

Debris flow monitoring experience in the Cancia basin (Dolomites, Northeast Italian Alps).

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The monitoring campaign presented here aims to understand the dynamics of sediment transport processes in small head-water catchments of the Italian Alps and to evaluate the rainfall thresholds for debris flow triggering.

The monitored basin of Cancia is located on the Eastern Italian Dolomites, in the Belluno Province. In particular, it is situated on the left side on the Boite river valley, next to the Borca di Cadore village, and is delimited by the western slope of the Mt. Antelao. The drainage area is 1.8 km² while the elevation ranges from 2451 m a.s.l. to 880 m a.s.l., with a slope varying from 30-40° in the upper part to 10-15° in the lower part (fan area). The basin is characterized by a lithology very common in the Italian Alps, which consist of high permeability, poorly sorted rock debris, containing boulders up to 3-4 m in diameter, and include heterogeneous scree, alluvium and old debris flow deposits. The spatial distribution of sediment is characterized by: an upper part where prevails the presence of rocks, a medium part characterized by poorly sorted rock debris and fine sediment material, and a downstream part plenty of sediment material

The Cancia basin is prone to stony debris flows, owing to the plenty availability of loose and coarse sediments and frequent convective events. In particular, the smaller grain sized material is provided by the erosion of lateral slope, while gravel, pebbles and cobbles are provided by the upper part of the basin, characterized by rocky material. The precipitation regime is marked by rainfalls of short duration and high intensity, usually occurring in the summer period.

The debris flow channel has began to be surveyed in August 2009 to identify the debris flow generation area. At the beginning of July 2013 topographical surveys of the channel downstream the triggering area began in order to investigate the morphological evolution of the debris flow channel from 2013 until 2015. Moreover, at the beginning of summer 2014 a monitoring station, composed by a rain gauge and two couples of cameras and pressure transducers, was installed in the triggering area at the purpose of investigating the debris flow initial development.

Comparison of the channel cross section geometry in proximity of the monitoring station allows us to investigate the morphological tendencies of the Cancia basin. The analysis of collected data suggests that the catchment is characterized by the cyclic occurrence of sediment accumulation in the main channel as a consequence of intense meteorological events, followed by debris flow activations when both the volume of deposited material and the rainfall intensity are large enough. The consequent severe erosion of the channel bed channel and of the side-slopes leads to the starting of a new deposition-erosion cycle.

This morphological behaviour of the basin clearly emerges from the analysis of the data collected on July 23th, 2015 and August 4th, 2015. In particular, the monitoring station provided information about: debris flow depth and basal pressure, and characteristics of the triggering rainfalls. The analysis of such data show that during the stony debris flow event occurred on July 23th, 2015, no excess pore pressure is observed along the front propagation as already observed in recent experimental laboratory flume investigations. Therefore a quasi hydrostatic pressure distribution is associated to the fluid phase.