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Earth Radiation Budget Experiment (ERBE) reprocessing using Clouds and the Earth's Radiant Energy System (CERES) angular distribution models

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NASA's Earth Radiation Budget Experiment (ERBE) scanning broadband radiometers flew on board the NOAA 9 (Feb 1985 to Jan 1987) and NOAA 10 (Jan 1987 to May 1989) and measured broadband shortwave ($\sim$0.2 μm to 5 μm), longwave (4 μm to 200 μm) and total radiances. While the observations provided solid evidence of the cooling effect to the Earth system by clouds, the uncertainty of cloud radiative effects by region or by cloud type is large compared to those derived more recently from NASA's Clouds and the Earth Radiant Energy System (CERES) observations. In ERBE, top-of-atmosphere (TOA) irradiances were derived by applying 12 scene-type dependent anisotropic directional models (ADMs). Scene type viewed by ERBE scanners was estimated from broadband radiances using a maximum likelihood estimate method (Wielicki and Green, 1989). In this study, we use data taken by Advanced Very High Resolution Radiometer (AVHRR) on board the NOAA-9 and 10 satellites to derive cloud properties similar to those produced by the CERES cloud algorithm, which utilizes Moderate Resolution Imaging Spectrometer (MODIS) data collocated within the larger CERES footprints. The CERES-MODIS cloud retrieval algorithm has been adapted to operate with the available spectral channels on AVHRR. This allows direct application of newer CERES ADMs to ERBE scanner radiances, which in turn reduces the uncertainty in the TOA irradiances. We describe the process of applying CERES ADMs and present the difference between TOA irradiances derived from CERES ADMs and ERBE-derived irradiances.

Reference

Wielicki, B. A., and R. N. Green, 1989: Cloud identification for ERBE radiative flux retrieval, J. Appl. Meteor., 28, 1133-1146.