

Challenges and Insights from the New European Wind Atlas Project

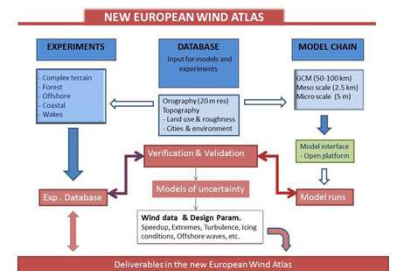
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Objectives of the NEWA Project

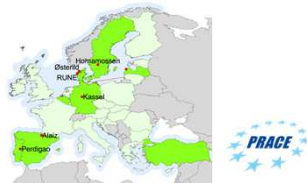
- Development of a high-value data base of high-fidelity experiments
- Development of methodologies for wind resource assessment and wind turbine site suitability based on a mesoscale to microscale mode-chain
- Publication of a European Wind Atlas database accessible through a web interface
- Definition of a verification and validation framework for the model-chain based on the experimental campaigns and means to quantify the uncertainties of the wind atlas

Project Structure



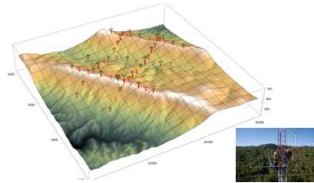
Challenges

Mapping wind resources and associated uncertainties across Europe using supercomputing for seamless high-resolution spatial planning



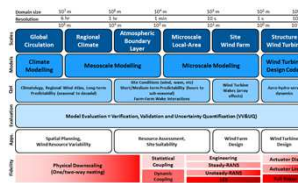
Spatial coverage of wind atlas and location of experimental campaigns [1]. In darker green, countries participating in the ERA-Net project.

Conducting experimental campaigns of unprecedented size to characterize complex flow conditions across a wide range of wind climates and topography



Perdigao experiment, in Portugal, comprising 331 sensors deployed in 50 towers, 21 scanning lidars and other remote sensing instruments [1][2].

Bridging meteorological models and wind engineering tools to improve physical insight of flow models leading to more reliable wind assessment



Multi-scale multi-fidelity modeling framework, wind applications and associated quantities of interest [3].

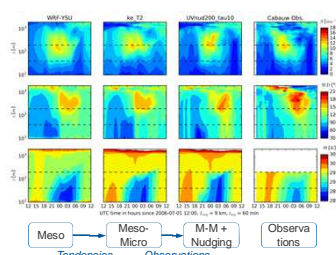
Tapping the potential of open data science to foster collaborative research and transfer of knowledge to industry



NEWA web interface to explore the wind atlas database built on FAIR data principles.

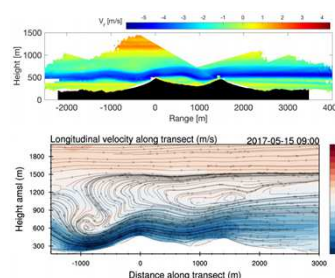
Insights

Meso-micro coupling to change the paradigm of design tools traditionally based on idealized inflow conditions



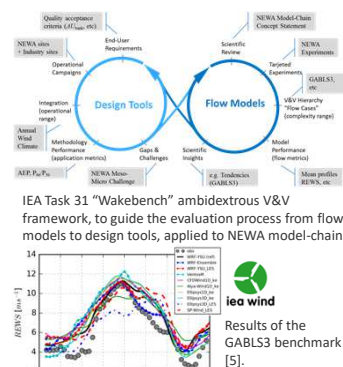
GABLS3 diurnal cycle simulated with 1) a mesoscale model, 2) a mesoscale k-e URSAN model driven by mesoscale tendencies (offline meso-micro coupling), 3) the same meso-micro model nudged to mast observations to reduce bias [4].

Uncovering flow complexity in complex terrain with scanning lidar technology and high-fidelity simulations

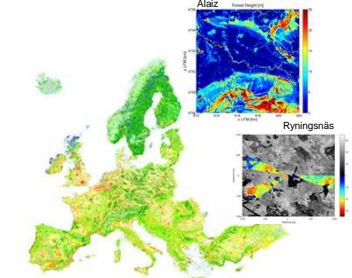


Scanning lidar radial-velocity measurements across a double-hill transect from the Perdigao experiment [2] and transient simulation with WRF-VENTOS[®]/M of a counterflow phenomenon [6].

Building a hierarchy of benchmarks for verification and validation of meso-micro models and wind assessment methodologies



Improving wind resource assessment using the best available input data from ERA5 reanalysis to airborne laser scanning of canopy



CORINE Land Cover 2012 map to characterize surface boundary conditions of the wind atlas and canopy map for the Alaiç experiment in Spain and Ryningnsås benchmark in Sweden [7].

Open-Access Resources

- NEWA open-source model chain based on WRF and OpenFOAM (beta release in Jan'18)
- Database of experiments, released throughout 2018 from the NEWA data server
- V&V benchmarks released through Windbench.net, open to external participation within the IEA Task 31 Wakebench
- EU Wind Atlas database and web interface, release at NEWA final workshop next to WindEurope 2019 (April 2019)

References

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- [2] Menke R., et al. (2017) Vindkraftnet Meeting, June 2017
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- [7] Arnqvist J., et al. (2017) Ryningnsås benchmark, in preparation

www.neweuropeanwindatlas.eu

Acknowledgements



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