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## Improving the reliability of the decision-making process in a rockslide Early Warning procedure

**Davide Bertolo**

Geological Survey - Regione Autonoma Valle d'Aosta, Attività geologiche, QUART, Italy (d.bertolo@regione.vda.it)

During the last decades, the progresses in rock slope monitoring improved the reliability of the Early Warning Systems (EWS) all over the world. Among their features, EWS are designed to provide to the decision makers objective tools in order to support their decisions in activating emergency plans.

The choice to design an EW System, if only based on displacement or rainfall thresholds, may not be sufficient to support the decision-making process, when the monitored rockslide is threatening high value targets, both in terms of exposed human lives and potential economic losses.

As a matter of fact, the integrated monitoring systems usually installed on active rock slopes provide many different data about the behaviour of these phenomena. Most of these data are worth to be weighted in the decisional process, as they are relevant to confirm a specific event scenario.

In addition, experts and EWS managers are facing an increasing demand by the stakeholders and the population, to effectively communicate in a user-friendly way the decision-making process, as well as the uncertainty degree associated with each decisional step.

That is a necessity which becomes critical in the moment when the population and the stakeholders have no direct perception of a potential catastrophic event and the civil protection measures are preventively activated before the emergency.

The aim of this work is to present the Early Warning procedure elaborated by the regional Geological survey of the Aosta Valley Autonomous Region (Italy), which is based on the experience derived from the emergency management of the Mont de La Saxe rockslide in 2013.

The new EW procedure has been successfully tested for the first time during the rockslide activation in spring 2014 and it has been refined and improved during the following years.

The potential collapse of the Mont de La Saxe rockslide threatens a part of the important touristic resort of Courmayeur and the E25 Motorway, one the most important national communication axes, connecting the industrial areas of the Northern Italy with France and Switzerland.

In such a sensitive situation, a not sufficiently motivated alert could have led to impacting civil

protection measures like the evacuation of two villages and the traffic interruptions, damaging the Italian economy and the regional tourism.

Therefore, the EW managers have decided to strengthen the existing EW procedure, based on displacement thresholds, in order to achieve the maximum amount of confidence in the decisional process. The new procedure is based on a Bayesian inferential process, combining the available data provided by the monitoring system.

Thanks to this approach a quantitative degree of confidence can be assigned to each decisional step, increasing the warning levels up to the declaration of the emergency condition.

At the same time, the new EW procedure provides a transparent and replicable decisional process, where the confidence degree associated to the civil protection alert can be declared in the alert bulletins.

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