is-enes
INFRASTRUCTURE FOR THE EUROPEAN NETWORK FOR EARTH SYSTEM MODELLING

IS-ENES3 C&E Europe
Autum School
November 2022

Climate Services

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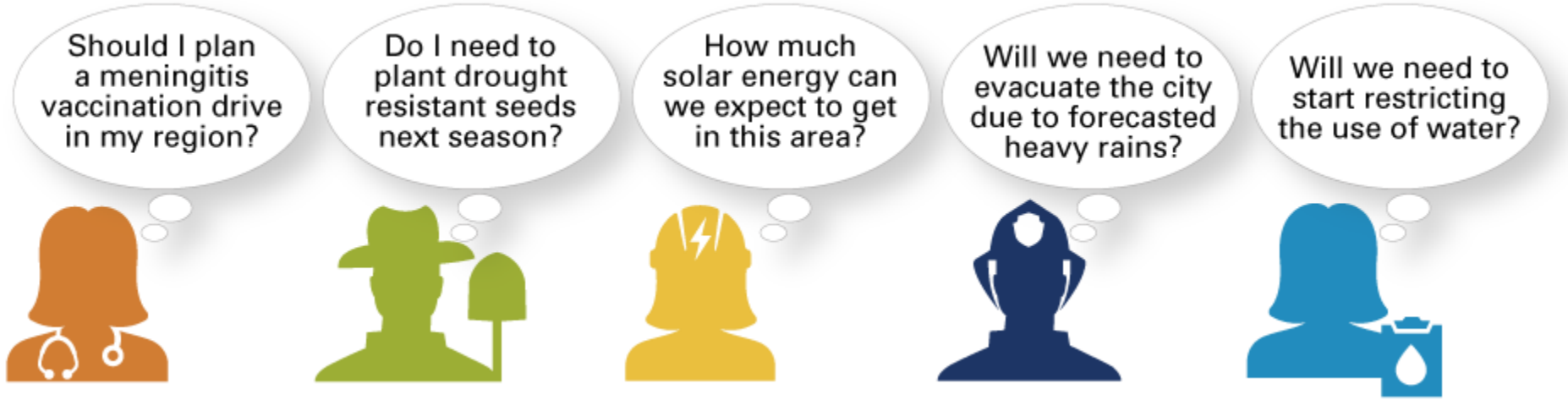
29 November 2022

The IS-ENES3 project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824084

What are climate services?

Climate services provide climate information to help individuals and organizations make climate smart decisions



Source: Global Framework for Climate Services

Climate Services

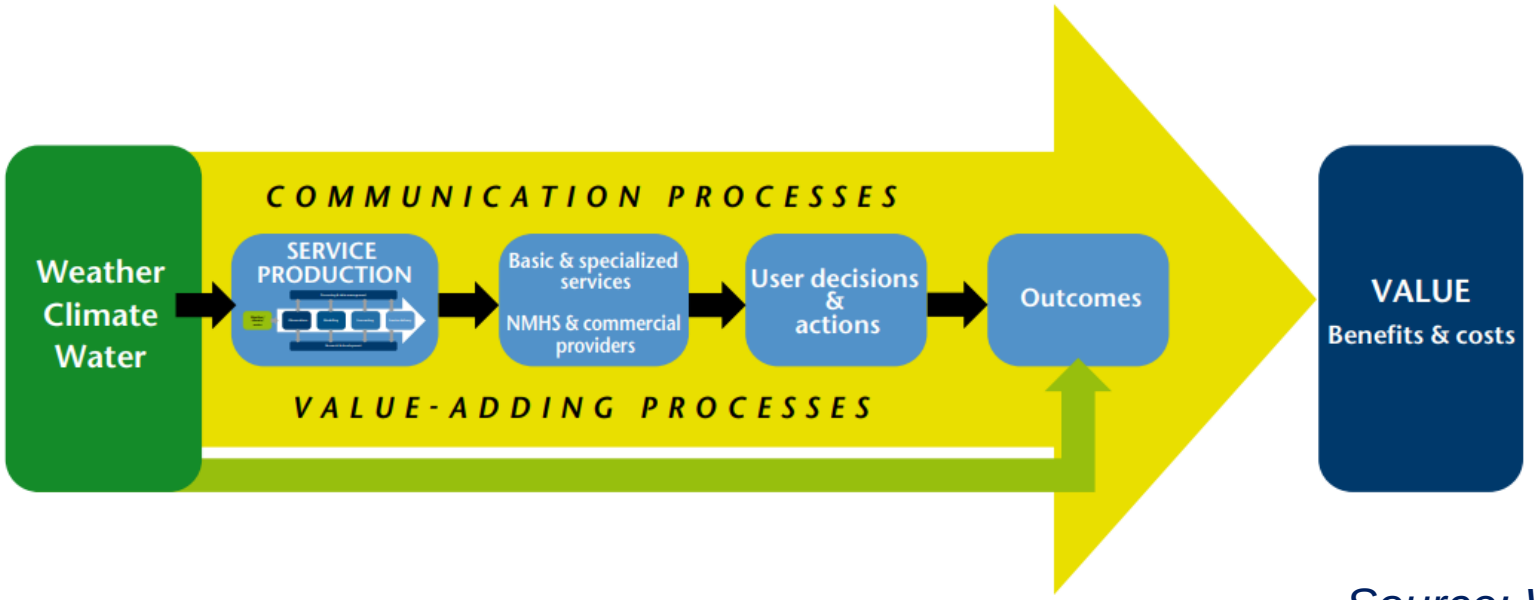
- Just providing climate data or information is not enough!
- As with weather forecasts, the value of climate data and climate impact assessment lies in the extent that they lead to actions or inform decisions
- Of course, easy access to data is part of this

Source: The E-nvironmentalist

Value chain

Ideally, users benefit from the information that weather/climate services provide

- Increase wellbeing or economic output
- Avoid harm



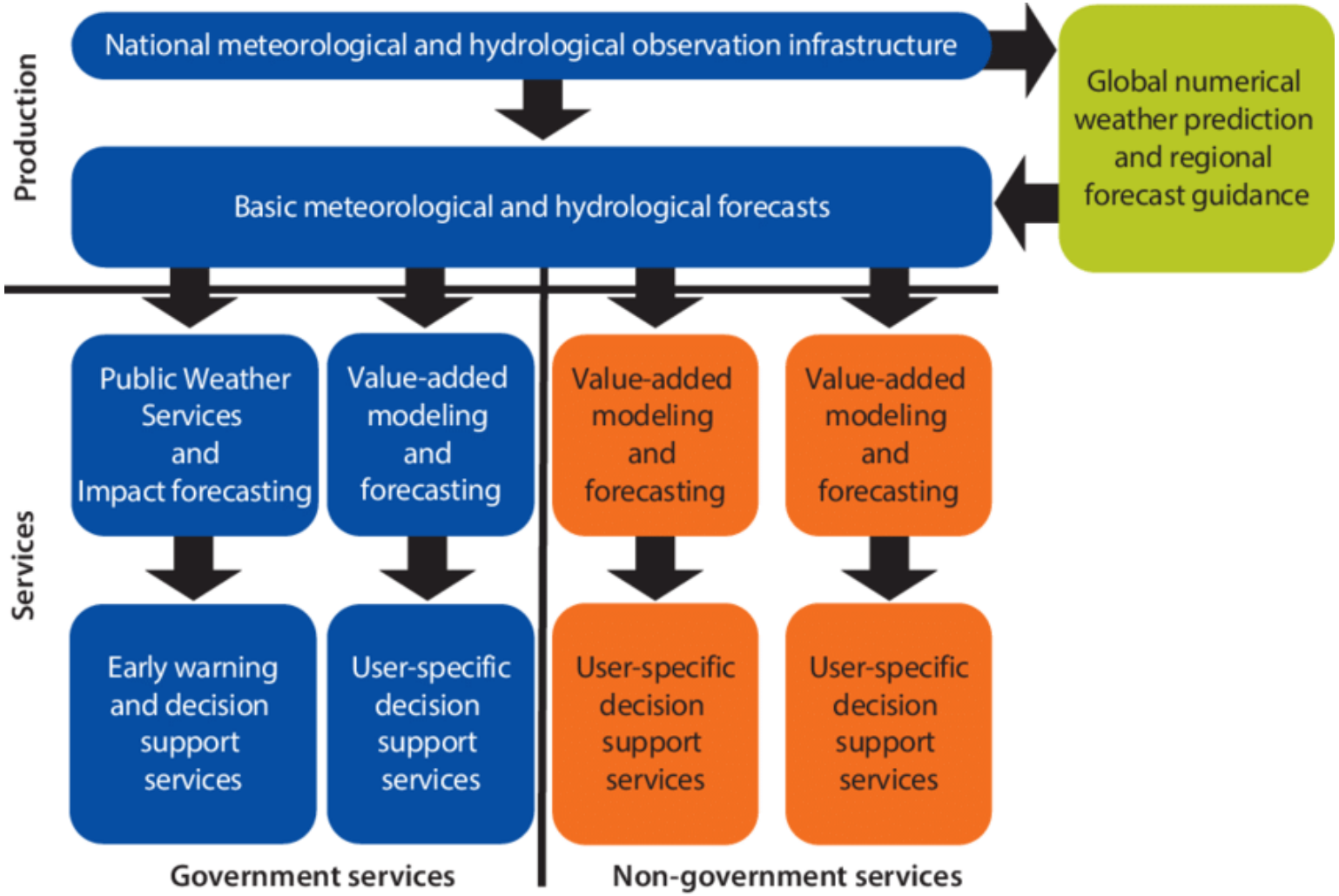
Source: WMO, 2015

Value chain (2)

Weather and climate services value chains have different components...

