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. *There are some weaknesses in the methods and results that could be improved to make a stronger paper. For instance, due to these simplifying assumptions, the optimized design geometries are quite surprising and raise as many questions as answers. The authors acknowledge that these are more qualitative and instructive design geometries than immediately applicable, but in that case more sensitivity studies and trade-off studies should be executed. Also, the presentation of the methods and results is fairly long winded and somewhat repetitive. Efforts could be made to tighten up the language and organization. However, instead of discussing these weaknesses in more detail, I am more concerned with the uniqueness and level of contribution of this paper.*

    On the first view, the presented approach might seem to follow more simplifying assumption than other studies on optimizing spar-buoy floating wind turbine support structures. However, as outlined in the introduction (lines 49-51 and 56-59 on page 3) and discussed in more detail throughout the paper (lines 199-203 on page 7, 513-520 on pages 22/23, lines 571-579 on page 27, and lines 679-683 on page 31, lines 695-698 on page 31) the less restricted optimization problem is chosen well-considered and deliberately, to allow the consideration of novel design solutions, including alternative manufacturing approaches and structural realization methods. The common optimization approaches and defined optimization problems consider spar-type structures, which are manufactured by welding cylindrical or tapered elements together. Due to the critical aspect of having large taper angles (as addressed in lines 658-673 on pages 30/31), as well as based on the structural aspects for the commonly manufactured floater designs, the range of potential optimized floater designs and shapes is limited. However, the manufacturing solution, such as choosing between welded conical sections and tendons or truss elements for connections, cannot directly be implemented in an optimization approach. Thus, the final solution has to be selected subsequent to the optimization. But in order to not prevent innovations, thus, this paper addresses an approach to be more open-minded and allow for alternative manufacturing approaches and structural realization methods. Thus, more design variables are defined and the corresponding allowable value ranges are specified well thought out to include the aspect of innovativeness. This approach shows a novel contribution to the future design development of floating offshore wind turbine support structures. The novelty and innovativeness of the proposed approach and resulting optimized design is substantiated by the fact that the potential structural realization approaches resemble the highly innovative concepts followed in research projects (AFLOWT, TetraSpar).

2. *If I do a literature search on the keywords "floating spar optimization", I get many hits and papers going back at least 15 years, only some of which are mentioned by the authors. Some of these papers also build on the OC3 spar that the authors have chosen for their baseline and/or use genetic algorithms to explore the design space as is done here. Furthermore, many of these papers do not make the same simplifying assumptions as this work does, leaving me to think*

that I should trust those other papers more. This also leads me to wonder what the novel contribution to the literature here is. I do not see that clearly stated in the paper.

The authors add a more detailed literature review (paragraph from lines 44 to 59 on pages 2 and 3) on optimization applications of spar-type floating wind turbine support structures and point out the differences of the followed approach presented in this paper compared to other approaches found in the literature. This underlines the novel contribution of this paper, as answered also in detail in comment number 1. Thus, this freer optimization formulation of the project can allow out of the box thinking and potentially push for more disruptive designs, which can unlock the potential of floating wind.

3. *An even more significant concern for me is the similarity between this paper and a previous one already published by the authors that also does a similar optimization of the OC3 spar with a GA: https://doi.org/10.1016/j.oceaneng.2020.107186. Much of the material here on the methods and discretization is nearly identical to their previous paper and leaves me to wonder why these two efforts were not combined. To me, this submission has not done enough to separate itself from the authors' prior work and perhaps also not enough to separate itself from the prior work of others. What is different just doesn't meet the bar of its own journal paper, so perhaps a conference setting would be more appropriate. I am willing to hear the authors retort to my concerns, but I am inclined to decline this submission.*

This paper built on, but has a completely separate aim from the previous publication by the authors (https://doi.org/10.1016/j.oceaneng.2020.107186). In the previous publication, the basic three design variables (one column with a height and diameter, as well as the ballast density), common to define a standard spar-buoy floater, are selected and the considered allowable value ranges follow directly the focus of reducing costs, material, and outer dimension, while the cost itself is not specified as objective. The work presented in that previous publication deals with a very simple structure and related simple optimization approach and also mainly deals to prove the validity of the applied optimization framework and approach. This paper submitted now to WES is substantially different and significantly advances the work already completed by the authors. This paper considers a more realistic geometry, which implies as well different methods and approaches (other and more design variables, not cost-driven but broader and well thought out selected allowable value ranges, formulation of the optimization problem directly for cost reduction, open-minded approach allowing for alternative structural realization methods and innovation). Based on this paper and applied approach, the way towards more realistic analyses, with more DLCs included and coupled with structural analyses, is as well paved.