

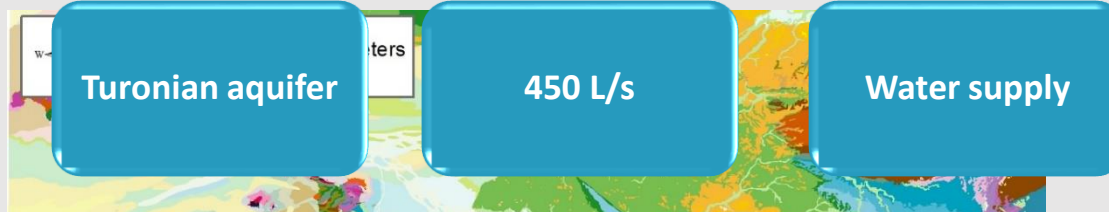
# HIGH-RESOLUTION HYDROCHEMICAL MONITORING IN A MULTILAYER KARST AQUIFER

The Example of Toulon springs (Dordogne, France)

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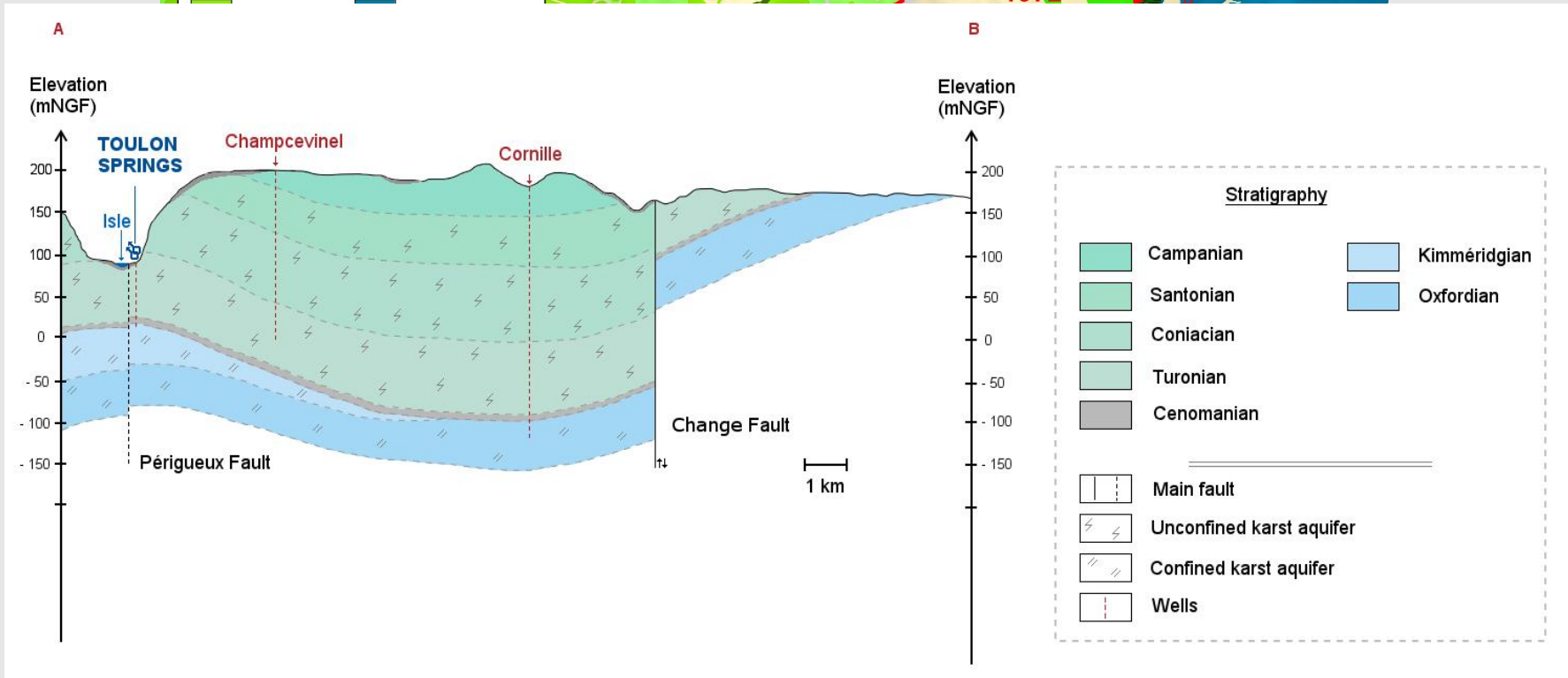
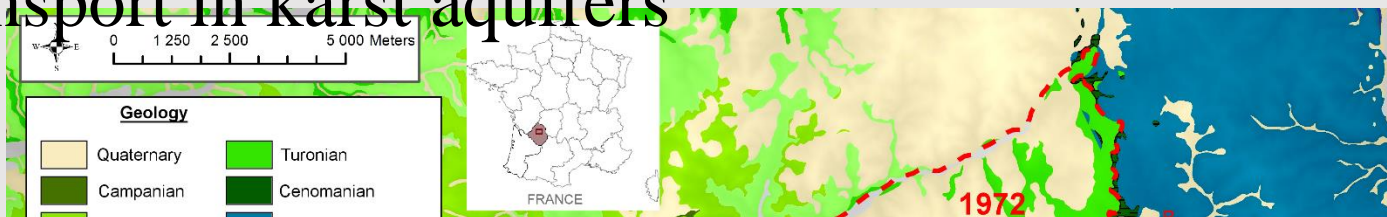
# General characteristics