...and different players

Division of responsibilities may be different in each country



Source: World Bank, 2013

Who are the users?

- What decisions are (or can be) supported by weather/climate information? Who make these decisions? What other stakeholders are involved?
- Stakeholders are *"those who have interests in a particular decision, either as individuals or as representatives of a group. This includes people who influence a decision, or could influence it, as well as those affected by it"* (Hemmati, 2002)
- Stakeholder analysis or mapping: identify the key stakeholders among all possible stakeholders
- Users are stakeholders, but not all stakeholders are users

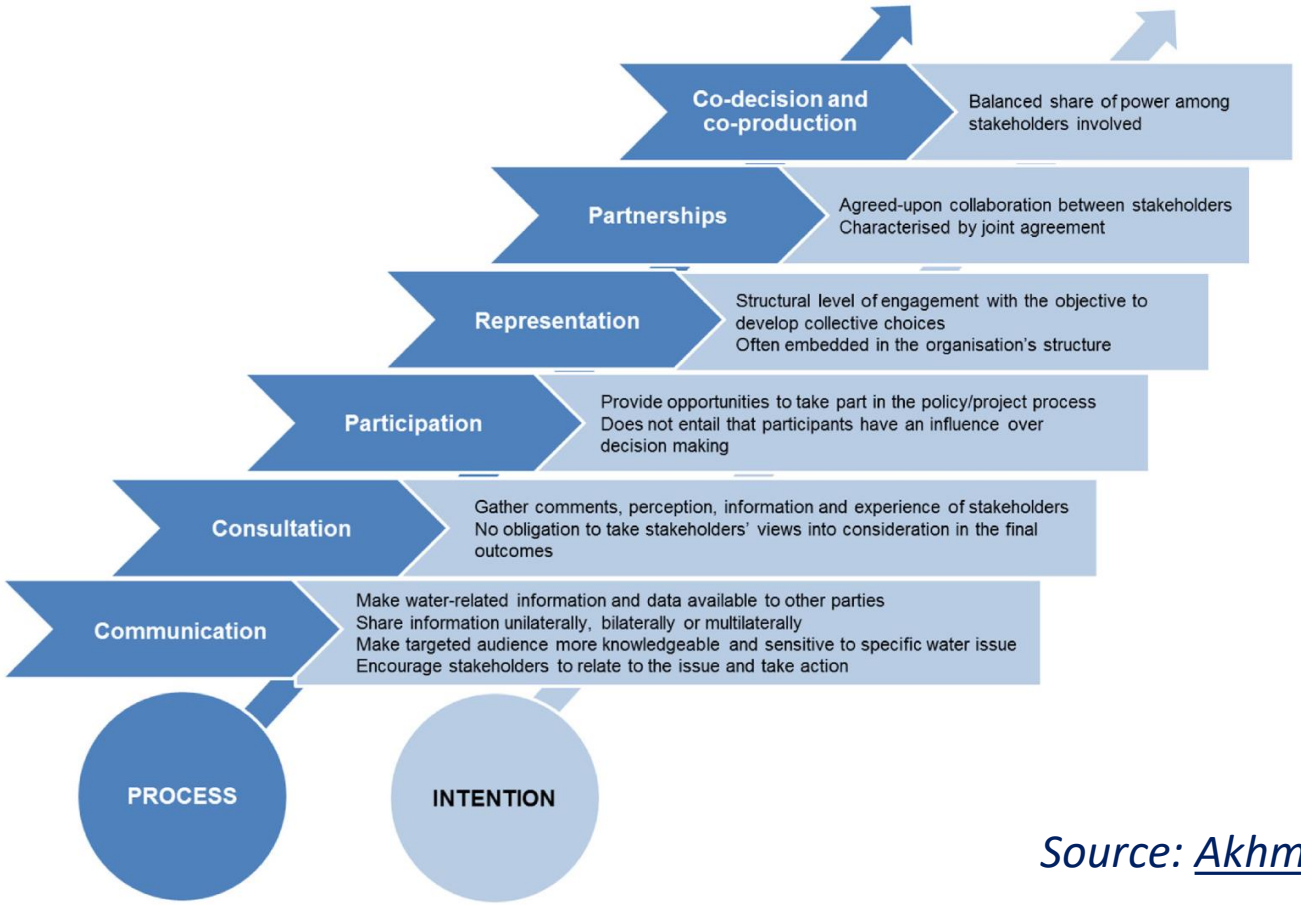
Who are the users?

Examples of actors, users and stakeholders

Source: PreventionWeb

Stakeholder engagement

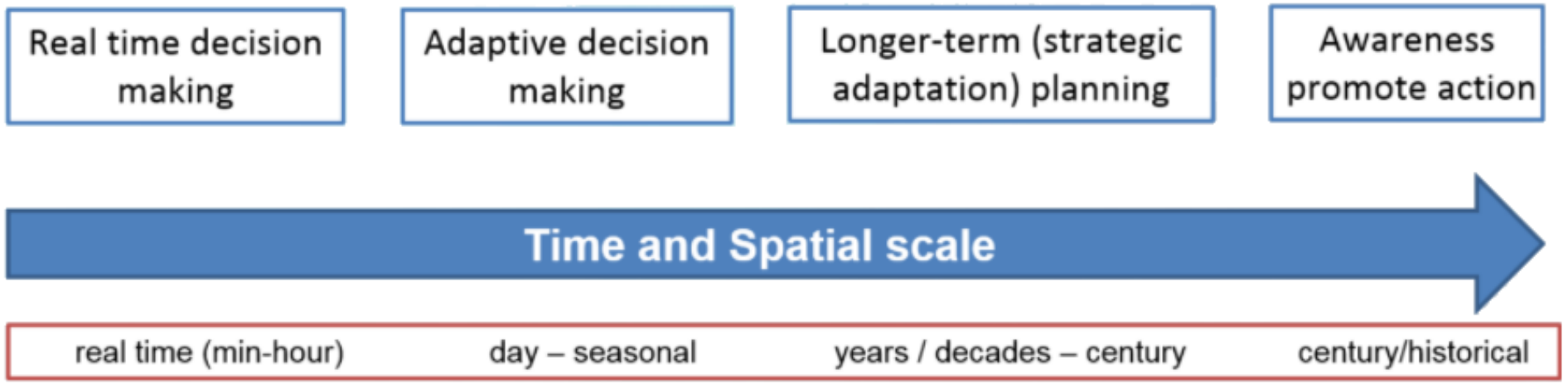
Levels of user/stakeholder engagement range from *one-way flow of information* to *full integration into the production or decision-making process*



Source: Akhmouch & Clavreul, 2016

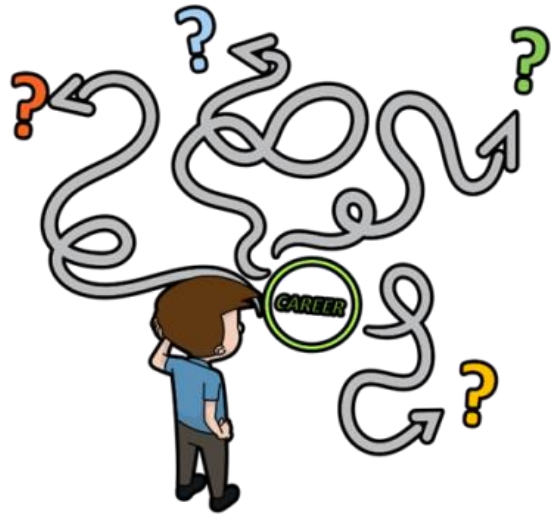
Types of decision

- Different types of decision will require different types of information



Modified from: Copenhagen Institute of Interaction Design

Types of Climate Services



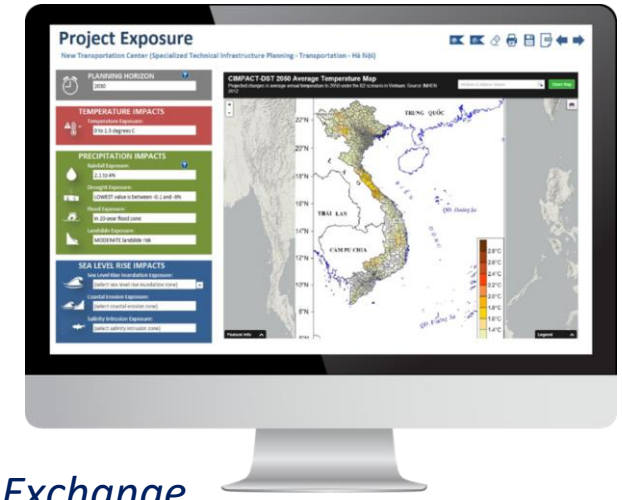
Climate services can be grouped in many different ways:

- Sector
  - e.g., agriculture, energy, utilities, transportation,...
- Type of user
  - e.g., policy makers, urban planners, small businesses, ...
- Type of product delivered
  - e.g., basic climate data, information on impacts of climate change, tools for visualisation of information,...
- Type of provider
  - e.g., NHMSs, public organisations, universities, research institutes, private companies...

