



# Accounting for Climate Change in Water and Agriculture management

PHD THESIS IN AGRONOMIC SCIENCES

# Yield forecast predictions based on Remote Sensing

**Manel Khlif**

Supervisor : **Zohra Lili Chabaane** (UCAR, Lr GREEN-TEAM)

Supervisor : **Maria Jose Escorihuela** ( isardSAT, Barcelona)

Supervisor : **Aicha Chahbi Bellkanji**(UCAR, Lr GREEN-TEAM)

# PLAN

**01** Introduction

**02** Study Area

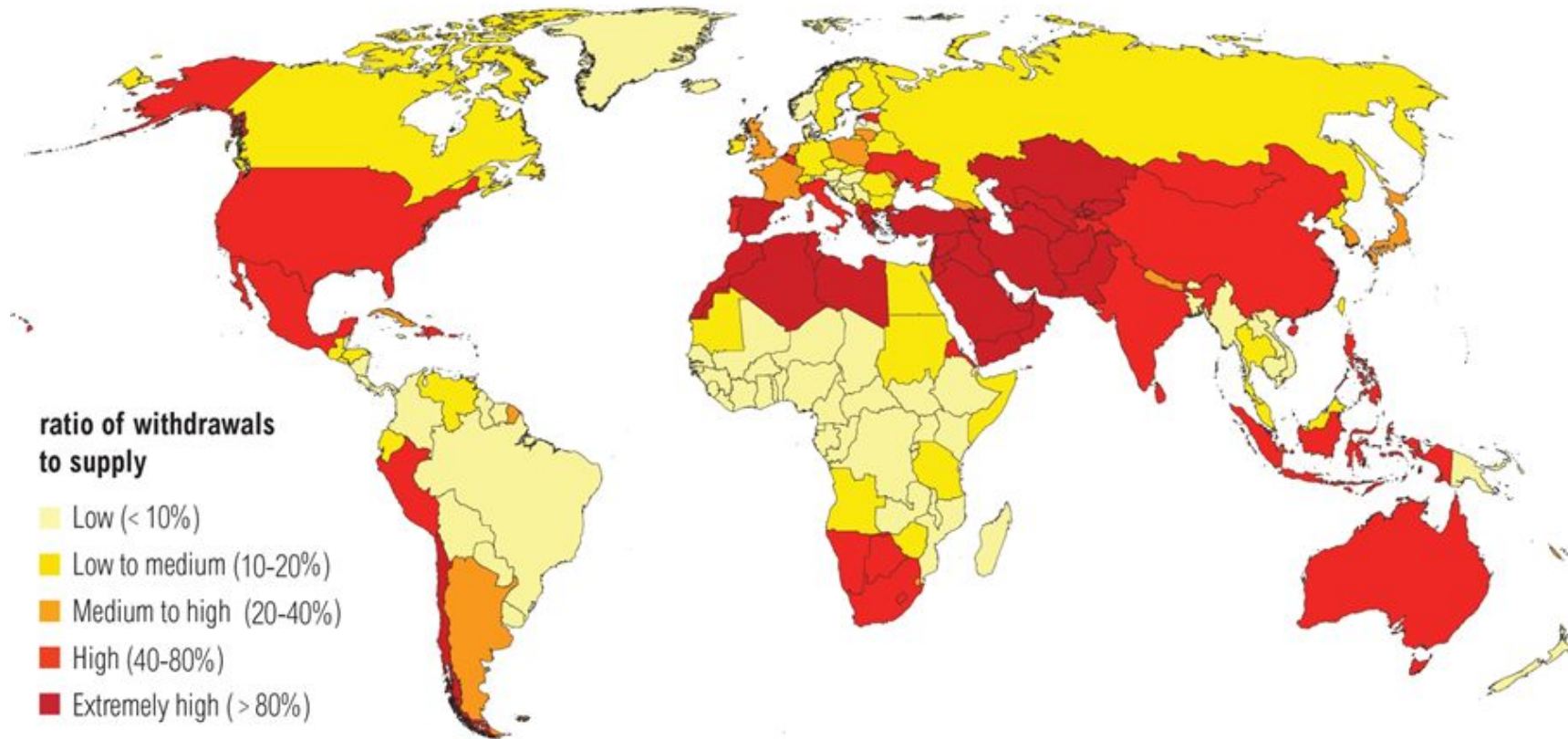
**03** Methodology

**04** Results

**05** Conclusion

---

## Water Stress by Country: 2040



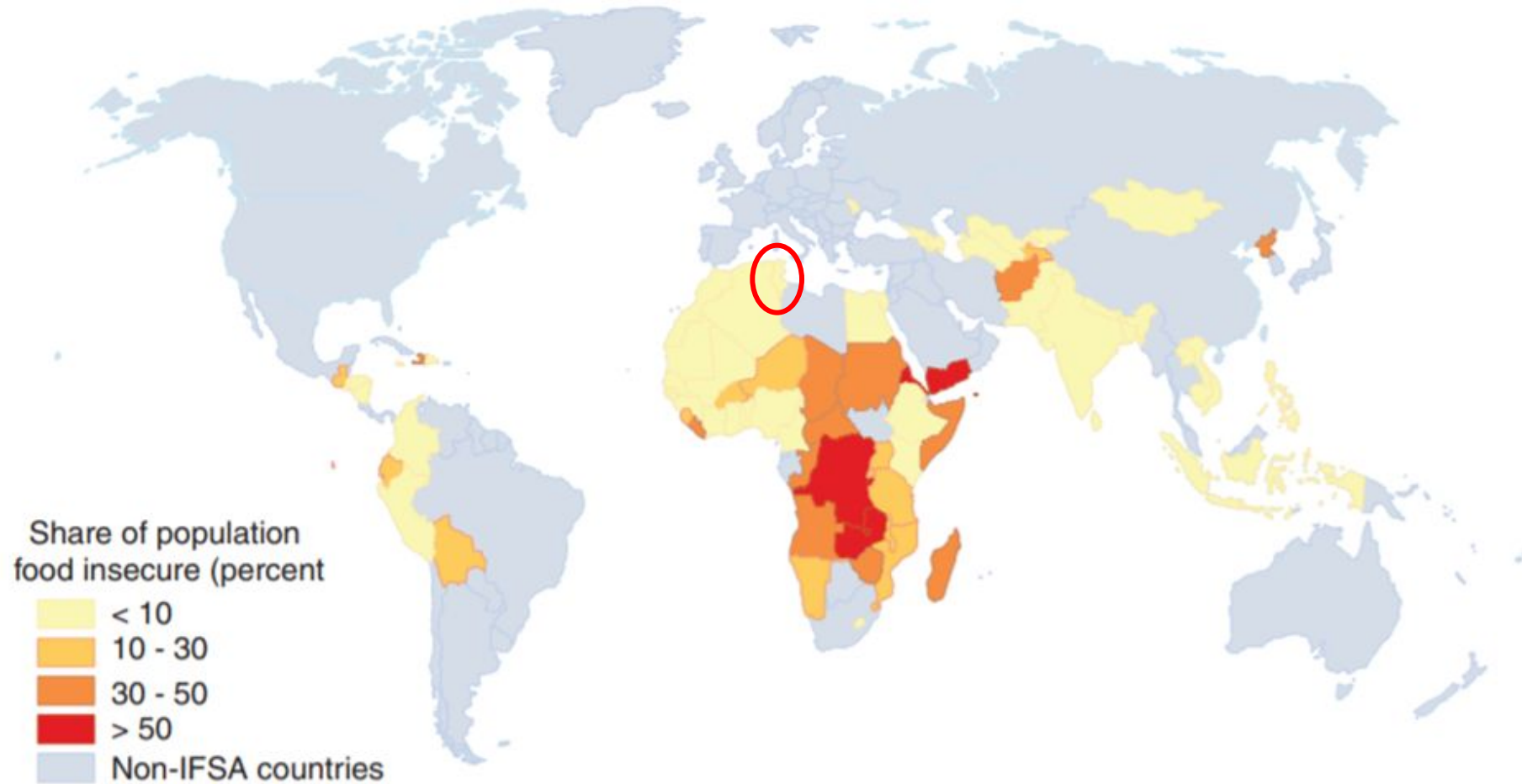
**NOTE:** Projections are based on a business-as-usual scenario using SSP2 and RCP8.5.

For more: [ow.ly/RiWop](https://ow.ly/RiWop)

# Problematic

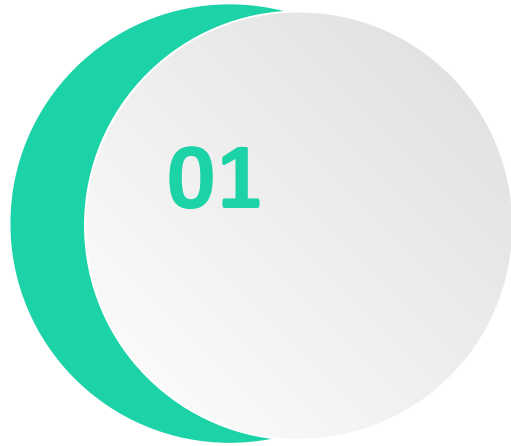


Share of population that is projected to be food insecure, 2029



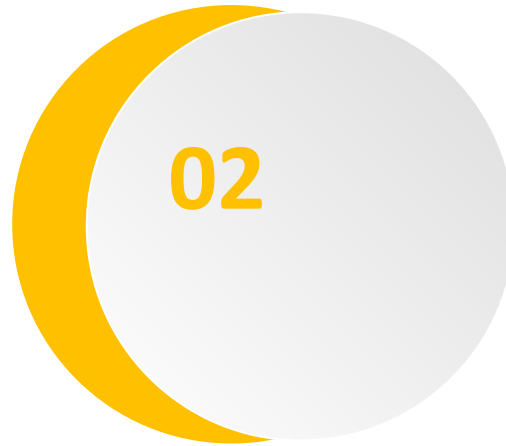
IFSA = International Food Security Assessment.

Source: USDA, Economic Research Service, based on results from the International Food Security Assessment model.



