Reviewer comments appear in **black** and author responses in **blue**.

Reviewer 2

Dear authors,
The article is well written and interesting to read. The subject is original within the field of wind energy research and is of relevance for the future offshore wind farm development of the east coast in the USA. The results show that there is considerable icing risk in the mid-Atlantic offshore wind farm areas and that the effect of wind farm wakes on icing risk is minimal. The manuscript would benefit by considering the points below.
We thank the reviewer for devoting time to our article and for providing suggestions that improve the work.

Specific comments:
Regarding the two sentences and corresponding references:
"Some observations indicate that excessive icing can reduce torque enough that blade rotation stops entirely, causing up to 80 % reduced power production for a single turbine".
"Some turbines have icing detection and mitigation technology included at added cost, although current strategies need improvement (Madi et al., 2019)."
I believe these statements are a bit outdated, especially seen in the light that the paper is mainly focusing on future wind energy scenarios. I do not want to make an advertisement for specific solutions, but there are many de-icing, or anti-icing solutions where power reduction can be avoided (see e.g. https://www.iqpc.com/media/1001147/37957.pdf, https://wicetec.com, https://www.video.vestas.com/video/21313125/vestas-anti-icing-system). I suggest that the text should be updated to state that it will be important to include some proper anti-icing solutions.
Thank you for the suggestion. Per reviewer 1's feedback, we have changed the first sentence to "One study found that excessive icing induced a power loss of 63 % for a single turbine over a 51-h icing event (Gao and Hu, 2021)".

We believe it is still necessary to provide context for the issue, that icing can reduce power production. Our Madi et al. (2019) reference lists a variety of different icing mitigation strategies and we have added IEA Task 19 as well. Given that we focus on a future scenario we have modified the sentence to not focus on the setbacks of ice mitigation strategies, as these strategies are improving and will continue to improve in the future: "Despite the energy losses in some studies, various strategies can mitigate or even prevent ice accretion altogether (Madi et al., 2019)."

It becomes clear after reading section 2.1 that the NOW-23 data set is also based on WRF runs. I would suggest mentioning that at the beginning of section 2.1.
We now mention that this modeling data set is based on WRF runs in sentence two of the paragraph, before describing the model setup: "This data set quantifies wind resources spanning all offshore regions of the United States for more than 20 years using the Weather Research and Forecasting (WRF) model version 4.2.1 (Powers et al., 2017)."

Table 1 is a bit strange. Maybe there should be a column with simulation type number 1-3, or something similar that could be referred to in the text. "Turbine type" should be "turbine rated power", or if you want to keep turbine type then mention the type. The period does not need a column (as it is the same for all simulations) could be mentioned in the figure caption.
Thank you for the suggestions, which improve the readability and utility of the table. We have incorporated several of your suggestions:

- The column title "Turbine type" has been changed to "Turbine rated power".
- We now mention the period of analysis in the caption.
- Because we do not use the TKE 0 % simulations in this study, we have removed their mention from the table.
- We added a column titled "Acronym" for clarity. Further, we explicitly mention that the acronym "WFP" will refer to the simulation with 100 % added TKE: "Thus, for the remainder of this article we refer to the 100 % added TKE simulation as "WFP".

Table 1. List of WRF simulations characterized by turbine characteristics. The simulation period spans 01 September 2019 to 01 September 2020.

Simulation type	Acronym	Turbine rated power	Added TKE	# Turbines
No Wind Farms	NWF	N/A	N/A	0
Wind Farm Parameterization	WFP	12 MW	100 %	1,418

Line 152: Why can SST be replaced by skin temperature?
The skin temperature in WRF is the temperature of the surface, whether the surface is land or ocean. So, the skin temperature is the same as the SST and we mask the skin temperature to only retrieve data over the ocean. We do so because the SST field is very coarse.

Have the authors investigated how the results would change if you would use the most conservative thresholds? It would be beneficial to include a sensitivity study about that, e.g. on a small subset of data or at the POI.

