



Taking uncertainties into account regarding the impact of droughts in the Mediterranean region

Minotaur group

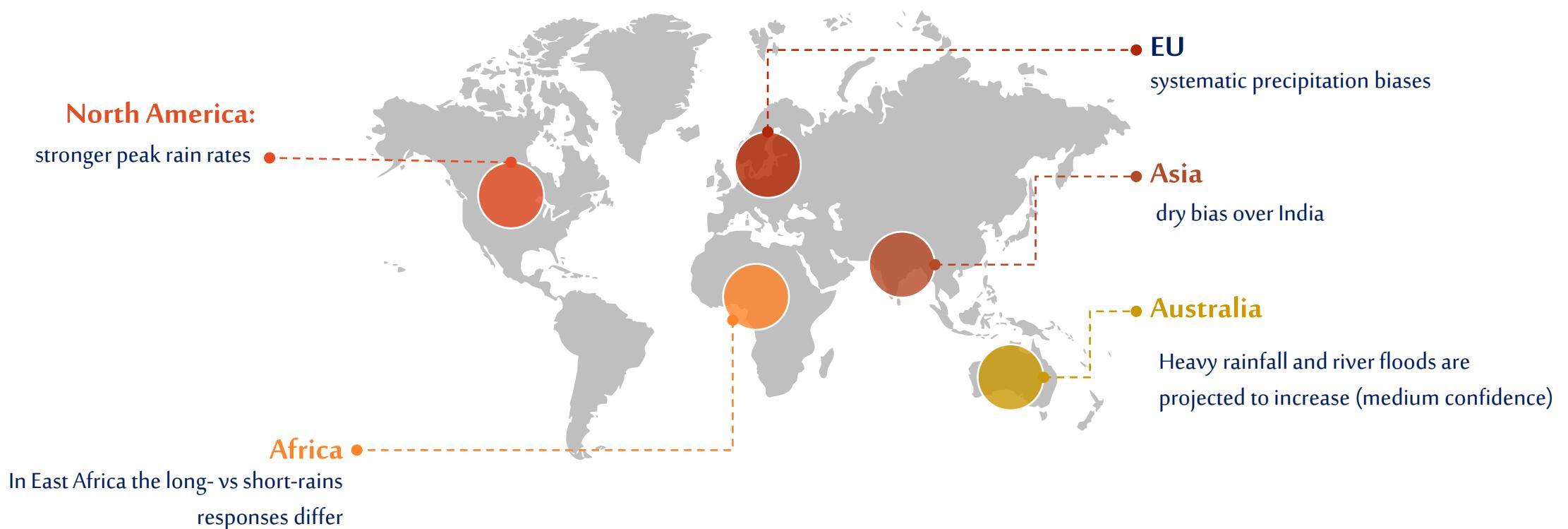
Anastasia Akakpo-Numado, Chrysa Vamvakaki, Safwan Mohammed, Christian Pagé



Introduction

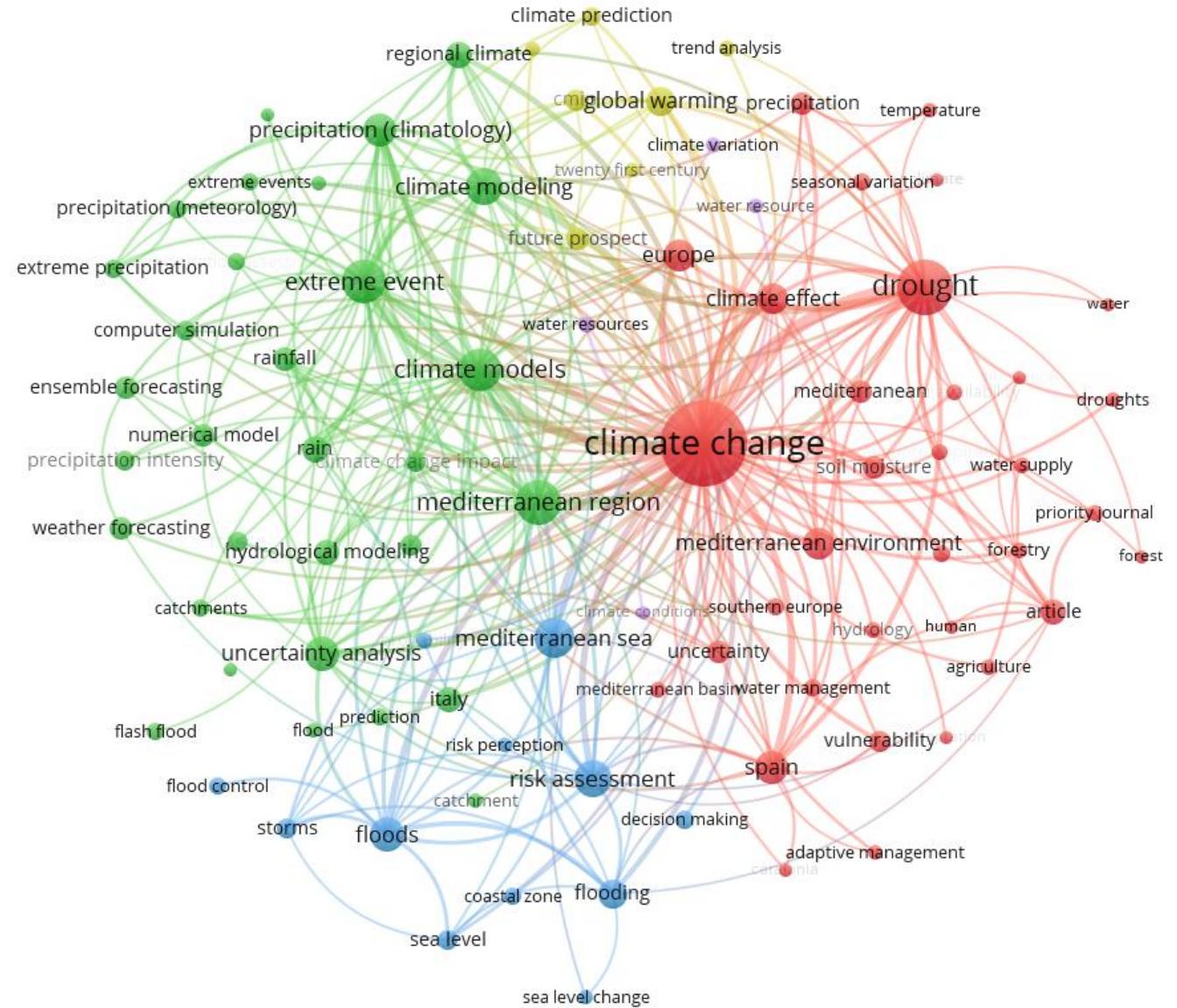
Climate models are computer simulations of the Earth's climate system, including the atmosphere, ocean, land and ice. They can be used to recreate the past climate or predict the future climate.

