

Interactive comment on “Wind tunnel testing of wake steering with dynamic wind direction changes” by Filippo Campagnolo et al.

Anonymous Referee #2

Received and published: 24 June 2020

This paper presents results from wind tunnel experiments that assess the performance of open-loop wake steering controllers for a wind farm consisting of 3 scaled wind turbines. I very much enjoyed reading this manuscript: It is well-written and the results are organized and presented well.

A few suggestions for improvement include the following:

1. To me, “normalized power” is equivalent to “power coefficient”. I think the authors mean to refer to the “maximal power coefficient” when they refer to “power coefficient”.
2. I prefer the descriptor “locally greedy” as a more accurate name for the standard approach “in which each machine works independently from the others to maximize its own power output”. The wind farm is not being greedy, but rather the wind turbines are

C1

being independently, locally greedy.

3. The US National Renewable Energy Laboratory’s most recent release of FLORIS does include secondary steering. It may be helpful to more clearly indicate or label that the FLORIS version used in this paper is an older version (such as labeling it as FLORIS-2018?).

4. Page 7 (and possibly elsewhere): I’m not sure that the “time speed-up factor” is the best “name” for η_{t} . When I first read the introductory paragraph of Section 2.3, I was confused. A “speed-up factor” suggests that it is greater than 1, but $\eta_{t} = 1/80$ « 1. Perhaps just call this a “time scaling factor”?

5. Page 22, line 17: It is stated that “in Fig. 16a, the power gains are equal to about 4 – 6% ...” I didn’t understand this, since when I look at Fig. 16a, it looks like the power gains are mostly around 10% or even more.

6. I did not completely follow the derivations in Appendix A. What is the difference between $P_{n,d}$ (in A5) and $P_{n,2}$ (in A1)? In (A5), presumably d can be 2 or 3; if (A1) also applies equally well to the 2nd or 3rd turbine, then write (A1) as such as well. And should the denominator on the left-hand side of equation (A1) be C_P (rather than $C_P^{\{II\}}$)? Since there are manipulations with inequalities in arriving at the proper range for $\sin(F \gamma_u)$ on the right hand side of (A5), it should be more explicitly stated that $E > 0$ (and perhaps any other conditions that are assumed).

7. A comment on Wang et al. (2020): I don’t think it is good practice to cite a reference that is “in preparation”, since the readers cannot yet access this reference. I will ultimately leave it to the editors of WES to determine whether this is allowable or not.

The following are smaller corrections and suggestions for improvement:

I. Page 1, Line 25, insert the word “a” before “coordinated”: “. . . the turbines in a wind farm operate in a coordinated, collaborative fashion.”

II. Page 6, Figure 3: the right-most x-axis label in the left plot is very close to the left-

C2

most x-axis label in the middle plot, making it collectively look like the number “1.15”. Would it be possible to separate these two plots by another few millimeters?

III. Page 16, lines 9 and 10: No paragraph break is needed here.

IV. Page 21, Figure 13, left plot, suggest moving legend box: It seems there is room in the upper left of the plot to have the legend box there rather than over the bars actually being plotted.

V. Page 22, line 8, add “the” before “farm”: “the total power output at the farm level decreases”

VI. Page 25, line 10, suggested re-wording: “A few observations can be made from the results for the shaft DELs.”

Interactive comment on Wind Energ. Sci. Discuss., <https://doi.org/10.5194/wes-2020-70>, 2020.