Thank you for this excellent suggestion. We have added a sensitivity analysis to Appendix section B, testing between air temperatures of -1.7°C and -2°C and between sea surface temperatures of 5°C and 8.9°C. Our findings are that the maximum number of icing hours do not change much, but the regional variability changes considerably depending on the thresholds used:

"As discussed in Section 2.3, we detect FSS conditions using common thresholds for the meteorological conditions (Dehghani-Sanij et al., 2017; Guest and Luke, 2005; Line et al., 2022). These criteria require strong wind speeds greater than 9 m s−1, cold air temperatures below −1.7° C, and cold SSTs less than 7° C. As reviewed by Dehghani-Sanij et al., (2017), FSS conditions are promising when the air temperature is below either −1.7° C or −2° C to account for the lower freezing point of saline ocean water; the salt content of which determines this threshold. Although SST thresholds of 5° C or 7° C are prevalent, a threshold up to 8.9° C has been used (U.S. Navy, 1988). As such, we quantify some of the uncertainty by calculating the number of hours that FSS conditions occur using conservative thresholds, which produce fewer icing hours (FEWER), and liberal thresholds, which promote more icing hours (MORE) (Table B1). As there is wider agreement regarding the wind speed threshold (Dehghani-Sanij et al., 2017; Guest and Luke, 2005; Line et al., 2022; Monahan et al., 1983; Monahan and MacNiocaill, 1986; Ross and Cardone, 1974), we hold it constant. Due to computational constraints, we only assess the number of icing hours throughout the domain at 10 m and during January 2020 because it has the greatest number of icing hours.

Table B1. Icing detection criteria by sensitivity analysis type.

Acronym	Air temperature	Sea surface temperature	Wind speed
FEWER	<−2° C	<5° C	>9 m s^{-1}
MORE	<−1.7° C	<8.9° C	>9 m s-1

As expected, more conservative thresholds produce fewer FSS hours and vice versa (Fig. B1a,b,c). In FEWER, the meteorological conditions conducive to icing maximize at 60 hours. Using more liberal criteria in MORE, the maximum number of hours increases to 67. Despite the small change in the maximum number of hours FSS occurs, the regional variation is large; the area covered by icing conditions increases from 8,924 km2 to 135,244 km2 from FEWER to MORE, or roughly 15 times greater than FEWER, or 2.2 times greater than our production set of criteria. Regional variability follows SST patterns and only occurs in FEWER where the SST is relatively cold in the Long Island Sound and Nantucket Sound (Table B1b), as discussed previously.

