

National Aeronautics and  
Space Administration  
**Langley Research Center**  
Hampton, Virginia 23681-2199

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

## **Data Products Catalog**

**Release 4  
Version 16  
February 2008**



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

**Data Management System**

**Data Products Catalog**

**Release 4  
Version 16**

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February 2008

## 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.
04/04	R4V6	Updated the FSW section.
08/04	R4V7	Updated the SSF section.
09/04	R4V8	Updated the FSW, SFC, and SSF sections.
04/05	R4V9	Updated the FSW section.
06/05	R4V10	Updated the SRBAVG section.
07/05	R4V11	Updated the CRS section.
11/05	R4V12	Updated the BDS section.
02/06	R4V13	Updated the GEO and GGEO sections.
03/06	R4V14	Updated the MOA section.
05/07	R4V15	Updated the AVG, SYN, ZAVG, CRS, and FSW sections.
02/08	R4V16	Updated SSF-Ed2 and CRS 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 Systems and Applications, Inc., for her support in preparing this document.

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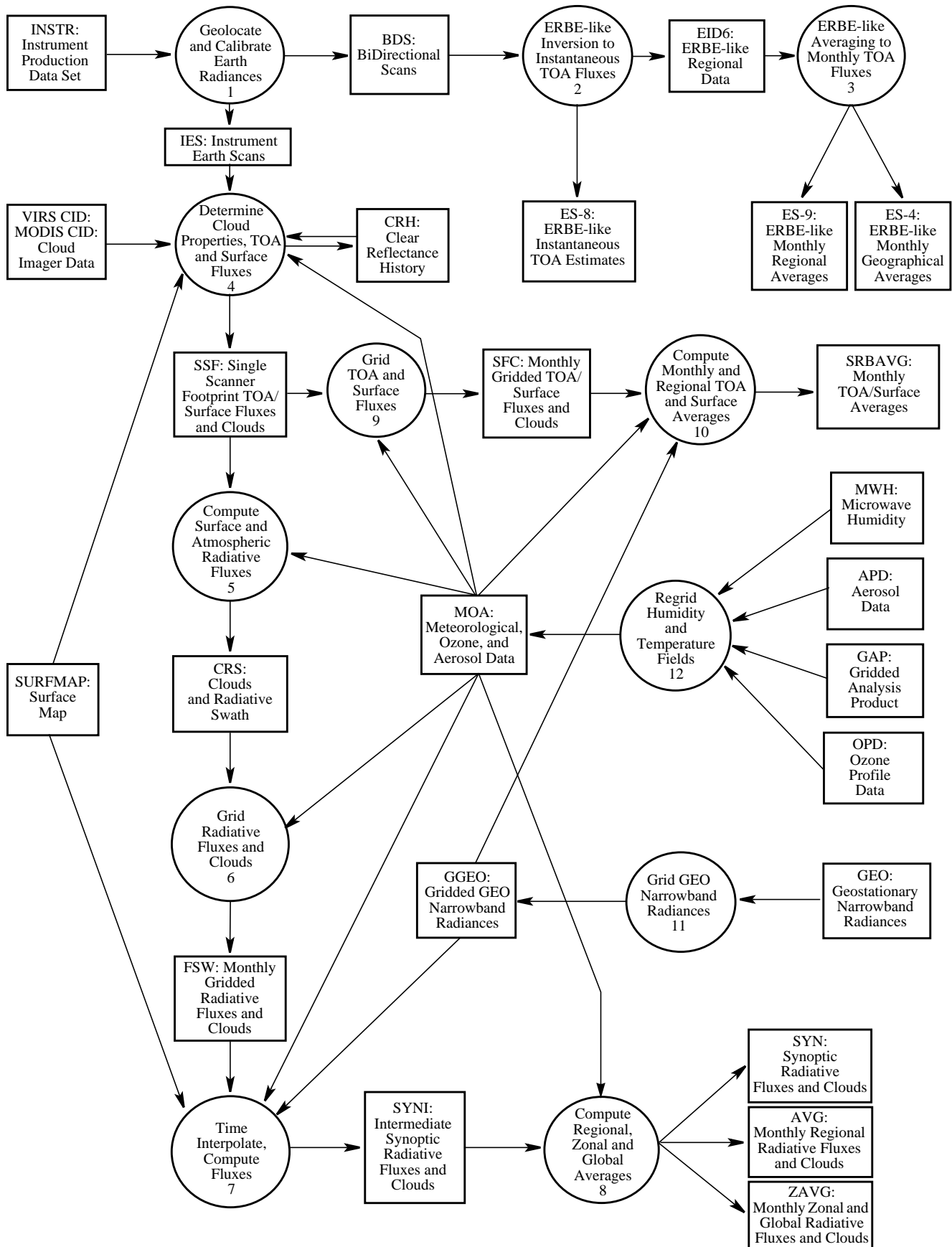
## 1.0 Introduction

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  $\mu\text{m}$ ), a total channel (0.3 - 200  $\mu\text{m}$ ), and an infrared window channel (8 - 12  $\mu\text{m}$ ). 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

<b>SCCR Approval Date</b>	<b>Release/Version Number</b>	<b>SCCR Number</b>	<b>Description of Revision</b>	<b>Section(s) Affected</b>
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"<sup>1</sup>
- Frequency - How often the product is received or produced
- Configuration Code - Unique identifier that defines the software and input file versions 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.

---

<sup>1</sup> **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

<b>SCCR Approval Date</b>	<b>Release/Version Number</b>	<b>SCCR Number</b>	<b>Description of Revision</b>	<b>Section(s) Affected</b>
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](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:** Edition1-CV, Edition3 ++ see NOTE

**Terra:** Edition1, Edition1-CV, Edition2, Edition3 ++ see NOTE

**Aqua:** Edition1, Edition1-CV, Edition2, Edition3 ++ 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. Solar and Lunar Azimuth and Elevation Angle SDSs are only available on Edition1-CV BDS products and Edition2 BDS products with a configuration code of 031033 or higher and Edition3. In addition, the Satellite-Celestial Vdata parameters for Solar and Lunar Beta and Eta Angles along with Earth-Moon Distance, Moon Colatitude at start of record and Moon Longitude at start of record are only available for Edition1-CV BDS products, Edition2 BDS products with a configuration code of 031033 or higher and Edition3 BDS products.



### 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	<a href="#">Table B-1</a>	1	36	~25907
CERES_metadata Vdata	<a href="#">Table B-2</a>	1	14	~1024
BDS Product-specific Metadata	<a href="#">Table 2.1-2</a>	1	11	~66
BDS SDS Summary	<a href="#">Table 2.1-3</a>	1 .. 13091	47	1,249,567,630
BDS Vdata Summary	<a href="#">Table 2.1-4</a>	1 .. 13091	185	32,230,162
<b>Total Size (Bytes):</b>				<b>1,281,824,789</b>
<b>Total Size (MBytes, including ~0.2% HDF overhead; 1MByte = 1024<sup>2</sup>Bytes):</b>				<b>1,224.89</b>

### 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](#).

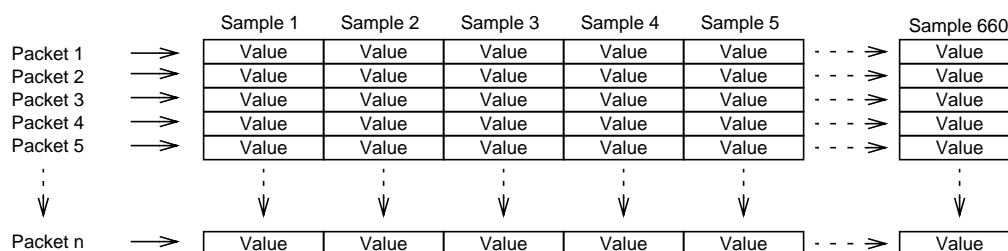


Figure 2.1-1. BDS SDS Schematic

[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	<a href="#">Reference 3</a>	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	<a href="#">Table 3.2-1</a>	N/A	34,560,240
Secondary Sample Level QA Flags	13091x660	uint32	<a href="#">Reference 3</a>	N/A	34,560,240
Primary Scan Level QA Flags	13091x660	uint32	<a href="#">Reference 3</a>	N/A	34,560,240
Secondary Scan Level QA Flags	13091x660	uint32	<a href="#">Reference 3</a>	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 <sup>-1</sup>	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 <sup>-1</sup>	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 <sup>-2</sup> sr <sup>-1</sup>	34,560,240
CERES WN Filtered Radiance Upwards	13091x660	float32	0.0 .. 50.0	W m <sup>-2</sup> sr <sup>-1</sup>	34,560,240
CERES TOT Filtered Radiance Upwards	13091x660	float32	0.0 .. 700.0	W m <sup>-2</sup> sr <sup>-1</sup>	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
Solar Elevation Angles <sup>2</sup>	13091x660	float32	0.0 .. 360.0	deg	34,560,240
Solar Azimuth Angles <sup>2</sup>	13091x660	float32	0.0 .. 360.0	deg	34,560,240
Lunar Elevation Angles <sup>2</sup>	13091x660	float32	0.0 .. 360.0	deg	34,560,240
Lunar Azimuth Angles <sup>2</sup>	13091x660	float32	0.0 .. 360.0	deg	34,560,240
SW Slow Mode and Drift Corrected Counts <sup>1</sup>	13091x660	float32	0.0 .. 4095.0	count	34,560,240
WN Slow Mode and Drift Corrected Counts <sup>1</sup>	13091x660	float32	0.0 .. 4095.0	count	34,560,240
TOT Slow Mode and Drift Corrected Counts <sup>1</sup>	13091x660	float32	0.0 .. 4095.0	count	34,560,240
SDS Total Size (Bytes)					1,249,567,630
SDS Total Size (MBytes, plus a small HDF overhead percentage)					1194.06

<sup>1</sup> 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. These SDSs are also available on TRMM, Terra and Aqua Edition1-CV and Terra and Aqua Edition2 BDSs beginning with CC-Code 031033 and TRMM, Aqua and Terra Edition3 BDSs.

<sup>2</sup> These SDSs are available on TRMM, Aqua and Terra Edition1-CV BDSs and Terra and Aqua Edition2 BDSs beginning with CC-Code 031033 and TRMM, Aqua and Terra Edition3 BDSs.

## 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	18	13091	160	2,094,560
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)				32,230,162
Vdata Total Size (MBytes, plus a small HDF overhead percentage)				30.80

## 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	<ul style="list-style-type: none"> <li>• Updated format to comply with standards.</li> </ul>	All
1/16/04	R4V1	497	<ul style="list-style-type: none"> <li>• Updated to add newly added SDSs. Also reordered the tables to match the order on the BDS.</li> <li>• Updated format to comply with standards.</li> </ul>	All  All
11/18/05	R4V2	599	<ul style="list-style-type: none"> <li>• Updated to add newly added SDSs containing Solar and Lunar Azimuth and Elevation Angles along with updated Satellite-Celestial Vdata to add Solar and Lunar Beta and Eta Angles, Earth-Moon Distance, Colatitude of Moon at start of record and Longitude of Moon at start of record, per Reqt.# 1-5.</li> <li>• Updated format to comply with standards.</li> </ul>	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: \[http://asd-www.larc.nasa.gov/ceres/collect\\\_guide/list.html\]\(http://asd-www.larc.nasa.gov/ceres/collect\_guide/list.html\)](#) (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
<b>ES-8 Total Product Size (MB/Day)</b>			<b>469.105</b>
<b>ES-8 Total Product Size with HDF Data Compression</b>			<b>293.5<sup>a</sup></b>

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 <sup>6</sup> .. 8x10 <sup>6</sup>	13092	32 bit real	51.14
X component of satellite position at record end	m	-8x10 <sup>6</sup> .. 8x10 <sup>6</sup>	13092	32 bit real	51.14
Y component of satellite position at record start	m	-8x10 <sup>6</sup> .. 8x10 <sup>6</sup>	13092	32 bit real	51.14
Y component of satellite position at record end	m	-8x10 <sup>6</sup> .. 8x10 <sup>6</sup>	13092	32 bit real	51.14
Z component of satellite position at record start	m	-8x10 <sup>6</sup> .. 8x10 <sup>6</sup>	13092	32 bit real	51.14
Z component of satellite position at record end	m	-8x10 <sup>6</sup> .. 8x10 <sup>6</sup>	13092	32 bit real	51.14
X component of satellite velocity at record start	m sec <sup>-1</sup>	-1x10 <sup>4</sup> .. 1x10 <sup>4</sup>	13092	32 bit real	51.14
X component of satellite velocity at record end	m sec <sup>-1</sup>	-1x10 <sup>4</sup> .. 1x10 <sup>4</sup>	13092	32 bit real	51.14
Y component of satellite velocity at record start	m sec <sup>-1</sup>	-1x10 <sup>4</sup> .. 1x10 <sup>4</sup>	13092	32 bit real	51.14
Y component of satellite velocity at record end	m sec <sup>-1</sup>	-1x10 <sup>4</sup> .. 1x10 <sup>4</sup>	13092	32 bit real	51.14
Z component of satellite velocity at record start	m sec <sup>-1</sup>	-1x10 <sup>4</sup> .. 1x10 <sup>4</sup>	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 <sup>-1</sup>	-1x10 <sup>4</sup> .. 1x10 <sup>4</sup>	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: <sup>a</sup>					
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
<b>Total Vdata Size (MB)</b>					<b>1.117</b>

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 <sup>-2</sup> sr <sup>-1</sup>	-2 .. 700	13092x660	32 bit real	33752.81
CERES SW filtered radiance	W m <sup>-2</sup> sr <sup>-1</sup>	-4 .. 510	13092x660	32 bit real	33752.81
CERES WN filtered radiance	W m <sup>-2</sup> sr <sup>-1</sup> μm <sup>-1</sup>	-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 <sup>-2</sup> sr <sup>-1</sup>	-10 .. 510	13092x660	32 bit real	33752.81
CERES LW unfiltered radiance	W m <sup>-2</sup> sr <sup>-1</sup>	0 .. 200	13092x660	32 bit real	33752.81
CERES WN unfiltered radiance	W m <sup>-2</sup> sr <sup>-1</sup> μm <sup>-1</sup>	0 .. 15	13092x660	32 bit real	33752.81
CERES SW flux at TOA	W m <sup>-2</sup>	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 <sup>-2</sup>	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
<b>Total SDS Size (MB)</b>					<b>467.108</b>

**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	<ul style="list-style-type: none"> <li>• Updated document to reflect new formats and to comply with standards.</li> </ul>	All
04/26/02	R3V2	341	<ul style="list-style-type: none"> <li>• Updated LW Flux range from [ 0 .. 500] to [ 50 .. 450].</li> <li>• Added the ES-8 Spectral Response Functions Vdata Summary table.</li> <li>• Moved Vdata parameter list from front page to ES-8 Vdata Structures section.</li> <li>• Moved SDS data listing from front page to ES-8 Scientific Data Sets section.</li> <li>• Updated format to comply with standards.</li> </ul>	Table 2.2-4  Table 2.2-3  Vdata  SDS  All
02/23/04	R4V1	503	<ul style="list-style-type: none"> <li>• Updated product versions for Aqua Edition1 to include Edition2.</li> <li>• Supplied footnote for availability of Spectral Response Functions Vdata.</li> <li>• Updated format to comply with standards.</li> </ul>	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](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 <a href="#">Table B-1</a>	1	35	
CERES_metadata Vdata	See <a href="#">Table B-2</a>	1	14	
ES-9 Product Specific Metadata	See <a href="#">Table 2.3-2</a>	1	1	
ES-9 Vgroup Summary	See <a href="#">Table 2.3-3</a>	1	6	1099.115
<b>ES-9 TOTAL SIZE (MB/Month)</b>				<b>1099.115</b>

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 <a href="#">Table 2.3-4</a>	$10368^a \times 10^b$	0.396
2	Monthly (Day) Averages	See <a href="#">Table 2.3-5</a>	$10368^a \times 28^b$	1.107
3	Monthly (Hour) Averages	See <a href="#">Table 2.3-5</a>	$10368^a \times 28^b$	1.107
4	Daily Averages	See <a href="#">Table 2.3-5</a>	$10368^a \times 31 \times 28^b$	34.330
5	Monthly Hourly Averages	See <a href="#">Table 2.3-5</a>	$10368^a \times 24 \times 34^b$	32.273
6	Hourbox Data	See <a href="#">Table 2.3-6</a>	$(10368 \times 744)^c \times 34^b$	1029.902
<b>Total SDS size (MB)</b>				<b>1,099.115</b>

- 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  $10,368 \times 744 = 7,713,792$ .

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 <a href="#">ES-9 Collection Guide</a>
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	
	Total	Clear	Total	Clear	Total	Clear	Total	Clear
Table in <a href="#">ES-9 Collection Guide</a>	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	
	Total	Clear	Total	Clear	Total	Clear	Total	Clear
<b>Sky (Cloud Cover) Vgroup</b>	<b>5-5</b>	<b>5-6</b>	<b>5-7</b>	<b>5-8</b>	<b>5-9</b>	<b>5-10</b>	<b>5-11</b>	<b>5-12</b>
Table in <a href="#">ES-9 Collection Guide</a>	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 <a href="#">ES-9 Collection Guide</a>	
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	<ul style="list-style-type: none"> <li>• Updated format to comply with standards.</li> </ul>	All
2/23/04	R4V1	503	<ul style="list-style-type: none"> <li>• Updated product versions for Aqua Edition1 to include Edition2.</li> <li>• Updated format to comply with standards.</li> </ul>	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: \[http://asd-www.larc.nasa.gov/ceres/collect\\\_guide/list.html\]\(http://asd-www.larc.nasa.gov/ceres/collect\_guide/list.html\)](#) ([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 <a href="#">Table B-1</a>	35	
CERES_metadata Vdata	See <a href="#">Table B-2</a>	14	
ES-4 Product Specific Metadata	See <a href="#">Table 2.4-2</a>	1	
ES-4 Vgroup Summary	See <a href="#">Table 2.4-3</a>	9	25.482
<b>ES-4 Data Size (MB/Month)</b>			<b>25.5</b>
<b>ES-4 Metadata Size (MB/Month)</b>			<b>1.5</b>
<b>ES-4 TOTAL SIZE (MB/Month)</b>			<b>27.0</b>

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 <a href="#">Table 2.4-4</a>	10368 (72 x 144)	19.232
2	5.0 Degree Nested Regional	See <a href="#">Table 2.4-5</a>	2592 (36 x 72)	4.808
3	10.0 Degree Nested Regional	See <a href="#">Table 2.4-6</a>	648 (18 x 36)	1.202
4	2.5 Degree Zonal	See <a href="#">Table 2.4-7</a>	72	0.134
5	5.0 Degree Zonal	See <a href="#">Table 2.4-8</a>	36	.067
6	10.0 Degree Zonal	See <a href="#">Table 2.4-9</a>	18	.033
7	2.5 Degree Global	See <a href="#">Table 2.4-10</a>	1	.002
8	5.0 Degree Global	See <a href="#">Table 2.4-11</a>	1	.002
9	10.0 Degree Global	See <a href="#">Table 2.4-12</a>	1	.002
<b>Total Product Size (MB)</b>				<b>25.482</b>

### 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	
	Total	Clear	Total	Clear	Total	Clear	Total	Clear
Table in <a href="#">ES-4 Collection Guide</a>	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	
	Total	Clear	Total	Clear	Total	Clear	Total	Clear
Table in <a href="#">ES-4 Collection Guide</a>	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	
	Total	Clear	Total	Clear	Total	Clear	Total	Clear
<b>Sky (Cloud Cover) Vgroup</b>								
<b>Table in ES-4 Collection Guide</b>	<b>5-12</b>	<b>5-13</b>	<b>5-14</b>	<b>5-15</b>	<b>5-16</b>	<b>5-17</b>	<b>5-18</b>	<b>5-19</b>
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	
	Total	Clear	Total	Clear	Total	Clear	Total	Clear
<b>Sky (Cloud Cover) Vgroup</b>								
<b>Table in ES-4 Collection Guide</b>	<b>5-20</b>	<b>5-21</b>	<b>5-22</b>	<b>5-23</b>	<b>5-24</b>	<b>5-25</b>	<b>5-26</b>	<b>5-27</b>
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	
	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	
	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	
	Total	Clear	Total	Clear	Total	Clear	Total	Clear
<b>Sky (Cloud Cover) Vgroup</b>								
<b>Table in ES-4 Collection Guide</b>	<b>5-44</b>	<b>5-45</b>	<b>5-46</b>	<b>5-47</b>	<b>5-48</b>	<b>5-49</b>	<b>5-50</b>	<b>5-51</b>
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	
	Total	Clear	Total	Clear	Total	Clear	Total	Clear
<b>Sky (Cloud Cover) Vgroup</b>								
<b>Table in ES-4 Collection Guide</b>	<b>5-52</b>	<b>5-53</b>	<b>5-54</b>	<b>5-55</b>	<b>5-56</b>	<b>5-57</b>	<b>5-58</b>	<b>5-59</b>
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	
	Total	Clear	Total	Clear	Total	Clear	Total	Clear
<b>Sky (Cloud Cover) Vgroup</b>								
<b>Table in ES-4 Collection Guide</b>	<b>5-60</b>	<b>5-61</b>	<b>5-62</b>	<b>5-63</b>	<b>5-64</b>	<b>5-65</b>	<b>5-66</b>	<b>5-67</b>
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	
	Total	Clear	Total	Clear	Total	Clear	Total	Clear
<b>Sky (Cloud Cover) Vgroup</b>								
<b>Table in ES-4 Collection Guide</b>	<b>5-68</b>	<b>5-69</b>	<b>5-70</b>	<b>5-71</b>	<b>5-72</b>	<b>5-73</b>	<b>5-74</b>	<b>5-75</b>
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	<ul style="list-style-type: none"> <li>• Updated format to comply with standards.</li> </ul>	All
2/23/04	R4V1	503	<ul style="list-style-type: none"> <li>• Updated product versions for Aqua Edition1 to include Edition2.</li> <li>• Updated format to comply with standards.</li> </ul>	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: \[http://asd-www.larc.nasa.gov/ceres/collect\\\_guide/list.html\]\(http://asd-www.larc.nasa.gov/ceres/collect\_guide/list.html\)](#) ([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, Edition2F

**Aqua:** Edition1A, Edition1B, Ed2A-NoSW, Edition2A, Ed2B-NoSW, Edition2B, Ed2C-NoSW, Edition2C

## 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 <sup>-1</sup>	-10 .. 10	n	64-bit real	1.87
SSF-4	Y component of satellite inertial velocity	km sec <sup>-1</sup>	-10 .. 10	n	64-bit real	1.87
SSF-5	Z component of satellite inertial velocity	km sec <sup>-1</sup>	-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 <sup>-1</sup>	-300 .. 300	n	32-bit real	0.94
SSF-17	Rate of change of clock angle	deg sec <sup>-1</sup>	-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	Dimensions	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	Dimensions	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 process	N/A	0 .. 5000	n	16-bit integer	0.47
SSF-29	Cloud Classification	N/A	0 .. 32766	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	Dimensions	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 <sup>-1</sup>	-100 .. 100	n	32-bit real	0.94
SSF-58	Surface wind - V-vector	m sec <sup>-1</sup>	-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 <sup>31</sup> -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 <sup>-2</sup>	0 .. 10000	n x 2	32-bit real	1.87
SSF-90	Stddev of liquid water path for cloud layer (3.7)	g m <sup>-2</sup>	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 <sup>-2</sup>	0 .. 10000	n x 2	32-bit real	1.87
SSF-92	Stddev of ice water path for cloud layer (3.7)	g m <sup>-2</sup>	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	$\mu\text{m}$	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	$\text{W m}^{-2} \text{sr}^{-1} \mu\text{m}^{-1}$	-1000 .. 1000	n x 5	32-bit real	4.68
SSF-119	Stddev of imager radiances over clear area	$\text{W m}^{-2} \text{sr}^{-1} \mu\text{m}^{-1}$	0 .. 1000	n x 5	32-bit real	4.68
SSF-120	Mean imager radiances over overcast cloud area	$\text{W m}^{-2} \text{sr}^{-1} \mu\text{m}^{-1}$	-1000 .. 1000	n x 5	32-bit real	4.68
SSF-121	Stddev of imager radiances over overcast cloud area	$\text{W m}^{-2} \text{sr}^{-1} \mu\text{m}^{-1}$	0 .. 1000	n x 5	32-bit real	4.68
SSF-122	Mean imager radiances over full CERES FOV	$\text{W m}^{-2} \text{sr}^{-1} \mu\text{m}^{-1}$	-1000 .. 1000	n x 5	32-bit real	4.68
SSF-123	Stddev of imager radiances over full CERES FOV	$\text{W m}^{-2} \text{sr}^{-1} \mu\text{m}^{-1}$	0 .. 1000	n x 5	32-bit real	4.68
SSF-124	5th percentile of imager radiances over full CERES FOV	$\text{W m}^{-2} \text{sr}^{-1} \mu\text{m}^{-1}$	-1000 .. 1000	n x 5	32-bit real	4.68
SSF-125	95th percentile of imager radiances over full CERES FOV	$\text{W m}^{-2} \text{sr}^{-1} \mu\text{m}^{-1}$	-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	Dimensions	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 condensation nuclei ocean, average	CCN cm <sup>-2</sup>	0.0 .. 1*10 <sup>10</sup>	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	<ul style="list-style-type: none"> <li>Updated document to reflect new formats and to comply with standards.</li> </ul>	All
6/21/02	R3V2	367	<ul style="list-style-type: none"> <li>Changed range of SSF ID in SSF_Header.</li> <li>Added 2 tables for data available on Terra and Aqua products.</li> <li>Added explanation about differences between TRMM products and the Terra and Aqua products.</li> <li>Modified cover page to add information for all CERES satellites.</li> <li>Added Revision Record page.</li> <li>Updated format to comply with standards.</li> </ul>	SSF Metadata Tables 2.5-14 & 2.5-15 SSF Scientific Data Sets Cover page SSF Revision Record All
5/21/03	R3V3	438	<ul style="list-style-type: none"> <li>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.</li> <li>Added Beta1 data set for Aqua satellite.</li> <li>Updated format to comply with standards.</li> </ul>	Tables 2.5-14 & 2.5-15 Cover page All
8/27/03	R3V4	463	<ul style="list-style-type: none"> <li>Changed range for ADM geo (SSF-30) and removed the '(TBD)' in the parameter name.</li> <li>Updated format to comply with standards.</li> </ul>	Table 2.5-6 All
6/04/04	R4V1	533	<ul style="list-style-type: none"> <li>Changed (SSF-30) SDS name from "ADM geo" to "Snow/ice percent coverage clear-sky overhead-sun vis albedo."</li> <li>Changed (SSF-29) SDS name from "CERES WN ADM type for inversion process" to "Cloud Classification."</li> <li>Changed (SSF-29) Range from "0 .. 5000" to "0 .. 32766."</li> <li>Updated format to comply with standards.</li> </ul>	Table 2.5-6 Table 2.5-6 Table 2.5-6 All
6/15/07	R4V2	659	<ul style="list-style-type: none"> <li>Added additional versions for Terra and Aqua.</li> </ul>	Product Version Section

## 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, Edition2C

**Terra:** Edition2A, Edition2B, Edition2F

**Aqua:** Edition2A, Edition2B, Edition2C



## 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	<a href="#">Table B-1</a>	1	36
CERES_metadata Vdata	<a href="#">Table B-2</a>	1	14
CRS Product-specific Metadata	<a href="#">Table 2.6-2</a>	1	3
CRS_Header Vdata	<a href="#">Table 2.6-2</a>	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 and Aqua satellites, the CRS contains 250 SDSs. The first 131 SDSs (160 SDSs for Terra and Aqua) 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 <sup>a</sup>	Terra and Aqua CRS SDS Number <sup>b</sup>	SDS Name	Units	Range	Dim	Data Type
1	TRMM-132	Terra-161	Photosynthetically active radiation over surface	W m <sup>-2</sup>	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 and Aqua SSF and CRS granules.

b. The first 160 Terra and Aqua CRS SDSs are listed in the corresponding SSF DPC pages.

Table 2.6-4. Vertical Profile Description

SARB SDS	TRMM CRS SDS Number <sup>a</sup>	Terra and Aqua CRS SDS Number <sup>b</sup>	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 and Aqua SSF and CRS granules.

b. The first 160 Terra and Aqua CRS SDSs are listed in the corresponding SSF DPC pages.

Table 2.6-5. Pristine Vertical Flux Profiles

SARB SDS	TRMM CRS SDS Number <sup>a</sup>	Terra and Aqua CRS SDS Number <sup>b</sup>	SDS Name	Units	Range	Dim	Data Type
6	TRMM-137	Terra-166	SW flux - upward - pristine	W m <sup>-2</sup>	0 .. 1400	n x 2	32 bit real
7	TRMM-138	Terra-167	SW flux - downward - pristine	W m <sup>-2</sup>	0 .. 1400	n x 2	32 bit real
8	TRMM-139	Terra-168	LW flux - upward - pristine	W m <sup>-2</sup>	0 .. 850	n x 2	32 bit real
9	TRMM-140	Terra-169	LW flux - downward - pristine	W m <sup>-2</sup>	0 .. 700	n x 2	32 bit real
10	TRMM-141	Terra-170	WN flux - upward - pristine	W m <sup>-2</sup>	0 .. 370	n x 2	32 bit real
11	TRMM-142	Terra-171	WN flux - downward - pristine	W m <sup>-2</sup>	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 and Aqua SSF and CRS granules.  
 b. The first 160 Terra and Aqua CRS SDSs are listed in the corresponding SSF DPC pages.

