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Understanding the changing behaviour of a Mediterranean mountain catchment using stable isotopes and hydrometric data

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Mediterranean mountain areas shares hydrological processes of both wet and dry environments in a seasonal pattern that leads to a changing behaviour along the year. This hydrological behaviour has been investigated in the last two decades in the Vallcebre Research Catchments (NE Spain, 42º 12'N, 1º 49'E) using a twofold approach based on hydrometric measurements and modelling. Results obtained have shown the complexity of the rainfall-runoff relationship as well as the strong non-linearity of the catchment's hydrological response. During wet periods, the hydrological behaviour of the catchments is broadly similar to that observed in more humid regions. On the contrary, during dry periods or during wetting up transitions, some hydrological processes characteristic of humid conditions may be temporarily absent, triggering a different combination of hydrological processes.

In order to improve the understanding of the hydrological behaviour of these catchments, water stable isotopes have been used in the last 3 years for determining the relative contribution of event and pre-event water at the rainfall-runoff event scale. Even if the use of stable isotopes in seasonal Mediterranean catchments has been relatively limited so far compared to humid temperate catchments, results obtained in the Vallcebre Research Catchments showed that the information they provide was very helpful in combination with detailed hydrometric data.

Results obtained using stable isotopes were generally in line with previous finding in these catchments, even if the contribution of pre-event water was higher than expected in some conditions. Two components hydrograph separations indicated that pre-event water accounted for 30% to almost 100% of the runoff depending on antecedent wetness conditions, on the extent of saturated areas within the catchment and on rainfall characteristics, helping to build a more complete picture of the changing behaviour of Mediterranean mountain catchments.