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Changes in SO_2 flux degassing regime prior to the 2014 Stromboli eruption

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Volcanic eruptions are often accompanied by release of huge amounts of magmatic SO_2. Capturing sizeable precursory SO_2 flux variations prior to eruption has revealed far more challenging, instead, in spite of the recent progresses in instrumental gas monitoring. Here, we report on the SO_2 fluxes variations we detected at Stromboli volcano prior to the effusive eruption started on the 6th August 2014. The SO_2 fluxes were regularly quantified at high-rate (0.5 Hz) using two fully autonomous permanent SO_2 camera devices installed – within the framework the ERC-FP7 project "Bridge"- at two sites located at 0.5 km (Roccette) and 1.75 km (Sciara del Fuoco rim) distance from the crater terrace. This system provided sufficient spatial resolution, ($\sim$0.4 m) to allow for separate evaluation of gas emissions from the centrals/NE craters (CC and NEC, $\sim$150 t/d on average) and from the northern hornitos (NH, $\sim$15 t/d on average) that was active in summer 2014. Notwithstanding its marginal contribution to the total SO_2 flux, the NH was vigorously active before the effusive eruption onset, and produced a large number of ash-free explosions, which individual SO_2 output was easily measurable at high sampling rate with the SO_2 cameras. From the beginning of June 2014, the NH exhibited a progressive increase of its explosive SO_2 release (from $\sim$1 t/d up to $\sim$5 t/d) which culminated in correspondence with a sequence of lava overflows on the beginning of July 2014. A notable correlation between the explosive degassing pattern and co-acquired acoustic pressure and satellite-derived Volcanic Radiative Power was observed. The relative contributions of the individual degassing craters to the total gas emissions varied in response to the displacement of the magma level within the conduits, with the largest SO_2 fluxes being observed during lava overflows. Our results here indicate detectable changes in the relative gas contribution from the different craters and in their degassing modes, although in the absence of sizeable pre-eruptive variations of the total SO_2 output. Our observations offer new insights for the understanding of degassing dynamics within shallow conduit systems.