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Interactive comment on "Validation of a coupled atmospheric-aeroelastic model system for wind turbine power and load calculations" *by* Sonja Krüger et al.

Anonymous Referee #1

Received and published: 5 February 2021

This paper presents an implementation of the actuator surface model using FAST into the LES code PALM. The code is later used to simulate a series of conditions from an experimental campaign.

The manuscript presents interesting results comparing experimental measurements and LES.

Some general comments needed to improve the manuscript are:

1. Extend the literature review, especially for FAST and LES coupling 2. Improve vague language by providing a quantitative assessment (e.g. "enormous reduction of the computing time") 3. Shorten parts of the manuscript (e.g., combine figures and

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possibly remove some) 4. Improve the comparison between the turbine models (e.g. add plots for quantities along the blades)

Here are some specific comments to improve the manuscript:

Abstract:

“The comparisons of the simulations to the NREL literature values show very promising results.” It is hard to tell what this statement means. I would recommend removing it or talking about something more specific.

“an enormous reduction of the computing time”: This statement should be backed up by a number. For example, “our coupling offers a 10X speedup in comparison to similar methods.”

Section 2:

Section 2 should be shortened, and the authors should look into the literature. Coupling between FAST and LES has been done for a long time in other codes, see for example: https://www.nrel.gov/docs/fy12osti/53567.pdf https://iopscience.iop.org/article/10.1088/1742-6596/1452/1/012071/meta

Is there a subgrid-scale turbulence model? What are the numerics of the LES code?

Section 3.1:

It is not clear what the difference between the 4 modeling approaches is. A table would be a good way of describing them. The authors only compare power output. To improve the comparison, the authors should look at some quantities along the blade such as velocity, lift, force, etc. Also, how many points along the blade are used?

“The wind speeds at the rotor area are then estimated using the induction model SWIRL of FAST. SWIRL uses the so-called Taylor’s frozen turbulence hypothesis (Taylor, 1938) and calculates the induced velocity in axial and tangential direction” It is not clear how this is done. I could not find the “SWIRL” model in the literature. FAST uses

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blade element momentum theory to compute induction.

Section 3.2:

What is the power of the reference turbine? The y-label of figure 4 does not seem to be right.

Section 3.2.1:

Figure 5 – This figure needs to be improved. Please add some distances and arrows indicating the wind direction

Section 3.2.3:

There are too many plots in this section. Some plots can be combined into the same figures. For example, the different root bending moments Mx and My can be in the same figure next to each other.

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