Review of **Blind test comparison on the wake behind a yawed wind turbine** by *F. Muehle et al.*

GENERAL COMMENTS

This article is highly relevant to wind farm engineering, particularly in that it provides a very good overview of what state-of-the-art CFD can presently achieve in terms of prediction reliability of wind farm productivity in complex operating conditions.

SPECIFIC COMMENTS

With reference to the two bi-pole structures (contours of vertical wind speed behind the front rotor of test case 1, Fig. 8), it would be beneficial to add some discussion on the possible causes of these structures. The small-scale bi-pole structure seems to exist also behind the FprWIND turbind (test case 3, Fig. 15). It would be helpful to comment on whether such small-scale bi-pole only arises due to the wind tunnel environment, or whether, in certain conditions, it may also be observed in field operation.

With reference to the discussion on the wake characteristics of the downstream turbine (section 4.2.2.) it should be noted that the second turbine, impacted upon by the wake of the front turbine, will also generate 'its own wake', which in the absence of the oncoming wake of the upstream turbine, would not be deflected at all. Discussion and attempts to clarify the evolution of the resulting wake (strength, direction, etc.) behind the downstream rotor, in this reviewer's opinion, ought to acknowledge the existence of the aforementioned strongly nonlinear interaction, which is indeed very relevant to the application of these results to wind farm control by means of sacrificial turbines in the front row.

TECHNICAL ORRECTIONS/COMMENTS/QUERIES

Readability could be improved by concluding Section Introduction with a clear overview of the article.

At line 15 of section 2.1 it is stated that tip Reynolds number of the NTNU turbine is 110,000. It would appear that the reference velocity used for calculating this, is the absolute wind speed of 10 m/s (this is not stated in the paper and it probably should). At line 29 it is stated that S826 was designed for Reynolds about one order of magnitude higher. However, I think that the Reynolds of 1 million refers to relative wind speed whereas that at line 15 to absolute speed. The 2 differ by a factor of 6, implying that the operational Reynolds is much closer to the design one. Please comment/amend as appropriate.

Figure 3. Since the oncoming flow is sheared, one should also indicate the orientation of the rotor angular speed because the turbine performance is in principle different depending on such sign. This information would be irrelevant only in the ideal case of zero wind shear. This information is only provided towards the end of the article, but it is suggested to add before the result section a clear schematic with the turbine, the three Cartesian axis and a graphical indication of the angular speed orientation.

Caption of Fig. 4 starts with 'Inflow at different wind tunnel positions …'. The word 'inflow', if I understand the figure correctly, may be misleading, because x/D>0 denotes positions downstream of the turbine, I assume? Please clarify/amend if required.

Section 3.3.1, line 27: please write time step as 10^{-3} for clarity. It would also be useful to add comments on why this value was selected, and on mesh refinement analysis to ensure reasonable independence of the computed mean results on both the spatial and the temporal resolution. These comments should be added also for the other 3 CFD set-ups. It should also be indicated what percentage of the rotor period does this number correspond to. And also if the driving criterion for this choice was to allow the development of the upstream turbulence generated by the Synthetic eddy model.

For clarity and to allow other research groups to use these results, it would be very useful to provide for each of the 4 sets of CFD simulations the distance of the inflow and outflow boundaries the distance from the first turbine along the direction of the wind stream.

Section 3.3.5, line 12. I think it's 'moment', not 'moments'.

First 2 lines of section 3.4.2 appear misplaced in that section.

Page 14, line 6: please provide clear definition of Angle of Attack in yawed wind or cite suitable reference.

Section 4.1.2. Please specify for both experimental data and numerical results whether the presented contours of streamwise velocity are averaged over a certain time interval or if they are instantaneous values. If they are averaged, please provide time interval.

Figures 7a and 8a: are these lines at hub height? Or averages along vertical direction? Please specify.

Page 19, line 1: '… and the TST … 5 is computed using u_{ref}=10 m/s'. This sentence is unclear.

At page 26 (Discussion and conclusions) it is stated 'The fourth simulation fully resolved the rotor geometry and directly calculated the forces on the rotor. The time-step in these simulations was chosen to be rather large in order to save computational time which might have negatively influenced the accuracy of the blade forces'. This statement presumably refers to the Siemens analyses, which used time step of 10-3 seconds. Why is this step considered small? With reference to what? Is it expected that the optimal time-step for a rotor resolved simulation should be smaller than for an ACL simulation? It would be very helpful to provide the value of the time-step for all 4 CFD simulation sets. As commented above, is the Siemens time-step too large for the synthetic eddy method although sufficient for resolving rotor unsteady aerodynamics ? Is this time-step deemed insufficient to resolve the wake turbulence? Comments on this would be very helpful to the wind farm CFD community.

The KTH simulation used measured lift and drag data. Was the maximum value of the angle of attack for which experimental data were available greater than the largest AoA expected in the 3D simulation? Or were empirical extrapolations used in the CFD look-up tables, similarly to what done in BEM analyses?

The IDDES simulations used Synthetic Eddy Method to enforce turbulent inflow fluctuations. It should be specified, however, if the other three simulation sets did something similar or used instead steady inflow conditions.