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Modelling the regional impact of volcanic bromine using WRF-Chem

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Volcanoes are known to be a geochemically important source of halogen species into the troposphere. Spectroscopic investigations have detected high levels of reactive bromine within volcanic plumes, and measurements have shown in-plume ozone depletion. Both of these phenomena are believed to be the result of complex bromine chemical cycles involving heterogeneous and photolytic stages.

The impacts of this chemistry on regional scales are largely unknown. We present results from a regional three-dimensional WRF-Chem model where we have added a volcanic source of bromine and incorporated bromine reactions to the chemical mechanism.

Mount Etna, Europe's most active volcano, has been used as a case study. The intensity and composition of Etna's emissions are known to vary considerably over time, and we present results showing how the regional impacts vary with these parameters. Additionally we present results demonstrating how the variation in meteorological conditions can perturb the in-plume bromine chemistry. While in-plume ozone destruction is the most striking result, model results also show the potential for volcanic bromine to perturb tropospheric NO_x and HO_x chemistry.