ASSESSMENT OF GROUNDWATER-RIVER INTERACTIONS IN THE CARBONATE FORMATIONS OF THE NORTHEASTERN AQUITAINE BASIN (FRANCE)

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Eaux-SCARS

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RÉGION Nouvelle-Aquitaine

Géosciences pour une Terre durable brgm

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Dordogne PÉRIGORD LE DÉPARTEMENT dordogne.fr

LOT-ET-GARONNE Le Département

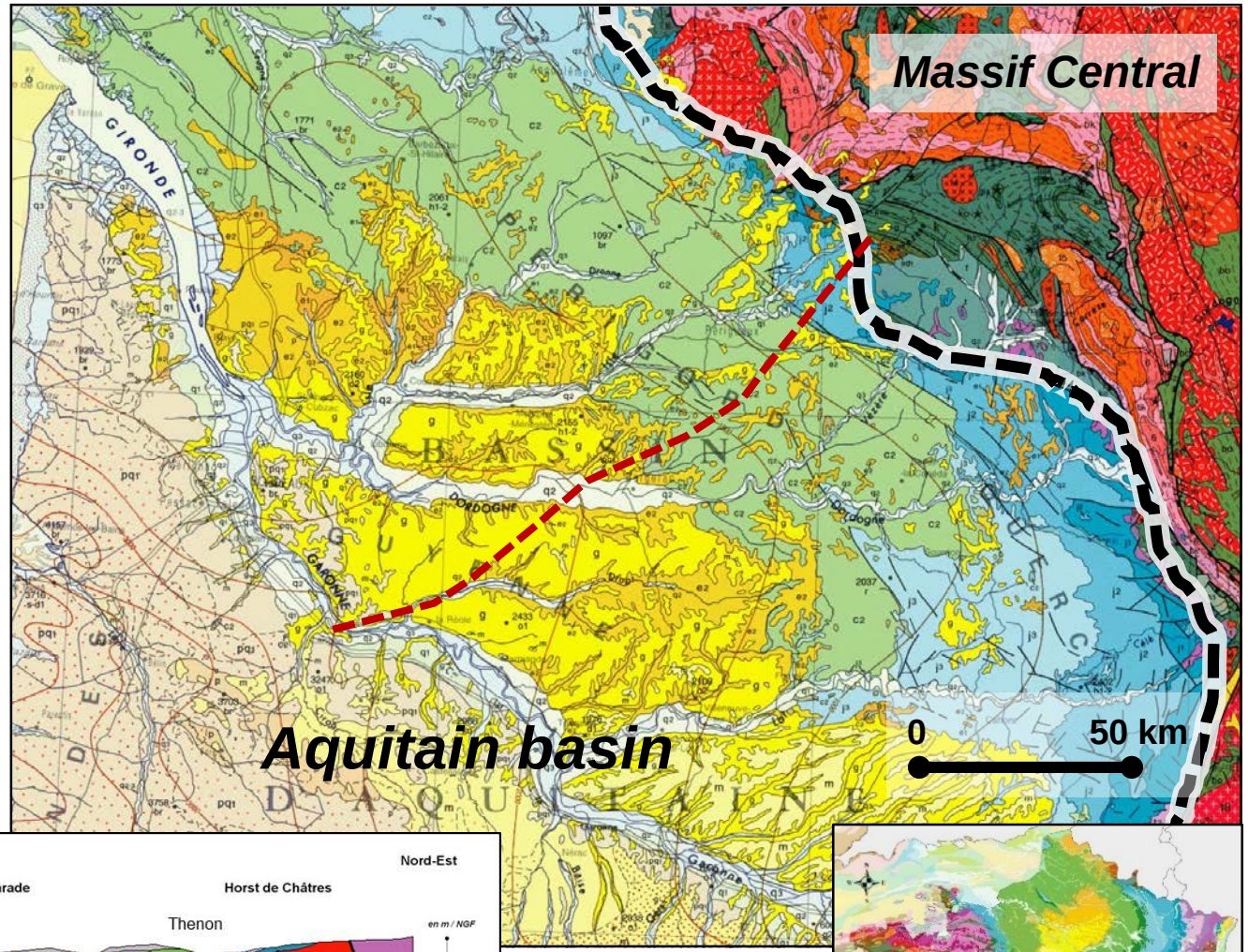
LOT LE DÉPARTEMENT

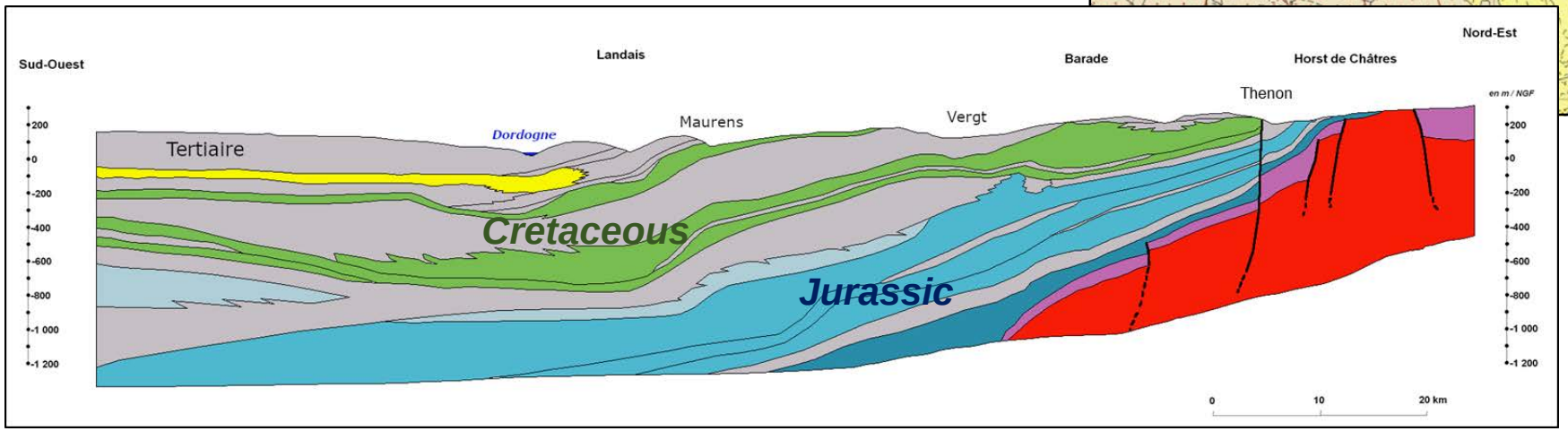
CHARENTE LE DÉPARTEMENT

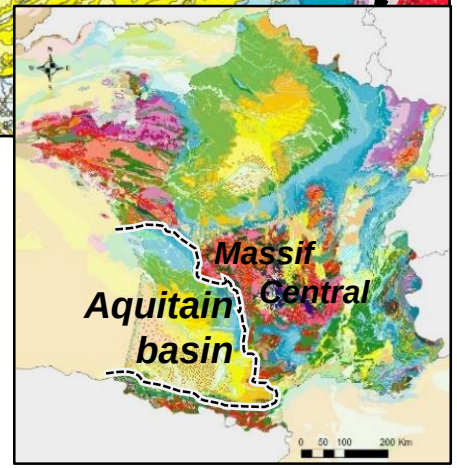
Context

Groundwater resources in the **Jurassic** and **Cretaceous** carbonate aquifers of a multi-layer sedimentary basin

Strategic aquifers for the majority of the region's water needs (drinking water, irrigation, industry)





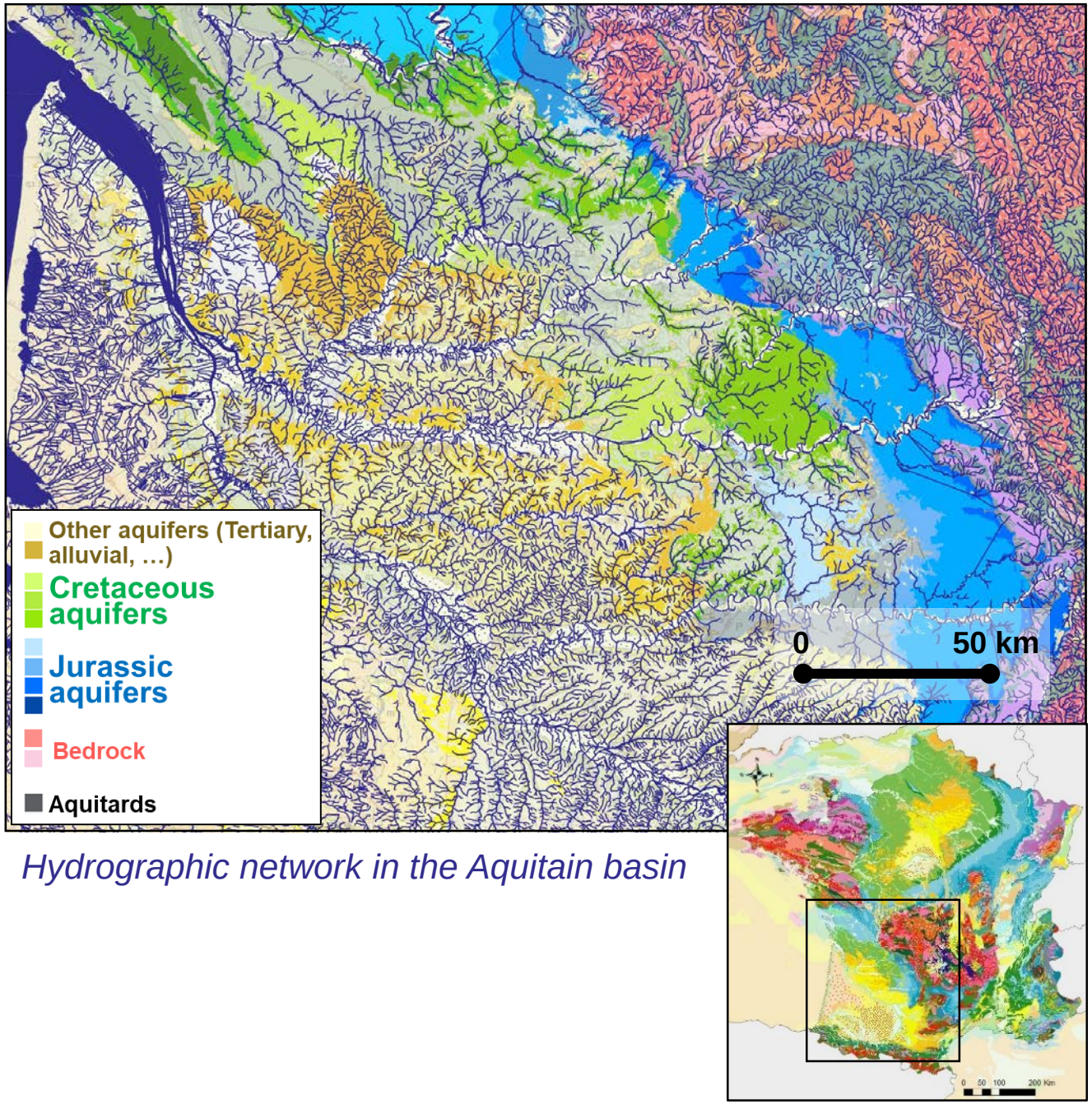


Context

Outcrop areas: aquifers closely linked to surface environments

Principal hydrographic network:
- originates and runs off the bedrock (at the east)
- crosses the Jurassic and Cretaceous formations

Low water levels become increasingly severe:
- ➢ restrictions on agricultural withdrawals
- ➢ source of tension between users