Table 2.6-6. Constrained Clear Sky Profiles

SARB SDS	TRMM CRS SDS Number <sup>a</sup>	Terra and Aqua CRS SDS Number <sup>b</sup>	SDS Name	Units	Range	Dim	Data Type
12	TRMM-143	Terra-172	SW flux - upward for clear-sky	W m <sup>-2</sup>	0 .. 1400	n x 5	32 bit real
13	TRMM-144	Terra-173	SW flux - downward for clear-sky	W m <sup>-2</sup>	0 .. 1400	n x 5	32 bit real
14	TRMM-145	Terra-174	LW flux - upward for clear-sky	W m <sup>-2</sup>	0 .. 850	n x 5	32 bit real
15	TRMM-146	Terra-175	LW flux - downward for clear-sky	W m <sup>-2</sup>	0 .. 700	n x 5	32 bit real
16	TRMM-147	Terra-176	WN flux - upward for clear-sky	W m <sup>-2</sup>	0 .. 370	n x 5	32 bit real
17	TRMM-148	Terra-177	WN flux - downward for clear-sky	W m <sup>-2</sup>	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 and Aqua SSF and CRS granules.  
 b. The first 160 Terra and Aqua CRS SDSs are listed in the corresponding SSF DPC pages.

Table 2.6-7. Constrained Total Sky Profiles

SARB SDS	TRMM CRS SDS Number <sup>a</sup>	Terra and Aqua CRS SDS Number <sup>b</sup>	SDS Name	Units	Range	Dim	Data Type
18	TRMM-149	Terra-178	SW flux - upward for total-sky	W m <sup>-2</sup>	0 .. 1400	n x 5	32 bit real
19	TRMM-150	Terra-179	SW flux - downward for total-sky	W m <sup>-2</sup>	0 .. 1400	n x 5	32 bit real
20	TRMM-151	Terra-180	LW flux - upward for total-sky	W m <sup>-2</sup>	0 .. 850	n x 5	32 bit real
21	TRMM-152	Terra-181	LW flux - downward for total-sky	W m <sup>-2</sup>	0 .. 700	n x 5	32 bit real
22	TRMM-153	Terra-182	WN flux - upward for total-sky	W m <sup>-2</sup>	0 .. 370	n x 5	32 bit real
23	TRMM-154	Terra-183	WN flux - downward for total-sky	W m <sup>-2</sup>	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 and Aqua SSF and CRS granules.  
 b. The first 160 Terra and Aqua CRS SDSs are listed in the corresponding SSF DPC pages.

Table 2.6-8. Pristine Constraint-Initial Flux Deltas

SARB SDS	TRMM CRS SDS Number <sup>a</sup>	Terra and Aqua CRS SDS Number <sup>b</sup>	SDS Name	Units	Range	Dim	Data Type
24	TRMM-155	Terra-184	SW flux adjustment at surface - upward - pristine	W m <sup>-2</sup>	-1400 .. 1400	n	32 bit real
25	TRMM-156	Terra-185	SW flux adjustment at TOA - upward - pristine	W m <sup>-2</sup>	-1400 .. 1400	n	32 bit real
26	TRMM-157	Terra-186	SW flux adjustment at surface - downward - pristine	W m <sup>-2</sup>	-1400 .. 1400	n	32 bit real
27	TRMM-158	Terra-187	LW flux adjustment at surface - upward - pristine	W m <sup>-2</sup>	-600 .. 600	n	32 bit real
28	TRMM-159	Terra-188	LW flux adjustment at surface - downward - pristine	W m <sup>-2</sup>	-700 .. 700	n	32 bit real
29	TRMM-160	Terra-189	LW flux adjustment at TOA - upward - pristine	W m <sup>-2</sup>	-700 .. 700	n	32 bit real
30	TRMM-161	Terra-190	WN flux adjustment at surface - upward - pristine	W m <sup>-2</sup>	-50 .. 50	n	32 bit real
31	TRMM-162	Terra-191	WN flux adjustment at surface - downward - pristine	W m <sup>-2</sup>	-50 .. 50	n	32 bit real
32	TRMM-163	Terra-192	WN flux adjustment at TOA - upward - pristine	W m <sup>-2</sup>	-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 and Aqua SSF and CRS granules.  
 b. The first 160 Terra and Aqua CRS SDSs are listed in the corresponding SSF DPC pages.

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

SARB SDS	TRMM CRS SDS Number <sup>a</sup>	Terra and Aqua CRS SDS Number <sup>b</sup>	SDS Name	Units	Range	Dim	Data Type
33	TRMM-164	Terra-193	SW flux adjustment at surface - upward for clear-sky	W m <sup>-2</sup>	-1400 .. 1400	n	32 bit real
34	TRMM-165	Terra-194	SW flux adjustment at TOA - upward for clear-sky	W m <sup>-2</sup>	-1400 .. 1400	n	32 bit real
35	TRMM-166	Terra-195	SW flux adjustment at surface - downward for clear-sky	W m <sup>-2</sup>	-1400 .. 1400	n	32 bit real
36	TRMM-167	Terra-196	LW flux adjustment at surface - upward for clear-sky	W m <sup>-2</sup>	-600 .. 600	n	32 bit real
37	TRMM-168	Terra-197	LW flux adjustment at surface - downward for clear-sky	W m <sup>-2</sup>	-700 .. 700	n	32 bit real
38	TRMM-169	Terra-198	LW flux adjustment at TOA - upward for clear-sky	W m <sup>-2</sup>	-700 .. 700	n	32 bit real
39	TRMM-170	Terra-199	WN flux adjustment at surface - upward for clear-sky	W m <sup>-2</sup>	-50 .. 50	n	32 bit real
40	TRMM-171	Terra-200	WN flux adjustment at surface - downward for clear-sky	W m <sup>-2</sup>	-50 .. 50	n	32 bit real
41	TRMM-172	Terra-201	WN flux adjustment at TOA - upward for clear-sky	W m <sup>-2</sup>	-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 and Aqua SSF and CRS granules.  
 b. The first 160 Terra and Aqua CRS SDSs are listed in the corresponding SSF DPC pages.

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

SARB SDS	TRMM CRS SDS Number <sup>a</sup>	Terra and Aqua CRS SDS Number <sup>b</sup>	SDS Name	Units	Range	Dim	Data Type
42	TRMM-173	Terra-202	SW flux adjustment at surface - upward for total-sky	W m <sup>-2</sup>	-1400 .. 1400	n	32 bit real
43	TRMM-174	Terra-203	SW flux adjustment at TOA - upward for total-sky	W m <sup>-2</sup>	-1400 .. 1400	n	32 bit real
44	TRMM-175	Terra-204	SW flux adjustment at surface - downward for total-sky	W m <sup>-2</sup>	-1400 .. 1400	n	32 bit real

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

SARB SDS	TRMM CRS SDS Number <sup>a</sup>	Terra and Aqua CRS SDS Number <sup>b</sup>	SDS Name	Units	Range	Dim	Data Type
45	TRMM-176	Terra-205	LW flux adjustment at surface - upward for total-sky	W m <sup>-2</sup>	-600 .. 600	n	32 bit real
46	TRMM-177	Terra-206	LW flux adjustment at surface - downward for total-sky	W m <sup>-2</sup>	-700 .. 700	n	32 bit real
47	TRMM-178	Terra-207	LW flux adjustment at TOA - upward for total-sky	W m <sup>-2</sup>	-700 .. 700	n	32 bit real
48	TRMM-179	Terra-208	WN flux adjustment at surface - upward for total-sky	W m <sup>-2</sup>	-50 .. 50	n	32 bit real
49	TRMM-180	Terra-209	WN flux adjustment at surface - downward for total-sky	W m <sup>-2</sup>	-50 .. 50	n	32 bit real
50	TRMM-181	Terra-210	WN flux adjustment at TOA - upward for total-sky	W m <sup>-2</sup>	-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 and Aqua SSF and CRS granules.  
 b. The first 160 Terra and Aqua CRS SDSs are listed in the corresponding SSF DPC pages.

Table 2.6-11. Satellite Emulated Window Channel

SARB SDS	TRMM CRS SDS Number <sup>a</sup>	Terra and Aqua CRS SDS Number <sup>b</sup>	SDS Name	Units	Range	Dim	Data Type
51	TRMM-182	Terra-211	WN filtered radiance -satellite emulated	W m <sup>-2</sup> sr <sup>-1</sup>	0 .. 50	n	32 bit real
52	TRMM-183	Terra-212	WN filtered radiance adjustment-satellite emulated	W m <sup>-2</sup> sr <sup>-1</sup>	0 .. 50	n	32 bit real
53	TRMM-184	Terra-213	WN flux - satellite emulated - TOA	W m <sup>-2</sup>	2 .. 50	n	32 bit real
54	TRMM-185	Terra-214	WN flux adjustment - satellite emulated - TOA	W m <sup>-2</sup>	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 and Aqua SSF and CRS granules.  
 b. The first 160 Terra and Aqua CRS SDSs are listed in the corresponding SSF DPC pages.

Table 2.6-12. Unfiltered Total Longwave

SARB SDS	TRMM CRS SDS Number <sup>a</sup>	Terra and Aqua CRS SDS Number <sup>b</sup>	SDS Name	Units	Range	Dim	Data Type
55	TRMM-186	Terra-215	Total LW unfiltered radiance - satellite emulated	W m <sup>-2</sup> sr <sup>-1</sup>	0 .. 200	n	32 bit real
56	TRMM-187	Terra-216	Total LW unfiltered radiance adjustment - satellite emulated	W m <sup>-2</sup> sr <sup>-1</sup>	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 and Aqua SSF and CRS granules.  
 b. The first 160 Terra and Aqua CRS SDSs are listed in the corresponding SSF DPC pages.

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

SARB SDS	TRMM CRS SDS Number <sup>a</sup>	Terra and Aqua CRS SDS Number <sup>b</sup>	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

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

SARB SDS	TRMM CRS SDS Number <sup>a</sup>	Terra and Aqua CRS SDS Number <sup>b</sup>	SDS Name	Units	Range	Dim	Data Type
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
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 and Aqua SSF and CRS granules.  
 b. The first 160 Terra and Aqua CRS SDSs are listed in the corresponding SSF DPC pages.

Table 2.6-14. Aerosol Constituency Information

SARB SDS	TRMM CRS SDS Number <sup>a</sup>	Terra and Aqua CRS SDS Number <sup>b</sup>	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 and Aqua SSF and CRS granules.  
 b. The first 160 Terra and Aqua CRS SDSs are listed in the corresponding SSF DPC pages.

Table 2.6-15. Constraint Status

SARB SDS	TRMM CRS SDS Number <sup>a</sup>	Terra and Aqua CRS SDS Number <sup>b</sup>	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	Constraint 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 and Aqua SSF and CRS granules.  
 b. The first 160 Terra and Aqua CRS SDSs are listed in the corresponding SSF DPC pages.

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

SARB SDS	TRMM CRS SDS Number <sup>a</sup>	Terra and Aqua CRS SDS Number <sup>b</sup>	SDS Name	Units	Range	Dim	Data Type
76	N/A	Terra-236	SW flux - upward - cloudy skies with no aerosol	W m <sup>-2</sup>	0 .. 1400	n	32 bit real

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

SARB SDS	TRMM CRS SDS Number <sup>a</sup>	Terra and Aqua CRS SDS Number <sup>b</sup>	SDS Name	Units	Range	Dim	Data Type
77	N/A	Terra-237	SW flux - downward - cloudy skies with no aerosol	W m <sup>-2</sup>	0 .. 1400	n	32 bit real
78	N/A	Terra-238	LW flux - upward - cloudy skies with no aerosol	W m <sup>-2</sup>	0 .. 850	n	32 bit real
79	N/A	Terra-239	LW flux - downward - cloudy skies with no aerosol	W m <sup>-2</sup>	0 .. 700	n	32 bit real
80	N/A	Terra-240	WN flux - upward - cloudy skies with no aerosol	W m <sup>-2</sup>	0 .. 370	n	32 bit real
81	N/A	Terra-241	WN flux - downward - cloudy skies with no aerosol	W m <sup>-2</sup>	0 .. 370	n	32 bit real
82	N/A	Terra-242	SW flux adjustment at surface - upward - cloudy skies with no aerosol	W m <sup>-2</sup>	-1400 .. 1400	n	32 bit real
83	N/A	Terra-243	SW flux adjustment at TOA - upward - cloudy skies with no aerosol	W m <sup>-2</sup>	-1400 .. 1400	n	32 bit real
84	N/A	Terra-244	SW flux adjustment at surface - downward - cloudy skies with no aerosol	W m <sup>-2</sup>	-1400 .. 1400	n	32 bit real
85	N/A	Terra-245	LW flux adjustment at surface - upward - cloudy skies with no aerosol	W m <sup>-2</sup>	-600 .. 600	n	32 bit real
86	N/A	Terra-246	LW flux adjustment at surface - downward - cloudy skies with no aerosol	W m <sup>-2</sup>	-700 .. 700	n	32 bit real
87	N/A	Terra-247	LW flux adjustment at TOA - upward - cloudy skies with no aerosol	W m <sup>-2</sup>	-700 .. 700	n	32 bit real
88	N/A	Terra-248	WN flux adjustment at surface - upward - cloudy skies with no aerosol	W m <sup>-2</sup>	-50 .. 50	n	32 bit real
89	N/A	Terra-249	WN flux adjustment at surface - downward - cloudy skies with no aerosol	W m <sup>-2</sup>	-50 .. 50	n	32 bit real
90	N/A	Terra-250	WN flux adjustment at TOA - upward - cloudy skies with no aerosol	W m <sup>-2</sup>	-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 and Aqua SSF and CRS granules.  
 b. The first 160 Terra CRS and Aqua CRS SDSs are listed in the corresponding SSF DPC pages.

Table 2.6-17. Sizing Information<sup>a</sup>

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 AND AQUA 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	<ul style="list-style-type: none"> <li>• Updated format to comply with standards.</li> </ul>	All
12/20/02	R3V2	408	<ul style="list-style-type: none"> <li>• Added text to indicate a different number of SDSs for the different satellites.</li> <li>• Updated table to include sizing information for the different satellites.</li> <li>• Updated summary information to include the Product Version section and eliminated the references to the CERES Configuration Codes.</li> <li>• Corrected references to the height used as the TOA by SARB to 0.1 hPa.</li> <li>• Updated format to comply with standards.</li> </ul>	2.6 Table 2.6-16 2.6 2.6 All
12/20/02	R3V3	408	<ul style="list-style-type: none"> <li>• Replaced references to the 0.1 hPa height with the term TOA and defined pristine skies as containing no clouds or aerosols.</li> <li>• Removed column containing individual SDS hourly size information from VGroup tables and added Table 2.6-17.</li> <li>• Replaced single Item Number column in VGroup Tables with three columns to distinguish the Item Number between satellites.</li> <li>• Updated format to comply with standards.</li> </ul>	2.6  Tables 2.6-3 through 2.6-17  Tables 2.6-3 through 2.6-16  All
7/30/03	R3V4	458	<ul style="list-style-type: none"> <li>• Updated introduction to discuss the aerosol-free total sky additions to the CRS.</li> <li>• Added new table to contain the aerosol-free total sky information.</li> <li>• Updated sizing table to reflect the additional data.</li> <li>• Updated format to comply with standards.</li> </ul>	2.6 Table 2.6-16 Table 2.6-17 All



CRS Revision Record (2 of 2)

<b>SCCR Approval Date</b>	<b>Release/Version Number</b>	<b>SCCR Number</b>	<b>Description of Revision</b>	<b>Section(s) Affected</b>
1/16/04	R3V5	498	<ul style="list-style-type: none"> <li>• 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.</li> <li>• Corrected name shown for SARB SDS 1.</li> <li>• Updated format to comply with standards.</li> </ul>	Table 2.6-15  Table 2.6-3 All
6/28/04	R4V1	541	<ul style="list-style-type: none"> <li>• Included references to the Aqua satellite.</li> <li>• Updated format to comply with standards.</li> </ul>	Section 2.6 Tables 2.6-6 through 2.6-17 All
12/20/05	R4V2	597	<ul style="list-style-type: none"> <li>• Added Edition2A to the Product Version category Aqua.</li> </ul>	Section 2.6
4/05/07		651	<ul style="list-style-type: none"> <li>• Added Edition2B to the Product Version category Aqua.</li> </ul>	Section 2.6
2/01/08	R4V3	668	<ul style="list-style-type: none"> <li>• Added Edition2F to the Product Version category Terra.</li> </ul>	Product Version Section
4/05/07		651	<ul style="list-style-type: none"> <li>• Added Edition2C to the Product Version category Aqua.</li> </ul>	Product Version Section

## 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:** Edition2C

**Aqua:** Beta1, Edition2A, Edition2B

## 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	<a href="#">Table B-1</a>	1	36
CERES_metadata Vdata	<a href="#">Table B-2</a>	1	14
FSW Product Specific Metadata	<a href="#">Table 2.7-2</a>	1	2

Table 2.7-2. FSW Product-specific Metadata

Item	Parameter Name	Description	Data Type	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 DS 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	<a href="#">Table 2.7-4</a>	n	6	124.42
Regional Identification Data	<a href="#">Table 2.7-5</a>	n	5	88.87
Surface Map And Clear Area Data	<a href="#">Table 2.7-6</a>	n	11	533.23
Imager Radiances Statistics	<a href="#">Table 2.7-7</a>	n	5	302.17
Angular Model Scene Type Data	<a href="#">Table 2.7-8</a>	n	7	2150.73

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

<b>Vdata Name</b>	<b>Description Table</b>	<b>Records</b>	<b>Number of Fields</b>	<b>VData Size (MB)</b>
TOA Fluxes	<a href="#">Table 2.7-9</a>	n	12	639.88
Pristine Vertical Flux Profiles - TRMM	<a href="#">Table 2.7-10</a>	n	12	1866.24
Constrained Clear Sky Profiles - TRMM	<a href="#">Table 2.7-11</a>	n	30	1555.20
Constrained Total Sky Profiles - TRMM	<a href="#">Table 2.7-12</a>	n	30	1555.20
Constraintment - Initial Flux Deltas - TRMM	<a href="#">Table 2.7-13</a>	n	27	1399.68
Pristine Vertical Flux Profiles - Terra/Aqua	<a href="#">Table 2.7-14</a>	n	12	639.88
Constrained Clear Sky Profiles - Terra/Aqua	<a href="#">Table 2.7-15</a>	n	30	1599.72
Constrained Total Sky Profiles - Terra/Aqua	<a href="#">Table 2.7-16</a>	n	30	1599.72
Constraintment - Initial Flux Deltas - Terra/Aqua	<a href="#">Table 2.7-17</a>	n	27	1261.99
Surface Emissivity	<a href="#">Table 2.7-18</a>	n	7	124.42
Cloud Overlap Conditions	<a href="#">Table 2.7-19</a>	n	11	195.52
Cloud Layer - High	<a href="#">Table 2.7-20</a>	n	18	817.63
Cloud Layer - UpperMid	<a href="#">Table 2.7-21</a>	n	18	817.63
Cloud Layer - LowerMid	<a href="#">Table 2.7-22</a>	n	18	817.63
Cloud Layer - Low	<a href="#">Table 2.7-23</a>	n	18	817.63
Constraintment - Adjustments	<a href="#">Table 2.7-24</a>	n	7	124.42
Aerosol LAND	<a href="#">Table 2.7-25</a>	n	3	53.32
Aerosol OCEAN	<a href="#">Table 2.7-26</a>	n	7	124.42
Cloudy Skies With No Aerosols	<a href="#">Table 2.7-27</a>	n	21	1261.99
Satellite Emulated Window Channel	<a href="#">Table 2.7-28</a>	n	4	213.29
Aerosol Constituency Information	<a href="#">Table 2.7-29</a>	n	1	124.42
<b>TOTAL SIZE</b>				<b>14433.0</b>

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 <sup>a</sup>	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 $\mu\text{m}$ in clr	$\mu\text{m}$	-1.0 .. 5.0	3	32-Bit Float	1
FSW-18	Aerosol Opt. Depth at 1.6 $\mu\text{m}$ in clr	$\mu\text{m}$	-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. H <sub>2</sub> O	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	$\mu\text{m}$	0.4 .. 15.0	4	32-Bit Float	5
FSW-25	Imager Radiance	$\text{W m}^{-2}\text{sr}^{-1}$ $\mu\text{m}^{-1}$	-1000.0 .. 1000.0	4	32-Bit Float	5
FSW-26	Imager Radiance Clr-sky	$\text{W m}^{-2}\text{sr}^{-1}$ $\mu\text{m}^{-1}$	-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)	$\text{W m}^{-2}$	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 <sup>-2</sup>	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 <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
FSW-35	LW TOA Clear-Sky	W m <sup>-2</sup>	0.0 .. 500.0	4	32-Bit Float	3
FSW-36	WN TOA Clear-Sky	W m <sup>-2</sup>	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 <sup>a</sup>	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
FSW-39	SW TOA UPWARD Clear-Sky <sup>a</sup>	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
FSW-40	LW TOA UPWARD Clear-Sky <sup>a</sup>	W m <sup>-2</sup>	0.0 .. 850.0	4	32-Bit Float	3
FSW-41	WN TOA UPWARD Clear-Sky <sup>a</sup>	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-42	SW TOA Total-Sky	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
FSW-43	LW TOA Total-Sky	W m <sup>-2</sup>	0.0 .. 500.0	4	32-Bit Float	3
FSW-44	WN TOA Total-Sky	W m <sup>-2</sup>	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 Pristine Sky (TOA)	W m <sup>-2</sup>	0.0 - 1400.0	4	32-Bit Float	3
FSW-47	SW Downward Pristine Sky (TOA)	W m <sup>-2</sup>	0.0 - 1400.0	4	32-Bit Float	3
FSW-48	LW Upward Pristine Sky (TOA)	W m <sup>-2</sup>	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 Elements
FSW-49	LW Downward Prestine Sky (TOA)	W m <sup>-2</sup>	0.0 - 700.0	4	32-Bit Float	3
FSW-50	WN Upward Prestine Sky (TOA)	W m <sup>-2</sup>	0.0 - 370.0	4	32-Bit Float	3
FSW-51	WN Downward Prestine Sky (TOA)	W m <sup>-2</sup>	0.0 - 370.0	4	32-Bit Float	3
FSW-52	SW Upward Prestine Sky (SRF)	W m <sup>-2</sup>	0.0 - 1400.0	4	32-Bit Float	3
FSW-53	SW Downward Prestine Sky (SRF)	W m <sup>-2</sup>	0.0 - 1400.0	4	32-Bit Float	3
FSW-54	LW Upward Prestine Sky (SRF)	W m <sup>-2</sup>	0.0 - 850.0	4	32-Bit Float	3
FSW-55	LW Downward Prestine Sky (SRF)	W m <sup>-2</sup>	0.0 - 700.0	4	32-Bit Float	3
FSW-56	WN Upward Prestine Sky (SRF)	W m <sup>-2</sup>	0.0 - 370.0	4	32-Bit Float	3
FSW-57	WN Downward Prestine Sky (SRF)	W m <sup>-2</sup>	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 Elements
FSW-58	SW Upward Clear Sky (TOA)	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
FSW-59	SW Downward Clear Sky (TOA)	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
FSW-60	LW Upward Clear Sky (TOA)	W m <sup>-2</sup>	0.0 .. 850.0	4	32-Bit Float	3
FSW-61	LW Downward Clear Sky (TOA)	W m <sup>-2</sup>	0.0 .. 700.0	4	32-Bit Float	3
FSW-62	WN Upward Clear Sky (TOA)	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-63	WN Downward Clear Sky (TOA)	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-64	SW Upward Clear Sky (70hPa)	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
FSW-65	SW Downward Clear Sky (70hPa)	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
FSW-66	LW Upward Clear Sky (70hPa)	W m <sup>-2</sup>	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 Elements
FSW-67	LW Downward Clear Sky (70hPa)	W m <sup>-2</sup>	0.0 .. 700.0	4	32-Bit Float	3
FSW-68	WN Upward Clear Sky (70hPa)	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-69	WN Downward Clear Sky (70hPa)	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-70	SW Upward Clear Sky (200hPa)	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
FSW-71	SW Downward Clear Sky (200hPa)	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
FSW-72	LW Upward Clear Sky (200hPa)	W m <sup>-2</sup>	0.0 .. 850.0	4	32-Bit Float	3
FSW-73	LW Downward Clear Sky (200hPa)	W m <sup>-2</sup>	0.0 .. 700.0	4	32-Bit Float	3
FSW-74	WN Upward Clear Sky (200hPa)	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-75	WN Downward Clear Sky (200hPa)	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-76	SW Upward Clear Sky (500hPa)	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
FSW-77	SW Downward Clear Sky (500hPa)	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
FSW-78	LW Upward Clear Sky (500hPa)	W m <sup>-2</sup>	0.0 .. 850.0	4	32-Bit Float	3
FSW-79	LW Downward Clear Sky (500hPa)	W m <sup>-2</sup>	0.0 .. 700.0	4	32-Bit Float	3
FSW-80	WN Upward Clear Sky (500hPa)	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-81	WN Downward Clear Sky (500hPa)	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-82	SW Upward Clear Sky (SFC)	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
FSW-83	SW Downward Clear Sky (SFC)	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
FSW-84	LW Upward Clear Sky (SFC)	W m <sup>-2</sup>	0.0 .. 850.0	4	32-Bit Float	3
FSW-85	LW Downward Clear Sky (SFC)	W m <sup>-2</sup>	0.0 .. 700.0	4	32-Bit Float	3
FSW-86	WN Upward Clear Sky (SFC)	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-87	WN Downward Clear Sky (SFC)	W m <sup>-2</sup>	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 Elements
FSW-88	SW Upward Total Sky (TOA)	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
FSW-89	SW Downward Total Sky (TOA)	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
FSW-90	LW Upward Total Sky (TOA)	W m <sup>-2</sup>	0.0 .. 850.0	4	32-Bit Float	3
FSW-91	LW Downward Total Sky (TOA)	W m <sup>-2</sup>	0.0 .. 700.0	4	32-Bit Float	3
FSW-92	WN Upward Total Sky (TOA)	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-93	WN Downward Total Sky (TOA)	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-94	SW Upward Total Sky (70hPa)	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
FSW-95	SW Downward Total Sky (70hPa)	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
FSW-96	LW Upward Total Sky (70hPa)	W m <sup>-2</sup>	0.0 .. 850.0	4	32-Bit Float	3
FSW-97	LW Downward Total Sky (70hPa)	W m <sup>-2</sup>	0.0 .. 700.0	4	32-Bit Float	3
FSW-98	WN Upward Total Sky (70hPa)	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-99	WN Downward Total Sky (70hPa)	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-100	SW Upward Total Sky (200hPa)	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
FSW-101	SW Downward Total Sky (200hPa)	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
FSW-102	LW Upward Total Sky (200hPa)	W m <sup>-2</sup>	0.0 .. 850.0	4	32-Bit Float	3
FSW-103	LW Downward Total Sky (200hPa)	W m <sup>-2</sup>	0.0 .. 700.0	4	32-Bit Float	3
FSW-104	WN Upward Total Sky (200hPa)	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-105	WN Downward Total Sky (200hPa)	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-106	SW Upward Total Sky (500hPa)	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
FSW-107	SW Downward Total Sky (500hPa)	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
FSW-108	LW Upward Total Sky (500hPa)	W m <sup>-2</sup>	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 Elements
FSW-109	LW Downward Total Sky (500hPa)	W m <sup>-2</sup>	0.0 .. 700.0	4	32-Bit Float	3
FSW-110	WN Upward Total Sky (500hPa)	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-111	WN Downward Total Sky (500hPa)	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-112	SW Upward Total Sky (SFC)	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
FSW-113	SW Downward Total Sky (SFC)	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
FSW-114	LW Upward Total Sky (SFC)	W m <sup>-2</sup>	0.0 .. 850.0	4	32-Bit Float	3
FSW-115	LW Downward Total Sky (SFC)	W m <sup>-2</sup>	0.0 .. 700.0	4	32-Bit Float	3
FSW-116	WN Upward Total Sky (SFC)	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-117	WN Downward Total Sky (SFC)	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3

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

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

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

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

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

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

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

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

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

<b>Terra/ Aqua SDS Index</b>	<b>SDS Name / Parameter</b>	<b>Units</b>	<b>Range</b>	<b>SDS rank/ dim</b>	<b>Data Type</b>	<b>No. of Ele- ments</b>
FSW-63	SW flux - downward - clear-sky - TOA	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
FSW-64	SW flux - downward - clear-sky - 70hPa	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
FSW-65	SW flux - downward - clear-sky - 200hPa	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
FSW-66	SW flux - downward - clear-sky - 500hPa	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
FSW-67	SW flux - downward - clear-sky - SFC	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
FSW-68	LW flux - upward - clear-sky - TOA	W m <sup>-2</sup>	0.0 .. 850.0	4	32-Bit Float	3
FSW-69	LW flux - upward - clear-sky - 70hPa	W m <sup>-2</sup>	0.0 .. 850.0	4	32-Bit Float	3
FSW-70	LW flux - upward - clear-sky - 200hPa	W m <sup>-2</sup>	0.0 .. 850.0	4	32-Bit Float	3
FSW-71	LW flux - upward - clear-sky - 500hPa	W m <sup>-2</sup>	0.0 .. 850.0	4	32-Bit Float	3
FSW-72	LW flux - upward - clear-sky - SFC	W m <sup>-2</sup>	0.0 .. 850.0	4	32-Bit Float	3
FSW-73	LW flux - downward - clear-sky - TOA	W m <sup>-2</sup>	0.0 .. 700.0	4	32-Bit Float	3
FSW-74	LW flux - downward - clear-sky - 70hPa	W m <sup>-2</sup>	0.0 .. 700.0	4	32-Bit Float	3
FSW-75	LW flux - downward - clear-sky - 200hPa	W m <sup>-2</sup>	0.0 .. 700.0	4	32-Bit Float	3
FSW-76	LW flux - downward - clear-sky - 500hPa	W m <sup>-2</sup>	0.0 .. 700.0	4	32-Bit Float	3
FSW-77	LW flux - downward - clear-sky - SFC	W m <sup>-2</sup>	0.0 .. 700.0	4	32-Bit Float	3
FSW-78	WN flux - upward - clear-sky - TOA	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-79	WN flux - upward - clear-sky - 70hPa	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-80	WN flux - upward - clear-sky - 200hPa	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-81	WN flux - upward - clear-sky - 500hPa	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-82	WN flux - upward - clear-sky - SFC	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-83	WN flux - downward - clear-sky - TOA	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3

