Multi-lidar wind resource mapping in complex terrain

by
Robert Menke et al.

Review

General comments

The manuscript „Multi-lidar wind resource mapping in complex terrain“ by Robert Menke et al. presents dual Doppler lidar measurements from the Perdigao 2017 campaign and compares them to combined mesoscale and large eddy simulations on the basis of ten minute averages. The presented lidar scan pattern along a line with constant height above a ridge is novel and interesting and could possibly serve in applications for resource assessment in complex terrain in the future.

Nevertheless, there are major objections with the current status of the manuscript as a scientific paper. The authors need to add a clear scientific objective and rewrite the manuscript following a red line to answer the research question. Therefore the current knowledge gaps need to be clarified in the introduction, too. The structure of the manuscript needs revision to follow the IMRAD scheme. The figures are well made, some corrections are stated in the specific comments.

The role of the presented simulations is unclear, since they are just introduced briefly and the agreement to the measurements is quite bad. The interesting findings of wind speed differences over the ridges should not just be described in the text but better discussed. The authors should consider to focus on the validation of the lidar scans using the available in situ measurements on the met masts or on improving the simulations on the basis of all presented flow measurements and a realistic forest representation.

Specific comments and technical corrections

1. Better define terms or choose just one for similar meanings: scanning lidar, WindScanner, Multi-lidar, dual-Doppler, etc.
2. Please proofread the manuscript on use of times.
3. P2L5, examples for current usage of long range lidar: please precise type of lidar applications, i.e. for single wind turbine wakes no large areas have to be scanned. Please limit references to some recent papers. Further state of the art applications of scanning long range lidar worth mentioning here are scanning lidar based wind/power forecasts and research on wind farm wakes.
4. Sec 2.1.1: shorten description of 2015 campaign since not used here. Focus on setup used in this article. Better explain and justify statements made (e.g. laser beams need to be chosen “as low as possible”).
5. P4L16: $\cos(5°) \approx 0.996$, please correct.
6. Sec 2.1.2: Focus on relevant information. Type of lidar power supply not relevant, limit information to the fact of disturbances in power supply.
7. Fig 1: Please use consistent naming for met masts, lidars, etc. Here lidars are named 105, 106, etc. In Table 1 names are WS5, WS6, etc.
8. Fig 1: Please add information about the used coordinate system (PT-TM06/ETRS89) in the text.
9. Sec 2.1.3: Please shorten description of the networking schemes etc. to the relevant information (offsets and usage of GPS time). Add information on spatial averaging along the scan trajectory resulting from continuous scanning and in beam direction resulting mainly from the pulse length. Basic information like the type of the used lidar systems is missing.
10. P5L6: Please specify descriptions of setup. “Range gates were placed every 10 m *along the laser beam* ...”.
11. P5L15: unit of first numbers missing! 0.42 s pm 1.03 s or (0.42 pm 1.03) s
12. Sec 2.2: Information on humidity sensors mentioned in the manuscript is missing here!

13. P5L20: “The 100 m masts also have instruments at 80 and 100 m.” What kind of instruments are those? Is this information relevant here?
14. Sec 3: If you decide to show simulation results please describe the setup in more detail. It is ok to reference to another detailed description but all basic information needed to understand this work should be included.
15. P6L17-19: Move information on data availability to section “Data availability”
16. P6L21: Please describe the vertical coordinate system and relate it to the coordinates used for lidar data and simulation data.
17. Sec 4.2.1: Has the filter method used here been introduced before? Has it been validated? Is the assumption of the “certain degree of continuity” of the atmosphere and are the chosen thresholds appropriate here? In Figure 2 this approach is called “dynamic filtering approach”. Please use consistent naming. Why is the approach dynamic when thresholds are static and chosen manually?
18. Fig 2: Labels a), b) etc. are missing. b) is called “filtered data” in the title and “dynamic filtering approach” in the caption. The order of c) and d) is swapped in the caption. Please correct.
19. Sec 4.3: The information from this short section should be moved to Sec. 3.
20. Sec 5.1: This section is said to contain results but starts with methods (c.f. comment on IMRAD-structure above).
21. Fig 4: Please specify lidars used for single subplots.
22. Fig 4: U_hor and U_proj not introduced in the text. Markers and fits could not be distinguished.
23. Sec 5.2: Findings described are not referenced to the relating figure.
24. P11L7: Please move methodology for the retrieval of atmospheric stability to methods section.
25. Fig 5: Please define N, u and elev given in the plots.
26. Fig 6: Different line styles are suggested for both WRF conditions to support readability in black and white printing.
27. P16L28: Calling the aerial laser scanner measurements “lidar” might confuse the reader. Please distinguish between the terms for wind lidar and lidar for distance measurements.
28. P16L25 and following: It could be expected that numerical simulations without forest parametrization and with a non-realistic forest parametrization will lead to poor results. I suggest simulations with a realistic forest parametrization or excluding simulations with a change of the focus of the manuscript (see comment above).
29. Sec 6: The major part of this section is a summary, not a conclusion. Please rewrite.