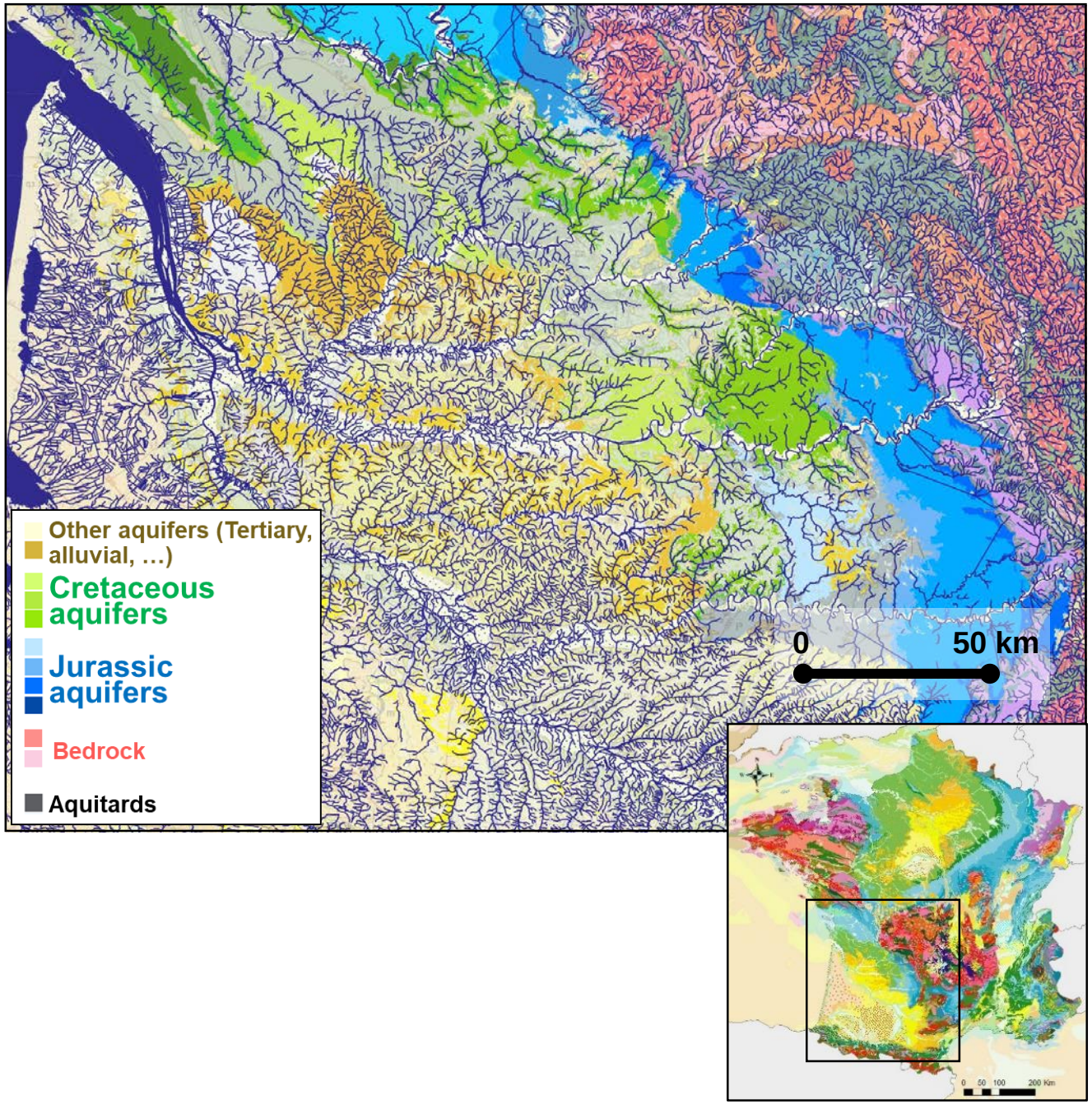
Hydrographic network in the Aquitain basin

Objectives

- **Better understanding the groundwater-rivers interactions:**
  - o groundwater support to river flow
  - o groundwater recharge by rivers

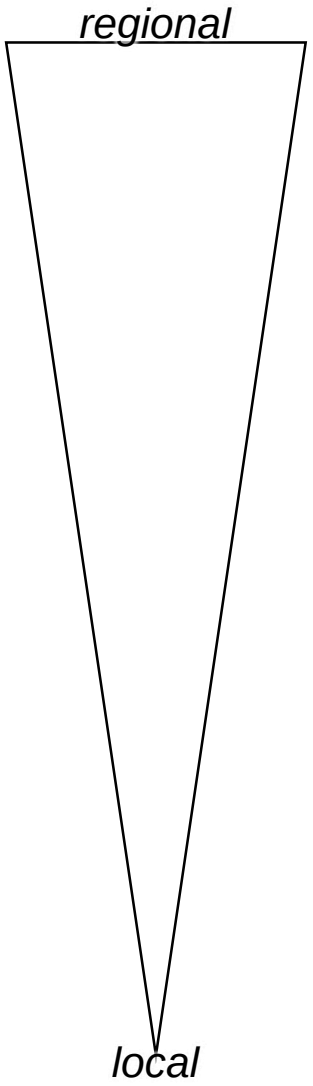
  ⇒ Identifying areas with tension on water resources

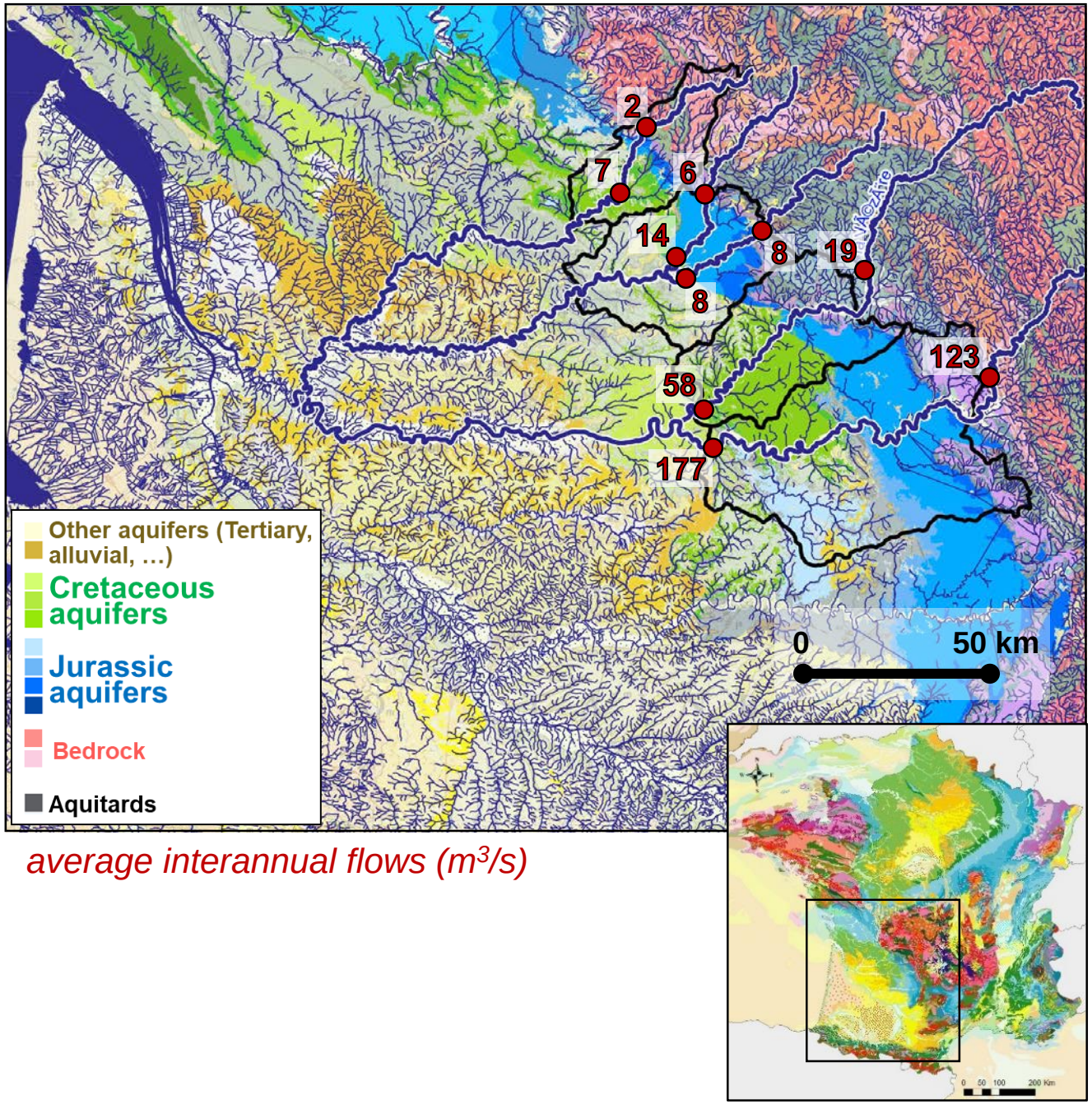
- **Integrating this knowledge:**
  - o Sharing with local stakeholders
  - o Management tools (hydrogeological models, …)



Different investigations & scales

- **Focus on 5 river systems in carbonate aquifers**





average interannual flows (m^3/s)

Different investigations & scales

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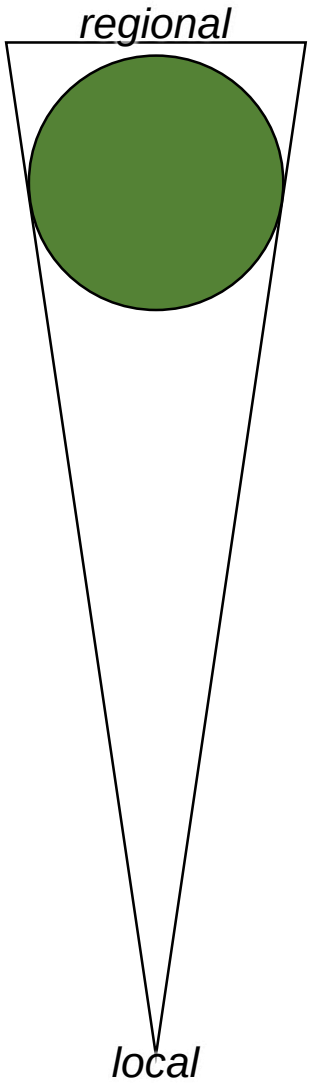
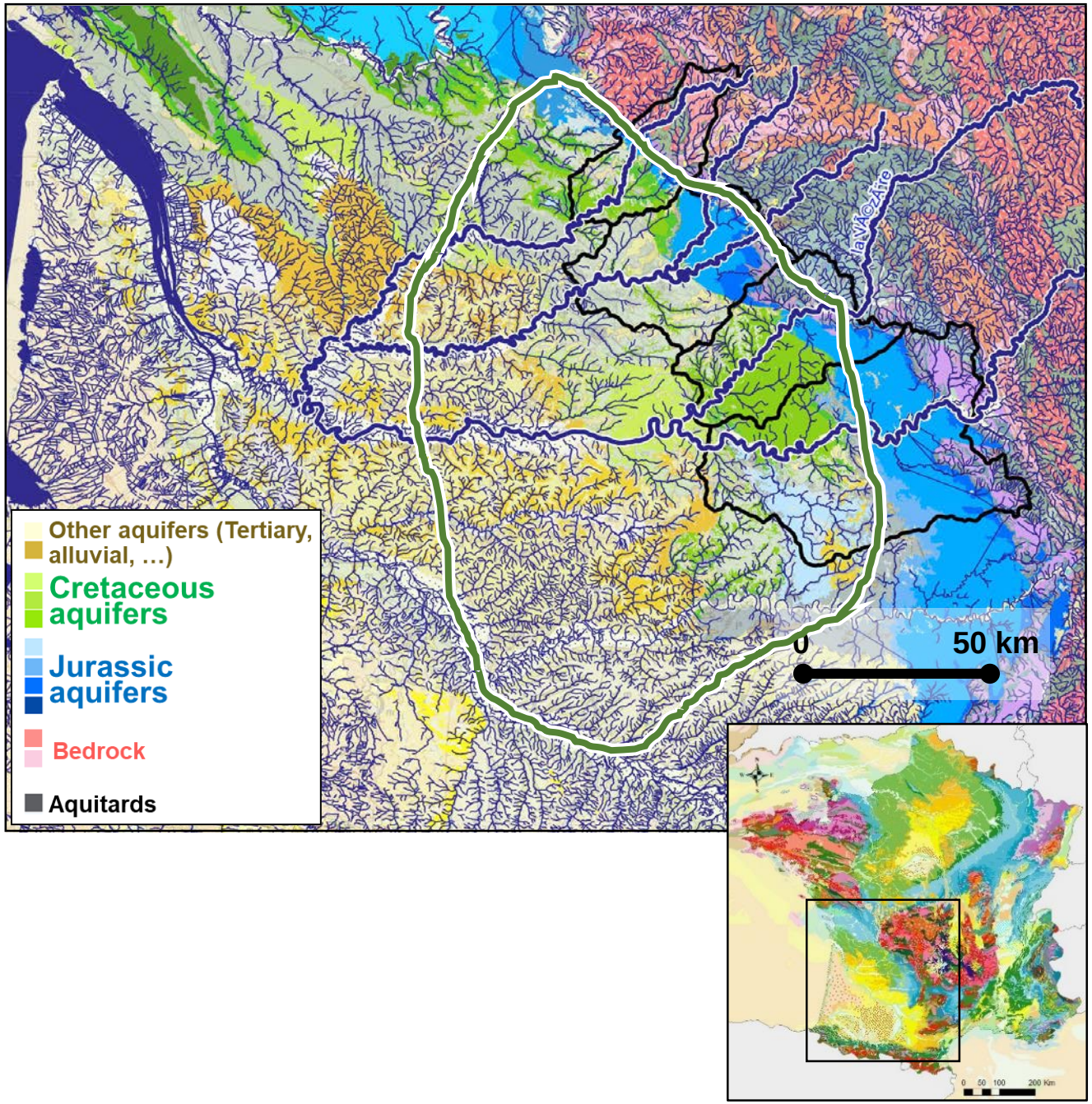


