EXPERIMENTAL SETUP FOR SCALING THE DYNAMIC OF INFILTRATION PROCESSES IN KARST AQUIFERS. SIERRA DE SEGURA (SOUTHERN SPAIN)

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1 INTRODUCTION

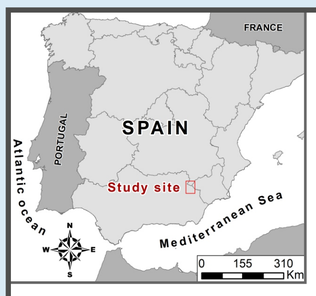
Advancing our current expertise of infiltration processes in karst aquifers is crucial for a better evaluation of water resources management as an adaptation to the global climate change scenario. In this work, continuous records of soil moisture* and soil temperature* from four lysimetric plots (LP) located in the Sierra de Segura (Southern Spain) have been jointly analised with the natural responses** (hydrodynamics, water temperature and electrical conductivity) from seven karst springs and an epikarstic spring. The characteristics from each lysimetric plots (altitude, soil development, type of vegetation, and edaphic properties) and the distance to the springs allow us to better understand the dynamics of infiltration processes. Small-scale systems allow us to study subsurface flows, in contrast to larger-scale systems, which can be used for looking at processes linked to recharge modality, response times, or water resource evaluation.

[(*15 min data) (**hourly data)]

2 OBJECTIVES

- Improving the understanding of dynamics of recharge and groundwater flow, taking into account factors conditioned by spatial and temporal scales.
- Estimate the surface-groundwater interactions and the processes which regulate the effective recharge, for the purpose of developing a more efficient method to evaluate water resources.

3 SITE SETTING & METHODOLOGY



Period		Lithology
Quaternary		Colluvial deposits
Neogene		Marls
		Calcarenite and limestones
Cretaceous	Upper	Dolostone and limestones
	Lower	Sand marl and loams
	Lower	Limestone and dolostones
Jurassic	Upper	Limestones
	Middle	Dolostones
	Lower	Limestones
Triasic		Clay and sandstones

Legend

- Spring (m a.s.l.)
- Water reservoir
- River network
- Weather station
- Lysimetric plot (m a.s.l.)
- Watershed
- Sink hole

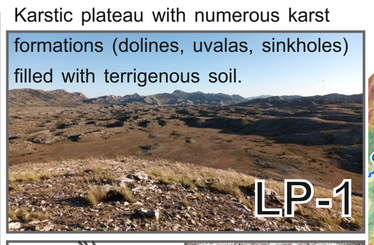
Altitude (m a.s.l.)

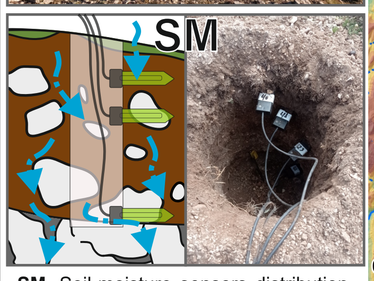
2.200 - 2.400 / 1.400 / < 600

Figure 1. Topographical map and landscape details of the study area. The entire area extends over 3000 km² of permeable outcrop. Upper Cretaceous-Terciary limestones and dolomites are the principal materials forming the main aquifer.

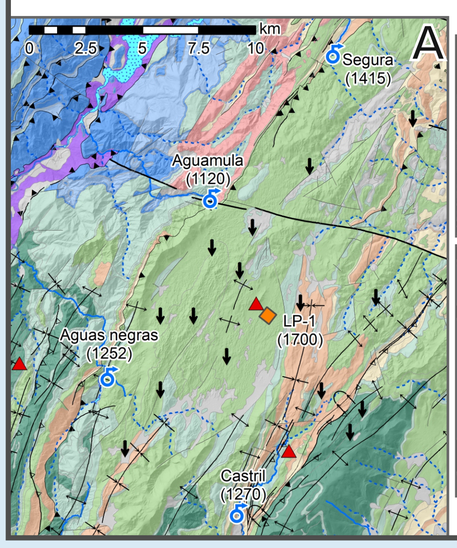
A. Central sector of Sierra de Segura, including Campos de Hernan Pelea (200 km² endhorreic area).

