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# Satellite monitoring of volcanic SO2 emissions within the Volcano Fast Response System (Exupéry)

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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 such as 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.

The GOME-2 instrument 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 instrument to determine the total column density of SO2. 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.

Ensembles of backward trajectories using the FLEXTRA model are applied to relate exceptional SO2 values to particular sources or regions and hence attribute them to a volcanic or anthropogenic origin. Trajectory density maps give an overview of the most probable location of the emission source. Additionally, the moment of the eruption as well as the emission and the plume height can be estimated. Hypothetical forward trajectories starting at potentially active volcanoes allow forecasting the dispersion of volcanic SO2 and ash depending on the emission height in case of an eruption. For validation purposes the dispersion model FLEXPART provides a three dimensional forecast of the plume motion and the transport of SO2 for several days.

The GOME-2 observations of volcanic SO2 are used in a new Volcano Fast Response System (Exupéry) developed within the framework of the German Geotechnology Program that includes both ground-based and space-based measurements of different volcanic parameters. The daily GOME-2 SO2 data as well as hypothetical trajectories and probability density maps are supplied to a database approximately 7 hours after the measurement and displayed in a GIS system that can be accessed by local authorities and observatories to provide additional information in the case of volcanic unrest.

In this contribution we present exemplary results of GOME-2 SO2 observations and the trajectory matching technique for recent volcanic eruptions. Further we will present initial validation results for GOME-2 SO2 data using ground-based measurements in combination with other satellite observations, as well as dispersion modeling. We will focus on the use of the GOME-2 SO2 data and model results within the Exupéry project.