In climate models, "uncertainty" refers to the range of possible climate futures that models project and the limitations in our scientific understanding of the Earth's climate system



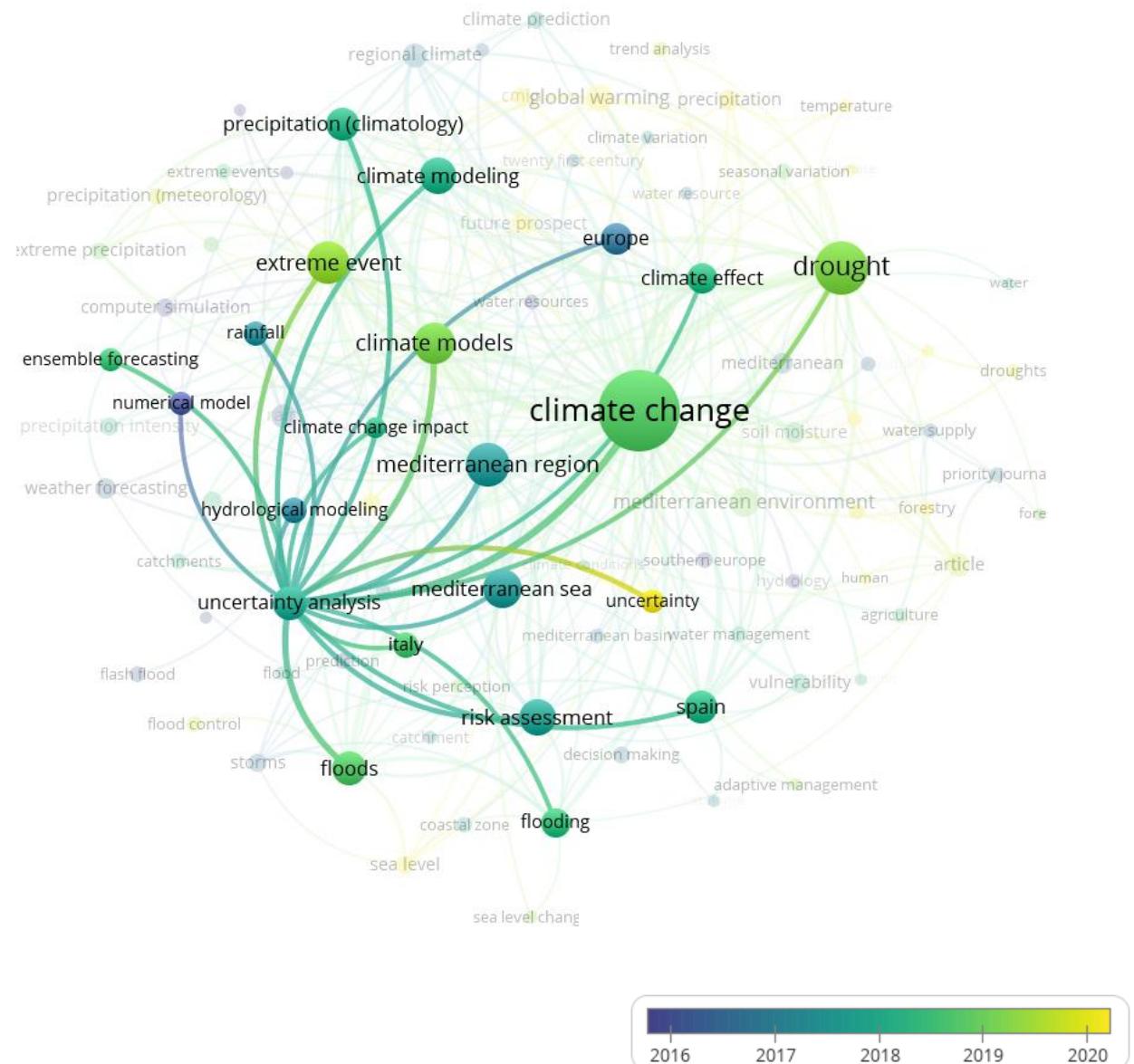
Introduction

- **Scopus database.**
- `((drought OR "extreme event" OR "extreme precipitation" OR flood OR heatwave OR "compound event"))AND ((uncertain*OR probabilistic* OR Bayesian*OR ensemble* OR "confidence interval*" OR projection* OR "model uncertainty"))AND((impact*ORrisk*))AND ((Mediterranean OR "Mediterranean basin" OR "Mediterranean region")`
- 4 clusters were distinguished

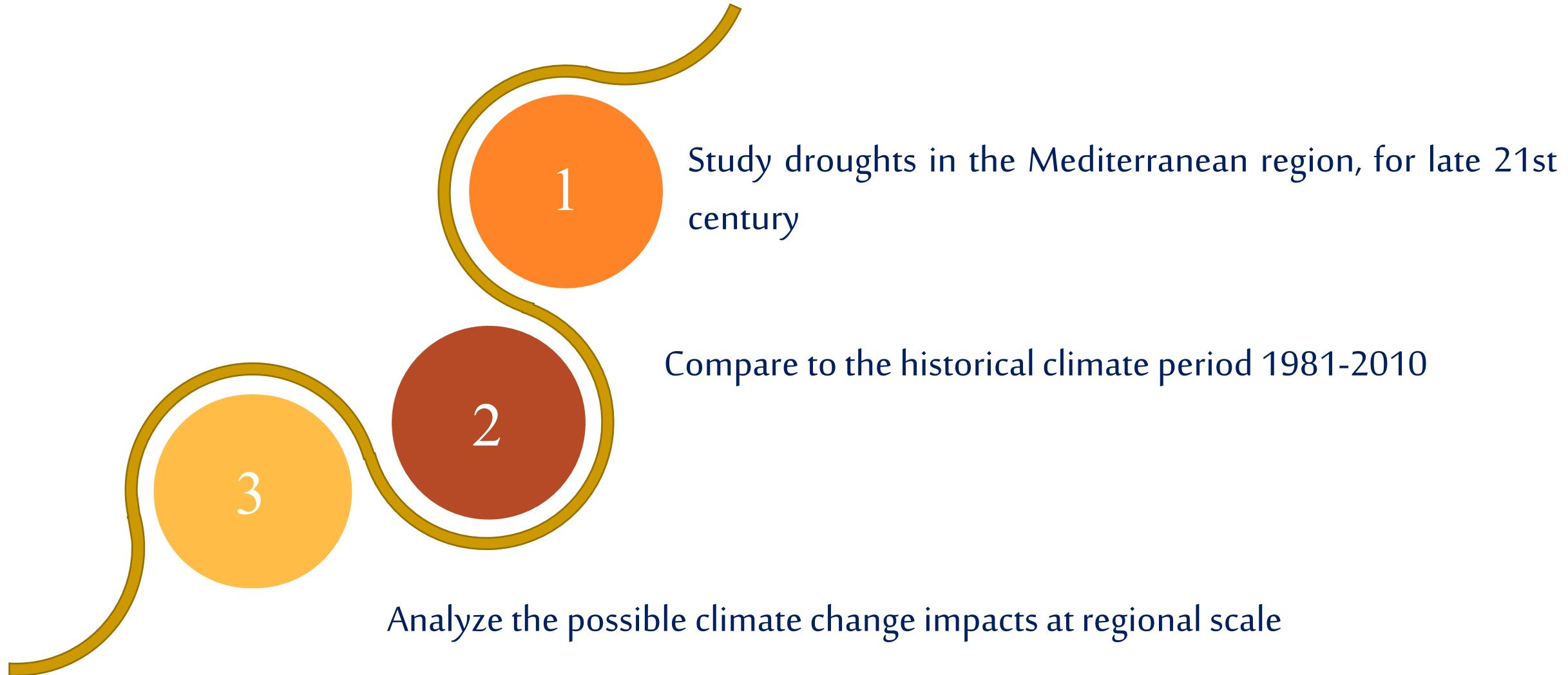


Introduction

- N=579 from 1996 till 2026
- Uncertainty were highly connected with drought, climate change, climate model
- 2016-2018 the peak



