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Modelling of the long-range transport of volcanic SO2 and ash plumes utilising space-based measurements

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Volcanic eruptions and unrest are among the main natural hazards, which influence nature, human beings and climate. Since volcanic ash and trace gases may damage the material and engines of aircrafts, they also affect air traffic. Most of the active volcanoes are not monitored regularly yet. The combination of satellite observations and atmospheric transport modelling can aid to provide global information on the dispersion and transport of ash and trace gases. One of these trace gases is sulphur dioxide (SO2), which is a good marker for volcanic ash clouds.

Within the projects SACS (Support to Aviation Control Service) of GSE-PROMOTE and Exupéry (development of a fast response system for volcanic unrest) SO2 total columns are retrieved from different space-borne instruments (GOME-2, SCIAMACHY and OMI). Relevant parameters such as the location of the emission source, the moment of the eruption as well as the emission height are derived from observations via backward trajectory ensemble matching techniques. Using these parameters the source term for the Lagrangian particle dispersion model FLEXPART is estimated as a first guess. The long-range transport of volcanic SO2 and ash for several days throughout the whole atmosphere as well as for special altitudes is provided. The results have been compared to space-based observations from IASI (Infrared Atmospheric Sounding Interferometer) and AIRS (Atmospheric Infrared Sounder), as well as to ground-based measurements. Furthermore a comparison between the Lagrangian particle dispersion model results and the results of an Eulerian chemical transport model (POLYPHEMUS) using the same source term is shown.

Results for recent explosive eruptions will be presented, such as the Etna eruption in May 2008 and the eruptions of the Okmok and Kasatochi volcano in Alaska in July 2008 and August 2008 respectively.