Mathematical and Numerical Models of Lava Dome Dynamics

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Dome-building eruptions may vary from unthreatening effusion to highly unpredictable and hazardous activity including collapse of domes and associated pyroclastic flow hazards. We analyse the influence of the thermal cooling and the crystal content growth on the lava dome morphology at Volcán de Colima in Mexico during a long dome-building episode lasting from early 2007 to fall 2009 without explosive dome destruction. For this, we develop several mathematical models of lava dome dynamics including the kinetics of crystal content growth, temperature-dependence of melt viscosity, latent heat, and nonlinear heat exchange between the lava and the air. Camera images of the lava dome growth together with recorded volumes of the erupted lava have been used to constrain our numerical models and hence to fit the observation data of the dome growth at Volcán de Colima by nudging model forecasts to observations. We shall present the mathematical models and results of the ongoing modelling.