Wind Energ. Sci. Discuss., referee comment RC1
https://doi.org/10.5194/wes-2021-137-RC1, 2022

Comment on wes-2021-137

Anonymous Referee #1

Referee comment on "Sensitivity analysis of mesoscale simulations to physics parameterizations over the Belgian North Sea using WRF-ARW" by Adithya Vemuri et al., Wind Energ. Sci. Discuss., https://doi.org/10.5194/wes-2021-137-RC1, 2022

Summary:

This study explores a series of possible WRF physics configurations for a Storm Ciara in the North Sea on 10 February 2020. The authors vary temporal resolution of the initial and lateral boundary condition data, the size of the WRF domains themselves, the boundary layer scheme, the cumulus scheme, and the microphysics scheme. The WRF model output from each simulation is validated against observations of wind speed and wind direction at an offshore wind farm. Model precipitation data is also evaluated against Doppler radar observations at the offshore wind farm. The authors found that scale-aware cumulus and boundary layer schemes, along with 1-hourly input data and a larger WRF domain generally performed better for this case.

Recommendation:

Reject.

Major Comments:

- A thorough technical English edit is required. There are numerous issues throughout the manuscript, most of which are specifically mentioned in the Minor Comments from the Abstract through Section 2 as examples of the issues that need fixing. I only mentioned a couple items from Sections 3–5.
- Lines 95–98 provide the key to defining the niche that this article aims to fill. I think you need to do a better job honing in and repeatedly showing how your work fills that niche. I also think that validating against data at only a single point for a single storm is inadequate to fill that niche. That is really the biggest fundamental issue I have with this manuscript, and why I gave it a Reject instead of a Major Revision. A single case study can have value if you do more than validate against observations only at a single point, while validating at a single point can have some value if you evaluate multiple cases. Are there any other buoys or towers that are available for offshore wind validation? I am aware of FINO1 in the North Sea region, but I believe it is outside your d04, unfortunately.
- Validating precipitation at only a single point is of limited use, even over many cases, when your goal is to determine which model configuration gave the most realistic simulation of precipitation. If you want to validate model precipitation or reflectivity, then you should leverage the land-based radar that you do have data from, and do object-based validation with MODE (https://dtcenter.org/met-online-tutorial-metv8-0/mode) for a more comprehensive validation.
- Many of the figures need substantial revision. (I originally had these subpoints labeled a–d, but this text editor in the WES form renumbered them to 40–43 for some reason.)
  - Fig. 1 (several of these comments also apply to Figs. 6, 8, 10, and 11): It is customary to plot coastlines or national borders in black or gray on most maps. Using a color from your colorbar (red) is simply confusing. Also, your filled contour colors do not match the colorbar. The thin ribbons of darker colors around fields of pastel colors also make this figure difficult to interpret with any confidence. Additionally, in this figure the colorbar label says "Precipitation" but has units of mm/h. Precipitation would have units of mm, but mm/h are units for precipitation rate. The caption also states that the figure is depicting radar reflectivity, which again is not quite the same thing as precipitation rate, though they of course are related to one another. The caption also states that the observed radar reflectivity (or really, radar-derived precipitation rate) is valid at 04:00, but line 137 says it is valid at 04:40. Which is it?
  - Figs. 3 and 4: You should have a thin gray line in your legend if it is in your plot. In the x-axis label (also in Figs. 5, 7, and 9), also use a date format like 10 Feb 2020. 10/2/2020 will easily confuse American readers into thinking the date is 2 Oct 2020.
  - Fig. 5: The orange dashed line is quite faint and difficult to see.
  - Fig. 6 (most of these comments also apply to Figs. 8, 10, and 11): First, calling these Domain 1 and Domain 2 is misleading. These are really Domain Configurations 1 and 2; both these domain configurations have domains 1–4, so when you say domain 1 or domain 2, my mind automatically thinks of the outermost two WRF domains. Second, the radar contour lines all look the same color, which seems like a mistake. Third, restrict your WRF filled contour range to the equivalent of the radar-derived precipitation rate, or at least restrict the lower bound cutoff to something like 0.01 mm/h. Is it really raining at lower values than that, anyway? Values below your lower bound should be transparent/not plotted. That will also solve the undesirable issue of the entire domain being filled with a dark blue that makes other features difficult to discern while also being meaningless. Fourth, state in the caption what the star is.
- Line 135: To be completely honest, changes in wind direction of 40° do not seem like a huge shift—it is not even half of a quadrant. If 40° is a hugely consequential shift that wind farm operators need to be quite concerned about, then it would be helpful to provide some justification.
- Table 2: I suggest either reordering pairs A–K based on the order they are discussed in

Sections 4.1–4.4, reordering Sections 4.1–4.4, or both (my preference). It makes more sense to me to look first at the size of the domain and the lateral boundary condition temporal frequency, before then comparing different physics schemes. Also, in Table 2 ensure that cell borders are turned on to separate the different experiment pairs in the cumulus pair column. Additionally, in the section titles for Sections 4.1–4.4, it would be helpful to include the experiment pair letters.

