Dear reviewer,

we would like to express our deep thank to you for your careful review of our work. We tried to incorporate most of your comments, which we found generally very helpful and formulated in a positive way. We believe that the manuscript could be improved greatly in this way.

We respond to your comments directly in the following:

This work has a significant scientific contribution, as it deals with a very relevant issue: the testing of floating offshore wind turbines at wave basins. It brings attention to the main uncertainties associated with this type of experiments and proposes some potential improvements on the processes particularly oriented to use of the experimental data for computational tools validation. It also shows how these proposals have been tried out in a particular experiment, showing and analysing the results.

The paper theme is well explained and is supported by referenced previous works. The description of different testing methods is presented highlighting pros and cons. The motivation and objectives of this work are presented in a clear and justified way. The experiment performed is described with detail and the results are shown including a throughout analysis. The writing of the text is clear and well structured.

In general, it is a very well-presented work of great interest due to its subject matter and the results it teaches.

Getting into the different scientific issues addressed in the paper, I have the following comments and questions:

- The wind generator is one of the key aspects for obtaining accurate results on wave basin tests of scaled down floating offshore wind turbines. Obtaining an homogeneous air flow with a wind generator on a non-controlled open space is not straightforward. Description of the wind generator is well performed, and a velocity field measurement is presented at one section.
    - Have these measurements been performed using only a Prandtl probe?
    - How was the turbulence been measured? Any high frequency measuring instrument, as hot wire, has been used.
    - Has cross-flow (y, z directions) been measured?

A Prandtl probe has been used (see section 4.1). Unfortunately, it was a unidirectional device. A sentence is added to highlight this shortcoming (also in the comparison with other wind generators):

“Another shortcoming of the evaluation of the wind speed quality is that flow velocities perpendicular to the main flow direction have not been measured (or evaluated) neither in literature nor in the present case.”

No additional high-frequency turbulence measurement equipment has been utilised. Although this would have surely been the more accurate way to characterise the wind tunnel, we found it a bit out of scope to run a second test series, because we did not expect to identify a strong influence of high frequent turbulence on the measured rotor thrust in such non-ideal environment.

- One of the main questions that arises to me is the way how the wind turbine rotor has been scaled. What I understand from the text is that the rotor is not a scaled down version of a real wind turbine rotor, but an existing model rotor designed for wind tunnel tests as described in reference Shultz 2022. Then, there are some questions about how the full-scale rotor is defined:
    - It is stated that the scaling factor for the wind turbine rotor is 150. Does this mean that the full-scale rotor is a direct geometrical scale-up of the model rotor?
    - It is not clear whether tip speed ratio is maintained between full-scale and experiments. It is stated that the tests are performed at a constant rotational speed and different constant wind speeds. May be stating what was this rotational wind speed at the experiments and the equivalent full-scale one would solve the question.
    - It is not clear to me either how the wind speed has been scaled down. From table 1, it seems that it has been scaled down by a factor of 2 (from 10 m/s to 5 m/s). But criterium for this value is not explained.
    - I don't understand on Appendix A, the part of equation A4 that states that u_{laero} is determined by the ratio of aerodynamic and hydrodynamic scaling factors: $u_{laero} = u_{lhidro} (l_{aero} / l_{hydro})$. May be this can be explained from the answer to previous question.

Thanks for this hint. We agree that the scaling was not described as clear as we would wished it to be. We have reworked section 3 to clarify the above comments, but also answer them here shortly. In addition, we have included a comparison with two measurement series in the wind tunnel, where the influence of the TSR and the chosen TSR are shown (see section 7.1).

