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WIND ENERGY SCIENCE DISCUSSIONS

Interactive comment on "Characterization of a new perturbation system for gust generation: The Chopper" *by* Ingrid Neunaber and Caroline Braud

Anonymous Referee #2

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General:
A novel approach for generating high velocity fluctuations with a rotating chopper disc in a wind tunnel is presented. The effect of the disc is investigated for two different rotational velocities of the chopper at a constant wind speed. The absolute flow is measured detailed by a 1D hot wire array, which is traversed downstream. From this data the absolute velocity, the turbulence intensity and spectra are calculated. Furthermore, the author shows that each gust can be divided in the mean velocity, the gust shape and additional turbulence.
Overall, the study shows a very interesting approach for a new device to generate velocity fluctuations under controllable conditions. The study has been carried out very conscientiously and to a large extent. In my opinion, however, the results show that the

flow of the chopper needs to be investigated in more detail. The author shows just two different cases, which are compared to each other. Furthermore, the high turbulence intensities of up to 60%, as well as an absolute velocity minimum close to 0 m/s show that a hot wire is not a suitable measuring instrument for measurements near the chopper. The study would therefore benefit greatly from a measurement technique that can distinguish between positive and negative velocities. LDA measurements, for example, are suitable for this purpose. Also the used wind tunnel seems to have a huge problem with the high blockage induced by the chopper, which is indicated by the large recovery time of the velocity.
The approach of flow modulation upstream presented here is very interesting and the results presented here show a nice first insight, but in my opinion the results must be looked at more closely and above all more critically due to the used hot wires and the limited cases.

Specific Comments:

1. Section 1: The goal of the study is well motivated, as it is a current problem of the wind energy community. Also the current literature is well reviewed. However, the work of D. Greenblatt (e.g. Unsteady Low-Speed Wind Tunnels (2016)) should also be included in the literature, as here speed variations due blockage using a louver have already been worked with.
2. Section 1: The authors show in figure 1 the EOG which serves as motivation. Also, a duration of 10.5s is mentioned. Unfortunately, the authors do not compare their results of the chopper against those defined gusts. I am also missing the mentioned frequency of the gust in the presented results, or an explanation why this frequency was not used.
3. Section 2: The author should comment on the use of 1D hot wires since the wake of a flat plate is a very complex and three-dimensional flow.

4. Section 2 (P4 L76): The authors do not comment why the flow velocity of 25 m/s is used and why they choose the presented frequencies. They also choose to measure “more than 20 gust events” and do not comment why they choose to do so. In addition for the 0.4 Hz case the number of measured gusts is doubled compared to the 0.04Hz case. Were all data used for the evaluation?

5. Section 3 (P5 Fig 3): The data show a large recovery time of the flow velocity after the chopper leaves the measurement section. This is not discussed by the authors but shows that the wind tunnel is probably not suited for such high blockages.

6. Section 3.1 (P5 L97): For the case with higher rotation higher fluctuations are measured. The duplication of velocity do not match with the induced blockage. This indicates strong aerodynamic effects of the chopper since the measured spikes occur when the chopper enters the test section. I think the authors need to be careful with interpreting these peaks without knowledge of the ongoing effects.

7. Section 3.1 (P6 L103): The decomposition of the gust into mean velocity, fluctuations and turbulence is a nice approach. It should be complained in more detail, how the decomposition was calculated.

8. Section 3.2 (Fig 6 7): The flow field has been studied very thoroughly and the results are well presented. The results show nevertheless a high asymmetric shape. This seems to be correlated with the shape of the chopper and with the time the blade stays in the inlet of the wind tunnel. Are there plans to improve this with a different geometric chopper shape? How should one deal with such high asymmetries during experiments with model wind turbines or blades?

9. Section 3.3 (P10 Fig 10): The shown fluctuations seem to be cut at low velocities. Here it needs to be verified if the results are correct or if this is a result of the used

1D hot wire and the used calibration.

10. Section 3.3 (P10 Fig 10): The average gusts show for both cases a peak at t/T = -0.05. The author does not comment on this peak, but it seems to be present in all gusts, since it shows up in the averaged data. The peak is also present for different positions as it can be observed in Fig. 11 as well.

11. Section 3.3 (P11 Fig 13): It is explained how the gust duration is determined; however, I am missing error bars in the plot. Also an explanation why the threshold of 0.025 is used is not explained further, but is crucial for the calculated gust duration.

12. Section 3.4 : The integral length scales are calculated from the data, but is the information one could draw from this? I think if those numbers are presented the should be put in some context.

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