Geophysical Research Abstracts
Vol. 16, EGU2014-14302, 2014
EGU General Assembly 2014

Radiative transfer effects of high SO_2 and aerosol loads during major volcanic eruptions

Christoph Hörmann, Marloes Penning de Vries, Steffen Beirle, and Thomas Wagner
Max-Planck Institute Mainz, Institute for Chemistry, Mainz, Germany (c.hoermann@mpic.de)

Satellite remote sensing of volcanic emissions nowadays allow to globally track and quantify large plumes after major eruptions. Especially the detection of sulphur dioxide (SO_2) via Differential Optical Absorption Spectroscopy (DOAS) has become one of the most common applications to monitor the input of gaseous volcanic species into the Earth's atmosphere.
While SO_2 can be spectroscopically identified because of its strong absorption bands in the UV, the DOAS method can usually only be applied for optical weak absorbers. However, if the SO_2 loading of the atmosphere becomes very high, which may occur in the course of a strong volcanic eruption, the atmosphere can no longer be considered transparent throughout the commonly used wavelength range of evaluation between 300 and 325 nm. The associated radiative transfer usually results in a strong underestimation of the SO_2 slant column density (SCD), mainly because the solar radiation that is detected by the satellite instruments has only penetrated the outermost layers of the SO_2-rich volcanic plume. In order to overcome this problem, we recently proposed to use a combination of results from the standard and additional alternative fit windows at longer wavelengths (326.5-335 nm and/or 360-390 nm). Here, the SO_2 absorption cross-section is generally weak, but sufficiently strong for the detection of very high SO_2 loads. A first comparison of the results showed that generally a typical relationship can be identified between SO_2 SCDs from different evaluation wavelength ranges. However, occuring differences for some observations can only be explained by the additional influences of large amounts of volcanic aerosols on radiative transfer.
We present first results from a study on the possible characterisation of volcanic aerosol properties and thereby associated impacts of the radiative transfer on the SO_2 DOAS retrieval at different fit windows. Satellite observations of the SO_2 column densities and UV Aerosol Indices (UVAI) by the Ozone Monitoring Instrument (OMI) as well as the Global Ozone Monitoring Instrument (GOME-2) will be analysed and supported by simulations with the Monte-Carlo radiative transfer model McArtim for the volcanic eruption of the Kasatochi volcano in August 2008.