Consiglio Nazionale
delle Ricerche

Research Institute for Geo-Hydrological Protection

in the Department of Earth System Sciences and Environmental Technology

an Institute of the Italian National Research Council (CNR)

Debris-flow monitoring in the Alps

Experimental observations on a dangerous flow process typical of Alpine areas

Not all that flows in creeks is water. Debris flows i.e., surges in which solid particles move together with little water, may occur in steep mountain streams, mainly as a consequence of intense rainfall. Debris flows have a high kinetic energy, and may cause major damage if they encroach buildings, roads and bridges. They are also a primary cause of landslide casualties. The video below shows an example of debris flows.

https://youtu.be/DXA7D82S4Ow

The low frequency of debris flows (most of the affected streams experience less than one event per year) does not attenuate the hazard, and makes the observation of debris flows particularly difficult. Hence, the experimental measurement of debris flows in adequately equipped monitoring sites is of utmost importance.

Since the early 1990s, we monitor debris-flows in Alpine catchments. The first instrumented catchment was the Moscardo Torrent (Udine), which was followed by the Marderello Torrent (Torino) and the Gadria Creek (Bolzano). In this last site, managed by the Departments of Hydraulic Works and Civil Protection of the Autonomous Province of Bozen-Bolzano, we cooperate with other scientists for the execution of survey campaigns and data analysis.

Results

Debris-flow monitoring in the Italian Alps has allowed us to collect significant amounts of data on the triggering rainfall, and on the velocity, discharge and volumes of the debris flows. We have used the data to develop and test numerical models that simulate the propagation and deposition of the debris flows, and for mapping the potentially inundated areas. Another practical outcome of our debris-flow monitoring consists in the development of systems for real time debris-flow warning and alarm. Our numerical models and alarm systems can be used in areas at risk where local data are not available.

Granting institutions

- SedAlp – Sediment management in Alpine basins, EU Alpine Space Programme (2012–2015)
- GESTO – Management of sediment transport in small mountain catchments (Free University of Bozen-Bolzano, 2011-14)
- Design and testing of a debris-flow monitoring system in the frame of the Interreg IV Project Monitor II (Autonomous Province of Bozen-Bolzano, 2010-12)

To know more

Link to the Project “Monitor II” in IRPI website »

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Marchi L, Arattano M, Deganutti AM. 2002. Ten years of debris-flow monitoring in the Moscardo Torrent (Italian Alps). *Geomorphology* 46(1-2), 1-17. DOI:10.1016/S0169-555X(01)00162-3.

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