Experimental investigation of pyroclastic flows generated by continuous supply of material

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Understanding the dynamics of pyroclastic flows is an important step in developing better models for the internal physical processes within these flows and in providing better hazard assessment to local populations. Fluidization and related reduced internal friction is a key contributor to this for fines-rich flows, with particle settling and exsolution of gas from juvenile tephra being the primary contributors.

Scaled analogue experiments have been conducted in order to investigate the degree to which high pore pressure controls the mechanism of flows generated from sustained supply of material at source. Sub-80 micron diameter silica beads are released into a flume capable of providing a pre-determined basal gas flux along the length of the channel. The gas flux can be set from zero through to the minimum fluidization velocity of the particles at which the material is fully supported by internal pore pressure. Vertical release from a large hopper provides a relatively sustained sediment supply, enabling the vertical migration of the flow boundary layer and aggrading deposit to be observed and the flow runout distance to be investigated.

By varying mass flux and the initial condition of the flow as it enters the flume, we are able to observe how flow dynamics, runout and deposition vary as a function of the input, which can provide insight into the interpretation of deposits in the field. This in turn has implications for the understanding of pyroclastic flow behavior at active volcanic centers, and the hazards posed by these types of eruptive behavior.