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Observation of halogen oxides in volcanic plumes at Different Plume Ages

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Ground based remote sensing measurements in the near UV and VIS using Differential Optical are now a standard tool to assess information of volcanic emissions. Next to the detection of sulphuric dioxide (SO_2), the technique also allows detection of halogen oxides (e.g. BrO, ClO and OClO), which are secondary, chemical products of primarily hydrogenated halides. These products have a great impact on atmospheric chemistry due their high reactivity and their contribution to ozone destruction cycles. The fastest reaction cycle involves Bromine and is analogous to the polar "Bromine Explosion" and observed Ozone Depletion Events. By using chemical models, one can relate these measurements to the primary constituents and gain insight into volcanic processes as well as determine the impact of volcanic emissions on the atmosphere.

To study ongoing chemistry in volcanic plumes, dilution and dispersion of the plume can be compensated by taking the ratio of a chemically inert tracer species to reactive compounds. SO_2 can be used as an approximate tracer for common plume ages studied (hours). Simultaneous measurements at several different distances from the crater and thus different plume ages (2 to 60 minutes after emission) have been performed in extensive campaigns in July 2008 and 2009 at Mt. Etna, Italy. Although models show a continuous raise of BrO/SO_2 ratio, our data fails to show the predicted increase in ratio as the plume grows older.