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Riparian Zone control on flow regime in a small Mediterranean catchment named Fuirosos, Catalonia (Spain)

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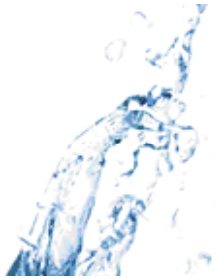

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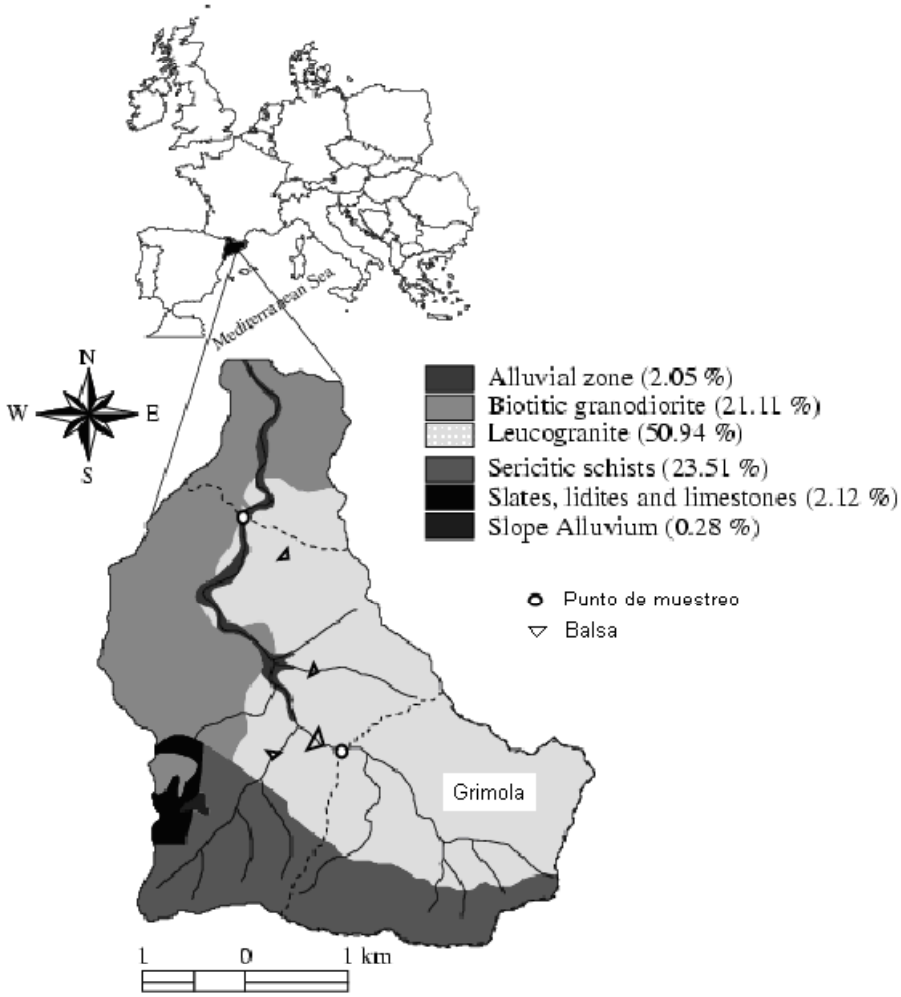
Objective:

- Field studies have pointed out that the local riparian aquifer can be subjected to seasonal and/or annual hydrological changes which may affect the relationship between biochemistry solute transport and the hydrology of stream-local aquifer system (Cirmo and McDonnell, 1997)
- In the analysis of an intermittent stream, this may represent an important mechanism to take into account in order to explain its non-linear behaviour.

