CERES Terra Edition3 SFC
CERES Aqua Edition3 SFC
Data Quality Summary

Investigation:	**CERES**
Data Product:	**Monthly Gridded TOA/Surface Fluxes and Clouds (SFC)**
Data Set:	**Terra (Instruments: CERES-FM1 or CERES-FM2, MODIS)** **Aqua (Instruments: CERES-FM3 or CERES-FM4, MODIS)**
Data Set Version:	**(Terra) Edition3A** **(Aqua) Edition3A**

The purpose of this document is to inform users of the accuracy of this data product as determined by the CERES Science Team. The document summarizes key validation results, provides cautions where users might easily misinterpret the data, provides links to further information about the data product, algorithms, and accuracy, and gives information about planned data improvements. This document also automates registration in order to keep users informed of new validation results, cautions, or improved data sets as they become available.

This document is a high-level summary and represents the minimum information needed by scientific users of this data product. It is strongly suggested that authors, researchers, and reviewers of research papers re-check this document for the latest status before publication of any scientific papers using this data product.

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Nature of the SFC Product

This document discusses SFC versions Terra and Aqua Edition3A. This document was written for both Terra and Aqua Edition3 products, since the purpose of the SFC is to spatially grid the SSF parameters. The CERES product edition naming convention is a function of input and algorithm differences. Consistent input and algorithms are necessary to avoid algorithm shock to the output parameters in order to retain a consistent climate quality record. See the figure of CERES input data sets used to produce CERES Edition3A products (PDF). There are no algorithm or coding changes between Terra Edition2C/F/G and Aqua Edition 2A/B/C/D or Edition3A. See the table of CERES Edition2 product versions. The only difference between Edition3 and Edition2 is that the CERES Edition3 product uses the CERES Edition3 instrument calibration to generate the TOA observed fluxes. However all other inputs, such as clouds, and algorithms are the same as Edition2. **The user should always use the latest Edition that is available.** For Edition3 only the CERES instrument in cross-track mode is processed into a SFC product. See monthly scan mode table.

The Monthly Gridded TOA/Surface Fluxes and Clouds (SFC) archival data product contains hourly single scanner 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 of data from a single CERES instrument mounted on one satellite. Individual SFC Edition3A files contain information for five consecutive latitude bands.

Instantaneous CERES footprint data are sorted by region and time. Gridded means of SSF data are calculated in hourly local solar time increments for each region with at least one CERES observation. These region/time increments are centered on the local half-hour and are referred to as "hourboxes." The major categories of data output on the SFC are as follows:

- Region-specific data such as surface properties and elevation
- Time and viewing geometry data
- Total-sky radiative fluxes at the top of the atmosphere (TOA) and surface
- Clear-sky radiative fluxes at TOA and surface
- Layer mean cloud properties for 4 pressure layers
- Shortwave flux averages for the prominent angular directional model (ADM) scene classes.

All CERES footprints with a non-default value of either Shortwave (SW) or Longwave (LW) flux are used in the SFC product. CERES data collected during the Rotating Azimuth Plane (RAP), crosstrack, and the alongtrack scan modes are used.

When referring to a CERES data set, please include the satellite name and/or the CERES instrument name, the data set version, and the data product. Multiple files that are identical in all aspects of the filename except for the 6 digit configuration code differ little, if any, scientifically. Users may, therefore, analyze data from the same satellite/instrument, data set version, and data product without regard to configuration code. Depending upon the instrument analyzed, these data sets may be referred to as
"CERES Terra FM1 Edition3A SFC" or "CERES Aqua FM4 Edition3A SFC",

Cautions and Helpful Hints

There are several cautions and helpful tips that the CERES Science Team notes regarding the use of CERES-Terra SFC data:

- TOA SW data are corrected to a common solar zenith angle (SZA) before averaging in each hourbox. This requires two corrections:
    1. The modification of the solar insolation from the SZA of the observation to the SZA of the central time of the hourbox,
    2. The correction of the observed albedo to the SZA of the central time using directional models of albedo as a function of SZA and scene type.

  For surface SW fluxes, only the correction based on the change in solar insolation is applied. There is no correction for the change of albedo with SZA.

