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An Evaluation of Satellite-Based and Re-Analysis Radiation Budget Datasets Using CERES EBAF Products

Shashi Gupta (1), Paul Stackhouse (), Takmeng Wong (), Colleen Mikovitz (), Stephen Cox (), and Taiping Zhang ()

(1) Science Systems and Applications, Inc., Suite 200, Hampton, VA, 23666, United States (Shashi.K.Gupta@nasa.gov), (2) Science Directorate, NASA Langley Research Center, MS 420, Hampton, VA 23681, United States (paul.w.stackhouse@nasa.gov), (3) Science Directorate, NASA Langley Research Center, MS 420, Hampton, VA 23681, United States, (4) Science Systems and Applications, Inc., Suite 200, Hampton, VA, 23666, United States, (5) Science Systems and Applications, Inc., Suite 200, Hampton, VA, 23666, United States, (6) Science Systems and Applications, Inc., Suite 200, Hampton, VA, 23666, United States

Top-of-atmosphere (TOA) and surface radiative fluxes from CERES Energy Balanced and Filled (EBAF; Loeb et al., 2009; Kato et al. 2013) products are used to evaluate the performance of several widely used long-term radiation budget datasets. Two of those are derived from satellite observations and five more are from re-analysis products. Satellite-derived datasets are the NASA/GEWEX Surface and TOA Radiation Budget Dataset Release-3 and the ISCCP-FD Dataset. The re-analysis datasets are taken from NCEP-CFSR, ERA-Interim, Japanese Re-Analysis (JRA-55), MERRA and the newly released MERRA2 products. Close examination is made of the differences between MERRA and MERRA2 products for the purpose of identifying improvements achieved for MERRA2. Many of these datasets have undergone quality assessment under the GEWEX Radiative Flux Assessment (RFA) project. For the purposes of the present study, EBAF datasets are treated as reference and other datasets are compared with it. All-sky and clear-sky, SW and LW, TOA and surface fluxes are included in this study.

A 7-year period (2001-2007) common to all datasets is chosen for comparisons of global and zonal averages, monthly and annual average timeseries, and their anomalies. These comparisons show significant differences between EBAF and the other datasets. Certain anomalies and trends observed in the satellite-derived datasets are attributable to corresponding features in satellite datasets used as input, especially ISCCP cloud properties. Comparisons of zonal averages showed significant differences especially over higher latitudes even when those differences are not obvious in the global averages. Special emphasis is placed on the analysis of the correspondence between spatial patterns of geographical distribution of the above fluxes on a 7-year average as well as on a month-by-month basis using the Taylor (2001) methodology. Results showed that for 7-year average fields correlation coefficients between spatial patterns exceed 0.95 for all fluxes with very few exceptions.

References:
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