

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

EOSDIS Product Code: CER12

The Monthly Gridded TOA/Surface Fluxes and Clouds (SFC) archival data product contains hourly single satellite flux and cloud parameters averaged over 1.0-degree regions. Input to the SFC Subsystem is the Single Scanner Footprint TOA/Surface Fluxes and Clouds (SSF) archival data product. Each SFC covers a single month swath from a single CERES instrument mounted on one satellite. The product is written in HDF and contains metadata as well as gridded science data. For TRMM, data will be organized onto eight SFC HDF files, each containing data for ten 1.0-degree equal-angle zones. For Terra and Aqua, data will be organized onto 36 SFC HDF files, each containing data for five 1.0-degree equal-angle zones. Each record contains spatially averaged data for an individual region. The science data are Vdata with multiple records. Each record contains spatially averaged data for an individual region.

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

- Region data
- Imager Radiances Statistics
- Angular model scene classes
- Total-sky radiative fluxes at TOA and Surface
- Clear-sky radiative fluxes at TOA and Surface
- Surface Emissivity
- Cloud category properties for four cloud layers

A complete listing of metadata and science parameters for this data product can be found in [Tables 2.8-1](#) through [Table 2.8-8](#).

Level: 3

Frequency: 1/Month

Portion of Globe Covered

File: Gridded Satellite Swath

Record: 1.0-Deg Equal-angle Region

Time Interval Covered

File: Month

Record: Hour

Portion of Atmosphere Covered

File: TOA and Surface

Product Version

TRMM: Edition2B

Terra: Beta1

Aqua: Beta1

SFC Metadata

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

Table 2.8-1. SFC Metadata Summary

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

Table 2.8-2. SFC Product-specific Metadata

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

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

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

Table 2.8-4. Time and Position Data

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

Table 2.8-5. Regional Identification Data

Field No.	Field Name / Parameter	Data Type	Units	Range	No. of Elements
1	Region Number	32-Bit Float	N/A	1 .. 64800	1
2	Hour Box Number	32-Bit Float	N/A	1 .. 744	1
3	Num. Footprints in Region	32-Bit Float	N/A	1 .. 450	1
4	Colatitude	32-Bit Float	deg	1 .. 180	1
5	Longitude	32-Bit Float	deg	1 .. 360	1

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

Field No.	Field Name / Parameter	Data Type	Units	Range	No. of Elements
1	Alt. of Srf. above Sea	32-Bit Float	m	-1000.0 .. 10000.0	1
2	Surface Type Percentage	32-Bit Float	N/A	0.0 .. 100.0	20
3	Precipitable Water	32-Bit Float	cm	0.001 .. 10.0	1
4	Snow/Ice Percentage	32-Bit Float	N/A	0.0 .. 100.0	1
5	Aerosol Opt. Depth at 0.63um in clr	32-Bit Float	µm	-1.0 .. 5.0	1
6	Aerosol Opt. Depth at 1.6um in clr	32-Bit Float	µm	-1.0 .. 5.0	1

Table 2.8-7. Imager Radiances Statistics

Field No.	Field Name / Parameter	Data Type	Units	Range	No. of Elements
1	Imager Viewing Zenith Angle	32-Bit Float	deg	0 .. 360	1
2	Imager Relative Azimuth. Angle	32-Bit Float	deg	0 .. 360	1
3	Imager Channel Central Wavelength	32-Bit Float	μm	0.4 .. 15.0	5
4	Imager Mean Radiances	32-Bit Float	$\text{W m}^{-2} \text{sr}^{-1} \mu\text{m}^{-1}$	-1000 .. 1000	5
5	Imager Radiances over clear area	32-Bit Float	$\text{W m}^{-2} \text{sr}^{-1} \mu\text{m}^{-1}$	0 .. 1000	5

Table 2.8-8. Angular Model Scene Type

Field No.	Field Name / Parameter	Data Type	Units	Range	No. of Elements
1	Incident Solar Flux	32-Bit Float	N/A	0.0 .. 1400.0	1
2	Snow/Ice Percentage from Imager History	32-Bit Float	percent	0.0..100.0	1
3	Area Coverage	32-Bit Float	N/A	0.0 .. 100.0	20
4	SW Scene ID	32-Bit Float	N/A	0 .. 5000	20
5	Albedo (mean)	32-Bit Float	N/A	0.0 .. 1.0	20
6	Albedo (std)	32-Bit Float	N/A	0.0 .. 1.0	20
7	LW (mean)	32-Bit Float	W m^{-2}	0.0 .. 400.0	20
8	LW (std)	32-Bit Float	W m^{-2}	0.0 .. 400.0	20

