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Monitoring of volcanic SO2 emissions using the GOME-2 satellite instrument

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Volcanic eruptions are a major hazard to the local population near large volcanoes and to aviation, they also play an important role in global climate change. Atmospheric SO2 is an important indicator for volcanic eruptions and volcanic activity like passive degassing. Space based atmospheric sensors like GOME-2 on MetOp and OMI on EOS-Aura make it possible to detect the emissions of volcanic SO2 in near-real time (NRT) and monitor volcanic activity and eruptions on a global scale. This is important as satellites are often the first, and sometimes the only, source of information on volcanoes in remote locations because ground based monitoring of volcanic gases with MAX-DOAS, COSPEC or direct gas measurements is carried out only for a limited number of volcanoes.

The GOME-2 instrument on the satellite MetOp provides operational measurements of the SO2 columns with a spatial resolution of 80x40 km^2 and a global coverage within about one day. Volcanic sulfur dioxide emissions are determined from solar backscatter measurements in the ultra-violet spectral range between 315 - 326 nm, applying the Differential Optical Absorption Spectroscopy (DOAS) method. This retrieval technique uses the high spectral resolution of the instruments to determine the total column density of SO2. With GOME-2 it is possible to detect and track volcanic eruption plumes in near-real time (NRT), which makes it a valuable tool for aviation warning, as SO2 can be used as a tracer for volcanic eruption plumes that are hazardous to aircraft. The ability to monitor changes in volcanic degassing behavior is of great importance for early warning of volcanic activity, as large increases in SO2 fluxes are often an indicator for new episodes of volcanic unrest.

In this contribution, we present exemplary results of volcanic SO2 retrieved from GOME-2 data using the Differential Optical Absorption Spectroscopy method, including analyses for recent volcanic eruptions and volcanic degassing events detected by GOME-2. We will present the use of the operational GOME-2 SO2 data for early warning of volcanic hazards within the Aviation Control Support Service and within a new Volcano Fast Response System (Exupéry) that includes both ground-based and satellite observations.