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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Retrieval of stratospheric and tropospheric BrO columns from multi-axis DOAS measurements at Reunion Island (21° S, 56° E)" *by* N. Theys et al.

N. Theys et al.

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Theys et al. provide evidence for BrO in the free troposphere above Reunion Island. As far as I can judge, their analysis of their measurements is sound, and I recommend publication in ACP after a few minor changes:

Referee comment: Photolysis of short-lived halocarbons provides a plausible explanation for the occurrence of BrO in the free troposphere. However, an alternative would be direct upward transport of inorganic bromine (see e.g. Yin et al., Atmos. Chem. Phys., 1, 19-36, 2001). Although this is briefly mentioned in the introduction, it is not further discussed in the paper. Based on your measurements, are there any clues that support either one of these possibilities?

Reply: Not really. Our observations provide evidences for a substantial amount of inorganic bromine being present in the free-troposphere well above the boundary layer, however it is difficult to convincingly argue on the origin of this free-tropospheric background. Nevertheless we tend to believe that if inorganic bromine were to be predominantly transported upward from the boundary layer, one should observe larger quantities closer to the surface (see discussion below).

Referee comment: You show that you cannot see evidence for BrO in the boundary layer. It would be very interesting to see what upper limit you can assign to the BrO mixing ratio here, based on the uncertainties of your measurements. Can you rule out any importance of boundary-layer BrO, or are mixing ratios around a ppt still possible?

Reply: We have performed a sensitivity test by considering a 1-km thick boundary layer with 1 ppt of well-mixed BrO during daylight (SZA$<80^{\circ}$), corresponding to an extra tropospheric BrO column of about 0.25 x 1013 molec/cm^2. Since in our measurement setup the sensitivity to boundary layer BrO varies with the viewing direction (see Figure 10), one expects that under these conditions the off-axis BrO DSCDs measured at 3° elevation would exceed the zenith-sky DSCDs by about 3.5 x 1013 molec/cm^2. Such an enhancement is definitely not observed (cf. Figure 6), however one cannot exclude a possible enhancement in the range of approximately 1 x 1013 molec/cm^2. Accounting for the fact that the oceanic boundary layer can be thinner than 1 km, we come to an upper limit of approximately 0.5 ppt of BrO in the boundary layer.

Referee comment: Introduction: A reference that could be used when referring to polar ozone depletion events is the recent review paper by Simpson et al. (Atmos. Chem. Phys. Discuss., 7, 4285-4403, 2007).

Reply: The reference to Simpson et al. has been added in the text.

Referee comment: Page 8280, line 12: Did you mean “sparse” instead of “spare”?

Reply: Yes. This typo has been corrected.

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Referee comment: Hendrick et al. has been published in ACPD and can be moved from the footnote into the list of references.

Reply: Done

Referee comment: Check spelling of Ny-Ålesund in the title of Wittrock et al. (2004).

Reply: We agree with the referee comment and we have made the changes in the text.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 8261, 2007.

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Interactive Comment