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Geoscientific Model Development Discussions

Interactive comment on "Impact of model improvements on 80-m wind speeds during the second Wind Forecast Improvement Project (WFIP2)" *by* Laura Bianco et al.

Anonymous Referee #1

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Review of the manuscript gmd-2019-80 Impact of model improvements on 80-m wind speeds during the second Wind Forecast Improvement Project (WFIP2) by Laura Bianco et al.

Summary

Within the context of the WFIP2 experiment, the authors evaluate the HRRR model on the performance for the 80 m wind speed. In addition they test whether a set of newly implemented physics schemes and/or increased spatial resolution improve the model performance. The evaluation covers multiple seasons, multiple starting times (Z00 and Z12) and is performed against a multiplicity of observational systems. In

general an increased resolution improves the model forecast, and the experimental physics suite is only beneficial in the HRRR, but not in the NEST version. Finally the authors unravel under which types of atmospheric phenomena the experiments result in a reduced or enlarged model bias. I find this study a very thorough evaluation that clearly illustrates the challenges the field faces when comparing and improving modelling systems, i.e. against different statistical metrics for different resolutions, under contrasting scale awareness of the model etc. However, I think the paper can be strengthened with limited amount of extra work in order to become more complete in terms of model variables and in terms of setting the future research agenda for model development.

Recommendation: major revisions

Major Remarks:

1. My first concern relates to the fact that this manuscript does not describe the physical package of EXP. The authors refer to earlier papers that document these modifications. While I understand the argument of doing so, as a reader I find it usually very unattractive to first read one or two other papers to understand the current one. SO I would encourage the authors to reserve some room to summarize the physical settings of EXP, so it becomes more clear to the reader what settings are underlying the bias reductions. I also think this helps the paper to generate more citations.

2. Although I understand that the focus of WFIP2 is on wind energy, it would be interesting for the readership to learn to what extent the model improvements also hold for wind speeds at other heights above the surface (60 m, 100m, 120 m – hub heights are rapidly increasing). One does not need to show all graphs for all heights, buts some guidance whether improved skill for the 80-m wind is also present at other levels is interesting for the readership of the paper.

3. In addition, it would be interesting to report whether improved statistics for wind also generate improved statistics for other variables as boundary-layer height, wind

direction, 10-m wind speed, 2m-temperature (let's say the routine synoptic variables). Again, no additional graphs are needed, but some guidance to know whether improved 80-m wind also improves or deteriorates the other variables is interesting to see the consistency of the improvements.

4. P6, ln 1: you suggest that the drag is too active in the revised physics. Is it possible to make this more concrete? E.g. one can discuss that this excess drag only occurs for grid cells where the modified drag scheme is active (since it switches on and off depending on the Froude number). Also if the PBL height in the model is too small, the drag has its divergence over a too shallow layer, making it too active in the atmosphere though the surface drag might be correct. In addition, it would be interesting to see whether one can distinguish whether the change in drag is due to local processes (surface drag) or modified synoptic settings induced indirectly by the drag.

5. I find the paper has a rather large amount of figures, while they are not always discussed in much depth. E.g. fig 14 can be removed, including the related text on P11, ln 1-18. In addition to that I would encourage the authors to extend the discussion about which atmospheric conditions are responsible for the model improvement. E.g. can the bias reduction be plotted against the geowind or vs atmospheric stability.

6. Although I appreciate the classification of the biases along different flow patterns, the exact definitions used to classify/categorize the flow patterns is missing in the paper. As such the reproducibility of the work is hampered.

7. Methodological concern: section starting at P11, ln 31: here the bias correction is applied and then it is concluded that the skills improves further. This is logical since you just removed the bias. A better way to do this is to split the data set in two parts and determine the bias correction on the first half and evaluate it independently on the second half of the data set. I could not understand from the paper whether this procedure was followed.

8. Finally: although I appreciate the efforts to report the model improvements and its

statistical evaluation, I think the paper can be strengthened by adding a section that summarizes the future research agenda concerning surface drag, the wind speed at hub heights. This is the journal of geoscientific model development, so in my opinion it should also prioritize the research efforts of the future.

Minor remarks:

P5, ln 7: when reading this I was wondering whether the statistics for other metrics behaved the same. This is dealt with later on in the paper, but perhaps it is good to announce already here that RMSE scores will be discussed later on. Just for the expectation management.

P5, ln 8: ... with SIGNIFICANTLY? smaller ...

P5, ln 11-15: this is a very long and unclear sentence

P7, ln 4-5: paragraph of 1 sentence, should be avoided

P7, ln 14: cite in chronological order.

P7, ln 18: .... always positive for wind speed.

P7, ln 24: model instead of models

P10, ln 12: reword "negative blue bar"

P10, ln 18-22: these sentences read like a figure caption, so is quite redundant

Figure 3: I would prefer to see this graph to be revised towards a column chart since the lines between the season do not say much. The statistics belong only to the season and are not connected.

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