FRANCE ENERGIES MARINES

PRESS RELEASE | 4 March 2025

OFFSHORE WIND - Characterising turbulence to optimise the systems design

Sites with a high potential for the development of floating wind turbines may concentrate challenges represented by a detailed characterisation of the wind resource and atmospheric turbulence. Atmospheric turbulence corresponds to rapid variations in air speed and direction, generating vortex structures that induce considerable loads on wind turbines and impact wind turbines wakes. Offshore measurements are required to validate the numerical models used to assess wind and associated turbulence at sea. How can these measurements be done at sea? This is the question addressed by the POWSEIDOM JIP.

The lidar, a promising system to characterise atmospheric turbulence

While the installation of anemometers on offshore deployed masts is excluded, due to the high cost of installation, operation and maintenance, the use of remote sensing devices such as profiling lidar is promising. Similar to radar but emitting laser pulses of infrared light instead of radio waves, lidar sensor analyses the properties of the wave returned from the target. Less expensive than using anemometers at sea, when deployed on a buoy, this technology is now certified for wind resource estimation. However, it is not widely used to characterise atmospheric turbulence, due to the lack of proper algorithms to derive turbulence metrics from the lidar signal.

A new data set and valuable recommendations

A Vaisala WindCube v2.1 profiling lidar (certified to IEC 61400-12-1 standard) was deployed in December 2022 on Planier island. Located 9 km offshore, this site allows to capture undisturbed atmospheric phenomena representative of the conditions encountered at floating offshore wind farm sites in the Mediterranean. At the end of the first 12 months of the acquisition campaign, the measurements taken with lidar enabled to compile an unprecedented set of data (mean winds and direction, turbulence intensity, shear, occurrence and intensity of low-layer jets). As a result of this work, recommendations have been drawn up for calculating the forces induced by the wind on turbines. This information is invaluable for optimising system design and increasing the profitability of projects, especially in the Mediterranean Sea.

Floating lidar and turbulence intensity measurement

For wind measurements at sea, lidar are generally deployed on buoys, which however induces challenges in retrieving wind and turbulence information, due to the buoys motion. With this in mind, the POWSEIDOM project team tested a lidar installed on a mobile platform reproducing the movements of a buoy deployed at sea. The measurements obtained were compared with those of a fixed lidar and a preliminary version of a motion compensation algorithm for measuring turbulence was developed. These results were published in an international peer-reviewed journal called *Remote Sensing* in April 2024.

Work on the POWSEIDOM JIP is continuing as part of the DRACCAR-NEMO JIP started in 2023. Co-led by France Energies Marines and the German reference institute Fraunhofer IWES, this project aims to provide industry with high-performance measurement and modelling tools for assessing turbulence on any type of site, in order to optimise the design of offshore wind turbines and farms.

POWSEIDOM in a nutshell

➪ See project webpage

Duration: 30 months (2021-2024) | **Budget:** €834K

Press contact: Mélusine Gaillard - melusine.gaillard@ite-fem.org - T. +33 (0)2 98 49 98 27