The paper proposes a method to solve the wind farm layout optimization problem while taking into account alignment constraints. These can be relevant when the navigability of vessels within the wind farm is considered. This method is based on an algorithm that parametrizes the possible turbines' positions within the domain through the intersections of a grid based on parallelograms. This enables to reduce the size of the problem and to obtain an effective convergence. The problem is rigorously formulated and the algorithm is widely described within the document. Finally, the selection of the hyperparameters are discussed and the algorithm is used to solve a widely known example to prove its effectiveness. Overall, this work introduces an interesting method to tackle the challenging layout optimization problem, but it could be further improved by making some modifications. Here I have included my suggestions.

GENERAL COMMENTS

The contributions of this paper should be highlighted more within the methodology. This comment mainly refers to the identification of the innovative aspect introduced in this research with respect to the several works available in literature where the turbine layouts are parameterized through angles and distances of a regular grid. For instance, many studies do not consider the possibility of "not occupying" a grid intersection (which is consider here). Another innovative aspect is the application of a domain composed by multiple regions. Such aspects (along with the other differences) should be highlighted.

We have added the following paragraph on lines 35-38:

By alignment constraint, we place the turbines on the intersections of a regular grid made of parallelograms whose shape and orientation are to be determined while considering the possibility of not occupying all grid's intersections. This possibility is a key feature of the proposed algorithm, and its interest is illustrated in the numerical examples of the paper

Overall, the paper defines the optimization problem using clear and rigorous mathematical expressions and definitions. However, a more detailed description of such expressions within the text could facilitate the readability of the work.

The aspect of introducing the alignment constraint to focus for instance on the navigability of vessels within the farm is innovative and interesting. To give additional value to this aspect, I would suggest to add some references where this requirement is mentioned.

The authors of this paper contributed their expertise to industrial partners responding to tenders for offshore wind farm projects. All these projects required alignment constraints, as formulated in this paper. Unfortunately, the technical specifications are not publicly available. However, regular layout constraints are mentioned in two technical reports from the French Ministry of Transport and the Maritime and Coastguard Agency from the UK. These reports are now cited in the introduction on lines 39-40

The fact that the parameters Delta_1 and Delta_2 do not depend on each turbine ensure the alignment constraint. However, it could be interesting to mention (as future work) that allowing small deviations of these parameters for every turbine could be the starting point for a sensitivity analysis based on the relaxation of such constraint.

We have added the following sentence in the conclusion of the paper.

Finally, to quantify the effect of alignment constraints on the wake losses, one could perform a sensitivity analysis by allowing small displacements of each turbine, resulting in an almost aligned layout.

Several times the authors refer to the description of the algorithms included in the Appendix. To facilitate the reading, I would suggest to include a description of the algorithm (e.g. using some block visualizations) within the main text.

Done

SPECIFIC COMMENTS

- In the lines 33-34, it is mentioned that there is no method in the literature that takes into account the alignment constraints. However, these are implicitly taken into account when the turbines are placed at the intersection points of a regular grid. Despite the number of optimization variables that define such a grid are limited in most of the studies, this should be mentioned in the introduction.

  We have added the following paragraph on lines 35-38:

  By alignment constraint, we place the turbines on the intersections of a regular grid made of parallelograms whose shape and orientation are to be determined while considering the possibility of not occupying all of the grid's intersections. This possibility is a key feature of the proposed algorithm, and its interest is illustrated in the numerical examples of the paper

- In section 3.1, the parameters used for the parameterization of the grid shape are described only by referring to the Figure 1. However, a brief description within the text could facilitate the reading.

  We have added the following paragraph on lines 101-103:

  The grid is a parallelogram-based tiling of the plane, the parameters r_1, r_2 are the two sides' length of the parallelogram, the parameter θ_1 (resp. θ_2) is the angle formed between the side of the parallelogram of length r_1 (resp. r_2) and the x-axis. Finally the parameters v_x, v_y is the offset between the origin of the Cartesian and the parallelogram-based grids

- The mathematical formulation of the objective function (Equation 8) is clear but "over-complicated" with respect to the ones usually present in the literature (even though they are equivalent). I would suggest to provide further description within the text to facilitate the reading.

  We have rewritten the definition in a less abstract fashion and including more details to facilitate the reading.

- I would suggest to modify the notation used to indicate the turbine diameter to make the expressions more clear.

Done, the notation is now D_{turb}

- Figures 4 and 5 are quite difficult to understand and interpret. I would suggest to use a 2d visualization including various lines/points for the different parameters.

We have modified these Figures according to the reviewer suggestions.

- In section 5.1 the method used to compute the AEP is described. I would include also the discretization adopted to for the wind speed and the wind direction values, which are relevant for the computational time that is further described.

We included the discretization bins to compute the AEP (line 206)

- In table 2, it is not clear if the computational time column refers to the step 4 of the algorithm described in section 4.1. If this is the case, it would be helpful to mention also the computational time required for the step 2 (section 4.1) as a function of the hyperparameters. Moreover, please highlight why only some combinations of angles are present in the table.

In these tables, the shape parameters displayed are the optimal ones corresponding to the best layout. To avoid any ambiguity, we now name the column "optimal shape parameters."

- In every table that the computational time is mentioned, the processor that has been used should be mentioned to facilitate the reading.

Done

- The title of section 6 does not match exactly its content. I would recommend to modify it in order to enhance that a new method is introduced to increase the performance. Moreover, in this section it is not clear why the focus of the modified algorithm is on the AEP increase instead of the computational time reduction, please provide some arguments. My concern arises since at the beginning you highlight the need of increase the speed of convergence instead of the need of converging to a better result. Finally, I would consider using a visualization to show the increased performance of this method (more effective than a table), e.g. increase of AEP as a function of the number of turbines, also to enhance the linear behavior mentioned in the text.

We have explained in more detail that fine-tuning the shape parameters using the proposed method is too computationally expensive. However, it is necessary to get a good layout AEP-wise. Therefore, an efficient shape-parameter-space exploration method allows for fine-tuning these parameters while keeping computation time reasonable. This explanation ranges from line 243 to 249