

Reviewer comments on "Hurricane impacts in the United States East Coast offshore wind energy lease areas"

April 4, 2025

1 General comments

The manuscript "Hurricane impacts in the United States East Coast offshore wind energy lease areas" by Thompson et al. presents simulations of two hurricane cases along the U.S. East Coast. Four model configurations are analyzed for each hurricane case, including atmosphere-only WRF simulations and atmosphere-wave-ocean coupled COAWST simulations. In addition, the effects of wind turbines on the hurricanes are analyzed using simulations with and without wind farm parameterizations.

The manuscript contains novel aspects such as 1.) the use of buoys and IMERG data to validate tropical cyclone simulations, 2.) the presented analysis of the atmosphere-ocean-wave-coupled modeling framework applied to tropical cyclone cases including wind turbine effects. The manuscript addresses three clearly stated research questions that are relevant to the wind energy sector and of broad international interest. The methods are well described and the analysis is valid. The title and abstract give a good summary of the manuscript, the manuscript is well written and overall well structured.

The manuscript uses eleven rather long tables, and not all of them may be needed in the main article. Many figures show panels for both WRF and COAWST simulations, although in some cases the difference between the two is not easy to see (see specific suggestions in the Specific Comments section). At the same time, some figures contain a lot of information while being rather small.

2 Specific comments

1. Introduction: Lines 34-40: You might consider extending this argument for tropical cyclone events, and include that tropical cyclones may not be adequately covered by available offshore measurements.
2. Line 184: Note that the effective model resolution using WRF is about 7 times the grid spacing Skamarock (2004).
3. Figure 1a,b): I think it would be helpful to the reader to show these two panels larger in the main article. This would help to better see the agreement between the observed and simulated track, and you could also consider not showing Table 1. The precipitation time series is also shown in Fig. 10, I think one of the two figures should be sufficient.
4. Fig. 2b and Table 2), the scheme of COAWST is not further explained in the text. So I would suggest not to show Fig. 1 b and Table 2b in the main article, but to give them in the supplement.
5. line 255: Could you explain what 3×3 smoothing means?
6. Figures 1, 3, 6, 7: The difference between the WRF and COAWST simulations is not easy to see in these figures. While the difference between the two is discussed to some extent in the text, one could consider not showing both panels in all cases, or showing the difference between the two. For Figures 6 and 7, you might consider showing the map and wind field for either the COAWST or WRF simulation only, while showing the time series for both in the same plot.
7. Figures 8, 9: It is difficult to read the T_p , HH WS, and Hs from the 3-D bubble plots. Can you consider a different visualization; this could be adding the T_p via contours or colors in the plots (e-h), or showing a separate joint probability of HH WS and T_p .

3 Technical corrections

1. Line 21: The abbreviation HH WS is used only once in the abstract. Therefore, I would recommend not introducing it.
2. Line 28: The abbreviation IC is used only once in the abstract. I would recommend introducing abbreviations only if they are used more than once.
3. Line 135: Personally, I have never come across the term "storyline simulations" and would prefer to use "case study" instead.
4. Section 2.1: You could refer to Fig. 1a and b when describing the hurricanes.
5. For the date format, e.g. in Table 1 and others, following the mathematical notation and terminology guidelines of wind energy science, I would recommend using "27 Aug 18:00" instead of "1800 27 Aug".
6. Line 179: I would suggest referring to Fig. 1c in a separate sentence, explicitly stating that the figure shows the power and thrust curves used for the Fitch parameterization.
7. Table 3: The table shows not only the sources of the initial and boundary conditions but also the model resolution; could you update the title?
8. Line 150: The abbreviation WS has already been introduced in line 58.
9. Line 278: I think you meant to write "of 3 - 10.6 m s⁻¹,..."?
10. Line 275: I suggest introducing the peak period with a few more words, e.g. "period of the peak energy in the wave spectrum".
11. Table 5, 6: To help the reader, you might consider removing the horizontal lines between the buoy, WRF, and COAWST data of the same buoy location.
12. Fig. 5 and others: While the idea of grouping the colors is good, the colors between "COAWST No WT" and "COAWST Yes WT" and between "WRF No WT" and "WRF Yes WT" are too close together to be clearly distinguished.

References

Skamarock, W. C.: Evaluating mesoscale NWP models using kinetic energy spectra, *Mon. Weather Rev.*, 132, 3019–3032, <https://doi.org/10.1175/MWR2830.1>, 2004.