

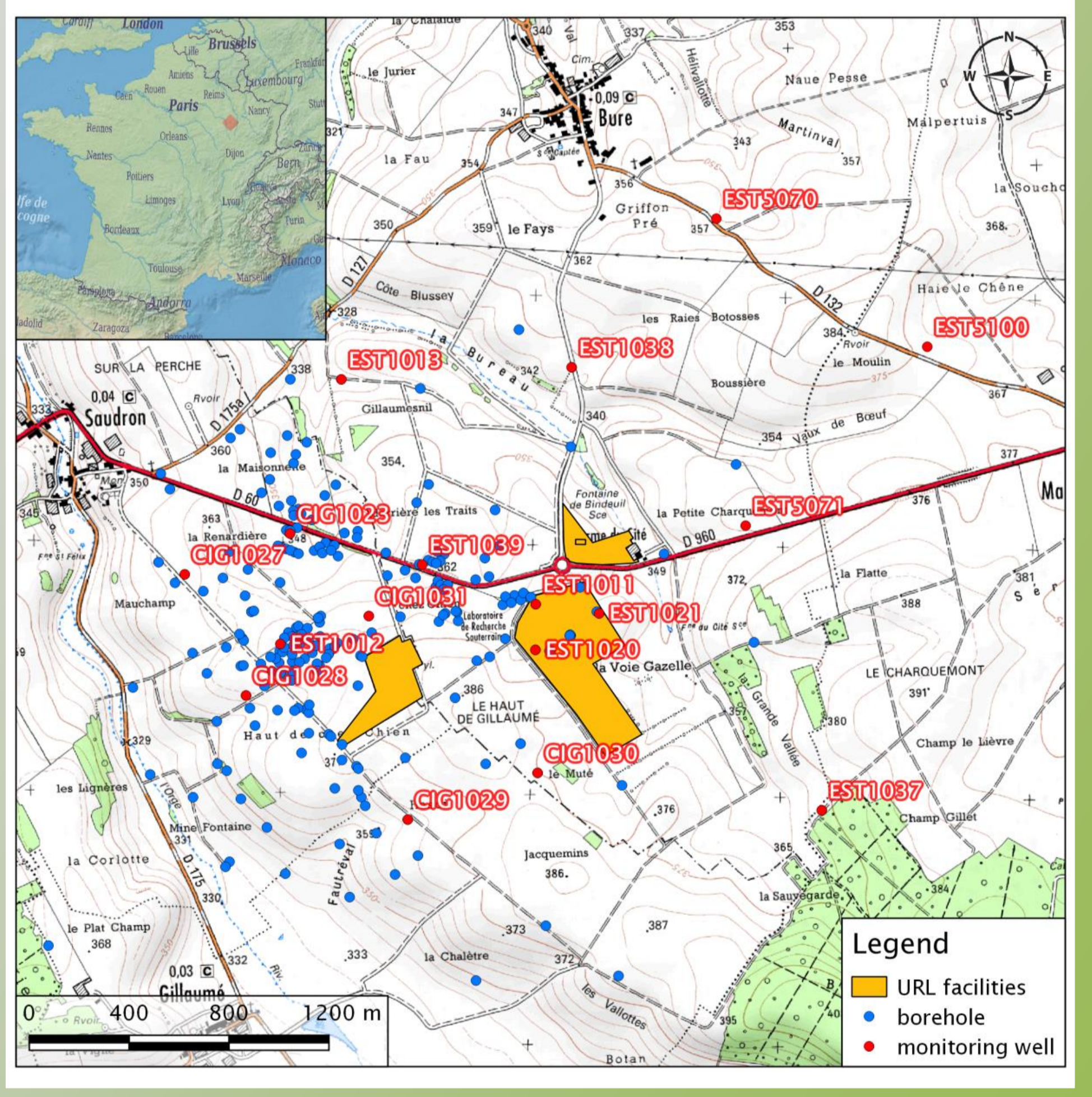
Abstract n°2358

Context and objectives

Subject to licensing, the Cigeo project, a deep geological repository of radioactive wastes should be built in eastern France in the Meuse and Haute-Marne departments. Cigeo will consist of a 500 m deep underground facility where radioactive waste packages would be emplaced and surface facilities where radioactive waste would be received and placed in final disposal packages. A comprehensive understanding of the shallow ground water flow regimes in the outcropping "Calcaires du Barrois", a Tithonian limestone and marl formation is required for the surface facilities construction and environmental impact assessment.

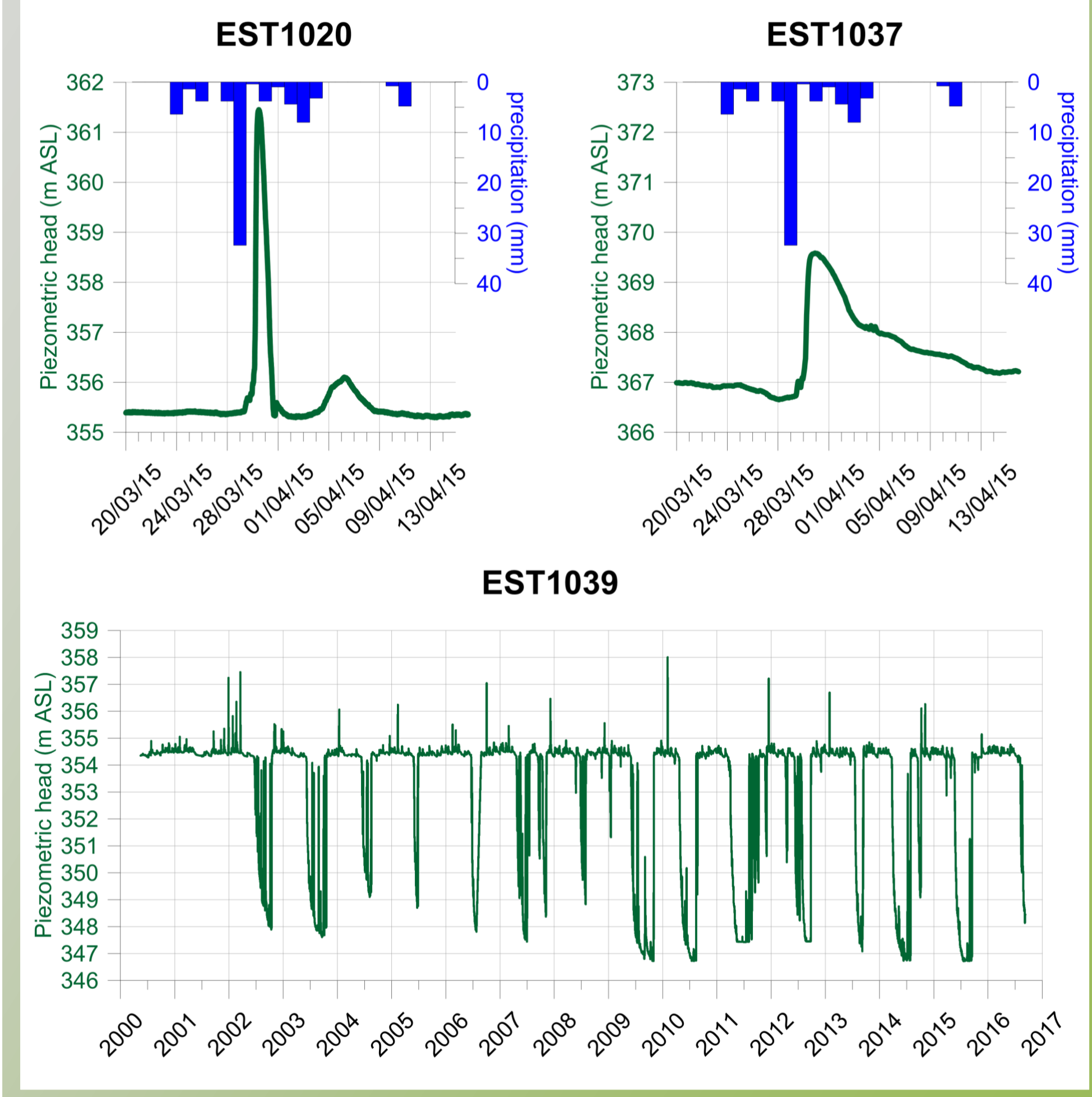
Methodology

- Piezometric level monitoring (in 15-20 monitoring wells for 15 years at a 15 min measuring interval)
- Boreholes drilling (more than 200 over 20 years)
 - Core drilling
 - Downhole logging (gamma-ray, optical, etc)
- Geological conceptual and numerical models



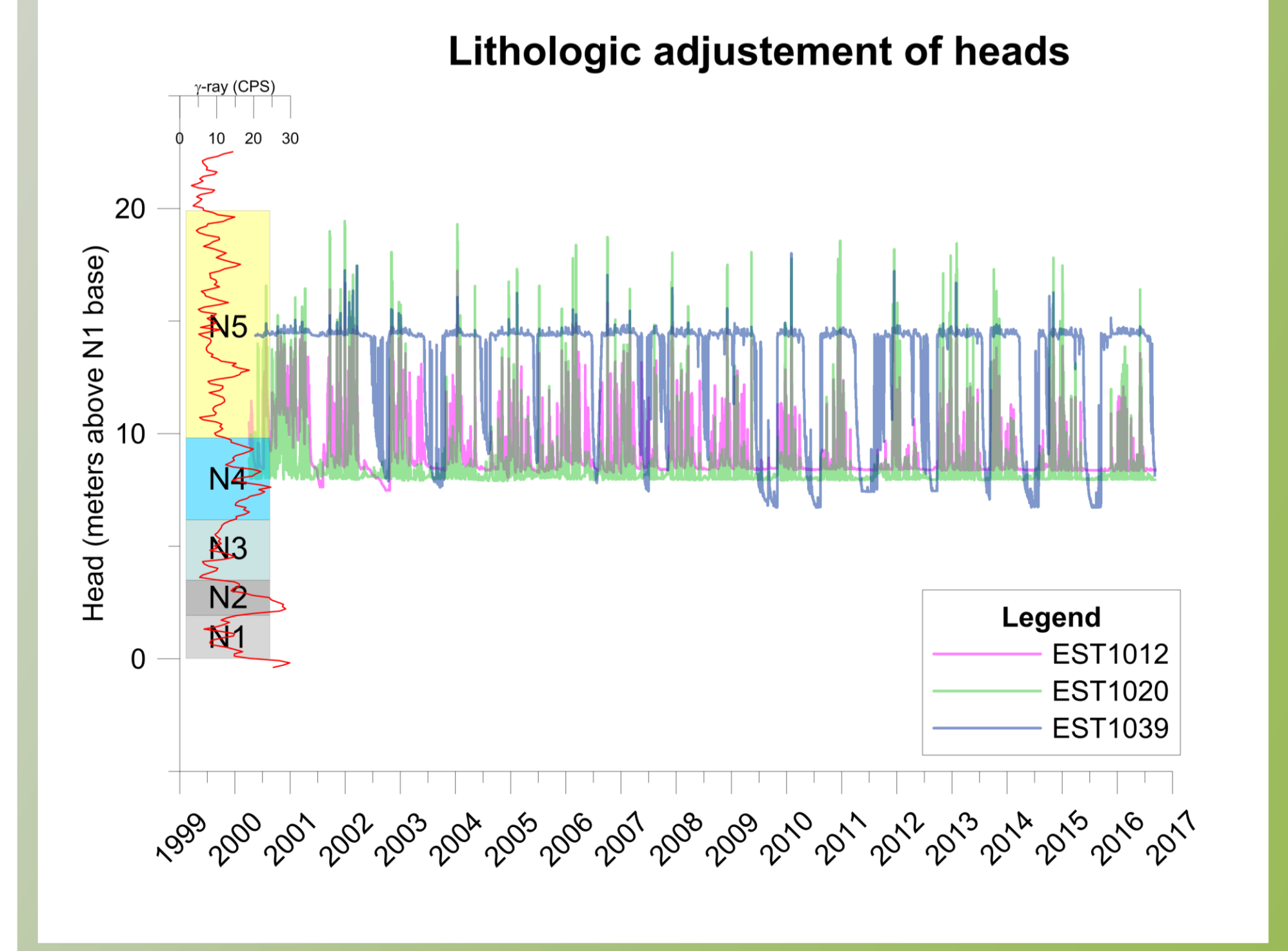
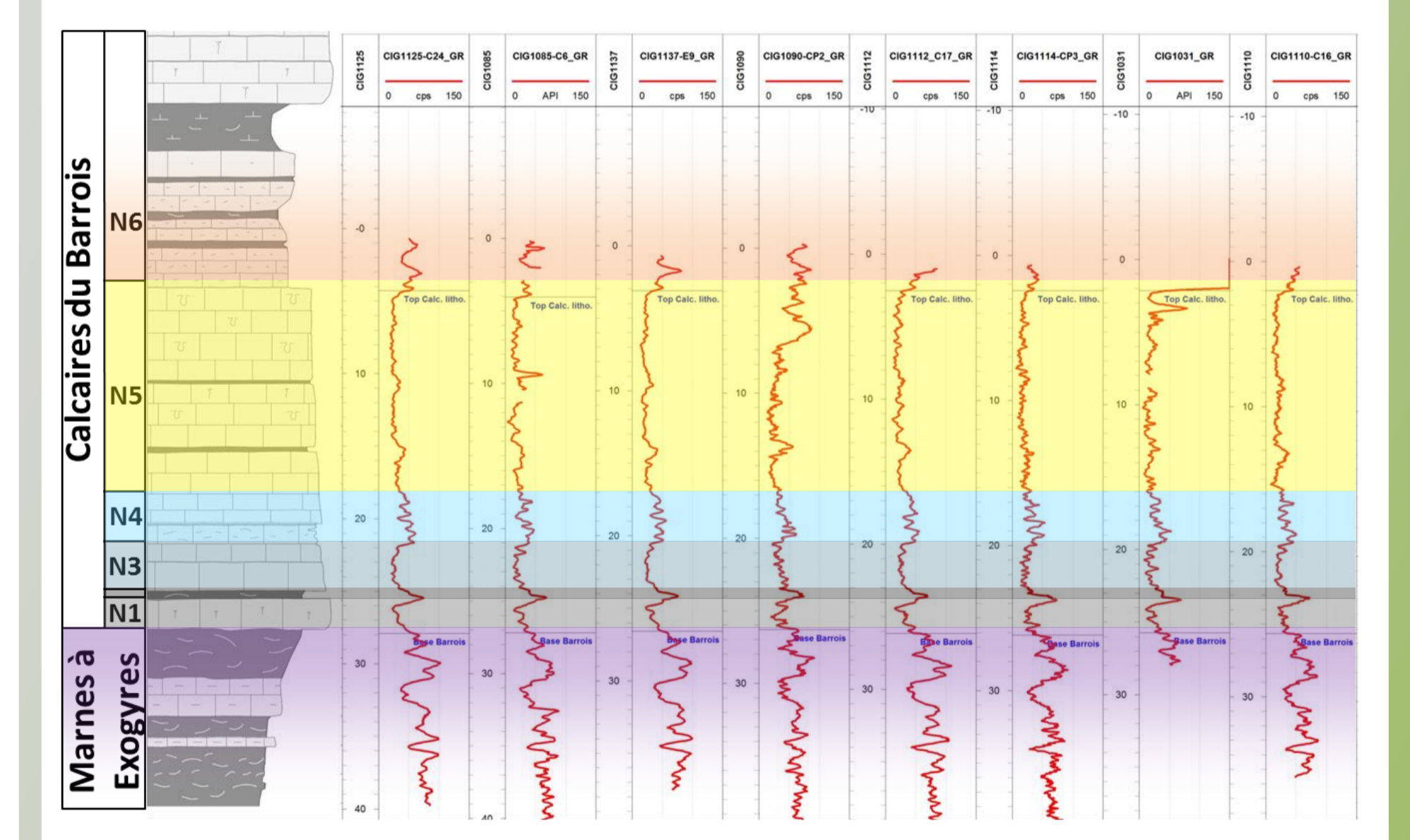
Hydrogeology

- Found variable reaction to precipitation in time and amplitude between monitoring wells
- Observed base and top piezometric level thresholds
- Evidenced important vertical differences in hydraulic conductivity



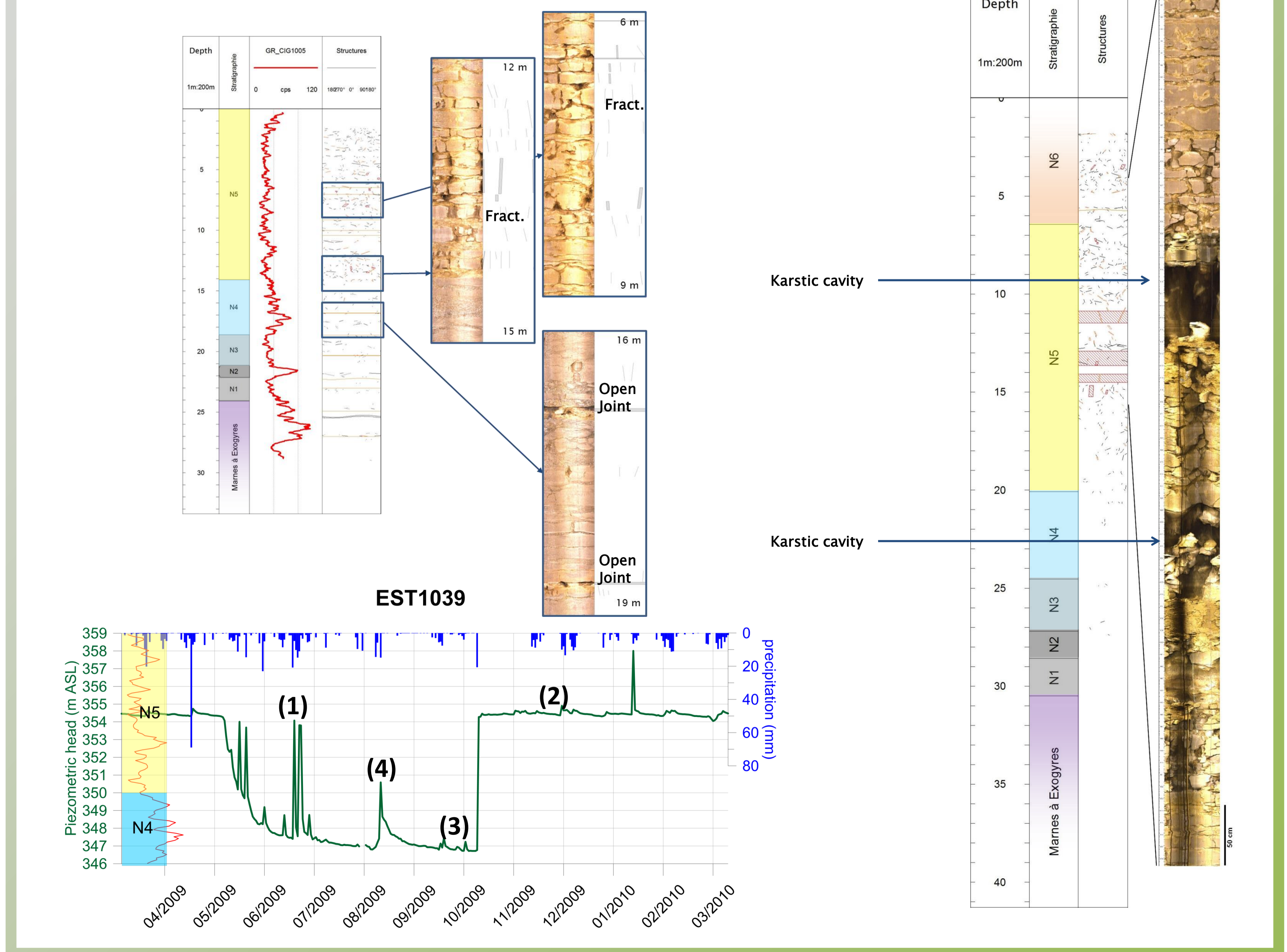
Lithology

- Built a stratigraphic and lithological model based on correlation between 89 boreholes
- Distinguished 7 surfaces separating 6 lithological intervals (N1 to N6) mainly characterized by a dominant carbonate or marl content
- Found the limestone formation to have a regular thickness with small negligible spatial variability
- Determined the scale of the 6 lithological intervals to be coherent with the hydrogeological observations



Conceptual model

- An intensely fractured upper level in the lithological intervals N5 and N6 characterized by open fractures 5 to 20 cm wide enlarged or not by dissolution resulting in high hydraulic conductivity.
- Fractures favoring vertical ground flow inducing rapid un-sustained piezometric level changes in monitoring wells during low water table period (1) and a steady high threshold level during high water table period (2)
- A lower level in N1 to N4 intervals characterized by dominant joints from 1 to 10 cm wide opened by dissolution, allowing horizontal ground water flow at the lower water table threshold (3)
- Joint hydraulic conductivity smaller than vertical fractures induce assymetrical piezometric level variations during low water table period (4)
- Rare multi-decimeter wide karstic cavities and pathways



Conclusion

- Observations of the piezometric level variations are well corroborated with borehole observations
- Analysis of different downhole logging tools contributed to a reasonable physical representation of ground water flow in this karstic aquifer

Perspective

- Proton Magnetic Resonance surveys to study water content variations of the Calcaire du Barrois formation
- In situ geochemical monitoring and tracer testing to confirm ground water origins and flow paths
- Quantifying hydraulic conductivity vertical variability with packer tests

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