A new Wind Atlas for Italy

Simone Sperati[1], Stefano Alessandrini[2], Filippo D'Amico[1], Will Cheng[2], Riccardo Bonanno[1], Matteo Lacavalla[1], Davide Airoldi[1], Alessandro Amaranto[1], Martina Aiello[1]

1. RSE SpA, Milano, ITALY, Italy

2. NCAR, Boulder, CO, USA

Objective & Background

Nowadays, improvements in numerical weather models and wind generation technologies call for an upgraded representation of the spatio-temporal variability of the wind conditions to effectively support strategic planning at a national level. In this context, this work presents the new Italian Wind Atlas – Atlante EOLico ItaliANo (AEOLIAN), coming 20 years after its first release, to support the stakeholders in planning the future wind generation towards the ambitious targets set for Italy by the European "Fit for 55" package for 2030 (i.e., about 21.5 GW of installed wind power plus 3.5 GW offshore).

Method

AEOLIAN is the result of a novel approach that combines the Weather Research and Forecasting (WRF) numerical code with the Analog Ensemble (AnEn) statistical technique. Hourly numerical model simulations have been initially carried out using WRF over 30 years (1990-2019) with a horizontal resolution of 4 km, nesting a 1.33 km inner grid only for the 2015-2019 period. The AnEn has been then applied to extend the 5 high-resolution years to the previous 25 years, creating a 30-year high-resolution dataset that embeds the whole country, including the offshore areas. Also, 10-m observational wind speed data have been used for observational nudging in the simulations of the 5 high-resolution years.

Principal Findings

Verification has been carried out using observational wind speed data on a range of stations located in different terrain complexity. It is found that the AnEn is effective in generating wind speed data with low statistical differences compared to the WRF simulations. Overall, AEOLIAN is competitive with the New European Wind Atlas (NEWA) in terms of reconstructed wind speed at different heights from terrain, showing a slightly higher accuracy.

Conclusion

This work demonstrates that stronger exploitation of wind energy, especially offshore, is possible. In fact, looking e.g., at the Full Load Hours (FLH) map at 100 m a.gl./a.s.l., it is shown that as much as 60% of the offshore areas belonging to the Exclusive Economic Zone (EEZ) have a specific producibility higher than 3000 MWh/MW. The exploitation of wind resources is then essential in pursuing the extremely ambitious decarbonization objectives of the EU.

This work aims to provide the audience with a reliable tool to gather helpful information about the wind conditions that characterize a specific area of Italy to meet the needs of the public authorities, industry operators, and researchers in the field. Data are available for open access and can be explored and downloaded from a public webGIS at https://atlanteeolico.rse-web.it/.