Response to Associate Editor

August 27, 2021

The authors appreciate the valuable comments from the Associate Editor (AE) in order to improve the quality of the work. Modifications are carried out in the revised manuscript, which are highlighted using purple text.

- Abstract
  - AE: It is not self-evident that yawed flow conditions must be characterized – elaborate. Can you provide quantitative values regarding the results in terms of performance. Can you add a one sentence explanation for WHY the increase and subsequent drop ocurrs?
  - Abstract: The abstract is now modified in order to provide a quantitative value for the performance rise with a concise explanation of the aerodynamic phenomenon studied.
- Introduction:
  - AE: Enforced visual and noise regulations are not the main reasons why we don't see broad uptake of small / urban wind. LCOE for small wind in urban settings is not competitive with large utility-scale wind farms for several reasons. Some are the environmental and operational conditions for small wind (as you note), others are economies of scale, technology learning and more. Why DWTs over non DWTs for small urban wind? It is not well justified. A duct can introduce speed ups but the duct itself presents a large additional capital cost. A sentence or two more in motivation would be helpful. How prevalent are situations operating in yawed flow conditions for small wind DWTs? I would think that passive or active yaw systems would largely obviate this operational condition except for infrequent situations... what does the standard IEC 61400-2 saw about this?
  - The AE indicated the importance of cost to be highlighted in the ducted wind turbine (DWT) design space. To this aim, a recent study (Design considerations for a small DWT) providing a detailed investigation on the parameters related to the cost of the DWT system is now included in the reference list. In our current manuscript, the discussion is now limited to the parameters relating to the (aerodynamic) performance.

- AE: What is the point of the bare turbine left figure in Figure 1? It is not helpful. Better would be to show two images of DWT, one in normal inflow and one in yawed inflow conditions.
- Figure 1 includes a schematic of flow around a bare wind turbine and a DWT in order to highlight the importance of the additional duct thrust force, which remains dominant in our discussion. The figure aids the reader to draw a parallel comparison between the performance of a bare and ducted system; performance of bare system in yaw is also indicated in Figure 10 of this manuscript for the sake of completeness.
- AE: It is strange that in Gilbert and Foreman they saw now change in performance with yaw angle up to 30 degree. This does not agree with recent results in the literature from a myriad of sources. See literature from Paul Fleming, Pieter Gebraad, Jennifer King, Jan-Willem van Wingerden, and many more... you should reference the literature on operation with yaw offset for normal turbines since it is quite relevant and also extensive and recent.
- To our best knowledge, we have included all studies highlighting the effects of yaw on the performance of DWT. In order to avoid confusion to the readers, the discussion did not include the references studying the yaw offsets in relation to bare wind turbine performance.
- AE: Use of URANS is insufficiently motivated. What did Phillips and company use?.
- Following AE's comment, the motivation for the use of the URANS approach is highlighted. Also, the limitations of the numerical study performed by Phillips et al. is now included.

- Duct – AD flow model:
  - AE: Consider making this a subset of section 3 on methodology and computational setup.
  - The authors believe that section 2, which deduces the aerodynamic performance parameters for DWT, be a separate section. Section 3 details the numerical methodology and the numerical setup. Including section 2 within section 3 would create interruption in the flow for the readers.

- Methodology and Computational setup:
  - AE: Might also point out why not using LES for the simulations. They are more expensive but when you are investigating physical phenomena, it is often best to start with highest fidelity – i.e. is URANS enough? Explain why and also explain the limitations of using URANS instead of LES.

- Following AE's comment, we now start the discussion with LES simulations performed in this context. Then, the choice of URANS approach for our current investigation is identified.

- Numerical verification and validation:

  - AE: Explanation of using 2D instead of 3D URANS for analysis is still week even after updates. Figure 6 shows decent divergence of the experimental and simulation data – comparison with other fidelity analysis tools (i.e. time-averaged stats of LES) would be helpful. Appendix A moves in this direction. I don't think this should be appendix.

  - For our main discussion, we try to limit our numerical validation study of the URANS approach with two independent wind tunnel experiments. The additional validation in Appendix B was performed to highlight the flow characteristics, in particular the skewed wake, being captured using URANS approach and LES simulations.

  - AE: It is important to the overall work. it would be better to elaborate on appendix A statement "despite this source of uncertainty, the overall. . . ." In what ways good agreement? And what are the reasons for the lack of agreement?

  - We now explicitly highlight the uncertainties involved in the numerical validation study (Appendix B) showing comparison between a duct-AD model (URANS approach) and a DWT model (LES approach).

- Results and discussion:

  - AE: There are issues in figure 9 – what is going on there? It makes it impossible to read this section. Cp goes up with the yawed conditions, it would be good to discuss in conclusions / future work about potential impacts on loading. Something is missing here in terms of discussing the novelty of the findings in the context of other work – why do we care about these results?

  - The text in this section is further modified in order to offer clarity to the readers.

- Conclusions:

  - AE: These need to be strengthened considerably – do not use bullets. Speak more critically of the work in the context of the study limitations and also tie into a discussion on future work.

  - Following AE's comments, this section has been completely re-written, which now includes discussion on the future work.