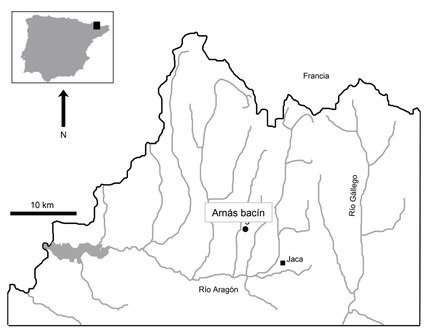
# Arnás catchment

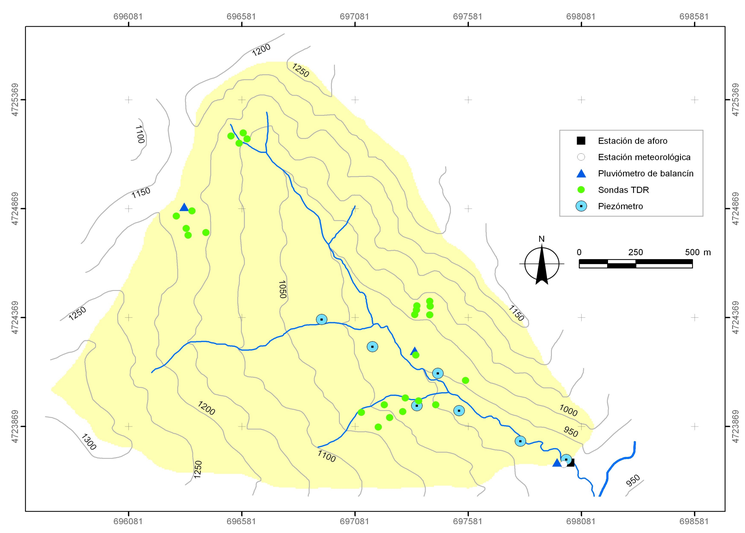
# Upper Aragón valley, Spain

## Basin characteristics

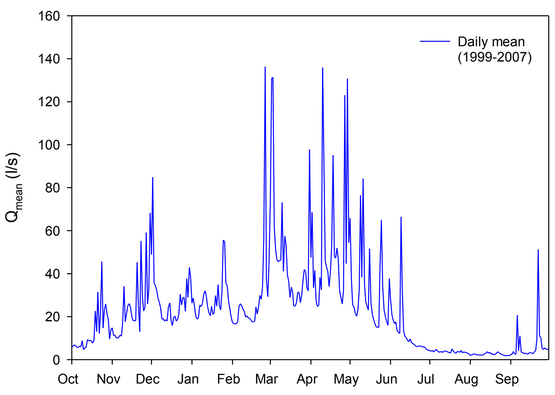
| | |
|---|---|
| River Basin / River Basin (according EU-WFD) | Lubierre river basin/ Aragón river basin |
| Operation (from… to…) | Since 1996, still in operation |
| Gauge coordinates / Gauge datum: | 0°35'W; 42°38'N/ 910 m a.s.l. |
| Catchment area: | 2.84 km² |
| Elevation range: | 910-1430 m a.s.l. |
| Basin type: ( alpine, mountainous, lowland) | Mountainous |
| Climatic parameters: (mean precipitation, temperature and others) | 950 ± 220 mm (1999-2005) |
| Land use: | 20% forest, 73% shrubs, 5.5% grass, 1.5 bare soil |
| Soils: | Regosols rich in carbonates and Cambisols |
| Geology: | Eocene flysch |
| Hydrogeology: (Type of aquifers, hydraulic conductivity) | |
| Characteristic water discharges: ($Q_{min}$, $Q_{max}$, $Q_{mean}$) | 0.0 l/s, 22.3 l/s, 4290 l/s |

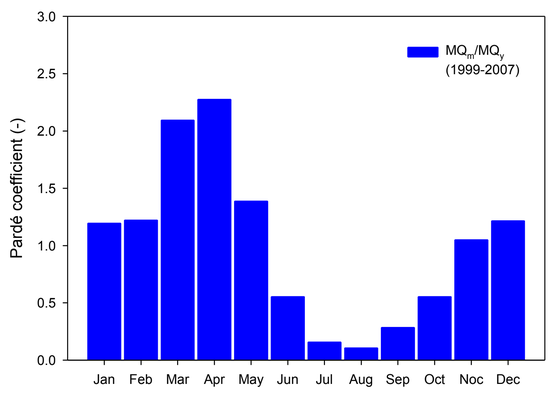
## Map of the research basin




## Mean hydrograph / Pardé flow regime




## Special basin characteristics (hydrogeology, lakes, reservoirs etc.)

Tha Arnás catchment was totally cultivated in non-terraced fields until the middle of the 20th century, then progressively abandoned and naturally re-vegetated with shrubs.

