IS-ENES3 Climate Impact Autumn School
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Climate Services

Rutger Dankers
Wageningen Environmental Research (NL)
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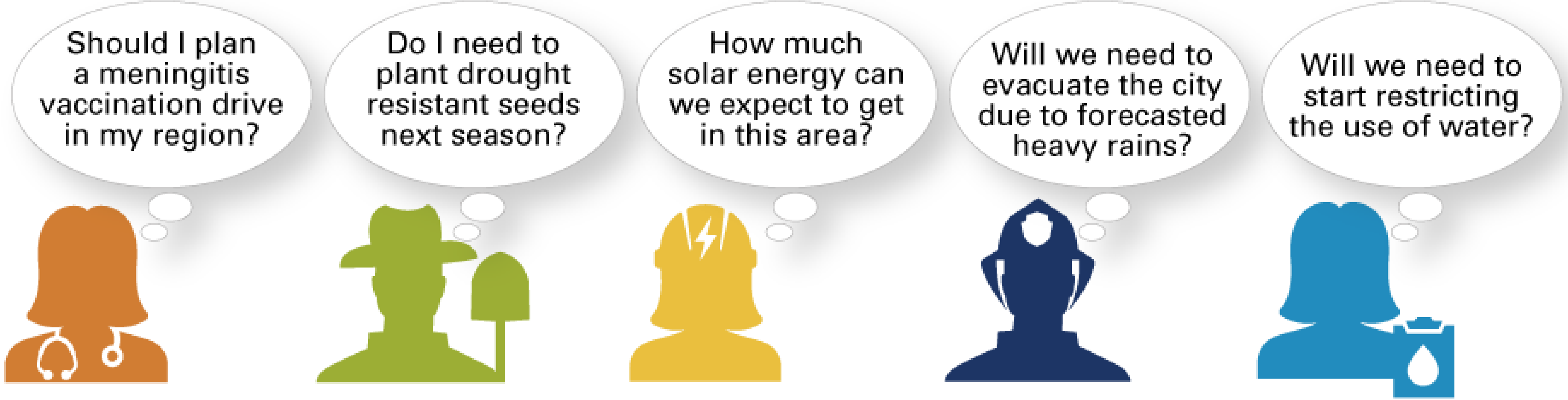
What are climate services?

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



Source: [Global Framework for Climate Services]

Climate Services

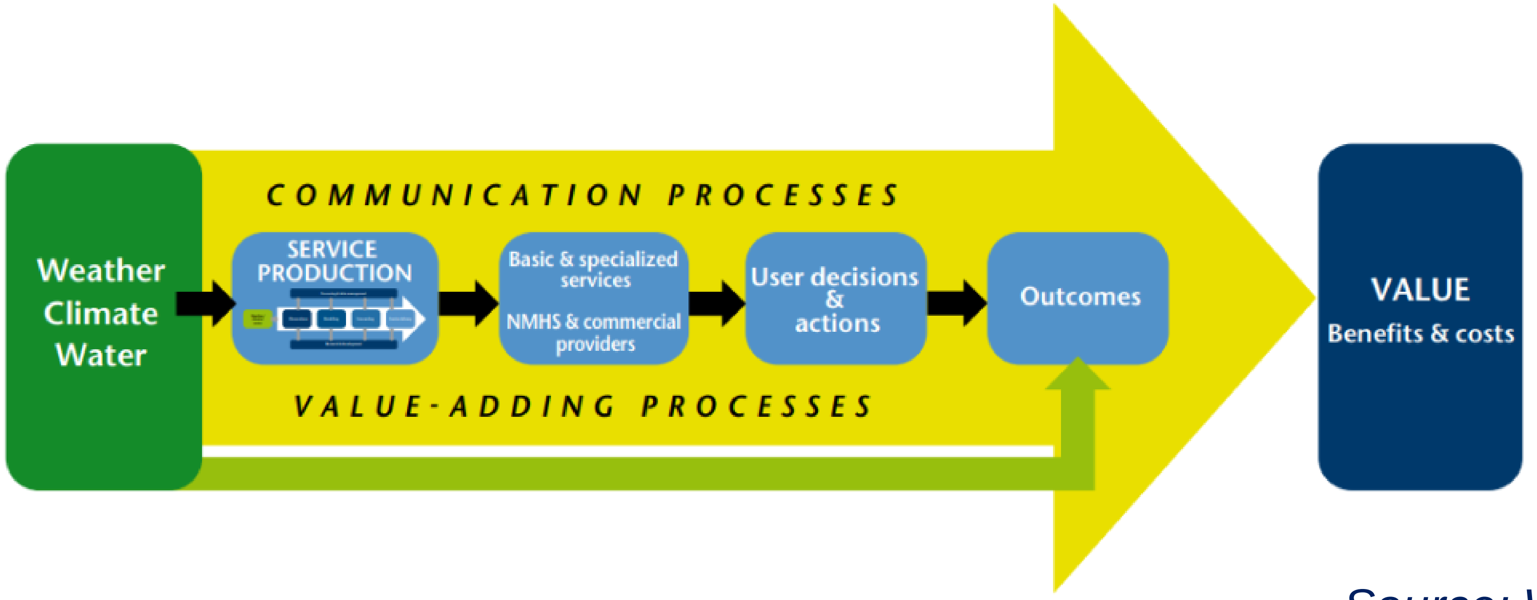
- Just providing climate data or information is not enough!
- As with weather forecasts, the value of climate data and climate impact assessment lies in the extent that they lead to actions or inform decisions
- Of course, easy access to data is part of this

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

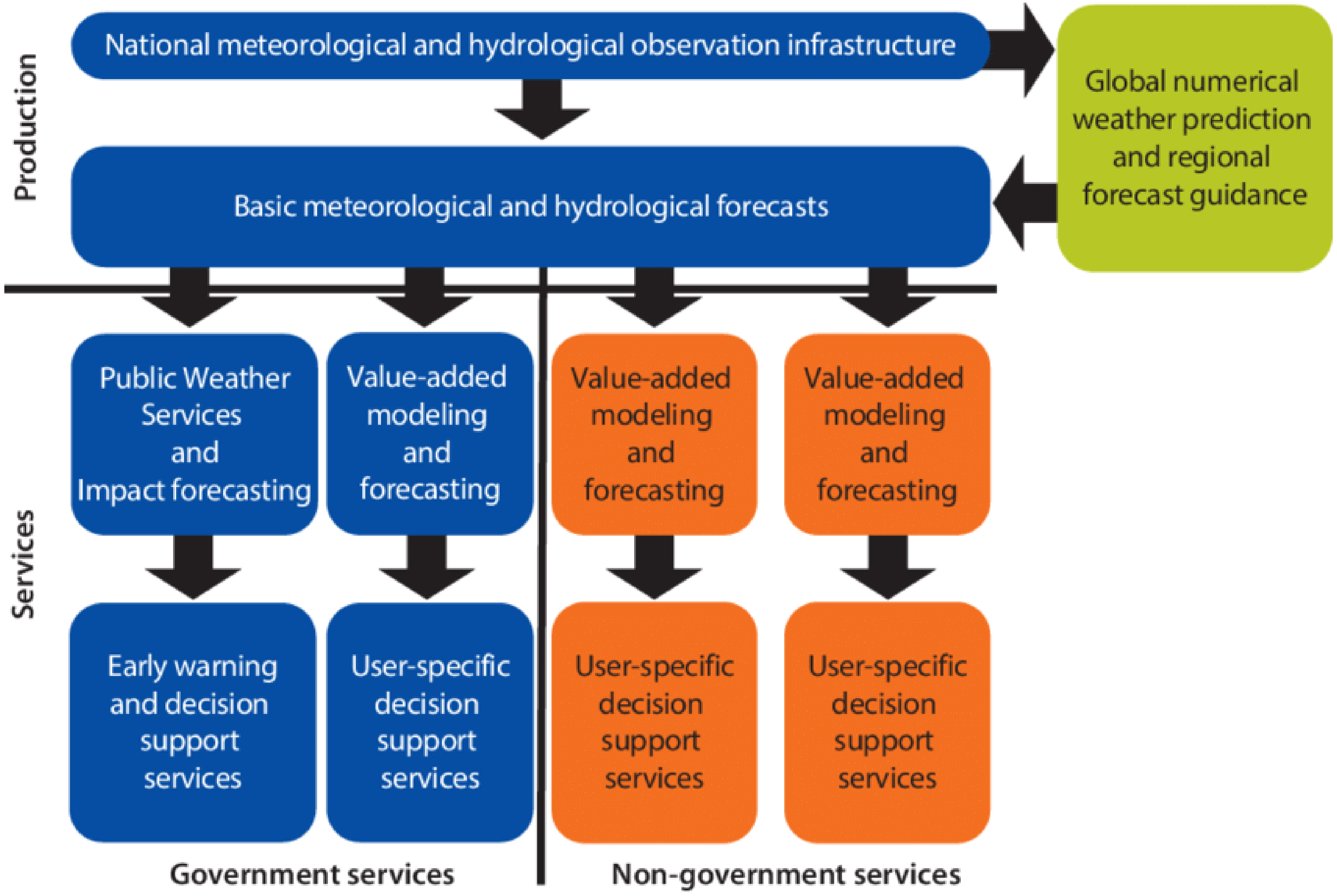
Value chain (2)