Piezometric and physico-chemical campaigns



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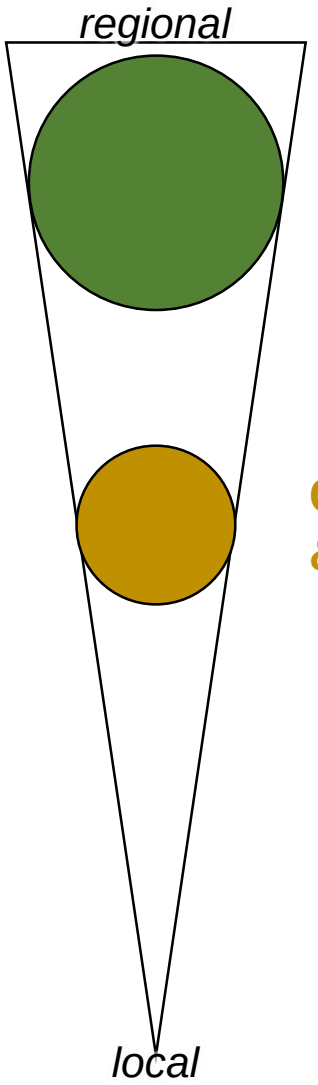
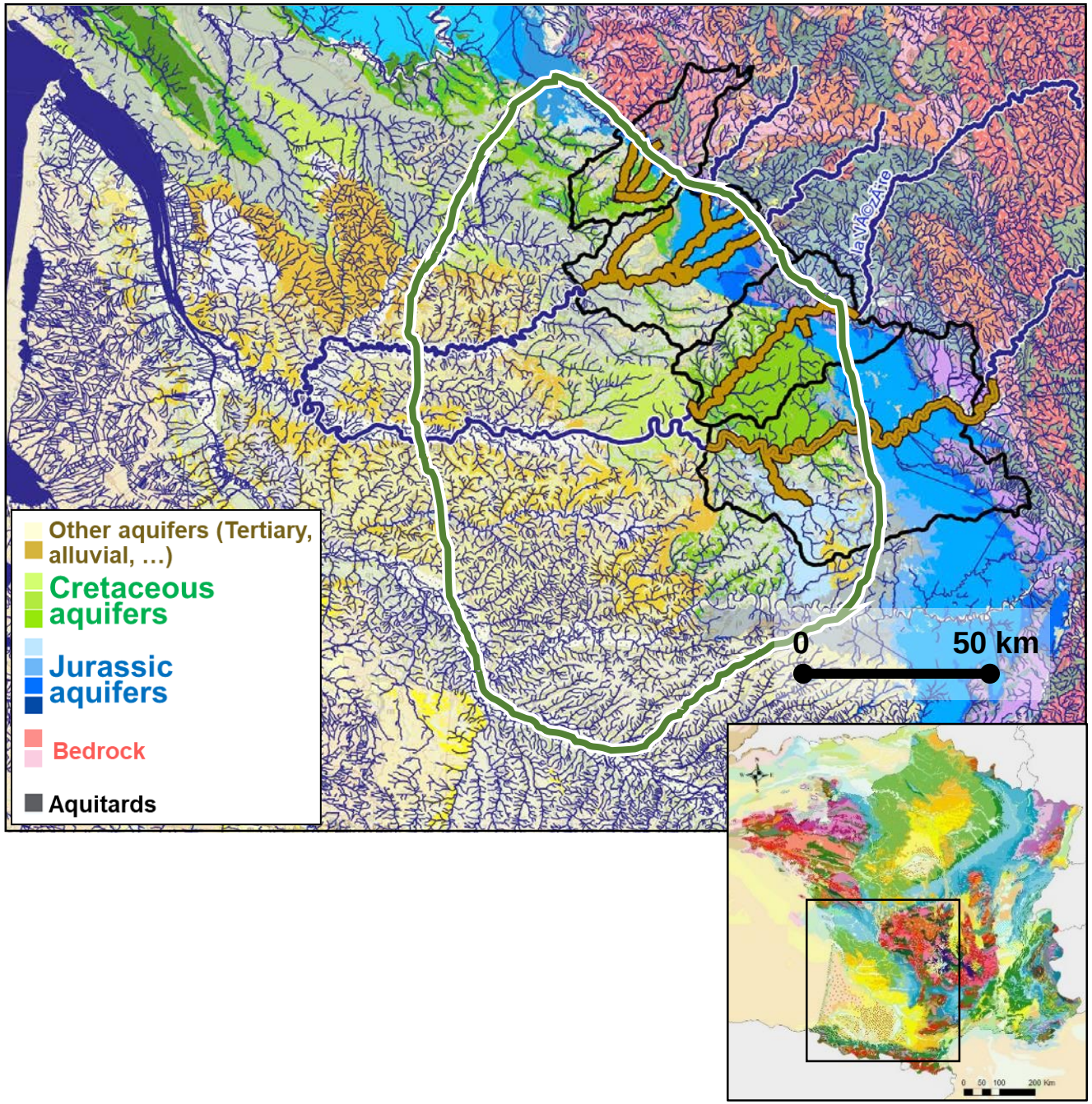


Piezometric and physico-chemical campaigns

Continuous monitoring & Differential river gauging



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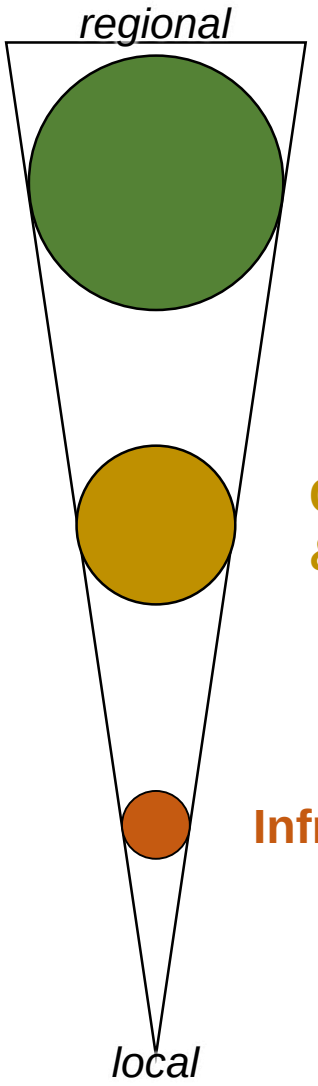

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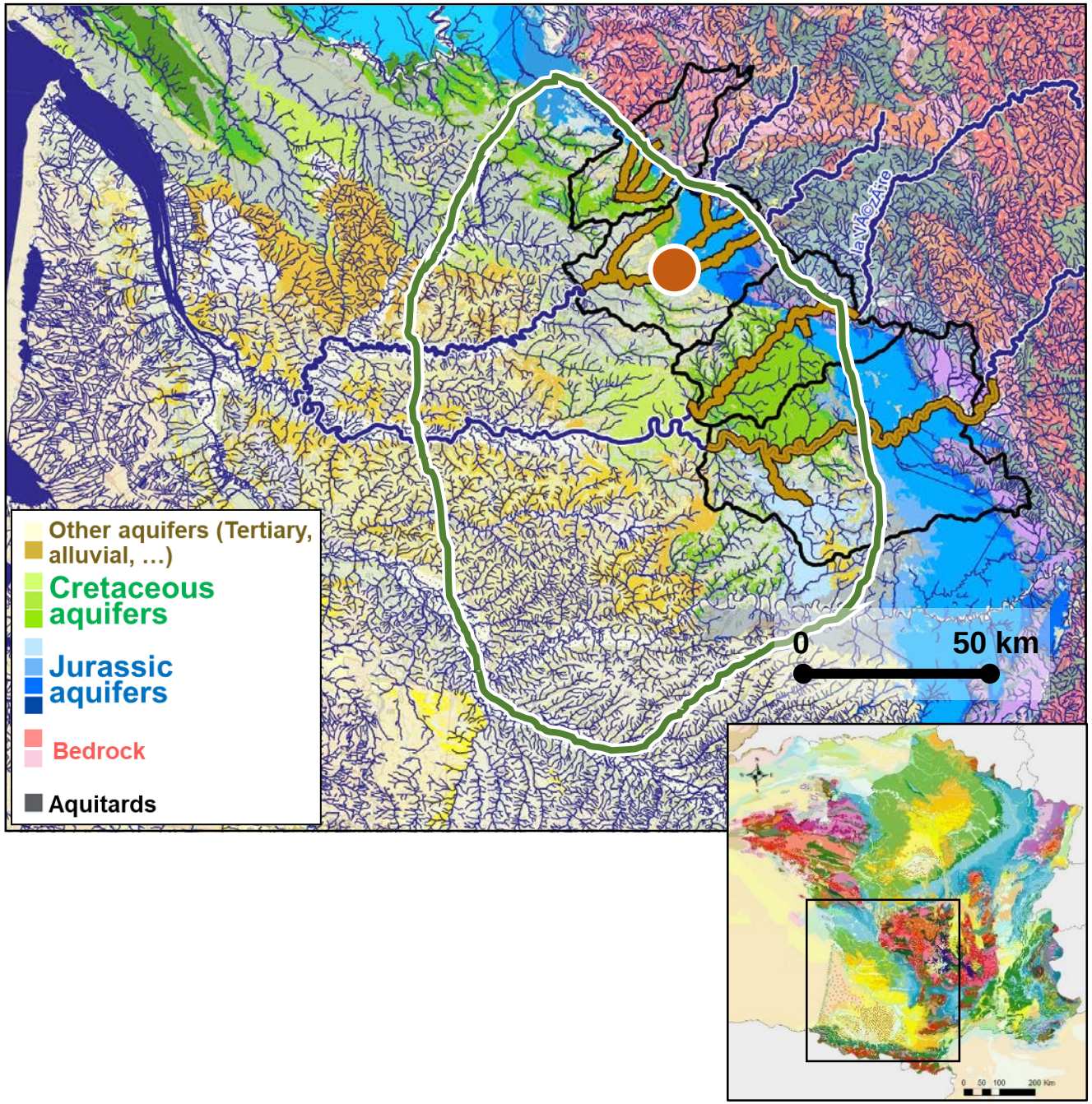
Continuous monitoring & Differential river gauging

