Geophysical Research Abstracts
Vol. 14, EGU2012-7893, 2012
EGU General Assembly 2012

Solar absorption estimated from surface radiation measurements and collocated satellite products

M. Z. Hakuba (1), M. Wild (1), D. Folini (1), A. Sanchez-Lorenzo (1), and G. Schaepman-Strub (2)

(1) Institute for Atmospheric and Climate Science, ETH Zurich, Zurich, Switzerland, (2) Institute of Evolutionary Biology and Environmental Studies, University of Zurich, Zurich, Switzerland

The Earth's climate and life-relevant processes are governed by the incoming solar radiation as part of the global energy balance. Changes in the atmospheric energy budget largely affect the global climate and hydrological cycle, but the quantification of the different energy balance components is still afflicted with large uncertainties. The overall aim of the research presented here is an improved understanding of the mean state and spatio-temporal variations of the global energy balance through reducing the uncertainties in one of its components, i.e. the absorption of solar radiation within the climate system.

To quantify the solar absorption at the surface and within the atmospheric column, we combine the worldwide surface radiation measurements of the Global Energy Balance archive (GEBA) and Baseline Surface Radiation Network (BSRN) with collocated satellite-inferred surface albedo and top-of-atmosphere (TOA) radiation data (MODIS, CERES).

Our analysis of the present mean state, temporal and spatial variability during the last decade (2000-2010) focuses on Europe and Asia, and will expand worldwide in a later step.

We examined the quality and homogeneity of station records beyond 2000 provided by GEBA to identify a subset of station records of sufficient quality. We find the vast majority of monthly records to be suitable for our purposes. The considered GEBA sites indicate overall positive trends in Europe, and mostly negative trends over Asia during the last decade (2000-2010).

To derive the surface solar absorption at the measurement sites, we intend to combine the shortwave fluxes with the collocated surface albedo from MODIS. The MODIS products include the so-called black-sky albedo (under the assumption of direct radiation only) and white-sky albedo (under diffuse isotropic conditions). The majority of GEBA sites comprises only global radiation data, which do not differentiate between direct and diffuse components. To determine solar absorption from the global radiation records only, the blue-sky albedo is needed, a linear combination of white- and black-sky albedo based on the ratio of diffuse and direct illumination. To circumvent the determination of blue-sky albedo, we first tested the accuracy of combining white-sky albedo with global radiation (BSRN) only (1), and compared the results to the more sophisticated approach of combining black- and white sky albedo from MODIS with BSRN direct and diffuse radiation records (2). We find a monthly bias of around -1 W/m2 between the mean surface absorption derived by approach (1) and approach (2) averaged over 30 BSRN sites. Thus, the more simple approach (1) might be justified to estimate surface solar absorption at the GEBA sites, and to further combine it with the TOA radiation (CERES) to quantify the solar absorption in the atmospheric column.