The authors would like to thank the reviewer for the constructive recommendation and comments which will help improve the current and future work. In the following, the authors would like to respond to the reviewer's comments. The addressed comments are included in italic font.

1. *page 1, line 45. The author does not provide an adequate literature review of the current state of the art in optimization of floating wind turbine support structures, except listing eight papers. The authors should, the studies related to single objective optimization, gradient-free optimization, and spar-buoy floater, which are most relevant to the study in this paper. Besides, there are also studies of multi-objective GA optimization of floating wind turbine support structures, which are also relevant to this study. Additionally, how the mooring system is treated in the relevant studies? After an adequate literature review, the authors need to justify the value and contribution of this work.*

    The authors extend this paragraph and add a more detailed literature review on optimization applications of spar-type floating wind turbine support structures. The separate aspect of optimizing the mooring system is now included and addressed in more detail in Section 2.3 (paragraph in lines 188-195 on page 7).

2. *page 7, line 190. A general comment is related to the assumption that the mooring system is kept constant in this study. the mooring system is composed of a few mooring lines. Did the authors use constant values for the horizontal and vertical stiffness of each mooring line? Or, did the authors use a constant mooring stiffness matrix for the entire mooring system? The former approach is more reasonable, because the floater pitch stiffness depends on the product of the horizontal stiffness of mooring line and the radius of the fairlead. Can the authors predict what is the impact of their assumption on the optimized designs? The optimizer may take advantage of the assumption. Can the authors improve the way to treat the mooring system? This minor improvement can provide a more realistic way to include the mooring system. Alternatively, the authors may consider provide a representative design of the mooring system that satisfies the mooring stiffness for the chosen optimized design. Such practice and guide would make the methodology in the study more convincing.*

    The realization of the mooring system and the use of the resulting mooring system properties follows the first approach mentioned by the reviewer. Each mooring line is specified through its length, diameter, mass in water, extensional stiffness, added mass coefficient, drag coefficient, damping coefficient for inner damping, fixation point at anchor, as well as fixation point at fairlead. As mentioned (line 189 on page 7) the mooring system itself can cover a separate optimization. This is now underlined in more detail by added literature (as indicated in 1. as well). These literatures also confirm that, following the applied approach, a corresponding mooring system design, which represents the same resulting mooring system properties but matches possible attachment points on the optimized floater geometry, can be obtained through a separate subsequent optimization. The literature as well emphasizes the mentioned aspect (lines 192-195) that the system performance can further be improved through a subsequent optimization of the mooring system.

3. *page 17, section 4.3.2. The authors classify the optimizers into single-objective optimizers and multi-objective optimizers. It is a little confusing. While single-objective and multi-objective*

optimization are widely used, this often points to the formulation of the optimization problem, rather than the optimizer. The performance of the optimizer highly depends on the algorithm itself. On the other hand, for example, GA can be used to solve both single-objective and multi-objective optimization problem as stated by the authors. In a strict way, GA can be called sing-objective and multi-objective optimizer. The authors may re-write this paragraph to avoid the confusion and directly highlight that they are using GA algorithm.

The paragraph is reformulated, to ensure that the currently termed single-objective and multi-objective optimizers mean optimizers that can deal with single-objective and multi-objective formulated optimization problems.

4. *page 30, line 658. This study lacks a verification of the optimized design. Can the authors verify the hydrodynamic properties of the floater by using high-fidelity tools such as WAMIT?*

Unfortunately, the authors do not have a license to other high-fidelity tools, such as WAMIT, for performing a verification of the specific optimized design. The hydrodynamic properties and calculations performed within MoWiT are verified for other geometries (OC3 spar-buoy, OC6 semi-submersible, but also a large diameter bottom-fixed monopile or the OC5 jacket), where data from other tools for comparison was available. As pointed out on page 30, the proposed realization of the optimized spar-buoy floater design without having that strongly constricted shape or instead of this using a tapered connection between the upper column and the bottom part of the base column, but with utilizing tendons for connecting the bottom part of the base column to the upper column, will not experience the shortcomings of the hydrodynamic calculation approaches.

