



Surface shortwave irradiance over the Tibet Plateau from ISCCP-D1 data

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Shortwave (0.2-4.0 μm) irradiance at the surface was estimated from the D1 data of the International Satellite Cloud Climatology Project (ISCCP) for the period of July 1983 – December 2004. The algorithm used for estimating the irradiance accounts for changes in surface air pressure, absorption by water vapor and ozone and for scattering and absorption by aerosol and cloud. Clouds are placed in the atmosphere according to the top heights reported in the ISCCP data, while their geometrical thickness is prescribed. The algorithm is initialized with monthly climatology of aerosol amount obtained from chemical transport models. The propagation of shortwave radiation in a vertically layered, horizontally inhomogeneous scattering and absorbing atmosphere is calculated using the delta-Eddington approximation of radiative transfer. Monthly means of surface irradiances derived for two sites at the Tibet Plateau are compared to those with the ISCCP-FD satellite estimates and with ground observations. The latter data are from the GEWEX (Global Energy and Water cycle Experiment) Asian Monsoon Experiment (GAME) Asian Automatic weather station Network (AAN) collection. The comparison shows a good agreement, $\sim 8\text{-Wm}^{-2}$ bias error, between the satellite estimate and ground observation. This bias represents a $\sim 40\text{-Wm}^{-2}$ improvement over an earlier estimate that did not account for varying surface elevation and used overly simplistic aerosol climatology for initialization. However, except for winter months, the new estimates are still smaller than the observed shortwave irradiances. Further analysis revealed that the reduction in bias is mostly due to accounting for the actual surface elevation.