Author's Responses 1

Thank you for the valuable feedback on our manuscript. We addressed the remarks in the comments below.

Please note that the reviewer's comments are written in green, and the authors' responses are written in black.

Please also note that all line numbers in the responses refer to the line numbers in the **marked version** of the manuscript.

This is a comment on my previous review and how I think the authors have responded:

1.: It is great to see the large change in figure 1. It really shows that the intermittence is small scale, not general for all scales. This has really improved the manuscript. The second point for this comment is also well addressed.

Thank you for your positive feedback. Your comment has really helped us to improve this figure and to correct the equations.

2.: The authors argue why they limit their investigations to isotropic turbulence. This certainly limits the scope of the paper but it is acceptable.

We agree with you, it is certainly a limitation of the scope of the paper. However, we wanted to show how the time-mapping affects the statistics and highlight the effects on the loads.

3.: The way the spectra are shown is definitely improved. But it gives rise to another question: Why are your theoretical spectra offset from the simulated spectra? it is around 50% in the inertial sub-range and similar in the energy-containing range except at the very lowest κ_1. This has to be explained.

Thanks for pointing out this issue. We have checked our process carefully and repeated it for a wide range of model input parameters to ensure the correctness of our workflow. First of all, in figures 6-b and 6-c, the x-axis was κ_2 and κ_3 respectively. These figures have been corrected and plotted against κ_1 instead.
That brings up the second issue which is the considerable difference in the inertial sub-range. The reason behind such a shift is the turbulence field scaling process needed to achieve the target TI. On the other hand, the Mann-box field without scaling fits the theoretical curve as expected (see attached Fig. 1 below). Fig. 6 in the paper has been corrected and only the non-scaled field is shown which matches the theoretical curve. Also the same was done in Fig. A1 in the appendix.

