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Sources and sinks of water and sediment in a Mediterranean landscape: an example of connectivity from the Guadelentin area, SE Spain

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Mediterranean environments are highly dynamic, reflecting often neo-tectonic activity, highly variable climatic conditions and transforming land use in response to demographic and socio-economic changes, both in the past and present. As a result, quantification of the hydrological response and water-induced soil erosion is a concern in the light of the sustainability of human activities as well as in relation to landscape development. In both cases, not only the amount of water and erosion are of interest but also the distance over which water and material is transported and where it is infiltrating or deposited, either for shorter or longer times; the connectivity between pathways of water and sediment transport is not static but depends primarily on the amount of surface runoff, infiltration capacity and sediment supply. As a result, vestiges of erosion processes often indicate very different intensities. In the case of the Guadelentín area, estimates of net erosion losses range from 0.4 tons•ha-1.yr-1 for plots to 2 tons•ha-1.yr-1 at the sub-catchment scale. In addition, net erosion rates for agricultural areas are generally due to soil conservation measures but can be catastrophic in the case of extreme events when these measures fail. In order to delineate the different sources of water as well as sediment and erosion losses in relation to the connectivity between sources and sinks we compared the runoff response at various scales and a sediment record from an artificial reservoir at the outlet of a catchment of 2 km2 of extensive land use over the period 1938-present with the stochastic results of a distributed and dynamic erosion model that was applied over the same periods. This model was calibrated with information at the plot to hillslope scale over the recent period 1995-2008 and validated against larger events that connected the catchment with the underlying cultivated slopes. In addition to the delineation of the more significant sources and sinks of water and material and the interpretation of these findings in the light of the geomorphological activity of the region, the skill of the model to reproduce erosive events was also assessed.