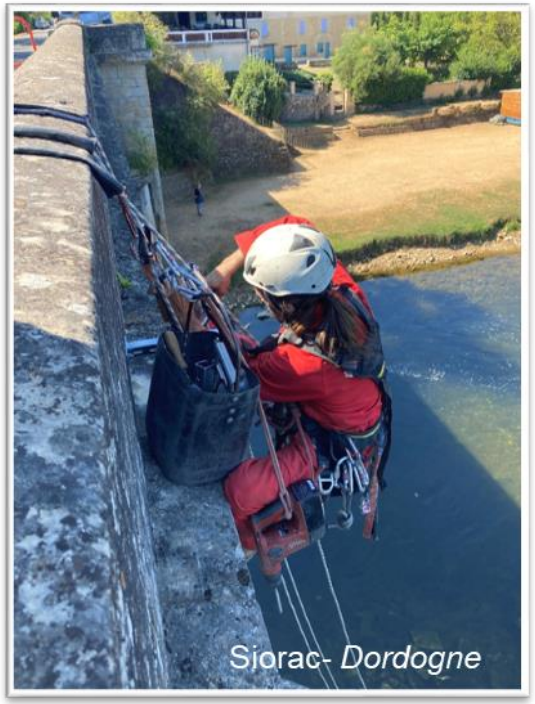
Infrared Thermal imaging

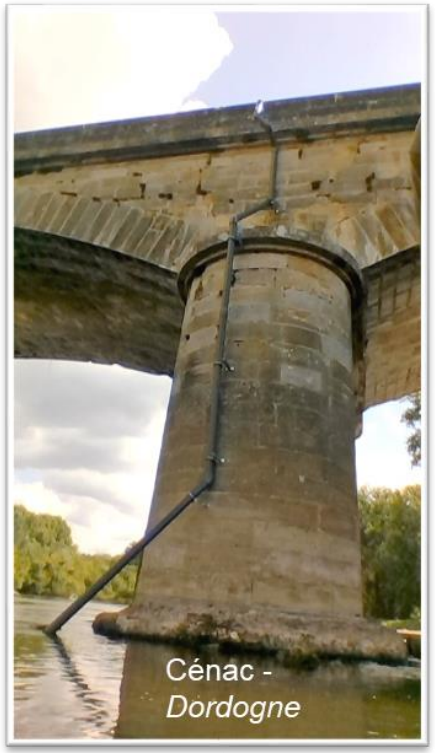


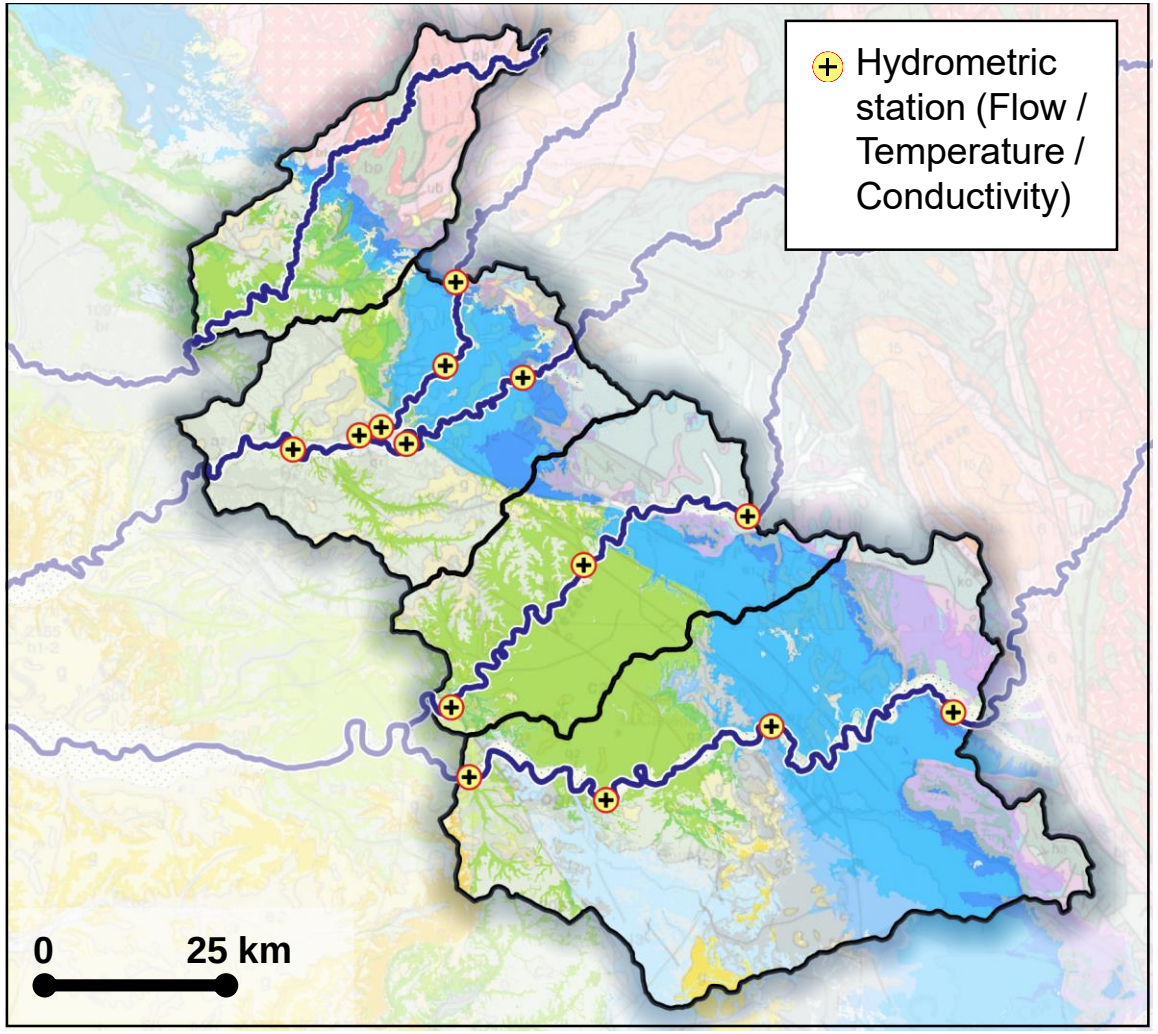
Continuous monitoring

- **Objective: possible differentiation of water origin in rivers using electrical conductivity**

- Continuous flow, temperature and conductivity monitoring
- 14 hydrometric stations







- **Rainwater:** almost no mineralisation,
- **Infiltration and rapid run-off into river:** low mineralisation,
- **Groundwater:** high mineralisation

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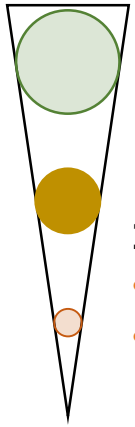
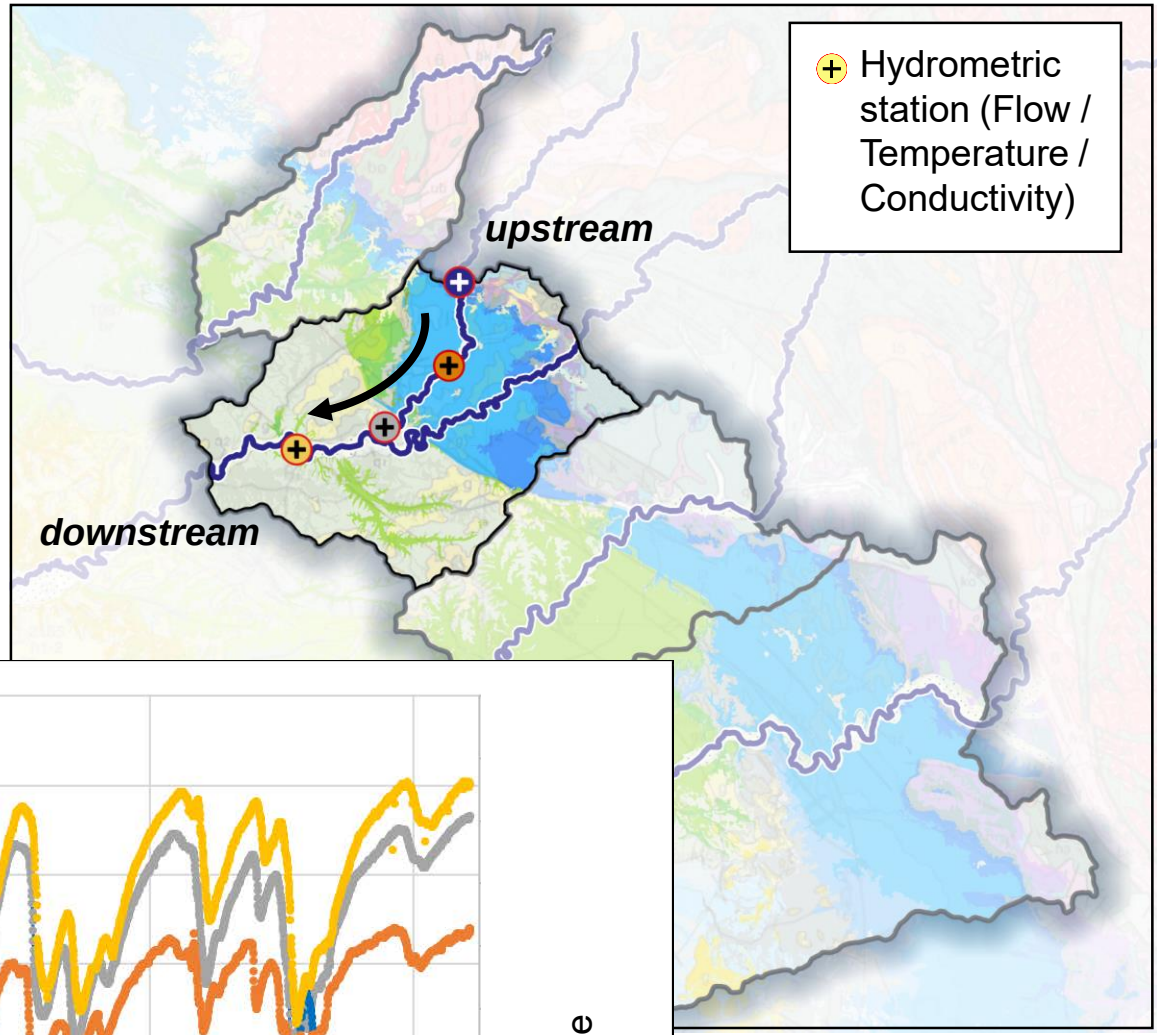
Continuous monitoring

