Evaluation of artificial neural network (ANN) and adaptive neuro-fuzzy inference system (ANFIS) methods in prediction of global solar radiation

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Abstract
Solar radiation is an important climate parameter which can affect hydrological and meteorological processes. This parameter is a key element in development of solar energy application studies. The purpose of this study is the assessment of artificial intelligence techniques in prediction of solar radiation ($R_s$) using artificial neural network (ANN) and adaptive neuro-fuzzy inference system (ANFIS). Minimum temperature, maximum temperature, average relative humidity, sunshine hours and daily solar radiation recorded in four synoptic stations (Esfahan, Urmieh, Shiraz and Kerman) were used during the period 1992-2006. The results showed that ANN and ANFIS intelligent models are powerful tools in prediction of global solar radiation for the selected stations. Prediction by ANN was found to be more accurate than ANFIS. Also, the accuracy of prediction in Kerman with higher sunny hours was better than other stations ($R^2 > 0.9$). Additionally, using linear regression model, the most effective factors affecting $R_s$ in each site was introduced. The results revealed that sunshine hour is the most important determining parameter affecting surface solar radiation. In contrast, in most sites minimum air temperature and mean relative humidity showed the least effect on surface global solar radiation.

Keywords: global solar radiation, ANN, ANFIS, regression model, prediction

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