- Table 7: In the Average NED column for rows 10 and 11, you have 1.10 in green, 1.111 in yellow, and 1.32 in red. The values 1.10 and 1.111 are so close that it is misleading to make them such different colors. Is the difference between 1.10 and 1.111 in this metric even meaningful? What would be a meaningful difference in NED or Kantorovich distance? In any case, in Tables 4–7, I really think you would be better off keeping the color scale and ranges from Table 3.
- Lines 325–327: First, change "ensemble" to "ensemble mean" or "ensemble average". Second (and more importantly), there are many papers and books that explain why the ensemble mean usually outperforms individual ensemble members (e.g., Wilks 2019, ht tps://www.elsevier.com/books/statistical-methods-in-the-atmospheric-sciences/wilks/978-0-12-815823-4). It would be worthwhile to engage with some of that literature here, especially since your findings of the ensemble mean not being the best are contrary to what was expected. Do you have any insights as to why the ensemble mean performs comparatively poorly in the Kantorovich distance for wind speed and wind direction? This appears to be why the NED is not the best for the ensemble mean for the wind variables. Perhaps this is a side effect of the randomness introduced by having a sample size of only one event validated at only one point?

Minor Comments/Typos:

- Title: Storm Ciara is a proper noun, so "storm" should be capitalized here and throughout the manuscript.
- Throughout: Change "RADAR" to "radar". It has been decades since radar was written in all caps in formal writing.
- Throughout: Whether you use Oxford commas or not, the journal guidelines state that you need to be consistent, but there is not consistency of usage in your article. There are many places where you do use Oxford commas (e.g., line 55), and many more places where you do not (e.g., line 12). I strongly prefer and encourage them because I think it enhances readability, but it is a personal style choice. Just be consistent.
- Throughout: Follow the journal's guidelines on defining nearly all acronyms and abbreviations at first usage.
- Throughout: Change "[horizontal] resolution" to "[horizontal] grid spacing". It is quite common for people to use resolution and grid spacing as synonyms, but they do not mean quite the same thing. A numerical model's effective resolution is usually about 6–8 times the horizontal grid spacing.
- Throughout: Provide the time zone for all times in this article. I presume your times are in UTC, but it is never stated.
- Lines 2, 30: Change "Weather, Research and Forecasting" to "Weather Research and Forecasting".
- Line 3: Change "long and short wave radiation" to "longwave and shortwave radiation". See also line 152 (remove the hyphens).

- Line 4: Change “amongst others” to “and others”.
- Line 5: Change “WRF-physics set-up and impact of temporal resolution of re-analysis dataset” to “WRF physics setup and the impact of temporal resolution of a reanalysis dataset”.
- Line 6: Change “the event” to “occurrences”.
- Line 7: It would be nice to mention in the abstract when Storm Ciara occurred.
- Line 11: Change “Kain-Fritsch, Grell-Devenyi, and scale-aware Grell-Freitas and multi-scale Kain-Fritsch” to “Kain-Fritsch, Grell-Devenyi, scale-aware Grell-Freitas, and multi-scale Kain-Fristch”.
- Line 14: Change “data on” to “data of”.
- Line 23: Change “associated to” to “associated with”.
- Line 30: Change “open-source” to “public domain”. Also, since you use WRF v4.2, you should instead cite the WRF v4 technical note (Skamarock et al. 2019, https://doi.org/10.5065/1dfh-6p97). Consider also citing Powers et al. (2017, https://doi.org/10.1175/BAMS-D-15-00308.1).
- Line 48 and elsewhere: Add a comma after “i.e.” (Also add commas after “e.g.”)
- Line 49: Change “explicitly” to “explicit”.
- Line 52: Change “grid-column” to “grid column”.
- Line 62: Change “explores; redistribution of” to “redistributes”.
- Line 109: Change “Island of Mauritius” to “island of Mauritius”. Island is not part of the proper name for Mauritius, and thus is a common noun that should not be capitalized.
- Line 111: “concluded in no particular combination of WRF physics” — This is awkwardly worded. Please revise.
- Line 113: Change “sensitivity analyzes” to “sensitivity analyses”.
- Line 114: “time-lapse considered within the diurnal cycle” — This is awkwardly worded. Please revise.
- Line 124: “exposed” is an odd word choice here.
- Line 127: Change “on” to “over”. Change “transpiring” to “transiting” (or to “moving”, or something similar).
- Line 131: “in Ostend, located at the Belgian offshore coast” — Perhaps you mean “at the Belgian coast”?
- Line 132: Please define what you mean by “over the local region”. How local? D04 is not very big to begin with.
- Line 137: Change “RMI-B, for brevity” to “RMI-B; for brevity”.
- Line 140: Change the semicolon after Damiani et al. (2018) to “and”.
- Line 141: Change “addition to” to “addition of”.
- Line 143: Change “context of wind energy applications” to “context of offshore wind energy applications in this region”.
- Line 154: It should just be Tewari et al., 2004, not Mukul Tewari et al., 2004. Ensure that is corrected in your reference manager.
- Line 202: Change “encompasses” to “has” or “uses” (or similar). Also use the definite article “the” before each of these physics scheme names and datasets.
- Line 218: Change “an equivocal literature” to “equivocal findings”.
- Table 3 caption: Capitalize Euclidean.
- All throughout Section 4: I think you need to consistently refer to domain configuration 1 and 2, as each domain configuration has domains 1, 2, 3, and 4. If you say domain 1, the reader will think of your outermost WRF domain, which is domain 1 (d01).
- Tables 4–7 captions: You forgot to include NED in the captions. Also, change “subject to” to “with” or “comparing”.
- Line 322: This sentence is awkwardly worded.