5. *page 32, line 725. This study assumes a rigid floater with a constant thickness. However, the chosen final design has a neck-like weak feature. The authors noted in the conclusion that this can be manufactured by using truss structures. Can the authors further illustrate this? Further, how would this bias the cost and performance of the chosen design?*

The innovative structural realization opportunities are explained in lines 513-520 on pages 22/23, lines 571-579 on page 27, and lines 679-683 on page 31. Here it is meant that the bottom part of the base column can be connected to the upper column by means of tendons or truss elements. Thus, it is not meant that the optimized spar-buoy geometry is fully replaced by a truss structure, but instead of having tendons between upper column and bottom part of base column, also rigid braces/truss elements might be used. As mentioned in lines 575-577 on page 27, it is expected that such an alternative structural realization – if it represents a rigid connection – will represent similar system performance. With respect to the costs, it might be more comparative to use tendons instead of truss elements, however, this would imply a more detailed analysis including manufacturing costs in addition to material costs.

6. *A general comment is related to the computation time for the optimization problem. How long does it takes? Can the authors provide such information?*

The information on the computation time has already been provided in line 463 on page 19.

7. *Another general comment is related to the interpretation of the optimized design. The authors have noted its similarity with TetraSpar. Can the authors compare the system properties of the baseline design and the optimized design? For example, the buoyancy and mass centers of the entire wind turbine, the eigen-frequencies of the coupled floater-tower vibration mode?*

   The authors reformulate the statement to ensure that the similarity of the optimized spar-buoy floater with TetraSpar is purely meant with respect to the innovative structural realization approach and not referring to the specific system properties.

Thanks as well for the minor comments added. Even if the reviewer leaves for some points the final decision on the implementation to the authors, the authors also would like to respond to these comments.

1. *page 10, section 3. It is better to modify the formulation of the optimization problem into a single-objective optimization, which is the case in this study.*

   By setting $l = 1$, as done in Section 3.2 on page 11, the prevailing case of a single-objective optimization problem is defined.

2. *page 10, section 3.1. It may be easier to follow, if the design variables are replaced with di and hi. Alternatively, one can also use du, dm, dl, hu, hm, hl, hb. But it does not affect the results. It is up to the authors.*

   The authors prefer to follow the general formulation of an optimization problem with design variables x_i, objective functions f_i, equality constraints h_i, and inequality constraints g_i. Thus, and as the definition of the design variables x_i is clearly given in Section 3.1, the authors stay with the used terms x_i.

3. *page 11, line 305. "It is not practical to simulate ... the full set of DLCs". It is better to put "the full set of DLCs" right after "simulate".*

   The sentence is reordered accordingly.

4. *page 11, line 307. "... might be relevant and driving the design ...". It may be changed to "... may be relevant or design driving ..."*

   The sentence is adjusted accordingly.

5. *page 17, line 407-412. The sentence is too long. It can be divided into three sentences.*

   Due to the adjustments made based on the reviewer's main comment number 3, the long sentence referred to in this comment is no longer existing.

6. *page 23, Fig. 5. It is better to remove the baseline design. The text in the legend "original desing" may be "original design". The text "optimum individual" means the final chosen optimized*

design, which may not be the global optimum. “optimum individual” may be replaced with “optimized design”.

The authors intend by plotting the baseline design to allow an easier and faster (visual) comparison of the presented example designs, as this way it is shown that always a similar scale is presented and the example geometries can always be put in relation to the one and the same baseline design. The text in the legend is adjusted according to the comments.

7. *page 26, Fig. 7. It is better to put the baseline design and the optimized design side by side. Then it is clearer to see the difference between the two designs.*

   For the authors it is rather easier to compare the designs and clearer to see the differences in both heights and diameters, when having both geometries plotted in one picture and having the geometries distinguished through using different colors.

8. *page 31, line 673, “where trusses or tendons prevent any utilization of strongly tapered sections". Do the authors want to mean that the trusses or tendons support the use of strongly tapered sections?*

   By means of this sentence it is meant that by allowing for alternative and innovative structural realization approaches, such as the use of tendons or truss elements, a strongly tapered section, which would be required when just following the common structural realization approach, would no longer be required.

9. *page 32, line 725. The sentence is too long.*

   This is the automatically generated author contributions statement, as required by the format of the journal.