

CERES shortwave (SW), longwave (LW), and window (WN) channel radiative fluxes are derived from empirical Angular Distribution Models (ADMs) that convert a measured radiance in a given Sun-Earth-satellite viewing configuration to a top-of-atmosphere (TOA) radiative flux. Recently, a new set of ADMs were developed from 9 months of CERES-TRMM SSF measurements over the Tropics (Loeb et al., 2003a,b). These ADMs were used to generate TOA fluxes on the CERES-TRMM Edition2B SSF product. The TRMM ADMs were also used to produce TOA fluxes for the CERES-Terra Edition1A SSF product while a new set of global ADMs based on CERES/Terra data were being developed.

The new global CERES/Terra ADMs are now complete and are being used to generate TOA fluxes on the CERES-Terra Edition2A SSF product. The new ADMs are based on 32 months (Mar 2000 - Oct 2002) of CERES-Terra Edition1A SSF data. The main features of the new Terra ADMs are:

- Empirical ADMs over snow and sea-ice.
- Increased angular resolution in nonpolar regions (2 degrees).
- Use of "continuous" SW and LW ADM scene types over ocean, land, and desert.
- Monthly 1 degree regional clear land+desert ADMs.
- Neural network scheme to improve TOA flux estimates for footprints with excessive "no retrievals". No retrievals can occur when imager data is missing or when the cloud algorithm cannot provide a physical retrieval. If the scene characteristics over 35% or more of a CERES FOV are unknown, TOA fluxes are estimated using a neural network scheme. Approximately 3% of the CERES data fall in this category.

Caution: During the processing of SSF Edition2A, an error was detected in the SW TOA flux code for CERES FOVs that are cloudy over land and desert. The error is most pronounced for optically thin cloud over bright background surfaces, with instantaneous TOA flux errors reaching 25%. [View a [summary of the error](#) (PDF).] Regional average errors of instantaneous TOA fluxes (at the Terra overpass time) are determined by comparing 1° latitude-longitude averages of fluxes from the Edition2A code ("original") and a corrected version of the code ("corrected"). The regional errors are most pronounced over central Africa, reaching 7 W m⁻² in some 1° regions. The regional average error over all land and desert is approximately 1 W m⁻². In terms of 24-hour average regional errors, these correspond to approximately 2 W m⁻² errors over central Africa and 0.3 W m⁻² for all land and desert surfaces. The global 24-hour average SW flux error due to the code bug is approximately 0.1 - 0.2 W m⁻².

Plans are underway to produce an updated SSF with a correct version of the production code in Spring or Summer 2004. This new version will be called Edition2B and will supersede SSF Edition2A.

The tables below provide additional details on Terra ADM scene classification and validation results. Further details can be found in the following CERES Science Team Meeting presentations:

- [Development of New CERES/Terra Angular Distribution Models](#) - Fall 2002 (PDF)
- [TOA Radiative Flux Estimation From CERES Angular Distribution Models](#) - Spring 2003 (PDF)
- [TOA Radiative Flux Estimation From CERES/Terra Angular Distribution Models](#) - Fall 2003 (PDF)

CERES/Terra Shortwave Channel ADMs for Different Scene Types

| Scene Type | Description |
|---------------------|---|
| Clear Ocean | Function of wind speed; Correction for aerosol optical depth included. |
| Cloud Ocean | Function of cloud phase; Continuous function of cloud fraction and cloud optical depth (5-parameter sigmoid). |
| Land & Desert Clear | 1°- regional monthly ADMs using Analytical Function of TOA BRDF (Ahmad and Deering, 1992). |
| Land & Desert Cloud | Function of cloud phase; continuous function of cloud cover and cloud optical depth; used 1°-regional clear-sky BRDFs to account for background albedo. |

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|----------------|--|
| Permanent Snow | Function of Cloud Fraction, Surface Brightness, cloud optical depth |
| Fresh Snow | Function of Cloud Fraction, Surface Brightness, Snow Fraction, cloud optical depth |
| Sea-Ice | Function of Cloud Fraction, Surface Brightness, Ice Fraction, cloud optical depth |

CERES/Terra Longwave and Window Channel ADMs for Different Scene Types

| Scene Type | Description |
|-------------------------------------|---|
| Clear Ocean, Land, Desert | Function of Ocean, Forest, Cropland/Grass, Savanna, Bright Desert, Dark Desert, precip. water, lapse rate, skin temperature. |
| Clouds Over Ocean, Land Desert | Function of precip. water, skin temp, sfc-cloud temp. diff; continuous function of parameterization involving cloud fraction, cloud and sfc emissivity, sfc and cloud temp. |
| Permanent Snow, Fresh Snow, Sea-Ice | Each a function of cloud fraction, sfc temp, sfc-cld temp diff |

CERES/Instantaneous SW TOA flux uncertainties for Terra and TRMM ADMs

| Region | S ₀ W m ⁻² | Terra ADMs W m ⁻² (%) | | TRMM ADMs W m ⁻² (%) | |
|---------|----------------------------------|----------------------------------|------------|---------------------------------|------------|
| | | Clear-Sky | All-Sky | Clear-Sky | All-Sky |
| Tropics | 1150 | 5.2 (2.2) | 14.3 (5.1) | 7.7 (3.5) | 14.3 (5.8) |
| Midlat | 870 | 4.2 (3.0) | 13.5 (3.9) | 7.3 (5.6) | 13.7 (4.1) |
| Polar | 540 | 12.8 (4.3) | 17.3 (5.9) | 37.0 (11.7) | 29.2 (9.8) |

CERES/Instantaneous LW TOA flux uncertainties for Terra ADMs

| Region | Terra ADMs W m ⁻² (%) | | TRMM ADMs W m ⁻² (%) | |
|---------|----------------------------------|-----------|---------------------------------|-----------|
| | Clear-Sky | All-Sky | Clear-Sky | All-Sky |
| Tropics | 3.3 (1.1) | 5.1 (1.8) | 3.4 (1.1) | 5.3 (1.9) |
| Midlat | 2.9 (1.0) | 5.4 (2.3) | 2.7 (1.0) | 5.6 (2.2) |
| Polar | 3.4 (1.6) | 4.0 (2.0) | 3.3 (1.4) | 5.0 (2.3) |

Uncertainties in Regional Mean SW TOA fluxes (24-hour averages)

| | December 2001 | | June 2002 | |
|------------|---------------|--------------|-----------|--------------|
| | Mean Bias | Regional RMS | Mean Bias | Regional RMS |
| TRMM ADMs | 0.21 | 1.77 | -0.85 | 1.89 |
| Terra ADMs | -0.42 | 0.89 | -.056 | 0.96 |

Uncertainties in Regional Mean Daytime LW TOA fluxes

| | December 2001 | | June 2002 | |
|------------|---------------|--------------|-----------|--------------|
| | Mean Bias | Regional RMS | Mean Bias | Regional RMS |
| TRMM ADMs | -0.13 | 1.45 | 0.35 | 1.32 |
| Terra ADMs | -0.04 | 0.93 | 0.26 | 0.82 |

Uncertainties in Regional Mean Nighttime LW TOA fluxes

| | December 2001 | | June 2002 | |
|------------|---------------|--------------|-----------|--------------|
| | Mean Bias | Regional RMS | Mean Bias | Regional RMS |
| TRMM ADMs | 0.28 | 1.63 | 0.69 | 1.37 |
| Terra ADMs | -0.1 | 1.34 | 0.24 | 1.02 |

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