Surface Radiation Budget (SRB)

Description:

The NASA/GEWEX Surface Radiation Budget (SRB) project computes Top-of-atmosphere and Surface radiative fluxes at a 1^o x 1^o spatial scale for both shortwave (0.28 – 4 mm) and longwave (4 – ∞ mm) wavelengths. All products are computed at a base temporal resolution of 3-hourly and these are subsequently used to produce daily, monthly-averaged 3-hourly, and monthly averages. SRB uses the International Satellite Cloud Climatology Project (ISCCP, http://isccp.giss.nasa.gov/) as input for global satellite visible and infrared radiances. SRB processes the 3-hourly ISCCP "DX" or pixel data sets using the ISCCP cloud detection to group radiances in clear and cloudy classes and the ISCCP clear-sky composite radiances to establish background reflectances and skin temperatures. For the SW algorithm, clear and cloud radiances are used with ERBE angular distribution models and narrowband-to-broadband fits to estimate the TOA clear and cloud albedos (Pinker and Laszlo, 1992). Using these TOA albedos together with atmospheric and surface information from other inputs, a radiative transfer model lookup table is used to infer the SW TOA and surface fluxes. The LW algorithm uses ISCCP retrievals of visible optical depth and/or cloud top temperatures to constrain water and ice cloud optical properties. In addition, the LW algorithm applies a maximum-random overlap scheme to the cloud scenarios. SRB computes flux estimates at every time step using a radiative transfer model (Fu *et al*., 1997) with the cloud scenarios, atmospheric temperature, water vapor profiles and surface skin temperatures. The meteorological information, including temperature and humidity profiles, are taken from NASA's Global Modeling and Assimilation Office Goddard Earth Observing System v4 assimilation data sets (GMAO GEOS-4). The current algorithm uses either ISCCP retrieved skin temperatures or GEOS-4 skin temperatures depending on surface and cloud conditions. SRB also runs heritage SW and LW surface flux only algorithms for redundancy and comparison with both the main GEWEX algorithms and the CERES project running similar algorithms (Gupta *et al*., 1992 – LW, 2001 – SW). SRB is currently developed and maintained NASA Langley Research Center (email: paul.w.stackhouse@nasa.gov). More information on SRB is available at http://gewex-srb.larc.nasa.gov.

Data availability:

The current SRB Release 3.0 data sets provide the 3-hourly and other temporally averaged data products from July 1983 through December 2007. The data products are available in binary and netCDF formats at http://eosweb.larc.nasa.gov/PRODOCS/srb/table_srb.html. Older versions of the data sets are available at this website upon request. A special 10 year GEOS-4 skin temperature only data set is also available at this website.

Quality:

The quality of the downward surface products was assessed by comparisons with corresponding ground-measured fluxes over a period of sixteen years (1992-2007) from a

number of sites of the Baseline Surface Radiation Network (BSRN). From the aggregate data set for all monthly averaged sites and years, SW mean bias and RMS differences relative to all available site measurements is -4.2 W m^{-2} (-2.5%, model fluxes lower) and 23.1 W m^{-2} (13.5%) respectively. LW monthly mean bias and RMS differences relative to all available site measurements are -0.1 W m^{-2} (-0.02%, model fluxes higher) and 11.2 W m^{-2} (3.6%) respectively.

The data quality is affected by changes in the observing system and input data sets. For the period July 1983 – June 1998 (with the exception of April 1988 – March 1989), there is a coverage gap between geosynchronous satellites, centered on the meridians of the Indian subcontinent. Polar orbiting satellites cover the gap with several overpasses per day, but noticeable spatial discontinuities result. Transitions between various satellites have also been observed to cause temporal discontinuities in the flux products, the largest being the transition in January 2006, when the ISCCP reference polar orbiting satellite transitions from NOAA-16 to NOAA-18. The result is a reduction of globally averaged SW surface fluxes on the order of 1 W m^{-2}, with locally higher amounts, especially over ocean. In October 2001, the TOVS algorithm used by ISCCP for atmospheric temperature and water vapor was abruptly changed, causing 2-5 W m^{-2} flux zonal discontinuities over tropical land areas for surface upward LW fluxes.

Relationship to other GEWEX products:

SRB uses ISCCP data for input and observations from BSRN for validation. SRB provides SW fluxes to the SEAFlux project.

References:

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