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Long term monitoring of a Mediterranean karst system used for water supply. Implication for the characterization and modelling of its dynamics. Case of the Lez karst system (MEDYCYSS Observatory)

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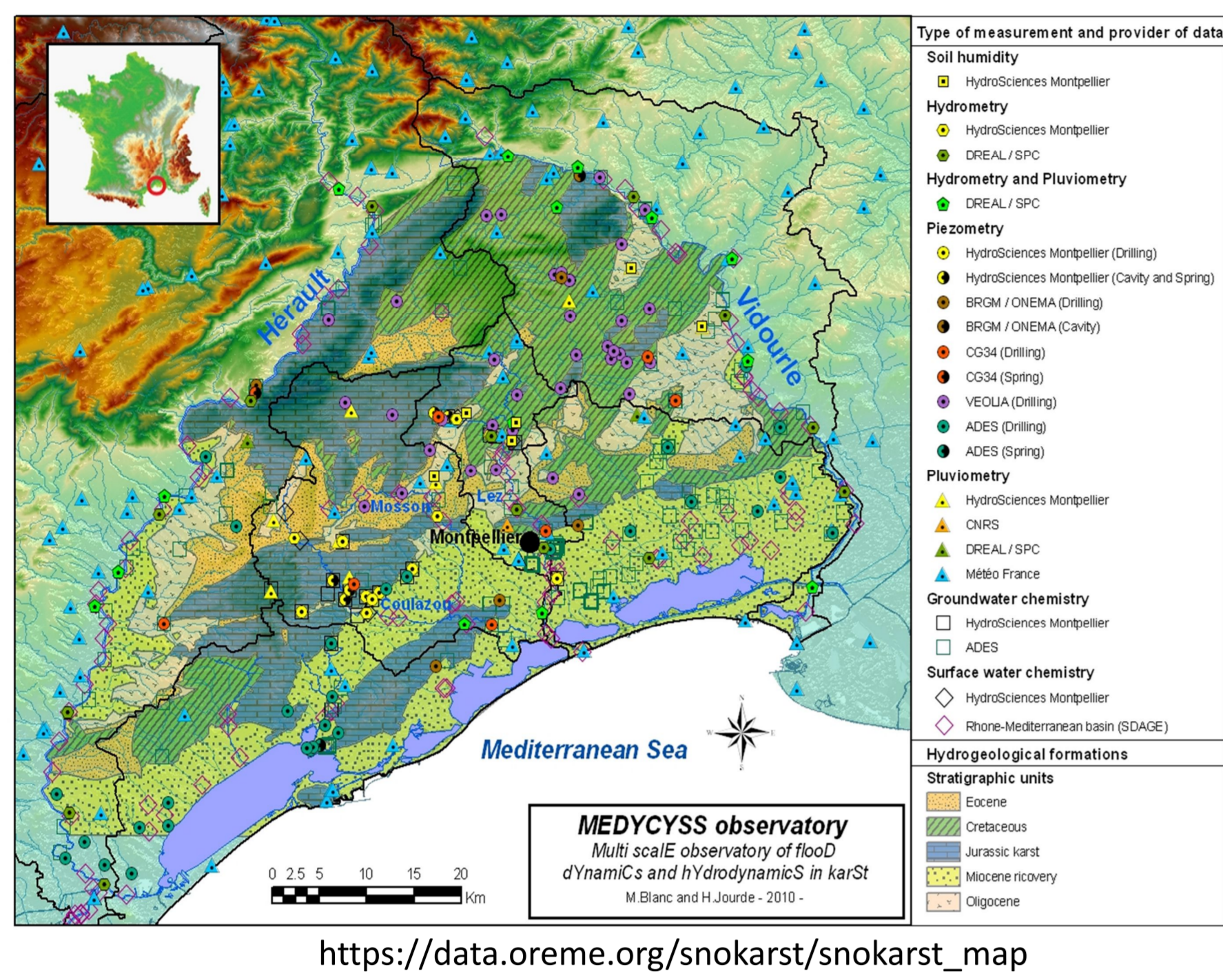
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A mediterranean territory



