CERES BDS TRMM-PFM Edition1 Data Quality Summary

Investigation:	**CERES**
Data Product:	**BiD**irectional **S**can [BDS]
Data Set:	**TRMM**
Data Set Version:	**Edition1**

Nature of Data Product

The files in this data product contain one day (24 hours) of filtered radiances with geolocations for each footprint. There are three channels for each footprint:

- a total channel (TOT) that covers the wavelength range from about 0.4 microns to beyond 200 microns,
- a shortwave channel (SW) that covers the wavelength range from about 0.4 microns to about 4.5 microns,
- a window channel (WN) that covers the wavelength range from about 8.0 microns to about 12.0 microns

A filtered radiance for a particular channel is the integration over wavelength of the product of radiance and the dimensionless spectral response for that channel.

The data are arranged in 6.6 second scans, with 660 samples per scan. Under normal conditions, the CERES instrument on TRMM uses a Fixed Azimuth Plane Scan (FAPS) mode for two days and Rotating Azimuth Plane Scan (RAPS) mode for one day. A few days have the FAPS scans in the along-track azimuth, during which spatial coverage is extremely limited. Most of the time, the FAPS scans are taken with a cross-track azimuth, so that the footprints nearly cover the swath beneath the satellite from one limb to the other and then back in the reverse direction. The RAPS scans also sample the swath from limb-to-limb, but the spatial coverage has gaps that are scattered across the observable swath. **Data Users are stongly urged to use the field-of-view locations included in this data product rather than attempting to locate the footprints based on satellite orbit, scan elevation angle, and scan azimuth. Data users should note that the colatitude and longitude given in the geolocation have a default coordinate system that is geodetic. In a few cases (such as the viewing angles), the coordinate system may be geocentric. Users of this data should also note that geolocation is generally given for a point on the Earth's surface and for a point on a surface 30 km above the nominal geoid used in ERBE. Users are responsible for taking care to understand and account for differences between geocentric locations and geodetic ones as well as the difference in altitude.**

The CERES Team has gone to considerable effort to remove instrument artifacts from these data. As part of their work, the Team sets quality assessment flags for each measurement. **Data Users are also strongly urged to examine the flags that the CERES Team sets in order to determine if the data for that footprint are good.** For more detailed information regarding the meaning of these flags or for other information about this product, consult the BDS entry in the CERES Data Product Catalog (PDF).

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 which are identical in all aspects of the filename except for the 6 digit configuration code (see Collection Guide) 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. This data set may be referred to as "CERES TRMM Edition1 BDS."

Validation and Quality Assurance Process for this Data Set

The CERES Team has performed the following validation and quality assurance processes on this data set:

- Development of an error budget for the ground and in-flight calibrations
- Determination of instrument offsets using observations of deep space
- Verification of ground calibration transfer to orbit using internal and solar calibration sources in flight
- Monitoring of calibration stability using internal and solar calibration sources in flight
- Verification of geolocation using coast-line crossings

The CERES Team has not yet prepared on-line versions of these studies. Data users who have detailed questions about these studies should consult the Algorithm Theoretical Basis Documents or contact the LaRC DAAC User Services for information a CERES Science Team contact or for other resources that can clarify what has been done.

Current Estimated Uncertainty of Data in this Data Set

Radiometric Uncertainty:

The filtered radiances in this data product's files contain instrument noise, which acts like a Gaussian random variable added to each value. The algorithm that converts the raw instrument counts to filtered radiances also contains uncertainties from several sources:

- sample-dependent offsets - determined through observations of deep space during a TRMM pitchover
- determination of the gain - primarily using ground calibrations that have systematic errors from sources such as blackbody emissivities, calibration masks, and spectral response measurements
- possible changes in instrument radiometric characteristics owing to differences between the space environment and the calibration environment

The CERES team is currently evaluating the ground calibration uncertainties and monitoring the calibrations using internal flight sources and solar calibrations. We recognize that different uncertainties affect measurements with different time and space scales. Measurement precision is the random component of uncertainty for a particular time and space scale. Accuracy is the agreement of an ensemble average of the measurements with true values on the particular time and space scale. For the radiometric measurements in the BDS_TRMM_Edition1 data product, the instrument noise is probably the dominant contributor to the precision, while systematic errors are more likely to affect the gain of the instrument, and thereby its accuracy. The following tables give a more quantitative assessment of the calibration uncertainty, using the concept of a fidelity interval.