# Local and Research issues

Protection perimeter
Turbidity and nitrates troubles
Calco-carbonic equilibrium
High-resolution monitoring
Spatialization of infiltration

Improve knowledge of conceptual models of flow and transport in karst aquifers



# Objectives of the present study

**Examining the chemical parameters in a multilayer karst system using high-resolution monitoring**

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**Temporal evolution of chemical parameters**

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**Time series analysis**

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**Hysteresis analysis**

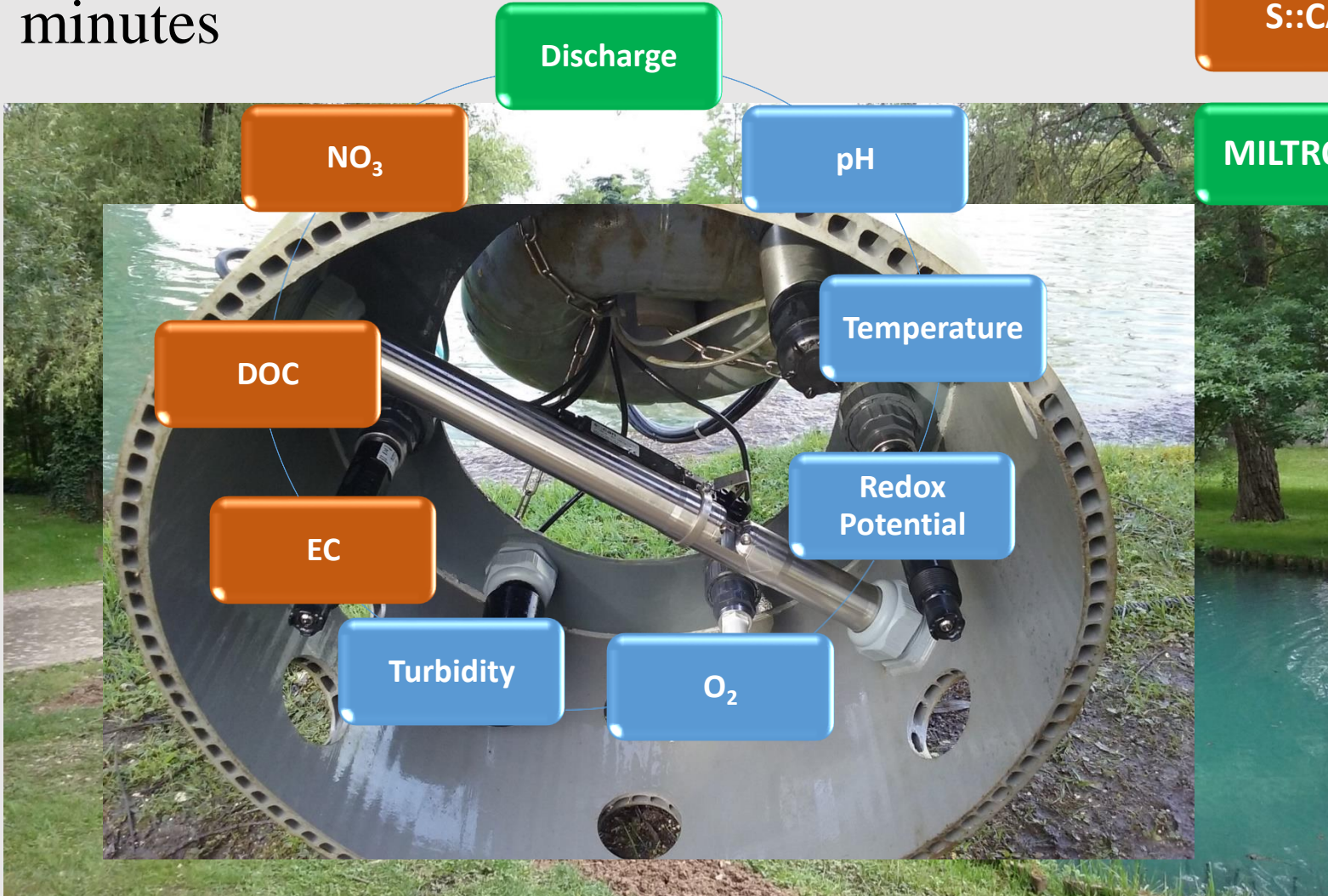
# Materials

Precise measurements of chemical parameters every 6 minutes

HACH

S::CAN

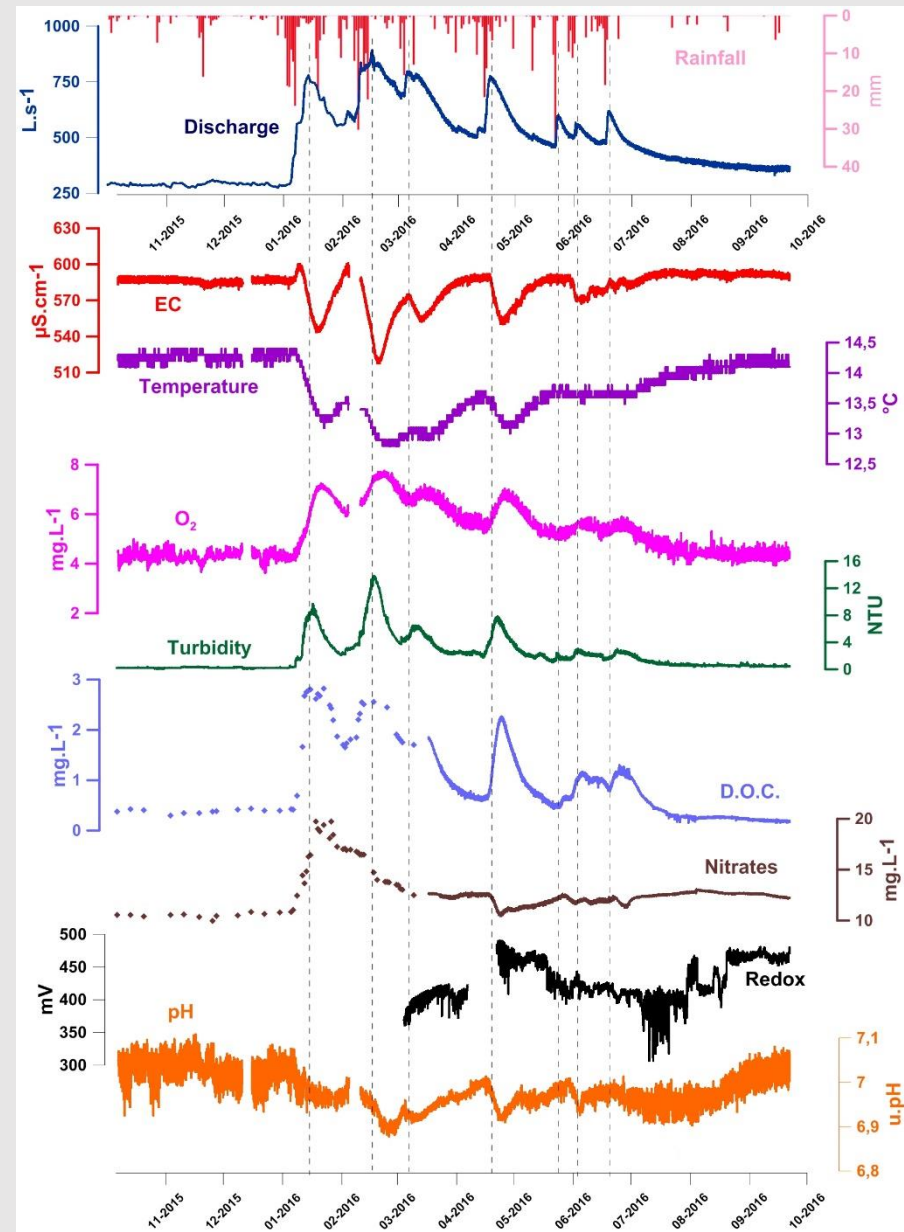