Source: Bessembinder et al., 2019

Types of information

- Primary climate data / ECVs
  - e.g., change in maximum temperature
- ‘Impact-relevant’ data
  - e.g., number of heatwave days
- Impact data
  - e.g., expected morbidity and excess mortality due to high temperatures
- Decision support system



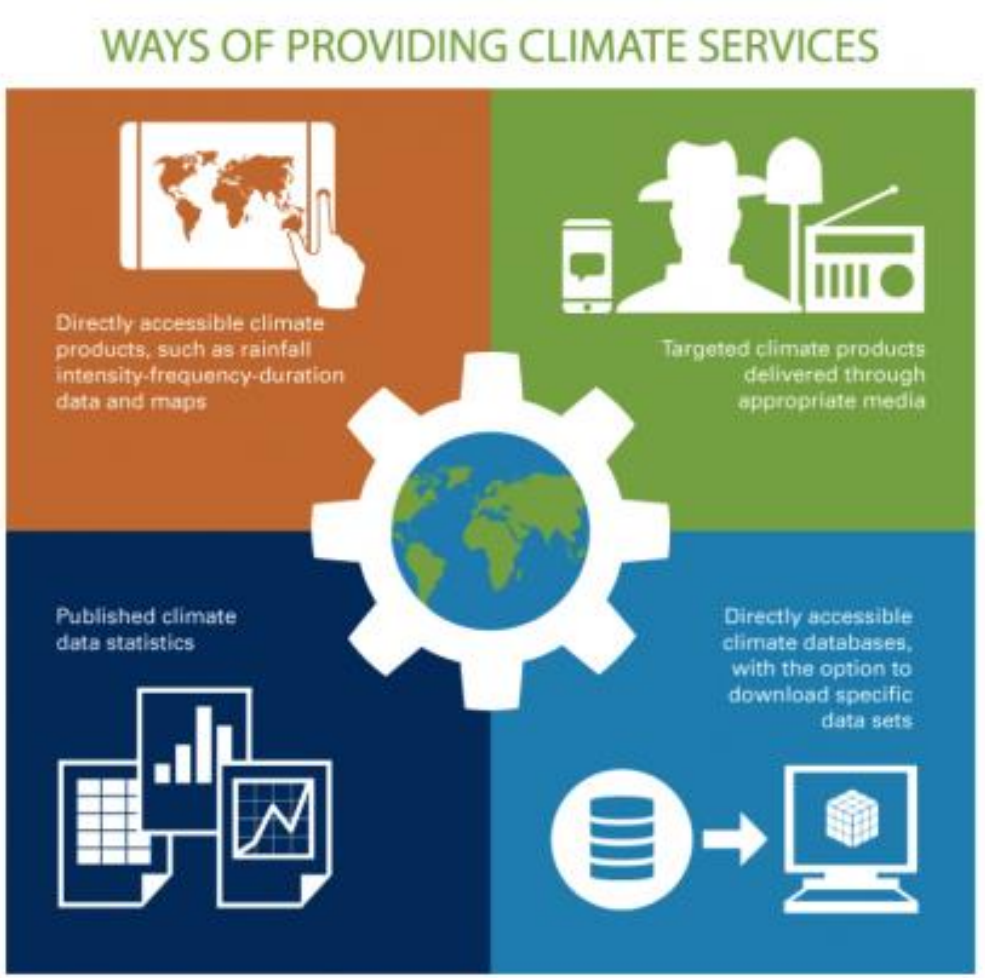
Source: Climate Adaptation Knowledge Exchange

Types of delivery

The method of providing climate information has to fit the users' needs and context

- For example, rural communities in developing countries may not have access to internet

Source: CGIAR

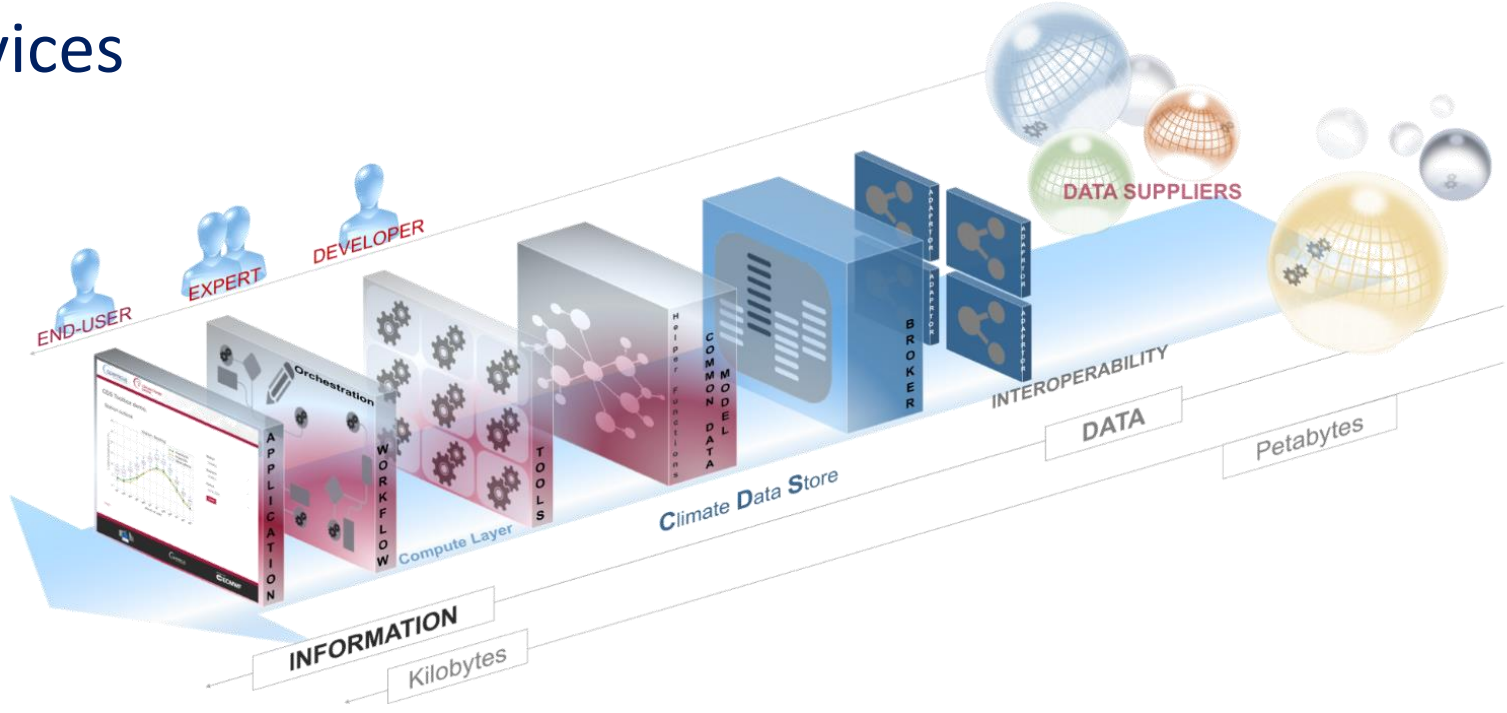


Source: WMO, 2017

Examples of Climate Services

Copernicus Climate Change Service (https://climate.copernicus.eu/)