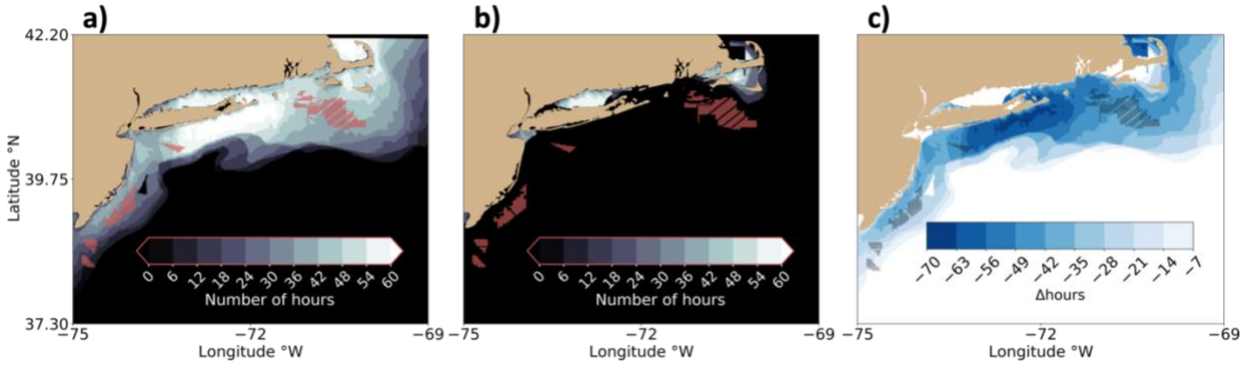


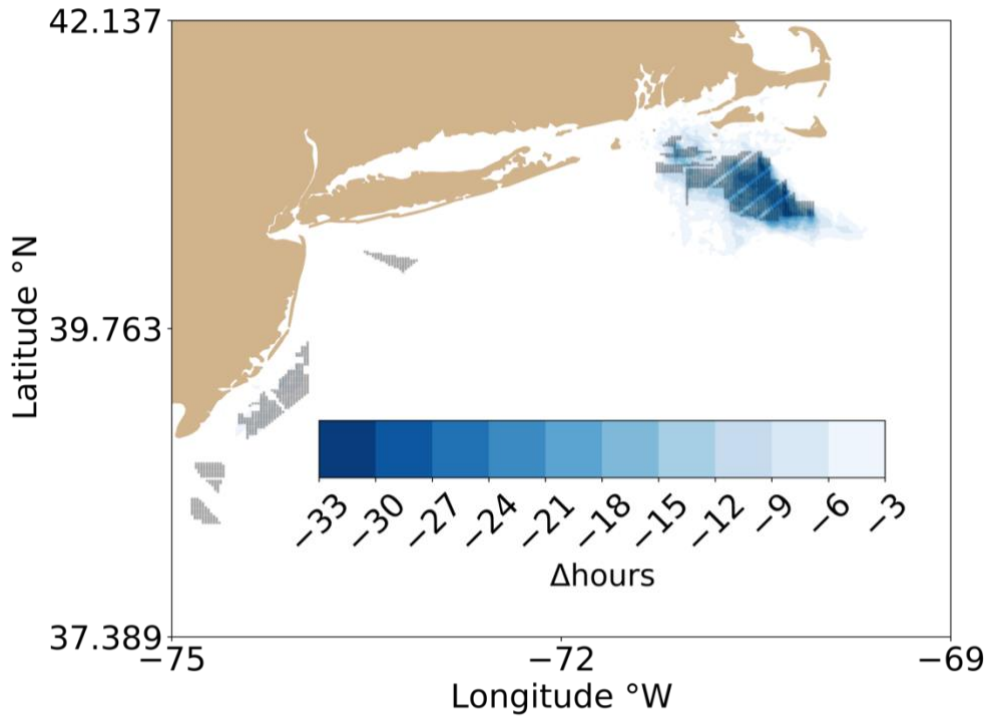
Fig. B1. The number of hours FSS conditions occur during January 2020 at 10 m in NWF using thresholds for (a) FEWER, (b) MORE, and (c) the (FEWER-MORE) difference. Lighter contouring indicates more freezing hours in (a) and (b). Darker blues represent a larger reduction in number of hours in (c). Turbine locations are shown as red dots in (a) and (b) and as black dots in (c).

Why is the acronym for predictability chosen as PPR?
Thank you for this thoughtful question. This icing predictability equation has been reported in the literature as PPR (Dehghani-Sanij et al., 2017; Guest and Luke, 2005). However, this may be a typo, as the original authors used "PR" (Overland, 1990; Overland et al., 1986). To squash this recurrence, we have changed the acronym to "PR" throughout the article.

Fig. 2: It's a little bit confusing that the turbine locations are shown for these simulations that were performed without turbines. Could you state in the caption that the locations are shown for illustrative purposes, but were not included in the simulation results?
We have clarified this point in the figure caption: "Red dots represent turbine locations but do not exist in (a) or (b) and are shown for reference."

Fig. 7: Is it percentage or difference in whole hours? If percentage, the color bar label needs to state that by adding e.g. [%]. Could you include smaller intervals on the color scale, so it's possible to see more variation?
We now show the change in number of hours for consistency with other figures and have changed the figure caption as follows: "The (WFP-NWF) change in number of FSS hours at 10 m November 2019 to March 2020. Blue contours indicate a reduction."

We have also doubled the contour interval to enhance the granularity:



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