--------------------------------------- *Reply on RC1* ---------------------------------------

Thank you for your detailed review. I have made overall modification of the paper structure. I listed below the comments and answers.

(1) comments from referees:

> In the abstract, it is stated that incorporating floater flexibility and added mass reduces the error to 5%. However, Section 3.1 shows that the error decreases from 33% to 28% when added mass is considered, and further to 5% when floater flexibility is included. I would recommend to highlight this finding in the abstract.

(2) author's response:

> I clarify this point in the abstract, adding the percentage difference per parameter with respect to the measured tower frequency modes.

(1) comments from referees:

> In paragraph 6 of Section 1, the reference to Zhixin Zhao (2022) should be verified. The software used is not HAWC2, and the floater type discussed in that study is not a spar-type.

(2) author's response:

> Thank you for having notice it. Indeed the reference was wrong. The correct reference is the work of Borg et al. 'Floating substructure flexibility of large-volume 10MW off-shore wind turbine platforms in dynamic calculations.'

(1) comments from referees:

> In Section 2.2.1, it is mentioned that the floater and tower are discretized using beam or shell elements. However, later sections refer to the model as using shell elements. Please clarify this to avoid confusion.

(2) author's response

> I clarify this point in the text. The Homer model is composed of full shell elements (floater and tower) . Beams elements were used to model the tower only in OpenFast model.

(1) comments from referees:

> Additionally, the structural model in Homer should be described in more detail—for example, specifying which components (e.g., tower, floater) are modeled with beam elements and which with shell elements.

(2) author's response

> More details were added (line 10th section 2,2,1)

(1) comments from referees:

> In the final two paragraphs of Section 3, the displacements and moments at the tower are discussed, but the corresponding figures are missing. Please include the relevant figures and expand the discussion to thoughtfully interpret these results.

(2) author's response

I'm sorry about the error. The last two figures were correctly added (page11).

(1) comments from referees:

The reference formatting should be corrected to comply with the journal's guidelines: https://www.wind-energy-science.net/submission.html#references. Additionally, some references appear to be duplicated, please remove.

(2) author's response

Doubled references were removed. A general modification of references was done. Reordering of references done.

(1) comments from referees:

There should be a space between a number and the unit. Please ensure consistent formatting throughout the manuscript.

(2) author's response

The corresponding modification were done

(1) comments from referees:

In Table 1, the decimal separator should be corrected: "8,3 m" should be written as "8.3 m".

(2) author's response

Corrected

(1) comments from referees:

The figure order in the text should be reviewed and updated to improve readability. For instance, Figure 4 is introduced before Figure 3, and Figure 9 appears before Figure 8.

(2) author's response

The general figure ordering was corrected.

(1) comments from referees:

The in-text citation formatting should be checked for consistency and compliance with the journal's style guide.

(2) author's response

Formatting seems correct following https://www.wind-energy-science.net/submission.html#references.

(1) comments from referees:

A proofreading for grammar is recommended. Several sentences contain awkward phrasing or are missing grammatical elements such as subjects.

(2) author's response

Overall corrections/modification were done.

--------------------------------------- ***Reply on RC2*** ---------------------------------------

Thank you for your detailed review. I have made overall modification of the paper structure.

(1) comments from referees:

Please provide some more information about how the values in Figure 3 are calculated (in 4-5 lines). Since you use those values you must report how you calculate them (eg using 1 day measurements ? 1 hour? how you make the frequency calculations?). You are providing relevant references but this critical information should be included in this paper too.

(2) author's response

Yes, Indeed some information was skipped. I have added a more detailed description of how reference modes were estimated and compare to the continuous modal shape estimation. To ensure the correct modal shape tracking over time, the Modal assurance criterion (MAC) was used to assess the correlation between the continuously estimated and reference mode shapes. When the MAC value exceeded 0.9, the corresponding mode shape was retained as a valid tracked mode. These retained modes are those presented on the figure 3.

(1) comments from referees:

The authors and in order to approximate the floater structure to the rigid hypothesis in the Homer model, the material Young modulus was increased from the steel value of 2.1E +11Pa to 1E +20Pa. How did you decided this increase? why not 1E+30Pa etc? How reliable is this very stiff value and if is a realistic one. The rationality for this increase should be discussed. Or you must present a sensitivity analysis. Moreover, the authors should explian if this is a generic value that should be followed in all possible FOWTs or if this is just a value that is valid only for the purposes of the present paper

(2) author's response

A specific analysis was not performed to determine the Young's modulus value that would make the modal shapes of the HOMER model most closely approximate those of the OpenFAST model, which assumes a rigid floater. This decision was based on the fact that, during the initial comparison between the two models (OpenFAST: rigid; HOMER: flexible), it became evident that stiffness has a dominant influence on the tower's modal frequencies. Therefore, we considered that calibrating the Young's modulus to match an inherently simplified or physically inconsistent reference model (OpenFAST) would not provide meaningful insight.
The purpose of this comparison was solely to demonstrate that increasing the floater stiffness in the physically consistent HOMER model leads the system's modal behavior to converge toward that of a rigid-floater configuration.

Therefore, I added to the paper that the value is only valid for the purposes of the present study

(1) comments from referees:

Moreover the authors should provide more information about the manual trial and error tuning performed to fit the measured spectrum. Please provide the sensitivity analysis results and how you decide the suggested value.

My main concern with the paper is that the trial and error methods are not methods with permanent scientific added value. Sometimes the trial and error methods result to completely unrealistic and unscientific results. Please expalin further the process and provide statements about the generality of the process as well as the advantages and disadvantages that the process has. If possible try to defend the suggested values with any possible mathematical or analytical method.

(2) author's response

The parametric optimization analysis was conducted after the manuscript had reached its final writing stage. The results from this optimization confirmed the values previously obtained through manual trial-and-error calibration. We agree that the trial-and-error approach is not a rigorous scientific method, thus, we have now included a brief section describing the parametric optimization of the tower adjustment factors in OpenFAST. Below is a link to a webinar in which I presented these optimization results at the late 2024.

https://www.youtube.com/watch?v=UPZwo6hY4jQ&list=PLk6pEgFE9zTmIer0hLQFmNlKEcq4rSHVI&index=2

(1) comments from referees:

The authors should explain clearly the possible methods that researchers can use when dealing with hydroelasticity and how hydroelasticity is included in time domain calculations in connection with what they did. More references hould be added and more discussion about this in Introduction section.

(2) author's response

In the introduction, we chose to provide a concise overview of the problem and summarize previous work which, together with our own findings, demonstrates that float flexibility must be considered for large floating structures.

Section 2.2.3 presents the current methods used to estimate hydrodynamic forces and includes references discussing the limitations of approaches based on rigid-float assumptions. We also cite the studies by Chenyu et al. (2017) and Borg et al. (2016), which propose iterative methods implemented in specific time-domain software tools.

In the same section, we introduce our calibration approach developed within OpenFAST, as potential solutions to this hydroelastic coupling problem are inherently linked to the time-domain simulation tool employed. This is the key point we aimed to emphasize, and therefore, we decided to relocate this discussion from the introduction to the methodology section.