WEBINAR

3 September 2019 - h 12.30 pm CEST

Copernicus Sectoral Information System for Disaster Risk Reduction (C3S_430)

Speakers

Carlo Buontempo
European Centre for Medium-Range Weather Forecasts

Paola Mercogliano
Euro-Mediterranean Center on Climate Change, REMHI Division

Claire Jacobs
Wageningen Environmental Research

Moderator

Jaroslav Mysiak
Euro-Mediterranean Center on Climate Change, RAAS Division

To join the webinar, register here: http://bit.ly/Web03Sep

Climate Change

EURO-MEDITERRANEAN CENTRE ON CLIMATE CHANGE FOUNDATION (CMCC)

MISSION

To investigate and model our **climate system** and its interactions with **society** to provide reliable, rigorous, and timely **scientific results**, which will in turn stimulate sustainable growth, protect the **environment**, and **develop science driven** adaptation and **mitigation policies** in a **changing climate**

cmcc
Centro Euro-Mediterraneo sui Cambiamenti Climatici

European Commission | Copernicus Europe's eyes on Earth | ECMWF

Climate Change

EURO-MEDITERRANEAN CENTRE ON CLIMATE CHANGE FOUNDATION (CMCC)

cmcc
Centro Euro-Mediterraneo sui Cambiamenti Climatici

NETWORK

European Commission | Copernicus Europe's eyes on Earth | ECMWF

RESEARCH DIVISIONS

Advanced Scientific Computing (ASC)
Climate Simulation and Prediction (CSP)
Economic analysis of Climate Impacts and Policy (ECIP)
Impacts on Agriculture, Forests and Ecosystem Services (IAFES)
Ocean modeling and Data Assimilation (ODA)
Ocean Predictions and Applications (OPA)
Risk Assessment and Adaptation Strategies (RAAS)
REgional Models and geo-Hydrological Impacts (REMHI)
Sustainable Earth Modelling Economics (SEME)

Climate Change

EURO-MEDITERRANEAN CENTRE ON CLIMATE CHANGE FOUNDATION (CMCC)

cmcc
Centro Euro-Mediterraneo sui Cambiamenti Climatici

TOPICS

European Commission | Copernicus Europe's eyes on Earth | ECMWF

Climate Change

EURO-MEDITERRANEAN CENTRE ON CLIMATE CHANGE FOUNDATION (CMCC)

Publications

Events

Education

Communication

cmcc Centro Euro-Mediterraneo sui Cambiamenti Climatici

OUTREACH

European Commission | Copernicus Europe's eyes on Earth | ECMWF

Climate Change

QUESTIONS & ANSWERS SESSION

To participate in the Q&A Session, please use the “Questions” menu provided by the Go-to-Webinar system

European Commission | Copernicus Europe's eyes on Earth | ECMWF

Disaster risk reduction and The Copernicus Climate Change Service

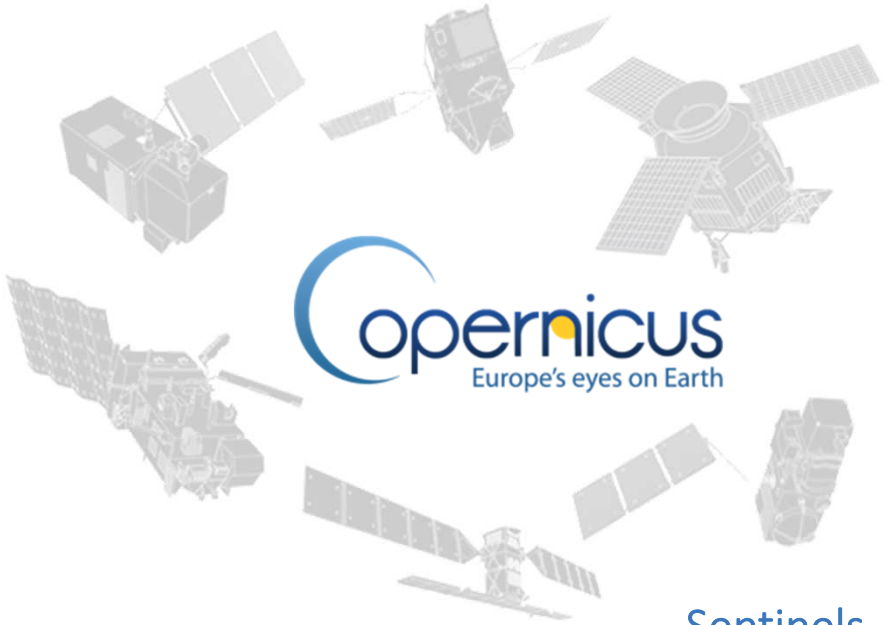
Carlo Buontempo
Carlo.Buontempo@ecmwf.int