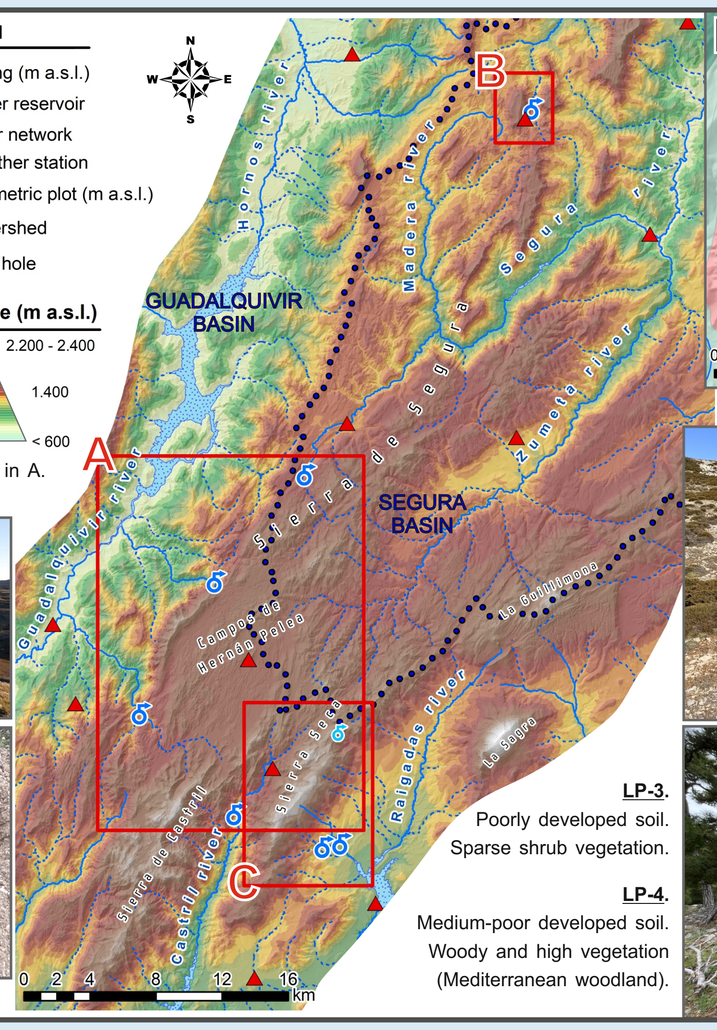
LP-1. Landscape of the lysimetric plot in A. Karstic plateau with numerous karst formations (dolines, uvalas, sinkholes) filled with terrigenous soil.

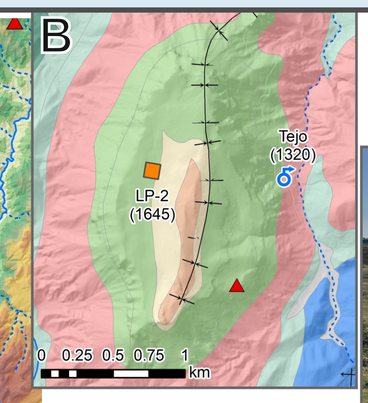




SM. Soil-moisture sensors distribution.





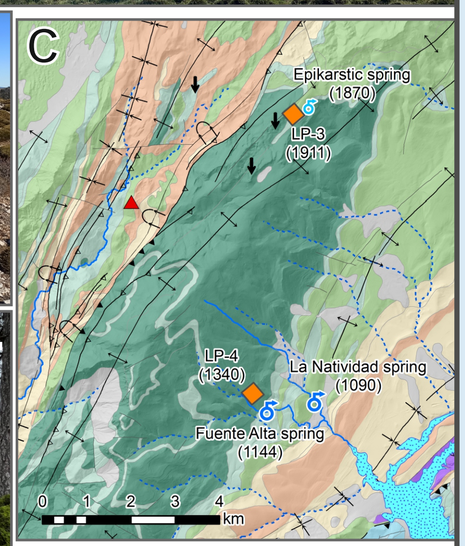


B. Calar del Espino recharge area (6 km²).

LP-2. Landscape of the lysimetric plot in B. Higlhly rocky surface with a poorly soil development and punctual areas with vegetation.

