



Evaluation of ERA5 and other reanalyses to simulate wind power production over France

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The latest hourly reanalysis from ECMWF, ERA5, is already used for energy applications and shows improvements from previous commonly used reanalyses (Olauson, 2018). The purpose of this study is to assess how ERA5 is performing when used to simulate wind power production at local and regional scales. ERA5 is also compared to other reanalyses such as the global MERRA-2 from NASA, the European COSMO-REA6 from DWD, or the French high-resolution model AROME from Météo-France.

The study is conducted over France, with the use of two public datasets of observed wind power production: 30-minute power timeseries at the regional scale published by RTE (TSO) and annual energy at the local scale published by Enedis (main DSO). The study has 2 parts:

1) Wind-speed validation: at a few locations where wind measurements were available at around 50-100 meters above ground, we made direct validations of the modeled wind speed. Despite overall good skills, some problems were detected with ERA5, in particular an assimilation problem leading to jumps in the time series at 10 am and 10 pm. Some workarounds are investigated.

2) Power output validation: the reanalysed wind speeds are transformed into generated power and compared to observed productions. The geographical coordinates, hub heights and turbine models are derived from thewindpower.net database. At each location, the hourly wind speed at two heights is extrapolated to the hub height with a power law and transformed into power output through the turbine's power curve.

The simulated and observed wind power production are compared in terms of annual bias at the local scale. They are also aggregated at the regional level and compared to observations in terms of hourly variability, distribution, seasonal and diurnal cycles... Simple bias-correction methods are discussed. ERA5 shows very good skills and has lower biases than other reanalyses in the northern half of France where most models tend to overestimate the wind speed. The results of COSMO-REA6 are disappointing, showing almost no diurnal cycle, probably due to a lack of convection. Because of its spatial resolution of about 30 km, ERA5 is less skilled in the mountainous regions of southern France, where higher resolution models tend to better simulate the wind power.