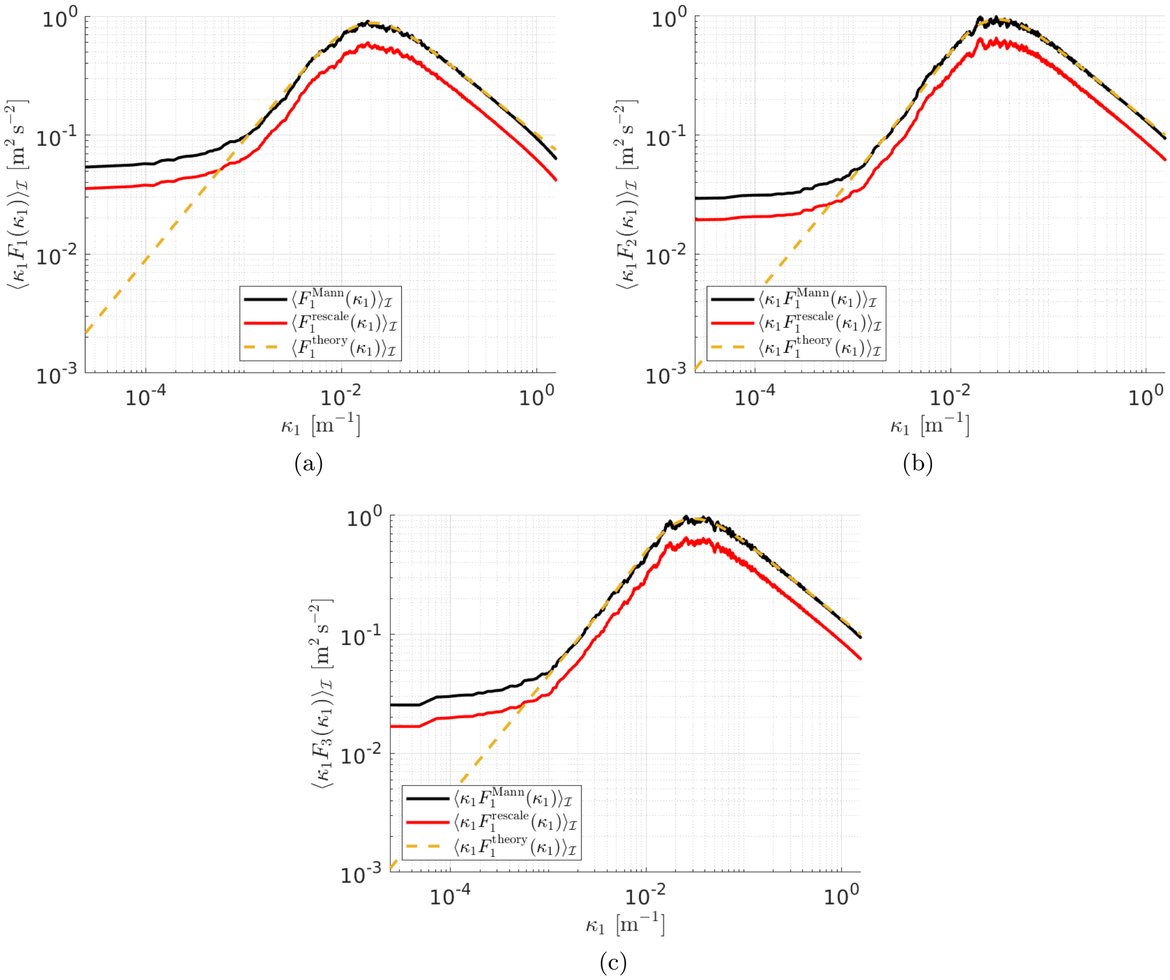

Figure 1: Comparison of averaged spectra in (a) x_1-, (b) x_2-, and (c) x_3-directions for the Mann field $(F_i^{\mathrm{Mann}}(\kappa_i))$, a rescaled Mann field e.g.: $(F_i^{\mathrm{rescale}}(\kappa_i))$ and the theoretical spectra $(F_i^{\mathrm{theory}}(\kappa_i))$

One last point here is the difference at the low κ values $< 10^{-3}$. That can be attributed to the smoothing which estimates the average based on an averaging window. Since there are a limited number of points in this range, the average isn't representative. We tried different average windows (see the attached Fig.2 below) and included in the paper what we think is a good compromise between the clarity of the figure and the accuracy.

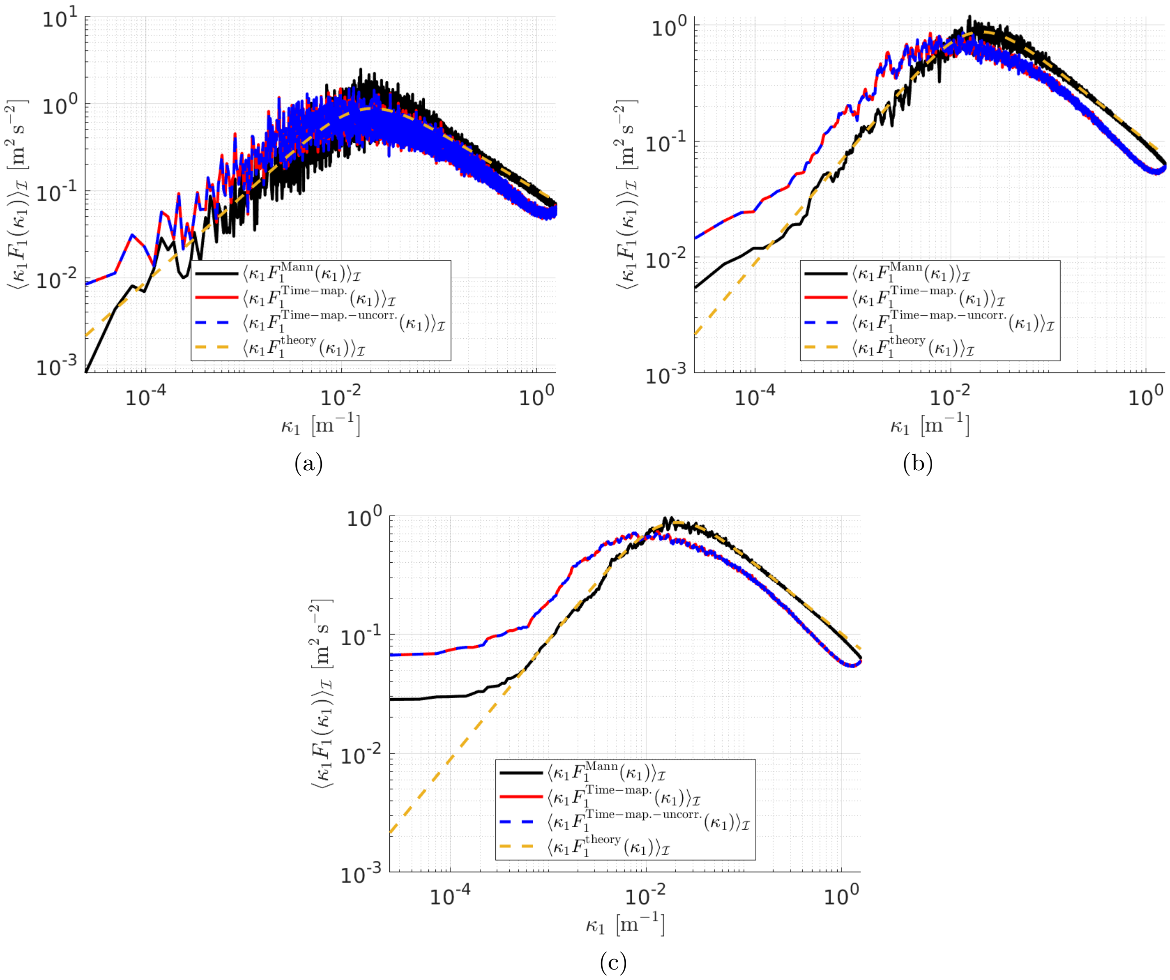

Figure 2: Comparison of spectra in x_1 direction with smoothing using different averaging windows = (a) 1 point (no averaging), (b) 10 points, and (c) 50 points