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

<b>Terra/ Aqua SDS Index</b>	<b>SDS Name / Parameter</b>	<b>Units</b>	<b>Range</b>	<b>SDS rank/ dim</b>	<b>Data Type</b>	<b>No. of Ele- ments</b>
FSW-84	WN flux - downward - clear-sky - 70hPa	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-85	WN flux - downward - clear-sky - 200hPa	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-86	WN flux - downward - clear-sky - 500hPa	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-87	WN flux - upward - clear-sky - SFC	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3

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

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

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

<b>Terra/ Aqua SDS Index</b>	<b>SDS Name / Parameter</b>	<b>Units</b>	<b>Range</b>	<b>SDS rank/ dim</b>	<b>Data Type</b>	<b>No. of Ele- ments</b>
FSW-101	LW flux - upward - total-sky - 500hPa	W m <sup>-2</sup>	0.0 .. 850.0	4	32-Bit Float	3
FSW-102	LW flux - upward - total-sky - SFC	W m <sup>-2</sup>	0.0 .. 850.0	4	32-Bit Float	3
FSW-103	LW flux - downward - total-sky - TOA	W m <sup>-2</sup>	0.0 .. 700.0	4	32-Bit Float	3
FSW-104	LW flux - downward - total-sky - 70hPa	W m <sup>-2</sup>	0.0 .. 700.0	4	32-Bit Float	3
FSW-105	LW flux - downward - total-sky - 200hPa	W m <sup>-2</sup>	0.0 .. 700.0	4	32-Bit Float	3
FSW-106	LW flux - downward - total-sky - 500hPa	W m <sup>-2</sup>	0.0 .. 700.0	4	32-Bit Float	3
FSW-107	LW flux - downward - total-sky - SFC	W m <sup>-2</sup>	0.0 .. 700.0	4	32-Bit Float	3
FSW-108	WN flux - upward - total-sky - TOA	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-109	WN flux - upward - total-sky - 70hPa	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-110	WN flux - upward - total-sky - 200hPa	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-111	WN flux - upward - total-sky - 500hPa	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-112	WN flux - upward - total-sky - SFC	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-113	WN flux - downward - total-sky - TOA	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-114	WN flux - downward - total-sky - 70hPa	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-115	WN flux - downward - total-sky - 200hPa	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-116	WN flux - downward - total-sky - 500hPa	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3
FSW-117	WN flux - upward - total-sky - SFC	W m <sup>-2</sup>	0.0 .. 370.0	4	32-Bit Float	3

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

<b>Terra/ Aqua SDS Index</b>	<b>SDS Name / Parameter</b>	<b>Units</b>	<b>Range</b>	<b>SDS rank/ dim</b>	<b>Data Type</b>	<b>No. of Ele- ments</b>
FSW-118	SW flux adjustment at surface upward - pristine	W m <sup>-2</sup>	-1400.0 .. 1400.0	4	32-Bit Float	3



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

<b>Terra/ Aqua SDS Index</b>	<b>SDS Name / Parameter</b>	<b>Units</b>	<b>Range</b>	<b>SDS rank/ dim</b>	<b>Data Type</b>	<b>No. of Ele- ments</b>
FSW-119	SW flux adjustment at TOA - upward - pristine	W m <sup>-2</sup>	-1400.0 .. 1400.0	4	32-Bit Float	3
FSW-120	SW flux adjustment at surface - downward - pristine	W m <sup>-2</sup>	-1400.0 .. 1400.0	4	32-Bit Float	3
FSW-121	LW flux adjustment at surface - upward - pristine	W m <sup>-2</sup>	-700.0 .. 700.0	4	32-Bit Float	3
FSW-122	LW flux adjustment at surface - downward - pristine	W m <sup>-2</sup>	-600.0 .. 600.0	4	32-Bit Float	3
FSW-123	LW flux adjustment at TOA - upward - pristine	W m <sup>-2</sup>	-700.0 .. 700.0	4	32-Bit Float	3
FSW-124	WN flux adjustment at surface - upward - pristine	W m <sup>-2</sup>	-50.0 .. 50.0	4	32-Bit Float	3
FSW-125	WN flux adjustment at surface - downward - pristine	W m <sup>-2</sup>	-50.0 .. 50.0	4	32-Bit Float	3
FSW-126	WN flux adjustment at TOA - upward - pristine	W m <sup>-2</sup>	-50.0 .. 50.0	4	32-Bit Float	3
FSW-127	SW flux adjustment at surface upward - clear-sky	W m <sup>-2</sup>	-1400.0 .. 1400.0	4	32-Bit Float	3
FSW-128	SW flux adjustment at TOA - upward - clear-sky	W m <sup>-2</sup>	-1400.0 .. 1400.0	4	32-Bit Float	3
FSW-129	SW flux adjustment at surface - downward - clear-sky	W m <sup>-2</sup>	-1400.0 .. 1400.0	4	32-Bit Float	3
FSW-130	LW flux adjustment at surface - upward - clear-sky	W m <sup>-2</sup>	-700.0 .. 700.0	4	32-Bit Float	3
FSW-131	LW flux adjustment at surface - downward - clear-sky	W m <sup>-2</sup>	-600.0 .. 600.0	4	32-Bit Float	3
FSW-132	LW flux adjustment at TOA - upward - clear-sky	W m <sup>-2</sup>	-700.0 .. 700.0	4	32-Bit Float	3
FSW-133	WN flux adjustment at surface - upward - clear-sky	W m <sup>-2</sup>	-50.0 .. 50.0	4	32-Bit Float	3
FSW-134	WN flux adjustment at surface - downward - clear-sky	W m <sup>-2</sup>	-50.0 .. 50.0	4	32-Bit Float	3
FSW-135	WN flux adjustment at TOA - upward - clear-sky	W m <sup>-2</sup>	-50.0 .. 50.0	4	32-Bit Float	3
FSW-136	SW flux adjustment at surface upward - total-sky	W m <sup>-2</sup>	-1400.0 .. 1400.0	4	32-Bit Float	3
FSW-137	SW flux adjustment at TOA - upward - total-sky	W m <sup>-2</sup>	-1400.0 .. 1400.0	4	32-Bit Float	3
FSW-138	SW flux adjustment at surface - downward - total-sky	W m <sup>-2</sup>	-1400.0 .. 1400.0	4	32-Bit Float	3
FSW-139	LW flux adjustment at surface - upward - total-sky	W m <sup>-2</sup>	-700.0 .. 700.0	4	32-Bit Float	3

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

<b>Terra/ Aqua SDS Index</b>	<b>SDS Name / Parameter</b>	<b>Units</b>	<b>Range</b>	<b>SDS rank/ dim</b>	<b>Data Type</b>	<b>No. of Ele- ments</b>
FSW-140	LW flux adjustment at surface - downward - total-sky	W m <sup>-2</sup>	-600.0 .. 600.0	4	32-Bit Float	3
FSW-141	LW flux adjustment at TOA - upward - total-sky	W m <sup>-2</sup>	-700.0 .. 700.0	4	32-Bit Float	3
FSW-142	WN flux adjustment at surface - upward - total-sky	W m <sup>-2</sup>	-50.0 .. 50.0	4	32-Bit Float	3
FSW-143	WN flux adjustment at surface - downward - total-sky	W m <sup>-2</sup>	-50.0 .. 50.0	4	32-Bit Float	3
FSW-144	WN flux adjustment at TOA - upward - total-sky	W m <sup>-2</sup>	-50.0 .. 50.0	4	32-Bit Float	3

Table 2.7-18. Surface Emissivity

<b>TRMM/ Terra/ Aqua SDS Index</b>	<b>SDS Name / Parameter</b>	<b>Units</b>	<b>Range</b>	<b>SDS rank/ dim</b>	<b>Data Type</b>	<b>No. of Ele- ments</b>
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 <sup>-2</sup>	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 (1 of 2)

<b>TRMM/ Terra/ Aqua SDS Index</b>	<b>SDS Name / Parameter</b>	<b>Units</b>	<b>Range</b>	<b>SDS rank/ dim</b>	<b>Data Type</b>	<b>No. of Ele- ments</b>
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

Table 2.7-19. Cloud Overlap Conditions (2 of 2)

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

Table 2.7-21. Cloud Layer - UpperMid (mean std num\_obs)

TRMM/ Terra/ Aqua SDS Index	SDS Name / Parameter	Units	Range	SDS rank/ dim	Data Type	No. of Ele- ments
FSW-181	Area Fraction Percentage - upper mid cloud	percent	0.0 .. 100.0	3	32-Bit Float	1
FSW-182	Effective Pressure - upper mid cloud	hPa	0.0 .. 1100.0	4	32-Bit Float	3
FSW-183	Effective Temperature - upper mid cloud	K	100.0 .. 350.0	4	32-Bit Float	3
FSW-184	Effective Height - upper mid cloud	km	0.0 .. 20.0	4	32-Bit Float	3
FSW-185	Top Pressure - upper mid cloud	hPa	0.0 .. 1100.0	4	32-Bit Float	3
FSW-186	Bottom Pressure - upper mid cloud	hPa	0.0 .. 1100.0	4	32-Bit Float	3
FSW-187	Particle Phase - upper mid cloud	N/A	1.0 .. 2.0	4	32-Bit Float	3
FSW-188	Liquid Water Path - upper mid cloud	gm <sup>-2</sup>	0.0 .. 10000.0	4	32-Bit Float	3
FSW-189	Ice Water Path - upper mid cloud	gm <sup>-2</sup>	0.0 .. 10000.0	4	32-Bit Float	3
FSW-190	Liquid Particle Radius - upper mid cloud	µm	0.0 .. 40.0	4	32-Bit Float	3
FSW-191	Ice Particle Diameter - upper mid cloud	µm	0.0 .. 300.0	4	32-Bit Float	3
FSW-192	Vis. Opt. Depth (linear) - upper mid cloud	N/A	0.0 .. 400.0	4	32-Bit Float	3
FSW-193	Vis. Opt. Depth (log) - upper mid cloud	N/A	-6.0 .. 6.0	4	32-Bit Float	3
FSW-194	Infrared Emissivity - upper mid cloud	N/A	0.0 .. 2.0	4	32-Bit Float	3
FSW-195	Vertical Aspect Ratio - upper mid cloud	N/A	0.0 .. 20.0	4	32-Bit Float	3
FSW-196	Adj. Vis. Opt. Depth - upper mid cloud	N/A	-400.0 .. 400.0	3	32-Bit Float	1
FSW-197	Adj. Fractional Area - upper mid cloud	N/A	-1 .. 1	3	32-Bit Float	1
FSW-198	Adj. Effective Temp. - upper mid cloud	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 - lower mid cloud	percent	0.0 .. 100.0	3	32-Bit Float	1
FSW-200	Effective Pressure - lower mid cloud	hPa	0.0 .. 1100.0	4	32-Bit Float	3
FSW-201	Effective Temperature - lower mid cloud	K	100.0 .. 350.0	4	32-Bit Float	3
FSW-202	Effective Height - lower mid cloud	km	0.0 .. 20.0	4	32-Bit Float	3
FSW-203	Top Pressure - lower mid cloud	hPa	0.0 .. 1100.0	4	32-Bit Float	3
FSW-204	Bottom Pressure - lower mid cloud	hPa	0.0 .. 1100.0	4	32-Bit Float	3
FSW-205	Particle Phase - lower mid cloud	N/A	1.0 .. 2.0	4	32-Bit Float	3
FSW-206	Liquid Water Path - lower mid cloud	gm <sup>-2</sup>	0.0 .. 10000.0	4	32-Bit Float	3
FSW-207	Ice Water Path - lower mid cloud	gm <sup>-2</sup>	0.0 .. 10000.0	4	32-Bit Float	3
FSW-208	Liquid Particle Radius - lower mid cloud	µm	0.0 .. 40.0	4	32-Bit Float	3
FSW-209	Ice Particle Diameter - lower mid cloud	µm	0.0 .. 300.0	4	32-Bit Float	3
FSW-210	Vis. Opt. Depth (linear) - lower mid cloud	N/A	0.0 .. 400.0	4	32-Bit Float	3
FSW-211	Vis. Opt. Depth (log) - lower mid cloud	N/A	-6.0 .. 6.0	4	32-Bit Float	3
FSW-212	Infrared Emissivity - lower mid cloud	N/A	0.0 .. 2.0	4	32-Bit Float	3
FSW-213	Vertical Aspect Ratio - lower mid cloud	N/A	0.0 .. 20.0	4	32-Bit Float	3
FSW-214	Adj. Vis. Opt. Depth - lower mid cloud	N/A	-400.0 .. 400.0	3	32-Bit Float	1
FSW-215	Adj. Fractional Area - lower mid cloud	N/A	-1 .. 1	3	32-Bit Float	1
FSW-216	Adj. Effective Temp. - lower mid cloud	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 - low cloud	percent	0.0 .. 100.0	3	32-Bit Float	1
FSW-218	Effective Pressure - low cloud	hPa	0.0 .. 1100.0	4	32-Bit Float	3
FSW-219	Effective Temperature - low cloud	K	100.0 .. 350.0	4	32-Bit Float	3
FSW-220	Effective Height - low cloud	km	0.0 .. 20.0	4	32-Bit Float	3
FSW-221	Top Pressure - low cloud	hPa	0.0 .. 1100.0	4	32-Bit Float	3
FSW-222	Bottom Pressure - low cloud	hPa	0.0 .. 1100.0	4	32-Bit Float	3
FSW-223	Particle Phase - low cloud	N/A	1.0 .. 2.0	4	32-Bit Float	3
FSW-224	Liquid Water Path - low cloud	gm <sup>-2</sup>	0.0 .. 10000.0	4	32-Bit Float	3
FSW-225	Ice Water Path - low cloud	gm <sup>-2</sup>	0.0 .. 10000.0	4	32-Bit Float	3
FSW-226	Liquid Particle Radius - low cloud	µm	0.0 .. 40.0	4	32-Bit Float	3
FSW-227	Ice Particle Diameter - low cloud	µm	0.0 .. 300.0	4	32-Bit Float	3
FSW-228	Vis. Opt. Depth (linear) - low cloud	N/A	0.0 .. 400.0	4	32-Bit Float	3
FSW-229	Vis. Opt. Depth (log) - low cloud	N/A	-6.0 .. 6.0	4	32-Bit Float	3
FSW-230	Infrared Emissivity - low cloud	N/A	0.0 .. 2.0	4	32-Bit Float	3
FSW-231	Vertical Aspect Ratio - low cloud	N/A	0.0 .. 20.0	4	32-Bit Float	3
FSW-232	Adj. Vis. Opt. Depth - low cloud	N/A	-400.0 .. 400.0	3	32-Bit Float	1
FSW-233	Adj. Fractional Area - low cloud	N/A	-1 .. 1	3	32-Bit Float	1
FSW-234	Adj. Effective Temp. - low cloud	K	TBD	3	32-Bit Float	1

Table 2.7-24. Constraint - 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

<b>Terra/ Aqua SDS Index</b>	<b>SDS Name / Parameter</b>	<b>Units</b>	<b>Range</b>	<b>SDS rank/ dim</b>	<b>Data Type</b>	<b>No. of Ele- ments</b>
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

<b>Terra/ Aqua SDS Index</b>	<b>SDS Name / Parameter</b>	<b>Units</b>	<b>Range</b>	<b>SDS rank/ dim</b>	<b>Data Type</b>	<b>No. of Ele- ments</b>
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)

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

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

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

Table 2.7-28. Satellite Emulated Window Channel (1 of 2)

<b>Terra/ Aqua SDS Index</b>	<b>SDS Name / Parameter</b>	<b>Units</b>	<b>Range</b>	<b>SDS rank/ dim</b>	<b>Data Type</b>	<b>No. of Ele- ments</b>
FSW-273	WN flux - satellite emulated - TOA Total-Sky	W m <sup>-2</sup>	2.0 .. 50.0	4	32-Bit Float	3
FSW-274	WN flux adjustment - satellite emulated - TOA Total-Sky	W m <sup>-2</sup>	2.0 .. 50.0	4	32-Bit Float	3



Table 2.7-28. Satellite Emulated Window Channel (2 of 2)

<b>Terra/ Aqua SDS Index</b>	<b>SDS Name / Parameter</b>	<b>Units</b>	<b>Range</b>	<b>SDS rank/ dim</b>	<b>Data Type</b>	<b>No. of Ele- ments</b>
FSW-275	WN flux - satellite emulated - TOA Clear-Sky	W m <sup>-2</sup>	2.0 .. 50.0	4	32-Bit Float	3
FSW-276	WN flux adjustment - satellite emulated - TOA Clear-Sky	W m <sup>-2</sup>	2.0 .. 50.0	4	32-Bit Float	3

Table 2.7-29. Aerosol Constituency Information

<b>Terra/ Aqua SDS Index</b>	<b>SDS Name / Parameter</b>	<b>Units</b>	<b>Range</b>	<b>SDS rank/ dim</b>	<b>Data Type</b>	<b>No. of Ele- ments</b>
FSW-277	Aerosol Constituency Ratio	Percent	0.0 .. 100.0	4	32-Bit Float	7

## 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	<ul style="list-style-type: none"> <li>• Updated format to comply with standards.</li> </ul>	All
02/07/03	R3V2	424	<ul style="list-style-type: none"> <li>• Updated parameters in Regional Identification Data, Regional Imager Data.</li> <li>• Updated Angular model scene category</li> <li>• Updated vdata sizes.</li> <li>• Added MODIS aerosols for land and Ocean.</li> <li>• Updated format to comply with standards.</li> </ul>	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	<ul style="list-style-type: none"> <li>• Added cloudy skies with no Aerosols.</li> <li>• Updated flux profile parameters.</li> <li>• Added Snow/Ice Percentage from Imager History parameter to Angular Model Scene type.</li> <li>• Updated format to comply with standards.</li> </ul>	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	<ul style="list-style-type: none"> <li>• Added two new columns to include SDS index numbers for TRMM &amp; Terra.</li> <li>• Julian Time SDS data type is set to 64-bit. Added a note.</li> <li>• Added new tables for TRMM profile flux SDSs, since these names are defined differently for TRMM and Terra.</li> <li>• Updated units and range values.</li> <li>• Updated format to comply with standards.</li> </ul>	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	<ul style="list-style-type: none"> <li>• Deleted Snow/Ice Percentage from Imager History parameter to Angular Model Scene type.</li> <li>• Updated SDS Indices.</li> <li>• Deleted Terra SDS Index columns where ever SDS Indices are the same for TRMM, Terra and Aqua. Updated Column Titles.</li> <li>• Updated Terra SDS Indices.</li> <li>• Added product name in front of SDS index in the first column of the table.</li> <li>• Updated format to comply with standards.</li> </ul>	<p>Table 2.7.8</p> <p>Tables 2.7.9, 2.7.14 - 2.7.27</p> <p>Tables 2.7.9, 2.7.8, 2.7.18 - 2.7.24</p> <p>Tables 2.7.15 - 2.7.17, 2.7.25 - 2.7.27</p> <p>Tables 2.7.4 - 2.7.27</p> <p>All</p>
02/07/05	R4V2	575	<ul style="list-style-type: none"> <li>• Added Total-Sky and Clear-sky Satellite Emulated Window Channel parameters.</li> <li>• Added Aerosol Constituency Ratio Parameter.</li> <li>• Updated parameter names.</li> <li>• Updated sds sizes.</li> <li>• Updated format to comply with standards.</li> </ul>	<p>Table 2.7.28</p> <p>Table 2.7.29</p> <p>Tables 2.7.14, 2.7.20 - 2.7.23</p> <p>Table 2.7-3</p> <p>All</p>
02/07/06	R4V3	575	<ul style="list-style-type: none"> <li>• Added Edition2A and Edition2B to the Product Version category Aqua.</li> </ul>	<p>Section 2.7</p>

## 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 regions in a 1.0-degree nested grid. The data are processed and written in local time. 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	<a href="#">Table B-1</a>	1	36
CERES_metadata Vdata	<a href="#">Table B-2</a>	1	14
SFC Product Specific Metadata	<a href="#">Table 2.8-2</a>	1	2

Table 2.8-2. SFC Product-specific Metadata

Item	Parameter Name	Description	Data Type	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	<a href="#">Table 2.8-4</a>	n	6	106.48
Regional Identification Data	<a href="#">Table 2.8-5</a>	n	5	88.74
Surface Map and Full-Clear area Data	<a href="#">Table 2.8-6</a>	n	6	443.69
Imager Radiances Statistics	<a href="#">Table 2.8-7</a>	n	5	301.71
Angular Model Scene Type	<a href="#">Table 2.8-8</a>	n	7	2147.47
TOA Fluxes (mean std num_obs)	<a href="#">Table 2.8-9</a>	n	8	425.94
Surface Fluxes (mean std num_obs)	<a href="#">Table 2.8-10</a>	n	18	958.37
Surface Emissivity	<a href="#">Table 2.8-11</a>	n	2	35.49
Layer Cloud - HIGH (mean std num_obs)	<a href="#">Table 2.8-12</a>	n	15	763.15
Layer Cloud - UPPERMID (mean std num_obs)	<a href="#">Table 2.8-13</a>	n	15	763.15
Layer Cloud - LOWERMID (mean std num_obs)	<a href="#">Table 2.8-14</a>	n	15	763.15

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)	<a href="#">Table 2.8-15</a>	n	15	763.15
Aerosol LAND	<a href="#">Table 2.8-16</a>	n	3	53.24
Aerosol OCEAN	<a href="#">Table 2.8-17</a>	n	7	124.23
<b>Vdata TOTAL SIZE</b>				<b>7737.99</b>

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 Element s
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 Elemen ts
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 <sup>-2</sup> sr <sup>-1</sup> μm <sup>-1</sup>	-1000 .. 1000	4	32-Bit Float	5
SFC-21	Imager Radiances over clear area	W m <sup>-2</sup> sr <sup>-1</sup> μm <sup>-1</sup>	-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 Elemen ts
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 <sup>-2</sup>	0.0 .. 400.0	4	32-Bit Float	20
SFC-28	LW (std)	W m <sup>-2</sup>	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 Elemen ts
SFC-29	SW TOA Clear-sky	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
SFC-30	LW TOA Clear-sky	W m <sup>-2</sup>	0.0 .. 500.0	4	32-Bit Float	3
SFC-31	WN TOA Clear-sky	W m <sup>-2</sup>	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 <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
SFC-34	LW TOA Total-Sky	W m <sup>-2</sup>	0.0 .. 500.0	4	32-Bit Float	3
SFC-35	WN TOA Total-Sky	W m <sup>-2</sup>	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 Elemen ts
SFC-37	SW SRF Model A Clear-Sky	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
SFC-38	LW SRF Model A Clear-Sky	W m <sup>-2</sup>	0.0 .. 700.0	4	32-Bit Float	3
SFC-39	WN SRF Model A Clear-Sky	W m <sup>-2</sup>	0.0 .. 250.0	4	32-Bit Float	3
SFC-40	Net. SW SRF Model A Clear-Sky	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
SFC-41	Net. LW SRF Model A Clear-Sky	W m <sup>-2</sup>	-250.0 .. 50.0	4	32-Bit Float	3
SFC-42	SW SRF Model B Clear-Sky	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
SFC-43	LW SRF Model B Clear-Sky	W m <sup>-2</sup>	0.0 .. 700.0	4	32-Bit Float	3
SFC-44	Net. SW SRF Model B Clear-Sky	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
SFC-45	Net. LW SRF Model B Clear-Sky	W m <sup>-2</sup>	-250.0 .. 50.0	4	32-Bit Float	3
SFC-46	SW SRF Model A Total-Sky	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
SFC-47	LW SRF Model A Total-Sky	W m <sup>-2</sup>	0.0 .. 700.0	4	32-Bit Float	3
SFC-48	WN SRF Model A Total-Sky	W m <sup>-2</sup>	0.0 .. 250.0	4	32-Bit Float	3
SFC-49	Net. SW SRF Model A Total-Sky	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
SFC-50	Net. LW SRF Model A Total-Sky	W m <sup>-2</sup>	-250.0 .. 50.0	4	32-Bit Float	3
SFC-51	SW SRF Model B Total-Sky	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
SFC-52	LW SRF Model B Total-Sky	W m <sup>-2</sup>	0.0 .. 700.0	4	32-Bit Float	3
SFC-53	Net. SW SRF Model B Total-Sky	W m <sup>-2</sup>	0.0 .. 1400.0	4	32-Bit Float	3
SFC-54	Net. LW SRF Model B Total-Sky	W m <sup>-2</sup>	-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 <sup>-2</sup>	0.0 .. 10000.0	4	32-Bit Float	3
SFC-65	Ice Water Path	g m <sup>-2</sup>	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 Elemen ts
SFC-79	Liquid Water Path	g m <sup>-2</sup>	0.0 .. 10000.0	4	32-Bit Float	3
SFC-80	Ice Water Path	g m <sup>-2</sup>	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 Elemen ts
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 <sup>-2</sup>	0.0 .. 10000.0	4	32-Bit Float	3
SFC-95	Ice Water Path	g m <sup>-2</sup>	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 Elemen ts
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 Elemen ts
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 <sup>-2</sup>	0.0 .. 10000.0	4	32-Bit Float	3
SFC-110	Ice Water Path	g m <sup>-2</sup>	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 Elemen ts
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 Elemen ts
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	<ul style="list-style-type: none"> <li>• Updated parameters in Regional Identification Data, Regional Imager Data.</li> <li>• Updated format to comply with standards.</li> </ul>	Tables 2.11-5 & 2.11-7 All
02/03/03	R3V3	388	<ul style="list-style-type: none"> <li>• Updated vdata sizes.</li> <li>• Added MODIS aerosols for land and Ocean.</li> <li>• Updated format to comply with standards.</li> </ul>	Table 2.11-3 Tables 2.11-16 & 2.11-17 All
02/03/03	R3V4 R4V1	388	<ul style="list-style-type: none"> <li>• 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.</li> <li>• Changed units of 10 ,11 in Layer Cloud category from mm to <math>\mu\text{m}</math>.</li> <li>• The revision and version numbers were changed at this time.</li> <li>• Updated format to comply with standards.</li> </ul>	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	<ul style="list-style-type: none"> <li>• Added Snow/Ice Percentage from Imager History parameter to Angular Model Scene type.</li> <li>• Updated format to comply with standards.</li> </ul>	Table 2.8.8  All
06/04/04	R4V3	530	<ul style="list-style-type: none"> <li>• Deleted Snow/Ice Percentage from Imager History parameter to Angular Model Scene type.</li> <li>• Added product name in front of SDS index in the first column of the table.</li> <li>• Updated sds sizes.</li> <li>• Updated format to comply with standards.</li> </ul>	Table 2.8.8  Tables 2.8.4 - 2.8.17 Table 2.8-3 All

## 2.9 Synoptic Radiative Fluxes and Clouds (SYN)

### EOSDIS Product Code: CER07

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 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 GMT based intervals. Also at 3-hour intervals are estimates of the adjusted (tuned) fluxes at the five 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 averaged cloud parameters.

The SYN contains the following apriori and observed input:

- Regional data
- Cloud category properties for four (low, lower middle, upper middle and high) cloud layers
- Observed CERES TOA clear-sky and all-sky fluxes
- MODIS based spectral aerosol optical depths

The SYN contains the following constrained (tuned) vertical flux profiles for both clear-sky and total-sky conditions evaluated at the TOA, 70mb, 200mb, 500mb, and surface:

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

The constrained (tuned) and initial (untuned) profiles for the following are included for pristine (clear-sky no-aerosol), clear-sky, total-sky-no-aerosol, and total-sky conditions:

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

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

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

The SYN contains the direct and diffuse shortwave surface fluxes for total-sky, clear-sky, pristine and actinic conditions. The SYN also contains surface UVA and UVB downwelling and direct diffuse ratios for total-sky, clear-sky, pristine, and total-sky-no-aerosol conditions.

**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:** Entire Global

**Record:** 1 CERES region

**Product Version:**

**TRMM:** N/A

**Terra:** Beta3

**Aqua:** N/A

## 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	<a href="#">Table B-1</a>	1	36
CERES_metadata Vdata	<a href="#">Table B-2</a>	1	14
SYN_Header Vdata	<a href="#">Table 2.9-2</a>	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

[Table 2.9-3](#) List of the Vgroups contained in the Monthly Hourly Averages and Monthly Averages Vgroups in AVG.