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

...and different players

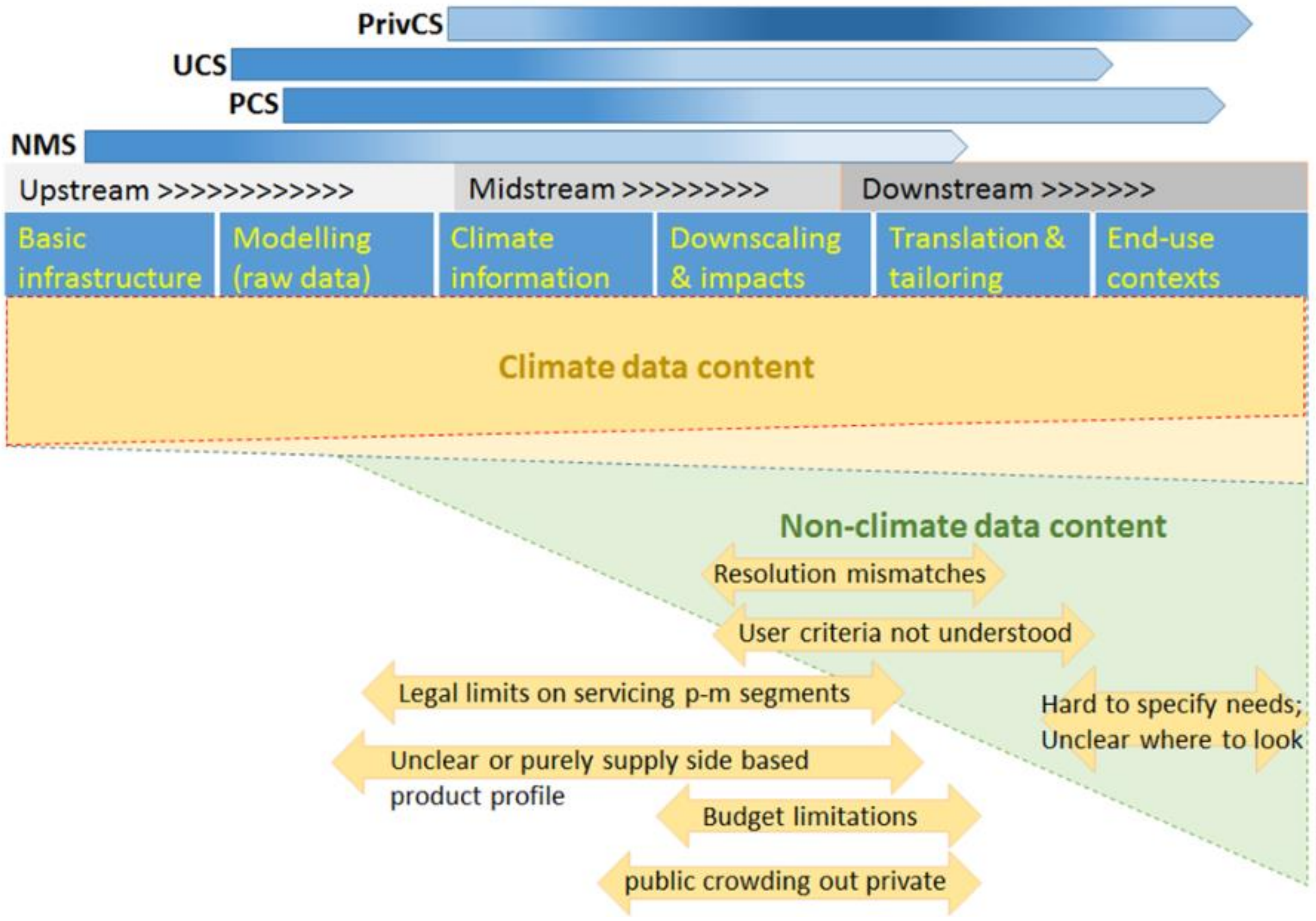
Division of responsibilities may be different in each country

Source: World Bank, 2013



Value chain (3)

Different parts of the CS value chain will be dominated by different players, and face different obstacles



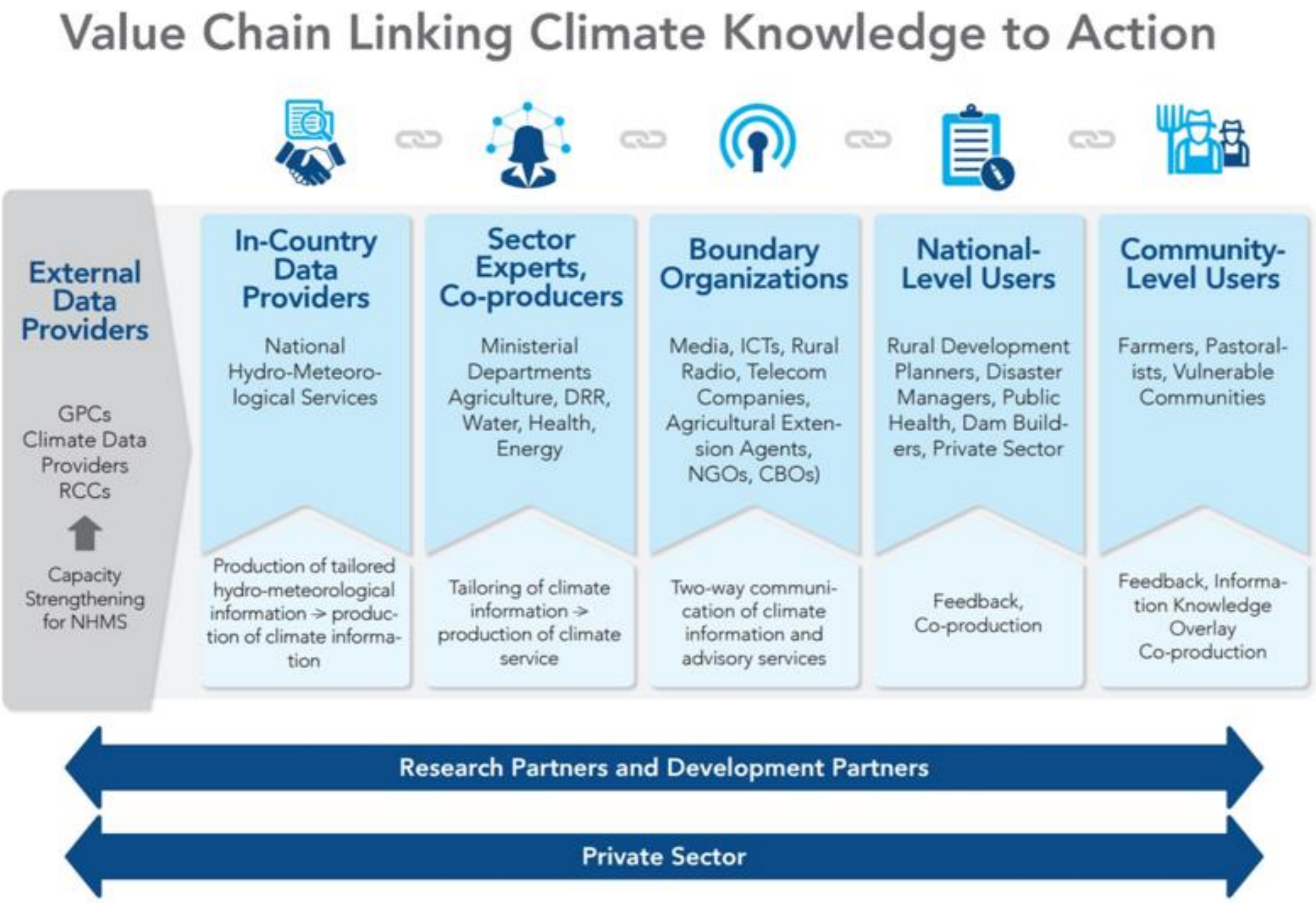
Source: <u>EU-MACS project, 2018</u>

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?

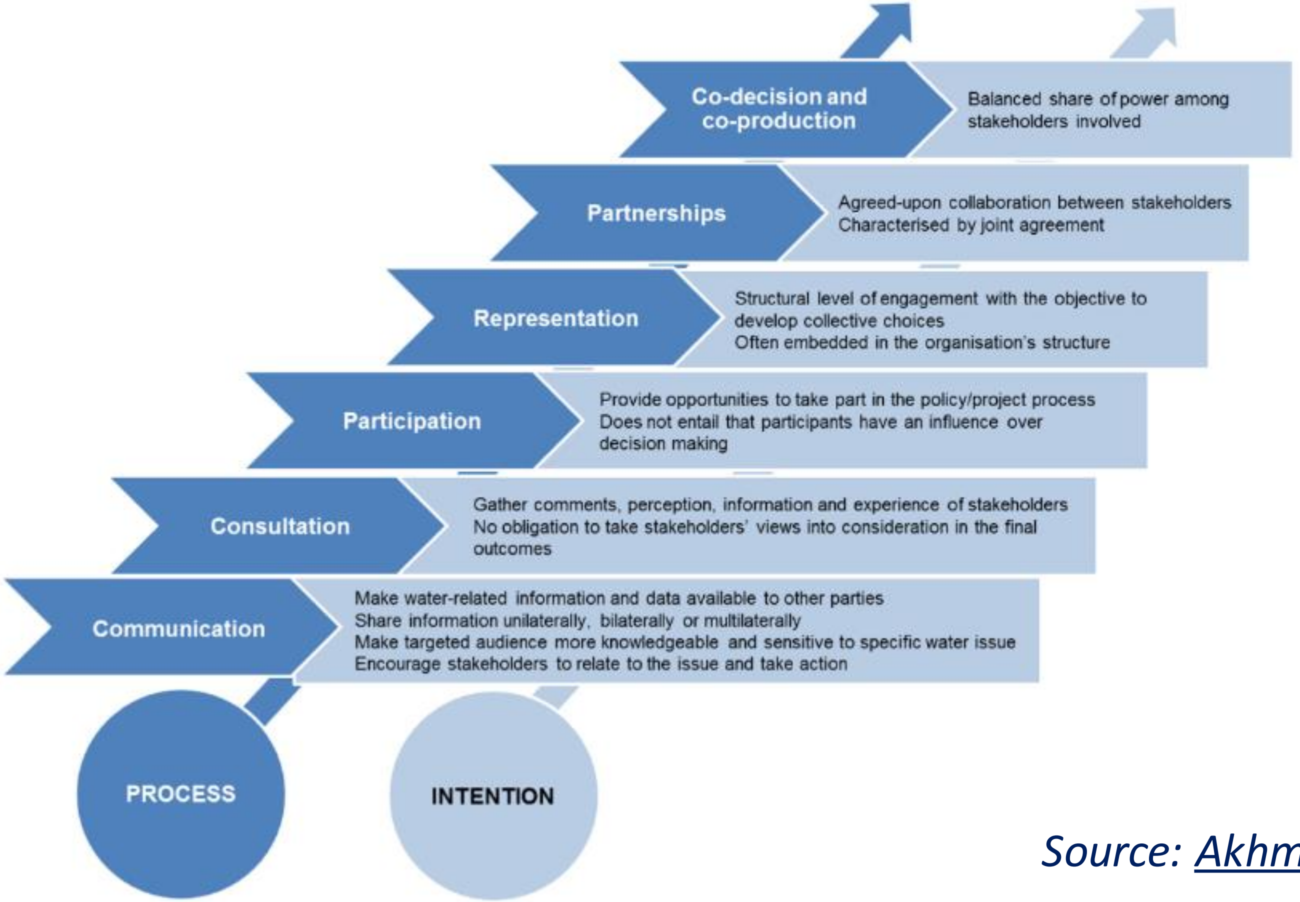
Examples of actors, users and stakeholders



