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The COMTESSA project: Tomography of artificial SO_2 plumes with multiple SO_2 cameras for improving our understanding of plume dispersion and turbulence

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SO_2 cameras are part of a well-established methodology to measure sulphur dioxide (SO_2) emissions from both natural and anthropogenic sources (e.g. volcanoes, power plants, ...). Nine fast and highly sensitive SO_2 cameras have been developed in the scope of the ERC Advanced Grant project COMTESSA (Camera Observation and Modelling of 4D Tracer Dispersion in the Atmosphere).
Within COMTESSA SO_2 from artificial releases will be used to image tracer dispersion under different boundary layer conditions and thereby deepen our understanding of turbulence and plume dispersion in the atmosphere. Within the next four years, several artificial release experiments are planned in spring to autumn time, when UV radiation is sufficiently high. SO_2 will be released in controlled puffs and continuous plumes from a tower, and will be observed by the nine SO_2 cameras. Six of these operate in the ultraviolet spectral range and three operate in the infrared spectral range. The artificial release experiments will provide a large data set of high time- and space-resolution images from nine observation points. These images enable 4D reconstruction of the SO_2 plume concentrations using tomographic techniques. A suite of eddy covariance measurements of heat and momentum fluxes and other meteorological measurements will complement this data set.
Summed up, the COMTESSA release experiments offer the unique occasion to study and validate commonly used parameter retrievals from imaging data at volcanoes (i.e. SO_2 column densities and emission rates, plume speed) and to compare quantitative measurements in the UV and IR spectral range.
The presentation illustrates the planned experiments, outlines the requirements for the camera hard- and software, describes the new cameras and tests performed with them, and presents first results from an experimental tomographic setup observing SO_2-filled Teflon bags (100 l capacity).