Response letter - "Sensitivity of fatigue reliability in wind turbines: effects of design turbulence and the Wöhler exponent" Manuscript number: wes-2023-47

Response to referee #1:

We would like to thank the reviewer 1 for the final check and comments which helped us improve the final revision of the paper. The comments from the reviewer and their responses are presented in the continuing with two colors of black and blue, correspondingly.

Thank you very much for the nice revision of the paper. I think that the quality of the paper has been improved significantly. I have just a few minor comments on your revision.

1) Eq. 11: The notation Mxi is a bit confusing as it could be understood as $M \times xi$. M_{xi} would be much clearer but this is just a matter of taste.

   Thank you. Noted and corrected.

2) Eq. 13: Is it actually $E[DELs^m]$and not just $DELs^m$, as you talk about a single sample of a 10-minute time series here? $E[DELs^m]$ would mean that you average something, but the averaging of several seeds follows in Eq. 14. Hence, I think it should be $DELs^m$.

   Corrected.

3) Eq. 14: Is it actually $E[DEL_{bin}{}^m]$and not just $DEL_{bin}{}^m$on the left side of the equation? As the right side of the equation means to take the mean value, the current definitions would mean $E[DEL_{bin}{}^m]=E[DELs^m]$, and therefore, $DEL_{bin}{}^m=DEL_s{}^m$. Furthermore, in Fig. 4, you show DEL_{bin} (as written in the caption). And what you actually show is $(E[DEL_s{}^m])^{1/m}=DEL_{bin}$, is you rewrite Eq. 14 as follows: $DEL_{bin}{}^m=\sum_{s=1}^{ss}\frac{(\mathrm{DELs})^m}{ss}$. If you do this, you have to use $DEL_{bin}{}^m$ instead of $E[DEL_{bin}{}^m]$ in Eq. 15 and 16 as well. This would remove all $E[...]$in the paper, which makes things much clearer.

   That is true since all the notations are realizations of DEL_bin. Corrected and changed to $DELbin$ in equations 14, 15, and 16.

4) L. 552-554: Do you actually mean Fig. B1 and not Fig. 9? Is it $m=12$and not $m=10$(in line 554), as Fig. 9 shows $m=10$. If you mean Fig. 9, a reference to Fig. B1 is missing.

   Corrected. Thank you for mentioning.

5) Fig. 11: A legend is missing.

   True. Corrected.

6) Comment 42 of the first review: “Section 3.2: How are the best fitting distributions determined? Out of which distributions is the best fitting distribution chosen? How is the goodness of the fit judged?” You answered the first two questions, i.e., how did you fit (maximum likelihood estimations (MLE)) and which distributions (GEV etc.). However, you did not answer, how the best distribution is chosen (I do not mean the best distribution parameters, this is done using MLE, but actually the best distribution, i.e., GEV etc.).

   Completed the sentence in the section 3.2 to: ‘We find the best distribution fits among different options (GEV, lognormal, normal, and Weibull in this case) using maximum likelihood method and Akaike information criterion (Akaike, H., 1973).’ The corresponding reference is also added.

7) Comment 49 of the first review: “L. 547: You state that MC can only be done when having the computational resources. […]” I am still not really convinced that MC is not suitable here. Even when using 1000 loops with 1 million evaluations of Eq. (21) each, the processor time is probably relatively small compared to processor time of the approximate 100,000 aero-elastic simulations and probably even low compared to using 6 seeds per bin (i.e., more than 1,000 aero-elastic simulations). However, it is fine to use FORM, as you showed that it is a sufficient approximation. Hence, you do not have to give further explanations on this topic in the revision.

   We appreciate your comment. The simulations for the study are performed using HPC cluster. Thus, we agree with your statement: if such facility is not accessible, the whole study would be computationally more expensive and if available, the Monte Carlo can also be done using the same. However, the reliability analysis was done using personal computer and here the comparison in is between FORM and MC not their computational expense compared to the aeroelastic simulations.

Typos etc.:

8) Your notation is still not completely consistent, e.g., in Eq. 13, you write Neqbut in line 256 it is Neq. Similar, in line 249, it is $Mi$and in Eq. 12 it is Mxi.

   Thank you for noting. Corrected in the text.

9) Table 5: Par 2 and Par 3.

   Corrected.

10) Check you references, as, for example, Sørensen is not written correctly (l. 767).

   Corrected.

Response to referee #2:

We would like to thank reviewer #2 for the nice feedback. We are glad that the final version met the reviewer's expectations.