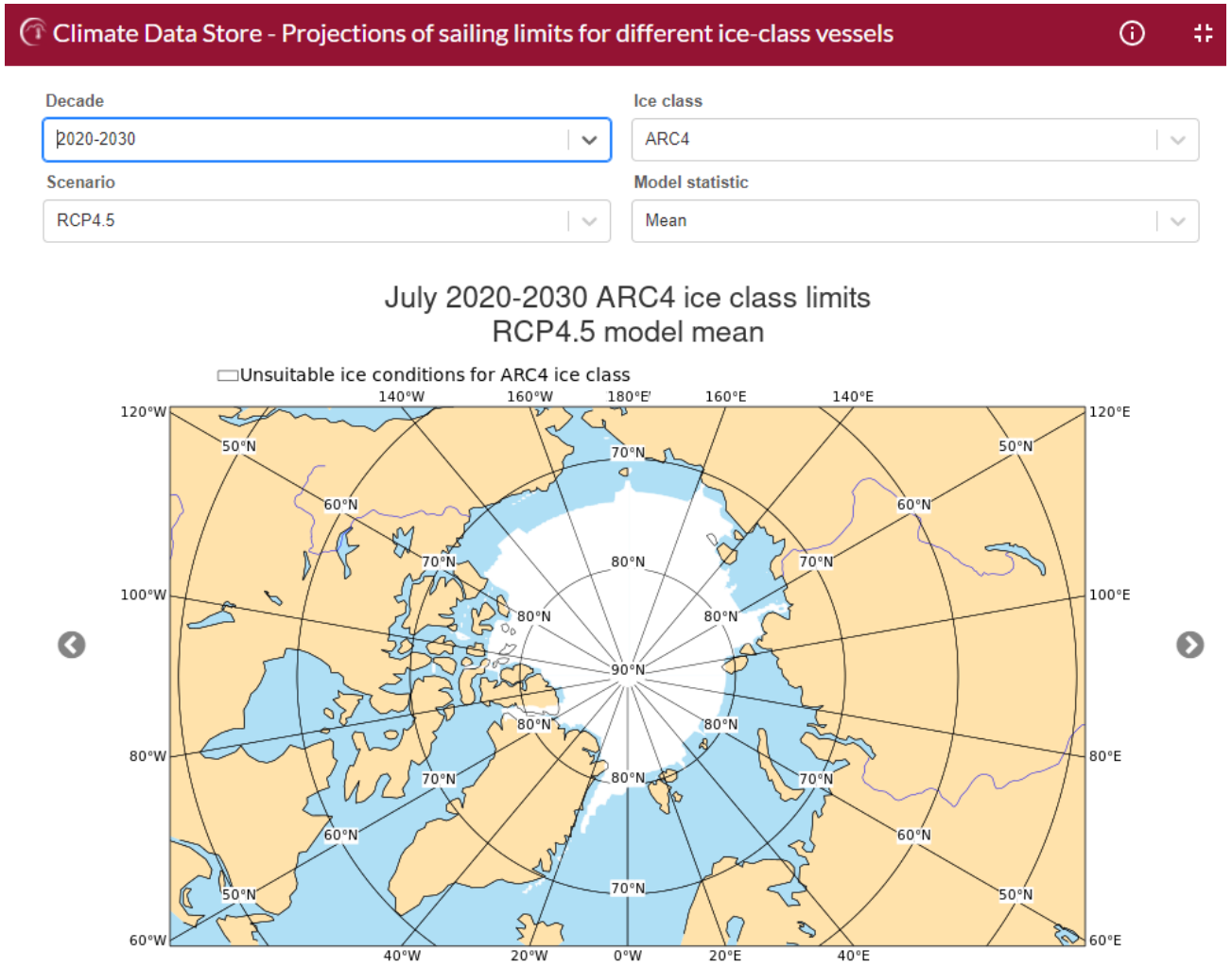
- Part of the EU's Copernicus programme
- Aim is to open up data for the benefit of multiple end users
- Key part is the climate data store
- Sectoral information services



Examples of Climate Services

Copernicus Climate Change Service (https://climate.copernicus.eu/)

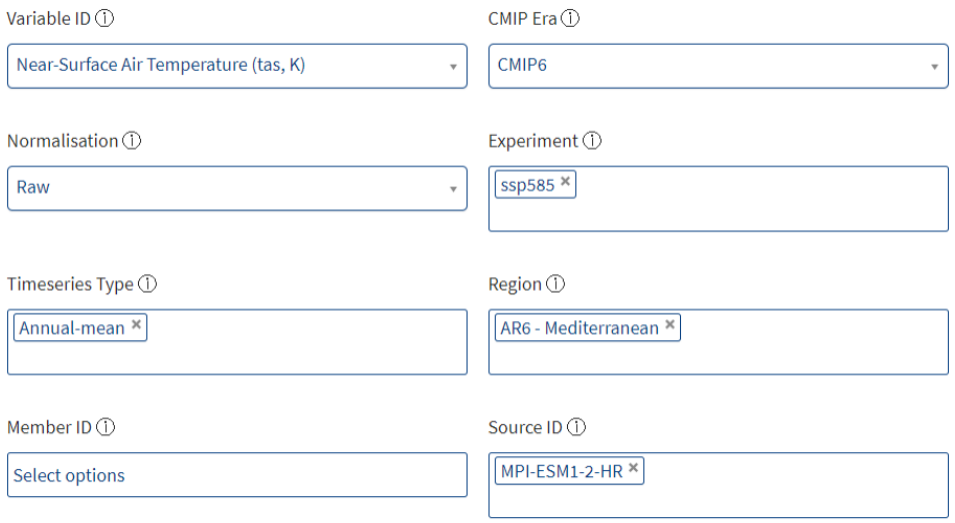
- Access to climate data
- Pre-processed data and indicators
- Applications allowing users to explore data in a user-friendly way
- Applications providing sector-specific information

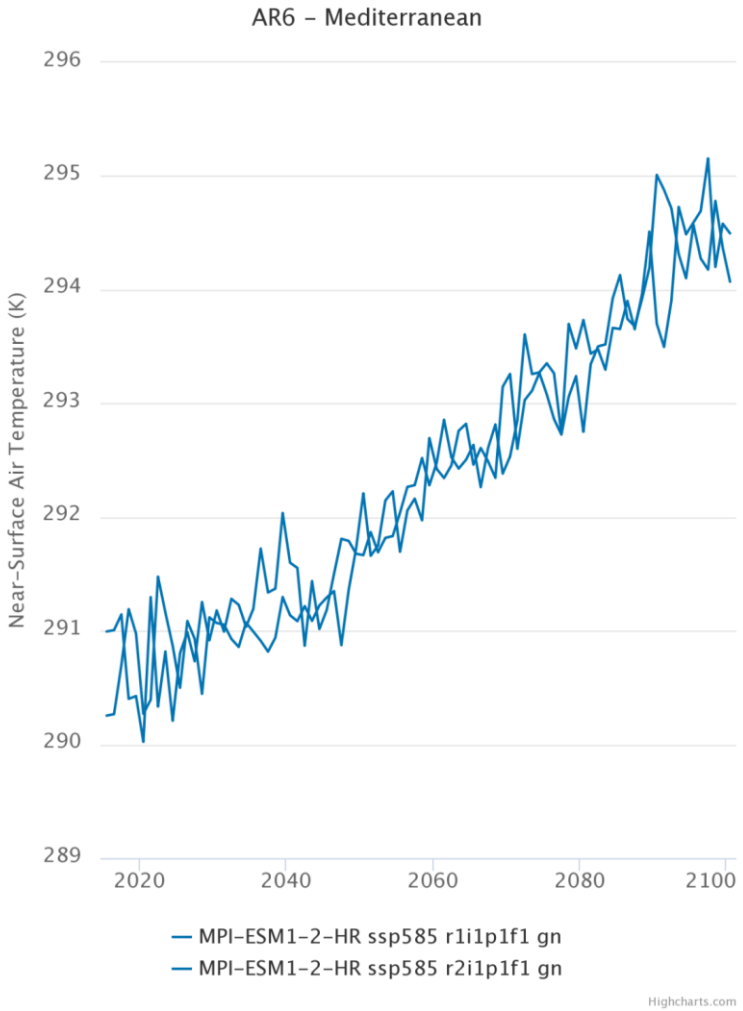


Examples of Climate Services

CMIP6 Visualisation Tool (https://cmip6.science.unimelb.edu.au/)

- "Easy" visualisation of new CMIP6 scenarios
- Download regional averages in text format
- Open source python library

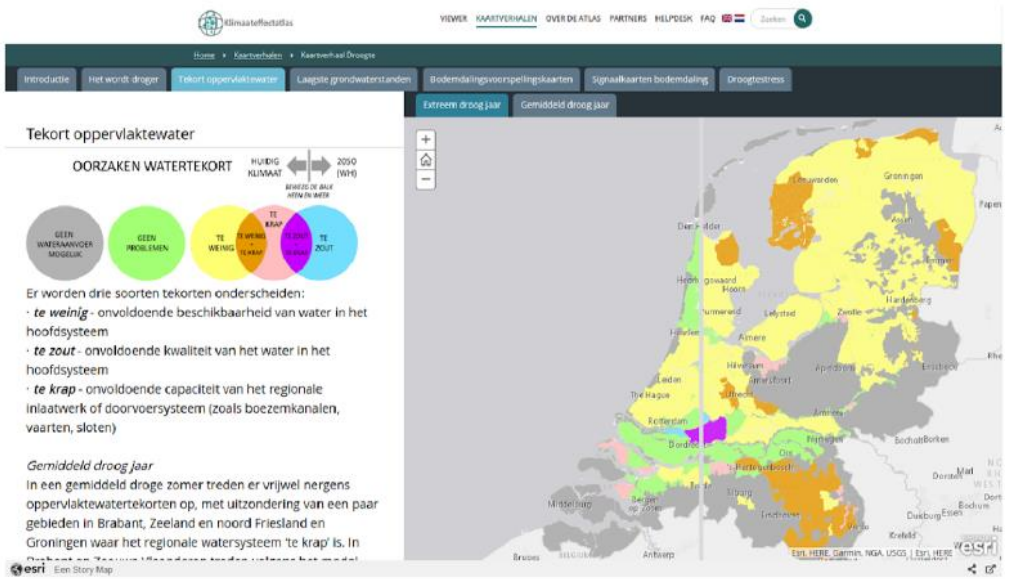




Examples of Climate Services

Klimaat Effect Atlas (https://www.klimaateffectatlas.nl/)

