DRACCAR - NEMO

New methods for turbulence measurements and models in offshore wind

DURATION: 30 months | **LAUNCH:** 2023 | **BUDGET:** €2,032K

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CONTEXT

A key phase in the development of a wind energy project is a comprehensive assessment of the inflow wind conditions. This is essential to determine the financial feasibility of a project. Whilst the characteristics of the mean flow (like speed, direction) are relatively simple to assess by modelling or measurement tools, **a lack of confidence in the characterization of wind fluctuations, i.e., turbulence, over a range of scales, has subsequently resulted in high levels of conservativeness being employed by wind turbine designers.**

OBJECTIVE

To provide methodologies and tools for a comprehensive assessment of turbulence at prospective offshore wind sites

SCIENTIFIC CONTENT

Review and redefinition of turbulence metrics for the offshore wind applications

Measurements of atmospheric turbulence

- Improvement of reconstruction procedures of turbulence metrics derived from lidar profiler
- Derivation of turbulence from scanning lidars in dual-Doppler configuration
- Investigation and implementation of universal multifractals for higher-order turbulence statistics
- Joint measurement campaign at Normandy test site to support method development

Modeling of turbulent flows

- Calibration of turbulence length-scales (100m - 1,000 m) using large eddy simulations and incorporate them into mesoscale model
- Adaptation of numerical model settings to derive recommendations for turbulence data simulation
- Assessment of different lidar configurations' ability to reconstruct turbulence information through virtual lidars in large eddy simulationwind fields

Reconstruction of offshore wind metrics using data-driven methods

- Use of statistical and machine learning models to estimate offshore wind metrics from onshore measurements and numerical models outputs
- Comparison of data-driven models and large eddy simulations for offshore turbulence forecasting

TECHNOLOGIES

STAGES OF THE VALUE CHAIN

Preparatory studies

Design

EXPECTED RESULTS

- **Collection** of a new turbulence dataset
- **Methodology** for the reconstruction of turbulence from wind lidars (ground-based, floating and scanning)
- **Industry applicable turbulence** from meso-scale modelling
- **Site-specific transfer functions**, combining observations and model output, to derive offshore information from onshore information

PARTNERS

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