Main focuses
Climate change and anthropogenic impacts on water resources (quantity and quality); Recharge processes, Surface water and groundwater interactions; Extreme climatic events

Databases:
Observatory created in 2008. First measurements date back to 1950

Main scientific issues

Observation and modeling of transfer processes associated with various entities (surface and underground) of Mediterranean karst hydrosystems. Specific focus are:

- underground hydrodynamics of karst aquifers subject to the actions of climate and anthropogenic forcings
- rapid hydrologic processes that take place during extreme floods in Mediterranean drainage basins that have a high karst component
- development of specific methods and tools based on a coupled hydrodynamic/hydrochemical approach to determine the quantitative and qualitative risks on water resources.

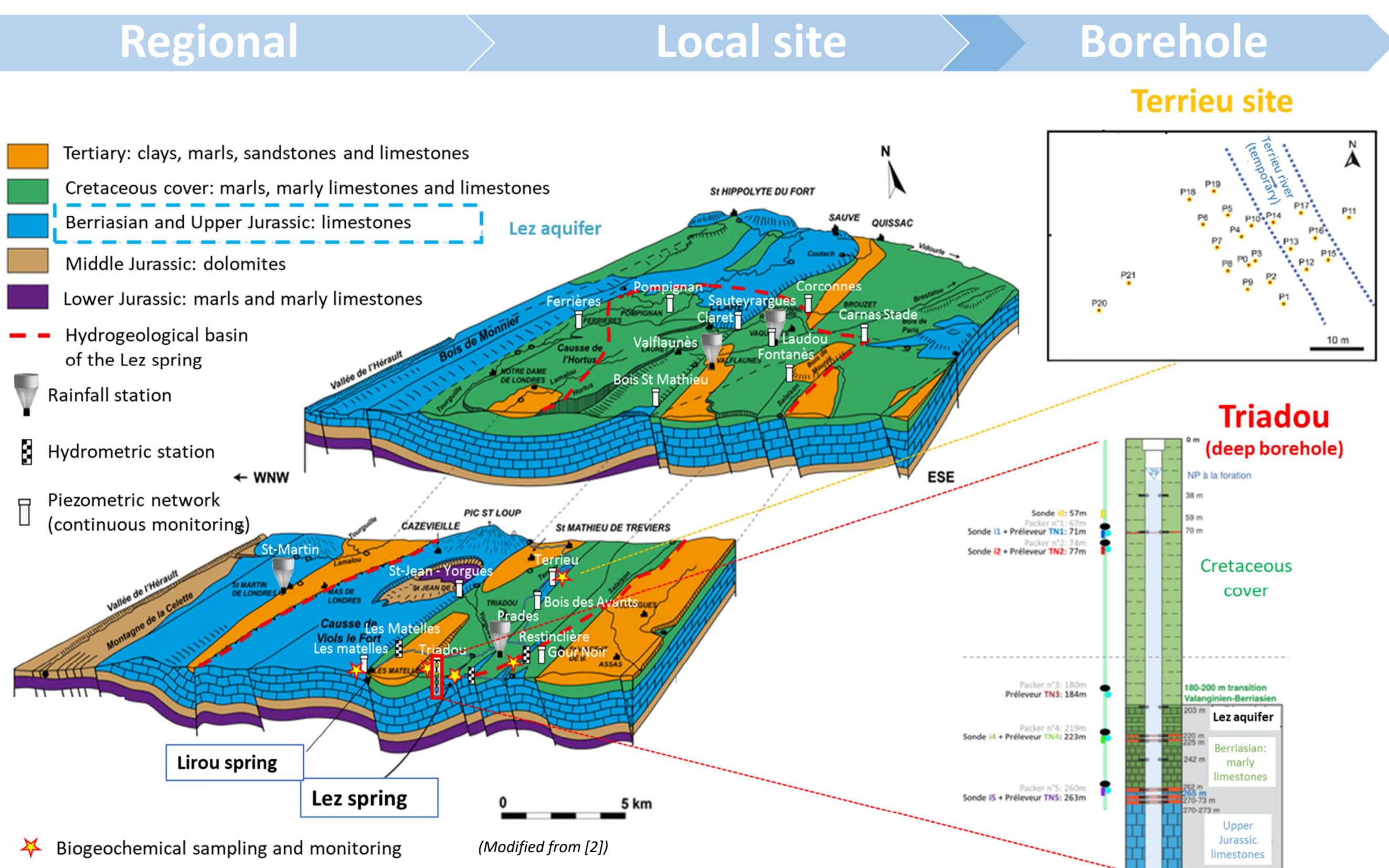
Research networks

MEDYCYSS belongs to national and international observation sites networks dedicated to the observation and monitoring of the Critical Zone:

- OSU OREME
- French KARST observatory network (SNO KARST, INSU/CNRS)
- Research Infrastructure OZCAR (Critical Zone Observatories: Research and Application), the French network of eLTER (European Long-Term Ecosystem Research infrastructure)

