Geophysical Research Abstracts
Vol. 20, EGU2018-3685, 2018
EGU General Assembly 2018

Recent Science Highlights from the Clouds and the Earth's Radiant Energy System (CERES)

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Earth's climate is determined by the exchange of radiant energy between the Sun, Earth and space. The absorbed solar radiation at the top-of-atmosphere (TOA) fuels the climate system, providing the energy required for atmospheric and oceanic motions. Earth's radiation budget (ERB) involves a balance between how much solar energy Earth absorbs and how much terrestrial thermal infrared radiation is emitted to space. Because of its critical role in climate, continuous monitoring of the ERB is necessary for improved understanding and prediction of climate variability and change.

A central objective of the Clouds and the Earth's Radiant Energy System (CERES) is to produce a long-term global climate data record of Earth's radiation budget along with the associated atmospheric and surface properties that influence it. CERES data products utilize a number of data sources, including scanning broadband radiometers measuring incoming and reflected solar radiation and OLR, polar orbiting and geostationary spectral imagers, meteorological, aerosol and ozone assimilation data, and snow/sea-ice maps based on microwave radiometer data.

In this presentation, we highlight recent scientific findings based upon the CERES record. We examine how the planetary heat uptake of Earth has varied using CERES data for 2000 onwards and compare with in-situ measurements of ocean heat uptake from Argo. We also discuss how the CERES observations are being used to reduce uncertainties in climate model projections of the temperature response to CO_2 doubling by constraining cloud feedback, the largest source of uncertainty in climate models. Finally, as there has been growing interest recently in using broadband nonscanner instruments to measure Earth's Energy Imbalance, we also discuss the challenges involved with that approach in light of experience with the 20-year nonscanner record from the Earth Radiation Budget Experiment (ERBE).