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piscope - A Python based software package for the analysis of volcanic SO_2 emissions using UV SO_2 cameras

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UV SO_2 cameras have become a common method for monitoring SO_2 emission rates from volcanoes. Scattered solar UV radiation is measured in two wavelength windows, typically around 310 nm and 330 nm (distinct / weak SO_2 absorption) using interference filters. The data analysis comprises the retrieval of plume background intensities (to calculate plume optical densities), the camera calibration (to convert optical densities into SO_2 column densities) and the retrieval of gas velocities within the plume as well as the retrieval of plume distances. SO_2 emission rates are then typically retrieved along a projected plume cross section, for instance a straight line perpendicular to the plume propagation direction. Today, for most of the required analysis steps, several alternatives exist due to ongoing developments and improvements related to the measurement technique.
We present *piscope*, a cross platform, open source software toolbox for the analysis of UV SO_2 camera data. The code is written in the Python programming language and emerged from the idea of a common analysis platform incorporating a selection of the most prevalent methods found in literature. *piscope* includes several routines for plume background retrievals, routines for cell and DOAS based camera calibration including two individual methods to identify the DOAS field of view (shape and position) within the camera images. Gas velocities can be retrieved either based on an optical flow analysis or using signal cross correlation. A correction for signal dilution (due to atmospheric scattering) can be performed based on topographic features in the images. The latter requires distance retrievals to the topographic features used for the correction. These distances can be retrieved automatically on a pixel base using intersections of individual pixel viewing directions with the local topography. The main features of *piscope* are presented based on dataset recorded at Mt. Etna, Italy in September 2015.