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Comment on amt-2021-233 by EC

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Community comment on "Modelling the spectral shape of continuous-wave lidar measurements in a turbulent wind tunnel" by Marijn Floris van Dooren et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2021-233-CC1, 2021

The manuscript “Modelling the Spectral Shape of Continuous-Wave Lidar Measurements in a Turbulent Wind Tunnel” by van Dooren et al. deals with an exciting wind tunnel experiment using the short-range WindScanner system with the new 6 inches optical lens developed at the Technical University of Denmark (DTU). The preprint shows promising performances of this system for turbulence characterization. Therefore, I believe that such a study is highly valuable for both engineers and scientists working on turbulence flow measurement techniques.

I have some questions and/or suggestions regarding specific aspects of the paper:

- The studies present some coherence measurements, which I found really interesting, given that similar studies were conducted with the short-range WindScanner system in an outdoor environment in 2014 [1]. The coherence can be defined for longitudinal, lateral and vertical separations. Therefore, it was unclear to me if the studies discussed lateral or longitudinal coherence. Maybe this can be explained in a few lines?
- The manuscript suggests that the frequency at which the lidar power spectrum deviates from the hot wire reference spectrum is the frequency at which the coherence drops under 0.5. Maybe a more accurate unit than the frequency is the wavenumber. Otherwise, the frequency at which the coherence becomes lower than 0.5 may depend on the mean wind speed. To go even further, the wavenumber multiplied by the separation distance D could be used as the coherence is a function of D. Therefore, at large distances, the frequency at which the coherence is under 0.5 will be much lower than at small distances.
- How does the spectral correction improve the coherence estimates? In [1], it was suggested that since the coherence is a normalized spectral characteristic, the spatial averaging effect has a limited influence on the coherence estimates. However, in [5], it was also suggested that the spatial averaging may not be negligible if the probe volume is significantly larger than a typical length scale of turbulence.
- For engineering applications, one fundamental turbulence characteristic in wind tunnel tests is the integral length scale, which can be calculated with the autocorrelation function. Have you attempted to estimate it with the lidar system? If yes, how does it compare with the hot wire anemometer measurements? In [1], an overestimation by the lidar system was observed. I am curious to know if it is also the case in your study.
- Although the purpose of the paper is on the high-frequency correction of the lidar velocity spectrum, the measurement technique presented in the manuscript has a wide

range of potential applications in a wind tunnel facility. One of them is the study of wake behind bluff bodies. The short-range WindScanner has been successfully used in the past to study the turbulent flow around bridge decks [2], a tree [3] or a fence [4] in "full-scale". What about scaled models in a controlled environment? Do you think including such a discussion in the manuscript may be relevant to highlight the possible applications of the short-range WindScanner system in wind tunnels in the field of wind engineering, wind energy or fluid mechanic?

References

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