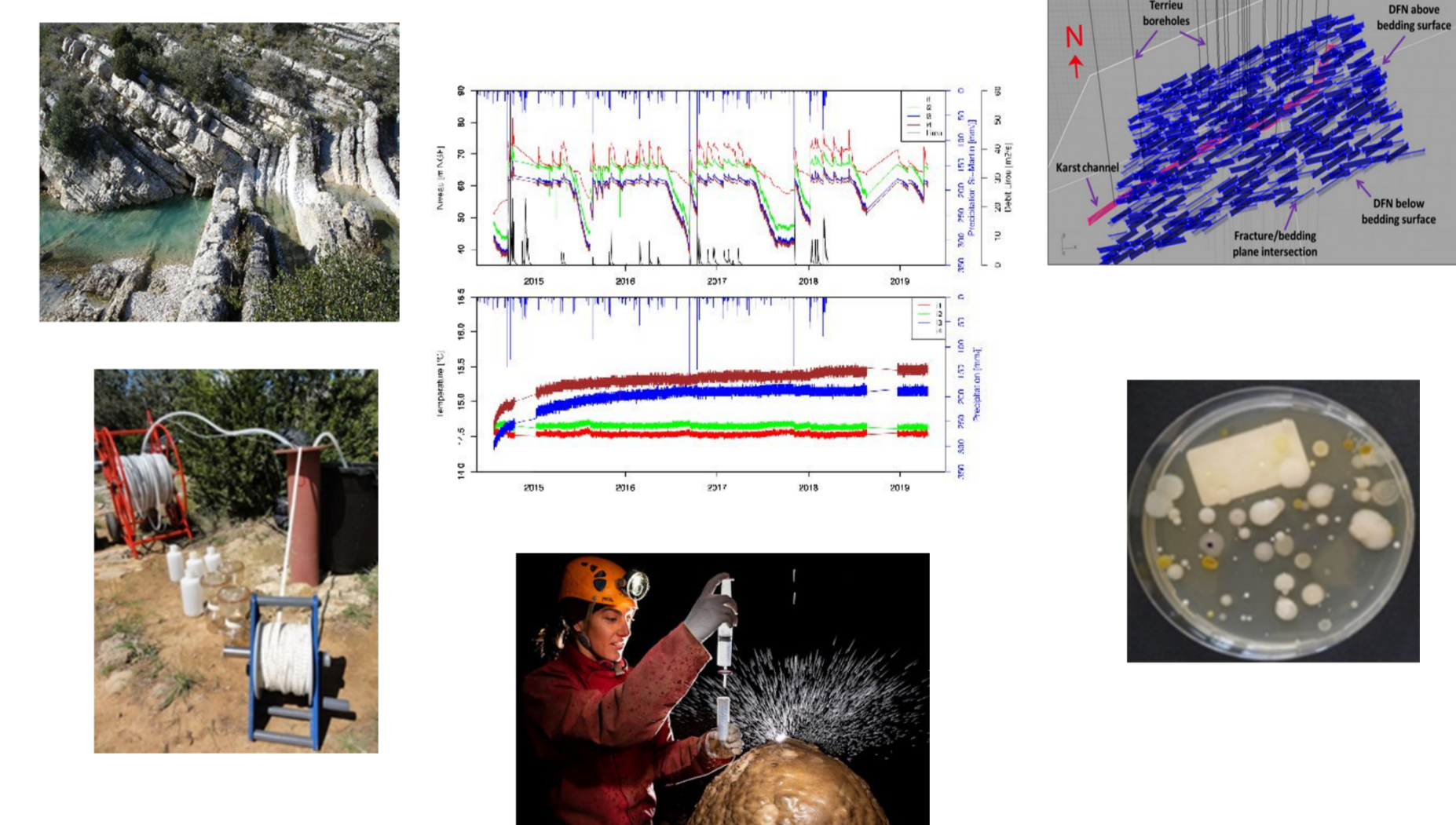
Tools, methods and monitorings

Multiscale spatial and temporal observations



Regular, flood events and high frequency monitorings

- **Meteorology:** 6 rain gauges, 2 weather stations (precipitation, wind, solar radiation, humidity) and a tower fluxes (water and carbon fluxes)
- **Hydrology:** stream water levels and discharges (9 stations)
- **Hydrodynamics:** Pressure, spring discharge (continuous monitoring). Boreholes measurements: loggings, flow profiles, pumping tests, hydraulic packers testings
- **Biogeochemistry:** T°, Electrical conductivity (EC), Major and trace elements, Total Organic Carbon (TOC), Natural fluorescence, Carbon and water stable isotopes, Sr-B-Li-Ra isotopes, dissolved gases (noble and anthropogenic), microbial ecology and antimicrobial resistance.



Observation networks

- **Regional scale:** boreholes, perennial and temporary springs, sink-holes
- **Local scale:** Terrieu experimental site, located 5 km from the Lez spring, 22 boreholes of 60 m depth spread over an area of 0,5 km²
- **Borehole scale:** continuous monitoring (P, T°, EC) on 15 boreholes, including the Triadou deep borehole (333m), located 700m upstream the Lez spring and near a temporary river (Triadou site). Equipped in 2014 with the "Multi-level monitoring PMPS, SolExperts » (Equipex CRITEX Project). It includes a series of packers isolating 5 producing zones for groundwater sampling and monitoring (P, T°).

