

Interactive comment on “Free flow wind speed from a blade-mounted flow sensor” by Mads Mølgaard Pedersen et al.

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Summary:

The manuscript develops a method to estimate the free inflow wind velocities, based on measurements from a 3D flow sensor mounted on the blade of a wind turbine. Basically, the disturbances of the flow caused by the wind turbine are calculated by means of aerodynamic models and procedures, and then they are subtracted from the velocities measured by the sensor to obtain the free wind velocities. Due to the complexity of measuring directly the free flow, validation of the results is performed by using two simulators.

The paper presents a topic of high interest and potential practical use, especially

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the possibility of guiding the turbine controller using inexpensive measurements from blade-mounted sensors. Publication in the journal is recommended; however, the authors should address the following comments first.

Major comments:

Is the Taylor's hypothesis valid if one considers the perturbations that each blade makes to the flow nearby the turbine? I am thinking of the complex interactions between the perturbations created by each blade separately.

The authors placed a sensor on only one blade; however, the azimuthal response is not symmetrical, i.e. each blade can deflect differently in a rotation cycle due to complex interactions with the wind field around the tower. As the authors indicate, deflections modify the three velocity components and thus we may expect that sensors in each blade show different measures. May the authors explain why measurements from only one blade were considered enough?

In high-wind shear flows (such as low-level jets) the free inflow wind velocity varies substantially with the height above the ground level ($V_0=f(z,t)$). Therefore, I would expect as result not a single time-series of V_0 but different time series at different heights. Wind shear is mentioned in page 11, line 12, but apparently for a different reason. May you address whether the method is applicable to the especial cases of high-wind shear flows?

Minor comments:

Page 3, line 9: the authors say that “this free wind is immeasurable”. This statement seems too strong, as in fact a device upstream, not necessarily mounted on the turbine, may do the work. Probably the idea is that the measurement is not practical, or not possible from turbine-mounted devices.

Page 4, line 9: the sensor is placed at “one-third from the tip”. The same distance is mentioned in other parts of the document. Is this an optimal distance, or is there any

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reason why this distance was specifically selected?

Page 4, line 31: please see minor comment # 1.

Page 6, lines 4-7: the model used in this study, and the two models used for verification seems to ignore the bound circulation on the airfoil surface. My concern is that, if this effect is important, the estimated free wind velocity may be different from the actual, and even so, go unnoticed by both verification codes. May you explain further how much this bound circulation can affect the result, or if it can be safely ignored?

Page 7, line 5: instead of "is based", may be better "are based"?

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