CLIMAAX Handbook overview

Handbook webinar
4 July 2024

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CLIMAAX
climate ready regions

Housekeeping

This session is recorded

Raise your hand to ask a question during dedicated Q&A moment or write in the chat

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Agenda

TIME	SPEAKER	TOPICS
10:00 - 10:05	Dana Stuparu (Deltares)	Welcome
10:05 - 10:10	Erika Meléndez (UPC)	Contractual process (setting up)
10:10 - 10:25	Michaela Bachmann (IIASA)	Framework presentation
	Anna Pirani (CMCC)	Use of climate change data
10:25 - 10:45	Christopher Polster (ECMWF)	Toolbox presentation
	Erika Meléndez (UPC)	Example demonstration with an example
10:45 - 11:00	Dana Stuparu (Deltares)	Q&A

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CLIMAAX Framework

Michaela Bachmann, Reinhard Mechler, Oscar Higuera-Roa
International Institute for Applied Systems Analysis (IIASA)

Handbook Webinar
4th of July 2024

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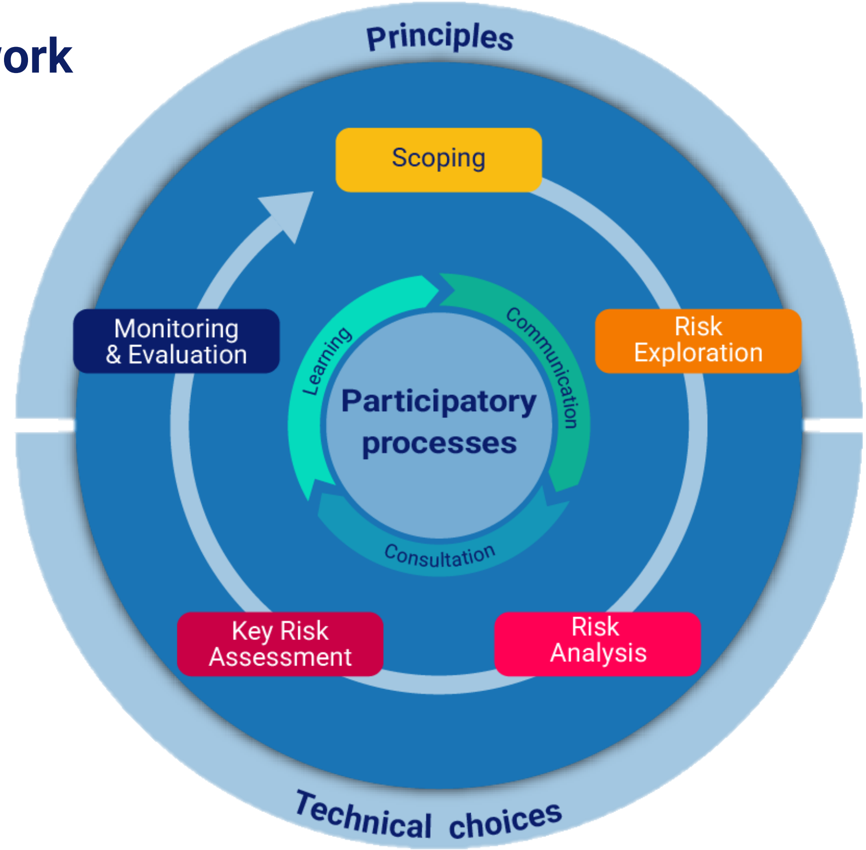
CLIMAAX Framework



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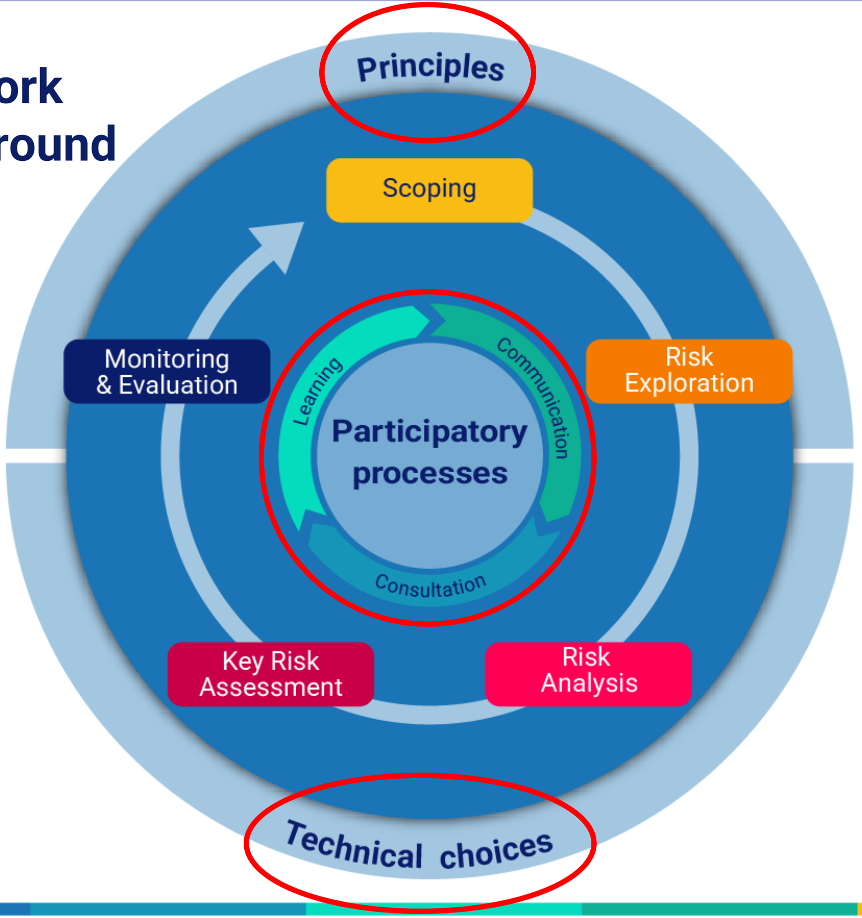
CLIMAAX Framework Conceptual Background



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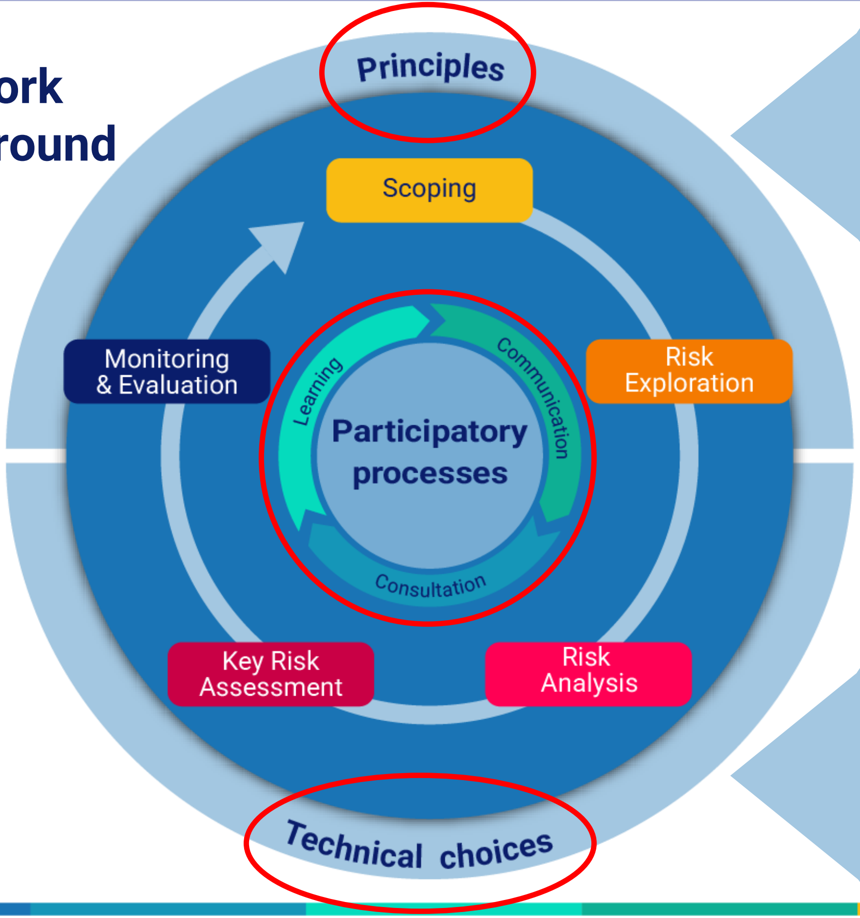

Social justice, equity and inclusivity

Quality, rigour and transparency

Precautionary approach

Climate Change Scenarios & Models

Global warming levels

Choice of time horizon

Integration of local data

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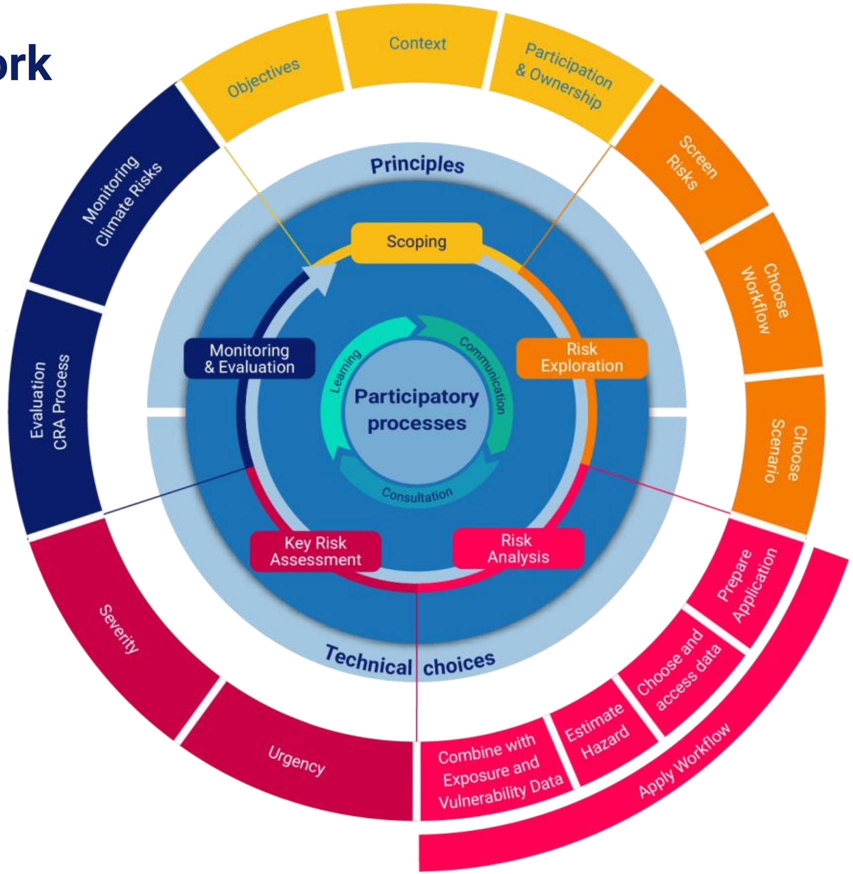
CLIMAAX Framework and substeps