The aim of this work is highlighting the role played by the riparian zone in explaining the non-linear response observed in the Fuirosos catchment

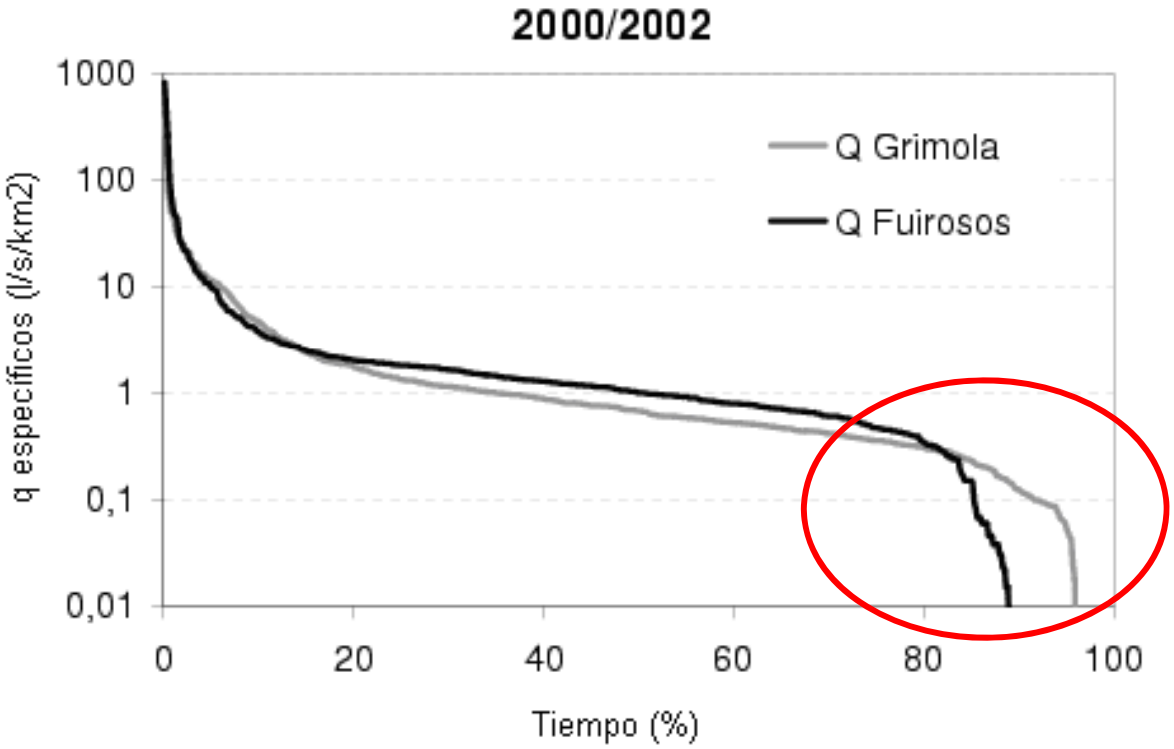
Study site: Fuirosos catchment

- Catchment area: 13 km^2
- Forest covers 90% of tot. area
- Well-developed riparian zone at the valley bottom
- Typically Mediterranean climate
- Intermittent stream
- Previously analysed (Bernal et al., 2004) with the INCA model (Wade et al., 2002)



