Answer to the Associate Editor

Dear Sir/Madam,

We thank the associate editor for the decision and the constructive recommendations on our manuscript. Below is our response to the associate editor's comments.

Associate Editor's summary:

Dear authors. thank you for your revised manuscript.

I suggest that you integrate into the manuscript some parts of the answers that you gave to the refeee:

- "It was shown by Cheynet (2019) that the uniform shear model (Mann model) (Mann, 1994) did account for neither the influence of measurement height nor the presence of the surface. These lead to an overestimation of the co-coherence of both the along-wind and the vertical wind components for near-neutral conditions."

- "The Vindeby dataset is located below the recent wind turbines' sizes, but this does not mean that the dataset may not be useful for wind turbine design purposes. In fact, the widely-known Kansas spectra are based on the observations at heights not exceeding 30 m (Kaimal et al., 1972) and have been adopted in the IEC 61400 (IEC 61400-1, 2005). From the Vindeby dataset, we found some similarities with the Kansas spectra for near-neutral conditions. For non-neutral conditions, the turbulence spectra at height 45 m above sea level have a consistent behaviour with the predicted spectra at FINO1 at 41.5 m which do not vary much with the observations at 61.5 m and 81.5 m above sea level (Cheynet et al., 2018)."

Overall response:

We have now incorporated the following into the manuscript:

- "Secondly, the version of the uniform-shear model (Mann, 1994) used within the field of wind energy does not account for the blocking by the ground, which may lead to an overestimation of the co-coherence of both the along-wind and the vertical wind components for near-neutral conditions (Cheynet, 2019). Thus, the co-coherence modelling using the uniform-shear model (Mann, 1994) is not discussed further in the present study." that replaces the lines 43-44 "Secondly, the vertical coherence of turbulence is not always described accurately by the spectral tensor (Mann, 1994; Cheynet, 2019).".

- "Although the Vindeby dataset is located below the recent wind turbines' sizes, this does not mean that the dataset may not be useful for wind turbine design purposes. In fact, the widely-known Kansas spectra were based on the observations at heights not exceeding 30 m (Kaimal et al., 1972) and have been adopted in the IEC 61400-1 (IEC 61400-1, 2005). From Vindeby dataset, we found some similarities with the Kansas spectra for near-neutral conditions. For non-neutral conditions, the turbulence spectra at height 45 m amsl have a consistent behaviour with the predicted spectra at FINO1 at 41.5 m which do not vary much with the observations at 61.5 m and 81.5 m amsl (Cheynet et al., 2018). The comparison between the turbulence characteristics at Vindeby and FINO1 is therefore valuable to further develop comprehensive spectral turbulence models that are suitable for modern OWT designs. Nevertheless, future atmospheric measurements at heights up to 250 m amsl are necessary to obtain the knowledge of turbulence characteristics where the surface-layer scaling may no longer be applicable." in lines 437-445.

References

Cheynet, E. (2019). Influence of the measurement height on the vertical coherence of natural wind. In *Conference of the Italian Association for Wind Engineering*, pages 207–221.

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Kaimal, J. C., Wyngaard, J. C. J., Izumi, Y., and Coté, O. R. (1972). Spectral characteristics of surface-layer turbulence. *Quarterly Journal of the Royal Meteorological Society*, 98(417):563–589.

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