- *No, the rotor is just a representative for a full scale turbine as it acts similar as today's full scale turbines in terms of thrust and power generation as well as the load distribution along the blades. To achieve this, the rotor design and airfoils need to be adopted to the low Reynolds number regime.*

- *Due to the fact that the turbine is redesigned and does not correspond to one particular full scale turbine, the TSR is not maintained.*

- *Wind speed scaling: We have modified an existing sentence in section 3, which says:"In order to achieve the Froude similarity of the mean thrust (assuming a constant thrust coefficient and tip speed ratio), the wind speed needs to be increased by the factor λ aero /λ hydro in comparison to conventional Froude scaling of the environmental conditions." This means that in the first step, the wind speed is calculated using Froude similarity (sqrt(λ hydro)) and than increased by a factor λ aero /λ hydro to account for the smaller rotor in comparison to conventional Froude scaling. In addition, we extended appendix A with a more detailed explanation. This should also solve the issue stated in the next point. An advice whether this is understandable would be helpful.*

- The results show inaccuracy on the thrust measurements, specially at the case with smallest wave period. It is stated that inaccuracy would come from inertial and weight measurements, as derived from the waves only tests, but also the thrust measurement introduces some variability. Has this been more deeply analysed?

The reviewer hits a critical point here. Of course, this could be the case. In order to check this, the sensor uncertainty (see Table 3) and the repetition error of the thrust force measurement in steady conditions was checked (see section 7.1). Both are most likely not the cause of these strong deviations.

May be a thrust measurement of the rotor with the plataform fixed (to separate this from inertial and gravitational forces measurement) could be done. Also, if thrust measurements of the rotor were performed at wind tunnel at same conditions, that could be an interesting analysis, to see possible effects of the flow quality

Thank you for this hint. As mentioned above, we added a comparison of such measurements with wind tunnel tests. Although the turbine is not mounted rigidly, but is free floating, only very little motions and a minimal platform pitch angle are monitored by the motion tracing system (see section 7.1).

- All the results show the surge, heave and pitch behavior of the model. Since it is a single point mooring platform, and therefore has yaw as free degree of freedom, I wonder if you have anlalysed the yaw behavior and its potential influences.

This is an interesting remark. We checked the yaw positions of the platform an found it to be between +-2° is all cases with only a small drift during the tests but no motion with the wave frequency. In most cases the variation of the position is even lower. In the 'with wind' cases, we observe a slight shift of the mean yaw angle to 1° and only very small deviations from this. The lower deviation from the mean is due to the fact the tower airfoils align support the alignment of the rotor. The small mean yaw offset arises from the rotor torque that causes a slight roll angle. This roll angle, in turn, moves the application point of the rotor thrust force slightly to the side, which then results in a yaw offset. This is a phenomenon we know from full-scale analysis, which can be found in

Netzband, S., Schulz, C. W., and Abdel-Maksoud, M.: Self-aligning behaviour of a passively yawing floating offshore wind turbine, Ship Technology Research, 67, 15–25, https://doi.org/10.1080/09377255.2018.1555986, 2020.

However, despite this topic is very exciting, we decided to not discuss it in this publication, because it is already quite broad and we were afraid to further confuse the reader with more topics.

- The platform has an airfoil shaped passive yaw mechanism covering part of the tower. It is not clear whether it is completely laying on the wake of the wind generator.
  - Could you confirm about this point?

Yes, this is the case. We added a sentence:
"The airfoil is fully covered by the wind field\footnote{Is has to be noted that the flow quality near the lower end of the airfoil around the tower is impaired due to boundary effects of the wind generator}"

  - Although the influence should be small, have you been considering it on the full-scale computations?

We considered the influence via lift and drag coefficients along the tower in the present (model-scale) simulations and also in related full-scale simulations on other publications. However, the influence of the tower is indeed very limited when the platform is aligned with the wind.

Finally, as particular technical correction I would suggest to show in a figure the axis conventions used to derive the results in terms of motions directions (surge, heave, pitch) and forces directions as well.

We agree that an overview of the setup including a coordinate system was missing. We added this and in Figure 7 and described the directions in the corresponding text.

Best regards and many thanks for your extensive review,

Christian W. Schulz on behalf of the authors