



The NASA GEWEX Surface Radiation Budget Project: Dataset Validation and Climatic Signal Identification

T. Zhang (1), P. W. Stackhouse, Jr. (2), S. K. Gupta (1), S. J. Cox (1), and J. C. Mikovitz (1)

(1) SSAI/NASA Langley, Radiation and Aerosol, Hampton, VA, United States (Taiping.Zhang@NASA.gov), (2) NASA Langley Research Center

The NASA GEWEX-SRB (Global Energy and Water cycle Experiment - Surface Radiation Budget) project has produced and archived shortwave and longwave radiative fluxes at the top of atmosphere (TOA) and the Earth's surface at a 1 degree latitude by 1 degree longitude resolution continuously for a time span of 24.5 years from January 1983 to December 2007. The latest version of the data in archive is Release 3.0 and is available as 3-hourly, daily and monthly means.

Primary inputs to the algorithms used to produce the data include: shortwave and longwave radiances from the ISCCP-DX data (the International Satellite Cloud Climatology Project data at the pixel level), cloud and surface properties derived therefrom, temperature and moisture profiles from GEOS-4 reanalysis product obtained from the NASA Global Modeling and Assimilation Office (GMAO), and column ozone amounts constituted from Total Ozone Mapping Spectrometer (TOMS), TIROS Operational Vertical Sounder (TOVS) archives, and Stratospheric Monitoring-group's Ozone Blended Analysis (SMOBA), an assimilation product from NOAA's Climate Prediction Center.

To quantitatively determine the reliability of the GEWEX-SRB data, extensive validation of the data has been performed against the ground-based Baseline Surface Radiation Network (BSRN) data, for which 5969 site-months of data from the BSRN archive (as of August 2011) from 52 BSRN sites located on all seven continents have been used. Quality check is first performed on the original BSRN data records which are at 1-, 2-, 3-, or 5-minute intervals, removing records which fail the tests by 11 quality flags. The data are then processed to produce 3-hourly, daily and monthly means. Criteria are designed to deal with missing records in the original data. Hourly interpolations are used when necessary and feasible. Information regarding missing records and interpolations is saved in output results to allow possible evaluation of reliability of the individual values in the output results. The BSRN 3-hourly, daily and monthly means are then compared with their GEWEX SRB counterparts. The roles of cloud conditions, latitudinal zones, and surface types in affecting the level of agreement are examined. In particular, the cloud conditions include all-sky as well as clear-sky conditions of two types, the actually observed clear-sky condition and the theoretically estimated one regardless of the actual cloud amount. The GEWEX SRB dataset is found to be in generally good agreement with the BSRN data.

The GEWEX SRB dataset is then investigated from the perspective of global climate change. Trends at individual sites, on hemispherical and global scales are computed from the 24 complete years of the data record. Thanks to the more or less continuous records at some of the BSRN sites, the derived trends from the satellite data can also be compared with those from the ground-based measurements.

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