Response to Adam Stock

Andrew P. J. Stanley, Christopher Bay, and Paul Fleming

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Adam, thank you for taking the time to read and provide feedback on this paper. We are very excited about this work, and we greatly appreciate your help to make this work as impactful as we think it can and should be.

We will incorporate your feedback into our revised paper. Below is a summary of your points in blue, and our response and the changes we will make in the revised paper immediately following shown in black.

It would be interesting to hear the author's views on the real-world applicability of the methodology. The control codesign methodology appears to only consider the energy capture of the turbines and does not consider other implications of a layout design such as accessibility, water depth or cabling lengths and layouts. Whilst one would not expect these aspects to be fully costed in and included in the analysis, the absence of these factors should be noted in the text with perhaps a comparison in the order of magnitude difference that such aspects may impart. Would these factors be easy to accommodate within the methodology? Is this a topic for future work perhaps?

This is an excellent point and one that we will address in the revised manuscript. Wind farm design is a very large problem involving many disciplines. In the paper we address layout optimization for yield, and one aspect of control. In a full wind farm one also needs to consider turbine selection or design, costs from foundations and cabling, accessibility for maintenance, impact to local species, social issues and acceptance, permitting... and the list goes on. Because of the wide variety of disciplines, and complex, computationally expensive processes of each of these aspects of design many of these processes are separated, with the design performed sequentially (i.e., first layout optimization for yield, then foundations, then electrical...). The ideal would be to eventually couple **all** aspects of design into a single process such that tradeoffs and sensitivities are fully captured enabling better wind farm design. There are several reasons why this is not currently done, a few being computational expense, legacy processes (depending on the institution), and different fidelities of models.

In this paper we provide a solution to one aspect of wind farm codesign, specifically layout optimization plus wake steering optimization. In the revised manuscript we will make this clear, and clearly state that full wind farm design is a more complex process to which we aspire to couple into a fully coupled multidisciplinary optimization process.

The text notes that "we expect larger comparative gains for larger plants with more turbines" but the basis for this assertion is not presented. Is it not the case that, beyond a certain point, wakes can become somewhat of a "wake soup" and there could be diminishing returns? Some discussion of the implications of applying the method on farms with more turbines would be useful.

Thanks for this feedback. We will address this in the revised manuscript to provide justification and/or further examples with more turbines.

The equation for the wake expansion r_wake = 0.1x + r_turbine seems broadly sensible, but there is no reference for this equation. Might this value change in different atmospheric conditions? Does the

wake continue expanding indefinitely? Furthermore, it would be useful for the authors to comment on the sensitivity of their results to changes in the wake expansion factor.

Yes this is a good point, as the implicit yaw angle relationship will certainly change depending on how wide a wake is assumed to be. The wake expansion is taken from the original formulation of the Jensen wake model. We will comment on this in the revised manuscript, and add discussion about how this could affect the implicit relationship, and how it could be improved in future iterations.

Alongside the result of "0.8% more energy than its sequentially designed counterpart" it would be informative to know the improvement compared to purely optimising layout with no WFFC applied.

Agreed. This is important information that we will include in the revision.

Why was the particular wind rose that was used chosen? Similar to the wake expansion point above, what sort of sensitivity does the method have to different wind roses? As a wider point, the work presents a single example – can the authors be sure that the result is typical? What are the bounds of that "typicality"?

Excellent point, this is a shortcoming in the preprint. We will add discussion about what we expect the sensitivity of the results depending on the many inputs to be.
