Interactive comment on "Massive Simplification of the Wind Farm Layout Optimization Problem" *by* Andrew P. J. Stanley and Andrew Ning

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The reviewer very much appreciates the effort in presenting results in a clear, concise, and visually appealing way, as well as the availability of the computational codes. These two efforts contribute enormously to the understanding, and reproducibility of the results, which should set a precedent to all authors of this journal.

Regarding content, in spite of the massive oversimplification of the layout optimisation that could quickly lead to infeasible designs due to the high number of constraints industry faces in practice, it is very valuable to see that AEP-wise the direct and parameterised approaches are not that different. It is furthermore acknowledged that this academic effort to benchmark three design procedures so robustly with three different

energy densities, shapes and windroses, provides high value and further evidence of AEP behaviour for this tremendously complicated optimisation problem.

Nevertheless, there are a few points for discussion, that should further improve the understanding of the proposed procedure and make the approach more transparent as well.

The optimal distribution of the turbines on the site boundary will depend on the windrose and shape of the site. Have you tested a more sophisticted algorithm to fill the perimeter with variable spacing according to wind direction and direction of the sites edges? Is a higher AEP expected than if placing them using a uniform spacing?

The authors suggest placing 45% of turbines on the boundary, when feasible. This sounds too case-specific. While I understand that the gradient-based optimisation algorithm requires a smooth function, and that letting the optimiser vary the spacing of the turbines on the perimeter and thus moving turbines inside the site would lead to "jumps" in the AEP response surface, I believe that fixing the number of turbines arbitrarily does not help the design space either. Would you suggest to re-run your method with different spacings/number of turbines on the perimeter? Is this done at all in the 100 randomly initialised runs of section 5? Why not make the spacing the design variable, and let the number of turbines on the boundary be variable. AEP surface would be too discontinuous?

A constant CT is assumed by the wake modelling, is there a noticeable difference in AEP compared to using a Ct curve?

During the initialisation procedure suggested, dy is 4 times dx, is there empirical evidence for it? However, if I understand correctly, dy is varied later to fit the desired number of turbines inside the site area, is this initial ratio not lost then?

Also, the b variable is initialised to offset rows by 20 deg, is there a reason for this seemingly arbitrary value? Why not stagger rows by one half dx?

The initialisation procedure is meant to fix the number of rows and columns across the optimisation. The last paragraph of section 2.2 implies that the optimisation does not allow turbines to "jump" between rows, or to trade columns for rows. Is this what varies between the 100 runs of section 5?

How are the authors checking which turbines are inside the area? Can you share what algorithm you are using for that matter?

How are the authors defining the inner area in which the grid turbines must lie? Is there a uniform buffer spacing from the perimeter enforced?

How do the authors foresee they will deal with prohibited zones inside the area?

How are turbines placed along the perimeter? Is there consideration that two turbines near a corner could be closer than the minimum desired spacing?

What can be said of the results in Fig. 8 with respect to farm energy density? And in general, do the similar AEP results hold for all area densities?

How would the authors deal in cases where all the internal and perimeter turbines have to align to an underlying base grid, for shipping and rescue operations?

What are the differences exactly between the 100 runs of the parameterised optimisation, the initial values of all variables? Different number of rows and columns? Or just the orientation angle theta?

Finally, is there future work aligned with this one? Are more/different variables interesting to look at for the design of wind farm layouts?

Technical correction: I suggest changing "verses" for "versus" in more than one place (e.g. line 25, fig 2).

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