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Use of post processing techniques and satellite irradiance data to forecast short wave solar radiation

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Solar forecast are essential for the estimation of hourly and daily photovoltaic energy production both for grid stability and for the energy market. Meteorological models can present large errors in forecasting solar irradiance, in frequent cases due to to the imperfect representation of the absorption of radiation by water vapour. Data driven approaches such as Artificial Neural Networks, or physical post-processing algorithms such as MOSRH [Solar Energy, Volume 117, July 2015, Pages 99-113], that improve WRF irradiance direct output, better predict short wave radiation by the integration of meteorological parameters at various altitudes and by tuning the results with a series of measured data. Data driven or hybrid techniques require ground based measurements in every prediction site, which can be logistically complex and time consuming especially when dealing with a large number of power plants.
Satellite derived short wave radiation (0.05° grid spacing) can be used as a valid alternative, because it can provide estimated radiation values in every point of the domain.
In this work satellite irradiance data have been used to determine the regression coefficients of the MOSRH algorithm for the entire country of Italy. The model domain points have been divided in 6 groups depending on their location in one of Italy's 6 energy markets, and in 4 different altitude ranges, for a total of 24 classes.
In order to validate satellite data quality, a comparison between satellite and ground based datasets, resulting in an hourly MAE of 10%, and a daily MAE of 6%, has been performed.
The hourly MAE of MOSRH forecast against satellite data is 18%, and the daily MAE is 12%; these values are comparable to the application of MOSRH with site-specific coefficients calculated with ground base observations.
This method, which can be applied over every area covered by satellite measurements, allows high quality solar forecasts and estimates for power plants which can't provide ground based solar irradiance measurements and for regional solar irradiance forecasts.