Study on Improvement of Sunshine Based Daily Global Radiation Model in China.

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Solar radiation received at the surface is of great importance for purposes like estimating crop productivity, designing solar energy system etc. However, measurement of global solar radiation is much less wide than measurement of sunshine duration and other meteorological variables throughout the world. Many models have therefore been developed to estimate global solar radiation. Among these models, the sunshine based Angström-Prescott equation has been the most widely used method. Many studies have shown that it can be used to estimate monthly global radiation with high accuracy. However, when applied to estimation of daily global radiation, its performance degrades due to many complicated reasons, especially for overcast days or days with precipitation. Purposes of this paper include examining the Angström-Prescott equation's performance in estimating daily global radiation in China, finding out cases where the Angström-Prescott equation's performance is not good, and sorting out a way to improve it. Daily meteorological data, including sunshine duration, global radiation, temperature, precipitation etc., from 98 stations in China were used in this study. Firstly, parameters of Angström-Prescott equation for each station were derived respectively, through regression of sunshine ratio and radiation ratio; Secondly, performance of the Angström-Prescott equation for each station was examined; Bad estimation samples were picked out and analyzed; Thirdly, a new equation was designed to produce better estimation of global radiation in cases where the Angström-Prescott equation's performance is not good; Finally, a new model was developed by combining the "good" part of Angström-Prescott equation and the new equation for estimating global radiation under overcast or rainy situations. The model's goodness of estimating daily global radiation was calculated for each station and compared to that of the Angström-Prescott equation. Results show that the model proposed can produce better daily global radiation estimation and is applicable to most stations across China.

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