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Climate of the Past Discussions

Interactive comment on "Middle and Late Pleistocene climate and continentality inferred from ice wedges at Batagay megaslump in the Northern Hemisphere's most continental region, Yana Highlands, interior Yakutia" *by* Thomas Opel et al.

Anonymous Referee #1

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The authors present a reconstruction of winter precipitation isotope ratios and inferred winter temperatures from relict ice wedges in Pleistocene strata in the Batagay megaslump headwall and late Holocene wedge ice near the Adycha River. These wedges span the last ∼140 ka. The authors claim this study fills an important gap in knowledge of paleoclimate of the Yana Highlands. Temporal variations in the isotopic composition of the ice wedges, particularly the wedges that are well-dated and substantial in size (i.e., least prone to post-depositional overprinting), broadly support

the conclusion that past stadial and interstadial winters in this region were cooler than today. Further, wedge ice from other areas across Siberia are more enriched than the Yana Highlands, both today and in the past, which suggests this region has always been the most continental area in northern Siberia.

I read this paper with great interest. Relict ice wedges are an important paleo-meteoric water archive with a tightly constrained seasonality (winter only) and offer some of the oldest known ice in the Northern Hemisphere, extending beyond the temporal limits of the Greenland ice cores. As I see it, ice wedges have an important role to play in advancing our knowledge of Quaternary climate change in non-glaciated Arctic regions where ice cores are not possible.

The authors do a good job explaining their methods and summarising the most important features of this interesting dataset. There are several uncertainties about the integrity of the smaller ice wedge samples, and dating of the pre-MIS 3 wedges, but the authors are up-front about these uncertainties and to a large extent they do not confound the conclusions highlighted in this paper. This paper lays the groundwork for future studies to develop more detailed ice wedge records and paleoclimate inferences from this site. The topic and scope of this work are highly appropriate for Climate of the Past.

I am mostly satisfied with the paper in its current form, but I have a few concerns that I feel should be addressed before it is accepted in final form. Following these revisions I would recommend this paper is accepted.

Major comments: To establish how much more continental the study area was in the past, the authors should consider that the global oceans were more enriched during past cold stages. For example, during MIS2 mean ocean water was ∼1.2‰ enriched in 18O. In the discussion, please acknowledge this and provide some discussion – note that standardising for this effect would make some of the relict wedge ice (e.g., B17-IW4) similar in value to the late Holocene wedge ice. I do appreciate there are un-

certainties about paleo-source region and possible heterogeneity in the isotope composition of marine source waters. However, some attention to this issue is needed.

specific comments P2, L31 – 'right side' is ambiguous, since it depends on which direction one is oriented. P3, L13 – 'MIS6 or MIS7'. Does cryostratigraphy provide any indication if this deposit (and the ice wedges) represent a glacial or interglacial period? Ideally say which is more likely. P4, L1 – you refer to this as the second study site, which is understandable but also confusing since there is a 'Site 2' in Figure 2. P4, L23-25 – if possible, please give a reference for pore ice-wedge ice exchange. P5, L21 – 'outlined below' P6, L23 – what is meant by redistribution? P11, L5-8 – The co-isotope linearity of this cluster is remarkable. Why not report the slope, intercept and r2 for a line drawn through all data within a cluster, as was done for the individual wedges? P11, L8-9 – arguably, the MIS6 wedge is part of the first cluster. Only one of the datapoints is an outlier. P11, L12-15 – this could be explained more. If you are correct, then divergence from the Cluster 1 line could provide valuable information about aridity. P11, L17 – please add a reference (e.g., Pfahl and Sodeman, 2014, Clim. Past.) P11, L21 – this is an interesting line of discussion. Can you expand on this point, and comment on how different snowpack evolutions would be expected to influence the isotopic composition of the eventual meltwaters? P12, L2-5, the point of this sentence is not entirely clear. P12, L9, specify that you are talking about d18O. Also, I would advise against specifying a number (e.g., -40). . .better to simply say even more depleted values compared to MIS3 wedge ice is expected. P12, L18-19, please clarify what is meant here. P14, L1, clarify that mean dexcess of 6 permille is a Late Holocene value. . .same for the Yakutia example. P14, L18-20, this last sentence seems irrelevant to the study. . .further, it is not clear how this study area provides the ideal conditions are validating/advancing the CI dating method. Suggest deleting this sentence. Figure 7. the #7 datapoint is missing x/y error bars.

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