Interactive comment on "Simulated wind farm wake sensitivity to configuration choices in the Weather Research and Forecasting model version 3.8.1" *by* Jessica M. Tomaszewski and Julie K. Lundquist

Anonymous Referee #1

Received and published: 18 February 2020

General Comment:

The manuscript by Tomaszewski and Lundquist tests the sensitivitiy of the WRF models wind farm parametrisation to different configurations. Despite quite a number of studies that were recently released on this topic using the WRF model, the manuscript still provides some useful additional insight into the sensitivitiy of the wind farm parametrisation and gives an important overview on how to setup the model to get consistent and more accurate results. It is nicely written and also the figures are generally formatted well. However, I have one major comment and a number of minor comments and

thus recommend publication after dealing with major revisions.

Major Comment:

MYNN parametristaion changes: In the framework of the sensitivity studies that were conducted for the New European wind atlas different WRF versions were evaluated ([1] & [2]). From the analysis of theres results, a sensitivity towards different versions of the MYNN scheme was found. This scheme was modified in January 2016 [3] and the changes were reverted in 2018 [4], so WRF versions 3.7.X to 3.9.X are affected. As significant differences and biases in the wind were reported, the reviewer suggests to test the impact of this parameter by either changing it manually in the version run by the authors or comparing a run from a newer WRF version.

Minor Comments:

Page 1 - Line 7: Repetition of the word "undermining" - Please consider rewriting

Page 1 - Line 13: spinning turbines – Better: rotating?

Page 1 - Line 14: in situ observations – Better: in-situ observations?

Page 2 - Line 7: Reducing carbon dioxide emissions – wind energy itself does not reduce carbon dioxide emissions just emits significantly less (only during manufacturing) than burning fossil fuels thus emissions are reduced if wind energy is used instead of fossil energy sources. Please be more precise here.

Page 2 - Line 21: A number of LES studies are mentioned here, however, RANS and industry models (bottom up approach) are still commonly used for wind farm wake investigations as well. These models are however often lacking in parametrisations of meteorological effects sucht as atmospheric stability or large scale wind turnings. For completeness however, I suggest to add some RANS and industry model studies to the discussion here.

Page 4- Table 1: Near surface temperature impact – a warming effect of wind farms is

heavily discussed by wind energy sceptics at the moment, which are also sometimes taking some information from the context. That's why I suggest to add something like "due to redistribution of heat" to the "near surface temperature impact" in Table 1 just to make sure that the turbines are of course not warming but redistributing the heat in the lower atmosphere.

Page 5 – Line 31: ...Siedersleben et al. (2018b) show little sensitivity to the exact turbine power curve. - Please remove this sentence here as it can be misinterpreted. In case of the Siedersleben paper it was a special case where by chance the turbine power curves/thrust curves were similar. When investing this from the turbine technology development perspective it will make a very big difference if a turbine with a specific power of some 250 W/m^2 or some 400 W/m^2 ist extracting energy from the flow. This is particular true when using the Fitch model as the difference between CP and CT curves that determine the turbulence will also change.

Page 6 – Figure 1 : It is very hard to read the "1km" in the central most domain. Maybe one could remove the unit or just put this information to the caption?

Page 8 Line 2-4: Lee and Lundquist 2017a)... – I wonder how much this might be related to the changes of the MYNN model. (related to the major comment)

Page 18 – Line 10: ... meteorological wake effects – better: large scale wake effects Code and Data Availability: It would be extremely helpful for the reproduction of results if the namelists and also the final turbine specifications (txt tables) for the different runs could be provided. So please upload to e.g. zenodo and refer to them in the code and data availability section.

References:

[1] Witha et al. (2019): WRF model sensitivity studies and specifications for the NEWA mesoscale wind atlas production runs, Technical Report, 73 pages, doi: https://doi.org/10.5281/zenodo.2682604

[2] Hahmann et al. (2020): The Making of the New European Wind Atlas, Part 1: Model Sensitivity, submitted to Geoscientific Model Development

[3] https://github.com/wrf-model/WRF/commit/215265a928e1afd2e9f120833cad9a5d6f6b75 1a3f1e15af30c3ef38c4079db0d9c4d4

[4] https://github.com/wrf-model/WRF/commit/bddd7f449ff972a592e297baff4dda8153666d3 1a3f1e15af30c3ef38c4079db0d9c4d4