

# Awareness and expectations from the climate adaptation digital twin

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# Digital twin of the Earth

A **digital twin of the Earth** is an information system that provides to users a digital replica of the state and temporal evolution of the Earth system with the purpose to monitor, forecast and assess the Earth system and the consequences of human interventions on it.

## How can the digital twin for climate change adaptation help research and society?

### Understanding processes

Simulations at high resolution allow researchers to understand the complex interactions of phenomena in the Earth system that determine how our planet evolves.

### Integrating climate with impact models

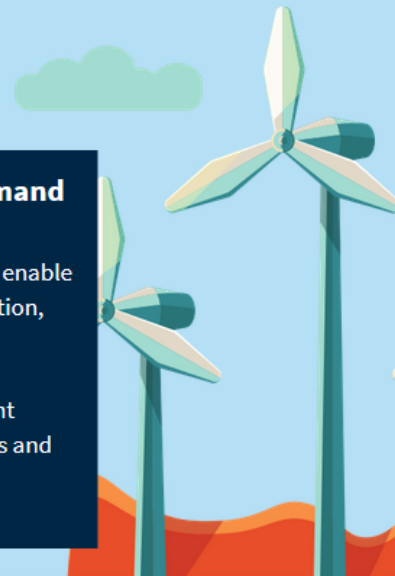
Climate and impact sector modelling is done in the same modelling chain, meaning that impact models access all the climate-related information they need while the digital twin is running (streaming).

### Improving decision-making

The integration with impact models offers the possibility to transform climate data into fit-for-purpose information, including sectoral indicators and risk indices, considering local vulnerability or adaptation tipping points.

### Requesting on-demand simulations

On-demand simulations enable experimentation, prediction, and scenario analysis to explore the potential consequences of different future climate conditions and user interventions.

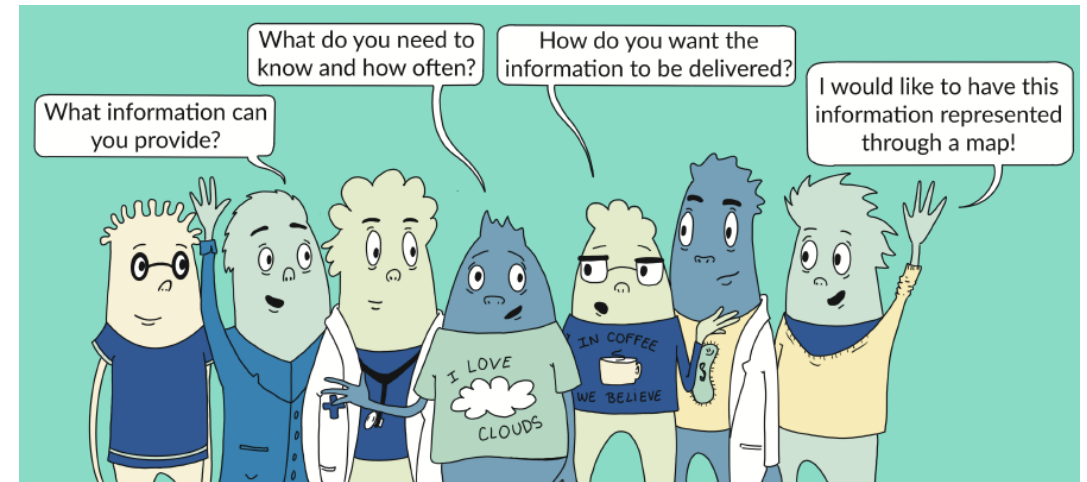


# Digital twin of the Earth

The climate adaptation DT will be a catalyst for scientific and technological innovation...

...but what about the social/human aspect?

...are all relevant stakeholders aware of the climate adaptation DT and its opportunities?



