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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Longpath DOAS observations of surface BrO at Summit, Greenland" *by* J. Stutz et al.

Anonymous Referee #1

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The authors report on LP-DOAS measurements of surface BrO made at the Summit research station (at 3200m) on the Greenland ice sheet during May/June 2007 and June/July 2008. They have identified periods during which air resided on the ice sheet for at least 3 days before arriving at Summit to investigate if BrO could be released locally from photochemical reactions in snow, rather than through transport of bromine rich air masses. Their observations and analysis suggest that local photolytical formation of reactive bromine at the surface can explain the BrO mixing ratios observed by the LP-DOAS. They furthermore theorize that the observed diurnal profile is caused by two competing effects which are the boundary layer evolution and photochemistry; they conclude that while the amount of BrO released is driven by solar radiation, the concentration is additionally modulated by the boundary layer height. Marine transport events have also been observed but they are understood to be rare and therefore the

observed enhanced surface BrO is not just transported there – indeed a very interesting result!

To summarize further: The authors conclude that while the photochemistry in snow is the major source for the BrO measured at Summit (meaning that reactive bromine is formed locally), it is not yet known how bromine is originally transported to the center of the Greenland ice sheet. The closest (and only?) source of bromide is the ocean around Greenland and the authors speculate that air rapidly transported from the marine boundary layer could deliver bromide to the surface at Summit – but as quoted above they also say (Page 6708, line 28): "However, marine transport events are rare and most likely not the main source of bromide in surface snow at Summit." A bit of a contradiction, right? Since their analysis shows that air masses with a clear marine origin were rare during the two campaigns, this raises the rather important question if during other times of the year the transport from the marine environment could be more frequent and could be responsible for replenishing the bromine content in the snow. It would help the discussion if the authors could provide more information on the topic if transport of marine air to Summit is more frequent during most of the year or if May-July display a typical behaviour in this regard. The bromine needs to come from somewhere and it certainly is vital to exclude the possibility (although rather unlikely) that it is introduced by anthropogenic activities around the Summit station (see comment SC C619).

Overall, this paper is a very well written, the observations and analysis are convincing and the content is clearly of scientific interest. The manuscript is certainly suitable for publication in ACP.

Specific comments:

Page 6711, lines 3 & 10-11: Explain what GSHOx stands for when first mentioned

Page 6714, line 15: typo: . . . Dispersion Model . . ..

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11, C2596–C2598, 2011

Page 6719, lines 19-20: Could you add some refs for the CH3Br and CH3I measurements or a very brief explanation how they are measured?

Page 6720, line 4: Delete space after 'decrease'

Page 6720, line 11: Change 'Fig/' to 'Fig.'

Figure 2: This looks very convincing for around 3 ppt but how does the absorption structure look for say 1 ppt? Where is the measurement threshold so you can still comfortably recognize the measured BrO absorption?

Figure 3: top 2 panels: The text inlay (2007: LP-DOAS etc.) covers the highest data points in panel B, why not move it slightly higher since the ticks on the x-axis are anyway covered.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 6707, 2011.