Source: PreventionWeb

Stakeholder engagement

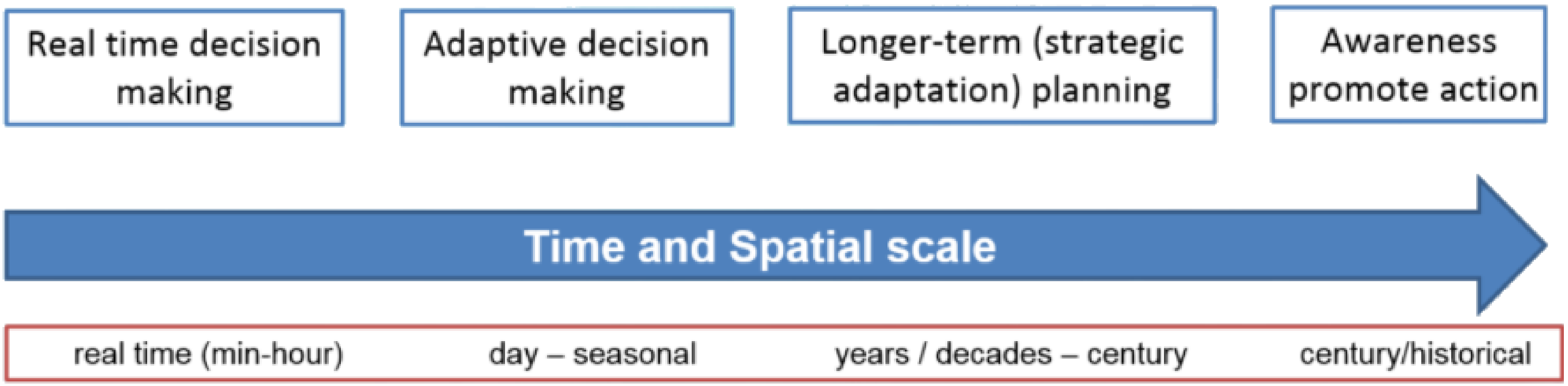
Levels of user/stakeholder engagement range from *one-way flow of information* to *full integration into the production or decision-making process*



Source: Akhmouch & Clavreul, 2016

Types of decision

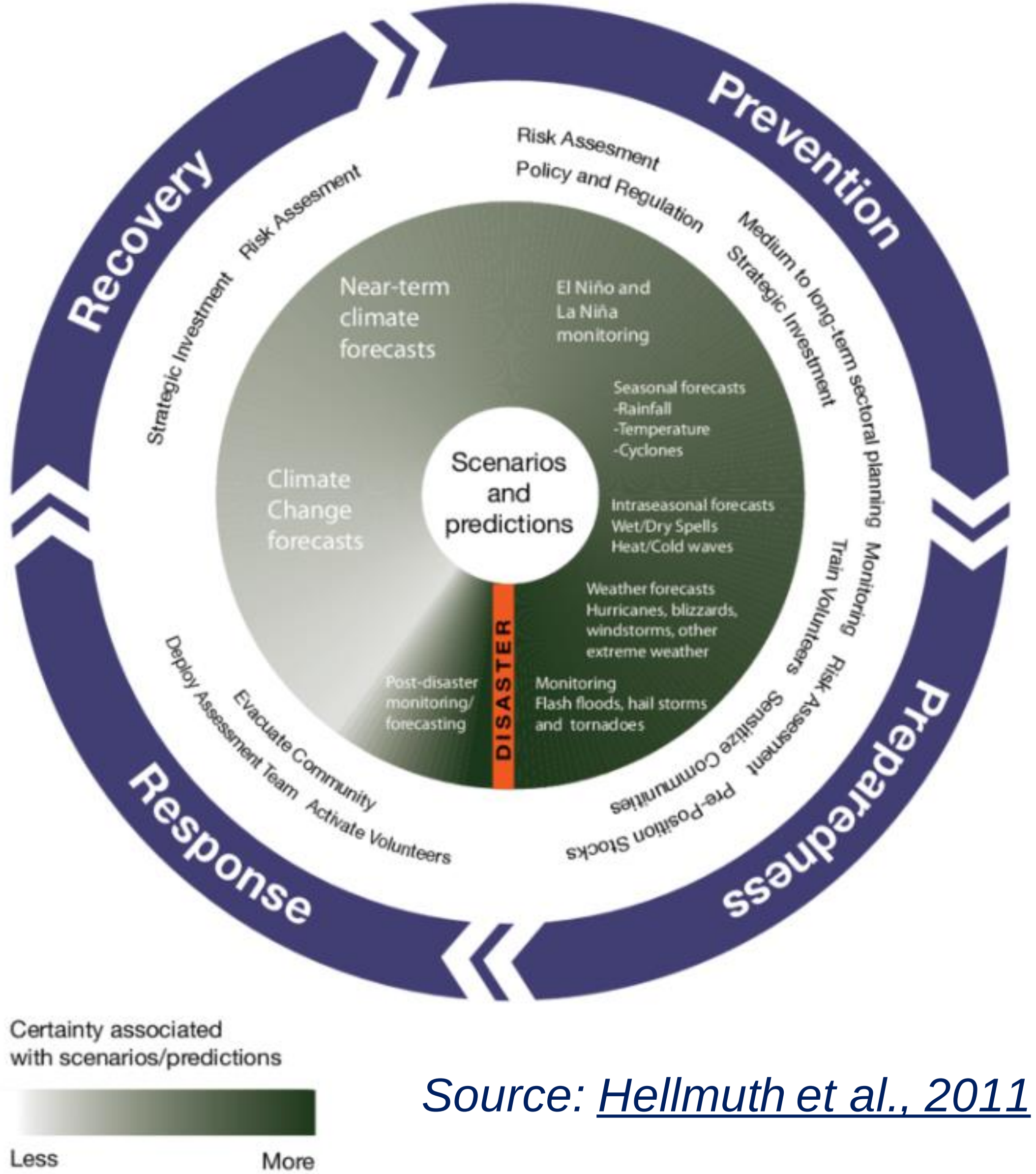
- Different types of decision will require different types of information



Modified from: Copenhagen Institute of Interaction Design

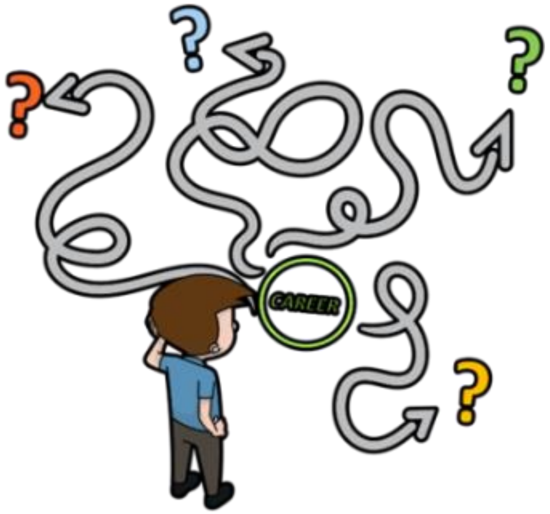
Types of decision

- Example from Disaster Risk Management
- Different actions at different timescales require different information



Source: Hellmuth et al., 2011

Types of Climate Services



Climate services can be grouped in many different ways:

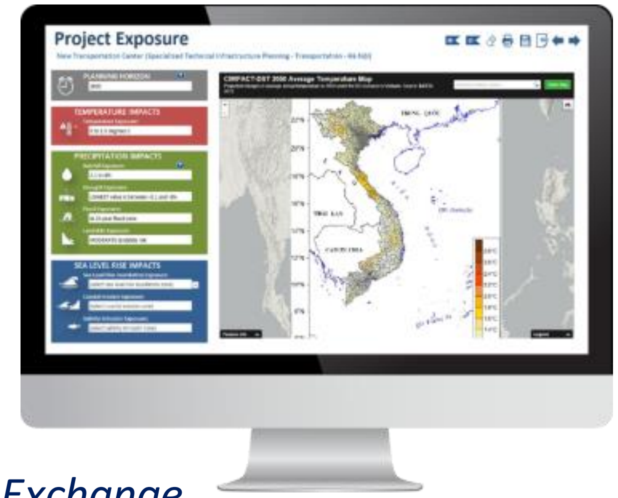
- Sector
  - e.g., agriculture, energy, utilities, transportation,...
- Type of user
  - e.g., policy makers, urban planners, small businesses, ...
- Type of product delivered
  - e.g., basic climate data, information on impacts of climate change, tools for visualisation of information,...
- Type of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