Study site: Fuirosos catchment

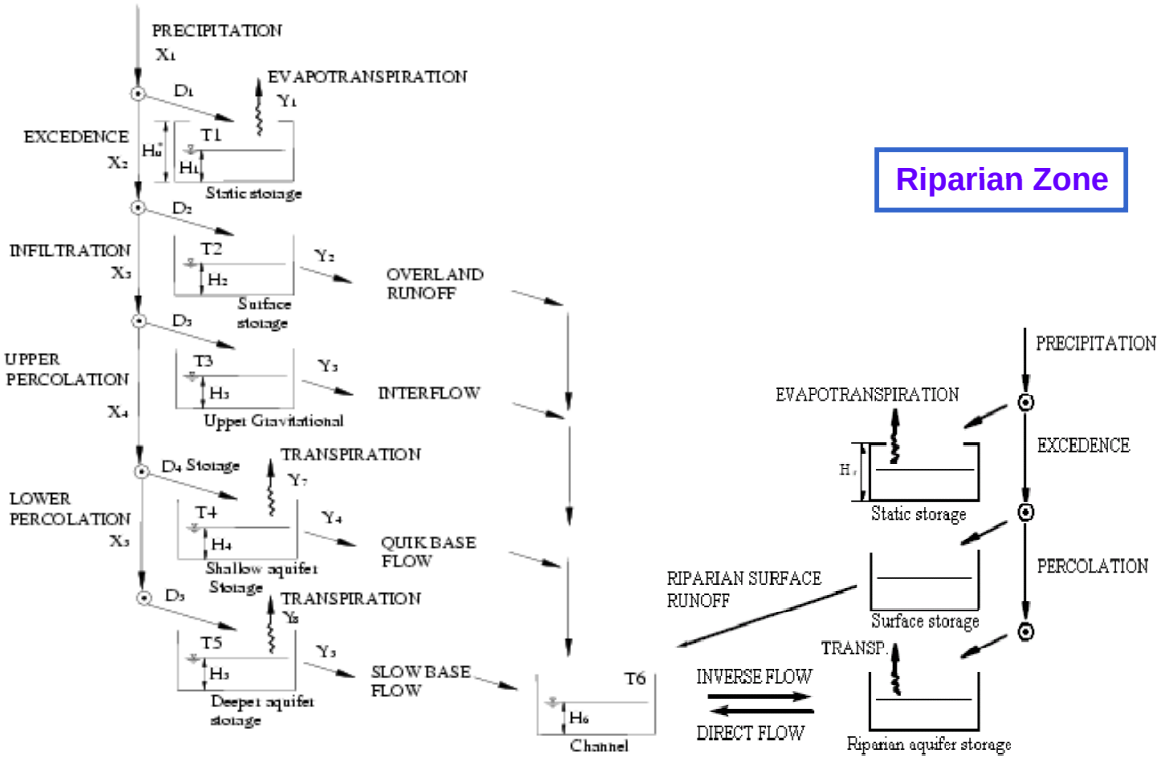
- Mean annual Ppt (P): 750 mm
- Mean annual ETP: 975 mm (Penman)



Hydrological model SD4-R

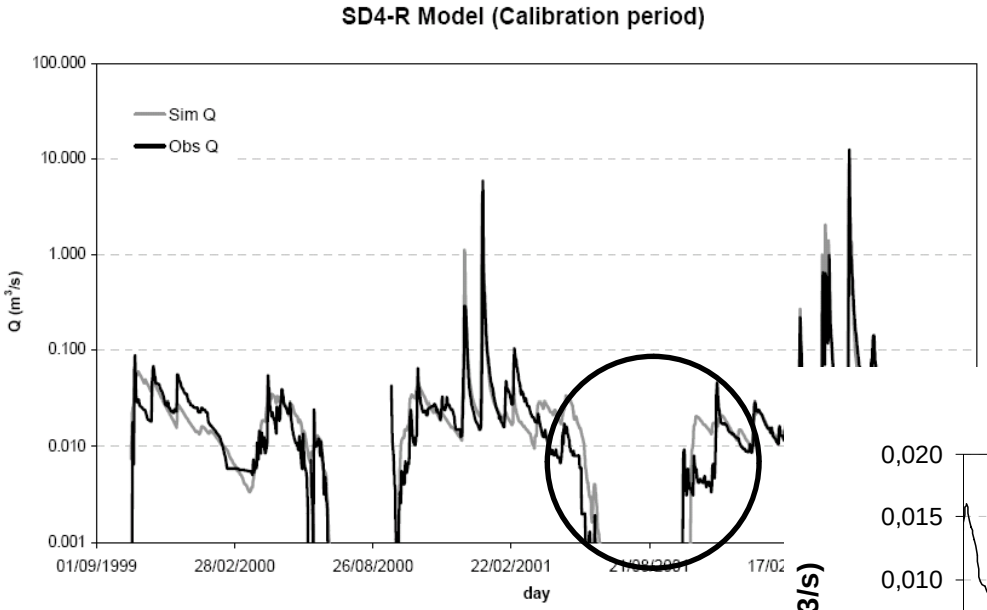
- Progressive perceptual modelling approach (Beven, 2000)

