

Interactive comment on “Applications of satellite winds for the offshore wind farm site Anholt” by Tobias Ahsbahs et al.

Anonymous Referee #1

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The manuscript displays data from different sources (SCADA, SAR, WRF) in order to analyse aspects of the wind field within and around the Anholt wind farm. The main purpose is to analyse the reliability of SAR data for this purpose. This is an important topic since data sources offshore are limited and SAR data seem to be promising. Nevertheless, the manuscript in its present stage is not fully convincing. I suggest major changes before a publication can be recommended.

Points for revision:

Major issues:

(1) The main point of this manuscript is the comparison between SCADA and SAR data and the ability of the SAR data to trace the wake of the wind farm. The manuscript

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should concentrate on this. Therefore, I suggest to skip the comparison with the WRF data. The WRF data are mentioned only marginally in the Abstract and in the Conclusions of the manuscript. This illustrates their minor importance for this investigation.

(2) There is considerable difference in data quality between SCADA and SAR data. First of all, SAR wind data at 10 m height is not a measurement but a product which arises from the stipulation of severe assumptions involving GMFs. That this could be a source of uncertainty is not even mentioned in the manuscript. Then, the 10 m SAR data must be extrapolated to the hub height of 81.6 m. This is done here by assuming a logarithmic wind profile. But the authors do not know how well this logarithmic profile depicts the reality. We know from earlier studies that the wind regime in the Baltic (Smedman and colleagues in the 1990s) is very often characterised by warmer air over colder waters. This leads to the formation of internal boundary layers, low-level jets and non-logarithmic vertical wind profiles. This problem must be addressed in a manuscripts which intends to promote the use of SAR data in offshore wind energy especially in the Baltic.

Further issues:

(3) The first paragraph of the Introduction summarises the impact of inhomogeneous coastal areas on offshore wind fields. Here the work of Dörenkämper et al. should be mentioned (Dörenkämper, M., Optis, M., Monahan, A., & Steinfeld, G. (2015). On the offshore advection of boundary-layer structures and the influence on offshore wind conditions. *Boundary-Layer Meteorology*, 155(3), 459-482).

(4) page 2, lines 22-27: aircraft measurements at hub height in the far wake of large offshore wind farms are now available. See: Platis, A., S.K. Siedersleben, J. Bange, A. Lampert, K. Bärfuss, R. Hankers, B. Cañadillas, R. Foreman, J. Schulz-Stellenfleth, B. Djath, T. Neumann, S. Emeis, 2018: First in situ evidence of wakes in the far field behind offshore wind farms. *Scientific Reports*, 8, 2163. DOI: 10.1038/s41598-018-20389-y

(5) page 2, line 2: a reference is missing

(6) page 2, line 8: wind farm parameterisation in WRF: here, the parameterisation available in WRF by Fitch should be mentioned: Fitch, A. C., Olson, J. B., Lundquist, J. K., Dudhia, J., Gupta, A. K., Michalakes, J., & Barstad, I. (2012). Local and mesoscale impacts of wind farms as parameterized in a mesoscale NWP model. *Monthly Weather Review*, 140(9), 3017-3038.

(7) How has the correlation coefficient displayed in Figure 2 been computed? From the bin means (black diamonds in the Figure) or from the full data set (grey circles in the Figure)? It actually does not look like that the grey circles can be explained by such a high correlation coefficient.

(8) What is displayed in the last line of Table 3?

(9) Subchapter 3.3.2: it does not really become clear why there are no discernible wake effects in the "short fetch" case.

(10) Chapter 3.4 and Figure 11 (related to the preceding comment): Figs. 11 c and d are in contradiction to Figs. 8 b and 9. While there are clear wake effects in Figs. 11 c and d, there are none in Figs. 8 b and 9. The wind direction in both groups of figure is nearly identical. This contradiction should at least be addressed in the manuscript. This contradiction seems to be a clear hint that SAR data is not easily interpretable (see the above comment no. 2).

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