



## An early warning system for rainfall-triggered shallow slides and debris flows. Application in Catalonia, Spain and Canton of Bern, Switzerland

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Risk mitigation for rainfall-triggered shallow slides and debris flows at regional scale is challenging. Early warning systems are a helpful tool to depict the location and time of future landslide events so that emergency managers can act in advance. Recently, some of the regions that are recurrently affected by rainfall triggered landslides have developed operational landslide early warning systems (LEWS). However, there are still many territories where this phenomenon also represents an important hazard and lack this kind of risk mitigation strategy.

The main objective of this work is to study the feasibility to apply a regional scale LEWS, which was originally designed to work over Catalonia (Spain), to run in other regions. To do so we have set up the LEWS to Canton of Bern (Switzerland).

The LEWS combines susceptibility maps to determine landslide prone areas and in real time high-resolution radar rainfall observations and forecasts. The output is a qualitative warning level map with a resolution of 30 m.

Susceptibility maps have been derived using a simple fuzzy logic methodology that combines the terrain slope angle, and land use and land cover (LULC) information. The required input parameters have been obtained from regional, pan-European and global datasets.

Rainfall inputs have been retrieved from both regional weather radar networks, and the OPERA pan-European radar composite. A set of global rainfall intensity-duration data has been used to assess if a rainfall event has the potential of triggering a landslide event.

The LEWS has been run in the region of Catalonia and Canton of Bern for specific rainfall events that triggered important landslides. Finally, the LEWS performance in Catalonia has been assessed.

Results in Catalonia show that the LEWS performance strongly depends on the quality of both the susceptibility maps and rainfall data. However, in both regions the LEWS is generally able to issue warnings for most of the analysed landslide events.

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