Multi-lidar wind resource mapping in complex terrain

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REVIEW

GENERAL COMMENT:

The manuscript analyzes data from the Perdigão 2017 campaign to show measurements from sonic anemometers, lidars, and compare those with modeled data.

The use of novel observational techniques, especially in complex terrain, is of great interest for the wind energy community. The technical description of the observations used is well-detailed (maybe even a bit too much), and the plots and figures are generally well-made.

However, the purpose of including modeling data (with a rather poor match with the observations) in this study is not made sufficiently clear in the manuscript, especially when considering the title, abstract, and introduction. As a consequence, the reader can be a bit lost in terms of the main goal and novelty of this piece of literature.

Along these lines, in order to create a more coherent story, the authors shall spend some time adding additional sentences throughout the manuscript describing the meaning and/or causes for the results shown, rather than purely describing the data plotted in the figures or listed in the tables.

SPECIFIC COMMENTS:

1. P.1 l.6: "we found that for different flow conditions on average […]" is not clear for a reader that has not read the whole paper yet.
2. P.1 l.7: "depending on the atmospheric conditions" is also too vague.
3. I think the story you are trying to tell in the abstract is missing some pieces. According to the first part of the abstract, your goal in this study is to demonstrate that scanning lidars can be used to measure wind in complex terrain. And you re-state this at the very end. However, you do not mention the comparison of the lidar measurements with other instruments to validate your thesis. Then, you mention you simulate the wind flow with WRF-LES to check whether it can represent well the wind flow by comparison with the lidars. And this is not mentioned at all in the title. Please clarify what the actual and final goal (and novelty) of this work is.
4. P.1 l.17: "cheaper" seems too much of a strong opinion to me. It actually depends.
5. P.2 l.5 change to "to assess" or "in assessing".
6. P.2 l.10 "use" instead of "present".
7. P.2 l.13: which parallel ridges? Do not assume the reader is familiar with the campaign: you haven't described it yet.

8. Introduction: the goal of the study is still not sharp clear. From how this reads, you are plotting data measured by the lidars, and comparing with modeled data. What is the advancement provided by this study? How does this relate with the title of the paper?

9. P.2 l.20-24: use either all "Section" or "section" throughout.

10. Figure 1: can you please center panel c in the figure?

11. Figure 1: please only use either "a.s.l." or "asl."

12. Section 2.1.1: most of this paragraph describes how the 2015 design was chosen. Instead, I would prefer the focus to be on the 2017 design. And refer to the 2015 design simply with something like "By extending the design of the 2015 campaign (reference), …".

13. P.4 l.25: again, I don't think we need to know how the 2015 were being generated.

14. P.4 l.26: "For these reasons, the initial deployment of instruments was complicated and time-consuming." is probably not needed in a scientific paper.

15. Section 2.1: I feel like this whole section has a bit too much details that would be beneficial for a technical report, not so much for the main body of a scientific publication. Please consider moving some details to an appendix/SI. Also, after filtering the relevant information, the division in subsections might not be needed anymore.

16. Table 1: the names of the WindScanners in the table do not match those shown in the maps in Figure 1. Please correct and be consistent.

17. P.5 l. 19: add "above ground level" after the height of the instruments on the masts.

18. Section 2.2: you have not mentioned the sonic anemometers anywhere in the abstract or introduction, so now this feels a bit confusing. Please clarify earlier in the text.

19. P.6 l. 18-20: this is a repetition of what later reported in the data availability section, and as such can be safely removed.

20. P.7 l.11: why did you choose 15 range gates and not a different number?

21. Figure 2: to make the panels larger, you can consider including only one color bar for the whole figure, instead of the four shown now, as they are all the same. Same comment with axis labels. Also, include panel names (a, b, c, d) in the figure.

22. Section 4.3: it seems like lidar data are computed as 10-minute average, while the LES data are instantaneous data. If this is the case, please comment on how this difference can impact your comparison between observations and modeled data.

23. Section 4.2.3: after reading the section, it is still not clear to me which timeframe you are using for your analysis. Only the IOP, or the full period of overlap among all lidars? Please clarify.

24. P.10 l. 13: do you mean "lidar data" here?

25. Figure 3: what is the temporal period of the comparison shown? Why were only certain wind directions chosen? This should also be specified in the main text, and not only in the figure caption. Also, please make the panels larger.

26. Figure 4: the titles of the plots are not consistent with those of Figure 3. Please, larger panels. Why are two regression lines shown in each plot? This is not described in the text.

27. Section 5.1: I think it is important, at the end of the section, to be explicit about the overall purpose of the comparison (which I guess was to validate the lidar data?).
28. Figure 5: only one color bar and larger panels, please. Some panels have a "N" label in the top-left corner, some have not: please be consistent.
29. Section 5.2.1 describes the data, but do you have any possible explanation on *why* what you describe is happening?
30. Table 3: over which time interval is TI (i.e. mean and std) calculated? Same question for TKE. Add "AGL" after "100 m". Is veer really in degrees? Or degrees per meter?
31. P. 13 l.7: where is turbulence dissipation shown in the table?
32. P.15: the correlation is quite poor, even for the "best" model setup. This should be pointed out in the text and critically explained.
33. P.15 l.12: so why you didn't pick 15m for the modeled tree height?
34. P. 17 l. 28: rephrase as "In the future, the system availability, which was only at 44% for the period investigated in this study, has to be improved."
35. Data availability: "high-resolution".
36. References: please make sure that all listed references are in the same format. Some titles have capital letters for each word, some have not. Some publications have the DOI not listed.