Table 2.9-3. Temporal Vgroups of SYN (1 of 2)

Vgroup Number	Vgroup Name	Monthly Hourly Averages / Monthly (Hour) Averages
1	Time and Position	See <a href="#">Table 2.9-4</a>
2	Observed TOA Fluxes	See <a href="#">Table 2.9-5</a>
3	Cloud Layer - High	See <a href="#">Table 2.9-6</a>
4	Cloud Layer - UpperMid	See <a href="#">Table 2.9-6</a>
5	Cloud Layer - LowerMid	See <a href="#">Table 2.9-6</a>
6	Cloud Layer - Low	See <a href="#">Table 2.9-6</a>
7	Stowe-Ignatov Aerosol Optical Depth	See <a href="#">Table 2.9-7</a>
8	MODIS Aerosol Optical Depth	See <a href="#">Table 2.9-8</a>
9	Tuned Pristine Fluxes	See <a href="#">Table 2.9-9</a>
10	Tuned ClearSky Flux Profiles	See <a href="#">Table 2.9-10</a>

Table 2.9-3. Temporal Vgroups of SYN (2 of 2)

Vgroup Number	Vgroup Name	Monthly Hourly Averages / Monthly (Hour) Averages
11	Tuned TotalSky-NoAerosol Fluxes	See <a href="#">Table 2.9-11</a>
12	Tuned TotalSky Flux Profiles	See <a href="#">Table 2.9-12</a>
13	Untuned Pristine Fluxes	See <a href="#">Table 2.9-13</a>
14	Untuned ClearSky Fluxes	See <a href="#">Table 2.9-14</a>
15	Untuned TotalSky-NoAerosol Fluxes	See <a href="#">Table 2.9-15</a>
16	Untuned TotalSky Fluxes	See <a href="#">Table 2.9-16</a>
17	Satellite Emulated WN TOA Fluxes	See <a href="#">Table 2.9-16</a>
18	TOA Flux Error	See <a href="#">Table 2.9-17</a>
19	Number of Hourboxes	See <a href="#">Table 2.9-17</a>
20	Constraintment Adjustments	See <a href="#">Table 2.9-18</a>
21	Surface SW Direct/Diffuse Fluxes	See <a href="#">Table 2.9-19</a>
22	UVA - UVB Fluxes	See <a href="#">Table 2.9-20</a>
23	PAR Fluxes	See <a href="#">Table 2.9-21</a>
24	Pristine-Sky SW MultiStream Correction	See <a href="#">Table 2.9-22</a>

### SYN Scientific Data Sets

The SYN contains 223 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 2.9-4](#) to [Table 2.9-24](#) 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 2.9-25](#). Under the Dimensions column in the following tables the 8 refers to the 8 3-hourly GMT time increment in the daily file. Although the 3-hourly mean is an average of hourly computations only the mean is given (no standard deviation).

Table 2.9-4. Time and Position (1 of 2)

SDS Index	SDS Name	Units	Range	Dimensions	Data Type
SYN-0	Region number	N/A	1 .. 64800	8	32-bit integer
SYN-1	Colatitude	Degree	0 .. 180	8	32-bit real
SYN-2	Longitude	Degree	0 .. 360	8	32-bit real



Table 2.9-4. Time and Position (2 of 2)

SDS Index	SDS Name	Units	Range	Dimensions	Data Type
SYN-3	Surface altitude above sea level	m	-1000 .. 10000	8	32-bit real
SYN-4	Surface type percent coverage	Percent	0 .. 100	8 x 20	32-bit real

Table 2.9-5. Observed TOA Fluxes

SDS Index	SDS Name	Units	Range	Dimensions	Data Type
SYN-5	SW TOA Total-Sky	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-6	LW TOA Total-Sky	W m <sup>-2</sup>	0 .. 500	8	32-bit real
SYN-7	WN TOA Total-Sky	W m <sup>-2</sup> μm <sup>-1</sup>	2 .. 50	8	32-bit real
SYN-8	SW TOA Clear-Sky	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-9	LW TOA Clear-Sky	W m <sup>-2</sup>	0 .. 500	8	32-bit real
SYN-10	WN TOA Clear-Sky	W m <sup>-2</sup> μm <sup>-1</sup>	2 .. 50	8	32-bit real

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

SDS Index	SDS Name	Units	Range	Dimensions	Data Type
SYN-11	Area Fraction Percentage	Percent	0 .. 100	8 x 4	32-bit real
SYN-12	Vis. Opt. Depth (linear)	N/A	0 .. 400	8 x 4	32-bit real
SYN-13	Vis. Opt. Depth (log)	N/A	-6 .. 6	8 x 4	32-bit real
SYN-14	Infrared Emissivity	N/A	0 .. 1	8 x 4	32-bit real
SYN-15	Liquid Water Path	g m <sup>-2</sup>	0 .. 10000	8 x 4	32-bit real
SYN-16	Ice Water Path	g m <sup>-2</sup>	0 .. 10000	8 x 4	32-bit real
SYN-17	Top Pressure	hPa	0 .. 1100	8 x 4	32-bit real
SYN-18	Effective Pressure	hPa	0 .. 1100	8 x 4	32-bit real
SYN-19	Effective Temperature	K	100 .. 350	8 x 4	32-bit real

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

SDS Index	SDS Name	Units	Range	Dimensions	Data Type
SYN-20	Effective Height	km	0 .. 20	8 x 4	32-bit real
SYN-21	Bottom Pressure	hPa	0 .. 1100	8 x 4	32-bit real
SYN-22	Liquid Particle Radius	μm	0 .. 40	8 x 4	32-bit real
SYN-23	Ice Particle Diameter	μm	0 .. 300	8 x 4	32-bit real
SYN-24	Particle Phase	N/A	1 .. 2	8 x 4	32-bit real
SYN-25	Vertical Aspect Ratio	N/A	0 .. 20	8 x 4	32-bit real

Table 2.9-7. Stowe-Ignatov Aerosol Optical Depth

SDS Index	SDS Name	Units	Range	Dimensions	Data Type
SYN-71	Aerosol visible optical depth - 0.63 μm	N/A	0 .. 5	8	32-bit real
SYN-72	Aerosol visible optical depth - 1.6 μm	N/A	0 .. 5	8	32-bit real

Table 2.9-8. MODIS Aerosol Optical Depth (1 of 2)

SDS Index	SDS Name	Units	Range	Dimensions	Data Type
SYN-73	Initial Aerosol Optical Depth	N/A	0 .. 5	8	32-bit real
SYN-74	Aerosol Opt. Depth at 0.47 μm in Land	N/A	0 .. 5	8	32-bit real
SYN-75	Aerosol Opt. Depth at 0.55 μm in Land	N/A	0 .. 5	8	32-bit real
SYN-76	Aerosol Opt. Depth at 0.66 μm in Land	N/A	0 .. 5	8	32-bit real
SYN-77	Aerosol Opt. Depth at 0.47 μm in Ocean	N/A	0 .. 5	8	32-bit real
SYN-78	Aerosol Opt. Depth at 0.55 μm in Ocean	N/A	0 .. 5	8	32-bit real
SYN-79	Aerosol Opt. Depth at 0.66 μm in Ocean	N/A	0 .. 5	8	32-bit real
SYN-80	Aerosol Opt. Depth at 0.87 μm in Ocean	N/A	0 .. 5	8	32-bit real
SYN-81	Aerosol Opt. Depth at 1.24 μm in Ocean	N/A	0 .. 5	8	32-bit real
SYN-82	Aerosol Opt. Depth at 1.64 μm in Ocean	N/A	0 .. 5	8	32-bit real

Table 2.9-8. MODIS Aerosol Optical Depth (2 of 2)

SDS Index	SDS Name	Units	Range	Dimensions	Data Type
SYN-83	Aerosol Opt. Depth at 2.13 $\mu\text{m}$ in Ocean	N/A	0 .. 5	8	32-bit real

Table 2.9-9. Tuned Pristine Fluxes

SDS Index	SDS Name	Units	Range	Dimensions	Data Type
SYN-84	Tuned Pristine SW Surface Up	$\text{W m}^{-2}$	0 .. 1400	8	32-bit real
SYN-85	Tuned Pristine SW Surface Down	$\text{W m}^{-2}$	0 .. 1400	8	32-bit real
SYN-86	Tuned Pristine SW TOA Up	$\text{W m}^{-2}$	0 .. 1400	8	32-bit real
SYN-87	Tuned Pristine LW Surface Up	$\text{W m}^{-2}$	0 .. 850	8	32-bit real
SYN-88	Tuned Pristine LW Surface Down	$\text{W m}^{-2}$	0 .. 700	8	32-bit real
SYN-89	Tuned Pristine LW TOA Up	$\text{W m}^{-2}$	0 .. 850	8	32-bit real
SYN-90	Tuned Pristine WN Surface Up	$\text{W m}^{-2}$	0 .. 370	8	32-bit real
SYN-91	Tuned Pristine WN Surface Down	$\text{W m}^{-2}$	0 .. 370	8	32-bit real
SYN-92	Tuned Pristine WN TOA Up	$\text{W m}^{-2}$	0 .. 370	8	32-bit real

Table 2.9-10. Tuned ClearSky Flux Profiles

SDS Index	SDS Name	Units	Range	Dimensions	Data Type
SYN-93	Tuned Clear-Sky SW Up	$\text{W m}^{-2}$	0 .. 1400	8 x 5	32-bit real
SYN-94	Tuned Clear-Sky SW Down	$\text{W m}^{-2}$	0 .. 1400	8 x 5	32-bit real
SYN-95	Tuned Clear-Sky LW Up	$\text{W m}^{-2}$	0 .. 850	8 x 5	32-bit real
SYN-96	Tuned Clear-Sky LW Down	$\text{W m}^{-2}$	0 .. 700	8 x 5	32-bit real
SYN-97	Tuned Clear-Sky WN Up	$\text{W m}^{-2}$	0 .. 370	8 x 5	32-bit real
SYN-98	Tuned Clear-Sky WN Down	$\text{W m}^{-2}$	0 .. 370	8 x 5	32-bit real

Table 2.9-11. Tuned TotalSky-NoAerosol Fluxes

<b>SDS Index</b>	<b>SDS Name</b>	<b>Units</b>	<b>Range</b>	<b>Dimensions</b>	<b>Data Type</b>
SYN-99	Tuned Total-Sky-NoAerosol SW Surface Up	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-100	Tuned Total-Sky-NoAerosol SW Surface Down	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-101	Tuned Total-Sky-NoAerosol SW TOA Up	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-102	Tuned Total-Sky-NoAerosol LW Surface Up	W m <sup>-2</sup>	0 .. 850	8	32-bit real
SYN-103	Tuned Total-Sky-NoAerosol LW Surface Down	W m <sup>-2</sup>	0 .. 700	8	32-bit real
SYN-104	Tuned Total-Sky-NoAerosol LW TOA Up	W m <sup>-2</sup>	0 .. 850	8	32-bit real
SYN-105	Tuned Total-Sky-NoAerosol WN Surface Up	W m <sup>-2</sup>	0 .. 370	8	32-bit real
SYN-106	Tuned Total-Sky-NoAerosol WN Surface Down	W m <sup>-2</sup>	0 .. 370	8	32-bit real
SYN-107	Tuned Total-Sky-NoAerosol WN TOA Up	W m <sup>-2</sup>	0 .. 370	8	32-bit real

Table 2.9-12. Tuned TotalSky Flux Profiles

<b>SDS Index</b>	<b>SDS Name</b>	<b>Units</b>	<b>Range</b>	<b>Dimensions</b>	<b>Data Type</b>
SYN-108	Tuned Total-Sky SW Up	W m <sup>-2</sup>	0 .. 1400	8 x 5	32-bit real
SYN-109	Tuned Total-Sky SW Down	W m <sup>-2</sup>	0 .. 1400	8 x 5	32-bit real
SYN-110	Tuned Total-Sky LW Up	W m <sup>-2</sup>	0 .. 850	8 x 5	32-bit real
SYN-111	Tuned Total-Sky LW Down	W m <sup>-2</sup>	0 .. 700	8 x 5	32-bit real
SYN-112	Tuned Total-Sky WN Up	W m <sup>-2</sup>	0 .. 370	8 x 5	32-bit real
SYN-113	Tuned Total-Sky WN Down	W m <sup>-2</sup>	0 .. 370	8 x 5	32-bit real

Table 2.9-13. Untuned Pristine Fluxes

<b>SDS Index</b>	<b>SDS Name</b>	<b>Units</b>	<b>Range</b>	<b>Dimensions</b>	<b>Data Type</b>
SYN-114	Untuned Pristine SW Surface Up	W m <sup>-2</sup>	0 .. 1500	8	32-bit real
SYN-115	Untuned Pristine SW Surface Down	W m <sup>-2</sup>	0 .. 1500	8	32-bit real
SYN-116	Untuned Pristine SW TOA Up	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-117	Untuned Pristine LW Surface Up	W m <sup>-2</sup>	0 .. 850	8	32-bit real
SYN-118	Untuned Pristine LW Surface Down	W m <sup>-2</sup>	0 .. 700	8	32-bit real
SYN-119	Untuned Pristine LW TOA Up	W m <sup>-2</sup>	0 .. 850	8	32-bit real
SYN-120	Untuned Pristine WN Surface Up	W m <sup>-2</sup>	0 .. 370	8	32-bit real
SYN-121	Untuned Pristine WN Surface Down	W m <sup>-2</sup>	0 .. 370	8	32-bit real
SYN-122	Untuned Pristine WN TOA Up	W m <sup>-2</sup>	0 .. 370	8	32-bit real

Table 2.9-14. Untuned ClearSky Fluxes

<b>SDS Index</b>	<b>SDS Name</b>	<b>Units</b>	<b>Range</b>	<b>Dimensions</b>	<b>Data Type</b>
SYN-123	Untuned Clear-Sky SW Surface Up	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-124	Untuned Clear-Sky SW Surface Down	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-125	Untuned Clear-Sky SW TOA Up	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-126	Untuned Clear-Sky LW Surface Up	W m <sup>-2</sup>	0 .. 850	8	32-bit real
SYN-127	Untuned Clear-Sky LW Surface Down	W m <sup>-2</sup>	0 .. 700	8	32-bit real
SYN-128	Untuned Clear-Sky LW TOA Up	W m <sup>-2</sup>	0 .. 850	8	32-bit real
SYN-129	Untuned Clear-Sky WN Surface Up	W m <sup>-2</sup>	0 .. 370	8	32-bit real
SYN-130	Untuned Clear-Sky WN Surface Down	W m <sup>-2</sup>	0 .. 370	8	32-bit real
SYN-131	Untuned Clear-Sky WN TOA Up	W m <sup>-2</sup>	0 .. 370	8	32-bit real

Table 2.9-15. Untuned TotalSky-NoAerosol Fluxes

<b>SDS Index</b>	<b>SDS Name</b>	<b>Units</b>	<b>Range</b>	<b>Dimen- sions</b>	<b>DataType</b>
SYN-132	Untuned Total-Sky SW Surface Up	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-133	Untuned Total-Sky SW Surface Down	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-134	Untuned Total-Sky SW TOA Up	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-135	Untuned Total-Sky LW Surface Up	W m <sup>-2</sup>	0 .. 850	8	32-bit real
SYN-136	Untuned Total-Sky LW Surface Down	W m <sup>-2</sup>	0 .. 700	8	32-bit real
SYN-137	Untuned Total-Sky LW TOA Up	W m <sup>-2</sup>	0 .. 850	8	32-bit real
SYN-138	Untuned Total-Sky WN Surface Up	W m <sup>-2</sup>	0 .. 370	8	32-bit real
SYN-139	Untuned Total-Sky WN Surface Down	W m <sup>-2</sup>	0 .. 370	8	32-bit real
SYN-140	Untuned Total-Sky WN TOA Up	W m <sup>-2</sup>	0 .. 370	8	32-bit real

Table 2.9-16. Untuned TotalSky Fluxes (1 of 2)

<b>SDS Index</b>	<b>SDS Name</b>	<b>Units</b>	<b>Range</b>	<b>Dimen- sions</b>	<b>DataType</b>
SYN-141	Untuned Total-Sky SW Surface Up	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-142	Untuned Total-Sky SW Surface Down	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-143	Untuned Total-Sky SW TOA Up	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-144	Untuned Total-Sky LW Surface Up	W m <sup>-2</sup>	0 .. 850	8	32-bit real
SYN-145	Untuned Total-Sky LW Surface Down	W m <sup>-2</sup>	0 .. 700	8	32-bit real
SYN-146	Untuned Total-Sky LW TOA Up	W m <sup>-2</sup>	0 .. 850	8	32-bit real
SYN-147	Untuned Total-Sky WN Surface Up	W m <sup>-2</sup>	0 .. 370	8	32-bit real
SYN-148	Untuned Total-Sky WN Surface Down	W m <sup>-2</sup>	0 .. 370	8	32-bit real

Table 2.9-16. Untuned TotalSky Fluxes (2 of 2)

SDS Index	SDS Name	Units	Range	Dimensions	Data Type
SYN-149	Untuned Total-Sky WN TOA Up	W m <sup>-2</sup>	0 .. 370	8	32-bit real

Table 2.9-17. Satellite Emulated WN TOA Fluxes

SDS Index	SDS Name	Units	Range	Dimensions	Data Type
SYN-150	Untuned Satellite Emulated WN TOA	W m <sup>-2</sup>	50 .. 400	8	32-bit real
SYN-151	Tuned Satellite Emulated WN TOA	W m <sup>-2</sup>	50 .. 400	8	32-bit real

Table 2.9-18. TOA Flux Error

SDS Index	SDS Name	Units	Range	Dimensions	Data Type
SYN-152	Tuned Minus Observed SW TOA	W m <sup>-2</sup>	-1400 .. 1400	8	32-bit real
SYN-153	Untuned Minus Observed SW TOA	W m <sup>-2</sup>	-1400 .. 1400	8	32-bit real
SYN-154	Tuned Minus Observed LW TOA	W m <sup>-2</sup>	-600 .. 600	8	32-bit real
SYN-155	Untuned Minus Observed LW TOA	W m <sup>-2</sup>	-600 .. 600	8	32-bit real

Table 2.9-19. Number of Hourboxes

SDS Index	SDS Name	Units	Range	Dimensions	Data Type
SYN-156	Number of Observed SW	N/A	1 .. 744	8	32-bit real
SYN-157	Number of Untuned SW	N/A	1 .. 744	8	32-bit real
SYN-158	Number of Tuned SW	N/A	1 .. 744	8	32-bit real
SYN-159	Number of Observed LW	N/A	1 .. 744	8	32-bit real
SYN-160	Number of Untuned LW	N/A	1 .. 744	8	32-bit real
SYN-161	Number of Tuned LW	N/A	1 .. 744	8	32-bit real

Table 2.9-20. Constraint Adjustments

<b>SDS Index</b>	<b>SDS Name</b>	<b>Units</b>	<b>Range</b>	<b>Dimen- sions</b>	<b>Data Type</b>
SYN-162	Total column precipitable water - initial	cm	0 .. 10	8	32-bit real
SYN-163	Total column precipitable water - adjusted	cm	-10 .. 10	8	32-bit real
SYN-164	Upper tropospheric precipitable water - initial	cm	0 .. 10	8	32-bit real
SYN-165	Upper tropospheric precipitable water - adjusted	cm	0 .. 10	8	32-bit real
SYN-166	Upper tropospheric humidity - initial	N/A	0.0 .. 100.0	8	32-bit real
SYN-167	Upper tropospheric humidity - adjusted	N/A	0.0 .. 100.0	8	32-bit real
SYN-168	Corrected initial broadband surface albedo	N/A	0.0 .. 1.0	8	32-bit real
SYN-169	Surface albedo - adjusted	N/A	0 .. 1	8	32-bit real
SYN-170	Aerosol optical depth - initial	N/A	0 .. 5	8	32-bit real
SYN-171	Aerosol optical depth - adjusted	N/A	0 .. 5	8	32-bit real
SYN-172	Skin temperature - initial	K	175 .. 375	8	32-bit real
SYN-173	Skin temperature - adjusted	K	175 .. 375	8	32-bit real
SYN-174	Surface pressure	hPa	0 .. 800	8	32-bit real
SYN-175	Column ozone - initial	du	0 .. 800	8	32-bit real
SYN-176	Column ozone - Flag source	N/A	0 .. 3	8	32-bit integer
SYN-177	Mean visible optical depth- adjusted	N/A	0 .. 400	8	32-bit real
SYN-178	Mean cloud fractional area - adjusted	%	0 .. 1	8	32-bit real
SYN-179	Mean cloud effective temperature - adjusted	K	175 .. 375	8	32-bit real



Table 2.9-21. Surface SW Direct/Diffuse Fluxes

<b>SDS Index</b>	<b>SDS Name</b>	<b>Units</b>	<b>Range</b>	<b>Dimensions</b>	<b>Data Type</b>
SYN-180	Total-Sky SW flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-181	Clear-Sky SW flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-182	Pristine-Sky SW flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-183	Actinic-Sky SW flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-184	Total-Sky SW flux - Direct	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-185	Clear-Sky SW flux - Direct	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-186	Pristine-Sky SW flux - Direct	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-187	Actinic-Sky SW flux - Direct	W m <sup>-2</sup>	0 .. 1400	8	32-bit real

Table 2.9-22. UVA - UVB Fluxes (1 of 2)

<b>SDS Index</b>	<b>SDS Name</b>	<b>Units</b>	<b>Range</b>	<b>Dimensions</b>	<b>Data Type</b>
SYN-188	TOA Downwelling UVB Flux	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-189	TOA Downwelling UVA Flux	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-190	Pristine UVB Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-191	Pristine UVB Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-192	Pristine UVA Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-193	Pristine UVA Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-194	Clear-Sky UVB Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-195	Clear-Sky UVB Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-196	Clear-Sky UVA Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-197	Clear-Sky UVA Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	8	32-bit real

Table 2.9-22. UVA - UVB Fluxes (2 of 2)

<b>SDS Index</b>	<b>SDS Name</b>	<b>Units</b>	<b>Range</b>	<b>Dimen- sions</b>	<b>Data Type</b>
SYN-198	Total-Sky-NoAerosol UVB Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-199	Total-Sky-NoAerosol UVB Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-200	Total-Sky-NoAerosol UVA Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-201	Total-Sky-NoAerosol UVA Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-202	Total-Sky UVB Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-203	Total-Sky UVB Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-204	Total-Sky UVA Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-205	Total-Sky UVA Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-206	Total-Sky Surface UV Index	N/A	0 .. 30	8	32-bit real
SYN-207	Clear-Sky Surface UV Index	N/A	0 .. 30	8	32-bit real
SYN-208	Pristine Surface UV Index	N/A	0 .. 30	8	32-bit real
SYN-209	Total-Sky-NoAerosol Surface UV Index	N/A	0 .. 30	8	32-bit real

Table 2.9-23. PAR Fluxes (1 of 2)

<b>SDS Index</b>	<b>SDS Name</b>	<b>Units</b>	<b>Range</b>	<b>Dimen- sions</b>	<b>Data Type</b>
SYN-210	TOA Downwelling PAR Flux	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-211	Total-Sky PAR Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-212	Total-Sky PAR Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-213	Total-Sky PAR PURV Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	8	32-bit real

Table 2.9-23. PAR Fluxes (2 of 2)

SDS Index	SDS Name	Units	Range	Dimensions	Data Type
SYN-214	Total-Sky PAR PURV Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-215	Total-Sky PAR ChlorA Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-216	Total-Sky PAR ChlorA Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-217	Clear-Sky PAR Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-218	Clear-Sky PAR Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-219	Pristine PAR Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	8	32-bit real
SYN-220	Pristine PAR Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	8	32-bit real

Table 2.9-24. Pristine-Sky SW MultiStream Correction

SDS Index	SDS Name	Units	Range	Dimensions	Data Type
SYN-221	SW TOA Flux - Up - Pristine-Sky - Corrected	W m <sup>-2</sup>	0 .. 1000	8	32-bit real
SYN-222	SW Surface Flux - Down - Pristine-Sky - Corrected	W m <sup>-2</sup>	0 .. 1000	8	32-bit real

Table 2.9-25. Sizing Information

Data Quantity	Size (MB)
Daily TOTAL SYN Size	596
Monthly TOTAL SYN Size	18476

## 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

<b>SCCR Approval Date</b>	<b>Release/Version Number</b>	<b>SCCR Number</b>	<b>Description of Revision</b>	<b>Section(s) Affected</b>
N/A	R3V1	N/A	<ul style="list-style-type: none"><li>• Updated format to comply with standards.</li></ul>	All
N/A	R3V2	639	<ul style="list-style-type: none"><li>• Updated to change all tables and added the SDS Index tables.</li></ul>	All

## 2.10 Monthly Regional Radiative Fluxes and Clouds (AVG)

### EOSDIS Product Code: CER08

The monthly Regional Radiative and Clouds (AVG) product contains monthly and monthly hourly (3-hour) averages of the Synoptic Radiative Fluxes and Clouds (SYN) product. This product is the CERES equivalent of the monthly regional averages in the ERBE ES-4 product of the CERES untuned and tuned radiative transfer modeled fluxes. This product is written in HDF\_EOS and contains meta data as well as gridded science data.

The AVG contains the following apriori and observed input:

- Regional data
- Cloud category properties for four (low, lower middle, upper middle and high) cloud layers
- Observed CERES TOA clear-sky and all-sky fluxes
- MODIS based spectral aerosol optical depths

The AVG contains the following constrained (tuned) vertical flux profiles for both clear-sky and total-sky conditions evaluated at the TOA, 70mb, 200mb, 500mb, and surface:

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

The constrained (tuned) and initial (untuned) profiles for the following are included for pristine (clear-sky no-aerosol), clear-sky, total-sky-no-aerosol, and total-sky conditions:

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

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

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

The AVG contains the direct and diffuse shortwave surface fluxes for total-sky, clear-sky, pristine and actinic conditions. The AVG also contains surface UVA and UVB downwelling and direct diffuse ratios for total-sky, clear-sky, pristine, and total-sky-no-aerosol conditions.

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:** Entire Global

**Record:** 1.0-Deg Regions

**Product Version:**

**TRMM:** N/A

**Terra:** Beta3

**Aqua:** N/A

## 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	<a href="#">Table B-1</a>	1	36
CERES_metadata gridded data	<a href="#">Table B-2</a>	1	14

[Table 2.10-2](#) List of the Vgroups contained in 1.0 Degree Regional Vgroups.

Table 2.10-2. Temporal Vgroups of AVG

Vgroup Number	Vgroup Name	Monthly Hourly Averages / Monthly (Hour) Averages
1	Monthly Hourly Averages	See <a href="#">Table 2.10-3</a>
2	Monthly Averages	See <a href="#">Table 2.10-3</a>

[Table 2.10-3](#) List of the Vgroups contained in the Monthly Hourly Averages and Monthly Averages Vgroups in AVG.

Table 2.10-3. Temporal Vgroups of AVG (1 of 2)

Vgroup Number	Vgroup Name	Monthly Hourly Averages / Monthly (Hour) Averages
1	Time and Position	See <a href="#">Table 2.10-4</a>
2	Observed TOA Fluxes	See <a href="#">Table 2.10-5</a>
3	Cloud Layer - High	See <a href="#">Table 2.10-6</a>
4	Cloud Layer - UpperMid	See <a href="#">Table 2.10-6</a>
5	Cloud Layer - LowerMid	See <a href="#">Table 2.10-6</a>
6	Cloud Layer - Low	See <a href="#">Table 2.10-6</a>
7	Stowe-Ignatov Aerosol Optical Depth	See <a href="#">Table 2.10-7</a>
8	MODIS Aerosol Optical Depth	See <a href="#">Table 2.10-8</a>
9	Tuned Pristine Fluxes	See <a href="#">Table 2.10-9</a>
10	Tuned ClearSky Flux Profiles	See <a href="#">Table 2.10-10</a>
11	Tuned TotalSky-NoAerosol Fluxes	See <a href="#">Table 2.10-11</a>
12	Tuned TotalSky Flux Profiles	See <a href="#">Table 2.10-12</a>
13	Untuned Pristine Fluxes	See <a href="#">Table 2.10-13</a>
14	Untuned ClearSky Fluxes	See <a href="#">Table 2.10-14</a>
15	Untuned TotalSky-NoAerosol Fluxes	See <a href="#">Table 2.10-15</a>

Table 2.10-3. Temporal Vgroups of AVG (2 of 2)

Vgroup Number	Vgroup Name	Monthly Hourly Averages / Monthly (Hour) Averages
16	Untuned TotalSky Fluxes	See <a href="#">Table 2.10-16</a>
17	Satellite Emulated WN TOA Fluxes	See <a href="#">Table 2.10-17</a>
18	TOA Flux Error	See <a href="#">Table 2.10-18</a>
19	Number of Hourboxes	See <a href="#">Table 2.10-19</a>
20	Constraintment Adjustments	See <a href="#">Table 2.10-20</a>
21	Surface SW Direct/Diffuse Fluxes	See <a href="#">Table 2.10-21</a>
22	UVA - UVB Fluxes	See <a href="#">Table 2.10-22</a>
23	PAR Fluxes	See <a href="#">Table 2.10-23</a>
24	Pristine-Sky SW MultiStream Correction	See <a href="#">Table 2.10-24</a>

### AVG Science Data

All of the AVG science data are organized into the HDF-EOS Grid data type, which is shown in [Table](#) 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. The 18 under the Dimensions column in the following tables the 18 refers to 9 = 8 monthly hourly (3-hour GMT based) + 1 monthly regional x 2 mean and standard deviation.

