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Interactive comment on "How realistic are the wakes of scaled wind turbine models?" *by* Chengyu Wang et al.

Anonymous Referee #2

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General Comments:

This paper presents a numerical evaluation study on how well scaled wind turbine experiments in wind tunnels represent actual wind turbine wakes. Large Eddy Simulation (LES) based predictions for the scaled turbine are first validated against wind tunnel data. The validated code is then used to simulate various full-scale turbines that are generated using scaling laws and using DTU 10 MW wind turbine as a baseline. Same code is also used to simulate the wake of the scaled turbine. The manuscript is well written in general and it does present interesting and important results regarding the representation of wakes obtained using scaled wind turbine tests in wind tunnels. Some more explanations and clarifications can be added to the text, after which the paper would be acceptable for publication.

Specific Comments:

1) Section 2.1, Inflow: In addition to the listed turbulence characteristics (i.e. TI and ILS) it would be useful if the authors also comment on the issues regarding the scaling of the turbulence spectra and Reynolds stress tensor (normal and shear stress components).

2) Section 2.1, Rotor vortex shedding: Do the authors refer to vorticity shedding throughout the blade span or to tip vortices, when they define the vortex-shedding frequency? This part needs to be defined more clearly.

3) Throughout the text I would suggest to use "Reynolds number mismatch" instead of "Reynolds mismatch" to be more precise.

4) Section 2.3: Regarding the mismatch of the Reynolds number, please comment on how tripping the boundary layer on the scaled wind turbine blade would impact this mismatch.

5) Section 2.3, Line 166, Tower and nacelle vortex shedding: The diameter of the G1 tower obviously can not be larger than that of the full-scale turbine tower and model turbine nacelle obviously can not have a frontal area larger than that of the full-scale machine. I think the authors meant relative size of the tower diameter and nacelle frontal area. Please correct and also mention how the relative size is determined (i.e. with respect to D ?). Line 370 also needs correction in this respect.

6) Line 252: Do the authors mean "design TSR" and "Non-dimensinal circulation"? If yes please correct.

7) Figure 3: Authors compare the mean (average) velocity distributions obtained from the experiments as well as the ones obtained from LES. What was the duration of the computational simulation to obtain the average results? Also what kind of sampling rate and sampling duration was used for the triple hot-wire probes during data acquisition? What about distributions of normal and shear Reynolds stress components? Do they

also look similar?

8) Line 332: Authors indicate that the operating conditions considered were at Region II. Why not region I where TSR is more or less near design value? In Region II TSR will be different than the design value.

9) Figure 5: Why are the selected downstream locations for high inflow TI cases different than those for the medium inlet TI cases? Same question here, how long was the simulation time for LES to obtain average quantitites? How was it selected and was it sufficiently long enough?

10) Regarding Table 2, please comment and elaborate on the consistent decrease of power and thrust coefficients from G178 to G178-nRA to G178-MC, both for 0 and 20 degree yaw cases.

11) Line 390: Recommend to use the actual blockage in percentage (i.e. A/Awt, which I think is more common in wind tunnel studies) instead of Awt/A. Also in Figure 11.

12) Line 441: The sentence starting with "Unfortunately ..." is not clear. I would recommend to rephrase.

13) I think the conclusions section is too long. It should be re-written, should be more concise focusing on the major conclusions of this study.

Technical Corrections:

1) Line 146: change "objected" to "object"

2) Line 151: change "smaller that" to "smaller than"

3) Line 344: Recommend to replace "different" with "lower"

4) Line 351: Recommend to use "quantitative" instead of "precise"

5) Recommend to present the axis as y/D and z/ D in Figure 3.

6) Regarding Figures 7 and 8, the second row actually is a normal stress, not a shear

stress. So please correct in the figure captions as well as in the text. Recommend to use "Reynolds normal stress" and "Reynolds shear stress".

7) Figure 9: Please enlarge axis titles, axis legends, plot title, etc. These are too small.

8) Line 366: Recommend to use "contour plot" instead of "panel".

9) Line 393: Chamorro and Porte-Agel, 2010 is not a recent reference as indicated in the text. Please correct.

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