

Interactive comment on “Global Trends of Large Wind Farm Performance based on High Fidelity Simulations” by Søren Juhl Andersen et al.

Anonymous Referee #1

Received and published: 28 February 2020

General comments In the manuscript the authors compare the results from different large eddy simulation codes for the performance of very large wind farms. The analysis focuses on the variability of the turbine power production in aligned and staggered wind farms. This is a relevant topic for the community and analysis of this aspect in large eddy simulations is still limited. As indicated at the end of the introduction this study is a continuation of the study by Andersen et al. (2015), but it includes more data and more analysis. The topic addressed in this study, the power variations in wind farms, is an important area that needs further study, relevant for the scientific community, and the readers of Wind Energy Science. Before I can recommend publication of the manuscript, I would like the authors to consider the points indicated below.

Specific comments * In some places the introduction feels a bit like a sum-

C1

mary list of several previous studies as each paragraph summarized the work of one paper. It would be nice when the introduction can be somewhat more coherent.

* There are very few recent papers (last 3 / 4 years) mentioned in the introduction. Please check whether some recent works need to be included in the discussion.

* Figure 2: The Forwind data are for a different turbulence intensity than the other two data sets. As discussed in the manuscript this significantly affects the results. It would be very nice when it would be possible to add one Forwind simulation for the same turbulence intensity as the other cases to allow for a more one to one comparison.

* Section 4.1.1 to 4.1.3 seem to be written rather independently. It would be nice to indicate the connection between these different cases.

* Figure 4 to 6 please give the relevant information necessary to read the figure in the caption or a legend. Now one has to go back to table 1 to find the necessary information to understand the figure. So please mention which mean flow properties are different for each presented data set in these figures.

* Figure 4: For the blue data $P/P_0=0.32/0.33$ seems a somewhat special value, i.e. there seems to a strong drop in the occurrence of productions that are higher/lower than this particular value. Is there a reason for this?

* In figure 7 there is one gray data point at $\sqrt{s_{ys_x}} \approx 16$, which is much higher than all the other data points. Can the authors discuss this particular cases in more detail.

* Figure 8: Would it be possible to indicate the results for the high and low turbulence intensity cases in different colors, so the effect can be observed and discussed? The figures also have a lot of white space, which can be reduced such that the actual data can be seen better.

* Line 326-329: The authors mention a difference of $\pm 0.5 \text{W/m}^2$. The values in the corresponding plot (figure 9) seem to vary between 0 and 2.25W/m^2 . Can the authors

C2

discuss more how this uncertainty should be interpreted?

* Figure 9-11: I am wondering whether the authors can comment in more detail on the uncertainty or potential bias that is introduced by the spread of the available data points over the considered parameter space, which is indicated in figure 12. Is this taken into account in the fitting procedure?

* In figure 2 we have seen that the turbulence intensity influences the performance of the wind farm significantly. In figure 9 to 11 the data for different turbulence intensities are combined. To what degree does this affect the presented results?

* Line 220: Do the authors have an idea on the reason for this increased variability.

— Technical corrections

* line 42: Same reference is mentioned twice. * Equation 4 seems missing. * Table 4: what is meant by "Data is only given for one row of 50 turbines"? * line 178: add as "space" after turbine spacings * line 365: Corrected typo in "ressources" * References: Several references need to be updated – line 467: please update: It is a 2015 paper that is listed as "accepted for publication" – line 481: Spaces are missing in this reference

Interactive comment on Wind Energ. Sci. Discuss., <https://doi.org/10.5194/wes-2019-109>, 2020.