

# Mediterranean Temporary Ponds : using isotope hydrology tools to describe and understand their behavior

Alexandra Mattei, Laurent Sorba, Emilie Garel, Sébastien Santoni, Sophie Orsini, Frédéric Huneau



*Eryngium pusillum*



Musella pond



*Moraea sisyrinchium*



*Triops cancriforme*



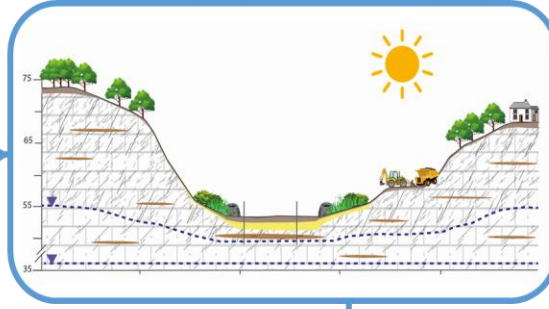
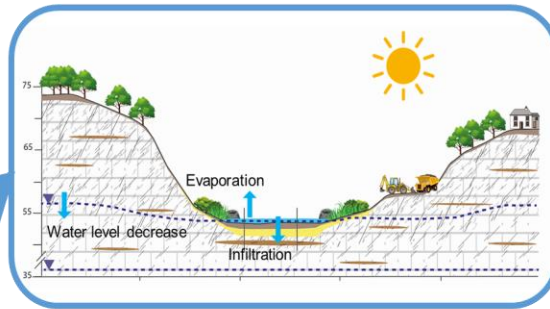
Musella NE well



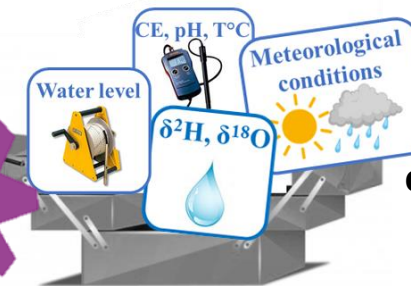
*Isoetes velata*



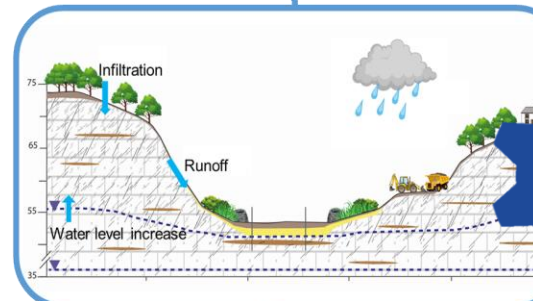
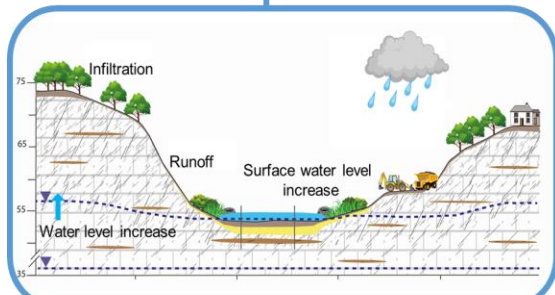
Dry period



Strong environmental interest



Hydro-period  
characterization using the  
tools of the isotope  
hydrology

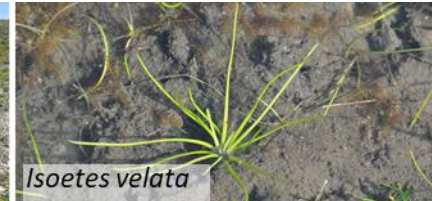
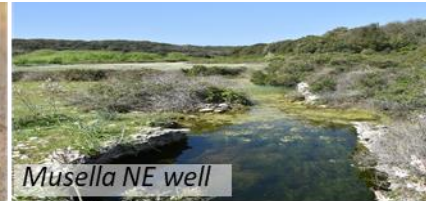
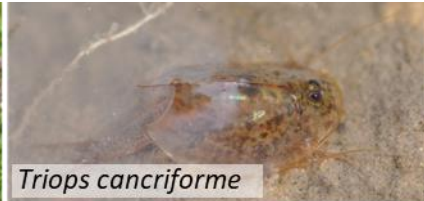


Hydrological and hydrogeological components  
of the flooding and drying processes  
comprehension



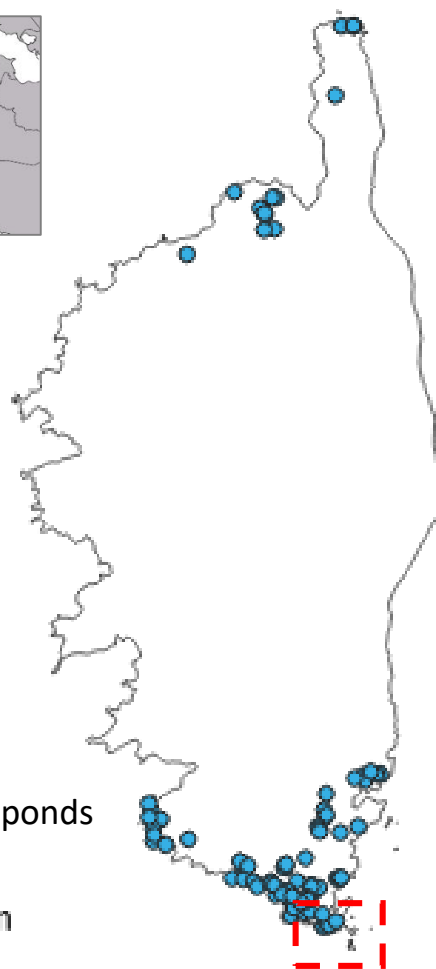
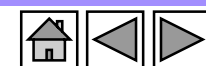
Protected area  
determination

