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Interactive comment on "Are Uncertainty Categories in a Wind Farm Annual Energy Production Estimate Actually Uncorrelated?" *by* Nicola Bodini and Mike Optis

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1 General Comments

The authors have worked to propose a more statistically accurate method for operational AEP wind farm estimates through correlations with various sources of uncertainty. The topic is certainly worthwhile, as large projects involve huge financial contributions and associated risk. Overall the paper is well laid and out and written. As per the comments, there are a number of places where wording and figure captions need improvement for clarity. Similarly some specific details of the method and metric

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equations need better definition.

My main challenge with the paper is the use of the word ‘uncertainty’ in a non-precise manner. Uncertainty accrues from various sources including measurement errors (epistemic) and underlying stochastic processes (aleatoric). Moreover, the statistical quantification of that uncertainty has to be careful, whether its a uniform, normal, or other distribution that describes the range of uncertain values (PDF of values). The paper is a bit too loose in using the term uncertainty, and also in the numerical MC sampling of those variables assumed uncertain. Tightening up the presentation in this respect would really help statistical validity and understanding of the method and results.

2 Specific Comments

1. In 25; I wonder given the emphasis of the paper on AEP if better figures to quote would be GWh produced vs. (or in addition to) GW installed capacity?

2. Around Table 1: Need to define windiness correction factor (formula, etc). The word ‘accuracy’ used throughout table; is that true? or is it really combination of epistemic and aleatoric uncertainties? Really need to discuss more on sources of uncertainty in terms of measurement errors and underlying stochastic processes involved.

3. In the intro discussion on operational AEP estimates, the wording seems a little counterintuitive, in that AEP can be calculated exactly (in terms of delivered energy) given the data (and just whatever error in the power meter itself). I think a little rewording here talking more about the purpose of operational AEP for e.g. future year operations, etc. would help reveal the intent and importance of the work.

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4. Would be nice to explicitly relate eqn 2 back to C_P equation for readers to understand exponential weighting

5. In 95; the data exclusions that end up being geographically driven suggest the need for some more discussion here (or later) on the ramifications for the correlations uncovered; i.e. are there physical reasons the correlations would be different for more complex terrain locations?

6. list in lns 105-115; not clear what 'regression' in item 5. Also 10-20 years of hindcast (vs. forward prediction) right?

7. Fig 2 'Wind IAV' not defined

8. Did you consider more efficient Monte Carlo sampling methods, and/or convergence of statistics at 10000 samples?

9. Table 2; need to define pdf type for each uncertain variable (uniform, normal, etc.) Would also be nice to see more justification for e.g. 0.5% uncertainty values assumed.

10. Fully linking Table 2 variables explicitly in Fig 2 would help to understand the method

11. Around ln 140; define how covariance defined, and numerical procedure in MC for ensuring the covariance is respected.

12. Throughout the word uncertainty is used; I think you're always meaning standard deviation, but need to explicitly define as numerical results are presented

13. It's not clear to me what's been plotted in Fig 4? How is uncertainty defined in % terms? How is computed across your results sets? Is that eqn 7?

14. Define which data used to make Fig 7

15. In conclusions, towards a universal method, should explore MC sampling convergence requirement. Also, the assumed distribution type (as defined presumably by the ‘uncertainty’) is undefined, so not clear how to implement and assumptions there.

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