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Doctoral thesis summary

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Title of the thesis	Characterization of hydrological processes in a Mediterranean mountain research catchment by combining distributed hydrological measurements and environmental tracers
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The main objective of this thesis is to characterize hydrological processes in a Mediterranean mountain catchment,by combining distributed hydrological measurements and environmental tracers in order to improve the understanding of catchment hydrological function.

During the period 2009-2013 hydrological data were collected from the Vallcebre Research Catchments, monitored since 1996 by the Surface Hydrology and Erosion group of the IDAEA-CSIC. Data include, in addition to rainfall and discharge measurements, distributed hydrological measurements and environmental tracers (both geochemical and isotope ones) at different time scales (seasonal to event scale).

With this information, this study first investigates the spatial and temporal variability of the depth to water table during rainfall-runoff events. The results show that the depth to water table did not rise uniformly throughout the catchment during rainfall-runoff events. The spatial variability of depth to water table was mainly controlled by location characteristics, especially the piezometer distance from the stream, which influenced the distribution of wetness conditions within the catchment. The wetness conditions in turn affected the timing of the water table response, as well as the magnitude of the streamflow response. Spatio-temporal water table variability during floods varied, depending on the catchment's antecedent wetness conditions

Dissolved organic carbon (DOC) concentration dynamics in different hydrological compartments were also analysed (rainfall, soil water, groundwater and stream water) at different time scales (seasonal to event scale). The results show some seasonality in rainwater and soil water DOC concentrations, while no clear seasonality was found in stream water and groundwater, where DOC dynamics were strongly related to discharge and water table variations. During storm events, DOC concentrations increased systematically in stream water. In addition, for storm events with several discharge peaks, the slope of the discharge/DOC concentration relationship was higher for the first peak. The increase in stream water DOC concentration during floods suggested a relevant contribution of soil water, as well as the existence of stream water DOC sources near or in the stream bed. The rather similar dynamics of stream water DOC concentration in all floods contrasted with the diversity of hydrological processes observed. This raises the question of the origin of the rapid DOC increase found and the validity of the use of DOC as a tracer.

Finally, water mean transit time (MTT) was calculated in different hydrological compartments of the catchment, using stable isotopes (δ18O and δ2H) and tritium. The use of δ18O signal variations in rainfall and in the sampled hydrological compartments showed some limitations on water age calculation in the catchment studied: it only indicated that MTT was greater than two years. The use of a new methodology (TEPMGLUE) to calculate MTT using tritium allowed consideration of different sources of uncertainty in water age determination, as well as evaluation of the benefit of using samples of different ages and of differing analytical quality. The results showed similar MTT calculations, whether including only the water samples taken in the 1990s or using all samples (1996-1998 and 2013). However, when calculating MTT with only high analytical quality samples taken in 2013, two different MTTs were obtained. The MTT results showed that, in the Vallcebre catchments, well water was the youngest, followed by stream and spring water. The study also showed the relevance of the rainfall tritium input function to MTT calculations. Finally, results showed that topography did not affect MTT spatial distribution, whereas geological settings did.

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Signature