Clouds and the Earth's Radiant Energy System (CERES) Monthly Gridded TOA/Surface Fluxes and Clouds (SFC) Data Set Abstract

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Data Set Description:

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. The nested grid scheme is as follows:

latitude	grid size (latitude x longitude)
0 – 45	1 x 1
45 – 70	1 x 2
70 – 80	1 x 4
80 – 89	1 x 8
89 – 90	1 x 360

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 is organized onto eight HDF files, each containing data for ten 1.0-degree equal-angle zones. For Terra and Aqua, data is organized onto 36 HDF files, each containing data for five 1.0-degree equal-angle zones. The science data are SDSs with multiple records. Each record contains spatially averaged data for an individual region.

The SFC product includes:

- Time and Position Data
- Regional Identification Data
- Surface Map and Full-Clear area Data
- Imager Radiances Statistics
- Angular Model Scene Type
- TOA Fluxes (mean std num_obs)
- Surface Fluxes (mean std num_obs)
- Surface Emissivity
- Cloud Layer - High (mean std num_obs)
- Cloud Layer - UpperMid (mean std num_obs)
- Cloud Layer - LowerMid (mean std num_obs)
- Cloud Layer - Low (mean std num_obs)
- MODIS land aerosols (Starting with Edition2A Terra, not available for TRMM)
- MODIS ocean aerosols (Starting with Edition2A Terra, not available for TRMM)

Only footprints with imager coverage are included. Therefore, CERES footprints which fall outside of the imager swath do not appear on the SFC product. The maximum VIRS viewing zenith angle is ~48°, and the maximum MODIS viewing zenith angle is ~65°.

Additional information about the format and content of the SFC can be found in the CERES Data Products Catalog. A detailed description of the SFC can be found in the SSF Collection Guide.

Summary of Changes:

The CERES Data Management Team and the Atmospheric Science Data Center (ASDC) at Langley use a Sampling Strategy, a Production Strategy, and a Configuration Code (CCode) to track versions of CERES primary data products. In general, minor reprocessing changes are tracked by increasing the Configuration Code while major reprocessing changes result in a new Production Strategy. The Sampling Strategy identifies the satellite and instruments which acquired the data in the product.

A summary of changes made to the CERES SFC product is shown in the following tables

Modification History for: Aqua | Terra | TRMM

Modification History of the CERES Aqua SFC Product
Also see Modification History for CERES SSF Aqua FM3 and FM4

Sampling Strategy and Production Strategy	CCode	Available at ASDC	Impact on Aqua SFC Product
Aqua-MODIS_Edition3A[4]	300300, 301300, 302300, 302301, 303303, 303304, 303305, 304305	Mar 2011	• Aqua Edition3A XTRK scan mode SSF data is used as input. • Single satellite monthly files can contain data from multiple CERES instruments therefore, the instrument identifier previously included in the Sampling Strategy is dropped in the file name.
Aqua-FM3-MODIS-Edition2D[4] Aqua-FM4-MODIS-Edition2D[4] Aqua-FM4-MODIS-Ed2D-NoSW[4]	023032		• Edition2D SSF and DAO-G5-CERES MOA are used as inputs.
Aqua-FM3-MODIS-Edition2C[4] Aqua-FM4-MODIS-Edition2C[4] Aqua-FM4-MODIS-Ed2C-NoSW[4]	022031	Nov 2008	• Edition2C SSF and DAO-GEOS4 MOA are used as inputs.
Aqua-FM3-MODIS-Edition2B[4] Aqua-FM4-MODIS-Edition2B[4] Aqua-FM4-MODIS-Ed2B-NoSW[4]	022031	Jul 2008	• Edition2B, Ed2B-NoSW SSF and DAO-GOES4 MOA are used as inputs.
Aqua-FM3-MODIS-Edition2A[4] Aqua-FM4-MODIS-Edition2A[4] Aqua-FM4-MODIS-Ed2A-NoSW[4]	022030	Jun 2006	• Edition2A SSF and DAO-GEOS4 MOA are used as inputs.
Aqua-FM3-MODIS-Edition1B[4] Aqua-FM4-MODIS-Edition1B[4]	022029	Mar 2005	• Edition1B SSF and DAO-GEOS4 MOA are used as inputs.
Aqua-FM3-MODIS-Edition1A[1] Aqua-FM4-MODIS-Edition1A[1]	022026		• Cosine of Solar Zenith Angle corrections are applied to MODIS Imager channel 1 radiances (SDS 21). • SW ADMs are corrected for snow. Clear-sky snow SW ADM type is set to 593, the Total-sky snow SW ADM type is set to 591 and the default SW ADM type is set to 592. (SDS 26) • Area fraction percentage is set to default when there are no imager data available for the hour. • Julian Time (SDS 1) is written as 8-byte REAL on SFC HDF product. • Snow/Ice Percentage from Imager History (SDS 24) is deleted from the Angular Model Scene Type definitions.