Source: Bessembinder et al., 2019

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

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



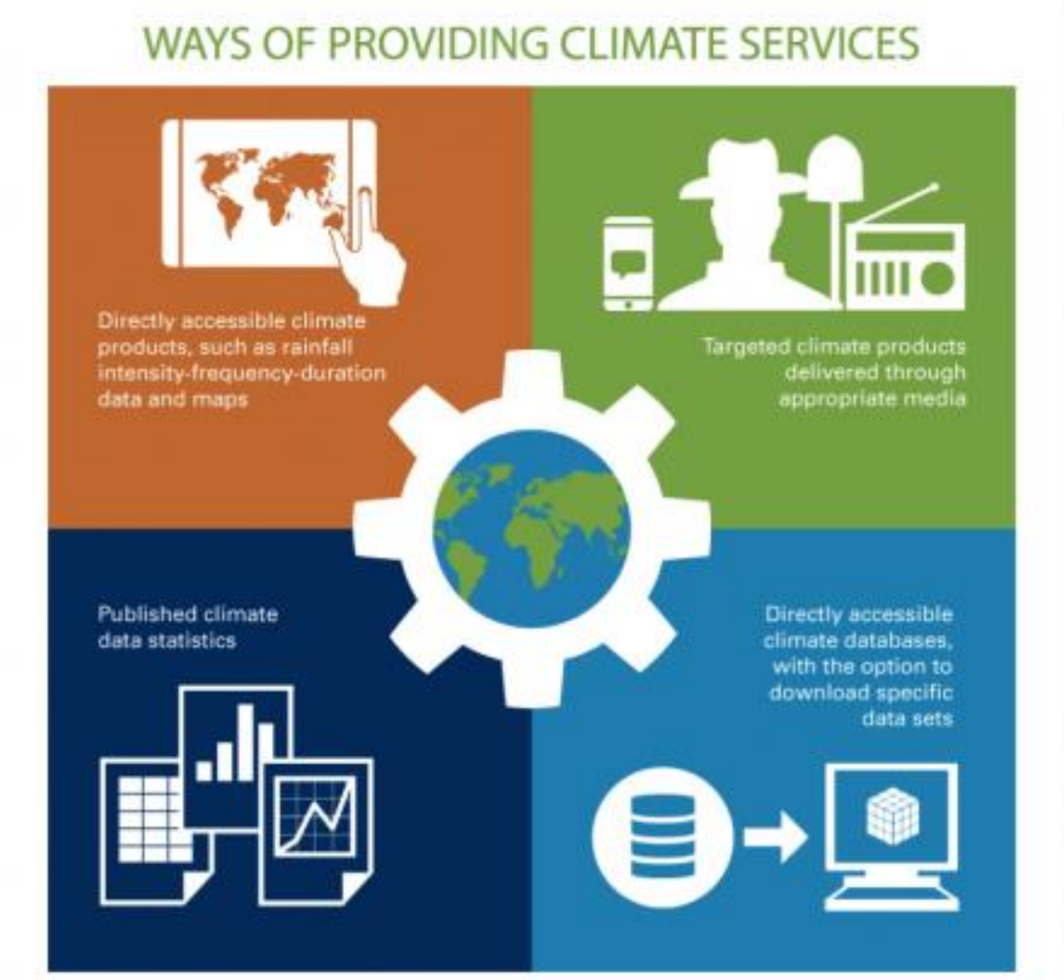
Source: Climate Adaptation Knowledge Exchange

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

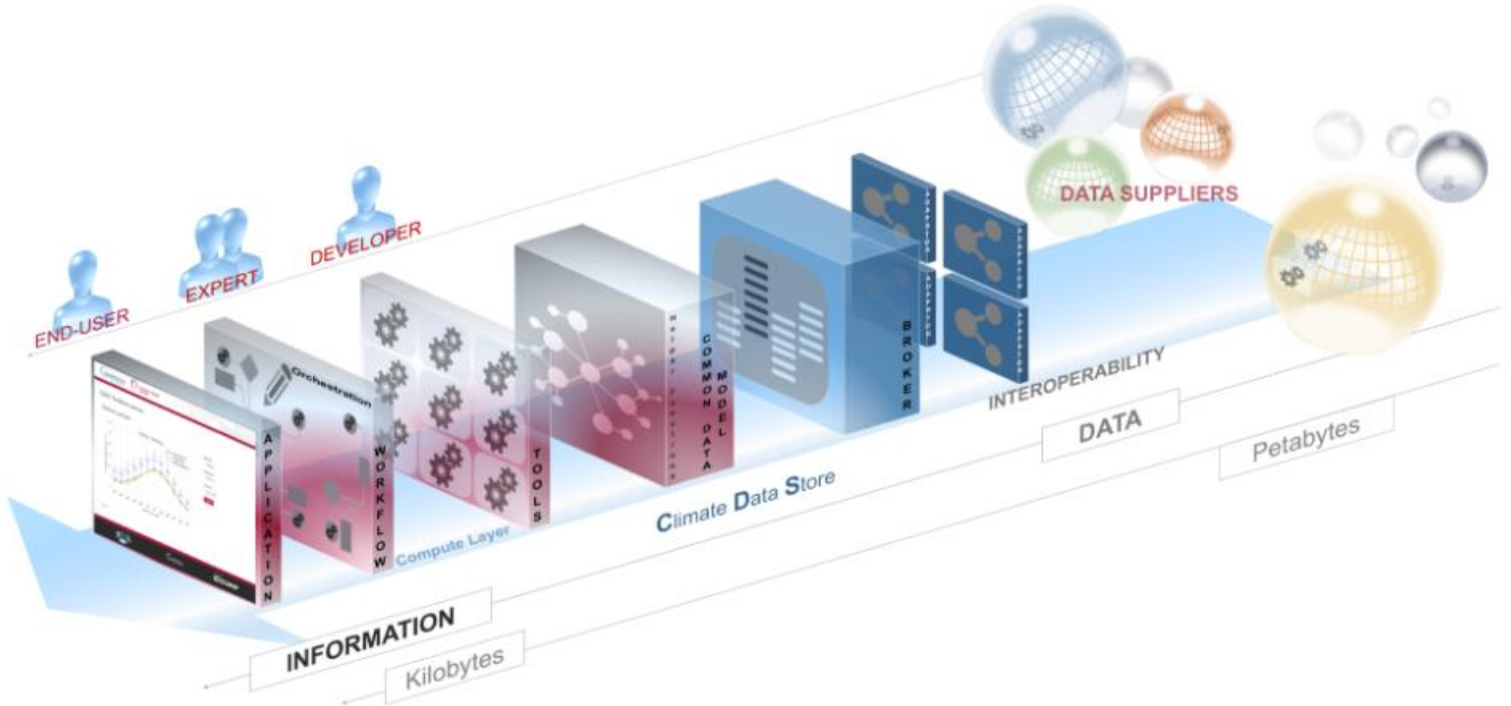


Source: WMO, 2017

Examples of Climate Services

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

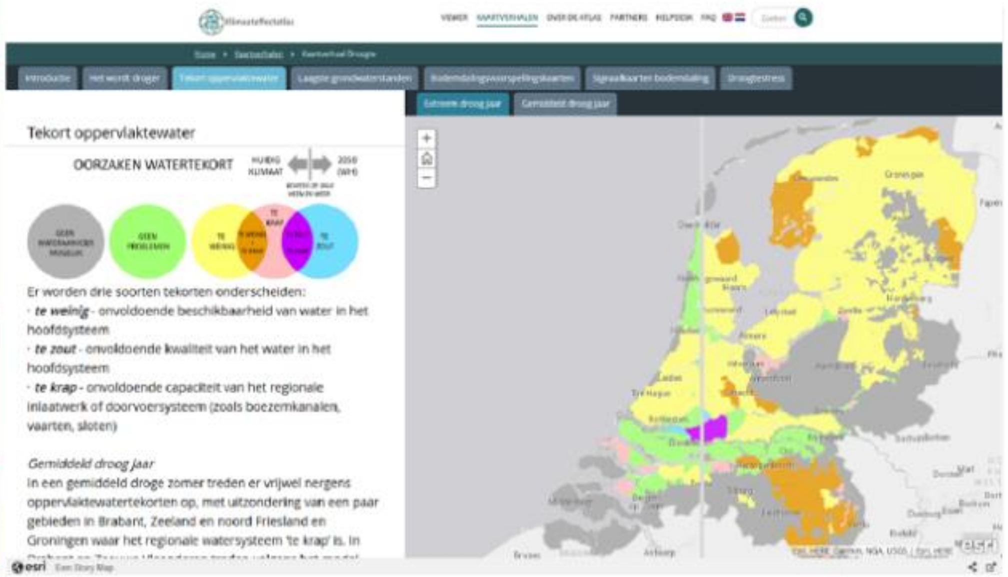
- Part of the EU's Copernicus programme
- Aim is to open up data for the benefit of multiple end users
- Key part is the climate data store
- Sectoral information serv