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

Field No.	Field Name / Parameter	Data Type	Units	Range	No. of Elements
1	SW TOA Clear-sky	32-Bit Float	W m^{-2}	0.0 .. 1400.0	3
2	LW TOA Clear-sky	32-Bit Float	W m^{-2}	0.0 .. 500.0	3
3	WN TOA Clear-sky	32-Bit Float	W m^{-2}	2.0 .. 50.0	3
4	ALB TOA Clear-sky	32-Bit Float	N/A	0.0 .. 1.0	3
5	SW TOA Total-Sky	32-Bit Float	W m^{-2}	0.0 .. 1400.0	3
6	LW TOA Total-Sky	32-Bit Float	W m^{-2}	0.0 .. 500.0	3
7	WN TOA Total-Sky	32-Bit Float	W m^{-2}	2.0 .. 50.0	3
8	ALB TOA Total-Sky	32-Bit Float	N/A	0.0 .. 1.0	3

Table 2.8-10. Surface Fluxes (mean std num_obs) (1 of 2)

Field No.	Field Name / Parameter	Data Type	Units	Range	No. of Elements
1	SW SRF Model A Clear-Sky	32-Bit Float	W m^{-2}	0.0 .. 1400.0	3
2	LW SRF Model A Clear-Sky	32-Bit Float	W m^{-2}	0.0 .. 700.0	3
3	WN SRF Model A Clear-Sky	32-Bit Float	W m^{-2}	0.0 .. 65.0	3

Table 2.8-10. Surface Fluxes (mean std num_obs) (2 of 2)

Field No.	Field Name / Parameter	Data Type	Units	Range	No. of Elements
4	Net. SW SRF Model A Clear-Sky	32-Bit Float	W m ⁻²	0.0 .. 1400.0	3
5	Net. LW SRF Model A Clear-Sky	32-Bit Float	W m ⁻²	-250.0 .. 50.0	3
6	SW SRF Model B Clear-Sky	32-Bit Float	W m ⁻²	0.0 .. 1400.0	3
7	LW SRF Model B Clear-Sky	32-Bit Float	W m ⁻²	0.0 .. 700.0	3
8	Net. SW SRF Model B Clear-Sky	32-Bit Float	W m ⁻²	0.0 .. 1400.0	3
9	Net. LW SRF Model B Clear-Sky	32-Bit Float	W m ⁻²	-250.0 .. 50.0	3
10	SW SRF Model A Total-Sky	32-Bit Float	W m ⁻²	0.0 .. 1400.0	3
11	LW SRF Model A Total-Sky	32-Bit Float	W m ⁻²	0.0 .. 700.0	3
12	WN SRF Model A Total-Sky	32-Bit Float	W m ⁻²	0.0 .. 65.0	3
13	Net. SW SRF Model A Total-Sky	32-Bit Float	W m ⁻²	0.0 .. 1400.0	3
14	Net. LW SRF Model A Total-Sky	32-Bit Float	W m ⁻²	-250.0 .. 50.0	3
15	SW SRF Model B Total-Sky	32-Bit Float	W m ⁻²	0.0 .. 1400.0	3
16	LW SRF Model B Total-Sky	32-Bit Float	W m ⁻²	0.0 .. 700.0	3
17	Net. SW SRF Model B Total-Sky	32-Bit Float	W m ⁻²	0.0 .. 1400.0	3
18	Net. LW SRF Model B Total-Sky	32-Bit Float	W m ⁻²	-250.0 .. 50.0	3

Table 2.8-11. Surface Emissivity

Field No.	Field Name / Parameter	Data Type	Units	Range	No. of Elements
1	LW Surface	32-Bit Float	N/A	0.0 .. 1.0	1
2	WN Surface	32-Bit Float	N/A	0.0 .. 1.0	1

Table 2.8-12. Layer Cloud - HIGH (mean std num_obs) (1 of 2)