Wet period



# The Musella temporary pond (Corsica, Western Mediterranean) as pilot site

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● Registered temporary ponds



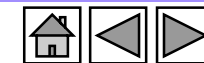
**Strong environmental interest (Site Natura 2000 and Znieff type 1) :**

- **4 protected plant species:** *Eryngium pusillum* (only French station), *Isoetes histrix*, *Ranunculus ophioglossifolius* and *Ranunculus revelierei*
- **4 species of amphibians:** *Hyla sarda*, *Pelophylax bergeri*, *Discoglossus sardus* and *Bufo balearicus*
- **2 rare branchiopod crustaceans for Corsica:** *Triops cancriformis* et *Chirocephalus salinus*



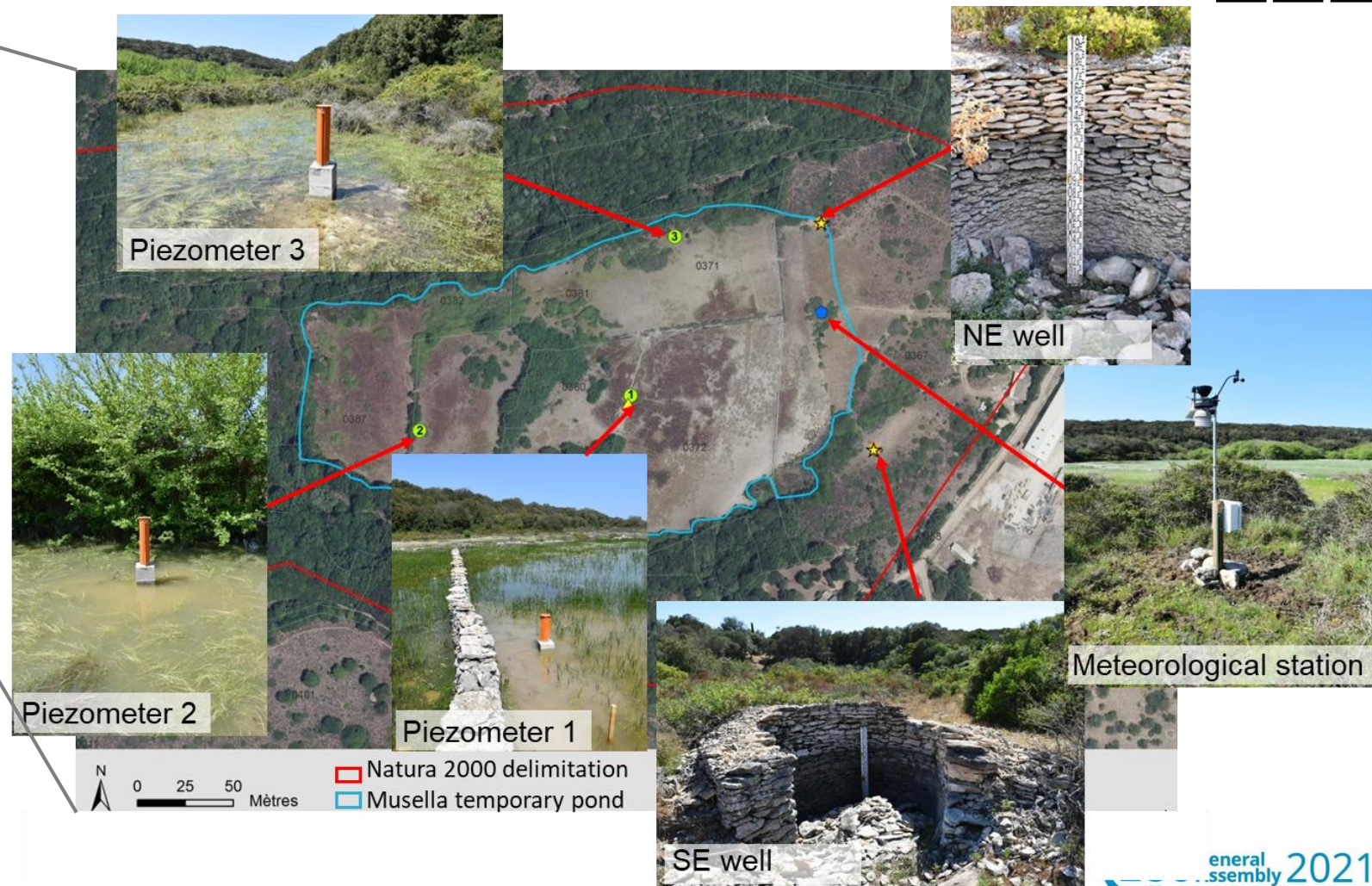
# The Musella temporary pond (Corsica, Western Mediterranean) as pilot site