Examples of Climate Services

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

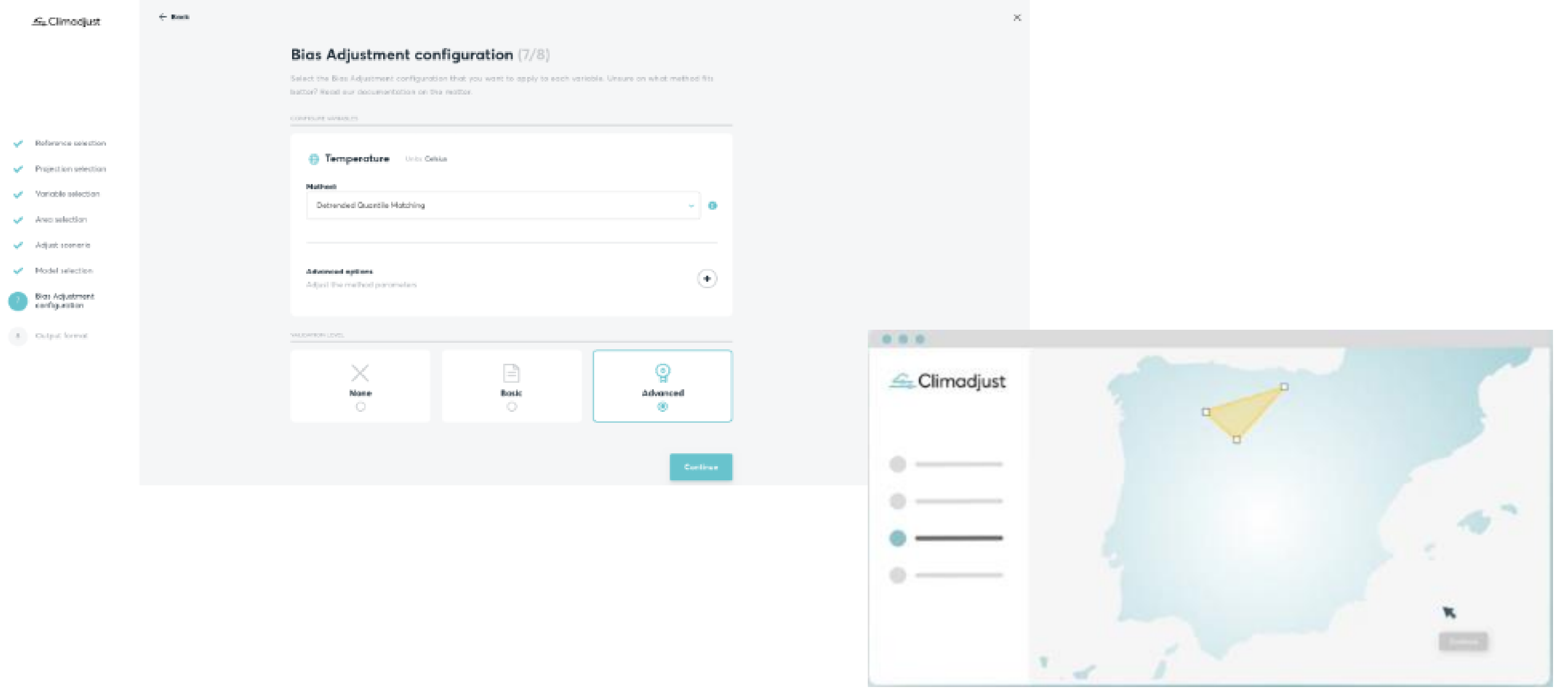
- Web portal showing climate impact information for The Netherlands
- Information on flooding, drought and heat
- Zoomable maps and storymaps, access to data layers
- Based on, and consistent with national climate scenarios

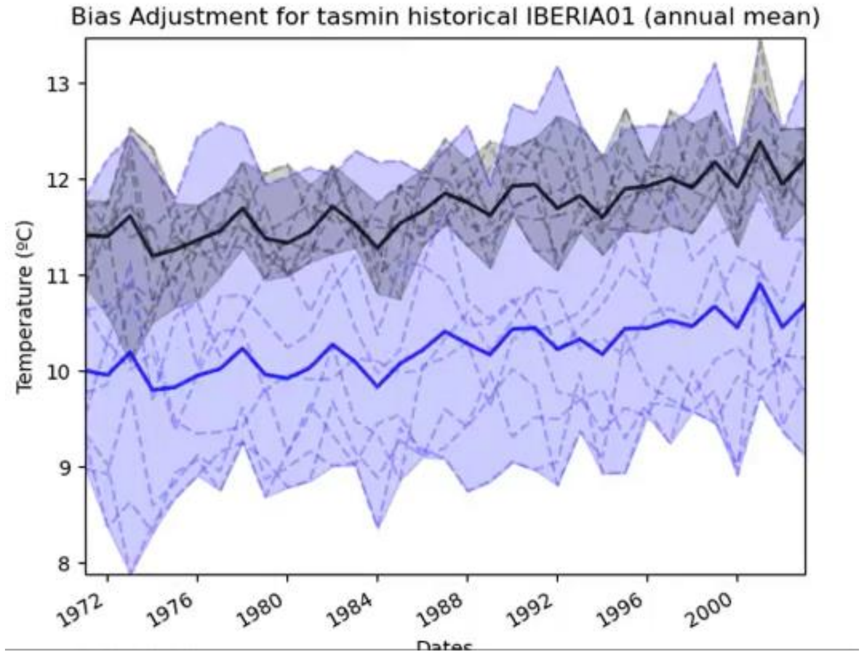


Examples of Climate Services

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/)

