

Wind Energ. Sci. Discuss., referee comment RC1
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Comment on wes-2021-141

Anonymous Referee #1

Referee comment on "Large-eddy simulation of airborne wind energy farms" by Thomas Haas et al., Wind Energ. Sci. Discuss., <https://doi.org/10.5194/wes-2021-141-RC1>, 2021

This paper reflects a great part of the complexity in modelling AWE systems, from the ABL over the wing to the flight dynamics and control modelling. It also explores different energy extraction methods advocated in the AWE community. They model the flow in an AWE wind farm with a simplified, pressure driven ASL and an actuator sector representation for the wing forces. The aerodynamic forces are calculated by a steady-state lifting-line, the dynamic motion by a point-mass model and the trajectory & operation is governed by model predictive control. Despite the complexity at hand, the authors have submitted a well-structured and exhaustive description of the methodology supported by high quality visualizations. The appendices and open provision of datasets also necessitates special mention.

Nevertheless, there are some areas the authors should improve on. At times certain modelling choices and their implications on the quantities of interest need more elaboration and verification. Not including unsteady aerodynamics in the wing modelling for instance could change the dynamic behavior. The grid resolution is extremely coarse with respect to the wing span and chord, so it is questionable if the unsteadiness on a chord-scale is captured at all by the current setup. This should be discussed in the paper. Furthermore, the aerodynamic behavior is only shown in terms of integrated quantities, yet the spanwise load distributions should be provided to demonstrate the correct and anticipated behavior of the wing. Finally, the value of the publication would greatly benefit from a more thorough analysis of the results. Despite the high modelling fidelity the authors are missing the opportunity to extract some high order statistics of the flow and loads and limit themselves to high-level descriptions and presenting average flow quantities. They are missing an opportunity here to highlight how AWE park flows differentiate themselves from conventional wind farm flows; if they are different at all. This could be enhanced by analyzing the induction factors of the AWES inside the farm and a discussion around how the trajectories could be optimized to avoid upstream wakes etc.

Overall the paper is of great relevance to the wind energy community and is of very high quality. Unfortunately the discussion is not matching the level of detail and attention given to the methodology, thus not allowing to derive any general conclusions applicable to

other AWE parks.

More detailed comments are given in the attached PDF, which the authors are welcome to respond to directly in the document if preferred.

Please also note the supplement to this comment:

<https://wes.copernicus.org/preprints/wes-2021-141/wes-2021-141-RC1-supplement.pdf>