Drawing by Inés Martín del Real (Barcelona Supercomputing Center)

**communications** earth & environment

Perspective



<https://doi.org/10.1038/s43247-024-01626-x>

## Digital twins of the Earth with and for humans

Check for updates

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# Awareness and expectations from the climate DT

## Methodology

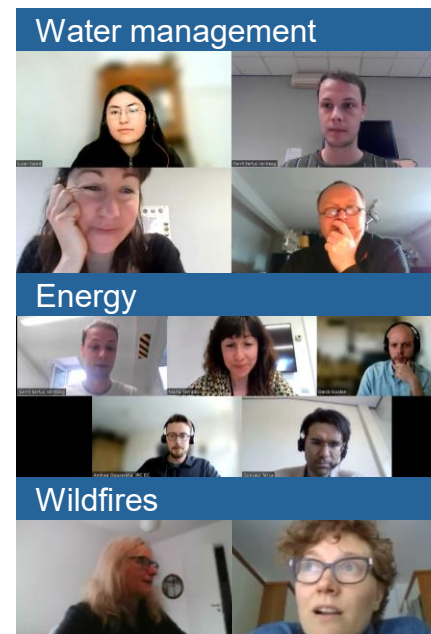
**1** - Survey on awareness and expectations from the Climate DT



Open for 3 months. Targeting climate adaptation researchers and practitioners from climate sensitive organisations, who have or could use climate information for adaptation purposes.  
**29 responses:** mainly organisations focusing activities in the EU and users from the public sector and academia, but also from the private and the third sectors.

**2** – One-on-one interviews with impact sector users

Semi-structured interviews with users involved in the development of applications that use Climate DT model outputs.

