

Response to Reviewers for:
An in-depth observational and modeling analysis to explore long-range offshore wakes under different stability regimes

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We would like to thank all the reviewers for their detailed and thoughtful comments. Suggestions and edits have been incorporated into the manuscript and we have responded to all the comments below in **red text**.

Thank you.

CC1:

This is a very interesting paper dealing with an important issue: the wakes of larger offshore wind farms. This note is not to be considered as critics but just serves in order to give some hints to additional studies addressing the same subject.

First of all, atmospheric stability had been neglected in offshore wind energy projects for a long time. See Emeis (2010)

https://onlinelibrary.wiley.com/doi/abs/10.1002/we.367?trk=public_post_comment-text for a first study which analyses the principle impact of atmospheric stability on wind farms wakes by a simple analytical model.

Thank you for sharing this reference. This is an interesting study, that again, emphasized the importance of stability on downwind wind farm wakes. I have added a citation to this study on line 33 and 336.

Atmospheric stability information could be displayed by so-called stability wind roses. Fig. 6 in Emeis et al. (2016) <https://iopscience.iop.org/article/10.1088/1742-6596/753/9/092014/pdf> gives an example how to do this. The stunning result is that stability and wind direction are strongly correlated for offshore areas of the midlatitudes. In the North Sea stable conditions are linked to southwesterly winds.

Thank you for this suggestion. This is shown in Figure 13, which correlates the annual frequency of the stability class to the wind direction, wind speed, and time of year. This figure shows that wind directions out of the west (200°-300°), which is the predominate wind direction in the North Sea (Figure 12), are more commonly associated with neutral conditions. This analysis has been expanded on further work, specifically focusing on comparison between stability and wind

direction in regions such as the New York Bight, but that is outside of the scope of this study and will be discussed further in future work.

There had been earlier studies on how to reproduce WIPAFF data by WRF simulations. Maybe a look at Siedersleben et al.

https://www.schweizerbart.de/papers/metz/detail/prepub/89817/Evaluation_of_a_Wind_Farm_Parametrization_for_Meso?l=DE may be helpful.

Thank you for this suggestion. I have added this citation to the manuscript, see lines 236 and 336.

Anyhow, this paper deserves publication finally.