Modification History of the CERES Aqua SFC Product
Also see Modification History for CERES SSF Aqua FM3 and FM4

Sampling Strategy and Production Strategy	CCode	Available at ASDC	Impact on Aqua SFC Product
Aqua-FM3-MODIS-Beta1[2] Aqua-FM4-MODIS-Beta1[2]	021024, 021025	May 2004	• Directional Model corrections are applied to TOA SW fluxes (SDS 31 & 35). • Snow/Ice percent (SDS 15) for Clear-sky area is calculated for each footprint using snow/ice, clear-area input values. • Admgeo parameter data from SSF are averaged and written to Snow/Ice Percentage from Imager History (SDS 24) in the Angular Model Scene Type definitions. • Cloud Layer Properties on each footprint are weighted by the area cloud fraction before its mean values are calculated. • MODIS Land Aerosols (SDS 119 - 121) are added to SFC product. • MODIS Ocean Aerosols (SDS 122 - 128) are added to SFC product. • SFC HDF product is written in compressed format.
Availability: (1) not available; (2) restricted to CERES analysts; (3) restricted to CERES Science Team and analysts; (4) public			

Modification History for: Aqua | Terra | TRMM

Modification History of the CERES Terra SFC Product
Also see Modification History for CERES SSF Terra FM1 and FM2

Sampling Strategy and Production Strategy	CCode	Available at ASDC	Impact on Terra SFC Product
Terra-MODIS_Edition3A[4]	300300, 300301, 301300, 302300, 302301, 303303, 303304, 303305, 304305	Mar 2011	• Terra Edition3A XTRK scan mode SSF data is used as input. • Single satellite monthly files can contain data from multiple CERES instruments therefore, the instrument identifier previously included in the Sampling Strategy is dropped in the file name.
Terra-FM1-MODIS-Edition2G[4] Terra-FM2-MODIS-Edition2G[4]	023030, 028035	May 2010	• Edition2G SSF and DAO-G5-CERES MOA products are used as inputs.
Terra-FM1-MODIS-Edition2F[4] Terra-FM2-MODIS-Edition2F[4]	022031	Oct 2007	• Edition2F SSF and DAO-GEOS4 MOA are used as inputs.
Terra-FM1-MODIS-Edition2C[4] Terra-FM2-MODIS-Edition2C[4]	022029	Dec 2004	• Edition2B SSF and DAO-GEOS4 MOA are used as inputs. • Record indexing error was corrected in SFC monthly process. In version Edition2B the months that have less than 31 days, the error caused to replace the first day of the month records with the following month overlap records for the regions in western hemisphere.
Terra-FM1-MODIS-Edition2B[4] Terra-FM2-MODIS-Edition2B[4]	022026	Oct 2004	• Cosine of Solar Zenith Angle corrections are applied to MODIS Imager channel 1 radiances (SDS 21). • SW ADMs were corrected for snow. Clear-sky snow SW ADM type is set to 593, the Total-sky snow SW ADM type is set to 591 and the default SW ADM type is set to 592. (SDS 26) • Area fraction percentage is set to default when there

Modification History of the CERES Terra SFC Product
Also see Modification History for CERES SSF Terra FM1 and FM2

Sampling Strategy and Production Strategy	CCode	Available at ASDC	Impact on Terra SFC Product
			are no imager data available for the hour. • Julian Time (SDS 1) is written as 8-byte REAL on SFC HDF product. • Snow/Ice Percentage from Imager History (SDS 24) is deleted from the Angular Model Scene Type Definitions.
Terra-FM1-MODIS-Edition2A(4) Terra-FM2-MODIS-Edition2A(4)	021024, 021025	Dec 2003	• Directional Model corrections are applied to TOA SW fluxes (SDS 31 & 35). • Snow/Ice percent (SDS 15) for Clear sky area is calculated for each footprint using snow/ice, clear-area input values. • Admgeo parameter data from SSF are averaged and written to Snow/Ice Percentage from Imager History (SDS 24) in the Angular Model Scene Type definitions. • Cloud Layer Properties on each footprint are weighted by the area cloud fraction before its mean values are calculated. • MODIS Land Aerosols (SDS 119 - 121) are added to SFC product. • MODIS Ocean Aerosols (SDS 122 - 128) are added to SFC product. • SFC HDF product is written in compressed format.
Availability: (1) not available;(2) restricted to CERES analysts; (3) restricted to CERES Science Team and analysts; (4) public			

Modification History for: Aqua | Terra | TRMM

Modification History of the CERES TRMM SFC Product
Also see Modification History for CERES SSF TRMM-PFM-VIRS

Sampling Strategy and Production Strategy	CCode	Available at ASDC	Impact on the Terra SSF Product
TRMM-PFM-VIRS_ Edition2B(4)	017020	Oct 2002	• Mean SW fluxes are calculated for the 20 most common angular directional models (ADM) used to produce fluxes for the CERES footprints in each hourbox. Information based on the ERBE-like scene identification classes is no longer retained on the SFC product. • TOA SW fluxes and Surface fluxes are corrected to a common Cosine of Solar Zenith Angle. • The definition of "clear-sky" used to calculate the mean clear-sky flux for each hourbox is now consistent with the definition used for the selection of ADMs. Footprint is defined as clear when the Cloud amount is less than 0.1%. • Colatitude, Longitude parameters are added to region Identification data. • Imager percent, 5th, 95th percentile imager radiances parameters are deleted from Imager Radiances Statistics. • SFC HDF product is written in a new format to provide user access to all observation hours' data for a specific 1-deg region.
Availability: (1) not available; (2) restricted to CERES analysts; (3) restricted to CERES Science Team and analysts; (4) public			

References:

An overview of the temporal interpolation and spatial averaging algorithms used for CERES can be found in the following reference:

Young, D. F., P. Minnis. D. R. Doelling, G. G. Gibson, and T. Wong, 1998: Temporal Interpolation Methods for the Clouds and Earth's Radiant Energy System (CERES) Experiment. *J. Appl. Meteorol.*, **37**, 572-590

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Acknowledgement:

The requested form of acknowledgment for any publication in which these data are used is:

"These data were obtained from the NASA Langley Research Center Atmospheric Science Data Center."

The Langley Data Center requests a reprint of any published papers or reports or a brief description of other uses (e.g., posters, oral presentations, etc.) of data that we have distributed. This will help the Data Center determine the use of data distributed, which is helpful in optimizing product development. It also helps us to keep our product related references current.

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