



## **Frictional and collisional particle interactions in uniform debris flows**

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To investigate the vertical structure of free-surface liquid-granular flows, it is of particular interest to analyse steady flow condition. With a particular experimental technique, in the recent past, a thorough activity has been devoted to the rheology of flowing mixtures of well-sorted granular particles and water (Armanini et al. 2005). In this contribution, we analyse the stratification of rheological mechanisms inside the flow, focusing on the coexistence, in particular conditions, of frictional and collisional regimes, on the stress transmission inside the flow and on particles kinematics. In particular, it was observed that debris flows may show locally a typical intermittence of the flow regime, switching alternatively from frictional to collisional. In our experiments debris flow is constituted by a mixture of water and perfectly spherical and uniform in size particles, introduced steadily in the upstream part of the flume and filmed through the sidewall of the channel utilizing a high-speed CCD camera. Particle kinematics were obtained utilizing Voronoï-based particle tracking techniques (Capart et al. 2002, Spinewine et al. 2003). The distributions of the concentration, of the intermittence factor, the normal and tangential stresses and the energy balance components have been obtained. Experimental data have been compared with the prediction of the kinetic theories.

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