science parameters for this data product can be found in Tables 2.11-1 and Table 2.11-2.

Level: 3
Frequency: Monthly
Portion of Atmosphere Covered: Surface to TOA

Time Interval Covered:
File: 1 Month
Record: 1 Month

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

Product Version:
TRMM:
Terra:
Aqua:

ZAVG Metadata

The types of ZAVG metadata are summarized in Table 2.11-1 and contain information which need only be recorded once per product. The CERES metadata are listed in Appendix B.

Table 2.11-1. ZAVG Metadata Summary

HDF Name	Description Table	Records	Number of Fields
CERES Baseline Header Metadata	Table B-1	1	36
CERES_metadata science data	Table B-2	1	14

ZAVG Science Data

All of the ZAVG science data are organized into the HDF-EOS Grid data type, which is shown in Table 2.11-2 below. This table contains a list of the parameters within each grid, including the field number, the field name, the data type, the units, the range, and the number of elements within each field.

Table 2.11-2. ZAVG Grid Data (1 of 4)

Field No.	Field Name	Data Type	Units	Range	No. of Elements
	Zone/Globe Parameters				
1	Surface Type Percent Coverage	32-Bit Float	percent	0.0 .. 100.0	20
2	Surface Altitude	32-Bit Float	m	-1000 .. 10000	1
3	Snow/Ice Percent Coverage	32-Bit Float	percent	0.0 .. 100.0	1
4	Fire Percent Coverage	32-Bit Float	percent	0.0 .. 100.0	1
5	Total Aerosol Visible Optical Depth @ 0.63 microns	32-Bit Float	µm	-1 .. 5	1
6	Total Aerosol Visible Optical Depth @ 1.6 microns	32-Bit Float	µm	-1 .. 5	1
7	Aerosol Percent Coverage	32-Bit Float	percent	0.0 .. 20.0	1
	TOA Fluxes for Clear-sky (mean, stdev, num obs)				
8	Clear-sky TOA SW Flux	32-Bit Float	Wm^{-2}	0.0 .. 800.0	27
9	Clear-sky TOA LW Flux	32-Bit Float	Wm^{-2}	0.0 .. 400.0	27
10	Clear-sky TOA WN Flux	32-Bit Float	Wm^{-2}	0.0 .. 800.0	27
11	Clear-sky TOA Albedo	32-Bit Float	N/A	0.0 .. 1.0	27
	TOA Fluxes for Total-sky (mean, stdev, num obs)				
12	Total-sky TOA SW Flux	32-Bit Float	Wm^{-2}	0.0 .. 800.0	27
13	Total-sky TOA LW Flux	32-Bit Float	Wm^{-2}	0.0 .. 400.0	27
14	Total-sky TOA WN Flux	32-Bit Float	Wm^{-2}	0.0 .. 800.0	27
15	Total-sky TOA Albedo	32-Bit Float	N/A	0.0 .. 1.0	27

Table 2.11-2. ZAVG Grid Data (2 of 4)

Field No.	Field Name	Data Type	Units	Range	No. of Elements
	Atmospheric Flux Profile for Clear-sky for 4 Layers - sfc, 500hpa, 70hpa, & TOA (mean, stdev, num obs)				
16	Clear-sky Upward SW Flux Profile	32-Bit Float	Wm^{-2}	0.0 .. 1400.0	108
17	Clear-sky Downward SW Flux Profile	32-Bit Float	Wm^{-2}	0.0 .. 1400.0	108
18	Clear-sky Upward LW Flux Profile	32-Bit Float	Wm^{-2}	0.0 .. 700.0	108
19	Clear-sky Downward LW Flux Profile	32-Bit Float	Wm^{-2}	0.0 .. 600.0	108
	Atmospheric Flux Profile for Total-sky for 4 Layers - sfc, 500hpa, 70hpa, & TOA (mean, stdev, num obs)				
20	Total-sky Upward SW Flux Profile	32-Bit Float	Wm^{-2}	0.0 .. 1400.0	108
21	Total-sky Downward SW Flux Profile	32-Bit Float	Wm^{-2}	0.0 .. 1400.0	108
22	Total-sky Upward LW Flux Profile	32-Bit Float	Wm^{-2}	0.0 .. 700.0	108
23	Total-sky Downward LW Flux Profile	32-Bit Float	Wm^{-2}	0.0 .. 600.0	108
24	Number of Atmospheric Layers	32-Bit Float	N/A	0 .. 4	9
25	Pressure - Atmospheric Layer	32-Bit Float	hPa	0 .. 1100	36
	Flux Adjustments Clear-sky - sfc, TOA (mean, stdev, num obs)				
26	Clear-sky Downward Sfc SW Flux Adj	32-Bit Float	Wm^{-2}	-1400.0 .. 1400.0	27
27	Clear-sky Downward Sfc LW Flux Adj	32-Bit Float	Wm^{-2}	-500.0 .. 500.0	27
28	Clear-sky Upward Sfc SW Flux Adj	32-Bit Float	Wm^{-2}	-1400.0 .. 1400.0	27
29	Clear-sky Upward Sfc LW Flux Adj	32-Bit Float	Wm^{-2}	-500.0 .. 500.0	27
30	Clear-sky Upward TOA SW Flux Adj	32-Bit Float	Wm^{-2}	-1400.0 .. 1400.0	27
31	Clear-sky Upward TOA LW Flux Adj	32-Bit Float	Wm^{-2}	-500.0 .. 500.0	27
	Flux Adjustments Total-sky - sfc, TOA (mean, stdev, num obs)				
32	Total-sky Downward Sfc SW Flux Adj	32-Bit Float	Wm^{-2}	-1400.0 .. 1400.0	27
33	Total-sky Downward Sfc LW Flux Adj	32-Bit Float	Wm^{-2}	-500.0 .. 500.0	27
34	Total-sky Upward Sfc SW Flux Adj	32-Bit Float	Wm^{-2}	-1400.0 .. 1400.0	27
35	Total-sky Upward Sfc LW Flux Adj	32-Bit Float	Wm^{-2}	-500.0 .. 500.0	27
36	Total-sky Upward TOA SW Flux Adj	32-Bit Float	Wm^{-2}	-1400.0 .. 1400.0	27
37	Total-sky Upward TOA LW Flux Adj	32-Bit Float	Wm^{-2}	-500.0 .. 500.0	27
	Clear-sky Adjustment Parameters (mean, stdev, num obs)				
38	Clear-sky Adj Precipitable Water	32-Bit Float	cm	-10.0 .. 10.0	27
39	Clear-sky Adj Suface Albedo	32-Bit Float	N/A	-1.0 .. 1.0	27
40	Clear-sky Adj Aerosol Optical Depth	32-Bit Float	N/A	-2.0 .. 2.0	27
41	Clear-sky Adj Skin Temperature	32-Bit Float	k	175.0 .. 375.0	27
	Surface Data				
42	Spectral Albedo	32-Bit Float	N/A	0.0 .. 1.0	54
43	Broadband Surface Albedo	32-Bit Float	N/A	0.0 .. 1.0	9
44	LW Surface Emissivity	32-Bit Float	N/A	0.0 .. 1.0	9
45	WN Surface Emissivity	32-Bit Float	N/A	0.0 .. 1.0	9
46	Imager_based Surf Skin Temp	32-Bit Float	k	175.0 .. 375.0	9
47	Photosynthetically Active Radiation	32-Bit Float	Wm^{-2}	0.0 .. 780.0	9
48	Direct/Diffuse Ratio at Surface, mean	32-Bit Float	N/A	0.0 .. 30	9
49	Corrected Initial Broadband Surf Albedo	32-Bit Float	N/A	0.0 .. 1.0	9

Table 2.11-2. ZAVG Grid Data (3 of 4)

Field No.	Field Name	Data Type	Units	Range	No. of Elements
	Angular Model Scene Types				
50	Angular Model Incident Solar Flux	32-Bit Float	N/A	0.0 .. 1400.0	9
51	Angular Model Fractional Area Coverage	32-Bit Float	percent	0.0 .. 100	108
52	Angular Model Albedo, mean, stdev	32-Bit Float	N/A	0.0 .. 1.0	216
53	Anugular Model LW Flux, mean, stdev	32-Bit Float	Wm^{-2}	0.0 .. 400.0	216
	Column Averaged Cloud Properties for 5 Weightings -TOA SW, TOA LW, SFC LW, LWP, & IWP (mean, stdev, num obs)				
54	Col Wtd Total Cld Area Fraction	32-Bit Float	percent	0.0 .. 100.0	45
55	Col Wtd Cld Effective Pressure	32-Bit Float	hPa	0.0 .. 1100.0	135
56	Col Wtd Cld Effective Temperature	32-Bit Float	K	100.0 .. 350.0	135
57	Col Wtd Cld Effective Height	32-Bit Float	km	0.0 .. 20.0	135
58	Col Wtd Cld Top Pressure	32-Bit Float	hPa	0.0 .. 1100.0	135
59	Col Wtd Cld Base Pressure	32-Bit Float	hPa	0.0 .. 1100.0	135
60	Col Wtd Cld Particle Phase	32-Bit Float	N/A	1.0 .. 2.0	135
61	Col Wtd Liquid Water Path	32-Bit Float	gm^{-2}	0.0 .. 10000.0	135
62	Col Wtd Ice Water Path	32-Bit Float	gm^{-2}	0.0 .. 10000.0	135
63	Col Wtd Water Particle Radius	32-Bit Float	mm	0.0 .. 40.0	135
64	Col Wtd Ice Particle Effective Diam	32-Bit Float	mm	0.0 .. 300.0	135
65	Col Wtd Cld Visible Optical Depth - lin	32-Bit Float	N/A	0.0 .. 100.0	135
66	Col Wtd Cld Visible Optical Depth - log	32-Bit Float	N/A	0.0 .. 100.0	135
67	Col Wtd Infrared Emissivity	32-Bit Float	N/A	0.0 .. 2.0	135
68	Col Wtd Cld Vertical Aspect Ratio	32-Bit Float	N/A	0.0 .. 20.0	135
	Adjustment Parameters for Column-Averaged Data for 5 Weightings - TOA SW, TOA LW, SFC LW, LWP, & IWP (mean, stdev, num obs)				
69	Col Wtd Adj Optical Depth - log	32-Bit Float	N/A	-400.0 .. 400.0	135
70	Col Wtd Adj Cld Fractional Area	32-Bit Float	N/A	-1.0 .. 1.0	135
71	Col Wtd Adj Cld Effective Temperature	32-Bit Float	K	100.0 .. 350.0	135
	Monthly Only Cloud Properties for 4 Layers -H, UM, LM, & L (mean, stdev, num obs)				
72	Cld Layer Total Cld Area Fraction	32-Bit Float	percent	0.0 .. 100.0	4
73	Cld Layer Effective Pressure	32-Bit Float	hPa	0.0 .. 1100.0	12
74	Cld Layer Effective Temperature	32-Bit Float	K	100.0 .. 350.0	12
75	Cld Layer Effective Height	32-Bit Float	km	0.0 .. 20.0	12
76	Cld Layer Top Pressure	32-Bit Float	hPa	0.0 .. 1100.0	12
77	Cld Layer Base Pressure	32-Bit Float	hPa	0.0 .. 1100.0	12
78	Cld Layer Particle Phase	32-Bit Float	N/A	1.0 .. 2.0	12
79	Cld Layer Liquid Water Path	32-Bit Float	gm^{-2}	0.0 .. 10000.0	12
80	Cld Layer Ice Water Path	32-Bit Float	gm^{-2}	0.0 .. 10000.0	12
81	Cld Layer Water Particle Radius	32-Bit Float	mm	0.0 .. 40.0	12
82	Cld Layer Ice Particle Effective Diam	32-Bit Float	mm	0.0 .. 300.0	12
83	Cld Layer Visible Optical Depth - lin	32-Bit Float	N/A	0.0 .. 100.0	12
84	Cld Layer Visible Optical Depth - log	32-Bit Float	N/A	0.0 .. 100.0	12
85	Cld Layer Infrared Emissivity	32-Bit Float	N/A	0.0 .. 2.0	12
86	Cld Layer Vertical Aspect Ratio	32-Bit Float	N/A	0.0 .. 20.0	12

Table 2.11-2. ZAVG Grid Data (4 of 4)

Field No.	Field Name	Data Type	Units	Range	No. of Elements
Adjustment Parameters for 4 Layers - H, UM, LM, & L (mean, stdev, num obs)					
87	Adj Cld Layer Optical Depth	32-Bit Float	N/A	-400.0 .. 400.0	12
88	Adj Cld Layer Fractional Area	32-Bit Float	N/A	-1.0 .. 1.0	12
89	Adj Cld Layer Effective Temperature	32-Bit Float	K	100.0 .. 350.0	12
Overlap Data for 11 cloud conditions - clear, L, LM, UM, H, H/UM, H/LM, H/L, UM/LM, UM/L, LM/L (mean, stdev, num obs)					
90	Overlap Condition Weighted Area Fraction	32-Bit Float	percent	0.0 .. 100.0	11

Total Bits / Record:	**153856**
Total Bytes / Record:	**19232**
Total Records / File:	**181**
Total Bytes / File:	**3,480,992**
Total MBytes/File	**3.32**

ZAVG Revision Record

The product Revision Record contains information pertaining to approved section changes. The table lists the date the Software Configuration Change Request (SCCR) was approved, the Release and Version Number, the SCCR number, a short description of the revision, and the revised sections. The authors are listed on the document cover.

ZAVG Revision Record

SCCR Approval Date	Release/ Version Number	SCCR Number	Description of Revision	Section(s) Affected
N/A	R3V1	N/A	• Updated format to comply with standards.	All

2.12 Monthly TOA/Surface 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. This product is written in HDF and contains metadata as well as gridded science data.

SRBAVG is composed of the following structures contained in three separate files (SRBAVG1, SRBAVG2, SRBAVG3):

On a Regional, Zonal, and Global Basis:

- Regional parameters (SRBAVG1)
- Total-sky radiative fluxes at TOA and surface (SRBAVG1)
- Clear-sky radiative fluxes at TOA and surface (SRBAVG1)
- Surface data (SRBAVG1)
- CERES and GEO Layer-averaged cloud properties (SRBAVG2)
- CERES Layer-averaged cloud properties (SRBAVG3)

A complete listing of metadata and gridded science parameters for this data product can be found in Tables 2.12-1 through 2.12-21.

Level: 3
Frequency: 1/Month
Portion of Atmosphere Covered: Surface and TOA

Time Interval Covered:
File: 1 Month
Record: 1 Month

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

Product Version:
TRMM: Edition2B
Terra: Edition2A
Aqua: N/A

SRBAVG Metadata

The types of SRBAVG metadata are summarized in Table 2.12-1 and contain information which need only be recorded once per product. The CERES metadata are listed in Appendix B. Table B-1 lists the CERES Baseline Header Metadata and Table B-2 lists the CERES_metadata Vdata.

Table 2.12-1. SRBAVG Metadata Summary

HDF Name	Description Table	Records	Number of Fields
CERES Baseline Header Metadata	Table B-1	1	36
CERES_metadata Science Data	Table B-2	1	14

All of the SRBAVG science data are organized into the HDF Grid data type and are contained in three files: SRBAVG1, SRBAVG2 and SRBAVG3, which are shown in Tables 2.12-5 through 2.12-21 below. Each table contains a list of the parameters within each grid, including the field number, the field name, the data type, the units, the range, and the number of elements within each field.

SRBAVG Scientific Data Sets

Table 2.12-2 List of the Vgroups for different Gridded Categories.

Table 2.12-2. Gridded Categories of SRBAVG1, SRBAVG2 and SRBAVG3

Vgroup Number	Vgroup Name	Description	Number of Records
1	1.0 Degree Regional	See Table 2.12-3	64800
2	1.0 Degree Zonal	See Table 2.12-3	180
3	Global	See Table 2.12-3	1

Table 2.12-3 List of the Vgroups contained in 1.0 Degree Regional, 1.0 Degree Zonal and Global Vgroups.

