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Venue: Joint WGNE/WGSIP meeting
Date: 6th November 2024

Funded by
the European Union

Motivation

Camera

Seamless climate predictions

Research gaps

SEASONAL CLIMATE PREDICTIONS:
Complexity; under development (e.g. Copernicus)

MULTI-ANNUAL CLIMATE PREDICTIONS:
Complexity; still emergent/ lack of examples

CLIMATE PROJECTIONS:
Familiarity, enhanced usability

ASPECT SEAMLESS CLIMATE PREDICTIONS:
Enhanced; integrated; consistent information across time scales; enhanced usability

M. Terrado (BSC)

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Overview

Facilitating climate adaptation using seamless predictions

ASPECT is a four-year Horizon Europe project that aims to improve and produce seamless climate predictions covering the next 30 years and embed these into societally important climate change adaptation decisions.

Short-term weather forecasts	Climate predictions					Long-term climate projections
	Sub-seasonal	Seasonal	Multi-annual	Decadal	Multi-decadal	
1-15 days	10-30 days	1-6 months	1-3 years	1-10 years	10-30 years	20-100+ years

Days   Weeks   Months   Seasons   Years   Decades   Centuries

Time

User-centred approach

Climate information is co-produced by working closely with stakeholders from societally important sectors, to address their needs, and produce useful and actionable information

- Super Users
- User Forums
- Case studies
- Uptake / upscaling

ASPECT SUPER USERS

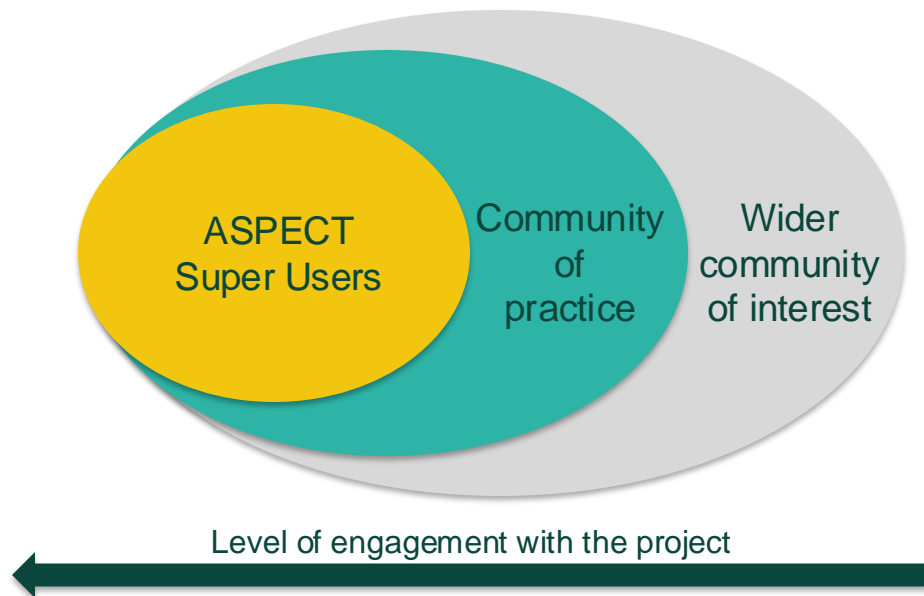Agriculture · Finance · Governance · Humanitarian · Disaster response

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Objectives

1. **Improve seasonal-to-decadal (S2D) forecasts**, targeting user-driven metrics and accounting for the signal-to-noise paradox and other model deficiencies.

2. **Pioneer new extended initialised forecasts up to 30 years ahead** and assess whether they can provide improved information for users.

3. **Pioneer new approaches to join the best forecasts** on seasonal / 1-5-year / 5-30-year time scales and apply them to user-relevant adaptation decisions.

4. Design and implement new ways to **extract high resolution information on extremes** from seasonal to 30-year predictions.

5. Explore for the first time how users can get value from considering **information on seasonal / 1-5-year / 5-30-year time scales together to improve decision-making**.

6. **Design and implement a delivery system for the data and methods** produced by ASPECT, enabling the scaling up of the use of climate risk information on the 1-30-year time scale beyond pilot case studies.