Table 2.10-4. Time and Position

SDS Name	Units	Range	Dimensions	Data Type
Region number	N/A	1 .. 64800	1	32-bit integer
Colatitude	Degree	0 .. 180	1	32-bit real
Longitude	Degree	0 .. 360	1	32-bit real
Surface altitude above sea level	m	-1000 .. 10000	1	32-bit real
Surface type percent coverage	Percent	0 .. 100	1 x 20	32-bit real

Table 2.10-4(b). SDS Index of Time and Position (1 of 2)

SDS Name	Regional Monthly Hourly	Regional Monthly
Region Number	0	220
Colatitude	1	221
Longitude	2	222



Table 2.10-4(b). SDS Index of Time and Position (2 of 2)

<b>SDS Name</b>	<b>Regional Monthly Hourly</b>	<b>Regional Monthly</b>
Surface altitude above sea level	3	223
Surface type percent coverage	4	224

Table 2.10-5. Observed TOA Fluxes

<b>SDS Name</b>	<b>Units</b>	<b>Range</b>	<b>Dimensions</b>	<b>Data Type</b>
SW TOA Total-Sky	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
LW TOA Total-Sky	W m <sup>-2</sup>	0 .. 500	18	32-bit real
WN TOA Total-Sky	W m <sup>-2</sup> μm <sup>-1</sup>	2 .. 50	18	32-bit real
SW TOA Clear-Sky	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
LW TOA Clear-Sky	W m <sup>-2</sup>	0 .. 500	18	32-bit real
WN TOA Clear-Sky	W m <sup>-2</sup> μm <sup>-1</sup>	2 .. 50	18	32-bit real

Table 2.10-5(b). SDS Index of Observed TOA Fluxes

<b>SDS Name</b>	<b>Regional Monthly Hourly</b>	<b>Regional Monthly</b>
SW TOA Total-Sky	5	225
LW TOA Total-Sky	6	226
WN TOA Total-Sky	7	227
SW TOA Clear-Sky	8	228
LW TOA Clear-Sky	9	229
WN TOA Clear-Sky	10	230

Table 2.10-6. Cloud Properties for Four Cloud Layers

SDS Name	Units	Range	Dimensions	Data Type
Area Fraction Percentage	Percent	0 .. 100	18 x 4	32-bit real
Vis. Opt. Depth (linear)	N/A	0 .. 400	18 x 4	32-bit real
Vis. Opt. Depth (log)	N/A	-6 .. 6	18 x 4	32-bit real
Infrared Emissivity	N/A	0 .. 1	18 x 4	32-bit real
Liquid Water Path	g m <sup>-2</sup>	0 .. 10000	18 x 4	32-bit real
Ice Water Path	g m <sup>-2</sup>	0 .. 10000	18 x 4	32-bit real
Top Pressure	hPa	0 .. 1100	18 x 4	32-bit real
Effective Pressure	hPa	0 .. 1100	18 x 4	32-bit real
Effective Temperature	K	100 .. 350	18 x 4	32-bit real
Effective Height	km	0 .. 20	18 x 4	32-bit real
Bottom Pressure	hPa	0 .. 1100	18 x 4	32-bit real
Liquid Particle Radius	μm	0 .. 40	18 x 4	32-bit real
Ice Particle Diameter	μm	0 .. 300	18 x 4	32-bit real
Particle Phase	N/A	1 .. 2	18 x 4	32-bit real
Vertical Aspect Ratio	N/A	0 .. 20	18 x 4	32-bit real

Table 2.10-6(b). SDS Index of High, Uppermid, Lowermid, Low (mean, stdev, num obs) in Cloud Properties (1 of 2)

SDS Name	Regional Monthly Hourly	Regional Monthly
Area Fraction Percentage	11 26 41 56	231 246 261 276
Vis. Opt. Depth (linear)	12 27 42 57	232 247 262 277
Vis. Opt. Depth (log)	13 28 43 58	233 248 263 278
Infrared Emissivity	14 29 44 59	234 249 264 279
Liquid Water Path	15 30 45 60	235 250 265 280
Ice Water Path	16 31 46 61	236 251 266 281
Top Pressure	17 32 47 62	237 252 267 282
Effective Pressure	18 33 48 63	238 253 268 283
Effective Temperature	19 34 49 64	239 254 269 284

Table 2.10-6(b). SDS Index of High, Uppermid, Lowermid, Low (mean, stdev, num obs) in Cloud Properties (2 of 2)

SDS Name	Regional Monthly Hourly	Regional Monthly
Effective Height	20 35 50 65	240 255 270 285
Bottom Pressure	21 36 51 66	241 256 271 286
Liquid Particle Radius	22 37 52 67	242 257 272 287
Ice Particle Diameter	23 38 53 68	243 258 273 288
Particle Phase	24 39 54 69	244 259 274 289
Vertical Aspect Ratio	25 40 55 70	245 260 275 290

Color Red - High Cloud  
 Color Green - Uppermid Cloud  
 Color Blue - Lowermid Cloud  
 Color Black - Low Cloud

Table 2.10-7. Stowe-Ignatov Aerosol Optical Depth

SDS Name	Units	Range	Dimensions	Data Type
Aerosol visible optical depth - 0.63 $\mu\text{m}$	N/A	0 .. 5	18	32-bit real
Aerosol visible optical depth - 1.6 $\mu\text{m}$	N/A	0 .. 5	18	32-bit real

Table 2.10-7(b). SDS Index of Stowe-Ignatov Aerosol Optical Depth

SDS Name	Regional Monthly Hourly	Regional Monthly
Aerosol visible optical depth - 0.63 $\mu\text{m}$	71	291
Aerosol visible optical depth - 1.6 $\mu\text{m}$	72	292

Table 2.10-8. MODIS Aerosol Optical Depth (1 of 2)

SDS Name	Units	Range	Dimensions	Data Type
Initial Aerosol Optical Depth	N/A	0 .. 5	18	32-bit real
Aerosol Opt. Depth at 0.47 $\mu\text{m}$ in Land	N/A	0 .. 5	18	32-bit real
Aerosol Opt. Depth at 0.55 $\mu\text{m}$ in Land	N/A	0 .. 5	18	32-bit real

Table 2.10-8. MODIS Aerosol Optical Depth (2 of 2)

SDS Name	Units	Range	Dimensions	Data Type
Aerosol Opt. Depth at 0.66 $\mu\text{m}$ in Land	N/A	0 .. 5	18	32-bit real
Aerosol Opt. Depth at 0.47 $\mu\text{m}$ in Ocean	N/A	0 .. 5	18	32-bit real
Aerosol Opt. Depth at 0.55 $\mu\text{m}$ in Ocean	N/A	0 .. 5	18	32-bit real
Aerosol Opt. Depth at 0.66 $\mu\text{m}$ in Ocean	N/A	0 .. 5	18	32-bit real
Aerosol Opt. Depth at 0.87 $\mu\text{m}$ in Ocean	N/A	0 .. 5	18	32-bit real
Aerosol Opt. Depth at 1.24 $\mu\text{m}$ in Ocean	N/A	0 .. 5	18	32-bit real
Aerosol Opt. Depth at 1.64 $\mu\text{m}$ in Ocean	N/A	0 .. 5	18	32-bit real
Aerosol Opt. Depth at 2.13 $\mu\text{m}$ in Ocean	N/A	0 .. 5	18	32-bit real

Table 2.10-8(b). SDS Index of MODIS Aerosol Optical Depth

SDS Name	Regional Monthly Hourly	Regional Monthly
Initial Aerosol Optical Depth	73	293
Aerosol Opt. Depth at 0.47 $\mu\text{m}$ in Land	74	294
Aerosol Opt. Depth at 0.55 $\mu\text{m}$ in Land	75	295
Aerosol Opt. Depth at 0.66 $\mu\text{m}$ in Land	76	296
Aerosol Opt. Depth at 0.47 $\mu\text{m}$ in Ocean	77	297
Aerosol Opt. Depth at 0.55 $\mu\text{m}$ in Ocean	78	298
Aerosol Opt. Depth at 0.66 $\mu\text{m}$ in Ocean	79	299
Aerosol Opt. Depth at 0.87 $\mu\text{m}$ in Ocean	80	300
Aerosol Opt. Depth at 1.24 $\mu\text{m}$ in Ocean	81	301
Aerosol Opt. Depth at 1.64 $\mu\text{m}$ in Ocean	82	302
Aerosol Opt. Depth at 2.13 $\mu\text{m}$ in Ocean	83	303

Table 2.10-9. Tuned Pristine Fluxes (1 of 2)

SDS Name	Units	Range	Dimensions	Data Type
Tuned Pristine SW Surface Up	$\text{W m}^{-2}$	0 .. 1400	18	32-bit real
Tuned Pristine SW Surface Down	$\text{W m}^{-2}$	0 .. 1400	18	32-bit real

Table 2.10-9. Tuned Pristine Fluxes (2 of 2)

SDS Name	Units	Range	Dimensions	Data Type
Tuned Pristine SW TOA Up	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Tuned Pristine LW Surface Up	W m <sup>-2</sup>	0 .. 850	18	32-bit real
Tuned Pristine LW Surface Down	W m <sup>-2</sup>	0 .. 700	18	32-bit real
Tuned Pristine LW TOA Up	W m <sup>-2</sup>	0 .. 850	18	32-bit real
Tuned Pristine WN Surface Up	W m <sup>-2</sup>	0 .. 370	18	32-bit real
Tuned Pristine WN Surface Down	W m <sup>-2</sup>	0 .. 370	18	32-bit real
Tuned Pristine WN TOA Up	W m <sup>-2</sup>	0 .. 370	18	32-bit real

Table 2.10-9(b). SDS Index of Tuned Pristine Fluxes

SDS Name	Regional Monthly Hourly	Regional Monthly
Tuned Pristine SW Surface Up	84	304
Tuned Pristine SW Surface Down	85	305
Tuned Pristine SW TOA Up	86	306
Tuned Pristine LW Surface Up	87	307
Tuned Pristine LW Surface Down	88	308
Tuned Pristine LW TOA Up	89	309
Tuned Pristine WN Surface Up	90	310
Tuned Pristine WN Surface Down	91	311
Tuned Pristine WN TOA Up	92	312

Table 2.10-10. Tuned ClearSky Flux Profiles (1 of 2)

SDS Name	Units	Range	Dimensions	Data Type
Tuned Clear-Sky SW Up	W m <sup>-2</sup>	0 .. 1400	18 x 5	32-bit real
Tuned Clear-Sky SW Down	W m <sup>-2</sup>	0 .. 1400	18 x 5	32-bit real
Tuned Clear-Sky LW Up	W m <sup>-2</sup>	0 .. 850	18 x 5	32-bit real

Table 2.10-10. Tuned ClearSky Flux Profiles (2 of 2)

SDS Name	Units	Range	Dimensions	Data Type
Tuned Clear-Sky LW Down	W m <sup>-2</sup>	0 .. 700	18 x 5	32-bit real
Tuned Clear-Sky WN Up	W m <sup>-2</sup>	0 .. 370	18 x 5	32-bit real
Tuned Clear-Sky WN Down	W m <sup>-2</sup>	0 .. 370	18 x 5	32-bit real

Table 2.10-10(b). SDS Index of Tuned ClearSky Flux Profiles

SDS Name	Regional Monthly Hourly	Regional Monthly
Tuned Clear-Sky SW Up	93	313
Tuned Clear-Sky SW Down	94	314
Tuned Clear-Sky LW Up	95	315
Tuned Clear-Sky LW Down	96	316
Tuned Clear-Sky WN Up	97	317
Tuned Clear-Sky WN Down	98	318

Table 2.10-11. Tuned TotalSky-NoAerosol Fluxes (1 of 2)

SDS Name	Units	Range	Dimensions	Data Type
Tuned Total-Sky-NoAerosol SW Surface Up	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Tuned Total-Sky-NoAerosol SW Surface Down	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Tuned Total-Sky-NoAerosol SW TOA Up	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Tuned Total-Sky-NoAerosol LW Surface Up	W m <sup>-2</sup>	0 .. 850	18	32-bit real
Tuned Total-Sky-NoAerosol LW Surface Down	W m <sup>-2</sup>	0 .. 700	18	32-bit real
Tuned Total-Sky-NoAerosol LW TOA Up	W m <sup>-2</sup>	0 .. 850	18	32-bit real

Table 2.10-11. Tuned TotalSky-NoAerosol Fluxes (2 of 2)

SDS Name	Units	Range	Dimensions	Data Type
Tuned Total-Sky-NoAerosol WN Surface Up	W m <sup>-2</sup>	0 .. 370	18	32-bit real
Tuned Total-Sky-NoAerosol WN Surface Down	W m <sup>-2</sup>	0 .. 370	18	32-bit real
Tuned Total-Sky-NoAerosol WN TOA Up	W m <sup>-2</sup>	0 .. 370	18	32-bit real

Table 2.10-11(b). SDS Index of Tuned TotalSky-NoAerosol Fluxes

SDS Name	Regional Monthly Hourly	Regional Monthly
Tuned Total-Sky-NoAerosol SW Surface Up	99	319
Tuned Total-Sky-NoAerosol SW Surface Down	100	320
Tuned Total-Sky-NoAerosol SW TOA Up	101	321
Tuned Total-Sky-NoAerosol LW Surface Up	102	322
Tuned Total-Sky-NoAerosol LW Surface Down	103	323
Tuned Total-Sky-NoAerosol LW TOA Up	104	324
Tuned Total-Sky-NoAerosol WN Surface Up	105	325
Tuned Total-Sky-NoAerosol WN Surface Down	106	326
Tuned Total-Sky-NoAerosol WN TOA Up	107	327

Table 2.10-12. Tuned TotalSky Flux Profiles

SDS Name	Units	Range	Dimensions	Data Type
Tuned Total-Sky SW Up	W m <sup>-2</sup>	0 .. 1400	18 x 5	32-bit real
Tuned Total-Sky SW Down	W m <sup>-2</sup>	0 .. 1400	18 x 5	32-bit real
Tuned Total-Sky LW Up	W m <sup>-2</sup>	0 .. 850	18 x 5	32-bit real
Tuned Total-Sky LW Down	W m <sup>-2</sup>	0 .. 700	18 x 5	32-bit real
Tuned Total-Sky WN Up	W m <sup>-2</sup>	0 .. 370	18 x 5	32-bit real
Tuned Total-Sky WN Down	W m <sup>-2</sup>	0 .. 370	18 x 5	32-bit real

Table 2.10-12(b). SDS Index of Tuned TotalSky Flux Profiles

SDS Name	Regional Monthly Hourly	Regional Monthly
Tuned Total-Sky SW Up	108	328
Tuned Total-Sky SW Down	109	329
Tuned Total-Sky LW Up	110	330
Tuned Total-Sky LW Down	111	331
Tuned Total-Sky WN Up	112	332
Tuned Total-Sky WN Down	113	333

Table 2.10-13. Untuned Pristine Fluxes

SDS Name	Units	Range	Dimensions	Data Type
Untuned Pristine SW Surface Up	W m <sup>-2</sup>	0 .. 1500	18	32-bit real
Untuned Pristine SW Surface Down	W m <sup>-2</sup>	0 .. 1500	18	32-bit real
Untuned Pristine SW TOA Up	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Untuned Pristine LW Surface Up	W m <sup>-2</sup>	0 .. 850	18	32-bit real
Untuned Pristine LW Surface Down	W m <sup>-2</sup>	0 .. 700	18	32-bit real
Untuned Pristine LW TOA Up	W m <sup>-2</sup>	0 .. 850	18	32-bit real
Untuned Pristine WN Surface Up	W m <sup>-2</sup>	0 .. 370	18	32-bit real
Untuned Pristine WN Surface Down	W m <sup>-2</sup>	0 .. 370	18	32-bit real
Untuned Pristine WN TOA Up	W m <sup>-2</sup>	0 .. 370	18	32-bit real

Table 2.10-13(b). SDS Index of Untuned Pristine Fluxes (1 of 2)

SDS Name	Regional Monthly Hourly	Regional Monthly
Untuned Pristine SW Surface Up	114	334
Untuned Pristine SW Surface Down	115	335
Untuned Pristine SW TOA Up	116	336
Untuned Pristine LW Surface Up	117	337



Table 2.10-13(b). SDS Index of Untuned Pristine Fluxes (2 of 2)

SDS Name	Regional Monthly Hourly	Regional Monthly
Untuned Pristine LW Surface Down	118	338
Untuned Pristine LW TOA Up	119	339
Untuned Pristine WN Surface Up	120	340
Untuned Pristine WN Surface Down	121	341
Untuned Pristine WN TOA Up	122	342

Table 2.10-14. Untuned ClearSky Fluxes

SDS Name	Units	Range	Dimensions	Data Type
Untuned Clear-Sky SW Surface Up	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Untuned Clear-Sky SW Surface Down	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Untuned Clear-Sky SW TOA Up	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Untuned Clear-Sky LW Surface Up	W m <sup>-2</sup>	0 .. 850	18	32-bit real
Untuned Clear-Sky LW Surface Down	W m <sup>-2</sup>	0 .. 700	18	32-bit real
Untuned Clear-Sky LW TOA Up	W m <sup>-2</sup>	0 .. 850	18	32-bit real
Untuned Clear-Sky WN Surface Up	W m <sup>-2</sup>	0 .. 370	18	32-bit real
Untuned Clear-Sky WN Surface Down	W m <sup>-2</sup>	0 .. 370	18	32-bit real
Untuned Clear-Sky WN TOA Up	W m <sup>-2</sup>	0 .. 370	18	32-bit real

Table 2.10-14(b). SDS Index of Untuned ClearSky Fluxes (1 of 2)

SDS Name	Regional Monthly Hourly	Regional Monthly
Untuned Clear-Sky SW Surface Up	123	343
Untuned Clear-Sky SW Surface Down	124	344
Untuned Clear-Sky SW TOA Up	125	345
Untuned Clear-Sky LW Surface Up	126	346
Untuned Clear-Sky LW Surface Down	127	347
Untuned Clear-Sky LW TOA Up	128	348
Untuned Clear-Sky WN Surface Up	129	349

Table 2.10-14(b). SDS Index of Untuned ClearSky Fluxes (2 of 2)

SDS Name	Regional Monthly Hourly	Regional Monthly
Untuned Clear-Sky WN Surface Down	130	350
Untuned Clear-Sky WN TOA Up	131	351

Table 2.10-15. Untuned TotalSky-NoAerosol Fluxes

SDS Name	Units	Range	Dimensions	Data Type
Untuned Total-Sky-NoAerosol SW Surface Up	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Untuned Total-Sky-NoAerosol SW Surface Down	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Untuned Total-Sky-NoAerosol SW TOA Up	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Untuned Total-Sky-NoAerosol LW Surface Up	W m <sup>-2</sup>	0 .. 850	18	32-bit real
Untuned Total-Sky-NoAerosol LW Surface Down	W m <sup>-2</sup>	0 .. 700	18	32-bit real
Untuned Total-Sky-NoAerosol LW TOA Up	W m <sup>-2</sup>	0 .. 850	18	32-bit real
Untuned Total-Sky-NoAerosol WN Surface Up	W m <sup>-2</sup>	0 .. 370	18	32-bit real
Untuned Total-Sky-NoAerosol WN Surface Down	W m <sup>-2</sup>	0 .. 370	18	32-bit real
Untuned Total-Sky-NoAerosol WN TOA Up	W m <sup>-2</sup>	0 .. 370	18	32-bit real

Table 2.10-15(b). SDS Index of Untuned TotalSky-NoAerosol Fluxes (1 of 2)

SDS Name	Regional Monthly Hourly	Regional Monthly
Untuned Total-Sky-NoAerosol SW Surface Up	132	352
Untuned Total-Sky-NoAerosol SW Surface Down	133	353
Untuned Total-Sky-NoAerosol SW TOA Up	134	354
Untuned Total-Sky-NoAerosol LW Surface Up	135	355
Untuned Total-Sky-NoAerosol LW Surface Down	136	356

Table 2.10-15(b). SDS Index of Untuned TotalSky-NoAerosol Fluxes (2 of 2)

SDS Name	Regional Monthly Hourly	Regional Monthly
Untuned Total-Sky-NoAerosol LW TOA Up	137	357
Untuned Total-Sky-NoAerosol WN Surface Up	138	358
Untuned Total-Sky-NoAerosol WN Surface Down	139	359
Untuned Total-Sky-NoAerosol WN TOA Up	140	360

Table 2.10-16. Untuned TotalSky Fluxes

SDS Name	Units	Range	Dimensions	Data Type
Untuned Total-Sky SW Surface Up	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Untuned Total-Sky SW Surface Down	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Untuned Total-Sky SW TOA Up	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Untuned Total-Sky LW Surface Up	W m <sup>-2</sup>	0 .. 850	18	32-bit real
Untuned Total-Sky LW Surface Down	W m <sup>-2</sup>	0 .. 700	18	32-bit real
Untuned Total-Sky LW TOA Up	W m <sup>-2</sup>	0 .. 850	18	32-bit real
Untuned Total-Sky WN Surface Up	W m <sup>-2</sup>	0 .. 370	18	32-bit real
Untuned Total-Sky WN Surface Down	W m <sup>-2</sup>	0 .. 370	18	32-bit real
Untuned Total-Sky WN TOA Up	W m <sup>-2</sup>	0 .. 370	18	32-bit real

Table 2.10-16(b). SDS Index of Untuned TotalSky Fluxes (1 of 2)

SDS Name	Regional Monthly Hourly	Regional Monthly
Untuned Total-Sky SW Surface Up	141	361
Untuned Total-Sky SW Surface Down	142	362
Untuned Total-Sky SW TOA Up	143	363
Untuned Total-Sky LW Surface Up	144	364
Untuned Total-Sky LW Surface Down	145	365
Untuned Total-Sky LW TOA Up	146	366
Untuned Total-Sky WN Surface Up	147	367
Untuned Total-Sky WN Surface Down	148	368

Table 2.10-16(b). SDS Index of Untuned TotalSky Fluxes (2 of 2)

SDS Name	Regional Monthly Hourly	Regional Monthly
Untuned Total-Sky WN TOA Up	149	369

Table 2.10-17. Satellite Emulated WN TOA Fluxes

SDS Name	Units	Range	Dimensions	Data Type
Untuned Satellite Emulated WN TOA	W m <sup>-2</sup>	-1400 .. 1400	18	32-bit real
Tuned Satellite Emulated WN TOA	W m <sup>-2</sup>	-1400 .. 1400	18	32-bit real

Table 2.10-17(b). SDS Index of Satellite Emulated WN TOA Fluxes

SDS Name	Regional Monthly Hourly	Regional Monthly
Untuned Satellite Emulated WN TOA	150	370
Tuned Satellite Emulated WN TOA	151	371

Table 2.10-18. TOA Fluxes Error

SDS Name	Units	Range	Dimensions	Data Type
Tuned Minus Observed SW TOA	W m <sup>-2</sup>	-1400 .. 1400	18	32-bit real
Untuned Minus Observed SW TOA	W m <sup>-2</sup>	-1400 .. 1400	18	32-bit real
Tuned Minus Observed LW TOA	W m <sup>-2</sup>	-600 .. 600	18	32-bit real
Untuned Minus Observed LW TOA	W m <sup>-2</sup>	-600 .. 600	18	32-bit real

Table 2.10-18(b). SDS Index of TOA Fluxes Error

<b>SDS Name</b>	<b>Regional Monthly Hourly</b>	<b>Regional Monthly</b>
Tuned Minus Observed SW TOA	152	372
Untuned Minus Observed SW TOA	153	373
Tuned Minus Observed LW TOA	154	374
Untuned Minus Observed LW TOA	155	375

Table 2.10-19. Number of Hourboxes

<b>SDS Name</b>	<b>Units</b>	<b>Range</b>	<b>Dimensions</b>	<b>Data Type</b>
Number of Observed SW	N/A	0 .. 744	9	32-bit real
Number of Untuned SW	N/A	0 .. 744	9	32-bit real
Number of Tuned SW	N/A	0 .. 744	9	32-bit real
Number of Observed LW	N/A	0 .. 744	9	32-bit real
Number of Untuned LW	N/A	0 .. 744	9	32-bit real
Number of Tuned LW	N/A	0 .. 744	9	32-bit real

Table 2.10-19(b). SDS Index of Number of Hourboxes

<b>SDS Name</b>	<b>Regional Monthly Hourly</b>	<b>Regional Monthly</b>
Number of Observed SW	156	376
Number of Untuned SW	157	377
Number of Tuned SW	158	378
Number of Observed LW	159	379
Number of Untuned LW	160	380
Number of Tuned LW	161	381

Table 2.10-20. Constraint Adjustments

SDS Name	Units	Range	Dimensions	Data Type
Total column precipitable water - initial	cm	0 .. 10	18	32-bit real
Total column precipitable water - adjusted	cm	-10 .. 10	18	32-bit real
Upper tropospheric precipitable water - initial	cm	0 .. 10	18	32-bit real
Upper tropospheric precipitable water - adjusted	cm	0 .. 10	18	32-bit real
Upper tropospheric humidity - initial	N/A	0.0 .. 100.0	18	32-bit real
Upper tropospheric humidity - adjusted	N/A	0.0 .. 100.0	18	32-bit real
Aerosol optical depth - initial	N/A	0 .. 5	18	32-bit real
Aerosol optical depth - adjusted	N/A	0 .. 5	18	32-bit real
Skin temperature - initial	K	175 .. 375	18	32-bit real
Skin temperature - adjusted	K	175 .. 375	18	32-bit real
Surface pressure	hPa	0 .. 800	18	32-bit real
Column ozone - initial	du	0 .. 800	18	32-bit real
Mean visible optical depth- adjusted	N/A	0 .. 400	18	32-bit real
Mean cloud fractional area - adjusted	%	0 .. 100	18	32-bit real
Mean cloud effective temperature - adjusted	K	175 .. 375	18	32-bit real

Table 2.10-20(b). SDS Index of Constraint Adjustments (1 of 2)

SDS Name	Regional Monthly Hourly	Regional Monthly
Total column precipitable water - initial	162	382
Total column precipitable water - adjusted	163	383
Upper tropospheric precipitable water - initial	164	384
Upper tropospheric precipitable water - adjusted	165	385
Upper tropospheric humidity - initial	166	386
Upper tropospheric humidity - adjusted	167	387
Aerosol optical depth - initial	168	388

Table 2.10-20(b). SDS Index of Constraint Adjustments (2 of 2)

<b>SDS Name</b>	<b>Regional Monthly Hourly</b>	<b>Regional Monthly</b>
Aerosol optical depth - adjusted	169	389
Skin temperature - initial	170	390
Skin temperature - adjusted	171	391
Surface pressure	172	392
Column ozone - initial	173	393
Mean visible optical depth- adjusted	174	394
Mean cloud fractional area - adjusted	175	395
Mean cloud effective temperature - adjusted	176	396

Table 2.10-21. Surface SW Direct/Diffuse Fluxes

<b>SDS Name</b>	<b>Units</b>	<b>Range</b>	<b>Dimensions</b>	<b>Data Type</b>
Total-Sky SW flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Clear-Sky SW flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Pristine-Sky SW flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Actinic-Sky SW flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Total-Sky SW flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Clear-Sky SW flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Pristine-Sky SW flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Actinic-Sky SW flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real

Table 2.10-21(b). SDS Index of Surface SW Direct/Diffuse Fluxes (1 of 2)

<b>SDS Name</b>	<b>Regional Monthly Hourly</b>	<b>Regional Monthly</b>
Total-Sky SW flux - Diffuse	177	397
Clear-Sky SW flux - Diffuse	178	398
Pristine-Sky SW flux - Diffuse	179	399
Actinic-Sky SW flux - Diffuse	180	400
Total-Sky SW flux - Direct	181	401
Clear-Sky SW flux - Direct	182	402

Table 2.10-21(b). SDS Index of Surface SW Direct/Diffuse Fluxes (2 of 2)

SDS Name	Regional Monthly Hourly	Regional Monthly
Pristine-Sky SW flux - Direct	183	403
Actinic-Sky SW flux - Direct	184	404

Table 2.10-22. UVA - UVB Fluxes (1 of 2)

SDS Name	Units	Range	Dimensions	Data Type
TOA Downwelling UVB Flux	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
TOA Downwelling UVA Flux	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Pristine UVB Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Pristine UVB Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Pristine UVA Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Pristine UVA Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Clear-Sky UVB Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Clear-Sky UVB Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Clear-Sky UVA Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Clear-Sky UVA Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Total-Sky-NoAerosol UVB Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Total-Sky-NoAerosol UVB Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Total-Sky-NoAerosol UVA Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Total-Sky-NoAerosol UVA Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Total-Sky UVB Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Total-Sky UVB Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Total-Sky UVA Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Total-Sky UVA Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real



Table 2.10-22. UVA - UVB Fluxes (2 of 2)

SDS Name	Units	Range	Dimen- sions	Data Type
Total-Sky Surface UV Index	N/A	0 .. 30	18	32-bit real
Clear-Sky Surface UV Index	N/A	0 .. 30	18	32-bit real
Pristine Surface UV Index	N/A	0 .. 30	18	32-bit real
Total-Sky-NoAerosol Surface UV- Index	N/A	0 .. 30	18	32-bit real

Table 2.10-22(b). SDS Index of UVA - UVB Fluxes

SDS Name	Regional Monthly Hourly	Regional Monthly
TOA Downwelling UVB Flux	185	405
TOA Downwelling UVA Flux	186	406
Pristine UVB Surface flux - Direct	187	407
Pristine UVB Surface flux - Diffuse	188	408
Pristine UVA Surface flux - Direct	189	409
Pristine UVA Surface flux - Diffuse	190	410
Clear-Sky UVB Surface flux - Direct	191	411
Clear-Sky UVB Surface flux - Diffuse	192	412
Clear-Sky UVA Surface flux - Direct	193	413
Clear-Sky UVA Surface flux - Diffuse	194	414
Total-Sky-NoAerosol UVB Surface flux - Direct	195	415
Total-Sky-NoAerosol UVB Surface flux - Diffuse	196	416
Total-Sky-NoAerosol UVA Surface flux - Direct	197	417
Total-Sky-NoAerosol UVA Surface flux - Diffuse	198	418
Total-Sky UVB Surface flux - Direct	199	419
Total-Sky UVB Surface flux - Diffuse	200	420
Total-Sky UVA Surface flux - Direct	201	421
Total-Sky UVA Surface flux - Diffuse	202	422
Total-Sky Surface UV Index	203	423
Clear-Sky Surface UV Index	204	424
Pristine Surface UV Index	205	425
Total-Sky-NoAerosol Surface UV- Index	206	426

Table 2.10-23. PAR Fluxes

SDS Name	Units	Range	Dimensions	Data Type
TOA Downwelling PAR Flux	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Total-Sky PAR Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Total-Sky PAR Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Total-Sky PAR PURV Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Total-Sky PAR PURV Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Total-Sky PAR ChlorA Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Total-Sky PAR ChlorA Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Clear-Sky PAR Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Clear-Sky PAR Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Pristine PAR Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Pristine PAR Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real

Table 2.10-23(b). SDS Index of PAR Fluxes

SDS Name	Regional Monthly Hourly	Regional Monthly
TOA Downwelling PAR Flux	207	427
Total-Sky PAR Surface flux - Direct	208	428
Total-Sky PAR Surface flux - Diffuse	209	429
Total-Sky PAR PURV Surface flux - Direct	210	430
Total-Sky PAR PURV Surface flux - Diffuse	211	431
Total-Sky PAR ChlorA Surface flux - Direct	212	432
Total-Sky PAR ChlorA Surface flux - Diffuse	213	433
Clear-Sky PAR Surface flux - Direct	214	434
Clear-Sky PAR Surface flux - Diffuse	215	435
Pristine PAR Surface flux - Direct	216	436
Pristine PAR Surface flux - Diffuse	217	437

Table 2.10-24. Pristine-Sky SW MultiStream Correction

SDS Name	Units	Range	Dimensions	Data Type
SW TOA Flux - Up - Pristine-Sky - Corrected	W m <sup>-2</sup>	0 .. 1000	18	32-bit real
SW Surface Flux - Down- Pristine-Sky - Corrected	W m <sup>-2</sup>	0 .. 1000	18	32-bit real

Table 2.10-24(b). SDS Index of Pristine-Sky SW MultiStream Correction

SDS Name	Regional Monthly Hourly	Regional Monthly
SW TOA Flux - Up - Pristine-Sky - Corrected	218	438
SW Surface Flux - Down- Pristine-Sky - Corrected	219	439

**Total Bits / Record:** 151296  
**Total Bytes / Record:** 18912  
**Total Records / File:** 64800  
**Total Bytes / File:** 1,225,497,560  
**Total MBytes/File:** 1225 MB

## 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	<ul style="list-style-type: none"> <li>• Updated format to comply with standards.</li> </ul>	All
N/A	R3V2	639	<ul style="list-style-type: none"> <li>• Updated to change all tables and added SDS Index tables.</li> </ul>	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 are the zonal and global averages of the monthly Regional Radiative and Clouds (AVG) product. This product is the CERES equivalent of the zonal and global averages in the ERBE ES-4 product of the CERES untuned and tuned radiative transfer modeled fluxes. This product is written in HDF\_EOS and contains meta data as well as gridded science data.

