

“The diurnally complete CERES radiative flux and cloud product”

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ABSTRACT

The Clouds and the Earth's Radiant Energy System (CERES) project has now surpassed the 10-year mark, has combined rigorous calibration, improved scene identification, and multi-satellite data fusion to produce a climate-accuracy data set of global 1° gridded radiative surface and TOA fluxes, and cloud properties. CERES provides the climate community with four observed TOA flux products. The ERBE-like product uses the same algorithms as ERBE in order to be compared with the ERBE time period. The SSF product uses the improved scene identification and radiance to flux conversion. The SYN product uses GEO derived clouds and fluxes to provide diurnally complete TOA fluxes. The EBAF product provides net balanced fluxes tied to the ocean heat storage term. This product is suited for climate modelers estimating the global mean energy budget. Each successive CERES flux product applies the improvements over the previous product. This presentation will focus on the diurnal averaging improvements by the inclusion of imager radiances from 5 geostationary (GEO) satellites at 3-hourly intervals to estimate the flux in between CERES observations. The regional monthly mean flux differences based on SYN (CERES/GEO) and SSF (CERES-only) can exceed 20 Wm⁻².

CERES shortwave and longwave fluxes have been rigorously validated and are key elements in evaluating the ability of climate models to predict both past and future climate states. The CERES normalization of GEO derived fluxes in order to maintain the CERES instrument calibration and are consistent globally within 0.1 Wm⁻², even if the GEO calibration is artificially altered by ±5%, twice the anticipated calibration error. The predicted GEO TOA fluxes normalized to Terra have been compared at Aqua times to Aqua flux observations, as well as with GERB hourly fluxes over the METEOSAT domain. Similarly ground based radiometers have been used to validate the CERES radiative transfer computed surface fluxes and have confirmed that the CERES/GEO fluxes have improved the computed surface flux product. Although the GEO based fluxes are of inferior quality then the CERES observed fluxes, they capture the diurnal signal more effectively than using constant meteorology between CERES measurements. The validation of the GEO derived fluxes and clouds will be shown.