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Interactive comment on "Halogen-based reconstruction of Russian Arctic sea ice area from the Akademii Nauk ice core (Severnaya Zemlya)" *by* A. Spolaor et al.

Anonymous Referee #1

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Review of "Halogen-based reconstruction of Russian Arctic sea ice area from the Akademii Nauk ice core (Severnaya Zemlya)" by Spolaor et al.

General comments

This manuscript describes halogen-records (bromine and iodine) in Akademii Nauk ice core taken in Severnaya Zemlya, and presents authentic and original scientific material that has relevant implications for halogen chemistry and sea-ice records. On the whole, the topic of the manuscript is relevant and suitable for the scope of the "The Cryosphere". Nevertheless, there are several points which require significant and careful revision for publication. My questions and specific comments are listed as follows.

1. Influence by surface melt and infiltration As stated in Section 2-1, surface melt and infiltration occurred in Akademii Nauk ice cap during summer. These processes are associated closely with ice core quality. Water-soluble species can move and infiltrate under the conditions with surface melt during summer. Additionally, bromine and iodine in surface snow can be liberated preferentially through photochemical reactions and phase change (melt/freeze) after deposition onto snow surface. To interpret ice core records, more and careful discussion about post depositional processes (photochemical reactions and phase change) and quality of ice core (summer melt and infiltration) are required.

2. Trajectory analysis Backward trajectory was calculated in this study. Calculated periods were 3 days in spring and 6 days in summer. Because transported distance depends strongly on the calculated periods for trajectory analysis, the calculated periods are fixed usually. Considering high uncertainty of longer periods, the calculated periods should be fixed to several days. What mode did you use to analyze the trajectory (vertical motion or isentropic)?

3. Classification of trajectory Air mass history by backward trajectory was classified into three groups in this study. What was the criteria to classify the trajectory into three groups? Variance of the trajectory in each group might be large. Therefore, static analysis is required to estimate the difference.

4. Comparison to Na+ and Cl- In this study, authors focused on halogens and sea-ice. In my opinion, this topic is very interesting and important to understand sea-salt and halogen chemistry, and past sea-ice change. Although Na+ and Cl- are major sea-salts, bromine and iodine were only discussed in this study. Comparison among Na+, Cl-, bromine, and iodine provides likely more and better knowledge about halogen chemistry and sea-ice change.

5. Bromine data Excess Br was plotted in Figures to understand connection between Br (explosion) and sea-ice. Because bromine can be supplied from gaseous bromines

and particulate bromine onto surface snow, total-Br (or both) might be better than only exc-Br.

6. Sources of bromine and iodine Short description about potential sources of bromine and iodine is helpful for readers. Please add source lists and discussion in text. Actually, bromide is supplied by transport of sea-salt particles from open sea and sea-ice (including frost flower), gaseous bromines released through heterogeneous reactions on sea-salt particles and sea-salts on snow/sea-ice, and others. Also, iodine (iodide and iodate) is derived from biological processes and sea-salts.

7. Typo: page 4411 Line 19: These so called called

Interactive comment on The Cryosphere Discuss., 9, 4407, 2015.