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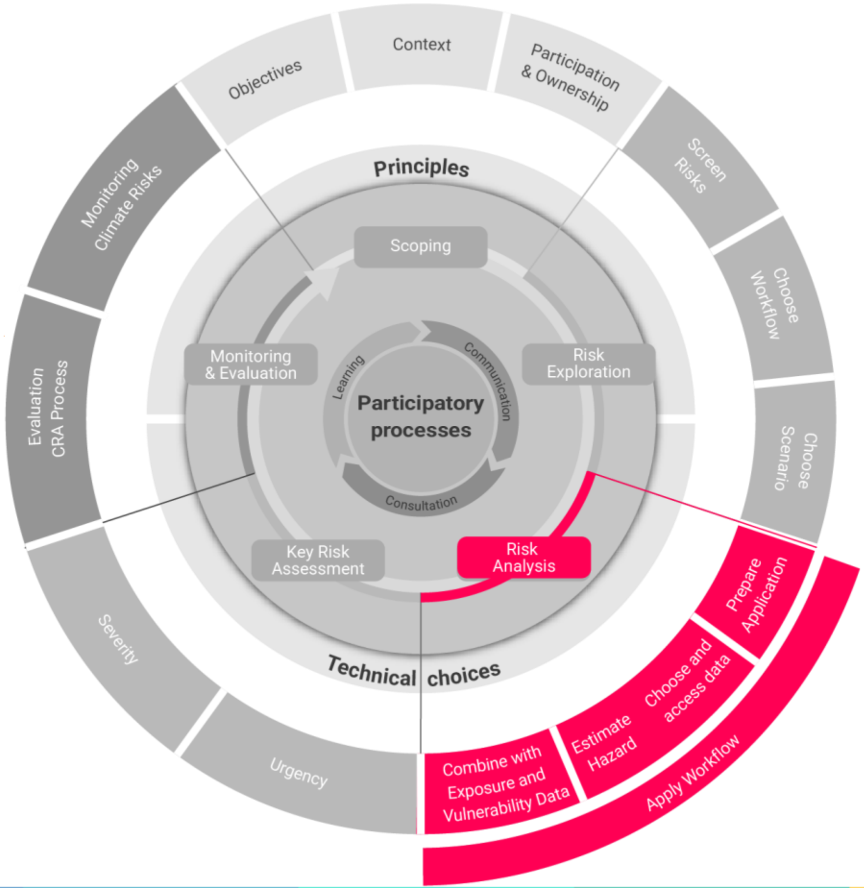

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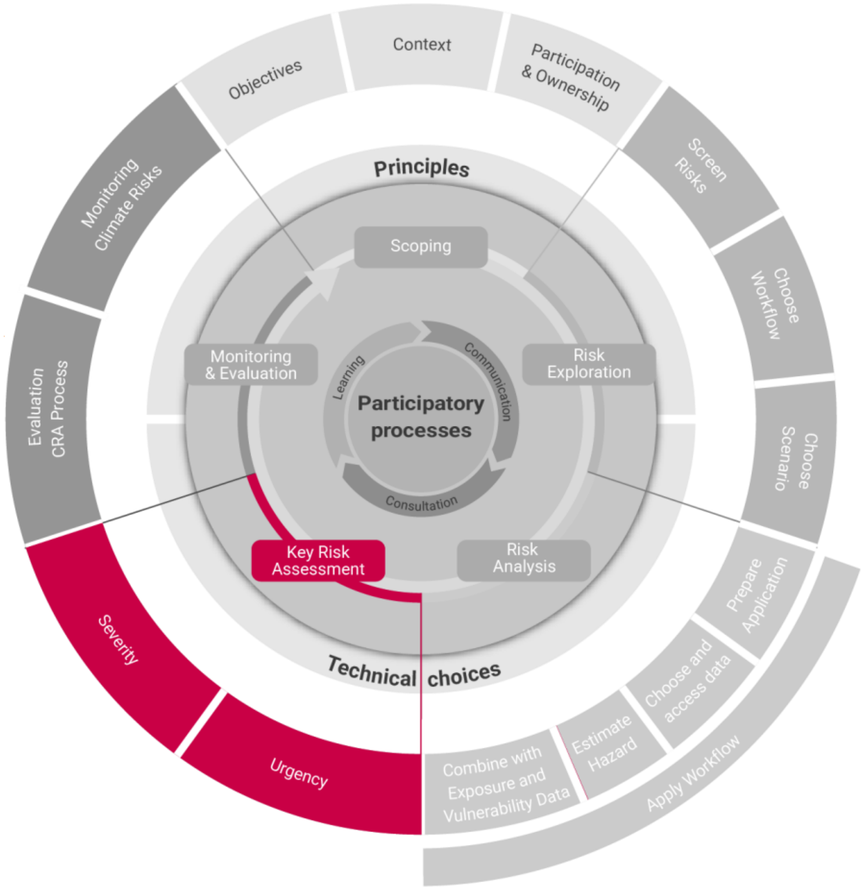

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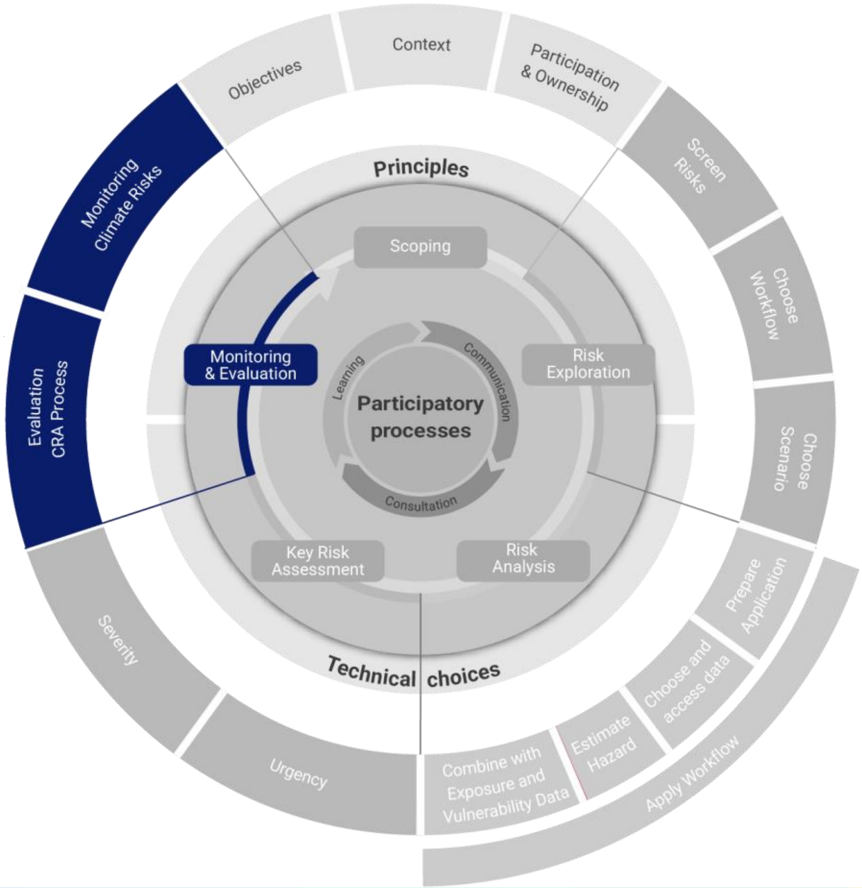

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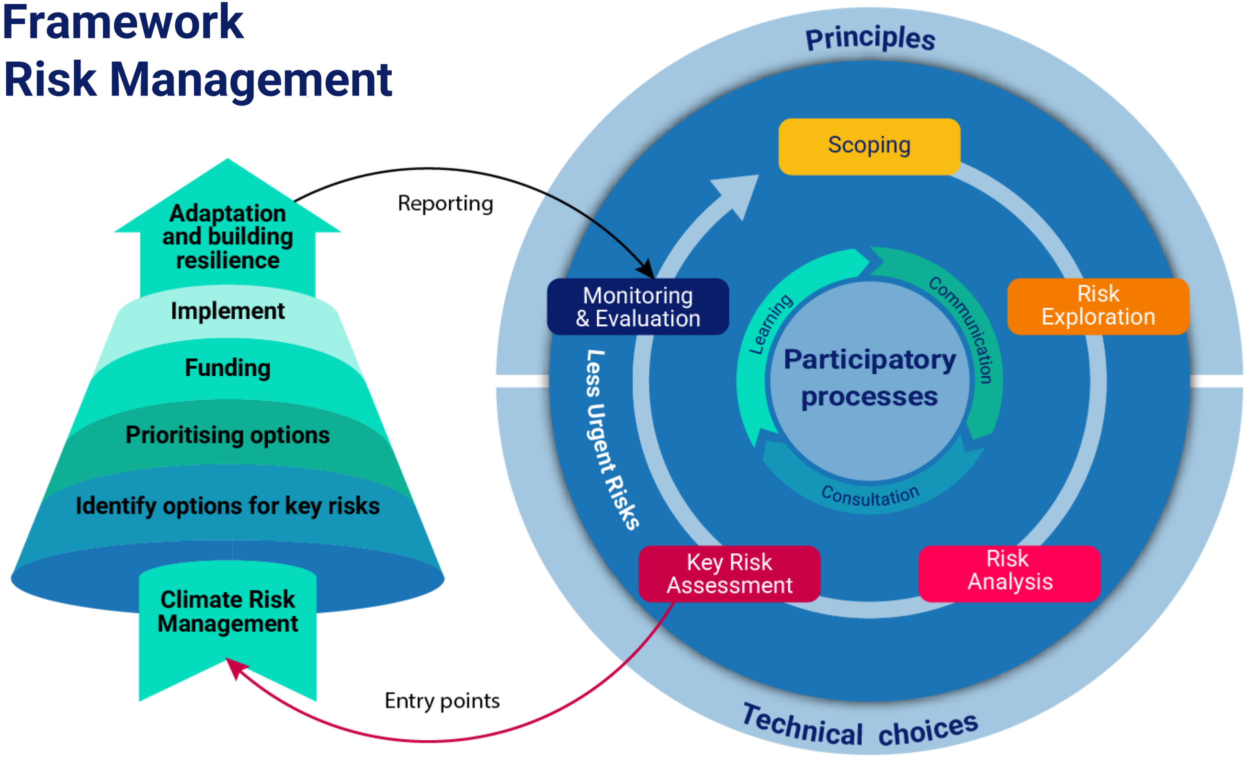
CLIMAAX Framework
& Climate Risk Management



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Assessing climate future information

Anna Pirani, Jeremy Pal, Gloria Mozzi, Davide Serrao, Majid Niazkar
CMCC @Ca'Foscari (Venice)

Handbook webinar
4 July 2024

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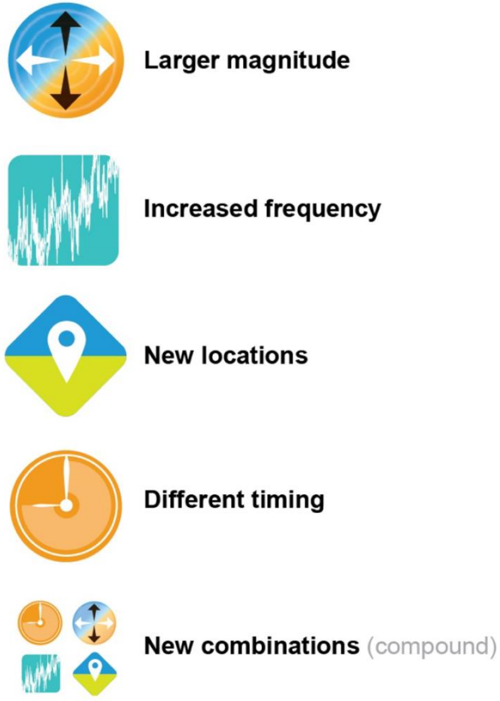
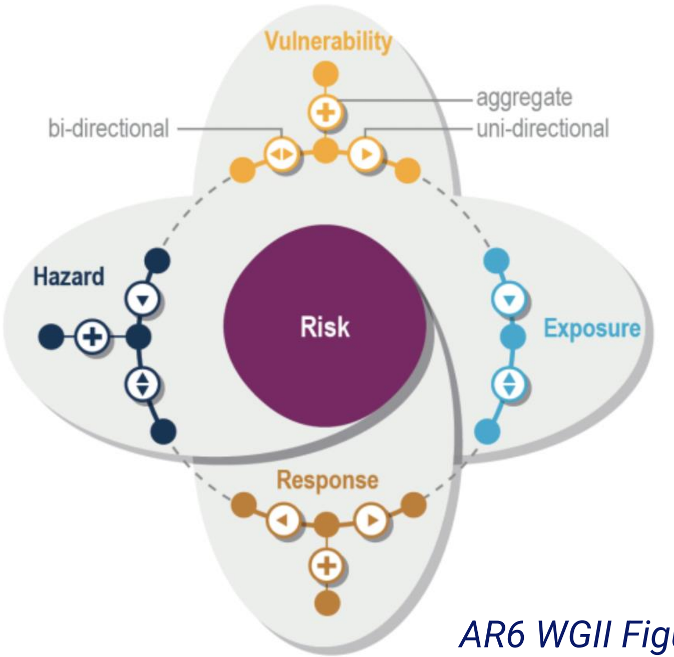
Treatment of climate risk in the context of climate change





Linking

- multiple climatic impact-drivers,
- societal and ecosystem vulnerabilities and exposure,
- consequences of responses to climate change.

