Wind Energ. Sci. Discuss., referee comment RC2
https://doi.org/10.5194/wes-2022-38-RC2, 2022

Comment on wes-2022-38

Anonymous Referee #2

Referee comment on "Extreme coherent gusts with direction change – probabilistic model, yaw control, and wind turbine loads" by Ásta Hannesdóttir et al., Wind Energ. Sci. Discuss., https://doi.org/10.5194/wes-2022-38-RC2, 2022

General comments:

This paper is both relevant and well written and it contains material relevant for important discussion on how to improve modeling related to gust events. It contains a study on the actual wind conditions that is close to a ECD event as well as a consequence study of the measured windconditions simplified in to a parametric study of standardized IEC gust of the ECD type with variation in the parameters wind speed, wind direction and rise time.

The first part of the study that relates to the measured wind event is in general very good. Only minor remarks to this part to enhance the clarity. Eg how is it ensured that the selected wind events are related to a situations like an ECD, where the increased wind speed and wind direction stay on this new plateau for substantial amount of time? How is it ensured that the wind structure is coherent over a area covering a multi MW wind turbine? Perhaps this is covered in a prior reference, but it could be made more clear to the reader.

It is also surprising that gusts with rise time down to 5s is included in this stude, as it is based on a previous study (Hannesdottir and Kelly, 2019) where the fastest gust seen for this site is 9s. How can this be? is this an artifact of the ISORM approach or can such fast events be justified as a coherent gust opposite being part of turbulence?

The second part of the paper addressing the consequence study of the chosen distribution of gust parameters is quite clear, and a public available turbine model with controller is used. It is nice that a public available turbine model is used as it makes it possible for

other to reproduce the results. However, to conclude that the results found is what is expected from using an inductrial controller is not clear at all and the author should be cautious about concluding anything general from this analysis. From the time series shown in the appendix, it appears as the controller is highly sensitive to rapid changes in wind speed as well as highly sensitive to yaw errors which is understandable as there are nothing done in the controller to ensure low loads in such extreme situations. At most, conclusions from the consequence studies can be seen as indicative and not representative of the reponse of all wind turbines.

Specific comments:

- Are the measured gust mainly related to the western or eastern sector. Is is mainly onshore ore offshore/near shore conditions that result in the measured gusts. Is there a difference in gusts from East or West?

- p.3 line 60. Is there a relation between start wind speed rise [m/s] and wind direction error as used in the standard, or how is it on this site?

- p.3 line 66. "from a variety of phenomena" like what? Can you give examples to the reader?

- How are the wind measurements done? Height of measurement, number of points, single or multiple metmast? Does a rise time of 5 seconds still correspond to a coherent gust with a spatial size of +100m?

- How is it ensured that eg the wind direction is "permanent" and not just a temporary gust returning at a low value after short time? Same question for the delta wind speed.

- How is it ensured that gust structures are large enough to quality for a coherent structure for a multi-MW turbine?

- It is stated that 92 gusts have been detected. How is it ensured that there is enough points?

- p.5 line 115. What is IDF?

- p.6 line 132. it is unclear how the correlation coefficients rho_ij calculated?

- p.6 line 137. How is U derived?

- p6 line 138. Is equation 12 to be understood as a dot product?

- p.7 Figure 2. It is quite difficult to see any quanticative results of these plot. In the right plot is appears as not data a present for a delta u<10m/s, whereas the left plot show the majority of points below 10m/s. Perhaps the points can be placed in Figure 3 with colors representing the rise time.

- p.7 line 156. Why is the rise time negative here?

- p.8 eq(17) Why is this shown as a dot product?

- p 10. It would be nice if eg the tower top resulting bending moment was included as well.

- p 10. Line232. "binding" -> "bending"

- p11. line 246. "may be seen". Can it be seen or can it not be seen? Please choose.

- p 11. Fig 5 Please write in captions what sensor is seen in the plot and or make it more clear from the individual figures

- p 12. Fig 6 Please write in captions what sensor is seen in the plot and or make it more clear from the individual figures

- p 16. Line 315. Are you sure the accuracy to the BEM model in HAWC2 decrease with yaw error? otherwise the work "may" should be included beween "(BEM)" and "decrease"

- p16. Line 316. Is is fine to reflect on the model accuracy, but as I read the paper, I am more concerned about the uncertainty in the simple turbine power controller than the aerodynamics.

- Appendix A. Figure A1 Please include wind speed and wind direction for clarity.

- Appendix A. Figure A1. What is the difference between the dottet and the solid lines?

- Appendix A. Figure A1. Gust parameters are written in the figure title, but it is unclear what the numbers represents.

- Appendix A. Figure A2. See comments related to figure A1