

Interactive comment on “Climate change threatens archeologically significant ice patches: insights into their age, internal structure, mass balance and climate sensitivity” by R. S. Ødegård et al.

Anonymous Referee #2

Received and published: 10 July 2016

This is a interesting research project at a very interesting site. The authors collected an impressive array of data from the perennial ice patch studied. This makes a contribution to the field as there are relatively few studies on ice patches, their development and evolution to draw information from. However, the paper lacks a central theme that ties all the data together, and more importantly, the analysis and interpretation of the data presented is rather superficial.

General comments: Overall, the paper is fairly well written but has a number of topographic and grammatical errors that, in some places, could lead to confusion. I have

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identified a few of these below, but a thorough copy edit should be done. As well, the authors could have done a better job in placing their findings in the broader context. For example, a similar study from the Canadian Arctic was published a few years ago (Meulendyk, T. et al., 2012. 'Morphology and development of ice patches in Northwest Territories, Canada.' *Arctic* 65, 43-58). It could have been used as a comparison to delve deeper into age, development, internal structure and radar stratigraphy of the results from this study. Further, the authors collected georadar and GNSS data to image the ice thickness and bed topography, but did not do a topographic correction to the radar lines to reveal the true internal structure of the ice body. The depth of the samples for radiocarbon dating should be given and so they can be put into a proper stratigraphic context.

Specific comments: P14, L12-13. I disagree that perennial ice patches can be used as indicators of permafrost. Just like warm-based glaciers, ice patches can be at the melting point at their base with no permafrost below them.

P15, L5 change theses to these

P15, L11-12 Explain why you suggest that at other ice patches the age of the ice does not correlate to that of the organic layers.

P15, L21 change treats to threats

P16, L8-12 This paragraph is unclear. All the dating is relative as all sample could be contaminated with carbon from different times.

P16, L29 The authors refer to the ice patch not developing into a glacier with basal sliding. However, earlier they argue that it is cold based and underlain by permafrost, in which case you wouldn't expect basal sliding. See other papers on cold based glaciers. The ice temperatures and evidence of internal deformation in Figure 6 suggests that at least at some point it has been a polar style glacier (ie. cold based).

P17L17 change events to event

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P17L24-29 The data presented are not detailed enough to support an assertion such as this.

P23L8-12 instead of referencing theses that are difficult to get ahold of, it would be good to reference published articles if they have come out from this work.

P25Table 2 It would be good to have the depth, or stratigraphic position, of the samples presented here to better understand the radiocarbon dates that in some cases appear to be out of order (e.g. L28&33)

P26Table 3 change intp to into

P31 Figure 4 Topographic correction should be applied to show true stratigraphic relationships such as in Figure 5. As they are presented the unconformity in the two figures appears to be very different. As well, there seems to be a problem with the application of gain to this profile. The processing methodology is not presented in the methods section, so it is unclear what was done. However, the uniform 15 ns of muted returns above the basal reflection suggests that the gain window may have been too large or that there was some other error in the processing.

P34 Figure 7 – the winter precipitation used appears to be the modeled values estimated from the regional weather data instead of the on-site data as shown Figure 11, where the modeled data is shown to be dramatically different than the measured.

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