AR6 WGII Figure 1.5b, IPCC AR6 risk framework (Reisinger et al., 2020)

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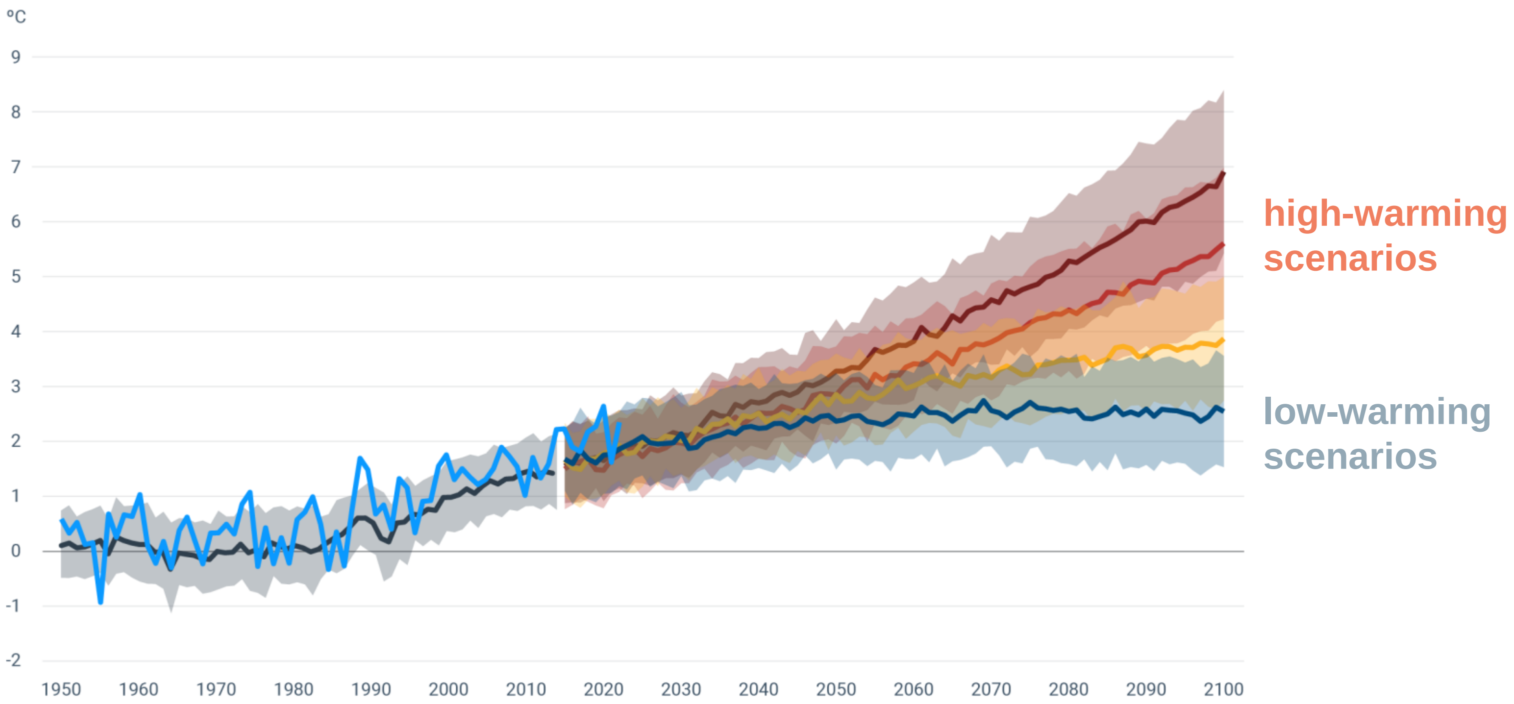
Which scenario? How much will Europe warm in this century?



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What to consider when choosing climate change scenarios?

- High or very high-end emissions scenarios can be explored to assess future high-risk outcomes.
- Comparison of projected changes (anomalies) to pre-industrial, historical conditions, or a low-end emissions scenario can be helpful as a baseline to assess current and future conditions.
- Comparison with more moderate risk outcomes, and the related implications for adaptation strategies, expected from low-end emissions scenarios may also be beneficial.

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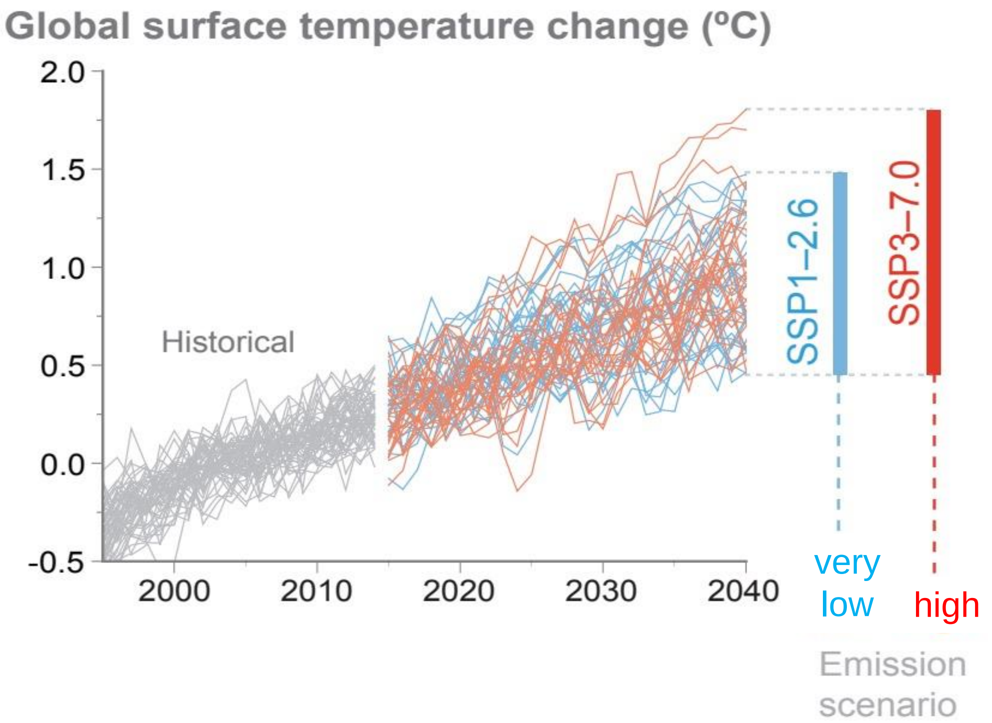
How to promote action now if in the near-term scenarios do not show big differences with the present situation?



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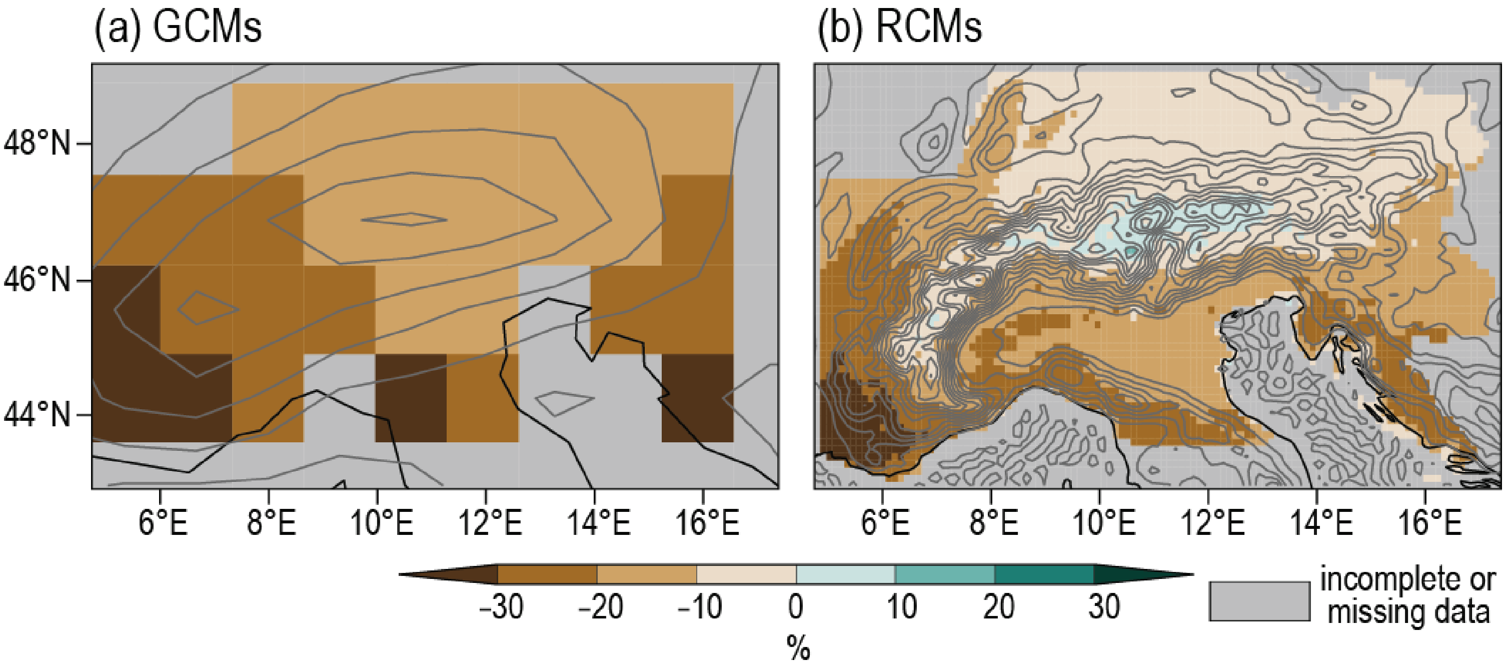
Which limitations to consider when using climate models at local scales?



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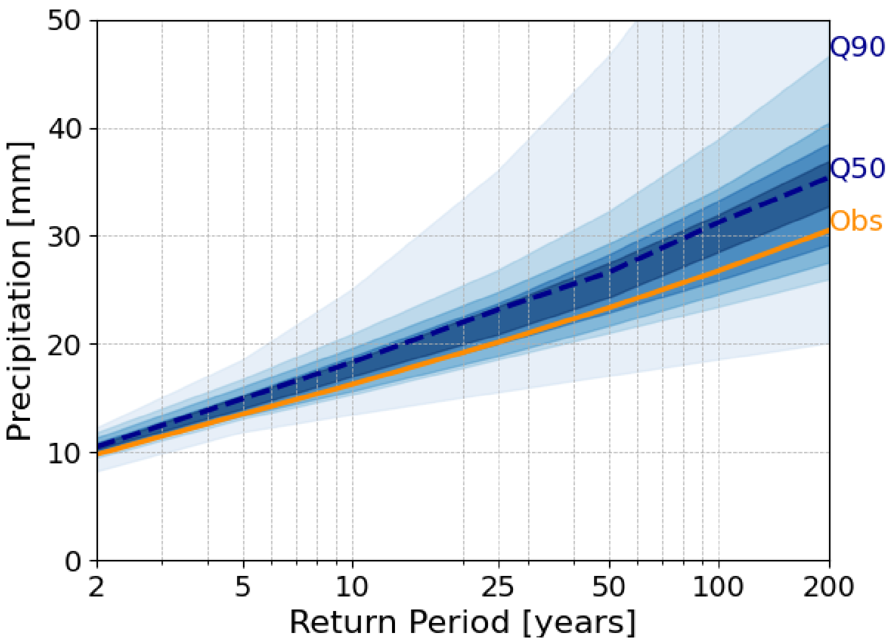
How should uncertainty be communicated?



