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Comment on wes-2021-33

Anonymous Referee #1

Referee comment on "Assessing boundary condition and parametric uncertainty in numerical-weather-prediction-modeled, long-term offshore wind speed through machine learning and analog ensemble" by Nicola Bodini et al., Wind Energ. Sci. Discuss., https://doi.org/10.5194/wes-2021-33-RC1, 2021

The manuscript describes a statistical (machine learning) approach to derive the uncertainty of wind data from mesoscale model simulations for longer time periods. The topic is relevant for wind energy. Thus, the manuscript should be published after revisions.

The manuscript is clearly written. Nevertheless, reading the manuscript rises a number of issues and questions which should be addressed in more detail in the manuscript.

(1) Lines 37-39: Using marine tower data (e.g. available offshore off the coasts of the Netherlands, Germany or Denmark) should at least be mentioned in the introduction in parallel to the possibility of using floating lidar data. There is more offshore wind data than those from buoys. Please add some references.

(2) Given that there is some tower data (some of them for more than ten years), could testing of the results from this study against long-term time series from the FINO1 or FINO3 platform in the German Bight be an option?

(3) The addressed wind conditions in this manuscript are those in coastal areas. Therefore, the reviewer is wondering why coastal effects in the wind fields are not addressed. This should at least be mentioned in the Introduction.

(4) Some configurations of the mesoscale model WRF have problems representing the atmospheric boundary layer in the transition region between land to open sea (see, e.g., Siedersleben et al., 2018, DOI 10.1127/metz/2018/0900). Has the WRF configuration chosen for this study been checked for the ability to properly simulate the transition from land to sea?

(5) This study addresses uncertainties in wind speed. How does the magnitude of these possible uncertainties in wind speed modelling relate to, e.g., interannual wind speed changes due to long-term oscillations in the global circulation (NAO etc.) or due to climate change?

(6) Figure 7: Why do unstable thermal stratification conditions have such a small share of all cases? Shouldn't the lagged annual SST variation (due to the much larger thermal inertia of the water) compared to the air temperature variation lead to roughly equally frequent stable and unstable situations (stable in late winter and spring, unstable in late summer and autumn)? Please give an explanation for the found bulk Richardson number distribution.

(7) Why is the 2 m inverse Obukhov length chosen as a parameter at all in Section 2.2? This parameter can only be relevant for the whole rotor area of the future wind turbines in cases with perfect vertical mixing. In stable conditions the depth of the Prandtl layer is much shallower than turbine hub height so that the near-surface Obukhov length is most probably irrelevant for the 100 m wind speed. This is likely to be also true for cases in which internal boundary layers are present (which frequently happens in coastal areas).

(8) Figure 3 demonstrates that the 2 m inverse Obukhov length is not a meaningful parameter, because it is always close to zero. Logically, the weight 0 has been attributed to this parameter in Table 4. So, once again, why has this parameter been included into this study?

(9) Assumed that the inverse Obukhov length has nevertheless some relevance, a not-discussed contradiction is that there seems to be a slight bias of the inverse Obukhov length towards instability in Figure 3 while there is a strong bias of the bulk Richardson number towards stable conditions in Figure 7? This should be explained. It seems to confirm the irrelevance of the inverse Obukhov length stated above.

(10) A major finding of this study is the increase in wind speed uncertainty close to the coast and for non-neutral stratifications. Does this point to weaknesses in the used method or to weaknesses in the used mesoscale model? Or is this a natural feature which comes out of this study? Please discuss this point in the Conclusions.