

# ***Interactive comment on “Long-term variation of sea ice and its response to thermodynamic factors in the Northwest Passage of the Canadian Arctic Archipelago” by Xinyi Shen et al.***

**Anonymous Referee #3**

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Long-term variation of sea ice and its response to thermodynamic factors in the Northwest Passage of the Canadian Arctic Archipelago author by Shen et al. The manuscript (MS) is interesting and fits with the scope of the journal but unfortunately, the data and the interpretation are not well presented. As the authors have highlighted in the MS title “response to thermodynamic factors”, but fail to justify the factors. The authors have discussed only the relation with SST and SAT. To understand thermodynamics, we should know the mixed layer depth (MLD), then only we could know the ocean heat transport. In my opinion, the article cannot be published in that form needs a lot of substantial improvements and modifications: I, therefore, suggest the article cannot be accepted in the present form.

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The abstract is very simple and doesn't show the novelty of the pertaining long-term sea ice and its response to thermodynamic factors. After reading the abstract I could see authors have just given the decadal observation of SIC and their correlation with SST and SAT. This section is drafted very poorly with the unfocused aim and finding highlights. Although the approached techniques are good but not justified by the authors in their explanations. Suggested to be more focused and rewrite the abstract. This section is lacking with clear aim and objective of the work as well as the concluding remarks/novelty of the work. Need to be more specific about the computational and processing techniques.

The sea ice thickness data for the Canadian Arctic Archipelago were utilized from for the model output of the AO- FVCOM. I could not see any data validation and any specific reasons for choosing this model. If any such study may be given. Data and methods are not complete need to be elaborated properly. I could not find any analysis details. Sea ice extent data details and analysis are missing how SIE was calculated? How the authors have divided the NWP into 10 subregions? What was the criteria or reference have been considered to divide the CAA? Materials and methods are poorly written and incomplete.

Authors have represented their results in just quantitative way in terms of spatial and temporal changes of SIC, SIE and SIT although sea-ice parameters have been published earlier by several authors sector-wise of whole Arctic regions. The MS is lacking with process and mechanism. Authors have attempted to explain the variations with only SST and SAT, this study needs to be extended by considering ocean heat transport and budget. The sea ice declining processes and their forcings are must be highlighted. In this present form, the paper is not recommended for publication.

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