An ensemble of model projections should be used to explore possible future regional climate.

- The median of the models (Q50) can be considered a best estimate.
- The spread indicates the uncertainty.
- The upper bound of the ensemble (e.g. Q90) can indicate a possible "worst case" outcome.

EURO CORDEX-11: Downscaled, 12.5-km, bias adjusted. 33 Ensemble members

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How can we develop “reliable” or “complete” regional climate information?

- Assemble all relevant lines of evidence relevant to assess changes in hazards.
- Study regional climate changes.
- Assess the robustness of regional climate change information based on multiple lines of evidence.

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CLIMAAX Handbook

Christopher Polster, Milana Vučković, Fredrik Wetterhall
ECMWF

Handbook webinar
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CLIMAAX
climate ready regions

CLIMAAX Handbook

Website: **handbook.climaax.eu**

- **Climate Risk Assessment** (CRA) resource
- Created by CRA experts
- Conceptual and technical guidance
- Experience from participating regions
- **Working document**

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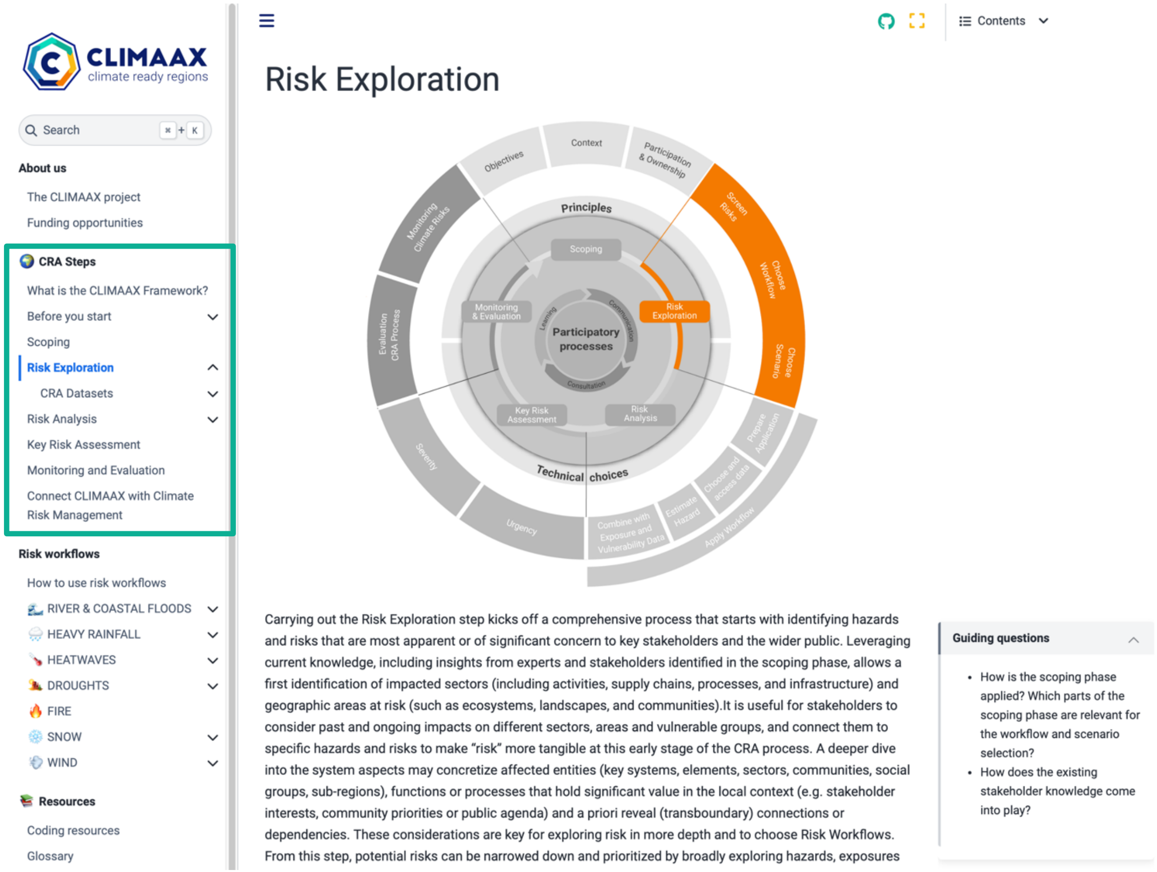
CLIMAAX Framework

Step-by-step with

- Descriptions
- Illustrations
- References
- Guiding Questions



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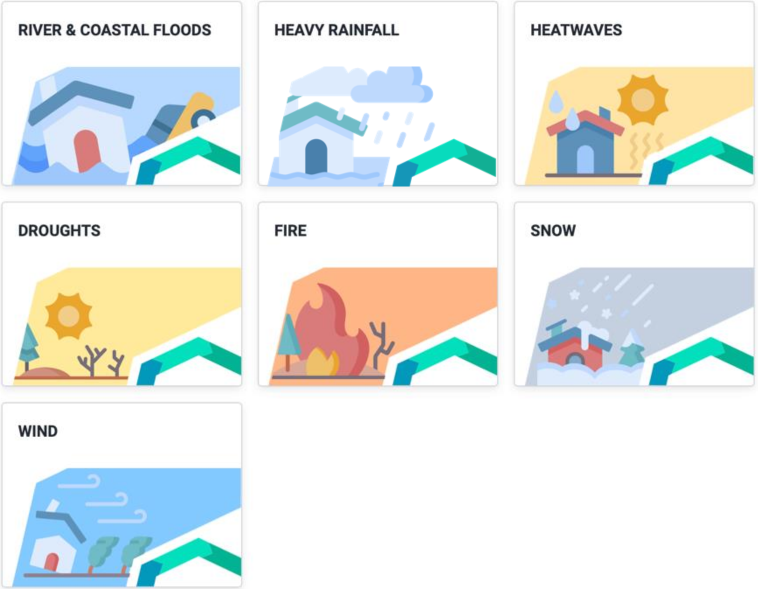
CLIMAAX Workflows

- Implementation of **Risk Analysis**
- Risk = Hazard × Exposure × Vulnerability



- Grouped **by hazard**
- **Starting point**, building blocks, examples
- **To be adapted to the local context**

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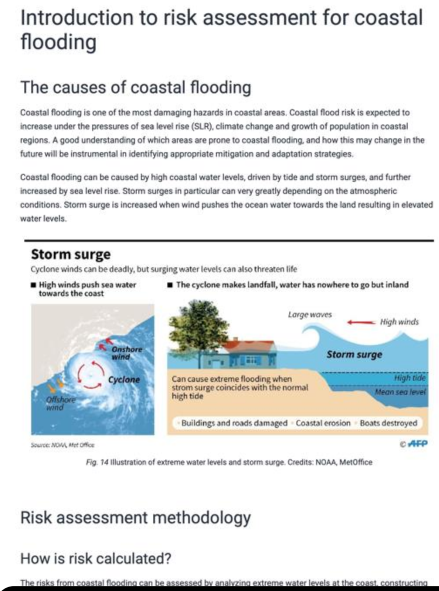
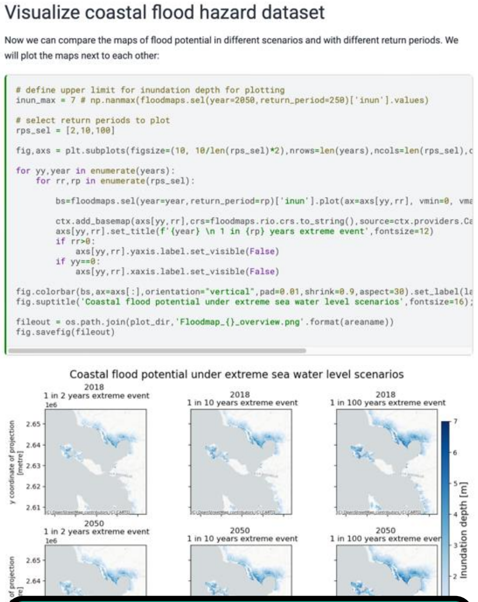
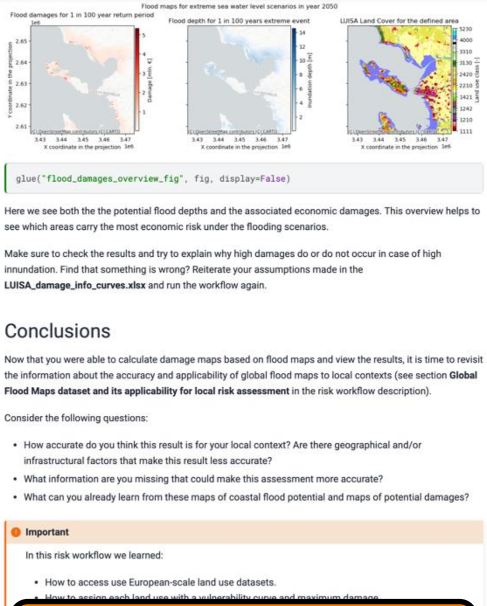
CLIMAAX Workflows: Structure



Introduction



Hazard assessment



Risk assessment

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CLIMAAX Workflows: Implementation

- **Python** programming language
- Jupyter notebooks
    - Data retrieval, processing and visualization
    - **Documentation**, **code** and **output** in one place
- Standard data formats

netCDF GeoTIFF

Note

The risk category for each region is always relative to the other regions considered in the workflow (here: country level) and therefore not directly comparable between datasets. This means that the risk category of one region may be higher or lower compared to the other regions, but not between e.g. historical vs. future datasets. Please refer to the risk assessment workflow for more details on how drought risk is calculated.

```
x_nuts, y_nuts = gpd.GeoSeries(nuts.geometry).unary_union.centroid.xy
slcted = nuts.loc[nuts['NUTS_ID'].str.slice(0,4) == focal, 'NUTS_ID']

fig = px.choropleth_mapbox(df_, geojson=nuts.geometry, locations='Location', color='risk_cat
                  animation_frame = 'data', color_continuous_scale="reds", range_color = [1,
                           mapbox_style="open-street-map")

# Customize line properties for selected polygons
fig.update_geos(fitbounds="locations", visible=False)

fig.update_layout(title="Current and projected drought risk",
                  mapbox_center = {"lat": list(y_nuts)[0], "lon": list(x_nuts)[0]},
                  mapbox_zoom=4,
                  height=700,
                 coloraxis_colorbar=dict(
                    title= "Risk category",
                    tickvals = [1, 2, 3, 4, 5],
                    ticktext = [1, 2, 3, 4, 5]
                 ))

fig.show()
```

Current and projected drought risk

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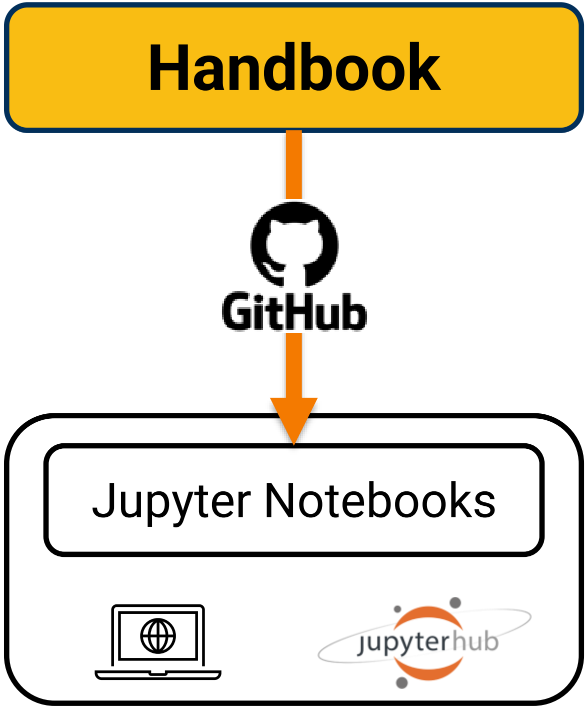
CLIMAAX Workflows: How To Run

