Wind Energ. Sci. Discuss.,
doi:10.5194/wes-2017-4-RC2, 2017

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Interactive comment on "Field Test of Wake Steering at an Offshore Wind Farm" *by* Paul Fleming et al.

Anonymous Referee #2

Received and published: 10 March 2017

General comments:

This paper presents experimental power production results when considering two-turbine combinations and yawing of the upstream turbine in a commercial offshore wind farm. The paper is reasonably written and publishable as a "discussion paper". I'm rather new to this journal and format, and I'm not sure if one of the goals is to have papers published quickly. The experimental data gathered in this paper are indeed relatively recent and are certainly of interest. However, further analysis perhaps including other data that might be associated with the data already presented would make the paper much stronger. The current paper only presents power data and the trends are not particularly strong. The main results are given in Figures 6 through 8 of the paper. In Figure 6, at the main wind direction of interest (-20 degrees), the yawed (SCADA-OPT) upstream turbine actually produces more power than the non-yawed

(SCADA-BASE) upstream turbine. In Figure 7, these two cases show about the same power production at the main wind direction of interest (50 degrees). A more complete analysis would also evaluate the differences in wind turbine structural loads between the various cases to more fairly assess any associated costs of using wake steering to increase power capture.

Specific comments:

1. Since there are not that many equations and variables in this paper, it would be better to choose more succinct one-letter variables rather than long variable names like "yawLoss" and "initWD". When written in 'math mode', these could represent the product of many variables represented by the individual letters. Even "pP" looks like p times P.

2. In the figures, the power look to be plotted in normalized form. The authors should state what they are normalized to, their own maximum power (as seems to be the case in the "Turbine C1 Power" plot in Figure 3) or some other power reference value (as seems to be the case in most other power plots in the paper).

3. In the figures, units should be given when needed. For instance, the "Turbine C1 Offset" plot in Figure 3 should indicate "(degrees)". And similarly for many other plots in the paper.

4. In general in the figures, use larger font sizes for the axis labels.

5. In the upper plot in Figure 6, it generally looks that "SCADA-BASE" yields more power than "SCADA-OPT". Is there an explanation for this? If you only look at subsets of the data where "SCADA-BASE" and "SCADA-OPT" yield much closer power levels to each other in the upper plot, then are there still the "promising" results for the corresponding subsets for the lower plots?

6. There are several sentences that are quite confusing, and the authors should carefully proofread and make sure that each sentence is easy to understand. For instance,

the sentence on Page 12, lines 30-31: "Yet, the spread of results completely overlaps with the region of the optimized controller occupying the upper portions of the baseline range." After re-reading this several times and looking at Figure 7, I'm still not completely sure what the authors mean. Do they just want to say "Yet, the spread of results of the optimized controller occupies the upper portions of the baseline range." ?

Similarly, the last sentence on Page 12: "As noted earlier, when turbine D3 is waked by turbine R1 at 54 degrees, it is the deeper wake, being 8.5D spacing and no noticeable change in wake loss occurs, pointing to wake steering being the primary cause of change." What does each of the words "change" refer to? Between what and what?

7. How much difference does 1 degree make in whether a wake impacts the downstream turbine? The diagram in Figure 2 indicates that D2 is at 51 degrees relative to C1 and that D3 is 81 degrees relative to C1. Yet, Figures 7 and 8 and the corresponding discussion in the text refer to "50 degrees" and "80 degrees" as the main wind direction to worry about. Further, in discussing Figure 7 looking at the C1-D2 pair, the text on Page 12 even says "To the left" of 50 degrees, "the baseline case grows smaller ... The power is low despite no wake ... " So one degree off, and there is no wake from C1 hitting D2 anymore? How much to the left are the authors really referring to? It might be useful to provide information on how many degrees is needed in each pairing before there is effectively no wake.

Technical corrections:

a. In the last sentence of the introduction, use a different word than "feedback" ... perhaps "evaluation"?

b. Be consistent with variable names. The variables k_d and k_e sometimes appear as K_d and K_e.

c. In Table 1, for parallel structure, perhaps label the Envision turbine as "Envision 4 MW". Also, the values for the variable "initWD" are presumably given in degrees? And

all the other variables are dimensionless?

d. In Figure 3, given the legend, the curve in the lower left plot should be red.

e. In Figures 6 through 8, the legend label "SCADA-OFF" should be "SCADA-BASE" and "SCADA-ON" should be "SCADA-OPT".

f. Figures 6 to 8, lowest plots: I would suggest removing the word "unique" and just use "Number of days" as the y-axis label. I'm not sure what "unique" is meant to indicate. It made me think that if a day was counted for "SCADA-BASE", then it could not be also counted for "SCADA-OPT", though I don't think that is true.

g. Figures 6 to 8, caption: "amount of days" should be "number of days"

h. The ordering of references might be improved. For instance, why is Fleming 2014b not right after Fleming 2014a?

i. Is the Trujillo et al. reference a journal paper, a conference paper, a report, or a personal correspondence?

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