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Integrating high-resolution hydrology and geomorphometry for flash flood characterization

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Flash floods represent a major natural hazard whose characterization is usually challenging due to their rapid temporal evolution and severe but localized spatial dynamics. Post-event monitoring of flash floods, in fact, represents still at present a key step in order to improve the assessment of both hazard and vulnerability. In this study, we integrate a chain of tools for an improved characterization of flash flood dynamics and related slope instability phenomena, focusing on a flash flood occurred on Aug 5-6 2017 over a 100 km^2 alpine catchment of northeastern Italy. The analyzed dataset encompasses the availability of calibrated radar rainfall, systematic post-event survey of cross sections, ad hoc post-event LiDAR terrain data and satellite/aerial imagery. The methodological framework of the hydrological analysis embraces the calibration of a rainfall-runoff model, its downscaling to ungauged catchments and its cross-validation with field surveys for an estimate of peak discharge and related geomorphic effects. The application of a morphometric index of sediment connectivity has allowed investigating the topographic potential for sediment to be routed downstream and to analyze spatial connectivity patterns at high resolution for all the sub-catchments. The analysis of available (pre and post) satellite and aerial imagery and, above all, the precious availability of pre and post event high-resolution LiDAR DTMs has permitted the assessment of erosion and deposition patterns in the study area together with the estimation volume uncertainty. Preliminary results portray the inner dynamic of the event as characterized by severe spatial and temporal variability and show consistency between simulated discharge and field surveys. The flood response of analyzed sub-catchments shows as well important correlation with the spatial patterns of the triggering thunderstorm. Sediment connectivity pattern has proved to be an important factor controlling the severity of the response at the analyzed catchments. The integration of geomorphic change detection framework for such event has permitted the volumetric quantification of the erosional processes phenomena thus enabling the analysis of the relation between both the triggering and the response quantitative magnitudes.