

Response to Anonymous Referee #2 comments of Manuscript ID WES-2023-128 entitled “Aerodynamic effects of leading edge erosion in wind farm flow modeling”

Thank you for taking the time to review our article. We have addressed your comments attentively, for which the details are provided below.

1. I found the abstract did mention some of the critical conclusions drew by this manuscript, such as i) the AEP loss was overestimated up to 7% in previous studies; ii) due to the wake loss effect, there is an optimum repairing strategy for a wind farm to maintain its high productivity.
The abstract has been updated to also include these critical conclusions.
2. The abbreviation AEP standing for the annual energy loss was not introduced with its full name when it first occurs.
This has been corrected.
3. The abbreviation CI (I guess, standing for confidence interval) was not introduced with its full name when it first occurs in the description of Figure 2.
This has been corrected.
4. The description of Figure 2 mentions that the solid line represents the ensemble mean while the label in figure indicates that it is for median, which is confusing. The author should clarify.
This has been corrected.
5. In the text describing Figure 3(a) in line 164, the categorization of aerodynamic losses is not properly referenced. Please list the specific CFD simulations and reviews that the authors are referring to.
As mentioned in line 120, there exists no standardized aerodynamic loss categorization scheme. Section 2.3 (Aerodynamic loss categories) is devoted to justifying the chosen values for the lift-to-drag losses based on the references provided in the section. These values are not universal since they might vary for different airfoils but it is the authors belief that the chosen values represents realistic lift-to-drag losses on the wind turbine used in the present study. We have tried to address your comment by rewriting most of the section and adding information where it was lacking. As it is now also mentioned in the text, it is a first attempt at defining aerodynamic categories and more work remains to be done here.
6. In line 165, the “between” is duplicated.
This has been corrected.
7. I found that Table 1 is not giving much information, should the authors consider removing it?
The authors agree that the table might be a bit redundant and it has therefore been removed.
8. The description of Figure 4 is unclear, should the “securities” be replaced by “severities”?
Yes, it should have stated ”severities” and not ”securities”. This has been updated.
9. I found that the Figure 4 is confusing because it is trying to deliver two things: 1) from the root to the tip of the blade, the tendency of erosion is increasing; 2) from the root to the tip of the blade, the lift-to-drag losses are increasing. Are the increasing lift-to-drag losses are dominantly caused by the increasing degrees of erosion? The authors might need to clarify to make the figure clearer.
Figure shows an example of the typical distribution of erosion defects along the wind turbine blade. The erosion defect are categorized by their aerodynamic impact on the lift-to-drag ratio, ranging from a-f. The aerodynamic loss categories are directly associated with a reduction in lift-to-drag ratio as specified in Figure 3(b). The figure caption has been updated to better clarify this.
10. In Figure 12 right panel, I found that the color bar is confusing (especially the unit seems to be percentage). It will be good if the authors can clarify on that.
The unit should not have been in % since it is normalized between 0 and 1. This has been corrected.
The main take away from the figure should be that the largest AEP gain is obtained by repairing the most severely damaged turbines but that there is also an added, and clearly visible benefit from repairing the turbines that contributes more to the overall AEP, i.e., the turbines less affected by the wakes. The figure caption has been updated to clarify this.