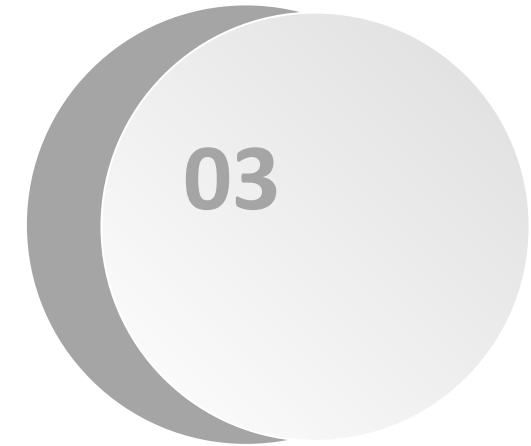
### Axe 1

Improved  
drought  
forecasting  
capabilities



### Axe 2

- Evaluate the impacts of drought periods on cereal yields
- Quantify yields according to drought indices

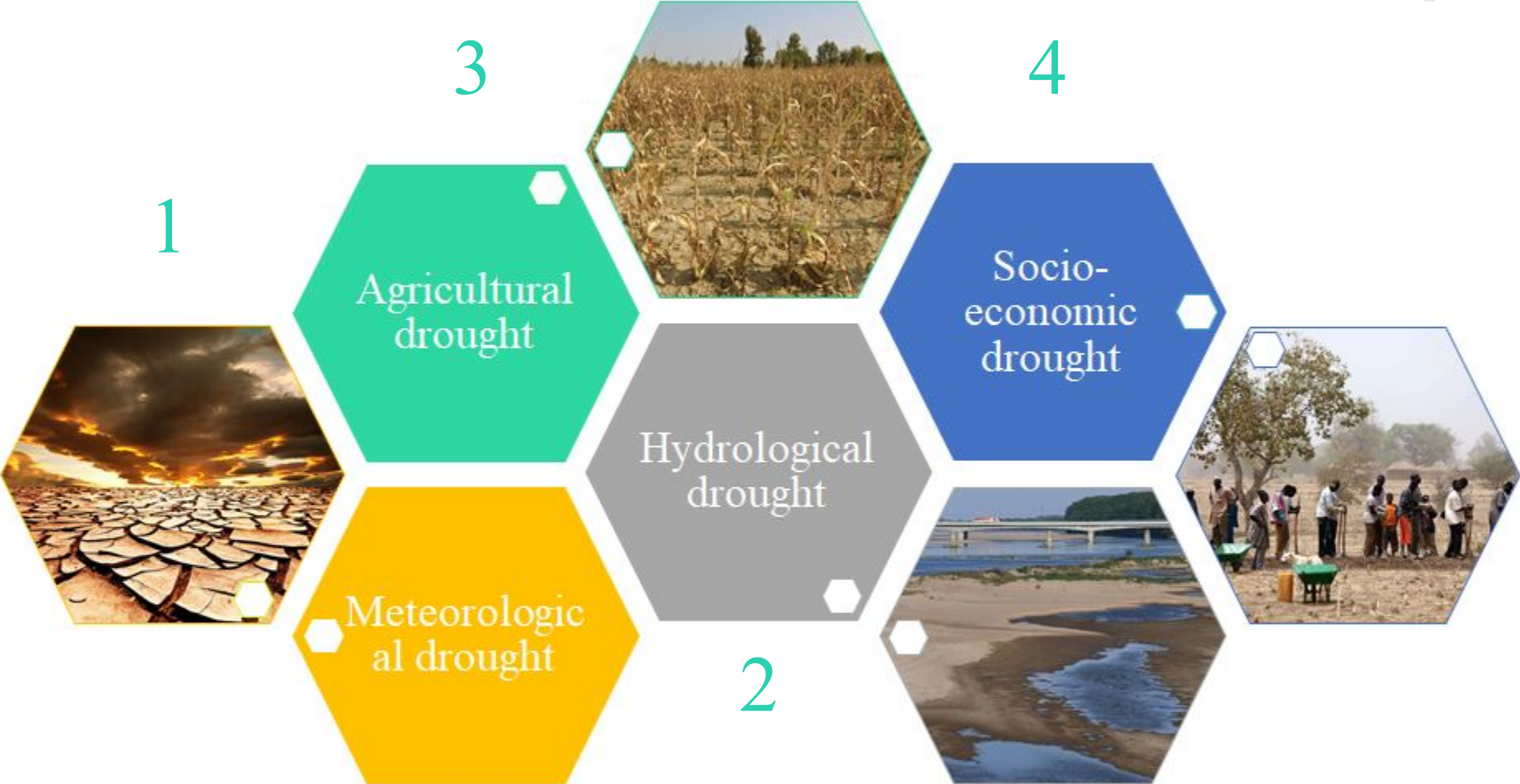


### Axe 3

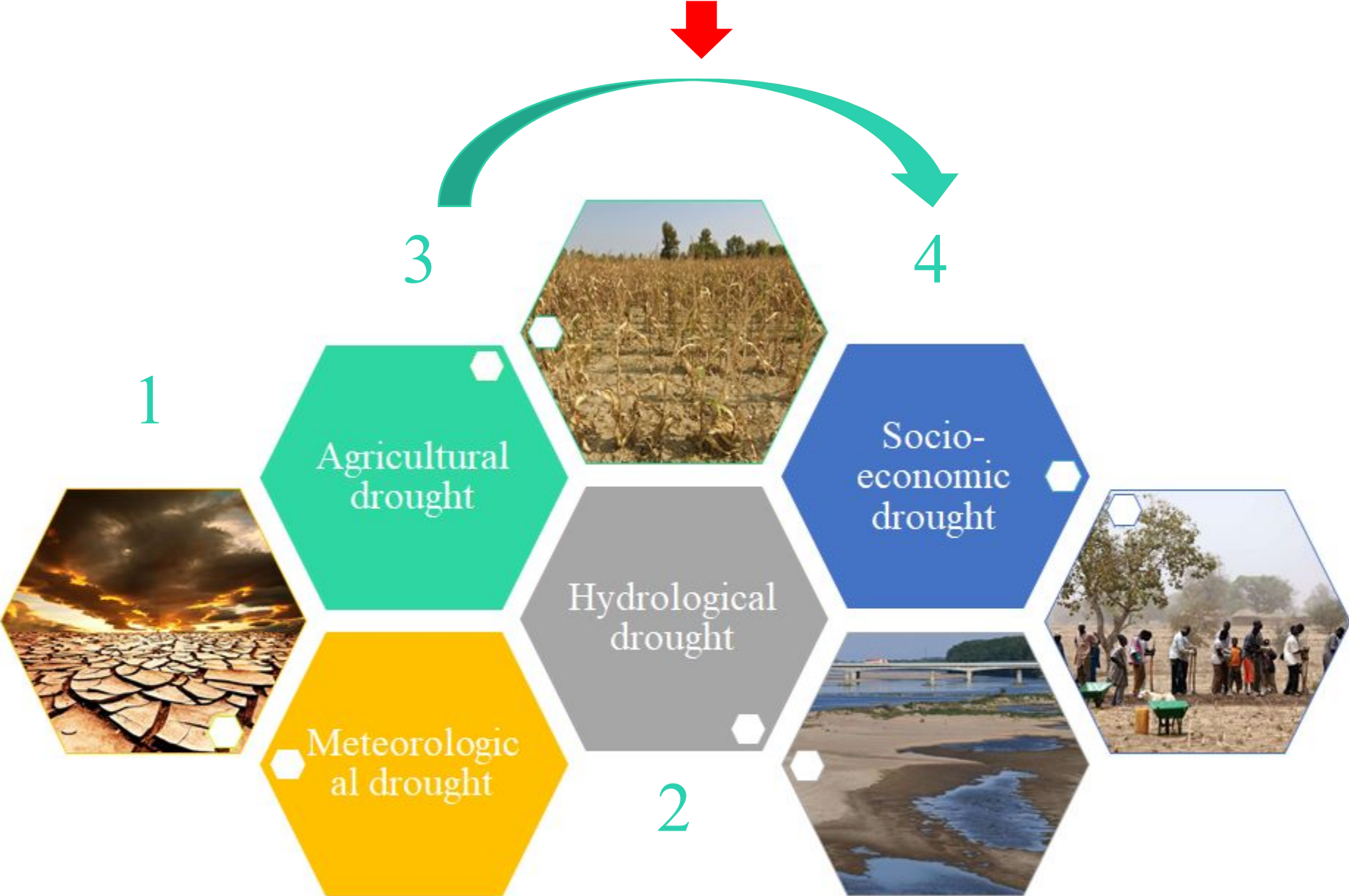
Early estimation  
and  
spatialization of  
cereal yields



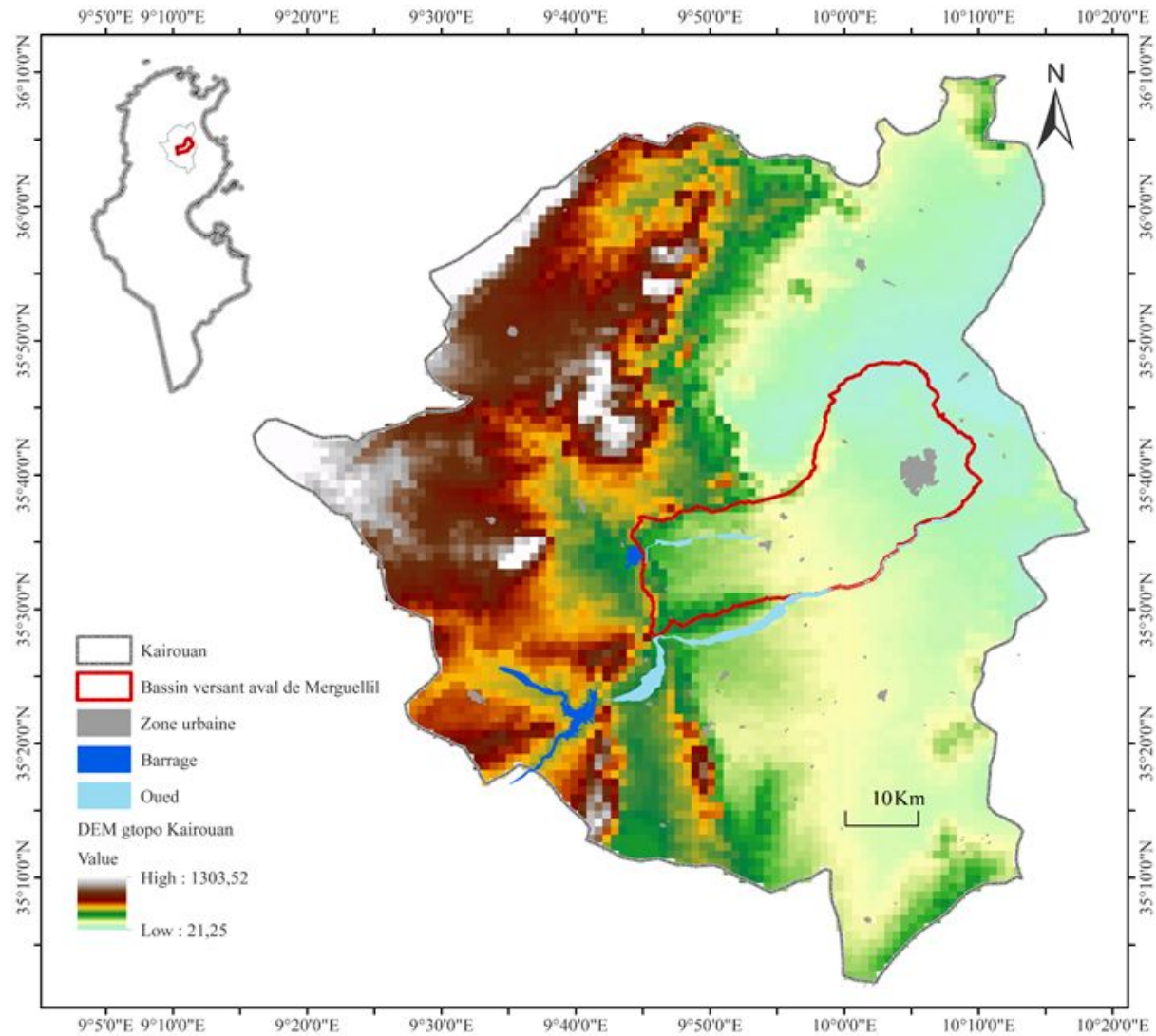
# Drought ?