- Available from **GitHub**
- **All open-source software** (no licenses required!)
- Environments:
  - **Local computer**
  - **(CLIMAAX) JupyterHub**



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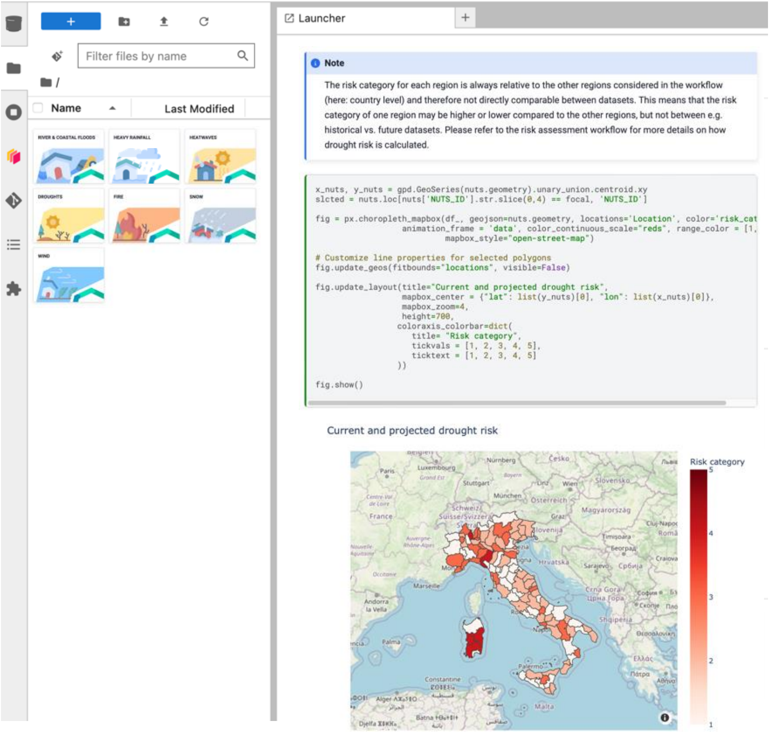
CLIMAAX JupyterHub

- **Computing and storage** in the cloud
- Maintained by CLIMAAX
- **Ready-to-use** environment:
  - Software preinstalled
  - Workflows prepared
- Upload your **own data**



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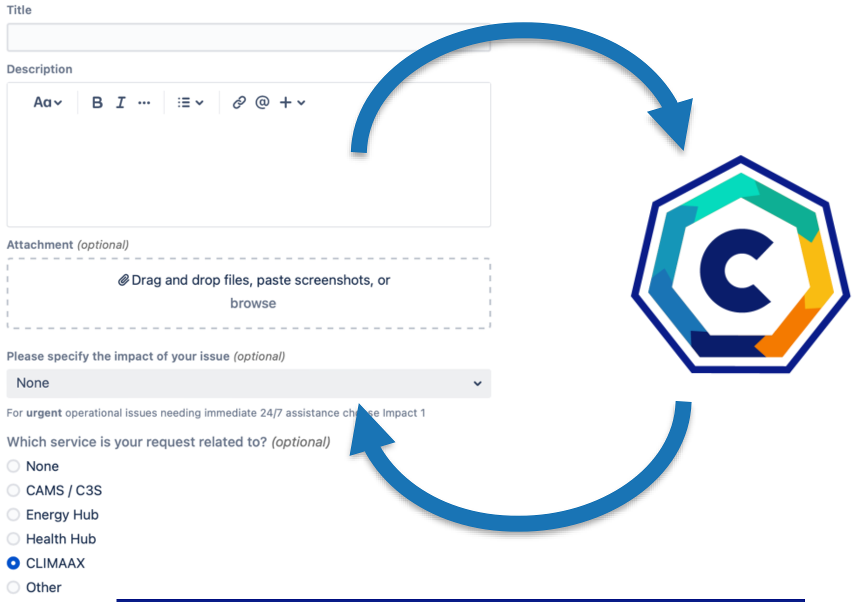
CLIMAAX Support

- **Support desk** for JupyterHub, Workflows and Framework

- Forum (public)
- GitHub
- Handbook documentation



Introduction provided separately

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Summary

Handbook

- Framework
- Workflows
- Documentation

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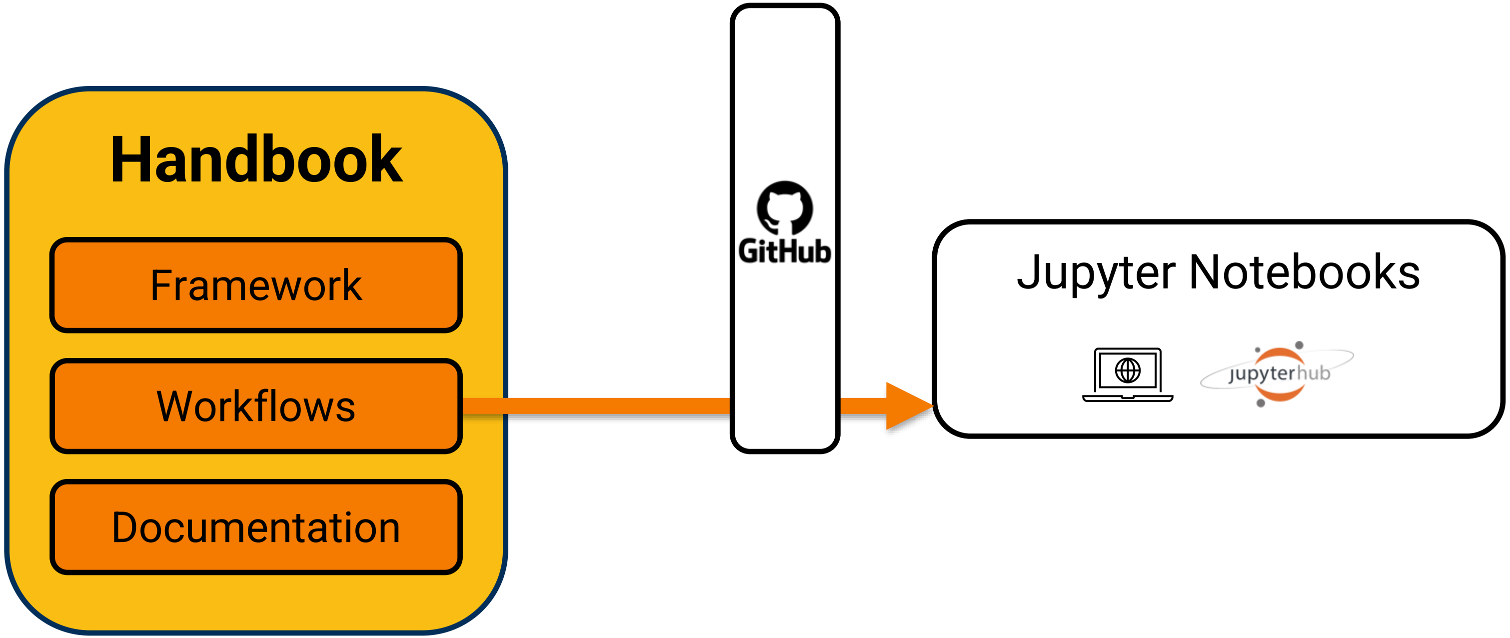
Summary



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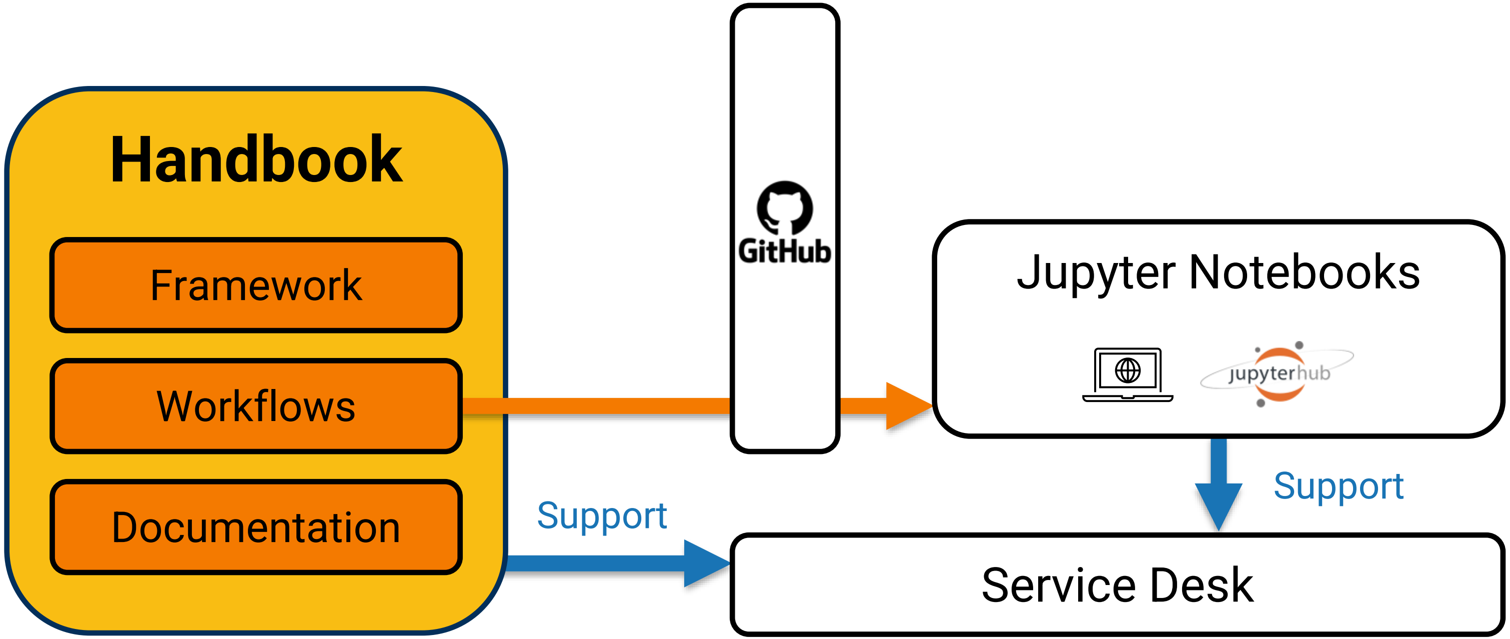

