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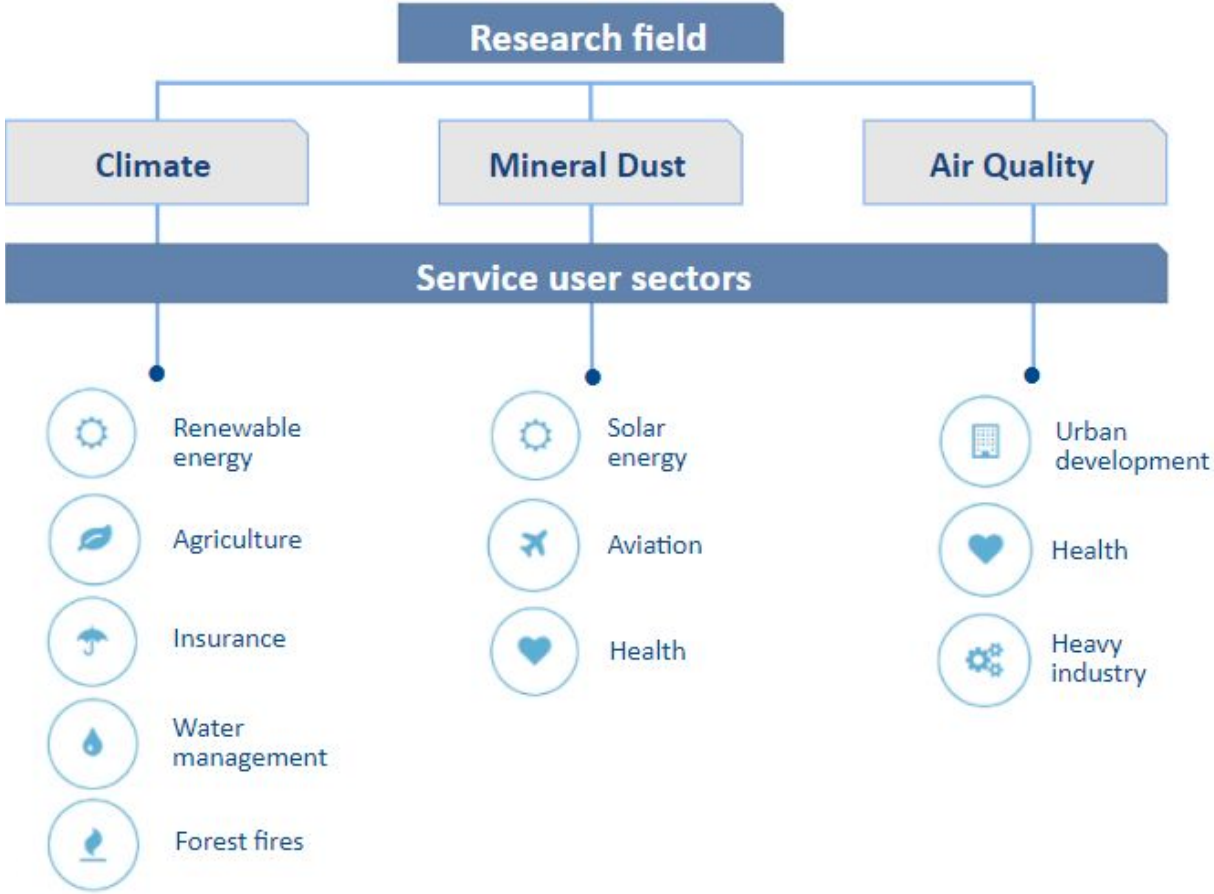
Centro Nacional de Supercomputación

What are the newcomers doing in Earth System Services?

From research to services



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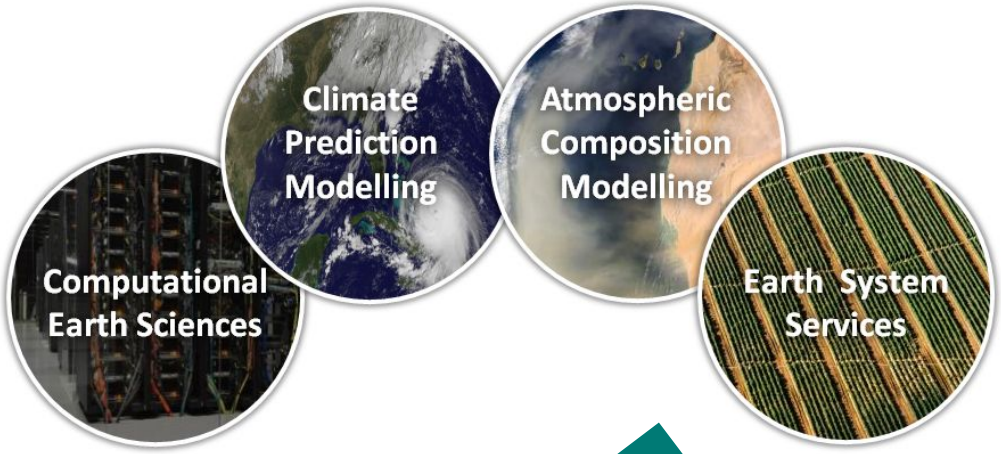


