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An integrated model for underground eruption dynamics

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Ubiquitous analyses of the products of volcanic eruptions reveal discharge of magmas initially stored at multiple levels inside the crust, giving rise to complex patterns of mixing and overall evolution of composition. The resulting eruption dynamics and eruption duration depend on the interplay between such different magmas and the evolution of the conditions in the different domains from their provenance to the surface. We have developed a simple dynamic model that allows to investigate the evolution of an eruption, in terms of space distribution of flow quantities from depth to surface, mass flow rate, and overall duration, in a composite system including vertically distributed dykes, conduits and chambers interacting with each other. A sensitivity analysis allows to identify the parameters (e.g., magma composition(s), volatile contents, size of the different domains, depth of the plumbing system, etc.) that have more relevant roles in determining the evolution and magnitude of the resulting eruption.