Impacts of a lengthening open water season on Alaskan coastal communities

Review for "The Cryosphere" journal, Discussion Paper

November 30, 2017

The premise of this paper is to highlight the impacts of a lengthening open water season on Alaska coastal communities. Overall I find it an interesting and highly relevant paper. There is much current interest in defining impacts of environmental change according to indicators of relevance in a community context, and thus ultimately to help support decision-making at different scales. The extended record of the Historical Sea Ice Atlas (HSIA) is a valuable dataset for analyzing trends over time, although there are multiple challenges in doing so at appropriate scales and within particular community contexts. This paper tries to cover a lot of ground in a short paper. There are a number of good points made, although several areas where I would like more clarification, appropriate reference support, and nuanced discussion. It is also a paper well suited for discussion, and I look forward to reading feedback from other reviewers and discussants. Below are my contributions to this iterative review process, organized according to the key areas where I feel revisions would be needed prior to acceptance for full publication.

1) **Community uses of sea ice** – Given the premise of the paper to investigate the direct and indirect impacts of a lengthening open water season on four Alaskan coastal communities (Barrow, Kotzebue, Shishmaref, and Nome), I think it would be important to have more characterization of geographic (e.g. physical conditions, typical sea ice extent and cycles) and cultural (e.g. uses of sea ice particular kinds of sea ice for particular hunting or harvesting practices, links to seasonal traditions or community events) context up front. It could be added to the introduction, or be in a new "community context" section, but without this it makes it hard to interpret some of the arguments being made later in the Discussion. The references to communities are highly generalized, without much sense of how their uses or priorities for sea ice may be shared or different, and this would help to strengthen arguments as well as deepen the relevance of the analysis to the communities in question. Related to this, there is little explanation for the selection of the four communities beyond the diversity of sea ice regimes and subsistence activities (but these are not really introduced). In addition, Nome does not appear in most trend analyses, and Wales appears inconsistently in the text. More explanation and consistency in the communities of interest would be important. Furthermore, many of the references I am used to seeing that describe community use, conditions, and importance of sea ice from local perspectives in Alaska could be better incorporated throughout this paper to support both the local context as well as the analysis of direct and indirect impacts (e.g. work by Huntington, Eicken, Krupnik, Norton, George, Druckenmiller, among others).
2) **Selection of 30% ice concentration threshold** – The choice of selecting 30% threshold for freeze-up and break-up needs more discussion and justification, as well as greater consideration of associated limitations. I find this to be quite low, if considering travel on landfast ice. It would also be very helpful to more clearly relate this to community use of sea ice. What would local perceptions of freeze-up approximate to in terms of ice concentration? You cited some of my previous work (Laidler et al., 2009) in which we used 9/10 (90%) ice concentration for freeze-up in terms of being navigable on snowmobile or foot (vs. 5/10 which is the common definition for freeze-up in relation ship navigation). At 30%

concentration I would think there is still a lot of broken moving ice. Perhaps the overall trends would not change much, but this threshold selection is critical in terms of the arguments being made, and how this would translate to impacts on communities. This also has important implications for how transitional stages are considered, which are not really captured with one threshold (e.g. 30% used as break-up and as ice-free definition within the paper). I think this threshold selection and representation of transitional seasons is deserving of more careful consideration and/or articulation.

3) **Figure 1** – This figure does not give a good sense of scale of ice area covered around each community, or resolution of grid cells. Could a larger and more detailed figure be created to better represent this?
4) **Interview citations** – Two interviews are cited in the text, and referenced as being interviewed in Kotzebue in 2013. There is no other context about these interviews in terms of how they were related to this research or other community-based projects, or any details in the Methods section about how interviews were undertaken and with what focus and which participants. I would like to see more of these local and Indigenous perspectives included in the paper, but they also need to be clearly explained and included in methods. Furthermore, interview quotes included from other papers need to be fully cited to the paper they were published in (as well as the individual), so they can be appropriately credited and contextualized.
5) **BSI interpretations** – This analysis does not seem well connected to the rest of the paper, and the calculations and methods involved are presented in the Discussion rather than Methods. Perhaps getting into this analysis in sufficient depth is beyond the scope of the paper? It would be good to really clarify what the primary goal and emphasis of the paper is. If it is indeed on community impacts (and related to community priorities and concerns), then expanding in areas noted above may be preferred to this particular aspect of analysis.
6) **Societal levels and accessibility arguments** – I think what you are trying to refer to here is not societal levels (or scales), but decision-making or jurisdictional scales. This needs to be clarified throughout. The arguments here are also covered in such a generalized fashion, that it is difficult to connect to the sea ice and community-specific trend analysis. What would this mean in different community contexts? And when you talk about the accessibility of HSIA, to whom are you referring? How accessible and useable (and/or currently used) is the HSIA in Alaskan coastal communities?
7) **Typos and References** – There are a number of minor typographic errors throughout, as well as a number of incomplete references, that need to be attended to. I can provide more details on these if requested.

In the process of trying to compile my feedback, a number of other questions have arisen for me. But I will leave it here to see what the other reviewers and discussants say, and how the authors choose to respond. I am then happy to continue being part of the iterative review and discussion process.

Best wishes,
Gita Ljubicic
Department of Geography and Enviornmental Studies
Carleton University, Ottawa, Canada