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Interactive comment on "An analysis of offshore wind farm SCADA measurements to identify key parameters influencing the magnitude of wake effects" *by* Niko Mittelmeier et al.

Anonymous Referee #1

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The manuscript entitled "An analysis of offshore wind farm SCADA measurements to identify key parameters influencing the magnitude of wake effects" deals with the using of operating information supplied by the wind turbines to assess the atmospheric stability conditions and then to make some conclusions about the wake interaction effects. The objective is fully relevant: wind farms, and particularly offshore ones, are not equipped with meteorological measurements to determine the real-time and reliable meteorological conditions (wind speed, wind direction and particularly atmospheric stability). On the other hand, wind farm models need field data to be validated. The authors attempt to find an indirect way to assess atmospheric stability in order to determine the magnitude of the expected wake effects, according to this parameter.

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On the other hand, the methodology used in this manuscript to obtain the presented conclusions does not sound rigorous enough at this stage to be published in a journal. Some hypothesis are too strong and the methodology is not validated.

Please find below the arguments to justify the recommendation:

- A direct correlation is expected between the turbulence intensity and the atmospheric stability. Though, for a fixed stability condition, turbulence intensity can have big scatter and particularly at low wind speeds. Reference to the works from Dorenkampfer et al. (2012 and 2015) are used to justify this strong simplification but these references are a PhD thesis and a proceeding from a national conference. I would suggest to make references to publications in peer-review journals and to develop the arguments that give the possibility to reduce the stability effect to a turbulence intensity effect, and particularly at low Wind speeds.

- LiDAR measurements at Nord See wind farm NO : PPI planes are described as horizontal. LiDAR is located on the helicopter platform from the wind turbine NO48. One therefore guess that is corresponds to an altitude close to the hub height. Consequently, the laser beam should meet the wind turbine rotors NO44 and NO45, leading to unusable data in the vicinity of both rotors. On the other hand, on Figure 4, the visualizations of the velocity field, as well as the normalized velocity evolution versus the downwind distance do not present any unresolved areas close to the rotors. The velocity induction through the rotor is presented and discussed. Please explain how these data were reconstructed close to the rotors.

- §3.3 New classification and validation. This part is confusing. The authors determine a classification of the wake effect on the basis of the median of the normalized power of a wind turbine in wake interaction. It means that the intensity of the wake effect is determined by its statistical occurrence and not by its strength. Please elaborate an argumentation to justify this strategy of classification

- §4.2 Correlation analysis. It is not clear whether the data are sorted only according

to the turbulence intensity or also to the wind speed (as performed in Fig. 5). If the data are not sorted according to the wind speed, it means that different operating conditions are plotted without distinction in this correlation matrix. How can one expect to get strong correlations between data coming from the incoming flow conditions (fully independent of the operation parameters) and operation-driven data coming from the wind turbines without any additional filters ? Could you please show the evolution of the relative power fluctuation PO_TI with the WT power or with the wind speed? Regardless of this crucial point, one cannot state that the level of correlation is acceptable in order to use this information as a representation of the turbulence intensity, and even less of the atmospheric stability.

- §4.3.1 New classification and validation on Alpha Ventus. By applying the new classification; discrepancies in the power production due to the assessed stability is rather small and difficult to interpret. By comparing Fig 5 and Fig 9, one notice that the frequency of occurrence of each stability class is also totally dependent of the classification method. For instance, on the top-right plot, the unstable case occurrence is 13% of samples for the new classification, instead of 56% with the classification based on turbulence intensity. It show again the poor correlation between both information.

- The thresholds used in the new classification are different for each tested wind farms. It is justified by the fact that the wind turbines are different. But how can one explain that thresholds are different on the same wind farm (Ormonde) but for different wind directions? Please elaborate on this point.

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