User engagement strategy

User engagement refers to how the consortium interacts with potential users of seamless climate information both within (i.e. across WPs and with Super Users) and outside the ASPECT consortium. Co-developing a common model of user engagement should help us devise strategies that enhance user interactions and fosters the development of robust communities of practice for upscaling of project outputs.

ASPECT Super Users

Community of practice

Wider community of interest

Level of engagement with the project

- **Internal user community:** project partners + Super Users collaboratively developing prototype climate services.

- **Community of practice:** users that know what to do and start to build capacity to be able to use climate services. Expected to be a legacy of ASPECT.

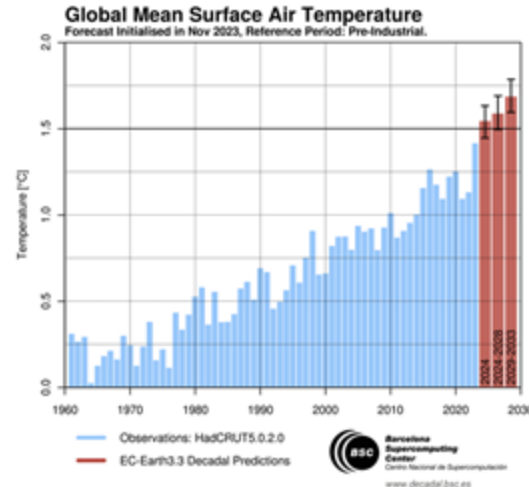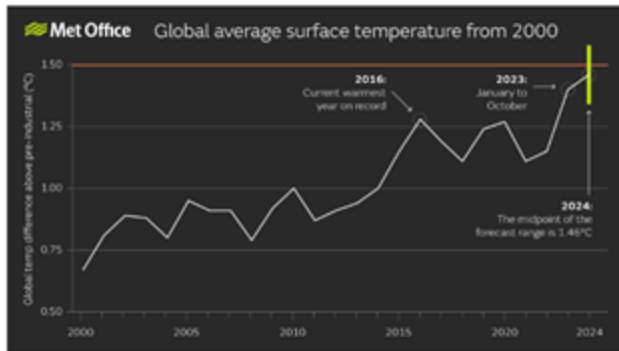- **Community of interest:** individuals that are aware of and desire to use climate services.

Enhanced simulations

Objective 1

Improve seasonal-to-decadal (S2D) forecasts, targeting user-driven metrics and accounting for the signal-to-noise paradox and other model deficiencies.

- A structured questionnaire was developed and distributed among WPs to **gather user feedback on perceived needs.**

- **Main conclusion: the consortium proposed increasing ensemble sizes and extending the reforecast period might be helpful to improve** the quality of the different products currently available for the users.

Global Mean Surface Air Temperature
Forecast Initialised in Nov 2023, Reference Period: Pre-Industrial.

Observations: HadCRUT5.0.2.0
EC-Earth3.3 Decadal Predictions

ASPECT research has contributed to develop decadal predictions showing that 2024 is likely to be the warmest year on record globally, which could exceed 1.5°C.

Met Office — Global average surface temperature from 2000

https://decadal.bsc.es/

New simulations

Objective 2

Pioneer new extended initialised forecasts up to 30 years ahead and assess whether they can provide improved information for users.

- **Bridge seasonal and decadal:** New experimental protocols featuring 2-3 forecast years (extended seasonal) produced biannually with a reforecast period from 1981-2022 and around 20 ensemble members.

- **Bridge decadal and projections**: Initialized climate outlooks to 20-30 years. These will serve as an extension of decadal forecasts but with less frequent reforecast samples.

Preliminary efforts to analyse the results have begun, with substantial support from WPs involving users and the wider scientific community, now adopting this protocol as part of the Decadal Climate Prediction Project (DCPP).

