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Use of Satellite Data to Support the Offshore Wind Energy Sector -Towards a joint Helmholtz Strategy

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The offshore wind energy sector has grown massively over the last decade and research concerning the assessments of available power and potential environmental impacts is facing challenges to keep track with this unprecedented development. In this presentation we will focus on the big potential of satellite remote sensing to help making the offshore wind technology a success.

Satellite synthetic aperture radar (SAR) data provide a wealth of information about near surface wind fields over the ocean. We will present some recent work at Hereon concerning the use of these data for the support of the offshore wind energy sector. A focus is on the analysis of atmospheric wake effects, which are relevant for the quantification of expected wind power yields, as well as for the assessment of secondary impacts on the ocean. Statistical analysis of wake intensities and geometric properties will be discussed using data from the European Sentinel-1A/B satellites. Results concerning the dependence of the lee effects on parameters of the atmospheric boundary layer, e.g. atmospheric stability, as well as the role of wind turbine properties (e.g. rotor diameter, turbine spacing) are analysed. The ongoing work to condense the satellite information into parametric models is described. Furthermore, a brief summary is given of the work related to the analysis of coastal effects (e.g. spatial wind speed gradients), which are of high relevance for the offshore wind industry.

It will furthermore be explained how the remote sensing work is embedded within a broader offshore wind research strategy at Hereon, including numerical modelling, ground-based observations, artificial intelligence and digital twins.

The presentation will include information about past and ongoing projects with Hereon participation in the context of the above activities. Furthermore, ideas for the cooperation between different Helmholtz association groups on this topic and a common strategy are discussed.

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