“Grand Challenges in Designing Resilient Wind Energy Systems in Areas Prone to Tropical Cyclones” highlights the state of the science, needs, and gaps pertaining to the assessment of and preparation for tropical cyclones in offshore wind project infrastructure. The paper addresses a significant need in both research and industry, representing the effect of a complex phenomenon comprising many sub-domains of expertise. The following **major** revisions are recommended for a more complete and useful article.

Specific comments

1. The paper is oriented toward project infrastructure (“wind energy systems”), but is currently limited to turbines and their foundations. All infrastructure governed by standards, especially offshore substations and cables (array, export cable landfalling), should be identified and considered for a publication in “grand challenges” to be comprehensive. For example, sediment transport will vary based on TC features, path, and soil properties, resulting in potentially uncovered cables not buried below the stable seabed. Additionally, work has been done in the oil and gas domain to quantify maximum wave crest heights generated by TCs (substation deck heights), but there remain gaps in the characterization and usage of these values in both O&G and offshore wind. These aspects should also be addressed in this paper; please update Table 2 accordingly.

2. Section 2.1 discusses turbulence measurement by LiDAR of TC winds. Das 2022 presented LiDAR measurements of TCs (Wind profile and structure during severe storms in the Gulf of Mexico, OMAE2022-86835) and Holmes 2024 (https://doi.org/10.12989/was.2024.39.4.305) proposes a turbulence model for TCs. It is suggested these works be engaged with in a review of TCs and turbulence.

3. Current LES models show more or less symmetrical tropical cyclone features about the eye. TCs traveling through higher latitudes do not exhibit such symmetry, however; how is this accounted for in the proposed models? What biases are currently exhibited in both modeled winds and ocean features when such extra-tropical transitions are not represented?

4. Section 2.2.1 on synthetic storm track modeling addresses winds. Considering dataset concurrency and coherence, please extend this discussion to the state of the art and future needs for fully coupling metocean models (from which ocean design values are obtained) to synthetic storm track datasets.

5. Continuing with synthetic tracks, models are naturally reliant on observations for calibration and validation, and will be subject to gaps in temporal and spatial features in this record, in addition to events occurring after observations were put in place (i.e., post 1979). Please comment on the influence of this gap on the range of modeled storm features, especially concerning the rarest events that may fall outside of the observation window.

6. Starting at line 341, parametric models are discussed. Please connect this and its representation/non-representation in current input to design methods such as multi-decadal coupled metocean hindcasts. The work of Cox, Cardone, et al in reconstructed winds and coupled ocean models has contributed to fundamental advances in project engineering and should also be referenced (see, i.e., "Reconstruction of hurricane katrina's wind fields for storm surge and wave hindcasting", Ocean Engineering 2010)

7. The sentence starting on 366 should be reformulated. "Training" is not the correct word for inclusion of nonlinear features represented in 3rd-generation spectral wave models.

8. Line 367: Consider referring to the originating work by Holthuijsen ("Wind and waves in extreme hurricanes", 2012) on breaking saturation. More work than Qiao 2020 has been conducted on the largest waves generated by TCs; it is fairly established that they are wind-driven. Please include more than one reference for this concept.

9. Line 380: substitute "array" or "export" cable for "submarine"; these have different electrical properties. The line continues with, "as hydrodynamic modeling advances…". Please indicate what this means and what those advances are/would be from existing methods. Breaking and surge are captured to varying degrees in current-day methods, and most are coupled, although coupling characteristics vary in quality.

10. As you note in line 420, wave breaking/slamming is not fully characterized in offshore wind design. Please elaborate on the state of knowledge and gaps in TC-generated breaking wave modeling and include this significant feature in section 5.

11. Section 3.1: Are there any compounding effects to consider in the design process concerning both higher modeled waves and higher safety factors, including the uncertainty around derived parameters? Please comment.

12. Section 3.1: How should a designer assess the total load environment with respect to location and proximity to historical storm paths?

13. Section 4: How sensitive is risk quantification to TC paths?

14. Section 4: What is the minimum number of events required for a “reliable” risk estimate?

15. Lines 553 – 560 are speculative and a “grand challenges” paper is not the right forum for these ideas. These lines should be removed.

16. Line 621 mentions better temporal and spatial coverage of current measurements. However, the paper does not address the representation or mis-representation of currents in design activities. Please elaborate on this. Spatial and temporal availability of wave measurements (and associated spectral parameters) should also be considered, alongside the effect of missing measurements on assimilated data products.

17. Operation and maintenance of energy systems hinges on the definition of what “surviving” a TC means. How should academia, developers, and i.e., the insurance industry go about establishing a definition of what this means?

18. Section 2.2.4 discusses the influence of climate change. Continuous improvement of the GCMs is ongoing, however, their coarse resolution still poses a challenge to drawing meaningful conclusions for wind projects/individual installations. Are there any recommendations for future work for this domain to better inform TC risk?

Technical comments

Line 367: terms that transfers

Line 713: assumptions