

## ***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 #2**

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General Comments:

The submitted manuscript presents results demonstrating both the connection between ice-core Br(exc) and spring sea ice in the Laptev Sea and the connection between iodine concentration and summer sea ice area as found in the Akademii Nauk ice core record. In a well-written and concise manuscript, the authors do an excellent job of demonstrating the statistically significant correlations and explaining the significance of the findings. The manuscript is relevant and of interest to the readership of The Cryosphere and I recommend for publication after some minor revisions.

Specific Comments:

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- pg 4411, lines 20-22: Some studies have also found Br depleted in the snowpack relative to Cl or Na, while others have found constant concentrations. It is more complex than simply stating there is enrichment of Br due to the bromine explosion and this should be discussed. - pg 4413, section 2.1: Changes of the bromine and iodine concentrations in the snowpack over time needs to be more fully discussed. What about processes/reactions that may change the concentrations post-deposition? Although there is some reference to the effect of movement due to meltwater percolation, is it possible to get an estimate on the expected error? - pg 4415, lines 4-6: Why was HYSPLIT run for a different number of days for spring (three) vs summer (six)? - pg 4416, line 17: To me, it looks like there is a greater minimum than 44% for the period 1996-2000 - pg 417, lines 6-8: States that "seasonal changes in Kara Sea ice area are comparable but smaller than those calculated for the Laptev Sea." This is because the Laptev Sea is a larger area than the Kara Sea. If you normalized by sea area, the changes would be more comparable. - pg 4418, lines 10-11: The authors state that the results "confirm the finding that Br(exc) is correlated with Laptev and kara Sea ice." However, the findings of the spring sea ice showed only correlation with Laptev ice and not Kara spring ice. This differs from the finding of the summer ice results with the Polyakov anomalies. - pg 4429, Table 1: Why was the Br(exc) not compared to the summer sea ice areas? Presumably this was due to negative Br(exc) values. However, it would be important to still present negative Br(exc) values and see how the trend varied with sea ice extent. Perhaps it would be better to use Br(enn) values for statistical correlations instead. If not, then a scaling of the Br(exc) would be required to take logarithms. - Although it is helpful to see the raw Br and Na concentrations in the supplement, it would be helpful to have a plot showing these trends in the manuscript as well. - pg 4421, lines 10-11: Why would the Svalbard record have less clear seasonal variability and be more susceptible to influences of summer melting and iodine re-emission when the climate conditions are similar?

Technical Corrections:

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- pg 4431, Figure 2: It would be helpful to crop all of the back trajectory images to show the same geographical region (i.e. enlarge images to have the same boundaries). - Be consistent in use of either paleoclimate and palaeoclimate (e.g., pg 4410, line 22 vs pg 4413, line 13) - pg 4412, line 23: missing "the" before "last 50 years" - pg 4418, line 12: missing "to" before "iodine"

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

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