MILTRONICS



# Acquisition of hydrochemical data

ADVANTAGES	DISADVANTAGES
Directly at the outlet	Presence of Algae / biofilm deposition
Data are more precise	pH and Redox Potential
Wiper cleaning for DOC/NO <sub>3</sub> sensor and turbidity sensor	

Weekly maintenance to acquire precise data



# Hydrochemical data

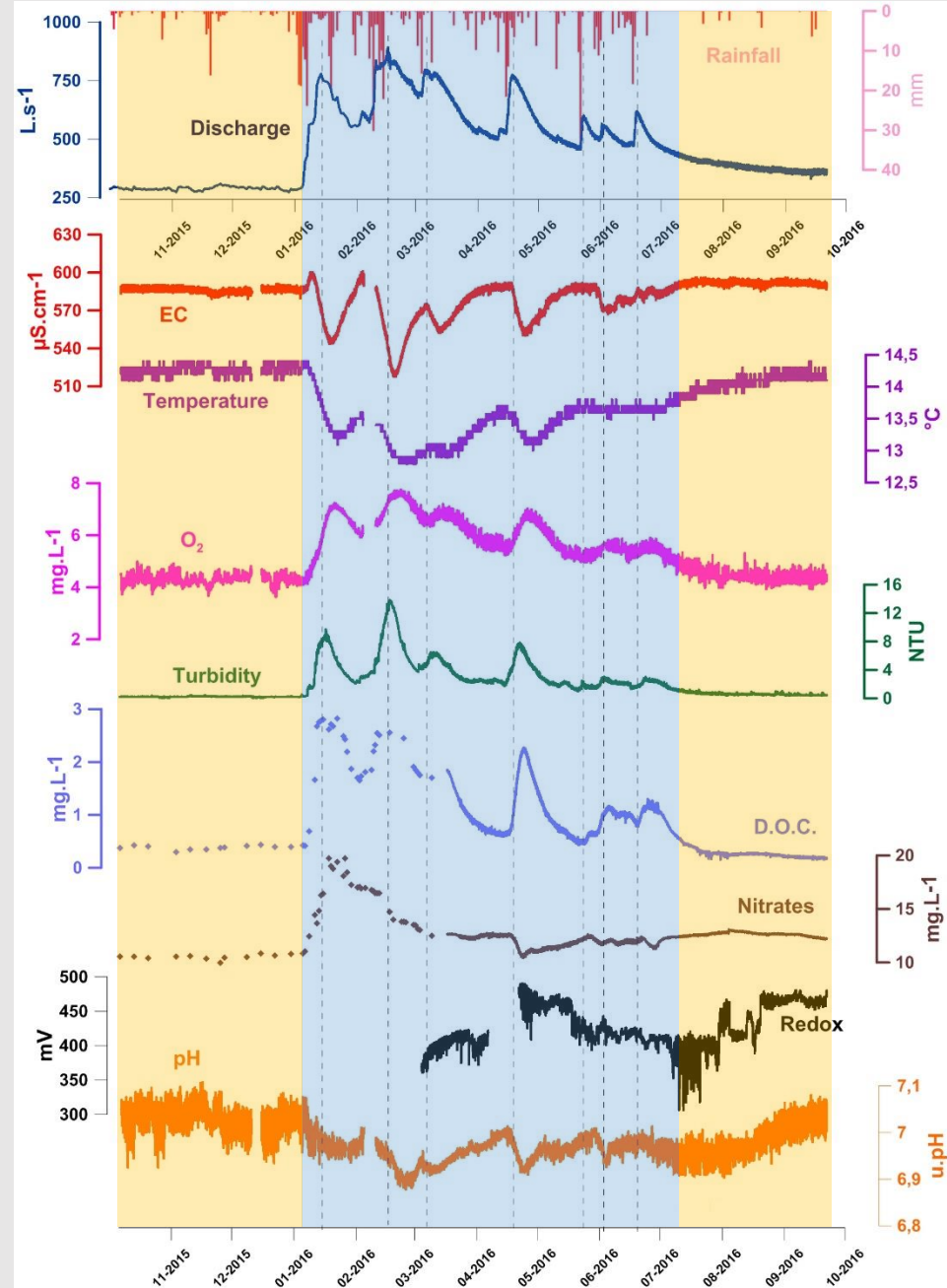
Low water condition :

