Wind Energ. Sci. Discuss., referee comment RC2
https://doi.org/10.5194/wes-2021-15-RC2, 2021

Comment on wes-2021-15

Anonymous Referee #2

Referee comment on "Objective and algorithm considerations when optimizing the number and placement of turbines in a wind power plant" by Andrew P. J. Stanley et al., Wind Energ. Sci. Discuss., https://doi.org/10.5194/wes-2021-15-RC2, 2021

General comment

The authors present an interesting paper on wind farm layout optimization, focussing on the sensitivity of the resulting wind farm layout to the chosen cost function (power output, cost of energy or profit). They study different basic cases, ranging from a row of turbines aligned to the incoming wind direction, to a 2D wind farm with a full wind rose with constant wind speed. They apply different algorithms to the studied cases, most of them gradient-free, including a genetic algorithm, a greedy algorithm and a novel algorithm (which according to my understanding also falls in the category of greedy algorithms). They apply all the algorithms on a gridded or quasi-gridded search space, excepting (to my understanding) a gradient-based algorithm only applied to a simple case. This results in a limiting factor for the overall wind power plant performance, although the authors emphasize that the main aim of their work is not to show the best layout configuration, but how results can be highly sensitive to the cost function used.

Their results show that the type of cost function selected has indeed a big impact on the attained layouts, especially regarding the amount of turbines assigned. In this way, for all cases considered, optimizing just on the power output provides solutions with more turbines than optimizing on the profit, and in turn this one keeps more turbines than optimizing on the cost of energy. The best performing algorithms are usually genetic algorithms and their novel greedy algorithm, called repeated sweep, which performs best in 2 of 3 cost functions on the most complex case. This evidences the high suitability of this algorithm when considering gridded search spaces for the turbine positioning. However, as results show, this algorithm, alongside with the other greedy algorithm used, increases considerably its computational cost as the problem complexity rises, which suggests that its efficiency might be compromised on more realistic frameworks involving more refined grids or turbine positioning-free search spaces.

Structure:

The paper has a potentially high scientific impact and while showing high quality in its results. However, although it is well structured in general, the results on the performance of the different algorithms would become more fluent and dynamic if the sections for each case study (6.2.2, 6.3.2, 6.4.2) were concentrated only in section 6.5, a section by the way already summarizing the performance of the algorithms on all cases.

Specific comments:

There are several comments throughout the paper, which are included in the attached PDF file.

Please also note the supplement to this comment:
https://wes.copernicus.org/preprints/wes-2021-15/wes-2021-15-RC2-supplement.pdf