

Developing PMF56-Hybrid Model and its Application to Predict Reference Evapotranspiration (ET₀) in the Lake Urmia Basin

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Abstract

Concerning the drying problem of the Lake Urmia in Iran, so far the relevant scientific research has not been conducted based on watershed management principles. The surface solar radiation (Rs) is one of the key input parameters in most of reference evapotranspiration (ET₀) prediction models. In the present research, four solar radiation models were evaluated to predict the monthly-mean values of daily ET₀ at seven synoptic stations located in the Lake Urmia basin during the 1985-2005 period. For the ET₀ prediction, we applied the Penman-Monteith-FAO 56 model (PMF56). At first, we evaluated four radiation models consisting of Hybrid: H, Ångström-Prescott: AP, Modified Daneshyar: MD, and Modified Sabbagh: MS. Four statistical criteria used included the mean error (ME), the mean absolute error (MAE), the root mean square error (RMSE), and the mean percentage error (MPE). The mean RMSE value of hybrid model was 1.7 MJ/m²/day while the RMSEs for the AP, the MD and the MS models were 2.9, 2.3, and 2.9 MJ /m²/day, respectively. The results revealed a higher performance of hybrid model to predict the monthly radiation. In addition, the Rs models used in the original PMF56 model were compared with a case in which the measured daily Rs data was used. Finally, by integrating the hybrid model and the PMF56, we developed a coupled model as PMF56-Hybrid. The application of the Hybrid and the MD models resulted in a decrease in the RMSEs. The AP model used in the PMF56 showed about 19% overestimation.

Keywords: Hybrid model, PMF56, Solar radiation, ET₀, Lake Urmia.

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