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Interactive
comment

Interactive comment on "Validation of a lookup-table approach to modeling turbine fatigue loads in wind farms under active wake control" *by* Hector Mendez Reyes et al.

Hector Mendez Reyes et al.

stoyan.kanev@tno.nl

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Dear reviewer, thank you for the evaluation of our manuscript and your useful comments. We have carefully considered them all in the revised version of the paper, as explained below. The changes made to the manuscript have been marked in yellow in the revised version for your convenience. Please notice that this revised version contains also the changes made to the manuscript based on the comments from the other reviewer. We have decided to leave those unmarked to avoid confusion with the changes made based on your comments.

Your comment: Could you explain a little on the selection of loads analyzed, is there

consensus opinion that this particular set of loads well covers/correlates all loads? For example, one might expect yaw bearing loads to be particularly impacted by offsetting wake, but is this essentially included in the tower top load? 1-2 paragraphs on why the included loads were selected, and if all excluded loads can be expected to behave similarly would be much appreciated.

Response: The locations at which the loads have been stored in the LUT have been carefully selected in consultation with experts from the industry. The goal was to choose a limited number of critical locations that are representative for the complete turbine structure. In the revised manuscript we have added Table 1 (page 7) which gives an overview of the complete set of locations. In addition, we have added a few lines to clarify this selection, see lines 24-29 on page 7.

Your comment: Page 5: You remove offsets at above rated wind speeds where AWC will not operate, but I believe AWC could well operate effectively up to wind speeds where downstream turbines are rated, which would be above-rated for upstream by 1-2 m/s, was this accounted for?

Response: This statement was misleading, the offsets are included in the LUT up to 14 m/s, where 12 m/s is the rated wind speed for the turbine. We have clarified this point in the revised version on page 6, lines 21-22.

Your comment: Fig 2: Would be helpful to also include what is the normalization in the caption

Response: The applied normalization is included in the caption now (page 9)

Your comment: Page 9: "but the impact of wakes on the loads are much more pronounced", I believe you, but can this be inferred from Fig 3?

Response: We agree that this was not explained clearly enough. The figure shows that the loads increase due to yawing is not more than around 10-15%, but the loads increase due to higher turbulence is much larger (>250%). Since the turbulence in

the wake is higher than in free stream, with 15% being more or less representative for a single wake situation offshore, and 5% for free stream, the loads experience at a downstream turbine due to wake effects (and hence higher turbulence) will be in the order of 250% - much more pronounced that the loads increase of 10-15% due to yawing. It is based on this fact that we argue that wake-induced loading is more pronounced that yaw-induced loading. We have revised the respective part of the text in the manuscript to better explain our argumentation, please refer to page 10 line 22 to page 11 line 1 in the revised manuscript.

Your comment: Fig 4: Is this somehow inverted on the y-axis with respect to fig 3? I understood the discussion in the text on the location of the nadir, but I was confused on the inversion

Response: No, no inversion. The reason for the different shape of the curves here is simply the lack of any turbulence. In the case of lack of turbulence, the effect of yaw offset on the loads is essentially exaggerated. However, adding just a little turbulence already induces loads that are more pronounced than those due to yaw misalignment only, so that at 5% turbulence the curves take the shape of those in Fig 3 and Fig 5. We have added some text to clarify this in the revised manuscript, see page 13 lines 6-9.

Your comment: Fig 8: Is raw data 10-minute bins? The agreement is nice

Response: Yes indeed, time series of duration 10 minutes have been used to calculate the raw loads. We added a clarification (page 15 line 9).

Once again, thank you for your fruitful comments which we hope to have considered appropriately in the revised version.

Best regards,

Stoyan Kanev (on behalf of all authors)

Please also note the supplement to this comment:
https://www.wind-energ-sci-discuss.net/wes-2019-34/wes-2019-34-AC2-supplement.pdf

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Interactive comment on Wind Energ. Sci. Discuss., https://doi.org/10.5194/wes-2019-34, 2019.

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Discussion paper