

Interactive comment on “From wake steering to flow control” by Paul Fleming et al.

Anonymous Referee #2

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[a4paper]article The paper compares a control-oriented model and detailed CFD simulations of wind turbine wakes. While in the baseline case the models fit well, the models disagree, if one or more turbines are yawed. The authors state at the end of the introduction that the paper’s contributions are:

1. A demonstration that the control-oriented model cannot describe all important effect of multiple wakes.
2. A demonstration that the effect is especially critical for arrays of multiple turbines.
3. A proposed new approach of wind farm control based on the analysis.
4. Recommendations of improvements to control-oriented modeling.

In the conclusion, the results are summarized in:

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1. Motivation to develop new physics for a control-oriented model for wind farm control which included the effect of counter-rotating vortices.
2. Suggestion that wind farm control should be more about generation of large-scale flow structures and not about redirection only.

Overview

Overall, the paper is well-written and includes very important findings for the wind turbine control community. Although the paper is already in a very good state, the descriptions of contributions and results could be improved. Further, some more details could help to understand the analysis.

Descriptions of contributions and results

1. The title is somehow misleading: It is clear after the reading why you chose the title (your result #2, the suggestion), but actually don't really "control the flow" but you analyze the effect of yawing wind turbines.
2. This brings me to another important point: you nicely describe new effects which are very important for wind farm control. This deserves from my opinion more credits. It is somehow included in your contribution #1 (demonstration that FLORIS cannot describe it), but might be good to highlight it more in a positive way.
3. In this way, your contributions #1 and #2 might be also be more specific to the new effects: i) A upwind wake steers the wake of a un-yawed turbine (see Figure 6 and 2nd and 3rd row in Figure 11) and ii) and the wakes of wind turbines in

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- the same row have interactions which are unneglectable (sumInd different from yawAll in Figure 11). The original contributions #1 and #2 are also overlapping.
- The contributions #3 and #4 are very similar to your results #2 and #1. However, the finding and description of the new effects are missing in the listing of the results. Further, the points i) Suggestion: “we need to control the flow and not only steer the wakes” and ii) Motivation: “this requires new models” are important but still quite vague to be listed as the main results of a scientific paper.
 - Addressing a similar issue: Your structure is: 1. Introduction, 2. Models, 3. Methods, 4-6 results, 7 conclusions. Sections 4-6 could be renamed to be more consistent, e.g. “one turbine case”, “two turbine case”, and “Multiple turbine case”. Or: “Results for two turbines”, “results for three turbines”, “results for a wind farm” or similar. The current section titles are a little bit confusing.

Missing details

Since a large portion of the paper is to compare FLORIS to SOWFA and to show the limits of it, it would be helpful to describe it in more details.

Other minor issues

- The ° sometimes is not a superscript, e.g. 2nd line of Section 4 and caption Figure 3.
- Figure 3: Linking the arrow size to a wind speed might be helpful to get a better feeling for the effects.

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3. Figure 4: Period is missing at end of caption.
4. Figure 5 and 9: ylabel of 2nd column is missing. And maybe the plots look smoother when you use a higher discretization (now it seems to be 0.2 D).
5. Figure 8: ylabel missing. And plots are too small. Maybe you could limit it to -2 D and +7 D.
6. Figure 9: “turbine” missing behind “hypothetical”.
7. Figure 10: The zero-indexing might be confusing. Why not turbine 1 to 12 and “yaw 1” to “yaw 3”?

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