

Interactive
Comment

***Interactive comment on* “Enhanced tropospheric BrO concentrations over the Antarctic sea ice belt in mid winter observed from MAX-DOAS observations on board the research vessel Polarstern” by T. Wagner et al.**

Anonymous Referee #4

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This manuscript describes MAX-DOAS measurements of tropospheric BrO made during a cruise through first year sea ice during the Antarctic winter 2006. Enhanced tropospheric BrO was, apart from one exception, continuously observed for a two month period when the ship was within the sea ice area, while outside the sea ice belt mostly only low BrO concentrations were observed. The paper also includes a detailed discussion of modelled MAX-DOAS AMFs which are important for the proper interpretation of the observed slant columns. The authors put quite some emphasis on discussing the advantages of ground-based MAX-DOAS observations compared to satellite ob-

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servations and point out why ground-based MAX-DOAS is an important tool for the observations of tropospheric bromine explosion events. The important findings of this study are in short: First, enhanced tropospheric BrO was observed one month earlier than had been previously observed by satellite; second, RT simulations indicate that MAX-DOAS observations are about an order of magnitude more sensitive compared to satellite observations; third, since the sensitivity of MAX-DOAS observations does hardly decrease with large SZA and low albedo, they are very well suited for observing enhanced BrO concentrations in the polar boundary layer. The paper is overall well written and presents some important new results.

Specific & technical comments:

Title: I am really struggling a bit with the title, specially the "..observed from MAX-DOAS observations .. "; how about a shorter approach such as: "Enhanced tropospheric BrO over Antarctic sea ice in mid winter observed by shipborne MAX-DOAS"

Page 1824, lines 20-21, abstract: "Furthermore, combination of both techniques .. " This has not been investigated in the manuscript any further and could be part of the conclusions but shouldn't be in the abstract.

Page 1825, lines 25-29: "remain" should come straight after "questions", not at the end of the sentence.

Page 1828, line 12: "glass fibres", should be "quartz fibres" ??

Page 1834, line 5: additional space between O4 and deltaSCDs.

Page 1834, lines 3-10: Can you speculate why there are times when the near surface BrO is low? Backtrajectory calculations to determine the origin of the observed air mass should be a useful tool to help explain this further. These calculations would also be a very helpful addition for the interpretation of the data set in general and I recommend that the authors should at least look into the possibility to add this to the analysis to strengthen their interpretation of the results.

Page 1834, line 8: could remind the reader here what the dates are for the whole period (24 June to 15 August).

Page 1834, lines 16 & 20: dates should be used in a consistent way throughout the paper.

Page 1834, 1 para.: Based on Figure 4, only on 7 July was very low tropospheric BrO observed for the whole day. The authors state that "Days with such large errors include the 6, 7, 11, and 13 July, when the optical density of the residual was up to 3%". Could you put the 3% residual in perspective to the optical density of BrO measured on 7 July? Since this is the only day when low BrO was observed within the sea ice region, is the retrieval quality good enough that this value really holds up??

Page 1836, 21-23: This statement in the conclusion and abstract is quite strong ("we find that MAX-DOAS observations.. ") while caption of Fig. 1 rather says "Our results indicate that.. ". Are you really sure that you can make the strong statement in the conclusion and abstract based only on this one case study (although admittedly a rather convincing one)?

Fig. 4d: The amount of BrO changes a lot during the two months period. It would be very interesting to see this further investigated. As mentioned above, a study where the observed air mass originates from and how long it has spent in close proximity to the sea ice should help to understand the fluctuations in BrO better.

It would also be very interesting to look at in-situ ozone measurements to define if the large tropospheric BrO values coincide with ozone depletion events. If in-situ ozone data is available then this would be a great addition to the results presented here and should really be included in this paper.

Some of the labels/axis captions in Figures 1,2,3 are quite small; they are readable but if they could be enlarged somewhat that would improve the figures, especially Fig. 3.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 1823, 2007.