Answers to RC1 Comments

June 22, 2023

Dear sir or madam,

Thank you very much for your comments on the revised manuscript. We find your suggestions enlightening.

Please, find below our answer to your new comments. We are looking forward to hearing from you.

Best regards,

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5. In my opinion, if no prism-layer mesh region or wall function is used, it is better to use a free-slip condition on the platform wall. The authors should consider this in future investigations and perhaps mention this as an option in this paper.

We have not consider the free-slip condition as we wanted to take into account the velocity of the platform and because of that we used the `movingWallVelocity` boundary condition. As you kindly suggest, we will consider the free-slip condition in further investigations.

6. I agree that some phase shift between the OpenFAST and OF2 results is to be expected because OpenFAST evaluates the wave loads using the wave spectrum at the undisplaced platform position without considering any surge offset of the platform. The phase shift table in the author's reply also show the OpenFAST loads are leading the OF2 loads as expected. However, the phase shift between OF2 and OpenFAST is not the same for heave force and pitch moment. If the difference is indeed purely caused by the floater offset, one would expect the heave force and pitch moment to have the same phase shift. As a confirmation, perhaps the authors can calculate the expected phase shift between OpenFAST and OF2 based on the platform surge offset and the wavelength.

As you suggest, we have computed the phase shift that would be expected if it would only be caused by the floater offset. For a mean surge displacement of 5 meters, the mean surge at the end of the simulation, the corresponding phase shift is $\sim 11°$. This suggest that there would be other effects that may affect to the phase shift. Nevertheless, we do not want to draw any conclusions in this respect due to the strong modulation of the waves (please, see next answer).

With regard to the wave modulation.

Firstly, in order to check the suitability of the spatial and temporal discretisation for the regular wave generation, free surface elevation was sampled at only one position. This sampling was used to verify that the wave had a proper amplitude and that the case configuration was able to keep the wave shape during the whole simulation time. The results show that only one sampling point is totally insufficient and a more thorough validation should have been carried out.

Therefore, we have checked the wave evolution along the wave channel without the structure and yes, we see a similar wave modulation as in Figure 9. We believe that this modulation comes from a misbehaviour of the boundary conditions.

In [Windt et al.(2019)Windt, Davidson, Schmitt, and Ringwood] a thorough study of numerical wave makers is carried out. In our work, we have used static boundary methods for both wave generation and absorption. At their research, Windt et al. found that the static boundary methods implemented by default in OpenFOAM are not as good as, for example, relaxation zone methods. This is due to their assumption of shallow water conditions for wave absorption.

At the manuscript, we have highlighted the misbehaviour of the boundary conditions employed that we believe they are the main source of error.

Because of this, we find that performing a detailed analysis of the phase shift between wave and load would draw misleading conclusions as the wave reflection could affect the phase of the computed loads.

Moreover, floating offshore wind turbines demand great time of simulation which has been found, [Larsen et al.(2019)Larsen, F to require suitable numerical schemes in order to keep the wave shape during the whole simulation. Having all of these issues in mind, we believe that wave generation and absorption is a critical aspect of FOWT simulations.

References

[Larsen et al.(2019)Larsen, Fuhrman, and Roenby] Larsen, B. E., Fuhrman, D. R., and Roenby, J.: Performance of interFoam on the simulation of progressive waves, Coastal Engineering Journal, 61, 380–400, https://doi.org/10.1080/21664250.2019.1609713, 2019.

[Windt et al.(2019)Windt, Davidson, Schmitt, and Ringwood] Windt, C., Davidson, J., Schmitt, P., and Ringwood, J. V.: On the assessment of numericalwave makers in CFD simulations, Journal of Marine Science and Engineering, 7, https://doi.org/10.3390/JMSE7020047, 2019.