1st review of ''Hai Bui et al. Implementation of a Simple Actuator Disc for Large Eddy Simulation (SADLES-V1.0) in the Weather Research and Forecasting Model (V4.3.1) for Wind Turbine Wake Simulation. Submitted to Egusphere, 2023''

Summary

The work focuses on downscaling simulations for wind energy applications, and presents an implementation of the standard Actuator Disk Model (ADM-std) and the perturbation method (PM) in WRF-LES. In this context, two cases are presented. First, an idealized single turbine case is presented, where some options are tested. These simulations are compared with PALM simulations, serving as a pseudo-validation. Secondly a downscaling of the ERA5 reanalysis data around the Alpha Ventus wind farm is presented.

General comments

Overall, the research presented in the paper is very relevant and interesting to the field. However, the paper has major issues, which are unacceptable in a scientific publication manuscript:

- The manuscript has two repeated copy-pasted portions, one from line 59-65/66-72 and another from 256-259/260-264.
- Multiples figures have major issues. In Figure 1b the axes units are marked as kilometres when it should be meters. Also, the grid shown in Figure 1a makes no sense. Figure 3,5,9,10 don't have proper legends on the colormap.

In addition, a few other very important points must be addressed:

- The actuator model implemented is not new in itself and the novelty is only in its implementation in WRF-LES. The text should be very clear with this. This is often not clear e.g. lines 2-3. Also, each time SADLES is used in the text, it should be replaced by WRF-SADLES, e.g. line 7, or eventually WRF-LES-SAD, which seems more appropriate.
- In the community, BEM stand for Blade Element Momentum theory, which is not the same as the Blade Element theory alone which is used in AD+R and ALM, the text should be corrected to avoid any confusion, e.g. line 23,67, etc.
- The idea expressed in lines 113-118, that the rotation affects the wake recovery which justify the use of an additional subgrid-scale turbulence term since the rotation is not explicitly included, is not correct. Multiple studies have shown that the rotation is not important in LES with Actuator Models. The wake recovery mainly depends on the interaction between the wake with the incoming flow turbulence, including the turbulence generated by the wake shear itself, which means of course on how the simulation capture this accurately, in which the numerics, the sgs model, etc. play a critical role. Adding an additional artificial subgrid-scale turbulence term is fine, but it should be presented as so. Please mention the f_{TKE} used.
- The strong use of instantaneous flow to analyse the flow is inappropriate. The instantaneous flow can be used for illustration but not for stong flow analyses and conclusions. For example, the statement lines 226-227 make no sense. Also, the statement lines 311-314 has no base/proof. In the same time, turbulence intensity plots are missing. Figures 5,6 and 10 must be reproduced with turbulence intensity.

These points should be addressed before continuing the review process.