Water of deep origin  
(Temperature, EC)

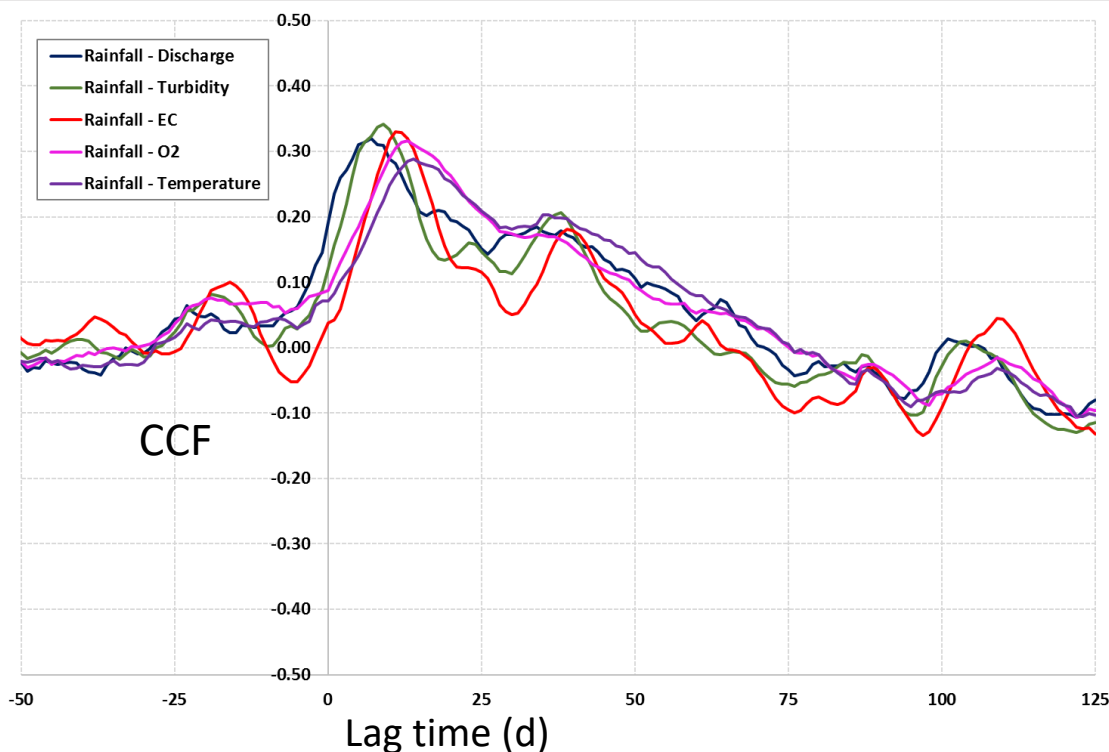
High water condition :

Shallow water participation  
(NO<sub>3</sub>, DOC, O<sub>2</sub>, turbidity)