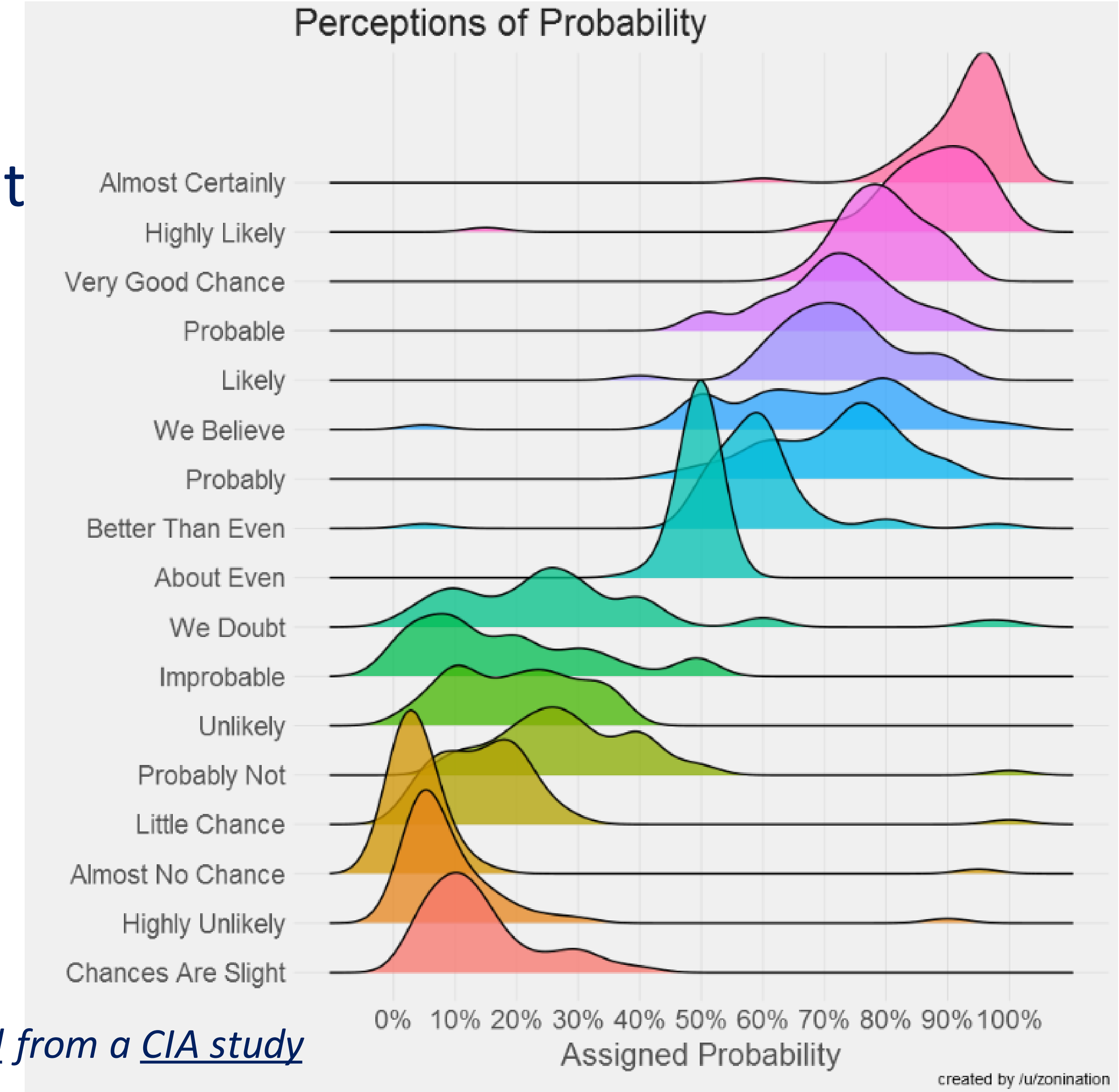
- Subseasonal to seasonal forecasts

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

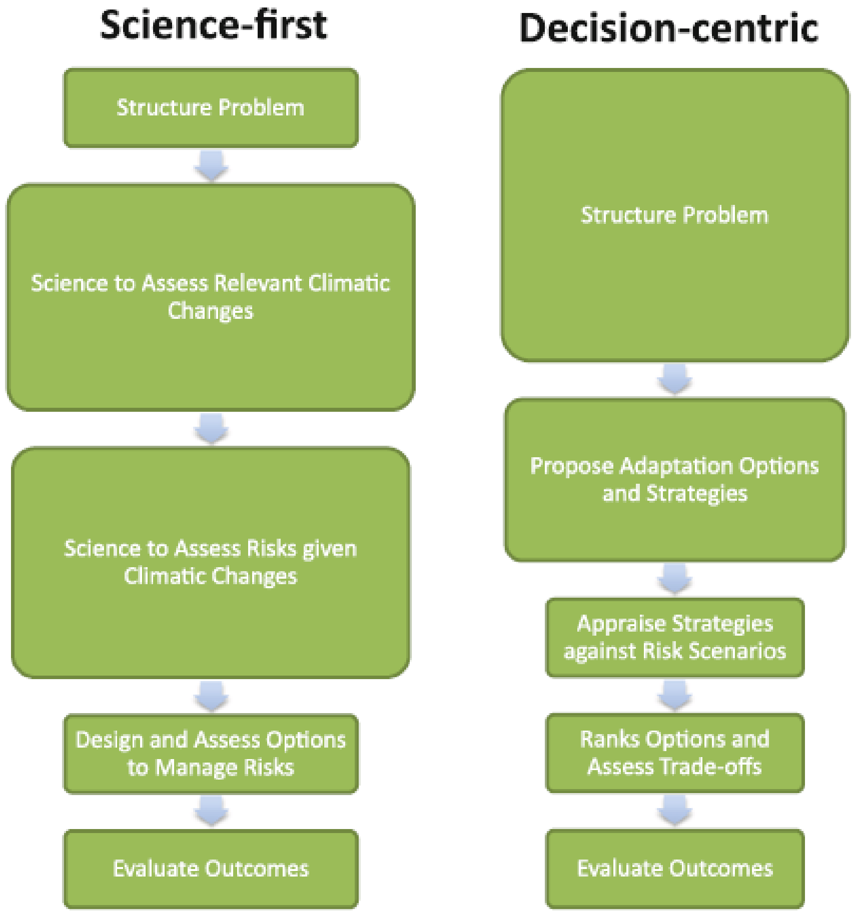
Common issues: uncertainties

- 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: uncertainties

Dealing with uncertainty in decision making: example from Thames Barrier

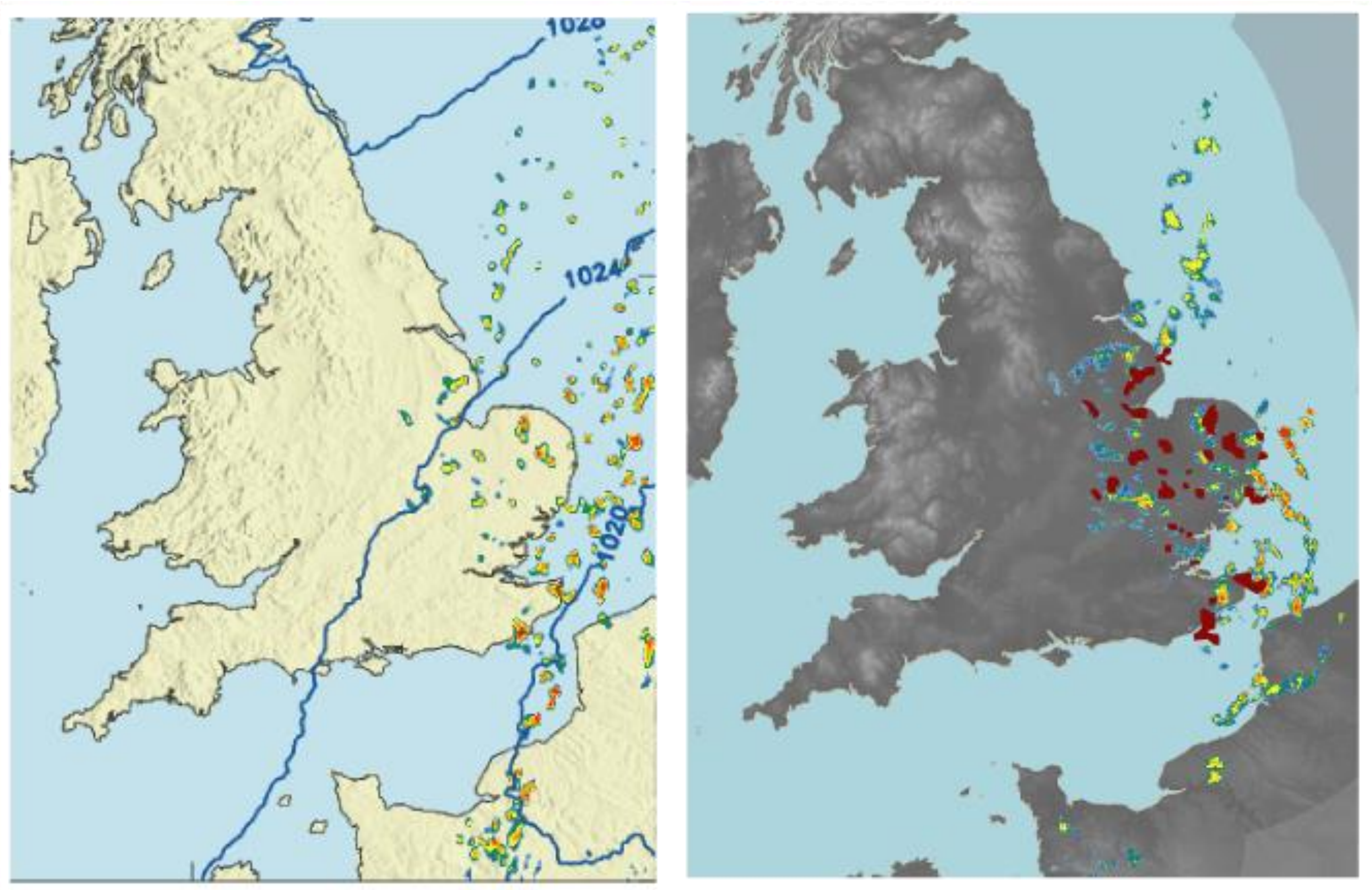
- Decision-centric process
- Combination of numerical models and expert judgement to develop narrative sea level rise scenarios
- Identify the timing and sequencing of possible 'pathways' of adaptation measures over time under different scenarios
- Monitoring framework that triggers defined decision points



Source: Ranger et al., 2013

Common issues: scale

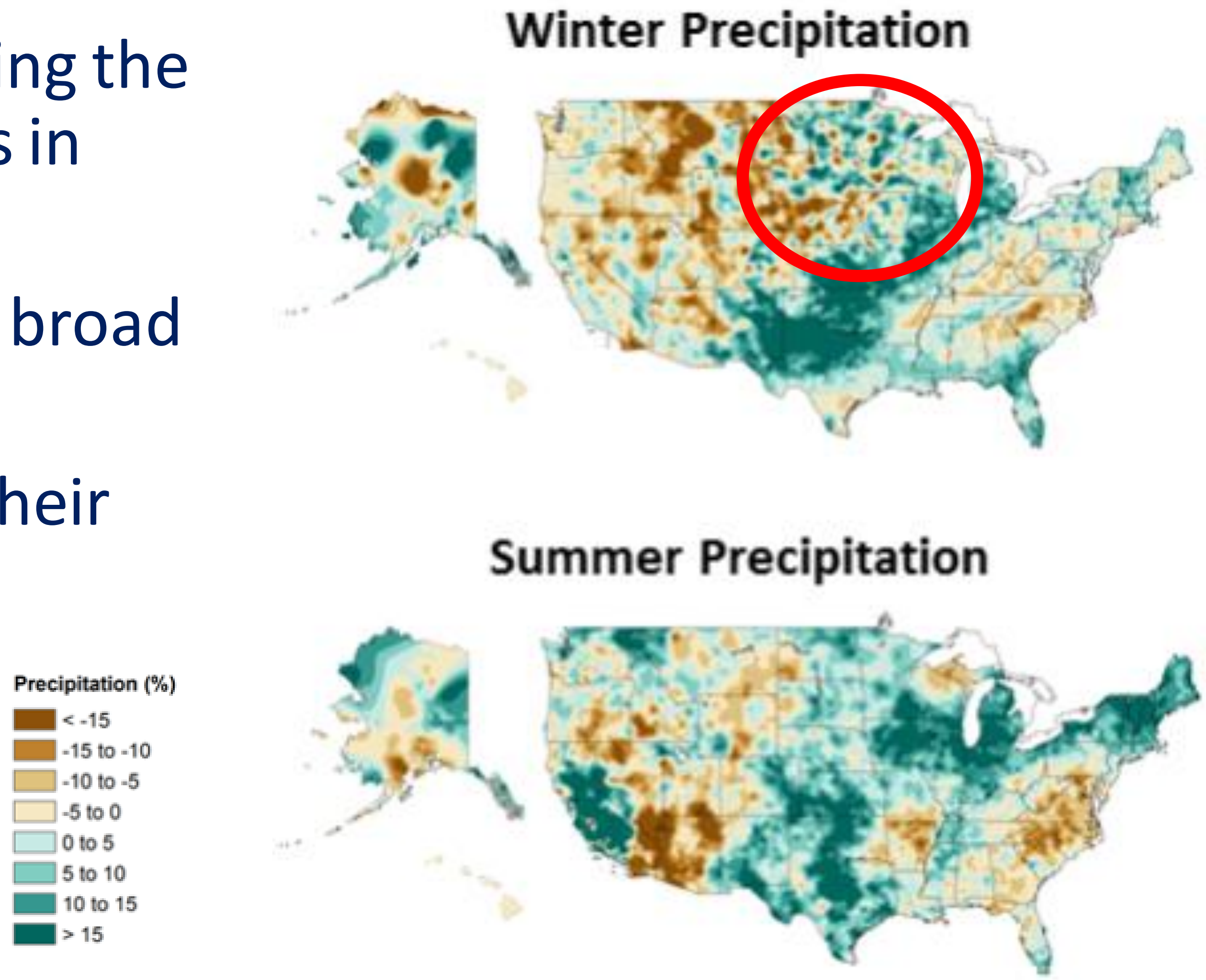
- Users often want data or information for a specific location or time
- Downscaling techniques may need to be applied... But may also introduce uncertainties
- Ask for the reasons behind the requirements: are the expectations realistic? Is resolution confused with accuracy?