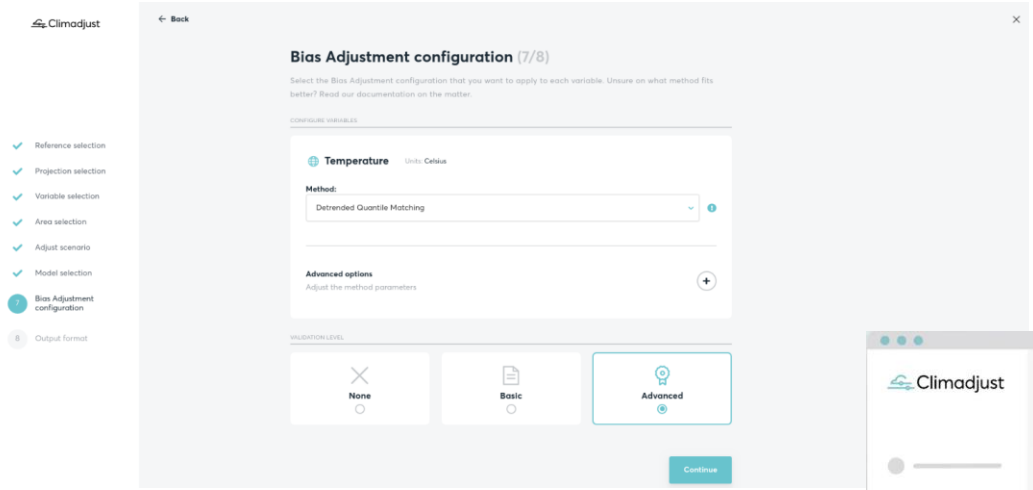
- Web portal showing climate impact information for The Netherlands
- Information on flooding, drought and heat
- Zoomable maps and storymaps, access to data layers
- Based on, and consistent with national climate scenarios

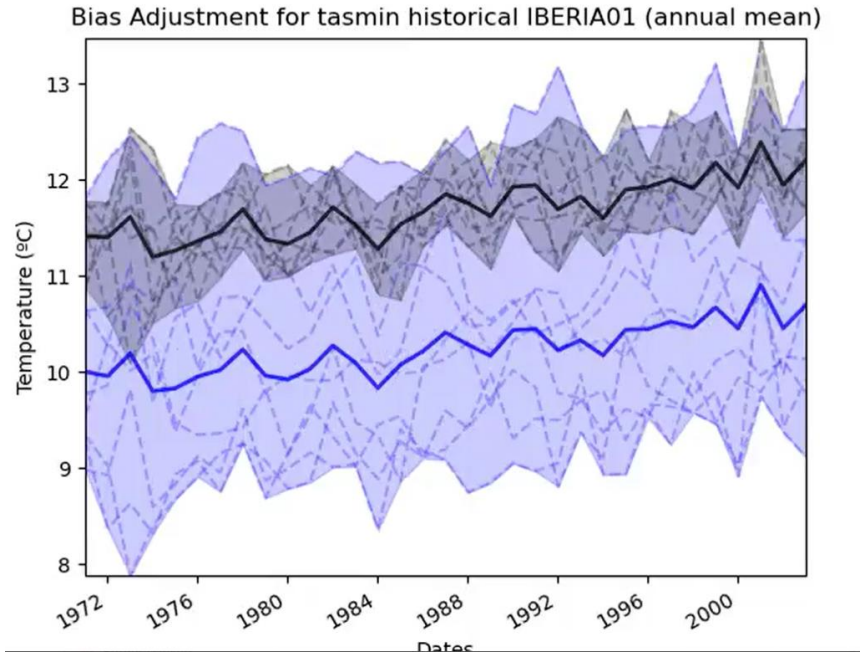


Examples of Climate Services

ClimAdjust (https://climadjust.com)

- Access to bias-corrected data from trusted sources
- Apply bias correction techniques to your own data
- Paid-for service (limited free data available)





Other examples

Many national meteorological services provide data and expertise on climate and climate change!

World Climate Service (http://worldclimateservice.com/)

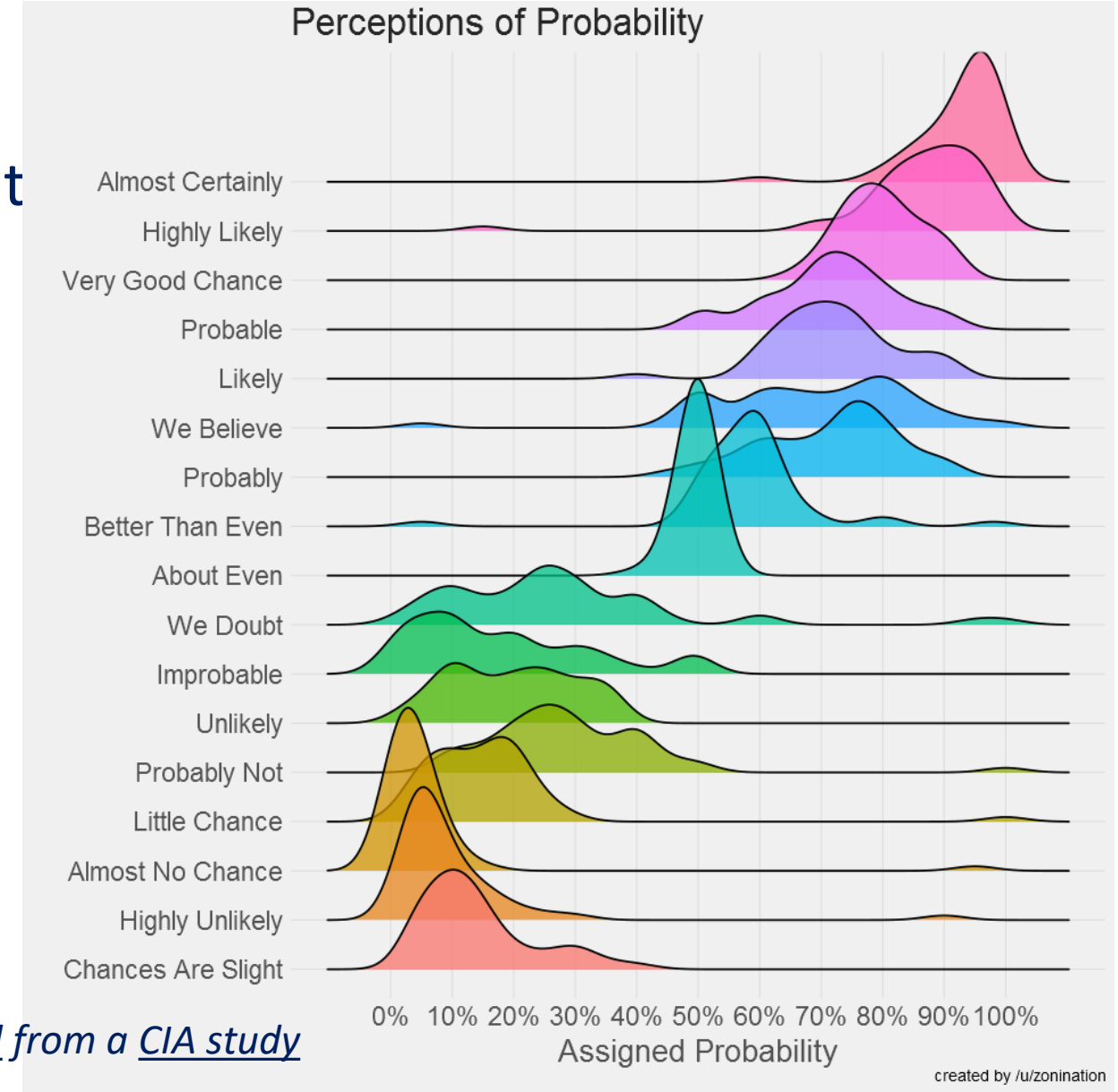
- Subseasonal to seasonal forecasts

The Climate Service (https://www.theclimateservice.com/)

- Climate Risk Analysis for corporations, financial institutions, real estate investors...

Common issues: uncertainties

- Communication of uncertainties is essential... But can also be a challenge
- People may interpret uncertainty terms differently... Even the word ‘uncertainty’ can be misunderstood!
- Similar issues have been found for likelihood statements in IPCC reports (e.g., Budescu et al., 2014)



Source: modified from a CIA study

Common issues: uncertainties

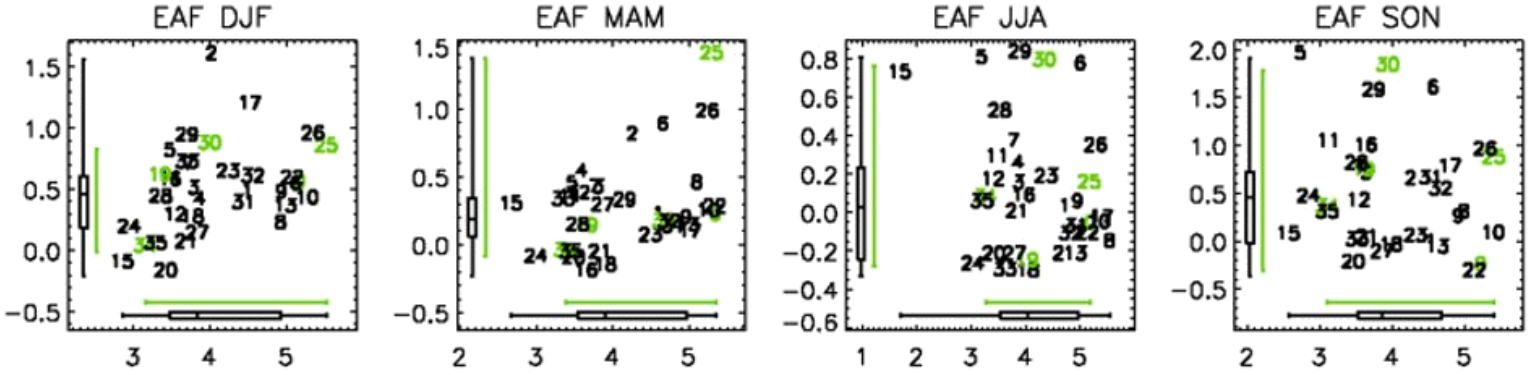
- Communicating ranges of probabilities (if known), in addition to language, may help
- Transparency about all known sources of uncertainty, including knowledge gaps and issues relating to the methodology and processing, promotes trust
- Testing the interpretation of the material by different user groups may be very insightful – but is not done often (co-production...)
- If probabilities are known (e.g., seasonal forecasts), a probabilistic cost-loss framework may improve the decision-making

