Prediction of clearness index using temperature measurements from Nigerian meteorological stations

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Abstract

Solar energy is an alternative energy source that can be used to supplement the conventional energy sources particularly in tropical areas. Agriculturists, architects, hydrologists, climatologists, and ventilating engineers depend on availability of information on solar radiation. The technology development of solar energy must start with ensuring of accurate study of radiation data at different conditions or states. The global solar irradiance is affected by meteorological parameters such as turbidity, relative humidity, degree of cloudiness, temperature and sunshine duration. Global solar radiation and mean temperature data for five Nigeria stations have been used to fit the Angstrom model for the clearness index (K_T =H/Ho), the mean temperature (T_{mean}) and maximum temperature (T_{max}). The tests of performance of the model for the five stations have been done in terms of the widely used statistical indicators, Mean bias error (MBE) and Root mean Square Error (RMSE). It was found from statistical model performance indicators that the models provided reasonably high degree of precision in the prediction of average monthly global solar radiation on horizontal surfaces.