With contributions from: Jean-Noël Thepaut, Cedric Bergeron,….
ECMWF

European Commission

IMPLEMENTED BY ECMWF

The EU Copernicus programme



Sentinels

Observations feeding into value-added Services

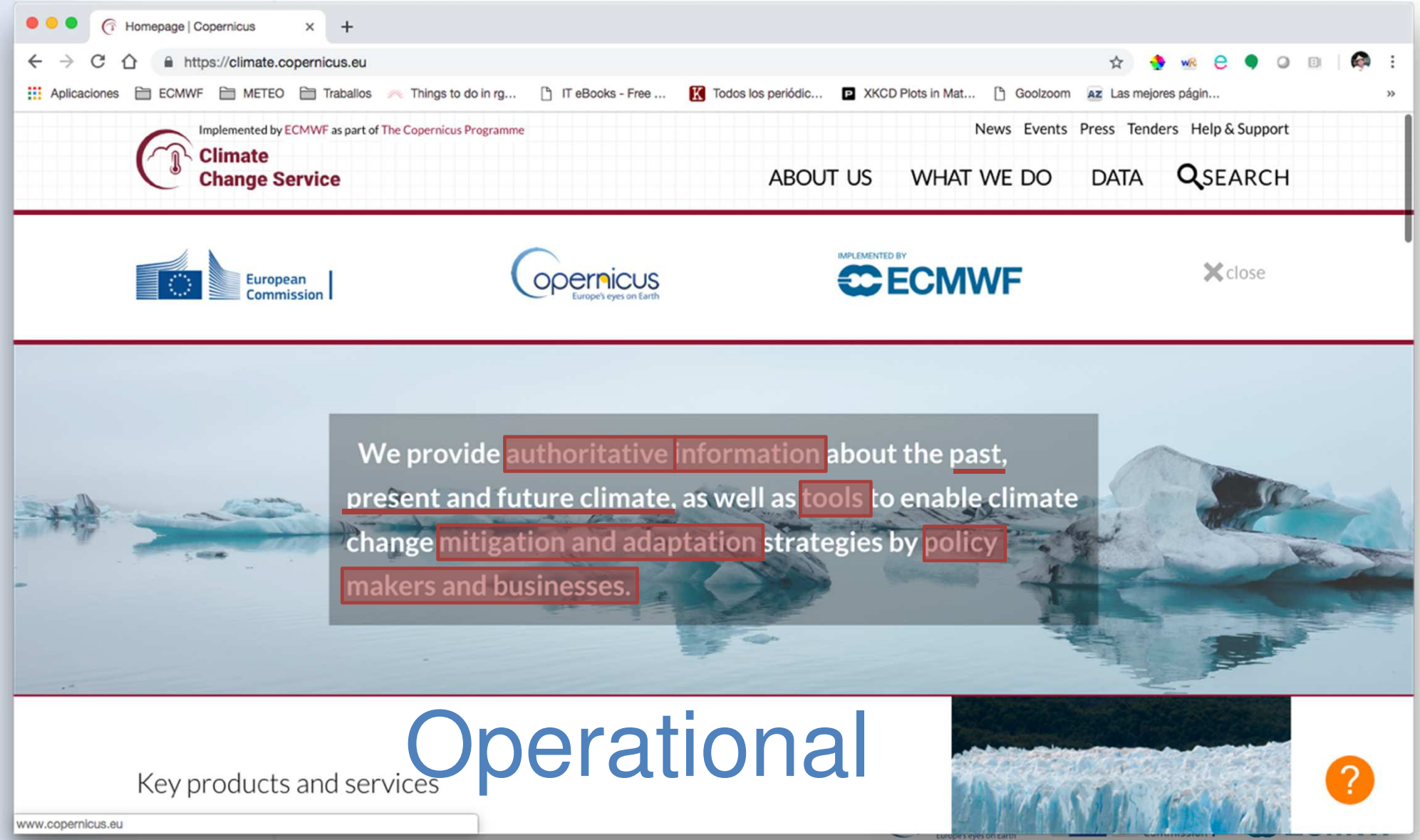
- Atmosphere
- Climate
- Land
- Marine
- Emergency
- Security

