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Assessment of a Climate Reanalysis Product for Estimating Hourly Wind Energy Production in Italy

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Recently, the Italian government has revised its national energy and climate plan (NECP) and has significantly increased its objective for wind energy capacity. However, climate change itself can affect the availability of wind resources, due to the increasing frequency of extreme weather conditions, and possible shifts in the mean climate conditions. Meanwhile, RSE has been developing the Meteorological Reanalysis Italian Dataset (MERIDA) to monitor climate variability in Italy over the last 20 years. MERIDA consists of a dynamic downscaling of the ERA5 global reanalysis using the WRF-ARW limited area model and provides hourly data. While MERIDA has a spatial resolution of 7 km, RSE has also developed MERIDA High-resolution for Renewable Energy Sources (HRES) with 4 km spatial resolution. MERIDA HRES represents an upgrade of MERIDA to describe the most relevant meteorological variables for applications related to renewable energy e.g. wind, air temperature, solar radiation.

This work presents an assessment of both MERIDA and MERIDA HRES hourly datasets for the estimation of wind power production in Italy. A comparative analysis has been conducted based on three different types of wind variables, namely: wind speed at 100 m height from MERIDA HRES, 100 m height wind speed extrapolated from MERIDA HRES wind speed at 10 m height, and 100 m height wind speed extrapolated from MERIDA wind speed at 10 m height. A wind power density model has been also developed as part of this work to estimate the wind energy production using wind speed variables. A validation for the results has been conducted vs the hourly actual wind energy output at bidding zone level based on historical data (from ENTSO-E). The results present the impact of both changes in spatial resolution and extrapolation of MERIDA datasets on the expected wind energy output vs the actual energy output.