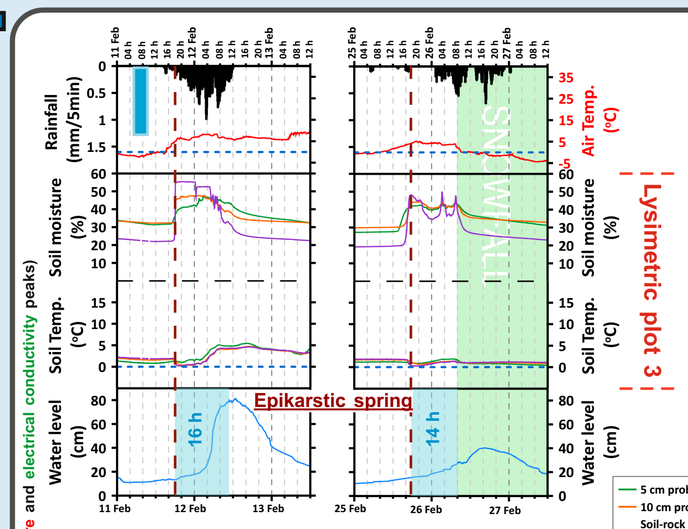
LP-3. Poorly developed soil. Sparse shrub vegetation.

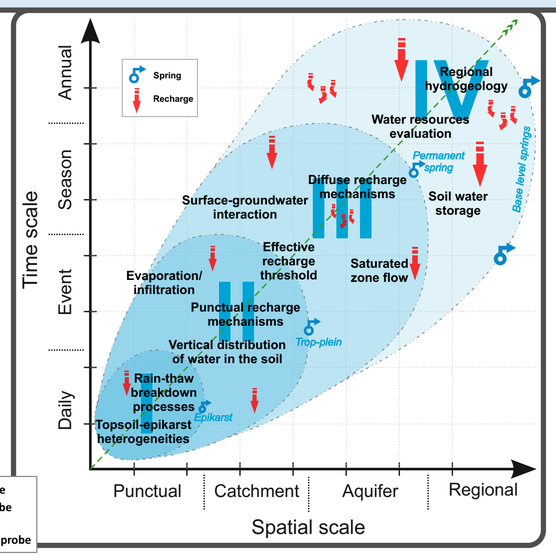
LP-4. Medium-poor developed soil. Woody and high vegetation (Mediterranean woodland).