The ZAVG contains the following apriori and observed input:

- Zonal/Global data
- Cloud category properties for four (low, lower middle, upper middle and high) cloud layers
- Observed CERES TOA clear-sky and all-sky fluxes
- MODIS based spectral aerosol optical depths

The ZAVG contains the following constrained (tuned) vertical flux profiles for both clear-sky and total-sky conditions evaluated at the TOA, 70mb, 200mb, 500mb, and surface:

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

The constrained (tuned) and initial (untuned) profiles for the following are included for pristine (clear-sky no-aerosol), clear-sky, total-sky-no-aerosol, and total-sky conditions:

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

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

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

The ZAVG contains the direct and diffuse shortwave surface fluxes for total-sky, clear-sky, pristine and actinic conditions. The ZAVG also contains surface UVA and UVB downwelling and direct diffuse ratios for total-sky, clear-sky, pristine, and total-sky-no-aerosol conditions.

A complete listing of metadata and science parameters for this data product can be found in [Tables 2.11-1](#) and [Table 2.11-3](#).

**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:** Entire Global

**Record:** Zonal or Global

**Product Version:**

**TRMM:** N/A

**Terra:** Beta3

**Aqua:** N/A

## 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	<a href="#">Table B-1</a>	1	36
CERES_metadata science data	<a href="#">Table B-2</a>	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 2.11-3](#) 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](#) List of the Vgroups for different Gridded Categories.

Table 2.11-2. Gridded Categories of ZAVG

Vgroup Number	Vgroup Name	Description	Number of Records
2	1.0 Degree Zonal	See <a href="#">Table 2.11-3</a>	180
3	Global	See <a href="#">Table 2.11-3</a>	1

[Table 2.11-3](#) List of the Vgroups contained in 1.0 Degree Zonal and Global Vgroups.

Table 2.11-3. Temporal Vgroups of ZAVG

Vgroup Number	Vgroup Name	Monthly Hourly Averages / Monthly (Hour) Averages
1	Monthly Hourly Averages	See <a href="#">Table 2.11-4</a>
2	Monthly Averages	See <a href="#">Table 2.11-4</a>

**Table 2.11-4** List of the Vgroups contained in the Monthly Hourly Averages and Monthly Averages Vgroups in ZAVG.

Table 2.11-4. Temporal Vgroups of ZAVG

<b>Vgroup Number</b>	<b>Vgroup Name</b>	<b>Monthly Hourly Averages / Monthly (Hour) Averages</b>
1	Observed TOA Fluxes	See <a href="#">Table 2.11-5</a>
2	Cloud Layer - High	See <a href="#">Table 2.11-6</a>
3	Cloud Layer - UpperMid	See <a href="#">Table 2.11-6</a>
4	Cloud Layer - LowerMid	See <a href="#">Table 2.11-6</a>
5	Cloud Layer - Low	See <a href="#">Table 2.11-6</a>
6	Stowe-Ignatov Aerosol Optical Depth	See <a href="#">Table 2.11-7</a>
7	MODIS Aerosol Optical Depth	See <a href="#">Table 2.11-8</a>
8	Tuned Pristine Fluxes	See <a href="#">Table 2.11-9</a>
9	Tuned ClearSky Flux Profiles	See <a href="#">Table 2.11-10</a>
10	Tuned TotalSky-NoAerosol Fluxes	See <a href="#">Table 2.11-11</a>
11	Tuned TotalSky Flux Profiles	See <a href="#">Table 2.11-12</a>
12	Untuned Pristine Fluxes	See <a href="#">Table 2.11-13</a>
13	Untuned ClearSky Fluxes	See <a href="#">Table 2.11-14</a>
14	Untuned TotalSky-NoAerosol Fluxes	See <a href="#">Table 2.11-15</a>
15	Untuned TotalSky Fluxes	See <a href="#">Table 2.11-16</a>
16	Satellite Emulated WN TOA Fluxes	See <a href="#">Table 2.11-17</a>
17	TOA Flux Error	See <a href="#">Table 2.11-18</a>
18	Constrainment Adjustments	See <a href="#">Table 2.11-19</a>
19	Surface SW Direct/Diffuse Fluxes	See <a href="#">Table 2.11-20</a>
20	UVA - UVB Fluxes	See <a href="#">Table 2.11-21</a>
21	PAR Fluxes	See <a href="#">Table 2.11-22</a>
22	Pristine-Sky SW MultiStream Correction	See <a href="#">Table 2.11-23</a>

### ZAVG Science Data

All of the ZAVG science data are organized into the HDF-EOS Grid data type, which is shown in [Table 2.11-4](#) 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. The 18 under the Dimensions column in the following tables the 18 refers to 9 = 8 monthly hourly (3-hour GMT based) + 1 monthly regional x 2 mean and standard deviation.



Table 2.11-5. Observed TOA Fluxes

SDS Name	Units	Range	Dimensions	Data Type
SW TOA Total-Sky	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
LW TOA Total-Sky	W m <sup>-2</sup>	0 .. 500	18	32-bit real
WN TOA Total-Sky	W m <sup>-2</sup> μm <sup>-1</sup>	2 .. 50	18	32-bit real
SW TOA Clear-Sky	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
LW TOA Clear-Sky	W m <sup>-2</sup>	0 .. 500	18	32-bit real
WN TOA Clear-Sky	W m <sup>-2</sup> μm <sup>-1</sup>	2 .. 50	18	32-bit real

Table 2.11-5(b). SDS Index of Observed TOA Fluxes

SDS Name	Zonal Monthly Hourly	Zonal Monthly	Global Monthly Hourly	Global Monthly
SW TOA Total-Sky	0	209	418	627
LW TOA Total-Sky	1	210	419	628
WN TOA Total-Sky	2	211	420	629
SW TOA Clear-Sky	3	212	421	630
LW TOA Clear-Sky	4	213	422	631
WN TOA Clear-Sky	5	214	423	632

Table 2.11-6. Cloud Properties for Four Cloud Layers (1 of 2)

SDS Name	Units	Range	Dimensions	Data Type
Area Fraction Percentage	Percent	0 .. 100	18 x 4	32-bit real
Vis. Opt. Depth (linear)	N/A	0 .. 400	18 x 4	32-bit real
Vis. Opt. Depth (log)	N/A	-6 .. 6	18 x 4	32-bit real
Infrared Emissivity	N/A	0 .. 1	18 x 4	32-bit real
Liquid Water Path	g m <sup>-2</sup>	0 .. 10000	18 x 4	32-bit real
Ice Water Path	g m <sup>-2</sup>	0 .. 10000	18 x 4	32-bit real

Table 2.11-6. Cloud Properties for Four Cloud Layers (1 of 2)

SDS Name	Units	Range	Dimensions	Data Type
Top Pressure	hPa	0 .. 1100	18 x 4	32-bit real
Effective Pressure	hPa	0 .. 1100	18 x 4	32-bit real
Effective Temperature	K	100 .. 350	18 x 4	32-bit real
Effective Height	km	0 .. 20	18 x 4	32-bit real
Bottom Pressure	hPa	0 .. 1100	18 x 4	32-bit real
Liquid Particle Radius	μm	0 .. 40	18 x 4	32-bit real
Ice Particle Diameter	μm	0 .. 300	18 x 4	32-bit real
Particle Phase	N/A	1 .. 2	18 x 4	32-bit real
Vertical Aspect Ratio	N/A	0 .. 20	18 x 4	32-bit real

Table 2.11-6(b). SDS Index of High, Uppermid, Lowermid, Low (mean, stdev, num obs) in Cloud Properties

SDS Name	Zonal Monthly Hourly	Zonal Monthly	Global Monthly Hourly	Global Monthly
Area Fraction Percentage	6 21 36 51	215 230 245 260	424 439 454 469	633 648 663 678
Vis. Opt. Depth (linear)	7 22 37 52	216 231 246 261	425 440 455 470	634 649 664 679
Vis. Opt. Depth (log)	8 23 38 53	217 232 247 262	426 441 456 471	635 650 665 680
Infrared Emissivity	9 24 39 54	218 233 248 263	427 442 457 472	636 651 666 681
Liquid Water Path	10 25 40 55	219 234 249 264	428 443 458 473	637 652 667 682
Ice Water Path	11 26 41 56	220 235 250 265	429 444 459 474	638 653 668 683
Top Pressure	12 27 42 57	221 236 251 266	430 445 460 475	639 654 669 684
Effective Pressure	13 28 43 58	222 237 252 267	431 446 461 476	640 655 670 685
Effective Temperature	14 29 44 59	223 238 253 268	432 447 462 477	641 656 671 686
Effective Height	15 30 45 60	224 239 254 269	433 448 463 478	642 657 672 687
Bottom Pressure	16 31 46 61	225 240 255 270	434 449 464 479	643 658 673 688
Liquid Particle Radius	17 32 47 62	226 241 256 271	435 450 465 480	644 659 674 689
Ice Particle Diameter	18 33 48 63	227 242 257 272	436 451 466 481	645 660 675 690
Particle Phase	19 34 49 64	228 243 258 273	437 452 467 482	646 661 676 691
Vertical Aspect Ratio	20 35 50 65	229 244 259 274	438 453 468 483	647 662 677 692

Color Red - High Cloud  
 Color Green - Uppermid Cloud  
 Color Blue - Lowermid Cloud  
 Color Black - Low Cloud

Table 2.11-7. Stowe-Ignatov Aerosol Optical Depth

SDS Name	Units	Range	Dimensions	Data Type
Aerosol visible optical depth - 0.63 $\mu\text{m}$	N/A	0 .. 5	18	32-bit real
Aerosol visible optical depth - 1.6 $\mu\text{m}$	N/A	0 .. 5	18	32-bit real

Table 2.11-7(b). SDS Index of Stowe-Ignatov Aerosol Optical Depth

SDS Name	Zonal Monthly Hourly	Zonal Monthly	Global Monthly Hourly	Global Monthly
Aerosol visible optical depth - 0.63 $\mu\text{m}$	66	275	484	693
Aerosol visible optical depth - 1.6 $\mu\text{m}$	67	276	485	694

Table 2.11-8. MODIS Aerosol Optical Depth

Item	SDS Name	Units	Range	Dimensions	Data Type
ZAVG-223	Initial Aerosol Optical Depth	N/A	0 .. 5	18	32-bit real
ZAVG-224	Aerosol Opt. Depth at 0.47 $\mu\text{m}$ in Land	N/A	0 .. 5	18	32-bit real
ZAVG-225	Aerosol Opt. Depth at 0.55 $\mu\text{m}$ in Land	N/A	0 .. 5	18	32-bit real
ZAVG-226	Aerosol Opt. Depth at 0.66 $\mu\text{m}$ in Land	N/A	0 .. 5	18	32-bit real
ZAVG-227	Aerosol Opt. Depth at 0.47 $\mu\text{m}$ in Ocean	N/A	0 .. 5	18	32-bit real
ZAVG-228	Aerosol Opt. Depth at 0.55 $\mu\text{m}$ in Ocean	N/A	0 .. 5	18	32-bit real
ZAVG-229	Aerosol Opt. Depth at 0.66 $\mu\text{m}$ in Ocean	N/A	0 .. 5	18	32-bit real
ZAVG-230	Aerosol Opt. Depth at 0.87 $\mu\text{m}$ in Ocean	N/A	0 .. 5	18	32-bit real
ZAVG-231	Aerosol Opt. Depth at 1.24 $\mu\text{m}$ in Ocean	N/A	0 .. 5	18	32-bit real
ZAVG-232	Aerosol Opt. Depth at 1.64 $\mu\text{m}$ in Ocean	N/A	0 .. 5	18	32-bit real
ZAVG-233	Aerosol Opt. Depth at 2.13 $\mu\text{m}$ in Ocean	N/A	0 .. 5	18	32-bit real

Table 2.11-8(b). SDS Index of MODIS Aerosol Optical Depth

SDS Name	Zonal Monthly Hourly	Zonal Monthly	Global Monthly Hourly	Global Monthly
Initial Aerosol Optical Depth	68	277	486	695
Aerosol Opt. Depth at 0.47 $\mu\text{m}$ in Land	69	278	487	696
Aerosol Opt. Depth at 0.55 $\mu\text{m}$ in Land	70	279	488	697
Aerosol Opt. Depth at 0.66 $\mu\text{m}$ in Land	71	280	489	698
Aerosol Opt. Depth at 0.47 $\mu\text{m}$ in Ocean	72	281	490	699
Aerosol Opt. Depth at 0.55 $\mu\text{m}$ in Ocean	73	282	491	700
Aerosol Opt. Depth at 0.66 $\mu\text{m}$ in Ocean	74	283	492	701
Aerosol Opt. Depth at 0.87 $\mu\text{m}$ in Ocean	75	284	493	702
Aerosol Opt. Depth at 1.24 $\mu\text{m}$ in Ocean	76	285	494	703
Aerosol Opt. Depth at 1.64 $\mu\text{m}$ in Ocean	77	286	495	704
Aerosol Opt. Depth at 2.13 $\mu\text{m}$ in Ocean	78	287	496	705

Table 2.11-9. Tuned Pristine Fluxes

SDS Name	Units	Range	Dimensions	Data Type
Tuned Pristine SW Surface Up	$\text{W m}^{-2}$	0 .. 1400	18	32-bit real
Tuned Pristine SW Surface Down	$\text{W m}^{-2}$	0 .. 1400	18	32-bit real
Tuned Pristine SW TOA Up	$\text{W m}^{-2}$	0 .. 1400	18	32-bit real
Tuned Pristine LW Surface Up	$\text{W m}^{-2}$	0 .. 850	18	32-bit real
Tuned Pristine LW Surface Down	$\text{W m}^{-2}$	0 .. 700	18	32-bit real
Tuned Pristine LW TOA Up	$\text{W m}^{-2}$	0 .. 850	18	32-bit real
Tuned Pristine WN Surface Up	$\text{W m}^{-2}$	0 .. 370	18	32-bit real
Tuned Pristine WN Surface Down	$\text{W m}^{-2}$	0 .. 370	18	32-bit real
Tuned Pristine WN TOA Up	$\text{W m}^{-2}$	0 .. 370	18	32-bit real

Table 2.11-9(b). SDS Index of Tuned Pristine Fluxes

<b>SDS Name</b>	<b>Zonal Monthly Hourly</b>	<b>Zonal Monthly</b>	<b>Global Monthly Hourly</b>	<b>Global Monthly</b>
Tuned Pristine SW Surface Up	79	288	497	706
Tuned Pristine SW Surface Down	80	289	498	707
Tuned Pristine SW TOA Up	81	290	499	708
Tuned Pristine LW Surface Up	82	291	500	709
Tuned Pristine LW Surface Down	83	292	501	710
Tuned Pristine LW TOA Up	84	293	502	711
Tuned Pristine WN Surface Up	85	294	503	712
Tuned Pristine WN Surface Down	86	295	504	713
Tuned Pristine WN TOA Up	87	296	505	714

Table 2.11-10. Tuned ClearSky Flux Profiles

<b>SDS Name</b>	<b>Units</b>	<b>Range</b>	<b>Dimensions</b>	<b>Data Type</b>
Tuned Clear-Sky SW Up	W m <sup>-2</sup>	0 .. 1400	18 x 5	32-bit real
Tuned Clear-Sky SW Down	W m <sup>-2</sup>	0 .. 1400	18 x 5	32-bit real
Tuned Clear-Sky LW Up	W m <sup>-2</sup>	0 .. 850	18 x 5	32-bit real
Tuned Clear-Sky LW Down	W m <sup>-2</sup>	0 .. 700	18 x 5	32-bit real
Tuned Clear-Sky WN Up	W m <sup>-2</sup>	0 .. 370	18 x 5	32-bit real
Tuned Clear-Sky WN Down	W m <sup>-2</sup>	0 .. 370	18 x 5	32-bit real

Table 2.11-10(b). SDS Index of Tuned ClearSky Flux Profiles

<b>SDS Name</b>	<b>Zonal Monthly Hourly</b>	<b>Zonal Monthly</b>	<b>Global Monthly Hourly</b>	<b>Global Monthly</b>
Tuned Clear-Sky SW Up	88	297	506	715
Tuned Clear-Sky SW Down	89	298	507	716
Tuned Clear-Sky LW Up	90	299	508	717
Tuned Clear-Sky LW Down	91	300	509	718
Tuned Clear-Sky WN Up	92	301	510	719
Tuned Clear-Sky WN Down	93	302	511	720

Table 2.11-11. Tuned TotalSky-NoAerosol Fluxes

SDS Name	Units	Range	Dimensions	Data Type
Tuned Total-Sky-NoAerosol SW Surface Up	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Tuned Total-Sky-NoAerosol SW Surface Down	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Tuned Total-Sky-NoAerosol SW TOA Up	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Tuned Total-Sky-NoAerosol LW Surface Up	W m <sup>-2</sup>	0 .. 850	18	32-bit real
Tuned Total-Sky-NoAerosol LW Surface Down	W m <sup>-2</sup>	0 .. 700	18	32-bit real
Tuned Total-Sky-NoAerosol LW TOA Up	W m <sup>-2</sup>	0 .. 850	18	32-bit real
Tuned Total-Sky-NoAerosol WN Surface Up	W m <sup>-2</sup>	0 .. 370	18	32-bit real
Tuned Total-Sky-NoAerosol WN Surface Down	W m <sup>-2</sup>	0 .. 370	18	32-bit real
Tuned Total-Sky-NoAerosol WN TOA Up	W m <sup>-2</sup>	0 .. 370	18	32-bit real

Table 2.11-11(b). SDS Index of Tuned TotalSky-NoAerosol Fluxes

SDS Name	Zonal Monthly Hourly	Zonal Monthly	Zonal Monthly Hourly	Zonal Monthly
Tuned Total-Sky-NoAerosol SW Surface Up	94	303	512	721
Tuned Total-Sky-NoAerosol SW Surface Down	95	304	513	722
Tuned Total-Sky-NoAerosol SW TOA Up	96	305	514	723
Tuned Total-Sky-NoAerosol LW Surface Up	97	306	515	724
Tuned Total-Sky-NoAerosol LW Surface Down	98	307	516	725
Tuned Total-Sky-NoAerosol LW TOA Up	99	308	517	726
Tuned Total-Sky-NoAerosol WN Surface Up	100	309	518	727
Tuned Total-Sky-NoAerosol WN Surface Down	101	310	519	728
Tuned Total-Sky-NoAerosol WN TOA Up	102	311	520	729

Table 2.11-12. Tuned TotalSky Flux Profiles

<b>SDS Name</b>	<b>Units</b>	<b>Range</b>	<b>Dimen- sions</b>	<b>Data Type</b>
Tuned Total-Sky SW Up	W m <sup>-2</sup>	0 .. 1400	18 x 5	32-bit real
Tuned Total-Sky SW Down	W m <sup>-2</sup>	0 .. 1400	18 x 5	32-bit real
Tuned Total-Sky LW Up	W m <sup>-2</sup>	0 .. 850	18 x 5	32-bit real
Tuned Total-Sky LW Down	W m <sup>-2</sup>	0 .. 700	18 x 5	32-bit real
Tuned Total-Sky WN Up	W m <sup>-2</sup>	0 .. 370	18 x 5	32-bit real
Tuned Total-Sky WN Down	W m <sup>-2</sup>	0 .. 370	18 x 5	32-bit real

Table 2.11-12(b). SDS Index of Tuned TotalSky Flux Profiles

<b>SDS Name</b>	<b>Zonal Monthly Hourly</b>	<b>Zonal Monthly</b>	<b>Global Monthly Hourly</b>	<b>Global Monthly</b>
Tuned Total-Sky SW Up	103	312	521	730
Tuned Total-Sky SW Down	104	313	522	731
Tuned Total-Sky LW Up	105	314	523	732
Tuned Total-Sky LW Down	106	315	524	733
Tuned Total-Sky WN Up	107	316	525	734
Tuned Total-Sky WN Down	108	317	526	735

Table 2.11-13. Untuned Pristine Fluxes (1 of 2)

<b>SDS Name</b>	<b>Units</b>	<b>Range</b>	<b>Dimen- sions</b>	<b>Data Type</b>
Untuned Pristine SW Surface Up	W m <sup>-2</sup>	0 .. 1500	18	32-bit real
Untuned Pristine SW Surface Down	W m <sup>-2</sup>	0 .. 1500	18	32-bit real
Untuned Pristine SW TOA Up	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Untuned Pristine LW Surface Up	W m <sup>-2</sup>	0 .. 850	18	32-bit real
Untuned Pristine LW Surface Down	W m <sup>-2</sup>	0 .. 700	18	32-bit real
Untuned Pristine LW TOA Up	W m <sup>-2</sup>	0 .. 850	18	32-bit real

Table 2.11-13. Untuned Pristine Fluxes (2 of 2)

<b>SDS Name</b>	<b>Units</b>	<b>Range</b>	<b>Dimen- sions</b>	<b>DataType</b>
Untuned Pristine WN Surface Up	W m <sup>-2</sup>	0 .. 370	18	32-bit real
Untuned Pristine WN Surface Down	W m <sup>-2</sup>	0 .. 370	18	32-bit real
Untuned Pristine WN TOA Up	W m <sup>-2</sup>	0 .. 370	18	32-bit real

Table 2.11-13(b). SDS Index of Untuned Pristine Fluxes

<b>SDS Name</b>	<b>Zonal Monthly Hourly</b>	<b>Zonal Monthly</b>	<b>Global Monthly Hourly</b>	<b>Global Monthly</b>
Untuned Pristine SW Surface Up	109	318	527	736
Untuned Pristine SW Surface Down	110	319	528	737
Untuned Pristine SW TOA Up	111	320	529	738
Untuned Pristine LW Surface Up	112	321	530	739
Untuned Pristine LW Surface Down	113	322	531	740
Untuned Pristine LW TOA Up	114	323	532	741
Untuned Pristine WN Surface Up	115	324	533	742
Untuned Pristine WN Surface Down	116	325	534	743
Untuned Pristine WN TOA Up	117	326	535	744

Table 2.11-14. Untuned ClearSky Fluxes (1 of 2)

<b>SDS Name</b>	<b>Units</b>	<b>Range</b>	<b>Dimen- sions</b>	<b>DataType</b>
Untuned Clear-Sky SW Surface Up	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Untuned Clear-Sky SW Surface Down	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Untuned Clear-Sky SW TOA Up	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Untuned Clear-Sky LW Surface Up	W m <sup>-2</sup>	0 .. 850	18	32-bit real
Untuned Clear-Sky LW Surface Down	W m <sup>-2</sup>	0 .. 700	18	32-bit real
Untuned Clear-Sky LW TOA Up	W m <sup>-2</sup>	0 .. 850	18	32-bit real
Untuned Clear-Sky WN Surface Up	W m <sup>-2</sup>	0 .. 370	18	32-bit real



Table 2.11-14. Untuned ClearSky Fluxes (2 of 2)

SDS Name	Units	Range	Dimen- sions	Data Type
Untuned Clear-Sky WN Surface Down	W m <sup>-2</sup>	0 .. 370	18	32-bit real
Untuned Clear-Sky WN TOA Up	W m <sup>-2</sup>	0 .. 370	18	32-bit real

Table 2.11-14(b). SDS Index of Untuned ClearSky Fluxes

SDS Name	Zonal Monthly Hourly	Zonal Monthly	Global Monthly Hourly	Global Monthly
Untuned Clear-Sky SW Surface Up	118	327	536	745
Untuned Clear-Sky SW Surface Down	119	328	537	746
Untuned Clear-Sky SW TOA Up	120	329	538	747
Untuned Clear-Sky LW Surface Up	121	330	539	748
Untuned Clear-Sky LW Surface Down	122	331	540	749
Untuned Clear-Sky LW TOA Up	123	332	541	750
Untuned Clear-Sky WN Surface Up	124	333	542	751
Untuned Clear-Sky WN Surface Down	125	334	543	752
Untuned Clear-Sky WN TOA Up	126	335	544	753

Table 2.11-15. Untuned TotalSky-NoAerosol Fluxes (1 of 2)

SDS Name	Units	Range	Dimen- sions	Data Type
Untuned Total-Sky-NoAerosol SW Surface Up	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Untuned Total-Sky-NoAerosol SW Surface Down	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Untuned Total-Sky-NoAerosol SW TOA Up	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Untuned Total-Sky-NoAerosol LW Surface Up	W m <sup>-2</sup>	0 .. 850	18	32-bit real
Untuned Total-Sky-NoAerosol LW Surface Down	W m <sup>-2</sup>	0 .. 700	18	32-bit real
Untuned Total-Sky-NoAerosol LW TOA Up	W m <sup>-2</sup>	0 .. 850	18	32-bit real

Table 2.11-15. Untuned TotalSky-NoAerosol Fluxes (2 of 2)

SDS Name	Units	Range	Dimensions	Data Type
Untuned Total-Sky-NoAerosol WN Surface Up	W m <sup>-2</sup>	0 .. 370	18	32-bit real
Untuned Total-Sky-NoAerosol WN Surface Down	W m <sup>-2</sup>	0 .. 370	18	32-bit real
Untuned Total-Sky-NoAerosol WN TOA Up	W m <sup>-2</sup>	0 .. 370	18	32-bit real

Table 2.11-15(b). SDS Index of Untuned TotalSky-NoAerosol Fluxes

SDS Name	Zonal Monthly Hourly	Zonal Monthly	Global Monthly Hourly	Global Monthly
Untuned Total-Sky-NoAerosol SW Surface Up	127	336	545	754
Untuned Total-Sky-NoAerosol SW Surface Down	128	337	546	755
Untuned Total-Sky-NoAerosol SW TOA Up	129	338	547	756
Untuned Total-Sky-NoAerosol LW Surface Up	130	339	548	757
Untuned Total-Sky-NoAerosol LW Surface Down	131	340	549	758
Untuned Total-Sky-NoAerosol LW TOA Up	132	341	550	759
Untuned Total-Sky-NoAerosol WN Surface Up	133	342	551	760
Untuned Total-Sky-NoAerosol WN Surface Down	134	343	552	761
Untuned Total-Sky-NoAerosol WN TOA Up	135	344	553	762

Table 2.11-16. Untuned TotalSky Fluxes (1 of 2)

SDS Name	Units	Range	Dimensions	Data Type
Untuned Total-Sky SW Surface Up	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Untuned Total-Sky SW Surface Down	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Untuned Total-Sky SW TOA Up	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Untuned Total-Sky LW Surface Up	W m <sup>-2</sup>	0 .. 850	18	32-bit real
Untuned Total-Sky LW Surface Down	W m <sup>-2</sup>	0 .. 700	18	32-bit real
Untuned Total-Sky LW TOA Up	W m <sup>-2</sup>	0 .. 850	18	32-bit real

Table 2.11-16. Untuned TotalSky Fluxes (2 of 2)

SDS Name	Units	Range	Dimensions	Data Type
Untuned Total-Sky WN Surface Up	W m <sup>-2</sup>	0 .. 370	18	32-bit real
Untuned Total-Sky WN Surface Down	W m <sup>-2</sup>	0 .. 370	18	32-bit real
Untuned Total-Sky WN TOA Up	W m <sup>-2</sup>	0 .. 370	18	32-bit real

Table 2.11-16(b). SDS Index of Untuned TotalSky Fluxes

SDS Name	Zonal Monthly Hourly	Zonal Monthly	Global Monthly Hourly	Global Monthly
Untuned Total-Sky SW Surface Up	136	345	554	763
Untuned Total-Sky SW Surface Down	137	346	555	764
Untuned Total-Sky SW TOA Up	138	347	556	765
Untuned Total-Sky LW Surface Up	139	348	557	766
Untuned Total-Sky LW Surface Down	140	349	558	767
Untuned Total-Sky LW TOA Up	141	350	559	768
Untuned Total-Sky WN Surface Up	142	351	560	769
Untuned Total-Sky WN Surface Down	143	352	561	770
Untuned Total-Sky WN TOA Up	144	353	562	771