Common issues: model selection

Criteria for selecting a subset of models or scenarios:

- Realism in simulating historical climate (model performance)
- Representative of spread in future projections
- Independence of models (“model family tree”)

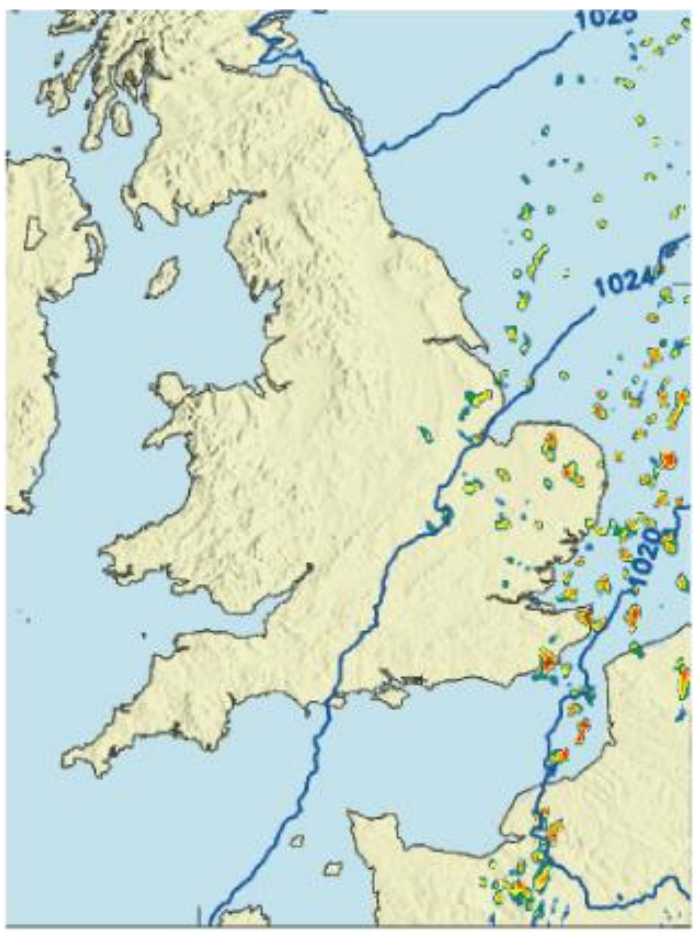
‘Optimal’ set of models will be different per region/variable.
Methods for selecting models have also been proposed in the literature.
Some C3S (in particular SIS) datasets have done the work for you.

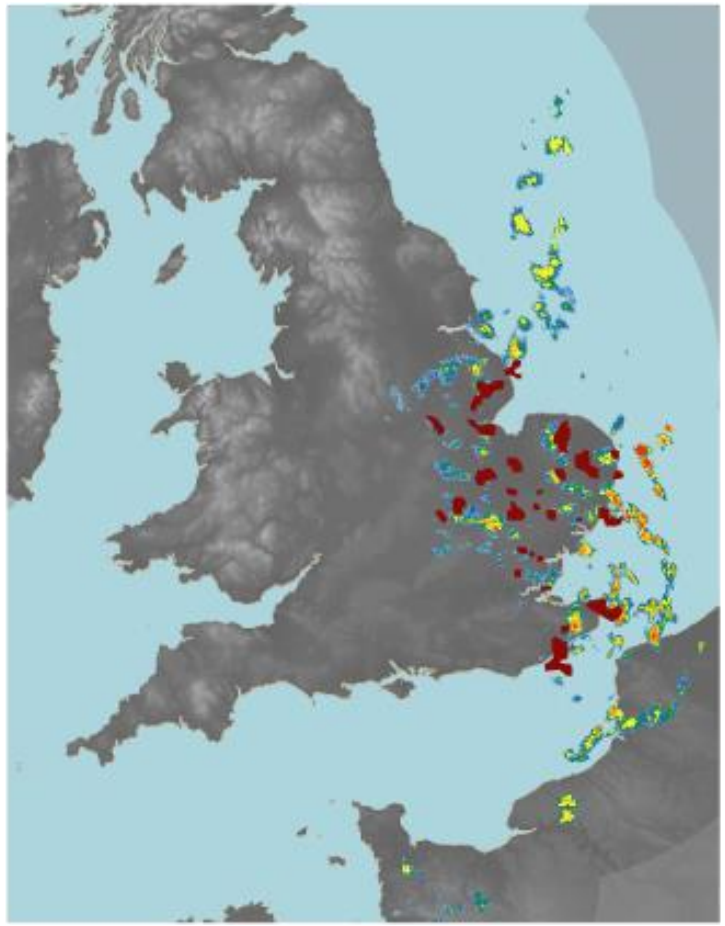


Source: *McSweeney & Jones, 2016*

Common issues: scale

- Users often want data or information for a specific location or time
- Downscaling techniques may need to be applied... But may also introduce uncertainties
- Ask for the reasons behind the requirements: are the expectations realistic? Is resolution confused with accuracy?