Goals



Method

03

icclim index - CDD

“A climate index is **a calculated value** that can be used to describe the state and the changes in the climate system” - icclim



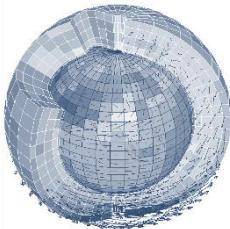
CCD → Maximum Consecutive Dry Days → $pr < 1 \text{ mm}$

Drought : Drought is a **prolonged dry period** in the natural climate cycle that can occur anywhere in the world. It is typically a slow on-set phenomenon caused by a lack of rainfall. - WMO

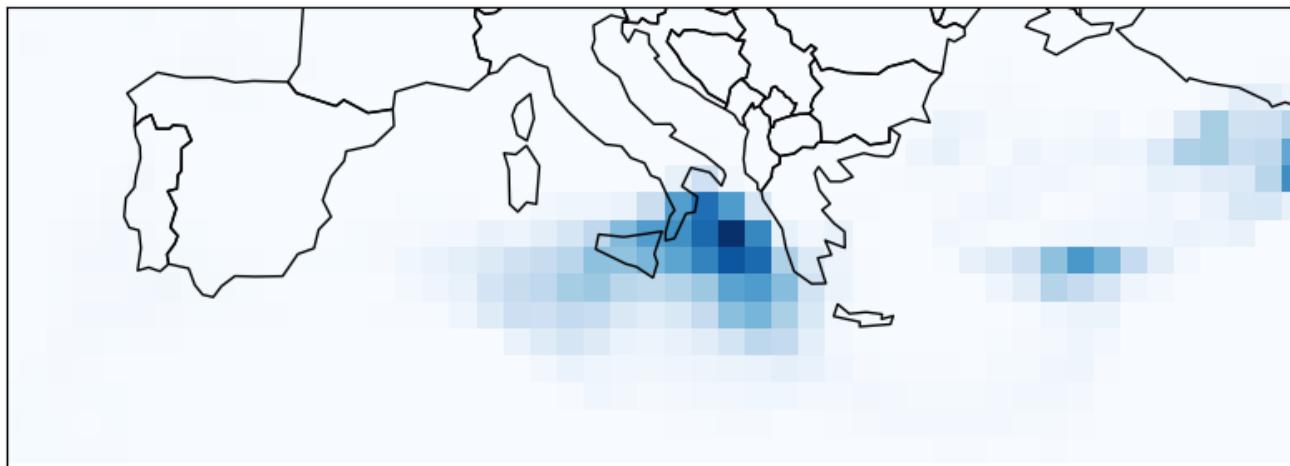
Method

03 Data

Global gridded data



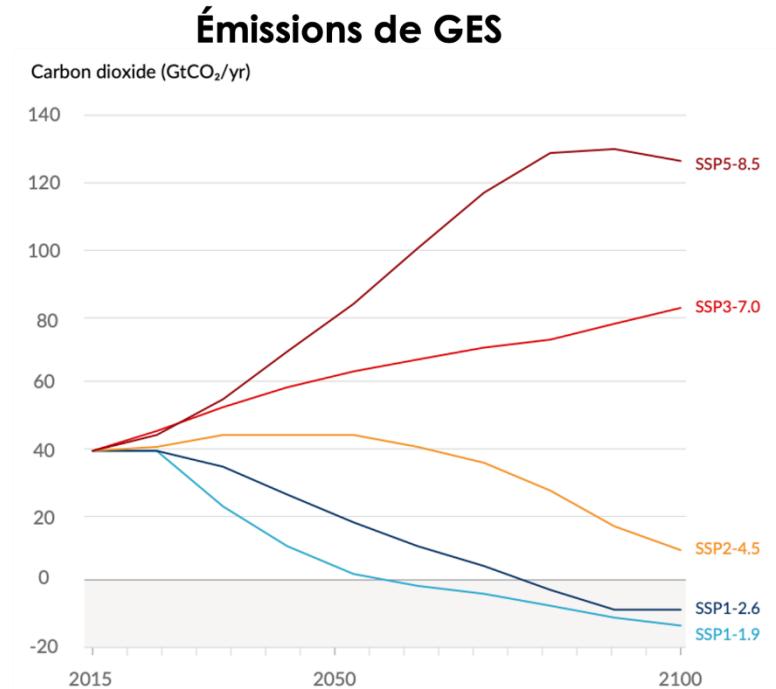
Model used :
CMCC
EC – earth 3



Spatial distribution:
Mediterranean
regions

Time distribution:
Hist : 1981 - 2010
Projections :
2081 - 2100

scenarios :
ssp-585
ssp-370



Method

03

Process

Global gridded data



Model used :

CMCC

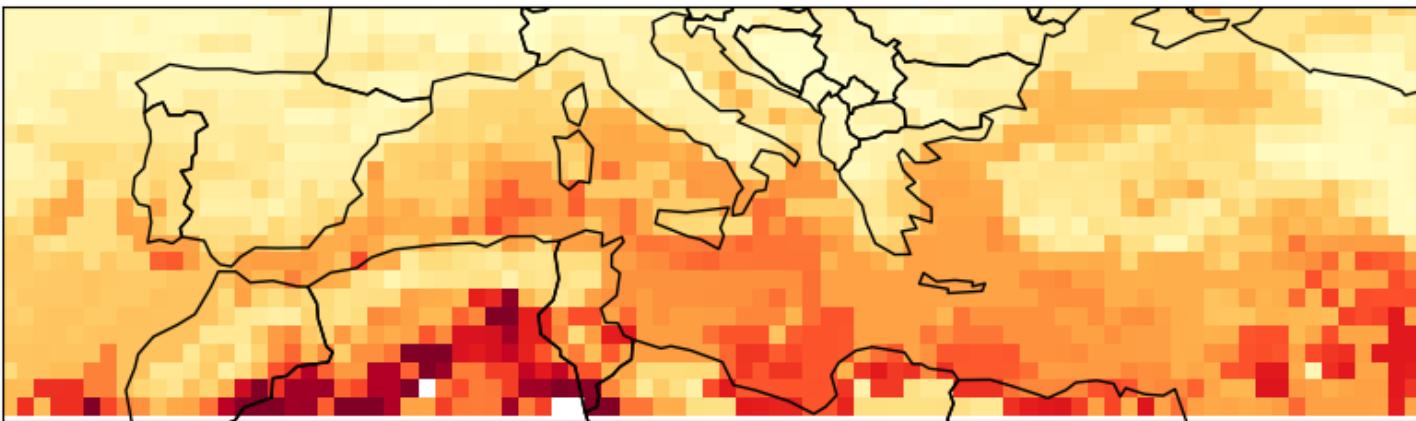
EC – earth 3

Spatial distribution:

Mediterranean regions



Computation of the index



50 100 150 200 250 300 350

CDD in 2085 – EC_Earth3

Time distribution:

