

Application of a global-to-beam irradiance model to the NASA GEWEX SRB dataset: An extension of the NASA Surface meteorology and Solar Energy datasets

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Abstract

The DIRINDEX model was designed to estimate hourly solar beam irradiances from hourly global horizontal irradiances. This model was applied to the NASA GEWEX SRB (Rel. 3.0) 3-hourly global horizontal irradiance data to derive 3-hourly global maps of beam, or direct normal, irradiance for the period from January 2000 to December 2005. The DIRINDEX model is a combination of the DIRINT model, a quasi-physical global-to-beam irradiance model based on regression of hourly observed data, and a broadband simplified version of the SOLIS clear-sky beam irradiance model. In this study, the input variables of the DIRINDEX model are 3-hourly global horizontal irradiance, solar zenith angle, dew-point temperature, surface altitude, surface pressure, sea-level pressure, aerosol optical depth at 700 nm, and atmospheric column water vapor. The resulting values of the 3-hourly direct normal irradiance are then used to compute daily and monthly means. The results are validated against the ground-based BSRN data. The monthly means show better agreement with the BSRN data than the results from an earlier endeavor which empirically derived the monthly mean direct normal irradiance from the GEWEX SRB monthly mean global horizontal irradiance. To assimilate the observed information into the final results, the direct normal fluxes from the DIRINDEX model are adjusted according to the comparison statistics in the latitude-longitude-cosine of solar zenith angle phase space, in which the inverse-distance interpolation is used for the adjustment. Since the NASA Surface meteorology and Solar Energy derives its data from the GEWEX SRB datasets, the results discussed herein will serve to extend the former.