Data access

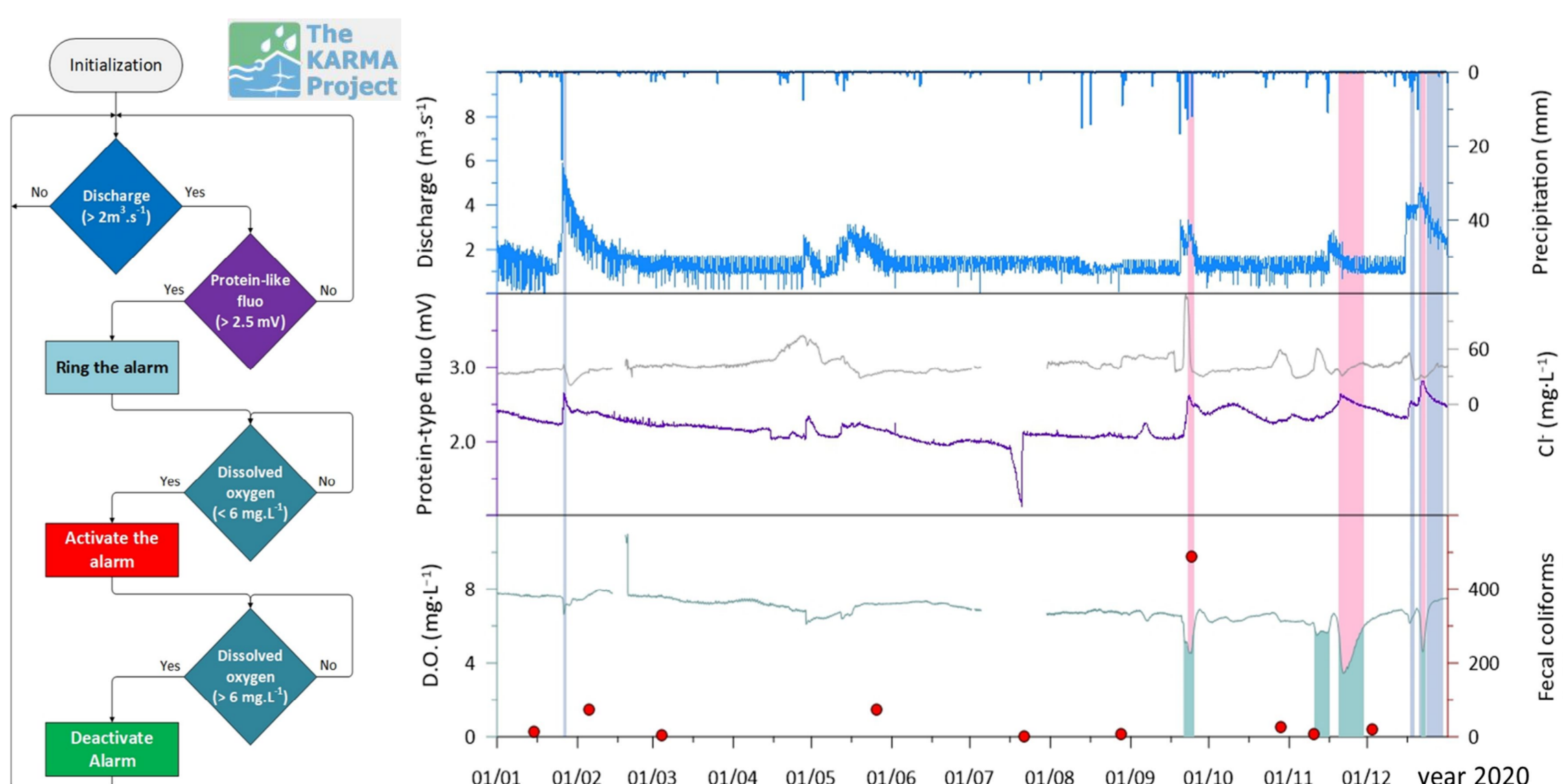
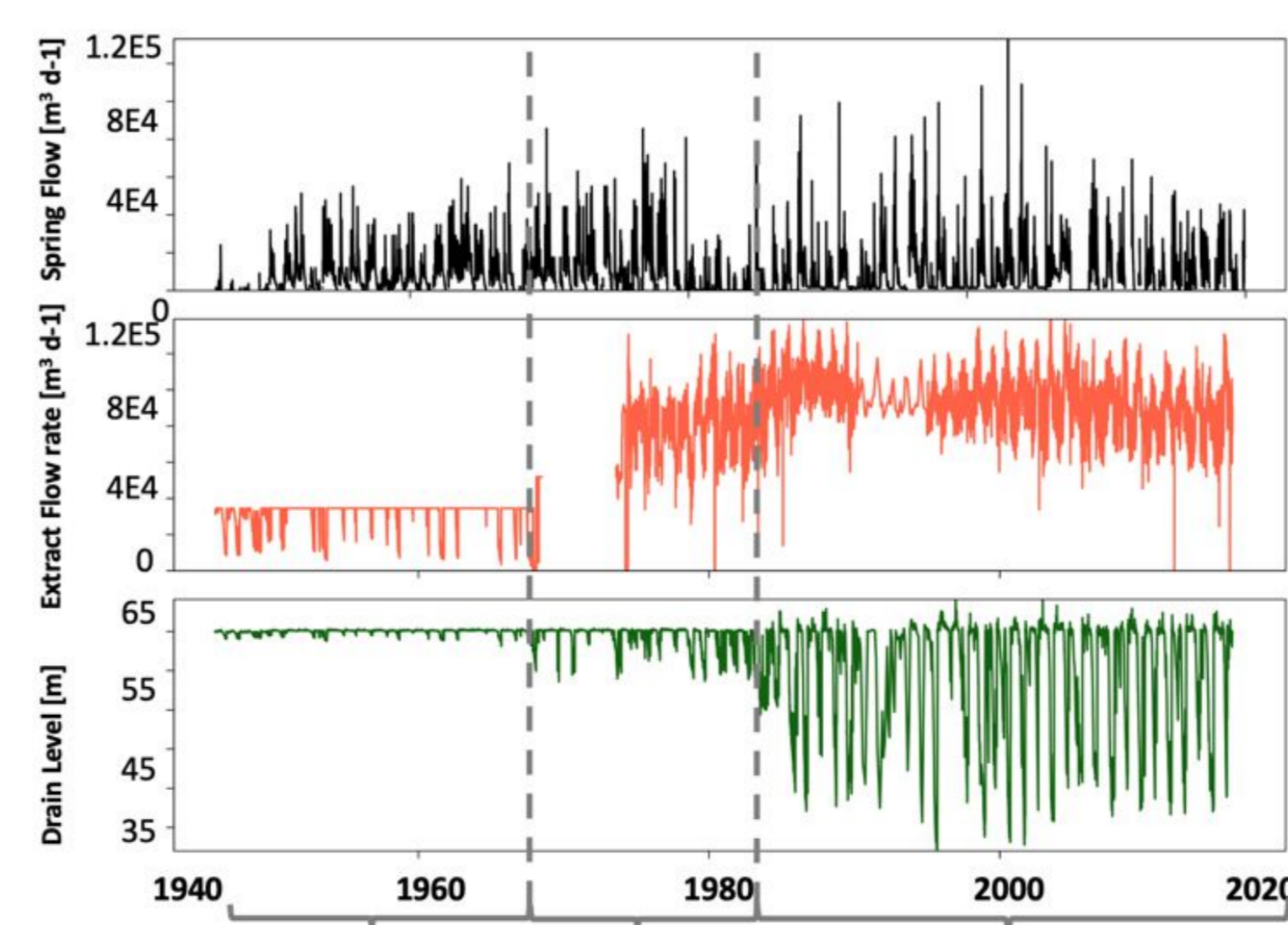
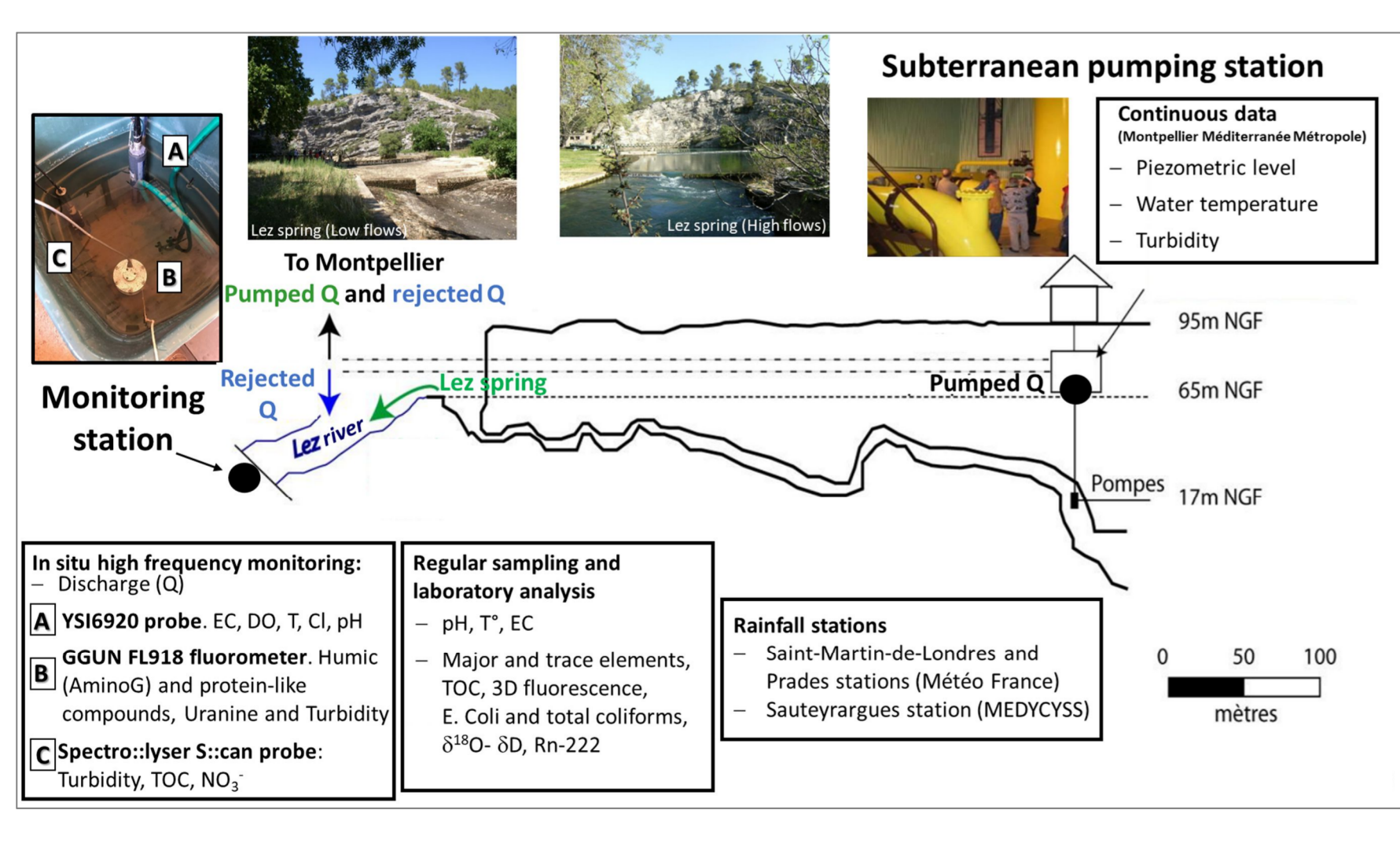
Observations are available to scientific community and general public via the following database platforms:
OSU OREME, OZCAR-THEIA, DEIMS-SDR eLTER
<https://data.oreme.org/observation/snokarst>
<https://deims.org/5b5ca767-0993-429c-8e58-a7efa39c936a>

Mediterranean karst water resources: water availability and quality

Ongoing scientific challenges

Characterization of climate change and anthropogenic impacts on the recharge processes and water resources :
Importance of long terms monitoring of karst systems

Development of specific hydrochemical tools to characterize the different origin of water, and water quality at karst outlets:
contribution of in situ high frequency monitoring to develop Early Warning Systems (EWS)



Coupling numerical approaches and modeling: see Poster # 48 (Sivel et al.)

References
 [1] Cousquer, Y., & Jourde, H. (Under review). Reducing Uncertainty of Karst Aquifer Modeling with Complementary Hydrological Observations for the Sustainable Management of Groundwater Resources.
 [2] Davaux, A. (2023). Facteurs d'échelle dans la hydrodynamisation des écoulements au sein d'un aquifère karstique : Analyse multi-échelles des propriétés hydrodynamiques et de transport de l'aquifère du Lez, Montpellier, 2023. PhD Thesis, Université de Montpellier.
 [3] Ulloa-Cedamano F., Batiot-Guilhe C., and Jourde H. (2022). Développement de systèmes d'alerte précoce (EWS) pour la contamination des eaux dans les zones karstiques méditerranéennes. 10th Workshop of SNO-KARST, 14-16 June 2022, France.