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Comparing computational models of slug rise at Stromboli with UV camera measurements of SO_2 flux

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Strombolian eruptions, particularly those at the archetypal Stromboli Volcano (Aeolian Islands, Italy) are generally accepted to be caused by the burst of gas slugs. Using computational fluid dynamic models implemented in Ansys Fluent®, with a range of conduit, magma and gas properties appropriate for current observations at Stromboli volcano, we simulate the rise of such gas slugs and demonstrate that during their ascent there is the potential for daughter bubble production from the slug base. These are bubbles which can detach from the influence of a slug to rise and burst at the surface independently. Within the models we can then estimate the amount and temporal pattern of gas released during and following individual slug burst events. This is achieved by integrating gas released near the magma surface. After correcting for atmospheric entrainment and diffusion we can then compare our modelled gas flux to our ultra-violet (UV) camera measurements of SO_2 flux at Stromboli (i.e. UV measurement of gas flux is performed at least $\approx$ 50 m above point of slug rupture at the magma surface). The UV camera measurements identify a broad range of degassing patterns following bursts, typifying the dynamic nature and the complexities of the system at Stromboli, including a previously identified coda in gas flux spanning tens of seconds to minutes (e.g. Tamburello et al. 2012). Whilst our models only analyse a narrow range of events at Stromboli, they highlight the possibility that the production of daughter bubbles could contribute to the gas flux observed at Stromboli. In some instances, the gas flux created by bursting daughter bubbles following a burst event is of a similar time span and could explain the observed gas flux coda. It is also possible that well documented puffing events could be explained by the bursting of daughter bubbles. Indeed, the larger modelled daughter bubbles, which are apparent as well-defined peaks in gas flux within both the UV camera record and modelled flux, have a total mass of $\approx$ 0.3 – 2.8 kg, a similar range to previous observations. The described phenomena is of course not limited to Stromboli and could play a key role in gas release regimes at a variety of volcanic targets where the potential for and rate of daughter bubble production (i.e. the stability and turbulence of a bubble or slug wake) can be estimated using the inverse viscosity parameter Nf (e.g. Nogueira et al. 2006).