Copernicus is the European Union's operational Earth Observation and Monitoring programme, looking at our planet and its environment for the ultimate benefit of all citizens.

User-driven with free and unrestricted data access

ECMWF

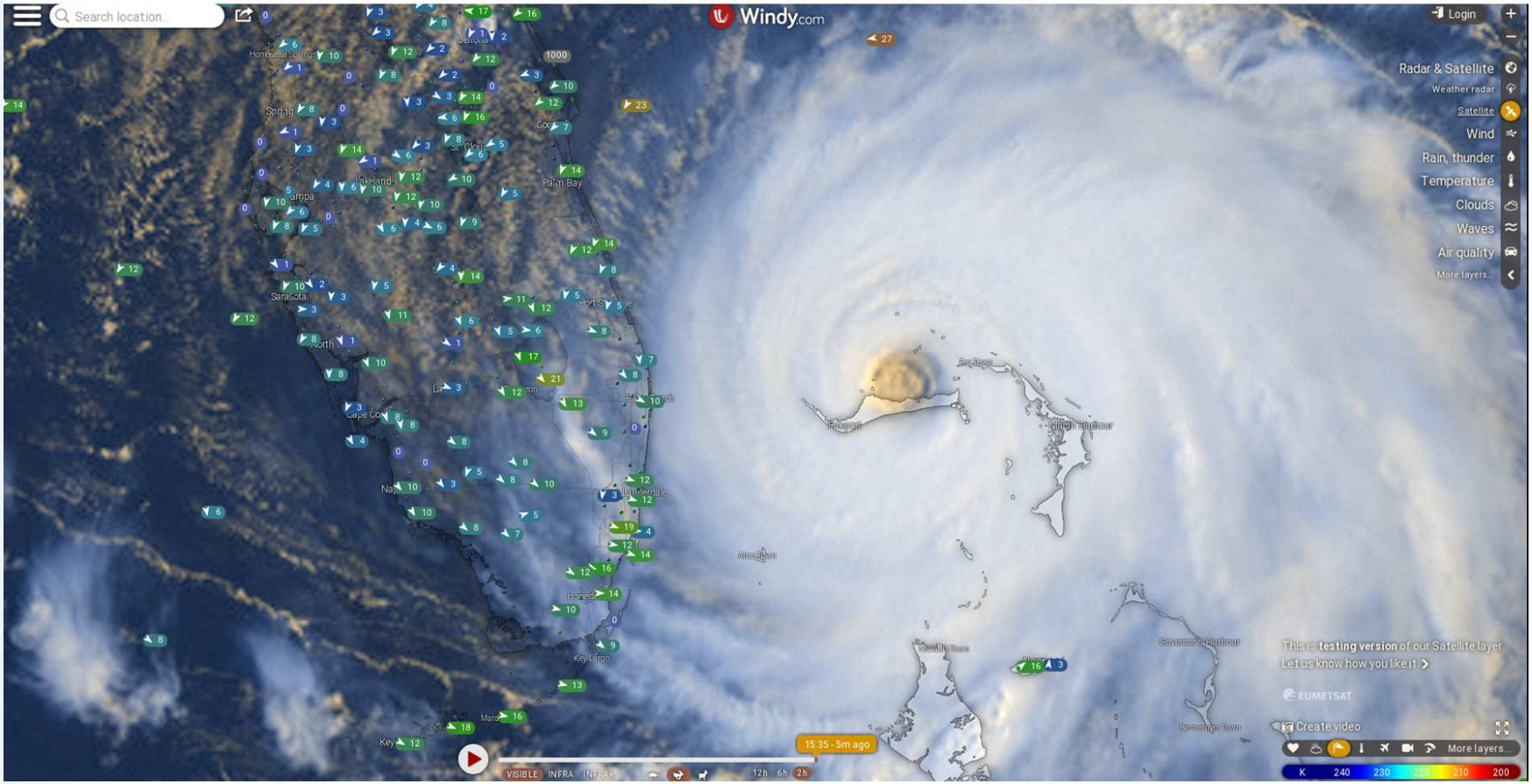
Climate Change



Climate Change

DDR and weather

Dorian at 14:35 UTC and observed winds around that time



Copernicus Europe's eyes on Earth | European Commission | ECMWF

Climate Change

Longer time-scales

BBC Sign in News Sport

NEWS

Home Video World UK Business Tech

World Africa Asia Australia Europe Latin

EL PAÍS

ESPAÑA

