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Three occurred debris flows in North-Eastern Italian Alps: documentation and modeling

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Three occurred events of debris flows are documented and modeled by back-analysis. The three debris flows events are those occurred at Rio Lazer on the 4th of November 1966, at Fiames on the 5th of July 2006 and at Rovina di Cancia on the 18th of July 2009. All the three sites are located in the North-Eastern Italian Alps. In all the events, runoff entrained sediments present on natural channels and formed a solid-liquid wave that routed downstream. The first event concerns the routing of debris flow on an inhabited fan. Map of deposition pattern of sediments are built by using post-events photos through stereoscopy techniques. The second event concerns the routing of debris flow along the main channel descending from Pomagagnon Fork. Due to the obstruction of the cross-section debris flow deviated from the original path on the left side and routed downstream by cutting a new channel on the fan. It dispersed in multiple paths when met the wooden area. Map of erosion and deposition depths are built after using a combination of Lidar and GPS data. The third event concerns the routing of debris flow in the Rovina di Cancia channel that filled the reservoir built at the end of the channel and locally overtopped the retaining wall on the left side. A wave of mud and debris inundated the area downstream the overtopping point. Map of erosion and deposition depths are obtained by subtracting two GPS surveys, pre and post event.
All the three occurred debris flows are simulated by modeling runoff that entrained debris flow for determining the solid-liquid hydrograph downstream the triggering areas. The routing of the solid-liquid hydrograph was simulated by a bi-phase cell model based on the kinematic approach. The comparison between simulated and measured erosion and deposition depths is satisfactory. The same parameters for computing erosion and deposition were used for the three occurred events.