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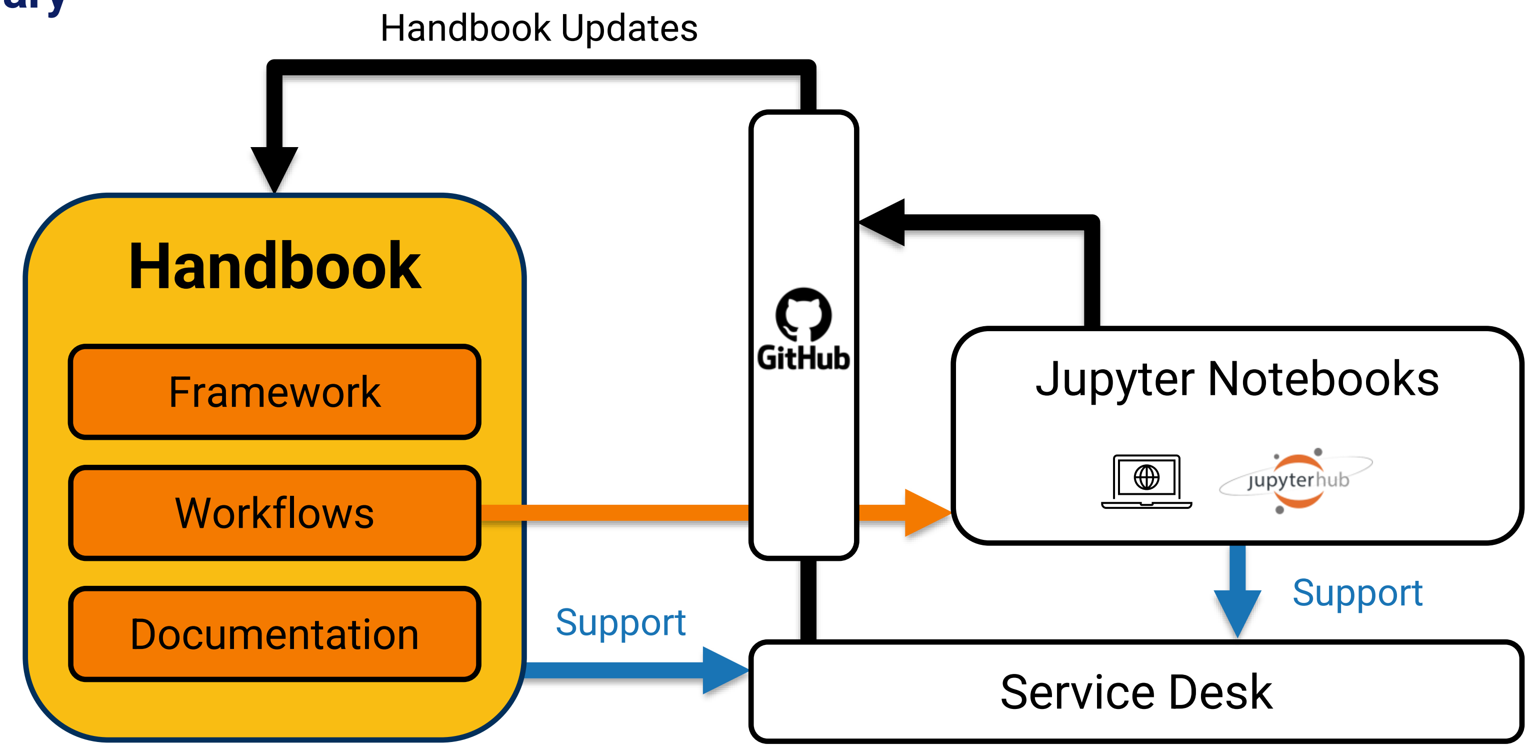

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Estimating changes in Heavy Rainfall

Catalonia Regional example

Erika Meléndez
Universitat Politècnica de Catalunya

Handbook webinar
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HEAVY RAINFALL

Terrassa, Spain 2023

Terrassa, Spain 2023

Blanes, Spain 2015

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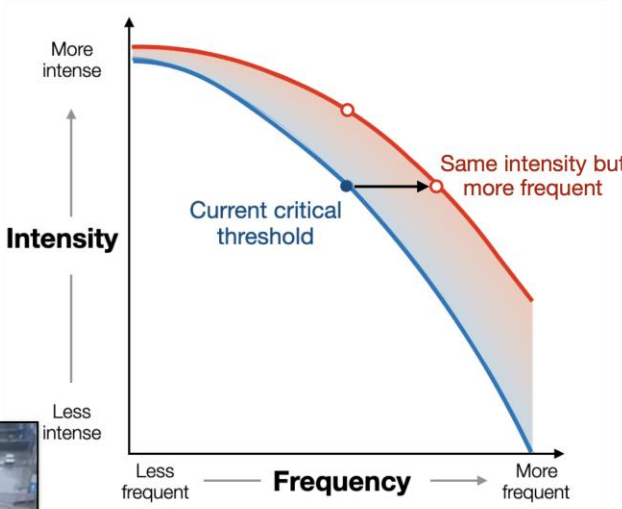
In a Climate Change Scenario

T > 10 years

30 mm/ 30 min

T > 2 years

30 mm/ 30 min



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In a Climate Change Scenario

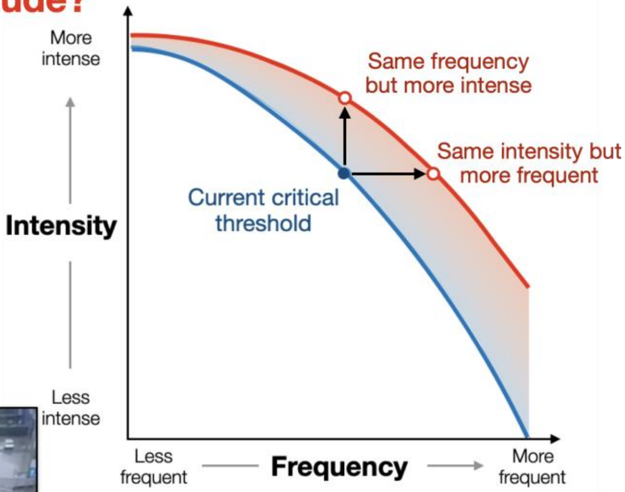
How do we manage the expected **change in frequency and magnitude?**

T > 10 years

30 mm/ 30 min

T > 10 years

45 mm/ 30 min



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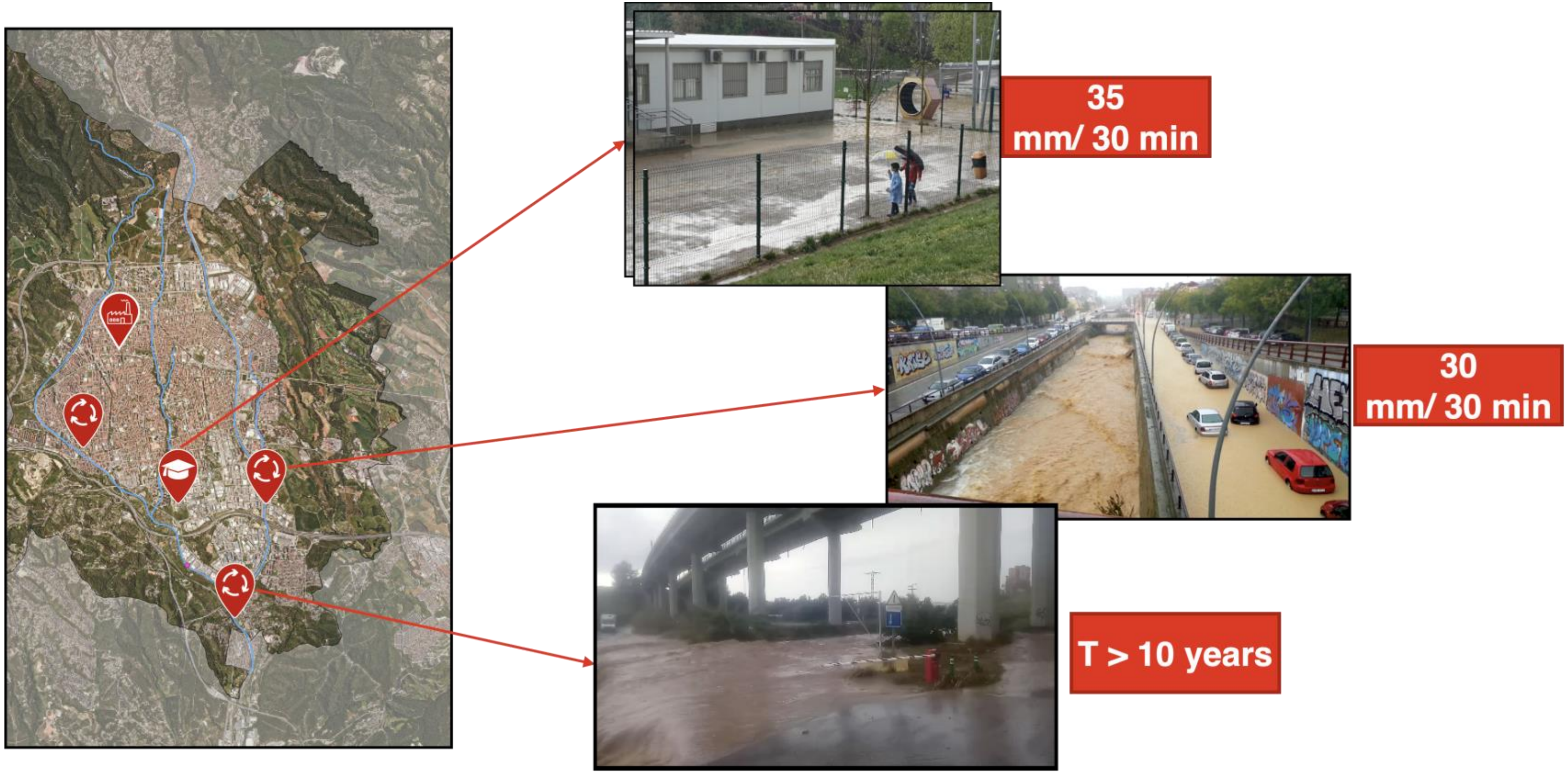
In a Climate Change Scenario



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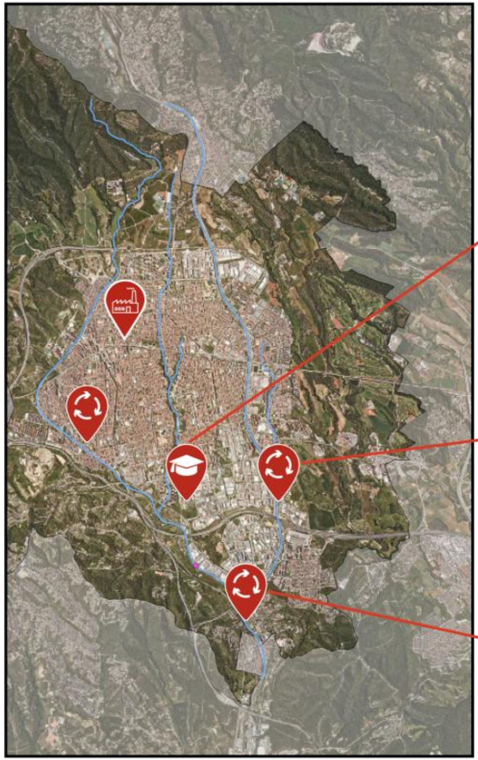
In a Climate Change Scenario



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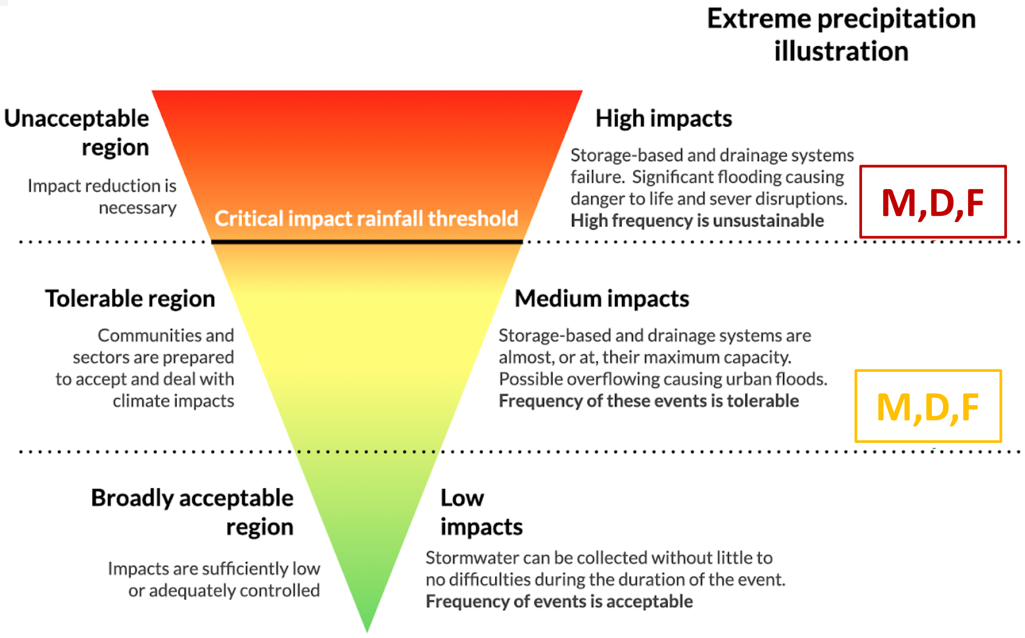
Heavy rainfall workflow: Structure

