Geophysical Research Abstracts
Vol. 14, EGU2012-4770-2, 2012
EGU General Assembly 2012

Surface solar radiation in the Tibetan Plateau from observations, reanalysis and model simulations

Q. You (1,2), A. Sanchez-Lorenzo (3), M. Wild (3), D. Folini (3), and K. Fraedrich (1)

(1) Meteorological Institute, KlimaCampus, University of Hamburg, Hamburg 21044, Germany, (2) Laboratory of Tibetan Environment Changes and Land Surface Processes, Institute of Tibetan Plateau Research, Chinese Academy of Sciences (CAS), Beijing 100085, China, (3) Institute for Atmospheric and Climate Science, ETH Zurich, Zurich, Switzerland

In this study, the annual and seasonal variations of all-sky and clear-sky surface solar radiation (SSR) in the eastern and central Tibetan Plateau (TP) during the period 1960-2009 are investigated, based on surface observationaldata, reanalyses and simulations with the global climate model ECHAM5-HAM. The observed mean all-sky SSR annual series shows a decreasing trend with a rate of -1.00 W m-2 decade-1, which is mainly seen in autumn and secondly in summer and winter. A stronger decrease of -2.80 W m-2 decade-1 is found in the clear-sky SSR observations, especially during winter and autumn. It is noticeable that in the clear-sky SSR series the signature of three major volcanic eruptions has been detected: Agung (1963), El Chichon (1982) and Pinatubo (1991). The comparisons with reanalysis show that both NCEP/NCAR and ERA-40 reanalyses cannot capture the decadal variations of observed all-sky and clear-sky SSR. This is probably due to a lack of temporal resolution in the aerosols emissions included in the reanalysis assimilation model, suggesting that SSR from reanalysis cannot be used to analyse surface fluxes to force physical models. The simulated ensemble SSR with the ECHAM5-HAM at both all-sky and clear conditions agree with the dimming shown by the surface observation, especially after 1980. Ensembles of transient sensitivity experiments with the ECHAM5-HAM model show that increasing aerosol emissions, such as sulfur dioxide, organic carbon and black carbon, enlarge the aerosol optical depth (AOD) at 550 nm in the TP. Equally, this increase in aerosol emissions result in a decrease of the simulated all-sky and clear-sky SSR in the TP, but less pronounced than in East China and North India.