



Young water fractions at diverse time scales are driven by varying runoff generation processes in a Mediterranean small research catchment

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The time water resides within a catchment has important implications for the water availability and quality for both ecosystem and human use. Here, we look at the short-term water transport using the concept of young water fraction (F_{yw}), defined as the proportion of water that is younger than 2-3 months. The study was conducted for the 0.56 Km² sub-humid Can Vila catchment (Vallcebre Research Catchments). During a period of over 58 months, the isotope ratios (²H and ¹⁸O) of rainwater was sampled at 5-mm rainfall intervals and stream water was sampled at variable time intervals (30 minutes to 1 week) depending on flow.

The early results of this research revealed intense dynamics of F_{yw} in relationship with discharge: F_{yw} had values between 0 for low flows and around 1 for the highest flows. Yet, the high variability of discharge and flashy response behaviour in this catchment along with the relatively large discharge sensitivity (S_d) of F_{yw} implied that even if the maximum sampled discharges were exceeded by only 0.01% of time, about 25% of the F_{yw} associated to the highest flows were estimated to be missed by the stream water sampling. This behaviour may be associated with a response dominated by saturation runoff generation mechanisms during wet episodes, which are known to drive the main hydrological response of this catchment.

Nevertheless, these results are obtained when all the samples are lumped for the whole 58 month period, but when different 12-month windows are investigated, the behaviour of F_{yw} becomes more intricate. Indeed, the wetter year was associated with the largest F_{yw} and S_d values, but drier years had irregularly varying values poorly correlated to precipitation or runoff statistics. Thus, other runoff generation mechanisms previously identified, including Hortonian-type overland flow in small degraded areas, that lead to runoff of new (and hence young) waters for low to moderate flows, will play a special role.

Current research is comparing F_{yw} analyses for groups of events of the same class, supported by hydrograph separation analyses and hydrometric indicators, for better understanding the

dynamic and complex response of F_{yw} in this catchment. Our work further advances the understanding of limitations and opportunities of the F_{yw} approach.