Response to comments from EiC. 18 December 2023.

Comments to the author:

Dear authors,

Thanks for improving your manuscript which is also ready for publication. I would like you to expand on the impact of poor lidar availability on your results. This could be done by referencing to Carrier-to-Noise-Threshold Filtering on Off-Shore Wind Lidar Measurements Gryning, SE and Floors, R Feb 1 2019 | 19 (3) Sensors.

I'm not sure you address this issue as much as it deserves.

Sincerely, Jakob Mann

Our response:

We wish there was a clearer statement regarding CNR thresholds used for the two data sets. It is, as you suggest, important. At your request we have:

Added this text to section 2 (Data sources).

> A critical determinant of LiDAR-derived wind speed and direction climates is the carrier-to-noise ratio (CNR) used in quality control procedures. CNR is the ratio of the received carrier strength to the intensity of the received noise. Larger values imply higher measurement accuracy but there is ambiguity in terms of the optimal CNR threshold to ensure high wind climate fidelity. Early research with coherent continuous-wave wind LiDAR proposed use of a –22 dB CNR threshold to screen out periods with unacceptably high wind speed uncertainty (Frehlich, 1996), and this threshold has subsequently been widely adopted (Bischoff et al., 2017). Detailed analyses of measurements to 600 m height with Leosphere WLS70 pulsed Doppler LiDAR relative to sonic anemometers, found use of a –22 dB CNR threshold caused a 7 to 12 % overestimation in the long-term mean wind speed, with the higher discrepancy over coastal and marine sites (Gryning et al., 2016). A more recent study, using data from the Leosphere WLS70 deployed on the FINO platform in the North Sea, found a high sensitivity of the wind rose and mean wind speed to use of thresholds lower than −29 dB (Gryning and Floors, 2019). That analysis further found that for heights of 100 to 200 m, application of a −22 dB CNR threshold caused a 12% overestimation of mean wind speed, which decreased to 9% when a CNR threshold value of –35 dB was applied (Gryning and Floors, 2019). Optimal CNR thresholds may vary with site conditions and instrument. Use of different thresholds will influence only data quality but also data availability.

Added this text to the conclusions:

> The differences in wind climates, energy density and estimated power production from the offshore and onshore LiDAR are of sufficient magnitude that they likely exceed any discrepancy due to application of different CNR thresholds in data screening proceedures for the two LiDAR networks.

As implied by the above we now cite 3 additional references (Bischoff et al. was previously cited):

Bischoff, O., Wurth, I., Gottschall, J., Gribben, B., Hughes, J., Stein, D., and Verhoef, H.: Floating Lidar Systems, IEA Expert Group Report on Recommended Practices, IEA Wind TCP RP 18 from Task 32. Available for download from: https://iea-wind.org/portfolio-item/recommended-practice-18/, 89, 2017.

Frehlich, R.: Simulation of coherent Doppler lidar performance in the weak-signal regime, Journal of Atmospheric and Oceanic Technology, 13, 646-658, 1996.

Gryning, S.-E., Floors, R., Peña, A., Batchvarova, E., and Brümmer, B.: Weibull wind-speed distribution parameters derived from a combination of wind-lidar and tall-mast measurements over land, coastal and marine sites, Boundary-Layer Meteorology, 159, 329-348, 2016.

Gryning, S.-E., and Floors, R.: Carrier-to-noise-threshold filtering on off-shore wind lidar measurements, Sensors, 19, 592, doi: 510.3390/s19030592, 2019.