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Climate of the Past Discussions

Interactive comment on "A glaciochemical study of 120 m ice core from Mill Island, East Antarctica" *by* Mana Inoue et al.

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Dear Anonymous referee #1

On behalf of my co-authors, I'd like to express my thanks for constructive comment on our article "A glaciochemical study of 120m ice core from Mill Island, East Antarctica". We were happy to receive your suggestions to improve our manuscript.

Please find below a response to each comment. We feel that the manuscript has been enhanced by incorporating these comments.

Kind Regards,

Mana Inoue

Responses to referee's comments:

1) Ice core site mean temperature

a. It would be useful to know the 10 to 15 meter depth snow pack temperature.

Text has been added on page 2, line 13. "The borehole temperature observed during the 2010/2011 summer is -13.86 Celsius, measured at a depth of 19.07 m from the 2011 C.E. surface (Roberts et.al., 2013)."

b. The ice core site does not show evidences for strong post-depositional processes, but in the ionic seasonal variations seem to have been damped in some sections of the core. Further, some sections also show reduction in the deuterium excess (D-ex). This may be a further evidence of post-depositional melting and fractionation.

We disagree with this comment. Crust layers in Figure 10 do not much with the D-ex reduction. The reduction in D-ex is due to sample resolution decrease with depth.

c. An examination of the Na+/Cl- relationship would give further evidence about the preservation of the original snow record.

Thank you. This is a good idea. However analysis of the Na+/Cl- relationship will be examined in a follow up paper which will be dedicated to post depositional migration of sea salt. As such, it is out of scope for this paper.

d. What is the mean temperature at the near Mirny Station during January and February? Does it reach temperatures above 0 Celsius even only in some days?

The average temperature at Mirny station during January and February is -1.84 and -5.25 Celsius respectively. It is possible to reach temperatures above 0 Celsius on some days. However, considering the ∼500 m summit altitude Mill Island ice core site is much less likely to experience melt. Moreover, there is no evidence of significant melt in Mill Island ice core (see comment above).

e. Does any part of the core show signal of ionic preferential melting?

As in section 5.2.2., there are no evidence of melt in entire Mill Island ice core.

2) Snow/ice density profile – ice stratigraphy

a. Considering the points above, and that the highest ionic amplitudes are found in the upper layers, it would be useful to have a density profile in this paper.

Thank you for the good suggestion. A density profile has been added to the manuscript.

b. It is quite common in cores of sites that suffer sporadic surface melting to have the original seasonal variations only in the upper layers. Further down, melting, followed by percolation and refreezing, damp the signal.

This is true, but there is no evidence of melt from the density profile. The Mill Island density profile also matches the Law Dome density profile.

c. The authors should at least report the thickness range of the observed crust/ice layers.

Thank you. Crust layers observed in the Mill Island ice core ranges $\sim$1 to 5 mm thickness. Text has been added to the manuscript. "The stratigraphy of the MI0910 ice core shows $\sim$1 to 5 mm thickness of higher density layers distributed occasionally throughout the entire ice core."

3) Ice core dating

a. The authors tell that dating was confirmed by well-known volcanic eruptions. Please identify these eruptions in the sulphate profile.

Figure 6 (a) has been replaced to show non-sea salt sulphate calculated with modified k' as in Appendix A. Although nssSO42- from well-known volcanic eruptions do not significantly stand out in the Figure 6 (a), there are peaks during these volcanic periods. These results match with Law Dome nssSO42- results. The text has been changed in this section to reflect this. "Although nssSO42- peaks do not stand out for the major volcanic eruption, the timing of some nssSO42- peaks in MI0910 records matches with the eruption years."

4) Figures

a. Figure 12 is redundant. Please consider removing it.

Thank you. Figure 12 has been removed.

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