Review of Bromine, iodine and sodium in surface snow along the 2013 Talos Dome – GV7 traverse (Northern Victoria Land, East Antarctica)

This paper scrutinizes the seasonal cycles of sodium, bromine, and iodine in 7 shallow cores (2 m long spanning the 2010-2014 years) drilled in East Antarctica. The data are discussed with respect to sea-ice halogen sources. Data on bromine and iodine in snow and ice are very welcome since they are still rather rare and are potentially interesting for a better understanding of the halogen chemistry at high southern latitudes in the past, for instance.

However, major revisions of the manuscript are needed before I can recommend publication. The first major problem is that there are too many statements in the text that are not correct or oversimplified. Also the problem is that the manuscript totally ignores several relevant atmospheric studies conducted in Antarctica. Finally, in the discussion of data (figures 4 to 7) it would be nice to show not only the EF values but also the excess bromine relative to sodium with respect to seawater (or sea-salt aerosol) composition (see below).

Line 38-51: You should better explain to the readers how the examination of the bromine enrichment possibly helps to reconstruct sea-ice extent? Several atmospheric studies showed that not only sea-ice related processes (that are still not fully understood) but also open-ocean sea-salt emissions are important for the bromine chemistry (please cite Sander et al., 2003; Yang et al., 2005). Also relevant to your work is the recent atmospheric study conducted (JGR, 2016) at the coast and inland in the same East Antarctic region. In this study, both surface data and satellite observations indicate that in this region whereas the bromine chemistry is indeed maximum in spring, there is only a factor of two differences or less between spring and summer (suggesting again the importance of open ocean emissions in summer). This JGR paper also clearly showed that gaseous bromine species (that are water soluble and will be trapped in snow) largely dominate bromine aerosol. These gaseous species are likely responsible for the observed bromine enrichment in snow. Their atmospheric lifetime is far longer than the aerosol one due to a fast recycling on various surfaces (aerosol, snow grain). Therefore I have difficulty to understand the relationship between bromine enrichment in snow and the sea-ice extent ? For instance, whereas you mentioned in line 64 the noise introduced by transport in using sodium to reconstruct sea-ice, you have also to mention that since the bromine enrichment is related to gaseous species, the non irreversible trapping of the bromine species in snow would strongly handicap their use as proxy of sea-ice: please comment and cite Thomas et al. (2011).

Sander, R., et al. (2003), Inorganic bromine in the marine boundary layer: A critical review, Atmos. Chem. Phys., 3, 1301–1336, doi:10.5194/acp-3-1301-2003.

Yang, X., R. A. Cox, N. J. Warwick, J. A. Pyle, G. D. Carver, F. M. O'Connor, and N. H. Savage (2005), Tropospheric bromine chemistry and its impacts on ozone: A model study, J. Geophys. Res., 110, D23311, doi:10.1029/2005JD006244.

Legrand, M., X. Yang, S. Preunkert, and N. Theys (2016), Year-round records of sea salt, gaseous, and particulate inorganic bromine in the atmospheric boundary layer at coastal (Dumont d'Urville) and central (Concordia) East Antarctic sites, J. Geophys. Res. Atmos., 121, doi:10.1002/ 2015JD024066.

Thomas, J. L., J. Stutz, B. Lefer, L. G. Huey, K. Toyota, J. E. Dibb, and R. von Glasow (2011), Modeling chemistry in and above snow at Summit, Greenland-Part 1: Model description and results, Atmos. Chem. Phys., 11, 4899–4914, doi:10.5194/acp-11-4899-2011.

Line 57 : You should cite here the atmospheric study conducted by Grilli et al. (2013) that showed a less active iodine chemistry in East Antarctica compared to the case of west Antarctica (Saiz-Lopez et al., 2007). Such a difference should enhance the motivation to examine iodine in snow throughout Antarctica (west and East).

Grilli, R., M. Legrand, A. Kukui, G. Méjean, S. Preunkert, and D. Romanini, First investigations of IO, BrO, and NO_2 summer atmospheric levels at a coastal East Antarctic site using mode-locked cavity enhanced absorption spectroscopy, *Geophys. Res. Lett.*, 40, 1-6, doi:10.1002/grl.50154, 2013.

Line 61-67 : As far as I know, the pioneering finding of a correlation between sea-ice and MSA in snow from Curran et al. (2003) was never clearly confirmed by more recent snow studies. Furthermore, several atmospheric studies reported no evidence of such a link at the decadal scale (Weller et al., 2011; Preunkert et al., 2007).

Weller, R., D. Wagenbach, M. Legrand, C. Elsässer, X. Tian-Kunze, and G. König-Langlo (2011), Continuous 25-years aerosol records at coastal Antarctica: Part 1. Inter-annual variability of ionic compounds and links to climate indices, Tellus, Ser. B, 63, 901–919, doi:10.1111/ j.1600-0889.2011.00542.x.

Preunkert, S., M. Legrand, B. Jourdain, C. Moulin, S. Belviso, N. Kasamatsu, M. Fukuchi, and T. Hirawake, Interannual variability of dimethylsulfide in air and seawater and its atmospheric oxidation by-products (methanesulfonate and sulfate) at Dumont d'Urville (Coastal Antarctica) (1999-2003), *J. Geophys. Res.*, 112, doi:10.1029/2006JD007585, 2007.

Line 68-71 : Why do you introduce a discussion on post-depositional effect here ? The existence of post-depositional effect would have no effect on decadal or centennial scales.
Why "in particular Greenland" ? Please see and cite the recent work from Olivia Maselli (special issue in CP)

Maselli, O. J., Chellman, N. J., Grieman, M., Layman, L., McConnell, J. R., Pasteris, D., Rhodes, R. H., Saltzman, E., and Sigl, M.: Sea ice and pollution-modulated changes in Greenland ice core methanesulfonate and bromine, Clim. Past Discuss., doi:10.5194/cp-2016-49, accepted, 2016.

Line 179 : This number surprises me : 80% ? To what are related the missed (non sea-salt) sodium source that you consider to account for up to 20 % ? I don't think that the crustal source is large enough (at least for present-day climate), see and cite Weller et al. (2008).

Weller et al., Seasonal variability of crustal and marine trace elements in the aerosol at Neumayer station, Antarctica, Tellus 60B, 742-752, 2008.

Line 201-204, please also cite the atmospheric study from Wagenbach et al. (1998)

Wagenbach, D., F. Ducroz, R. Mulvaney, L. Keck, A. Minikin, M. Legrand, J. S. Hall, and E. W. Wolff (1998), Sea-salt aerosol in coastal Antarctic regions, J. Geophys. Res., 103, 0,961–0,974, doi:10.1029/97JD01804.

Section 3.2: Please report excess bromine either as Br - 6.2 10^{-3}*Na (or with error calculation Br – 8 10^{-3}*Na in winter and use brome depletion factor in aerosol taken from Sander et al. 2003 or Legrand et al. 2016 for spring and summer).

Line 288-292: Not sure that this is right: at least for bromine the homogeneity is also related to the atmospheric lifetime.

End of the review