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Interactive comment on "Halogen cycling and aerosol pH in the Hawaiian marine boundary layer" *by* A. A. P. Pszenny et al.

R. von Glasow

roland@fiji.ucsd.edu

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Pzsenny et al. discuss the difficulties in reproducing the measured diurnal variation of the bromide enrichment factor in sea salt aerosol with a numerical model. The bromide enrichment factor (EF) is defined as the ratio of Br^- to Na^+ in the aerosol compared to the same ratio in seawater. Models usually predicted a maximum in the Br^- EF during day whereas measurements showed it to peak around sunrise. Pszenny et al. mention von Glasow et al. (2002) who found that the presence of clouds changes the diurnal variation of Br^- in the sea salt aerosol. In a recent modeling study (von Glasow and Crutzen, submitted to ACPD) we obtained diurnal variations of the EF that are similar to those in measurements even in cloud-free cases. The important difference in these cases is that the overall Br^- EF is significantly smaller.

When our cloud-free model runs have a very high bromine deficit, implying that most of the bromine is in the gas phase, then the diurnal variation of sea salt Br^- is mainly determined by exchange processes between particulate phases and the gas phase and Br^- shows a peak during day and a minimum during night. Under conditions when the multiphase catalytic cycles are not as efficient due to lower gas phase acidity, lower gas phase O_3, and/or higher temperature, then the additional bromide from the emission of fresh sea salt is not as rapidly released and accumulates over night in the sea salt aerosol and is depleted during day. This leads to a reversed diurnal variation in sea salt aerosol Br^- and bromide EF.

It would be very interesting to see if Pszenny et al. can reproduce this diurnal cycle as well if they forced their model to a smaller loss of bromide from the aerosol. From their figures I could not tell how big the "bulk" Br^- EF was but from their figure 6 I had the impression that the diurnal variation of the Br^- EF changed a little towards the "correct" one in scenario M1.

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