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Combining rainfall thresholds and field monitoring data for development of LEWS.

Maria Alexandra Bulzinetti[1], Minu Treesa Abraham[2], Neelima Satyam[2], Biswajeet Pradhan[3], and Samuele Segoni[1]

[1]Department of Earth Sciences, University of Florence, Florence, Via Giorgio La Pira, 4, 50121, Florence, Italy (mariaalexandra.bulzinetti@unifi.it ; samuele.segoni@unifi.it)

[2]Department of Civil Engineering, Indian Institute of Technology Indore, Madhya Pradesh, 452020, India (phd1901204011@iiti.ac.in; neelima.satyam@iiti.ac.in)

[3]Centre for Advanced Modelling and Geospatial Information Systems (CAMGIS), Faculty of Engineering and Information Technology, University of Technology Sydney, Sydney, PO Box 123, Australia (Biswajeet.Pradhan@uts.edu.au)

Landslide Early Warning Systems (LEWS) can provide enough time to take necessary precautions before the occurrence of landslides and can reduce the risk associated with it. Deriving empirical rainfall thresholds is the conventional approach in developing regional scale LEWS, but the major drawback of this approach is the relatively high number of false alarms. In this study, a prototype method for LEWS is proposed by combining rainfall thresholds and field monitoring data from MicroElectroMechanical Systems (MEMS) units that integrate a tilt sensor, a soil moisture meter and a real-time wireless transmitter. The study was conducted in the Kalimpong district of West Bengal, India. Tilt sensors were installed at different locations on unstable slopes of Kalimpong since July 2017 and the observations from July 2017 to August 2020 were used to enhance the performance of the existing rainfall thresholds.

During this period, both rainfall thresholds and tilt meters, when used separately, systematically overestimated landslide hazard, producing high false alarm rates. However, it was found that using a decisional algorithm that combines both approaches can reduce the false alarms and improve the overall efficiency of the system from 84 % (based on rainfall thresholds) to 92 % (combined method). The prototype LEWS is found to be promising to be developed as an operational LEWS capable to issue alerts with a lead time of 24 h.

The method is simple and can be easy exported to other sites with historical rainfall and landslide data and a network of slope monitoring sensors. Cost of installation of a large number of sensors is a major concern for developing countries like India, hence a cost-effective approach is used in this study: the use of MEMS sensors along with empirical rainfall thresholds is thus a simple and economical approach for the prediction of landslide events.