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Performance assessment of different day-of-the-year-based models for estimating global solar radiation - Case study: Egypt

Gasser E. Hassan[a,b,], M. Elsayed Youssef[a], Mohamed A. Ali[a,c], Zahraa E. Mohamed[c], Ali I. Shehata[b]

[a] Computer Based Engineering Applications Department, Informatics Research Institute, City for Scientific Research and Technological Applications, New Borg El Arab City 21934, Alexandria, Egypt

[b] Mechanical Engineering Department, College of Engineering and Technology Arab Academy for Science, Technology and Maritime Transport, Alexandria, Egypt

[c] Mathematics Department, Faculty of Science, Zagazig University, Zagazig, Egypt

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ABSTRACT

Different models are introduced to predict the daily global solar radiation in different locations but there is no specific model based on the day of the year is proposed for many locations around the world. In this study, more than 20 years of measured data for daily global solar radiation on a horizontal surface are used to develop and validate seven models to estimate the daily global solar radiation by day of the year for ten cities around Egypt as a case study. Moreover, the generalization capability for the best models is examined all over the country. The regression analysis is employed to calculate the coefficients of different suggested models. The statistical indicators namely, RMSE, MABE, MAPE, r and R^2 are calculated to evaluate the performance of the developed models. Based on the validation with the available data, the results show that the hybrid sine and cosine wave model and 4th order polynomial model have the best performance among other suggested models. Consequently, these two models coupled with suitable coefficients can be used for estimating the daily global solar radiation on a horizontal surface for each city, and also for all the locations around the studied region. It is believed that the established models in this work are applicable and significant for quick estimation for the average daily global solar radiation on a horizontal surface with higher accuracy. The values of global solar radiation generated by this approach can be utilized in the design and estimation of the performance of different solar applications.