Challenges in UV camera-based real-time SO_2 flux monitoring: insights from 5 years of continuous observations at Etna ad Stromboli

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The advent of UV cameras has recently paved the way to volcanic SO_2 flux observations of much improved temporal and spatial resolution, and has thus contributed to expanding use and utility of SO_2 fluxes in volcano monitoring. Recently, the first examples of permanent UV camera systems have appeared that are now opening the way to routine fully automated monitoring of the volcanic SO_2 flux at high-rate, and continuously (daily hours only). In 2014, using funding from the FP7-ERC project "Bridge" (http://www.bridge.unipa.it/), we deployed a network of 4 permanent UV cameras at Etna and Stromboli volcanoes (Sicily) that has been operating regularly since then. Using a suite of custom-built codes, data streamed by the UV camera are automatically processed and telemetered, allowing nearly real-time visualization and analysis of SO_2 fluxes. Here, we summarise the key results obtained during the last 5 years of continuous observations (2014-2018) to demonstrate potentials and challenges in real-time continuous SO_2 flux monitoring with UV cameras. We show that the spatially resolved SO_2 flux time-series delivered by the UV camera allow effectively tracking migration in volcanic activity from the Central to New South-East Crater (Etna), and shifts in degassing activity along the crater terrace (Stromboli). At both volcanoes, the high temporal of UV cameras allows capturing the escalation in active (strombolian) SO_2 degassing that typically precedes onset of paroxysmal (Etna in 2014-2016) or effusive (Stromboli in 2014) activity, and to quantify for the first time the syn- explosive SO_2 budget for larger-scale explosions, including 2 paroxysmal lava fountains (Etna) and 1 major explosion (Stromboli). We finally demonstrate the ability of our automatic camera systems to capture temporal changes in SO_2 flux regime, and thus to "live" monitoring degassing and eruptive behaviors at active volcanoes.