EGU21-14096
https://doi.org/10.5194/egusphere-egu21-14096
EGU General Assembly 2021

Estimation of All-weather Downward Longwave Radiation over the Tibetan Plateau

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The downward longwave radiation (DLR) is a critical parameter for radiation balance, energy budget, and water cycle studies at regional and global scales. The accurate estimation of the all-weather DLR with a high temporal resolution is important for the estimation of the surface net radiation and evapotranspiration. However, the most DLR products involve instantaneous DLR estimates based on polar orbiting satellite data under clear-sky conditions. To obtain an in-depth understanding of the performances of different models in the estimation of the DLR over the Tibetan Plateau, which is a focus area of climate change study, this study tested eight methods under clear-sky conditions and six methods under cloudy conditions based on ground-measured data. The results show that the Dilley and O'Brien model and the Lhomme model are most suitable under clear-sky conditions and cloudy conditions, respectively. For the Dilley and O'Brien model, the average root mean square error (RMSE) of the DLR under clear-sky conditions is approximately 22.5 W/m^2 at nine ground sites; for the Lhomme model, the average RMSE is approximately 23.2 W/m^2. Based on the estimated cloud fraction and meteorological data provided by the China land surface data assimilation system (CLDAS), the hourly all-weather daytime DLR with 0.0625° over the Tibetan Plateau was estimated. The results show that the average RMSE of the estimated hourly all-weather DLR was approximately 26.4 W/m^2. With the combined all-weather DLR model, the hourly all-weather daytime DLR dataset with a 0.0625° resolution from 2008 to 2016 over the Tibetan Plateau was generated. This dataset can better contribute to studies associated with the radiation balance and energy budget, water cycle, and climate change over the Tibetan Plateau.