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Quality Assessment of NSRDB Meteosat Prime Meridian Solar Radiation Data for Machine Learning and Forecasting Applications

Communication Info

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Abstract

Reliable meteorological data are crucial for developing accurate solar energy forecasting models and for applying machine learning techniques in renewable energy systems. This study evaluates the quality of solar radiation data obtained from the National Solar Radiation Database, specifically the Meteosat Prime Meridian Africa and Europe dataset, which provides hourly satellite-derived solar radiation observations across Africa and Europe[1], [2]. The assessment focuses on several key dimensions of data quality, including completeness, physical consistency, outlier detection, and temporal stability of the time series. The analysis considers key solar radiation variables such as Global Horizontal Irradiance (GHI), Direct Normal Irradiance (DNI), and Diffuse Horizontal Irradiance (DHI), together with meteorological parameters including air temperature and wind speed[3]. Physical consistency tests are applied to verify compliance with fundamental radiative constraints, while statistical methods are used to detect anomalies and extreme values. The results provide insights into the reliability and usability of the dataset and evaluate its suitability for solar forecasting and machine learning applications in renewable energy systems[4].

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