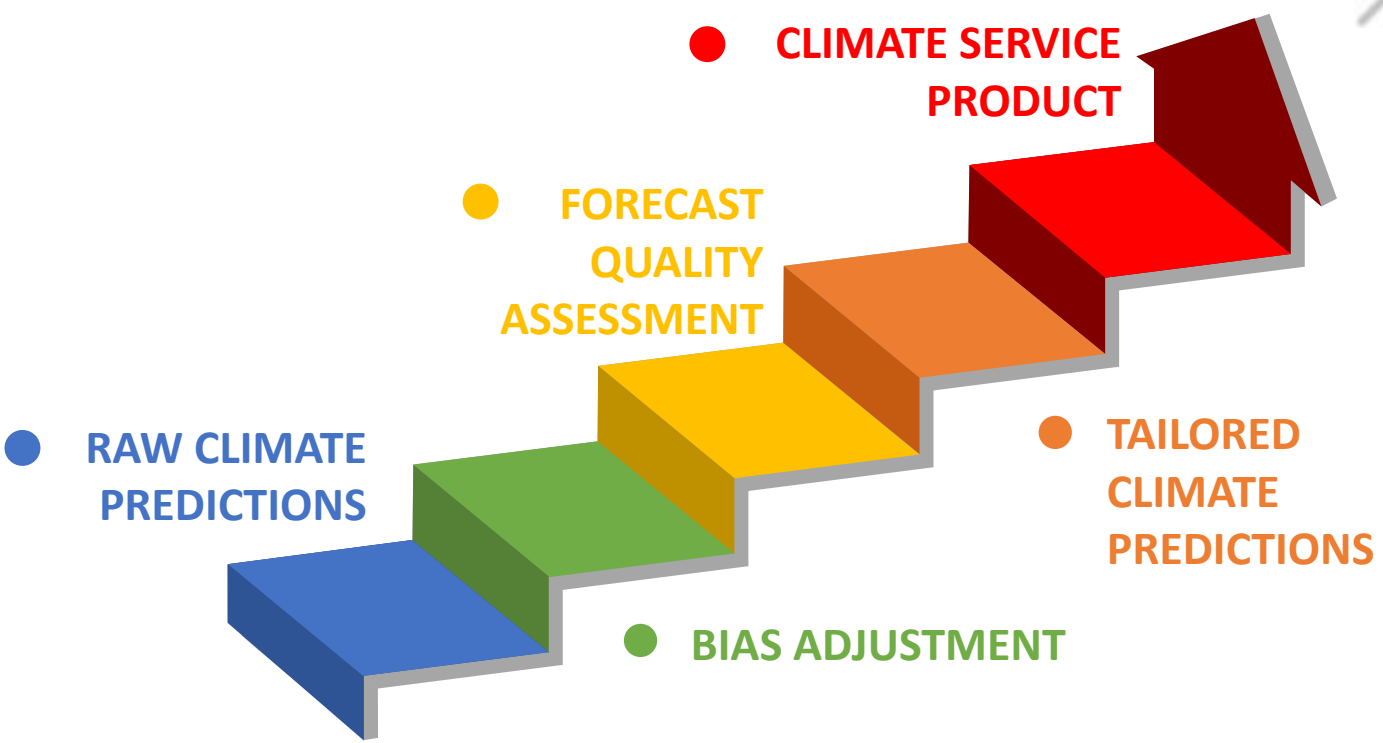
Climate Services

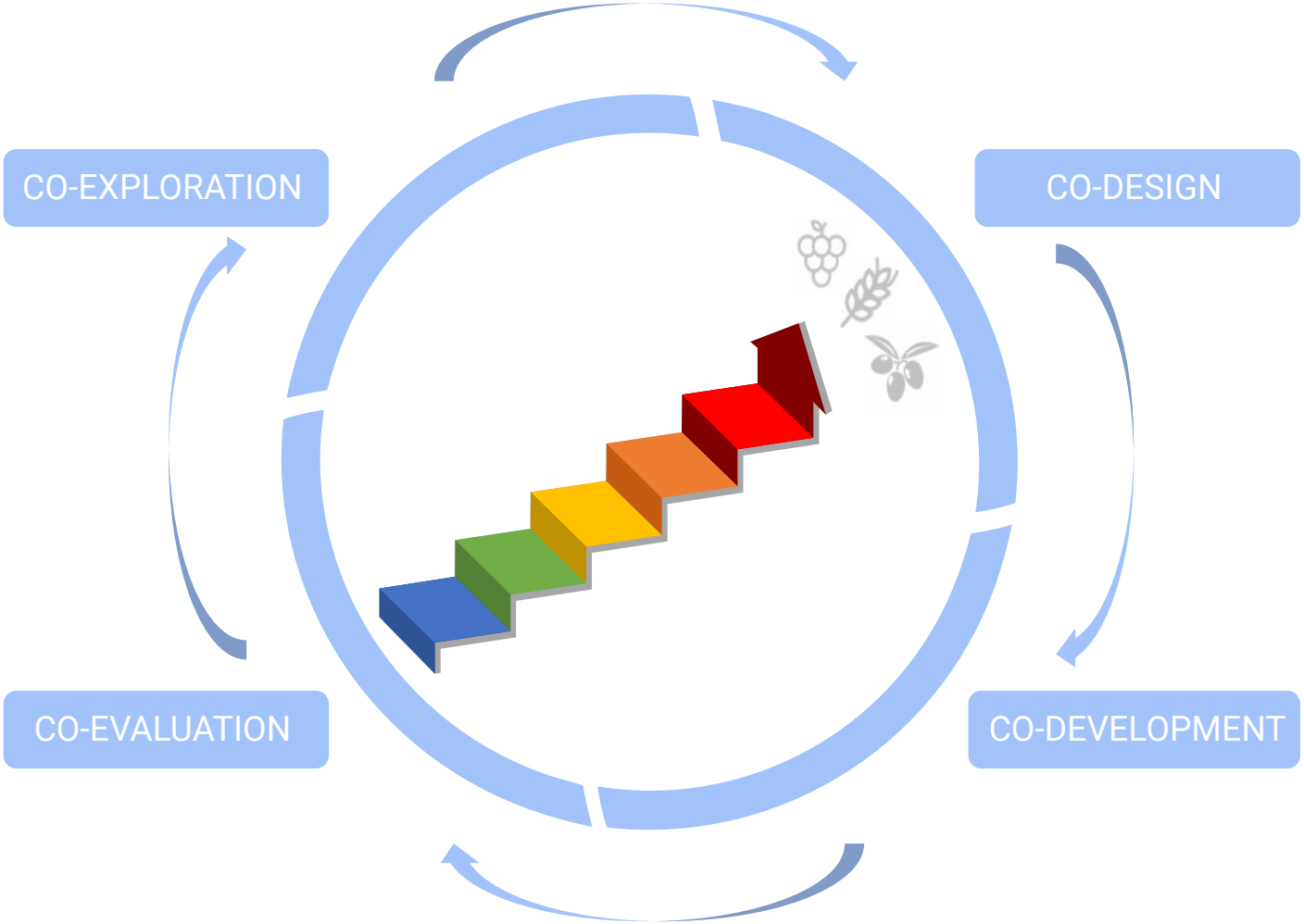
Air Quality Services

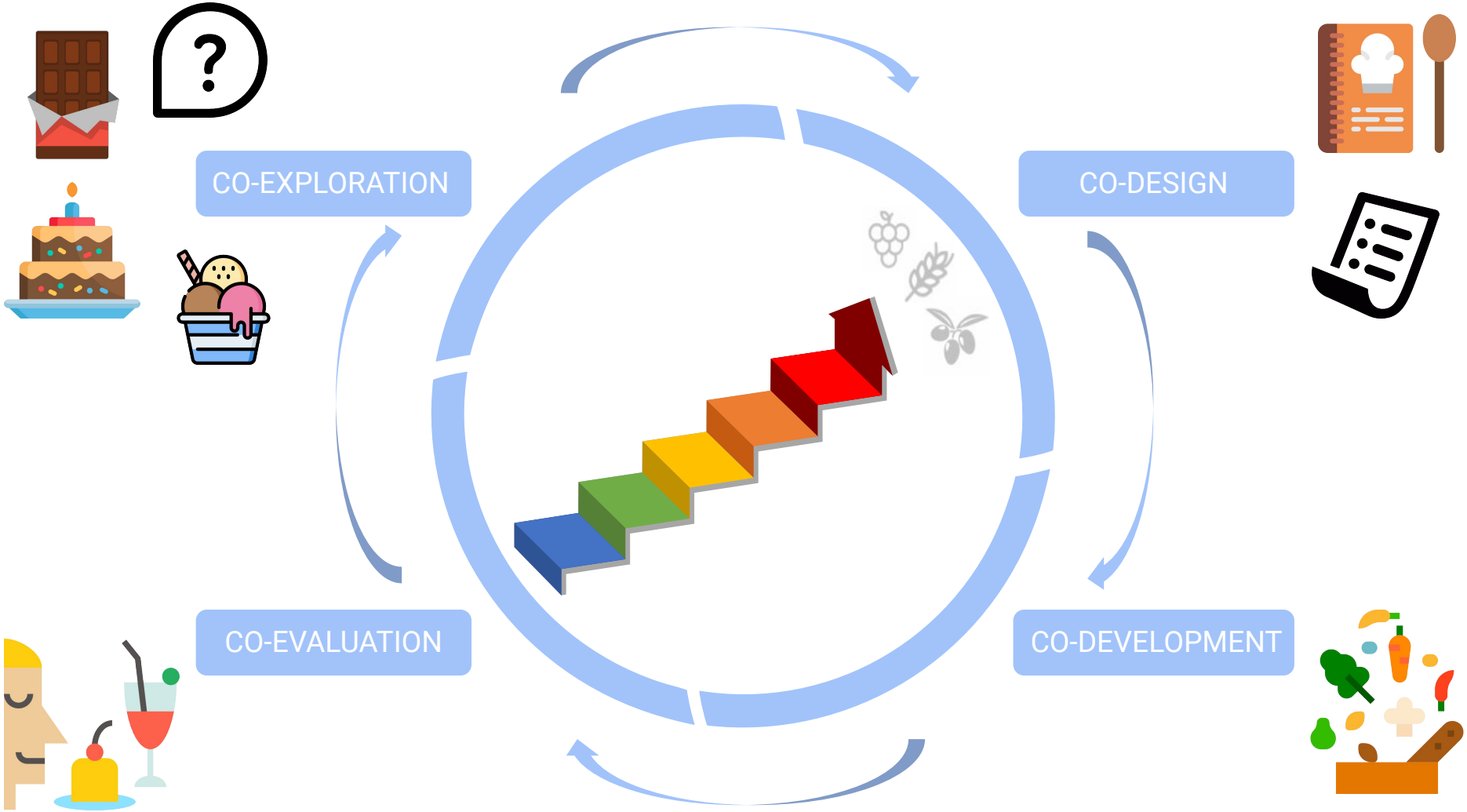
Knowledge Transfer Team

Barcelona Supercomputing Center
Centro Nacional de Supercomputación

ESS
Earth System Services


CLIMATE SERVICE PRODUCT
FORECAST QUALITY ASSESSMENT
RAW CLIMATE PREDICTIONS
TAILORED CLIMATE PREDICTIONS
BIAS ADJUSTMENT


CO-EXPLORATION
CO-DESIGN
CO-EVALUATION
CO-DEVELOPMENT

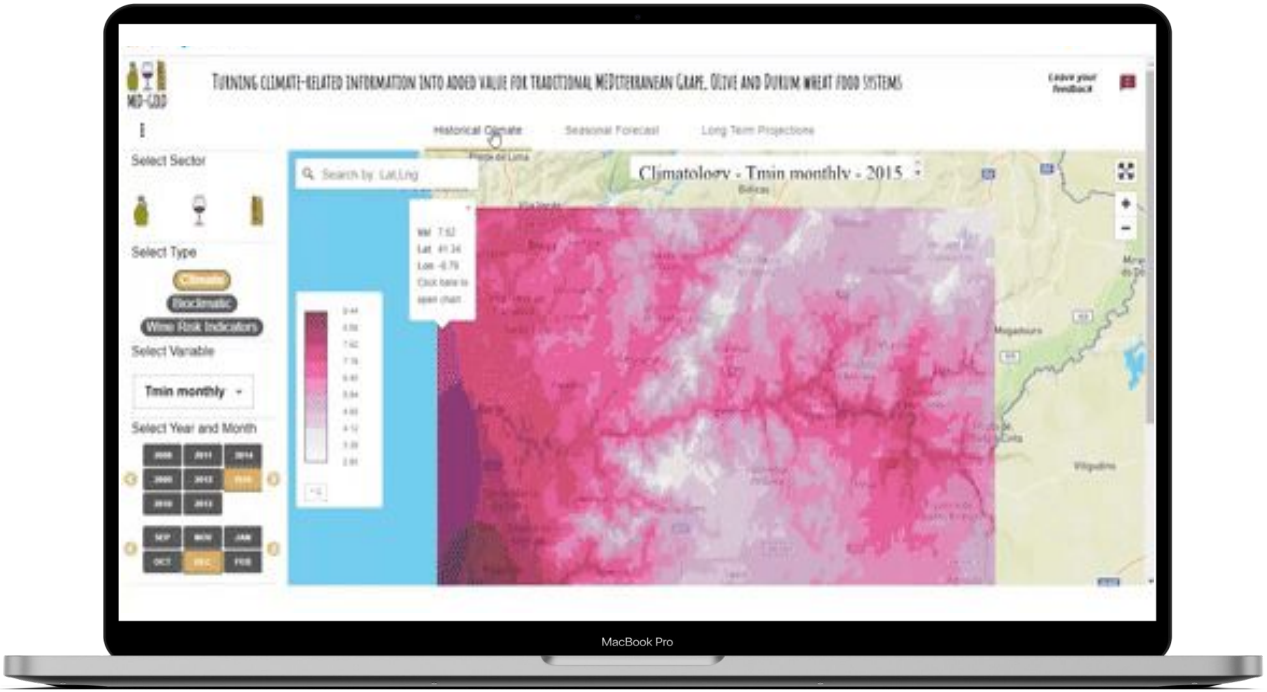

CO-EXPLORATION
CO-DESIGN
CO-EVALUATION
CO-DEVELOPMENT

S2S4E

Climate Services for Clean Energy

S2S4E
Climate Services for Clean Energy

Barcelona Supercomputing Center
Centro Nacional de Supercomputación



MED-GOLD

Barcelona Supercomputing Center
Centro Nacional de Supercomputación

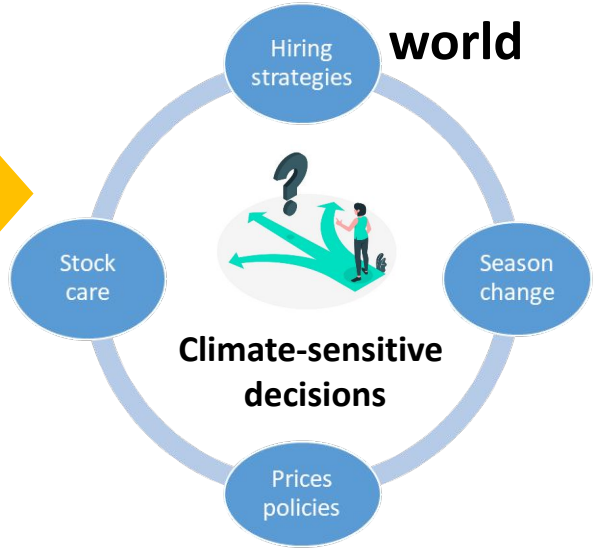
DECATHLON

From climate data to climate services

Climate world

CLIMATE SERVICES
Co-development scientists/end-users

End-users world



Climate-informed decision-making

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Why does Decathlon need climate predictions?

Image source:
https://elpais.com/elpais/2018/07/05/buenavida/1530805672_271996.html

BENEFITS

- Avoiding the extra-cost of keeping what is not sold
- Avoiding running out of products
- The stock transport is optimized (less carbon when transporting)

CLIMATE-SENSITIVE STRATEGIES AND DECISIONS

- Taking different advertising campaigns and prices policies
- Defining when the change of season should be done
- Managing properly the stock and redistribute it

Image source:
https://www.revistaoxigeno.es/material/por-que-es-tan-importante-material-montana_192247_102.html

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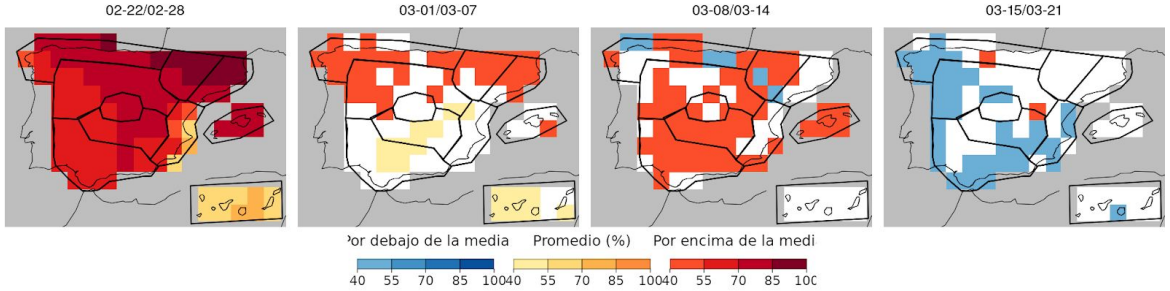
Our climate service product

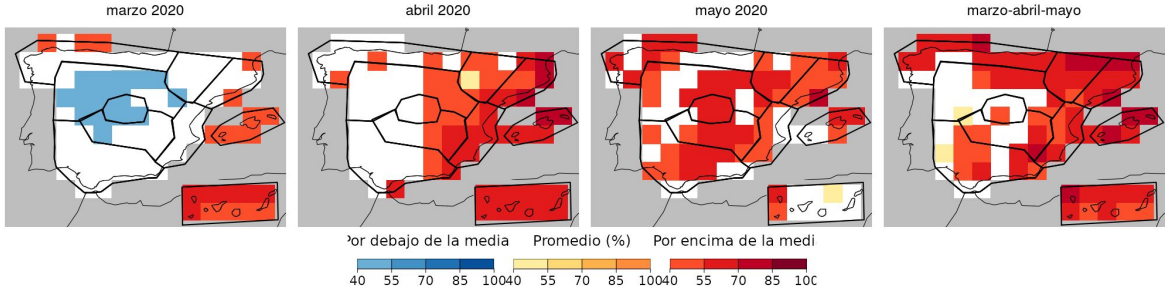
Barcelona Supercomputing Center
Centro Nacional de Supercomputación

