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Towards Observation-Based Time Series for the Partitioning of Solar Energy in the Climate System

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The partitioning of incoming solar energy between absorption in the atmosphere, absorption at the surface, and reflection back to space is a key aspect of energy balance studies. Although the partitioning of solar radiation is well understood in terms of long-term climatological means, the temporal variations are not yet well enough constrained by observations to allow thorough climate change studies.

We extend the climatological approach of Hakuba, et al. (2014) to monthly mean time series and combine homogeneous, representative, and bias-corrected surface solar radiation station data from the the Baseline Surface Radiation Network (BSRN) and the Global Energy Balance Archive (GEBA) with top of the atmosphere flux data from the Clouds and Earth's Radiant Energy System (CERES) and Moderate-resolution Imaging Spectroradiometer (MODIS) albedo data to calculate monthly mean time series for the partitioning of solar radiation in the climate system.

The combined time series cover a time period from 2000 to 2015. Due to the use of GEBA and BSRN data, we are able to derive observation based time series of atmospheric absorption of solar radiation for many regions around the globe including an uncertainty estimate. We use these time series to conduct climatological, seasonal, and trend analyses.

References:

Hakuba, M. Z., Folini, D., Schaepman-Strub, G., and Wild, M. (2014). Solar absorption over Europe from collocated surface and satellite observations. Journal of Geophysical Research: Atmospheres, 119, 3420–3437, DOI: 10.1002/2013JD021421