UNDERSTANDING TRANSPORT SECTOR NEEDS FOR CLIMATE INFORMATION, VIA THE PRIMAVERA PROJECT

Facilitators: Dr. Erika Palin and Dr. Galina Guentchev (Met Office, UK)

This project has received funding from the European Union's Horizon 2020 Research & Innovation Programme under grant agreement no. 641727.

HELLO AND WELCOME!
THANKS FOR JOINING US FOR THIS INTERACTIVE WORKSHOP TODAY

Please add your details to the sign-in sheet

Any personal data (as defined by the EU General Data Protection Regulations 2018) which you provide will not be used for any purpose outside the PRIMAVERA project

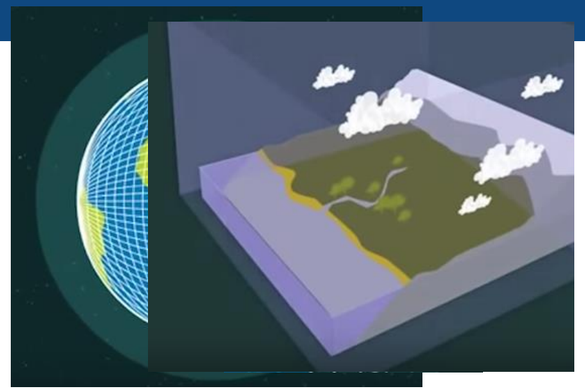
SESSION OUTLINE

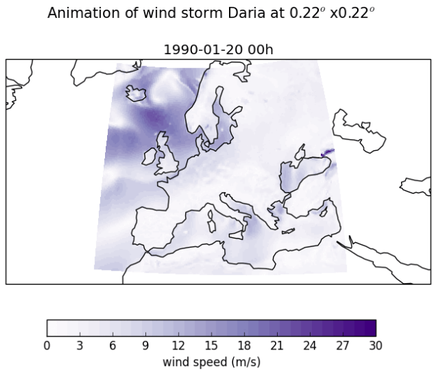
- PRIMAVERA project **overview**
- **User engagement** work in PRIMAVERA
- **Demo**: PRIMAVERA User Interface Platform (UIP) and Data Viewer
- **Using PRIMAVERA information for user benefit**: an example (low-pressure systems and rainfall)
- **Discussion**: getting to know more about user needs
- **Wrap-up** and **next steps**

WHAT IS PRIMAVERA?

PRIMAVERA

THE PRIMAVERA PROJECT





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PRIMAVERA - **PR**ocess-based climate s**IM**ulation: **A**d**V**ances in high-resolution modelling and **E**uropean climate **R**isk **A**ssessment:

a European Commission-funded project involving multiple European modelling centres, which are designing and running **new high resolution global climate models,**

and assessing their **ability to simulate societally important processes,**

and thereby to **support climate risk assessment activities** across Europe.

WHAT PRIMAVERA IS…AND IS NOT!

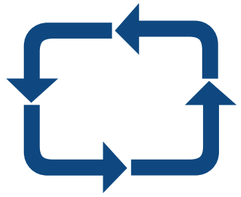
- **PRIMAVERA is…**
  - A **research** project
  - Seeking to understand how high-resolution, global model data could **potentially** be useful to stakeholders

- **PRIMAVERA is not…**
  - Providing an "**official dataset**" to use for climate risk assessments on transport
  - Providing "**the only answer**" to use in climate risk assessments on transport

THE PRIMAVERA CONCEPT

Do PRIMAVERA models improve the representation of key

PROCESSES?



(e.g. low-pressure systems)

How does this affect their representation of climate

METRICS?

(e.g. extreme rainfall)

And what could this mean for their representation of

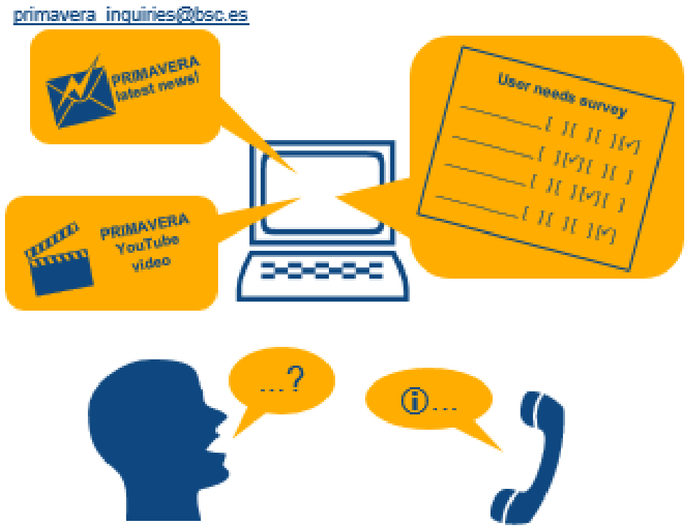
USER-RELEVANT IMPACTS?

(e.g. rainfall-derived flooding)

USER ENGAGEMENT

- WP10 (“translation”) – **climate risk assessment; case studies**
  - Insurance
  - Energy
  - Transport
  - Agriculture
  - Health
  - Water

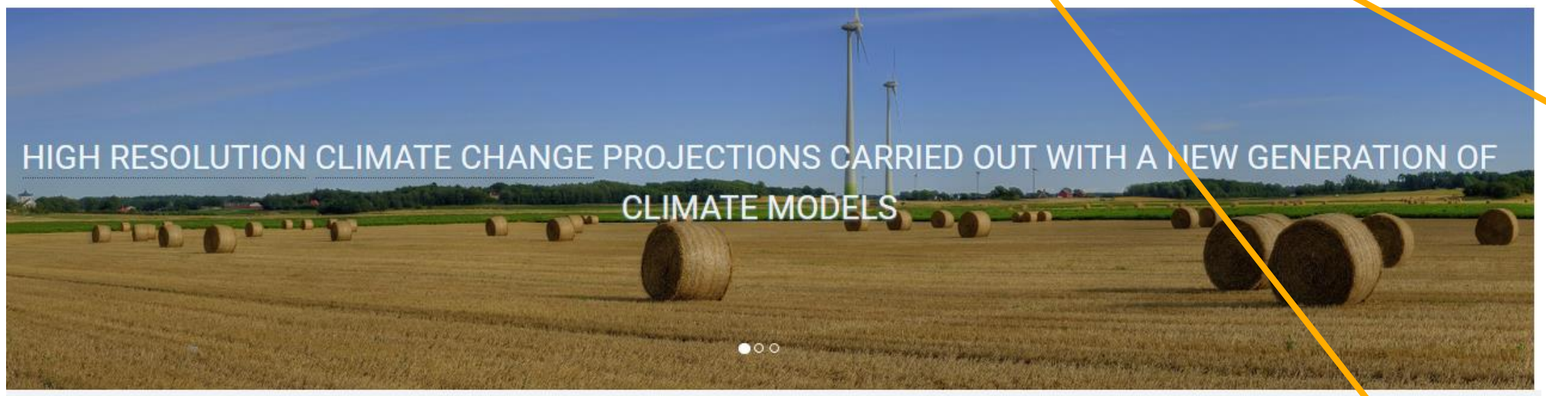
- WP11 (“broadcast”) – **user engagement & dissemination**
  - Video (>500 views)
  - Initial user survey (>80 replies)
  - Interviews (~50)
  - User Interface Platform
    - **http://uip.primavera-h2020.eu**
  - Conferences (science & user)
  - Webinars
  - Twitter



