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Evaluation of the Reanalysis Clear Sky Surface Incident Solar Radiation Products Over the Tibetan Plateau

Shuhua Zhang (1), Xingong Li (2), and Jiangfeng She (1)

(1) School of Geography and Ocean Science, Nanjing University, (zhangshuhua11@mails.ucas.ac.cn), (2) Department of Geography and Atmospheric Science, University of Kansas

Solar radiation is a key component of the surface energy balance, as well as a primary driver of ecological and hydrological processes. In Tibetan Plateau, solar radiation shows large heterogeneity over spatial due to topographic reliefs and terrain shading effects. Although the limited stations in Tibetan Plateau can be used to validate the reanalysis solar radiation products, the spatial scale mismatch issue between site and reanalysis products leads to uncertainty in the evaluation. In this paper, we proposed an integrated evaluation method for reanalysis clear sky surface incident solar radiation in Tibetan Plateau. Firstly, the spatial representativeness grading of ground station is evaluated using land cover in the reanalysis grid box, sky view factor and absolute relative error of the reanalysis solar radiation dataset directly compared with ground measurements. If the spatial representativeness of station meets the criteria, the reanalysis solar radiation is directly compared with ground measurements. Otherwise, upscaling of ground measurements is used to evaluate the reanalysis solar radiation products. We used a clear sky solar radiation model which combines MODIS atmosphere products and DEM (30m) to consider the atmosphere attenuation and terrain shading effect for direct and diffuse radiation to model spatial solar radiation. The clear sky solar radiation model was evaluated by the 8 stations in Tibetan Plateau. Then the modeled solar radiation was aggregated in spatial to be the scale-matched solar radiation for comparison. The results indicate that the integrated evaluation method can effectively evaluate the clear sky reanalysis solar radiation, reducing the absolute relative error from 33% to 27%, 17.87% to 14.25% for MERRA2 and ERA5, respectively.