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Interactive comment on "Probabilistic forecasting of wind power production losses in cold climates: A case study" *by* Jennie P. Söderman et al.

Anonymous Referee #1

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General comments: This article looked at applying two well-known probabilistic techniques from the atmospheric science community to the problem of production loss of wind turbines due to icing. The methods were applied on the NWP model simulations that were used as input to the icing model, which in turn is used as input to the power production model. The paper shows that a traditional model ensemble does not improve results when tested over two wind farms for a two week period, but that using forecasts from neighboring points does improve the forecast.

The article is well structured and the topic is of significant interest to the Wind Energy community. However, the methods are not described in enough detail for reproduction, and then observational data that is used is not described sufficiently nor of sufficient length for it to provide a good validation of the methods being tested. Finally, the paper

mentions that the cloud parameters LWC and MVD are key inputs to the icing model, but they are not analyzed in terms of the spread of the probabilistic approaches, which seems like an important metric to analyze.

Specific comments:

1. Section 2.1.1: How does the HarmonEPS used in this study differ from the operational usage of SMHI?

2. P4 L23-24: Do I read correctly that the models are all initialized using the ECMWF control member analysis, and only differ due to boundary conditions?

3. P5 L12: It would be interesting to see the impact of this averaging on the results. You state they are not here, but perhaps you could at least mention the improvement in error for the different variables in the text.

4. P5 L12: What are all parameters, and which parameters was the lifting validated against?

5. P6 L31-32: You note that different forms of water are fed separately through the model, how exactly is this carried out? Are you just running the model 4 times and summing the results? It is unclear to me how that would impact the accretion efficiency, which is a heat balance that depends on the mass flux of water impacting the structure.
6. P7 L2: Is the MVD only calculated for cloud water?

7. P7 L4: What is the empirical ice shedding model?

8. P7 L15: In not familiar with the term effect curve, is this just the power curve?

9. P11 L26: You mention that there could be an issue with warm turbines, but you mentioned that you have a mixture of mast and nacelle data. Did you investigate if the bias was different between the two sources?

10. P12 L10: could you list the % improvement of the wind speed and RH?

11. P13 L9: The shift from 10 sites to 3 was confusing when reading this paper, perhaps remind the reader that you only had production data at 4 sites, and had to discard one. I am not sure why you only looked at two of the three sites here though.

12. Section 3.2: You discuss quite often the LWC values and how they impact the ice growth. It is unclear to me what this parameter is, since your model includes two types of liquid water hydrometeors and two solid hydrometeors. Could you describe what it is, and if it doesn't already make sure it includes all of the relevant hydrometeors.

13. Section 3.2: In the experiment period and available data section, you mention that you have production data from each turbine at each site. It is unclear how you aggregated the production data to get a singular value. Can you state approximately how many turbines were at each of the two sites you used?

14. While it is understandable that you cannot list the wind farms themselves, can you at least describe how far apart they are, and if they are exposed to similar weather patterns.

15. Fig 6. It is hard to see the observations clearly, perhaps you could use a color like red that would stand out more.

16. Figure 9: Why was there no ice during the beginning of the period, even though there was still a fairly large amount of LWC?

17. Table 1: What is the mean RMSE the mean of?

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