Field No.	Field Name / Parameter	Data Type	Units	Range	No. of Elements
1	Area Fraction Percentage	32-Bit Float	percent	0.0 .. 100.0	1
2	Effective Pressure	32-Bit Float	hPa	0.0 .. 1100.0	3
3	Effective Temperature	32-Bit Float	K	100.0 .. 350.0	3
4	Effective Height	32-Bit Float	km	0.0 .. 20.0	3
5	Top Pressure	32-Bit Float	hPa	0.0 .. 1100.0	3
6	Bottom Pressure	32-Bit Float	hPa	0.0 .. 1100.0	3
7	Particle Phase	32-Bit Float	N/A	1.0 .. 2.0	3
8	Liquid Water Path	32-Bit Float	g m ⁻²	0.0 .. 10000.0	3
9	Ice Water Path	32-Bit Float	g m ⁻²	0.0 .. 10000.0	3
10	Liquid Particle Radius	32-Bit Float	μm	0.0 .. 40.0	3
11	Ice Particle Diameter	32-Bit Float	μm	0.0 .. 300.0	3
12	Vis. Opt. Depth (linear)	32-Bit Float	N/A	0.0 .. 400.0	3
13	Vis. Opt. Depth (log)	32-Bit Float	N/A	-6.0 .. 6.0	3

Table 2.8-12. Layer Cloud - HIGH (mean std num_obs) (2 of 2)

Field No.	Field Name / Parameter	Data Type	Units	Range	No. of Elements
14	Infrared Emissivity	32-Bit Float	N/A	0.0 .. 2.0	3
15	Vertical Aspect Ratio	32-Bit Float	N/A	0.0 .. 20.0	3

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

Field No.	Field Name / Parameter	Data Type	Units	Range	No. of Elements
1	Area Fraction Percentage	32-Bit Float	N/A	0.0 .. 100.0	1
2	Effective Pressure	32-Bit Float	hPa	0.0 .. 1100.0	3
3	Effective Temperature	32-Bit Float	K	100.0 .. 350.0	3
4	Effective Height	32-Bit Float	km	0.0 .. 20.0	3
5	Top Pressure	32-Bit Float	hPa	0.0 .. 1100.0	3
6	Bottom Pressure	32-Bit Float	hPa	0.0 .. 1100.0	3
7	Particle Phase	32-Bit Float	N/A	1.0 .. 2.0	3
8	Liquid Water Path	32-Bit Float	g m ⁻²	0.0 .. 10000.0	3
9	Ice Water Path	32-Bit Float	g m ⁻²	0.0 .. 10000.0	3
10	Liquid Particle Radius	32-Bit Float	μm	0.0 .. 40.0	3
11	Ice Particle Effective Diameter	32-Bit Float	μm	0.0 .. 300.0	3
12	Vis. Opt. Depth (linear)	32-Bit Float	N/A	0.0 .. 400.0	3
13	Vis. Opt. Depth (log)	32-Bit Float	N/A	-6.0 .. 6.0	3
14	Infrared Emissivity	32-Bit Float	N/A	0.0 .. 2.0	3
15	Vertical Aspect Ratio	32-Bit Float	N/A	0.0 .. 20.0	3

Table 2.8-14. Layer Cloud - LOWERMID (mean std num_obs) (1 of 2)

Field No.	Field Name / Parameter	Data Type	Units	Range	No. of Elements
1	Area Fraction Percentage	32-Bit Float	N/A	0.0 .. 100.0	1
2	Effective Pressure	32-Bit Float	hPa	0.0 .. 1100.0	3
3	Effective Temperature	32-Bit Float	K	100.0 .. 350.0	3
4	Effective Height	32-Bit Float	km	0.0 .. 20.0	3
5	Top Pressure	32-Bit Float	hPa	0.0 .. 1100.0	3
6	Cloud Base Pressure	32-Bit Float	hPa	0.0 .. 1100.0	3
7	Particle Phase	32-Bit Float	N/A	1.0 .. 2.0	3
8	Liquid Water Path	32-Bit Float	g m ⁻²	0.0 .. 10000.0	3
9	Ice Water Path	32-Bit Float	g m ⁻²	0.0 .. 10000.0	3
10	Liquid Particle Radius	32-Bit Float	μm	0.0 .. 40.0	3
11	Ice Particle Effective Diameter	32-Bit Float	μm	0.0 .. 300.0	3
12	Vis. Opt. Depth (linear)	32-Bit Float	N/A	0.0 .. 400.0	3
13	Vis. Opt. Depth (log)	32-Bit Float	N/A	-6.0 .. 6.0	3

Table 2.8-14. Layer Cloud - LOWERMID (mean std num_obs) (2 of 2)

