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Landslides triggered by November 2010 flood in NE Italy: a starting point for forecasting modelling and engineering geology design of remote sensing monitoring.

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From October 31 to November 2, 2010, an exceptional rainfall event hit the Vicenza Province, located in the Veneto Region (NE Italy). A maximum cumulative rainfall of about 500 mm and a mean of 336 mm over the area were recorded. This event represents one of the most intense and catastrophic historical floods of the last 100 years, together with the November 1966 and October 1992 floods, which affected the pre Alps and piedmont sectors of Veneto Region and the remaining part of Northern and Central Italy.
The intense rainfall triggered a huge number of mass movements in the North and West parts of the Vicenza Province. In the alluvial plain area the main rivers (e.g., Bacchiglione, Astico and Retrone rivers) overflowed their banks causing damages for millions of euro to infrastructures, industrial activities and private buildings.
In this work a preliminary analysis of the rainfall event and of the triggered landslides is dealt with. Following the heavy rainfall, over than 200 warnings of landslides, distributed over 20 municipalities of the Vicenza Province, were received at the Soil Protection Division. Immediately after the flood event, researchers from the Department of Geosciences of the University of Padua and technicians of the Vicenza Province started field surveys in the affected areas. A simplified database for storing main data on landslides was realized in order to determine the priority of interventions. Data on geographical location of landslides, time and date, kinematics, involved rocks, state of activity and, finally, caused and potential damages, have been collected.
After 2 months from the flood event 112 sites have been investigated. Regarding landslide types, 34.8% of phenomena have been classified as soil slips, 22.3% as complex landslides, 16% as rotational slides, 15.2 % as earth-flows and 11.6% as translational slides. Both localized and areal phenomena have been observed. Most movements are from small to medium size, 13.4% were classified as large and 5.4% as very large. In 14 cases, buildings were damaged and in 8 cases injuries are from moderate to severe. Roads have suffered the worst damage, with 64 cases of damages (21 moderately and 16 seriously).
The extreme event that hit the Vicenza Province represents a chance to refine and test forecasting models and to implement warning systems based on the relationship between rainfalls and landslides. In this frame, a preliminary hydrological alert system based on the return period of rainfall recorded at the rain gauges is proposed and discussed. In the next future research, the use of satellite data recently available from platforms with a very high revisit frequency (i.e. Cosmo-Skymed satellites) will be tested as a tool for near real-time monitoring of mass movements.