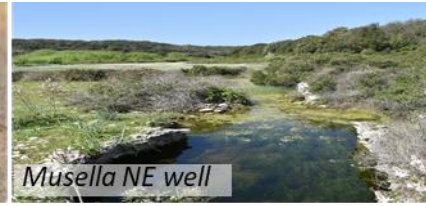
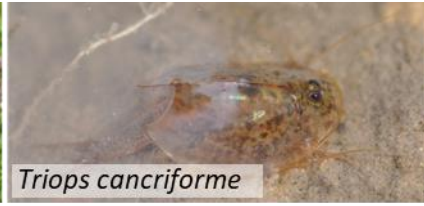
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Between **November 2017 - January 2021**  
**monthly** measurements of :

- Surface and groundwater levels
- Major ions
- Stable isotopes of the water molecules ( $\delta^2\text{H}$ ,  $\delta^{18}\text{O}$ )
- Field parameters (temperature, pH, electrical conductivity, dissolved oxygen)





*Eryngium pusillum*

Musella pond

*Moraea sisyrinchium*

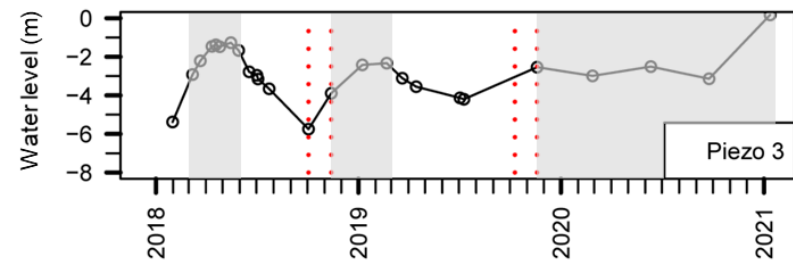
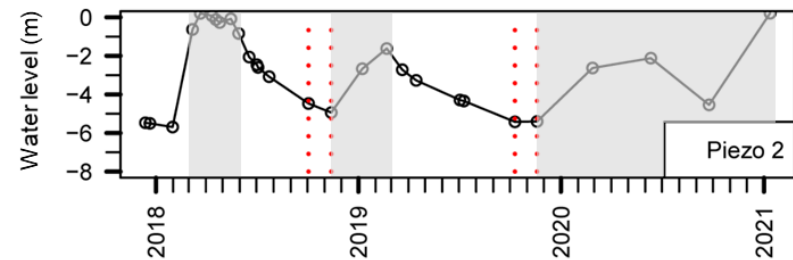
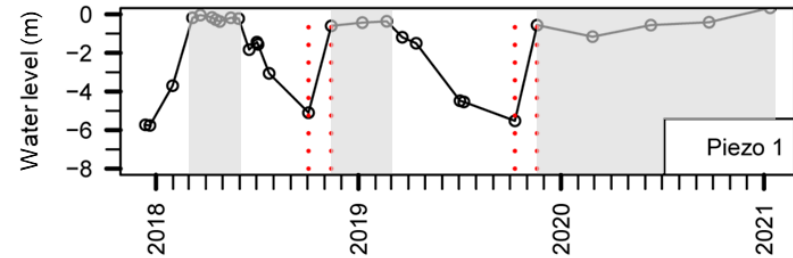
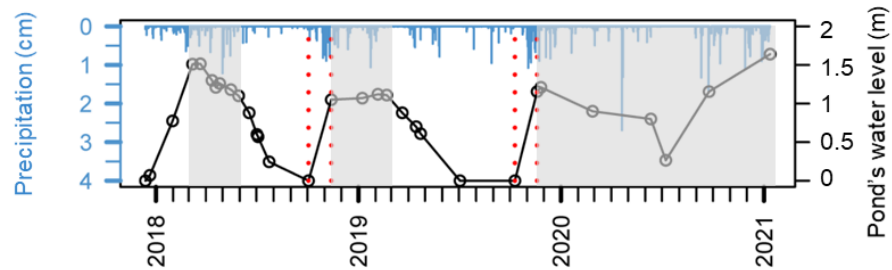
*Triops cancriforme*