USER INTERFACE PLATFORM - http://uip.primavera-h2020.eu

PRIMAVERA
User Interface Platform

HOME SECTORS RESOURCES SCIENCE SNIPPETS



Welcome to the PRIMAVERA User Interface Platform. The aim of this website is to disseminate the results of the project to users and potential users. The new climate information arising from PRIMAVERA high resolution simulations is presented in the context of different impact sectors. Also, specific results are presented in an interactive way by using storymaps. As the project is still ongoing, new content will be added regularly.

Please see the project's news page to keep updated on the project progress.

- Health
- Water
- Finance and insurance
- Energy
- Transport
- Agriculture

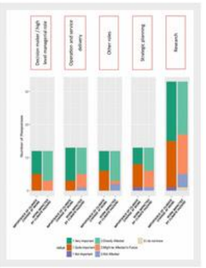
Storymaps

Videos

User survey

Results from the PRIMAVERA user survey

We conducted an online survey within the PRIMAVERA project as a first step towards understanding user needs for weather and climate information. The survey was aimed at a broader audience and used the questions and the language applicable for different user profiles. Altogether 83 responses were received from the participants from 12 different EU countries. Here are some of the answers we received.



We asked participants how important weather and/or climate change was to their personal work and for the professional decisions they made. We also asked them if at present, climate or weather hazards had an influence on the work of their organisation. For 55% of the participants weather and/or climate are very important for their personal work or for the professional decisions they make and for 42% it is quite important.

