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Effects of agricultural drainage systems on sediment connectivity in a small Mediterranean lowland catchment under contrasted rainfall events

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Traditional drainage systems combining man-made channels and subsurface tile drains have been used since Roman times to control water excess, favouring adequate soil water regime for agriculture purposes. However, mechanization of agriculture, abandonment or land use changes lead to a progressive deterioration of these drains in the last decades. The effects of these structures on hydrological and sediment dynamics have been previously analyzed in a small Mediterranean lowland catchment (Can Revull, Mallorca; Spain) by establishing an integrated sediment budget with a multi-technique approach. Moreover, the recent advances in morphometric techniques enable the completion of this analysis by the accurate identification of active areas (i.e. sources, pathway links, and sinks) and improve the understanding of (de-)coupling mechanisms of water and sediment linkages. In this study, an index of connectivity (IC) derived from a LiDAR-based high resolution DTM (< 1 pt m-2; RMSE < 0.2 m) was used to evaluate the spatial patterns of connectivity of the catchment. Design and configuration of the drainage system in Can Revull generated changes, favouring lateral decoupling between different compartments, with hillslopes-floodplain and floodplain-channels relationships showing a general decrease of IC values, and high longitudinal connectivity along the artificial channel network. Field observations after a low-magnitude high-frequency event (i.e. 23 mm in 5 h) corroborated that the drainage systems in Can Revull enabled rapid drainage of the water excess also promoting low surface runoff within the field crops, proving to be an effective management practice for erosion control in agricultural Mediterranean lowland catchments.. However, the occurrence of high-magnitude rainfall events may exceed the drainage capacity of the artificial channel network, giving rise to changes in the spatial patterns of connectivity, shifting the water pathways, triggering new sedimentary processes and considerably increasing the effective area of the catchment. The relationships between structural and functional connectivity according to the frequency-magnitude of the events is a challenge that will be addressed in this oral presentation.