- Mean SW fluxes are calculated for up to 20 ADM scene classes in each hourbox. These scene classes are a function of surface type, cloud amount, cloud phase, and optical depth and are consistent with the ADM types used for producing fluxes from the CERES instrument aboard the Tropical Rainfall Measuring Mission (TRMM) (see a discussion of TRMM ADM). These ADM scene classes are different from the ADM classes used to calculate fluxes on the Terra Edition2B SSF (see the SSF Edition2 Data Quality Summary). The data are sorted consistently with the TRMM ADM scene classes so that these data can be used with directional models (DRM) of the variation of albedo with solar zenith angle that were developed from TRMM data. These DRM are used to interpolate the measured albedos to unobserved hours of the day during the calculation of the monthly mean SW flux. TRMM data are used for DRM development since the TRMM orbit precesses through all local times and therefore samples the full range of SZA. The sun-synchronous Terra and Aqua orbits do not provide the SZA sampling necessary for ADM and directional model development.

- The mean clear-sky flux for each hourbox is calculated using only footprints with cloud amounts less than 0.1%.

- The SFC product contains data collected from rotating azimuth (RAP), alongtrack, and crosstrack scanning operating modes. Users can identify hours that include RAP data by checking the viewing zenith angle and relative azimuth angles for default values. These parameters cannot be defined for RAP data. The user can check the scan mode used on a given day by consulting the CERES Operations in Orbit web site.

- Users should be careful about comparisons of SFC CERES TOA fluxes with ERBE or ERBE-like fluxes. The geographic location of a CERES flux estimate is at the surface geodetic latitude and longitude of the CERES footprint centroid. On ERBE, all fluxes are located at a geocentric latitude and longitude corresponding to the 30-km level. Other differences are expected due to:
    1. The viewing zenith angle cut-off for ERBE-like footprints is 70°. For the Terra SFC, it is limited to 65° in crosstrack mode.
    2. ERBE-like fluxes were derived from ADMs developed from ERBE and NIMBUS-7 data. The SFC fluxes were derived using the new CERES ADMs.

  An overview of the ERBE-like/CERES flux differences can be found in the SSF Edition2 Data Quality Summary

- All CERES footprints with a non-default value of either SW or LW flux have been used as input to the SFC.

- The SFC contains gridded means of all data currently available on the SSF product. Users should consult the SSF Edition2 Data Quality Summary for information concerning the availability and accuracy of individual parameters. For instance, Shortwave Model A surface fluxes are limited to clear-sky footprints. Longwave Model A surface fluxes are also limited to clear-sky footprints. Shortwave Model B and Longwave Model B surface fluxes, however, are available for all-sky.

- The User should be aware that the Terra SFC contains aerosol parameters from MODIS that are not included on the TRMM SFC product. This results in a slight change in the read routines.

Accuracy and Validation

The User should consult the SSF Edition2 Data Quality Summary for information on the accuracy of the data used as input to the SFC. There are no known issues with the accuracy of the sorting and gridding of the data to produce the SFC.

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.

Expected Reprocessing

At this time, there are no scheduled revisions of the CERES Edition3A SFC data set. The CERES Team will continue detailed examination and documentation of the ground calibration and characterization data, as well as the in-flight calibration opportunities. Any future reprocessing of the Terra SSF will require an updated version of the SFC. Notification of any changes will be sent to registered users

Attribution

The CERES Team has gone to considerable trouble to remove major errors and to verify the quality and accuracy of this data. Please provide a reference to the following paper when you publish scientific results with the CERES SFC Edition3A data:

> Wielicki, B. A., B. R. Barkstrom, E. F. Harrison, R. B. Lee III, G. L. Smith, and J. E. Cooper, 1996: Clouds and the Earth's Radiant Energy System (CERES): An Earth Observing System Experiment, Bull. Amer. Meteor. Soc., 77, 853-868.

When Langley ASDC data are used in a publication, we request the following acknowledgment be included: "These data were obtained from the NASA Langley Research Center EOSDIS Distributed Active Archive Center."

The Langley ASDC requests two reprints of any published papers or reports which cite the use of data that we have distributed. This will help us determine the use of data that we distribute, which is helpful in optimizing product development. It also helps us to keep our product related references current.

When referring to a CERES product, please include the satellite name (Terra or Aqua), the dataset version (Edition3A), and the product name (SFC). For example, use CERES Terra Edition3A SFC data.

Feedback and Questions

For questions or comments on the CERES Quality Summary, contact the User and Data Services staff at the Atmospheric Science Data Center.

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