Table 2.12-3. Temporal Vgroups of SRBAVG1, SRBAVG2 and SRBAVG3

Vgroup Number	Vgroup Name	Monthly Hourly Averages / Monthly (Hour) Averages
1	Monthly Hourly Averages	See Table 2.12-4 for SRBAVG1 See Table 2.12-5 for SRBAVG2 and SRBAVG3
2	Monthly Averages	See Table 2.12-4 for SRBAVG1 See Table 2.12-5 for SRBAVG2 and SRBAVG3

Table 2.12-4 List of the Vgroups contained in the Monthly Hourly Averages and Monthly Averages Vgroups in SRBAVG1.

Table 2.12-4. Temporal Vgroups of SRBAVG1

Vgroup Number	Vgroup Name	Monthly Hourly Averages / Monthly (Hour) Averages
1	Region parameters	See Table 2.12-6
2	TOA Fluxes	See Table 2.12-7
3	Surface Fluxes	See Table 2.12-13
4	Surface Data	See Table 2.12-19

Table 2.12-5 List of the Vgroups contained in Monthly Hourly Averages and Monthly Averages Vgroups in SRBAVG2 (CERES and GEO Layer Cloud Properties) and SRBAVG3 (CERES Layer Cloud Properties).

Table 2.12-5. Temporal Vgroup of SRBAVG2 and SRBAVG3

Vgroup Number	Vgroup Name	Monthly Hourly Averages / Monthly (Hour) Averages
1	CERES and GEO Layer Cloud Properties	See Table 2.12-20
2	CERES Layer Cloud Properties	See Table 2.12-20

Table 2.12-6 List of the SDSs contained in the Regional Parameters Vgroup.

Table 2.12-6. Region Parameters in SRBAVG1

SDS Name	Data Type	Units	Range	No. of Elements
Region Number	4-Bit Integer	unitless	0.0 .. 44640	1
Colatitude	32-Bit Float	degree	0.0 .. 180.0	1
Longitude	32-Bit Float	degree	0.0 .. 360.0	1
Surface Type Percent Coverage	32-Bit Float	percent	0.0 .. 100.0	20
Surface Altitude	32-Bit Float	m	-1000.0 .. 10000	1
Snow/Ice Percent Coverage	32-Bit Float	percent	0.0 .. 100.0	1
Precipitable Water	32-Bit Float	cm	0.0001 .. 10.0	1
Total Aerosol Visible Optical Depth @0.63 microns	32-Bit Float	µm	0.0 .. 2.0	1
Total Aerosol Visible Optical Depth @1.6 microns	32-Bit Float	µm	0.0 .. 2.0	1

Table 2.12-7 List of the Vgroups contained in the TOA Fluxes Vgroup.

Table 2.12-7. TOA Fluxes in SRBAVG1

Vgroup Number	Vgroup Name	Monthly Hourly Averages / Monthly (Hour) Averages
1	Clear-Sky Raw Data Average	See Table 2.12-8
2	Total-Sky Raw Data Average	See Table 2.12-9
3	Clear-Sky non-GEO Method	See Table 2.12-10
4	Total-Sky non-GEO Method	See Table 2.12-11
5	Clear-Sky GEO Method	See Table 2.12-12
6	Total-Sky GEO Method	See Table 2.12-13

Table 2.12-8 List of the SDSs contained in the Clear-Sky Raw Data Average Vgroup.

Table 2.12-8. Clear-Sky Raw Data Average in SRBAVG1

SDS Name	Data Type	Units	Range	No. of Elements Monthly Hourly	No. of Elements Monthly
Clear-sky TOA SW Flux - Raw Data Average	32-Bit Float	Wm^{-2}	0.0 .. 800.0	72	3
Clear-sky TOA LW Flux - Raw Data Average	32-Bit Float	Wm^{-2}	0.0 .. 400.0	72	3
Clear-sky TOA WN Flux - Raw Data Average	32-Bit Float	Wm^{-2}	0.0 .. 800.0	72	3
Clear-sky TOA Albedo - Raw Data Average	32-Bit Float	N/A	0.0 .. 1.0	72	3
Clear-sky TOA Net Flux - Raw Data Average	32-Bit Float	Wm^{-2}	-300.0 .. 400.0	72	3

Table 2.12-9 List of the SDSs contained in the Total-Sky Raw Data Average Vgroup.

Table 2.12-9. Total-Sky Raw Data Average in SRBAVG1 (1 of 2)

SDS Name	Data Type	Units	Range	No. of Elements Monthly Hourly	No. of Elements Monthly
Total-sky TOA SW Flux - Raw Data Average	32-Bit Float	Wm^{-2}	0.0 .. 800.0	72	3
Total-sky TOA LW Flux - Raw Data Average	32-Bit Float	Wm^{-2}	0.0 .. 400.0	72	3
Total-sky TOA WN Flux - Raw Data Average	32-Bit Float	Wm^{-2}	0.0 .. 800.0	72	3

Table 2.12-9. Total-Sky Raw Data Average in SRBAVG1 (2 of 2)

SDS Name	Data Type	Units	Range	No. of Elements Monthly Hourly	No. of Elements Monthly
Total-sky TOA Albedo - Raw Data Average	32-Bit Float	N/A	0.0 .. 1.0	72	3
Total-sky TOA Net Flux - Raw Data Average	32-Bit Float	Wm^{-2}	-300.0 .. 400.0	72	3

Table 2.12-10 List of the SDSs contained in the Clear-Sky non-GEO Method Vgroup.

Table 2.12-10. Clear-Sky non-GEO Method in SRBAVG1

SDS Name	Data Type	Units	Range	No. of Elements Monthly Hourly	No. of Elements Monthly
Clear-sky TOA SW Flux - non-GEO Interpolation	32-Bit Float	Wm^{-2}	0.0 .. 800.0	72	3
Clear-sky TOA LW Flux - non-GEO Interpolation	32-Bit Float	Wm^{-2}	0.0 .. 400.0	72	3
Clear-sky TOA WN Flux - non-GEO Interpolation	32-Bit Float	Wm^{-2}	0.0 .. 800.0	72	3
Clear-sky TOA Albedo - non-GEO Interpolation	32-Bit Float	N/A	0.0 .. 1.0	72	3
Clear-sky TOA Net Flux - non-GEO Interpolation	32-Bit Float	Wm^{-2}	-300.0 .. 400.0	72	3

Table 2.12-11 List of the SDSs contained in the Total-Sky non-GEO Method Vgroup.

Table 2.12-11. Total-Sky non-GEO Method in SRBAVG1

SDS Name	Data Type	Units	Range	No. of Elements Monthly Hourly	No. of Elements Monthly
Total-sky TOA SW Flux - non-GEO Interpolation	32-Bit Float	Wm^{-2}	0.0 .. 800.0	72	3
Total-sky TOA LW Flux - non-GEO Interpolation	32-Bit Float	Wm^{-2}	0.0 .. 400.0	72	3
Total-sky TOA WN Flux - non-GEO Interpolation	32-Bit Float	Wm^{-2}	0.0 .. 800.0	72	3
Total-sky TOA Albedo - non-GEO Interpolation	32-Bit Float	N/A	0.0 .. 1.0	72	3
Total-sky TOA Net Flux - non-GEO Interpolation	32-Bit Float	Wm^{-2}	-300.0 .. 400.0	72	3

Table 2.12-12 List of the SDSs contained in the Clear-Sky GEO Method Vgroup.

Table 2.12-12. Clear-Sky GEO Method in SRBAVG1

SDS Name	Data Type	Units	Range	No. of Elements Monthly Hourly	No. of Elements Monthly
Clear-sky TOA SW Flux - GEO Interpolation	32-Bit Float	Wm^{-2}	0.0 .. 800.0	72	3
Clear-sky TOA LW Flux - GEO Interpolation	32-Bit Float	Wm^{-2}	0.0 .. 400.0	72	3
Clear-sky TOA WN Flux - GEO Interpolation	32-Bit Float	Wm^{-2}	0.0 .. 800.0	72	3
Clear-sky TOA Albedo - GEO Interpolation	32-Bit Float	N/A	0.0 .. 1.0	72	3
Clear-sky TOA Net Flux - GEO Interpolation	32-Bit Float	Wm^{-2}	-300.0 .. 400.0	72	3

Table 2.12-13 List of the SDSs contained in the Total-Sky GEO Method Vgroup.

Table 2.12-13. Total-Sky GEO Method in SRBAVG1

SDS Name	Data Type	Units	Range	No. of Elements Monthly Hourly	No. of Elements Monthly
Total-sky TOA SW Flux - GEO Interpolation	32-Bit Float	Wm^{-2}	0.0 .. 800.0	72	3
Total-sky TOA LW Flux - GEO Interpolation	32-Bit Float	Wm^{-2}	0.0 .. 400.0	72	3
Total-sky TOA WN Flux - GEO Interpolation	32-Bit Float	Wm^{-2}	0.0 .. 800.0	72	3
Total-sky TOA Albedo - GEO Interpolation	32-Bit Float	N/A	0.0 .. 1.0	72	3
Total-sky TOA Net Flux - GEO Interpolation	32-Bit Float	Wm^{-2}	-300.0 .. 400.0	72	3

Table 2.12-14 List of the Vgroups contained in the Surface Fluxes Vgroup.

Table 2.12-14. Surface Fluxes in SRBAVG1 (1 of 2)

Vgroup Number	Vgroup Name	Monthly Hourly Averages / Monthly (Hour) Averages
1	Clear-Sky Net	See Table 2.12-15
2	Total-Sky Net	See Table 2.12-16
3	Clear-Sky Down	See Table 2.12-17

Table 2.12-14. Surface Fluxes in SRBAVG1 (2 of 2)

Vgroup Number	Vgroup Name	Monthly Hourly Averages / Monthly (Hour) Averages
4	Total-Sky Down	See Table 2.12-18

Table 2.12-15 List of the SDSs contained in the Clear-Sky Net Vgroup.

Table 2.12-15. Clear-Sky Net in SRBAVG1

SDS Name	Data Type	Units	Range	No. of Elements Monthly Hourly	No. of Elements Monthly
Clear-sky Sfc Net SW Flux - Mod A	32-Bit Float	Wm^{-2}	0.0 .. 1400.0	72	3
Clear-sky Sfc Net SW Flux - Mod B	32-Bit Float	Wm^{-2}	0.0 .. 1400.0	72	3
Clear-sky Sfc Net LW Flux - Mod A	32-Bit Float	Wm^{-2}	-250.0 .. 50.0	72	3
Clear-sky Sfc Net LW Flux - Mod B	32-Bit Float	Wm^{-2}	-250.0 .. 50.0	72	3

Table 2.12-16 List of the SDSs contained in the Total-Sky Net Vgroup.

Table 2.12-16. Total-Sky Net in SRBAVG1

SDS Name	Data Type	Units	Range	No. of Elements Monthly Hourly	No. of Elements Monthly
Total-sky Sfc Net SW Flux - Mod A	32-Bit Float	Wm^{-2}	0.0 .. 1400.0	72	3
Total-sky Sfc Net SW Flux - Mod B	32-Bit Float	Wm^{-2}	0.0 .. 1400.0	72	3
Total-sky Sfc Net LW Flux - Mod A	32-Bit Float	Wm^{-2}	-250.0 .. 50.0	72	3
Total-sky Sfc Net LW Flux - Mod B	32-Bit Float	Wm^{-2}	-250.0 .. 50.0	72	3

Table 2.12-17 List of the SDSs contained in the Clear-Sky Down Vgroup.

Table 2.12-17. Clear-Sky Down in SRBAVG1 (1 of 2)

SDS Name	Data Type	Units	Range	No. of Elements Monthly Hourly	No. of Elements Monthly
Clear-sky Sfc Down SW Flux - Mod A	32-Bit Float	Wm^{-2}	0.0 .. 1400.0	72	3
Clear-sky Sfc Down SW Flux - Mod B	32-Bit Float	Wm^{-2}	0.0 .. 1400.0	72	3
Clear-sky Sfc Down LW Flux - Mod A	32-Bit Float	Wm^{-2}	0.0 .. 700.0	72	3
Clear-sky Sfc Down LW Flux - Mod B	32-Bit Float	Wm^{-2}	0.0 .. 700.0	72	3

Table 2.12-17. Clear-Sky Down in SRBAVG1 (2 of 2)

SDS Name	Data Type	Units	Range	No. of Elements Monthly Hourly	No. of Elements Monthly
Clear-sky Sfc Down WN Flux - Mod A	32-Bit Float	Wm^{-2}	0.0 .. 700.0	72	3

Table 2.12-18 List of the SDSs contained in the Total-Sky Down Vgroup.

Table 2.12-18. Total-Sky Down in SRBAVG1

SDS Name	Data Type	Units	Range	No. of Elements Monthly Hourly	No. of Elements Monthly
Total-sky Sfc Down SW Flux - Mod A	32-Bit Float	Wm^{-2}	0.0 .. 1400.0	72	3
Total-sky Sfc Down SW Flux - Mod B	32-Bit Float	Wm^{-2}	0.0 .. 1400.0	72	3
Total-sky Sfc Down LW Flux - Mod A	32-Bit Float	Wm^{-2}	0.0 .. 700.0	72	3
Total-sky Sfc Down LW Flux - Mod B	32-Bit Float	Wm^{-2}	0.0 .. 700.0	72	3
Total-sky Sfc Down WN Flux - Mod A	32-Bit Float	Wm^{-2}	0.0 .. 700.0	72	3

Table 2.12-19 List of the SDSs contained in the Surface Data Vgroup.

Table 2.12-19. Surface Data in SRBAVG1

SDS Name	Data Type	Units	Range	No. of Elements Monthly Hourly	No. of Elements Monthly
LW Surface Emissivity	32-Bit Float	N/A	0.0 .. 1.0	24	1
WN Surface Emissivity	32-Bit Float	N/A	0.0 .. 1.0	24	1

Total Bits/Region Record: 40,896
Total Bits/Zonal-Global Record: 65,792
Total Bytes/Region Record: 5,112
Total Bytes/Zonal-Global Record: 8,224
Total Records/File: 64,981
Total Bits/File: 6,932,692,628
Total Bytes/File: 866,586,616

Table 2.12-20 List of the Vgroups contained in the CERES and GEO Layer Cloud Properties (SRBAVG2) or CERES Layer Cloud Properties (SRBAVG3) Vgroups.

Table 2.12-20. CERES and GEO Layer Cloud Properties (SRBAVG2) and CERES Layer Cloud Properties (SRBAVG3)

Vgroup Number	Vgroup Name	Monthly Hourly Averages / Monthly (Hour) Averages
1	High	See Table 2.12-21
2	Upper Middle	See Table 2.12-21
3	Lower Middle	See Table 2.12-21
4	Low	See Table 2.12-21

Table 2.12-21 List of the SDSs contained in the High, Upper Middle, Lower Middle, Low Vgroups.

Table 2.12-21. High, Uppermid, Lowermid, Low (mean, stdev, num obs) in SRBAVG2 and SRBAVG3

SDS Name	Data Type	Units	Range	No. of Elements Monthly Hourly	No. of Elements Monthly
Cloud Area Fraction	32-Bit Float	N/A	0.0 .. 100.0	72	3
Cloud Effective Pressure	32-Bit Float	hPa	0.0 .. 1100.0	72	3
Cloud Effective Temperature	32-Bit Float	K	180.0 .. 350.0	72	3
Cloud Effective Height	32-Bit Float	km	0.0 .. 20.0	72	3
Cloud Top Pressure	32-Bit Float	hPa	0.0 .. 1100.0	72	3
Cloud Base Pressure	32-Bit Float	hPa	0.0 .. 1100.0	72	3
Cloud Particle Phase	32-Bit Float	fraction	1.0 .. 2.0	72	3
Liquid Water Path	32-Bit Float	gm^{-2}	0.0 .. 10000.0	72	3
Ice Water Path	32-Bit Float	gm^{-2}	0.0 .. 10000.0	72	3
Water Particle Radius	32-Bit Float	micron	0.0 .. 40.0	72	3
Ice Particle Effective Diam	32-Bit Float	micron	0.0 .. 300.0	72	3
Infrared Emissivity	32-Bit Float	N/A	0.0 .. 2.0	72	3
Cloud Visible Optical Depth - lin	32-Bit Float	N/A	0.0 .. 100.0	72	3
Cloud Visible Optical Depth - log	32-Bit Float	N/A	0.0 .. 100.0	72	3
Cloud Vertical Aspect Ratio	32-Bit Float	N/A	0.0 .. 20.0	72	3

Total Bits/Record:	**219,424**
Total Bytes/Record:	**27,256**
Total Record/File:	**64,981**
Total Bits/File:	**14,258,390,944**
Total Bytes/File:	**1,771,122,136**

SRBAVG Revision Record

The product Revision Record contains information pertaining to approved document changes. The table lists the date the Software Configuration Change Request (SCCR) was approved, the Release and Version Number, the SCCR number, a short description of the revision, and the revised sections. The document authors are listed on the cover.