Hist : 1981 - 2010

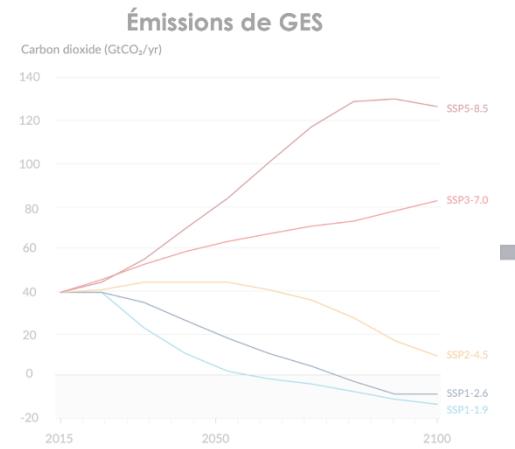
Projections :

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Method

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Process

Global gridded data



Model used :

CMCC

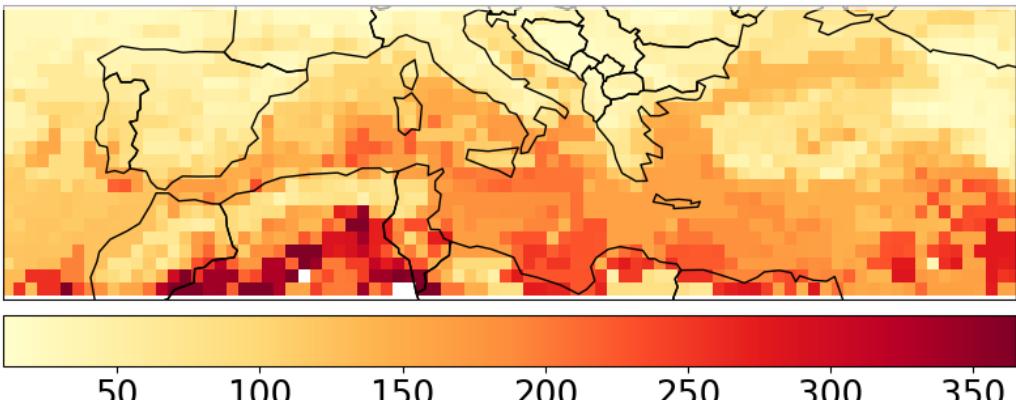
EC – earth 3

Spatial distribution:

Mediterranean regions



Computation of the index



CDD in 2085 – EC_Earth3

Time distribution:

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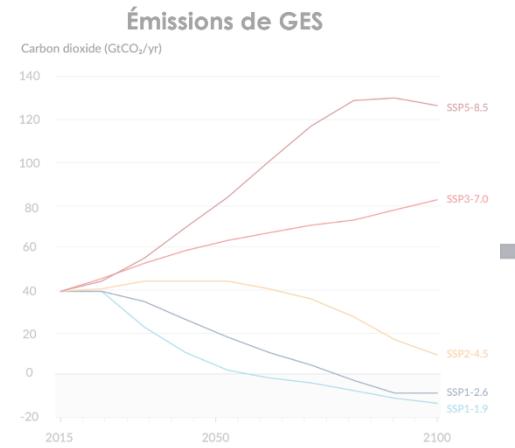
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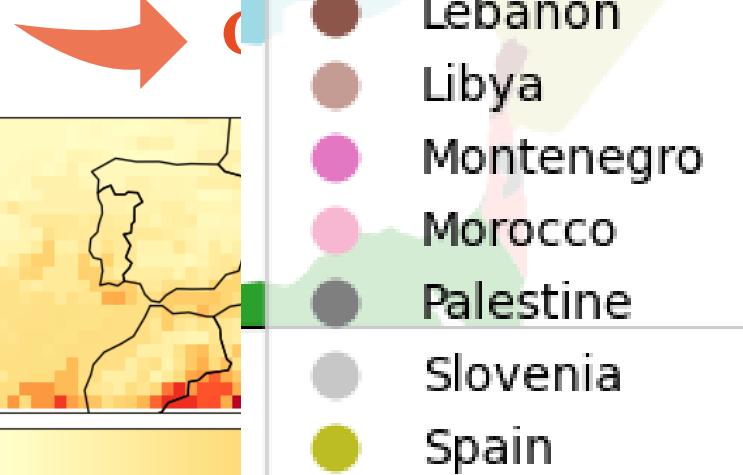
Average of the mean per country



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03 Pro

Global gr



CDD

- Albania
- Algeria
- Bosnia and Herzegovina
- Croatia
- Egypt
- France
- Greece
- Israel
- Italy
- Lebanon
- Libya
- Montenegro
- Morocco
- Palestine
- Slovenia
- Spain
- Syria
- Tunisia
- Türkiye



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Time distribution:

Hist : 1981 - 2010

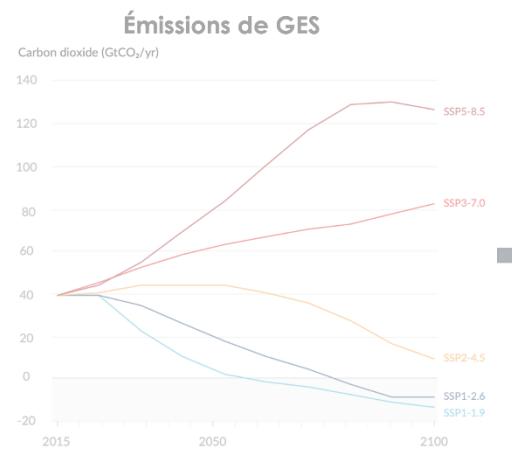
Projections :

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Average of the mean per country