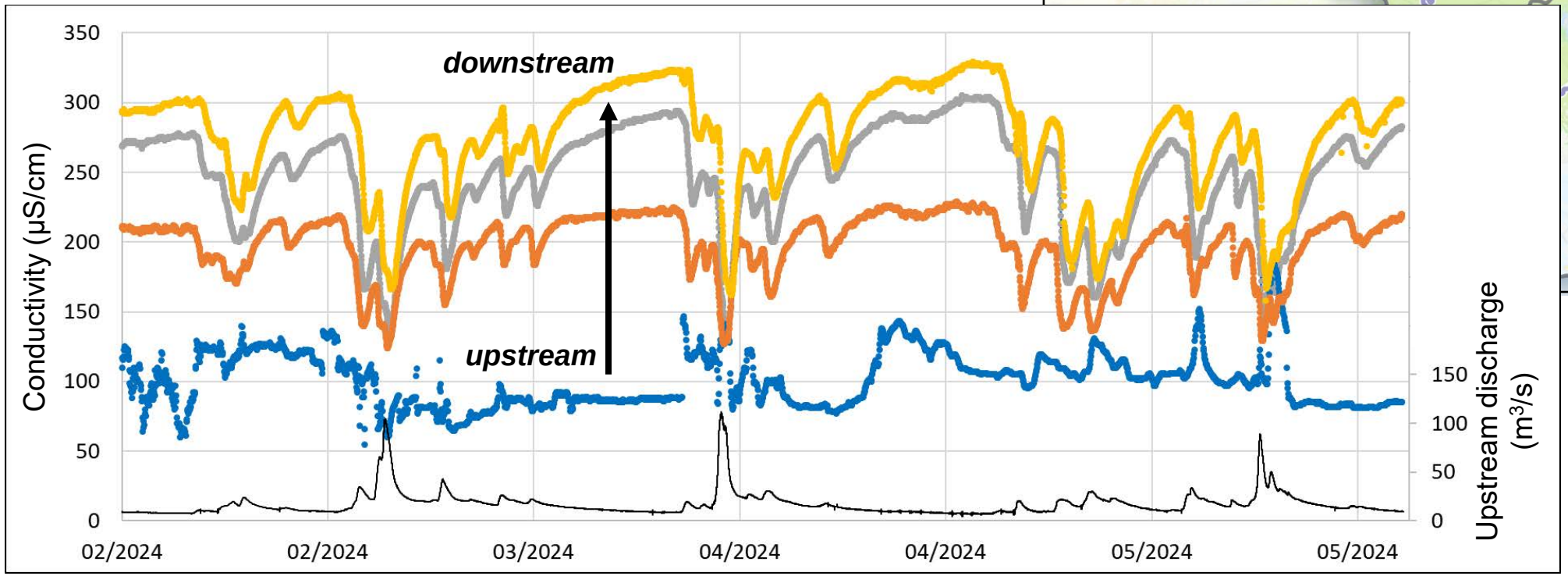


➢ **Objective: possible differentiation of water origin in rivers using electrical conductivity**

1st results:

- **For each station:** information on water origin
- **Along a reach (comparison of stations):** functioning in relation to groundwater-river exchanges





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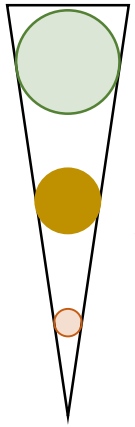
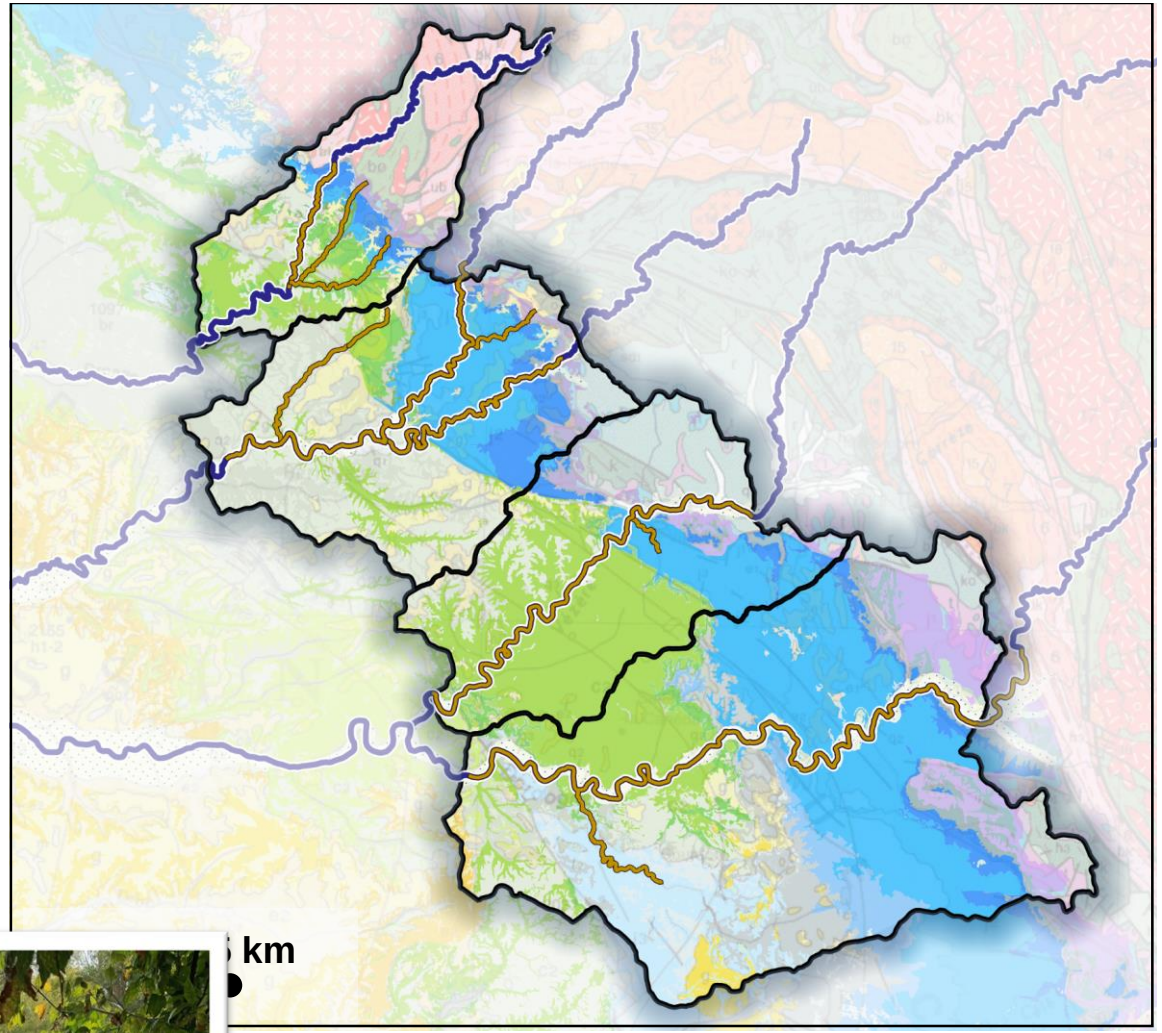
Differential river gauging



- **Objective: To identify infiltrating or draining sections according to hydrological conditions**

- 80 measurements during low water levels



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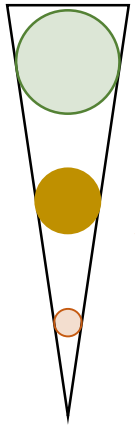

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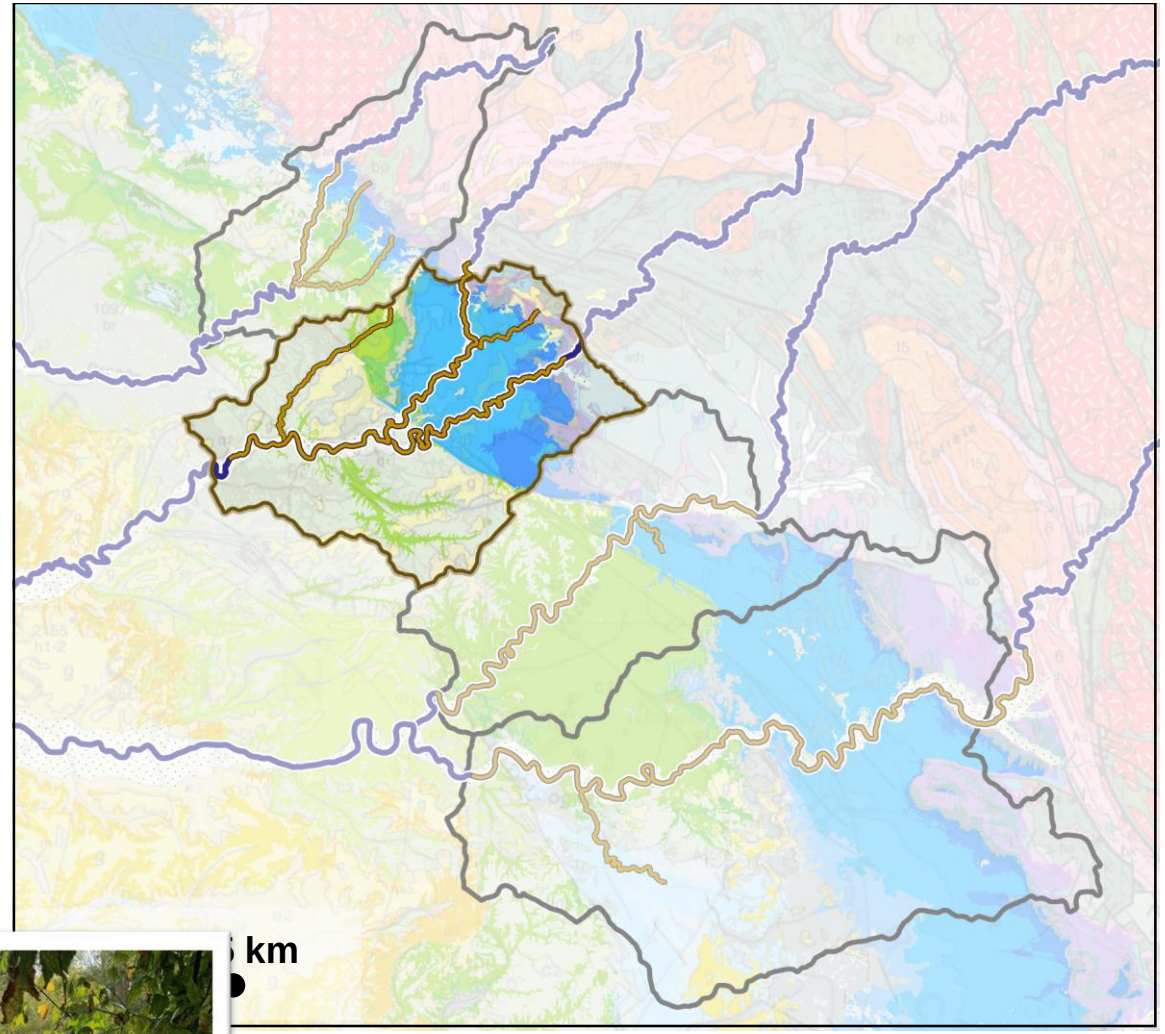

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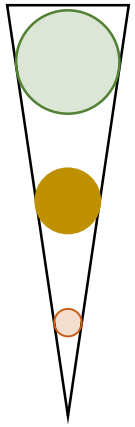

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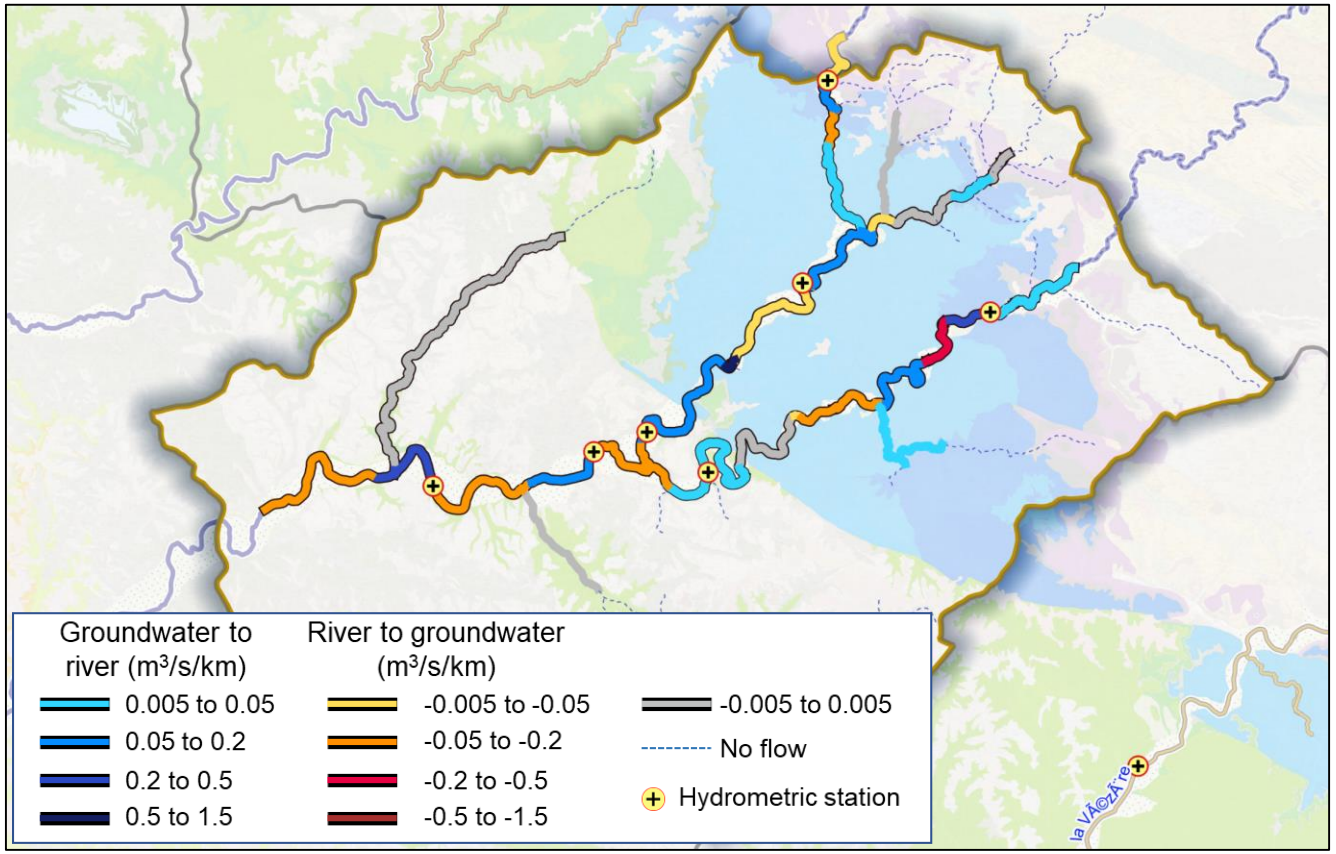