Field No.	Field Name / Parameter	Data Type	Units	Range	No. of Elements
14	Infrared Emissivity	32-Bit Float	N/A	0.0 .. 2.0	3
15	Vertical Aspect Ratio	32-Bit Float	N/A	0.0 .. 20.0	3

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

Field No.	Field Name / Parameter	Data Type	Units	Range	No. of Elements
1	Area Fraction Percentage	32-Bit Float	N/A	0.0 .. 100.0	1
2	Effective Pressure	32-Bit Float	hPa	0.0 .. 1100.0	3
3	Effective Temperature	32-Bit Float	K	100.0 .. 350.0	3
4	Effective Height	32-Bit Float	km	0.0 .. 20.0	3
5	Top Pressure	32-Bit Float	hPa	0.0 .. 1100.0	3
6	Bottom Pressure	32-Bit Float	hPa	0.0 .. 1100.0	3
7	Particle Phase	32-Bit Float	N/A	1.0 .. 2.0	3
8	Liquid Water Path	32-Bit Float	g m ⁻²	0.0 .. 10000.0	3
9	Ice Water Path	32-Bit Float	g m ⁻²	0.0 .. 10000.0	3
10	Liquid Particle Radius	32-Bit Float	μm	0.0 .. 40.0	3
11	Ice Particle Effective Diameter	32-Bit Float	μm	0.0 .. 300.0	3
12	Vis. Opt. Depth (linear)	32-Bit Float	N/A	0.0 .. 400.0	3
13	Vis. Opt. Depth (log)	32-Bit Float	N/A	-6.0 .. 6.0	3
14	Infrared Emissivity	32-Bit Float	N/A	0.0 .. 2.0	3
15	Vertical Aspect Ratio	32-Bit Float	N/A	0.0 .. 20.0	3

Table 2.8-16. Aerosol LAND

Field No.	Field Name / Parameter	Data Type	Units	Range	No. of Elements
1	cor_optdepth047_land	32-Bit Float	N/A	0.0 .. 5.0	1
2	cor_optdepth055_land	32-Bit Float	N/A	0.0 .. 5.0	1
3	cor_optdepth066_land	32-Bit Float	N/A	0.0 .. 5.0	1

Table 2.8-17. Aerosol OCEAN (1 of 2)

Field No.	Field Name / Parameter	Data Type	Units	Range	No. of Elements
1	eff_optdepth047_ocean	32-Bit Float	N/A	0.0 .. 5.0	1
2	eff_optdepth055_ocean	32-Bit Float	N/A	0.0 .. 5.0	1
3	eff_optdepth066_ocean	32-Bit Float	N/A	0.0 .. 5.0	1
4	eff_optdepth087_ocean	32-Bit Float	N/A	0.0 .. 5.0	1
5	eff_optdepth124_ocean	32-Bit Float	N/A	0.0 .. 5.0	1
6	eff_optdepth164_ocean	32-Bit Float	N/A	0.0 .. 5.0	1

Table 2.8-17. Aerosol OCEAN (2 of 2)

Field No.	Field Name / Parameter	Data Type	Units	Range	No. of Elements
7	eff_optdepth213_ocean	32-Bit Float	N/A	0.0 .. 5.0	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"> • Updated parameters in Regional Identification Data, Regional Imager Data. • Updated format to comply with standards. 	Tables 2.11-5 & 2.11-7 All
02/03/03	R3V3	388	<ul style="list-style-type: none"> • Updated vdata sizes. • Added MODIS aerosols for land and Ocean. • Updated format to comply with standards. 	Table 2.11-3 Tables 2.11-16 & 2.11-17 All
02/03/03	R3V4 R4V1	388	<ul style="list-style-type: none"> • Changed range of MOD04 effective optical depths from 0.0 .. 3.0 to 0.0 .. 5.0 based on changes to v003 MOD04 inputs starting with data date 01.Apr.2002. • Changed units of 10 ,11 in Layer Cloud category from mm to μm. • Updated format to comply with standards. • The revision and version numbers were changed at this time. 	Tables 2.11-16 & 2.11-17 Tables 2.11-12, 2.11-13, 2.11-14, 2.11-15 All All
10/29/03	R4V2	476	<ul style="list-style-type: none"> • Added Snow/Ice Percentage from Imager History parameter to Angular Model Scene type. • Updated format to comply with standards 	Table 2.8.8 All