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Assessing topsoil and bedrock hydrodynamic properties from natural and artificial rainfalls over a 10m^2 steep plot in Cevennes area (France)

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Flash floods are feature of Mediterranean climate characterized by heavy rainfalls in a few hours. Hydrological processes depend on both the topsoil and bedrock properties, which are still poorly known in the mountainous areas.

Thus, special attention was paid to characterize the water fluxes in the shallow near-surface area. This study focuses on a 10-m^{2}plot within a granitic hillslope in Cevennes area. Water content was monitored at several depths (up to 70cm) during both intense artificial and natural rainfall events, in order to study both infiltration and saturation processes in both extreme and normal conditions.

Inverse modeling was performed in order to estimate parameters, such as θs, θr, α, n, Ks associated to the Mualem-Van Genuchten formulation, using the HYDRUS-1D software. The deep boundary condition was also calibrated to assess the properties of the deep layers.

Although the topsoil depth is rather small ($\sim$40 cm), the water storage during the rainfalls was estimated to be some hundreds millimeters, which largely exceeds the topsoil capacity. It suggests that the weathered area (and maybe the fractured rock area) below the soil, can have an active role in the water storage and sub-surface flow dynamics. Similar parameters were used to perform correct simulations under both artificial and natural rainfalls: thus artificial rainfalls enhance extreme conditions corresponding to flash floods occurrence, and the identified flux patterns are robust in natural conditions.