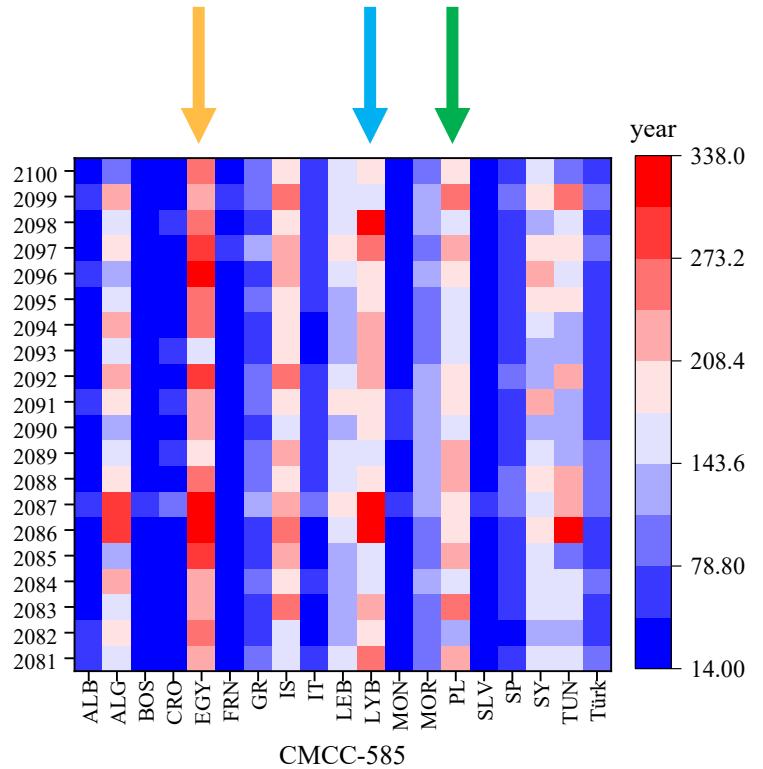
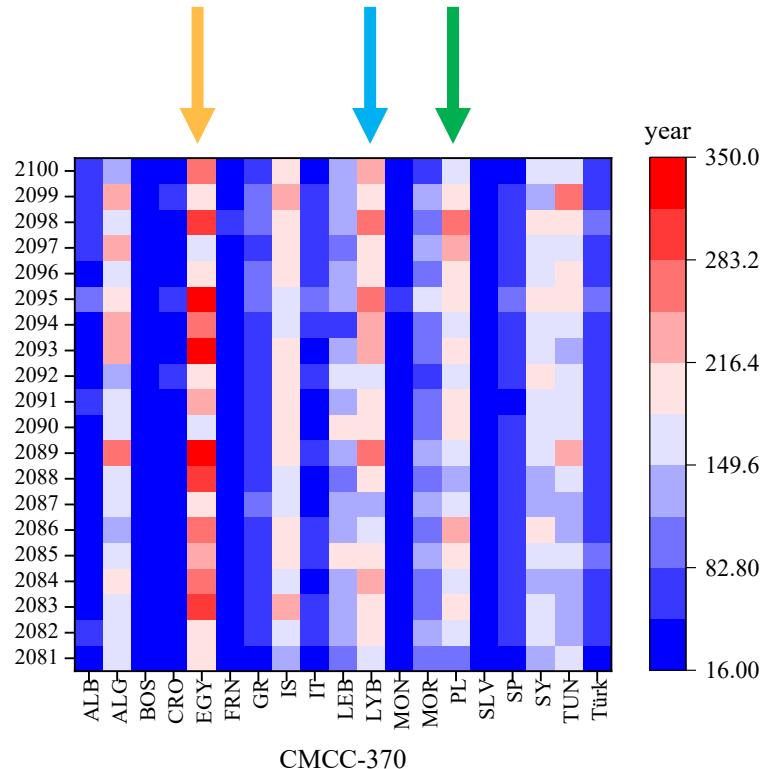
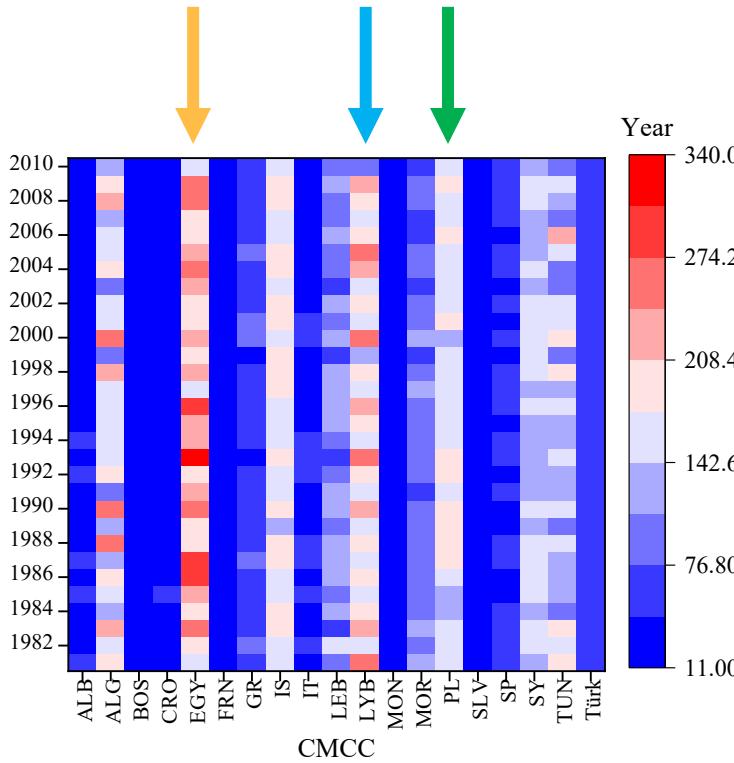


Results

04

CDD events

- Future climate model showed that CDD events will be more pronounced in EGY, LYB, and PL.

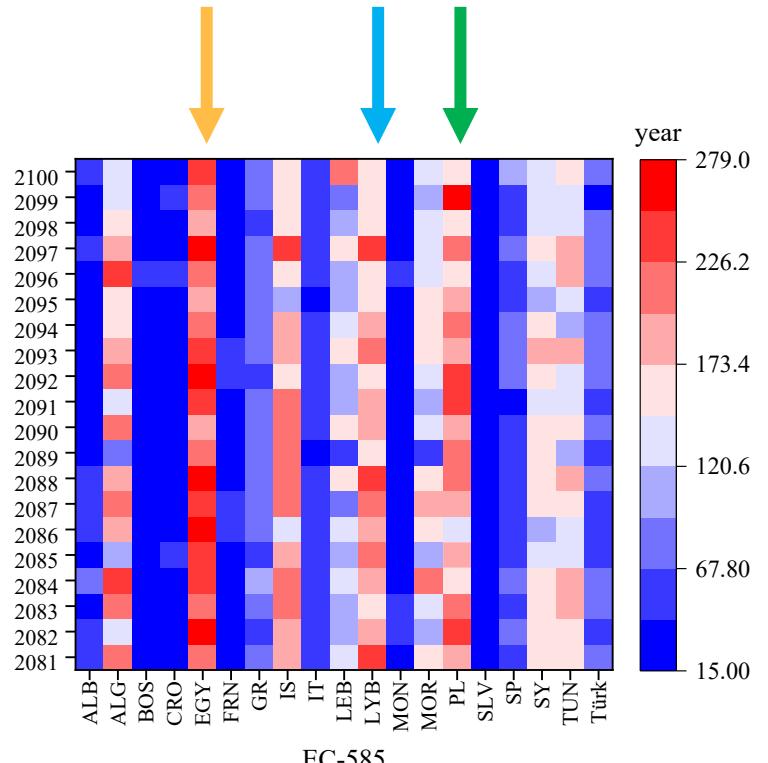
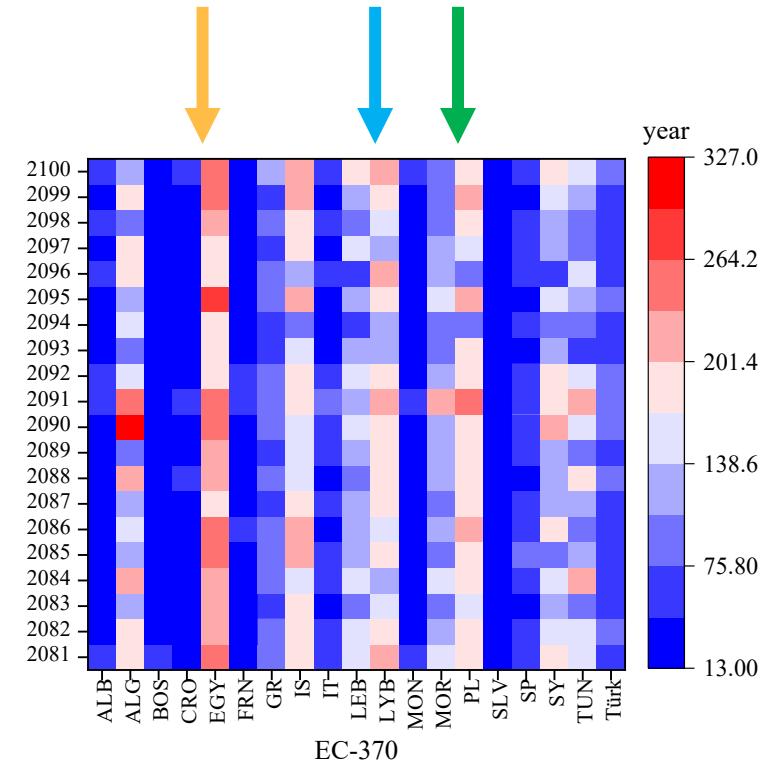
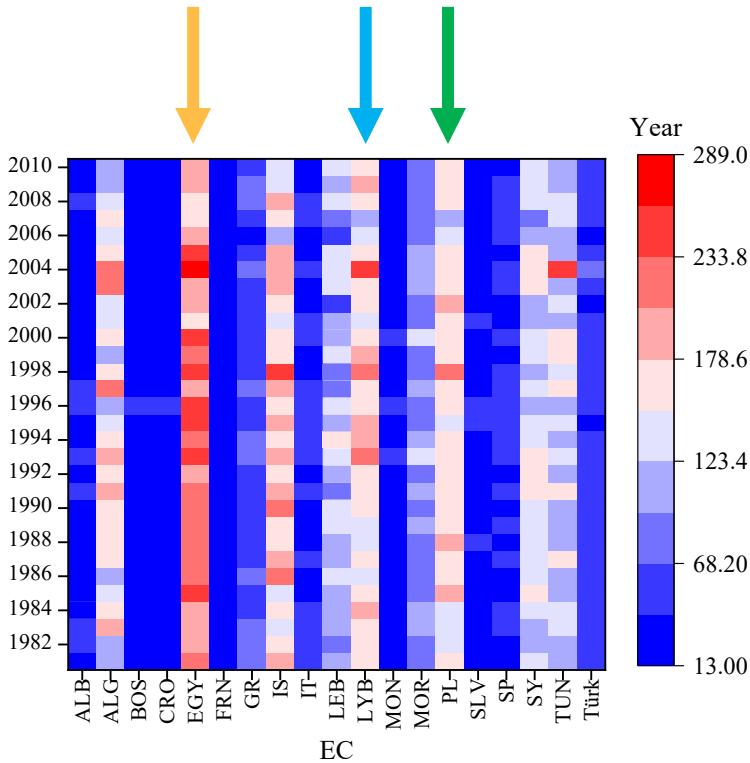