Search

News

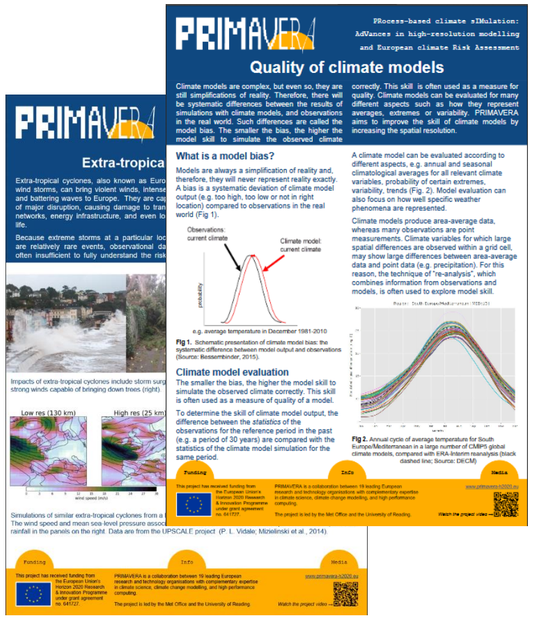
Sector factsheets

Climate factsheets

Glossary

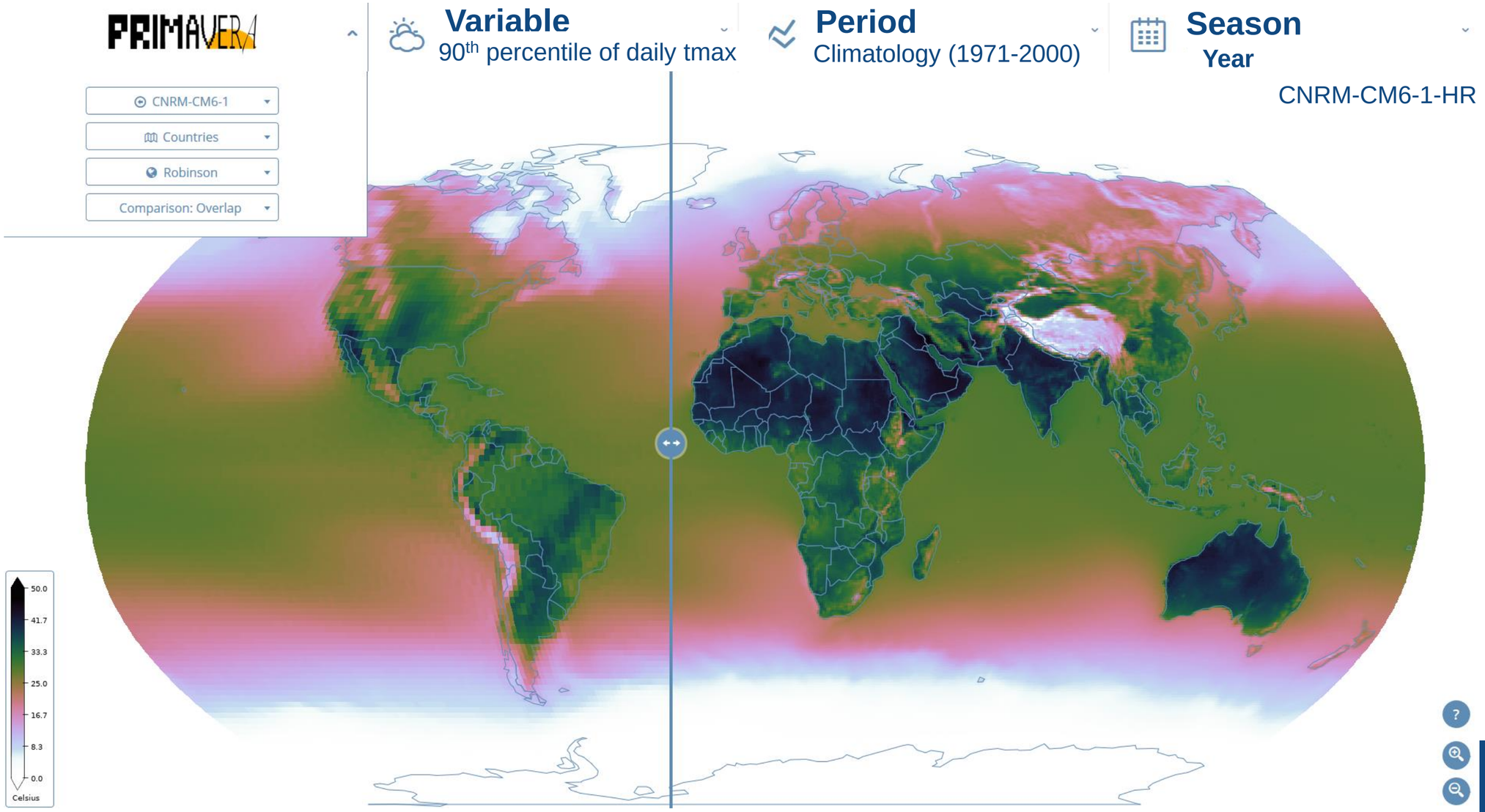
Mailing list

Presentations



PRIMAVERA

DATA VIEWER


PRIMAVERA
CNRM-CM6-1
Countries
Robinson
Comparison: Overlap
Variable
90th percentile of daily tmax
Period
Climatology (1971-2000)
Season
Year
CNRM-CM6-1-HR
50.0
41.7
33.3
25.0
16.7
8.3
0.0
Celsius

SESSION AIMS

- The **aims** of the rest of the session are to:
  - Find out more about your **roles**
  - Present some scientific results from PRIMAVERA to demonstrate **how the project could inform users**
  - Find out where you are in your **understanding and use of climate information**
  - Discuss **how PRIMAVERA could help you**

GETTING TO KNOW YOU…

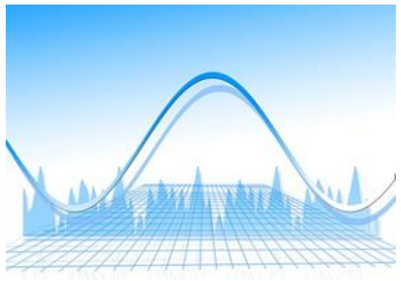
- **Where are you from – what country do you represent?** *(Please stick a dot on the map)*

- **What is your organization's main mode of transport focus?** *(Please stick a dot on the sheet)*

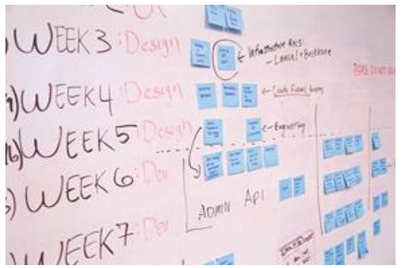
Road | Rail | Aviation | Marine | Inland w'ways | Urban | Other/multiple *(Please describe on a Post-It)*

- **Which category best describes your primary role within your organization?** *(Please stick a dot on the sheet)*

Decision maker – high level managerial



Researcher



Strategic (long-term) planning

Operations – service delivery / short-term planning

Other *(Please describe on a Post-It)*

PROVIDING INFORMATION TO SUPPORT CLIMATE RISK ASSESSMENTS IN THE TRANSPORT SECTOR USING A NEW GENERATION OF HIGH-RESOLUTION GLOBAL CLIMATE MODELS

Galina Guentchev, Erika Palin, Malcolm Roberts, Julia Lockwood & the PRIMAVERA team

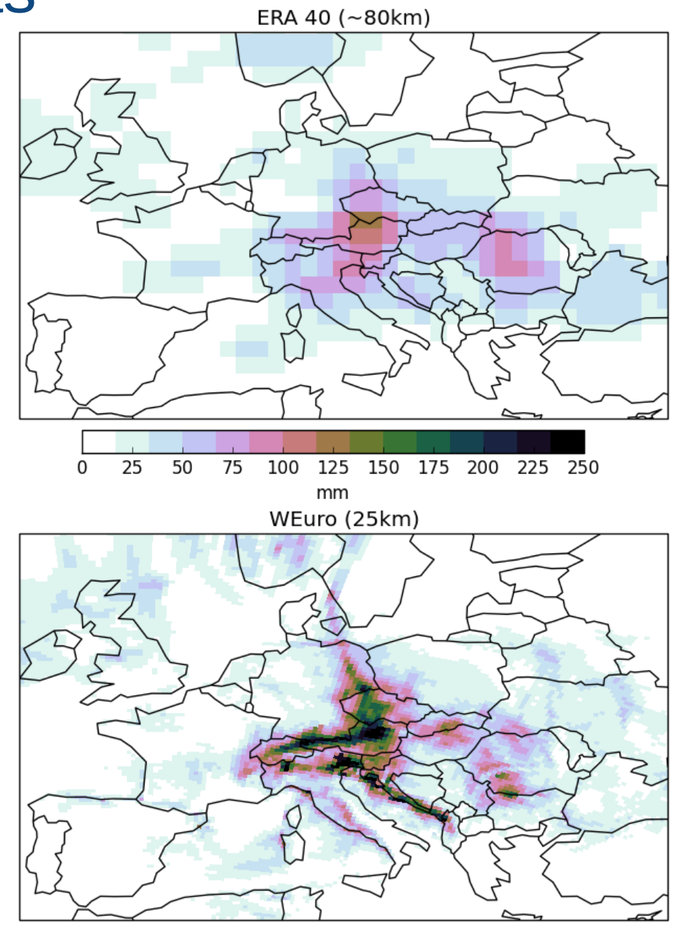
European Transport Conference, Dublin, 10th October 2019

This project has received funding from the European Union's Horizon 2020 Research & Innovation Programme under grant agreement no. 641727.

RAINFALL AND FLOODING USE CASE

PROCESS → METRIC → USER-RELEVANT IMPACT

- Interviewees rated **rainfall and rainfall related flooding** as having
  - **Highest impacts** on road, rail, aviation
  - Having impacts also on marine and inland waterways transport
- **Questions** we attempt to answer
  - How are the models representing the **processes** leading to rainfall related impacts?
    - **Low pressure systems** and the **paths** (tracks) they follow
      - Comparing cyclone **intensity metrics**
  - How **extreme rainfall** may change in the future? (not shown here)



Intense rainfall event leading to **flooding in 2002**, as seen in datasets with lower (top) and higher (bottom) resolution

CHARACTERISTICS OF CYCLONES

PROCESS → METRIC → USER-RELEVANT IMPACT

- Extra-tropical **cyclones** (ETCs) are the main cause of flooding and wind impacts in Europe in winter

- Comparing **PRIMAVERA models** with models from **CMIP5** – Coupled Models Inter-comparison Project – phase 5

- High resolution vs lower resolution

- Terminology - **difference** between models and observed data is also called BIAS

