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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Ground-based measurements of tropospheric and stratospheric bromine monoxide above Nairobi (1° S, 36° E)" *by* S. Fietkau et al.

Anonymous Referee #3

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Comments on " Ground-Based measurements of tropospheric bromine monoxide above Nairobi (1°S, 36°E) " by S. Fietkau et al.

The paper displays the first full year of BrO column available at an equatorial site, indicating a diurnal variation pm/am slightly smaller than at mid-latitude, little of no seasonal variation, and a value similar to that of the summer at mid-latitude in both hemispheres. Photochemical calculations are shown consistent with this but when including the daytime reaction BrONO2 + O3P available in the most recent NASA/JPL compilation, although still underestimating the total column by 25%. The tropospheric BrO burden is found relatively small (4-7.5 e12 mol / cm2) corresponding to an average

MR of 0.5-1 ppt.

Comments This is certainly good results worth publishing. However there are a number of short cuts or specific points requiring further improvements and discussion before being acceptable for publication.

Listed below are a series of topics requiring clarification as well as recommendations for the writing, which could be of some help.

Instrument / data analysis Complete lack of error analysis. Unacceptable for an experimental paper. Cannot accept 20% without any discussion. Distinction between precision and accuracy.

Observations Noise: What could be the causes of noise on BrO (Fig1) but also on NO2 (Fig 3) exceeding by far the precision of the measurements of the species.

Is Fig 2 really needed? What do we learn?

Seasonal variation No or little? Give a figure of amplitude $<$ 1 e13 or 5% Suggest adding monthly means (those shown in Fig 5) in Fig 2. Same for NO2. NO2 displays a significant seasonal variation (7 e14, 20%) BrO should be anticorrelated with this. Since not, suggest that part of NO2 is tropospheric. NOx pollution from Nairobi related to seasonal variation of surface wind direction? Information available from MaxDOAS ?

Arpag, very surprising. In contradiction with all other measurements. Requires comments.

Reunion Island not very convincing. Not full year available particularly the winter period, when NO2 is minimum. Disagreement with SCIAMACHY.

Reference to GOME and SCIA seasonal variation required.

Modelling Since NASA/JPL 2003 is used, the few exceptions which could impact Br chemistry should be given, particularly the details BrONO2 + O(3P) since it's one of the

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most important findings. What is the difference between climatology (from where?) and ECMWF (2003 I assume)? Probably very limited. Main change coming from BrONO2 + O(3P) Suggest remove Clima from Fig 4 and Fig 5. Describe Fig 4 first Fig 5 Would be easier to read if obs by markers and model by lines. But still 25% remaining difference between obs and model: measurements error? J BrONO2 (albedo in SCIATRAN?), BrONO2 + O(3P) (how much change in reaction rate to reconcile model with obs). Discussion needed.

Troposphere Data analysis: selection criteria for good weather? Fig 7. Seems to show sr, noontime and ss max. Suggest plot in local time instead of SZA Profile Max around 2.5 km msl, 1 km above station, low concentration near surface. Influence of pollution in PBL? Known to be quite high at Nairobi. Indications from NO2 MaxDOAS ?

Writing

Introduction P 6529, l 8 By mid-2004, the total tropospheric organic bromine reduced byĚ..below its peak value in 1998. P 6529, l 23, In the stratosphere Ě.

P 6530, l 8, new § Still in the stratosphere, the seasonal variation of twilight BrO at mid-latitudesĚ P6530, § 2 In the troposphere, significant amountsĚ

P6530, last 3 lines to p 6531 first 3 lines. I suggest remove them. The objective of starting measurements at Nairobi is clear enough. No need to insist.

P6530, §2, since satellite data are not used, I suggest to remove also.

P6535, l8, include addition of BrONO2 + O3P here.

Stratospheric BrO

Fig 1-3 (use of fig 2?) Describe first the figures before discussing the results: amplitude and possible reason for noise, seasonal variation (add monthly means + sigma perhaps on another fig). Amplitude smaller than errors? I don't understand what do you mean. Random error (precision)? If yes, monthly average should improve the comparison.

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Discussion a) amplitude of diurnal variation similar or slightly smaller to mid-latitude b) absence of seasonality compared to mid-and high latitude c) comparison of total amount compared to mid-lat summer in both hemispheres and tropics

Note that Reunion Island is tropical, and Nairobi equatorial. Better use the last term when you refer to Nairobi.

Comparison to photochemical model simulations Climato / ECMWF. Not very informative. See comments above. Essential : addition of BrONO2 + O3P. Sensitivity tests (Sinnhuber 2002) Which rate constants ? What are the most sensitive reactions for BrO ?

P 6538, l6 fit errors: random errors? L 15-16 confusion between tropics and equator. End of §, conclusions: Model fine with obs if BrONO2 + O3P included, better if reaction rates (which?) changed.

Troppospheric BrO P 6538, l25 Vertical sensitivity, not appropriate term P 6541 l5, 2-3 km above msl, 1 km above station. Comparison with Kiruna of little meaning.

Summary P 6541, l22 .. lack of seasonality of NO2: that's not what does the plot show P6542, l7, suggest to repeat here the amplitude of the increase 20%am, 10 % pm

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Interactive comment on Atmos. Chem. Phys. Discuss., 7, 6527, 2007.