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DAILY GLOBAL SOLAR RADIATION ESTIMATION USING AN ARTIFICIAL INTELLIGENT APPROACH

Daily solar radiation (DSR) is sparsely measured in meteorological stations in South Africa. The prediction of DSR is very crucial to solar energy conversion systems (design, modeling, and operation) as well as decision making of potential energy policies. The need for these solar system designs vary from the use of power and water supply for industrial purposes to agricultural and domestic uses. This paper employed the use artificial neural networks in predicting DSR from the Capes of South Africa using NASA satellite data for 30 years. Daily values of minimum and maximum temperature, relative humidity, precipitation, wind speed, atmospheric temperature and earth's temperature are used as the independent variable and the solar radiation as the dependent variable when training the model. Statistical metrics was used in comparing the predicted solar radiation with the observed solar radiation. ANN model recorded a better root mean square error (RMSE), mean absolute percentage error (MAPE) and correlation of determination (R²) values of 0.79 , 11.41 and 0.83 respectively in the Northern Capes compared to the Eastern Cape of RMSE, MAPE and R² values of 1.06 , 18.89 and 0.75 respectively and Western Cape of RMSE, MAPE and R² values of 1.57 , 27.34 and 0.60 respectively. The results show that the data form the Northern Cape has high predictive strength than its counterpart as its regression value tends closer to 1 than others.

Keywords: Artificial neural network; solar radiation; meteorological variables; MAPE.

Apply to be considered for a student ; award (Yes / No)?

Yes

Level for award;(Hons, MSc, PhD, N/A)?

PhD

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