

Interactive comment on “Simulation of transient gusts on the NREL5 MW wind turbine using CFD” by Annika Länger-Möller

Anonymous Referee #1

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Overall: The paper presents CFD(URANS) simulations of the NREL 5MW wind turbine. The aim is to examine transient gusts and the associated load implications. The underlying research question is interesting with some interesting conclusions, e.g. that the presence of the tower suppress separation. However, the article appears incomplete and somewhat unfocused, hence confusing at times. The written language is mediocre and could be improved for readability. Therefore, the recommendation is to reject the paper in the current state, but encourage to resubmit at a later stage. The author addresses a number of issues in the conclusion and these should be answered for resubmission. Hence, a more clear focus should be applied, e.g. how related is the tip vortex transportation actually to the transient loading during a gust? A number of suggestions will be given for improvements in the general comments, but detailed

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comments are omitted.

General comments: 1. Why are the gusts propagated with the speed of sound? This appears an odd choice as a real gust would propagate by its own velocity. 2. Why is the floor modelled, but no ABL? If a no-slip condition is applied, why not have a shear? The dependence on height appears to disappear without explanation in the equations. Otherwise, investigate a uniform inflow with the turbine "suspended" in space, which would give symmetry. 3. The turbine is stiff in the computations. Is this choice appropriate when examining extreme loads, particular for large wind turbines as the 5MW? This also affects the observed symmetry in Table 1 and whether this is to be expected. 4. Improved description of flow solver. What does dual cells, projection methods, prism layers, and C functions imply? 5. Why are there meshing issues involved for the nacelle, but not the hub nor tower? 6. How many cells in first grid? 7. The boundary condition definition is unclear, e.g. "the remaining farfield surface"? 8. How is such a small gust interesting? The cos gust basically results in a TI of 1.5% ($=\sqrt{2}/2 \cdot 0.25\text{m/s} / 11.4\text{m/s}$), hardly a defining design case. 9. How are the characteristic times chosen? And why would they be sinusoidal? It might follow the standards, but does this correspond to measured gusts or gusts from LES? 10. Explain spikes in e.g. Figure 3 around $t = 3230$ sec. 11. Is the use of average loads correct? Most people use equivalent loads. 12. Details are difficult to see in Figures 7-12. 13. In terms of experiments, why not validate the setup against the MEXICO experiments or Krogstad as there is nothing "special" about the NREL 5MW.

Technical Corrections: 1. Why are all references written twice? Please correct. 2. Wording is often rather strange, e.g. use of "regarding", "promising"(page 3, line 27), "respecting", 3. Sentences are back-to-front, e.g. page 2, line 9-10. Please correct. 4. Consistency. On page 2, there are mentioned "CFD" several times, while aero-elastic tools are denominated. Please also specify which CFD tools were used as there are large differences between "CFD" tools. 5. Periodic and initial is not the same(page 7, line 15).

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