Review: ***Data-driven optimisation of wind farm layout and wake steering with large-eddy simulations***

Summary

The authors describe an optimization method that uses data from low- and high-fidelity models employing a Bayesian framework. The authors test their optimization method in maximizing wind farm power production through micro-siting and wake steering. The authors compare the best-performing wind farm layout design from their optimization model against optimized wind farm layouts using FLORIS. The proposed framework can generate layouts with similar wind farm efficiency when compared to the optimized layouts obtained using FLORIS. For wake steering, the proposed optimization framework can overperform as compared to optimization using FLORIS. The LES-informed framework can leverage the high-fidelity model capabilities in capturing complex flow features for wind turbine siting and wake steering. The manuscript is well written, and the results are very interesting. However, I recommend major revisions to incorporate important details in the methodology and results.

Major comments:

1. Incomplete description of LES framework: The authors perform an impressive number of large-eddy simulations, but the description of the model setup is lacking. The authors are simulating atmospheric flow, but do they incorporate Coriolis in their simulations? Is there a capping inversion in their model, or is the potential temperature profile constant over the entire domain? What are the boundary conditions for the LES used for wind farm layout optimization (Monin-Obukhov similarity at the surface? periodic lateral BC?)? The actuator disk model uses a constant thrust coefficient (not realistic), but how is turbine power estimated (especially for partially waked conditions, like in Figure 2)? The turbine's thrust coefficient changes with yaw angle (Gebraad et al., 2017), which might partially explain the extreme yaw misalignment for the first three turbines in Section 4.
2. Blockage and speedups: The authors report that front-row turbines produce less power than a stand-alone turbine due to blockage, and that downstream turbines can produce more power than a stand-alone turbine due to speedups. I think these statements need to be explained further. Bleeg and Montavon (2022) show the importance of including a capping inversion in the simulation domain and the sensitivity to domain size for simulating blockage. Regarding speedups, the maximum wind speed in Figure 4 appears to be close to 9 m s^{-1}, which is an ~8% speedup compared to freestream conditions. Furthermore, some downstream turbines are producing ~10% more power than a stand-alone turbine. These speedups can be an artifact of the width of the numerical domain. How did these speedup regions change when you tested the 3 times wider numerical domain?
3. Computational requirements of this approach: The authors compare the optimized layouts obtained from LES- and FLORIS-informed frameworks, showing that the LES can

produce better results about 70% of the time. It is important to highlight the computational requirements needed to perform the LES- and FLORIS-informed optimizations given that the layouts from FLORIS can overperform when compared to the LES-BO methodology. Furthermore, how realistic is performing 4200 LES for wind turbine siting as compared to optimizing the layout using FLORIS and then evaluating multiple possible layouts using LES?

4. The authors show the capability of their methodology for optimizing a wind farm's layout and wake steering for a single turbine row. Can these two problems be addressed in the same optimization problem? Also, how feasible is it to optimize the yaw angles for wake steering for a whole wind farm rather than for a single turbine row?

Minor comments:

1. Figure 4: Rotating the reference frame in Figure 4 can be confusing for the reader. It might seem as if multiple layouts are being tested rather than a single layout for multiple wind directions.
2. What are the intermittent vertical lines in Figure 9 that appear in front of some turbines (e.g., turbines 11, 12, 13, 14, 16)?
3. FLORIS can incorporate varying thrust coefficients for waked turbines. Did you try incorporating a thrust curve in your actuator disk model so that the velocity deficit in waked turbines is not underestimated?