Minute-scale power forecast of offshore wind turbines using single-Doppler long-range lidar measurements

Frauke Theuer, Marijn Floris van Dooren, Lueder von Bremen, and Martin Kühn

Review

General Comment

The manuscript presents a methodology for short time (5-10min) wind power forecasts based on scanning lidar measurements. The methodology is tested with a unique dataset measured at the offshore wind farm Global Tech I. Overall, the paper follows a clear structure, and details are very well described. The authors make good use of existing methods such as lidar processing techniques. Figures are well prepared (despite some minor comments below). The results are present well and are discussed in great detail. Points that should be addressed prior publication are:

1. How large is the influence of the wind farm blockage effect on your forecast? Please try to estimate the influence and discuss how it could be integrated into your forecast methodology.

2. You point out that the wind profile estimation is one major factor influencing the quality of your forecast. In the paragraph starting in line 460 you state that additional wind profile information is needed. Please comment on why you did/could not use the wind speed measurements from the wind turbine nacelle? Having the lidar wind speed measurements at ~30 m and the wind speed at hub height should result in a fairly good estimation of the profile.

Specific Comments

1. Page 3, line 80: “TP” has already been introduced
2. Page3, line 86: Consider adding “(ϕ = 0°)” after “horizontal PPI scan” to make the difference to the high elevation scan clearer.
3. Figure 1b: specify the origin of the coordinate system
4. Line 106: replace “causes” with “factors”
5. Line 107: missing space before “Typically”
6. Line 112: How do you justify that all measurements with CNR between -26.5 dB and -5 dB can be considered as valid?
7. Line 121: “15” out of how many?
8. Line 145 -148: Consider moving this information to the figure caption.
9. Line 222: Replace “GTI” with “Global Tech I” in the heading.
10. Section 4 and throughout the entire manuscript: Please revise the use tenses. Many part of the manuscript are written in the past tense, which is not typical for scientific publications.
11. Line 246: What is the maximal number of wind vector retrievals?
12. Figure 6: Please improve the resolution of the figure.
13. Line 256: i. e.
14. Line 267: Can you please explain where the large range of 53 m results from.

15. Line 295: Please add the percentage of available data instead of the actual numbers only.
16. Line 299: Replace “worse” with “decreased”
17. Figure 7: Figure is showing availability over distance, caption refers to “range gate”. Please make this consistent.
18. Figure 9: Abbreviation “mae” not introduced
19. Figure 9: The lines are difficult to differentiate. Please try out using different colors and/or line types.
20. Line 318: missing space after “15”
21. Figure 12b: What is the reason for the plateaus in the data? They do not occur in Figure 11b.
22. Figure 15: Lines are again difficult to differentiate.
23. Line 446: measuring “at” target height?