Authors' reply to Referee #2

Dear Referee #2,

Thank you very much for reviewing our manuscript and the many valuable comments and suggestions to improve the quality and clarity of the paper. Your feedback is really appreciated. We have carefully considered all your comments and, where necessary, will make changes to the manuscript accordingly. Before it, please find below our point-by-point responses to your suggestions and concerns. The original comments are written in **blue** below, and the corresponding answer in black.

RC2: The article discusses methodology to observe effects of rainfall on wind farm meteorology and production. Given the vulnerability of wind farms to environmental conditions, the topic and associated results have potential to be valuable for industry-scale analysis and scientific significance.

However, the manuscript is not recommended for publication in its current form and major revisions are needed to be reconsidered. In terms of scientific quality, insufficient information is provided on the methodology toward repetition, and minimal discussion/references are provided to connect and validate analysis through related work. Manuscript presentation lacks organization and clarity, contains numerous unsupported claims, and includes incorrect and/or mislabeled results.

Answer: The authors acknowledge the referee for their interest in the subject covered by the manuscript and the requests provided for its quality improvement. The general comments raised are addressed in detail in the subsequent points below. Overall, additional information will be included for both the methodology and the references supporting the discussion, and the manuscript will be reorganised for increased clarity. Corrections and the inclusion of the missing information will also be covered.

RC2: The introduction does not provide sufficient context/motivation for the subject and is vague in describing factors expected to impact wind farm wake variations. There is a large amount of available literature discussing very relevant components of this problem, including (but not limited to): turbulence in single-turbine and farm wakes, the impact of compounding turbine wakes on production, effects of droplet adhesion and erosion on turbine blade aerodynamics, particle/droplet inertial coupling with turbulence (within and without wakes), effects of compounding wake turbulence on particle distributions, etc.

Answer: Authors thank the comment provided by the referee. According to your recommendation, wider context and motivation will be provided expanding the introduction of the manuscript.

RC2: The methodology is unclear and disorganized, providing little information into exact procedures, filtering techniques, error quantification, etc. Additionally, methods

are littered throughout the text and appear as afterthoughts rather than providing concise and sufficient relevance to the analysis.

Answer: Authors acknowledge the analysis provided by the referee. Following your comments and those from the other reviewer, we propose to thoroughly revise the article by restructuring it, grouping together topics related to methodology and clarifying its application.

RC2: The data analysis description should be included and combined with all methodology, especially as the analysis is mentioned as primary input parameters.

Answer: Yes, we have realised that we need to reformulate the structure of the article by grouping topics together. We will do this when we revise the article, as answered to the previous comment.

RC2: Description of data analysis, verification, and data cleaning provides no measure by which the data are verified, and no discussion of convergence or other means to "ensure the consistency of the original and calculated data".

Answer: Many thanks for your comment. To address it, further explanation about the data analysis, cleaning, verification and consistency checks will be provided in the reviewed manuscript, referencing to existing practices in the state of the art, where applicable.

RC2: References for data filtering are present within each section. But no details are provided as to how the data were filtered, and whether this filtering was performed only once on the initial dataset or in repeated/subsequent filtering steps.

Answer: The filtering process is currently described in section 4.1.3. In the reorganisation of the reviewed manuscript, a more detailed description of the filtering process will be included in the methodology section. More detail will be added on the generation of the initial datasets, clarifying how they are used in the rest of the process to avoid any ambiguity.

RC2: The statement "insufficient data" is used throughout the text, but these data are also mentioned to be key factors in validation. If this is the case, why should the presented data/methodology be trusted?

Answer: "Insufficient data" is used in line 133 to indicate that if we group data taking into account different variables, i.e. moments of rainfall with density x and turbulence intensity y, we are left with small data sets that we consider unrepresentative. For this reason, for the purpose of this article, in which we mainly want to analyse the effect of rainfall, we do not discretise other variables which, despite being very important, would limit the representativeness of the results.

In line with this argument in line 173, it is mentioned again that discretising by rainfall and, in turn, by turbulence intensity levels drastically reduces the amount of data, so

the decision is made to work only with the Boolean variable rainfall/no rainfall and then analyse the turbulence intensity value in each data set.

We will explain this issue in more detail in the review of the article to avoid any potential misinterpretation.

RC2: Several figures presented have no quantified values shown (5,6,8,9,10), leaving comments/references in associated text unsupported. Therefore, they are not useful for comparison of actual mean statistics and contributions based on environmental conditions and turbine production states. Stating comparisons as "left" and "right" or "higher" and "lower" have little impact on quantified validation.

Answer: Due to confidentiality restrictions on the commercial wind farm, we are not permitted to disclose the actual absolute values of the variables; therefore, axes in the figures mentioned had been intentionally decontextualised. In the revised manuscript, however, we will provide normalised values and variable units for each of the concerning figures for the sake of completeness. The findings will be described in greater quantified detail in the next version of the manuscript.

RC2: Discussion related to figures and results is minimal, providing little context for importance to the methodology and/or to wind farm wakes.

Answer: Although this is only an example of application and analysis using the methodology, in the next version we will give more details of the aspects to consider in the analysis of the figures. The conclusions drawn will also be discussed in greater detail.

RC2: Discussion includes several statements to the importance or non-importance of certain parameters (e.g. density, turbulence intensity, homogeneity, etc.), but does not give context or citations to support why this is declared or why it may (or may not) be relevant.

Answer: Authors acknowledge the comment. We will include values and/or references that corroborate these statements.

RC2: Figure 6 is not a set of windrose plots, but a repeat of Figure 5.

Answer: Yes, we apologise for this clerical error. The figure will be corrected in the next version of the manuscript.

RC2: The overall manuscript text contains several incomplete sentences/passages/labels and does not appear to have been reviewed with care prior to submission.

Answer: We apologise for this oversight. During the transfer of the article to the template, errors occurred that we did not detect. We will fix this when we review the article.