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Interactive comment on "Sensitivity of Uncertainty in Wind Characteristics and Wind Turbine Properties on Wind Turbine Extreme and Fatigue Loads" *by* Amy N. Robertson et al.

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The authors thank the reviewers for their thorough assessment, comments, and insights. Revised text in the attached revised manuscript is highlighted in red.

Reviewer's comments have been copied into the attached document and are shown in blue. Authors' responses are shown in black.

Please also note the supplement to this comment:
https://www.wind-energ-sci-discuss.net/wes-2019-2/wes-2019-2-AC3-supplement.pdf

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Discussion paper

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Discussion paper

Authors' Note to the Associate Editor and Reviewers

Title: Sensitivity of Uncertainty in Wind Characteristics and Wind Turbine Properties on Wind Turbine Extreme and Fatigue Loads

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1 General comments

1.1 Summary of key points

The paper is well written and its topic is relevant. The goals are clearly stated: sensitivity analyses for the NREL 5 MW turbine. They are ambitious because a large number of input and output variables are involved and a computationally demanding model (OpenFAST-based) is used. The choice to reduce the complexity of the analysis by using the relatively simple Elementary Effects approach is judicious. However, it seems to me that nevertheless, the problem is still too complex. To be able to tackle it, the authors work with a relatively small set of input vectors. This is the main weakness I find to be present in their analysis and they have not convincingly argued that the number of input vectors is sufficient.

A. The authors parameterized inflow inputs based on the capabilities of TurbSim and parameterized the turbine inputs to represent the main physical effects where uncertainties were probable.

A further issue is their adaptation of the Elementary Effects approach in a way that is insufficiently justified. The current exposition leaves me doubting that it is really a consistent sensitivity analysis approach. This does not mean that all their conclusions are arbitrary. On the contrary, I would guess that many conclusions about sensitivities are correct due to their broadly consistent nature over the whole input space and remain unaffected by details of the sensitivity analysis. (This may mean that they would also appear in simpler analyses and could perhaps be obtained from expert elicitation.)

A. Elementary Effects at its fundamental level can only be considered a screening method. However, the introduction of the use of Sobol numbers and radial trajectories increases its efficacy as a method for estimating sensitivity, not just as a screening method. Campolongo empirically demonstrated that the results obtained by EE can converge to a variance-based sensitivity index with increased number of Sobol points. In this work, the authors increased the number of Sobol starting points until the EE-based sensitivity metrics had shown convergence.

Despite my rather negative judgment about the method and assumptions, there are some gems in this paper. Notably, the authors' efforts in obtaining useful ranges for input variables have resulted in overview tables that are more broadly useful in their own right.

A. Agreed.

Fig. 1.

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