Provide both seasonal and quick variations



# Cross correlation function



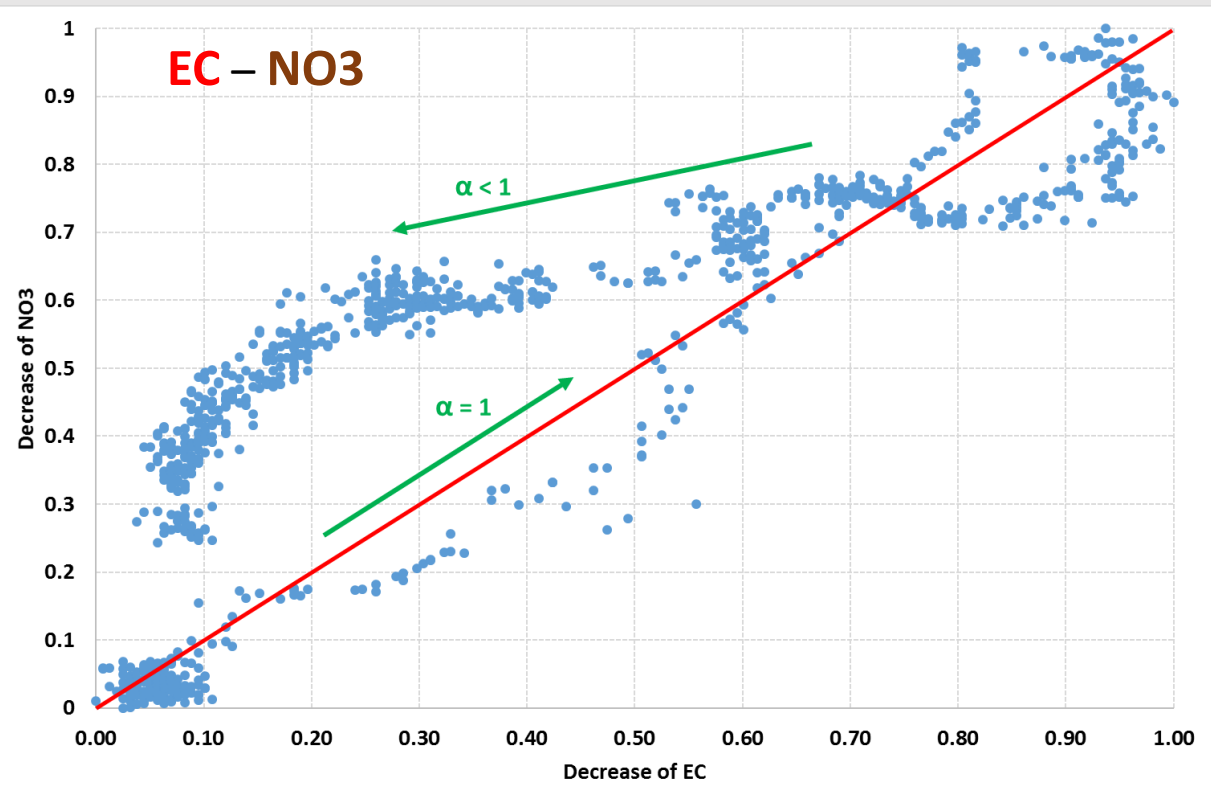
Parameter	Lag (d)	Correlation
Discharge	7	0.32
Turbidity	9	0.34
EC	11	-0.32
O <sub>2</sub>	14	0.29
Temperature	14	-0.31

Hydrochemical responses are complex and different for each parameter.