SD4-R model



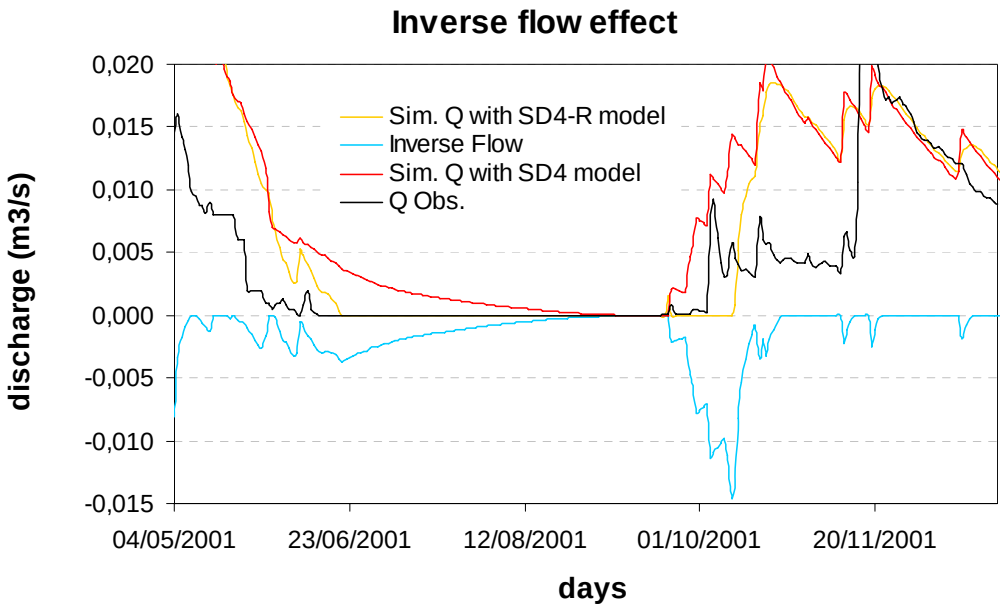
Riparian Zone

Calibration results:

