

Response to the comments by Reviewer 2

We thank the reviewer for the valuable comments. The comments are copied below and our responses are written in red.

This is a review paper that discusses recent advancements in the understanding of processes related to the Arctic climate system. With a focus on the ocean-ice-atmosphere interface, this paper covers a wide variety of important and timely topics, and contains a mind-boggling amount of information. Unfortunately, I believe that this is detrimental to the ultimate usefulness of this paper, as the large amount of information included results in a relatively scattered collection of summaries of various topics. Each of these various topics could (and most do) have individual review papers compiled summarizing major relevant advancements.

Unfortunately, I elected to suggest rejection of this paper. This was not a result of the paper's aim or because the subject matter discussed was not useful and interesting, but rather it was because I believe that as the current paper is written, it is simply too long (In the end, I spent more than a day reading through and thinking about this manuscript) and needs to be divided into multiple publications to be of use to the community. In addition to its length, I do not feel as though the current version provides adequate connections between the individual topics discussed (or even within individual subtopics). This results in a long summary of papers that does not add much to our understanding beyond brief discussion of needed research efforts to address missing pieces, as covered in the discussion section. In my opinion, this has the topical coverage of a text book (though it does not contain the level of detail that would be required in a textbook), rather than a journal review paper. If there is only limited discussion on the connections between the main subsections (Atmosphere, Sea ice and snow, and Ocean), why not break it up into three papers? I don't believe that section 5.2 (cross-disciplinary aspects) provides sufficient justification for cramming it all together into one very long paper.

It is my opinion that the publication(s) stemming from this effort would be significantly more useful if the authors:

- Divide the current paper into multiple sub-discipline papers in order to reduce the overall length and more efficiently reach the intended audiences. This doesn't mean that there can not be interdisciplinary discussion or links, but they would be specific to one of the three current topic areas instead of one section that attempts to draw links between all of these disciplines.

We understand the reviewer's point of view, as our original manuscript indeed did not have enough interdisciplinary discussion. We have, however, kept all the material in the single manuscript. The main motivation of the DAMOCLES project, this Special Issue, and writing of this manuscript was to address the Arctic atmosphere, sea ice, and ocean as a single, interactive system. We feel that the main challenges in understanding the changing climate system in the marine Arctic are related to the interaction of its components, and we want to encourage colleagues to have a broader perspective than traditionally taken. We also note that Reviewer 3 favoured our approach of addressing the atmosphere, sea ice, and ocean in a single manuscript. We have improved and significantly extended Sections 5 and 6 on interdisciplinary aspects, and added a note in the end of Introduction that a reader does not necessarily read through all the manuscript, but may focus on sections of his/her interest and then on the concluding sections 5 and 6.

- More explicitly draw connections between individual sub-topics within the new subdisciplines

to improve flow and readability.

We have better integrated the paragraphs and sections, among others by adding a short paragraph in the beginning or end on many sections and sub-sections to explain how the section/subsection is connected to the other parts of the manuscript.

- Make sure to add integrating conclusions that can only be made by synergistic evaluation of multiple individual publications and clearly bring those conclusions out in discussion on what we know and what we have yet to discover (this is done in limited fashion, but I believe more is required to make this paper/these papers really stand out in their own right). Without this it is my opinion that a review paper does not add much to the literature beyond a listing of useful references.

We believe that our revised version of Sections 5 and 6 includes reasonably good integrating conclusions.

- Make improvements to the figures, which, currently are relatively dry, sometimes confusing, potentially incomplete (e.g. no discussion of aerosols in the interactions between clouds and radiative transfer: : Or maybe that's included in "condensation/evaporation" and "ice crystals"?). In my opinion, the fact that there are five complex flow charts/block diagrams is a clear indication that too much material is being covered for one paper (even one review paper!).

We have reduced the number of box diagrams by removing the previous Figures 4 and 6. We have also added discussion on and references to the figures, among others on aerosols and interaction of clouds and radiative transfer in the present Figure 4.

In summary, while there is a ton of useful material contained within this paper, I just don't see very many people sitting down to read the whole thing. This would be a shame because I do believe that well-written publications summarizing our advances in understanding sub-grid-scale processes in the Arctic climate system would represent useful and necessary contributions to the current literature. Because I ultimately believe that the paper needs to be divided into multiple shorter papers with the abovementioned improvements, I can not recommend anything other than rejection of the current manuscript.

We felt the reviewer's comments very useful in improving the manuscript, and can only hope that the revised manuscript and the points of view we presented in this response will turn his/her attitude more positive towards our work.