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Do we really use rainfall observations consistent with reality in hydrological modelling?

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Spatial and temporal patterns in rainfall control how water reaches soil surface and interacts with soil properties (i.e. soil wetting, infiltration, saturation).
Once a hydrological event is defined by a rainfall with its spatiotemporal variability and by some environmental parameters such as soil properties (including land use, topographic and anthropic features), the evidence shows that each parameter variation produces different, specific outputs (e.g., runoff, flooding etc.).

In this study, we focus on the effect of rainfall patterns because, due to the difficulty to dispose of detailed data, their influence in modelling is frequently underestimated or neglected. A rainfall event affects a catchment non uniformly, it is spatially localized and its pattern moves in space and time. The way and the time how the water reaches the soil and saturates it respect to the geometry of the catchment deeply influences soil saturation, runoff, and then sediment delivery.

This research, approaching a hypothetical, simple case, aims to stimulate the debate on the reliability of the rainfall quality used in hydrological / soil erosion modelling. We test on a small catchment of the south of France (Roujan, Languedoc Roussillon) the influence of rainfall variability with the use of a HD hybrid hydrological - soil erosion model, combining a cinematic wave with the St. Venant equation and a simplified “bucket” conceptual model for ground water, able to quantify the effect of different spatiotemporal patterns of a very-high-definition synthetic rainfall.

Results indicate that rainfall spatiotemporal patterns are crucial simulating an erosive event: differences between spatially uniform rainfalls, as frequently adopted in simulations, and some hypothetical rainfall patterns here applied, reveal that the outcome of a simulated event can be highly underestimated.