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WIND ENERGY SCIENCE
DISCUSSIONS

Interactive comment on "Aero-elastic loads on a 10 MW turbine exposed to extreme events selected from a year-long Large-Eddy Simulation over the North Sea" *by* Gerard Schepers et al.

Anonymous Referee #1

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Dear authors, Thank you for the submission. To start, please note that the submission does not respect the formatting guidelines of the Wind Energy Science Journal. This clearly jeopardizes readability. Among the many changes you will be required to implement before publication, please avoid multi-level indentations and check the spacing of the text, which in the current submission varies from paragraph to paragraph. In addition, be consistent with the style of the figures, and most importantly use vectorized images. Figures 6-12 are poorly readable, and zooming in does not help. Overall, the formatting of the submission substantially reduces the quality of the work.

On the technical side, my impression is that the paper blends two interesting topics

into a not always clear discussion. You are mixing differences in the wind prescribed by the standards (wind from a met mast and wind from a high-fidelity wind solver) with a comparison between BEM and vortex models. Simultaneously, you ran simulations with flexible and rigid rotor blades. Overall, I find the results and the discussion confusing: I do not understand any more what comes from what. I strongly recommend distinguishing better the effects of each analysis. The two analyses (different wind inputs, BEM vs vortex) can stay in the same paper, but not as they are right now. Please isolate the effects and structure the discussion more clearly.

In addition, please address these comments: 1) I do not agree with the authors that the comparison between the observations at MMIJ and the predictions of GRASP is found satisfactory. I find the matching between the black dots and the colored lines quite poor. Please elaborate better about these differences. I don't really understand where the differences come from. Several potential sources are mentioned, but I get lost and I cannot draw any conclusion. Also, how can you later distinguish between the colored lines? How do you use them in the load analysis? 2) Let's for example look at Figure 6. The match at 0h is very poor. Why is it better at 2h? How do you use this discrepancy in the load analysis? What is the point of using GRASP if the matching is so poor? 3) Figure 10 shows an especially poor matching between numerical and field results. Please discuss the origin of this discrepancy. 4) Please make sure to spell out the acronyms. What is the EQL? Is it the damage equivalent load? If that is the case, DEL is much more commonly used than EQL. 5) At page 15 line 318 you write "In section 6. it will be shown that these cases are sufficient for the present assessment and there is no need to include special cases.". First, please note that you have two sections 6. Next, the paper has no analysis about the "special cases", so the sentence above is not really supported by the results. 6) At Page 17 line 344 you write "The present analysis is based on normal production cases (DLC 1.2) only which means that special and extreme load cases are excluded. As such the actual maximum extreme load from a full IEC spectrum could even be higher than the values presented in Fig. 14. Some indication for that is found in (Savenije, et al., December 2017) which shows that often non

DLC 1.2 cases (e.g. DLC 6.2, idling at storm loads) are more extreme indeed. However, in the sequel it will be shown that even the extreme loads from DLC 1.2 are higher than the loads from the extreme GRASP events by which there was no use to calculate the non-DLC1.2 load cases." I find this sentence confusing, please consider revising it. Are you saying that DLC 1.2 does not generate ultimate loads? Anyone who runs load analysis of wind turbines knows that most of ultimate loads do not originate from normal operating conditions, but from either extreme turbulence (1.3), extreme change of direction (1.4), faults (2.x), or storm cases (6.x). Your considerations are not at all a surprise, and I do not think that you need a full paragraph to state that. Also, please distinguish between 1.1 (ultimates) and 1.2 (fatigue). 7) My understanding is that you are feeding to the aeroelastic solver wind histories characterized by much lower turbulence intensities than standard class IA conditions. It is therefore not surprising that the maximum and fatigue loads are lower. Please elaborate about this. What conclusions can you draw after running the full comparison? 8) Please elaborate about the dynamic controller. The only detail I find is "Also the control of the AVATAR turbine is taken into account.", with no references. This would force readers to dive into the deliverables of INNWIND, which are neither few, nor always peer-reviewed. 9) Are you sure that no other discrepancies between the models affect your results? 10-20% difference in fatigue loads between BEM and vortex for a rigid rotor configuration seems excessive to me. The work https://www.wind-energ-sci-discuss.net/wes-2020-6/wes-2020-6.pdf, shows some differences, but it looks to me that they are far smaller than the ones reported in this work. Is the sheared inflow the source of the discrepancy? If you confirm the result, please discuss the sources of the difference. Also, please separate more clearly the comparison between 1.2 and LLJ, and the comparison BEM vs vortex. I got very lost while reading section 6. Why not splitting it in subsections 6.1 "1.2 vs LLJ", and 6.2 "BEM vs vortex"? 10) What is the last column of Table 2 "Mflat, EQL deterministic [Nm]". I don't understand what deterministic refers to. Please clarify. 11) The paragraph discussing the difference between the physical reason behind the 1P and 2P harmonics is interesting, but hard to read. To start, please do not structure

it in a two-level bulleted list. Next, please clearly separate the comparisons between modeling fidelity and wind inflow. 12) Please distinguish clearly between final conclusions and recommendations for future work. It appears to me that the conclusion of this work are not strong nor novel. Much seems instead work in progress. This is a strong shortcoming.

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