# Early intervention is needed before entering into a food insecure situation







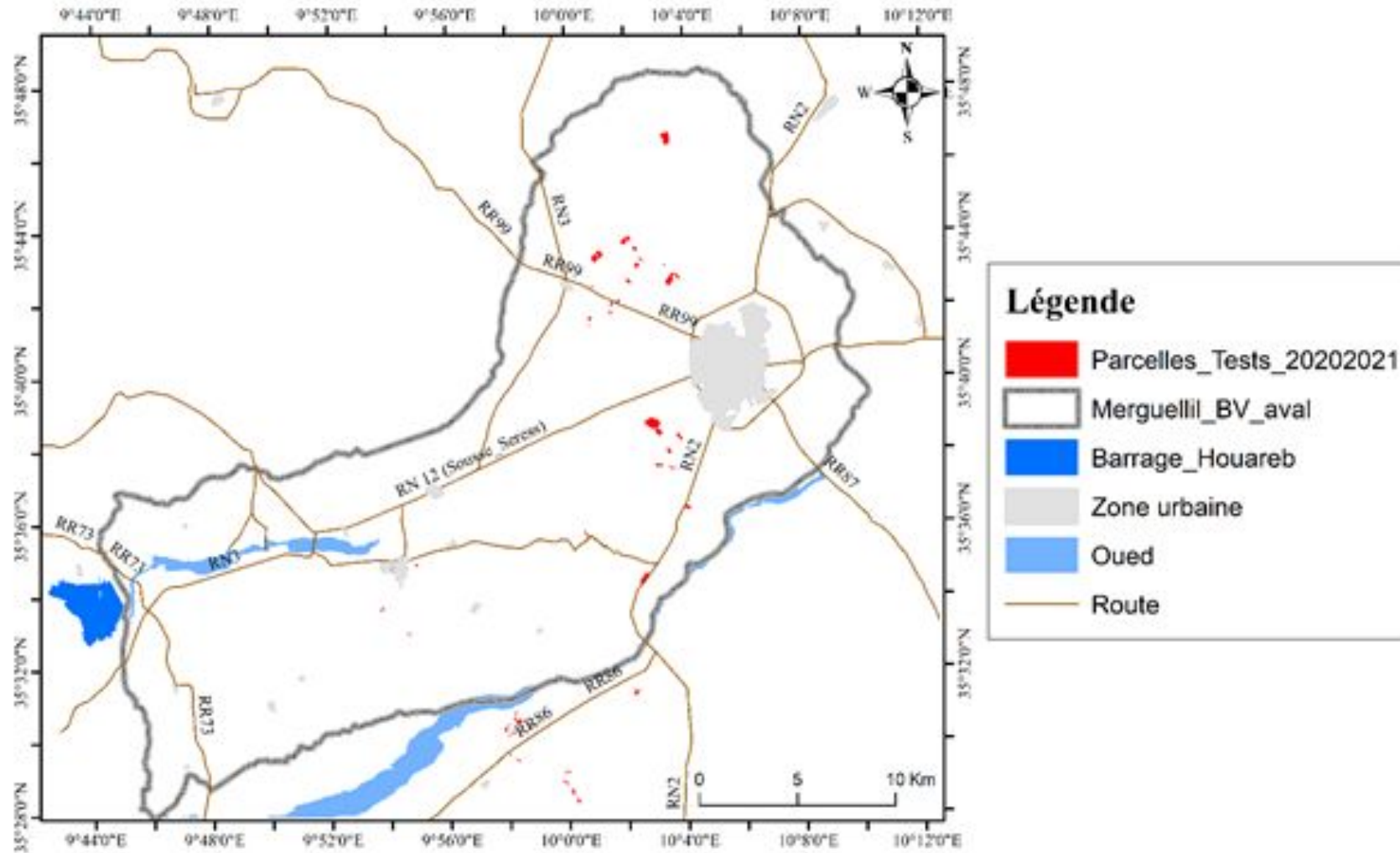
Dam El Houareb, 31/05/2012



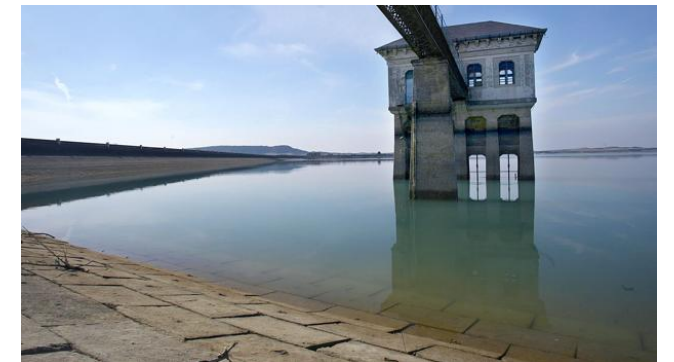
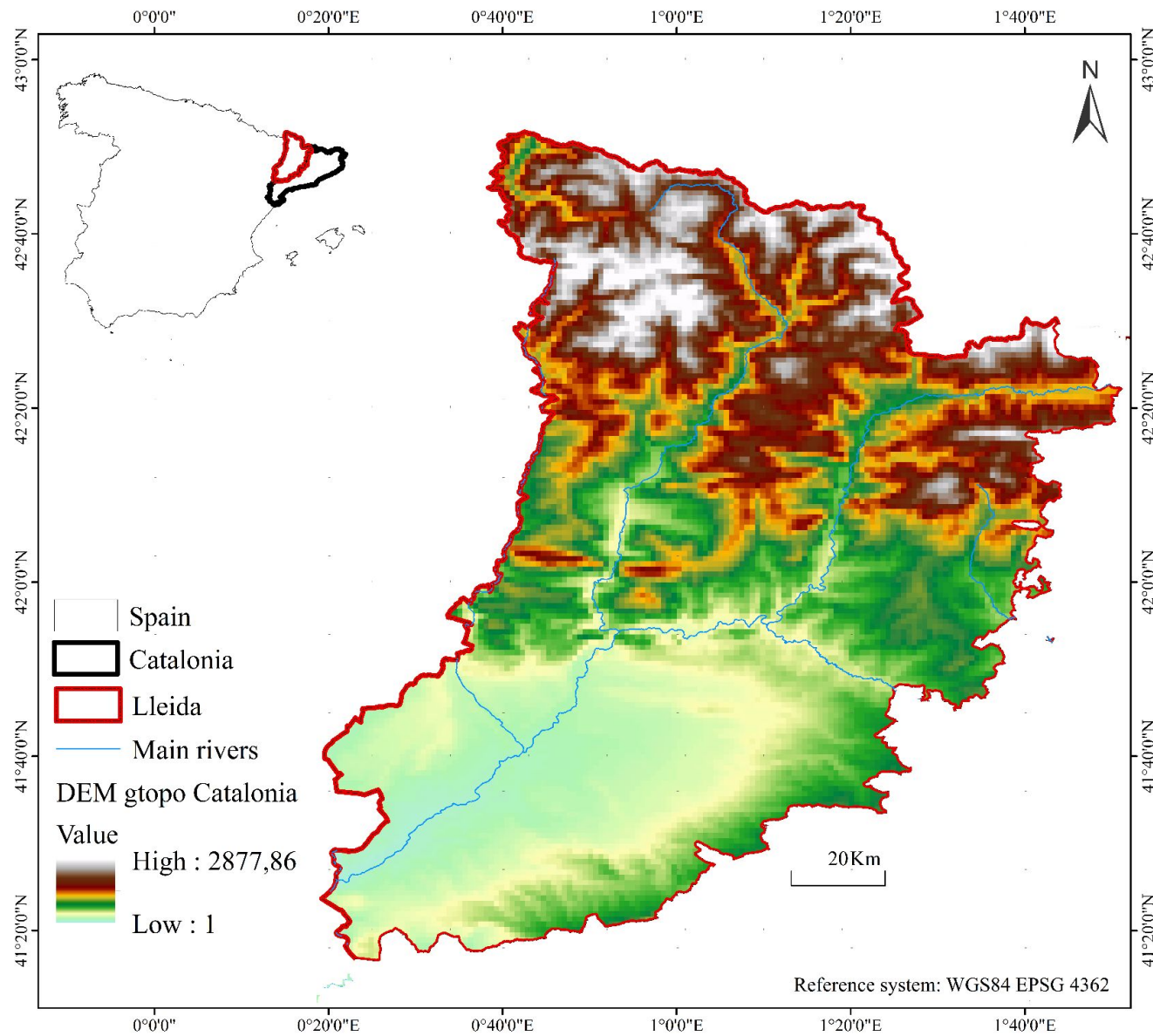
Dam El Houareb, 13/07/2017



