

## ***Interactive comment on “A Double Multiple Streamtube model for Vertical Axis Wind Turbines of arbitrary rotor loading” by Anis A. Ayati et al.***

**Anis A. Ayati et al.**

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Received and published: 16 October 2019

Dear Referee,

Thank you for your comments and kind words. Below, we answer your points one by one.

We appreciate the reviewer comments regarding the experimental setup section, we agree that additional details would benefit the quality of the paper. To this end, we have included the Rotor Diameter, Span, Chord, Blockage Ratio and inlet turbulence level of the wind tunnel test section in the text.

Regarding the tunnel blockage, the reviewer is correct that the presence of the model will affect the apparent free-stream velocity (and hence performance) of the turbine.

This will be commented in the text. In an effort to mitigate the blockage effect, the authors elected to construct a relatively small model so as to achieve the lowest blockage ratio which is mechanically feasible. No further corrections have been made to the measured performance of the model primarily because the classical correction of Glauert [1], often used for wind tunnel model blockage, assumes quasi-one dimensional flow through the rotor which is only valid at low induction factors  $a < 0.4$ , when using this type of theory for Blade Element Momentum [2]. As evident in figure 7 of this work, the typical high-solidity VAWT operates far outside the applicability of this basic correction with values exceeding  $a = 0.75$ . In the future, the authors would like to explore the possibility of creating a new blockage correction specifically aimed at high solidity VAWT operation.

"It is not clear which value of  $C_d$  is used for the conventional model on figs 6 to 9. Is it the Glauert empirical correction?"

The drag coefficient formula used for the conventional model is given in equation (2), p. 4 in the manuscript: it is the theoretical prediction of the Rankine-Froude theory for induction factors less than 0.4 and Glauert's empirical correction for larger induction factors. This will be emphasized in the revised version.

"Although this is not important, it is not stated if the computing time of 0.7 secs on line 200 corresponds to both methods (conventional and current)."

The computing time was essentially the same for both models. This will be clarified in the revised version.

"On figure 2, what does the case  $\beta \sim 0$  mean?"

This is the case of a solid plate, without any porous area.

"At the end of line 130, there is a typo: 'streamtbues'." The typo will be corrected in the revised version.

Sincerely, The authors.

[1] H. Glauert, Airplane Propellers, in Aerodynamic Theory (Springer, Berlin, Germany, 1935) pp. 169-360.

[2] M.O.L. Hansen, Aerodynamics of Wind Turbines, Vol. 17 (Earthscan, 2007).

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Interactive comment on Wind Energ. Sci. Discuss., <https://doi.org/10.5194/wes-2019-44>, 2019.

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Discussion paper

