



Probabilistic vs deterministic views in facing natural hazards: how to cope with them?

Arattano M. and Coviello V.

Italian National Research Council (CNR), Research Institute for Geo-hydrological Protection (IRPI), Italy

Debris flows are a very particular type of natural hazard.

A debris flow is a mass movement that may occur in mountain torrents. They are mixtures of water and debris that propagate at high speed in form of waves with very steep and bouldery fronts. They may have great destructive power.



Gatria Torrent – July 18, 2013 debris flow event

EWSs: measures for debris flow hazard mitigation

Among the passive countermeasures, Early Warning Systems (EWSs) are playing an increasing and significant role.

Debris flow warning system based on the use of pendulums, S. Bernard catchment (Maurienne Valley)



Early Warning Systems for debris flows

EWSs for debris flows, however, are not yet well developed, particularly those based on the use of ground vibration sensors, which are the most versatile detectors for such type of phenomena.





The current scene (back to 2010)

Evidences of this lack of knowledge were found on several occasions, in meetings with decision makers and practitioners.



A virtuous cooperation with an Italian SME

An Italian company (SIAP+MICROS) was in-charge of building a warning system that was named ALMOND-F (ALarm and MONitoring system for Debris-Flows), following our instructions and the tests started.



ALMOND-F
Alarm and Monitoring system for Debris-Flow



Geoethical issues: the Media

We soon found ourselves involved in problems that, **after a while**, we recognized as typical geoethical issues.

Journalists generally have a poor qualification in Earth sciences. In addition, the media often use sentences given by scientists out of the context in which they were originally stated, and thus can transform the meaning of their words in a sensationalist manner (Di Capua and Peppoloni, 2014).

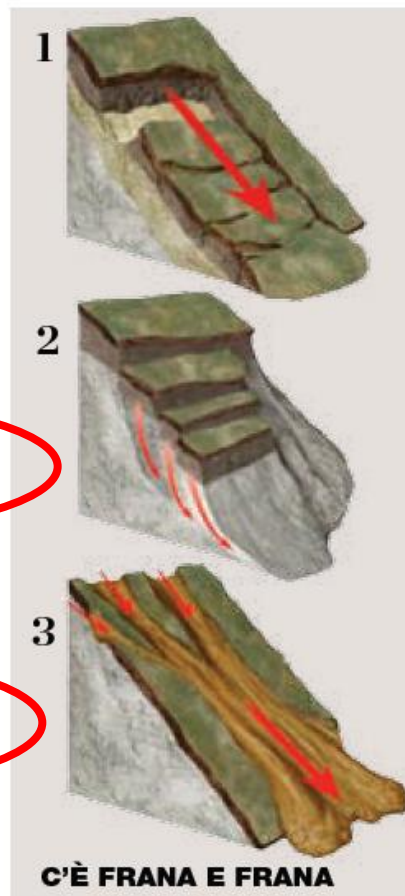


Le piogge staccano gli strati di terreno l'uno dall'altro. E la montagna scivola giù

Mig è in fase sperimentale e viene gestito dalla Protezione Civile nazionale di Toscana ed Emilia-Romagna.

FIUMI DI SASSI. Ci sono anche frane che si formano all'interno di torrenti di montagna. Sono costituite da un'alta concentrazione di massi, sassi e ghiaia che scorrono trascinati dall'acqua. Sono tra gli smottamenti più pericolosi, con fronti che possono raggiungere diversi metri di altezza e distruggere tutto ciò che trovano sul cammino.

Anche in questi casi, partendo dalle previsioni meteo, stiamo mettendo in opera sistemi di preallarme. Il più interessante è l'Almond-F (da Alarm and monitoring system for debris-flow), un apparato che limita al minimo i falsi allarmi. Come funziona? Lo spiega Massimo Arattano dell'Irpi-Cnr: «Ad alcune centinaia di metri l'uno dall'altro, in prossimità del torrente, vengono posti dei geofoni (piccoli sismometri, ndr) che captano le onde sismiche. Le informazioni vengono elaborate da algoritmi che determinano se si sta avvicinando il momento del distacco». E allora scatta l'allarme per bloccare il passaggio. Il sistema è stato sperimentato in Alto Adige, nel bacino del torrente Gadria. «Lo scorso 15 luglio, i "semafori rossi", per così dire, si sono accesi e poi spenti esattamente in concomitanza ▶





The quest for a deterministic type of answer

Several administrations were contacted to inform their personnel about the ALMOND-F and its performances.

One of the recurrent questions concerned the reliability of the system to grant the complete safety for the involved populace.

How close are you to grant a COMPLETE SAFETY and RELIABILITY of the system (durability of the hardware, no false alarms)?



Is it possible to deal somehow with this scene?

We realized that, posing this question, we had entered the field of geo-ethics.

What communication and educational strategies should be adopted to transfer the value of the geosciences to society? (Peppoloni and Di Capua, 2012).

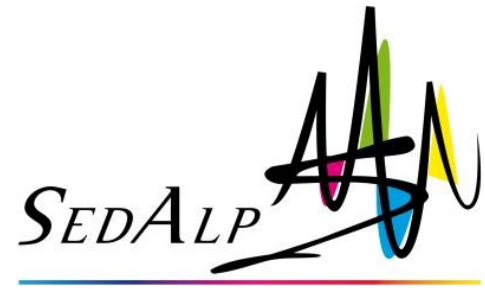


An answer implemented in the research activities





On July 15, 2014 a debris flow occurred in the Gatria creek that was recorded by the video camera. The closure algorithm correctly turned off the flashing light at the end of the process. Frames from the video camera part of the EWS testing field, time in the upper-left corner of each frame is in UTC+1 (local time): (a) the creek before the process (flashing light off); (b) arrival of the main front (flashing light on); (c) a secondary surge (flashing light still on); (d) the end of the process (flashing light off).



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Thank you



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