Region used for the analyses

Modelling centre	PRIMAVERA model analysed	CMIP5 model analysed
CMCC	CMCC-CM2-VHR4 (18km)	CMCC-CM (70km)
CNRM	CNRM-CM6-1-HR (50km)	CNRM-CM5 (100km)
ECEARTH	ECEARTH3-HR (36km)	ECEARTH (80km)
MOHC	HadGEM3-GC31-HM (25km)	HadGEM2-A (90km)
MPI	MPIESM-1-2-XR (34km)	MPI-ESM-MR (130km)
ECMWF	ECMWF-IFS-HR (25km)	Unavailable

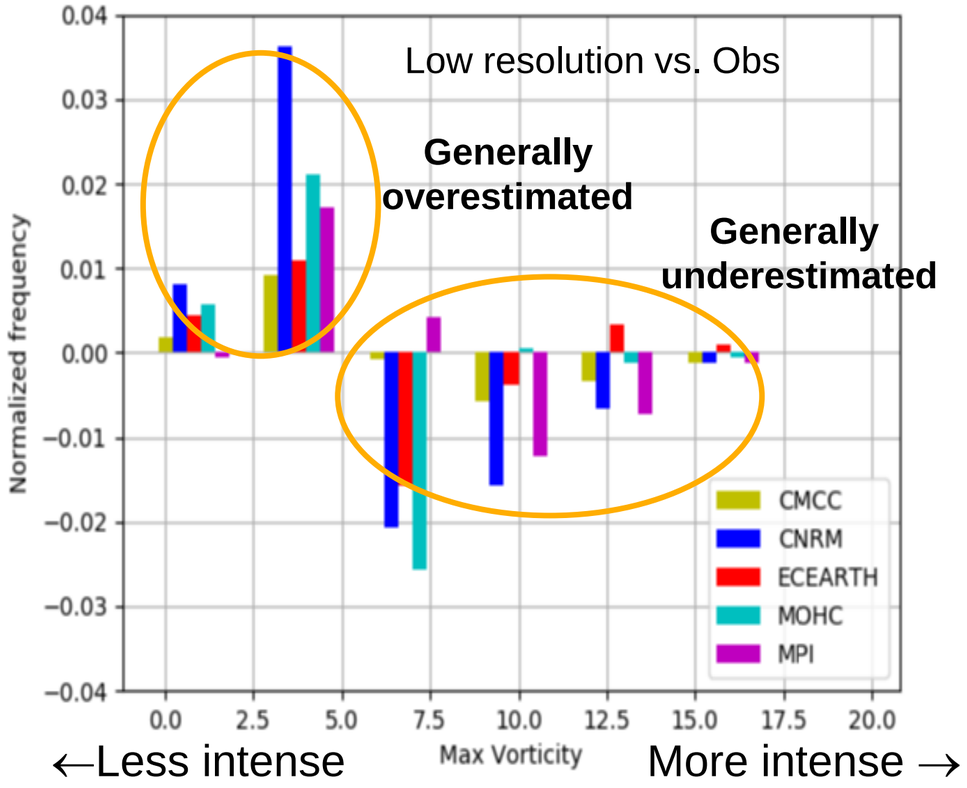
GCMs used in the analyses

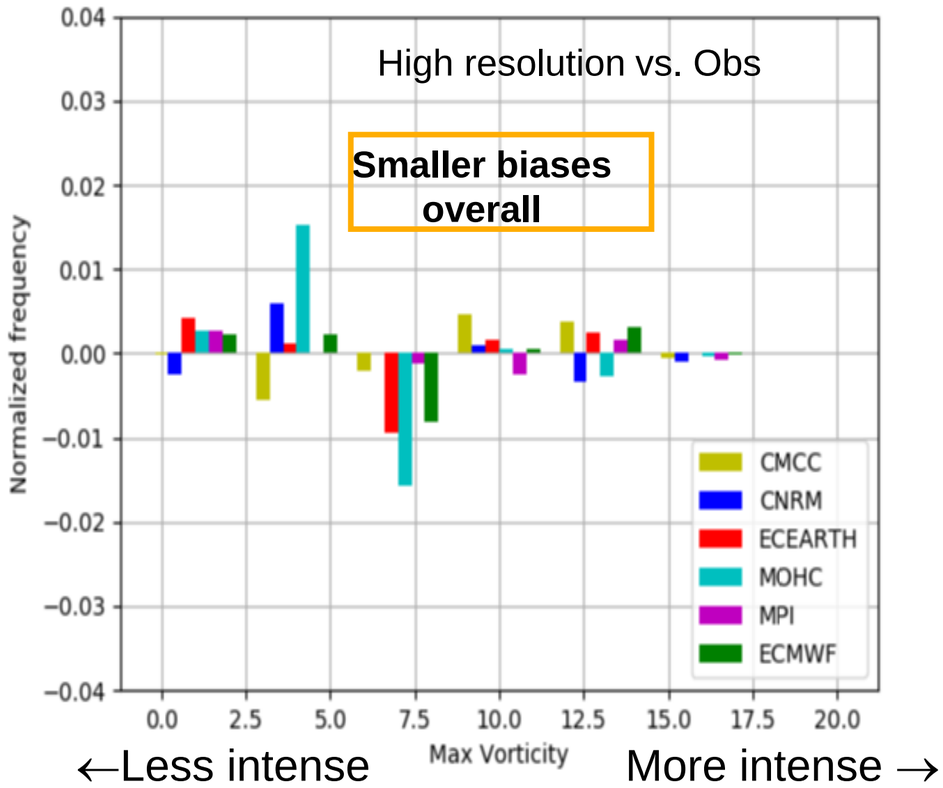
Number in parentheses indicates model's atmospheric resolution at 50ºN