Table 2.11-17. Satellite Emulated WN TOA Fluxes

SDS Name	Units	Range	Dimensions	Data Type
Untuned Satellite Emulated WN TOA	W m <sup>-2</sup>	-1400 .. 1400	18	32-bit real
Tuned Satellite Emulated WN TOA	W m <sup>-2</sup>	-1400 .. 1400	18	32-bit real

Table 2.11-17(b). SDS Index of Satellite Emulated WN TOA Fluxes

SDS Name	Zonal Monthly Hourly	Zonal Monthly	Global Monthly Hourly	Global Monthly
Untuned Satellite Emulated WN TOA	145	354	563	772
Tuned Satellite Emulated WN TOA	146	355	564	773

Table 2.11-18. TOA Fluxes Error

SDS Name	Units	Range	Dimensions	Data Type
Tuned Minus Observed SW TOA	W m <sup>-2</sup>	-1400 .. 1400	18	32-bit real
Untuned Minus Observed SW TOA	W m <sup>-2</sup>	-1400 .. 1400	18	32-bit real
Tuned Minus Observed LW TOA	W m <sup>-2</sup>	-600 .. 600	18	32-bit real
Untuned Minus Observed LW TOA	W m <sup>-2</sup>	-600 .. 600	18	32-bit real

Table 2.11-18(b). SDS Index of TOA Fluxes Error

SDS Name	Zonal Monthly Hourly	Zonal Monthly	Global Monthly Hourly	Global Monthly
Tuned Minus Observed SW TOA	147	356	565	774
Untuned Minus Observed SW TOA	148	357	566	775
Tuned Minus Observed LW TOA	149	358	567	776
Untuned Minus Observed LW TOA	150	359	568	777

Table 2.11-19. Constraint Adjustments (1 of 2)

SDS Name	Units	Range	Dimensions	Data Type
Total column precipitable water - initial	cm	0 .. 10	18	32-bit real
Total column precipitable water - adjusted	cm	-10 .. 10	18	32-bit real
Upper tropospheric precipitable water - initial	cm	0 .. 10	18	32-bit real
Upper tropospheric precipitable water - adjusted	cm	0 .. 10	18	32-bit real
Upper tropospheric humidity - initial	N/A	0.0 .. 100.0	18	32-bit real
Upper tropospheric humidity - adjusted	N/A	0.0 .. 100.0	18	32-bit real
Aerosol optical depth - initial	N/A	0 .. 5	18	32-bit real

Table 2.11-19. Constraintment Adjustments (2 of 2)

<b>SDS Name</b>	<b>Units</b>	<b>Range</b>	<b>Dimen- sions</b>	<b>DataType</b>
Aerosol optical depth - adjusted	N/A	0 .. 5	18	32-bit real
Skin temperature - initial	K	175 .. 375	18	32-bit real
Skin temperature - adjusted	K	175 .. 375	18	32-bit real
Surface pressure	hPa	0 .. 800	18	32-bit real
Column ozone - initial	du	0 .. 800	18	32-bit real
Mean visible optical depth- adjusted	N/A	0 .. 400	18	32-bit real
Mean cloud fractional area - adjusted	%	0 .. 100	18	32-bit real
Mean cloud effective temperature - adjusted	K	175 .. 375	18	32-bit real

Table 2.11-19(b). SDS Index of Constraintment Adjustments

<b>SDS Name</b>	<b>Zonal Monthly Hourly</b>	<b>Zonal Monthly</b>	<b>Global Monthly Hourly</b>	<b>Global Monthly</b>
Total column precipitable water - initial	151	360	569	778
Total column precipitable water - adjusted	152	361	570	779
Upper tropospheric precipitable water - initial	153	362	571	780
Upper tropospheric precipitable water - adjusted	154	363	572	781
Upper tropospheric humidity - initial	155	364	573	782
Upper tropospheric humidity - adjusted	156	365	574	783
Aerosol optical depth - initial	157	366	575	784
Aerosol optical depth - adjusted	158	367	576	785
Skin temperature - initial	159	368	577	786
Skin temperature - adjusted	160	369	578	787
Surface pressure	161	370	579	788
Column ozone - initial	162	371	580	789
Mean visible optical depth- adjusted	163	372	581	790
Mean cloud fractional area - adjusted	164	373	582	791
Mean cloud effective temperature - adjusted	165	374	583	792

Table 2.11-20. Surface SW Direct/Diffuse Fluxes

SDS Name	Units	Range	Dimensions	Data Type
Total-Sky SW flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Clear-Sky SW flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Pristine-Sky SW flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Actinic-Sky SW flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Total-Sky SW flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Clear-Sky SW flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Pristine-Sky SW flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Actinic-Sky SW flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real

Table 2.11-20(b). SDS Index of Surface SW Direct/Diffuse Fluxes

SDS Name	Zonal Monthly Hourly	Zonal Monthly	Global Monthly Hourly	Global Monthly
Total-Sky SW flux - Diffuse	166	375	584	793
Clear-Sky SW flux - Diffuse	167	376	585	794
Pristine-Sky SW flux - Diffuse	168	377	586	795
Actinic-Sky SW flux - Diffuse	169	378	587	796
Total-Sky SW flux - Direct	170	379	588	797
Clear-Sky SW flux - Direct	171	380	589	798
Pristine-Sky SW flux - Direct	172	381	590	799
Actinic-Sky SW flux - Direct	173	382	591	800

Table 2.11-21. UVA - UVB Fluxes (1 of 2)

SDS Name	Units	Range	Dimensions	Data Type
TOA Downwelling UVB Flux	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
TOA Downwelling UVA Flux	W m <sup>-2</sup>	0 .. 1400	18	32-bit real

Table 2.11-21. UVA - UVB Fluxes (2 of 2)

SDS Name	Units	Range	Dimensions	Data Type
Pristine UVB Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Pristine UVB Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Pristine UVA Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Pristine UVA Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Clear-Sky UVB Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Clear-Sky UVB Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Clear-Sky UVA Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Clear-Sky UVA Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Total-Sky-NoAerosol UVB Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Total-Sky-NoAerosol UVB Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Total-Sky-NoAerosol UVA Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Total-Sky-NoAerosol UVA Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Total-Sky UVB Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Total-Sky UVB Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Total-Sky UVA Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Total-Sky UVA Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Total-Sky Surface UV Index	N/A	0 .. 30	18	32-bit real
Clear-Sky Surface UV Index	N/A	0 .. 30	18	32-bit real
Pristine Surface UV Index	N/A	0 .. 30	18	32-bit real
Total-Sky-NoAerosol Surface UV-Index	N/A	0 .. 30	18	32-bit real

Table 2.11-21(b). SDS Index of UVA - UVB Fluxes

SDS Name	Zonal Monthly Hourly	Zonal Monthly	Global Monthly Hourly	Global Monthly
TOA Downwelling UVB Flux	174	383	592	801
TOA Downwelling UVA Flux	175	384	593	802
Pristine UVB Surface flux - Direct	176	385	594	803
Pristine UVB Surface flux - Diffuse	177	386	595	804
Pristine UVA Surface flux - Direct	178	387	596	805
Pristine UVA Surface flux - Diffuse	179	388	597	806
Clear-Sky UVB Surface flux - Direct	180	389	598	807
Clear-Sky UVB Surface flux - Diffuse	181	390	599	808
Clear-Sky UVA Surface flux - Direct	182	391	600	809
Clear-Sky UVA Surface flux - Diffuse	183	392	601	810
Total-Sky-NoAerosol UVB Surface flux - Direct	184	393	602	811
Total-Sky-NoAerosol UVB Surface flux - Diffuse	185	394	603	812
Total-Sky-NoAerosol UVA Surface flux - Direct	186	395	604	813
Total-Sky-NoAerosol UVA Surface flux - Diffuse	187	396	605	814
Total-Sky UVB Surface flux - Direct	188	397	606	815
Total-Sky UVB Surface flux - Diffuse	189	398	607	816
Total-Sky UVA Surface flux - Direct	190	399	608	817
Total-Sky UVA Surface flux - Diffuse	191	400	609	818
Total-Sky Surface UV Index	192	401	610	819
Clear-Sky Surface UV Index	193	402	611	820
Pristine Surface UV Index	194	403	612	821
Total-Sky-NoAerosol Surface UV- Index	195	404	613	822

Table 2.11-22. PAR Fluxes (1 of 2)

SDS Name	Units	Range	Dimensions	Data Type
TOA Downwelling PAR Flux	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Total-Sky PAR Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Total-Sky PAR Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Total-Sky PAR PURV Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real



Table 2.11-22. PAR Fluxes (2 of 2)

SDS Name	Units	Range	Dimensions	Data Type
Total-Sky PAR PURV Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Total-Sky PAR ChlorA Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Total-Sky PAR ChlorA Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Clear-Sky PAR Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Clear-Sky PAR Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Pristine PAR Surface flux - Direct	W m <sup>-2</sup>	0 .. 1400	18	32-bit real
Pristine PAR Surface flux - Diffuse	W m <sup>-2</sup>	0 .. 1400	18	32-bit real

Table 2.11-22(b). SDS Index of PAR Fluxes

SDS Name	Zonal Monthly Hourly	Zonal Monthly	Global Monthly Hourly	Global Monthly
TOA Downwelling PAR Flux	196	405	614	823
Total-Sky PAR Surface flux - Direct	197	406	615	824
Total-Sky PAR Surface flux - Diffuse	198	407	616	825
Total-Sky PAR PURV Surface flux - Direct	199	408	617	826
Total-Sky PAR PURV Surface flux - Diffuse	200	409	618	827
Total-Sky PAR ChlorA Surface flux - Direct	201	410	619	828
Total-Sky PAR ChlorA Surface flux - Diffuse	202	411	620	829
Clear-Sky PAR Surface flux - Direct	203	412	621	830
Clear-Sky PAR Surface flux - Diffuse	204	413	622	831
Pristine PAR Surface flux - Direct	205	414	623	832
Pristine PAR Surface flux - Diffuse	206	415	624	833

Table 2.11-23. Pristine-Sky SW MultiStream Correction

SDS Name	Units	Range	Dimensions	Data Type
SW TOA Flux - Up - Pristine-Sky - Corrected	W m <sup>-2</sup>	0 .. 1000	18	32-bit real
SW Surface Flux - Down-Pristine-Sky - Corrected	W m <sup>-2</sup>	0 .. 1000	18	32-bit real

Table 2.11-23(b). SDS Index of Pristine-Sky SW MultiStream Correction

SDS Name	Zonal Monthly Hourly	Zonal Monthly	Global Monthly Hourly	Global Monthly
SW TOA Flux - Up - Pristine-Sky - Corrected	207	416	625	834
SW Surface Flux - Down- Pristine-Sky - Corrected	208	417	626	835

**Total Bits / Record: 149760**  
**Total Bytes / Record: 18720**  
**Total Records / File: 181**  
**Total Bytes / File: 3,388,320**  
**Total MBytes / File: 3.39**

## 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	<ul style="list-style-type: none"> <li>• Updated format to comply with standards.</li> </ul>	All
N/A	R3V2	639	<ul style="list-style-type: none"> <li>• Updated to change all tables and added SDS Index tables.</li> </ul>	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:** Edition2C

**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	<a href="#">Table B-1</a>	1	36
CERES_metadata Science Data	<a href="#">Table B-2</a>	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 <a href="#">Table 2.12-3</a>	64800
2	1.0 Degree Zonal	See <a href="#">Table 2.12-3</a>	180
3	Global	See <a href="#">Table 2.12-3</a>	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 <a href="#">Table 2.12-4</a> for SRBAVG1 See <a href="#">Table 2.12-5</a> for SRBAVG2 and SRBAVG3
2	Monthly Averages	See <a href="#">Table 2.12-4</a> for SRBAVG1 See <a href="#">Table 2.12-5</a> 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 <a href="#">Table 2.12-6</a>
2	TOA Fluxes	See <a href="#">Table 2.12-7</a>
3	Surface Fluxes	See <a href="#">Table 2.12-13</a>
4	Surface Data	See <a href="#">Table 2.12-19</a>

**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 <a href="#">Table 2.12-20</a>
2	CERES Layer Cloud Properties	See <a href="#">Table 2.12-20</a>

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

Table 2.12-6(a). 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 2.12-6(b). SDS Index of Region Parameters in SRBAVG1

SDS Name	Regional Monthly Hourly	Regional Monthly	Zonal Monthly Hourly	Zonal Monthly	Global Monthly Hourly	Global Monthly
Region Number	0	59	118	167	216	265
Colatitude	1	60	119	168	217	266
Longitude	2	61	120	169	218	267
Surface Type Percent Coverage	3	62	121	170	219	268
Surface Altitude	4	63	122	171	220	269
Snow/Ice Percent Coverage	5	64	123	172	221	270
Precipitable Water	6	65	124	173	222	271
Total Aerosol Visible Optical Depth @0.63 microns	7	66	125	174	223	272
Total Aerosol Visible Optical Depth @1.6 microns	8	67	126	175	224	273

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 <a href="#">Table 2.12-8</a>
2	Total-Sky Raw Data Average	See <a href="#">Table 2.12-9</a>
3	Clear-Sky non-GEO Method	See <a href="#">Table 2.12-10</a>
4	Total-Sky non-GEO Method	See <a href="#">Table 2.12-11</a>
5	Clear-Sky GEO Method	See <a href="#">Table 2.12-12</a>
6	Total-Sky GEO Method	See <a href="#">Table 2.12-13</a>

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

Table 2.12-8(a). Clear-Sky Raw Data Average in SRBAVG1 (1 of 2)

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 <sup>-2</sup>	0.0 .. 800.0	72	3
Clear-sky TOA LW Flux - Raw Data Average	32-Bit Float	Wm <sup>-2</sup>	0.0 .. 400.0	72	3
Clear-sky TOA WN Flux - Raw Data Average	32-Bit Float	Wm <sup>-2</sup>	0.0 .. 800.0	72	3

Table 2.12-8(a). Clear-Sky Raw Data Average in SRBAVG1 (2 of 2)

SDS Name	Data Type	Units	Range	No. of Elements Monthly Hourly	No. of Elements Monthly
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 <sup>-2</sup>	-300.0 .. 400.0	72	3

Table 2.12-8(b). SDS Index of Clear-Sky Raw Data Average in SRBAVG1

SDS Name	Regional Monthly Hourly	Regional Monthly
Clear-sky TOA SW Flux - Raw Data Average	9	68
Clear-sky TOA LW Flux - Raw Data Average	10	69
Clear-sky TOA WN Flux - Raw Data Average	11	70
Clear-sky TOA Albedo - Raw Data Average	12	71
Clear-sky TOA Net Flux - Raw Data Average	13	72

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

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

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 <sup>-2</sup>	0.0 .. 800.0	72	3
Total-sky TOA LW Flux - Raw Data Average	32-Bit Float	Wm <sup>-2</sup>	0.0 .. 400.0	72	3
Total-sky TOA WN Flux - Raw Data Average	32-Bit Float	Wm <sup>-2</sup>	0.0 .. 800.0	72	3
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 <sup>-2</sup>	-300.0 .. 400.0	72	3



Table 2.12-9(b). SDS Index of Total-Sky Raw Data Average in SRBAVG1

SDS Name	Regional Monthly Hourly	Regional Monthly
Total-sky TOA SW Flux - Raw Data Average	14	73
Total-sky TOA LW Flux - Raw Data Average	15	74
Total-sky TOA WN Flux - Raw Data Average	16	75
Total-sky TOA Albedo - Raw Data Average	17	76
Total-sky TOA Net Flux - Raw Data Average	18	77

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

Table 2.12-10(a). 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 <sup>-2</sup>	0.0 .. 800.0	72	3
Clear-sky TOA LW Flux - non-GEO Interpolation	32-Bit Float	Wm <sup>-2</sup>	0.0 .. 400.0	72	3
Clear-sky TOA WN Flux - non-GEO Interpolation	32-Bit Float	Wm <sup>-2</sup>	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 <sup>-2</sup>	-300.0 .. 400.0	72	3

Table 2.12-10(b). SDS Index of Clear-Sky non-GEO Method in SRBAVG1 (1 of 2)

SDS Name	Regional Monthly Hourly	Regional Monthly	Zonal Monthly Hourly	Zonal Monthly	Global Monthly Hourly	Global Monthly
Clear-sky TOA SW Flux - non-GEO Interpolation	19	78	127	176	225	274
Clear-sky TOA LW Flux - non-GEO Interpolation	20	79	128	177	226	275
Clear-sky TOA WN Flux - non-GEO Interpolation	21	80	129	178	227	276
Clear-sky TOA Albedo - non-GEO Interpolation	22	81	130	179	228	277

Table 2.12-10(b). SDS Index of Clear-Sky non-GEO Method in SRBAVG1 (2 of 2)

SDS Name	Regional Monthly Hourly	Regional Monthly	Zonal Monthly Hourly	Zonal Monthly	Global Monthly Hourly	Global Monthly
Clear-sky TOA Net Flux - non-GEO Interpolation	23	82	131	180	229	278

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

Table 2.12-11(a). 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 <sup>-2</sup>	0.0 .. 800.0	72	3
Total-sky TOA LW Flux - non-GEO Interpolation	32-Bit Float	Wm <sup>-2</sup>	0.0 .. 400.0	72	3
Total-sky TOA WN Flux - non-GEO Interpolation	32-Bit Float	Wm <sup>-2</sup>	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 <sup>-2</sup>	-300.0 .. 400.0	72	3

Table 2.12-11(b). SDS Index of Total-Sky non-GEO Method in SRBAVG1

SDS Name	Regional Monthly Hourly	Regional Monthly	Zonal Monthly Hourly	Zonal Monthly	Global Monthly Hourly	Global Monthly
Total-sky TOA SW Flux - non-GEO Interpolation	24	83	132	181	230	279
Total-sky TOA LW Flux - non-GEO Interpolation	25	84	133	182	231	280
Total-sky TOA WN Flux - non-GEO Interpolation	26	85	134	183	232	281
Total-sky TOA Albedo - non-GEO Interpolation	27	86	135	184	233	282
Total-sky TOA Net Flux - non-GEO Interpolation	28	87	136	185	234	283

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

Table 2.12-12(a). 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 <sup>-2</sup>	0.0 .. 800.0	72	3
Clear-sky TOA LW Flux - GEO Interpolation	32-Bit Float	Wm <sup>-2</sup>	0.0 .. 400.0	72	3
Clear-sky TOA WN Flux - GEO Interpolation	32-Bit Float	Wm <sup>-2</sup>	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 <sup>-2</sup>	-300.0 .. 400.0	72	3

Table 2.12-12(b). SDS Index of Clear-Sky GEO Method in SRBAVG1

SDS Name	Regional Monthly Hourly	Regional Monthly	Zonal Monthly Hourly	Zonal Monthly	Global Monthly Hourly	Global Monthly
Clear-sky TOA SW Flux - GEO Interpolation	29	88	137	186	235	284
Clear-sky TOA LW Flux - GEO Interpolation	30	89	138	187	236	285
Clear-sky TOA WN Flux - GEO Interpolation	31	90	139	188	237	286
Clear-sky TOA Albedo - GEO Interpolation	32	91	140	189	238	287
Clear-sky TOA Net Flux - GEO Interpolation	33	92	141	190	239	288

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

Table 2.12-13(a). Total-Sky GEO Method 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 - GEO Interpolation	32-Bit Float	Wm <sup>-2</sup>	0.0 .. 800.0	72	3

Table 2.12-13(a). Total-Sky GEO Method in SRBAVG1 (2 of 2)

SDS Name	Data Type	Units	Range	No. of Elements Monthly Hourly	No. of Elements Monthly
Total-sky TOA LW Flux - GEO Interpolation	32-Bit Float	Wm <sup>-2</sup>	0.0 .. 400.0	72	3
Total-sky TOA WN Flux - GEO Interpolation	32-Bit Float	Wm <sup>-2</sup>	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 <sup>-2</sup>	-300.0 .. 400.0	72	3

Table 2.12-13(b). SDS Index of Total-Sky GEO Method in SRBAVG1

SDS Name	Regional Monthly Hourly	Regional Monthly	Zonal Monthly Hourly	Zonal Monthly	Global Monthly Hourly	Global Monthly
Total-sky TOA SW Flux - GEO Interpolation	34	93	142	191	240	289
Total-sky TOA LW Flux - GEO Interpolation	35	94	143	192	241	290
Total-sky TOA WN Flux - GEO Interpolation	36	95	144	193	242	291
Total-sky TOA Albedo - GEO Interpolation	37	96	145	194	243	292
Total-sky TOA Net Flux - GEO Interpolation	38	97	146	195	244	293

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

Table 2.12-14. Surface Fluxes in SRBAVG1

Vgroup Number	Vgroup Name	Monthly Hourly Averages / Monthly (Hour) Averages
1	Clear-Sky Net	See <a href="#">Table 2.12-15</a>
2	Total-Sky Net	See <a href="#">Table 2.12-16</a>
3	Clear-Sky Down	See <a href="#">Table 2.12-17</a>
4	Total-Sky Down	See <a href="#">Table 2.12-18</a>

[Table 2.12-15](#) List of the SDSs contained in the Clear-Sky Net Vgroup.

Table 2.12-15(a). 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 <sup>-2</sup>	0.0 .. 1400.0	72	3
Clear-sky Sfc Net SW Flux - Mod B	32-Bit Float	Wm <sup>-2</sup>	0.0 .. 1400.0	72	3
Clear-sky Sfc Net LW Flux - Mod A	32-Bit Float	Wm <sup>-2</sup>	-250.0 .. 50.0	72	3
Clear-sky Sfc Net LW Flux - Mod B	32-Bit Float	Wm <sup>-2</sup>	-250.0 .. 50.0	72	3

Table 2.12-15(b). SDS Index of Clear-Sky Net in SRBAVG1

SDS Name	Regional Monthly Hourly	Regional Monthly	Zonal Monthly Hourly	Zonal Monthly	Global Monthly Hourly	Global Monthly
Clear-sky Sfc Net SW Flux - Mod A	39	98	147	196	245	294
Clear-sky Sfc Net SW Flux - Mod B	40	99	148	197	246	295
Clear-sky Sfc Net LW Flux - Mod A	41	100	149	198	247	296
Clear-sky Sfc Net LW Flux - Mod B	42	101	150	199	248	297

[Table 2.12-16](#) List of the SDSs contained in the Total-Sky Net Vgroup.

Table 2.12-16(a). 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 <sup>-2</sup>	0.0 .. 1400.0	72	3
Total-sky Sfc Net SW Flux - Mod B	32-Bit Float	Wm <sup>-2</sup>	0.0 .. 1400.0	72	3
Total-sky Sfc Net LW Flux - Mod A	32-Bit Float	Wm <sup>-2</sup>	-250.0 .. 50.0	72	3
Total-sky Sfc Net LW Flux - Mod B	32-Bit Float	Wm <sup>-2</sup>	-250.0 .. 50.0	72	3

Table 2.12-16(b). SDS Index of Total-Sky Net in SRBAVG1

SDS Name	Regional Monthly Hourly	Regional Monthly	Zonal Monthly Hourly	Zonal Monthly	Global Monthly Hourly	Global Monthly
Total-sky Sfc Net SW Flux - Mod A	43	102	151	200	249	298
Total-sky Sfc Net SW Flux - Mod B	44	103	152	201	250	299
Total-sky Sfc Net LW Flux - Mod A	45	104	153	202	251	300
Total-sky Sfc Net LW Flux - Mod B	46	105	154	203	252	301

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

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

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 <sup>-2</sup>	0.0 .. 1400.0	72	3
Clear-sky Sfc Down SW Flux - Mod B	32-Bit Float	Wm <sup>-2</sup>	0.0 .. 1400.0	72	3
Clear-sky Sfc Down LW Flux - Mod A	32-Bit Float	Wm <sup>-2</sup>	0.0 .. 700.0	72	3
Clear-sky Sfc Down LW Flux - Mod B	32-Bit Float	Wm <sup>-2</sup>	0.0 .. 700.0	72	3
Clear-sky Sfc Down WN Flux - Mod A	32-Bit Float	Wm <sup>-2</sup>	0.0 .. 700.0	72	3

Table 2.12-17(b). SDS Index of Clear-Sky Down in SRBAVG1

SDS Name	Regional Monthly Hourly	Regional Monthly	Zonal Monthly Hourly	Zonal Monthly	Global Monthly Hourly	Global Monthly
Clear-sky Sfc Down SW Flux - Mod A	47	106	155	204	253	302
Clear-sky Sfc Down SW Flux - Mod B	48	107	156	205	254	303
Clear-sky Sfc Down LW Flux - Mod A	49	108	157	206	255	304
Clear-sky Sfc Down LW Flux - Mod B	50	109	158	207	256	305
Clear-sky Sfc Down WN Flux - Mod A	51	110	159	208	257	306

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

Table 2.12-18(a). 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 <sup>-2</sup>	0.0 .. 1400.0	72	3
Total-sky Sfc Down SW Flux - Mod B	32-Bit Float	Wm <sup>-2</sup>	0.0 .. 1400.0	72	3
Total-sky Sfc Down LW Flux - Mod A	32-Bit Float	Wm <sup>-2</sup>	0.0 .. 700.0	72	3
Total-sky Sfc Down LW Flux - Mod B	32-Bit Float	Wm <sup>-2</sup>	0.0 .. 700.0	72	3
Total-sky Sfc Down WN Flux - Mod A	32-Bit Float	Wm <sup>-2</sup>	0.0 .. 700.0	72	3

Table 2.12-18(b). SDS Index of Total-Sky Down in SRBAVG1

SDS Name	Regional Monthly Hourly	Regional Monthly	Zonal Monthly Hourly	Zonal Monthly	Global Monthly Hourly	Global Monthly
Total-sky Sfc Down SW Flux - Mod A	52	111	160	209	258	307
Total-sky Sfc Down SW Flux - Mod B	53	112	161	210	259	308
Total-sky Sfc Down LW Flux - Mod A	54	113	162	211	260	309
Total-sky Sfc Down LW Flux - Mod B	55	114	163	212	261	310
Total-sky Sfc Down WN Flux - Mod A	56	115	164	213	262	311

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

Table 2.12-19(a). 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

Table 2.12-19(b). SDS Index of Surface Data in SRBAVG1

SDS Name	Regional Monthly Hourly	Regional Monthly	Zonal Monthly Hourly	Zonal Monthly	Global Monthly Hourly	Global Monthly
LW Surface Emissivity	57	116	165	214	263	312
WN Surface Emissivity	58	117	166	215	264	313

**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 <a href="#">Table 2.12-21</a>
2	Upper Middle	See <a href="#">Table 2.12-21</a>
3	Lower Middle	See <a href="#">Table 2.12-21</a>
4	Low	See <a href="#">Table 2.12-21</a>

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

Table 2.12-21(a). High, Uppermid, Lowermid, Low (mean, stdev, num obs) in SRBAVG2 and SRBAVG3 (1 of 2)

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



Table 2.12-21(a). High, Uppermid, Lowermid, Low (mean, stdev, num obs) in SRBAVG2 and SRBAVG3 (2 of 2)

SDS Name	Data Type	Units	Range	No. of Elements Monthly Hourly	No. of Elements Monthly
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 <sup>-2</sup>	0.0 .. 10000.0	72	3
Ice Water Path	32-Bit Float	gm <sup>-2</sup>	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

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

SDS Name	Regional Monthly Hourly	Regional Monthly	Zonal Monthly Hourly	Zonal Monthly	Global Monthly Hourly	Global Monthly
Cloud Area Fraction	0 15 30 45	60 75 90 105	120 135 150 165	180 195 210 225	240 255 270 285	300 315 330 345
Cloud Effective Pressure	1 16 31 46	61 76 91 106	121 136 151 166	181 196 211 226	241 256 271 286	301 316 331 346
Cloud Effective Temperature	2 17 32 47	62 77 92 107	122 137 152 167	182 197 212 227	242 257 272 287	302 317 332 347
Cloud Effective Height	3 18 33 48	63 78 93 108	123 138 153 168	183 198 213 228	243 258 273 288	303 318 333 348
Cloud Top Pressure	4 19 34 49	64 79 94 109	124 139 154 169	184 199 214 229	244 259 274 289	304 319 334 349
Cloud Base Pressure	5 20 35 50	65 80 95 110	125 140 155 170	185 200 215 230	245 260 275 290	305 320 335 350
Cloud Particle Phase	6 21 36 51	66 81 96 111	126 141 156 171	186 201 216 231	246 261 276 291	306 321 336 351
Liquid Water Path	7 22 37 52	67 82 97 112	127 142 157 172	187 202 217 232	247 262 277 292	307 322 337 352
Ice Water Path	8 23 38 53	68 83 98 113	128 143 158 173	188 203 218 233	248 263 278 293	308 323 338 353
Water Particle Radius	9 24 39 54	69 84 99 114	129 144 159 174	189 204 219 234	249 264 279 294	309 324 339 354
Ice Particle Effective Diam	10 25 40 55	70 85 100 115	130 145 160 175	190 205 220 235	250 265 280 295	310 325 340 355
Infrared Emissivity	11 26 41 56	71 86 101 116	131 146 161 176	191 206 221 236	251 266 281 296	311 326 341 356
Cloud Visible Optical Depth - lin	12 27 42 57	72 87 102 117	132 147 162 177	192 207 222 237	252 267 282 297	312 327 342 357
Cloud Visible Optical Depth - log	13 28 43 58	73 88 103 118	133 148 163 178	193 208 223 238	253 268 283 298	313 328 343 358
Cloud Vertical Aspect Ratio	14 29 44 59	74 89 104 119	134 149 164 179	194 209 224 239	254 269 284 299	314 329 344 359

