

Comment on wes-2021-137

Anonymous Referee #2

Referee comment on "Sensitivity analysis of mesoscale simulations to physics parameterizations over the Belgian North Sea using Weather Research and Forecasting – Advanced Research WRF (WRF-ARW)" by Adithya Vemuri et al., Wind Energ. Sci. Discuss., <https://doi.org/10.5194/wes-2021-137-RC2>, 2022

General comments:

Overall, the manuscript is written in an understandable way. However, I see the need for additional revision for both language and parts of the content (more details in the specific comments section). The introduction is very detailed and provides sufficient references to connect the article to ongoing research and the state-of-the-art. While the methodology (evaluation metrics, model setups) has been described nicely and adequately, some details, especially about availability of measurements are missing. Furthermore, I think subsections for the different elements (model setup, evaluation metrics and description of validation data incl. pre- & post-processing and data availability) would be useful to keep the different components more separated.

Specific comments:

general remarks:

There are major inconsistencies in the way radar reflectivity and precipitation (rate) are handled in the manuscript. This is especially visible in some of the figures (captions mentions reflectivity while figure legends talk about precipitation with units of precipitation rates, e.g. Figure 1, 4), but also in the text (e.g. line 188-191). A major revision of all elements of the manuscript is needed by the authors with special attention to a consistent usage of atmospheric properties and units.

Throughout the paper, the term "horizontal resolution" has been used to describe the grid spacing of the WRF domains (among others in Table 1, line 145/146 and elsewhere). This

is misleading since horizontal (effective) resolution and grid spacing are not equivalent for numerical models like WRF (see e.g. Skamarock 2004, <https://doi.org/10.1175/MWR2830.1> for details). Please replace the term “horizontal resolution” with “grid spacing” where needed.

As mentioned earlier, the descriptions in the methodology section are quite convoluted with model setup, evaluation metrics, introduction and processing of measurements and WRF post-processing all described in the same section. I would suggest to introduce sub-sections for the model setup (incl. WRF post-processing of radar reflectivity), evaluation metrics and the measurements to enhance readability and to make space for more details, especially with respect to data availability for the radar and SCADA data (publicly available data, protected data or similar). If publicly available, please also state the access point of the data and provide more details about the wind farm.

remarks addressing specific lines:

Line 30: The reference (Skamarock et al. 2008) points towards Version 3 of the WRF model, but in your methodology section, you mention that you are using Version 4.2. Is there a particular reason why the Version 3 reference is used here and not Version 4?

Line 130: Reference(s) for the statements/quoted numbers of wind gust, travel path, effects etc. are missing. Please consider adding.

Line 151: “Subsequently, the model is run ...”. Please consider reformulation since the current formulation could be misinterpreted as two separate independent simulations (one 24h long simulation and one 21h long simulation). I assume the WRF simulation has been run in one continuous block?

Line 153/154: “The land surface interactions are kept constant”. Please reformulate since it is the parameterization scheme that is kept constant, not the interactions themselves.

Line 213: Make sure that you are talking about the correct boundary conditions (temporal resolution of the LATERAL boundary conditions not the INITIAL boundary conditions). Please correct.

Technical corrections:

Language corrections:

I am not a native English speaker, so I restrict myself here to mostly obvious formulations and spelling errors that caught my eyes.

Line 2: remove “,” after “Weather”

Line 4: replace “,” after “microphysics” with “and” Line 5: while the resolution of the re-analysis products is important, it is the temporal resolution of the lateral boundary condition updates that is investigated here (which is not necessarily identical), so I would suggest a formulation like “update interval of lateral boundary conditions” instead of “temporal resolution of re-analysis data”.

Line 10: remove “:”

Line 11: replace “Grell-Devenyi” to “Grell-Dévényi” (as written in Line 59)

Line 12: remove “,” after “Kain-Fritsch”

Line 23: replace “associated to” with “associated with”

Line 30: remove “,” after “Weather”

Line 34: I am not sure what you mean by “expanse of physics parameterizations”. Do you mean variety? I would suggest reformulation.

Line 61: replace “Frietas” with “Freitas”

Line 62: “[...] explores; redistribution [...]”. Sentence structure is unclear, please consider reformulation.

Line 87: replace “resolving” with “resolve”

Line 96: "XPIA" has not been introduced before. Please introduce the abbreviation.

Line 111: add "the" in front of "west Pacific Ocean"

Line 124: add "s" to "perspective"

Line 139: "potentially influential of the state of power". Unclear, do you mean "influenced by"?

Line 147: remove "largest" since there is only one parent domain.

Line 168/169: replace "PBL" with "PBL scheme"

Line 195/196: Insert "temporal" before resolution

Line 233: remove "to"

Line 237/38: capitalize "D" in "domain" for consistent naming

Line 248: This sentence is difficult to understand, please reformulate. Do you mean the Shin-Hong PBL scheme simulation is in better agreement with the SCADA data?

Line 260: replace "on" with "with" after "dependency"

Line 273: remove "through"

Line 291/292: add "scheme" or "parameterization" after "cumuls"

Line 333: Unclear what "wind-farm power excursions" means. Please reformulate.

Tables:

Table 1: Number of nested domain is misleading. Following WRF naming conventions (see e.g. <http://dx.doi.org/10.5065/1dfh-6p97>), it would be one parent domain (d01) and 3 nested domains (d02-d04). Furthermore, it would be good to mention if 1-way or 2-way nesting has been used.

Table 1: Time-step information incomplete. It is not clear which domain uses the 20s time step. I would suggest to either mention the time-steps for the four domains explicitly or state the domain which uses the 20s time step and provide the time step ratio.

Table 1: Consider replacement of “update frequency” with “update interval” to be consistent with the values given in the second column (1h and 3h are intervals, not frequencies)

Table 3-8: Units for MAEs, NEDs and Kantorovich distances are missing, please add. I would also suggest to change the E notation of the Kantorovich distance (rather uncommon in scientific literature) to decimal notation. The differences in scales of magnitude are not large enough to justify such notation to the expense of readability.

Figures:

In general, the font sizes in some of the figures are too small (especially Figure 1, 2 and the time series plots). Please adjust to increase readability.

Figure 1: Mismatch in time statement in caption (4:00) and reference in main text (4:40, l. 137). Please double-check. A description of the meaning of the star-symbol and the red lines is missing in the figure caption (and other figures captions as well). Please also consider changing the coastline color, which is too similar to colors used in the color map of the variable you are plotting.

Figure 1,6,8,10,11: Since the focus region is rather small, please add latitude and longitude information to make it easier to locate features.

Figure 3: insert “are” before “shown”

