

DRACCAR-NEMO

New methods for turbulence measurements and models in offshore wind

DURATION: 30 months (2023-2026) | BUDGET: €1,400K

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

MAIN ACHIEVEMENTS

Measurements of atmospheric turbulence

- Establishment of the ground-based dual-lidar turbulence retrieval method at the core of TwinDAR©
- Development of a spectral motion-correction method for floating lidars, significantly improving turbulence estimation accuracy
- Implementation of the universal multifractal for higher-order turbulence statistics

Modeling of turbulent flows

- Impact quantification of coastal effects and atmospheric stability on offshore wind turbulence
- Development of an improved turbulent kinetic energy (TKE) estimation method for mesoscale models, achieving better agreement with lidar observations

Reconstruction of offshore wind metrics using data-driven methods

- Exploration of statistical and machine-learning approaches for estimating offshore wind metrics from onshore measurements and numerical model outputs

CONCLUSION

This work strengthened the scientific and technological foundations of offshore wind assessment by combining advanced lidar methodologies, turbulence modeling improvements, and emerging machine-learning approaches, while contributing directly to the development of TwinDAR©.



© ELG21/Pixabay

TECHNOLOGIES



STAGES OF THE VALUE CHAIN



Preparatory studies

Design

MAIN OUTPUTS

- **TwinDAR©**, a software solution delivering DNV-compliant turbulence intensity measurements from ground-based pulsed lidars
- **Motion compensation algorithm** enabling accurate turbulence measurement from floating or mobile lidar platforms

PARTNERS



This project received French State funding managed by the National Research Agency under the France 2030 investment plan.



With the financial support of Ifremer, Pôle Mer Méditerranée, Occitanie and SUD Provence-Alpes-Côte d'Azur regions.

