Geophysical Research Abstracts
Vol. 12, EGU2010-11925, 2010
EGU General Assembly 2010

Improving the accuracy of the SO2 camera

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The SO_2 Camera is a novel technique to measure column densities and fluxes of SO_2 emitted by volcanoes using solar radiation scattered in the atmosphere as a light source. The instrument is based on two interference band-pass filters and a UV-sensitive CCD sensor.

A filter centered around 315 nm is used to measure the optical density of SO_2in the plume, whereas a second filter, centered around 330 nm, corrects the effects of aerosol scattering and therefore makes the technique applicable to volcanic plumes containing aerosols. The ability to deliver spatially resolved images of volcanic SO_2 distributions at a frame rate of the order of 1 Hz makes the SO_2 camera a very promising technique for monitoring the evolution of volcanic plumes, the quantitative determination of SO_2 emissions and flux measurements.

This poster explains the measurement principle and how to evaluate data measured with the SO_2camera. Several issues that can influence the measurement are addressed. For one, the change in light path through the stratosphere with changing solar zenith angle changes the spectral distribution measured on the earth's surface. As the absorption of SO_2 is highly dependent on the wavelength of light, these changes can influence the measured column densities. Secondly, as the camera uses scattered solar radiation as a light source, we have to take radiative transfer effects in account. The path between the sun and the instrument is not fixed, as effects like multiple scattering or 'radiative dilution' can occur and lead to an underestimation or overestimation of the SO_2 column density. Recommendations for correcting the individual effects during data analysis are given.

Aside from the above-mentioned intrinsic effects, there are several choices in the technical setup of the SO_2 camera which are discussed. A general description of the instrument's set-up and the camera control software are given. Finally, several measurement examples are shown and possibilities to combine SO_2 camera measurements with other remote sensing techniques are explored. For example, a co-located DOAS system was used to accurately calibrate the SO_2-camera data in real time and to correct for the radiative transfer effects.