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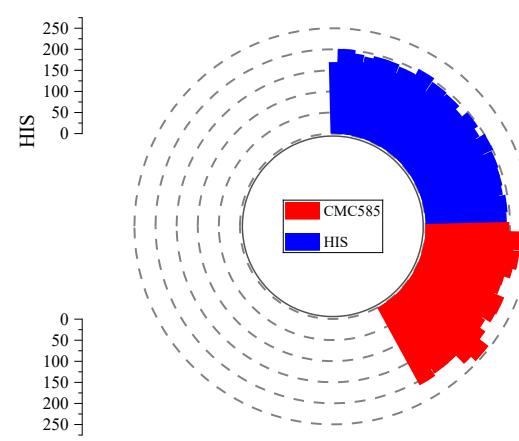
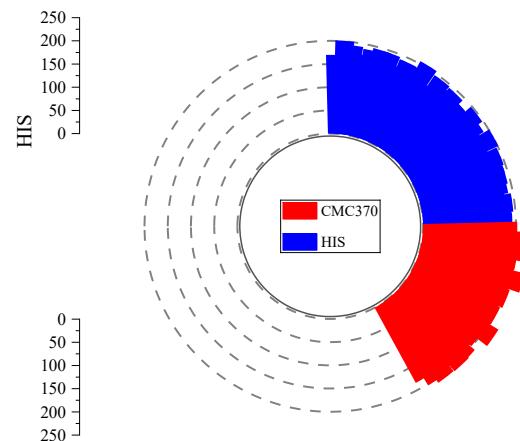
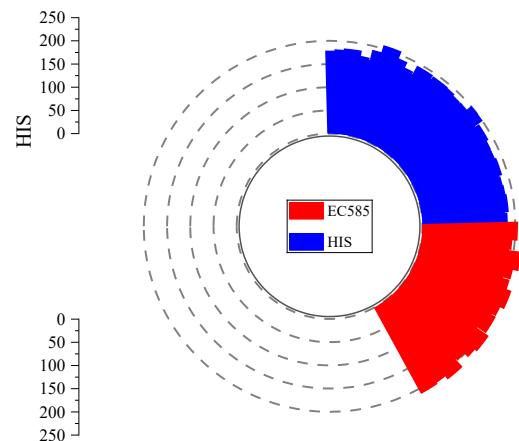
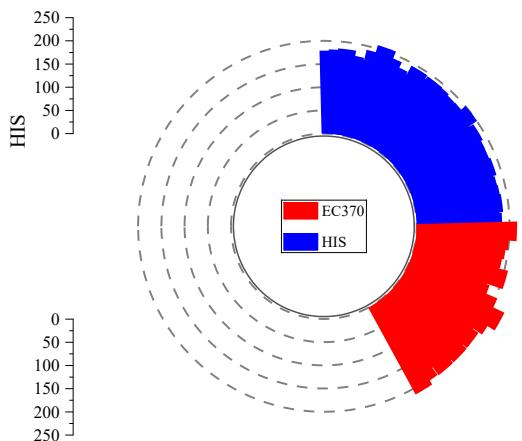


Results

04

Average CDD events across MED

- A noticeable increased of CDD was noticed
- For CMCC370 : 231 in late 21st century
- For CMCC585: 245 in late 21st century



