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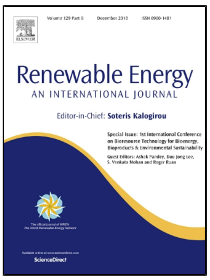

Solar Radiation Forecasting using Artificial Neural Network and Random Forest Methods: Application to Normal Beam, Horizontal Diffuse and Global Components

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Solar Radiation Forecasting using Artificial Neural Network and Random Forest Methods: Application to Normal Beam, Horizontal Diffuse and Global Components

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Abstract: Three methods, smart persistence, artificial neural network and random forest, are compared to forecast the three components of solar irradiation (global horizontal, beam normal and diffuse horizontal) measured on the site of Odeillo, France, characterized by a high meteorological variability. The objective is to predict hourly solar irradiations for time horizons from h+1 to h+6. The random forest (RF) method is the most efficient and forecasts the three components with a nRMSE from 19.65% for h+1 to 27.78% for h+6 for the global horizontal irradiation (GHI), a nRMSE from 34.11% for h+1 to 49.08% for h+6 for the beam normal irradiation (BNI); a nRMSE from 35.08% for h+1 to 49.14% for h+6 for diffuse horizontal irradiation (DHI). The improvement brought by the use of RF compared to Artificial Neural Network (ANN) and smart persistence (SP) increases with the forecasting horizon. A seasonal study is realized and shows that the forecasting of solar irradiation during spring and autumn is less reliable than during winter and summer because during these periods the meteorological variability is more important.

Keywords: Solar irradiation forecasting; ANN; Random Forest, Beam solar radiation; Diffuse solar radiation; Global solar radiation.

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