1 **Guidance on developing critical rainfall thresholds**

In terms of **M**agnitude (mm), **D**uration (hrs) and **F**requency (T/return period)



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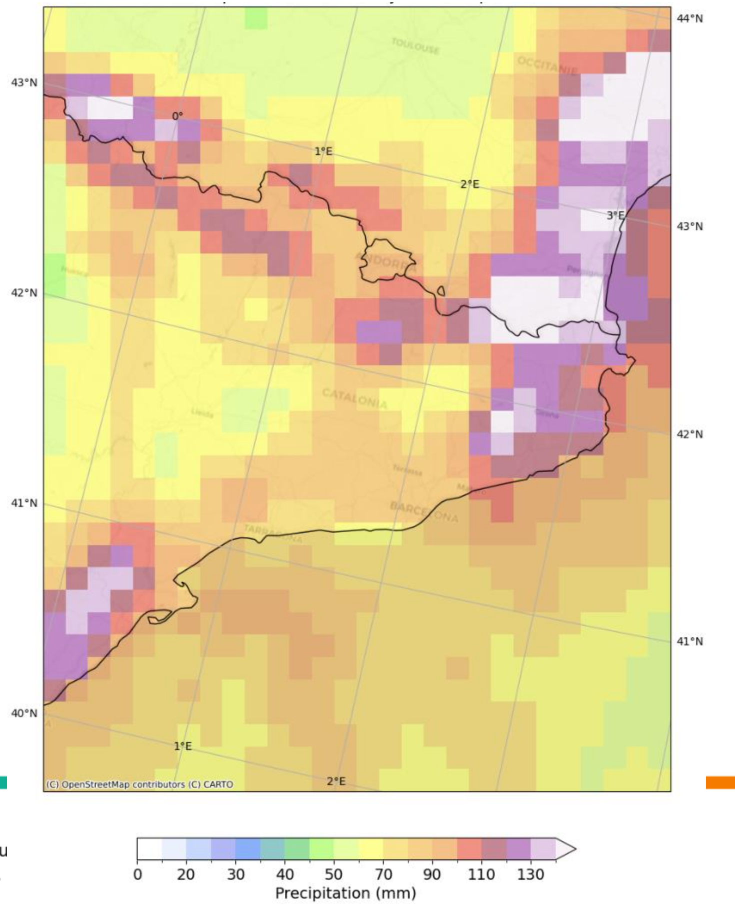
Heavy rainfall workflow: Structure

1. **Guidance on developing critical rainfall thresholds**
   In terms of **M**agnitude (mm), **D**uration (hrs) and **F**requency (T/return period)

2. **Calculating expected precipitation for different durations and frequencies**
   For current and future climate scenarios based on CORDEX

24-hour (**D**) Precipitation (**M**) for a 10-year return period (**F**) [1976-2005]



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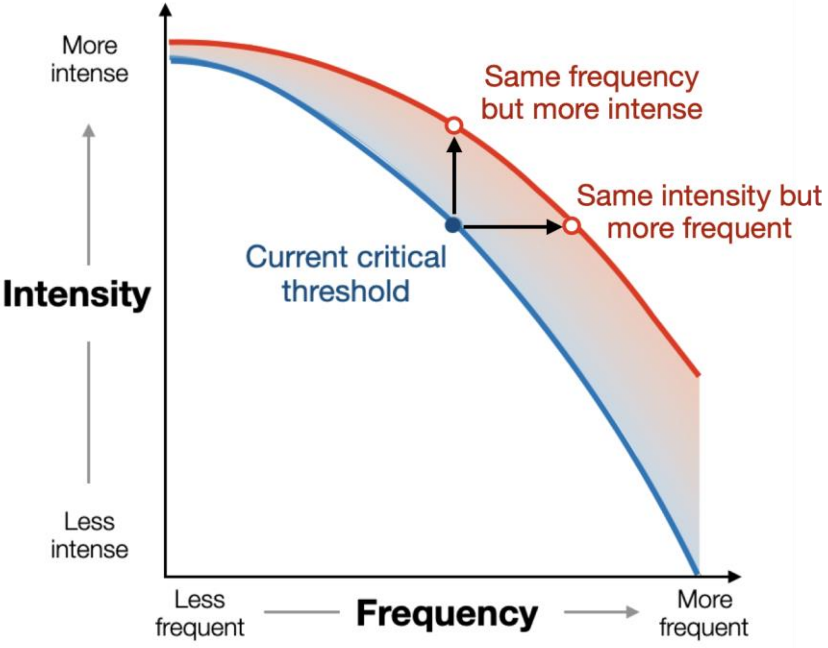
Heavy rainfall workflow: Structure

What will be the new return period (or frequency) for 100mm/24 hours in 2070?

1. **Guidance on developing critical rainfall thresholds**
   In terms of **M**agnitude (mm), **D**uration (hrs) and **F**requency (T/return period)

2. **Calculating expected precipitation for different durations and frequencies**
   For current and future climate scenarios based on CORDEX

3. **Assessment of threshold changes under climate scenarios**



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Are Rainfall warning levels ready for climate change?

A Case Study in Catalonia, Spain

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- Catalonia is highly vulnerable to extreme rainfall events
- The Meteorological Service of Catalonia (SMC) issues warnings for Dangerous meteorological Situations due to rainfall using two critical thresholds:

Low risk	High risk
100 mm/24 hours	200 mm/24 hours

How will these critical rainfall thresholds vary in the context of climate scenarios?

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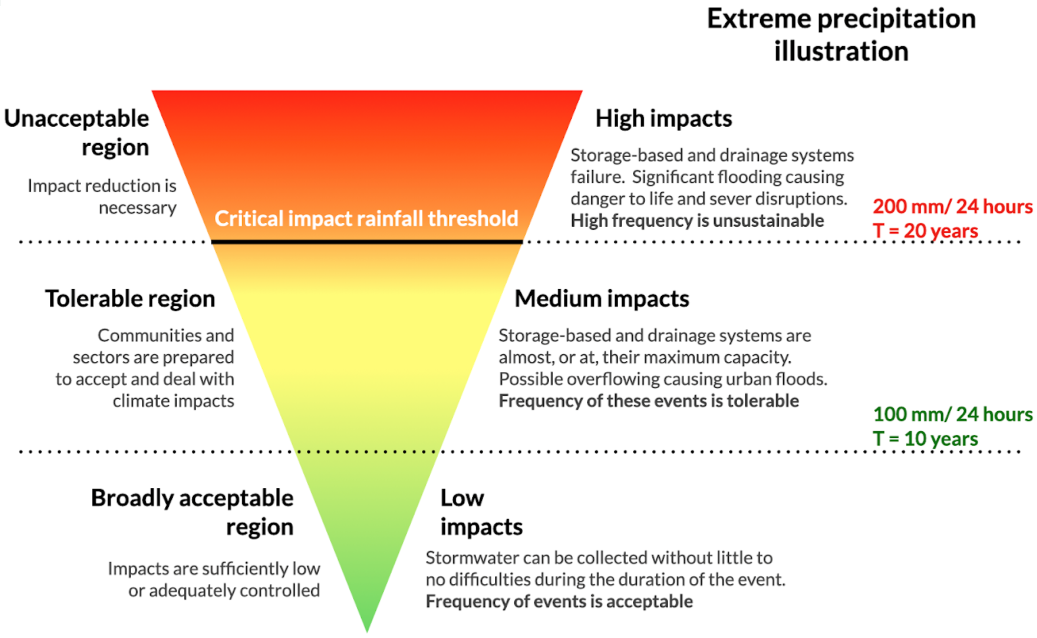
Heavy rainfall workflow: Structure

1 **Guidance on developing critical rainfall thresholds**

In terms of **M**agnitude (mm), **D**uration (hrs) and **F**requency (T/return period)



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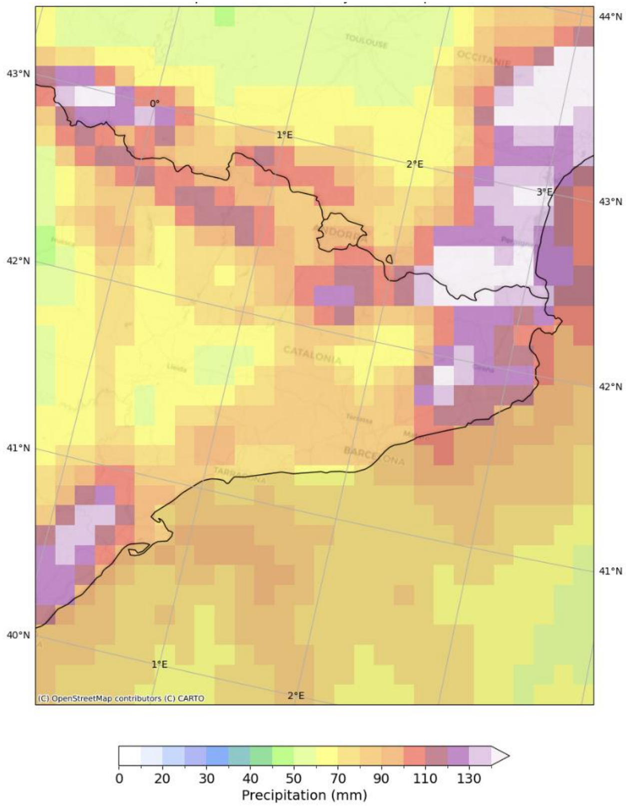
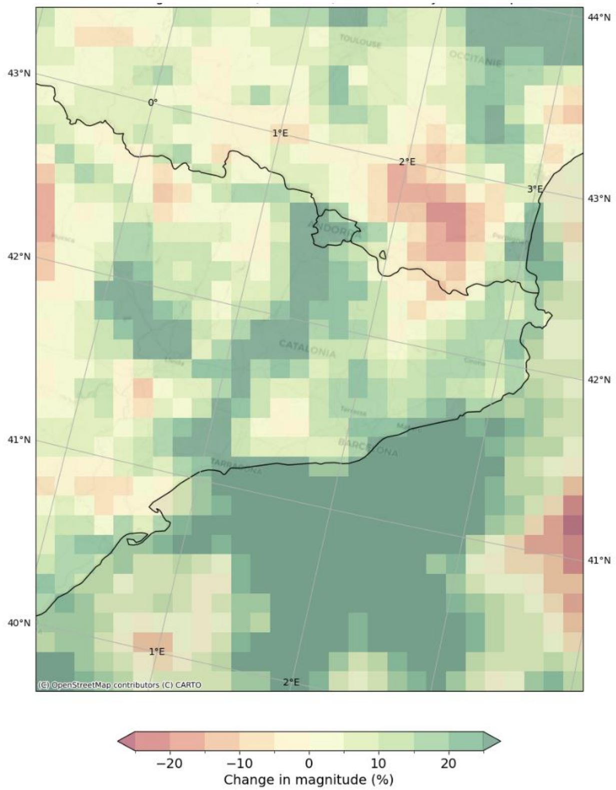
2 Calculating expected precipitation for different durations and frequencies

For current and future climate scenarios based on CORDEX

24-hour (**D**) Precipitation (**M**) for a 10-year return period (**F**) [1976-2005]