SRBAVG Revision Record

SCCR Approval Date	Release/ Version Number	SCCR Number	Description of Revision	Section(s) Affected
6/17/02	R3V2	368	• Changed column clouds to layer clouds and deleted the angular model scene types. • Added SRBAVG3. • Added SRBAVG3 and the Vgroup names. • Added region number, colatitude and longitude. • Changed ERBE-like to non-GEO. • Changed the net flux range. • Changed the net flux range and the ERBE-like to non-GEO. • Added another Vgroup name for cloud. • Changed the number of elements monthly hourly of the total cloud area fraction from 24 to 72. • Updated format to comply with standards.	2.12 2.12-2 & 3 2.12-5 2.12-6 2.12-7 2.12-8, 9,12,13 2.12-10 & 11 2.12-20 2.12-21 All
3/25/04	R3V3	516	• Updated information to add "Edition2A" to Terra under Product Version. • Updated format to comply with standards.	2.12 All

3.0 Internal Data Products

This section describes the internal CERES data products which are stored at the Langley DAAC. Each subsection contains a brief overview of the purpose and content of the data product followed by one or more tables which list every parameter contained in the product. The following data attributes are described in the overview sections:

- Level - The EOS data products are defined in terms of "levels"[1]
- Frequency - How often the product is received or produced
- Configuration Code - Unique identifier that defines the software and input file vesions used to produce the products
- 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 within 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.)

Additional tables may 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

Total file sizes are also provided. The bolded entries within the file are names for the group of parameters which follow.

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1. **Level 0:** raw instrument data at full sensor resolution.
Level 1A: raw instrument data at full sensor resolution, time-referenced, and annotated with ancillary information (including radiometric calibration coefficients and geolocation parameters such as platform ephemeris) computed and appended but not applied to the Level 0 data.
Level 1B: Level 1A data processed to sensor units and geolocated.
Level 2: derived geophysical variables at the same resolution and location as the Level 1 source data.
Level 3: geophysical variables mapped on uniform space-time grids, usually with some completeness and consistency.
Level 4: model output or results from analyses of lower level data, e.g., variables derived from multiple measurements.

Internal Data Products Revision Record

The product Revision Record contains information pertaining to approved section changes. The table lists the date the Software Configuration Change Request (SCCR) was approved, the Release and Version Number, the SCCR number, a short description of the revision, and the revised sections. The authors are listed on the document cover.

Internal Data Products Revision Record

SCCR Approval Date	Release/ Version Number	SCCR Number	Description of Revision	Section(s) Affected
N/A	R3V1	N/A	• Updated format to comply with standards.	All

3.1 Instrument Production Data Set (INSTR)

EOSDIS Product Code: CERX00a

The Instrument Production Data Set (INSTR) is the Level 0 raw data from the CERES Scanner. It is structured into packets by the onboard software as programmed by the instrument developer, TRW. The packets are formatted according to Consultative Committee for Space Data Systems (CCSDS) standards. Although the CERES output is the same on each satellite, the packets contain ancillary information which are unique to a particular spacecraft. There are six basic pieces of information contained in a normal CERES data packet (e.g., science output format):

1. Packet Header - Same CCSDS format for all instruments.
2. Time (secondary header) - format 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 TRMM Level 0 file format is illustrated in Figure 3.1-1 and the Terra Level 0 file format is illustrated in Figure 3.1-2. Table 3.1-1 and Table 3.1-2 lists the parameters and sizes for TRMM Level 0 files. Table 3.1-3 and Table 3.1-4 lists the parameters and sizes for Terra Level 0 files. Table 3.1-5 and Table 3.1-6 lists the parameters and sizes for Aqua Level 0 files.

Level: 0
Type: Internal
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

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)

QAC - List of packet IDs known to be corrupted or unusable
(Minimum number of QAC entries is always = 1)

MDUL - List of packet IDs missing

Figure 3.1-1. TRMM Level 0 File Format

Header File (Minumum Number = 384 Bytes)
Instrument Data Packets (Number of Packets x 7058 Bytes)

Figure 3.1-2. Terra Level 0 File Format

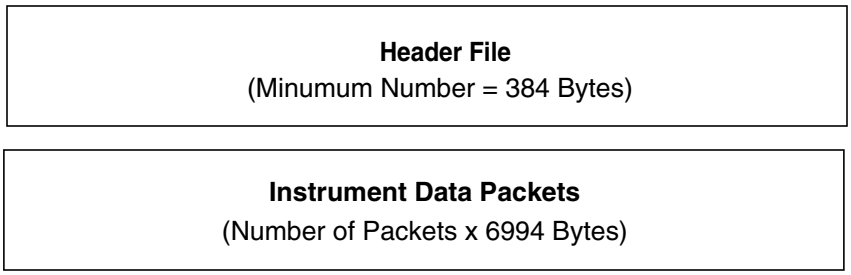

Figure 3.1-3. Aqua Level 0 File Format

Table 3.1-1. TRMM Instrument Production Data Set (INSTR) (1 of 2)

Description	Element Number	Units	Range	Elements per Record	Bits per Element
INSTR_PDS FILE HEADER					
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_DATA_PACKET [1..13091]					
Primary Packet_Header					
Version Number	1	N/A	N/A	1	3
Type	2	N/A	N/A	1	1
Secondary Header Flag	3	N/A	N/A	1	1
APID	4	N/A	N/A	1	11
Sequence Flags	5	N/A	N/A	1	2
Packet Sequence Count	6	N/A	N/A	1	14
Packet Length	7	N/A	N/A	1	16
Secondary Packet_Header					
Time Data	8	N/A	N/A	1	64
Instrument_Packet_Status					
Spare 1	9	N/A	N/A	1	16
Timecode ID	10	N/A	N/A	1	1
Quicklook Flag	11	N/A	N/A	1	1
Instrument ID	12	N/A	N/A	1	5
Data Version	13	N/A	N/A	1	5
Data Indicator	14	N/A	N/A	1	4
Packet Counter	15	N/A	0..65535	1	16
Spare 2	16	N/A	N/A	1	16
Spare 3	17	N/A	N/A	1	16
Measurement_Data (1 of the 5 following record types):					
Science_Record [660]					

Table 3.1-1. TRMM Instrument Production Data Set (INSTR) (2 of 2)

Description	Element Number	Units	Range	Elements per Record	Bits per Element
Azimuth Position Count	18	count	0..65535	660	16
Elevation Position Count	19	count	0..65535	660	16
Total Detector Output	20	count	0..4095	660	12
WN Detector Output	21	count	0..4095	660	12
SW Detector Output	22	count	0..4095	660	12
Instrument Analog Data - (Reference 3)	23	-	-	660	12
Memory_Record [660]					
Azimuth Position Count	19	count	0..65535	660	16
Elevation Position Count	20	count	0..65535	660	16
DAP Memory Dump Data	21	N/A	0..65535	660	16
ICP Memory Dump Data	22	N/A	0..65535	660	16
Fill Data	23	N/A	0..15	660	4
Instrument Analog Data - (Reference 3)	24	-	-	660	12
Gimbal_Record [660]					
Azimuth Position Count	19	count	0..65535	660	16
Elevation Position Count	20	count	0..65535	660	16
Elevation Error	21	count	0..65535	660	16
Azimuth Error	22	count	0..65535	660	16
Fill Data	23	N/A	0..15	660	4
Instrument Analog Data - (Reference 3)	24	-	-	660	12
Processor_Op_Record [660]					
Azimuth Position Count	19	count	0..65535	660	16
Elevation Position Count	20	count	0..65535	660	16
DAP Timing	21	N/A	0..65535	660	16
ICP Timing	22	N/A	0..65535	660	16
Fill Data	23	N/A	0..15	660	4
Instrument Analog Data - (Reference 3)	24	-	-	660	12
Fixed_Record [660]					
Fixed Pattern in Elevation Field	19	N/A	0..65535	660	16
Fixed Pattern for Azimuth Field	20	N/A	0..65535	660	16
Fixed Pattern for Total Channel Field	21	N/A	0..4095	660	12
Fixed Pattern for WN Channel Field	22	N/A	0..4095	660	12
Fixed Pattern for SW Channel Field	23	N/A	0..4095	660	12
Fixed Pattern for Analog Field	24	N/A	0..4095	660	12
Instrument Digital Status - (Reference 3)	25	-	-	1	2960
Fill Data	26	N/A	N/A	1	1104
INSTR_PDS FILE FOOTER					
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

Table 3.1-2. TRMM Instrument Production Data Set Sizes

Description	Sizes
Total Header Bits/File:	416
Maximum Data Bits/ Packet Record:	57,056
Maximum Records/File:	13,091
Maximum Data Bits/File:	746,920,096
Minimum Footer Bits/File:	72
Total Bits/File:	746,920,584
Total Bytes/File:	93,365,073
Total MBytes/file (1MB = 1024*1024 Bytes):	**89.04**

Table 3.1-3. Terra Instrument Production Data Set (INSTR) (1 of 3)

Description	Element Number	Units	Range	Elements per Record	Bits per Element
INSTR_PDS Header File					
See Reference 8, Table 8.1.2.7-1. PDS/EDS Construction Record					
INSTR_PDS_DATA_PACKET [1..13091]					
Primary Packet_Header					
Version Number	1	N/A	N/A	1	3
Type	2	N/A	N/A	1	1
Secondary Header Flag	3	N/A	N/A	1	1
APID	4	N/A	N/A	1	11
Sequence Flags	5	N/A	N/A	1	2
Packet Sequence Count	6	N/A	N/A	1	14
Packet Length	7	N/A	N/A	1	16
Secondary Packet_Header					
Time Data	8	N/A	N/A	1	64
Quick Look Flag	9	N/A	N/A	1	8
Instrument_Packet_Status					
Spare 1	10	N/A	N/A	1	8
Timecode ID	11	N/A	N/A	1	1
Quicklook Flag	12	N/A	N/A	1	1
Instrument ID	13	N/A	N/A	1	5
Data Version	14	N/A	N/A	1	5
Data Indicator	15	N/A	N/A	1	4
Packet Counter	16	N/A	N/A	1	16
Spare 2	17	N/A	N/A	1	16
Spare 3	18	N/A	N/A	1	16
Measurement_Data (1 of the 5 following record types):					
Science_Record [660]					

Table 3.1-3. Terra Instrument Production Data Set (INSTR) (2 of 3)

Description	Element Number	Units	Range	Elements per Record	Bits per Element
Azimuth Position Count	19	count	0..65535	660	16
Elevation Position Count	20	count	0..65535	660	16
Total Detector Output	21	count	0..4095	660	12
WN Detector Output	22	count	0..4095	660	12
SW Detector Output	23	count	0..4095	660	12
Instrument Analog Data - (Reference 3)	24	-	-	660	12
Memory_Record [660]					
Azimuth Position Count	19	count	0..65535	660	16
Elevation Position Count	20	count	0..65535	660	16
DAP Memory Dump Data	21	N/A	0..65535	660	16
ICP Memory Dump Data	22	N/A	0..65535	660	16
Fill Data	23	N/A	0..15	660	4
Instrument Analog Data - (Reference 3)	24	-	-	660	12
Gimbal_Record [660]					
Azimuth Position Count	19	count	0..65535	660	16
Elevation Position Count	20	count	0..65535	660	16
Elevation Error	21	count	0..65535	660	16
Azimuth Error	22	count	0..65535	660	16
Fill Data	23	N/A	0..15	660	4
Instrument Analog Data - (Reference 3)	24	-	-	660	12
Processor_Op_Record [660]					
Azimuth Position Count	19	count	0..65535	660	16
Elevation Position Count	20	count	0..65535	660	16
DAP Timing	21	N/A	0..65535	660	16
ICP Timing	22	N/A	0..65535	660	16
Fill Data	23	N/A	0..15	660	4
Instrument Analog Data - (Reference 3)	24	-	-	660	12
Fixed_Record [660]					
Fixed Pattern in Elevation Field	19	N/A	0..65535	660	16
Fixed Pattern for Azimuth Field	20	N/A	0..65535	660	16
Fixed Pattern for Total Channel Field	21	N/A	0..4095	660	12
Fixed Pattern for WN Channel Field	22	N/A	0..4095	660	12
Fixed Pattern for SW Channel Field	23	N/A	0..4095	660	12
Fixed Pattern for Analog Field	24	N/A	0..4095	660	12
Instrument Digital Status - (Reference 3)	25	-	-	1	2960
Terra_Ancillary_Data					
Ancillary Time Stamp	26	count	$0..1.84x10^1$	1	64
GPS/UTC Time Conversion	27	count	$0..4.29x10^9$	1	32
Solar Array Current	28	count	0..255	1	8
Mag Coil Current X	29	count	0..255	1	8
Mag Coil Current Y	30	count	0..255	1	8

Table 3.1-3. Terra Instrument Production Data Set (INSTR) (3 of 3)

Description	Element Number	Units	Range	Elements per Record	Bits per Element
Mag Coil Current Z	31	count	0..255	1	8
Satellite Position (X) Count	32	count	$0..4.29x10^9$	1	32
Satellite Position (Y) Count	33	count	$0..4.29x10^9$	1	32
Satellite Position (Z) Count	34	count	$0..4.29x10^9$	1	32
Satellite Velocity (X) Count	35	count	$0..4.29x10^9$	1	32
Satellite Velocity (Y) Count	36	count	$0..4.29x10^9$	1	32
Satellite Velocity (Z) Count	37	count	$0..4.29x10^9$	1	32
Satellite Attitude (Roll) Count	38	count	0..65535	1	16
Satellite Attitude (Pitch) Count	39	count	0..65535	1	16
Satellite Attitude (Yaw) Count	40	count	0..65535	1	16
Satellite Attitude Rate (Roll) Count	41	count	0..65535	1	16
Satellite Attitude Rate (Pitch) Count	42	count	0..65535	1	16
Satellite Attitude Rate (Yaw) Count	43	count	0..65535	1	16
Solar X Position	44	count	0..255	1	8
Solar Y Position	45	count	0..255	1	8
Solar Z Position	46	count	0..255	1	8
Lunar X Position	47	count	0..255	1	8
Lunar Y Position	48	count	0..255	1	8
Lunar Z Position	49	count	0..255	1	8

Table 3.1-4. Terra Instrument Production Data Set Sizes

Description	Sizes
Header File:	
Total Header Bits/File (typical max):	5,760
Total Bytes/File:	720
Total MBytes/file (1MB = 1024*1024 Bytes):	**0.0007**
Data File:	
Maximum Data Bits/ Packet Record:	56,464
Maximum Records/File:	13,091
Maximum Data Bits/File:	739,170,224
Minimum Footer Bits/File:	0
Total Bits/File:	739,170,224
Total Bytes/File:	92,396,278
Total MBytes/file (1MB = 1024*1024 Bytes):	**88.12**

Table 3.1-5. Aqua Instrument Production Data Set (INSTR) (1 of 2)

Description	Element Number	Units	Range	Elements per Record	Bits per Element
INSTR_PDS File Header					
See Reference 8, Table 8.1.2.7-1. PDS/EDS Construction Record					
INSTR_PDS_DATA_PACKET [1..13091]					
Primary Packet_Header					
Version Number	1	N/A	N/A	1	3
Type	2	N/A	N/A	1	1
Secondary Header Flag	3	N/A	N/A	1	1
APID	4	N/A	N/A	1	11
Sequence Flags	5	N/A	N/A	1	2
Packet Sequence Count	6	N/A	N/A	1	14
Packet Length	7	N/A	N/A	1	16
Secondary Packet_Header					
Time Data	8	N/A	N/A	1	64
Quick Look Flag	9	N/A	N/A	1	8
Instrument_Packet_Status					
Spare 1	10	N/A	N/A	1	8
Timecode ID	11	N/A	N/A	1	1
Quicklook Flag	12	N/A	N/A	1	1
Instrument ID	13	N/A	N/A	1	5
Data Version	14	N/A	N/A	1	5
Data Indicator	15	N/A	N/A	1	4
Packet Counter	16	N/A	N/A	1	16
Spare 2	17	N/A	N/A	1	16
Spare 3	18	N/A	N/A	1	16
Measurement_Data (1 of the 5 following record types):					
Science_Record [660]					
Azimuth Position Count	19	count	0..65535	660	16
Elevation Position Count	20	count	0..65535	660	16
Total Detector Output	21	count	0..4095	660	12
WN Detector Output	22	count	0..4095	660	12
SW Detector Output	23	count	0..4095	660	12
Instrument Analog Data - (Reference 3)	24	-	-	660	12
Memory_Record [660]					
Azimuth Position Count	19	count	0..65535	660	16
Elevation Position Count	20	count	0..65535	660	16
DAP Memory Dump Data	21	N/A	0..65535	660	16
ICP Memory Dump Data	22	N/A	0..65535	660	16
Fill Data	23	N/A	0..15	660	4

