Response to the comments about the submitted paper

Comparing and validating intra-farm and farm-to-farm wakes across different mesoscale and high-resolution wake models

We would like to thank Referee #3, Nicolai Gayle Nygaard, for the careful reading of our revised manuscript and for the useful comments and suggestions. Our detailed answers follow.

Please note that reviewers' comments are in italics while our answers are not. Additions to the original manuscript are indicated in blue.

Answers to Reviewer 3

Comment R3.1 - *p. 5 where does the pitch curve come from (eg turbine manufacturer or measured using a separate wind speed reference). Consider including a plot of it in the paper*
Answer to R3.1 Thank you for that question. We checked the details of the derivation of the equivalent wind turbine wind speed again and found that we only relied on the power curve below rated wind speed. Thus, we did not use the pitch curve at all. Sorry about the confusion. We modified the text, which now reads "The SCADA data include electric power, rotor speed, yaw position and nacelle wind speed.The SCADA data has been quality-controlled (Hansen et al., 2015). From the SCADA data, the equivalent wind turbine wind speed was derived from the 10-minute values of the power combined with the power curve below rated power.".

Comment R3.2 *Line 126 - I don't think the abbreviation RØ has ben defined before it is used*
Answer to R3.2 Thanks for spotting this. We have replaced "RØ" by "Rødsand II". In addition, we defined RØ and NY at line 70 of the new version: "The Fehmarn Belt with the wind farms Nysted (abbreviated NY in the following) and Rødsand II (abbreviated RØ in the following) has been selected as the study area (Fig. 2)".

Comment R3.3 *Fig. 6+8 - The abbreviation RS2-mast conflicts with the text where the mast is called RØ mast*
Answer to R3.3 We changed the title of figure 6. The y-label of figure 8 has been changed already (see Answer to R3.12 provided in response to the first review), but we accidentally included the old figure in the revised manuscript.

Comment R3.4 *Line 224 - "averaged over" is repeated*
Answer to R3.4 We removed one "averaged over". Additionally we removed one "filter" in line 332 and one "for" in line 400 of the submitted revised manuscript with tracked changes.

Comment R3.5 *Fig. 9 caption - Change "interpolated WRF results to" to "WRF results interpolated to"*
Answer to R3.5 Changed.

Comment R3.6 *Fig. 9 caption - change time steps to time stamps*
Answer to R3.6 Changed.

Comment R3.7 *Line 296 - can the larger bias not also be due to global blockage which is included in EWP and FIT, but not in NWP?*
Answer to R3.7 Global blockage should be embedded in the mast measurements as well as in the EWP and FIT simulations, but not in the NWF simulations. Thus, one would expect EWP and FIT to be more accurate than NWF. However, we don't find this from our simulations ($WS_{\mathrm{bias,NWF}}$ =-0.02 ms^{-1}, $WS_{\mathrm{bias,EWP}}$ =-0.17 ms^{-1} and $WS_{\mathrm{bias,FIT}}$ =-0.28 ms^{-1}). The reason for that is that a simple linear interpolation to the mast location using grid points within the farm and outside the farm cannot present the wind conditions at the mast accurately enough. This has been explained in the text as "The larger biases for EWP and FIT compared to NWF for the non-wake-affected sector can be partly attributed to the interpolation of wake-affected and non-wake-affected points to the mast location". The error due to the interpolation exceeds the effect of missing global blockage in NWF in this case.

Comment R3.8 *Line 323 - change taken to handled*
Answer to R3.8 Changed.

Comment R3.9 *Line 325 - add filtering before methods*
Answer to R3.9 Changed.

Comment R3.10 *Line 326 - delete rotor in rotor equivalent wind speed to be consistent with the rest of the text and the literature in general*
Answer to R3.10 Changed.

Comment R3.11 *Line 384 - ZON is the most complex engineering wake model in this study, not in general :-)*
Answer to R3.11 Agreed. We added "used in this study" to the text.

Comment R3.12 *Line 399 - add an s on deficit*
Answer to R3.12 Changed.

Comment R3.13 *Line 404 - should it be they?*
Answer to R3.13 Indeed, we changed it accordingly.

Comment R3.14 *Line 439 - change the to a distance of before 5 rotor diameters*
Answer to R3.14 Changed.

Comment R3.15 *Line 471 - add the before baseline*
Answer to R3.15 Changed.

Comment R3.16 *Line 481 - do the authors believe that engineering models should be calibrated differently for intra-farm and farm-farm interactions? In that case, how would one use such models in situations where neighbouring wind farms are present?*
Answer to R3.16 Thank you for that comment. We did not intend to argue for a different calibration for intra-farm and farm-farm interaction for engineering models. Instead we propose to also include farm-to-farm data sets in addition to intra-farm data sets for calibration. To make this clear, we modified the text as follows: "Future work could consider farm-to-farm calibration data-sets in addition to intra-farm calibration data-sets to improve their capability."

Comment R3.17 *Line 508 - a wind speed before variability*
Answer to R3.17 Changed.