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Interactive comment on "Seasonality of halogen deposition in polar snow and ice" *by* A Spolaor et al.

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Review of "Seasonality of halogen deposition in polar snow and ice"

By Spolaor et al.

This manuscript presents a report on the seasonality of bromine and iodine enrichment in two Arctic and one Antarctic location. This work follows previous reports by the same authors on the use of halogen records to infer Antarctic sea ice extent over glacial and interglacial periods. The current work further supports and extends the use of halogen enrichment in ice and the observed annual and seasonal variability to obtain information about past sea ice dynamics and its effect on halogen deposition on snow and ice. This work proposes some interesting thoughts about the processes

driving the observed seasonality in both bromine and iodine in Arctic and Antarctic ice records. The paper is well written and structured and thus I recommend publication in ACP.

I would be grateful if the authors can first address or comment in the revised manuscript the question at the end of the following paragraph:

One intriguing aspect of the observations reported here is the different seasonality in the bromine and iodine records. For instance, in the Law Dome data the peak in bromine is in the austral summer whereas for iodine is the austral winter. The authors suggest that for iodine one explanation can be that the IO recycling in the snowpack stops with the arrival of the polar night and then all the active gas phase iodine would be deposited during the winter and hence the winter peak in the iodine record. For bromine, satellite measurements have shown considerable levels of BrO (i.e. active bromine chemistry) in summer over the region of Law Dome, and in fact to some extent into the interior of the continent. As for iodine, to sustain these levels of BrO during the sunlit period an active recycling of bromine must also exist (e.g. on sea-salt aerosols and/or snow/ice surfaces). Such levels of reactive gas phase bromine are only sustained in the presence of sunlight since the recycling process on sea-salt/ice/snow needs of the uptake of oxidized bromine (e.g. BrONO2, HOBr, BrONO) which in the gas phase will only form via reactions with BrO and Br, both of which have a photochemical nature. Therefore, if gas phase bromine is present throughout the summer and its recycling, as for iodine, needs sunlight, when the polar night arrives all this bromine will presumably, as hypothesized for iodine, also be deposited and concentrated in the early winter snow strata. However, the bromine record does not show this. The question then is where does the bromine go in winter?

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 8185, 2014.