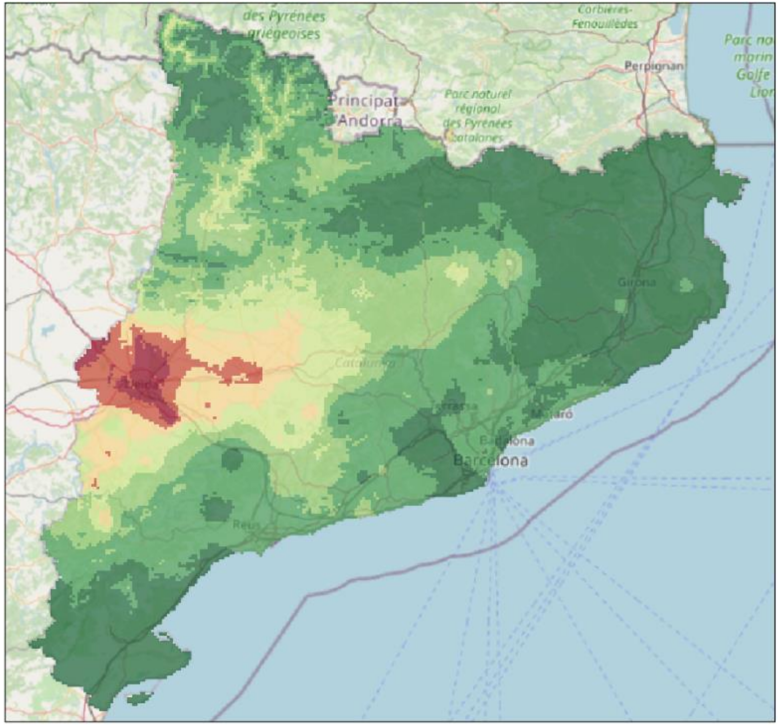
24-hour (**D**) Precipitation (**M**) for a 10-year return period (**F**) - Relative magnitude shift [2005 vs 2070]



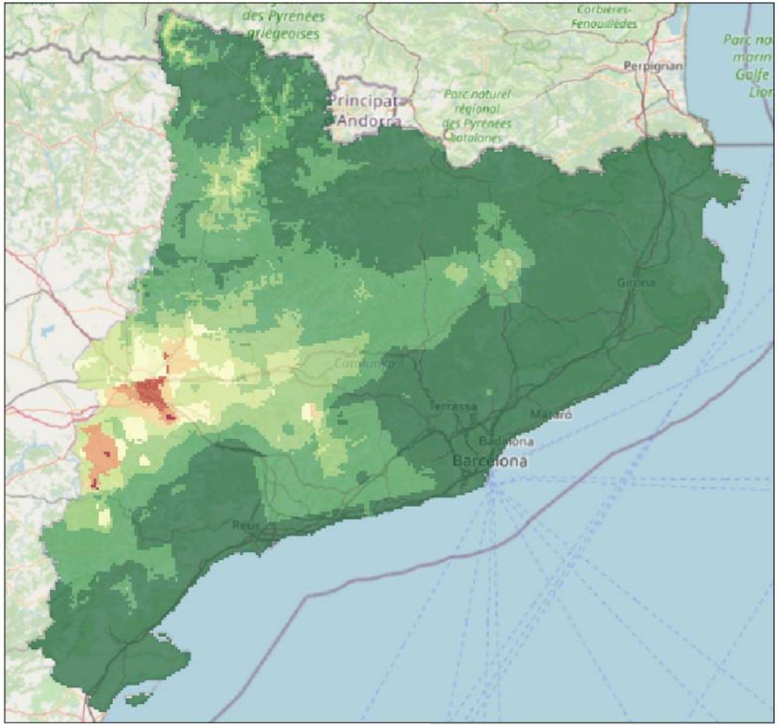
3 Assessing changes under climate scenarios

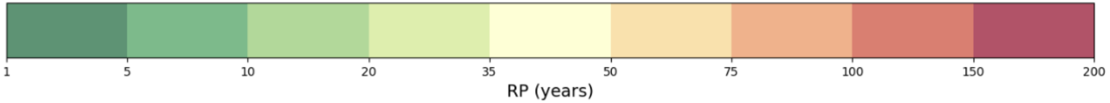
For current and future climate scenarios based on CORDEX

Return periods (**F**) for 100 mm/ 24 hours (**M/D**) [**1976-2005**]



Return periods (**F**) for 100 mm/ 24 hours (**M/D**) [**2041-2070, RCP 85**]

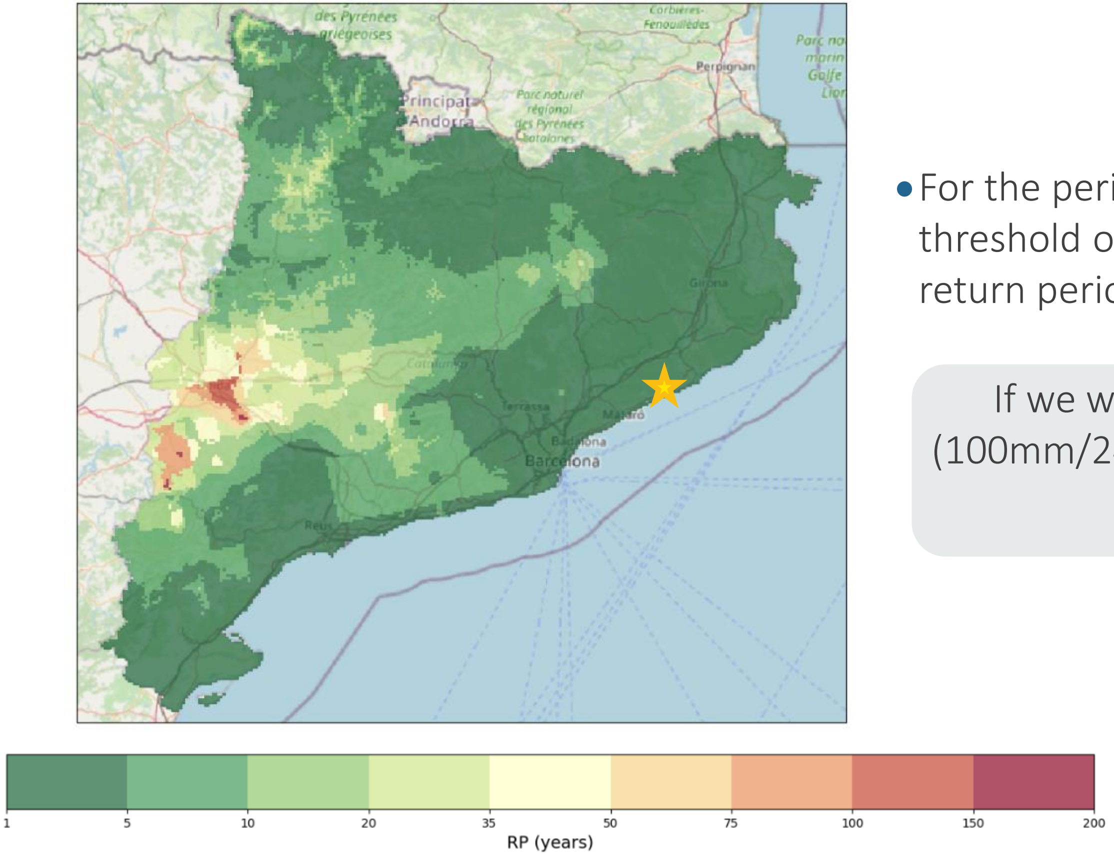




3 Assessing changes under climate scenarios

For current and future climate scenarios based on CORDEX

Return periods (**F**) for 100 mm/ 24 hours (**M/D**) [**2041-2070, RCP 85**]



Blanes

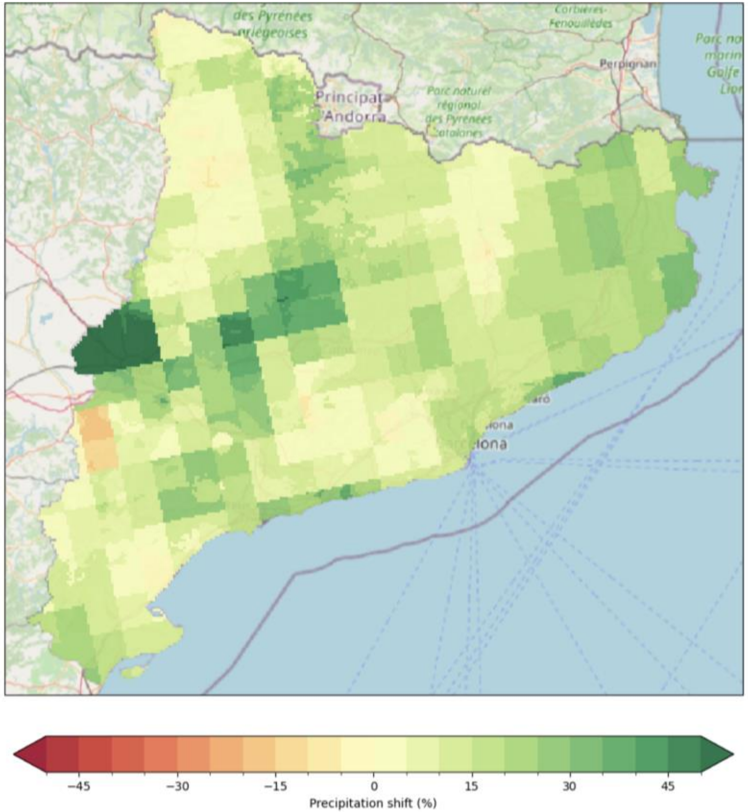
- For the period of 2041-2070, the critical rainfall threshold of 100 mm/24 hours, associated with a 5-year return period:

If we want to maintain the current magnitude (100mm/24 hours), the return period (F) **will change from 5 to 3 years**

3 Assessing changes under climate scenarios

For current and future climate scenarios based on CORDEX

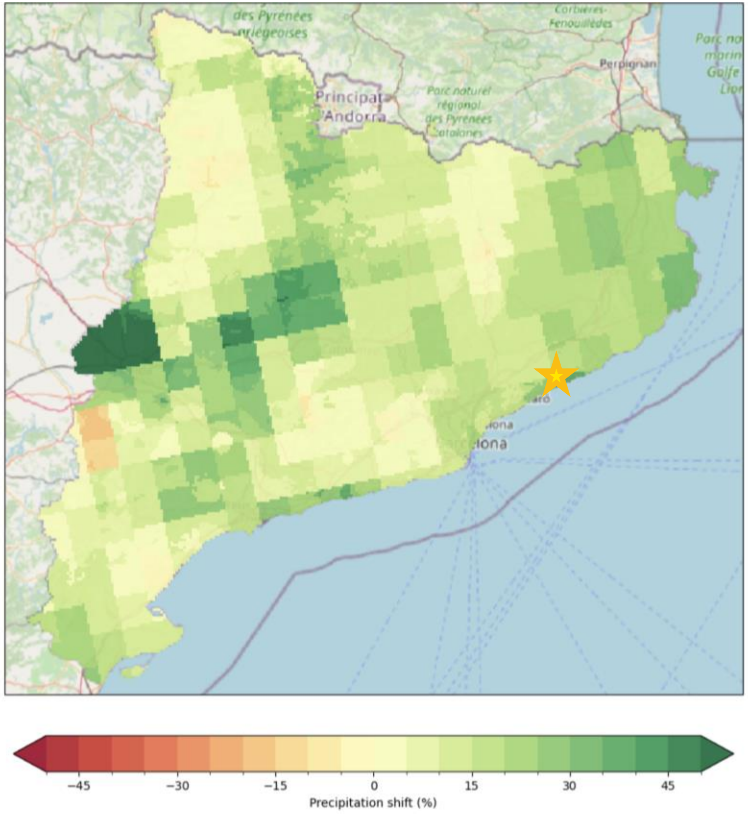
Relative magnitude shift [**2005 vs 2070**] for 100 mm/24 hours



3 Assessing changes under climate scenarios

For current and future climate scenarios based on CORDEX

Relative magnitude shift [**2005 vs 2070**] for 100 mm/24 hours



Blanes

- For the period of 2041-2070, the critical rainfall threshold of 100 mm/24 hours, associated with a 5-year return period:

If we want to maintain the same return period (frequency), the magnitude **will increase** by **19%** from the current magnitude (100/24 hours)

Q&A SESSION

Handbook webinar
4 July 2024

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Thanks!

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