Table 3.1-5. Aqua Instrument Production Data Set (INSTR) (2 of 2)

Description	Element Number	Units	Range	Elements per Record	Bits per Element
Instrument Analog Data - (Reference 3)	24	-	-	660	12
Gimbal_Record [660]					
Azimuth Position Count	19	count	0..65535	660	16
Elevation Position Count	20	count	0..65535	660	16
Elevation Error	21	count	0..65535	660	16
Azimuth Error	22	count	0..65535	660	16
Fill Data	23	N/A	0..15	660	4
Instrument Analog Data - (Reference 3)	24	-	-	660	12
Processor_Op_Record [660]					
Azimuth Position Count	19	count	0..65535	660	16
Elevation Position Count	20	count	0..65535	660	16
DAP Timing	21	N/A	0..65535	660	16
ICP Timing	22	N/A	0..65535	660	16
Fill Data	23	N/A	0..15	660	4
Instrument Analog Data - (Reference 3)	24	-	-	660	12
Fixed_Record [660]					
Fixed Pattern in Elevation Field	19	N/A	0..65535	660	16
Fixed Pattern for Azimuth Field	20	N/A	0..65535	660	16
Fixed Pattern for Total Channel Field	21	N/A	0..4095	660	12
Fixed Pattern for WN Channel Field	22	N/A	0..4095	660	12
Fixed Pattern for SW Channel Field	23	N/A	0..4095	660	12
Fixed Pattern for Analog Field	24	N/A	0..4095	660	12
Instrument Digital Status - (Reference 3)	25	-	-	1	2960

Table 3.1-6. Aqua Instrument Production Data Set Sizes

Description	Sizes
Header File:	
Total Header Bits/File (typical max):	5,760
Total Header Bytes/File:	720
Total MBytes/file (1MB = 1024*1024 Bytes):	**0.0007**
Data File:	
Maximum Data Bits/ Packet Record:	55,952
Maximum Records/File:	13,091
Maximum Data Bits/File:	732,467,632
Minimum Footer Bits/File:	0
Total Bits/File:	732,467,632
Total Bytes/File:	91,558,454
Total MBytes/file (1MB = 1024*1024 Bytes):	**87.32**

INSTR Revision Record

The product Revision Record contains information pertaining to approved section changes. The table lists the date the Software Configuration Change Request (SCCR) was approved, the Release and Version Number, the SCCR number, a short description of the revision, and the revised sections. The authors are listed on the document cover.

INSTR Revision Record

SCCR Approval Date	Release/ Version Number	SCCR Number	Description of Revision	Section(s) Affected
N/A	R3V1	N/A	• Updated format to comply with standards.	All
N/A	R3V2	N/A	• Updated to add Aqua Level-0 File Format. • Updated format to comply with standards.	3.1 All

3.2 Instrument Earth Scans (IES)

EOSDIS Product Code: CER09

The IES data product contains one hour of data from a single CERES scanner. The data records are ordered in time with a separate index that sorts the records by an 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 the 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 contain only Earth-viewing measurements. For the Tropical Rainfall Measuring Mission (TRMM) mission, there are approximately 225 Earth-viewing footprints (records) that are stored on an IES from each 3.3-second half-scan. The IES product size is derived by using the number of 3.3-second half-scans per hour (approximately 1091) times the number of Earth-viewing measurements per half-scan (approximately 225 for TRMM and 195 for Terra). This yields approximately 245475 and 212745 measurements per TRMM and Terra IES data products, respectively. The product size used within this catalog is determined using the TRMM numbers. The summary of HDF structures is shown in Table 3.2-1. The metadata are listed in Appendix B, Table 3.2-2, and Table 3.2-3. The complete listing of science parameters for this data product can be found in Tables 3.2-4 and 3.2-5.

Level: 1B
Frequency: 1/Hour
Configuration Code: 009001 and greater

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

Table 3.2-1 summarizes the contents and estimated product size of each data structure type contained within an IES file. Each IES product contains three metadata structures and three Vdata structures.

Table 3.2-1. IES HDF Structure Summary

Name	Description Table	Records	Number of Fields	Nominal Size (Bytes)
CERES Baseline Header Metadata	Table B-1	1	36	~25907
CERES_metadata Vdata	Table B-2	1	14	~1024
IES Product-specific Metadata	Table 3.2-2	1	11	~66
IES Header Vdata	Table 3.2-3	1	22	132
Along Track Sort Index	Table 3.2-4	n: 1..245,475	2	1,963,800
IES Data Record	Table 3.2-5	n: 1..245,475	30	33,384,600
Total Size (Bytes):				**35,375,529**
Total Size (MBytes, including ~0.2% HDF overhead; 1MByte = 1024^2Bytes):				**33.8**

IES Metadata

The IES product includes three metadata structures. These include the CERES Baseline Header Metadata and the CERES_metadata Vdata Metadata, which are listed in Appendix B. The IES-specific metadata parameters are listed in Table 3.2-2. An IES Header Vdata is also included as part of the IES metadata and the parameters are listed in Table 3.2-3.

Table 3.2-2. IES Product-Specific Metadata

Item	Parameter Name	Units	Range	Data Type
1	ScanMode	N/A	XtrkOnly, RapsOnly, FapsOnly, Raps/Faps, Xtrk/Raps, Xtrk/Faps, Xtrk/Raps/Faps	s(14)
2	Second Time Constant Mode	N/A	Off, On	s(3)
3	Ephemeris Data Used	N/A	Real, Pred, Sim	s(4)
4	Attitude Data Used	N/A	Real, Sim	s(4)
5	Percent Total Channel Bad	N/A	0.0 .. 100.0	F11.6
6	Percent Window Channel Bad	N/A	0.0 .. 100.0	F11.6
7	Percent Short Wave Channel Bad	N/A	0.0 .. 100.0	F11.6
8	Percent FAPS	N/A	0.0 .. 100.0	F11.6

Table 3.2-2. IES Product-Specific Metadata

Item	Parameter Name	Units	Range	Data Type
9	Percent RAPS	N/A	0.0 .. 100.0	F11.6
10	Percent Transitional	N/A	0.0 .. 100.0	F11.6
11	Percent Crosstrack	N/A	0.0 .. 100.0	F11.6
12	TOA_Model_Used	N/A	CERES-TOA or WGS 84	s(9)
13	Number Input Files	N/A	1 .. n	uint32

IES Vdata

The IES product contains three Vdata structures: the IES Header Vdata (Table 3.2-3), the Along-track Sort Index Vdata (Table 3.2-4), and the IES Data Record (Table 3.2-5). These data structures are listed below, where each list contains the field number, the field or parameter name, the data type, the units, and the range. The fields are listed in the order they are written to an IES. Data types are referenced by their HDF classification (e.g. char8, float32, float64, int8, uint8, int16, uint16, int32, uint32, int64, uint64).

Table 3.2-3. IES Header Vdata

Field No.	Field Name	Data Type	Units	Range
1	Whole Julian Day	float64	day	2449353 .. 2458500
2	Fractional Julian Day	float64	day	-0.01 .. 1.01
3	Hour Number	uint32	N/A	0 .. 23
4	Colatitude of Subsatellite Point at Surface at Hour Start	float32	deg	0.0 .. 180.0
5	Longitude of Subsatellite Point at Surface at Hour Start	float32	deg	0.0 .. 360.0
6	Colatitude of Subsatellite Point at Surface at Hour End	float32	deg	0.0 .. 180.0
7	Longitude of Subsatellite Point at Surface at Hour End	float32	deg	0.0 .. 360.0
8	Along-track Angle of Satellite at Hour End	float32	deg	0.0 .. 360.0
9	Number of Footprints	uint32	N/A	0 .. 245475
10	Earth-Sun Distance at Hour Start	float32	AU	0.98 .. 1.02
11	Satellite Position X	float64	km	-8000.0 .. 8000.0
12	Satellite Position Y	float64	km	-8000. 0.. 8000.0
13	Satellite Position Z	float64	km	-8000.0 .. 8000.0
14	Satellite Velocity X	float64	km sec^{-1}	-10.0 .. 10.0
15	Satellite Velocity Y	float64	km sec^{-1}	-10.0 .. 10.0
16	Satellite Velocity Z	float64	km sec^{-1}	-10.0 .. 10.0
17	N Vector X	float64	N/A	0.0 .. 1.0
18	N Vector Y	float64	N/A	0.0 .. 1.0
19	N Vector Z	float64	N/A	0. 0.. 1.0

Table 3.2-3. IES Header Vdata

Field No.	Field Name	Data Type	Units	Range
20	Satellite Type	uint32	N/A	0 = TRMM, 1 = Terra, 2 = EOS-AM2, 3 = EOS-PM1, 4 = EOS-PM2
21	Instrument Type	uint32	N/A	0 = PFM, 1 = FM1, 2 = FM2, 3 = FM3, 4 = FM4, 5 = FM5
22	Instrument Scan Mode	uint32	N/A	0 = Crosstrack, 1 = RAPS, 2 = FAPS, 3 =Transitional
Number of bytes per Vdata record:				**132**

Table 3.2-4. Along-track Sort Index

Field No.	Field Name	Data Type	Units	Range
1	Footprint_index	uint32	N/A	1 .. n
2	Along_Track_Angle	float32	N/A	-20.0 .. 360.0
Number of bytes per Vdata record:				**8**

Table 3.2-5. IES Data Record

Field No.	Field Name / Parameter	Data Type	Units	Range
1	Colatitude of CERES FOV at TOA	float32	deg	0.0 .. 180.0
2	Longitude of CERES FOV at TOA	float32	deg	0.0 .. 360.0
3	Colatitude of CERES FOV at Surface	float32	deg	0.0 .. 180.0
4	Longitude of CERES FOV at Surface	float32	deg	0.0 .. 360.0
5	CERES Viewing Zenith at Surface	float32	deg	0.0 .. 90.0
6	CERES Solar Zenith at Surface	float32	deg	0.0 .. 180.0
7	CERES Relative Azimuth at Surface	float32	deg	0.0 .. 360.0
8	CERES Viewing Azimuth at Surface wrt North	float32	deg	0.0 .. 360.0
9	Cross-track Angle of CERES FOV at Surface	float32	deg	-90.0 .. 90.0
10	Along-track Angle of CERES FOV at Surface	float32	deg	-20.0 .. 360.0
11	Cone Angle of CERES FOV at Satellite	float32	deg	0.0 .. 90.0

Table 3.2-5. IES Data Record

Field No.	Field Name / Parameter	Data Type	Units	Range
12	Clock Angle of CERES FOV at Satellite wrt Inertial Velocity	float32	deg	0.0 .. 360.0
13	Rate of Change of Cone Angle	float32	deg sec^{-1}	-100.0 .. 100.0
14	Rate of Change of Clock Angle	float32	deg sec^{-1}	-10.0 .. 10.0
15	X Component of Satellite Inertial Velocity	float64	km sec^{-1}	-10.0 .. 10.0
16	Y Component of Satellite Inertial Velocity	float64	km sec^{-1}	-10.0 .. 10.0
17	Z Component of Satellite Inertial Velocity	float64	km sec^{-1}	-10.0 .. 10.0
18	Radius of Satellite from Center of Earth at Observation	float64	km	6000.0 .. 8000.0
19	CERES TOT Filtered Radiance, Upwards	float32	W $m^{-2}sr^{-1}$	0.0 .. 700.0
20	CERES SW Filtered Radiance, Upwards	float32	W $m^{-2}sr^{-1}$	-10.0 .. 510.0
21	CERES WN Filtered Radiance, Upwards	float32	W $m^{-2}sr^{-1}$	0.0 .. 50.0
22	Colatitude of Subsatellite Point at Surface at Observation	float32	deg	0.0 .. 180.0
23	Longitude of Subsatellite Point at Surface at Observation	float32	deg	0.0 .. 360.0
24	Colatitude of Subsolar Point at Surface at Observation	float32	deg	0.0 .. 180.0
25	Longitude of Subsolar Point at Surface at Observation	float32	deg	0.0 .. 360.0
26	Scan Sample Number	uint16	N/A	1 .. 660
27	Packet Number	uint16	N/A	0 .. 32767
28	Time of Observation	float64	day	2449353.0 .. 2458500.0
29	Radiance and mode flags	uint32	N/A	0 .. (2**31)-1
30	Absolute Packet Number	uint32	N/A	0 .. 65535
Number of bytes per Vdata record:				**136**

IES Revision Record

The product Revision Record contains information pertaining to approved section changes. The table lists the date the Software Configuration Change Request (SCCR) was approved, the Release and Version Number, the SCCR number, a short description of the revision, and the revised sections. The authors are listed on the document cover.

SRBAVG Revision Record

SCCR Approval Date	Release/ Version Number	SCCR Number	Description of Revision	Section(s) Affected
N/A	R3V1	N/A	• Updated format to comply with standards.	All

3.3 ERBE-like Regional Data (EID-6)

EOSDIS Product Code: CERX02

The ERBE-like Regional Data (EID-6) product is generated daily by the ERBE-like Inversion Subsystem (2.0). It contains data for each 2.5^o region observed during a day; there are 10,368 possible regions. The EID-6 is a CERES Internal Data Product used to pass 2.5^o regional statistics calculated in Subsystem 2.0 to Subsystem 3.0. The EID-6 contains the following data as determined on a regional basis.

- 2.5^o one-dimensional region number
- Whole and fractional Julian date
- Average of shortwave and longwave TOA flux estimates
- Number of individual shortwave and longwave TOA flux estimates
- Standard deviation for shortwave and longwave TOA flux estimates
- Minimum and maximum individual estimates of shortwave and longwave radiant fluxes at the TOA
- Geographic scene type
- Cloud fraction (fraction of measurements associated with clear, partly-cloudy, mostly-cloudy, and overcast sky)
- Albedo fraction (fraction of shortwave measurements associated with clear, partly-cloudy, mostly-cloudy, and overcast sky)
- Satellite and Sun geometry [cosine of the solar zenith angle (shortwave estimates), spacecraft zenith angles (all estimates), relative azimuth angles (shortwave estimates)]
- Standard deviation for clear-sky albedos
- Average for longwave, clear sky TOA flux estimates
- Standard deviation for longwave, clear-sky TOA flux estimates
- Number of individual longwave, clear-sky TOA flux estimates

A complete listing of parameters for this data product can be found in Table 3.3-1.