INTENSITY OF CYCLONES – Max vorticity

PROCESS → METRIC → USER-RELEVANT IMPACT

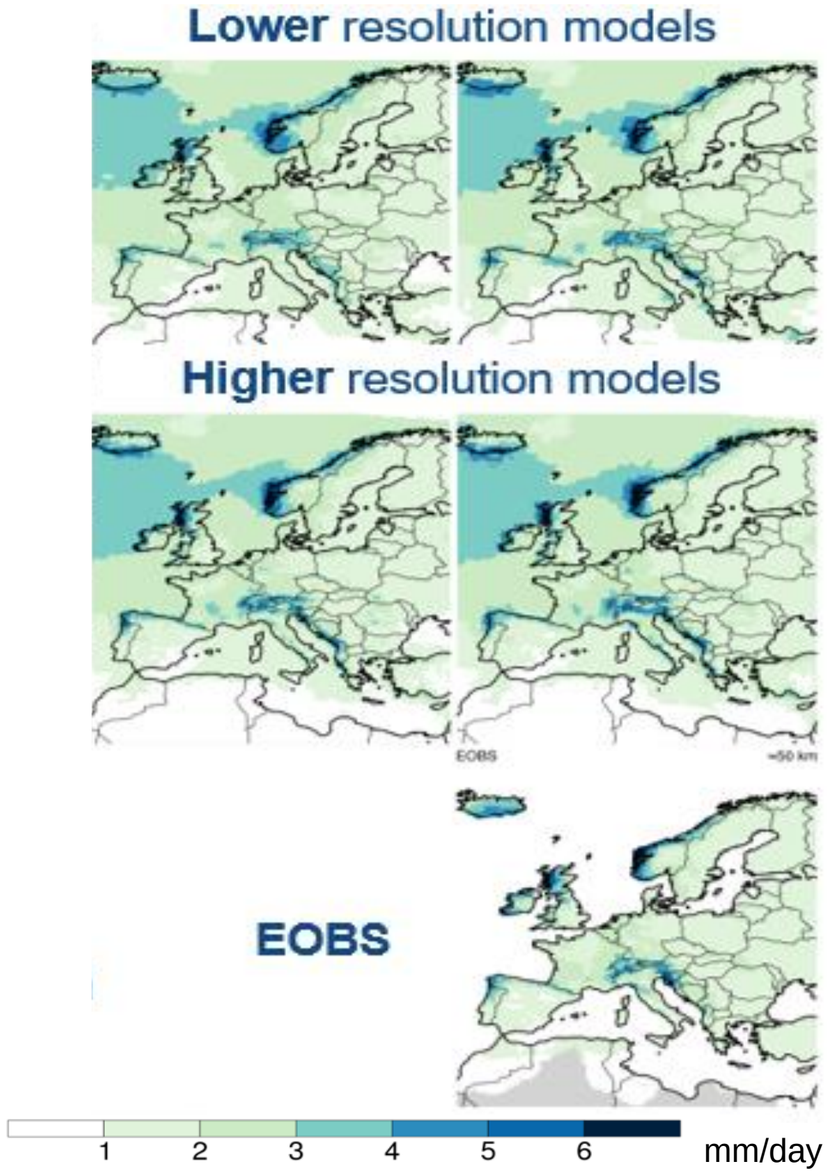
- The lower resolution models underestimate the frequency of more extreme storms, while **overestimating the frequency of less extreme storms**
- These differences are **reduced to a great extent** in the PRIMAVERA (higher resolution) models especially regarding the underestimation of the stronger storms





Annual rainfall (mm)

PROCESS → METRIC → USER-RELEVANT IMPACT



Annual rainfall

- Importance of resolution is even **larger for extreme rainfall**

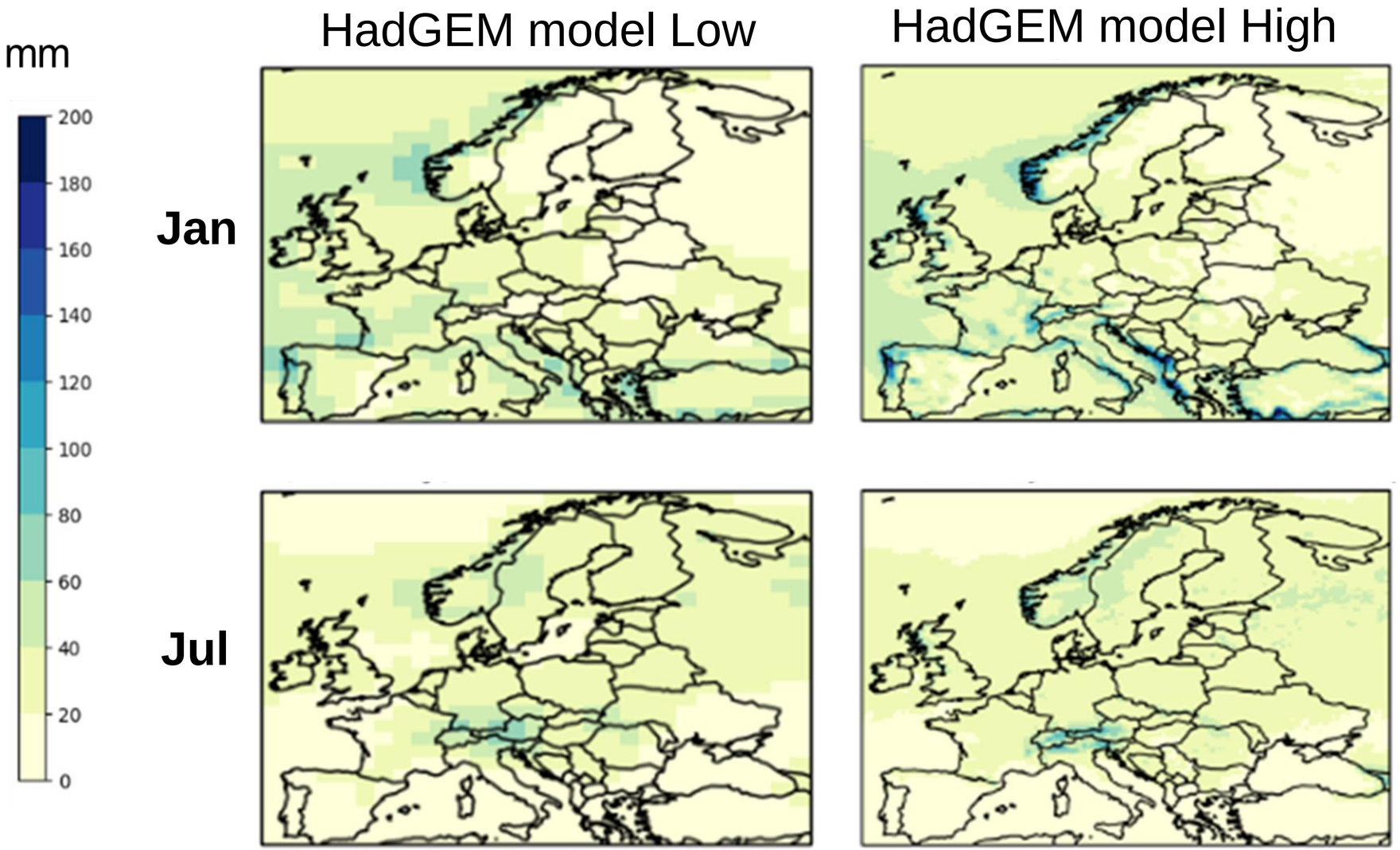
- Results from **quantitative statistical analysis**
  - maximum 5 day rainfall over 7 EU regions, 7 model pairs
  - number of models showing **statistically significant difference** in rainfall amounts between high and low resolution versions

Region	BRI	CEE	MED	NEE
RX5day	7	6	7	5
Region	**SCA**	**SEE**	**WSE**	**AVG**
RX5day	7	4	7	**6.1**

