Geophysical Research Abstracts
Vol. 21, EGU2019-4438, 2019
EGU General Assembly 2019

Back-analysis of the complex debris flow event occurred in the Buthier d'Ollomont Stream basin (Aosta, Italy) and some general anticipatory considerations that can be derived from it

Marta Martinengo (1), Daniel Zugliani (1), Paolo Ropele (2), and Giorgio Rosatti (1)

(1) University of Trento, Department of Civil, Environmental and Mechanical Engineering, Italy (marta.martinengo@unitn.it),
(2) Dipartimento programmazione, risorse idriche e territorio Opere idrauliche, Valle d'Aosta, Italy

On August 8, 2017, a three peaks rainstorm induced a complex sequence of debris flow phenomena in Buthier d'Ollomont Stream basin (Aosta, Italy) causing damages to houses and infrastructures in Voueces, municipality of Ollomont (Aosta, Italy). The three consecutives events (with initiation in Berruard Stream basin, right tributary of Buthier d'Ollomont Stream) were characterized by different hydrological characteristics, solid volume amounts and increasing effects on the territory. The first event involved only the upper part of Berruard Stream basin and it caused high erosion. Instead, the second debris flow reached the alluvial fan of Berruard Stream causing flooding and significant deposition. The last event first flooded the alluvial fan and then the remaining high concentration mixture flowed into Buthier d'Ollomont Stream and it reached Voueces with severe consequences.

Our study aims at understanding, reconstructing and simulating this complex debris flow phenomena in order to be able to derive some general considerations to be used in anticipatory contexts.

The back-analysis was carried out starting from the measurement of the deposits volumes by comparing the pre-event Digital Terrain Model (DTM) and the post-event Digital Surface Model (DSM). Then, the meteorological forcing was analyzed by taking into account the data of the nearest rain gauge and the total event hydrograph was estimated with a semi-distributed hydrological model. A three peaks shape characterizes the obtained hydrograph, shape consistent with the occurred debris flow phenomena. A first gross theoretical estimate of the deposited volumes was obtained from the time integral of the difference of the discharge leaving the interested area, estimated by using the volumetric method and the downstream fan pre-event slope, and the discharge entering the interested area, estimated with the volumetric method and the upstream pre-event fan slope. The obtained volume is consistent with the measured one, meaning that debris flow was substantially in equilibrium with fan slopes during the event (fan is far from triggering areas). Subsequently, the DTM has been manually modified to introduce spatial details, negligible for deposits volumes estimation but essential for obtaining proper simulations. Starting from the modified DTM and the hydrographs, several numerical simulations have been carried out with WEEZARD, a smart, cost-effective system, aimed at producing, managing and analyzing high-quality debris-flow simulations. A satisfactory total event reconstruction was obtained simulating in cascade the three events and calibrating the physical parameters (submergence, roughness and sediment diameter) in their validity ranges, minimizing the difference between measured and simulated bed variations. The simulation results show that predictive approaches based on hydrological estimates and volumetric method are reasonable choice in order to simulate phenomena far from initiation area. Actually, the mixture hydrographs, obtained from the volumetric method, are appropriate for event reconstruction although short impulsive waves, happened during the event, are not represented. Finally, the two-phase nature of the numerical model TRENT2D, present in WEEZARD, proved to be fundamental to simulate the deposition phenomena that caused flooding both in Berruard fan and in Voueces, feature that would not have been captured by a single-phase model.