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The control of vent geometry on the dynamics of volcanic plumes

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Volcanic vent geometry plays an important role in the dynamics of eruption plumes. We present three-dimensional numerical simulations of eruption clouds from circular and linear fissure vents to investigate the control of vent shape on the height and stability of volcanic plumes. Our results show that clouds ejected from circular or high-aspect-ratio fissure vents are associated with radially suspended flow (RSF) at the top of the jet region, whereas those emitted from narrow-fissure vents are not. No-RSF plumes are more stable than those associated with RSF because the highly concentrated parts of the ejected material are easily dissipated and mixed with air near the vent. The plume height in the RSF and no-RSF regimes increases and decreases with increasing aspect ratio, respectively. These observations suggest that the efficiency of air entrainment is influenced by the vent shape, which in turn controls the dynamics of the eruption plume.