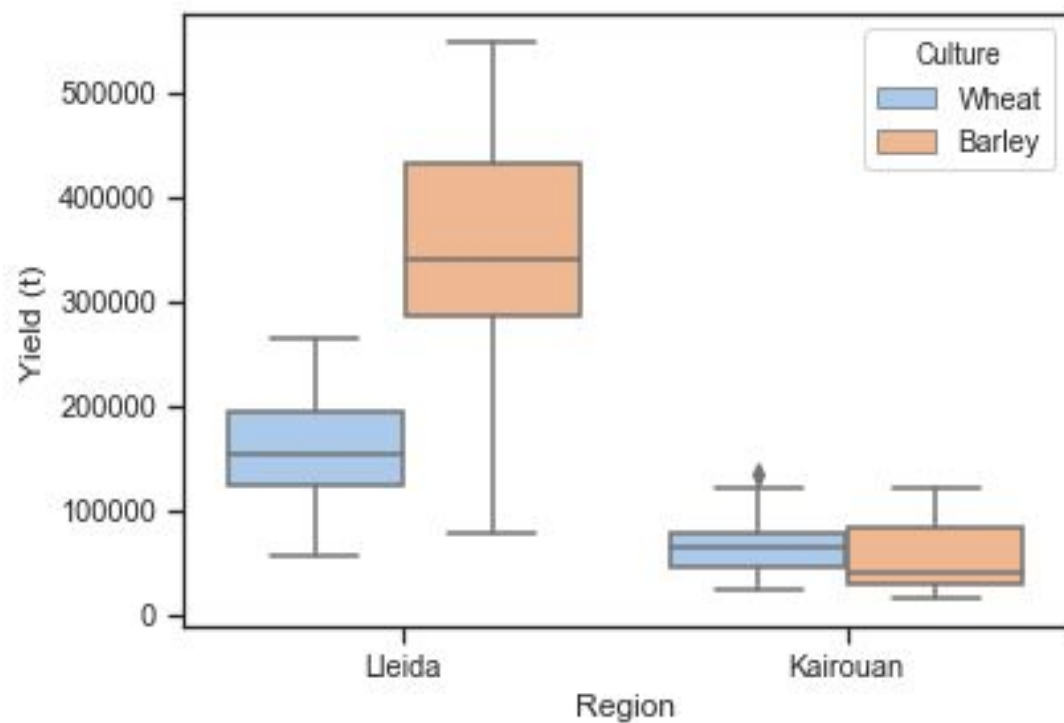
## Parcelles tests



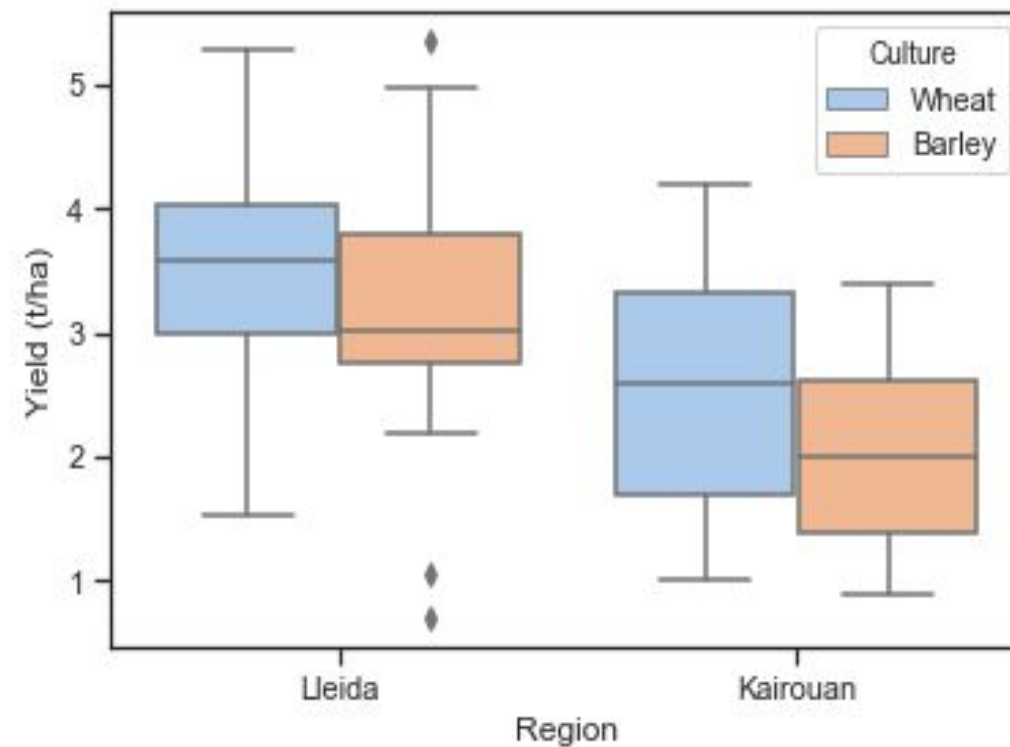
# Study Area



Dam Ebre, 2017

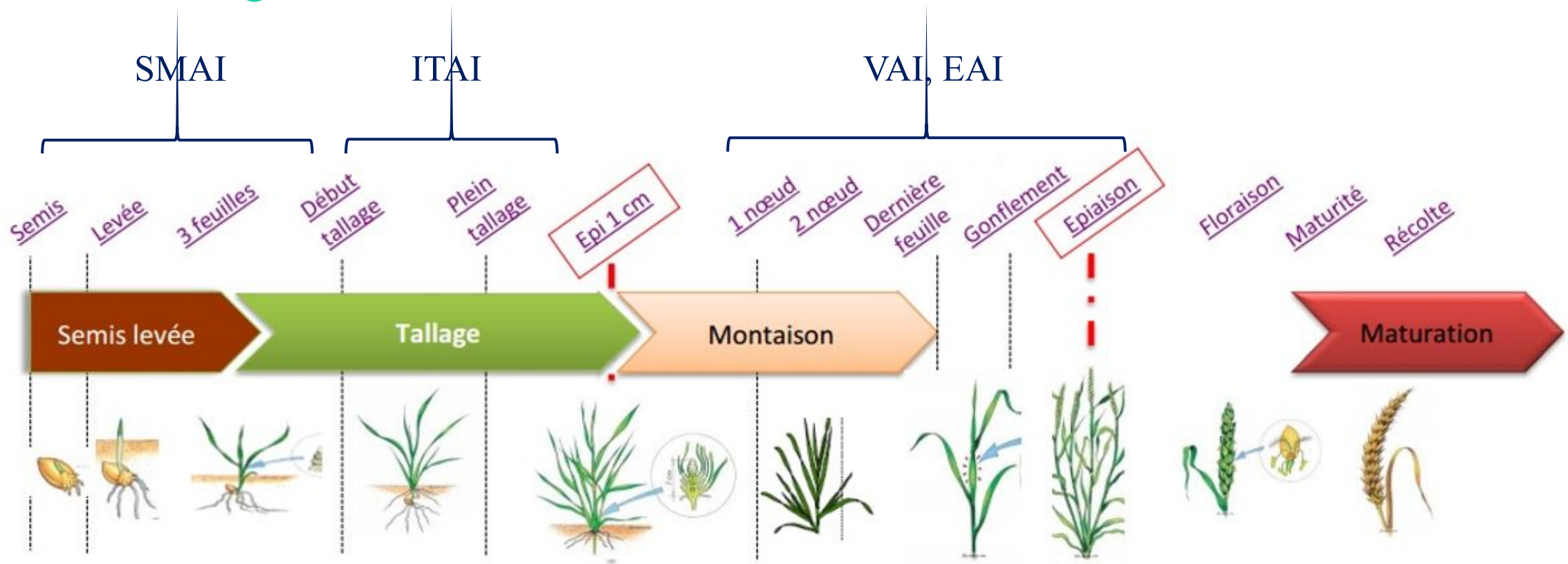


Cereal yield (in tons)



Cereal yield (in tons/ha)