Musella NE well

*Isoetes velata*

# Comparison between the flooding period and the piezometric level

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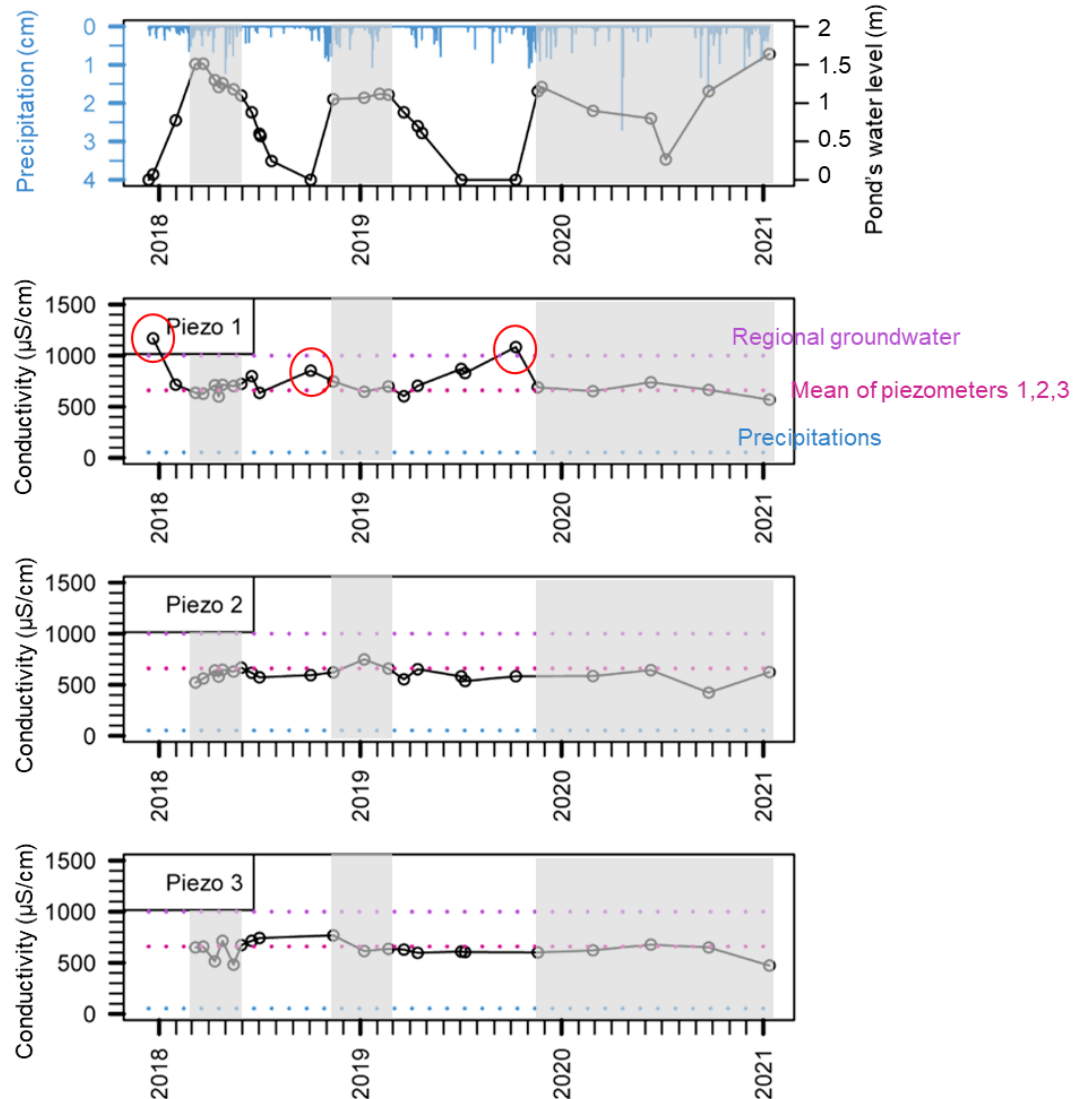


- The Musella temporary pond is a seasonal temporal pond alternating wet and dry periods every year, in accordance with the season
- A significant amount of rainfall over a short period of time is necessary for flooding
- The flooding lasts for several months
- When the water level of the pond is maximum, the piezometric level in piezometer 1 is also maximum
- A time lag of 3 months is observed on piezometers 2 and 3