- **OPERATIONAL REAL-TIME SEASONAL AND SUBSEASONAL PREDICTIONS OF THE MOST LIKELY TERCILE CATEGORY FOR SURFACE TEMPERATURE**

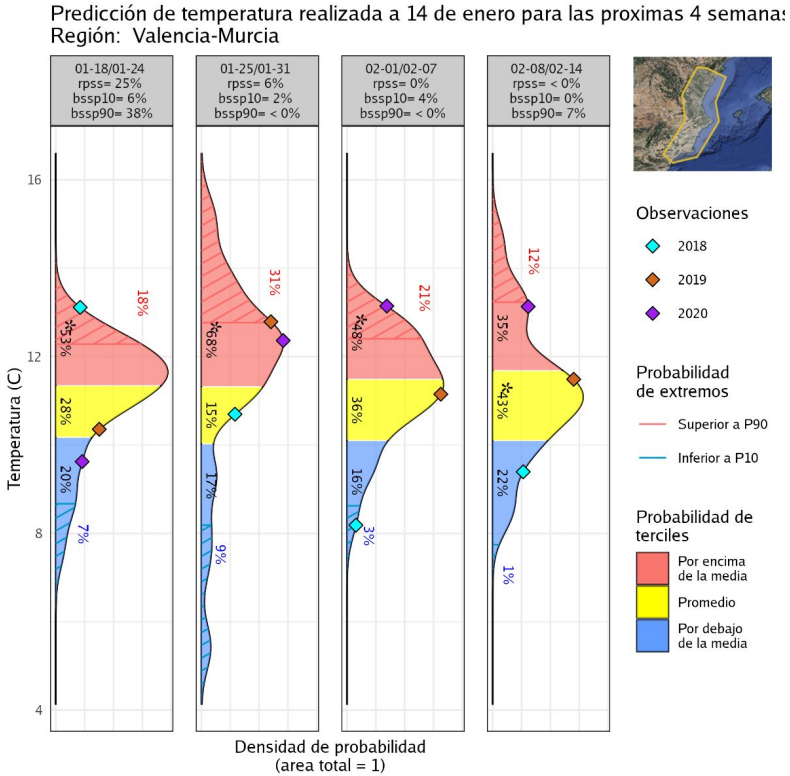
Predicción subestacional de temperatura

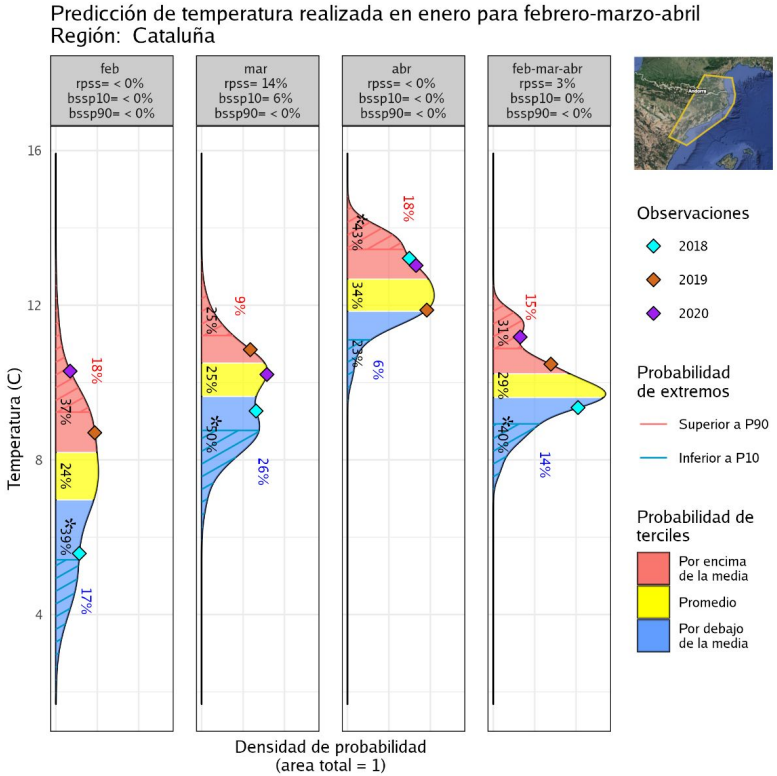


Predicción estacional de temperatura



- **FORECAST PROBABILITY DISTRIBUTION FOR THE REGIONS OF INTEREST DEFINED BY DECATHLON (FOR SEASONAL AND SUBSEASONAL TIMESCSALE)**





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Our product performance in two meteorological great-impact events

Barcelona Supercomputing Center
Centro Nacional de Supercomputación

The Filomena event

Image source: https://www.elplural.com/el-telescopio/tech/espana-filomena-espacio_257533102 Photo: ESA

Image source: https://atalayar.com/content/sat%C3%A9lites-metop-y-msg-clave-en-la-alerta-ante-la-gran-nevada-ca%C3%ADda-en-buena-parte-de-espa%C3%B1a PHOTO/Europa Press

Image source: cuidateplus.marca.com/bienestar/2021/01/12/como-prevenir-actuar-caidas-hielo-176335.htmlhttps://

Image source: https://www.elperiodico.com/es/economia/20210111/efectos-filomena-cubiertos-seguros-11448387

Image source: https://www.heraldo.es/noticias/aragon/2021/01/09/temporal-filomena-la-nieve-tiene-un-efecto-psicologico-positivo-1413878.html

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Centro Nacional de Supercomputación

Filomena's case study

OBSERVATIONS

vs

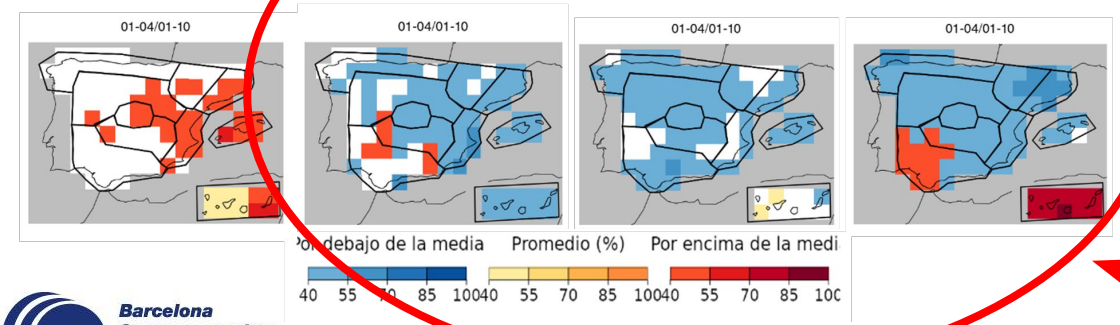
PREDICTED TERCILE CATEGORY FOR SURFACE TEMPERATURE DIFFERENT WEEKS IN ADVANCE

4 weeks in advance
Forecast issued on Dec 10

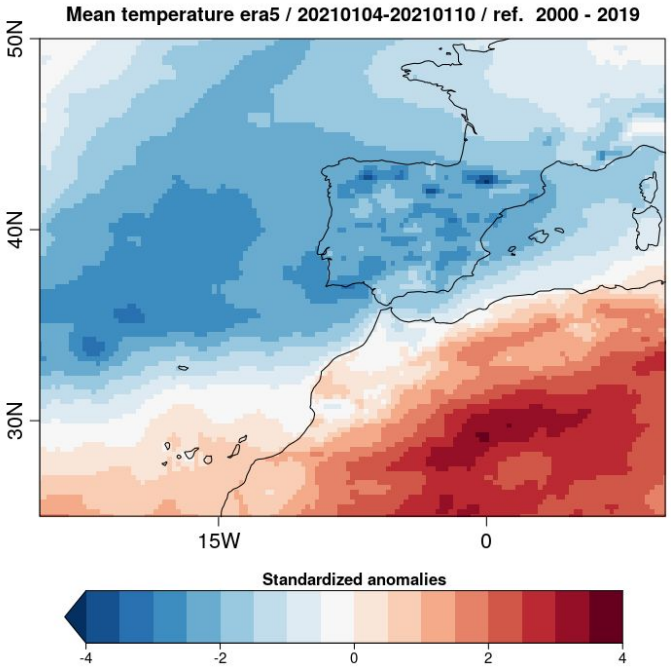
3 weeks in advance
Forecast issued on Dec 17

2 weeks in advance
Forecast issued on Dec 24

1 week in advance
Forecast issued on Dec 31



ANOMALY MAP



WELL-PREDICTED 3 WEEKS IN ADVANCE!

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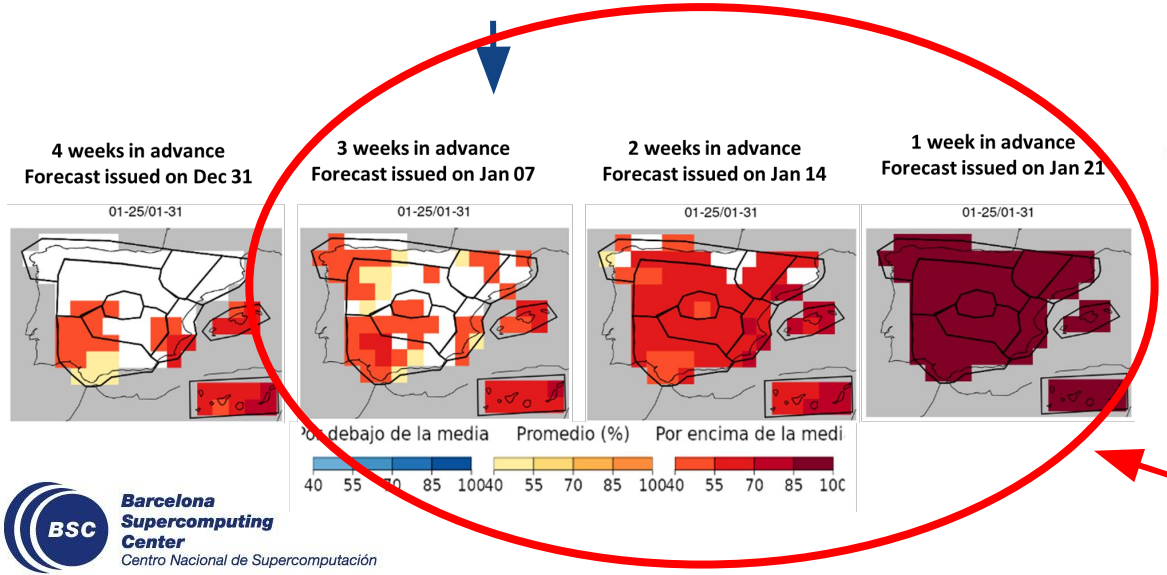
Centro Nacional de Supercomputación

The end January 2021 “warm” episode

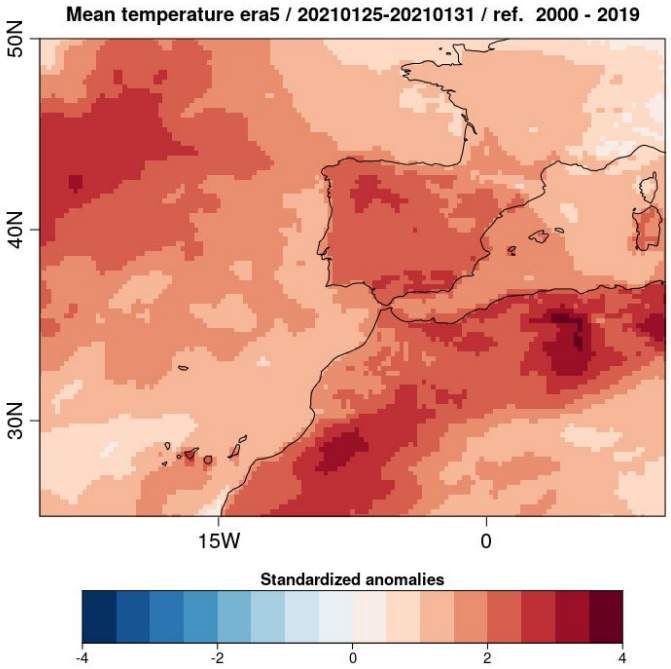
OBSERVATIONS

vs

PREDICTED TERCILE CATEGORY FOR SURFACE TEMPERATURE DIFFERENT WEEKS IN ADVANCE



ANOMALY MAP



WELL-PREDICTED 3-4 WEEKS IN ADVANCE!