Current practices: Illustration of the seasonal forecasts initialized every month (grey arrows) and decadal predictions (black arrow)
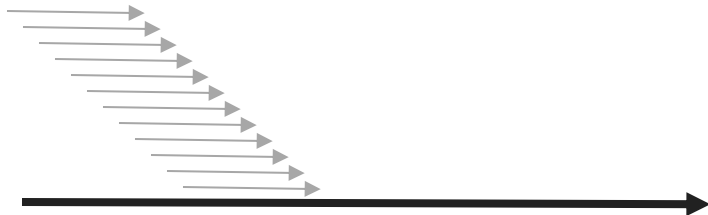
ASPECT innovation: Illustration of the seasonal forecasts initialized every month (grey arrows) and decadal predictions (black arrow)
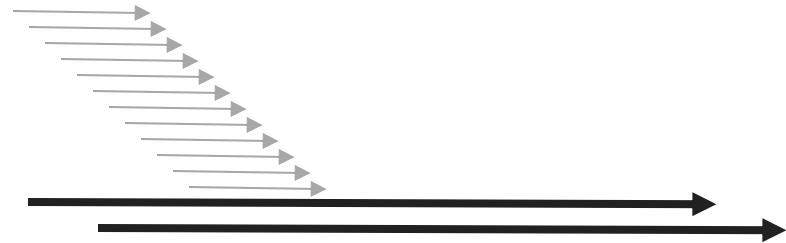
Temporal merging

Objective 3

Pioneer new approaches to join the best forecasts on seasonal / 1-5-year / 5-30-year time scales and apply them to user-relevant adaptation decisions.

- • **Development of methodologies to produce seamless climate information**

ASPECT simulations

- • ASPECT supports users in different socio-economic sectors adapt to climate variability and change simultaneously at all time scales (seamlessly), hence **reducing the risks of maladaptation**.
- • Two strategies:
  - ■ **stitching** (uses best predictions as long as possible and replaces information with longer predictions/projections)
  - ■ **shadowing** (picks specific trajectories from projection ensembles that are close to, or "in the shadow" of a certain "target trajectory")
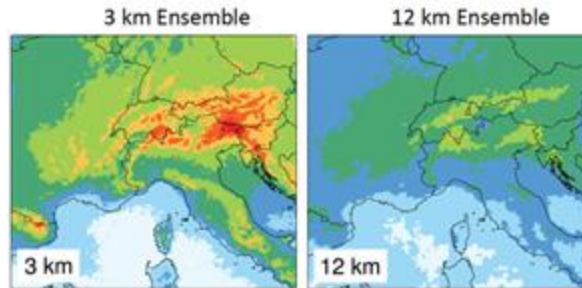
Downscaling

Objective 4

Design and implement new ways to extract high resolution information on extremes from seasonal to 30-year predictions.

- **Development of event-based dynamical downscaling** includes detecting particular events in a coarser model, efficiently spinning up regional climate models before these events, and performing short downscaling in a compact process chain. Application in the Emilia-Romagna region, IT.

Ensemble of climate models; taken from Carbon Brief, credit: Nikolina Ban

- **Development of statistical downscaling approaches** interpolation methods combined with bias adjustment and regression techniques and analogue-based methods focusing on large-scale atmospheric circulation and weather regimes. Application in Catalonia, ES.
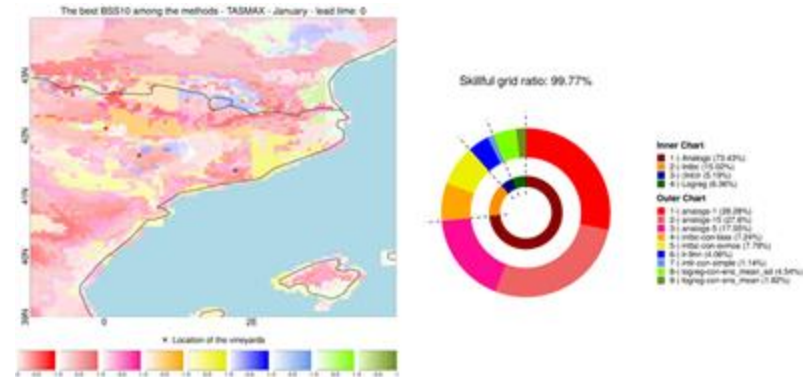
Eren Duzenli (BSC)

Super Users

Objective 5

Explore for the first time how users can get value from considering information on seasonal / 1-5-year / 5-30-year time scales together to improve decision-making.

- **Co-development of prototype climate services with Super Users.** Interactions through interviews, meetings and participation in User Forums.