# Temporal evolution of the physico-chemical parameters

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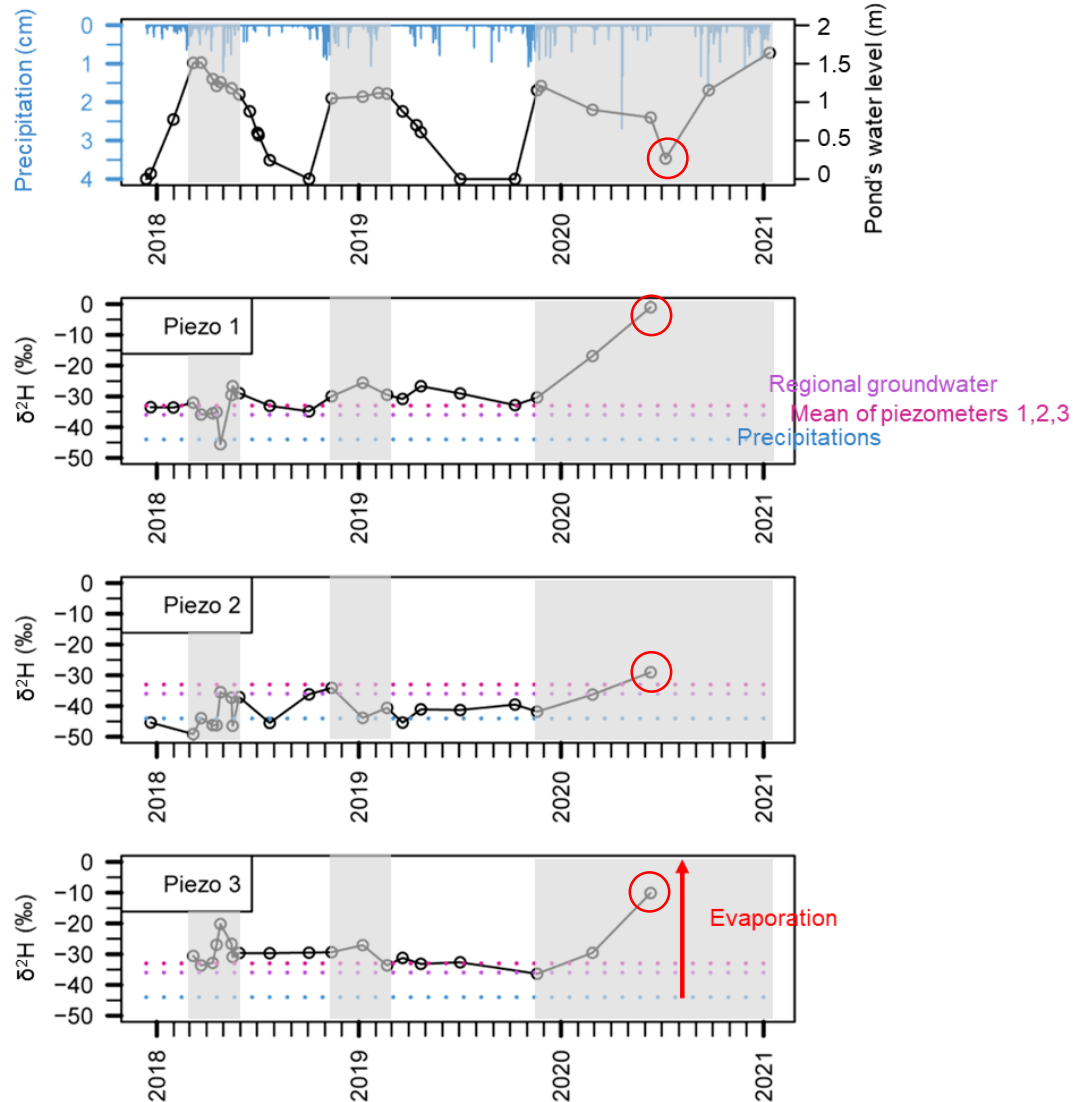


- In piezometer 1, an increase in conductivity systematically precedes the flooding period of the pond
- Piezometers 2 and 3 show relatively stable conductivities over time



# Temporal evolution of the water isotopic composition

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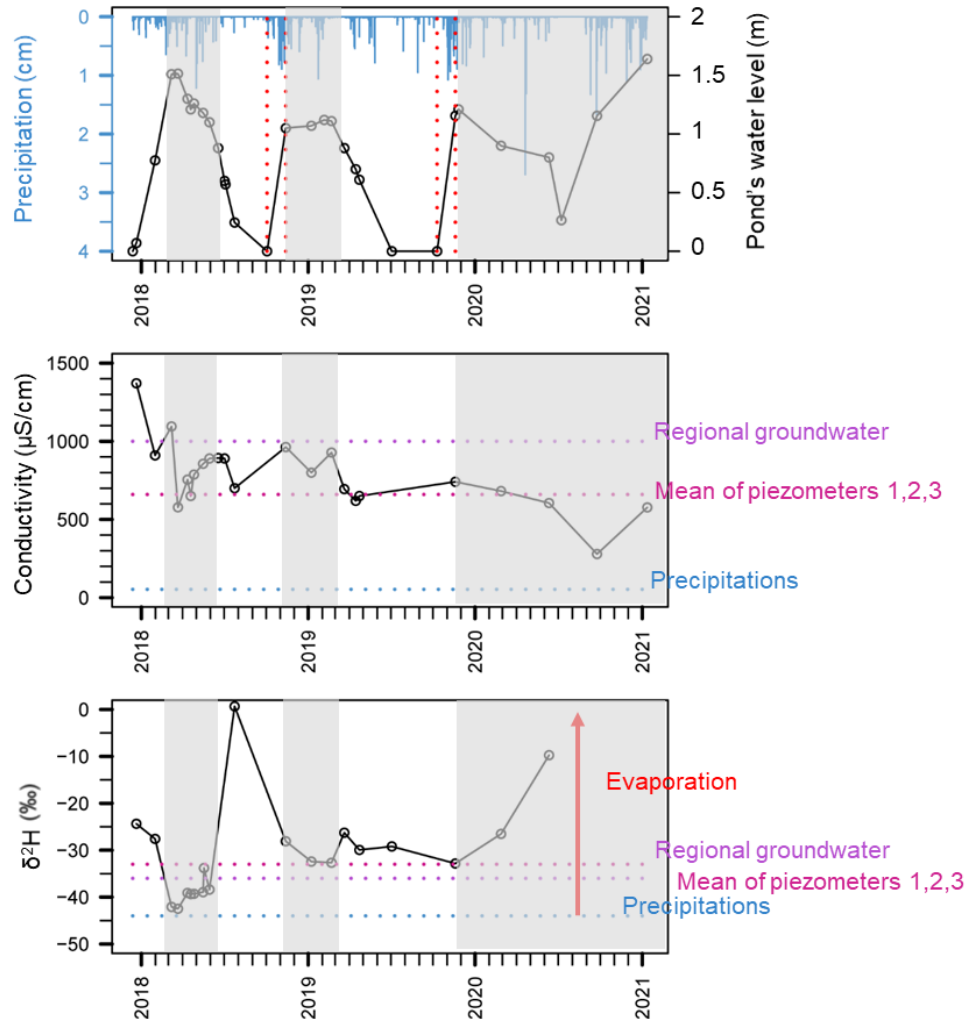