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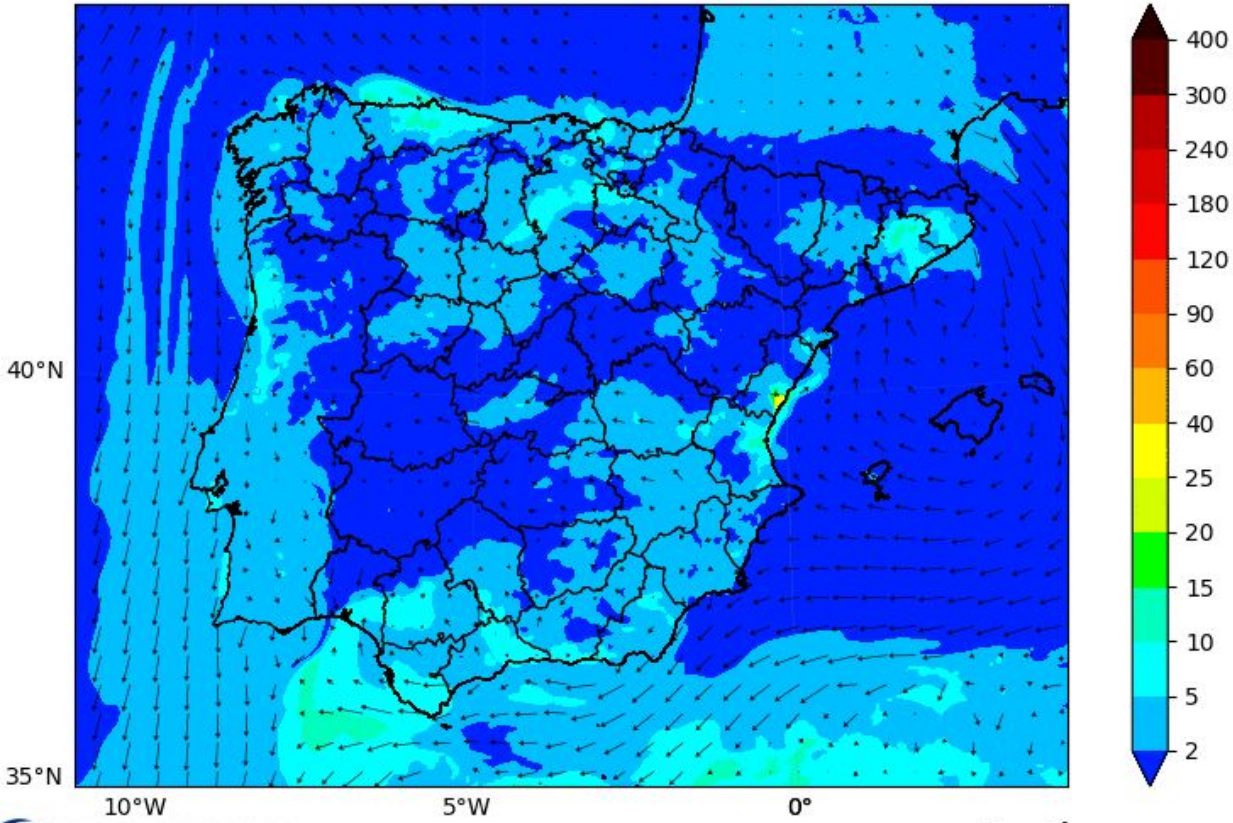
Centro Nacional de Supercomputación

DECATHLON

AIR QUALITY SERVICES

PM2.5 ($\mu g\ m^{-3}$) for 00UTC 20 May 2021

BSC-ES/FORECAST CALIOPE - Resolution: 4 km x 4 km



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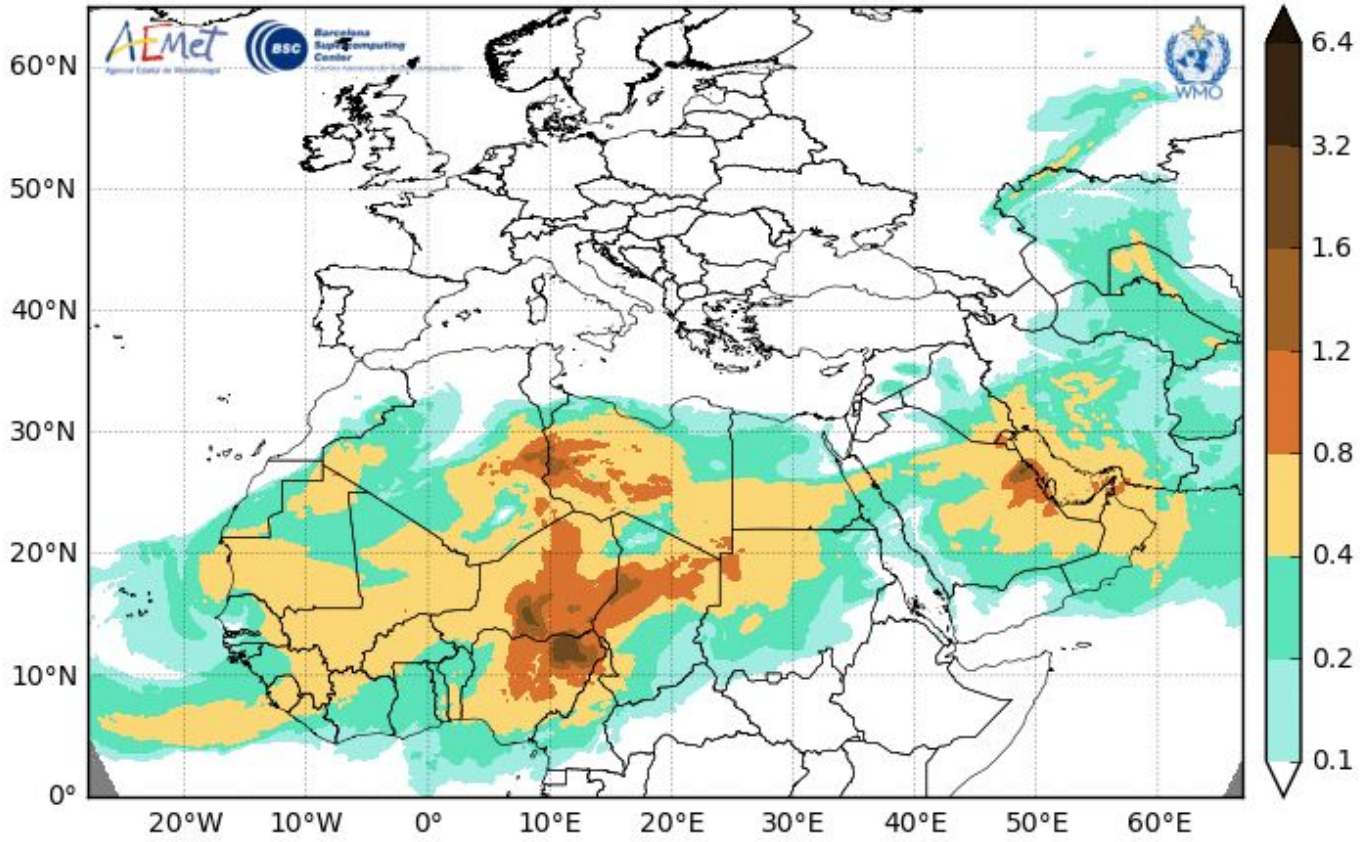
Centro Nacional de Supercomputación

CALIOPE EU

Barcelona Dust Forecast Center - *http://dust.aemet.es/*

NMMB-MONARCH Res:0.1°x0.1° Dust AOD

Run: 12h 18 MAR 2021 Valid: 12h 18 MAR 2021 (H+00)



Agencia Estatal de Meteorología

CALIOPE
URBAN

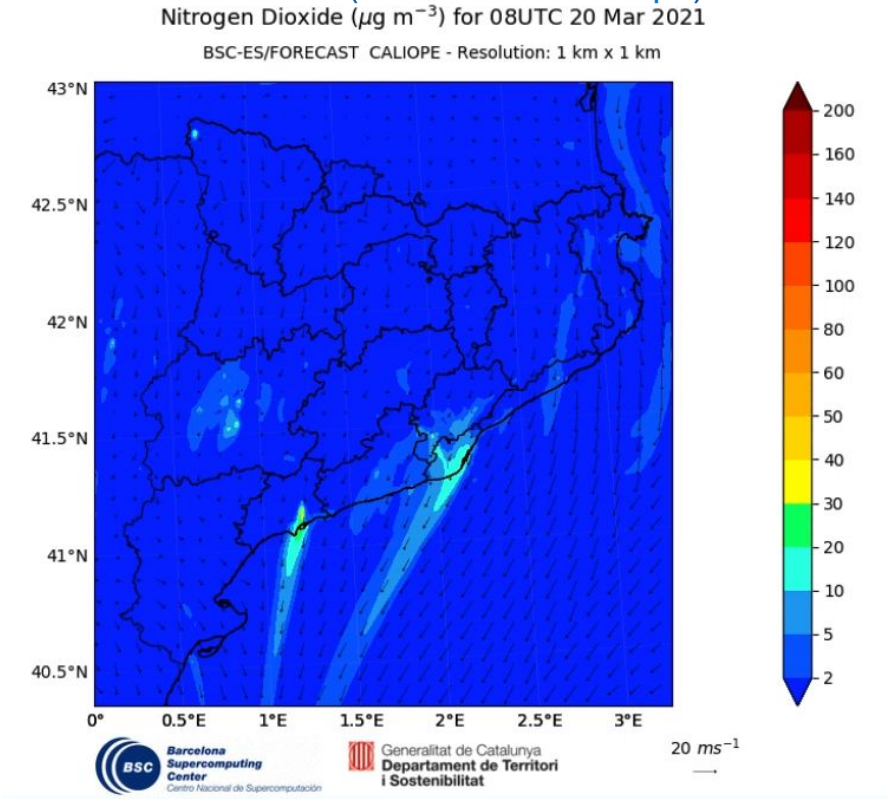
Barcelona Supercomputing Center
Centro Nacional de Supercomputación

Implementation of emission and air quality models in the region of Catalonia

CALIOPE: Air Quality Forecasting System

(www.bsc.es/caliope)

