The Cryosphere Discussions

The Cryosphere Discuss., author comment AC1
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Reply on RC1

Sofia Hallerbäck et al.

Author comment on "Climate warming shortens ice durations and alters freeze and break-up patterns in Swedish water bodies" by Sofia Hallerbäck et al., The Cryosphere Discuss., https://doi.org/10.5194/tc-2021-304-AC1, 2022

Thank you for the review of the article. We are glad to hear that you found the paper interesting. Also thank you also for sharing ideas for further research. Below you can find our point-by-point respond to your comments and suggestions.

Comment: This paper describes and analyses a comprehensive Swedish data set on lake ice freezing and break-up since the beginning of the 18th century. It shows that the ice cover duration has reduced, freeze-up occurs later and break-up earlier in the beginning of the 21th century compared to times before 1990'ies. The largest changes are observed in the Northern Sweden. Variability of the lake ice cover between years has also increased. It is shown that the changes are related to the increasing air temperature.

Response: To clarify, the largest changes in ice duration are observed in southern Sweden, not northern Sweden.

Comment: The data set on lake freeze-up and break-up dates could be utilized for validation of regional climate model and regional reanalysis results. Contemporary NWP and climate models tend to include prognostic lake parametrizations such as FLake. Such comparisons have been done for shorter periods, see e.g. some papers in https://gmd.copernicus.org/articles/special_issue944.html. Results of such comparisons could help in improvement of the parametrizations. On the other hand, the model results include comprehensive temperature, radiation, also possibly lake water surface temperature and other relevant data for the past and future climate that could be related to changes in lake surface state. This is something to think about for further studies, not suggested for this paper (but perhaps to mention that the processed data is available for such purposes).

Response: We agree that ice duration is an interesting factor that would be beneficial to include more often in climate models, climate and ecological research and decision making. Thank you for your suggestions. As noted in the paper, the data is available from the SMHI. The ERA5 re-analysis data that is now available (yet still preliminary) from 1950-today could be an excellent source of long-term lake ice and climatic data as suggested, which could be combined with the observations, but it should also be noted that some of the observational data used in this paper starts much earlier than this.

Comment: This is a comprehensive analysis of a unique data set. The manuscript is well written and the results exceptionally clearly illustrated by the figures. Earlier studies are presented and discussed well. Perhaps it would be possible to check some of very recent related papers, like Korhonen, 2019 (ISBN 978-951-51-2800-3). I really do not have serious remarks, the paper could be published in its present form.

Response: Thank you again for your suggestions and positive feedback. We agree that it is a good idea to add recent related papers. As suggested, we now cite Korhonen 2019.