## Choice of drought indices

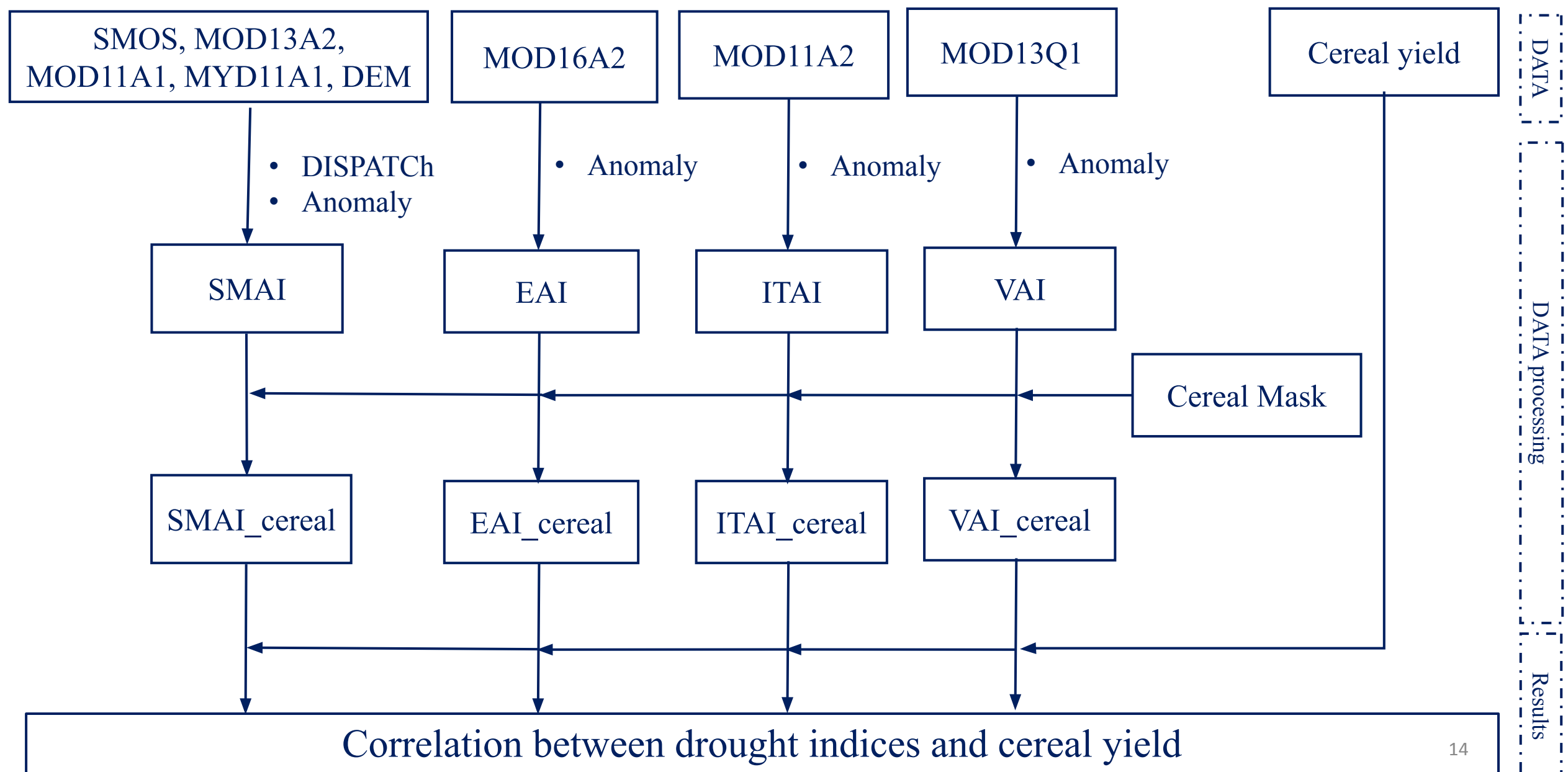


Emergence,  
beginning of  
development

Thermal stress

Vegetative activity

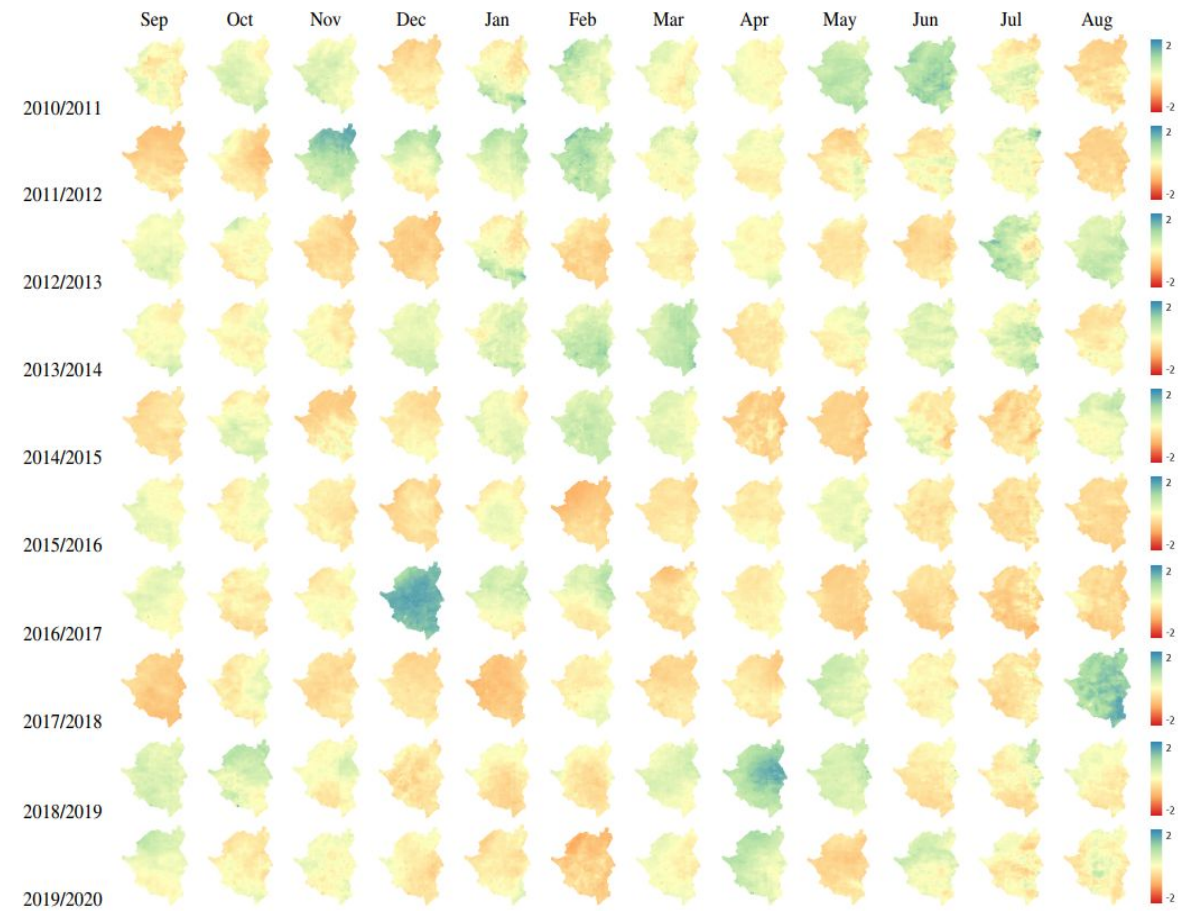
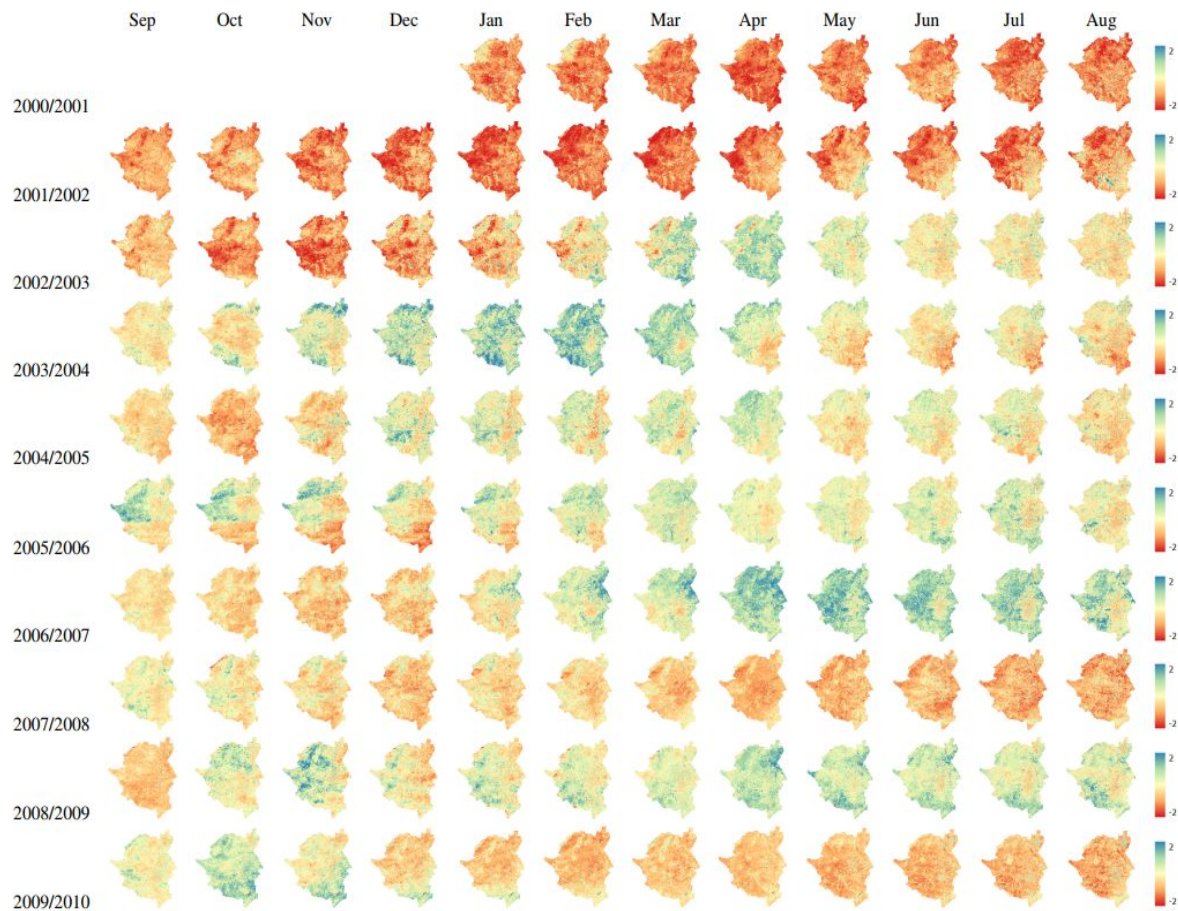
# Methodology