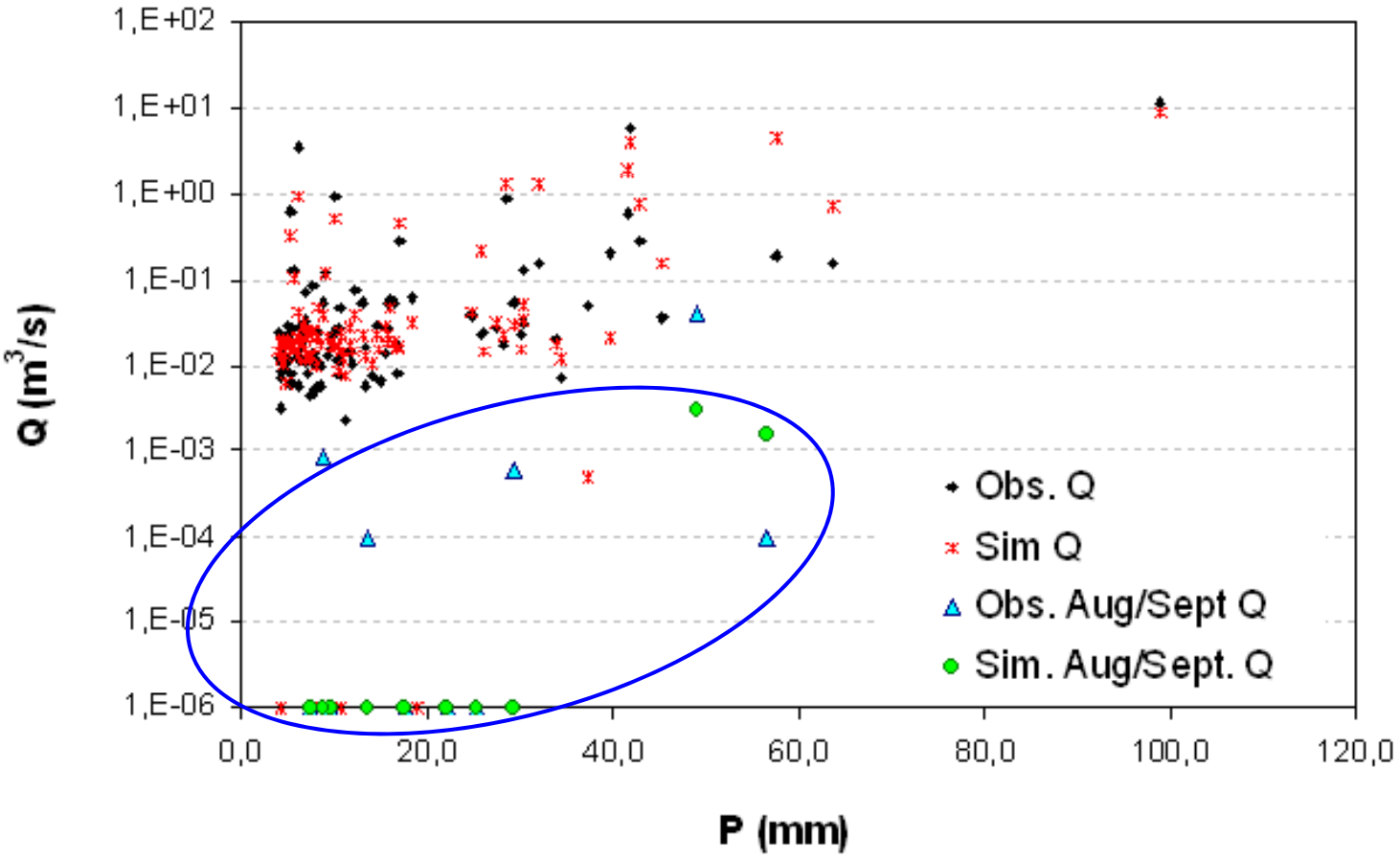


- Nash Index: 0,77
- Global BE Index: 5%
- Simulated peak flow: 8.6 m^3/s
- Observed peak flow: 10.9 m^3/s

- Simulated discharge less than 0,001 m^3/s: 212 (SD4-R)
- Observed discharge less than 0,001 m^3/s: 220

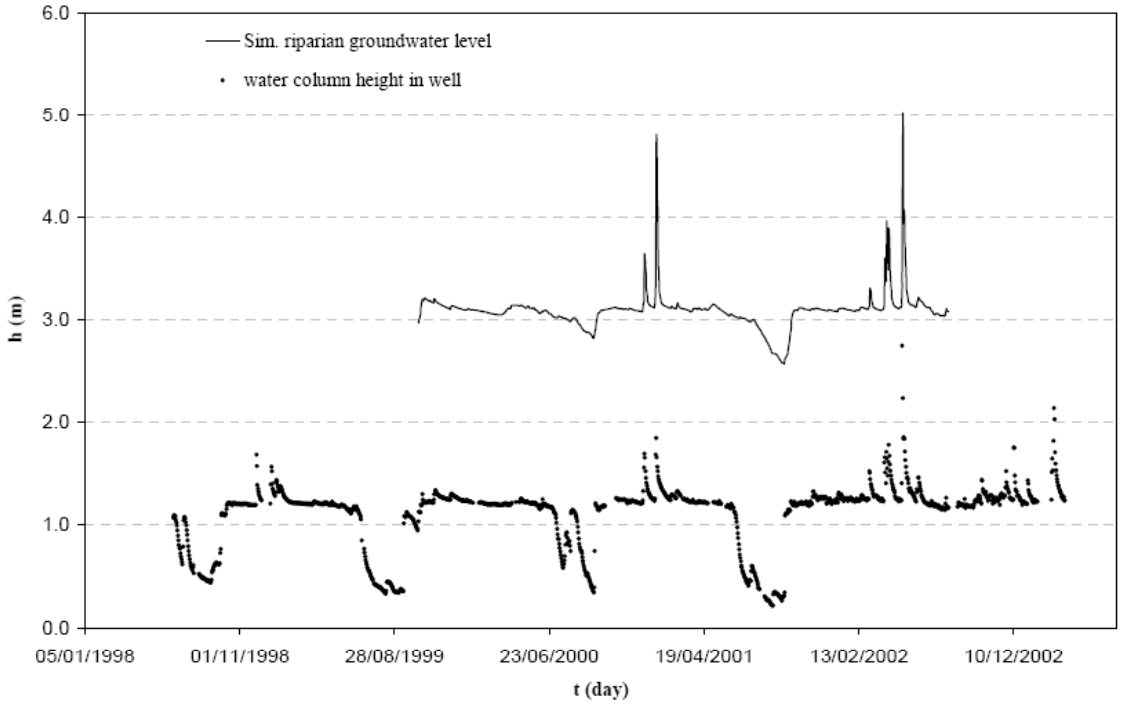


Calibration results:

