

## Validation of Three Satellite-Estimated Downward Shortwave Radiation Datasets Over Land Surface

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### **ABSTRACT:**

This paper validates three satellite-estimated downward shortwave radiation datasets using in-situ measurements from 1999 to 2002. The satellite-estimated datasets include: the Global Energy and Water cycle Experiment -Surface Radiation Budget (GEWEX-SRB V3.0), International Satellite Cloud Climatology Project-Flux Data- Surface Radiative Fluxes (ISCCP-FD-SRF), the Clouds and the Earth's Radiant Energy System-Monthly Gridded Radiative Fluxes and Clouds (CERES-FSW). These datasets are at different spatial and temporal resolutions, and the evaluation is performed at their native resolutions. In-situ measurements at North America from SURFRAD, at Tibetan Plateau, South Asia, Mongolia and North Siberia from GAME/AAN, at Amazon from AERONET are selected to evaluate the satellite-estimated datasets. Totally 25 sites around the world represent different kinds of climate, landcover and terrain. Validation results indicate that, in general, GEWEX-SRB and ISCCP-FD data compare much more favorably with surface measurements than FSW data. GEWEX-SRB and ISCCP-FD agree well at North America and Mongolia while CERES-FSW has a  $24\text{W/m}^2$  or 4% mean bias at North America and  $38\text{W/m}^2$  or 6.5% mean bias in Mongolia. At Tibetan Plateau, the region of great variation in elevation, GEWEX-SRB and ISCCP-FD slightly underestimate at most sites while CERES-FSW overestimate and have low  $R^2$  at most sites. Biases of FSW in Tibetan Plateau range from  $-46.4\text{W/m}^2$  to  $91.6\text{W/m}^2$  with an absolute average of  $45\text{W/m}^2$  or 6.6%. Both ISCCP-FD and CERES-FSW exceed the surface observation at Amazon while GEWEX-SRB slightly underestimate the radiation at most sites in that region, but GEWEX-SRB has the highest accuracy of the three with absolute average bias of  $8.6\text{W/m}^2$  or 2%. All three data estimate well at North Siberia and FD has the highest accuracy with an absolute average bias of  $4.5\text{W/m}^2$  or 2.5%. But in South Asia, all three data have large bias and FSW is the worst with an average bias of 17% and very low  $R^2$ . Validation suggests that these three satellite-estimated datasets have comparatively low accuracy at low latitude cloudy regions and high elevation regions although they have high accuracy at many other regions. And CERES-FSW data has large errors at Tibetan Plateau and South Asia. Another problem about the data organization is also found in CERES-FSW. Data belong to next month may appear in last month's file. Therefore, special attention should be given when using CERES-FSW data.

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absolute average bias: the average bias are calculated using the absolute value of each bias  
 $R^2$  is the coefficient of determination

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