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INVESTIGATING THE POTENTIAL INFLUENCE OF IMPRECISE LANDSLIDE INFORMATION ON THE ASSESSMENT OF LANDSLIDE TRIGGERING THRESHOLDS

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Determination of landslide triggering thresholds is subject to various sources of uncertainty. A significant part stems from imprecise rainfall and landslide information[1,2]. In this work we analyse the possible impacts of the uncertain knowledge of initiation instants on the assessment of rainfall intensity-duration (ID) landslide triggering thresholds.

Our analysis is based on an ideal synthetic hourly dataset of rainfall and landslide data, generated by a hydrological and slope stability landslide model[3]. Then the ideal dataset is modified according to three hypothetical schemes which mimic a range of possible realistic scenarios of rainfall-landslide dataset collection and analysis (Fig. 1). In particular, scenarios are conceptualized as a combination of delayed landslide observation and approximated reporting of landslide triggering instants, which generate indirectly random errors *e*. In particular, the three schemes are: 1) small delay reporting, where errors are in the range from 0 to 30 hours; 2) large delay reporting, with errors in the range from 0 to 54 hours; 3) anticipated reporting (errors within the range -18 and 6 hours). Each scheme is analysed by considering different criteria to single-out rainfall events and different temporal aggregations of rainfall (hourly and daily).

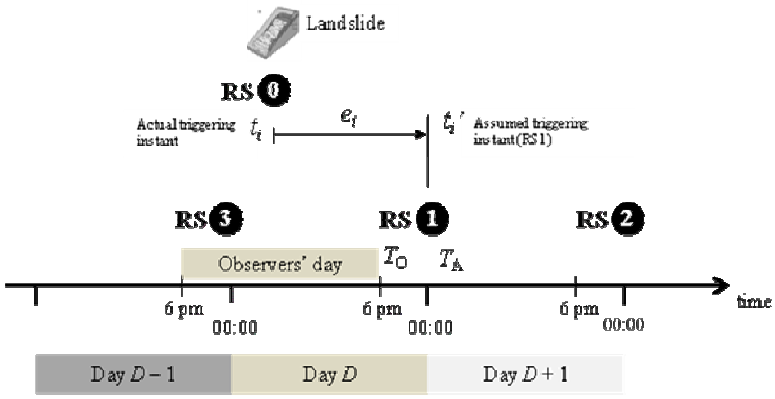

Figure 1. Hypothetical scenarios for the analysis of potential uncertainty of landslide triggering thresholds due to imprecise knowledge of initiation instants[4]

The analysis shows that the impacts the above uncertainty sources are quite limited until the errors are do not exceed one day in the positive direction (landslides triggered at instants prior to the erroneous ones). In case of negative errors, and positive errors exceeding one day, the impacts on threshold assessment and performance can be significant. In general, errors influence thresholds in a way that they are lower that the correct ones. The amount of threshold underestimation can be enough to induce an excessive number of false positives, hence limiting possible landslide mitigation benefits. The induced range of uncertainty can be of an order of magnitude that exceeds that related to the variability from site to site of physio-geographical factors influencing slope stability, thus limiting the possibilities to establish a link between the latter and the threholds.

Keywords: Uncertainty, Early warning systems, Montecarlo simulation, Peloritani mountains, Sicily, Natural hazards.

References

1. Berti, M., Martina, M. L. V, Franceschini, S., Pignone, S., Simoni, A. and Pizziolo, M. (2012). Probabilistic rainfall thresholds for landslide occurrence using a Bayesian approach, J. Geophys. Res. Earth Surf., 117(4), 1–20.
2. Nikolopoulos, E. I., Crema, S., Marchi, L., Marra, F., Guzzetti, F. and Borga, M. (2014). Impact of uncertainty in rainfall estimation on the identification of rainfall thresholds for debris flow occurrence, Geomorphology, 221, 286–297.
3. Peres, D. J. and Cancelliere, A.: Estimating return period of landslide triggering by Monte Carlo simulation (2016), Journal of Hydrology, 541, 256–271.
4. Peres, D. J., Cancelliere, A., Greco, R., and Bogaard, T. A (2017). Influence of uncertain identification of triggering rainfall on the assessment of landslide early warning thresholds, Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2017-328, in review.