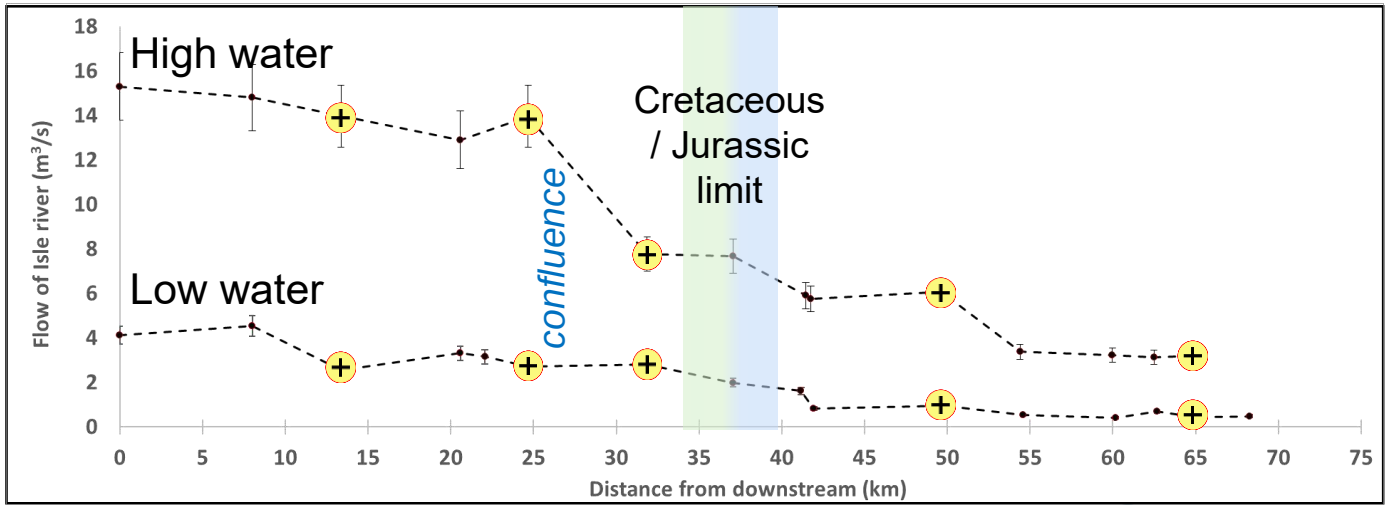

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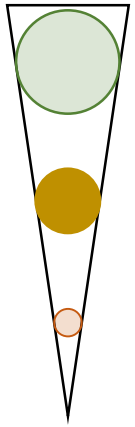

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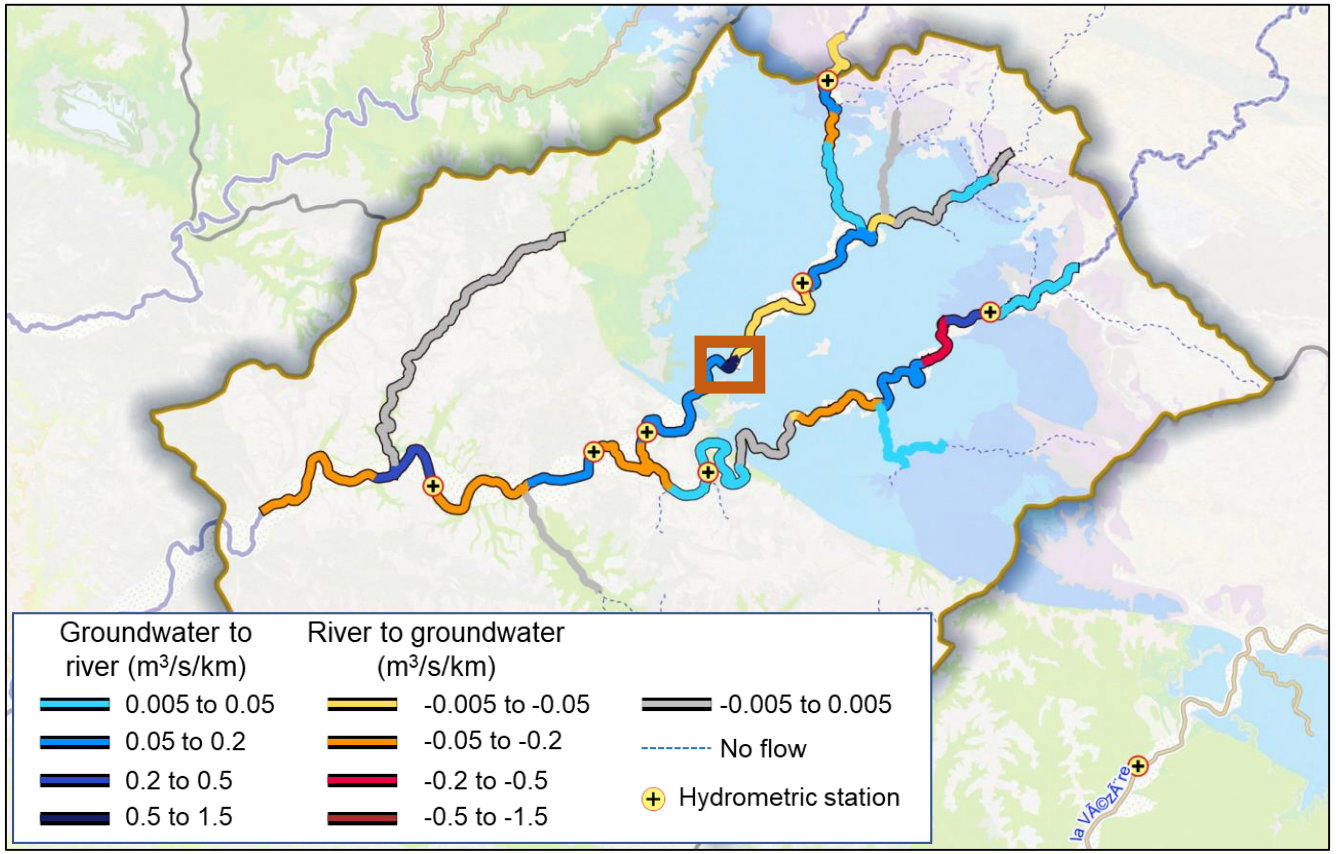

