

Interactive comment on “Full HAWT rotor CFD simulations using different RANS turbulence models compared with actuator disk and experimental measurements” by Nikolaos Stergiannis et al.

Anonymous Referee #2

Received and published: 27 March 2017

The paper addresses the flow around two identical wind turbines placed in row. The actuator disk model and full rotor CFD simulations using a variety of turbulence models. Comparisons are carried out amongst the different predictions and against measured velocity profiles. Comments 1. It is mentioned that steady state simulations are carried out in the rotating frame. It is also mentioned that the tunnel geometry is included in the simulations. It is not clear how the two may be combined in full rotor simulations when the wind tunnel cross section is square. Perhaps the utilities of Open-Foam mentioned include the implementation of sliding grids. If this is the case, please specify accordingly the relevant details. 2. One missing information regarding the ADM results

C1

concerns the axial induction. Was a measured power and thrust curve used? Please specify. 3. I assume that inflow turbulence is similarly implemented in both models (ADM and full rotor CFD). The plots in Fig 6 seem to suggest that in the ADM results the level of turbulence is higher upstream of the 1st rotor. Is this correct? And if so is there an explanation? 4. It seems that the ADM model only accounts for thrust and not torque. Please specify. Furthermore, I believe that in Fig 5 the axial flow velocity is recorded and that the full rotor contours correspond to the azimuth averaged velocity. If so, it is important to also compare the axial force. 5. In Fig 6 the two models are compared in terms of k . I noted that the k - ϵ results from the full rotor simulations are not symmetric which implies that they are not averaged in azimuth. If so, then is such a comparison valid? 6. In Fig 8 the ADM results underestimate the acceleration seen in the measurements at both ends of the plot window. This is important when partial wake effects on the loading are of interest. Otherwise I agree that the k - ϵ RNG model outperforms amongst the different models. Also in connection to comment #3 it would be very useful if there are thrust or power measurements to make a comparison. 7. As also mentioned in the paper, the slow flow recovery seen in Fig 9 may be related to the evolution of inflow turbulence along the computational domain. Wind tunnel measurements on disks and small rotors indicated that by increasing the TI level faster recovery is obtained. Otherwise, in the specific set up, the k - ϵ realizable model performs rather well. 8. Finally, I would suggest to add in the last section that full rotor simulations should be also checked as regards the evolution of inflow TI.

Conclusion: The contains interesting results, but also some unclear points that need clarification. To my opinion the corresponding revisions are important.

Interactive comment on Wind Energ. Sci. Discuss., doi:10.5194/wes-2017-6, 2017.

C2