Maximum 5 day rainfall – RX5day (mm)

PROCESS → METRIC → USER-RELEVANT IMPACT

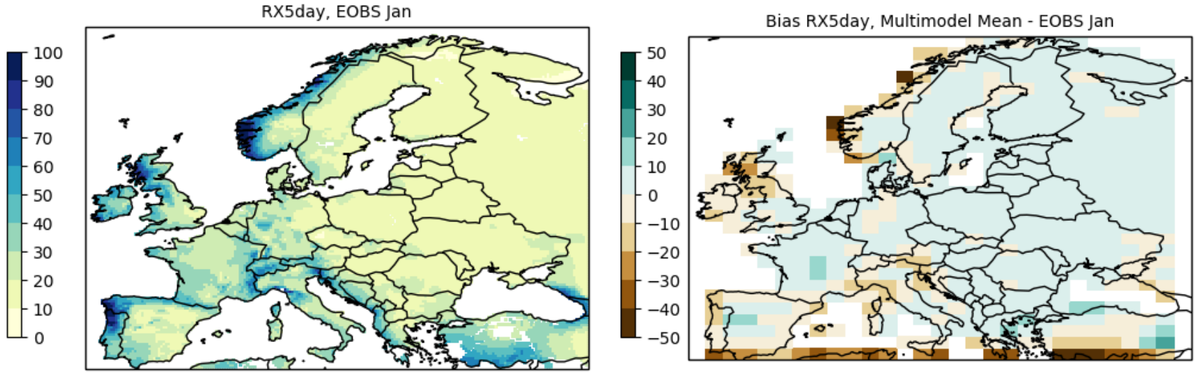
- Higher resolution leads to **more detailed** and **more realistic climate**