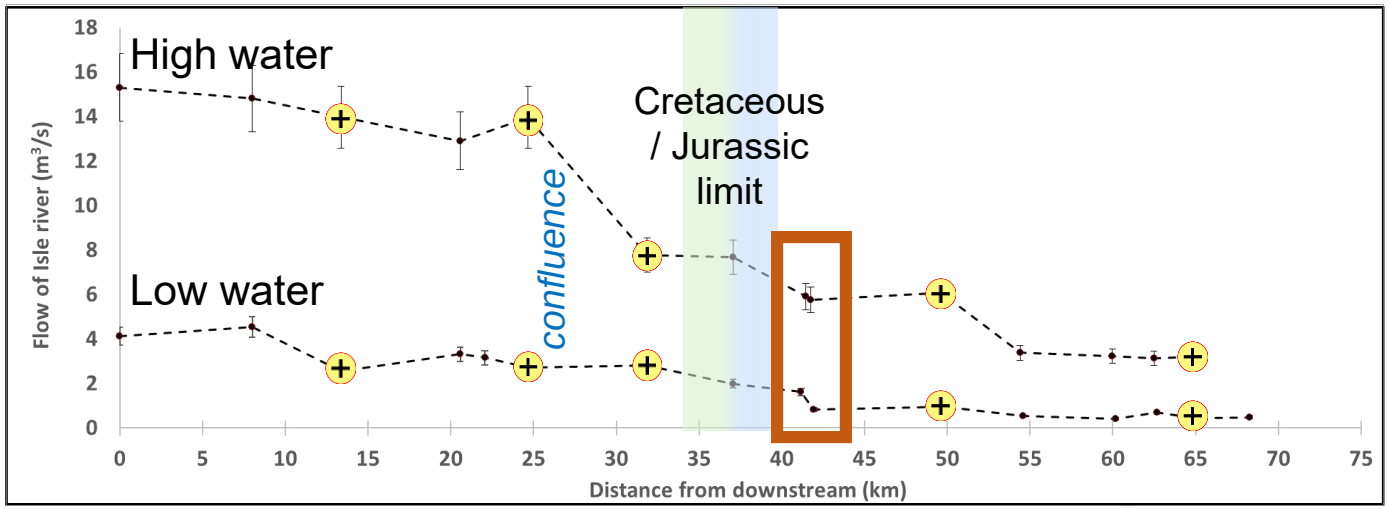

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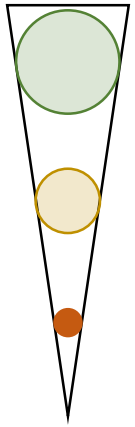
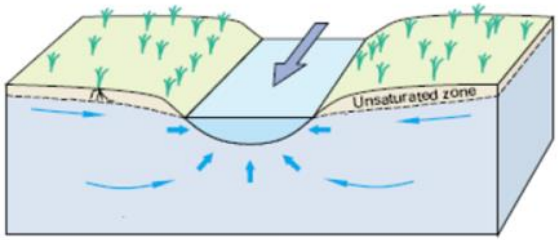
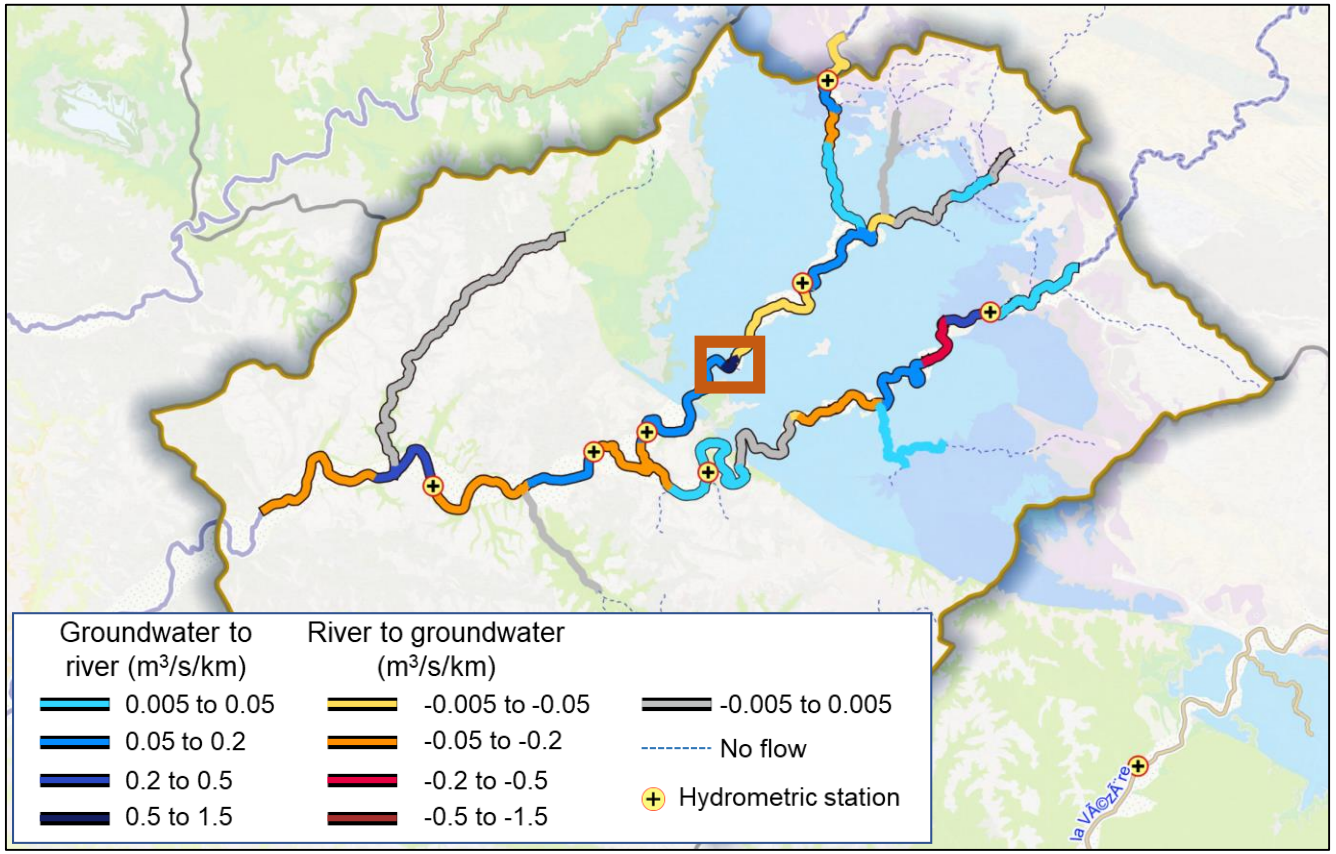
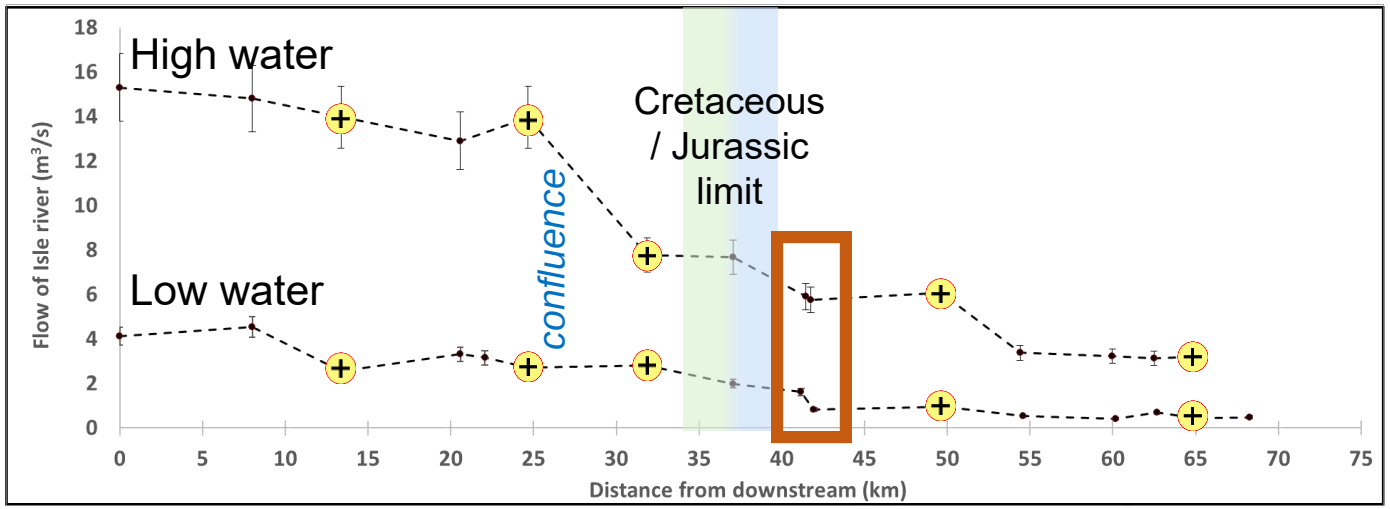


- **Objective**: **test the relevance of the thermal approach to highlight groundwater contributions to river flow**



Groundwater to river





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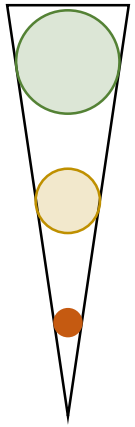

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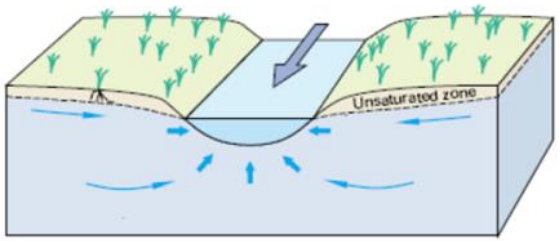
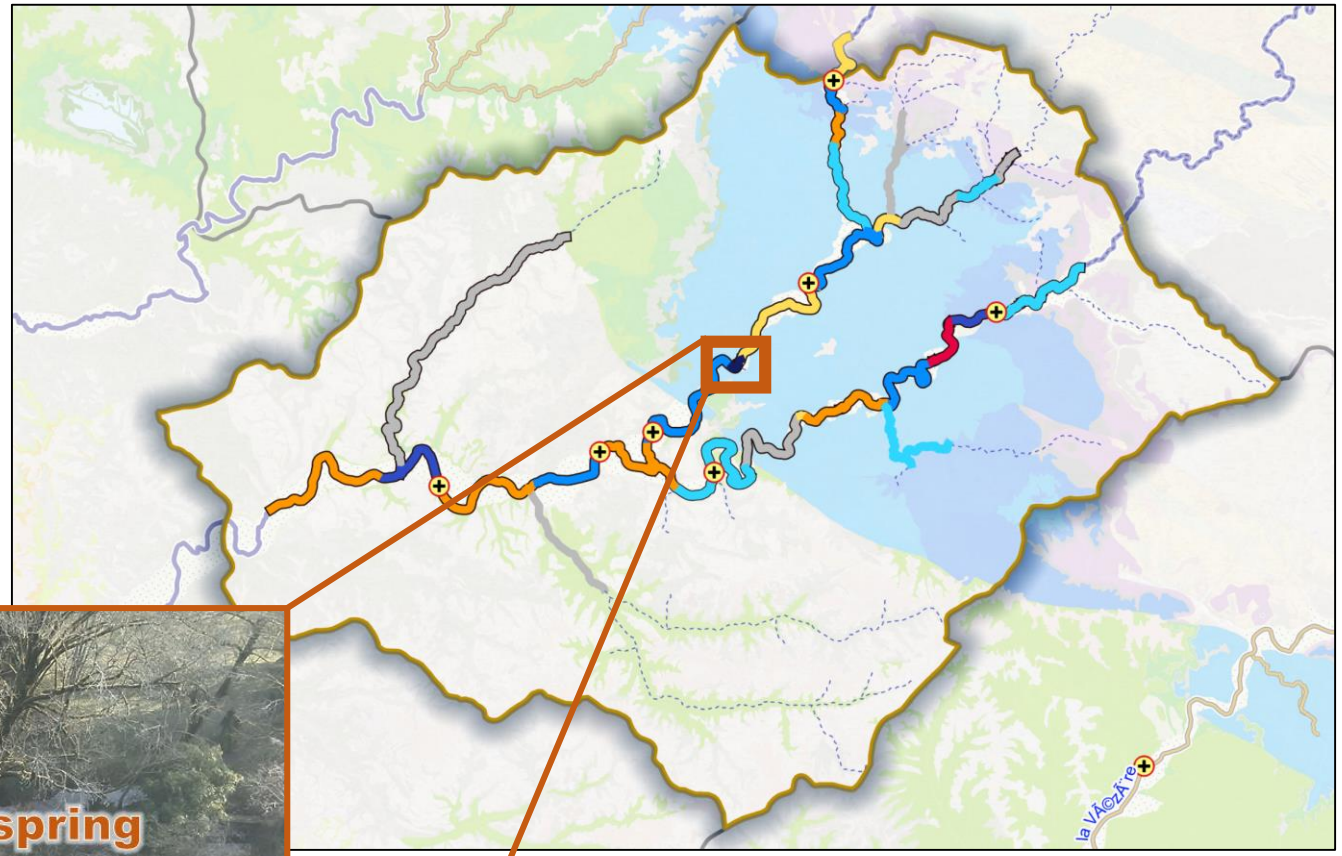
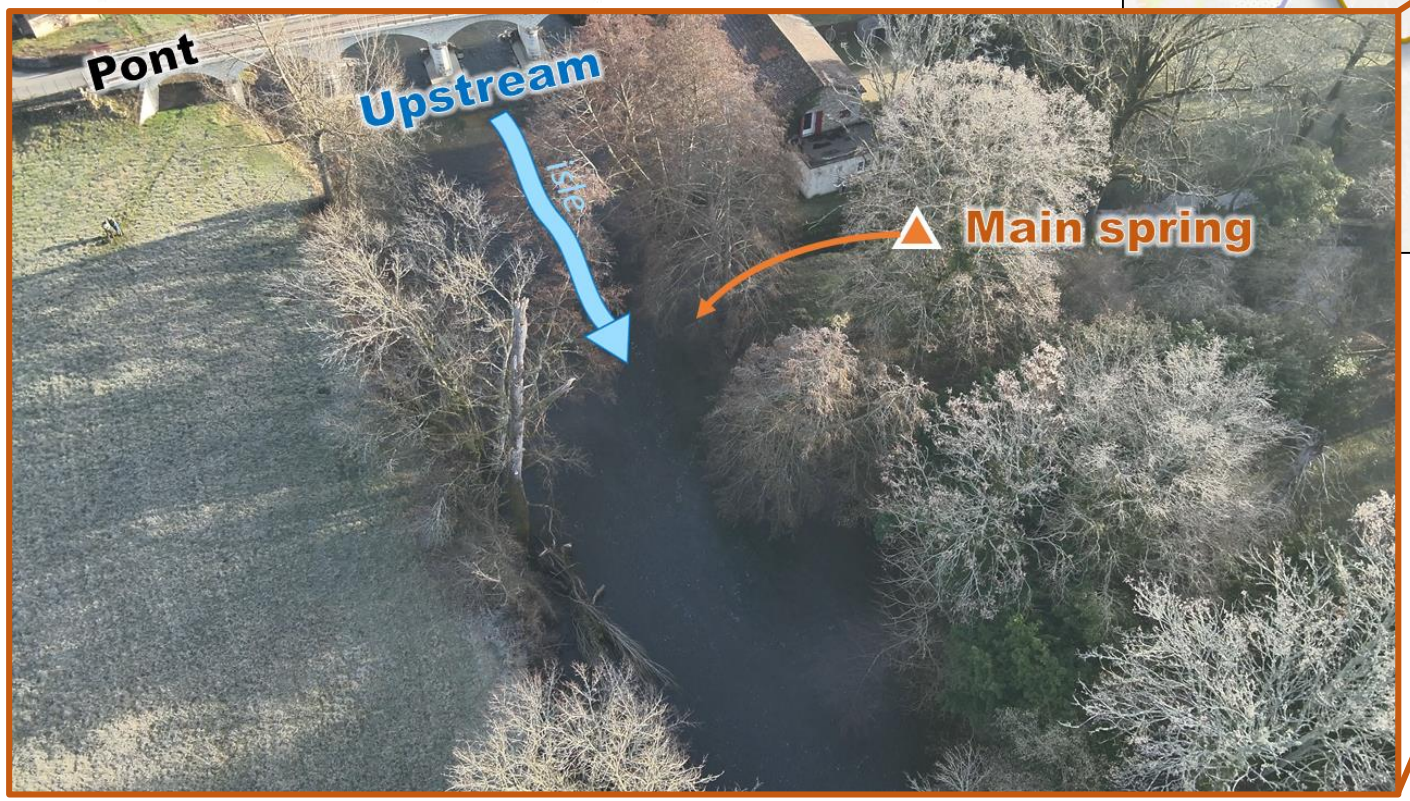