- Piezometers 1 and 3 have an isotopic composition close to that of the regional limestone aquifer
- Piezometer 2 has an isotopic composition close to that of precipitation
- The isotopic enrichment observed on the 3 piezometers in June 2020 is consistent with the decrease in the water level in the pond observed at the same time



# Temporal evolution of the pond's water isotopic composition and conductivity

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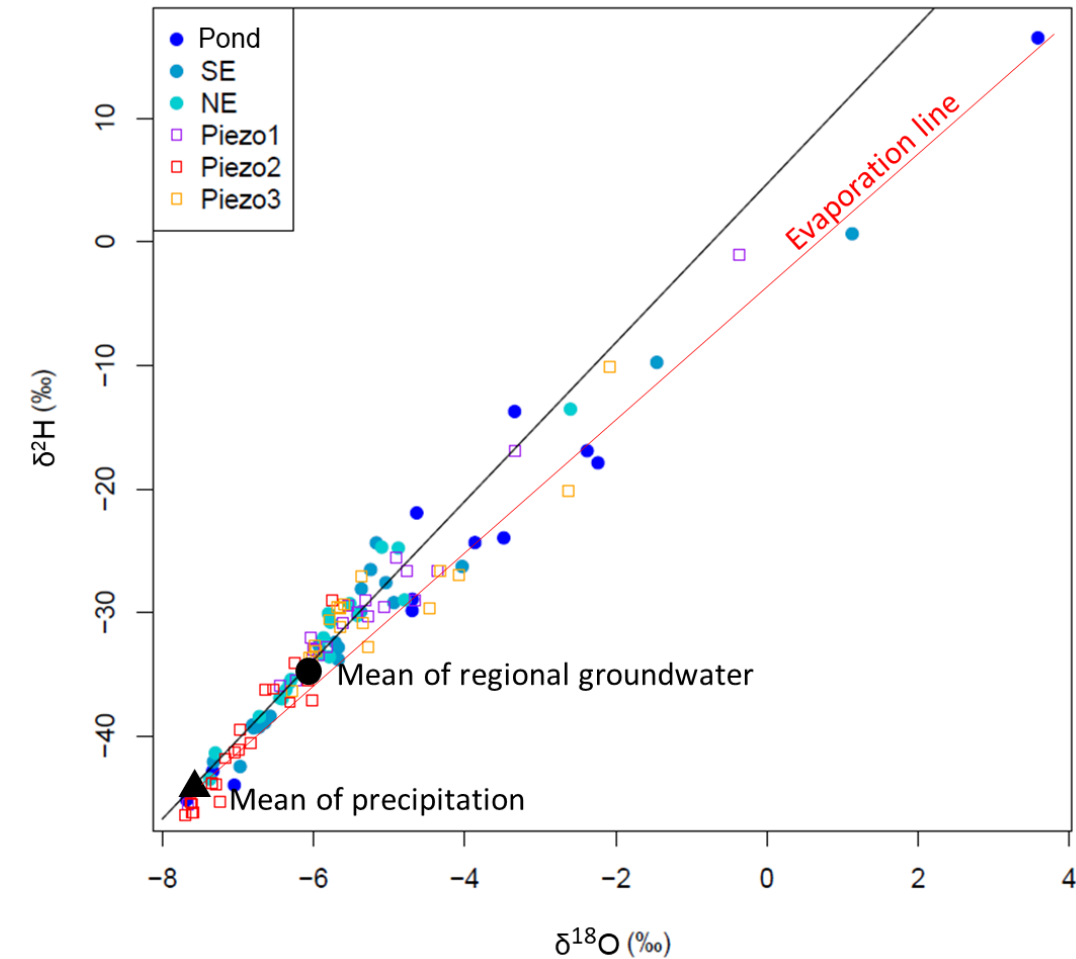


- During the wet period, the isotopic composition measured in the pond is close to that of the regional limestone aquifer
- When the water level in the pond decreases the measured isotopic composition is enriched in heavy isotopes
- When the pond is already flooded, precipitation contributes directly to the increase of the water level. This results in a decrease in the conductivity



