

Interactive comment on “Climate information preserved in seasonal water isotope at NEEM: relationships with temperature, circulation and sea ice” by Minjie Zheng et al.

Anonymous Referee #2

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The manuscript represents a new insight into the factors controlling the formation of stable water isotope content in the north-west Greenland (NEEM site). The authors use 4 shallow cores to study the variability of stable isotopes in snow in 1855-2004. The authors manage to separate the whole ice sequence into summer and winter layers to study differently the corresponding seasonal isotopic signal. They show that summer precipitation constitutes about 70 % of the annual sum. The authors further demonstrate a strong correlation of the summer $\delta^{18}\text{O}$ with the regional summer temperature, but it is not the case for winter $\delta^{18}\text{O}$ and winter temperature. The regional climatic indices (NAO and AMO) are shown to have relatively weak influence on the NEEM isotopes, in contrast to the central and southern Greenland sites. Finally, it is

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suggested that winter d18O values in NEEM are primarily governed by sea ice concentration in Baffin Bay.

The manuscript is nicely written and easy to read. It provides new valuable information and understanding of the processes of the formation of stable water isotopes in the polar regions. Overall, I suggest to publish it with only minor corrections.

Specific comments.

The figures are too small, especially 1 and 3.

Figure 1: you often mention Baffin Bay in the manuscript, it would be nice to show it on the map.

lines 149-150: the average accumulation rate at NEEM (21.6 cm/yr) is only slightly higher than the threshold (20 cm), and since the accumulation rate is highly variable in time, there were periods when it was <20 cm. How does it affect the interpretation of the isotopic record?

lines 151-155 and farther: I understand your way to define the lengths of the seasons and I do not have objections to using this approach. But there are more simple ways to deal with it. You may, for example, divide each annual d18O cycle into winter and summer halves using a chosen d18O value, and then define for each year the amount of ice accumulated during summer and winter, as well as mean summer and winter d18O values. Would not it be more straightforward? Could you please comment on this?

line 183: I suggest to write "or a combination of the both, " to make it clearer.

line 209: are these SNR values for a single core or for the stack of 4 cores?

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