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Coincident observations of SO2 and BrO from volcanic eruptions by the GOME-2 instrument

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Bromine monoxide (BrO) plays a key role as a catalyst in the depletion of both, tropospheric and stratospheric ozone (O_3), e.g. during springtime in polar regions. In addition to sources like salt lakes or the surface of sea ice in polar regions, volcanic emissions are a further natural source of BrO. Injections of volcanic BrO into the troposphere by degassing volcanoes, or into the stratosphere during a major eruption, are therefore very likely to have an important impact on atmospheric chemistry. Since the first observation of BrO in the volcanic plume of Soufrière Hills in 2002 by ground-based Multi-Axis Differential Optical Absorption Spectroscopy (MAX-DOAS) measurements, similar observations have been made at several volcanoes worldwide. After the eruption of the Kasatochi volcano in 2008, large amounts of volcanic BrO were also detected for the first time by a satellite instrument (GOME-2). The capability of GOME-2 to monitor such events allows the examination of entire volcanic plumes on a much larger scale than is possible using ground-based measurements.

We present results from a study of all volcanic eruptions that were monitored by the GOME-2 instrument during the period between January 2007 and June 2010, and in which both sulfur dioxide (SO_2) and BrO were observed in the vicinity of the volcanic plume. The resulting slant column densities (SCDs) for SO_2 and BrO are investigated for a possible correlation and the BrO/SO_2 ratios are discussed. Unlike what has been reported from ground-based measurements alone, a close correlation between SO_2 and BrO appears to occur only for some of the observed eruptions, or only for certain parts of the examined volcanic plumes. Ideas are presented which try to explain the occurrence of different spatial SO_2 and BrO distributions in aged volcanic plumes.