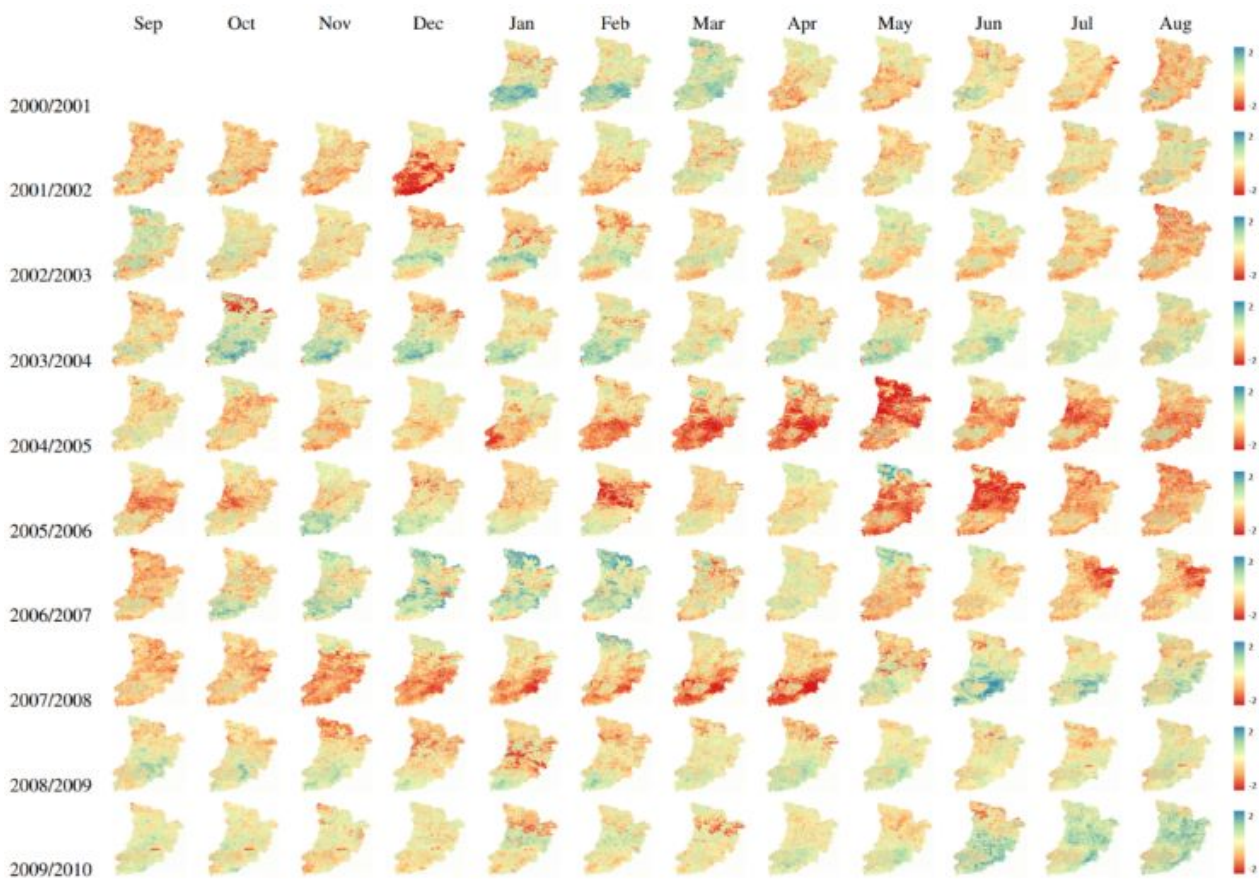
## VAI

## SMAI

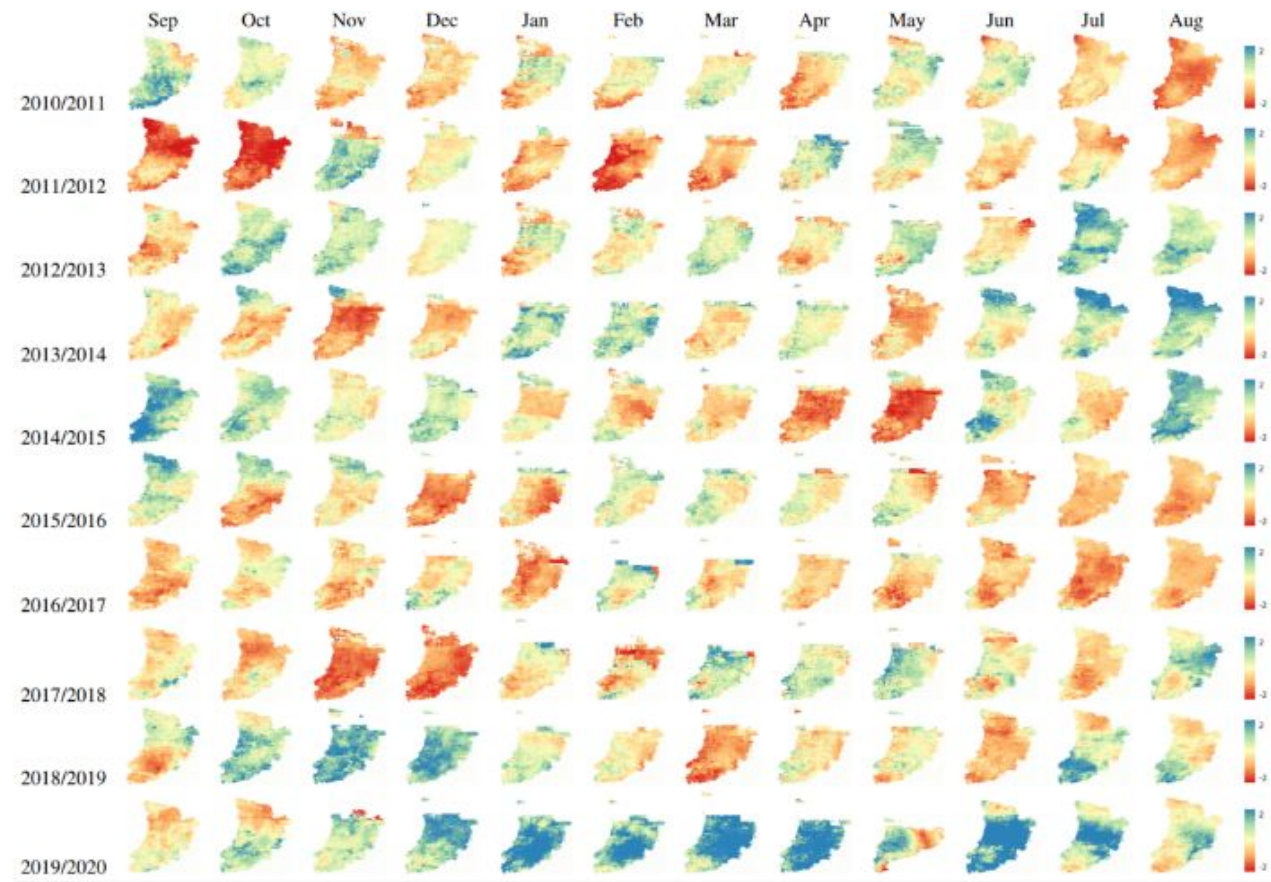




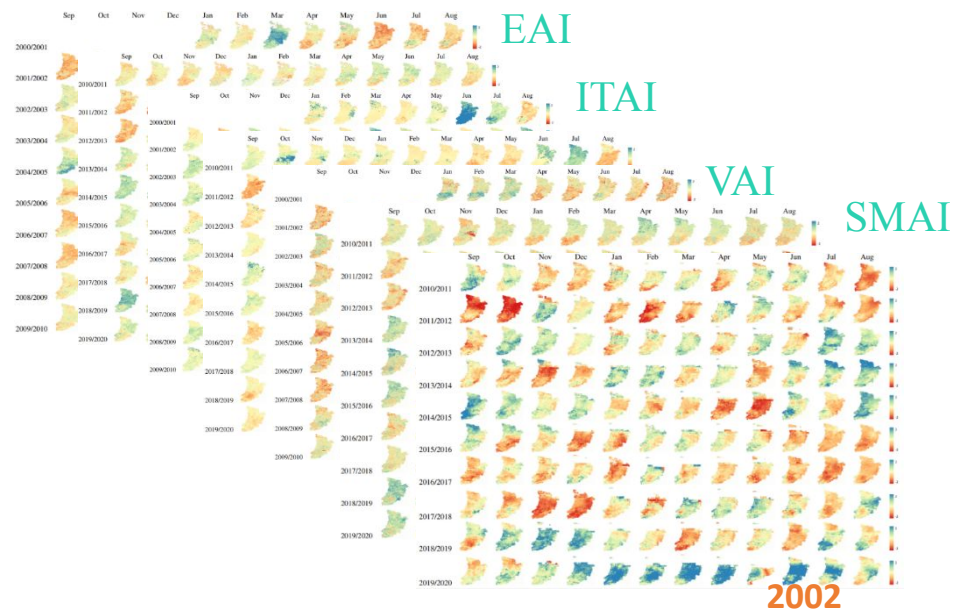
## VAI



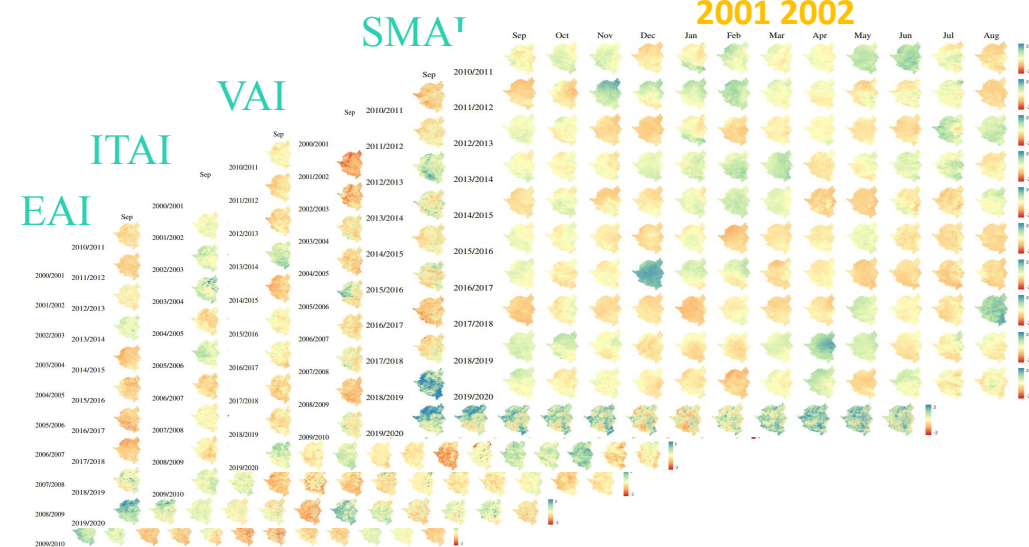
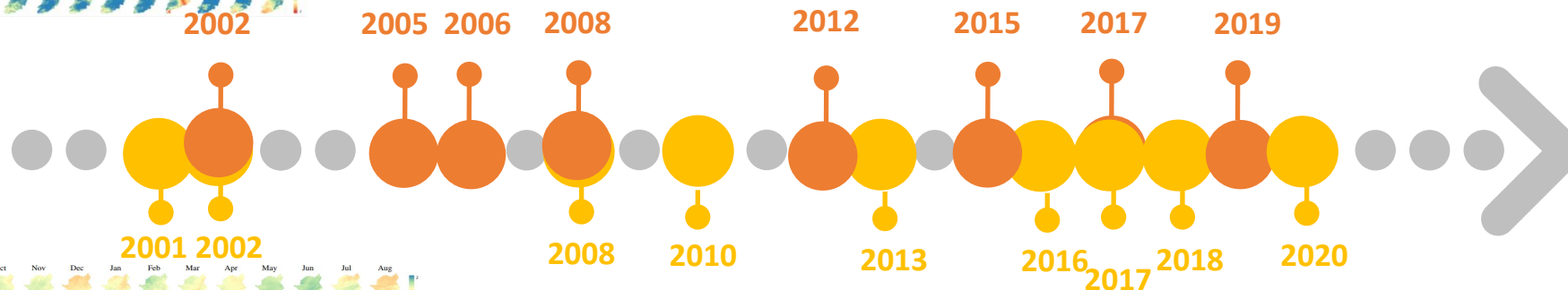
## SMAI





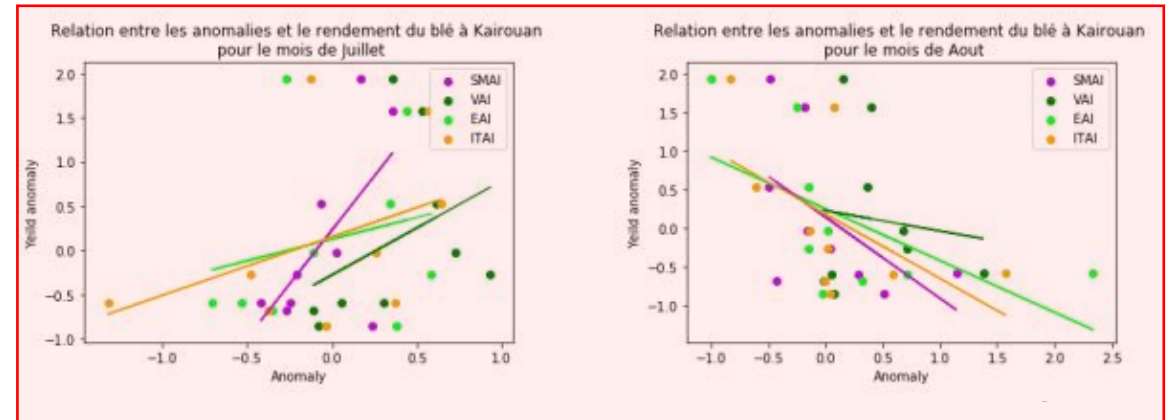
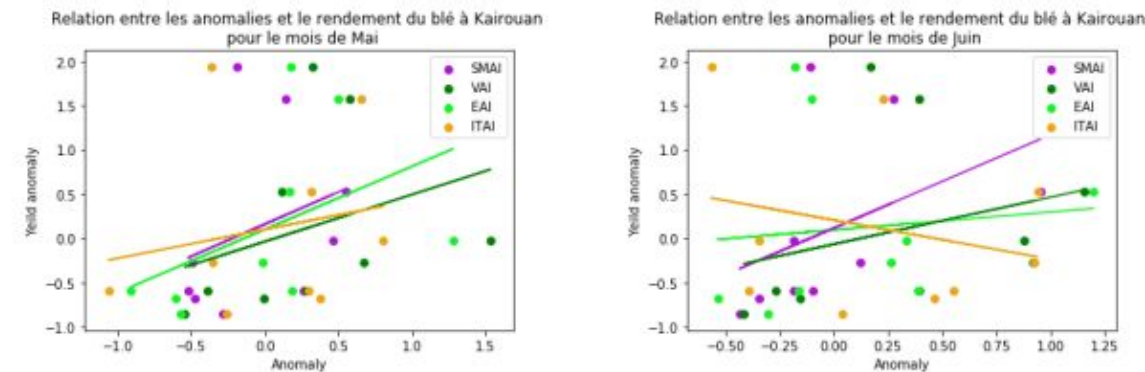
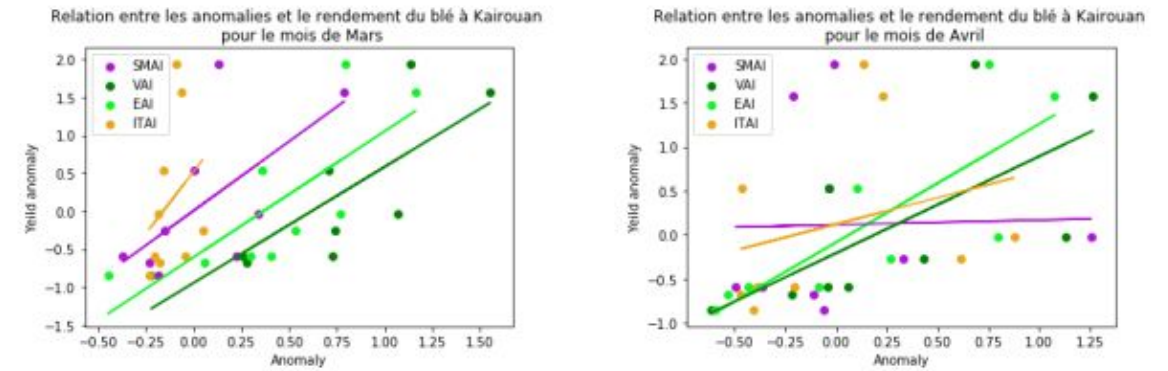
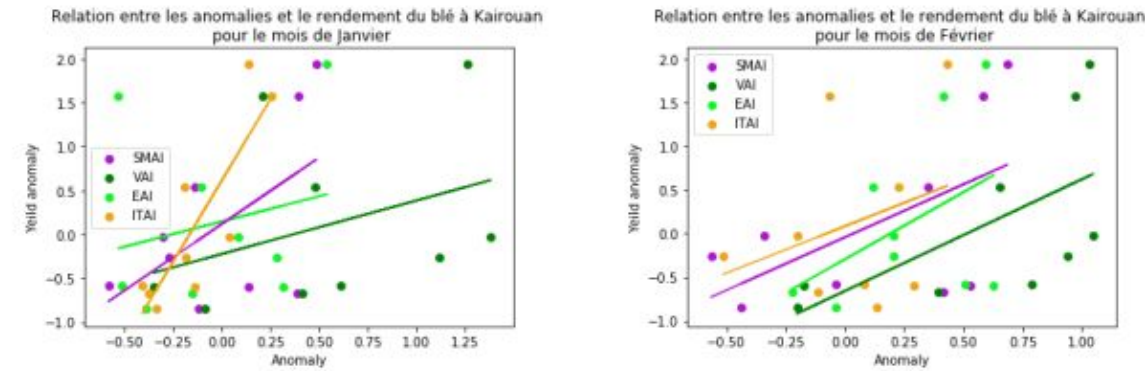
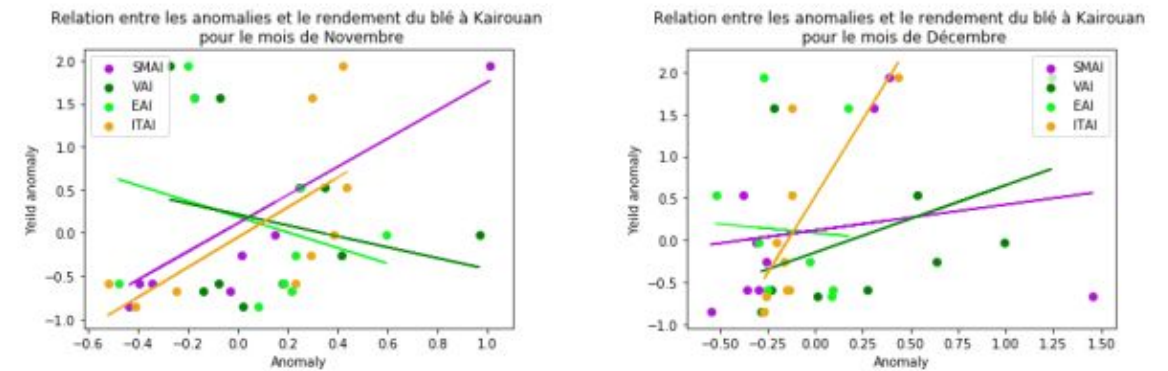
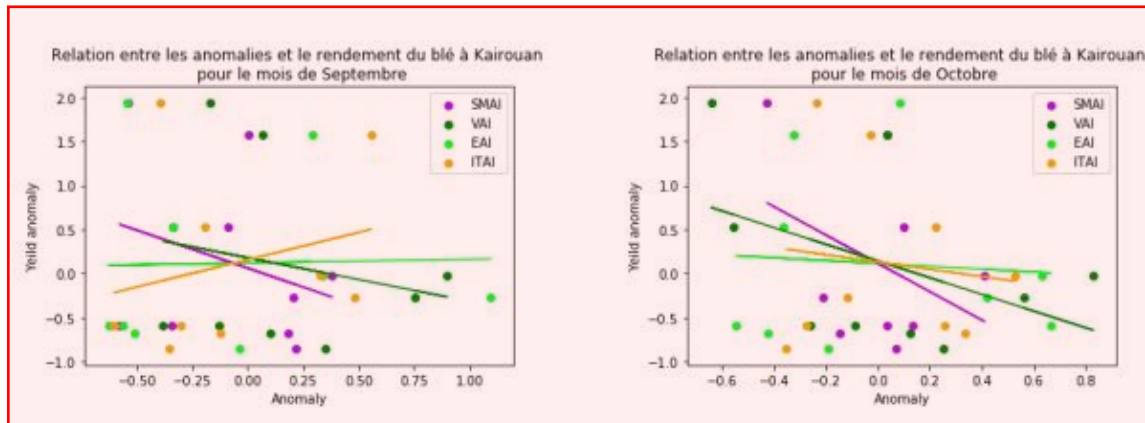