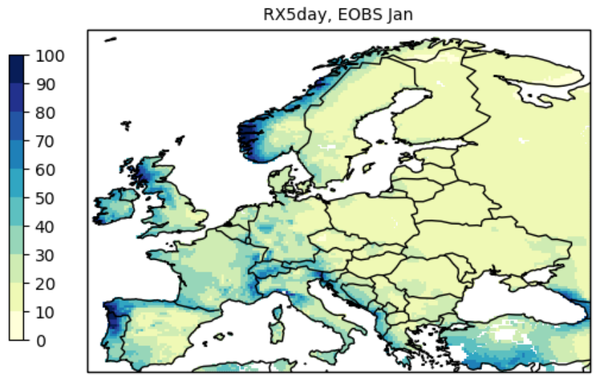
RX5day – DIFFERENCES FROM OBS

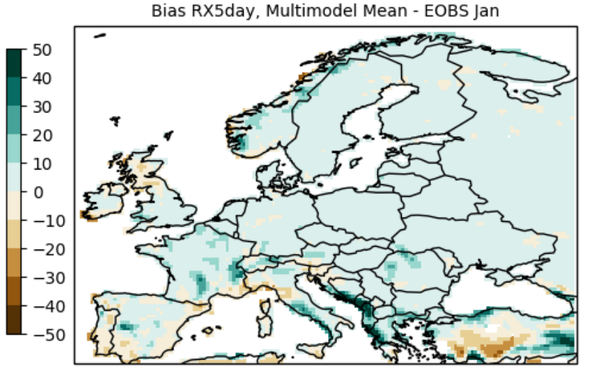
PROCESS → METRIC → USER-RELEVANT IMPACT

Low resolution models

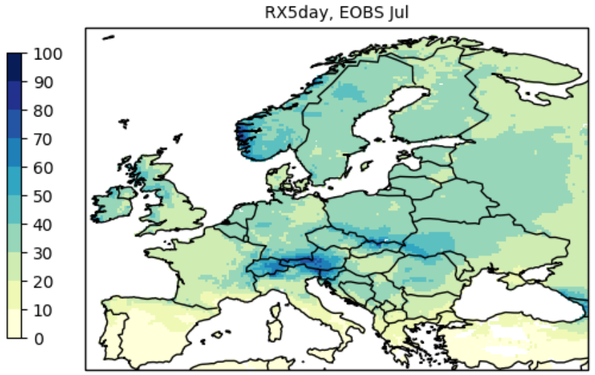


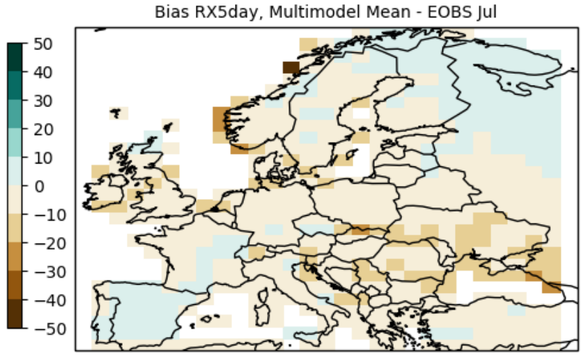
High resolution models

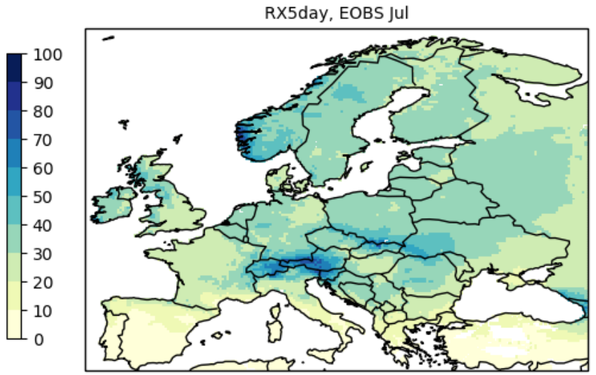


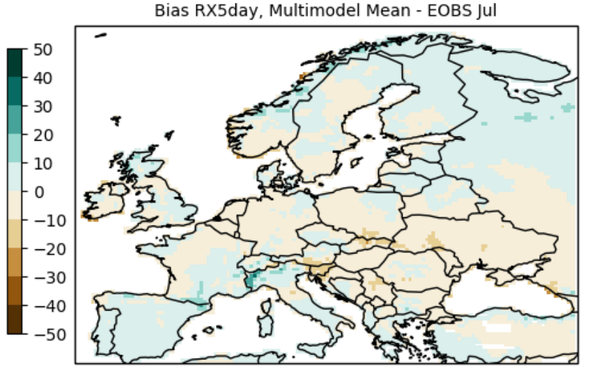


Multi-model mean differences from EOBS – **January**









Multi-model mean differences from EOBS – **July**

YOU JUST SAW A PRESENTATION OF A USE CASE PREDOMINANTLY GUIDED BY THE VISION OF SCIENTISTS…

RESEARCH SHOWS…

USEFUL AND **USABLE** CLIMATE INFORMATION

PERSISTENT BARRIERS

BECAUSE LESS ATTENTION PAID TO **APPLICABILITY** AND **FIT** TO USER NEEDS

Cash et al. 2002

USER PARTICIPATION AND CO-DESIGN OF PRODUCTS

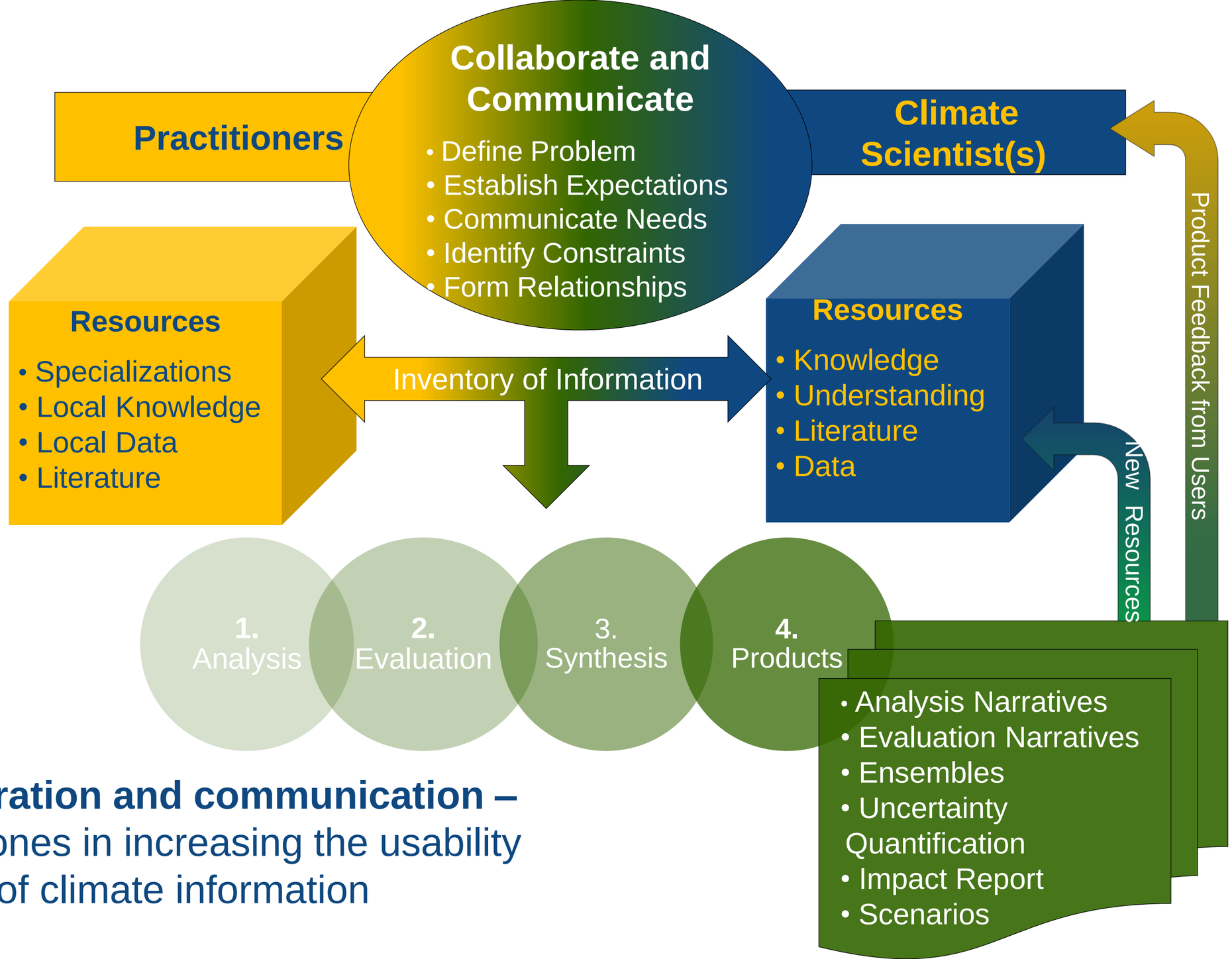
Improves **usability** of climate predictions

Increases **transparency**

Allows for **tailoring**

Allows for better **communication of uncertainty**

Bridges **gap** between climate projections and **user readiness**



Collaboration and communication – cornerstones in increasing the usability of climate information

Figure courtesy of L. Briley, prepared for NCPP

WHERE DO YOU SEE YOURSELF?

Exploring	Learning	Applying
I'm just starting out with all this – **what climate information is out there?**	I know something about climate effects on my sector/organisation but don't know what to do about that – **how does climate affect my organization?**	I've got a good handle on what climate means for my organisation – **but how can I use climate information to improve my planning**?

- *Please put a sticky dot on the chart to show where you think you fit (add a Post-It note if you want to explain further!)*

HOW MIGHT PRIMAVERA HELP YOU?

What climate information is out there?

How does climate affect my organization?

How can I use climate information to improve my planning?

HOW CAN PRIMAVERA HELP?

