Wind Energ. Sci. Discuss., referee comment RC2
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Comment on wes-2022-36

Anonymous Referee #2

Referee comment on "Wind tunnel investigation of the aerodynamic response of two 15 MW floating wind turbines" by Alessandro Fontanella et al., Wind Energ. Sci. Discuss., https://doi.org/10.5194/wes-2022-36-RC2, 2022

The manuscript entitled « Wind tunnel investigation of the aerodynamic response of two 15 MW floating wind turbines" deals with the influence of the floating motion on the rotor-integral values as torque and power and on the near wake properties. The thrust and torque variations are compared to the predictions obtained with a quasi-steady model. As expected, the comparison is satisfying for low-frequency motions. Regarding the wake, the results tend to show that the wake becomes more stable and that the turbulent mixing is reduced.

The present work is of great interest for a better understanding of the aerodynamic response of a wind turbine when subjected to floating motion. The research team has developed a very comprehensive set-up to study this topic and the different articles provided by them show incremental and complementary pieces of research, enhancing the global knowledge on the subject.

On the other hand, some improvements are still needed before publication acceptance. The comments below will list them:

Major comments:

- The experimental set-up is not comprehensive enough. Give technical details on the hot wire anemometry that you use (probe, anemometers, cut-off frequency of the probe, calibration procedure, etc …the brand?). The same for the load cells.
- Page 2, lines 149-150: More explanations are needed on the frequency choices. Give the full and model scale values of the natural frequencies for ActiveFLoat and WindCrete. Explain why you choose to add a configuration with the frequency of the wave spectrum peak of a specific site. Do we really expect to see the floaters moving at

this frequency?

- On general, once you have defined the reduced frequencies give the values in reduced frequencies only (in body text but also in figure captions and legend).
- Page 2, lines 166-168: explain where does this threshold comes from. Explain what it means and what is the physics behind
- Definition of load cases : the present experiments are performed for constant blade pitch and rotor speed. The terms “Above-rated” and “below rated” refer to different control strategies (fixed rotor speed OR fixed blade pitch) that you do not respect here. Consequently, you are simply testing to different steady operating points. So do not use the terminology AR and BR because it could confuse the reader
- Figure 5: if I have well understood, the plots are built with sine functions using the Thrust or torque amplitudes and phases obtained by the experiments. Wouldn’t it be more synthetic to present a 2D-plot of the amplitude or phase versus the motion amplitude (x axis) and frequency (y axis)?
- Equations 14 and 15 : Explain these formula. It is not explained how they are established.
- Figure 6 : the linear scale used for the x axis is not appropriate to the chosen configurations. Having the points for the highest frequency on the plots makes necessary to zoom out and makes impossible to see whether the points are in agreement with the quasi-static model. Please find a better way to plot these results to make visible the agreement between model and experiments.
- Time series of velocity within the wake (figure 9) : It is chosen to study the influence of the motion only on the axial velocity time series at hub height, so in the wake centre. One can though expect to better observe the influence of the motion on other velocity components (for instance on the lateral velocity component for the sway or yaw) or on other locations (for instance, the wake edges, in the shear layer, where the meandering signature is often easier to observe). Therefore, it is essential to extend the study to other velocity components and space locations before interpreting these results.
- Figure 9 : the figure is big, whereas it does contain limited information. Could it be replaced by a table with the values of standard deviations or the amplitude of the phase averaged values?
- Conclusion, Page 19, lines 386_388 : “The difference in phase shift can be due to the inflow conditions created pitch motion which is non-uniform across the rotor, or by other phenomena not considered in this analysis.”. This statement appears for the first time in the conclusion and is not mentioned in the previous discussion related to these results. Additionally, does it mean that the inflow is not uniform enough to ensure the symmetry of the flow?

Minor comments:

- Choose between “wave-peak frequency” and "wave frequency"
- Line 18 : farther
- Line 21 : floating wind farms
- Line 66 : We
- Lines 72-74 : “Past test campaigns at Politecnico di Milano focused on the response to low-frequency motion where the movement of the system is large because of resonant excitation.” : why is this information important in the present paper?
- Lines 104-105 : “Graphs of the results section are made in accordance with the recommendations of Stoelzle and Stein (2021) to improve data perception.” : why is this information important here? What do they do as special ?
- Line 113 : the turbine has individual blade pitch control but this functionality is not

used in the present paper : collective pitch control.

- Line 129 : two wind turbines
- Table 2 : do not use CP but the greek symbol beta, as usual for blade pitch and define the reference of this blade pitch . beta =0° when…?
- Lines 160-161 : "Results of different studies about the aerodynamic wind turbines are presented as function of fr in the article of Ferreira et al. (2021)." : what are the take-away messages of this article?
- Line 174: " For the last two conditions…" : which ones exactly?
- Line 179 : were instead of where
- Figure 2 : indicate "f_r" on the colorbar legend (you use 2 different reduced frequencies in the paper, so it could be confusing). Difficult to see the ActiveFloat symbols
- Line 200 : why not testing the other (lower) frequencies for the wake measurements?
- Table 3 : a reference to a previous work?
- Figure 3 : not clear how the contour lines are calculated
- Line 232 : what is IFFT?
- Line 258 : …the thrust coefficient, …
- Equation 5 : U_infinity ? instead of U ?
- Line 285 : "… Van der Veen (2012), where he uses…"
- Line 286-289 : is this part needed?
- Line 301 : remove "than"
- Line 304 : correct the formula
- Line 311 : "In case of pitch, the phase is not −pi/2 for any frequency" . A bit too straightforward. Elaborate an explanation for that
- Line 322 : "…supports the idea that…
- Line 325 : the blockage effect seems to be very important.
- Figure 7 : remove the grey background
- Conclusion : you do not put anymore the yaw in the class of motion that modify the apparent wind speed
- Line 391 : "with focus on…"
- Lines 392-394 : this is new information that was not discussed previously. Please add this into the results discussion