# Comparison of the water stable isotopic data

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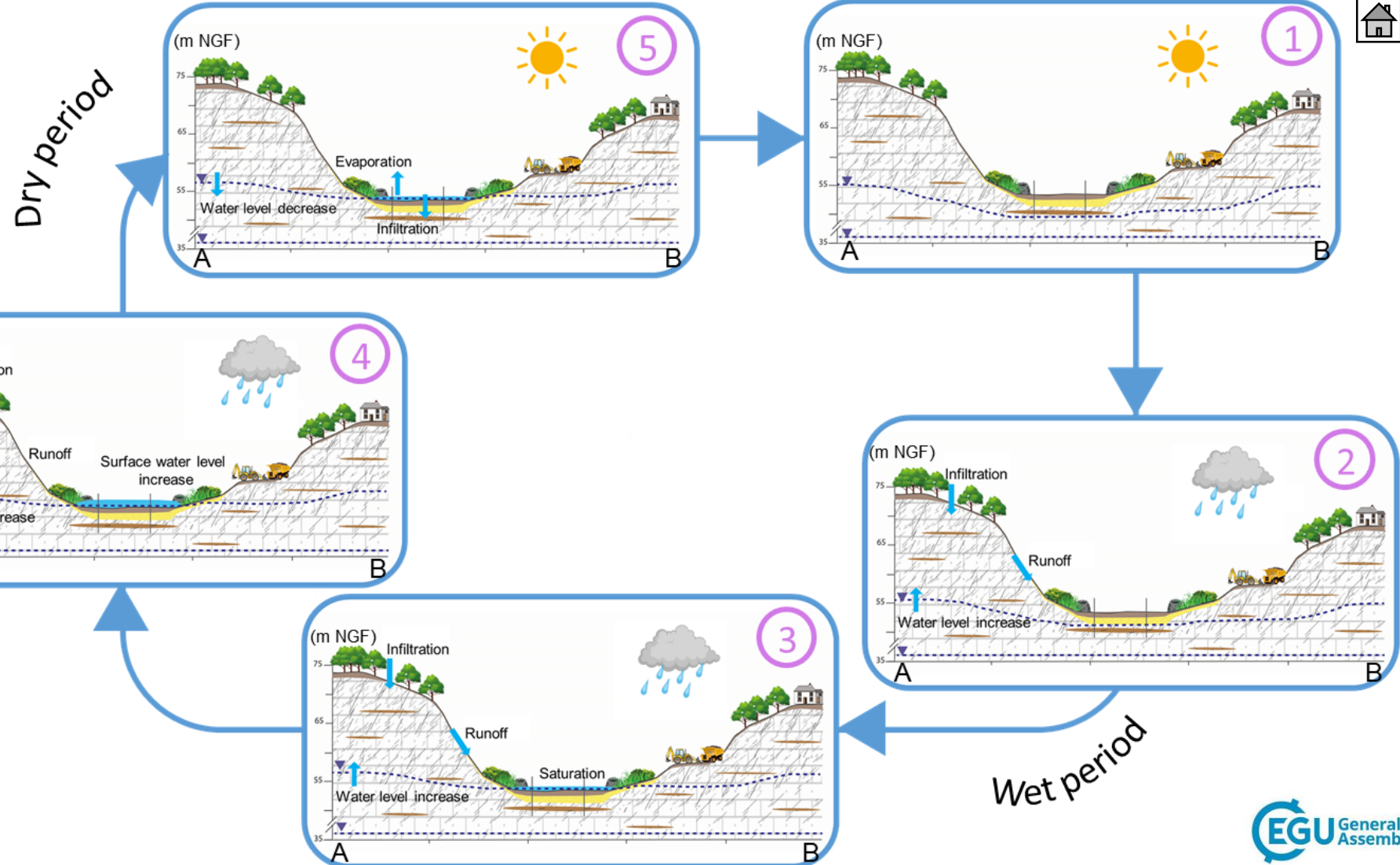
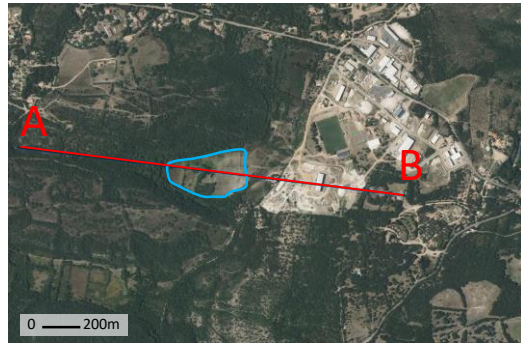


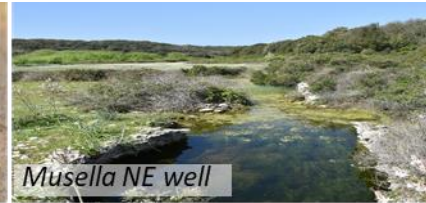
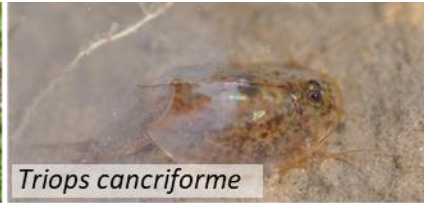
- The water stable isotopic composition of the pond is closer to the mean regional groundwater isotopic composition than that of the mean of the local precipitation



