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The flow structure of pyroclastic density currents: evidence from particle models and large-scale experiments

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Pyroclastic flows are ground hugging, hot, gas-particle flows. They represent the most hazardous events of explosive volcanism, one striking example being the famous historical eruption of Pompeii (AD 79) at Vesuvius. Much of our knowledge on the mechanics of pyroclastic flows comes from theoretical models and numerical simulations. Valuable data are also stored in the geological record of past eruptions, i.e. the particles contained in pyroclastic deposits, but they are rarely used for quantifying the destructive potential of pyroclastic flows. In this paper, by means of experiments, we validate a model that is based on data from pyroclastic deposits. It allows the reconstruction of the current's fluid-dynamic behaviour. We show that our model results in likely values of dynamic pressure and particle volumetric concentration, and allows quantifying the hazard potential of pyroclastic flows.