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Mapping the European wind climate: validation of the New European Wind Atlas

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To accurately represent the local wind climate for siting of wind turbines, atmospheric models must capture phenomena at scales ranging from global to the turbulent scales. However, since no single model can feasibly account for all the scales, a chain of models is commonly used. In the New European Wind Atlas (NEWA) project the wind climate in the lower part of the atmospheric boundary layer was estimated using a model-chain consisting of the ERA5 global reanalysis dataset, which was used to force the Weather Research and Forecasting (WRF) mesoscale model (Skamarock et al., 2018), and finally local microscale terrain effects were added to the WRF-derived wind climates using the Wind Analysis and Application (WAsP) linearized flow model.

To validate the NEWA model-chain a comprehensive analysis was made using one year of wind measurement from more than 300 tall masts (40 - 150 m tall) positioned all over Europe. The spatial coverage and the continuous one-year measurements ensured that many types of terrain and flow regimes were represented and that seasonal dependencies were minimized, in the validation.

This study presents a statistical analysis of the wind climates estimated by each model in the NEWA model-chain, emphasizing the accuracies of both the wind speed and wind direction distribution, as well as the estimated power output for a reference turbine, at each site, and on how these quantities depend on the large scale flow regime and the complexity of the terrain at the site, e.g. the steepness of the orography and the proximity to coastlines and other surface roughness features.

References

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