Level: 2
Frequency: 1/Day
Configuration Code: 000000 and greater

Time Interval Covered
File: Day
Record: N/A

Portion of Globe Covered
File: Regional
Record: Individual Region

Portion of Atmosphere Covered
File: TOA

Table 3.3-1. ERBE-like Daily Regional Averages (EID-6) (1 of 2)

Description	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
EID-6					
EID-6_File_Header					
Logical Header (RKEY)	N/A		1	64	
Logical Header (IBUF)	N/A		9	288	
Production Date	N/A		1	64	
Production Time	N/A		1	80	
Data Begin Date	N/A		6	384	
Data End Date	N/A		6	384	
EID-6_Regional_Data_Records					
Region number	number	1 .. 10368	1	64	1
Julian day	day	2449353 .. 2458500	1	64	2
Julian time	day	0 .. 1	1	64	3
Regional_Average_Estimates					
SW flux average value	$W\ m^{-2}$	0 .. 1400	1	64	4
LW flux average value	$W\ m^{-2}$	50 .. 450	1	64	5
Regional_SW_Statistics					
SW flux number of values	number	0 .. 500	1	64	6
SW flux standard deviation	$W\ m^{-2}$	0 .. 1400	1	64	7
SW flux minimum value	$W\ m^{-2}$	0 .. 1400	1	64	8
SW flux maximum value	$W\ m^{-2}$	0 .. 1400	1	64	9
Regional_LW_Statistics					
LW flux number of values	number	0 .. 500	1	64	10
LW flux standard deviation	$W\ m^{-2}$	0 .. 400	1	64	11
LW flux minimum value	$W\ m^{-2}$	50 .. 450	1	64	12
LW flux maximum value	$W\ m^{-2}$	50 .. 450	1	64	13
Geo_Scene					
Geographic Scene Type	N/A	1 .. 5	1	64	14
Clear-sky fraction	N/A	0 .. 1	1	64	15
Partly-cloudy fraction	N/A	0 .. 1	1	64	16
Mostly-cloudy fraction	N/A	0 .. 1	1	64	17
Overcast fraction	N/A	0 .. 1	1	64	18
Albedos					
Albedo for Clear-sky	N/A	0 .. 1	1	64	19
Albedo for partly-cloudy	N/A	0 .. 1	1	64	20
Albedo for mostly-cloudy	N/A	0 .. 1	1	64	21
Albedo for overcast	N/A	0 .. 1	1	64	22

Table 3.3-1. ERBE-like Daily Regional Averages (EID-6) (2 of 2)

Description	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
Angular_Averages					
Average of cosines of solar zenith angles	N/A	0 .. 1	1	64	23
Average of spacecraft zenith angles	deg	0 .. 90	1	64	24
Average of relative azimuth angles	deg	0 .. 180	1	64	25
Clear-sky_Statistics					
Clear-sky albedo standard deviation	N/A	0 .. 1	1	64	26
Clear-sky LW flux average value	$W\ m^{-2}$	50 .. 450	1	64	27
Clear-sky LW flux standard deviation	$W\ m^{-2}$	0 .. 400	1	64	28
Clear-sky LW flux number of values	number	0 .. 500	1	64	29
Spares					
Spare	N/A	N/A	1	64	30
Spare	N/A	N/A	1	64	31

TRMM Sizes

Total Data Bits/Record:	1984
Total Records/File (TRMM):	27597
Total Data Bits/File:	54752448
Total Bits/File:	54752448
Total MB/File:	**6.5**

Terra Sizes

Total Data Bits/Record:	1984
Total Records/File (Terra):	72845
Total Data Bits/File:	144524480
Total Bits/File:	144524480
Total MB/File:	**17.2**

Aqua Sizes

Total Data Bits/Record:	1984
Total Records/File (Aqua):	72597
Total Data Bits/File:	141423488
Total Bits/File:	141423488
Total MB/File:	**16.9**

Note: The sizing estimate for the EID6 in the "Internal Products Summary" Table 1.0-4 is for Terra.

EID6 Revision Record

The product Revision Record contains information pertaining to approved section changes. The table lists the date the Software Configuration Change Request (SCCR) was approved, the Release and Version Number, the SCCR number, a short description of the revision, and the revised sections. The authors are listed on the document cover.

EID6 Revision Record

SCCR Approval Date	Release/ Version Number	SCCR Number	Description of Revision	Section(s) Affected
N/A	R3V1	N/A	• Updated format to comply with standards.	All

3.4 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 (2160 x 1080=2,332,800 grid boxes). The data coverage is 24 hours and is produced every day. The CRH data product has visible albedo information.

The parameters are derived from cloud imager measurements by Subsystems 4.1 - 4.3. The CRH product is the same structure for both Moderate Resolution Imaging Spectrometer (MODIS) values and Visible Infrared Scanner (VIRS) values, and are differentiated by their file names. The CRH product is archived because the product is needed for reprocessing. A complete listing of parameters for these data products can be found in Table 3.4-1.

Level: 3
Frequency: Every Day
Configuration Code: 013006 and greater

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

Time Interval Covered
File: Life of Mission
Record: Every Day

Portion of Atmosphere Covered
File: Surface

Table 3.4-1. Clear Reflectance History (CRH)

Description	Param Num	Units	Range	Bits/Elem
CRH 0.6 micron albedo				
Visible albedo for collimated, overhead sun illumination	1	x10 percent	0 ...1000	16
Visible albedo running mean, overhead sun illumination	2	x10 percent	0 ...1000	16
Number of albedo counts, since last updated	3	N/A	> = 0	32
Total Data Bits/Grid:				64
Total Grids/File:				2,332,800
Total Data Bits/File:				149,299,200
Total Bits/CRH Data Set:				**149,299,200**
Total MBytes/CRH Data Set:				**17.8**

CRH Revision Record

The product Revision Record contains information pertaining to approved section changes. The table lists the date the Software Configuration Change Request (SCCR) was approved, the Release and Version Number, the SCCR number, a short description of the revision, and the revised sections. The authors are listed on the document cover.

CRH Revision Record

SCCR Approval Date	Release/ Version Number	SCCR Number	Description of Revision	Section(s) Affected
N/A	R3V1	N/A	• Updated format to comply with standards.	All

3.5 Gridded GEO Narrowband Radiances (GGEO)

EOSDIS Product Code: CERX14

The GGEO product is a single file containing metadata, a header record, and multiple data records. The metadata are the CERES Baseline Header Metadata listed in Table B-1 of Appendix B. The header record contains the year/month data date, the actual data starting and ending dates, and the first and the last zones found on the file.

Each data record, called an hourbox, contains data particular to a single grid region and hour. The number of hourboxes on the file is determined by the number of data hours per day, the maximum number of days per month (plus one day for overlap hours), and the number of regions in the nested grid for the zones contained on the file (8 hours per day x 32 days per month x 44012 regions on globe = 11,267,072 hourboxes maximum). Hourboxes for which there are no International Satellite Cloud Climatology Project (ISCCP) data are filled with default values.

A listing of the parameters contained within each data record can be found in Table 3.5-1. Following is a brief explanation of the parameters.

- The Satellite Number identifies the satellite which collected the hourbox radiance data.
- The Time parameter gives the Greenwich mean time (GMT) time for the “key” pixel in the hourbox (the pixel which lies closest to the region centroid).
- The three angle measurements are derived from the centroid of the region at the time indicated in the Time parameter.
- The visible and infrared radiance statistics give the mean, variance, and number for the pixels within the hourbox.

Level: 3
Frequency: Monthly
Configuration Code: 007002 and greater

Time Interval Covered
File: Monthly
Record: Every Third Hour

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

Portion of Atmosphere Covered
File: TOA

Table 3.5-1. Gridded GEO Narrowband Radiances (GGEO) Summary Table

Name	Description Table	Records	Number of Fields	Nominal Size (Bytes)
CERES Baseline Header Metadata	Table B-1	1	36	~25907
CERES_Metadata Vdata	Table B-2	1	14	~1024
GGEO Header Record	Table 3.5-2	1	5	44
GGEO Data Record	Table 3.5-3	11,267,072	11	44

Table 3.5-2. GGEO Header Record

Description	Element Number	Units	Range	Elements/ Record	Bits/ Elem	Bits/ Rec
Year/Month Data Date (yyyymm)		N/A	N/A	1	32	32
Data Starting Date (yyyyddd)		N/A	N/A	1	32	32
Data Ending Date (yyyyddd)		N/A	N/A	1	32	32
First Zone on File		N/A	N/A	1	32	32
Last Zone on File		N/A	N/A	1	32	32
Excess Header Space		N/A	N/A	N/A	N/A	192

Table 3.5-3. GGEO Data Record

Description	Element Number	Units	Range	Elements/ Record	Bits/ Elem	Elem Num	Bits/ Rec
Satellite Number	1	N/A	N/A	1	32	1	32
Time	2	hhmmss	0 .. 235959	1	32	2	32
Cos of Satellite Zenith Angle	3	N/A	-1.0 .. 1.0	1	32	3	32
Cos of Solar Zenith Angle	4	N/A	-1.0 .. 1.0	1	32	4	32
Relative Azimuth Angle	5	deg	0.0 .. 180.0	1	32	5	32
visible radiance: mean, var, num obs	6	$W\ m^{-2}sr^{-1}$	0.0 .. 20.0	3	32	6	96
infrared radiance: mean, var, num obs	7	$W\ m^{-2}sr^{-1}mm^{-1}$	0.0 .. 600.0	3	32	9	96

Total Meta Bits/File:	**70 752**
Total Data Bits/Record:	**352**
Total Records/File:	**11 267 072**
Total Data Bits/File:	**3 966 009 344**
Total Bits/File:	**3 966 080 096**
Total Bytes/File:	**495 760 012**
Total MBytes/File:	**472.8**

GGEO Revision Record

The product Revision Record contains information pertaining to approved section changes. The table lists the date the Software Configuration Change Request (SCCR) was approved, the Release and Version Number, the SCCR number, a short description of the revision, and the revised sections. The authors are listed on the document cover.

GGEO Revision Record

SCCR Approval Date	Release/ Version Number	SCCR Number	Description of Revision	Section(s) Affected
N/A	R3V1	N/A	• Updated format to comply with standards.	All

3.6 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 file are derived from several data sources external to the CERES system, such as the European Centre for Medium Range Weather Forecasting (ECMWF), Data Assimilation Office (DAO), NOAA, and various other meteorological satellites. These data have various horizontal and temporal resolutions. The Regrid MOA Subsystem interpolates the aerosol and ozone data horizontally to conform with the horizontal resolution of the meteorological data. An index number is assigned to each of the possible meteorological horizontal grids. The number of global regions, records and file sizes also change accordingly. Profile data are interpolated vertically to conform with CERES requirements. The MOA file also contains column precipitable water data measured by the Special Sensor Microwave/Imager (SSM/I) on their native grid (0.5° x 0.5°). For certain primary meterological data sources, the MOA file also contains the input skin temperature data on their native grid. All data are temporally interpolated to provide data to the CERES processing system on either every hour or every six hours, depending on the primary meterological data source.

The MOA contains the pressure, geopotential height, skin temperature, and u-vector and v-vector wind speed at the surface; vertical profiles of temperature and humidity for 58 atmospheric levels; vertical profiles for 18 atmospheric levels below the tropopause of u-vector and v-vector wind speed data; the tropopause height; air mass index; column precipitable water based on humidity profiles column precipitable 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 Tables 3.6-1 and Table 3.6-2. The sizes of the MOA files and of the parameters they contain are given in Table 3.6-3.

Level: 3
Frequency: 1/Hour or 1 every 6 Hours
Configuration Code: 009010 and greater

Portion of Globe Covered
File: Global
Record: One region

Time Interval Covered
File: 1 hour
Record: 1 hour

Portion of Atmosphere Covered
File: Surface to TOA

Table 3.6-1. Meteorological, Ozone, and Aerosol (MOA) Header

Description	Parameter Number	Units	Range	Elements/ Record	Data Type
Header					
Date and Hour		N/A	ASCII string	27	Character
MOA Processing Date		N/A	ASCII string	19	Character
Byte Buffer for Compiler Compatibilities		N/A	ASCII string	2	Character
MOA Grid Index		N/A	1 .. 7	1	32-bit Integer
Number of MOA Regions		N/A	13104 .. 44012	1	32-bit Integer
Temperature, Humidity, and Ozone Profile Fixed Pressure Levels		hPa	0 .. 1100	58	32-bit Real
Wind Speed Profile Pressure levels		hPa	0 .. 1100	18	32-bit Real

Table 3.6-2. MOA Regional Record (1 of 2)

Description	Parameter Number	Units	Range	Elements/ Record	Data Type
MOA Regional Record					
MOA Region Number	1	N/A	1 .. 44012	1	32-bit Integer
Surface Pressure	2	hPa	0 .. 1100	1	32-bit Real
Surface Geopotential Height	3	m	-100 .. 10000	1	32-bit Real
Surface Skin Temperature	4	K	175 .. 375	1	32-bit Real
Surface Wind Speed, U-Vector	5	m sec^{-1}	-100 .. 100	1	32-bit Real
Surface Wind Speed, V-Vector	6	m sec^{-1}	-100 .. 100	1	32-bit Real
Flag, Sea Surface State	7	N/A	0 .. 9	1	32-bit Integer
Flag, Source Surface Data	8	N/A	0 .. 4	1	32-bit Integer
Temperature Profiles	9	K	175 .. 375	58	32-bit Real
Specific Humidity Profiles	10	g kg^{-1}	0.001 .. 30.000	58	32-bit Real
Wind Speed Profile, U-Vector	11	m sec^{-1}	-100 .. 100	18	32-bit Real
Wind Speed Profile, V-Vector	12	m sec^{-1}	-100 .. 100	18	32-bit Real
Flag, Source Meteorological Profiles	13	N/A	0 .. 4	1	32-bit Integer
Tropopause Height	14	hPa	50 .. 450	1	32-bit Real
Air Mass Index	15	N/A	0 .. 10	1	32-bit Integer
Column Precipitable Water	16	cm	0.001 .. 10.000	1	32-bit Real
Column Averaged Relative Humidity	17	N/A	0 .. 100	1	32-bit Real
Microwave Precipitable Water	18	g cm^{-2}	0.001 .. 10.000	1	32-bit Real
Microwave Precipitable Water, std	19	g cm^{-2}	TBD	1	32-bit Real
Flag, Source Microwave Column Precipitable Water	20	N/A	0 .. 6	1	32-bit Integer
Ozone Mass Mixing Ratio Profiles	21	g g^{-1}	0.0 .. 0.00005	58	32-bit Real
Flag, Source Ozone Profile Data	22	N/A	0 .. 2	1	32-bit Integer

Table 3.6-2. MOA Regional Record (2 of 2)

Description	Parameter Number	Units	Range	Elements/ Record	Data Type
MOA Regional Record					
Column Ozone	23	DU	0 .. 500	1	32-bit Real
Flag, Source Column Ozone	24	N/A	0 .. 2	1	32-bit Integer
Optical Depth, Total Column	25	N/A	0 .. 2	1	32-bit Real
Flag, Source Optical Depth, Total Column	26	N/A	0 .. 1	1	32-bit Integer
SSM/I Regional Water Vapor Data					
Microwave Precipitable Water for SSM/I Region		g cm^{-2}	0.001 .. 10.000	200	32-bit Real
Skin Temperature Data					
Surface Temperature Data for GEOS3 or ECMWF Region		K	175 .. 375	180 or 200	32-bit Real

Table 3.6-3. MOA File and Parameter Sizes for Primary Data Sources

	DAO-GEOS2	DAO-GEOS3	ECMWF
Total Meta Megabytes/File	0.00034	0.00034	0.00034
Total Data Megabytes/MOA Regional Record	0.00088	0.00088	0.00088
Total MOA Regional Records/File	13104	44012	44012
Total MOA Regional Record Megabytes/File	12.1	40.7	40.7
Total Megabytes/SSM/I Record	0.00088	0.00088	0.00088
Total SSM/I Records	1296	1296	1296
Total SSM/I Data Megabytes/File	1.2	1.2	1.2
Total Megabytes/Skin Temperature Record	0	0.00088	0.00088
Total Skin Temperature Records	0	724	2048
Total Skin Temperature Megabytes/File	0	0.6	1.9
Total Megabytes/File	**13.3**	**42.5**	**43.8**
Total Files/Day	24	4	4
Total Megabytes/Day	319.2	170	175.2
Total Megabytes/Month	**9895.2**	**5270**	**5431.2**
Total Gigabytes/Month	9.9	5.3	5.4

Note: The MOA sizes shown in the Internal Products Summary, Table 1.0-4, are based on the sizes shown above in the ECMWF column.

MOA Revision Record

The product Revision Record contains information pertaining to approved section changes. The table lists the date the Software Configuration Change Request (SCCR) was approved, the Release and Version Number, the SCCR number, a short description of the revision, and the revised sections. The authors are listed on the document cover.

MOA Revision Record

SCCR Approval Date	Release/ Version Number	SCCR Number	Description of Revision	Section(s) Affected
N/A	R3V1	N/A	• Updated format to comply with standards.	All

4.0 Ancillary Data Products

This section describes the ancillary non-CERES data products which are stored at the Langley DAAC. Each subsection contains a brief overview of the purpose and content of the data product followed by one or more tables which list every parameter contained in the product. The following data attributes are described in the overview sections:

- Level - The EOS data products are defined in terms of "levels"[1]
- Type - Data type (Primary, 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 within 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.)

