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A novel dynamical-based method for the determination of the rain pertaining to a debris-flow event and its use for the determination of rainfall thresholds

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A novel method for the determination of the volume of rain pertaining to a debris-flow event is presented. The volume is back-reconstructed, by using a set of relations obtained considering a convenient simplified description of the dynamics of the debris flows, starting from the knowledge of the volume occupied by the mixture during the deposition stage. The used relations are derived from the mass balance equations of the liquid and the solid phases, integrated in space over suitable control volumes, and in time over the event interval. Once the volume of rain has been estimated, the averaged intensity I and the duration D of the event is evaluated from the knowledge of the relevant hydrograph and the area of the basin. If a sufficiently large number of couples (I, D) can be evaluated, then a rainfall threshold can be computed by using a literature approach, e.g. the frequentist method.

The proposed backward dynamical method has been applied to a study area, namely the Trentino-Alto Adige region, located in the Italian Alps. The resulting threshold has been compared with the threshold obtained, for the same area, with a classical literature approach based on the Critical Duration time. Pros and cons of the novel approach is then analyzed.