# Hysteresis analysis

Start of increase of EC  
 Start of decrease of NO<sub>3</sub>

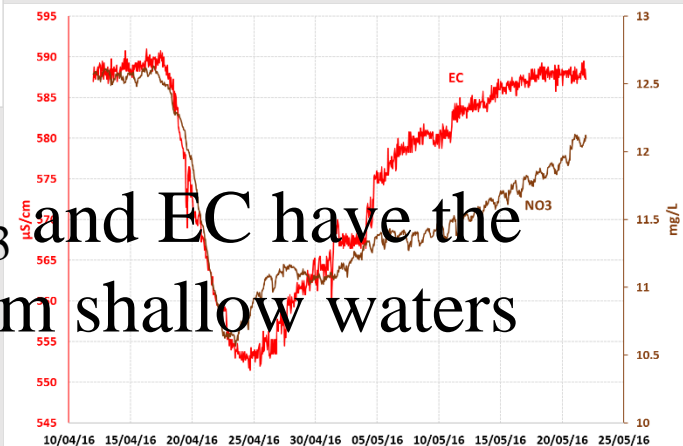


Flood event April 2016

EC and DOC have a synchronous behaviour

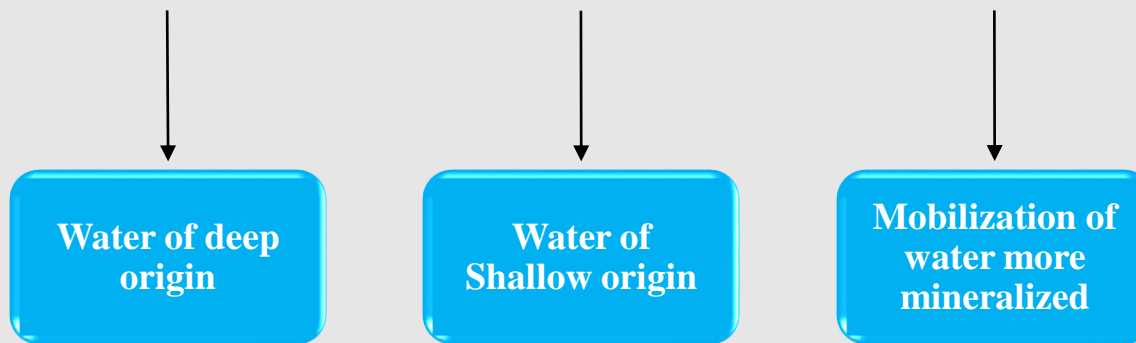
EC and NO<sub>3</sub> decrease together but NO<sub>3</sub> is more inertial

Increase of DOC, and decrease of NO<sub>3</sub> and EC have the same cause : Dilution waters come from shallow waters



# Interpretation

High-resolution monitoring exhibit different water types flowing at Toulon springs

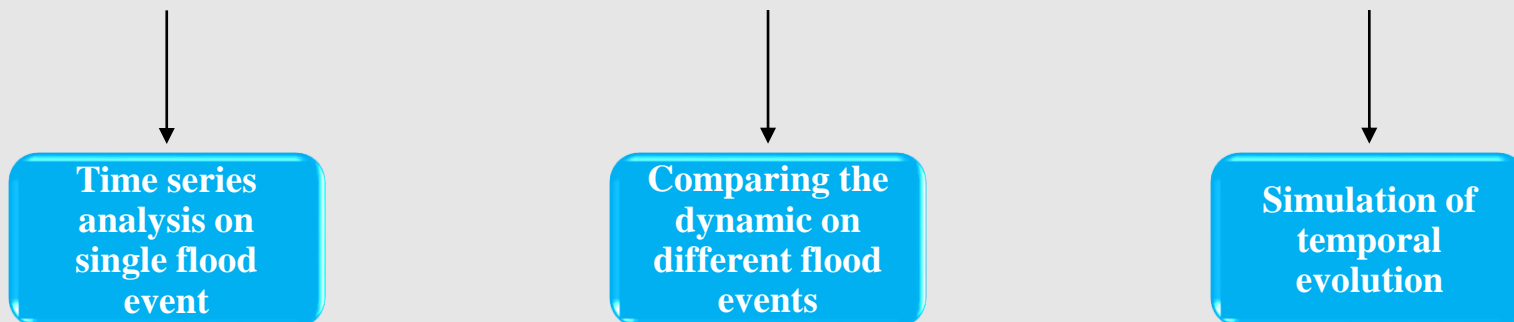


Decrease in mineralization of water is directly linked with the participation of shallow water as noticed by DOC concentration

# Conclusion

Temporal variations can be studied with high-resolution monitoring to assess pressure transfer (Discharge) and mass transfer (EC, DOC, NO<sub>3</sub>) in karst aquifers

First approach is interesting but need further data to confirm assumptions on the dynamic of hydrochemical parameters



# Thank you for your attention

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