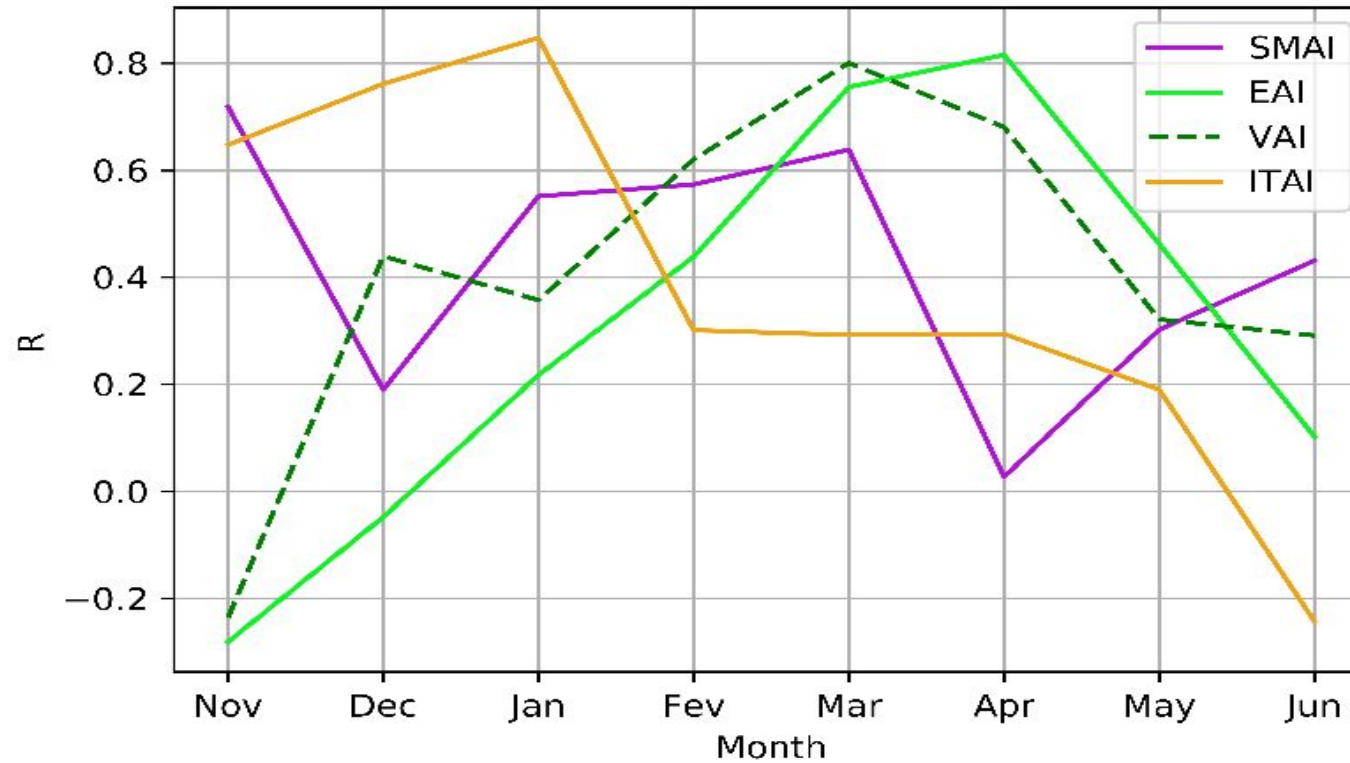
# Drought events in Lleida



# Drought events in Kairouan

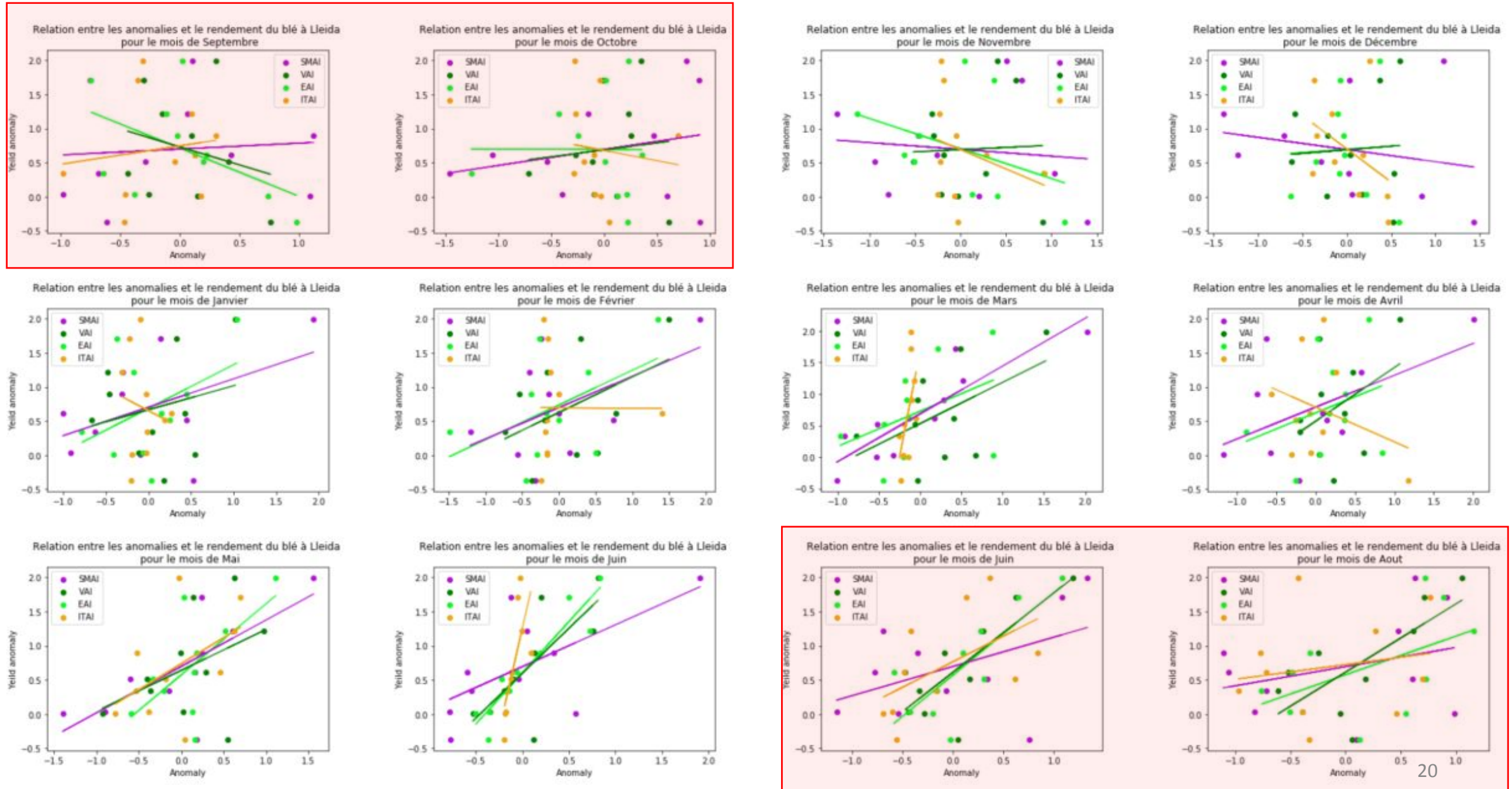




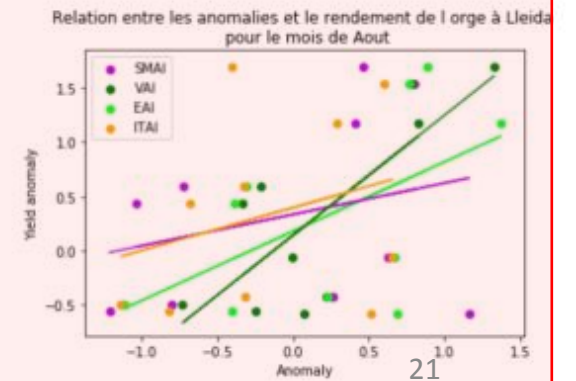
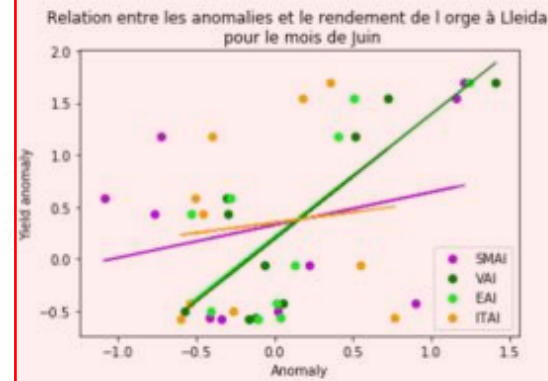
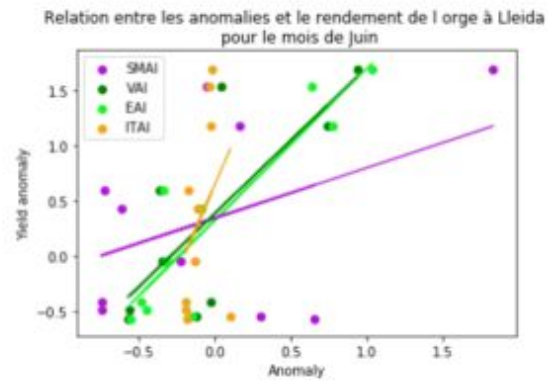
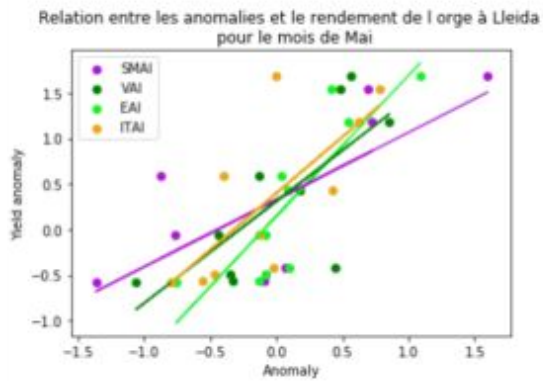
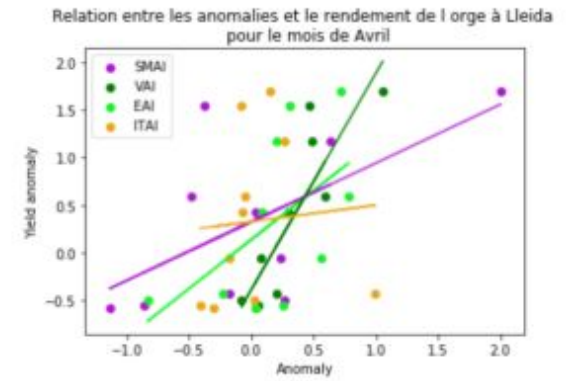
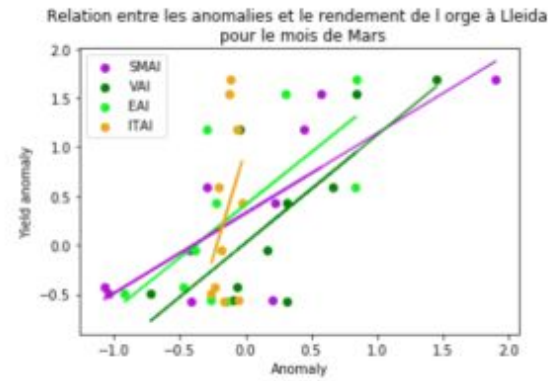
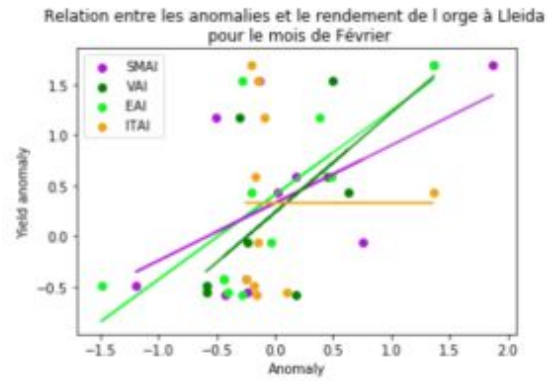
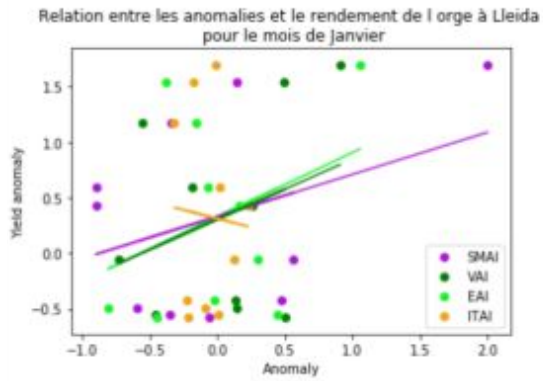
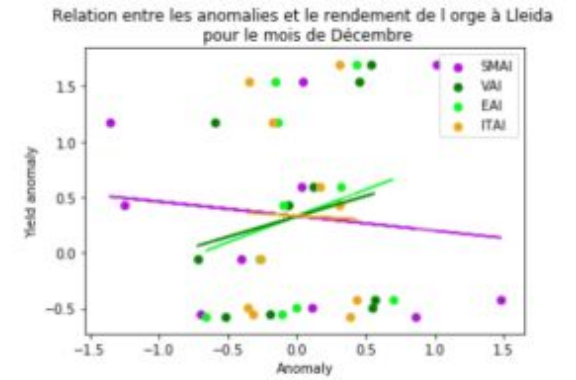
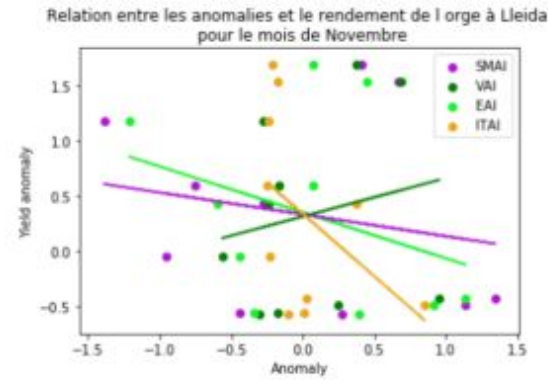
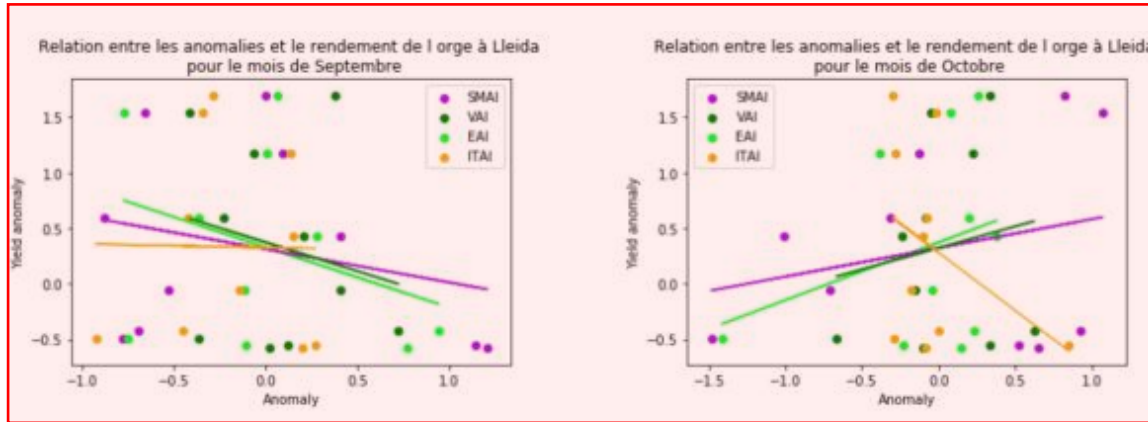


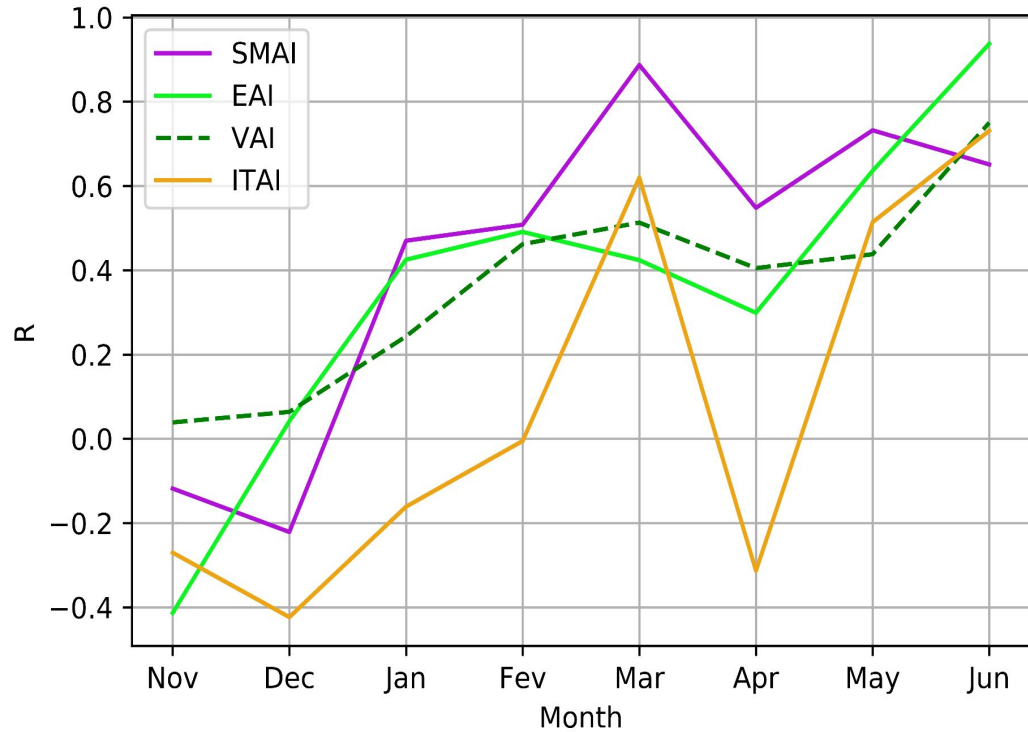
Correlation variation between cereal yields anomalies and drought indices for the governorate of Kairouan

# Results

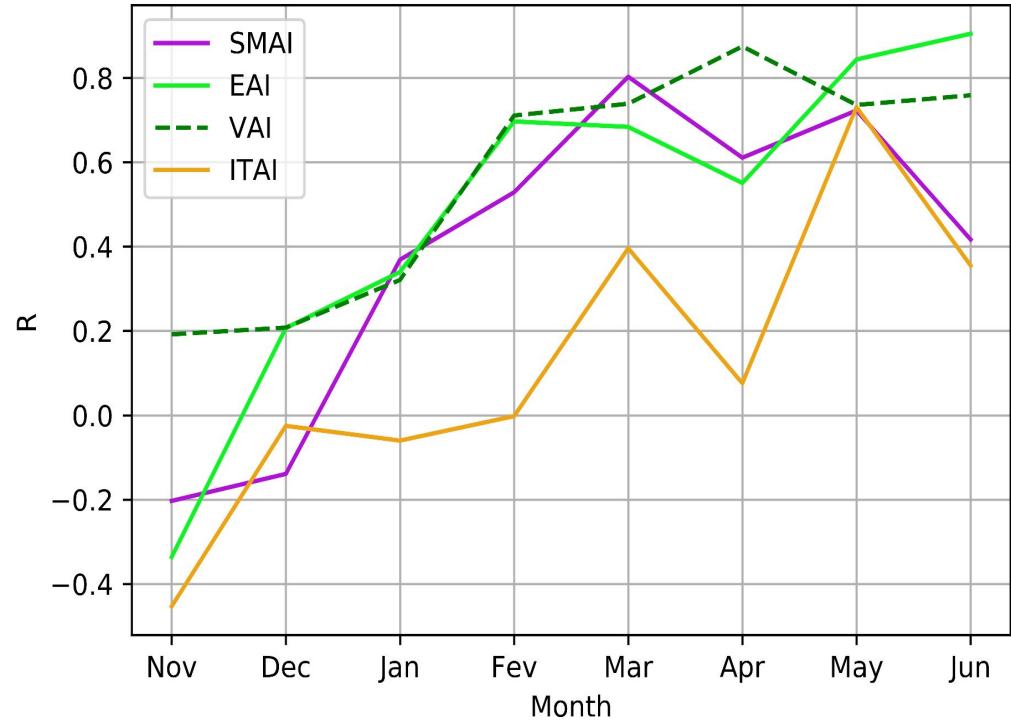


# Results





Correlation variation between wheat yields anomalies and drought indices of Lleida province



Correlation variation between barley yields anomalies and drought indices of Lleida province

Climate Change  
Management and  
monitoring tools

Application of ML  
Comparison with the  
prediction of other model

Meduim spatial  
resolution

Valorization of results

- Article
- EGU2022



Food  
Security  
Water  
Security

Conclusion

A wide-angle photograph of a lush green wheat field stretching to the horizon. The sky is a vibrant blue, filled with numerous fluffy white cumulus clouds. The wheat in the foreground is tall and dense, with some golden heads beginning to emerge. The overall scene is bright and clear, suggesting a sunny day.

Thank you for your  
attention!