Picture courtesy of Nigel Roberts, UK Met Office

Common issues: scale

- Another example: what is causing the ‘salt-and-pepper’ –like patterns in changes in precipitation?
- A climatologist may look at the broad patterns...
- ... But a user may only look at their location of interest

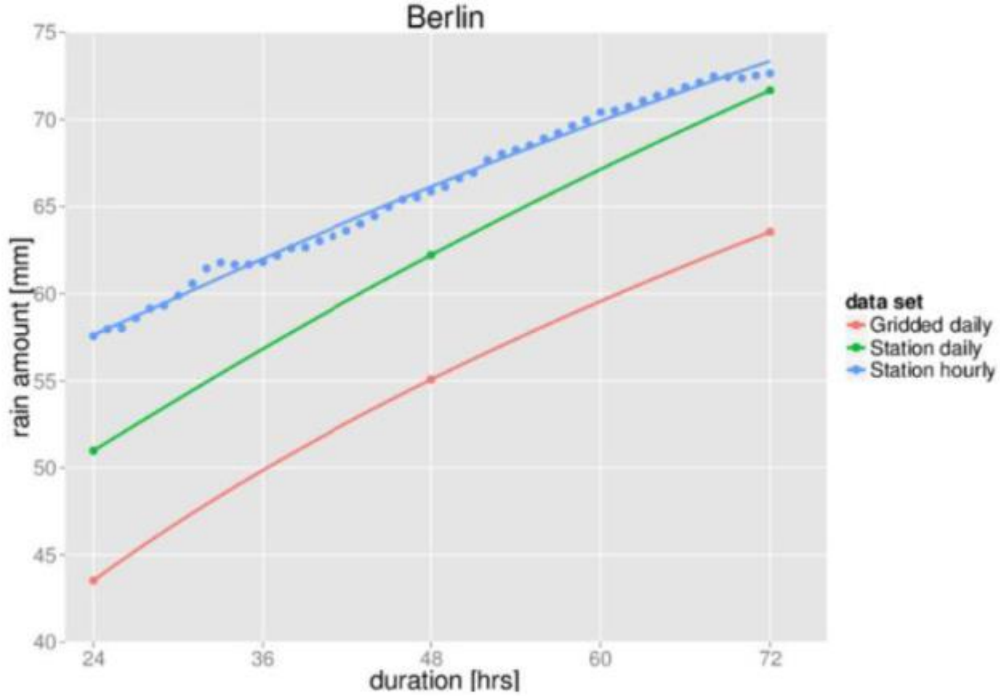


Source: US Fourth National Climate Assessment, 2017

Common issues: extremes

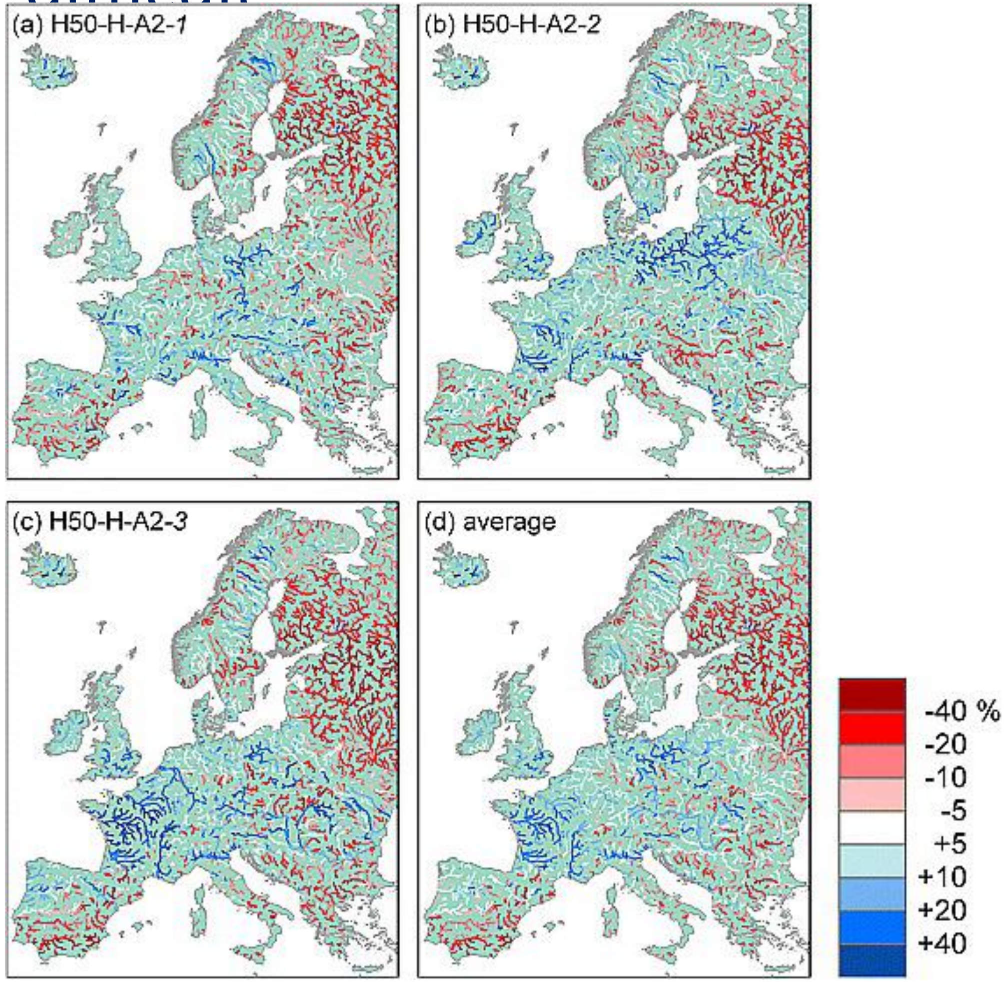
Different source data may give different results

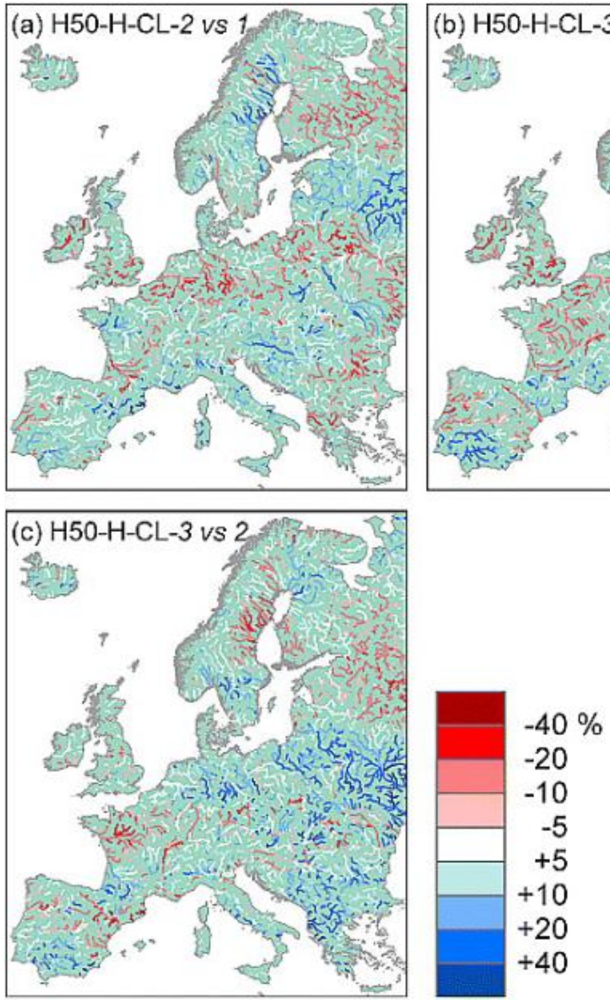
- Estimate of extreme rainfall in a 24h period from daily data is lower than estimate from hourly data
- Method used to calculate the extremes will also have an influence!



