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The interplay between man and the environment: modelling land use and evolving hydrological response in a Mediterranean catchment

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Increasingly, man plays an active role in the hydrological cycle thus modifying the storage and transport of water near the topographic surface and the resulting geomorphic work. This influence cannot be simply neglected when looking at the internal organization of catchments or at long-term changes in their response. It can be postulated that in medium-sized catchments (1-1000 km2) prolonged human activity, such as agriculture, may alter hydrological functioning and leave a persistent anthropogenic imprint. Whether this human imprint can be observed depends on the intensity of the human activities and the activity of natural processes.

For a 15-km2 large Mediterranean catchment, a comparison between pristine and human-impacted conditions for a 6000-year period from simulations with the meso-scale landscape dynamics model CALEROS revealed marked changes in its internal organization (e.g., soil properties, sediment transport) but little difference in annual water and sediment output at its outlet, even under intensifying agricultural practices. The question, therefore, arises whether the human impact can be inferred at the hillslope and catchment scale at all and if so, whether it is persistent over time. To answer this question, two numerical experiments were performed to detect the human signal in the dynamics of water and sediment output at the catchment scale. Using the existing experiment, water and sediment output were contrasted against their natural variability and the moment determined at which the human impact is positively identified. In a second, follow-up experiment, human activity is ceased completely at different stages of its development and its declining influence evaluated in order to determine when –if at all- the human imprint is obscured.

Although the results of this study are evidently conditioned by the physiographic setting of the study area and by the interactions simulated by the model, they can help us to understand the organization of medium-sized catchments and their resilience in light of ongoing changes.