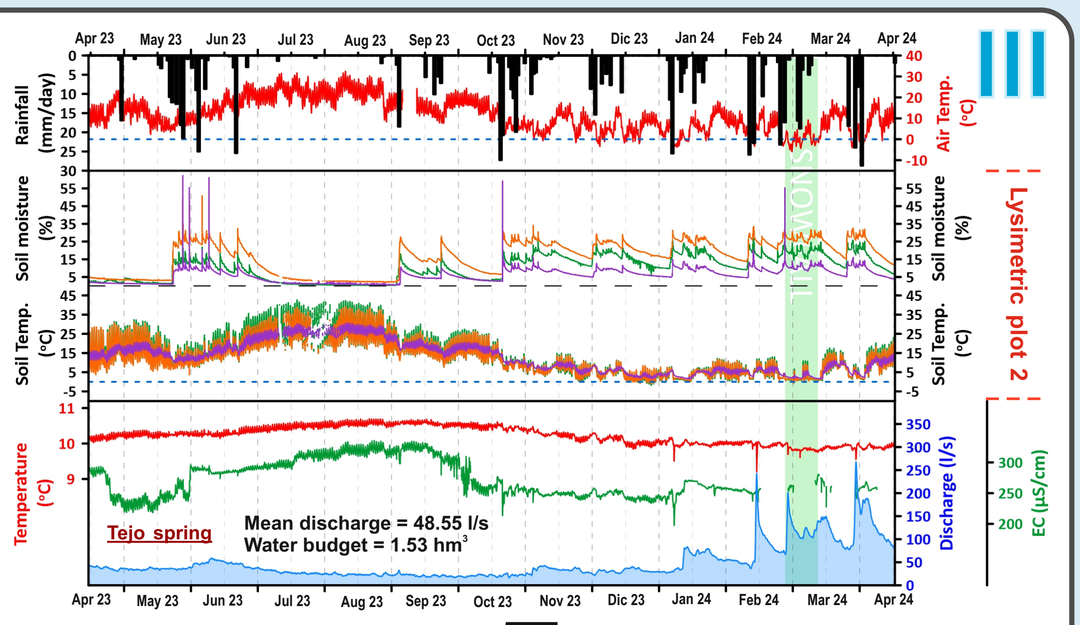


C. Sierra Seca recharge area (60 km²).

4 RESULTS







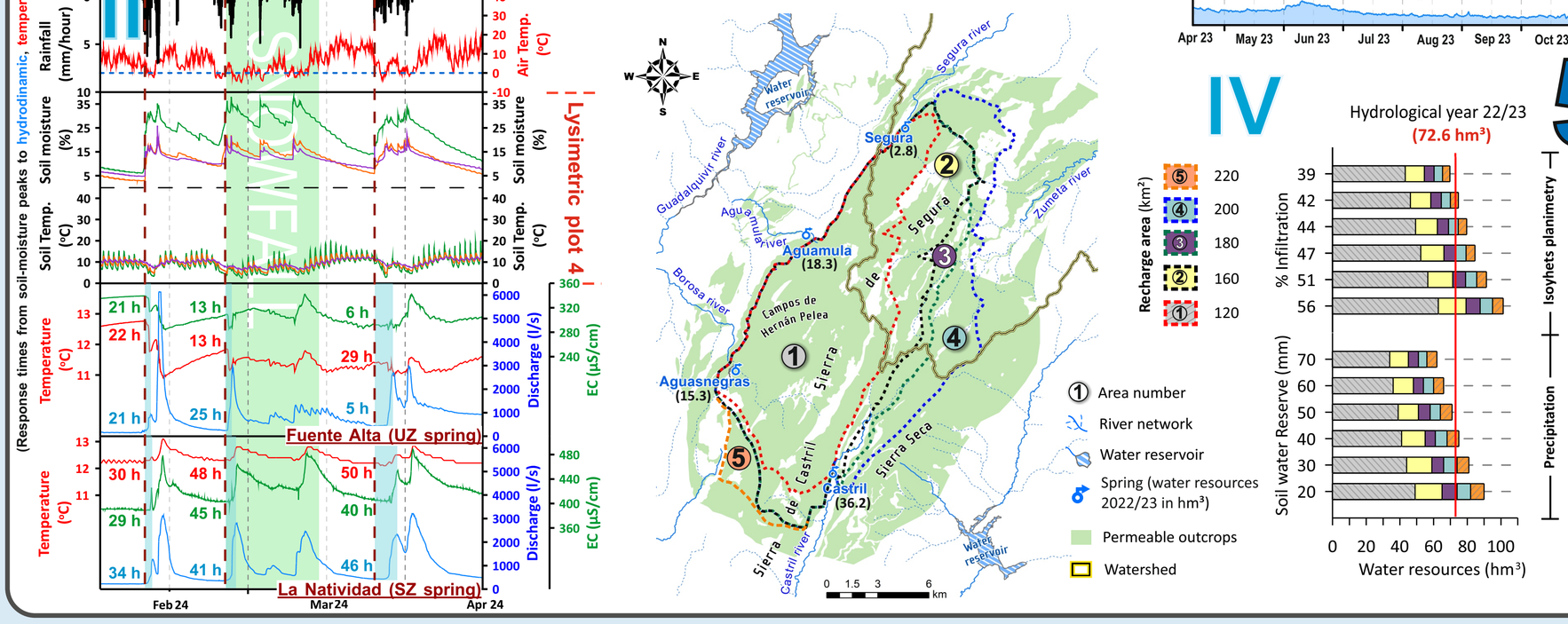


Figure 2. Continous records of the different parameters measured on field and description of the distribution of the different recharge processes, regarding temporal and spatial scale.
I - Punctual scale (*LP-3*), **II** - Catchment scale *(LP-2*), **III** - Aquifer scale (*LP-3 &LP-4*), **IV** - Regional scale (*LP-1*).

5 CONCLUSIONS

- Topsoil-epikarst processes -

The behaviour of the epikarstic spring reflects the sub-surface flow dynamics by distinguishing rainfall and snowfall, with a higher buffering and day/night variations for the latter case.

— Scaling issues —

The different catchment scales on which the four lysimetric plots have been established are allowing us to separate the main processes taking place during aquifer recharge.

- Punctual to catchment scale -

It can define the processes occurring in the soil after the storms for every recharge zone (different soil distribution and recharge modality) with the analysis of the vertical progression of water into the soil for each lysimetric plot.

- Catchment to regional scale -

Provides important information about effective recharge thresholds that trigge different magnitudes of responses, providing a and very innovative tool for assessing water resouces more precisely.

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