Common issues: extremes

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

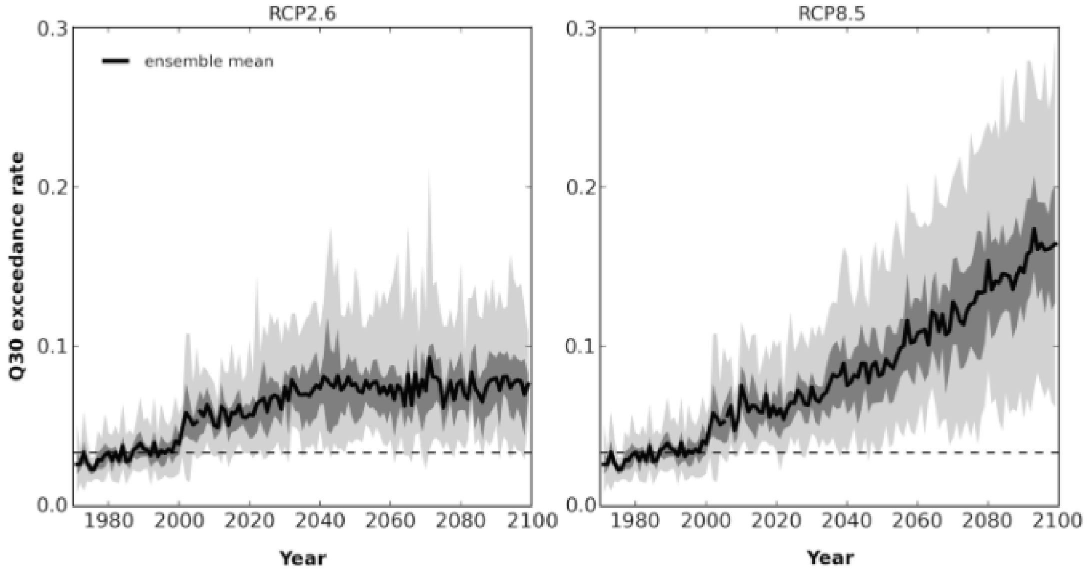




Source: Dankers & Feyen, 2009

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

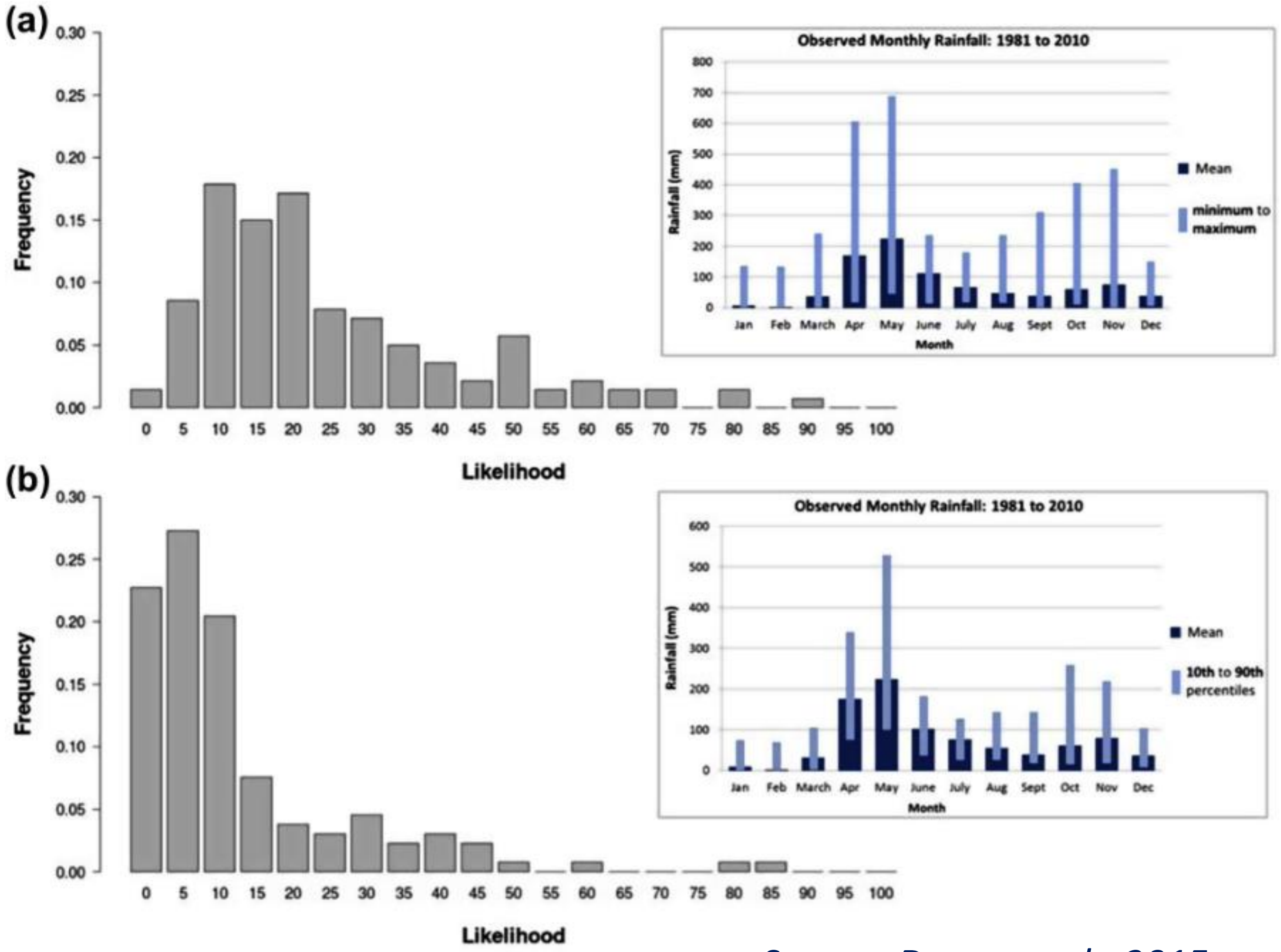


Source: Dankers & Kundzewicz , 2020

Common issues: visualisation

The choices made when visualising data, will influence the interpretation

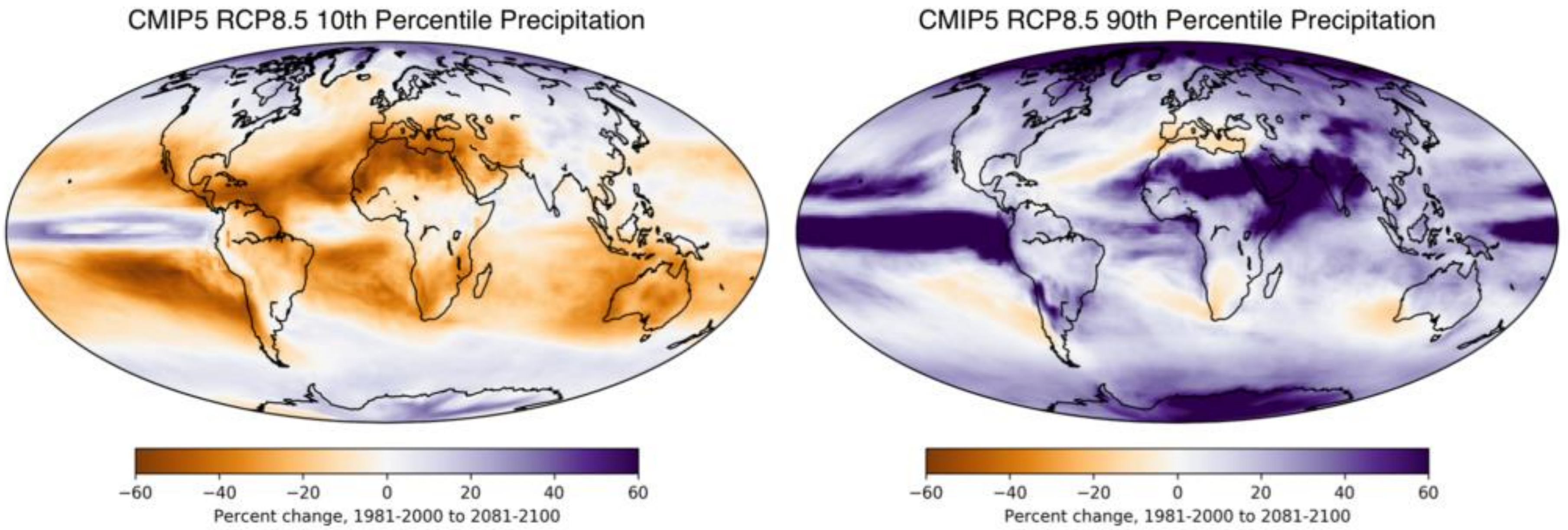
- Example: what do people think is the likelihood of April rainfall exceeding 500 mm?
- Different estimates when presented with percentiles (bottom) instead of min-max (top)



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*

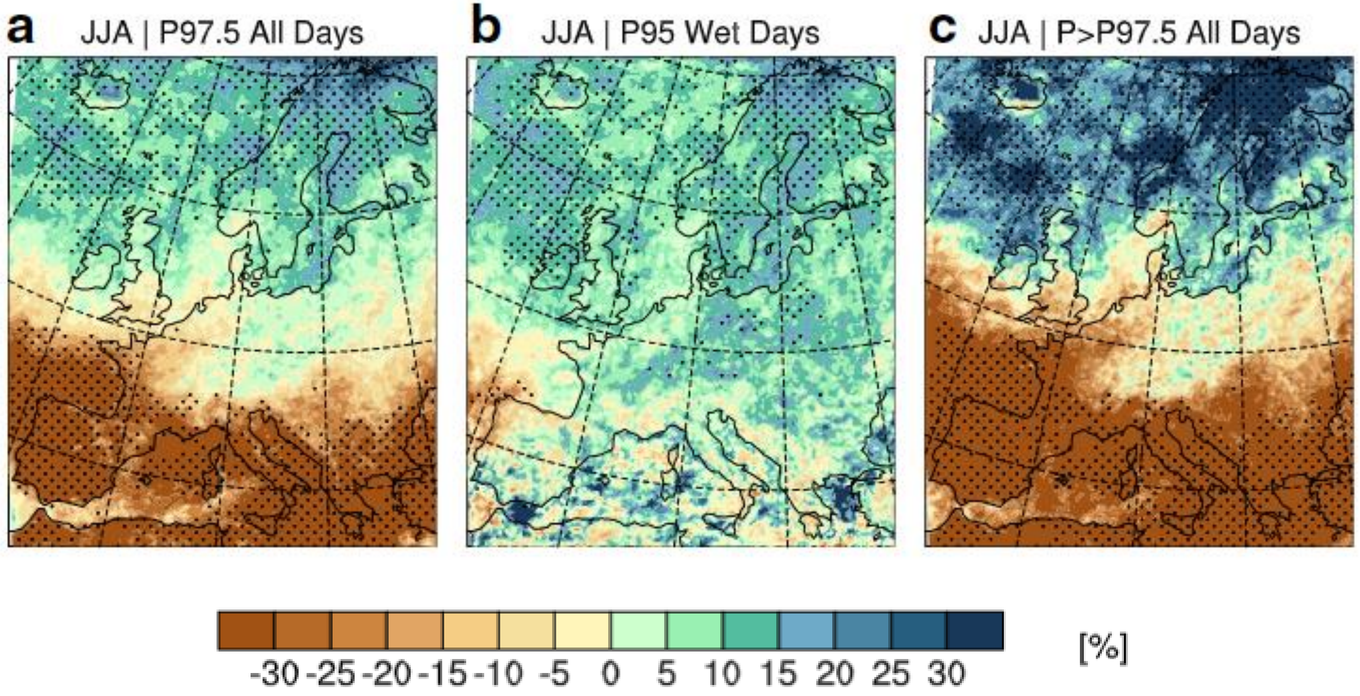


Source: CarbonBrief

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

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!