1st cohort of Super Users (involved in the proposal stage)

Codorniu, Spain (grape/ wine)

Clearglass, UK (pensions)

British Red Cross, UK (disaster response during extreme events)

Emilia Romagna Region, Italy (EU Mission for Climate Adaptation)

2nd cohort of Super Users (recruitment process)

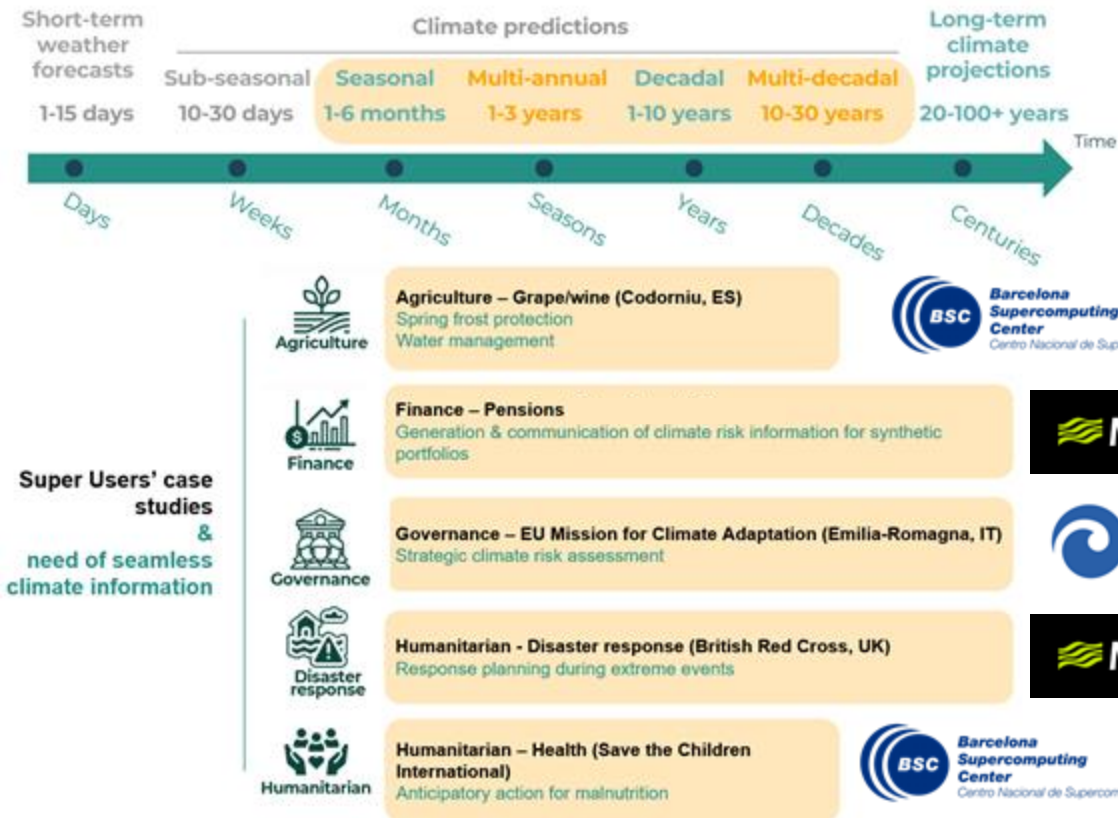Save the Children International (humanitarian sector)

Super Users

Objective 5

Explore for the first time how users can get value from considering information on seasonal / 1-5-year / 5-30-year time scales together to improve decision-making.

- **Identification of Super Users' needs for seamless climate information**. Guiding the work of the project technical WPs.

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Days — Weeks — Months — Seasons — Years — Decades — Centuries

Super Users' case studies & need of seamless climate information

Agriculture — Agriculture – Grape/wine (Codorniu, ES)
Spring frost protection
Water management
Barcelona Supercomputing Center *Centro Nacional de Supercomputación* (BSC)

Finance — Finance – Pensions
Generation & communication of climate risk information for synthetic portfolios
Met Office

Governance — Governance – EU Mission for Climate Adaptation (Emilia-Romagna, IT)
Strategic climate risk assessment
CMCC Centro Euro-Mediterraneo sui Cambiamenti Climatici

Disaster response — Humanitarian - Disaster response (British Red Cross, UK)
Response planning during extreme events
Met Office

Humanitarian — Humanitarian – Health (Save the Children International)
Anticipatory action for malnutrition
Barcelona Supercomputing Center *Centro Nacional de Supercomputación* (BSC)

Climate information

Objective 6

Design & implement a delivery system for the data and methods produced by ASPECT, enabling the scaling up of the use of climate risk information on the 1-30-year time scale beyond pilot studies.

