Comment on wes-2021-104

Anonymous Referee #2

Referee comment on "Vortex identification methods applied to wind turbine tip vortices" by Rodrigo Soto-Valle et al., Wind Energ. Sci. Discuss., https://doi.org/10.5194/wes-2021-104-RC2, 2021

The authors presented an interesting study in particular in presenting vortex identification methods and their application in PIV data to analyze tip vortex structures of wind turbines. The results are quite informative in terms of identification of vortex core, vortex location and vortex jittering. The manuscript is well designed in structure and clearly presented. To this reviewer, the manuscript is worth being published. However, there are some serious issues need to be further clarified or revised.

General comments:

- The authors should explain their contribution to the field more clearly. The paper definitely needs more description in terms of its novelty and how it distinguishes itself from previous literatures. In particular, the methods and their applications have been already addressed by other researchers; hence, the authors should demonstrate their contribution.
- In the introduction section, the authors addressed different PIV measurements performed by previous investigators particularly those focused on tip vortex flow. However, to this reviewer, there are more studies, also worked on the behavior of tip vortices, that can be included in the literature review.
- The authors have presented an extensive description of VIM methods which predict vortex behaviors. It would be very informative to include analytical approaches such Rankine model which predict tangential velocity profiles of vortex and compare your results with those that can be obtained from those models.
- The authors are well familiar with the fact that there are two governing parameters, i.e. local Reynolds number and tip speed ratio that affect the flow structure of the turbine including tip vortices. The authors need to discuss further about the role of tip speed ratio in their assessments of vortex location, vortex core radii and vortex jittering.

- The authors have employed the results obtained from a PIV measurement to perform their analysis. However, they should present more specifications of the PIV test such the sampling rate of the measurement, the phase phase-lock process and the number image pairs per second for each azimuth angle of the blade.
- The authors should provide enough information if during the measurements the turbine was subjected to any blockage effect in the wind tunnel or not. Regarding that, they should calculate blockage ratio of the turbine based on the tunnel cross section area and considering the tip speed ratio at which the turbine is performing, they should discuss whether the turbine is experiencing blockage effect. If the blockage effect is high, it would affect the experimental results including the velocity field and wake expansion (which also determines the vortex location) significantly.
- The authors should demonstrate more clearly that how the convection velocity has been estimated, particularly from the PIV data. Did you consider the sampling rate of the measurements for each azimuth angle of the blade? How did you make sure that you are tracking the same vortex as moving from one image pair to the next one?

Specific Comments:

- Page 3, line 70: what is Θ_M?
- Page 7, line 145: what is the tip speed ratio of the turbine? Is it smaller or bigger than the design tip speed ratio?
- Page 7, line 150: More clarification about the experiment set-up and process is required, such as the sampling rate, frequency of the laser and camera as well as error analysis.
- Page 7, line 155: How was the process of phase-lock measurements performed?
- Page 7, Figure 2: the location of the camera is not clear in the figure.
- Page 10, line 195: what is $v(x,y)$? it is mentioned that $v(x,y)$ is induced velocity; however, at line 185 induced velocity is represented by $u'(x,y)$. Which one is the correct one? It is confusing.
- Page 11, line 230: It is mentioned that "the presence of the multiple maxima and the ring-like distribution of the parameters ω and Q can be explained through different hypothesis. On one side, the cause could be the level of noise in the vortex core because the lack of seeding." If this can be one of the reasons, why you do not get the similar behavior in Figure 6?

Please also note the supplement to this comment:
https://wes.copernicus.org/preprints/wes-2021-104/wes-2021-104-RC2-supplement.pdf