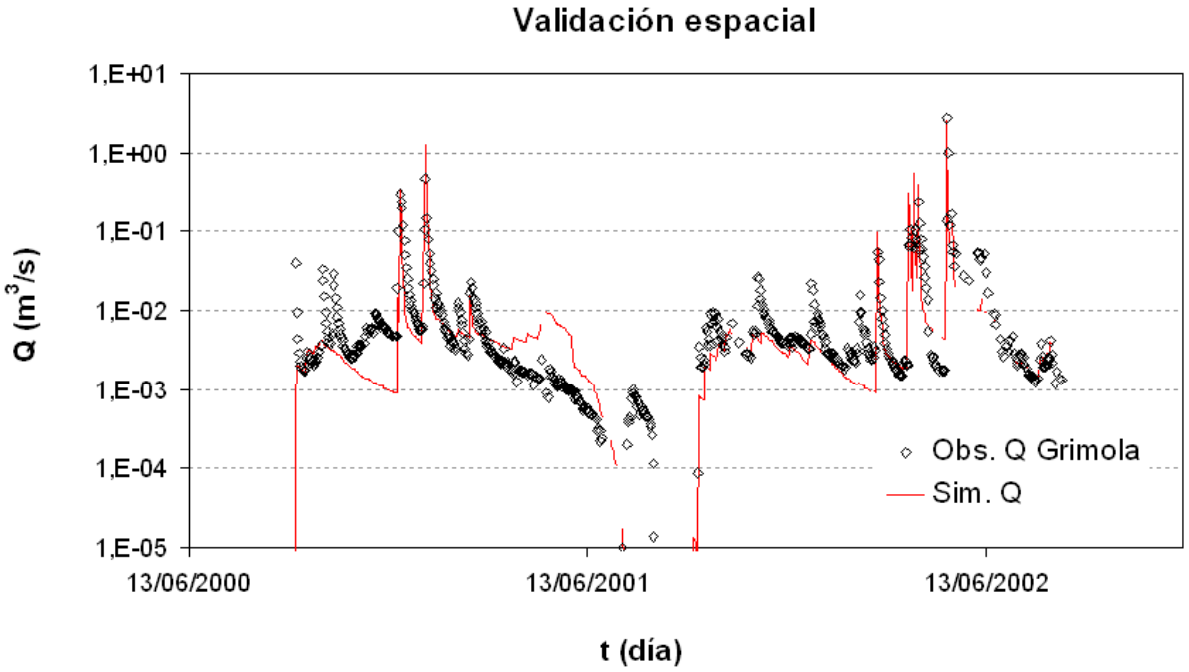


Quality Validation result:

- The temporal dynamics of the water level observed in a well located in the riparian area was compared with the temporal dynamics of simulated riparian water



Spatial Validation results:



Nash Index : 0.7

Total BE Error < 5%

- For the spatial validation at Grimola subcatchment, the riparian tank did not represent a key compartment, as it was for the Fuirosos catchment.

Conclusions:

- Our results suggested that the riparian tank exerted an important control on low streamflow, despite the fact that evapotranspiration by riparian vegetation represented a small fraction of water loss in annual terms (only 0.7%).
- It was highlighted the riparian zone as a key compartment for modelling successfully the drying-up period and the non-linear hydrological behaviour of semiarid systems during the wetting-up period.

Conclusiones:

- The sensitivity analysis of the riparian submodel parameters revealed that they exerted a very limited influence on the total flow (for a reduction by 50% the effect on total flow was less than 1%).
- This spatial validation result was coherent with our catchment perception: at Grimola (where there is not a well-developed riparian area exerting a great control on low flow), there is no need to include a riparian tank in the model in order to successfully represent the stream dry period.

Further research step: