Avec le soutien de :

RÉPUBLIQUE FRANÇAISE
Liberté
Égalité
Fraternité

eau GRAND SUD-OUEST
AGENCE DE L'EAU ADOUR-GARONNE

COLLOQUE
GESTION DES EAUX SOUTERRAINES

Du 15 au 17 février 2023
à l'ENSEGID - Bordeaux INP

Etude des relations karst-rivière par surveillance de la chlorophylle
Intérêt et cas d'études

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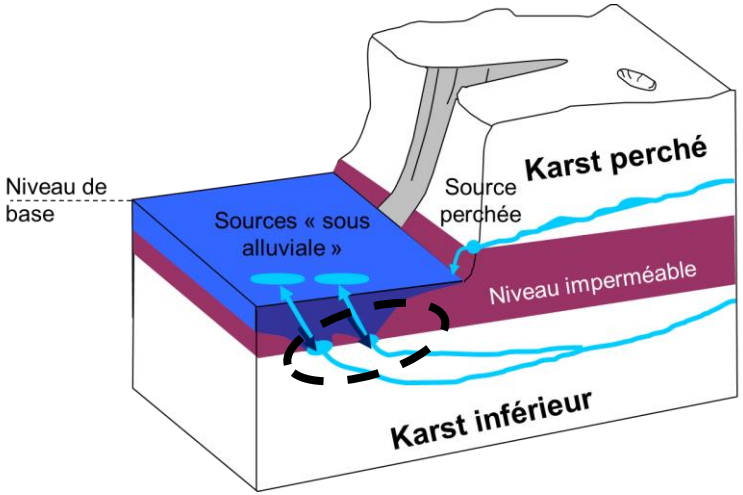
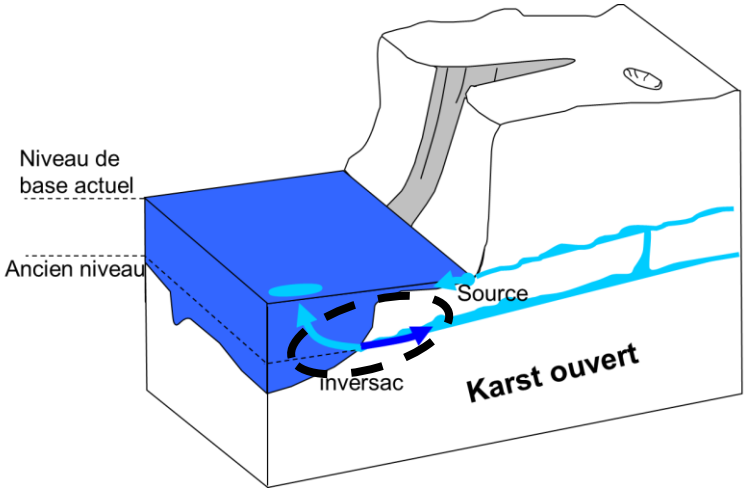
BORDEAUX INP Ensegid

ahsp les hydrogéologues des services publics

Karst river relations





Karstic network discharge into river and lake :

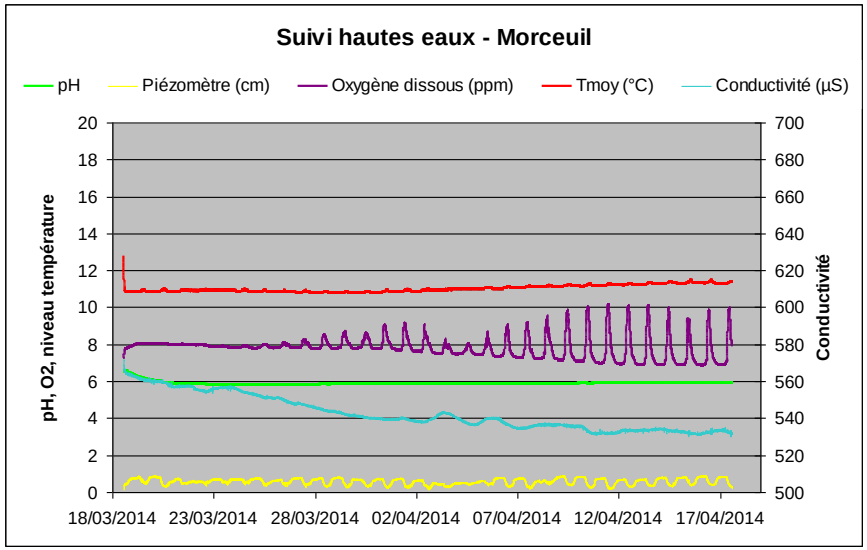
- ❑ An hydrogeological problem
- ❑ A drinking water production problem

Estavelle problem (Inversac)

Indicators of Estavelle phenomena

Mixed water: Review of tested methods

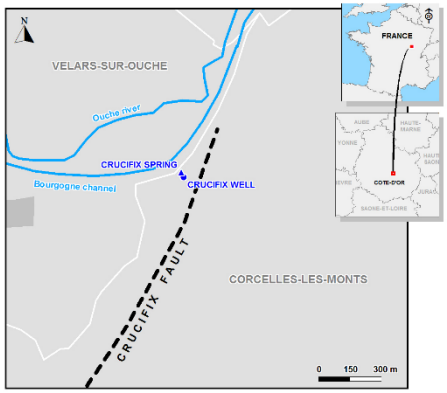
- No evidence of Estavelle/Inversac phenomena using level monitoring (Morcueil spring, Suzon springs, Ouche valley springs – Burgundy)
  - very low hydraulic gradient (<1/10000)
  - Very low drawdown (<3 cm for 140 m^3/h)
- No evidence with majors elements
  - The waters have often the same origin in limestone aquifer
  - Calco-carbonic equilibrium varies in surface water due to photosynthesis
- But sometimes…evidence from physico survey (see Morcueil monitoring)



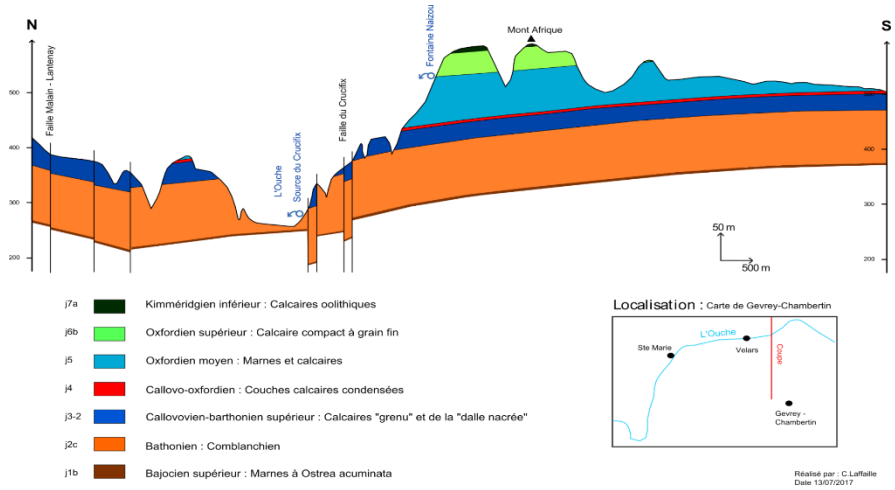
So why not chlorophyll-a as indicator of Estavelle?

Crucifix Spring case study
Velars sur Ouche, Côte d'Or

Hydrogeological setting



- Aquifer: Bathonian limestones (Comblanchien formation) covered by Oxfordian limestones
- Karstic circulation (from 10 to 50 m/h)
- Major anthropogenic construction: the Burgundy Canal supplied by reservoirs



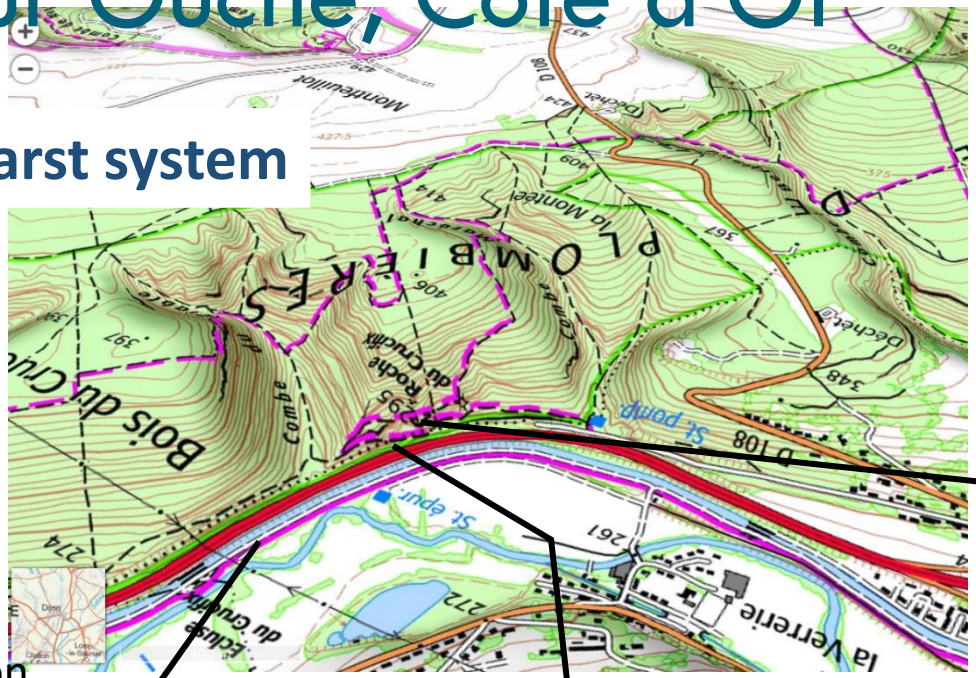
Crucifix karst: an ideal site to study the Inversac phenomena

With:

- Burgundy Canal
- Karstic spring on the main conduit (Dijon Metropole resource)
- Water well on fissured system (SAD)

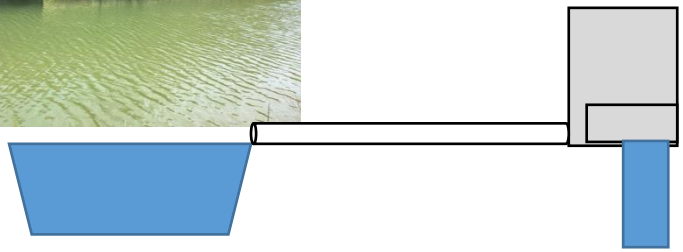
Crucifix Spring case study
Velars sur Ouche, Côte d'Or

The Crucifix karst system

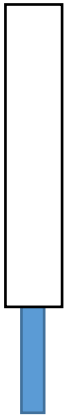


Canal – Eutrophisation

Crucifix spring



Water well



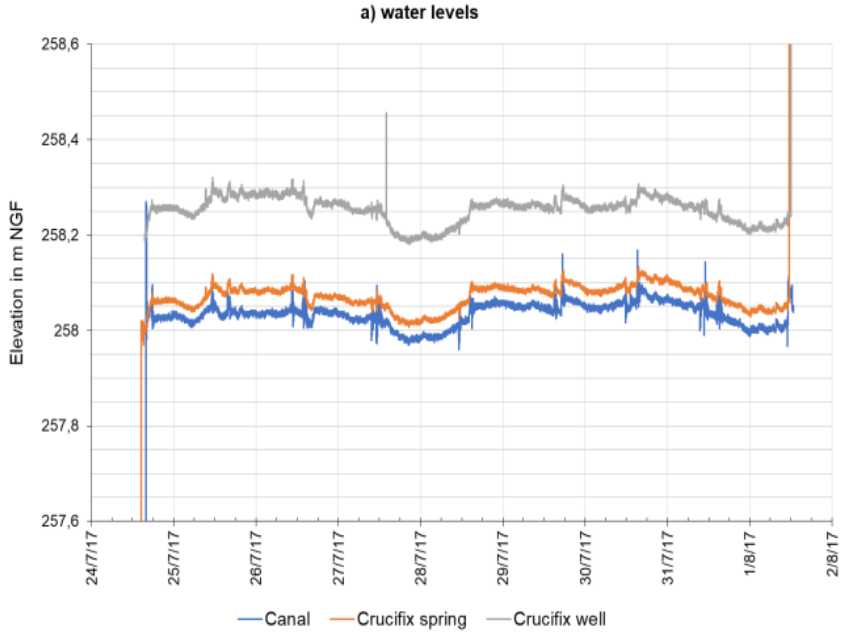
Crucifix Spring case study

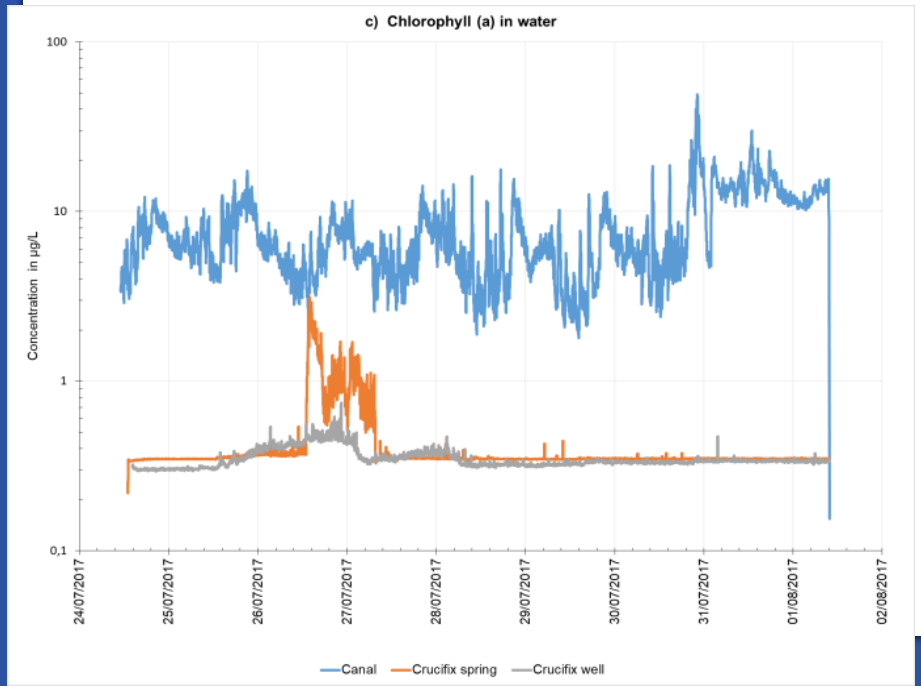
Two major Estavelle/Inversac events

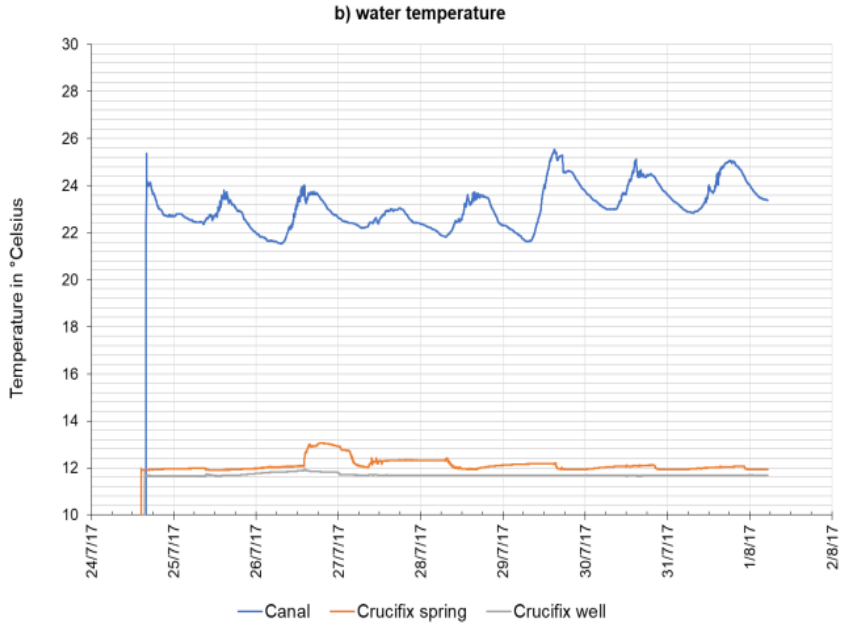
- ❑ **No detection using level monitoring**
- ❑ **Minor temperature signal in the spring (no signal in the well)**

The chlorophyll-a signal is more significant

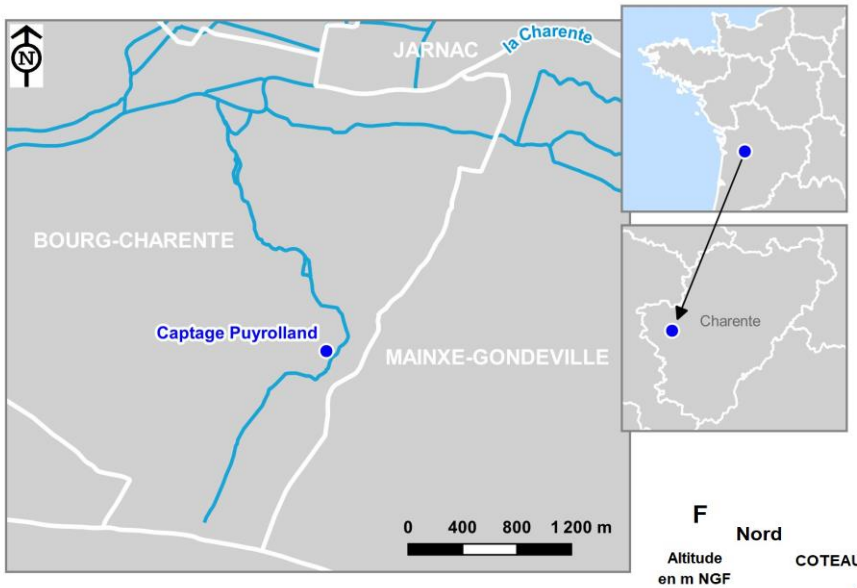
- ❑ **Inversac in the spring: pronounced spike in Chl-a concentration**
- ❑ **Less evident in the SAD**



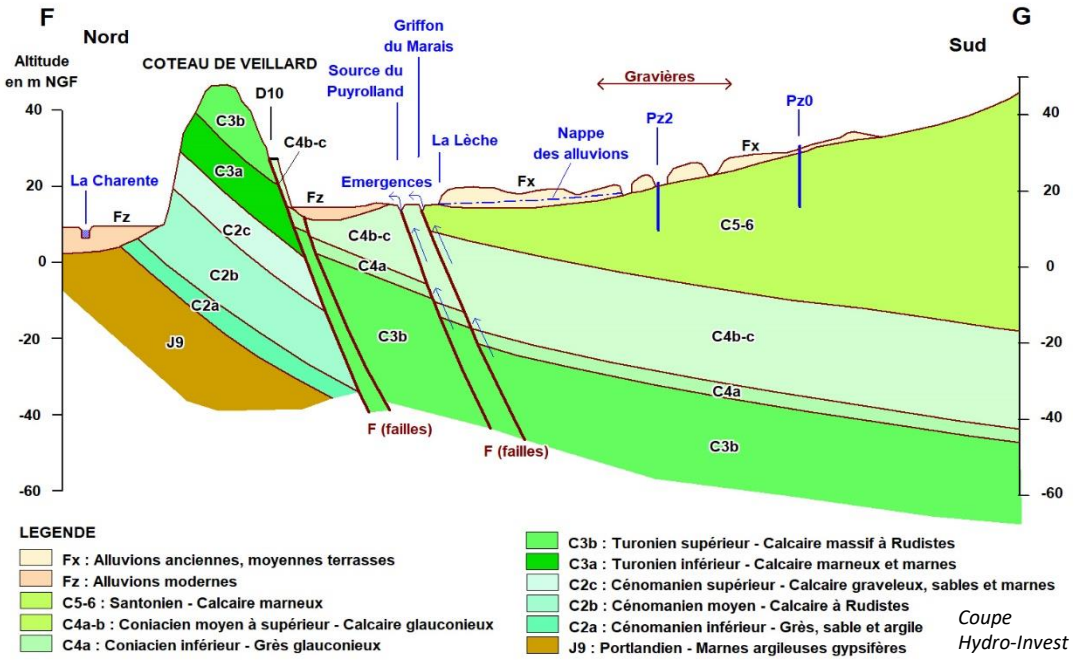




Cas du captage de Puyrolland (16)



Contexte hydrogéologique :

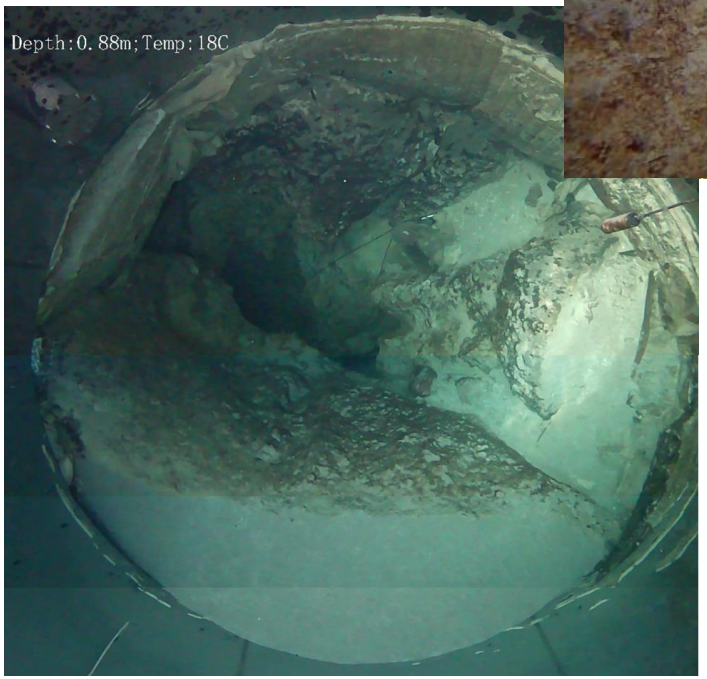


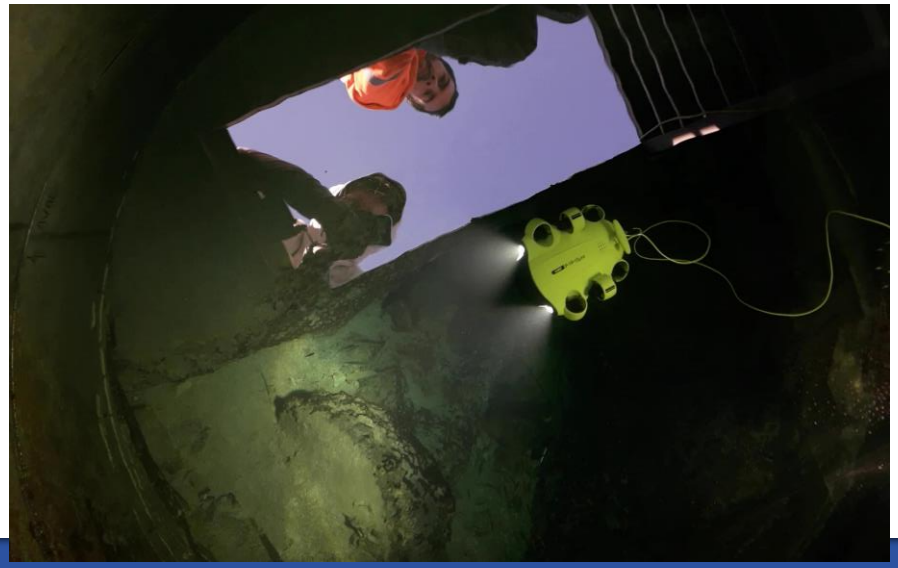
Coupe Hydro-Invest

Cas du captage de Puyrolland (16)

Ouvrage : cuvelage inox, <u>non étanche,</u>

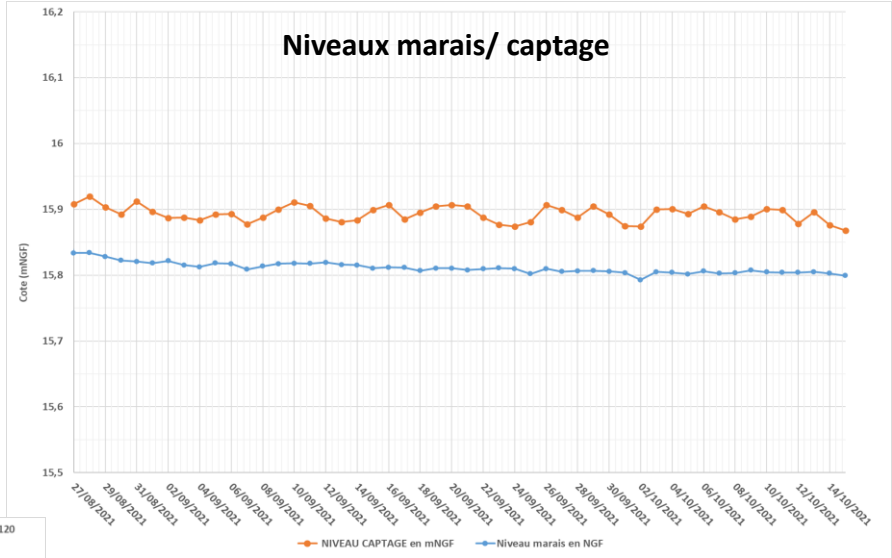
<u>=> Risque d'intrusion d'eau superficielle en exploitation</u>

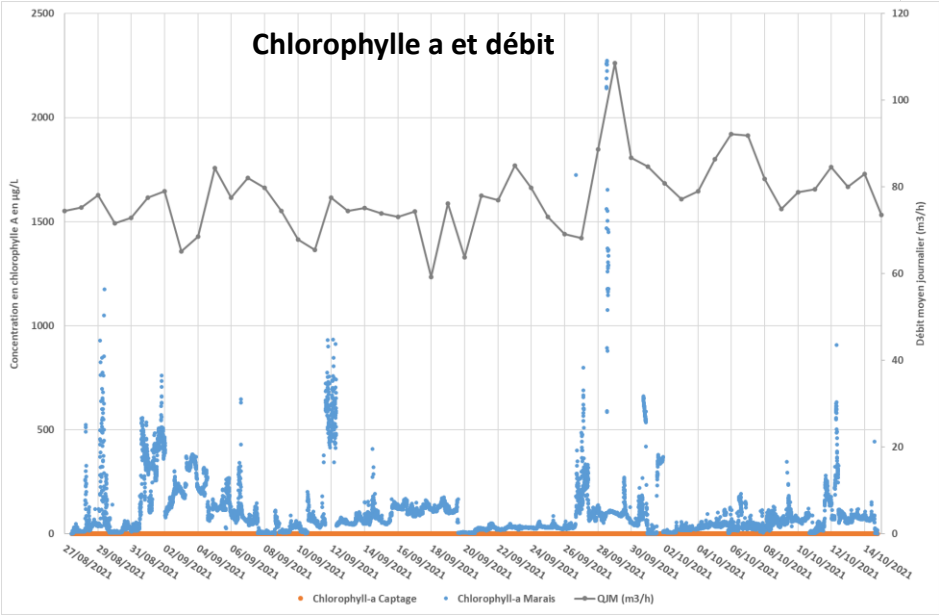




Cas du captage de Puyrolland (16)

Suivi d'étiage chlorophylle a
marais / captage
en exploitation
+ test pompage 2xQ





=> CONCLUSION :
ABSENCE
D'INTRUSION

Conclusion

The experiments highlighted :

- ❑ **Temperature and water levels are not good indicators to Inversac/Estavelle detection**
- ❑ **Use of chlorophyll-a probe is more efficient to detect the mass transfer from canal**

Passive management :

- ❑ **Delineation of gw basin of each spring**

Active management of karstic resources :

- ❑ **Chlorophyll-a continuous monitoring**
- ❑ **Alert or pumping command**

Thanks