

Reviewer Response
April 24, 2019

We thank the reviewers for their helpful and constructive remarks. We have prepared a revised version of the paper including the suggestions of the reviewers, and below outline these changes in response to your recommendations.

Additionally, since the original submission, both the FLORIS model and the energy ratio method have been improved somewhat independently of this research, and these improvements are reflected somewhat in the final analysis. The energy ratio method is described in greater detail, and a link to the source code are now included.

Reviewer 1:

Page 2 line 17, spelling of "University"

This is fixed

Page 15, last sentence is not entirely clear and a bit confusing.

This sentence is removed

Table 1: the difference in wind conditions between baseline and controlled could also be explained more clearly.

More text was included to make these cases more clear:

The energy ratio calculation is repeated on several differently-defined FLORIS models of the site to provide a point of comparison. An "Aligned" case simulates every observed wind speed and direction in the Baseline field data with all turbines perfectly aligned to the flow, while a "Baseline" case uses the actual small offsets observed. An "Optimal" case, simulates all the wind speeds and direction in the Controlled field data using the exact offset requested by the control strategy, while "Controlled" applies the actual achieved offset. These four settings are summarized in Table~\ref{tab:floris}. For each of the FLORIS models, and for each 1-minute wind speed and direction observed in the field, a matching FLORIS simulation was run and the power of T3 and T4 tabulated and the energy ratio computed. When considering gains in energy, "FLORIS Optimal Gain" refers to the change from "Aligned" to "Optimal" whereas "FLORIS Controlled Gain" refers to the change from "Baseline" to "Controlled".

Reviewer 2:

Author list: depending on their contribution you might consider to move some persons to the acknowledgment section.

The test campaign was a large group undertaking and it was decided to share authorship among those who worked across aspects of the campaign

Abstract: You could consider to add the 3.7% of the aggregated analysis as well. Wake steering is a wind farm control method and thus the effect to the combined energy is also very important.

Good point, this value is now added

Figure 4: You could add some other wind speed as well to provide a better feeling for the 2 D lookup-table.

This figure is updated to include additional wind speeds and the caption updated to reflect

Text to Figure 5: You could provide the time constants of the low pass filter. It is partly visible from Fig. 9, but might help to better understand the issue with the time offset.

Each of the filters has a 30-s time constant this is now included in the description.

And why did you use a filter for the offset? Wouldn't it be enough to have the inputs filtered?

It was felt more cautious to filter the offset to smooth the step changes when the wind direction changes from 139-138, however, indeed this appears now unnecessary and is not used in phase 2

Equation 1 and 2: You could mention that u^* is the frictional velocity, and 0 means perturbations.

This is corrected

And isn't the unit m missing in $L < -1000$?

This is corrected

Figure 6 and 7c are without a box, all others have one.

Figure 7c was updated to include a box to match the other subplots in that figure, while figure 6 was left for now since it stands alone, however this can be added in the final version

Figure 7c: After some time, I figured out that the third color is due to the overlay of baseline and controlled case. Couldn't you simply have to column for each wind speed bin? And what are the lines?

Figure 7c is replaced by a dodged histogram to make the comparison more visually apparent

Figure 7d and 8: What does the shading here mean? The 95% confidence interval seems to be unlikely, since the mean is not centered.

The points are medians and the shadings are 95% confidence of the medians, descriptions are updated in the legends and text

Equation 3: You could consider to describe all components of the equation. It is pretty clear what A means, but just for the sake of completeness.

These descriptions are added

And couldn't you use the mean power curve from T4 outside of the controlled region to get the power from the sodar within the controlled region instead of the power coefficient to avoid issues with wind speeds near rated?

The complexity of the terrain as the wind moves to the west or east cause the relationship between sodar and turbine to be non-constant outside of the controlled region unfortunately

Equation 4-6: you could consider to write the subscripts in normal text mode (not math mode).

This change is made

Page 14, line 15: There is an additional)

Fixed

Figure 11-15: Is the shading the 95% confidence interval? If so, you could add this to the captions or in the text.

This is the 95% interval, and the description now included the caption of figure 11:

Figure 11. Energy ratio for T3 for field data and the Baseline and Controlled FLORIS cases (see Table 1). An energy ratio of 0.5 corresponds to a production of 50% of the total expected based on the measured inflow without considering wakes. The vertical magenta lines indicate the region where control is applied and a difference between the Baseline and Controlled is expected. Size of circles at each point indicate the number of points in the bin, while the bands indicate 95% confidence as computed by the bootstrapping.

Also, the placing is a bit strange. . . e.g. Figure 15 is on page 20 and the reference on page 17... but might be the usual latex mystery

This is indeed a latex mystery, but we hope that working with the journal editors, the placement of figures can be more reasonably situated in the final version,