Interactive comment on “The tropospheric processing of acidic gases and hydrogen sulphide in volcanic gas plumes as inferred from field and model investigations” by A. Aiuppa et al.

Anonymous Referee #1

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This is a good paper that warrants publication in ACP. The authors find that SO2/HCl, SO2/HF, and SO2/H2S ratios are independent of time as the plume ages, suggesting that SO2, HCl, HF, and H2S are all unreactive under plume conditions. This finding is surprising for H2S, which would be expected to decay rapidly under model plume conditions by reaction with Cl atoms. There is little doubt that the Cl + H2S reaction is very fast. The authors find that regeneration of H2S from SH + HBr, while an important reaction under plume conditions, cannot maintain the observed H2S concentration (in model simulations) in competition with the expected fast loss of H2S by reaction with Cl. It seems that actual Cl levels must be much lower than those generated in the model. It would be worthwhile for the authors to add a paragraph summarizing the possibility...
(or lack thereof) that reaction with organics could be driving down the Cl concentration. Once the plume cools below about 150 °C, organic peroxy radicals become stable and chain regeneration of Cl should become inefficient. Hence, if levels of organics are comparable to levels of H2S, they could rapidly drive down the Cl concentration. As the authors point out, the observation of significant levels of ClO in the plume is a problem unless levels of both O3 and NO (which interconvert ClOx radicals) are extremely low. This appears to be the case for O3 but I’m not sure about NO.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 11653, 2006.