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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

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(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 ClO_x 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.

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