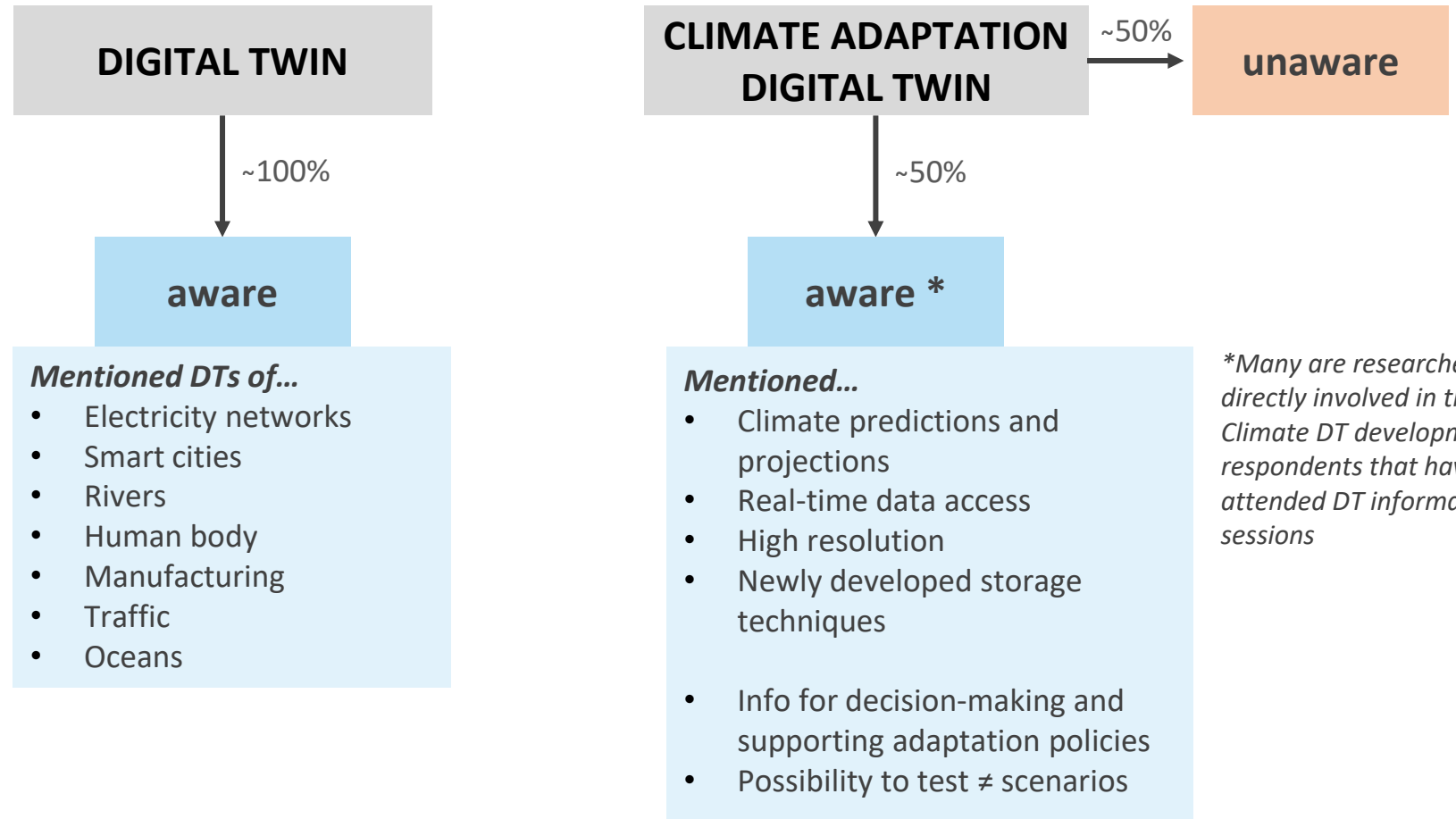


**3** – Attendance to digital twin-related events

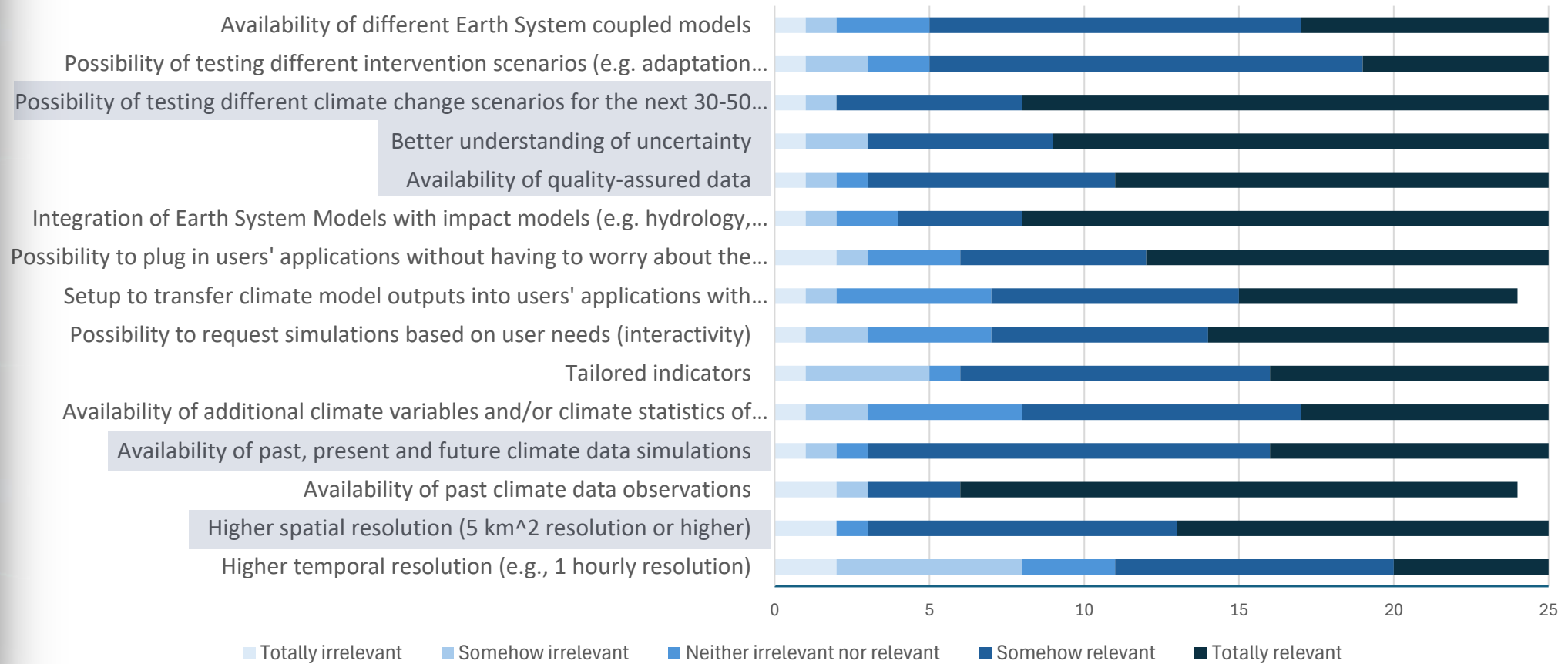


Events gathering scientists, technology developers and potential users, providing an excellent environment for