Laboratory experiments on transport and deposition of granular flows over a variable break in slope: insights for depositional behaviour of pyroclastic and volcaniclastic density currents

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Gravity-driven flows in volcanic areas comprise some of the most complex and hazardous natural phenomena, and can occur either during explosive eruptions or during volcanic quiescence. Among volcanic gravity-driven flows the study of those characterised by high-particle concentration is exceedingly important, since they encompass some of the most destructive volcanic phenomena. In all these phenomena the same basic forces govern motion, but differing mixture compositions, initial and boundary conditions yield varied dynamics and deposits. Examples range from dry rock avalanches, in which pore fluid may play a negligible role, to liquid-saturated debris flows and gas-charged pyroclastic density currents, in which fluids may enhance bulk mobility. Field studies on real volcanic gravity-driven deposits remain an irreplaceable tool for obtaining crucial information about their behaviour. This is because a volcanic gravity-driven deposit records the physical processes that occurred at time of deposition, and particle morphology and deposit texture can yield precious information about transportation regime. However, the direct observation of physical processes acting on real flows is usually prevented by the hostile nature of these natural phenomena. For this, laboratory experiments can supply precious information for validating sedimentological models derived from field studies. New insights on behaviour of granular flows come from laboratory experiments carried out using a 5 m flume engineered at the Instituto de Geologia, University of San Luis Potosi (Mexico). The flume is equipped with different sets of sensors and the spreading area is bordered with glassy walls in order to observe the deposit aggradation. The experimental runs are carried out using real volcanic particles combined to form synthetic grain size distributions. A set of laboratory experiments were performed using the same Weibull grain size distribution and changing the slope ratio between flume and expansion box area. The results indicate how depositional behaviour is greatly influenced by the slope ratio, whit changing velocity and flow runout using different slope configurations. These first results highlight some fundamental processes in particle transportation and deposition over break in slope useful for the understanding of natural granular gravity currents.