New developments in UV imaging for the monitoring of volcanic SO2

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SO2 monitoring is a common technique at many volcanic centres. Recently, automated networks of scanning spectrometers have led to great improvement in frequency and accuracy of measurements. Simultaneously a new instrument has been proposed to acquire 2D images of volcanic plumes in the UV spectrum. This imaging technique (hereafter referred to as UV camera) provides additional contextual information, as well as a quantitative way of determining plume velocity from a single remote location, without relying on weather reports. These advantages are to be balanced with a loss of spectroscopic information when using bandpass filters, leading to reduced precision in the measurements. Following on the work of Kantzas et al., we have designed, built and begun testing a UV imaging system, along with corresponding acquisition and processing software, that combines two CCD cameras equipped with UV filters and a USB2000+ spectrometer.

The cameras acquire simultaneous images of the drifting plume at two different wavelengths. The 310nm filter captures the absorption of UV light by the SO2 molecules present in the plume, while the 330nm filter captures a reference image subject to the broader effects of other gas species and aerosols. The USB2000+ spectrometer is used as a spot check to calibrate the images, acquiring high-resolution spectra in the range 280-400nm. Comparing the SO2 retrieval from the USB2000+ with those from the corresponding pixels in the calibrated image allows us to guarantee the accuracy of our calibration, and to estimate the effects of light dilution resulting from scattering of UV photons between the plume and the instrument.

We have tested the instrument at the Navajo Generating Station, the largest coal burning plant in the American Southwest, located near Page, AZ. Preliminary data have also been acquired at Stromboli volcano, Italy and Semeru volcano, Indonesia.