Wind Energ. Sci. Discuss., referee comment RC2
https://doi.org/10.5194/wes-2022-17-RC2, 2022

Comment on wes-2022-17

Carl Shapiro (Referee)

Referee comment on "Addressing deep array effects and impacts to wake steering with the cumulative-curl wake model" by Christopher J. Bay et al., Wind Energ. Sci. Discuss., https://doi.org/10.5194/wes-2022-17-RC2, 2022

This paper gives adds the super-Gaussian model of Blondel and Cathelain and the cumulative wake superposition of Bastankhah et al. to the Gauss-curl hybrid model to address issues with deep array effects. The comparisons to high-fidelity models and field data are comprehensive. The paper is a worthwhile addition to the considerable research on wind farm wake modeling that is necessary for wind farm design and control.

Introduction: I enjoyed this clear discussion of the complications of wake modeling (including wake super position and near and far wake models) in various wind farm configurations. Two issues that could use some discussion are (1) momentum conserving models and linearized momentum conserving models (often called mass conserving models) and (2) the choice of wake expansion rate through turbulence characteristics.

Section 2.2: It is hard to decipher where each of these equations come from and how they have been modified in this implementation. Is there a consistent theoretical basis for adding the Blondel & Cathelain model and cumulative model of Bastankhah et al. to the GCH model? Or are the additions heuristic?

Section 2.2: This model has a large number of free parameters, which makes it more difficult to use. Could you discuss in more depth how these parameters are selected to make the model more widely useable.

All graphs: Please use vector formats for these images and use consistent font sizes. The resolution is fairly low and the font is sometimes hard to read. Use more descriptive titles without using underscores.

Figure 1: The improvement here is not as apparent to me as claimed in the text. I would have assumed that the super-Gaussian near wake model would improve the agreement in the near wake. In fact, the opposite seems to be the case. Furthermore, the choice to tune the results at x/D=7 affects the model accuracy. If the tuning had been done at x/D=3 the results might be quite different. A better approach would be to minimize the error over all measurements.

Section 3.2.2: Since these results are for a single turbine, they are only including the effect of including the Blondel & Cathelain model in the GCH model and the Bastankhah model does that have an impact, correct? Or am I misunderstanding that? I suggest adding some discussion on what aspects of the model are being tested here.

Section 4: The paper has a lot of great data for the comparison. While the graphs are very instructive to understand the differences between the models, it's hard to compare the average error. Could you provide average error results for each of these graphs in a table?

Figure 10: What do the color plots on the right represent? There is no label and they are difficult to read.

Sections 3&4: I suggest changing the "Reflection" subsections to "Discussion."