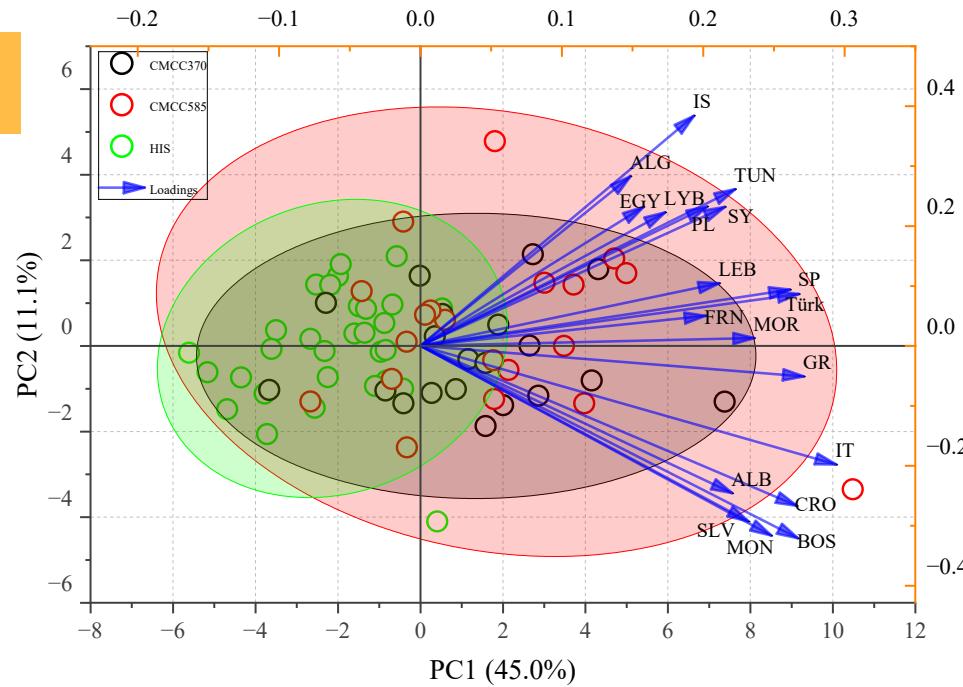
Results

04

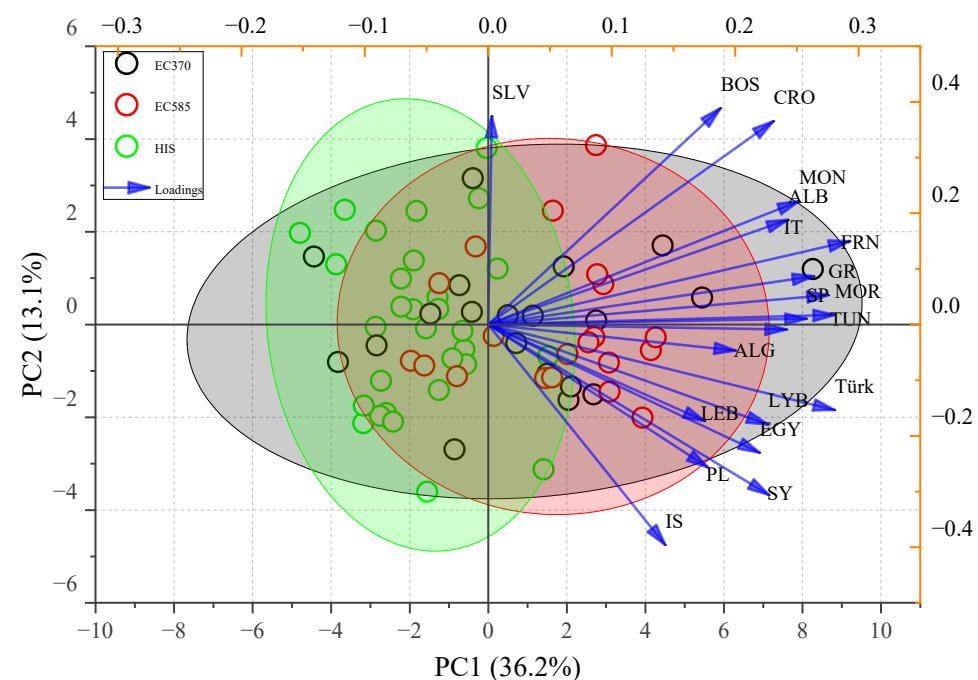
PCA for CDD events 1980-2010 vs 2080-2100

- For CMCC three groups can be discriminated
- For EC-Earth3 two groups can be discriminated

CMCC



EC-Earth

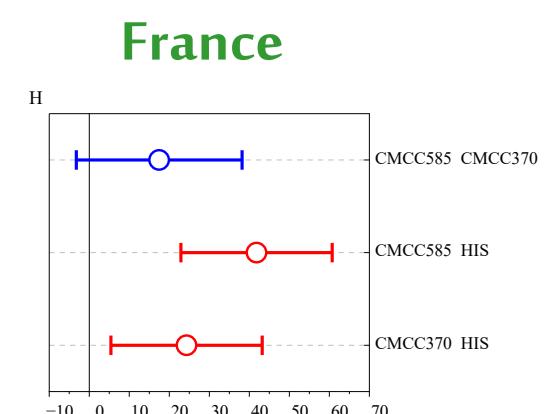
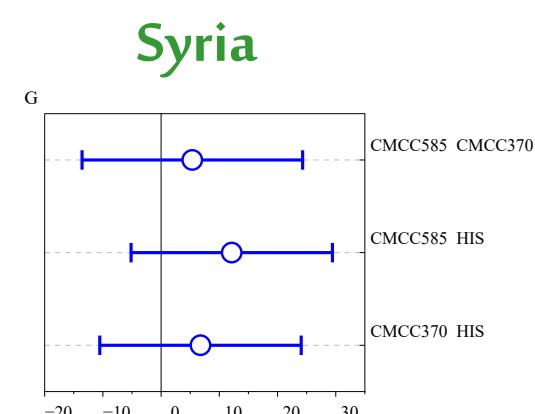
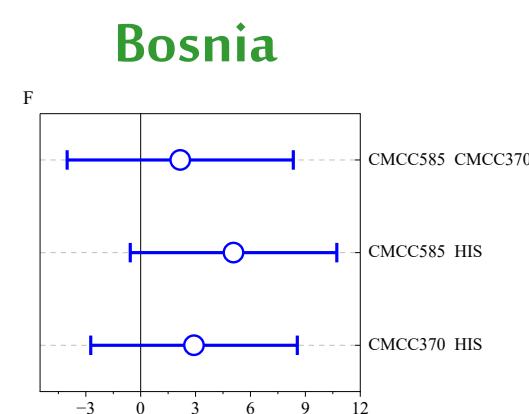
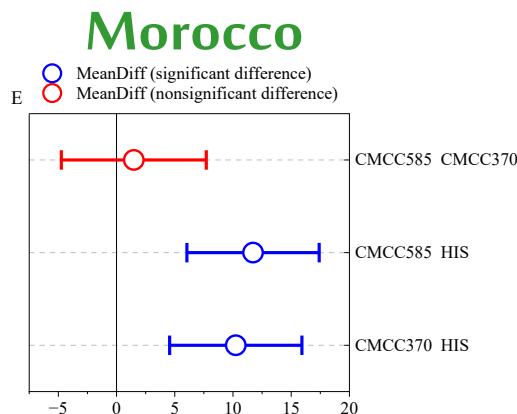
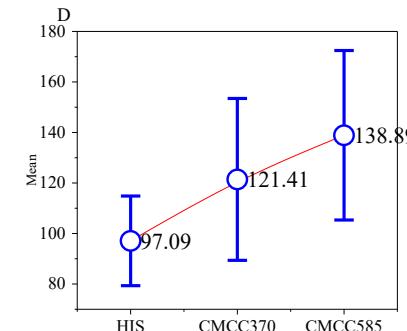
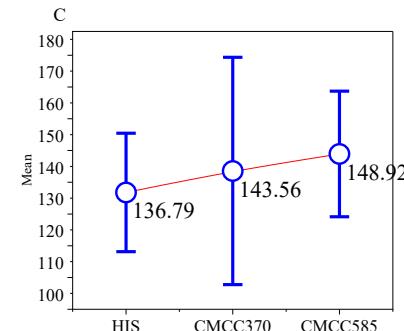
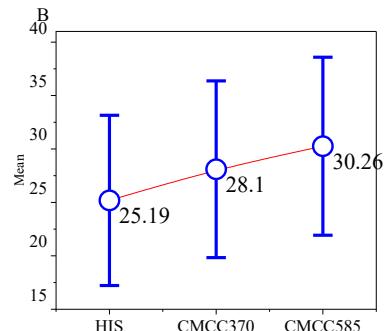
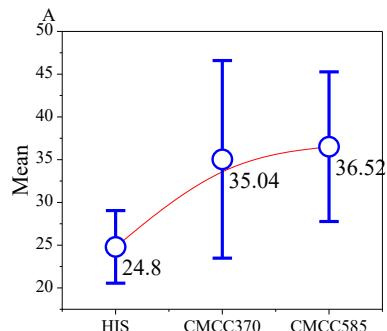


