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

Anonymous Referee #1

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Thank you for this paper. The paper presents an important step in wind farm control, the use of controlled wind tunnel experiments to study the design of dynamic wind farm controllers, in this case by studying the behavior of open loop controllers in a dynamic, but controlled environment. Overall, the work is novel and relevant and convincingly presented and a good contribution to the research literature.

Comments:

Good introduction, with good ties to literature

Section 2.3:

Nt and the concept of time speed up, could you explain a little further what this means and how it works?

Section 3.5: For FLORIS you reference a paper, is this version of FLORIS than different than the public version at https://github.com/NREL/floris ?

Fig. 9: Believe the smoothing effect is influenced by the decision to use both positive and negative yaw, uncertainty has a different effect I think when only a single direction is used, which itself could be a means of handling uncertainty, ie using large angles, but only on one side and shift the peak away from the transition. I worry that the small angles of say the sigma=6 deg case end up providing little difference from the range of offsets which occur naturally at a commercial site

P 17: "FLORIS does not include secondary steering", just to be clear though, the public version of FLORIS does include secondary steering. It could be useful to rename the baseline model something other than simply FLORIS as I worry this mis-represents the current state of the code. Perhaps FLORIS-NoSS or something to that effect?

Perhaps drawing on this point, couldn't one say also that beside the inclusion of secondary steering, the differences between the models might be closed by additional tuning? That is, the problem with the first model might not be its simplicity (although agree not including ss is a problem) but that it is not calibrated?

Maybe going even further, you could say, based on Fig 10, prior to implementing at a site, fine calibration and tuning is not very impactful on the prior estimation of gains, but it becomes critical to the realized gains and therefore upon implementation, and not in the estimation phase, a calibration of the model to collected SCADA data is very beneficial. Could this be a general result of the paper?

Fig 16 and Discussion of: Very interesting! In my experience too, we tend to think of the result of uncertainty as leading to "wrong-way steering" and this being the fundamental problem, and so inclusion of uncertainty leads to very conservative yaw offsets. However, one issue is that practical yaw systems can often lead to a tendency to undershoot desired yaw offsets which aren't accounted for in the static model. Your analysis that the effect of uncertainty is dependent on the fidelity of the model is interesting and

nice to see it come out of the data.

Conclusions: – “A robust implementation may lead to power losses in conditions with weak or absent wake interactions. This might suggest the use of wake steering only around conditions where significant wake effects are expected, whereas it should be switched off elsewhere.” – I suspect this could be scheduled on wind speed

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