Such environment, affected by past agricultural practices, with more intensive uses in some areas and more conservative uses in others, now constitutes a "mosaic" of land patches that react differently under varying rainfall and catchment moisture conditions.

## Instrumentation and data

| Measured hydrological parameters | Measuring period | Temporal resolution | Number of stations |
|---|---|---|---|
| Stream flow | 1996 – cont. | 5 min | 1 |
| Precipitation | 1996 – cont.<br>2001, 2005 – cont. | 5 min<br>Impuls/ 0.2 mm | 1<br>2 |
| Air temp., Air hum, wind speed, radiation | 1996 – cont. | 15 min | 1 |
| Groundwater level | Nov 2003 – cont | 20 min | 7 |
| Soil water moisture | 1996 - 98<br>Jul-Dec 2005 | Once every 2/3 weeks | 25 points at 4 locations |
| Suspended sediment transport | 1996 – cont. | 5 min | 1 |
| Solutes transport | 1996 – cont. | 15 min | 1 |
| Bedload transport | Sept 2003 – Sept 2006 | Flood event | 1 |

## Applied models

1. TOPMODEL

## Main scientific results

1. Rainfall and runoff show a strong non-linearity during the hydrological year; sreamflow response is determined by catchment moisture conditions, in particular by water-table dynamics.
2. Water-table is highly seasonal, with a dry period in summer, followed by a progressive rise in piezometric levels during the autumn wetting-up period, and a saturation period in winter. Spatial variability in the water table is low within the catchment during wet and dry periods, but increase significantly during the wetting-up period.
3. During dry conditions, infiltration excess runoff over areas devoid of vegetation is the main active runoff process, occurring in response to short and intense rainstorms.
4. During wet periods, both saturation excess runoff over vegetated areas and subsurface flow are the dominant runoff processes operating within the catchment, generating slower streamflow responses.
5. During the wetting-up transition, the magnitude of the streamflow response is highly variable, depending mainly on the water-table level prior to the event and to a lesser degree on rainfall depth and intensity. Both infiltration excess runoff and saturation excess runoff processes can occur at the same time in different parts of the catchment.
6. Sediment sources are concentrated in a few places, mainly in areas adjacent to the main channel. In contrast, the slopes have limited geomorphic activity due to the presence of dense shrubs and grasslands, or are hydrologically disconnected from the fluvial network (i.e. bare scars of landslides)
7. The results reveal the importance of intense but infrequent events in the sediment response. Higher amounts of suspended sediment are found to be exported during spring and autumn, when the catchment is hydrologically more active, confirming the strong influence of runoff on sediment transport.
8. At the flood event, the analysis of SSC-Q relationships is useful for interpreting both the catchment hydrological and sedimentological behavior, confirming that during dry conditions infiltration excess runoff is the dominant process over the main sediment sources areas, whereas the wetting of the catchment causes dilution effects due to enlargement of the saturated areas, together with an increase in the base flow discharge.
9. The sediment balances for two hydrological years indicated the prevalence of solutes (48% and 61%, respectively), followed by suspended sediment (46% and 34%) and bedload (6% and 5%).

## Key references for the basin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6. García-Ruiz, J.M., Arnáez, J., Beguería, S., Seeger, M., Martí-Bono, C., Regüés, D., Lana-Renault, N., White, S. (2005): Runoff generation in an intensively disturbed, abandoned farmland catchment, Catena, 59, pp. 79-92.


## Contact


Dr. N Lana-Renault (1), Dr. D Regüés (2), Dr. JM García Ruiz (2)
1) Physical Geography Research Institute, Utrecht University, Faculty of Geosciences, P.O. box 80115, 3508 TC Utrecht, The Netherlands
2) Instituto Pirenaico de Ecología, CSIC, Campus de Aula Dei, Apdo. 13034, 50080 Zaragoza, Spain
lana-renault@geo.uu.nl, dregues@ipe.csic.es, humberto@ipe.csic.es