Ref.: Article WES-2024-132 “Analyzing the performance of vertical wind profilers in rain events”
Author(s): Adriel J. Carvalho et al.
MS type: Research article”

Dear Reviewer2,

We have attached the comments regarding the paper "Analyzing the Performance of Vertical Wind Profilers in Rain Events" by Adriel J. Carvalho et al. The answers are in red, and the modifications are indicated in red in the manuscript.

Best wishes,

Denisson Q. Oliveira
Federal University of Maranhão, Brazil

ANSWERS TO REVIEWER2

The authors appreciate the reviewer's comments. We hope that the authors' answers and the manuscript's modifications match all the concerns. All modifications are indicated below and inserted in red in the manuscript.

The paper investigates the performance of SODAR and LIDAR vertical wind profilers during precipitation events, focusing on their Range Availability (RA) and the reliability of wind speed measurements. The study analyzes data from the Brazilian equatorial coastal region, comparing observations near and far from the shoreline. Results indicate that rainfall significantly impacts SODAR performance while having minimal effects on LIDAR near the coast. The findings aim to guide the selection of wind profiling technologies for regions with high rainfall and varying meteorological conditions. The paper has multiple unique strengths including (1) covering both SODAR and LIDAR profilers, providing a comparative assessment of their performance under varying conditions (with metrics such as Pearson Correlation); (2) addressing a critical issue for wind energy project developers in regions with high rainfall, offering actionable insights for technology selection; (3) relatively good 14 months of data (both dry and rainy) and (4) highlighting the importance of location (near vs. far from the coast) in determining the performance of LIDAR and SODAR technologies. However, multiple areas need to be addressed:

The findings are specific to the studied region, with limited discussion on how the results might apply to other geographic areas or climates.

The authors thank the reviewer for the valuable comments. The study developed in this article aims to demonstrate quantitative comparisons between the two technologies without the intention of speculating results in different climates or geographic conditions due to numerous variables that can affect the performance of the sensors that could not be quantified, such as high roughness length, low humidity, and temperature. However, on Brazil's equatorial margin, there is a large area with great wind potential and characteristics similar to those observed in this study. Section 2, "Methodology," references the papers of Assireu et al., 2022, and Pimenta et al., 2023. Both provide a detailed description of the study region, which will allow the reader to identify whether the conclusions of this work can be extrapolated to their area of interest. Additional comments are inserted into sections 2, 3, and 4.

The paper does not address the potential trade-offs between accuracy and computational or operational costs of using LIDAR versus SODAR.

This study refrained from comparing costs, transportability, and sensor software, given that there are changes over time in the prices of the various technologies, maintenance costs, component lifetimes, sensor size, and embedded software that depend on each vendor. Several vendors are on the market, and only two were used in the experiments. Such comparisons could lead the analysis to a commercial issue. The intent was to analyze the performance of the two technologies in terms of field-proven range and accuracy under

certain conditions. Additional comments regarding these points are inserted in the "Introduction".

While Pearson correlation is used to validate the representativeness of the measurements, no detailed analysis is provided for extreme weather events or edge cases.

The authors appreciate the suggestion. To address the reviewer's question, for the SODAR, the different rainfall intensities (C10) were compared with the consistency of rainfall (CON10). The drop in RA was found to be more related to CON10 than to C10 since, with high CON10; the RA reduction occurs for all C10 levels. As CON10 decreases, there is a smaller reduction in RA, although higher C10 values have some influence on RA for CON10 values lower than 10. A table showing RA values (mean, standard deviation, and coefficient of variation) with various C10 intensities and the maximum CON10 value was added and discussed. Additionally, for the LIDAR, it was observed that even during extreme rainfall events, as depicted in Figure 5, its performance was not affected at the time of the event, further demonstrating its resilience under high-intensity precipitation conditions. These comments have been inserted in Section 3.2.

Key terms such as "dynamic recovery" for SODAR and specific RA thresholds for decision-making are not well-defined.

Thanks for the suggestion. The paragraph in item 3.1 describing the recovery of the Sodar range after a precipitation event was changed to address the reviewer's observation of defining the time and range values that characterize a fast recovery. The following text has been included:

During precipitation events, the SODAR's loss of range showed a correlation with CON10 and C10. However, the pattern observed was the fast recovery of range after the precipitation ended. In other words, measurements taken after the end of precipitation generally return to 80% of the full range in the first sampling after the end of precipitation. Figure 1 (Figure 2 in the revised manuscript) depicts the equipment's range during operation when several precipitation events occurred, demonstrating the analyzed correlation.

Some sections, such as the methodology and results, lack clarity in distinguishing novel contributions from existing literature.

Thanks for the suggestion. The authors have updated some sections with additional comments to improve the manuscript. The contributions have been inserted in the Section 1 Introduction, and the literature review in Section 1.1 has been updated to indicate the contributions clearly.