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Novel, high sensitivity and high frequency instruments for in-situ measurements of volcanic gases

Mike Burton (1), Antonio Chiarugi (2), Francesco D'Amato (3), Silvia Viciani (3), Manuel Queisser (1), and Alessandro La Spina (2)

(1) University of Manchester, School of Earth and Environmental Science, Manchester, United Kingdom (mike.burton@manchester.ac.uk), (2) Istituto Nazionale di Geofisica e Vulcanologia, Italy, (3) Istituo Nazionale di Ottica, Italy

The accurate, precise and traceable measurement of volcanic gas compositions and fluxes is a key pillar upon which our understanding of volcanic processes and geological volatile cycles rests. While enormous progress has been made in the quality and quantity of in-situ gas composition measurements in recent years, the number of instruments which are both field deployable and able to accurately measure magmatic gas compositions remains quite limited. This makes intercomparisons and validations, key activities for any quantitative field study, challenging. Furthermore, the potential of UAV and airborne technology can only be fully realised when we have high frequency measurements of volcanic gases from several gas sensors simultaneously, as gas concentrations can vary quickly during flight, and any frequency response delay between individual gas sensors may introduce significant artifacts in retrieved gas ratios.

For these reasons, within the European Research Council project CO_2Volc, we have produced and field-tested new, custom-built TDLS- and LED-based in-situ gas sensing systems, capable of measuring H_2O, CO_2, SO_2, HCl and HF at 5-10 Hz and sub-ppm precision for CO_2 and SO_2, and 50 ppb detection limit for HCl and HF. Here, we report results from the field tests, and examine the potential new applications they offer.