

Interactive comment on “Canadian Snow and Sea Ice: Trends (1981–2015) and Projections (2020–2050)” by Lawrence Mudryk et al.

Anonymous Referee #2

Received and published: 25 October 2017

This paper presents an assessment of historical (1981 onwards) and projected (until 2050) sea-ice and snow cover changes in Canada and the Canadian marine areas. It is well written and the methods applied are sound. The results are correctly and carefully interpreted and discussed in appropriate depth. The assessment does not provide any radically new insight into the field, but by looking at sea ice and continental snow cover at the same time, it offers an interesting comparison between the two domains. Moreover, it offers some interesting points of view on some specific aspects such as North American snow cover data and sea-ice thickness in the Canadian Arctic Archipelago. Using in situ data to complement large-scale data in some specific cases and areas is a valuable idea. The authors justify the exclusive focus on Canadian continental and marine areas by institutional reasons, and Canada (plus its marine areas, with or

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without Hans Island) is clearly large enough for such a national assessment to make sense in an international publication, but at some places in the paper, it might have been interesting to put the results into a somewhat broader geographical context. The natural system does not care about national borders. I therefore think that the paper should be published after some minor changes suggested in the following.

Specific comments 1) Several of the figures were provided at rather low resolution, for example Figure 6. Please provide high-resolution figures in the end.

2) Line 35: If possible, you might consider providing the information about CANSISE in the acknowledgments rather than in the introduction; it is not of scientific interest per se.

3) Line 42: A more relevant reference for CMIP6 is Eyring et al., GMD 2016: <https://www.geosci-model-dev.net/9/1937/2016/>

4) Line 79: “future projections”: climate projections are always for the future, I think. “climate projections” might be better

5) Line 159: “Laliberte” -> “Laliberté”

6) Line 187: “This difference may stem from...”: It should be possible to evaluate how much of the discrepancy is due to not using the NOAA record. This might be an interesting information.

7) Line 205: “The reduced warming and cooling over northwestern Canada...” This sentence is a bit cryptic. Can you be a bit more explicit, e.g. explain what the Mydrik et al 2014 paper says?

8) Line 211-217: It is unclear to me why subtracting a mean value should change the correlation – which means that I certainly haven’t understood your explanation of centered and uncentered spatial correlations. Please consider giving some more detail on the method. What does an uncentered correlation mean physically?

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- 9) Line 224: "...ice (...) is more difficult to melt than snow..." OK, one understands this of course, but the formulation sounds a bit strange.
- 10) Line 239 "the summer is ice season": delete "is"
- 11) Line 281: Relative impact of natural variability, scenario uncertainty and model uncertainty: Can you quantify this a bit better in this particular context?
- 12) Line 287: Typo ("reigon")
- 13) Line 302: OK, but SCF should also depend on precipitation rate, and probably more so than SIC does.
- 14) Line 324: Missing full stop at the end of the sentence. This result (that a large portion of the inter-model spread is associated with internal variability) is striking and might be emphasized/elaborated on a bit more.
- 15) Line 356: Full description in Laliberté et al., 2016: OK but can you give a very short description of the method here?
- 16) Line 361: "... will be sea ice free in September." Add, for clarity, "by 2050"; please indicate whether this concerns decadal averages, 30-year averages, extreme years,....
- 17) Line 388: "precipitation availability": sounds strange to me. Precipitation either occurs or not, it is not "available" for somebody to buy it.

Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2017-198>, 2017.

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