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Estimation of global solar irradiation with Artificial Neural Network in Timimoun city-Algeria

Information on solar radiation and its components at a certain place is crucial for the design and study of solar energy system. Solar engineers, CSP, architects, farmers, and hydrologists need information on solar radiation for a variety of uses, including solar heating, cooking, drying, and interior lighting for structures. In this study, four models developed using meteorological and astronomical parameters inputs data for training and testing the ANN model. Data was collected during an 11-year period (2010-2021) in the city of Timimoun (Latitude 29.15 N, longitude 0.15 E) in the southern Algerian. Average temperature, wind speed, relative humidity, atmospheric pressure, extraterrestrial solar irradiation, sunshine duration, and others are the inputs parameters. This study makes use of the feed forward back-propagation technique. The mean bias error (MBE), mean absolute error (MAE), root-mean-square error (RMSE), and correlation coefficient (R) assessment methods are used to evaluate how effectively these models perform. Model 4 provided the best combination of global solar radiation for estimating, according to the statistical analysis of the data, with a coefficient of correlation (R) higher than 0.93, a mean absolute error of less than 7%, and a relative RMSE of less than 10%, in comparison to other models. This model can be used when information is available to build solar energy systems in Sahara climate regions, such as for heating and cooling.

Keywords: Solar radiation, CSP, ANN, Solar energy, Artificial neural network