Additional tables may 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

Total file sizes are also provided. The bolded entries within the file are names for the group of parameters which follow.

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1. **Level 0:** raw instrument data at full sensor resolution.
Level 1A: raw instrument data at full sensor resolution, time-referenced, and annotated with ancillary information (including radiometric calibration coefficients and geolocation parameters such as platform ephemeris) computed and appended but not applied to the Level 0 data.
Level 1B: Level 1A data processed to sensor units and geolocated.
Level 2: derived geophysical variables at the same resolution and location as the Level 1 source data.
Level 3: geophysical variables mapped on uniform space-time grids, usually with some completeness and consistency.
Level 4: model output or results from analyses of lower level data, e.g., variables derived from multiple measurements.

Ancillary Data Products Revision Record

The product Revision Record contains information pertaining to approved section changes. The table lists the date the Software Configuration Change Request (SCCR) was approved, the Release and Version Number, the SCCR number, a short description of the revision, and the revised sections. The authors are listed on the document cover.

Ancillary Data Products Revision Record

SCCR Approval Date	Release/ Version Number	SCCR Number	Description of Revision	Section(s) Affected
N/A	R3V1	N/A	• Updated format to comply with standards.	All

4.1 VIRS Cloud Imager Data (VIRS CID)

EOSDIS Product Code: CERX05

The VIRS Cloud Imager Data (CID_VIRS) are Level-1B 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 estimated number of scan line records in 1 hour (11,817). The product is written in Hierarchical Data Format (HDF). It contains Vdata and Scientific Data Sets (SDS), which hold data for all of the scan line records. The VIRS HDF Structure Summary Table 4.1-1 lists the type of HDF structure along with the name of the structure. A complete listing of parameters for this data product can be found in Tables 4.1-2 and 4.1-3. The VIRS Level-1B product is described in more detail in the Level 1 File Specifications - Volume 3 (Reference 5). The five 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

Level: 1B
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 4.1-1. VIRS HDF Structure Summary

HDFName	HDF Structure Type	Num Records	Table Number	Size (bits)
VIRS Core Metadata	HDF Annotations	1	Reference 5	80 000
VIRS Product Specific Metadata	HDF Annotations	1	Reference 5	80 000
VIRS Swath Data for product decoding	HDF Vgroup	1	None	40 000
Scan Time	Vdata Structures	1 .. 11, 817	Table 4.1-2	756 288
Scan Status	Vdata Structures	1 .. 11, 817	Table 4.1-3	1 796 184
Navigation	Vdata Structures	1 .. 11, 817	Table 4.1-4	8 319 168
Geolocation	SDS Data Structures	1 .. 11, 817	Table 4.1-5	197 391 168
Calibration Counts	SDS Data Structures	1 .. 11, 817	Table 4.1-5	5 672 160
Local Direction	SDS Data Structures	1 .. 11, 817	Table 4.1-5	20 419 776
Channels	SDS Data Structures	1 .. 11, 817	Table 4.1-5	246 738 960
Total VIRS Megabytes/File:				**57.37**

Table 4.1-2. Scan Time VData

Field Name	Description	Field Num	Num Records	Data Type	Units	Range
scanTime	Time of the scan	1	1 .. 11, 817	64-bit float	sec	0 .. 86400

Table 4.1-3. Scan Status VData (1 of 2)

Field Name	Description	Field Num	Num Records	Data Type	Units	Range
missing	Missing Information Flag	1	1 .. 11, 817	8-bit integer	N/A	0 .. 2
validity	Status Mode Flag	2	1 .. 11, 817	8-bit integer	N/A	N/A
qac	Quality and Accounting Capsule	3	1 .. 11, 817	8-bit integer	N/A	N/A
geoQuality	Geolocation Quality	4	1 .. 11, 817	8-bit integer	N/A	N/A
ch1Quality	Quality of Channel Data	5	1 .. 11, 817	8-bit integer	N/A	N/A
ch2Quality	Quality of Channel Data	6	1 .. 11, 817	8-bit integer	N/A	N/A
ch3Quality	Quality of Channel Data	7	1 .. 11, 817	8-bit integer	N/A	N/A
ch4Quality	Quality of Channel Data	8	1 .. 11, 817	8-bit integer	N/A	N/A
ch5Quality	Quality of Channel Data	9	1 .. 11, 817	8-bit integer	N/A	N/A

Table 4.1-3. Scan Status VData (2 of 2)

Field Name	Description	Field Num	Num Records	Data Type	Units	Range
scOrient	Current Spacecraft Orientation	10	1 .. 11, 817	8-bit integer	N/A	0 .. 4
acsMode	Current ACS Mode	11	1 .. 11, 817	8-bit integer	N/A	0 .. 8
yawUpdateS	Yaw Update Status	12	1 .. 11, 817	8-bit integer	N/A	0 .. 2
virsInstS	VIRS Instrument Status	13	1 .. 11, 817	8-bit integer	N/A	0 .. 3
virsMode	VIRS Mode	14	1 .. 11, 817	8-bit integer	N/A	0 .. 3
virsAbnCon	VIRS Abnormal Conditions	15	1 .. 11, 817	8-bit integer	N/A	N/A
fractOrbitN	Fractional Orbit Number	16	1 .. 11, 817	32-bit float	N/A	N/A

Table 4.1-4. VIRS Navigation VData (1 of 2)

Field Name	Description	Field Num	Num Records	Data Type	Units	Range
scPosX	Spacecraft Geocentric Position	1	1 .. 11, 817	32-bit float	m	TBD
scPosY	Spacecraft Geocentric Position	2	1 .. 11, 817	32-bit float	m	TBD
scPosZ	Spacecraft Geocentric Position	3	1 .. 11, 817	32-bit float	m	TBD
scVelX	Spacecraft Geocentric Velocity	4	1 .. 11, 817	32-bit float	m sec^{-1}	TBD
scVelY	Spacecraft Geocentric Velocity	5	1 .. 11, 817	32-bit float	m sec^{-1}	TBD
scVelZ	Spacecraft Geocentric Velocity	6	1 .. 11, 817	32-bit float	m sec^{-1}	TBD
scLat	Spacecraft Geodetic Position	7	1 .. 11, 817	32-bit float	deg	TBD
scLon	Spacecraft Geodetic Position	8	1 .. 11, 817	32-bit float	deg	TBD
scAlt	Spacecraft Geodetic Position	9	1 .. 11, 817	32-bit float	m	TBD
scAttRoll	Spacecraft Geocentric Attitude	10	1 .. 11, 817	32-bit float	deg	TBD
scAttPitch	Spacecraft Geocentric Attitude	11	1 .. 11, 817	32-bit float	deg	TBD
scAttYaw	Spacecraft Geocentric Attitude	12	1 .. 11, 817	32-bit float	deg	TBD
att1	Sensor Orientation Matrix	13	1 .. 11, 817	32-bit float	N/A	N/A
att2	Sensor Orientation Matrix	14	1 .. 11, 817	32-bit float	N/A	N/A
att3	Sensor Orientation Matrix	15	1 .. 11, 817	32-bit float	N/A	N/A
att4	Sensor Orientation Matrix	16	1 .. 11, 817	32-bit float	N/A	N/A
att5	Sensor Orientation Matrix	17	1 .. 11, 817	32-bit float	N/A	N/A
att6	Sensor Orientation Matrix	18	1 .. 11, 817	32-bit float	N/A	N/A
att7	Sensor Orientation Matrix	19	1 .. 11, 817	32-bit float	N/A	N/A
att8	Sensor Orientation Matrix	20	1 .. 11, 817	32-bit float	N/A	N/A
att9	Sensor Orientation Matrix	21	1 .. 11, 817	32-bit float	N/A	N/A

Table 4.1-4. VIRS Navigation VData (2 of 2)

Field Name	Description	Field Num	Num Records	Data Type	Units	Range
green HourAng	Greenwich Hour Angle	22	1 .. 11, 817	32-bit float	deg	TBD

Table 4.1-5. VIRS Science Data Sets

SDS Name	Description	Rank	Dimensions	Data Type	Units	Range
geolocation	Earth location of the center of the field-of-view	3	(11817, 261, 2) scan line x pixel x (latitude, longitude)	32-bit float	deg	-90 .. 90 -180 .. 180
calCounts	Raw calibration counts	4	(11817, 3, 2, 5) scan line x {blackbody, space view, solar diffuser} x data word x channel	16-bit integer	count	N/A
local Direction	Angles to the satellite and sun from the center of the field of view	4	(11817, 27, 2, 2)scan line x pixel x {satellite, sun} x {zenith angle, azimuth angle}.	16-bit integer	deg	TBD
channels	Radiances	3	(11817, 261, 5) scan line x pixel x channel	16-bit integer	mW $cm^{-2}sr^{-1}$ mm-1	TBD

VIRS CID Revision Record

The product Revision Record contains information pertaining to approved section changes. The table lists the date the Software Configuration Change Request (SCCR) was approved, the Release and Version Number, the SCCR number, a short description of the revision, and the revised sections. The authors are listed on the document cover.

VIRS CID Revision Record

SCCR Approval Date	Release/ Version Number	SCCR Number	Description of Revision	Section(s) Affected
N/A	R3V1	N/A	• Updated format to comply with standards.	All

4.2 MODIS Cloud Imager Data (MODIS CID)

EOSDIS Product Code: CERX04

MODIS Cloud Imager Data (CID_MODIS) from the EOS spacecraft is a Level-1B data set with nineteen of the MODIS channels. CID_MODIS consists of two or more data sets. The first is the Level-1B data set, which contains the calibrated radiances; and the second is the companion Geolocation data set. The sizes listed in the following data description reflect the estimated number of scan line records (200) in 5 minutes of data. The files are written in Hierarchical Data Format (HDF) and are composed of Scientific Data Sets (SDS) and Vdatas.

The MODIS Level-1B HDF Structure Summary, Table 4.2-1, lists the types and names of HDF structures contained in the Level-1B product along with the names of the structures. A complete listing of parameters for the Level 1B data product can be found in Tables 4.2-2 through 4.2-3. The MODIS Geolocation HDF Structure Summary, Table 4.2-4, lists the names and types of HDF structures contained in the geolocation product. A complete listing of the parameters for the MODIS Geolocation product can be found in Tables 4.2-4 and 4.2-5. For more information on the MODIS Project, see Reference 6.

It is assumed that only Earth-viewing radiances and uncertainties and any information needed to interpret these values from the Level-1B product will be sent to the LaRC DAAC. 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			

Level: 1B
Type: Ancillary
Frequency: 1 per 5.0-Min

Time Interval Covered
File: 5.0-Min
Record: Instantaneous

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

Portion of Atmosphere Covered
File: Satellite Altitude

Table 4.2-1. MODIS Level-1B HDF Structure Summary

HDF Name	HDF Structure Type	Num Records	Table Number	Size (bytes)
MODIS Core Metadata	HDF Annotations	1	Reference 6	10 000
MODIS Archive Metadata	HDF Annotations	1	Reference 6	10 000
MODIS Product Specific Metadata	HDF Annotations	1	Reference 6	10 000
MODIS Swath Data	Vdata Structure	1	Table 4.2-2	72
MODIS Level 1-B SDS	SDSs	1 .. 1044	Table 4.2-3	294 693 396
Total MODIS Level-1B Bytes/File:				294 723 468

Table 4.2-2. MODIS Level-1B Swath Data Vdata

Field Name	Description	Field Num	Num Records	Data Type	Units	Range
Scan Number	Scan number	1	1	32-bit integer	N/A	1 .. 200
Complete Scan Flag	1 = Complete scan , 0 = Incomplete scan	2	1	32-bit integer	N/A	0 .. 1
Total Frames	Total number of frames in scan	3	1	32-bit integer	N/A	TBD
EV_Frames	Total number of earth view frames	4	1	32-bit integer	N/A	TBD
SD_Frames	Total number of solar diffuser frames	5	1	32-bit integer	N/A	TBD
SRCA_Frames	Total number of SRCA frames	6	1	32-bit integer	N/A	TBD
BB_Frames	Total number of blackbody frames	7	1	32-bit integer	N/A	TBD
SV_Frames	Total number of space view frames	8	1	32-bit integer	N/A	TBD
Scan Type	Type of scan (day, night, mixed)	9	1	8-bit character	N/A	N/A
Scan Start Time	Start time of scan	10	1	64-bit float	TBD	TBD
Mirror Side	TBD	11	1	8-bit integer	N/A	1 .. 2
Scan Data Presence	TBD	12	1	32-bit integer	TBD	TBD
Missing Packets	TBD	13	1	32-bit integer	TBD	TBD
Packets with Bad CRC	TBD	14	1	32-bit integer	TBD	TBD
Discarded Packets	TBD	15	1	32-bit integer	TBD	TBD
Moon in SV Port	TBD	16	1	8-bit integer	TBD	0 .. 1
On-Orbit Maneuver	TBD	17	1	8-bit integer	TBD	0 .. 1
No. SV Outliers	TBD	18	1	32-bit integer	TBD	0 .. 15
No. BB Outliers	TBD	19	1	32-bit integer	TBD	0 .. 15
No. thermistor outliers	TBD	20	1	32-bit integer	TBD	0 .. 12

Table 4.2-3. MODIS Level-1B Science Data Sets (1 of 2)

SDS Name	Description	Rank	Dimensions	Data Type	Units	Range
Latitude	Subset of the geodetic latitude	2	{2000, 271} scan x pixel	32-bit float	deg	-90 .. 90
Longitude	Subset of the geodetic longitude	2	{2000, 271} scan x pixel	32-bit float	deg	-180 .. 180
Dimensions	Values of the various dimensions in the product	1	{45}	32-bit integer	N/A	N/A
Slope_and_Offset	Values needed to convert scaled instrument data to radiances	2	{38, 8} band x scale quantity	32-bit float	N/A	N/A
SD sector Pixel quality	Solar diffuser pixel quality	3	{200, 30, 10} scan x SD frame x track	16-bit integer	TBD	TBD
SRCA sector Pixel quality	SRCA pixel quality	3	{200, 40, 10} scan x SRCA frame x track	16-bit integer	TBD	TBD
BB sector Pixel quality	Blackbody pixel quality	3	{200, 50, 10} scan x BB frame x track	16-bit integer	TBD	TBD
SV sector Pixel quality	Space view pixel quality	3	{200, 30, 10} scan x SV frame x track	16-bit integer	TBD	TBD
Earth sector Pixel quality	Earth View pixel quality	3	{200, 1354, 10} scan x EV frame x track	16-bit integer	TBD	TBD
EV_250_RefSB	Band 1 radiances at 1/4 km resolution	3	{1, 8000, 5416} band x scan x pixel	16-bit integer	$W\ m^{-2}sr^{-1}mm^{-1}$	TBD
EV_250_RefSB_Uncert_Indexes	Band 1 uncertainty indexes at 1/4 km resolution	3	{1, 8000, 5416} band x scan x pixel	8-bit integer	N/A	TBD
EV_250_Aggr1km_RefSB	Band 1 radiances at 1 km resolution	3	{1, 2000, 1354} band x scan x pixel	16-bit integer	$W\ m^{-2}sr^{-1}mm^{-1}$	TBD
EV_250_Aggr1km_RefSB_Uncert_Indexes	Band 1 uncertainty indexes at 1 km resolution	3	{1, 2000, 1354} band x scan x pixel	8-bit integer	N/A	TBD
EV_500_Aggr1km_RefSB	Band 6, 7 radiances at 1 km resolution	3	{2, 2000, 1354} band x scan x pixel	16-bit integer	$W\ m^{-2}sr^{-1}mm^{-1}$	TBD
EV_500_Aggr1km_RefSB_Uncert_Indexes	Band 6, 7 uncertainty indexes at 1 km resolution	3	{2, 2000, 1354} band x scan x pixel	8-bit integer	N/A	TBD

Table 4.2-3. MODIS Level-1B Science Data Sets (2 of 2)