discussion, where the main knowledge gaps and expectations from potential users could be identified.

# Awareness: do people know about the DT?

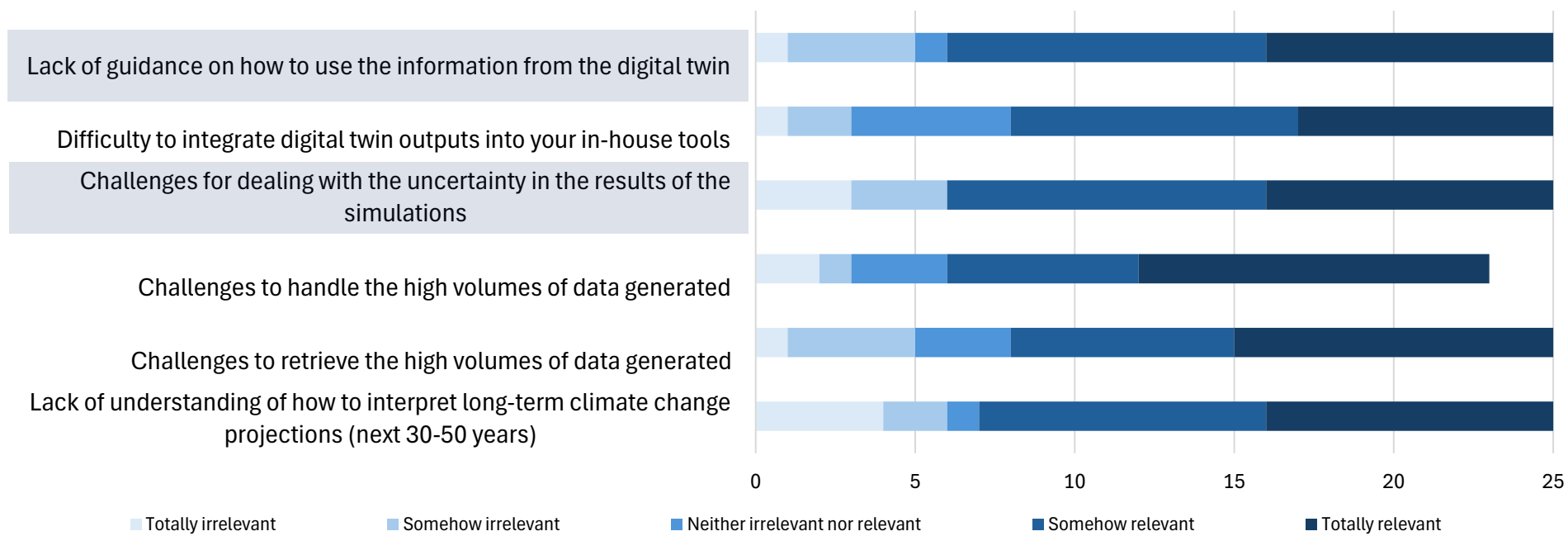


# Main perceived opportunities of the DT



Terrado et al. (in prep.)

