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Release of reactive halogenated species from sea-salt aerosols under arctic and tropospheric conditions in smog-chamber experiments

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Recent field experiments and laboratory studies show that atomic Br and Cl are produced from sea salt aerosols in NO_x poor periods; e.g. during Arctic spring. The halogen release is based on the uptake of gaseous HOX (e.g. HOBr) on aqueous, acidified salt surfaces. Br and Cl, once mobilized to reactive gaseous forms, play an important role in atmospheric ozone depletion and destruction of hydrocarbons.

Aerosol smog chamber facilities at lowered temperature (down to -28˚C) enable us to simulate the halogen release mechanism under arctic and tropospheric conditions.

In the presence of ozone and HCl, Cl_2 can be produced heterogeneously on glass walls [1]. To avoid this wall reaction, our experiments were performed in a teflon (FEP 200A, Dupont) smog chamber (3500 l), which is installed in a coolable laboratory at Bayreuth. The salt aerosols are generated by atomizing salt solutions containing the typical Br/Cl ratio of 1/660 in seawater and increasing the Br content up to sixfold. OH-radicals were produced by photolysis of ozone, the initial ozone concentrations were in a range of 300 to 500ppb. To ensure the aqueous surface of the aerosols, the experiments were performed at relative humidities above 76%.

The Cl- and OH-radical concentrations ($2x10^6$ $<[OH]<6x10^6 cm^{-3}$respectively ($2x10^4$ $<[Cl]<1x10^5$ cm^{-3}) were determined from the simultanous consumption of 4 reference compounds with well-known OH- and Cl-rate constants and an inert standard (perfluorohexane). The Br-radical concentration was calculated on the basis of

the ozone depletion; from our experiments we evaluate a value of [Br] = 1-2 ppt.

The dependence of radical concentrations on illumination, temperature and on the concentration and composition of the salt solution will be presented.

[1] W. Behnke, C. Zetzsch (1989), Smog chamber investigations of the influence of NaCl aerosol on the concentration of ozone in a photosmog system, Proceedings of International Ozone Symposium 1988, pp.519-523.