Review: *Grand Challenges in Designing Resilient Wind Energy Systems in Areas Prone to Tropical Cyclones*

General Comments

This study considers the Grand Challenges of wind turbine design and controls during tropical cyclone conditions. The paper includes an extensive literature review and places in context the current state of the science work for observations, modeling, operations, and design. Additionally, the authors include future directions and elaborate on the Grand Challenges for wind energy in regions prone to tropical cyclones.

The paper is overall well written and summarizes nicely the needs of the wind energy industry to collect more pertinent observations, improve both physical and engineering models to better capture the atmospheric motions during these events, investigate more operational stress mitigation strategies, and better quantify risk. I have included several minor and technical suggestions to hopefully improve the paper and, thus, **I recommend the paper to be accepted upon minor revisions.**

Major Revisions

N/A

Minor Revisions

- Abstract, L8: The North Sea has its own hazards; I don't know if it would be characterized as "less hazardous."
- Table 1 - what does a hyphen signify in the "shortest distance to TC" mean? Direct passage of eyewall? Unknown? What about hyphens in the other columns? What are the numbers in parentheses within the blade damage and tower collapse columns? What does "foundation" mean in the tower collapse column? Are these all onshore? The caption could be used to answer these, or the column labels could be improved.
- L150 - consider mentioning that lidars on offshore platforms need to be corrected for wave motions and that is not necessarily a trivial task for producing higher-order statistical moments for wind.
- Figure 5 - what is a "storm" here? Based on the yellow line being TC Cat 1+, I imagine that "storms" aren't TCs but other events?
- L229 - An argument to consider here is that these mesoscale (and greater) models typically have numerical diffusion to dampen noise at small scales. Thus, the Nyquist frequency of the model will be $2\Delta x$ but often much of that signal is damped and the *effective resolution* of the model may be closer to $5\text{-}6\Delta x$ (Knievel et al., 2007). So for resolving a signal of 2 km you may actually need $\Delta x = 333\text{-}400$ m.

- L285+ - some of these studies are LES with grid spacing of ~100 m which, borrowing from the suggestion from the IWRAP dataset, could also be too coarse for wind energy purposes especially considering the effective resolution of the models.
- L323 - consider clarifying that precipitation may be less impactful *to wind turbines*. It can be very impactful to other applications

Technical Suggestions

- L214 - "AI/ML" has not been defined and in other parts of the paper is referred to only as "ML" or "ML/AI"
- L253 - SWAN not defined.
- L299 - I don't think this is the right citation for the WRF model. The website says to use: Skamarock, W. C., J. B. Klemp, J. Dudhia, D. O. Gill, Z. Liu, J. Berner, W. Wang, J. G. Powers, M. G. Duda, D. M. Barker, and X.-Y. Huang, 2019: A Description of the Advanced Research WRF Version 4. NCAR Tech. Note NCAR/TN-556+STR, 145 pp. doi:10.5065/1dfh-6p97
- L391 - models are out of chronological order
- L454 - space before period
- L495 - format of citation changed and isn't consistent with other parenthetical citations in the sentence. Maybe remove "e.g.," here and on line 498?
- Section 3.2.2 - this section in particular seems to place citations in the middle of the sentence and is pretty hard to read.
- L556 - hyphen needs trailing space
- L581 - missing "respectively" or are they both functions for probability density and cumulative probability?
- Section 5 - why are the sub-sections presented as dashed items here and not sub-sections (e.g., 5.1, 5.2, etc)?
- L647 - missing space after sentence
- L662 - models out of chronological order

References

1. Knievel, J. C., Bryan, G. H., & Hacker, J. P. (2007). Explicit numerical diffusion in the WRF model. Monthly Weather Review, 135(11), 3808-3824.