

SO₂ camera measurements at Popocatepetl Volcano (Mexico). Insights into the dynamics of an atypical open vent volcano

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Popocatepetl Volcano (Mexico) has been, since its reawakening in 1994, one of the strongest permanent emitters of sulfur dioxide in the world (e.g. Delgado, 2008). Its activity poses also a direct threat to the most populated area of Mexico including its capital city. Activity has so far consisted of cycles of dome building and destruction by vulcanian explosions, alternating with periods of quiescent degassing. Average SO₂ emission rate over the whole eruption is about 50 kg/s but peaks of activity have released up to >1000 kg/s. Popocatepetl volcano is atypical because other volcanoes capped by an active lava dome usually exhibit SO₂ emission rates one or two orders of magnitude lower. Volcanoes hosting lava domes and plugs are known to be subject to sealing processes that precludes them from sustaining high SO₂ emission for long periods.

We have used a UV camera to obtain high temporal resolution measurements of SO₂ emission rates at Popocatepetl volcano. The state-of-the-art UV camera technique was coupled with a coaligned mini-DOAS, and often backed by ground-based DOAS traverses, in order to ensure the maximal accuracy of the results. Frequent field campaigns, with durations of up to several weeks, were conducted during various states of volcanic activity. This has allowed us to build a detailed picture of the sort-timescale variations of the degassing. Spikes of SO₂ emissions are superimposed over a long term, slowly varying trend of 50-100 kg/s. We propose a model of gas slugs bursting beneath a highly fractured dome to explain this degassing pattern. Strong fluxing of gas, provided by unerupted mafic-intermediate magma, is suggested to hamper sealing processes from plugging the conduit.