Geophysical Research Abstracts
Vol. 21, EGU2019-14232, 2019
EGU General Assembly 2019

Integrating rainfall thresholds and susceptibility maps into a dynamic hazard matrix for regional scale early warning of landslides

Samuele Segoni, Veronica Tofani, Ascanio Rosi, Filippo Catani, and Nicola Casagli
University of Firenze, Department of Earth Sciences, Florence, Italy (samuele.segoni@unifi.it)

Regional scale landslide early warning systems are usually based on rainfall thresholds that can be used to issue timely warnings with a poor spatial resolution, as the warning is usually generalized for a wide alert zone. On the contrary, susceptibility maps can have a very fine spatial resolution, but they do not carry any temporal information. However, recent approaches have been proposed to integrate rainfall thresholds and susceptibility maps, bringing together the pros of the two methodologies and overcoming their cons.
In this work, we exemplify a recently proposed methodology (Segoni et al., 2018) to combine a susceptibility map and a set of rainfall thresholds into a dynamic hazard matrix to refine the outputs of an existing regional scale landslide early warning system.
Northern Tuscany (Italy) was the selected test site, because a recent landslide susceptibility map and a set of recently updated rainfall thresholds were available. These products were processed before being integrated into the matrix: the susceptibility map was reclassified, and the threshold set was expanded defining additional thresholds. Subsequently, the susceptibility classes (S1, low susceptibility; S2 medium susceptibility; S3 high susceptibility) and the rainfall rate classes (R1, R2, R3) were combined in the hazard matrix, defining five hazard classes, from H0 (null hazard) to H4 (high hazard).
The most important and most innovative part of the proposed methodology is the calibration of the dynamic matrix. The calibration has two objectives: (i) setting a strict correspondence between hazard classes, physical interpretation and expected ground effects (thus providing a solid basis to plan adequate hazard management procedures); (ii) optimizing the forecasting capability of the system to maximize correct predictions and to minimize false and missed alarms.
The proposed approach was validated against an independent dataset. The validation demonstrated that the use of the proposed procedure in a regional warning system brings two main advantages: (i) it is possible to better hypothesize when and where landslide are expected and with which hazard degree (a good correspondence was observed between forecasted hazard levels and landslides occurred), thus fostering a more effective hazard and risk management (e.g., setting priorities of intervention); (ii) the spatial resolution of the regional scale warning system is markedly refined because from time to time the areas where a given landslide hazard level is expected represent only a fraction (ranging from 2% to 61% in our test site) of the alert zone.

References

Segoni S, Tofani V, Rosi A, Catani F and Casagli N (2018) Combination of Rainfall Thresholds and Susceptibility Maps for Dynamic Landslide Hazard Assessment at Regional Scale. Front. Earth Sci. 6:85. doi: 10.3389/feart.2018.00085