Results

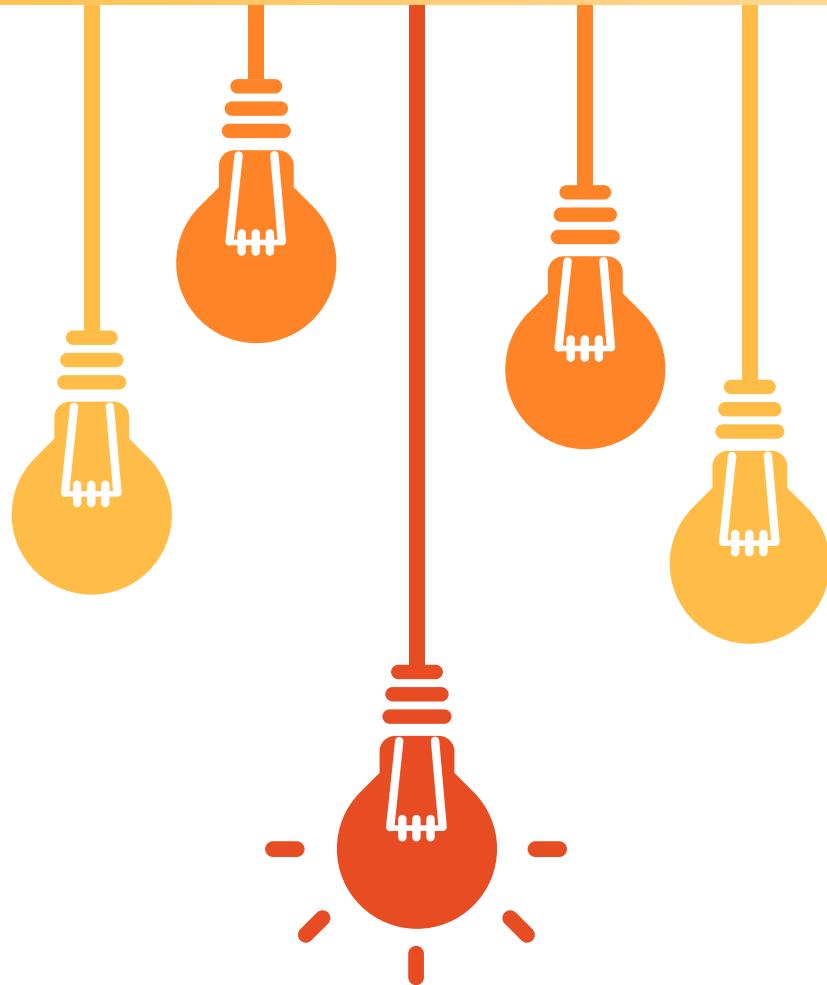
04

Uncertainty CDD 1980-2010 vs 2080-2100

- Four countries were chosen
- An increased of CDD events were noticed, with significant differences.



Discussion



CDD

→ More indicator to have a more complete analysis

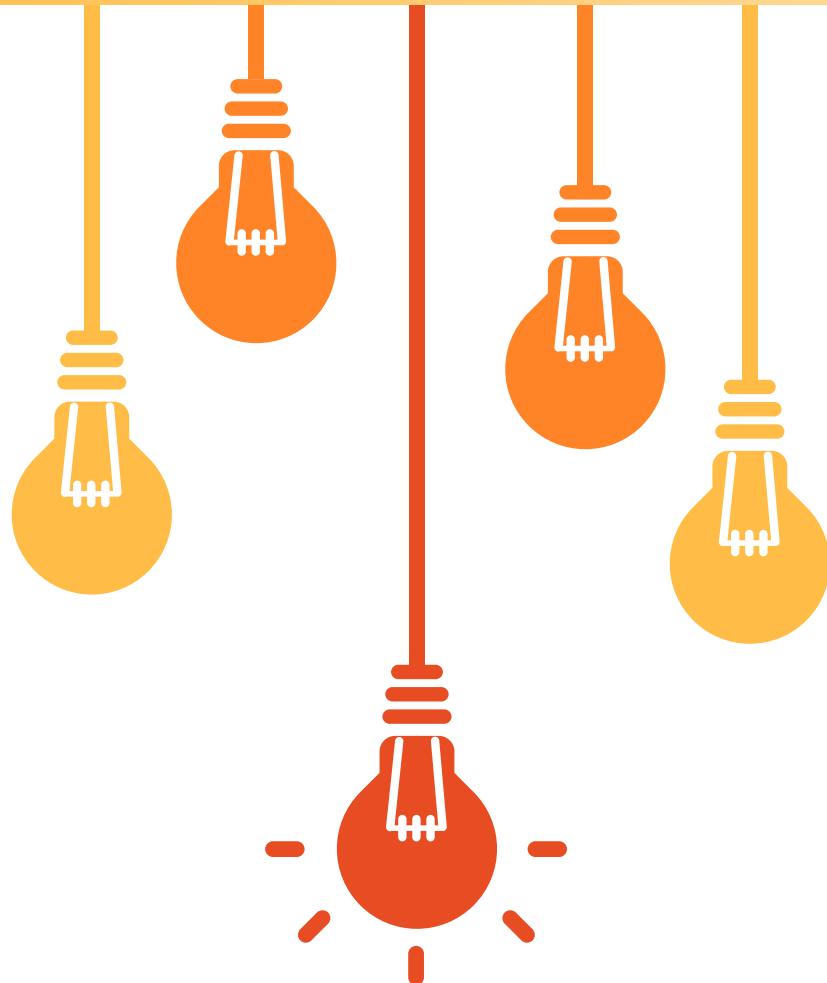


2 climate models are not sufficient (CMCC, EC-Earth3)



Large differences in the impacts on the MED regions

Conclusion



CDD

Will be more pronounced in the MED basin



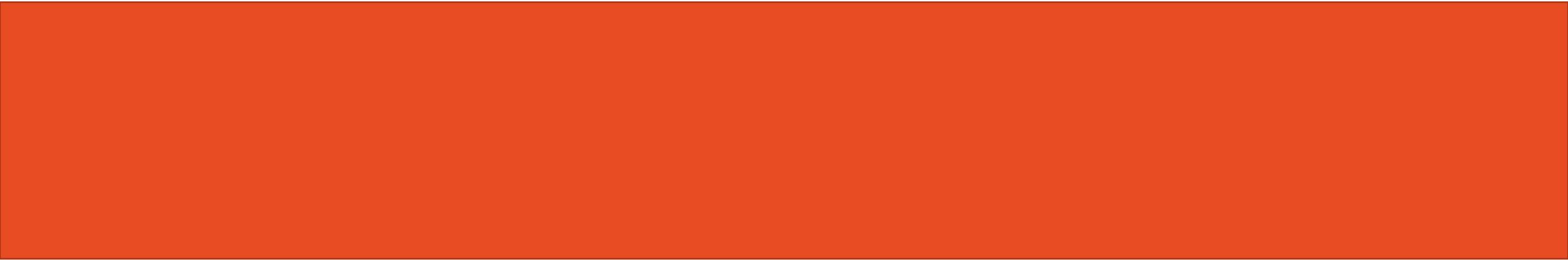
CMCC585: 245 CDD in late 21st century



Geographical locations affected the uncertainty



We must PREPARE for future in the MED



Thank you for your attention