Surveillance Service and Air Control



The goal of the project

Surveillance Service
and Air Control

1. Monitor exceedances

2. Pollution Warnings

3. Inform & Advice

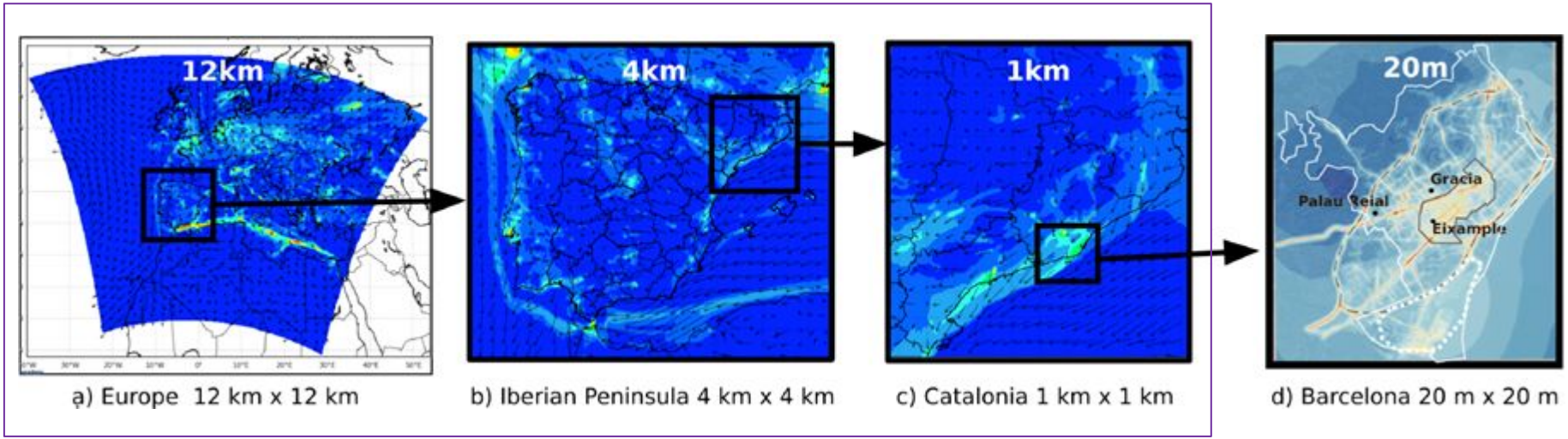
4. Regulation

CALIOPE

Next steps of the project: CALIOPE-Urban

1st Year

2nd Year



a) Europe 12 km x 12 km

b) Iberian Peninsula 4 km x 4 km

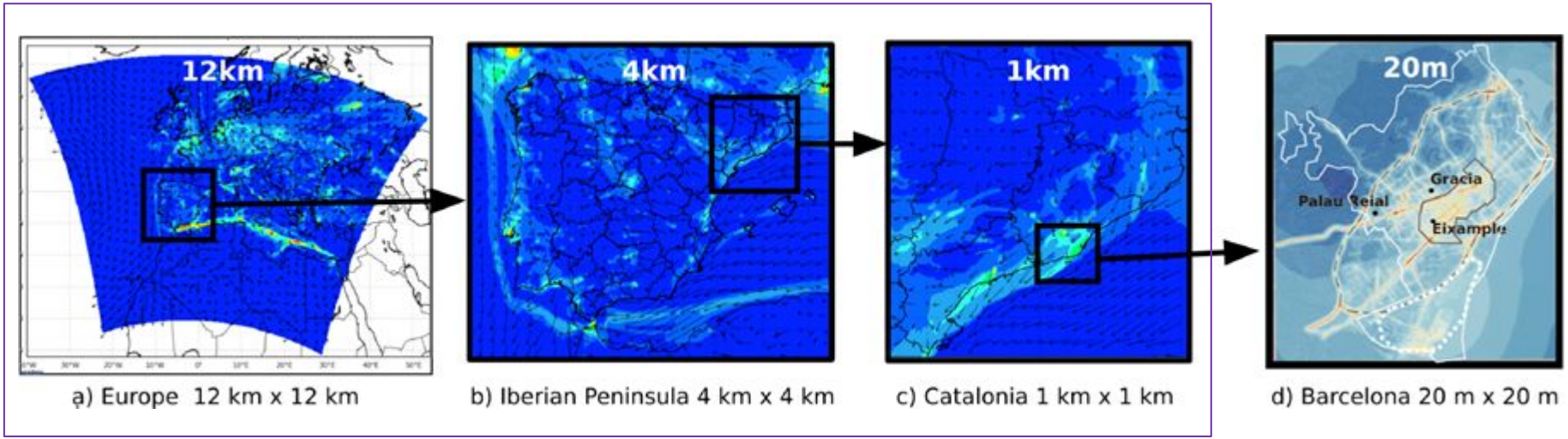
c) Catalonia 1 km x 1 km

d) Barcelona 20 m x 20 m

Regional

Urban

CALIOPE-Urban



a) Europe 12 km x 12 km

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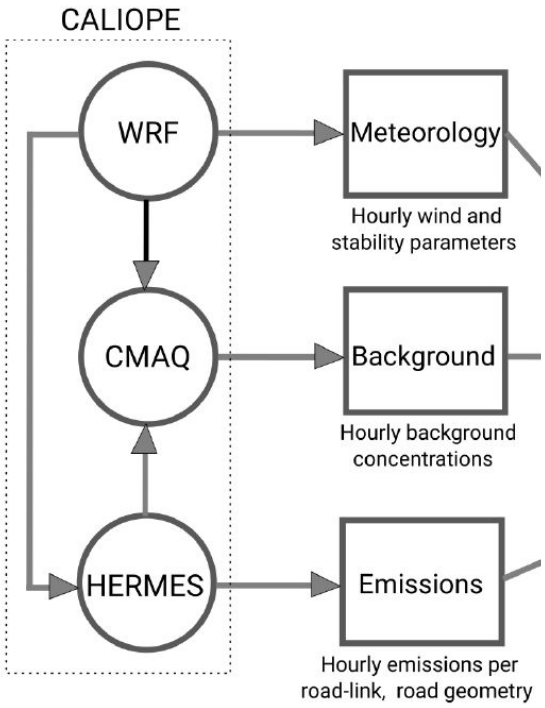
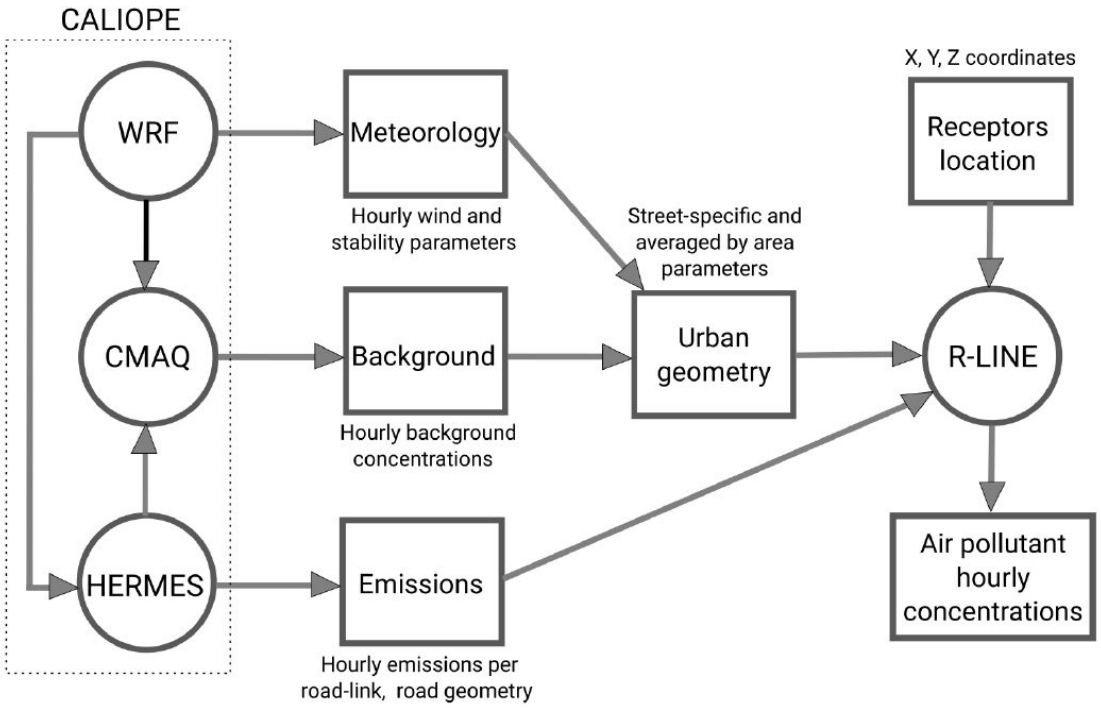
Regional

Urban

Workflow


CALIOPE
WRF
CMAQ
HERMES
Meteorology
Hourly wind and stability parameters
Background
Hourly background concentrations
Emissions
Hourly emissions per road-link, road geometry

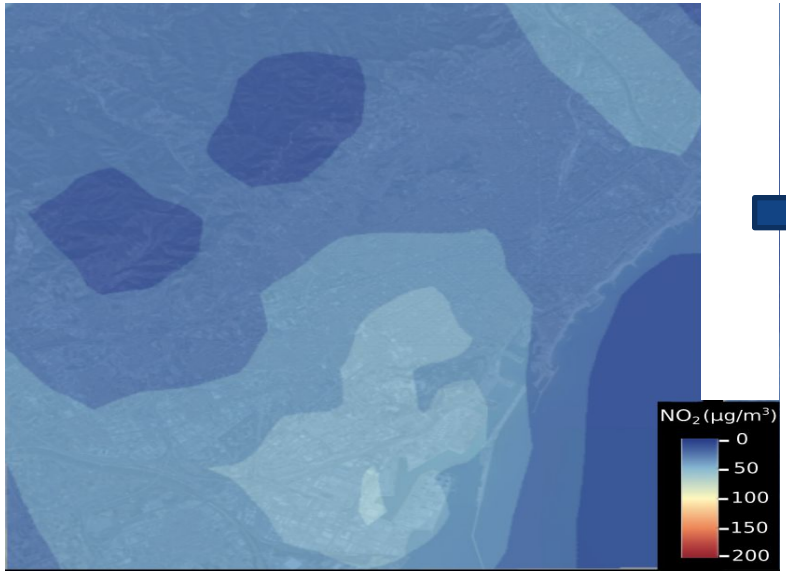
Workflow


CALIOPE
WRF
CMAQ
HERMES
Meteorology
Hourly wind and stability parameters
Background
Hourly background concentrations
Emissions
Hourly emissions per road-link, road geometry
Street-specific and averaged by area parameters
Urban geometry
X, Y, Z coordinates
Receptors location
R-LINE
Air pollutant hourly concentrations

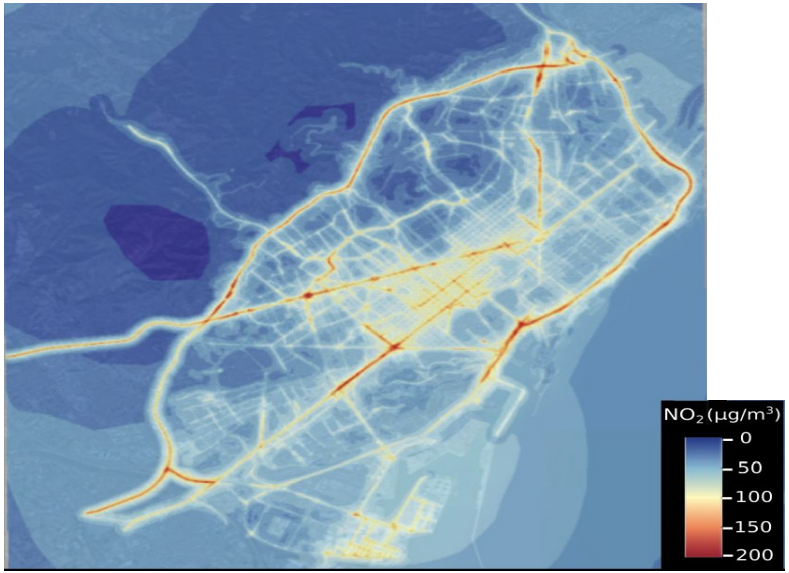
The aim of the urban scale

Improve precision at the edges of traffic emissions

CALIOPE 1kmx1km resolution



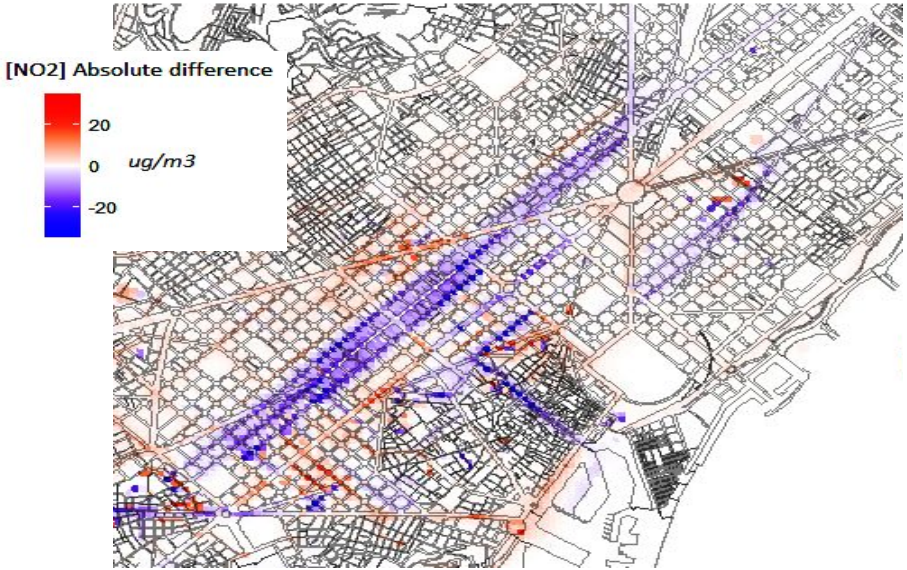
CALIOPE–Urban 20mx20m resolution



Source: Benavides et al. (2020)

Why do we need high resolution?

