Cities on Volcanoes 9
November 20-25, 2016
Puerto Varas, Chile
*'Understanding volcanoes and society: the key for risk mitigation'*

# Laboratory experiments highlight the internal structure and dynamics of volcanic granular flows

**Roberto Sulpizio[1], Damiano Sarocchi[2], Pierfrancesco Dellino[1], Luis Angel Rodriguez-Sedano[2], Bernardino Barrientos[3]**

[1]Dipartimento di Scienze della terra e Geoambientali, via Orabona 4, 70125, Bari

[2]Universidad Autonoma de San Luis Potosì, Facultad de Ingegneria, San Luis Potosì, Mexico

[3]Centro de Investigaciones en Optica, A.C., Leon, Juanajuato, Mexico

Keywords: laboratory experiments, granular flows, pyroclastic density currents

Most of our current knowledge on hazardous volcanic granular-type mass flows stems from interpreting resulting deposits because direct observations are largely limited. Current sediment transport and deposition models (underlying these interpretations) are still largely debated. This is because of the complex and hitherto not fully understood physics of granular matter. Laboratory experiments on poly-disperse granular flows of volcanic material have been designed in order to try bridging this gap. They highlight some important characteristics of internal organization and general kinematics of granular flows that can be extended to the generality of poly-dispersed, flowing granular matter. In particular, it is demonstrated that the poly-disperse granular flows are intrinsically unsteady when flowing down a slope. They self-organise their internal structure in order to have a coarse-grained flow front, and a reverse grading of particles in the flow body that produces a lower, sinusoidal fine grained bed over which flows the upper and coarser part of the granular mixture. The flow front propagates inertially, while frictional forces dominate the main body. The competing effects of shear instabilities and elongational strain are responsible for the observed unsteadiness in the motion of the main body of the flow. It is therefore demonstrated that the often neglected unsteady flow in granular material (in the favour of quasi-steady regimes that are far easier described in a continuum-type models adapted from traditional fluid mechanics) is the common behaviour of moving granular matter, a result of great interest for many field of research in Earth science, physics, engineering and industry.