SDS Name	Description	Rank	Dimensions	Data Type	Units	Range
EV_1KM_RefSB	Band 17, 18, 19, 26 radiances at 1 km resolution	3	{4, 2000, 1354} band x scan x pixel	16-bit integer	$W\ m^{-2}sr^{-1}mm^{-1}$	TBD
EV_1KM_RefSB_ Uncert_Indexes	Band 17, 18, 19, 26 uncertainty indexes at 1 km resolution	3	{4, 2000, 1354} band x scan x pixel	8-bit integer	N/A	TBD
EV_1KM_Emissive	Band 20, 23, 24, 25, 27, 29, 31, 32, 33, 34, 35, 36 radiances at 1 km resolution	3	{12, 2000, 1354} band x scan x pixel	16-bit integer	$W\ m^{-2}sr^{-1}mm^{-1}$	TBD
EV_1KM_Emissive_ Uncert_Indexes	Band 20, 23, 24, 25, 27, 29, 31, 32, 33, 34, 35, 36 uncertainty indexes at 1 km resolution	3	{12, 2000, 1354} band x scan x pixel	8-bit integer	N/A	TBD

Table 4.2-4. MODIS Geolocation HDF Structure Summary

HDF Name	HDF Structure Type	Num Records	Table Number	Size (bytes)
MODIS Geolocation Core Metadata	HDF Annotations	1	Reference 6	10 000
MODIS Geolocation Archive Metadata	HDF Annotations	1	Reference 6	10 000
MODIS Geolocation Product Specific Metadata	HDF Annotations	1	Reference 6	10 000
MODIS Geolocation Swath Structural Metadata	HDF Annotations	1	Reference 6	10 000
MODIS Geolocation Data	SDS	39	Table 4.2-5	59 678 050
Total MODIS Geolocation Bytes/File:				59 718 050

Table 4.2-5. MODIS Geolocation Science Data Sets (1 of 3)

SDS Name	Description	Rank	Dimensions	Data Type	Units	Range
Focal_length	Focal length for detectors	1	{37} band	64-bit float	mm	TBD
band_position	Scan IFOV Offsets of band trailing edges with respect to the Optical Center	1	{37} band	64-bit float	TBD	TBD
detector_space	Nominal detector spacing in the cross-scan direction	1	{37} band	64-bit float	mm	TBD
detector_offsets	Offsets of detector positions from nominal locations on the focal plane	2	{37, 2} band x {scan, track}	64-bit float	mm	TBD

Table 4.2-5. MODIS Geolocation Science Data Sets (2 of 3)

SDS Name	Description	Rank	Dimensions	Data Type	Units	Range
T_offset	Offsets of the first sample for a band to time of 1km frame	1	{37} band	64-bit float	TBD	TBD
num_samples	Number of samples per frame for each band.	1	{37} band	16-bit integer	N/A	N/A
Scan number	Scan number in granule	1	{200} scan	16-bit integer	N/A	N/A
EV frames	Number of Earth view frames in scan	1	{200} scan	16-bit integer	N/A	N/A
SD frames	Number of solar diffuser frames in scan	1	{200} scan	16-bit integer	N/A	N/A
SV frames	Number of space view frames in scan	1	{200} scan	16-bit integer	N/A	N/A
EV start time	Earth view start time (TAI)	1	{200} scan	64-bit float	sec	TBD
SD start time	Solar diffuser view start time (TAI)	1	{200} scan	64-bit float	sec	TBD
SV start time	Space view start time (TAI)	1	{200} scan	64-bit float	sec	TBD
SD Sun zenith	Sun vector zenith angle in SD frame	1	{200} scan	32-bit float	deg	TBD
SD Sun azimuth	Sun vector azimuth angle in SD frame (clockwise rotation about SD Z axis with respect to SD Y axis)	1	{200} scan	32-bit float	deg	TBD
Moon Vector	Moon unit vector in instrument frame	2	{200, 3} scan x vector dimension	32-bit float	TBD	TBD
sun_ref	Unit Sun vector in ECR frame at scan center time	2	{200, 3} scan x vector dimension	32-bit float	TBD	TBD
Mirror side	Mirror side	1	{200} scan	16-bit integer	TBD	TBD
num_impulse	Number of mirror encoder samples for this scan	1	{200} scan	8-bit integer	TBD	TBD
impulse_enc	Mirror angles from encoder data.	2	{200, 25} scan x encoder values	64-bit float	N/A	N/A
impulse_time	Mirror encoder sample times from start of scan	2	{200, 25} scan x encoder values	64-bit float	sec	TBD
L1 scan quality	L1A scan quality flags	2	{200, 4} scan x flag	32-bit integer	N/A	N/A
Geo scan quality	Geolocation scan quality flags	2	{200, 4} scan x flag	8-bit integer	N/A	N/A
EV center time	Earth view center frame time (TAI)	1	{200} scan	64-bit float	sec	TBD
orb_pos	ECR orbit position at scan center time	2	{200, 3} scan x vector dimension	64-bit float	m	TBD

Table 4.2-5. MODIS Geolocation Science Data Sets (3 of 3)

SDS Name	Description	Rank	Dimensions	Data Type	Units	Range
orb_vel	ECR orbit velocity at scan center time	2	{200, 3} scan x vector dimension	64-bit float	m sec^{-1}	TBD
T_inst2ECR	instrument-to-ECR frame transformation matrix at scan center time	3	{200, 3, 3} scan x vector x vector dimension	64-bit float	TBD	TBD
attitude_angles	Spacecraft attitude at scan center time expressed in the Orbital Reference frame (roll, pitch, yaw)	2	{200, 3} scan x vector dimension	64-bit float	deg	TBD
ang_rates	Spacecraft attitude rates in spacecraft reference frame (roll, pitch, yaw)	2	{200, 3} scan x vector dimension	32-bit float	deg sec^{-1}	TBD
Longitude	Geodetic longitude	2	{2000, 1354} scan x pixel	32-bit float	deg	-180 .. 180
Latitude	Geodetic latitude	2	{2000, 1354} scan x pixel	32-bit float	deg	-90 .. 90
Height	Height above ellipsoid	2	{2000, 1354} scan x pixel	16-bit integer	m	TBD
SensorZenith	Sensor (spacecraft) zenith angle	2	{2000, 1354} scan x pixel	16-bit integer	deg	0 .. 180
SensorAzimuth	Sensor (spacecraft) azimuth angle	2	{2000, 1354} scan x pixel	16-bit integer	deg	-180 .. 180
Range	Slant range (to spacecraft)	2	{2000, 1354} scan x pixel	16-bit integer	m	TBD
SolarZenith	Solar zenith angle	2	{2000, 1354} scan x pixel	16-bit integer	deg	0 .. 180
SolarAzimuth	Solar azimuth angle	2	{2000, 1354} scan x pixel	16-bit integer	deg	-180 .. 180
Land/SeaMask	EOS Land/Sea Mask	2	{2000, 1354} scan x pixel	8-bit integer	N/A	N/A
gflags	Geolocation flags	2	{2000, 1354} scan x pixel	8-bit integer	N/A	N/A

CID_MODIS Instrument Data		**CID_MODIS Geolocation Data**		**CID_MODIS Total Data Volume**	
Total Bytes/File :	**294 ,723,468**	**Total Bytes/File:**	**59,748,050**	**TotalMbytes/Granule:**	**338.1**
Total Mbytes/File:	**281.1**	**Total Mbytes/File:**	**56.98**	**Total Mbytes/Hour:**	**57.0**
Total Mbytes/Hour:	**3,372.2**	**Total Mbytes/Hour:**	**683.8**	**Total Mbytes/Day:**	**97,367**
Total Mbytes/Day:	**80,948**	**Total Mbytes/Day:**	**16,410**	**Total Mbytes/Month:**	**3,018,378**

MODIS CID Revision Record

The product Revision Record contains information pertaining to approved section changes. The table lists the date the Software Configuration Change Request (SCCR) was approved, the Release and Version Number, the SCCR number, a short description of the revision, and the revised sections. The authors are listed on the document cover.

MODIS CID Revision Record

SCCR Approval Date	Release/ Version Number	SCCR Number	Description of Revision	Section(s) Affected
N/A	R3V1	N/A	• Updated format to comply with standards.	All

4.3 Surface Map (SURFMAP)

EOSDIS Product Code: CERX07

The Surface Map (SURFMAP) product is a composite of various products each containing a different surface condition. The individual products each contain a single parameter arranged on a global 1/6-degree by 1/6-degree equal-angle grid (2160x1080 = 2,332,800 cells).

The SURFMAP products are updated at different frequencies, depending on the type of data. See Table 4.3-1 for a list of the individual products and their update frequency, units, and sizes. The last entry in the table is a static ASCII file of surface directional models and other relevant surface information.

Level: 3
Frequency: Variable
Configuration Code: 009000 and greater

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

Time Interval Covered
File: Variable
Record: Variable

Portion of Atmosphere Covered
File: Surface

Table 4.3-1. SURFMAP Product

SURFMAP Data Type	Description	Update Frequency	Units	Range	Bits/ Element	Size in MB
ECO	IGBP Ecosystem map	1 / mission	N/A	0 .. 18	8	2.33
TER	Characteristic Terrain Map	1 / mission	N/A	0 .. 99	8	2.33
DEM	Digital elevation map	1 / mission	m	-120 .. 8000	16	4.66
EM03.75	Emissivity Map for 3.75 micron channel	1 / mission	N/A	.0 .. 1.0	8	2.33
EM10.80	Emissivity Map for 10.80 micron channel	1 / mission	N/A	.0 .. 1.0	8	2.33
EM11.90	Emissivity Map for 11.90 micron channel	1 / mission	N/A	.0 .. 1.0	8	2.33
EMBR	Emissivity Map for 0.2 - 50 micron channel (Broadband)	1 / mission	N/A	.0 .. 1.0	8	2.33
EMWN	Emissivity Map for 8 - 12 micron channel (Window)	1 / mission	N/A	.0 .. 1.0	8	2.33
ERBE	ERBE scene id map	1 / mission	N/A	1 .. 6	8	2.33
ICE	Ice map	1 / day	percent	0 .. 100	8	2.33
SNOW	Snow map	1 / day	in	0 .. 255	8	2.33
H2O	Percent water content map	1 / mission	percent	0 .. 100	8	2.33
LIB	Surface Models	1/mission	N/A	--	--	~5K
Total SURFMAP Size						**28.8**

SURFMAP Revision Record

The product Revision Record contains information pertaining to approved section changes. The table lists the date the Software Configuration Change Request (SCCR) was approved, the Release and Version Number, the SCCR number, a short description of the revision, and the revised sections. The authors are listed on the document cover.

SURFMAP Revision Record

SCCR Approval Date	Release/ Version Number	SCCR Number	Description of Revision	Section(s) Affected
N/A	R3V1	N/A	• Updated format to comply with standards.	All

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 five sets of B1 data currently available (including two sets of METEOSAT). Others may be added in the future as other satellites are launched. The five sets currently available are

1) Geostationary Meteorological Satellite (GMS) in GMS format
2) Meteorological Satellite (METEOSAT) in METEOSAT format (2 satellites)
3) Geostationary Operational Environmental Satellite (GOES-East) in Canadian format
4) Geostationary Operational Environmental Satellite (GOES-West) 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-East: fifteen 3480 cartridges
4) GOES-West: 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 (Reference 7). They are used by the CERES Project.

GEO Revision Record

The product Revision Record contains information pertaining to approved section changes. The table lists the date the Software Configuration Change Request (SCCR) was approved, the Release and Version Number, the SCCR number, a short description of the revision, and the revised sections. The authors are listed on the document cover.

GEO Revision Record

SCCR Approval Date	Release/ Version Number	SCCR Number	Description of Revision	Section(s) Affected
N/A	R3V1	N/A	• Updated format to comply with standards.	All

4.5 Aerosol Data (APD)

EOSDIS Product Code: CERX10

The ancillary data product, Aerosol Product Data (APD), is input to the CERES Regrid Meteorological, Ozone, and Aerosol Data Subsystem. The APD is the source of backup climatological total column aerosol optical depth data, and is made up of one data file for each month. The first record of each file is based on global three-hourly data provided by Dr. Rachel Pinker that are monthly averaged over two years. These averages are on a 2.5° equal-area grid.

The second record of each file is based on monthly data provided by Dr. Larry Stowe that are also averaged over two years. These averages are on a 1.0° equal-angle grid for the area between 70S and 70N. The Regrid Meteorological, Ozone, and Aerosol Data Subsystem interpolates these data horizontally to conform with the MOA horizontal grid, and then stores the value from one source on the MOA product.

Level: 3
Type: Ancillary
Frequency: Monthly

Portion of Globe Covered
File: Global
Record: One region

Time Interval Covered
File: Monthly
Record: Monthly

Portion of Atmosphere Covered
File: Total column

Table 4.5-1. APD File Sizes

Source	Size (Monthly)
University of Maryland, College Park (Dept. of Meteorology) (Pinker) and NOAA/NESDIS (Stowe)	406 KB

APD Revision Record

The product Revision Record contains information pertaining to approved section changes. The table lists the date the Software Configuration Change Request (SCCR) was approved, the Release and Version Number, the SCCR number, a short description of the revision, and the revised sections. The authors are listed on the document cover.

APD Revision Record

SCCR Approval Date	Release/ Version Number	SCCR Number	Description of Revision	Section(s) Affected
N/A	R3V1	N/A	• Updated format to comply with standards.	All

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 is made up of multiple files that contain vertical profiles of temperature, specific humidity, and wind speed profiles as a function of pressure, along with surface temperature and pressure. These data are primarily obtained from the European Centre for Medium Range Weather Forecasts (ECMWF) on a 0.5° latitude x 0.5° longitude grid. ECMWF's analysis data are available every six hours, while their forecast data are available every three hours. A secondary data set is also available from the Data Assimilation Office (DAO) on either a 2.0° latitude x 2.5° longitude grid (GEOS-2), or on a 1.0° latitude x 1.0° longitude grid (GEOS-3), depending on the data date desired. DAO/GEOS-2 data are available for the TRMM timeframe, while DAO/GEOS-3 data are available beginning with the TERRA launch. DAO's diagnostic products are available every three hours, while their prognostic products are available every six hours. The Regrid Meteorological, Ozone, and Aerosol Data Subsystem interpolates these data temporally and vertically to conform with CERES processing requirements. The ECMWF Input Products are shown in Table 4.6-1. The DAO Input Products are shown in Tables 4.6-2 and 4.6-3.

Level: 3
Type: Ancillary
Frequency: Every 3 or 6 hours
region
Time Interval Covered
File: Every 3 or 6 hours
Record: Every 3 or 6 hours

Portion of Globe Covered
File: Global
Record: 0.5° x 0.5°, 2° x 2.5°, or 1° x 1°

Portion of Atmosphere Covered
File: Surface to TOA

Table 4.6-1. ECMWF Input Products

ECMWF File Name	ECMWF File Size (Daily)	Temporal Resolution	Products Used by CERES
ecmwf130.yyyymmdd	11 MB	Six hourly	Vertical profiles of temperature
ecmwf131.yyyymmdd	11 MB	Six hourly	Vertical profiles of U-component of wind
ecmwf132.yyyymmdd	11 MB	Six hourly	Vertical profiles of V-component of wind
ecmwf133.yyyymmdd	33 MB	Six hourly	Vertical profiles of specific humidity
ecmwf152.yyyymmdd	365 KB	Six hourly	Surface pressure
ecmwf235.yyyymmdd	2.1 MB	Three hourly	Forecast and current skin temperatures
TOTAL SIZE	**68.5 MB**		

Table 4.6-2. DAO/GEOS-2 Input Products

DAO File Name	DAO File Size (Daily)	Temporal Resolution	Products Used by CERES
ceres_geos2_trmm.pave.yyyymmdd	419 KB	Three hourly	Surface pressure
ceres_geos2_trmm.phis.yyyymmdd	209 KB	Six hourly	Surface height
ceres_geos2_trmm.ps.yyyymmdd	209 KB	Six hourly	Surface pressure
ceres_geos2_trmm.q10m.yyyymmdd	419 KB	Three hourly	Specific humidity at 10 meters
ceres_geos2_trmm.sphu.yyyymmdd	7.5 MB	Six hourly	Vertical profiles of specific humidity
ceres_geos2_trmm.t10m.yyyymmdd	419 KB	Three hourly	Temperature at 10 meters
ceres_geos2_trmm.tg.yyyymmdd	419 KB	Six hourly	Ground Temperature
ceres_geos2_trmm.tmpu.yyyymmdd	7.5 MB	Six hourly	Vertical profiles of temperature
ceres_geos2_trmm.tropp.yyyymmdd	209 KB	Six hourly	Tropopause height
ceres_geos2_trmm.u10m.yyyymmdd	419 KB	Three hourly	Wind speed u-vectors at 10 meters
ceres_geos2_trmm.uwnd.yyyymmdd	7.5 MB	Six hourly	Vertical profiles of wind speed u-vectors
ceres_geos2_trmm.v10m.yyyymmdd	419 KB	Three hourly	Wind speed v-vectors at 10 meters
ceres_geos2_trmm.vwnd.yyyymmdd	7.5 MB	Six hourly	Vertical profiles of wind speed v-vectors
TOTAL SIZE	**33.1 MB**		

Table 4.6-3. DAO/GEOS-3 Input Products

DAO File Name	DAO File Size (Daily)	Temporal Resolution	Products Used by CERES
DAS.llk.asm.tsyn2d_mis_x.AM100.yyyymmdd00.yyyymmdd21.V01	46 MB	Three hourly	Surface pressure, surface height, specific humidity at 10 meters, temperature at 10 meters, ground temperature, tropopause height, wind speed u-vectors at 10 meters, and wind speed v-vectors at 10 meters
DAS.llk.asm.tsyn2d_mis_x.AM100.yyyymmnd00.yyyymmnd21.V01	46 MB	Three hourly	Surface data for the next day
DAS.llk.asm.tsyn3d_mis_p.AM100.yyyymmdd00.yyyymmdd18.V01	300 MB	Six hourly	Vertical profiles of specific humidity, temperature, wind speed u-vectors, and wind speed v-vectors
DAS.llk.asm.tsyn3d_mis_p.AM100.yyyymmnd00.yyyymmnd18.V01	300 MB	Six hourly	Vertical profile data for the next day
TOTAL SIZE	**692 MB**		

Note: A combination of ECMWF and DAO/GEOS-3 files sizes are used in the Ancillary Products Summary Table 1.0-5.

