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Creating an artificial neural network time series model for the prediction of daily solar radiation in Oran

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ABSTRACT

Water and clean energies are currently a major scientific and political concern. The use of numerical prediction is often recommended in these areas, for optimal exploitation of renewable energy resources, mainly for seawater desalination and other energy and food security activities. In this study, we present an application of artificial neural networks (ANN), developed for daily solar energy forecasting. The ANN model developed is based on the multi-layer perceptron, the most widely used ANN type in renewable energy and time series forecasting. The developed model has two main properties: I. The ANN training is based on long-term reanalysis data, allowing the model to be trained even in areas where no radiation measurements are available, as is the case for marine areas and in the new desalination plants. II. The model allows automatic selection of the optimal ANN model architecture based on the training data. A thirty-nine-year time series of reanalysis data between 1980 and 2018 was used for training and model implementation. Thus, the model accuracy was evaluated based on one-year data (2019). The obtained error analysis results show that the developed model has a good performance in line with previous studies. The developed ANN models are characterized by reasonable daily prediction accuracy, with a root mean square error of 3.248 MJ/(m^2 d) for solar radiation prediction. This verifies the accuracy and ability of the model to predict solar radiation to ensure optimal management of solar energy farms.

Keywords: Artificial neural networks; Multi-layer perceptron; ANN time series model; Renewable energies; Daily forecast

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