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Interactive comment on "Correlations of power output fluctuations in an offshore wind farm using high-resolution SCADA data" *by* Janna K. Seifert et al.

Anonymous Referee #1

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In the manuscript the authors analyze the correlations of power output fluctuations in the offshore wind farm Global Tech I wind farm based on SCADA data obtained over an eight month period. The required data analysis to study these phenomena in SCADA data is very challenging. The topic is relevant and interesting for the wind energy community and suitable for publication in Wind Energy Science Discussions.

That being said, I believe the authors should carefully revise the manuscript before it can be considered for publication. The current manuscript lacks clarity on various important points (see below), which need clarification and more detailed discussion.

Please find below the corresponding list of comments, recommendations , suggestions,

and questions.

* In the abstract it is unclear what "clustering algorithm k-means" is. This method may not be known to all readers and requires explanation. * Even after reading the entire manuscript the goal and exact outcome of this analysis remains vague. It seems that during this analysis the data is sorted, based on the power fluctuations, and that based on this division the power correlations in certain parts of the data are more pronounced than in other parts of the data set. What does this tell us exactly? I guess from figure 8 and 9 we can see that power correlations are more pronounced for certain turbines than for others (however, data from the same turbines seems to be included in different clusters). So in figure 8 cluster 5 is dominated by turbines on the first row, but a similar observation can be made from figure 6a already. So it is not quite clear what the added value of the "k-means clustering algorithm" analysis in this work is. This should be clarified, or that analysis should be removed from the manuscript.

Line 15: "7 wind farms were connected to the grid"? ==> This seems low. I guess only wind farms above a certain size are included. Line 47: It seems a bit strange that wind direction changes have only a a little effect on power output fluctuations. In fact, I would say that the results presented in the current manuscript indicate the opposite. What kind of wind farm did Dai et al. (2017) considered?

Line 76: It is stated that U is not measured, but calculated from the measured power. Please clarify how exactly that is done, and to what degree this procedure could affect the presented findings. Line 78: "However, it can still be used for assessing the effect of the wind speed on the wind turbine." ==> what effect of the wind speed on the wind turbine are you referring to (you use the power to get the wind speed).

Figure 1: Throughout the manuscript the authors focus on the 90 degree and 270 degree wind directions. Figure 1 suggests the wind farm is not perfectly aligned with the 270 / 90 degree direction (for example turbine 15 seems a little lower than turbine 9). Is this indeed the case, and if so, why did the authors not select the wind directions

corresponding to the wind farm alignment in the red box of figure 1.

Table 1: Is the filtering really performed with "no yawing", or is this also practically implemented with some low threshold?

Line 108-111: Please clarify what you mean? Do you refer to turbines which are limited in production because of other consideration than their own individual controller?

Line 163-165: in the explanation of t_norm you refer to some time averages. What time averages do you exactly use (over the 600 time second window)?

Line 171: Why is this reference speed chosen and not a higher value? In figure 4 we see the peak values are observed at t_norm=1.1 to 1.2. Can you give some more detailed consideration as what we can infer from this value.

Figure 2 (and other places): a total of over 9 million intervals is mentioned. Are these statistically independent, or not? Please clarify.

Figure 4: Why are the results not symmetric? I.e. for example 260 shows pronounced peak, but 280 degree does not. This aspect should be discussed. See also my above question on the selection of the 90 and 270 degrees wind directions.

Line 203: For wind directions approaching 0° and 180° the wind turbines in a pair are oriented more perpendicular to the wind. Fluctuations reach the downstream turbine earlier. ==> If the turbines are perpendicular for these wind directions, what is then the "downstream" turbine?

Line 224: Normalized by what?

Table 2 and other tables: If possible, I believe it would also be useful to mention the average power outputs of the wind turbines A and B

Line 250: "Even though such wind turbines are filtered out for the analysis, they still influence the surrounding wind turbines in an unpredictable way." ==> Please clarify the meaning of this statement. If the data is filtered such that all turbines are operations

what effects are then not filtered for?

Figure 7 (line 260-263): If figure 7 is just showing two lines already shown in figure 4 why do we need this additional figure?

Line 264-265: "into a reasonable set of groups and a greater number of cluster did not lead to further clusters of importance for the present analysis (see appendix B)." ==> Please clarify this statement. Also after reading the appendix this was not quite clear to me. What does "reasonable" mean? And what is a cluster of importance?

Line 308: Please be specific so the conclusion section can be read independently.

Line 320: It is unclear to me what can be learned from these different clustering approaches. Why are these specific ones suggested?

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