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Non-stationary nature of SO_2 degassing at Etna's North-east crater (Italy).

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Investigating Etna's long-term SO_2 flux behaviour has led to important conclusions on the structure of the volcano's magma feeding system, magma production (and degassing) rates, and causes for the excess degassing behaviour. Nonetheless, our knowledge of the short-term (timescales of seconds to a few hours) behaviour of magmatic volatiles (e.g., bubble coalescence, separate ascent and surface bursting of gas-rich bubbles) in the volcano's upper feeding conduit system is still fragmentary, and based on indirect evidences (petrologic-textural data, observation of geophysical signals , physical modelling and laboratory experiments). In the past, direct gas flux measurements at Etna have been taken with insufficient temporal resolution for fast conduit processes to be investigated. UV cameras now allow imaging of gas flux emissions, and exploration of underlying volcanic degassing processes, with an improved temporal resolution. In this work we show that UV cameras can valuably assist in capturing the rapid (timescale of seconds) SO_2 flux variations occurring during the quiescent activity of a basaltic volcano. We have, in particular, investigated the non-stationary nature of degassing activity at Etna's North-east crater, which is shown here to exhibit a somewhat periodic degassing behaviour (characteristic periods ranging 40-250 s). A similar degassing behaviour has recently been observed at other volcanoes (Stromboli, Erebus, San Cristobal, Gorely), and probably represents a common feature of all basaltic volcanoes. We finally present a preliminary model, which results suggest that the periodic degassing pattern may reflect inhomogeneous distribution of gas bubbles in a magmatic conduit, and their clustering to form trains of variably spaced gas bubble layers.