# Hydrogeological contributor of the flooding and drying processes of the pond

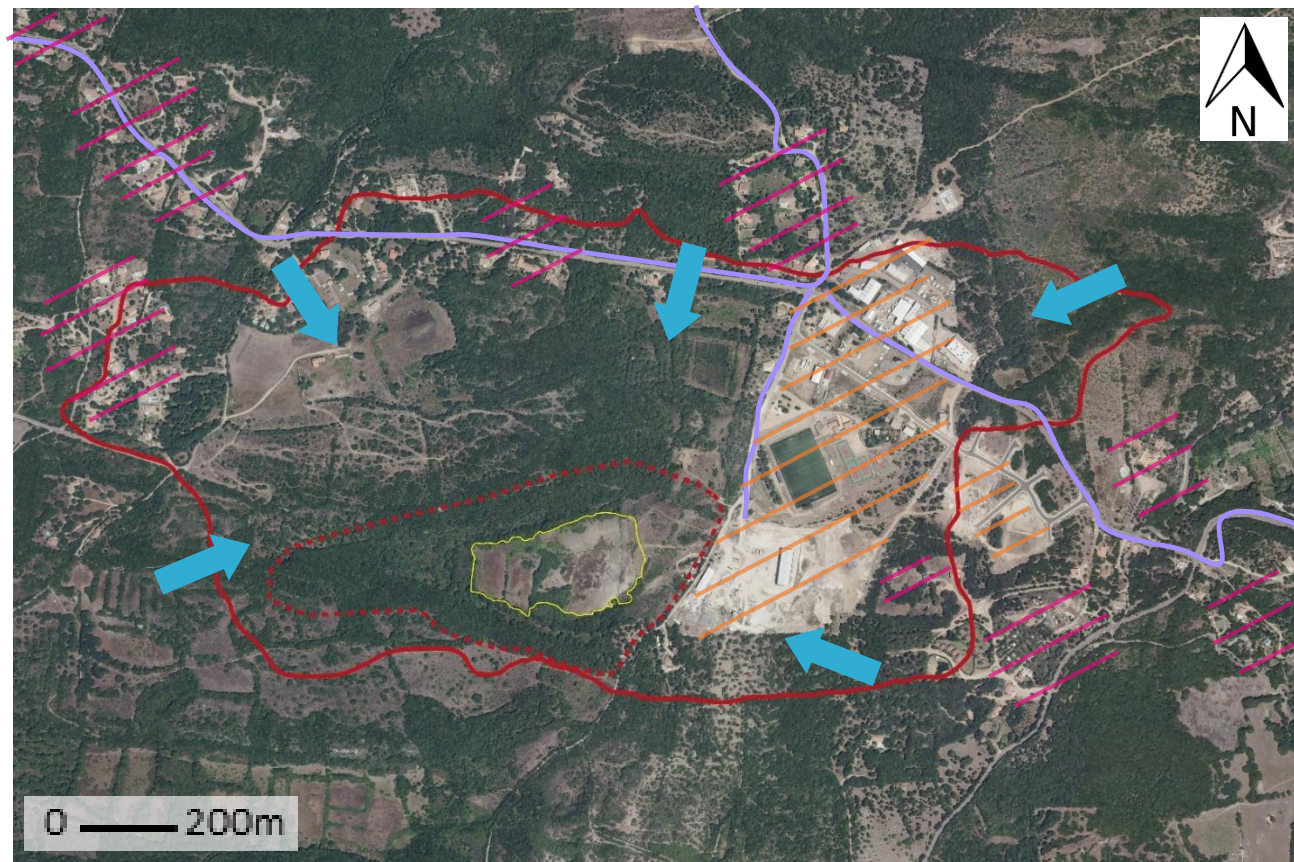
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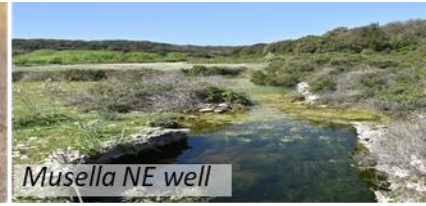
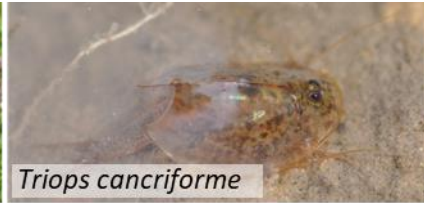
# Conclusions

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- The tools of the **isotope hydrology** have allowed to highlight the **flooding process** of a Mediterranean temporary pond
- The tools of the isotope hydrology have demonstrated the **groundwater dependent ecosystem** behavior of the Musella Temporary pond
- This study highlight the need to include both **hydrological and hydrogeological watersheds** within the **delimitation of the protection area** of the Mediterranean temporary ponds

- - - Natura 2000 delimitation  
 - - - Hydrological watershed  
 ➡ Water flow direction  
 — Road network  
 Industrial area  
 Urban area



# Affiliations

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