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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Impact of reactive bromine chemistry in the troposphere" *by* R. von Glasow et al.

Anonymous Referee #0

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Review of acpd-2004-0113, Impact of reactive bromine chemistry in the troposphere, von Glasow et al.

The paper presents a useful discussion of the impacts of tropospheric reactive bromine focussing on the impacts on ozone destruction and the oxidation of DMS. An interesting sensititvity approach has been used to investigate the impacts of various bromine spatial distributions using a global CTM run at moderate T10 resolution. The paper appears well balanced and presents an important study of the global impacts of halogen chemistry. The language is clear and the points well-argued. It makes a valuable contribution to the understanding of atmospheric halogen cycling and reinforces the necessity to further explore halogen chemistry at low concentration levels.

The first useful finding in the paper is that a 10x faster recycling mechanism better

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represented the measured bromine column concentrations - so this was used in the majority of model runs. The predicted inorganic bromine trends in all simulations are logical and this leads to the conclusion that stratospheric input plus CH3Br photolysis at reasonable levels are insufficient to explain the observed tropospheric BrO column and zonally averaged 24 hour mixing ratio: it would be useful to know by how much the stratospheric inorganic source and / or CH3Br input had to be increased to match the observed quantities.

The ozone destruction in all simulations is significant, with very high losses when the simulated BrO levels closely match the observations (up to 40% local destruction and 6 to 18% zonal annual average). This represents a very important neglected ozone sink; strongest in the southern FT and smallest in the northern lower levels. Tropospheric ozone burden is reduced significantly in all cases.The OH:HO2 ratio is increased significantly in all runs, leading to some of the reduced ozone concentration by reducing its production. This effect is greatest at higher latitudes and is associated with widespread reduced HO2 levels and increased FT OH concentrations. Tropical OH production is, however reduced by ozone redution, offsetting most of the OH increase due to the BrO + HO2, HOBr photolysis chain here. H2O2 reduction associated with HO2 reduction may reduce SO2 oxidation - though this may be offset by hypohalous acid oxidation channels. Effect on the NOx ratio is generally modest due to competing NOx reduction due to Br chemistry but perturbation to the photostationary state due to ozone reduction. The effect is only significant in the stratosphere and high latitude upper troposphere.

The next major effect explored was the oxidation of DMS. A cloudy MBL reduction in CCN forming potential and increase in soluble mass by condensation & presumably in-cloud oxidation will reduce both the first and second indirect radiative effects. The DMS burden was variable due to the emission sources and variability in BrO. It was found that the effect of halogen chemistry on DMS was significant at low BrO levels. This will lead to overestimated prediction of CCN number if halogen chemistry is neglected

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and underestimated DMS flux if this is calculated using atmospheric oxidant chemistry without BrO.

My only major criticism of the work is that, although it presents a significant improvement over simulations with a prescribed halogen field, the predicted halogen field will not include a major source - that of seasalt aerosols. This source will increase the concentration of reactive gaseous halogens and will therefore change the scenario which best fits observations. This should be discussed further.

Specific Comment: p4885 lines 17 to 23 - the sentence is overly long and difficult to read. It should be broken down into several sentences or punctuated more appropriately

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Interactive comment on Atmos. Chem. Phys. Discuss., 4, 4877, 2004.

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