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Ecohydrological separation in a Mediterranean mountain environment (Vallcebre research catchments, NE Spain)

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Until very recently, a general paradigm in hydrology was that water is well mixed in the soil, and therefore groundwater, stream water and plant transpiration are all sourced by this well mixed pool. However, recent works (Brooks et al., 2010; Goldsmith et al., 2012) have shown the existence of different water pools in the soil, where tightly bound water, potentially used by plants, does not mix with mobile water that potentially contributes to groundwater and streamflow.
This new "two water worlds hypothesis" of ecohydrological separation of water between streams and trees should however be verified in areas with different climates and land covers (McDonnell, 2014). With this objective, we examine this hypothesis in the Vallcebre Research Catchments (NE Spain, 42º 12'N, 1º 49'E) using the dual isotope-based approach combined with meteorological and hydrometric monitoring.
Since May 2015, stable water-isotopes have been monitored in rainfall (2 locations), in throughfall and stemflow below Scots pines as well as in stream water at the Can Vila (0.56 km2) catchment outlet. Moreover, three spatially distributed sampling campaigns in different antecedent soil moisture conditions have been performed (May, August and November 2015) within the catchment. During the sampling campaigns soil samples (10, 20, 30, 50 and 100 cm) and xylem samples (3 Scots pines) were collected at 8 locations, with different topographic indices. Water in soil and xylem samples was extracted by cryogenic vacuum distillation. This information was complemented with mobile soil water sampled in 3 lysimetric profiles (20, 50 and 100 cm) and in 13 piezometers (150-300 cm deep) distributed within the catchment. These campaigns were combined with a similar regular sampling, every 15 days (From May to December 2015) at one of the 8 locations. All the isotopic information, obtained by infrared spectroscopy, has been combined with continuous measurement of meteorological, soil moisture and potential, piezometric levels and hydrological variables at plot and catchment scales. These results will provide some new insights on the relevance of the two water worlds concept in a highly seasonal Mediterranean climate.