1) Analysis regulation scenarios through simulations



Why do we need high resolution?

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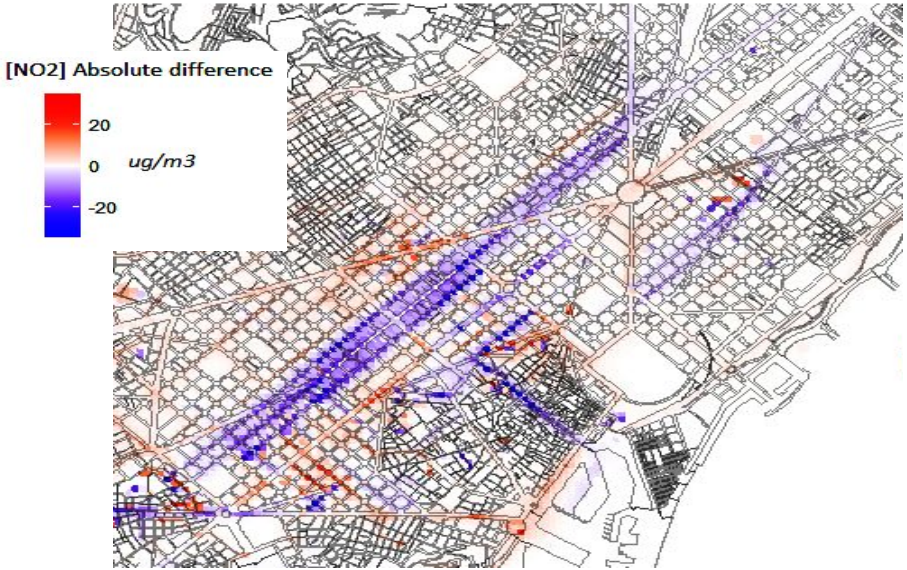
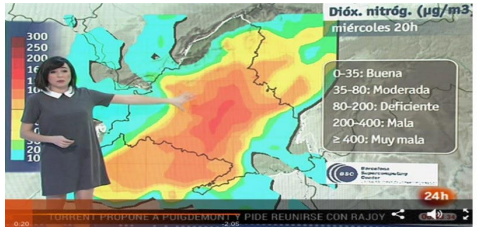
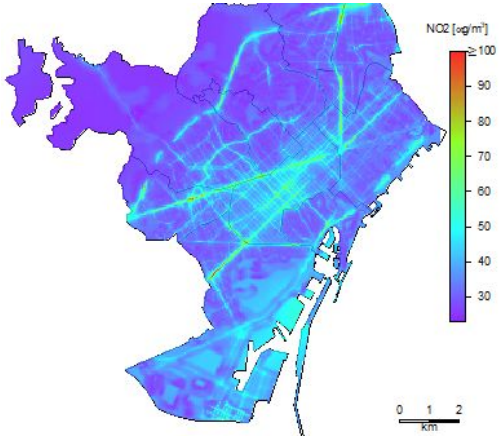


2) City air quality forecast



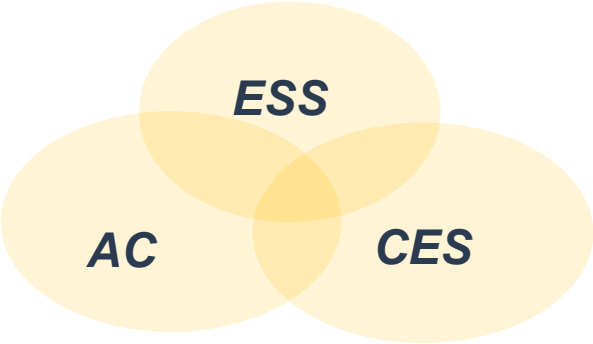
3) Diagnosis and study of the health impact



Perspectives

Work is already under way on implementing :

- CALIOPE-urban on operational mode
- Statistical data fusion methodologies for bias correction



CALIOPE
URBAN

Barcelona Supercomputing Center
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KNOWLEDGE TRANSFER TEAM

RESEARCH ENGINEERS

SOCIAL SCIENTISTS

UX/UI DESIGNERS

SCIENCE COMMUNICATORS

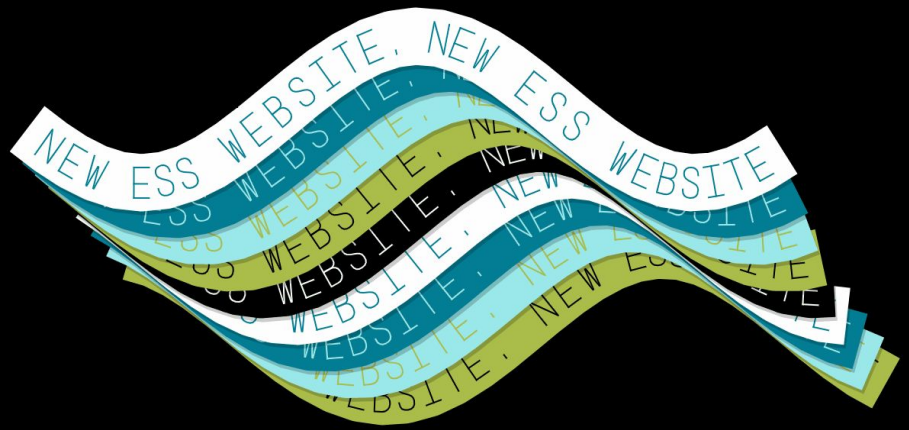
ENVIRONMENTAL ECONOMISTS

Seasonal Hurricane Predictions
Seasonal Hurricane Predictions
7 PREDICTED
5 TO DATE
PAST ACTIVITY

Deserts
Oceans

Ukko

Climate services factsheet 7
Use of climate information in the wind stakeholder chain


NEW ESS WEBSITE. NEW ESS WEBSITE

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HOME | SECTORS | SERVICES | NEWS | ABOUT US | GET INVOLVED

Earth System Services

Demonstrating the ongoing value of climate services, air quality services and dust services to the society and the economy

Sectors

- Agriculture
- Air quality & mobility planning
- Aviation
- Forest fires
- Health
- Heavy industry
- Insurance
- Solar energy
- Water management
- Wind energy

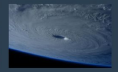
Our services

Access directly to the most popular services we offer.
If you want to know more about our work consult our climate services!

Check our work

Caliope system

Hurricane predictions



Resilience prototype

Get access to the images resulting from our research!

Image catalogue

Connect to the BSC Social Networks

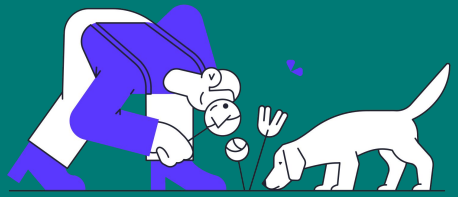
Contact info

You can also contact us by:

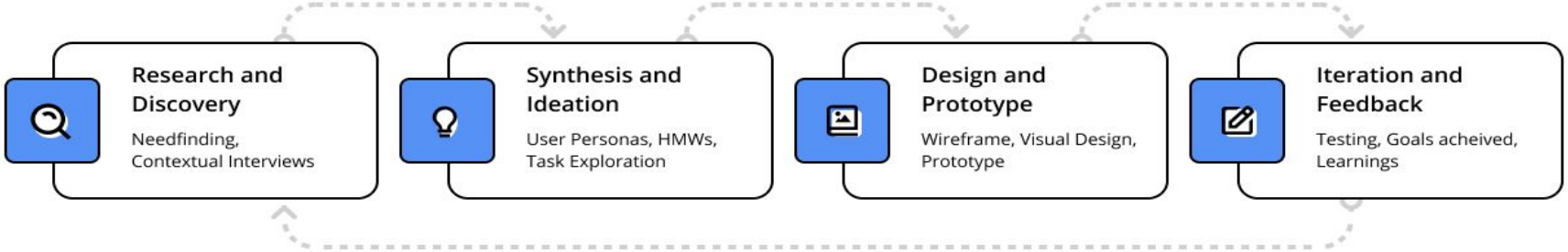
- c/ Jordi Girona, 31
- (+34) 934134076
- info-services-es@bsc.es
- N 41.388262 E 2.114664

Recent News

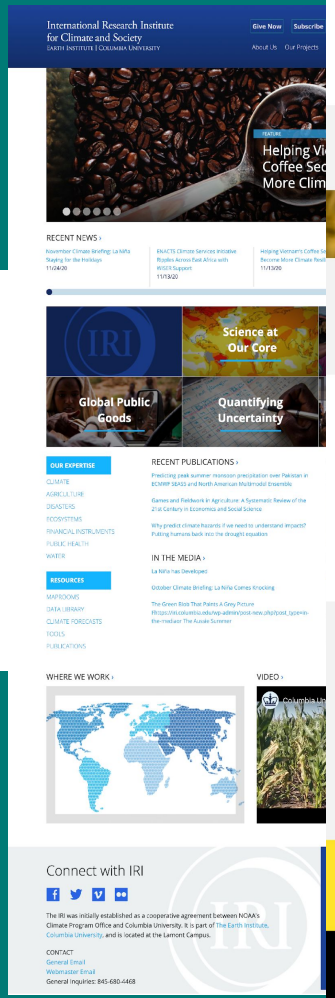
Europe is building a 'digital twin' of Earth to revolutionize climate forecasts
AIRBARAVIR
Colorado State ups hurricane season prediction 'extremely active'
Catalonia in Venice - airbarbaire
¿Cuánto se ha reducido la contaminación durante el confinamiento?
Una agencia integral per a l'acció climàtica