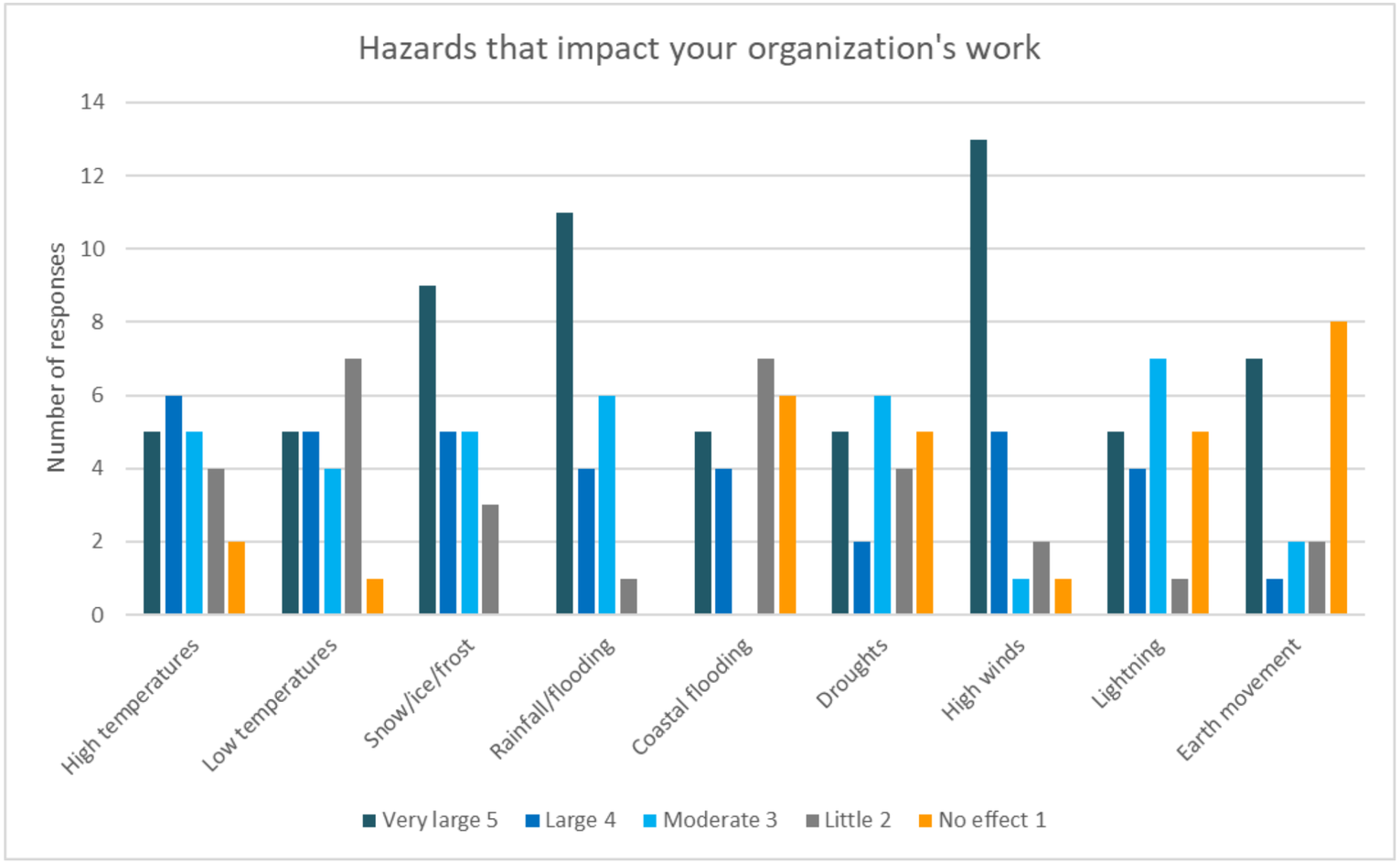
- **Increasing awareness, e.g.**
  - Webinars, presentations
  - UIP
  - Data viewer
  - Factsheets

- Help **identifying relevant hazards** / impacts
  - Transport sector in UIP
  - Factsheets
  - Workshop

- Help **working with climate information**
  - Work with us on a use case specific for you

DISCUSSION QUESTIONS

- In the past, have you tried to **find** climate information?
  - Where did you look?
  - What did you look for?
  - What did you find?
- Do any of these **hazards** sound important to you? →
- What (if anything) is **stopping** you from using climate information?



- High temperature, low temperature, snow/ice/frost, rainfall/flooding, coastal flooding, droughts, high winds, lightning, earth movement

DISCUSSION QUESTIONS

- What metrics or variables can be useful in your planning and adaptation efforts?
  - Number of **days with specific conditions** or **seasonal mean** of a variable
    - such as **seasonal mean rainfall or number of days with very wet days per season/year**
  - Number of **days exceeding a threshold**
    - such as **number of days with wind speeds exceeding a given values per year/season**
  - **Spell duration**
    - for example, **heatwave duration**
  - **Spatial extent** of certain conditions
    - for example, **spatial extent of wet conditions**

DEFINING THRESHOLDS – RAINFALL

Do you have examples of rainfall **thresholds** that are useful to you?

Threshold	Impacts	Transportation mode	Study/Document/ Project
>= 30mm/day >= 100mm/day >= 150mm/day >= 50mm/day	Possible, likely, certain Harmful	Road, rail, metro in EU	Vajda et al. 2014 EWENT D1, 2011
>= 100mm/48hrs >= 150mm/24hrs	Lower road network: landslides, erosion, bridge damages; Regional floods, landslides, erosion.	Road and rail infrastructure EU	EWENT D1, 2011
1 in 200 years return period rainfall event for new construction with a 20% allowance for climate change	Design standard to control bridge scour	Rail and road	RSSB – Tomorrow's railway and climate change adaptation: Executive Report, 2016
30mm/1hour, 60mm/6hrs, 90mm/12hrs, 150mm/24hrs	Route blocked, runways closed, loss of situational awareness; APT limited infrastructure, total APT closed	Aviation in EU	EWENT D1, 2011

DEFINING THRESHOLDS – TEMPERATURE

Do you have examples of temperature **thresholds** that are useful to you?

Threshold	Impacts	Transportation mode	Study/Document/ Project
Daily mean t >= 25º, >= 32º, >= 43ºC Daily maximum t >= 25º, >= 32º, >= 43ºC	Possible, likely, certain harmful	Road and rail in EU	EWENT D1, 2011 Vajda et al. 2014
Less than 28ºC 28ºC to <=33ºC 33ºC to <= 35ºC > 35ºC	Unlikely track failure Possible track failure Likely track failure Certain track failure	Rail Netherlands	Oslakovic et al. 2013
>35ºC	Surface dressing of roads must be suspended as the asphalt will not cool sufficiently quickly	Road UK	CCRA, Thornes et al. 2012
Above 25ºC	Payloads may have to be reduced for take-off owing to the lower air density	Aviation UK	CCRA, Thornes et al. 2012

And finally…

Would anyone be interested to **work with us** on identifying **useful metrics** and **exploring the value** of PRIMAVERA outputs?

WRAP-UP & NEXT STEPS

REFERENCES

- **Cash et al. 2002** - Salience, credibility, legitimacy and boundaries: Linking research, assessment and decision making, Faculty Res. Work. Pap. Ser. RWP02-046, 24 pp., John F. Kennedy Sch. of Gov., Harvard Univ., Cambridge, Mass.
- **EWENT - D1** - Extreme weather impacts on European networks of transport – Review on extreme weather impacts on transport systems
- **Oslakovic et al. 2013** - Risk assessment of climate change impacts on railway infrastructure
- **RSSB, 2016** – Tomorrow's railway and climate change adaptation: Executive Report.
- **Thornes et al. 2012 -** Climate Change Risk Assessment for the Transport Sector (CCRA), (Defra project code GA0204)
- **Vajda et al. 2011** - Severe weather affecting European transport systems: the identification, classification and frequencies of events - Natural Hazards, vol72, iss.1, pp169-188.

- **Transport Research Arena paper**: *Exploring user needs for climate risk assessment in the transport sector: how could global high-resolution climate models help?* Palin, Guentchev, Lockwood, 2018

THANK YOU!

QUESTIONS?

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@PRIMAVERA_H2020