Geophysical Research Abstracts, Vol. 7, 08612, 2005
SRef-ID: 1607-7962/gra/EGU05-A-08612

Investigating hydrological regimes and processes in a set of catchments with temporary waters

F. Gallart for the TEMPQSIM-HYDRO TEAM
ICTJA-CSIC, Barcelona, Spain (fgallart@ija.csic.es)

The traditional perception of runoff generation in semi-arid areas is that the primary generation mechanism is overland flow as the result of rainfall falling at an intensity greater than the local infiltration capacity of the soil (Beven, 2002). Nevertheless, field studies have shown that overland flow may also be produced in these environments as the result of saturation mechanisms, like the saturation of thin soils during large events (Martinez Mena et al. 1998), the seasonal saturation of valley bottoms (Ceballos et al. 2000) or the seasonal formation of a water table and saturated areas throughout the catchment, with relevant contribution from subsurface flow (Gallart et al. 2002). Hydrological systems are complex and different hydrologists might not necessarily agree about what are the most important processes in a catchment (Beven, 2002). Yet, many areas show a significant seasonality, so that the dominant processes may change throughout the year (Kirkby, in press).

Within the framework of the EU-funded project TEMPQSIM (EVK1-CT2002-00112) eight catchments have been investigated in order to improve the understanding and modelling of water quality in temporary waters. One of the first steps was the setting of perceptual models of the hydrological functioning, i.e the summary of perceptions of the processes controlling how the catchment responds to rainfall under different conditions (Beven, 2002). Different hydrological processes mean different pathways and residence times of exchange with rocks, soils and sediments, that control water quality. The method was the analysis of monthly precipitation and potential evapotranspiration rates, the flow duration curves, the rainfall-runoff relationships, the suspended sediment concentration and water electrical conductivity hysteresis loops for some events, and the catchment internal data for the smaller and more instrumented catchments.

The results showed that the catchments are less ‘dry’ that initially considered. Only one of the catchments (Albujón, SE Spain) was really semi-arid, as potential evapotranspiration exceeded precipitation throughout the year and runoff events were produced by large precipitation events with irregular spatial distribution; antecedent conditions were always dry, runoff coefficients were very low at both the event and annual scale, and transmission losses were relevant. All the remaining catchments showed clear wet seasons when precipitation exceeded potential evapotranspiration, and the ‘wet’ runoff generation mechanisms were confirmed for these seasons by the dependence of runoff coefficients on antecedent conditions rather on rainfall intensity and the relevant contribution of baseflow to total stream flow.

Nevertheless, local infiltration excess (Hortonian) overland flow was inferred during summer storms in the more instrumented catchments (Vallcebre, NE Spain and Vène, SE France), and urban overland flow was also observed somewhere (Albujón and Vène). The seasonal role of groundwater in maintaining baseflow was observed especially in karstic areas (Kratis, Greece) but was inferred even in areas with rather low permeability bedrocks (e.g. Mulargia, Sardinia, Italy). Human impact on stream flow was found to be relevant in the maintenance of low flows during the dry season (Pardiela, Portugal), or causing the eventual drying-out of some reaches due to water abstractions (Kratis). Winter low temperatures were the main reason for low flows in one catchment (Iskar, Bulgaria). Finally, the studied reach in one of the catchments (Tagliamento, N Italy) has an ephemeral regime due to the stream water infiltration into a deep alluvial deposit.

Beven, K,J. (2002) Runoff generation in semi-arid areas. In Dryland Rivers, ed L.J. Bull and M.J. Kirkby, John Wiley, Chichester, 57-105.

Ceballos, A., Schnabel, S. (1998). Hydrological behaviour of a small catchment in the dehesa landuse system (Exremadura, SW Spain). J. Hydrol., 210, 146-160.

Gallart, F., Llorens, P., Latron, J., Regüés, D. (2002) Hydrological processes and their seasonal controls in a small Mediterranean mountain catchment in the Pyrenees. Hydrol. Earth Syst. Sci. 6(3): 527-537.

Kirkby, M.J. (in press) Organisation and process. In Encyclopedia of Hydrological Sciences, ed. M.G. Anderson, John Wiley, Chichester.

Martínez-Mena M., Albaladejo J., Castillo, V.(1998) Factors influencing surface runoff generation in a Mediterranean semi-arid environment: Chicamo watershed, SE Spain. Hydrol. Proc. 12: 741-754.