# Main perceived challenges of the DT



Terrado et al. (in prep.)

# Need for an engagement and communication roadmap

1. Governance (define roles & responsibilities)
2. Early communication and engagement
3. Co-production
4. Maintain communication and engagement

## 1. GOVERNANCE

- Take into account the **characteristics of different audiences** and needs (scientific users, developers, professionals using information for decision-making, general public)
- Ensure that **users and developers are represented** in the development and maintenance of the DT
- Define who:
  - determines **what is available** on the DT
  - is in charge of **maintenance and updating**
  - **has access** to the DT and its outputs
  - **is liable** for the consequences of the use of the information provided



# Need for an engagement and communication roadmap

1. Governance (define roles & responsibilities)
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## 2. EARLY COMMUNICATION AND ENGAGEMENT

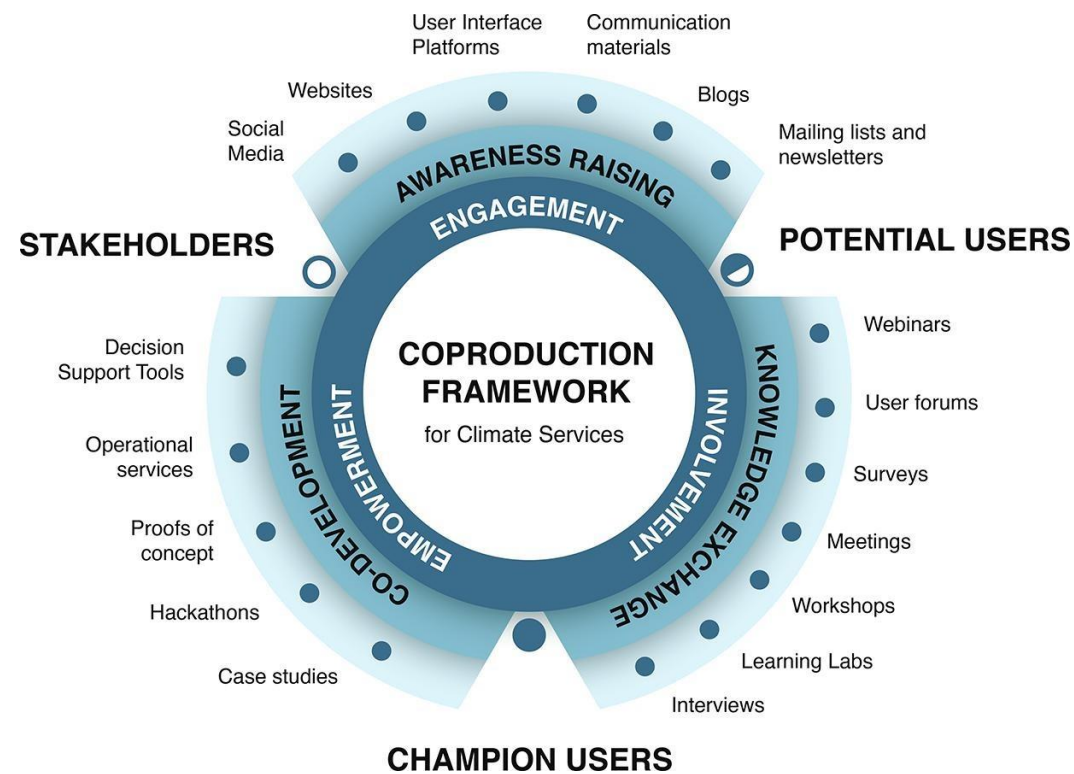
- **Involve users and developers from the beginning** of the design of the DT (not only at the end of the process)
- **Communicate early on** about the concepts like reliability of information, data quality and uncertainties as well as integration with other data sources (CORDEX, etc.)
- **Share success stories** (timely, including diversity of places)
- **Use amplifiers** for sharing stories (CC experts, formal expert groups, data journalists, media outlets)
- **Use communities of practice** and peer learning to support early adoption of DT outputs (e.g. research projects working on high-res modelling)

