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HS8.2.1 : The role of groundwater flow systems in solving water management and environmental problems

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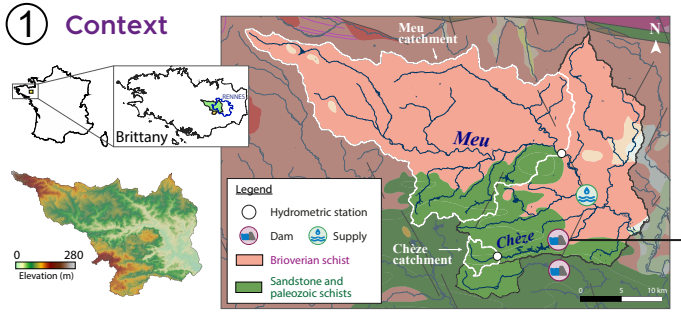
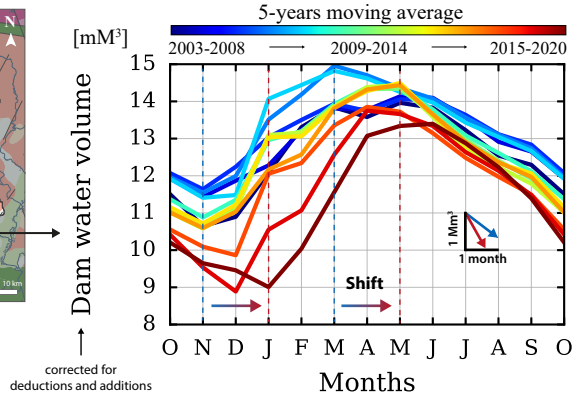
Spatial variability and changes in storage-discharge relationships of crystalline catchments: implications for resilience and water resources management (Rennes, France)

1 Context





- 13 water resources : drinking water supply of the Rennes area
- 26 Mm³/year produced (510 000 inhbts) : 1/3 for this catchment
- 2017, 2018, 2019 : unusual evolution of the Chèze dam levels

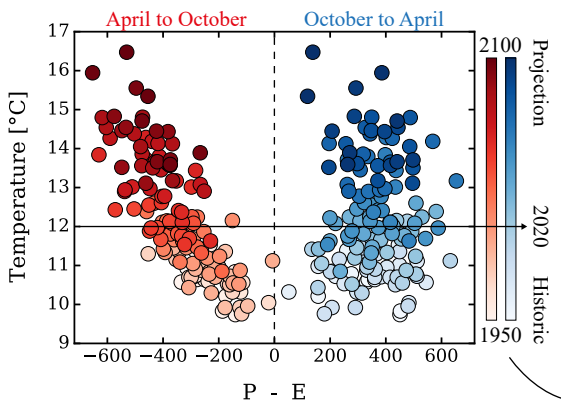
2 Questions

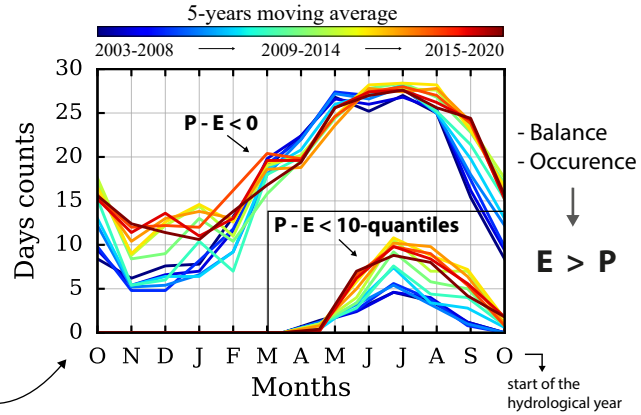
What would be the future of the reservoir for water supply?

- What are the key climatic factors that control spatio-temporal water resources availability?
- How do geology and topography impact the storage capacity and hydrological flux dynamic on the landscape?
- How will catchment resilience evolve with global change?

3 Climate analysis

Evolution of the Precipitation (**P**) - Evapotranspiration (**E**) balance (historic and projection*)





- Balance
- Occurence

E > P

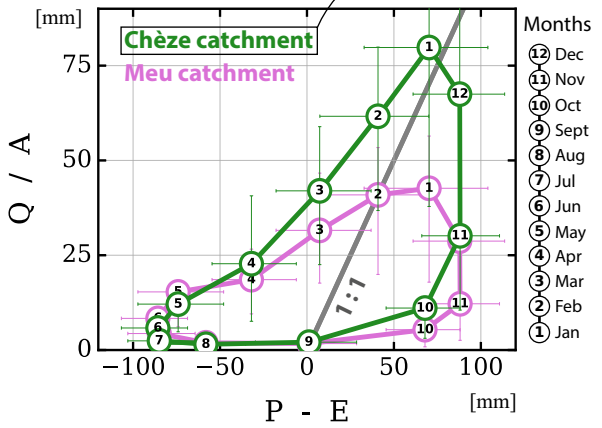
4 Hydrological analysis

Relationships of Storage-Discharge (**Q**) normalised by catchment Area (**A**)

Spatial evolution

Hydrometric station observed data
Intermonthly average (**1990 - 2020**)

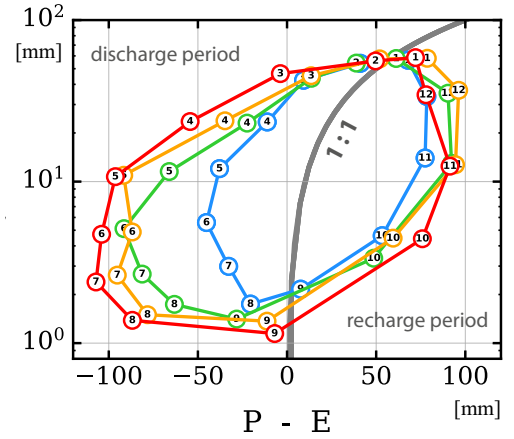
MODFLOW 3D



Temporal evolution

Groundwater flow model
Seepage zones + NSE_{log} = 0.9

Discharge simulated data (calibrated period : **1990 - 2020**)
Intermonthly average (**2020 - 2040**, **2040 - 2060**, **2060 - 2080***)



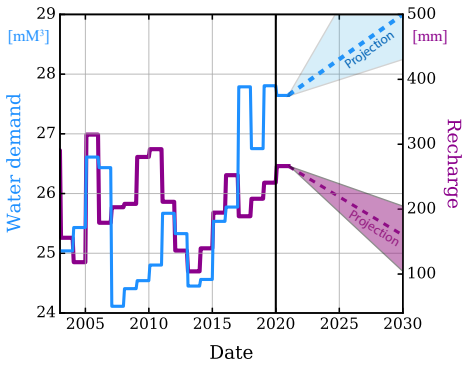
- Shape of hysteresis loop : capacity of the landscape to store water
- Topographic and lithological factors : resilience at catchment scale
- Projection : tendency to decrease the baseflow
- Dynamic : towards more extreme conditions

** Climatic and input model data of this work : SURFEX Météo-France (hydrological partitionning) - Climatic model : IPSL - Forecast : RCP8.5*

5 Conclusion and perspectives

- Climate change is already strongly affecting the **effective precipitation** (recharge) of the Rennes area (Brittany, France)
- Modeling forced by climatic forecasts show significant modification in term of **storage-discharge dynamic**
  - shift in time for recharge and extreme conditions
  - lower baseflow and with longer period
- Hydroclimatic trends coupled with increasing water demand weakens current **water management strategies**

→ How can we design sustainable system accounting this new redistribution of water resources availability **in space and time**?



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