

Response to reviewer (Andrea Vignaroli)

Thank you for taking the time to review this paper. We hope that we have answered your comments satisfactorily and look forward to further comments. In the marked-up version, the changes made relevant to your comments are marked in red. The blue changes have been made in response to the other reviewer.

General comments

Dear Barber et al., first of all I'd like to say that I completely agree with the underlying motivation for this work. It is important to focus on how inaccuracies in wind speed predictions translate in energy and show that it's a complex matter with a lot of variables (like wind direction, wind speed distribution, shear...) impacting the final results. It is very easy to be "right for the wrong reason". This is why so many studies focus on wind speed in one direction. The aim of those studies is to improve flow models and the only thing the scientific community can do is to design and conduct experiments while minimizing the amount of variables that could make the interpretation of results impossible.

Specific comments

As I said, the motivation and scientific question behind this work is very relevant. However I notice some decisions in your implementations which confuse me a bit. I don't understand if you decided to obtain results by including some of the uncertainty components of the AEP assessment process on purpose or you tried to avoid them. For example, you decided to base your results and comparison on long term corrected wind speed data being hopefully aware of increased uncertainty that you take with you during the AEP comparisons. How do you know that certain differences in AEP are not due to a long term correction far from perfect? Ok, but let's say that we want to include long term correction uncertainty on purpose to see how it translates in AEP, why did you decide to avoid vertical extrapolation from the measurement height to the hub height. Uncertainty of vertical extrapolation is another important source of uncertainty in the AEP assessment process. I would have avoided or included both.

- This is a good point, thank you for noticing this. It originates from the fact that the focus of the study was on the general comparison of costs and accuracy for the development of a WRA decision tool as described here: <https://www.mdpi.com/1996-1073/15/3/1110> and that we were not entirely aware of the extent of the discrepancy between wind speed and AEP errors before carrying out the project. This means that the study wasn't designed specifically with the goal of investigating discrepancies between wind speed and AEP accuracies. If it had been, we would certainly have taken a systematic approach to all the possible sources of error.
- The important question is now what we do about this problem in this paper? Such a systematic study is certainly not possible at this stage (the project has finished and there is no funding yet for a future project). Our suggestion is to make it clear that this work does not involve a systematic study aimed at quantifying and understanding all possible sources of discrepancy between wind speed and AEP accuracies, but instead aims to (a) make readers aware that this problem exists and (b) highlight some of the different factors that could lead to this discrepancy. We have re-written some parts (Abstract, start of Section 2, Section 4) in order to achieve this. Please let us know what you think.

I think that using wind speeds measured by nacelle anemometers for the purpose of the article is quite a stretch. It would require quite a lot of analysis (flow inclination, rotor speed, pitch settings) in order to make the statement “but the ration will still be valid”. I would have not used site 4.

- We do agree that site 4 is very different to the other sites for the reasons you mentioned. However, it would actually be interesting to understand the effect these differences may have on the wind speed and AEP error. Obviously there are far too many varying input conditions in order to do this within this work. It could be the topic of a further systematic study as discussed in the previous comment. If we now consider the new aim of the paper now to be "highlighting some of the factors that could lead to a discrepancy between wind speed and AEP accuracies" as discussed above, then site 4 could be included for the same reasons. We have adjusted the description of the results for this site accordingly (Section 4).

I am a bit puzzled how you can obtain a non zero error when you compare the wind speed at the calibration location when you consider one height only. (figure 2)

- Good point – we were puzzled about this too. The reason is actually because of interpolation errors. The location of the calibration measurement is not exactly correct in the simulations because it has to be located at a grid point (horizontally and vertically). This causes a small difference in wind speed at the calibration location. We have added some comments on this in Section 3.

My last specific comment is that you used given power curves for different wind turbine models for different sites. I assume that each of them are different with respect to generator/rotor area ratio and they will have different rated wind speed. Would it have been better to use only one for all sites so that the results are not affected by the power curve steepness? Given power curves are also tricky because they almost always need site specific adjustment. One way to make the study power curve independent would have been to use WPD (wind power density) as a metric instead of AEP.

- This is also a very good point that we did not think of for the same reasons as with your first comment. Now you mention it, we think that the steepness of the power curve will definitely have an effect on the results. We will definitely consider this if we get funding to do a more systematic study.
- For this paper, we again suggest resolving this issue by making it more clear that this work does not involve a systematic study aimed at quantifying and understanding all possible sources of discrepancy between wind speed and AEP accuracies, but instead aims to (a) make readers aware that this problem exists and (b) highlight some of the different factors that could lead to this discrepancy, as mentioned above. As well as that, we have now mentioned the topic in the analysis in Section 4.

Technical corrections

Line 51: It would be nice to mention that flow calculations in WindPro can be based on WASP CFD (EllipSys3D) or WASP linearized flow model (IBZ). I assume you used the IBZ model.

- Yes, we added this.

Line 56: WindSim can simulate more directions . But 12 were used for this analysis.

- OK, we changed this.

Line 107: I am missing some details of the MCP method used (linear least square, matrix, etc) and some metric for the reader to evaluate the accuracy of such a step (maybe a table with R^2 , measured and long term corrected mean wind speed?).

- We have created a new table for this information (Table 1).

Line 159 and Table 1: i don't think you explain the meaning of the abbreviation HSE or OST before using them

- You are right. We added this.

Line 260: Did you apply RIX correction? It's quite known that WASP IBZ results need RIX correction for complex sites which will make a difference in terms of accuracy.

- No – we added this this to Section 1 and to the analysis in Section 4.