- **Assessment of climate information use and user needs across Europe**
  - Quantitative survey with 1700+ respondents from climate sensitive organizations across Europe.
 - Annual multi-sector User Forums

- **Initial steps towards a delivery system**
  - New project datasets and their documentation stored in ESGF and MARS to ensure wider accessibility.
  - Online catalogue with decadal forecasts
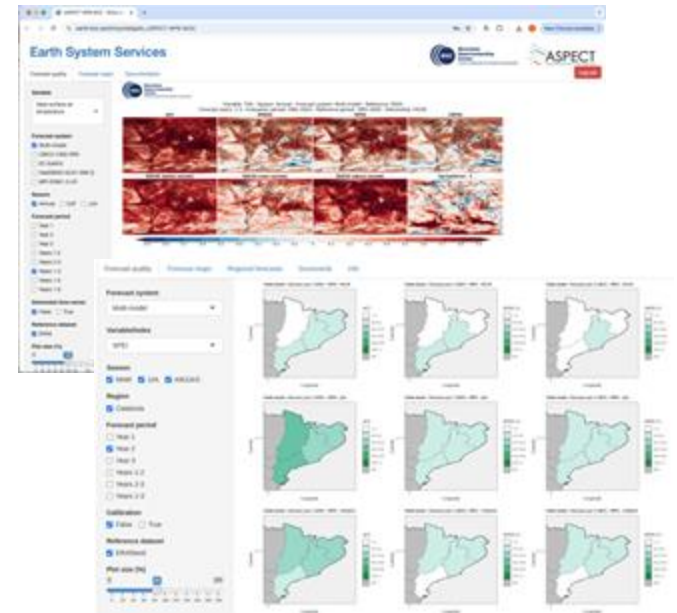
Challenges and way forward

1. **Transdisciplinarity.** Ensure smooth collaboration with Super Users in the framework of the different case studies. **Action: Development of an interaction protocol**. Establishment of a Stakeholder engagement committee with representatives from each WP.

2. **Usability.** Ensure predictions provided by the project have an added value for users (how unsharp may predictions be for still being useful). **Action: Co-evaluation task with Super Users**

3. **Upscaling.** Maintain an engaged community of practice to ensure upscaling of project results. **Action: create buy-in from particular user groups** (NMHS, RCOFs, regions from the EU Mission on Climate Adaptation…). Workshop for NMHS in October 2024, annual User Forums, additional capacity building activities.
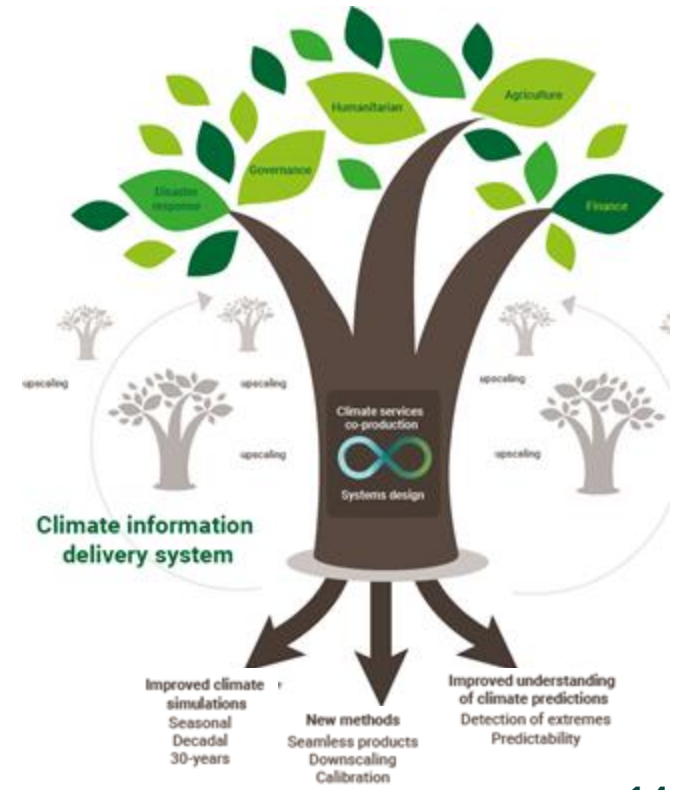
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CONNECT

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