GAP Revision Record

The product Revision Record contains information pertaining to approved section changes. The table lists the date the Software Configuration Change Request (SCCR) was approved, the Release and Version Number, the SCCR number, a short description of the revision, and the revised sections. The authors are listed on the document cover.

GAP Revision Record

SCCR Approval Date	Release/ Version Number	SCCR Number	Description of Revision	Section(s) Affected
N/A	R3V1	N/A	• Updated format to comply with standards.	All

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 as measured by the Spectral Sensor Microwave/Imager (SSM/I) microwave instrument. These data have a 0.5° latitude x 0.5° longitude horizontal resolution. The column precipitable water data are stored on the MOA files in their original resolution to conform with CERES processing requirements. MWH file size is shown in Table 4.7-1.

Level: 3
Type: Ancillary
Frequency: Daily

Portion of Globe Covered
File: Global
Record: One region

Time Interval Covered
File: Daily
Record: Daily

Portion of Atmosphere Covered
File: Total column

Table 4.7-1. MWH File Sizes

Source	Size (Daily)
Global Hydrology Resource Center (GHRC)	2.14 MB

MWH Revision Record

The product Revision Record contains information pertaining to approved section changes. The table lists the date the Software Configuration Change Request (SCCR) was approved, the Release and Version Number, the SCCR number, a short description of the revision, and the revised sections. The authors are listed on the document cover.

MWH Revision Record

SCCR Approval Date	Release/ Version Number	SCCR Number	Description of Revision	Section(s) Affected
N/A	R3V1	N/A	• Updated format to comply with standards.	All

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. Daily files for NCEP/Stratospheric Monitoring-Group Ozone Blended Analysis (SMOBA) data are the primary input data source. These data have a 2.5° latitude x 2.5° longitude equal-angle horizontal resolution on 24 vertical profile levels and total column values. As a backup source, daily data from Earth Probe-Total Ozone Mapping Spectrometer (EP-TOMS) may be used. These data have a 1.25° latitude x 1.25° longitude equal-angle horizontal resolution of *only* total column values. The Regrid Meteorological, Ozone, and Aerosol Data Subsystem interpolates these data temporally, horizontally and vertically to conform with CERES processing requirements. OPD file sizes are shown in Table 4.8-1.

Level: 3
Type: Ancillary
Frequency: Daily

Portion of Globe Covered
File: Global
Record: One region

Time Interval Covered
File: Daily
Record: Daily

Portion of Atmosphere Covered
File: 300hPa to TOA

Table 4.8-1. OPD File Sizes

Source	Size (Daily)
SMOBA	2.430 MB
EP-TOMS	0.163 MB

OPD Revision Record

The product Revision Record contains information pertaining to approved section changes. The table lists the date the Software Configuration Change Request (SCCR) was approved, the Release and Version Number, the SCCR number, a short description of the revision, and the revised sections. The authors are listed on the document cover.

OPD Revision Record

SCCR Approval Date	Release/ Version Number	SCCR Number	Description of Revision	Section(s) Affected
N/A	R3V1	N/A	• Updated format to comply with standards.	All

References

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   URL: http://hdf.ncsa.uiuc.edu/
2. Release B SCF ToolKit User's Guide for the ECS Project, June 1998.
3. Cloud's and the Earth's Radiant Energy System (CERES) Collection Documents,
   URL: http://asd-www.larc.nasa.gov/ceres/collect_guide/list.html
4. TRW DRL 55067.300.008E; In-flight Measurement Analysis (Rev. E), March 1997.
5. TSDIS Science Users Interface Control Specification Volume 3, Level 1 File Specifications, Release 3.06, July 8, 1998
   URL: http://www-tsdis.gsfc.nasa.gov/tsdis/tsdis.html
6. MODIS Level 1B lkm Earth View Data Product Specification, Version 2.0, Release 1, March 1997. URL: http://ltpwww.gsfc.nasa.gov/MODIS/
7. ISCCP URL: http://isccp.giss.nasa.gov/
8. TRW 2311 B301.00; ICD between EDOS and the EOS Ground System Elements; August 1996.

Appendix A
Acronyms, Abbreviations and Unit Definitions

ADM	Angular Distribution Model
APD	Aerosol Data
AVG	Monthly Regional Radiative Fluxes and Clouds
BDS	Bidirectional Scans
CADM	CERES Angular Distribution Model
CCSDS	Consultative Committee for Space Data Systems
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
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
EP-TOMS	Earth Probe - Total Ozone Mapping Spectrometer
ERBE	Earth Radiation Budget Experiment
ERBS	Earth Radiation Budget Satellite
FOV	Field of View
FSW	Monthly Gridded Radiative Fluxes and Clouds
GAP	Gridded Analysis Product
GB	Giga Byte
GEO	Geostationary Narrowband Radiances
GGEO	Gridded GEO Narrowband Radiances
GHRC	Global Hydrology Research Center
GMS	Geostationary Meteorological Satellite
GMT	Greenwich Mean Time
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
IWP	Ice Water Path
LaRC	Langley Research Center
L	Low
LM	Lower Middle

LW	Longwave
LWC	Liquid Water Content
LWP	Liquid Water Path
MB	Mega Byte
METEOSAT	Meteorological Satellite
MOA	Meteorological, Ozone, and Aerosols
MODIS	Moderate Resolution Imaging Spectrometer
MWH	Microwave Humidity
NASA	National Aeronautics and Space Administration
NCEP	National Centers for Environmental Predictions
NOAA	National Oceanic and Atmospheric Administration
OPD	Ozone Profile Data
RAPS	Rotating Azimuth Plane Scan
SARB	Surface and Atmospheric Radiation Budget
SDS	Scientific Data Set
SFC	Monthly Gridded TOA/Surface Fluxes and Clouds
SMOBA	Stratospheric Monitoring Group Ozone Blended Analysis
SRB	Surface Radiation Budget
SRBAVG	Monthly TOA/Surface Averages
SSF	Single Scanner Footprint TOA/Surface Fluxes and 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
TOA	Top of the Atmosphere, Top of Atmosphere
TOMS	Total Ozone Mapping Spectrometer
TRMM	Tropical Rainfall Measuring Mission
UM	Upper Middle
VIRS	Visible Infrared Scanner
WN	Window
Xtrk	Crosstrack
ZAVG	Monthly Zonal and Global Radiative Fluxes and Clouds

Unit Definitions

Units	Definition
AU	Astronomical Unit, Astronomical Units
cm	centimeter, centimeters
count	count, counts
day	day, Julian date
deg	degree, degrees
deg sec^{-1}	degrees per second
DU	Dobson Unit
fraction	fraction 0..1
g kg^{-1}	grams per kilogram
g m^{-2}	grams per square meter
hhmmss	hour, minute, second
hour	hour, hours
hPa	hectoPascals
in-oz	inch-ounces
K	Kelvin
km	kilometer, kilometers
km sec^{-1}	kilometers per second
m	meter, meters
mA	milliamp, milliamps
micron	micrometer, micrometers, micron
msec	millisecond, milliseconds
mW $cm^{-2}sr^{-1}\mu m^{-1}$	milliWatts per square centimeter per steradian per micron
m sec^{-1}	meters per second
N/A	not applicable, none, unitless, dimensionless
percent	percent, percentage 0..100
rad	radian, radians
sec	second, seconds
volt	volt, volts
W h m^{-2}	Watt hours per square meter
W^2 m^{-4}	square Watts per meter to the 4th
W m^{-2}	Watts per square meter
W $m^{-2}sr^{-1}$	Watts per square meter per steradian
W $m^{-2}sr^{-1}\mu m^{-1}$	Watts per square meter per steradian per micron
°C	degrees centigrade
μm	micrometer, micrometers, micron, microns

Appendix B
CERES Metadata

This section describes the metadata that are written to all CERES HDF products. Table B-1 describes the CERES Baseline Header Metadata that are written on both HDF and binary direct access output science data products. The parameters are written in HDF structures for CERES HDF output products and are written as 80-byte records for binary direct access output products. Some parameters may be written in multiple records. Table B-2 describes the CERES_metadata Vdata parameters which are a subset of the CERES Baseline Header Metadata and are also written to all CERES HDF output products.

Table B-1 lists the item number, parameter name, units, range or allowable values, the data type, and the maximum number of elements. Note that there are two choices for parameters 24-27 and two choices for parameters 28-31. The choices depend on whether the product is described by a bounding rectangle or by a GRing. Abbreviations used in the Data Type field are defined as:

s = string	date =	yyyy-mm-dd
F = float	time =	hh:mm:ss.xxxxxxZ
I = integer	datetime =	yyyy-mm-ddThh:mm:ss.xxxxxxZ

Table B-1. CERES Baseline Header Metadata (1 of 2)

Item	Parameter Name	Units	Range	Data Type	No. of Elements
1	ShortName	N/A	N/A	s(8)	1
2	VersionID	N/A	0 .. 255	I3	1
3	CERPGEName	N/A	N/A	s(20)	1
4	SamplingStrategy	N/A	CERES, TRMM-PFM-VIRS, Terra-FM1-MODIS, TBD	s(20)	1
5	ProductionStrategy	N/A	Edition, Campaign, Diagnostic-Case, PreFlight, TBD	s(20)	1
6	CERDataDateYear	N/A	1997 .. 2050	s(4)	1
7	CERDataDateMonth	N/A	1 .. 12	s(2)	1
8	CERDataDateDay	N/A	1 .. 31	s(2)	1
9	CERHRofMonth	N/A	1 .. 744	s(3)	1
10	CERHRofDay	N/A	1 .. 24	s(2)	1
11	RangeBeginningDate	N/A	1997-11-19 .. 2050-12-31	date	1
12	RangeBeginningTime	N/A	00:00:00.000000Z .. 24:00:00:000000Z	time	1
13	RangeEndingDate	N/A	1997-11-19 .. 2050-12-31	date	1
14	RangeEndingTime	N/A	00:00:00.000000Z .. 24:00:00:000000Z	time	1
15	AssociatedPlatformShortName	N/A	TRMM, Terra, Aqua, TBD	s(20)	1-4
16	AssociatedInstrumentShort-Name	N/A	PFM, FM1, FM2, FM3, FM4, FM5, TBD	s(20)	1-4
17	AssociatedSensorShortName	N/A	Total Detector, Window Detec-tor, ShortWave Detector	s(20)	3

Table B-1. CERES Baseline Header Metadata (2 of 2)

Item	Parameter Name	Units	Range	Data Type	No. of Elements
18	LocalGranuleID	N/A	N/A	s(80)	1
19	PGEVersion	N/A	N/A	s(10)	1
20	CERProductionDateTime	N/A	N/A	datetime	1
21	LocalVersionID	N/A	N/A	s(60)	1
22	ProductGenerationLOC	N/A	SGI_xxx, TBD	s(255)	1
23	NumberofRecords	N/A	1 .. 9 999 999 999	I10	1
24	WestBoundingCoordinate	deg	-180.0 .. 180.0	F11.6	1
25	NorthBoundingCoordinate	deg	-90.0 .. 90.0	F11.6	1
26	EastBoundingCoordinate	deg	-180.0 .. 180.0	F11.6	1
27	SouthBoundingCoordinate	deg	-90.0 .. 90.0	F11.6	1
24	GRingPointLatitude	deg	-90.0 .. 90.0	F11.6	3 .. 100
25	GRingPointLongitude	deg	-180.0 .. 180.0	F11.6	3 .. 100
26	GRingPointSequenceNo	N/A	0 .. 99999	I5	3 .. 100
27	ExclusionGRingFlag	N/A	Y (= YES), N (= NO)	s(1)	1
28	CERWestBoundingCoordinate	deg	0.0 .. 360.0	F11.6	1
29	CERNorthBoundingCoordinate	deg	0.0 .. 180.0	F11.6	1
30	CEREastBoundingCoordinate	deg	0.0 .. 360.0	F11.6	1
31	CERSouthBoundingCoordinate	deg	0.0 .. 180.0	F11.6	1
28	CERGRingPointLatitude	deg	0.0 .. 180.0	F11.6	3 .. 100
29	CERGRingPointLongitude	deg	0.0 .. 360.0	F11.6	3 .. 100
30	GRingPointSequenceNo	N/A	0 .. 99999	I5	3 .. 100
31	ExclusionGRingFlag	N/A	Y (= YES), N (= NO)	s(1)	1
32	AutomaticQualityFlag	N/A	Passed, Failed, or Suspect	s(64)	1
33	AutomaticQualityFlagExplanation	N/A	N/A	s(255)	1
34	QAGranuleFilename	N/A	N/A	s(255)	1
35	ValidationFilename	N/A	N/A	s(255)	1
36	ImagerShortName	N/A	VIRS, MODIS, TBD	s(20)	1
37	InputPointer	N/A	N/A	s(255)	800
38	NumberInputFiles	N/A	1 .. 9999	I4	1

Table B-2 describes the CERES_metadata Vdata parameters which are written to all CERES HDF output science products. The table lists the item number, parameter name, units, range or allowable values, and the parameter data type where s (x) denotes a string of x characters.

Table B-2. CERES_metadata Vdata

Item	Parameter Name	Units	Range	Data Type
1	ShortName	N/A	N/A	s(32)
2	RangeBeginningDate	N/A	1997-11-19 .. 2050-12-31	s(32)
3	RangeBeginningTime	N/A	00:00:00.000000Z .. 24:00:00:000000Z	s(32)

Table B-2. CERES_metadata Vdata

Item	Parameter Name	Units	Range	Data Type
4	RangeEndingDate	N/A	1997-11-19 .. 2050-12-31	s(32)
5	RangeEndingTime	N/A	00:00:00.000000Z .. 24:00:00:000000Z	s(32)
6	AutomaticQualityFlag	N/A	Passed, Failed, or Suspect	s(64)
7	AutomaticQualityFlagExplanation	N/A	N/A	s(256)
8	AssociatedPlatformShortName	N/A	TRMM, Terra, Aqua, TBD	s(32)
9	AssociatedInstrumentShortName	N/A	PFM, FM1, FM2, FM3, FM4, FM5, TBD	s(32)
10	LocalGranuleID	N/A	N/A	s(96)
11	LocalVersionID	N/A	N/A	s(64)
12	CERProductionDateTime	N/A	N/A	s(32)
13	NumberofRecords	N/A	1 .. 9 999 999 999	4-byte integer
14	ProductGenerationLOC	N/A	SGI_xxx, TBD	s(256)