Fidelity Intervals. These initial estimates include instrument noise, uncertainty in deep space determination of offsets, and statistical uncertainty in the estimates of the calibration coefficients during ground calibration (primarily instrument gain). Evaluation of the systematic calibration error budget is still underway, and is expected to increase the estimates above those given in the table below. Finally, confidence in the long term instrument stability will depend on the experience gained over several years using the in-orbit calibration sources. To date, the first six months of in-orbit calibrations of all three channels are statistically consistent with the ground determined instrument gain values. Consistency is within roughly 0.5% or better. The fidelity intervals are intended to convey the upper and lower bounds of filtered radiance within which the true value might lie for a particular measurement in the data files. They are symmetric about the measured value, so the tables contain only one-sided intervals. For example, for a total filtered radiance value of 30 W/m**2/sr, the true value is likely to be between 30 - 0.34 W/m**2/sr and 30 + 0.34 W/m**2/sr with a probability of 99.7%. Roughly speaking, the fidelity interval we quote is a "3 sigma" value.

Total Channel

Total Filtered Radiance in File [W/m**2/sr]	30	60	90	120	150
Filtered Radiance Interval with 99.7% Probability true Filtered Radiance is this close [W/m**2/sr]	0.34	0.33	0.32	0.33	0.35

Shortwave Channel

Shortwave Filtered Radiance in File [W/m**2/sr]	0	10	25	35	45
Filtered Radiance Interval with 99.7% Probability true Filtered Radiance is this close [W/m**2/sr]	0.12	0.11	0.11	0.11	0.12

Window Channel

Window Filtered Radiance in File [W/m**2/sr/micron]	1.5	3	5	7.5	10
Filtered Radiance Interval with 99.7% Probability true Filtered Radiance is this	0.030	0.029	0.029	0.029	0.032

close [W/m**2/sr/micron]					

Geolocation Uncertainty

The footprints in these data sets have a colatitude and longitude identified at the centroid of the Point Spread Function (PSF) (figure 1-5 in the Subsystem 1.0 ATBD provides an illustration of the PSF). There are two independent degrees of freedom associated with this centroid. Using the coast-line validation approach to provide an estimate of geolocation uncertainty, the CERES Team has apportioned these uncertainties into a component in the scan direction and a component perpendicular to the scan direction. See "Quick Look Results - Data Validation" for visualization of sample coast-line measurements.

Component	Angular Bias	Nadir Location Bias	Standard Deviation
Along-Scan	-0.095 degrees	-0.58 km	1.11 km
Across-Scan	+0.078 degrees	+0.48 km	1.08 km

Cautions Regarding Use of BDS_TRMM_Edition1 Data

No special cautions are noted at this time. Data users need to be aware of CERES spectral response tabulations for each channel when they apply filtered radiances to such investigations as verifying agreement with theoretical radiative transfer calculations (for a figure showing the spectral response of each channel, see the Subsystem 1.0 ATBD.

Expected Revisions of BDS_TRMM_Edition1 Data

At this time, there are no scheduled revisions of the **BDS_TRMM_Edition1** data. The CERES Team will continue detailed examination and documentation of the ground calibration and characterization data, as well as the in-flight calibration opportunities. 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 BDS_TRMM_Edition1 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 DAAC 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 DAAC 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.

Feedback:

For questions or comments on the CERES Quality Summary, contact NASA Langley DAAC User and Data Services.

Document Creation Date: 10/21/1998
Modified: 01/05/2000, 04/28/2000, 12/20/2000 (non-science related update), 08/27/2001 (non-science related update); Dec 12, 2001
Most Recent Update: December 12, 2001