



## Impact of climate variation and human activity on hydrological response: a millennium-scale model study for a highland Mediterranean catchment

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The close link between human occupancy and the Mediterranean landscape has long been recognized. Through the exploitation of the various but fragmented resources that these landscapes have to offer, man has been able to secure a living. However, these activities are often marginal and small shifts in population pressure, corresponding land use patterns or climatic variability can have large consequences on the redistribution of water and sediment in these areas.

The meso-scale landscape dynamics model, CALEROS, has been developed to simulate the interactions between climate, soil production and erosion, vegetation and land use on geomorphological to human time scales in Mediterranean environments. As such it is well-suited to investigate the relative impacts of climate, land cover and human activities on the hydrological catchment response and the associated sediment fluxes due to soil erosion and mass movements. As part of a geo-archeological study on the conservation potential of settlement history in the Contrada Maddalena from Neolithic times onwards (5000BP-present) we investigate here the relative contributions of climate and man over that period. To this end, we subject the model to climatic variations as reflected in proxy records and to differing levels of human activity through land use scenarios specifying technological constraints for different periods and individual energy requirement. To account for uncertainty, the model was run with similar but varying initial conditions while a hypothetical benchmark of natural variations was constructed by excluding human activity.

Model results allow to establish when human impacts become significant over natural variations and to discern shifts in catchment functioning as a result of sudden or climatic variations (e.g., Little Ice Age) as reflected in vegetation patterns and water and sediment fluxes within the catchment and at the outlet (sedi-, hydrographs). Preliminary results indicate an early divergence in catchment behaviour after the introduction of agriculture and marked shifts in catchment response to both variations in population pressure and climatic variations at the local and catchment scale. In order to establish the veracity of these results we compare model outcome at the local scale with land cover attributes, distributions of landscape characteristics (soil depth, slope) and archeological remains and we relate the findings to evidence from literature at the regional scale. Although the results are clearly constrained by past land use and climatic variations, the resulting trends and shifts in landscape dynamics provide an analogue for possible impacts in regions that experience similar developments.