

Interactive comment on “Wind turbines in atmospheric flow – FSI simulations with hybrid LES-IDDES turbulence modelling” by Christian Grinderslev et al.

Anonymous Referee #1

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The manuscript introduces a new method to perform detailed simulations of the Fluid Structure interaction of wind turbines in an atmospheric flow. The work is novel and relevant for Wind Energy Sciences readers. The manuscript is well very written and easy to read. The used simulation method is very involved and builds upon previous work by the authors. Overall, I believe the authors provide a good summary of the developed simulation method and refer to their previous work when appropriate. As the authors write modeling choices are unavoidable and appropriate validations for the case under consideration are presented. I believe the simulations are performed carefully. After reading the manuscript I have several comments / questions, see below, which I would like the authors to comment on.

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* The last part of the introduction, starting at "However, it is expected" is somewhat speculative as this is not actually shown in the manuscript and should be removed. * Line 87 (and other places): "The study is a continuation of (Grinderslev et al.)". This reference is not available to the referee and hence it can not be checked how this work is related to what is presented there. A short paragraph describing the connection between both works could be beneficial. * Figure 1: Can you include a scale (meters in the graph). Also where is the blend factor F_h defined? * line 271: in line 316 it is mentioned that no tower and nacelle are considered, so I am unsure how to interpret the statements here. * line 272: "for the initialization" ==> arguably this is part of the simulation method part (section 2.4) * line 290: directions of U,V,W should be defined * line 321: Can you provide a reference or additional explanation on this. * line 328/329: "The disc and rotor grids are similar to the setup used in (Grinderslev et al.), however in this study the background grid has changed to be suitable for LES." ==> Can you please clarify what is meant by making the grid suitable for LES? * Figure 4: the blue grid seems to extend further above the blades than below. Is there a reason for this, or my mistake in interpreting the figure? Is the "bending" of the blue region an effect of the bending of the blades? Just as figure 1 can you include a scale? * Figure 6: panel a yellow line is for 77 meters and in panel b for 93 meters. Please check. * Figure 10: please include a color scale. * Figure 12: This figure shows a snapshot, which shows that the instantaneous realization is different in the region up to 150 meters, i.e. the region where the turbine is roughly located. Did you check whether the turbulence intensity is affected by changing the model? * Figure 14: Do the crosses represent instantaneous realizations? * Figure 16: Do you know up to what degree omitting the tower and nacelle could influence the simulation result? * line 429: Here it is concluded that the domain may be too short. However, I could not find the corresponding discussion in the main text on which this conclusion is based. * charter 5: Some comments, for example why IDDES would be likely be insufficient for some cases, would benefit from some additional explanation.

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