The European wind from observational and simulated databases

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The New European Wind Atlas (https://map.neweuropeanwindatlas.eu) is developed based on the simulated wind field over Europe from a mesoscale model coupled to a microscale component through a statistical downscaling approach. The simulation that provides mesoscale inputs within the model chain has been decided upon a careful sensitivity analysis of potential model configurations. In order to accomplish model resolutions of 3 km over Europe, the broader European domain is partitioned into a set of 10 partially overlapping tiles. The wind field is simulated with the WRF model over these tiles and finally blended into a single domain. The wind outputs from a reference simulation is evaluated on the basis of its comparison with an observational database specifically compiled and quality controlled for the purpose of validating the wind atlas over the complete European domain. The observational database includes surface wind observations at ca. 4000 sites as well as 16 masts datasets. The observational dataset of surface wind (WISED) is informative about the spatial and temporal variability of the wind climatology, punctuated with singular masts that provide information of wind velocities at height. The validation of the mesoscale simulation aims at investigating the ability of the high-resolution simulation to reproduce the observed intra-annual variability of daily wind within the entire domain.

Observed and simulated winds are higher at the British, North Sea and Baltic shores and lowlands. Correlations are typically over 0.8. Surface wind variability tends to be overestimated in the northern coasts and underestimated elsewhere and inland. Mast wind variability tends to be overestimated except for some southern sites. Seasonal differences seem minor in these respects. Biases and RMSE can help identifying if systematic errors in specific tiles take place.

Therefore, performing model simulations of a high horizontal resolution over the broader European domain is possible. We can learn about the variability of surface and height wind both from observations and model simulations. Model observations are not perfect, but observations also present uncertainties. Good quality wind data, both at the surface and in masts are a requisite for robust evaluation of models. European wide features of wind variability can be recognized both in observations and simulations.