Color Red - High Cloud  
 Color Green - Uppermid Cloud  
 Color Blue - Lowermid Cloud  
 Color Black - Low Cloud

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

## 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	<ul style="list-style-type: none"> <li>• Changed column clouds to layer clouds and deleted the angular model scene types.</li> <li>• Added SRBAVG3.</li> <li>• Added SRBAVG3 and the Vgroup names.</li> <li>• Added region number, colatitude and longitude.</li> <li>• Changed ERBE-like to non-GEO.</li> <li>• Changed the net flux range.</li> <li>• Changed the net flux range and the ERBE-like to non-GEO.</li> <li>• Added another Vgroup name for cloud.</li> <li>• Changed the number of elements monthly hourly of the total cloud area fraction from 24 to 72.</li> <li>• Updated format to comply with standards.</li> </ul>	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	<ul style="list-style-type: none"> <li>• Updated information to add "Edition2A" to Terra under Product Version.</li> <li>• Updated format to comply with standards.</li> </ul>	2.12  All
11/08/04	R3V4	566	<ul style="list-style-type: none"> <li>• Updated information to add "Edition2C" to Terra under Product Version.</li> <li>• Updated to add the SDS Index tables.</li> <li>• Updated format to comply with standards.</li> </ul>	2.12  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"<sup>1</sup>
- Frequency - How often the product is received or produced
- Configuration Code - Unique identifier that defines the software and input file versions 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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<sup>1</sup> **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

<b>SCCR Approval Date</b>	<b>Release/Version Number</b>	<b>SCCR Number</b>	<b>Description of Revision</b>	<b>Section(s) Affected</b>
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

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

<b>Header File</b> (Mininum Number = 384 Bytes)
<b>Instrument Data Packets</b> (Number of Packets x 7058 Bytes)

Figure 3.1-2. Terra Level 0 File Format

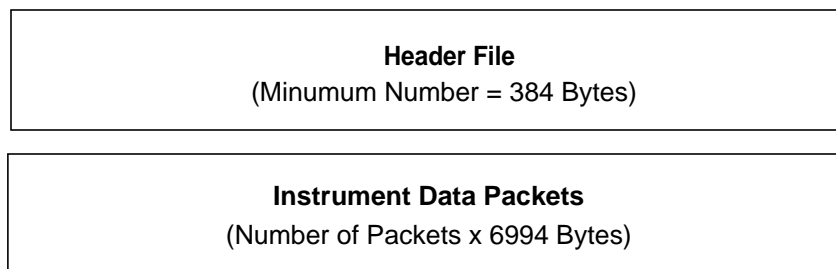


Figure 3.1-3. Aqua Level 0 File Format



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

Description	Element Number	Units	Range	Elements per Record	Bits per Element
<b>INSTR_PDS FILE HEADER</b>					
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
<b>INSTR_PDS_DATA_PACKET [1..13091]</b>					
<b>Primary Packet_Header</b>					
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
<b>Secondary Packet_Header</b>					
Time Data	8	N/A	N/A	1	64
<b>Instrument_Packet_Status</b>					
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
<b>Measurement_Data (1 of the 5 following record types):</b>					
<b>Science_Record [660]</b>					

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 - ( <a href="#">Reference 3</a> )	23	-	-	660	12
<b>Memory_Record [660]</b>					
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 - ( <a href="#">Reference 3</a> )	24	-	-	660	12
<b>Gimbal_Record [660]</b>					
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 - ( <a href="#">Reference 3</a> )	24	-	-	660	12
<b>Processor_Op_Record [660]</b>					
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 - ( <a href="#">Reference 3</a> )	24	-	-	660	12
<b>Fixed_Record [660]</b>					
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
<b>Instrument Digital Status - (<a href="#">Reference 3</a>)</b>	25	-	-	1	2960
<b>Fill Data</b>	26	N/A	N/A	1	1104
<b>INSTR_PDS FILE FOOTER</b>					
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
<b>Total MBytes/file (1MB = 1024*1024 Bytes):</b>	<b>89.04</b>

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

Description	Element Number	Units	Range	Elements per Record	Bits per Element
<b>INSTR_PDS Header File</b>					
See <a href="#">Reference 8</a> , Table 8.1.2.7-1. PDS/EDS Construction Record					
<b>INSTR_PDS_DATA_PACKET [1..13091]</b>					
<b>Primary Packet_Header</b>					
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
<b>Secondary Packet_Header</b>					
Time Data	8	N/A	N/A	1	64
Quick Look Flag	9	N/A	N/A	1	8
<b>Instrument_Packet_Status</b>					
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
<b>Measurement_Data (1 of the 5 following record types):</b>					
<b>Science_Record [660]</b>					

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 - ( <a href="#">Reference 3</a> )	24	-	-	660	12
<b>Memory_Record [660]</b>					
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 - ( <a href="#">Reference 3</a> )	24	-	-	660	12
<b>Gimbal_Record [660]</b>					
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 - ( <a href="#">Reference 3</a> )	24	-	-	660	12
<b>Processor_Op_Record [660]</b>					
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 - ( <a href="#">Reference 3</a> )	24	-	-	660	12
<b>Fixed_Record [660]</b>					
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
<b>Instrument Digital Status - (<a href="#">Reference 3</a>)</b>	25	-	-	1	2960
<b>Terra_Ancillary_Data</b>					
Ancillary Time Stamp	26	count	0..1.84x10 <sup>1</sup>	1	64
GPS/UTC Time Conversion	27	count	0..4.29x10 <sup>9</sup>	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 <sup>9</sup>	1	32
Satellite Position (Y) Count	33	count	0..4.29x10 <sup>9</sup>	1	32
Satellite Position (Z) Count	34	count	0..4.29x10 <sup>9</sup>	1	32
Satellite Velocity (X) Count	35	count	0..4.29x10 <sup>9</sup>	1	32
Satellite Velocity (Y) Count	36	count	0..4.29x10 <sup>9</sup>	1	32
Satellite Velocity (Z) Count	37	count	0..4.29x10 <sup>9</sup>	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
<b>Header File:</b>	
Total Header Bits/File (typical max):	5,760
Total Bytes/File:	720
<b>Total MBytes/file (1MB = 1024*1024 Bytes):</b>	<b>0.0007</b>
<b>Data File:</b>	
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
<b>Total MBytes/file (1MB = 1024*1024 Bytes):</b>	<b>88.12</b>

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

Description	Element Number	Units	Range	Elements per Record	Bits per Element
<b>INSTR_PDS File Header</b>					
See <a href="#">Reference 8</a> , Table 8.1.2.7-1. PDS/EDS Construction Record					
<b>INSTR_PDS_DATA_PACKET [1..13091]</b>					
<b>Primary Packet Header</b>					
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
<b>Secondary Packet Header</b>					
Time Data	8	N/A	N/A	1	64
Quick Look Flag	9	N/A	N/A	1	8
<b>Instrument_Packet_Status</b>					
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
<b>Measurement_Data (1 of the 5 following record types):</b>					
<b>Science_Record [660]</b>					
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 - ( <a href="#">Reference 3</a> )	24	-	-	660	12
<b>Memory_Record [660]</b>					
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
<b>Gimbal_Record [660]</b>					
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
<b>Processor_Op_Record [660]</b>					
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
<b>Fixed_Record [660]</b>					
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
<b>Instrument Digital Status - (Reference 3)</b>	25	-	-	1	2960

Table 3.1-6. Aqua Instrument Production Data Set Sizes

Description	Sizes
<b>Header File:</b>	
Total Header Bits/File (typical max):	5,760
Total Header Bytes/File:	720
<b>Total MBytes/file (1MB = 1024*1024 Bytes):</b>	<b>0.0007</b>
<b>Data File:</b>	
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
<b>Total MBytes/file (1MB = 1024*1024 Bytes):</b>	<b>87.32</b>

## 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	<ul style="list-style-type: none"> <li>• Updated format to comply with standards.</li> </ul>	All
N/A	R3V2	N/A	<ul style="list-style-type: none"> <li>• Updated to add Aqua Level-0 File Format.</li> <li>• Updated format to comply with standards.</li> </ul>	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

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

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

**Portion of Atmosphere Covered**  
**File:** 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	<a href="#">Table B-1</a>	1	36	~25907
CERES_metadata Vdata	<a href="#">Table B-2</a>	1	14	~1024
IES Product-specific Metadata	<a href="#">Table 3.2-2</a>	1	11	~66
IES Header Vdata	<a href="#">Table 3.2-3</a>	1	22	132
Along Track Sort Index	<a href="#">Table 3.2-4</a>	n: 1..245,475	2	1,963,800
IES Data Record	<a href="#">Table 3.2-5</a>	n: 1..245,475	30	33,384,600
<b>Total Size (Bytes):</b>				<b>35,375,529</b>
<b>Total Size (MBytes, including ~0.2% HDF overhead; 1MByte = 1024<sup>2</sup>Bytes):</b>				<b>33.8</b>

## 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 <sup>-1</sup>	-10.0 .. 10.0
15	Satellite Velocity Y	float64	km sec <sup>-1</sup>	-10.0 .. 10.0
16	Satellite Velocity Z	float64	km sec <sup>-1</sup>	-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
<b>Number of bytes per Vdata record:</b>				<b>132</b>

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
<b>Number of bytes per Vdata record:</b>				<b>8</b>

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 <sup>-1</sup>	-100.0 .. 100.0
14	Rate of Change of Clock Angle	float32	deg sec <sup>-1</sup>	-10.0 .. 10.0
15	X Component of Satellite Inertial Velocity	float64	km sec <sup>-1</sup>	-10.0 .. 10.0
16	Y Component of Satellite Inertial Velocity	float64	km sec <sup>-1</sup>	-10.0 .. 10.0
17	Z Component of Satellite Inertial Velocity	float64	km sec <sup>-1</sup>	-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 <sup>-2</sup> sr <sup>-1</sup>	0.0 .. 700.0
20	CERES SW Filtered Radiance, Upwards	float32	W m <sup>-2</sup> sr <sup>-1</sup>	-10.0 .. 510.0
21	CERES WN Filtered Radiance, Upwards	float32	W m <sup>-2</sup> sr <sup>-1</sup>	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
<b>Number of bytes per Vdata record:</b>				<b>136</b>

## 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.

### IES Revision Record

<b>SCCR Approval Date</b>	<b>Release/Version Number</b>	<b>SCCR Number</b>	<b>Description of Revision</b>	<b>Section(s) Affected</b>
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° 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° 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° 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](#).

<b>Level:</b> 2	<b>Portion of Globe Covered</b>
<b>Frequency:</b> 1/Day	<b>File:</b> Regional
<b>Configuration Code:</b> 000000 and greater	<b>Record:</b> Individual Region
<b>Time Interval Covered</b>	<b>Portion of Atmosphere Covered</b>
<b>File:</b> Day	<b>File:</b> TOA
<b>Record:</b> N/A	

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

Description	Units	Range	Elements/ Record	Bits/ Elem	Elem Num
<b>EID-6</b>					
<b>EID-6_File_Header</b>					
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	
<b>EID-6_Regional_Data_Records</b>					
Region number	number	1 .. 10368	1	64	1
Julian day	day	2449353 .. 2458500	1	64	2
Julian time	day	0 .. 1	1	64	3
<b>Regional_Average_Estimates</b>					
SW flux average value	W m <sup>-2</sup>	0 .. 1400	1	64	4
LW flux average value	W m <sup>-2</sup>	50 .. 450	1	64	5
<b>Regional_SW_Statistics</b>					
SW flux number of values	number	0 .. 500	1	64	6
SW flux standard deviation	W m <sup>-2</sup>	0 .. 1400	1	64	7
SW flux minimum value	W m <sup>-2</sup>	0 .. 1400	1	64	8
SW flux maximum value	W m <sup>-2</sup>	0 .. 1400	1	64	9
<b>Regional_LW_Statistics</b>					
LW flux number of values	number	0 .. 500	1	64	10
LW flux standard deviation	W m <sup>-2</sup>	0 .. 400	1	64	11
LW flux minimum value	W m <sup>-2</sup>	50 .. 450	1	64	12
LW flux maximum value	W m <sup>-2</sup>	50 .. 450	1	64	13
<b>Geo_Scene</b>					
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
<b>Albedos</b>					
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
<b>Angular_Averages</b>					
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
<b>Clear-sky_Statistics</b>					
Clear-sky albedo standard deviation	N/A	0 .. 1	1	64	26
Clear-sky LW flux average value	W m <sup>-2</sup>	50 .. 450	1	64	27
Clear-sky LW flux standard deviation	W m <sup>-2</sup>	0 .. 400	1	64	28
Clear-sky LW flux number of values	number	0 .. 500	1	64	29
<b>Spares</b>					
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
<b>Total MB/File:</b>	<b>6.5</b>

**Terra Sizes**

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

**Aqua Sizes**

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

**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

<b>SCCR Approval Date</b>	<b>Release/Version Number</b>	<b>SCCR Number</b>	<b>Description of Revision</b>	<b>Section(s) Affected</b>
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](#).

<b>Level:</b> 3	<b>Portion of Globe Covered</b>
<b>Frequency:</b> Every Day	<b>File:</b> Global
<b>Configuration Code:</b> 013006 and greater	<b>Record:</b> 1/6-Deg by 1/6-Deg
<b>Time Interval Covered</b>	<b>Portion of Atmosphere Covered</b>
<b>File:</b> Life of Mission	<b>File:</b> Surface
<b>Record:</b> Every Day	

Table 3.4-1. Clear Reflectance History (CRH)

Description	Param Num	Units	Range	Bits/Elem
<b>CRH 0.6 micron albedo</b>				
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
<b>Total Bits/CRH Data Set:</b>				<b>149,299,200</b>
<b>Total MBytes/CRH Data Set:</b>				<b>17.8</b>

## 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

<b>SCCR Approval Date</b>	<b>Release/Version Number</b>	<b>SCCR Number</b>	<b>Description of Revision</b>	<b>Section(s) Affected</b>
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 38520 regions on globe = 9861120 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.
- The clear sky visible and infrared radiance statistics give mean for the pixels within the hourbox.
- The cloud parameter statistics give mean for the pixels within the hourbox.

**Level:** 3

**Frequency:** Monthly

**Configuration Code:** 007002 and greater

**Portion of Globe Covered**

**File:** Global

**Record:** 1-Deg Equal-angle Regions

**Time Interval Covered**

**File:** Monthly

**Record:** Every Third Hour

**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	<a href="#">Table B-1</a>	1	36	~25907
CERES_Metadata Vdata	<a href="#">Table B-2</a>	1	14	~1024
GGEO Header Record	<a href="#">Table 3.5-2</a>	1	8	40
GGEO Data Record	<a href="#">Table 3.5-3</a>	9861120	49	196

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 (yyyddd)		N/A	N/A	1	32	32
Data Ending Date (yyyddd)		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
Record Size		N/A	N/A	1	32	32
Code Version		N/A	N/A	1	32	32
File Version		N/A	N/A	1	32	32

Table 3.5-3. GGEO Data Record (1 of 3)

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 <sup>-2</sup> sr <sup>-1</sup>	0.0 .. 20.0	3	32	6	96
infrared radiance: mean, var, num obs	7	W m <sup>-2</sup> sr <sup>-1</sup> mm <sup>-1</sup>	0.0 .. 600.0	3	32	9	96
clear sky visible radiance: mean	8	W m <sup>-2</sup> sr <sup>-1</sup>	0.0 .. 20.0	1	32	12	96
clear sky infrared radiance: mean	9	W m <sup>-2</sup> sr <sup>-1</sup> mm <sup>-1</sup>	0.0 .. 600.0	1	32	13	96
Lower cloud: Area fraction	10	percent	0.0 .. 100.0	1	32	14	32
Lower cloud: Effective temperature	11	K	100.0 .. 350.0	1	32	15	32

Table 3.5-3. GGEO Data Record (2 of 3)

Description	Element Number	Units	Range	Elements/Record	Bits/Elem	Elem Num	Bits/Rec
Lower cloud: Effective pressure	12	hPa	0.0 .. 1100.0	1	32	16	32
Lower cloud: Bottom pressure	13	hPa	0.0 .. 1100.0	1	32	17	32
Lower cloud: Top pressure	14	hPa	0.0 .. 1100.0	1	32	18	32
Lower cloud: Vis. optical depth (linear)	15	N/A	0.0 .. 400.0	1	32	19	32
Lower cloud: Vis. optical depth (log)	16	N/A	-6.0 .. 6.0	1	32	20	32
Lower cloud: Infrared emissivity	17	N/A	0.0 .. 2.0	1	32	21	32
Lower cloud: Particle phase	18	N/A	1.0 .. 2.0	1	32	22	32
LowMid cloud: Area fraction	19	percent	0.0 .. 100.0	1	32	23	32
LowMid cloud: Effective temperature	20	K	100.0 .. 350.0	1	32	24	32
LowMid cloud: Effective pressure	21	hPa	0.0 .. 1100.0	1	32	25	32
LowMid cloud: Bottom pressure	22	hPa	0.0 .. 1100.0	1	32	26	32
LowMid cloud: Top pressure	23	hPa	0.0 .. 1100.0	1	32	27	32
LowMid cloud: Vis. optical depth (linear)	24	N/A	0.0 .. 400.0	1	32	28	32
LowMid cloud: Vis. optical depth (log)	25	N/A	-6.0 .. 6.0	1	32	29	32
LowMid cloud: Infrared emissivity	26	N/A	0.0 .. 2.0	1	32	30	32
LowMid cloud: Particle phase	27	N/A	1.0 .. 2.0	1	32	31	32
UpperMid cloud: Area fraction	28	percent	0.0 .. 100.0	1	32	32	32
UpperMid cloud: Effective temperature	29	K	100.0 .. 350.0	1	32	33	32
UpperMid cloud: Effective pressure	30	hPa	0.0 .. 1100.0	1	32	34	32
UpperMid cloud: Bottom pressure	31	hPa	0.0 .. 1100.0	1	32	35	32
UpperMid cloud: Top pressure	32	hPa	0.0 .. 1100.0	1	32	36	32
UpperMid cloud: Vis. optical depth (linear)	33	N/A	0.0 .. 400.0	1	32	37	32
UpperMid cloud: Vis. optical depth (log)	34	N/A	-6.0 .. 6.0	1	32	38	32
UpperMid cloud: Infrared emissivity	35	N/A	0.0 .. 2.0	1	32	39	32
UpperMid cloud: Particle phase	36	N/A	1.0 .. 2.0	1	32	40	32
High cloud: Area fraction	37	percent	0.0 .. 100.0	1	32	41	32

Table 3.5-3. GGEO Data Record (3 of 3)

Description	Element Number	Units	Range	Elements/Record	Bits/Elem	Elem Num	Bits/Rec
High cloud: Effective temperature	38	K	100.0 .. 350.0	1	32	42	32
High cloud: Effective pressure	39	hPa	0.0 .. 1100.0	1	32	43	32
High cloud: Bottom pressure	40	hPa	0.0 .. 1100.0	1	32	44	32
High cloud: Top pressure	41	hPa	0.0 .. 1100.0	1	32	45	32
High cloud: Vis. optical depth (linear)	42	N/A	0.0 .. 400.0	1	32	46	32
High cloud: Vis. optical depth (log)	43	N/A	-6.0 .. 6.0	1	32	47	32
High cloud: Infrared emissivity	44	N/A	0.0 .. 2.0	1	32	48	32
High cloud: Particle phase	45	N/A	1.0 .. 2.0	1	32	49	32

**Total Meta Bits/File: 70 752**  
**Total Data Bits/Record: 1 568**  
**Total Meta data Records: 200**  
**Total Header Records: 1**  
**Total Records/File: 9 861 321**  
**Total Data Bits/File: 61 850 205 312**  
**Total Bits/File: 61 850 205 312**  
**Total Bytes/File: 1 932 818 916**  
**Total MBytes/File: 1932.8**



## 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	<ul style="list-style-type: none"> <li>• Updated format to comply with standards.</li> </ul>	All
N/A	R3V2	N/A	<ul style="list-style-type: none"> <li>• Updated Data record information in summary table.</li> <li>• Added new parameters to Header record.</li> <li>• Added clear sky radiances and cloud parameters.</li> <li>• Updated format to comply with standards.</li> </ul>	3.5-1  3.5-2 3.5-3  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 ( $0.5^\circ \times 0.5^\circ$ ). For certain primary meteorological 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 meteorological 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
<b>Header</b>					
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
<b>MOA Regional Record</b>					
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 <sup>-1</sup>	-100 .. 100	1	32-bit Real
Surface Wind Speed, V-Vector	6	m sec <sup>-1</sup>	-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 g <sup>-1</sup>	0.00001 .. .03	58	32-bit Real
Wind Speed Profile, U-Vector	11	m sec <sup>-1</sup>	-100 .. 100	18	32-bit Real
Wind Speed Profile, V-Vector	12	m sec <sup>-1</sup>	-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 <sup>-2</sup>	0.001 .. 10.000	1	32-bit Real
Microwave Precipitable Water, std	19	g cm <sup>-2</sup>	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 <sup>-1</sup>	0.0 .. 0.00005	58	32-bit Real
Flag, Source Ozone Profile Data	22	N/A	0 .. 3	1	32-bit Integer

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

Description	Parameter Number	Units	Range	Elements/Record	Data Type
<b>MOA Regional Record</b>					
Column Ozone	23	DU	0 .. 500	1	32-bit Real
Flag, Source Column Ozone	24	N/A	0 .. 3	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
<b>SSM/I Regional Water Vapor Data</b>					
Microwave Precipitable Water for SSM/I Region		g cm <sup>-2</sup>	0.001 .. 10.000	200	32-bit Real
<b>Skin Temperature Data</b>					
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
<b>Total Megabytes/File</b>	<b>13.3</b>	<b>42.5</b>	<b>43.8</b>
Total Files/Day	24	4	4
Total Megabytes/Day	319.2	170	175.2
<b>Total Megabytes/Month</b>	<b>9895.2</b>	<b>5270</b>	<b>5431.2</b>
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

<b>SCCR Approval Date</b>	<b>Release/Version Number</b>	<b>SCCR Number</b>	<b>Description of Revision</b>	<b>Section(s) Affected</b>
N/A	R3V1	N/A	<ul style="list-style-type: none"> <li>• Updated format to comply with standards.</li> </ul>	All
03/01/06	R3V2	615	<ul style="list-style-type: none"> <li>• Updated Table 3.6-2 to correct units and ranges for specific humidity profiles and values for ozone source flags.</li> <li>• Updated format to comply with standards.</li> </ul>	Table 3.6-2  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"<sup>1</sup>
- 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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<sup>1</sup>. **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	<ul style="list-style-type: none"> <li>• Updated format to comply with standards.</li> </ul>	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

<b>Channels</b>	<b>Micron</b>	<b>Resolution</b>
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	<a href="#">Reference 5</a>	80 000
VIRS Product Specific Metadata	HDF Annotations	1	<a href="#">Reference 5</a>	80 000
VIRS Swath Data for product decoding	HDF Vgroup	1	None	40 000
Scan Time	Vdata Structures	1 .. 11, 817	<a href="#">Table 4.1-2</a>	756 288
Scan Status	Vdata Structures	1 .. 11, 817	<a href="#">Table 4.1-3</a>	1 796 184
Navigation	Vdata Structures	1 .. 11, 817	<a href="#">Table 4.1-4</a>	8 319 168
Geolocation	SDS Data Structures	1 .. 11, 817	<a href="#">Table 4.1-5</a>	197 391 168
Calibration Counts	SDS Data Structures	1 .. 11, 817	<a href="#">Table 4.1-5</a>	5 672 160
Local Direction	SDS Data Structures	1 .. 11, 817	<a href="#">Table 4.1-5</a>	20 419 776
Channels	SDS Data Structures	1 .. 11, 817	<a href="#">Table 4.1-5</a>	246 738 960
<b>Total VIRS Megabytes/File:</b>				<b>57.37</b>

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 Cap- sule	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
virInstS	VIRS Instrument Status	13	1 .. 11, 817	8-bit integer	N/A	0 .. 3
virMode	VIRS Mode	14	1 .. 11, 817	8-bit integer	N/A	0 .. 3
virAbnCon	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 <sup>-1</sup>	TBD
scVelY	Spacecraft Geocentric Velocity	5	1 .. 11, 817	32-bit float	m sec <sup>-1</sup>	TBD
scVelZ	Spacecraft Geocentric Velocity	6	1 .. 11, 817	32-bit float	m sec <sup>-1</sup>	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 <sup>-2</sup> sr <sup>-1</sup> mm <sup>-1</sup>	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

<b>SCCR Approval Date</b>	<b>Release/Version Number</b>	<b>SCCR Number</b>	<b>Description of Revision</b>	<b>Section(s) Affected</b>
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	<a href="#">Reference 6</a>	10 000
MODIS Archive Metadata	HDF Annotations	1	<a href="#">Reference 6</a>	10 000
MODIS Product Specific Metadata	HDF Annotations	1	<a href="#">Reference 6</a>	10 000
MODIS Swath Data	Vdata Structure	1	<a href="#">Table 4.2-2</a>	72
MODIS Level 1-B SDS	SDSs	1 .. 1044	<a href="#">Table 4.2-3</a>	294 693 396
<b>Total MODIS Level-1B Bytes/File:</b>				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 <sup>-2</sup> sr <sup>-1</sup> mm <sup>-1</sup>	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 <sup>-2</sup> sr <sup>-1</sup> mm <sup>-1</sup>	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	<a href="#">Reference 6</a>	10 000
MODIS Geolocation Archive Metadata	HDF Annotations	1	<a href="#">Reference 6</a>	10 000
MODIS Geolocation Product Specific Metadata	HDF Annotations	1	<a href="#">Reference 6</a>	10 000
MODIS Geolocation Swath Structural Metadata	HDF Annotations	1	<a href="#">Reference 6</a>	10 000
MODIS Geolocation Data	SDS	39	<a href="#">Table 4.2-5</a>	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 <sup>-1</sup>	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 <sup>-1</sup>	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.

<b>Level:</b> 3	<b>Portion of Globe Covered</b>
<b>Frequency:</b> Variable	<b>File:</b> Global
<b>Configuration Code:</b> 009000 and greater	<b>Record:</b> 1/6-Deg by 1/6-Deg
<b>Time Interval Covered</b>	<b>Portion of Atmosphere Covered</b>
<b>File:</b> Variable	<b>File:</b> Surface
<b>Record:</b> Variable	

Table 4.3-1. SURFMAP Product

<b>SURFMAP Data Type</b>	<b>Description</b>	<b>Update Frequency</b>	<b>Units</b>	<b>Range</b>	<b>Bits/Element</b>	<b>Size in MB</b>
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
<b>Total SURFMAP Size</b>						<b>28.8</b>

## 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	<ul style="list-style-type: none"> <li>• Updated format to comply with standards.</li> </ul>	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: 4.8 MB per Hour
- 2) METEOSAT: 4.8 MB per Hour
- 3) GOES-East: 8.7 MB per Hour
- 4) GOES-West: 11.0 MB per Hour

**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	<ul style="list-style-type: none"> <li>• Updated format to comply with standards.</li> </ul>	All
N/A	R3V2	N/A	<ul style="list-style-type: none"> <li>• Updated data file sizes.</li> <li>• Updated format to comply with standards.</li> </ul>	All 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

<b>SCCR Approval Date</b>	<b>Release/Version Number</b>	<b>SCCR Number</b>	<b>Description of Revision</b>	<b>Section(s) Affected</b>
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
<b>TOTAL SIZE</b>	<b>68.5 MB</b>		

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
<b>TOTAL SIZE</b>	<b>33.1 MB</b>		

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
<b>TOTAL SIZE</b>	<b>692 MB</b>		

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

<b>SCCR Approval Date</b>	<b>Release/Version Number</b>	<b>SCCR Number</b>	<b>Description of Revision</b>	<b>Section(s) Affected</b>
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

<b>SCCR Approval Date</b>	<b>Release/Version Number</b>	<b>SCCR Number</b>	<b>Description of Revision</b>	<b>Section(s) Affected</b>
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

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



## References

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## **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 <sup>-1</sup>	degrees per second
DU	Dobson Unit
fraction	fraction 0..1
g kg <sup>-1</sup>	grams per kilogram
g m <sup>-2</sup>	grams per square meter
hhmmss	hour, minute, second
hour	hour, hours
hPa	hectoPascals
in-oz	inch-ounces
K	Kelvin
km	kilometer, kilometers
km sec <sup>-1</sup>	kilometers per second
m	meter, meters
mA	milliamp, milliamps
micron	micrometer, micrometers, micron
msec	millisecond, milliseconds
mW cm <sup>-2</sup> sr <sup>-1</sup> μm <sup>-1</sup>	milliWatts per square centimeter per steradian per micron
m sec <sup>-1</sup>	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 <sup>-2</sup>	Watt hours per square meter
W <sup>2</sup> m <sup>-4</sup>	square Watts per meter to the 4th
W m <sup>-2</sup>	Watts per square meter
W m <sup>-2</sup> sr <sup>-1</sup>	Watts per square meter per steradian
W m <sup>-2</sup> sr <sup>-1</sup> μm <sup>-1</sup>	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 Detector, 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	GRIingPointLatitude	deg	-90.0 .. 90.0	F11.6	3 .. 100
25	GRIingPointLongitude	deg	-180.0 .. 180.0	F11.6	3 .. 100
26	GRIingPointSequenceNo	N/A	0 .. 99999	I5	3 .. 100
27	ExclusionGRIingFlag	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	CERGRIingPointLatitude	deg	0.0 .. 180.0	F11.6	3 .. 100
29	CERGRIingPointLongitude	deg	0.0 .. 360.0	F11.6	3 .. 100
30	GRIingPointSequenceNo	N/A	0 .. 99999	I5	3 .. 100
31	ExclusionGRIingFlag	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)