



First detection of Cl₂ in the volcanic plume from Mt. Etna

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Degassing volcanoes are large local sources of atmospheric halogens including chlorine species. Chlorine emissions from degassing volcanoes may affect methane oxidation in the troposphere, while their injection into the stratosphere may cause ozone destruction.

Here we present new mass spectrometric in-situ measurements in the outgassing plume from the Sicilian volcano Mt. Etna. On 29 and 30 September 2011 during the CONCERT2011 campaign, the trace gas and particle composition of the Etna plume was probed with instruments onboard the DLR research aircraft Falcon. Elevated concentrations of chlorine and bromine species, as well as gaseous SO₂ and HNO₃ were detected with two Atmospheric chemical Ionization Mass Spectrometers (AIMS) onboard the Falcon. Here we focus on the detection of molecular chlorine within the young volcanic plume. Up to several nmol/mol Cl₂ and about an order of magnitude higher HCl mixing ratios were measured. The ratio of these two chlorine compounds and its evolution over 12 hours plume age are investigated. We speculate that the molecular chlorine had been injected directly by the Etna or had formed heterogeneously on sulphate aerosol and on coated volcanic ash particles within the plume.

To our knowledge, these are the first atmospheric observations of Cl₂ within a volcanic plume. The detection of molecular chlorine could promote new laboratory measurements of the reaction rates of chlorine species on coated volcanic ash particles. Further our data provide an input to microphysical and photochemical models. These may help to answer questions related to methane oxidation in regions, which are affected by volcanic emissions.