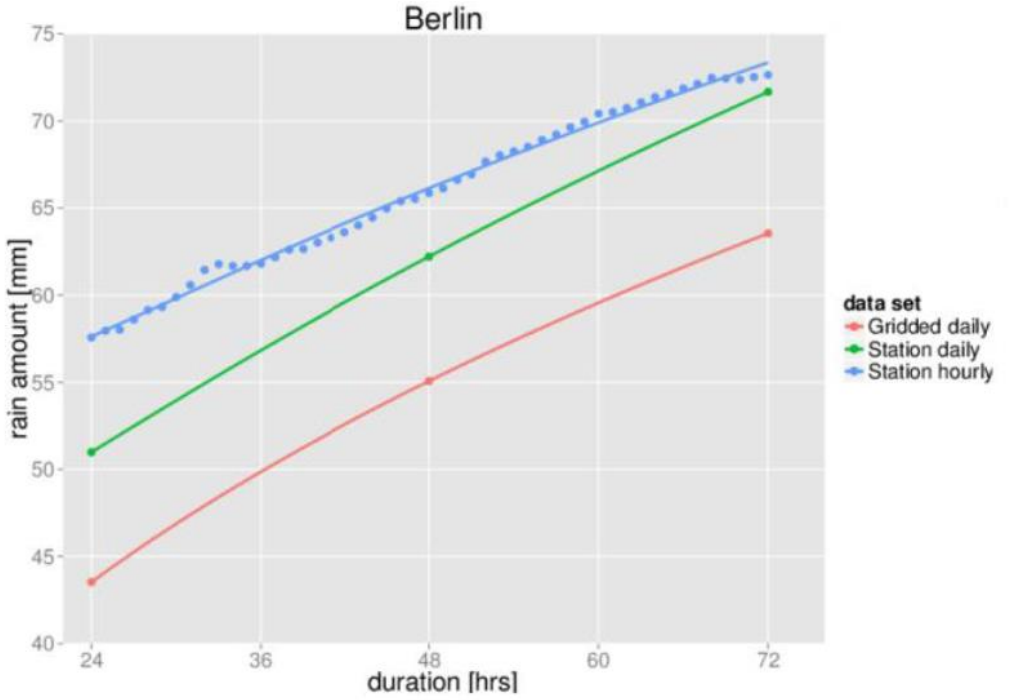


Picture courtesy of Nigel Roberts, UK Met Office

Common issues: extremes

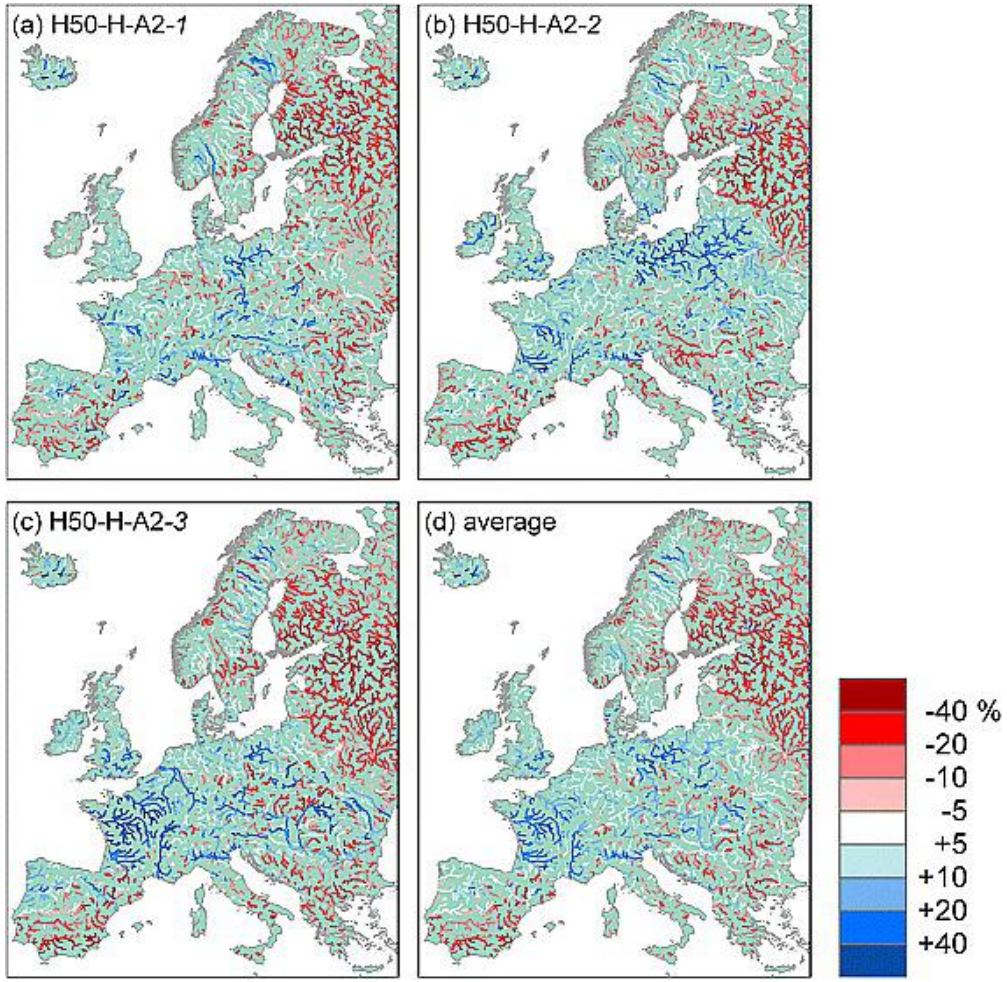
Different source data may give different results

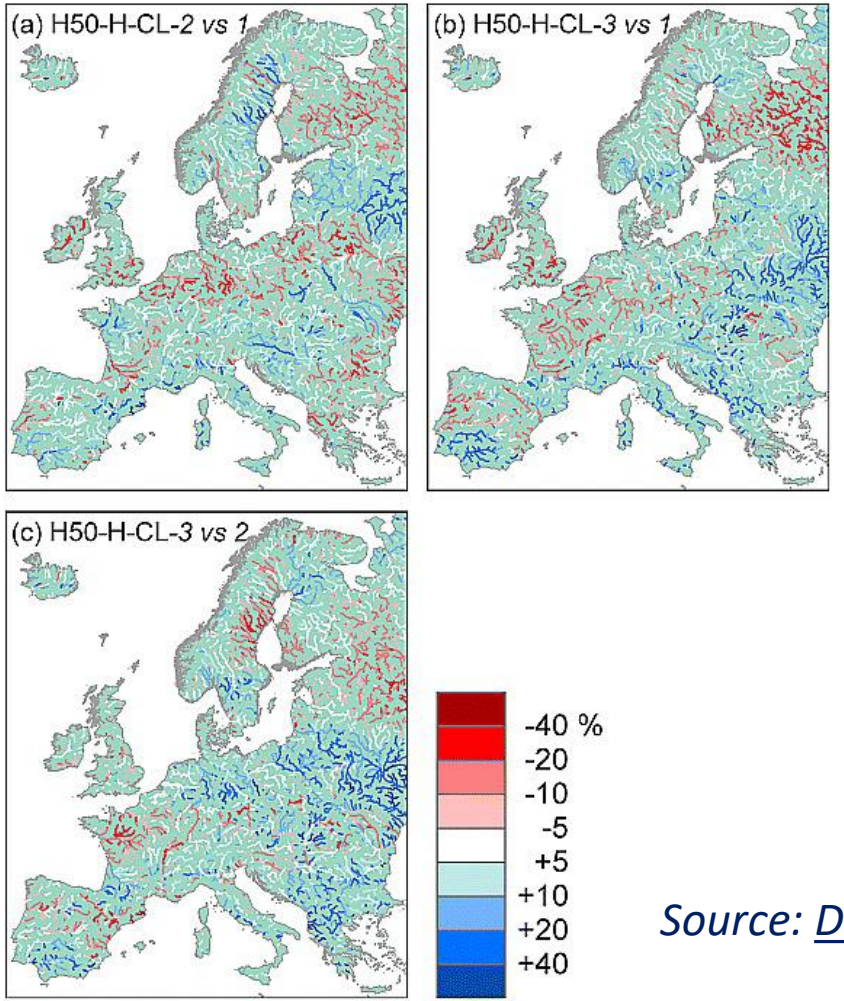
- Estimate of extreme rainfall in a 24h period from daily data is lower than estimate from hourly data
- Method used to calculate the extremes will also have an influence!



Common issues: extremes

Establishing trends in the occurrence of extreme events is very difficult!

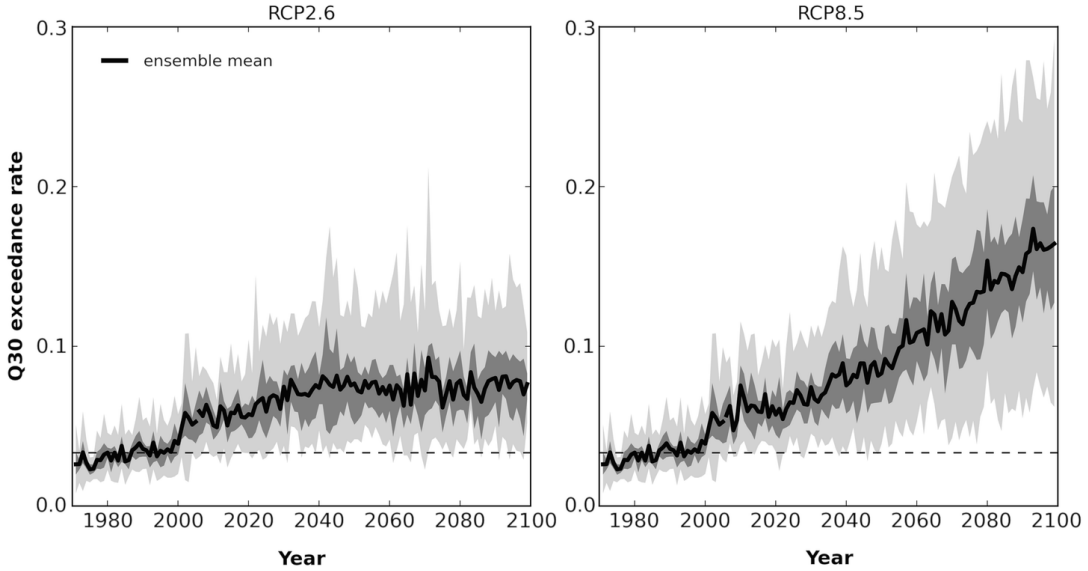




Source: Dankers & Feyen, 2009

Common issues: extremes

- Acknowledge the limitations of your data
  - Rule of thumb: 30-year timeseries can be used to robustly estimate a 30y return level, but not more extreme
- Use established methods from extreme value statistics to estimate the uncertainty range around your estimate of an extreme
- Scale up to larger regions for more robust patterns