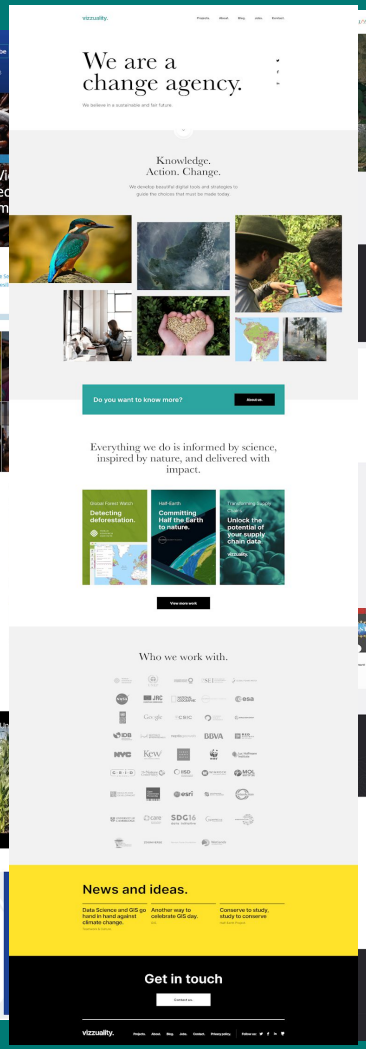


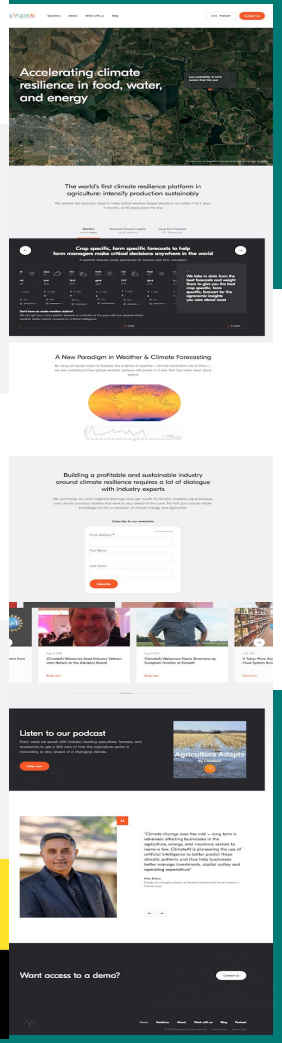
UX PROCESS


Research and Discovery
Needfinding, Contextual Interviews
Synthesis and Ideation
User Personas, HMWs, Task Exploration
Design and Prototype
Wireframe, Visual Design, Prototype
Iteration and Feedback
Testing, Goals acheived, Learnings

