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Lidar deployed on Planier Island (© FEM)

Characterising offshore wind turbulence to increase the profitability of future Mediterranean wind farms

Knowing the wind turbulence at sea: a necessity for the development of floating offshore wind in the Mediterranean

The Gulf of Lion in the Mediterranean will host several pilot and commercial floating wind farms in the coming years. It is therefore crucial for project developers to accurately characterise the wind resource as well as the turbulence, which corresponds to unpredictable and rapid variations in speed and direction. This phenomenon, which exists naturally, generates vortex structures that put a great deal of stress on the wind turbines and impact the wake between machines within the wind farms. In the Gulf of Lion, direct measurements of wind and wind turbulence are currently collected by a network of coastal anemometers. However, offshore data are needed to feed the numerical models used to characterise the resource and to design the systems.

While the installation of anemometers on masts deployed offshore is ruled out, due to their high cost of installation, operation and maintenance, the use of remote sensing devices such as profiling lidar is promising. Similar to radar but emitting pulses of infrared light instead of radio waves, this type of sensor measures the return time after reflection from the target. This technology is less expensive than the use of anemometers at sea and is now certified for wind resource estimation. On the other hand, it is not widely used to characterise wind turbulence, which is what the POWSEIDOM collaborative research project aims to address.

Towards the first ever Mediterranean database of continuous wind and turbulence data acquired at sea

Due to the lack of wind and turbulence data from direct measurements in the Gulf of Lion, the POWSEIDOM project partners deployed a Vaisala WindCube v2.1 profiling lidar (certified according to IEC 61400-12-1) on the island of Planier on 8 December 2022. This site was chosen because it is an island with no major relief, which makes it possible to capture undisturbed atmospheric phenomena and therefore representative of offshore conditions, like those of future pilot farm sites in the Mediterranean. This campaign will allow us to study the evolution of the strong onshore winds' characteristics of the Gulf of Lion, which generate winter storms that induce a lot of turbulence.

At the end of the 12 months of measurements, the first ever Mediterranean database of wind and turbulence data acquired at sea and continuously will be compiled. While the information on average wind speed and direction is of interest to all users in the area, the information on turbulence intensity is of considerable interest to wind farm developers. The measurements acquired at sea will be implemented in the new turbulence intensity reconstruction algorithm developed by the project team. The time series generated at different altitudes will provide valuable data for optimising the design of wind turbines and increasing the profitability of projects.

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The POWSEIDOM project in short

⇨ See the project web page
Duration: 30 months (2021-2024) | **Budget:** €834K