All the points discussed above are limited to Fig. 6 and they are mainly visualization issues of the turbulent field. That does not influence the used fields in the analysis and does not affect the results of the paper. The smoothing was done to improve the visual comparison between the theoretical model and the Mann-turbulent field. These modifications and further explanation of the new Fig. 6 are shown in lines 331-380 in the marked version of the paper.

4.: This part is also improved.

Thank you for your positive feedback

5.: I think the conclusion reflect the changes well.

Thank you for your positive feedback. Your comments have really helped us to improve the conclusion to be more clear.

6.: All in all, the authors have done significant improvements to the manuscript. It is a step in the way of obtaining non-Gaussian inflow fields, but there is still a long way to go. I think the manuscript is worthy of publication provided that the authors solve the issue with the offset between the simulated and theoretical, isotropic spectra.

Thank you for your positive feedback. We hope that the improvements in Fig. 6 and in the corresponding paragraphs in the paper have answered your questions. Thank you for your patience and effort.

Best regards, Jakob Mann

Author's Responses 2

Thank you for the valuable feedback on our manuscript. We addressed the remarks in the comments below.

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I would like to thank the authors for the answers to my remarks and questions to the revised version of the manuscript, the addition of Appendix B and the modification of Fig. 10, in which the time lags considered have now been selected in such a way that heavy tails are also visible for the RootFlap moments!.
The authors have completed Table 3 with the information on the turbine model and it is now clear that a tilt angle and gravity effects have been considered in the model, each of which produces deterministic 1P load variations for each blade. However, this supplementary information and the updated result in Fig. 10 raises a new fundamental question for me. The adaptation of the considered time lags in Fig. 10a has led to a sudden appearance of heavy tails in the root-flap moments that were not visible in the results of the first two versions of the manuscript. In my opinion this means that the heavy tails now visible in Fig. 10a are obviously caused by the deterministic 1P loads and not by the intermittency of the wind field. Fig. B1 in Appendix confirms the prominent 1P peak as well as the higher harmonics in the spectrum of the root-flap moments. A further indication that the heavy tails visible in Fig. 10a may be caused by deterministic loads results from the fact that the heavy tails strongly decay for higher time lags, while they are still clearly visible for the wind field (Fig. 8). A comparable behavior of decaying heavy tails for larger time lags can found in Fig. 10 for the their loads, so that also here it can be suspected that the visible heavy tails could be caused by deterministic 3P loads and not by the wind field.
If the heavy tails visible in the results for the time-mapping Mann model are caused by the deterministic loads, the question arises why the calculations with the original Mann model do not show heavy tails at all for any time lag (Fig. 10). Actually, I do not understand these results and would like to ask the authors to carefully check the calculations and the setups and provide more explanations. Are the turbine models really consistent? For the time being and with the available information and results, I cannot agree tostro the main conclusion of the manuscript (line 479ff), according to which the intermittency of the wind field generated by means of the time-mapped Mann model is transferred to the rotor loads. In order to demonstrate the influence of the intermittency of the wind field and to justify this conclusion, I strongly suggest to first consider a rotor without tilt and without gravity forces, i.e. without deterministic load variations, for both wind fields and I would be happy if my open questions and concerns could be solved.

We agree on the fact that heavy tails shown in Fig. 10 are closely related to the deterministic P loads. However, as you also pointed out, the heavy tails in Fig. 10 for the four loads, as well as the values of the kurtosis in Fig. 11 show a clear difference between the Mann and the time-mapping Mann models. Therefore, even though the intermittent behavior of the loads is related to the P frequencies, it is not purely caused by gravitational forces.
We have verified the comparison between the Mann and the time-mapping Mann to ensure the correctness of our calculations' correctness and identical set-ups for the numerical simulations. Furthermore, we have obtained similar results when comparing Mann and the time-mapping Mann wind

fields for other operational conditions, i.e. rotational speed, size of the turbine, mean wind speed, and turbulence intensity. In all cases, only the time-mapping Mann wind field induces heavy tails on the PDFs, and values of kurtosis are higher than 3 when calculating the increments of the loads. Such behavior is not observed with any of the Mann wind fields for the different simulations. Thus, we claim that the intermittency on the loads derives from the interaction of both, the intermittency of the wind field and the dynamics of the turbine.