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- Library Search
- Title and Author Search

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[Volumes and Issues](#) [Contents of Issue 3](#)

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Hydrological processes and their seasonal controls in a small Mediterranean mountain catchment in the Pyrenees

F. Gallart, P. Llorens, J. Latron, and D. Regúés

Institute of Earth Sciences 'Jaume Almera' (CSIC), Lluís Solé Sabarís s/n, E-08028 Barcelona

E-mail for corresponding author: fgallart@ija.csic.es

Abstract. The Vallcebre catchments are located in a middle mountain area of the Pyrenean ranges, built up by sedimentary rocks and loamy soils. The vegetation cover is pastures and forests of *Pinus sylvestris*, mostly occupying former agricultural terraces. Some relatively small, heavily eroded landscapes (badlands) occur in the catchments, playing a relevant hydrological and geomorphic role. Annual precipitation is 924 mm and potential (reference) evapotranspiration is about 700 mm. Rainfall interception in forests represents about 24% of precipitation; interception rates were similar throughout the seasons because of a compensation between rainfall intensities and atmospheric conditions. Soil moisture showed a temporal pattern characterised by the occurrence of marked deficit periods in summer and also, but less pronounced, in winter. During most of the year, subsurface flows on hillslopes drove the spatial organisation of soil moisture and the occurrence of saturated areas. Nevertheless, this spatial organisation was also controlled by the patterns of vegetation cover. During dry periods, subsurface flow ceased, saturated areas disappeared and the spatial patterns of soil moisture changed. Stream flow from these catchments was dominated by storm flow, and the runoff generating mechanisms showed a clear seasonal pattern, controlled mainly by the soil moisture and the extent of saturated areas. During the dry periods, runoff was produced only on impervious areas and badlands. At the end of the dry periods, some large rainfall events generated significant runoff because of the perched saturation of the shallow soil horizons. Thereafter, runoff generation was dominated by the role of saturated areas. Stream waters in catchments with badlands had very high suspended sediment concentrations. The seasonal pattern of erosion processes in badlands was characterised by physical weathering during winter, regolith breakdown and vigorous hillslope erosion during spring and summer, and efficient transport of sediments in autumn.

[Final Revised Paper](#) (PDF, 754 KB)

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