Groundwater to river





- **Winter 2023**

$T°_{river}$ (5 °C) << $T°_{groundwater}$ (11 °C)

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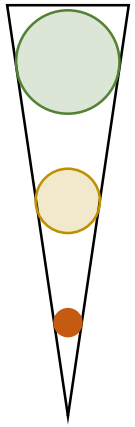
InfraRed Thermal imaging



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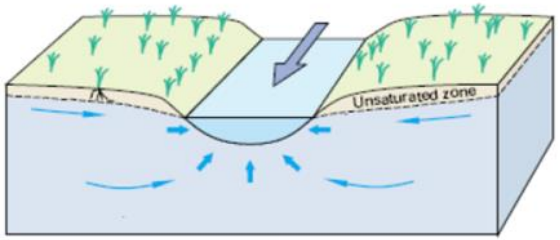
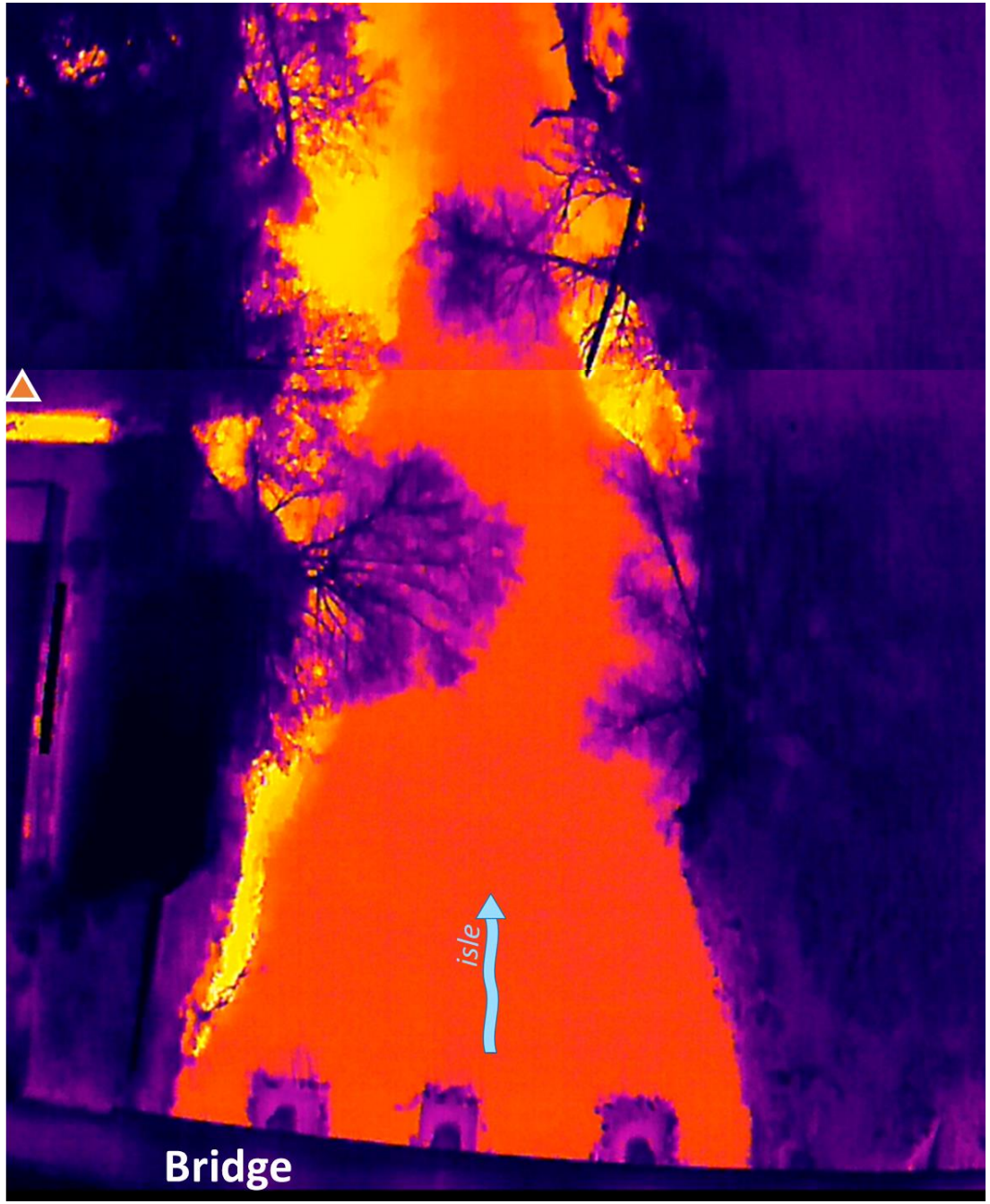


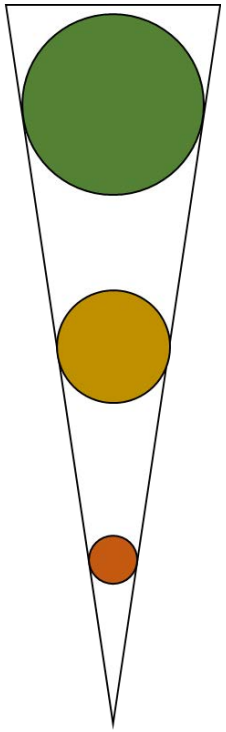
Groundwater to river

Identification of groundwater discharges because of:

- Good meteorological and hydrological conditions
- Good contrast between waters (≈ 6 °C)
- Important concentrated flows from groundwater compared to river discharge



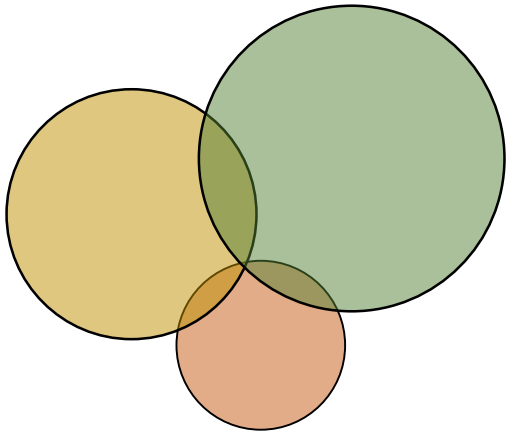
Conclusion & Outlook



- Results consolidation and harmonisation are in progress
- Combined approaches provide additional information in terms of
  - **space** (catchment area / section / local area)
  - **time** (high water / low water)
  - **process** (river to groundwater or groundwater to river)

  ⇒ **Ensure overall consistency**

Conclusion & Outlook



- Definition of **areas of interest** (groundwater recharge or surface water support, etc.)
- Support for **quantitative water resources management :**
  - **identification of areas with tension on water resources**
  - guarantee of **consistence between pressures and ecosystem water needs**

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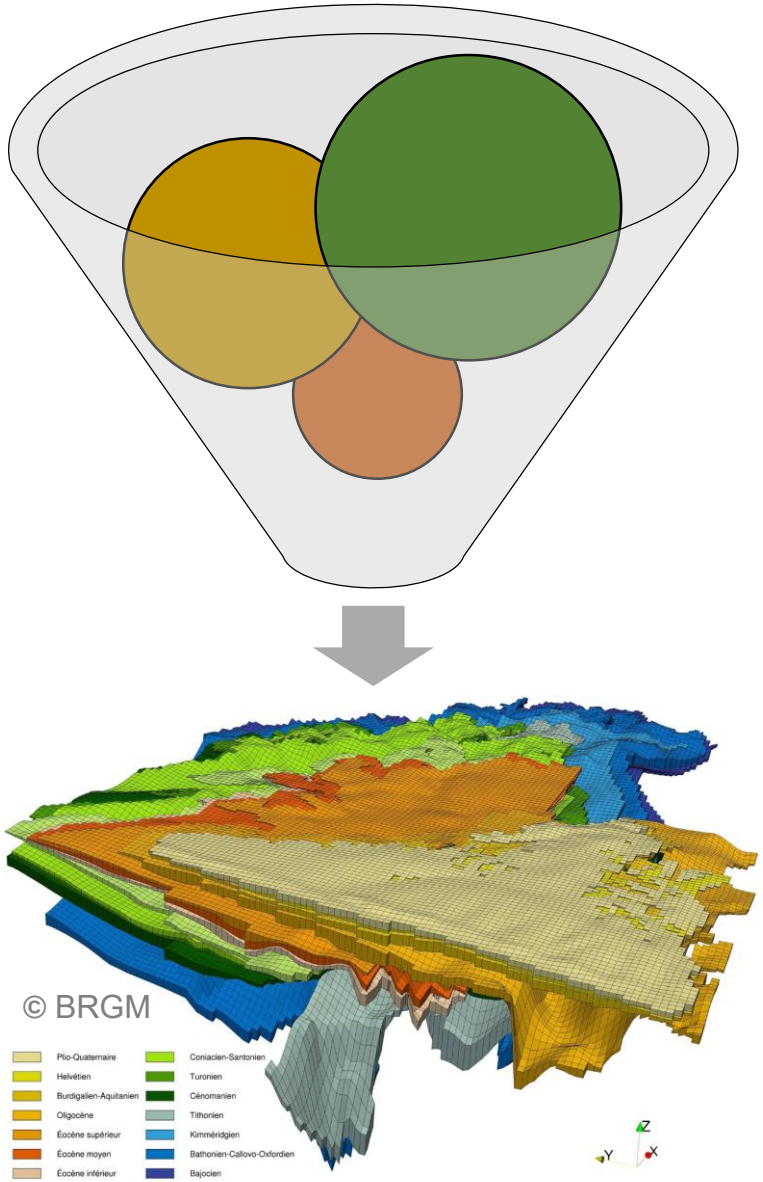
Conclusion & Outlook



Hydrogeological model

- Definition of **areas of interest** (groundwater recharge or surface water support, etc.)
- Support for **quantitative water resources management**

- **Challenge : transpose this complex knowledge into existing management tools**

  In this study area : existence of a grid-based distributed hydrogeological model (cells = 1 km²)

⇒ detailed knowledge of interactions *vs* quasi-regional management model

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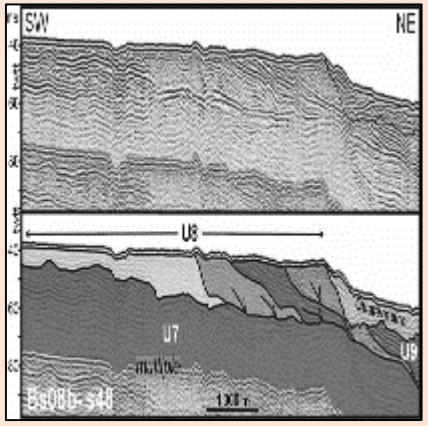

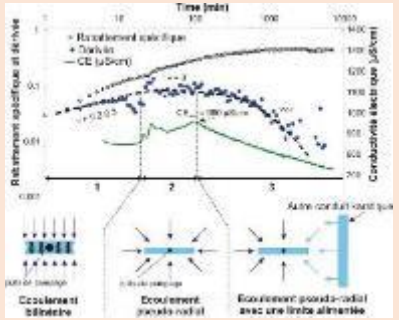

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