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Review and statistical analysis of different global solar radiation sunshine models

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ABSTRACT

For the optimal design and selection of solar energy conversion systems, as well as for other fields of interest, such as architecture, agriculture, hydrology and ecology, the knowledge of accurate global solar radiation data is extremely important. However, due to the cost and difficulty in solar radiation measurements these data are not easily available for many countries. Therefore many empirical models have been developed by various researchers to predict global solar radiation from readily available data. The number of developed models is relatively high, which makes it difficult to choose the most appropriate one for a particular purpose and site. There are several studies in which authors evaluate different models for specific location. However, there is no comprehensive study in which these models are evaluated in case of global use. The main objective of this study is to evaluate different solar radiation models on global scale, which might be helpful in the selection of the most appropriate and accurate model based on the available sunshine data. Using the radiation data corresponding to 924 sites throughout the world we conducted a detailed statistical analysis of 101 different solar radiation models that are available in literature. Ten statistical indicators were used to assess models performance. In addition, we introduced specific global performance indicator (GPI), by means of which all analyzed models are depicted with a single parameter and easily ranked.

Contents

1. Introduction

Renewable energy sources such as solar energy have great potential to mitigate some negative environmental issues including climate change caused by intensive fossil fuel exploitation. With fast technological improvement and decreasing costs, solar energy will surely play a relevant share of future energy systems [1]. In the prediction, study, and design of solar energy systems,

Abbreviation: erMAX, maximum absolute relative error; MAE, mean absolute error (kWh/m^2); MARE, mean absolute relative error; MBE, mean bias error (kWh/m^2); RMSE, root mean squared error (kWh/m^2); RMSRE, root mean squared relative error; RRMSE, relative root mean squared error (%)

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