

## ***Interactive comment on “Ground-ice stable isotopes and cryostratigraphy reflect late Quaternary palaeoclimate in the Northeast Siberian Arctic (Oyogos Yar coast, Dmitry Laptev Strait)” by Thomas Opel et al.***

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General comments: Water isotopes from ice cores are one of the most important climate proxies in Quaternary paleoclimate research. But long ice core records have significant spatial limitations. Relict ground ice in continuous permafrost regions has great potential to fill spatial and temporal gaps in the water isoscape. The manuscript reviewed here, in my view, represents an important contribution to the Quaternary literature. It provides new relict ice isotope data from Oyogos Yar (Dimitry Laptev Strait region) and compares with existing data from the nearby Bol'shoy Lyakhovsky Island

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locality. Together this regional dataset offers an impressive cross-section of climate-isotope variability over the last ~200 ka. Many of the deposits pre-date the limits of the radiocarbon method, and are notoriously challenging to constrain. The authors have done a commendable job establishing a regional chronostratigraphic framework that is both well illustrated and simple to understand. The manuscript was generally well written – some editorial type corrections are needed as outlined below. The data appear to be of high quality and were thoughtfully interpreted, and reasonable conclusions were ultimately drawn. I have only a few specific comments that I feel the authors should address. Following the suggested revisions, I would strongly recommend this manuscript is accepted.

Specific comments: - Abstract describes 'cold to very cold', 'very cold to moderate', 'very cold' and 'extremely cold' winter conditions during several key timeslices, but the benchmark is not clearly defined. Please state what the paleoclimate end members are (e.g., LGM to Late Holocene). - P14, L10: What is meant by '...fits good to a maximum in modelled summer temperatures...'? Are you referring to how the water isotope data match the modelled temperatures? If so, this comparison is perhaps unjustifiable since the ice wedge isotope values are from snowmelt and should therefore be compared with modelled winter temperatures. Considering uncertainties of age and seasonality (all winter months, or just some) of the relict ice, the data seem to compare reasonably well with modelled winter temperatures. I would recommend revising this bit so that the reader is not confused about the seasonality of the water. - P15, L24-25: This statement is a bit too strong and lacks accuracy – as it is currently written, it appears to say the primary signal in texture ice relates to secondary fractionation. However, the subsequent sentence contradicts that. Alternatively, you might say that climatic interpretation of water isotopes in texture ice is confounded by partial overprinting of the original meteoric signal by secondary fractionation processes associated with active layer freeze-thaw cycles, and that the degree of overprinting may depend heavily on the environmental context given contrasting variances across different units. - In section 5, tentative links are made between isotope variations in the Siberian study region

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and some of the high-amplitude (Dansgaard-Oeschger 'style') fluctuations in North Greenland, NGRIP ice core record. I would caution the authors about doing this so liberally. First, NGRIP is a different seasonality. Second, Greenland is a very special place, and most of these very strong climate oscillations in the NGRIP record are linked to local variability in the vigor of the North Atlantic heat pump (AMOC). While I can understand the appeal in making this comparison, since it may help to explain why the Siberian isotope data do not always compare well with the local modelled temperatures, I think more care is needed when attempting to correlate paleoclimate in the North Atlantic and East Siberian Arctic. My proposed solution would be to acknowledge these complex issues, re: seasonality, and also correlating high-amplitude events across such large distances. Finally, I would also suggest re-iterating that age uncertainties in the Siberian data are sufficient in most cases to bring the data in accord with the modelled temperatures.

Technical corrections: - P3, L17: no need for 'see e.g. discussion in' – this is already implied by citing the paper. - P3, L31-32: I understand the intended meaning of this sentence, but as it is currently written it suggests humans have been conducting field studies in this region since the mid-Pleistocene. - P4, L4: should be 'less extensively' - P4, L12: should be 'spatially and temporally' - P4, L26: mounds = colluvium? - P6, L17-18: is 12.5% (+/-0.5%) potassium content is a reasonable assumption? Please elaborate. - P6, L20-21: revise sentence structure, or break into 2 sentences. Example. The equilibrium technique was used to prepare ice-wedge and texture-ice samples for stable isotope analysis. Stable oxygen and hydrogen isotope ratios were measured on a Finnigan 215 MAT Delta-S at AWI Potsdam. - P6, L24: It is odd that the measurement precision hasn't changed in 17 years (i.e., since Meyer et al., 2000). Perhaps a more recent citation would be appropriate here, or simply ask the IRMS lab manager at AWI what the value is today, and report that. - P10, L13-15: Communication error. 'Holocene cracking' was not observed in the Yedoma Ice Complex. Rather, 'milky white ice veins' were observed in the YIC. Please revise the sentence. - P10, L22: when specific units are referred to (e.g., Unit II), 'Unit' should be capitalised. There

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are many instances of this spelling error throughout section 4. Please correct in the final manuscript. - P13, L25: revise to "...and have isotopic values that are depleted compared to ice wedges on Bol'shoy...". - P14, L8-9: revise to "The IRSL age for Unit III (102.4±9.7 kyr) points to a MIS5c origin rather than MIS5e (Eemian) as suggested previously (Wetterich et al., 2009; Kienast et al., 2011)." - P14, L20-21: I am not sure what is meant here. Please clarify this sentence. - P15, L1: "...factors such as..." - P16, L2-3: revise to 'As soil water migrates to a freezing front, the first ice...' - P16, L10-12: I am not sure what is meant here. Please clarify this sentence. - P16, L24: "...according to..." - P19, L1-3: if it adds value, why not add the Laskar winter insolation curve? - P19, L13: 'All in all, \*our\* data...' - P19, L23: '...pollen data from...' - P19, L34-35: please rephrase the sentence beginning with 'However,...' As it is currently written, I am not entirely sure what is meant. - P20, L1: please remind the reader (in brackets) how much d-excess increased. - P20, L12: '...in addition \*to\* and...' - Figure 7: Please specify if the standard error bars are 1 or 2 sigma.

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