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Near-field measurements around offshore wind turbines show how they enhance hydrodynamics in their direct environment

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In the southern North Sea, a relatively shallow shelf sea, offshore wind farms are being constructed and planned on an extensive scale. To assess the possible ecosystem effects of these upscaling efforts (from 20GW in 2020 to more than 300 GW in 2050), we need to quantify the effect of turbines on local hydrodynamics and suspended matter dynamics. In this study, we present the results of a field campaign aiming at quantifying these effects.

The campaign was undertaken in June 2022 in the Belgian Coastal Zone. We measured a set of hydrographic parameters at various locations around a single turbine, supplemented with water and sediment samples.

The data reveal how the turbine enhances the local hydrodynamics and hydrographic parameters. In the turbine wake, we observe an increase in turbulent kinetic energy. This leads to a more well-mixed water column. At the water surface, this leads to colder and more saline water, while the water near the seabed becomes warmer and less saline. These effects are closely linked to the direction of the tidal current, as the turbine-induced wake is only several turbine diameters wide. The wake length is much longer, extending for several hundreds of meters behind the turbine.

This presentation discusses the study setup and the steps required to quantify the impact of turbines on local hydrodynamics. Furthermore, we will discuss how this knowledge is implemented in large-scale models, as this step is crucial for assessing the ecosystem impact of upscaled offshore wind.