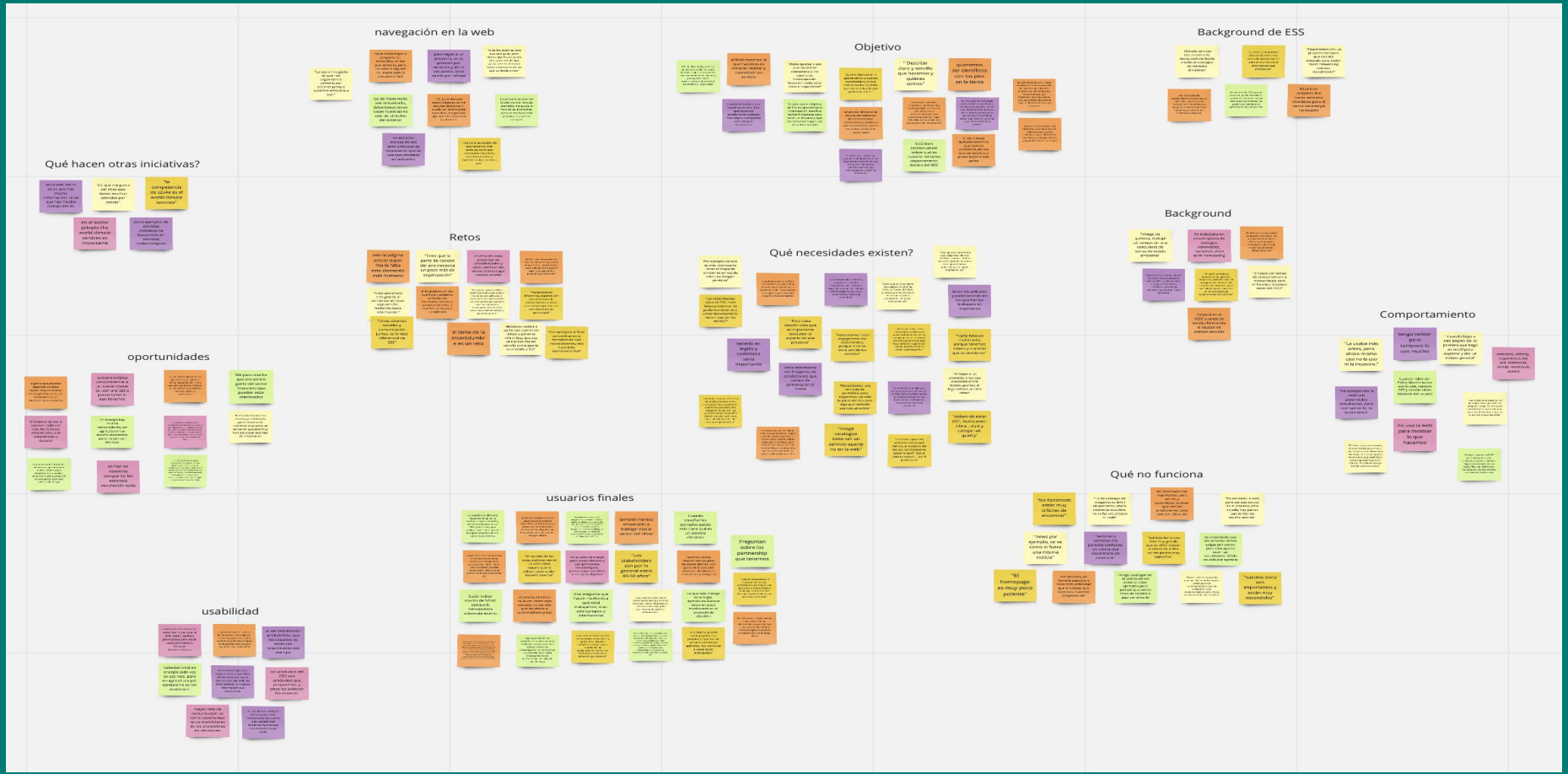
COMPETITOR ANALYSIS



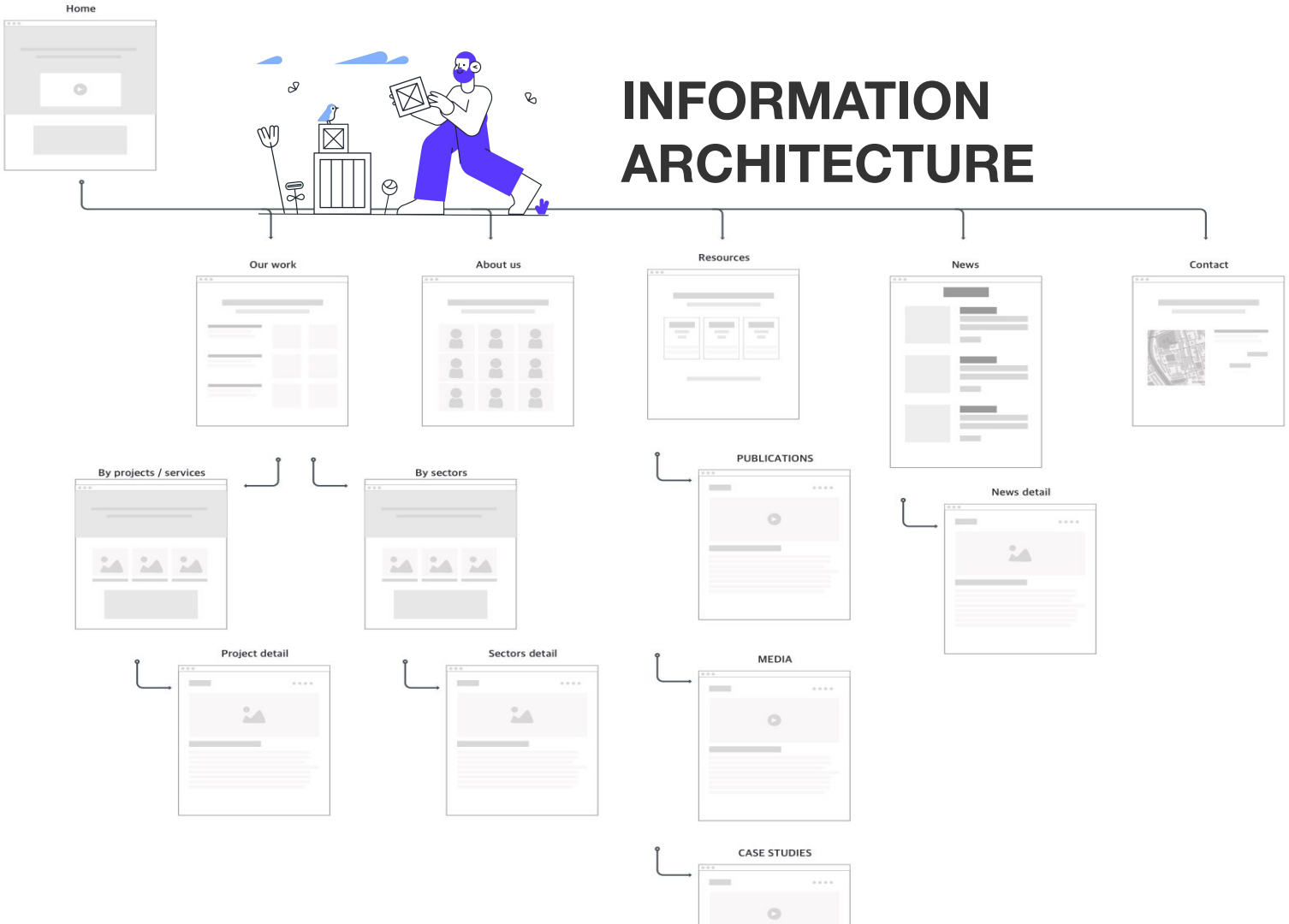




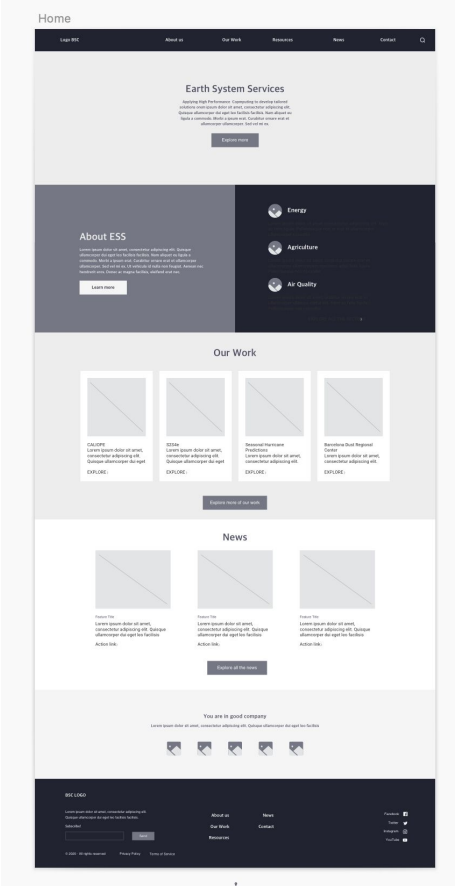
AFFINITY MAPS

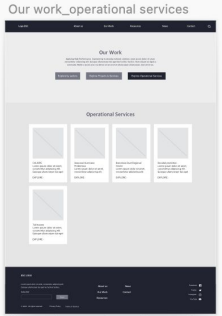


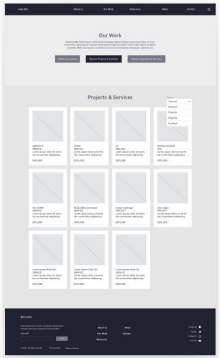
INFORMATION ARCHITECTURE

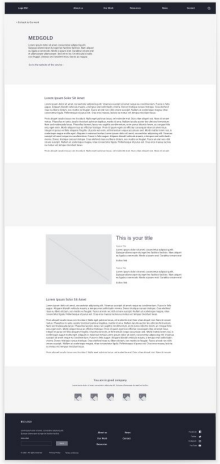


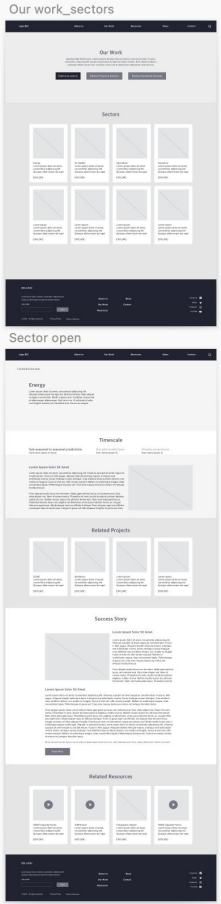
LOW FIDELITY PROTOTYPE



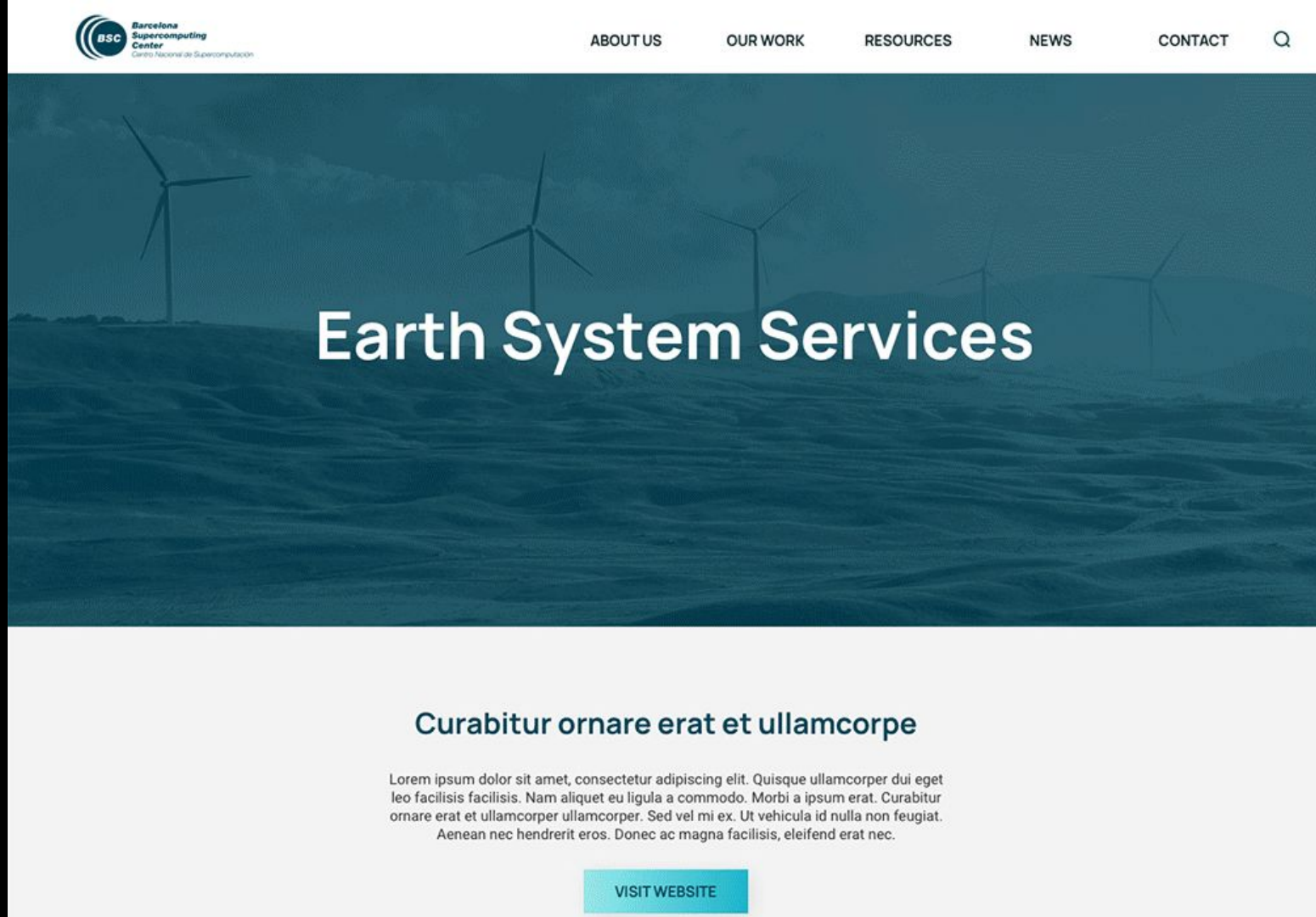




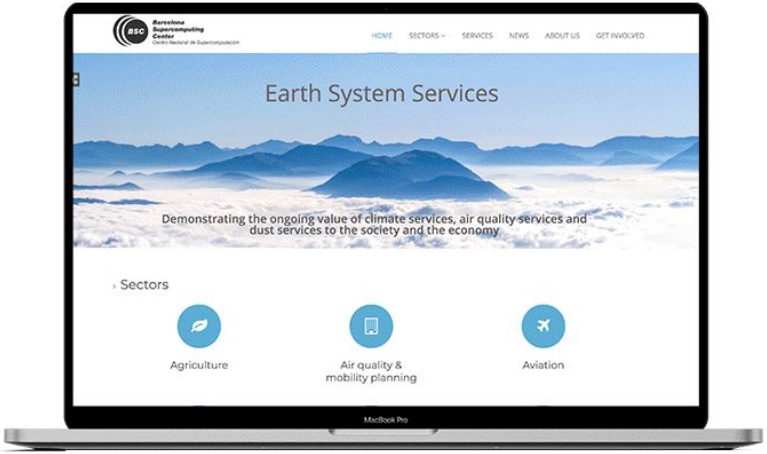




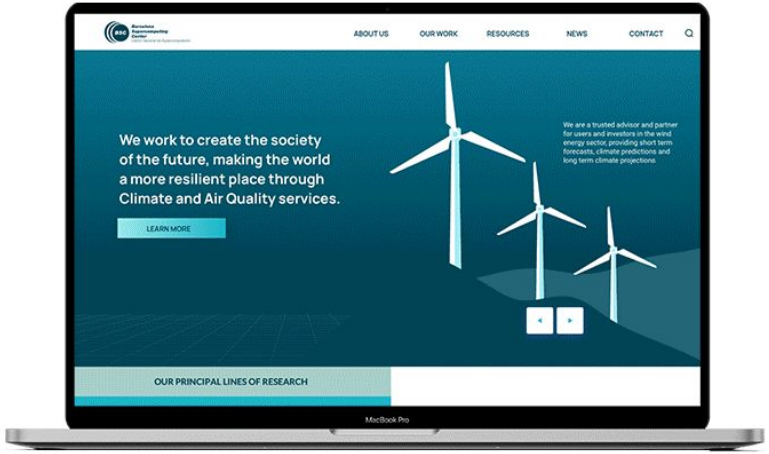
VISUAL STYLE



HIGH FIDELITY PROTOTYPE

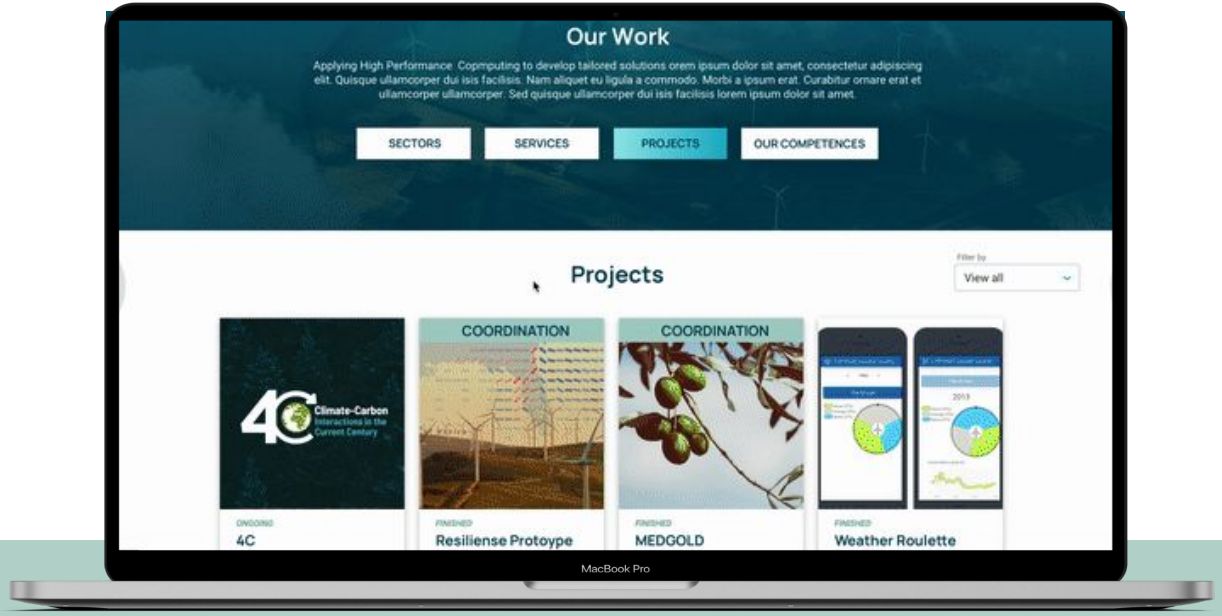


before

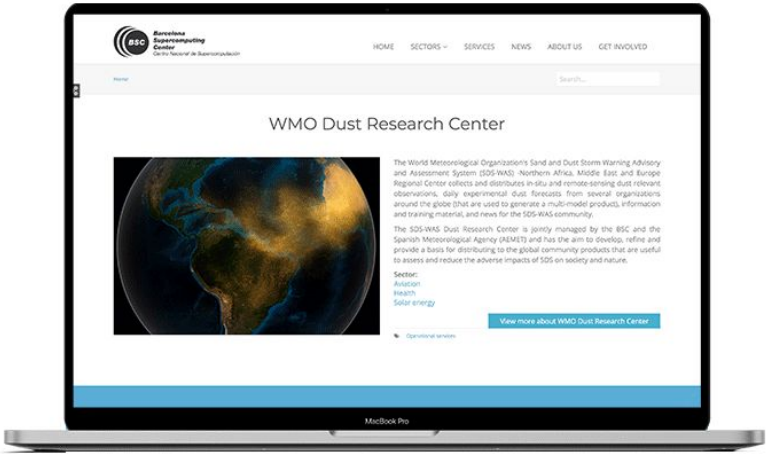


after

HIGH FIDELITY PROTOTYPE



HIGH FIDELITY PROTOTYPE



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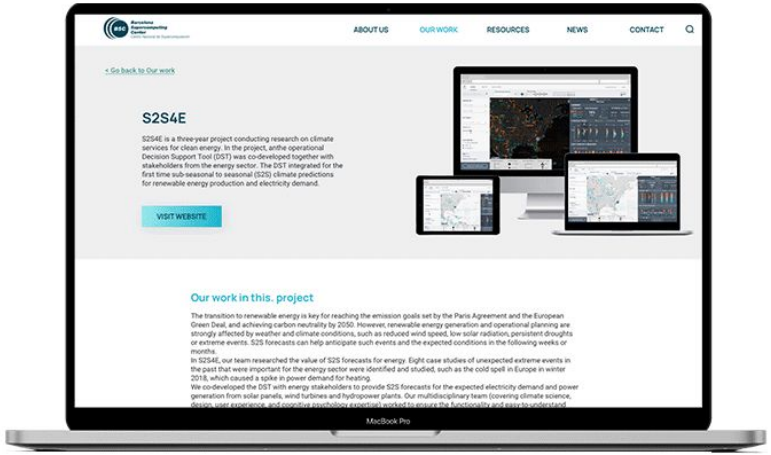

after

Thank you for your attention!

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