# Need for an engagement and communication roadmap

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3. Co-production
4. Maintain communication and engagement

## 3. CO-PRODUCTION

- Apply a **transdisciplinary co-production framework** that allows feedback loops between scientists, developers and users
- Involve boundary organisations



Bojovic et al. (2021)

# Need for an engagement and communication roadmap

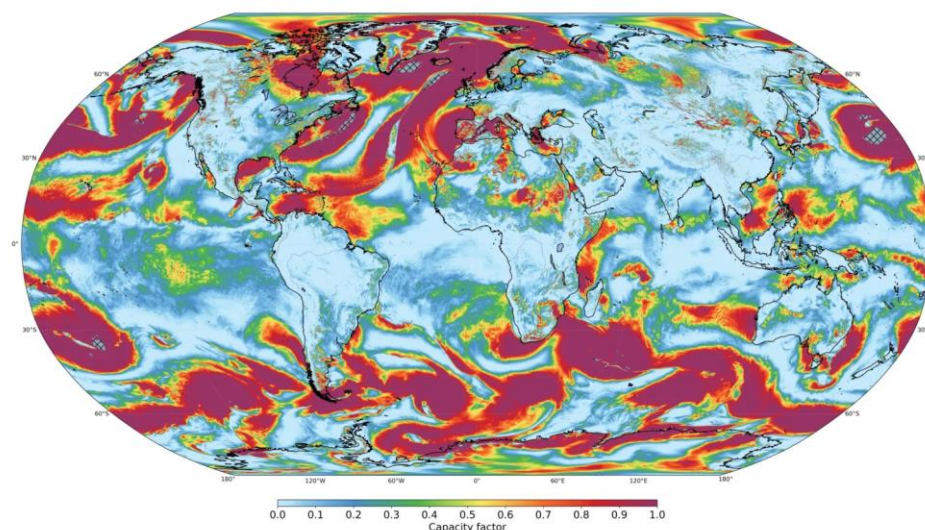
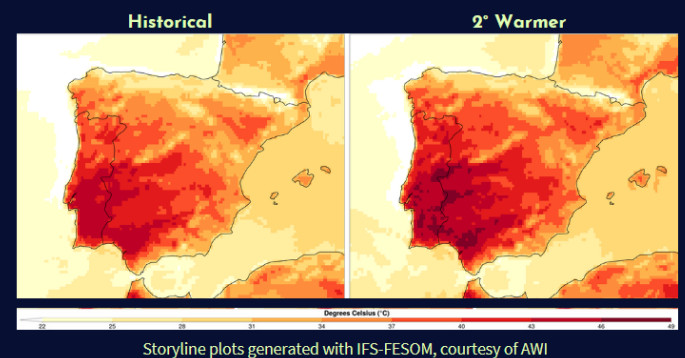
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## 4. MAINTAIN COMMUNICATION AND ENGAGEMENT

- Use storytelling and data visualization + transform climate data to impact information to raise awareness about the usefulness of DT outputs
- Possibility of requesting on-demand simulations to answer users' queries

### What if the heatwave that affected Europe in 2018 occurred in a +2°C warmer world ?

The digital twin allows not only to understand the conditions under which the 2018 heatwave had occurred, but also to simulate how much worse could this heatwave be if it occurs in a future warmer world.



Earth Sciences  
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# Thank you!

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