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Estimation of global solar radiation on horizontal surfaces in Jeddah, Saudi Arabia

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Abstract

The measured data of global solar radiation on a horizontal surface, as well as the number of sunshine hours, mean daily ambient temperature, maximum and minimum ambient temperatures, relative humidity and amount of cloud cover, for Jeddah (latitude $21^{\circ} 42'37''N$, longitude $39^{\circ} 11'12''E$), Saudi Arabia for the period 1996-2006 are analyzed. The data are divided into two sets. The sub-data set 1 (1996-2004) are employed to develop empirical correlations between the monthly average of daily global solar radiation fraction (H/H_0) and various meteorological parameters. The nonlinear Angström type model developed by Sen and the trigonometric function model proposed by Bulut and Büyükalaca are also evaluated. New empirical constants for these two models have been obtained for Jeddah. The sub-data set 2 (2005, 2006) are then used to evaluate the derived correlations. Comparisons between measured and calculated values of H have been performed. It is indicated that, the Sen and Bulut and Büyükalaca models satisfactorily describe the horizontal global solar radiation for Jeddah. All the proposed correlations are found to be able to predict the annual average of daily global solar radiation with excellent accuracy. Therefore, the long term performance of solar energy devices can be estimated. © 2009 Elsevier Ltd. All rights reserved.

Author Keywords

Global solar radiation; Meteorological data; Regression analysis

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