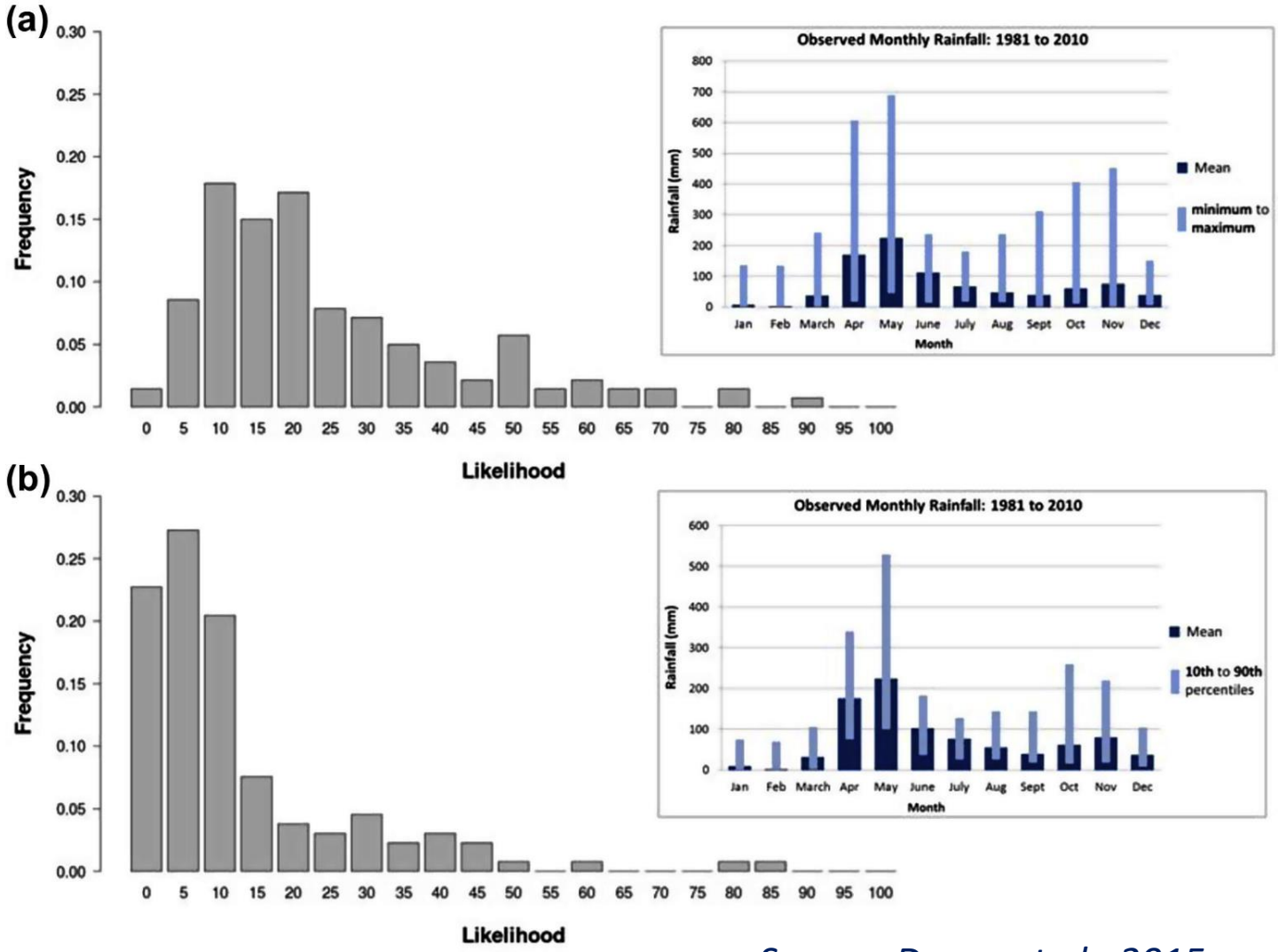


Source: Dankers & Kundzewicz , 2020

Common issues: visualisation

The choices made when visualising data, will influence the interpretation

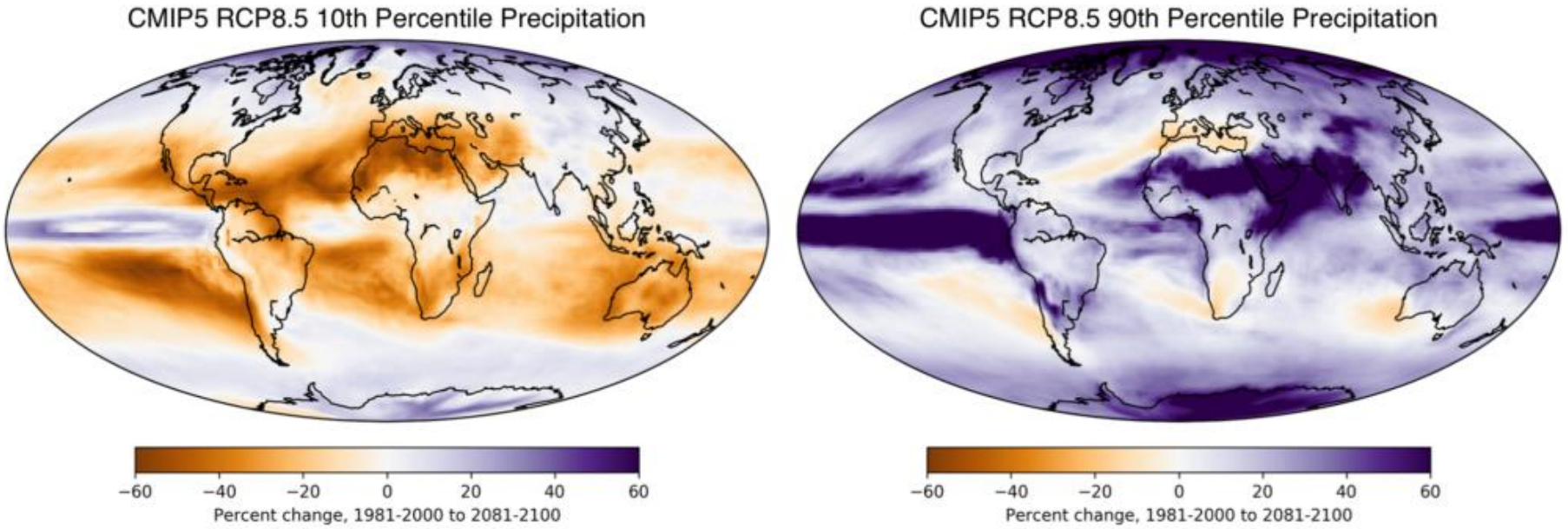
- Example: what do people think is the likelihood of April rainfall exceeding 500 mm?
- Different estimates when presented with percentiles (bottom) instead of min-max (top)



Source: Daron et al., 2015

Common issues: visualisation

- Maps showing ensemble statistics (including the mean) do, by themselves, not always show a realistic outcome
- The 90th percentile of change in mean precipitation across all CMIP5 models is unlikely to become reality *everywhere*

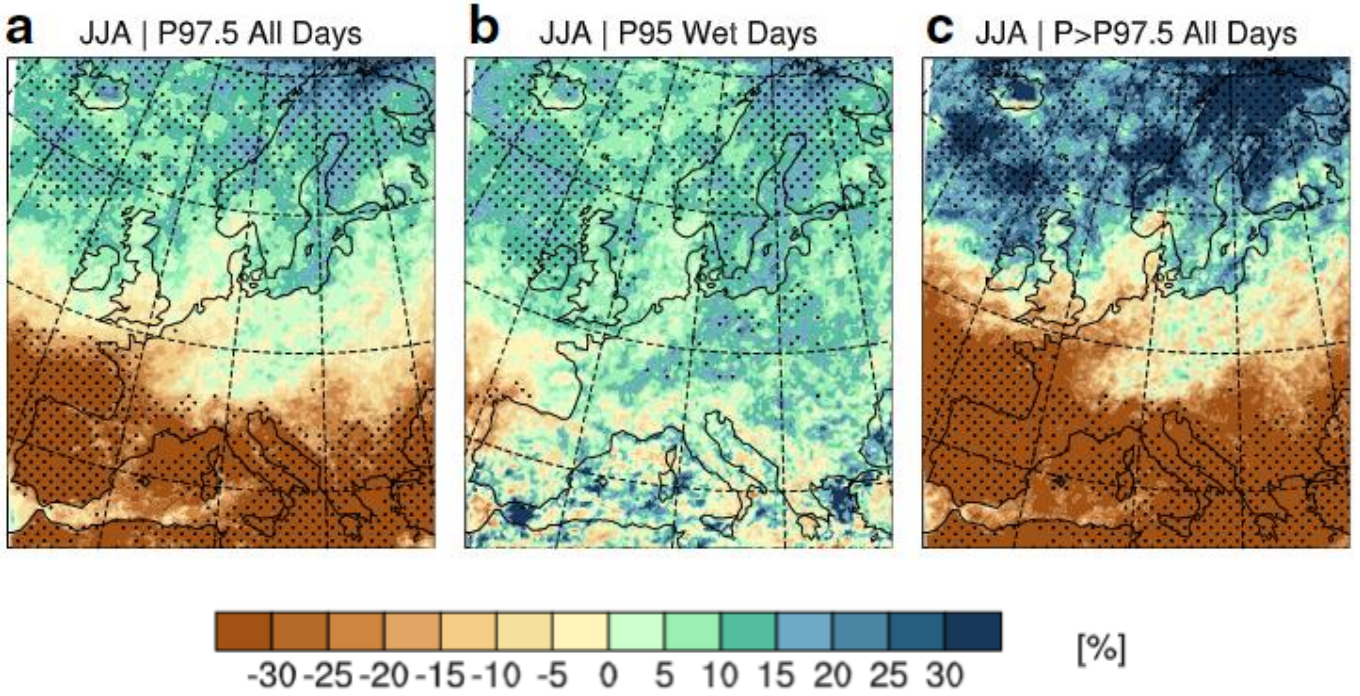


Source: CarbonBrief

Common issues: visualisation

How you process and represent the data will affect the interpretation

- Different ways of visualising extreme precipitation changes (based on all days, wet days only, or frequencies of exceeding a threshold) paint a very different picture... Yet these are the same data!



Source: Schär et al., 2016

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Concluding remarks

- To be successful, climate services need to add value to the users and inform the decisions they make
- Proper co-creation / co-production is difficult to achieve
- Expectations of the user may need to be managed
- Users may not always have a clear idea of what they want / what is possible
- Beware of pitfalls around data processing and visualisation, especially around extremes
- Check the interpretation of users, especially of visual information
- Monitoring and evaluation of the service are important!

Climate Services in Europe

The Climateurope2 project aims to develop future equitable and quality-assured climate services to all sectors of society by:

- Developing standardisation procedures for climate services
- Supporting an equitable European climate services community
- Enhancing the uptake of quality-assured climate services to support adaptation and mitigation to climate change and variability

Climateurope2

https://climateurope2.eu/