ANDALUCÍA CATALUÑA C. VALENCIANA GALICIA MADRID PAÍS VASCO MÁS COMUNIDADES TITULARES »

EL TIEMPO ›

Comienza la ola de calor con máximas de 39 grados en la mitad este

Avisos en 23 provincias, lo más grave en Zaragoza, Navarra, La Rioja, Bizkaia y Gipuzkoa

Europe heatwave: Why are temperatures on the continent soaring?

3 hours ago

Europe heatwave

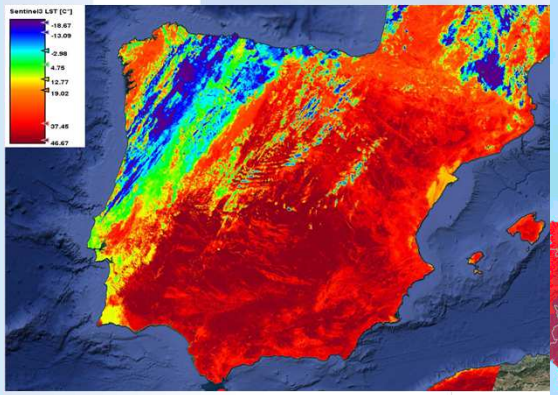
Top Stories

US Democrats

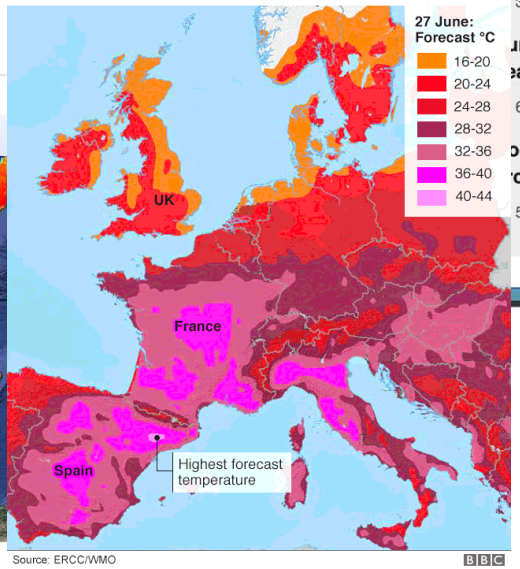
38 minutes ago

6 hours ago

5 hours ago



Heatwave gripping Europe



Neuer Temperaturrekord im Juni deutschlandweit

38,5°C — 27. UND 28. JUNI 1947 BÜHLERTAL

38,6°C — 26. JUNI 2019 COSCHEN

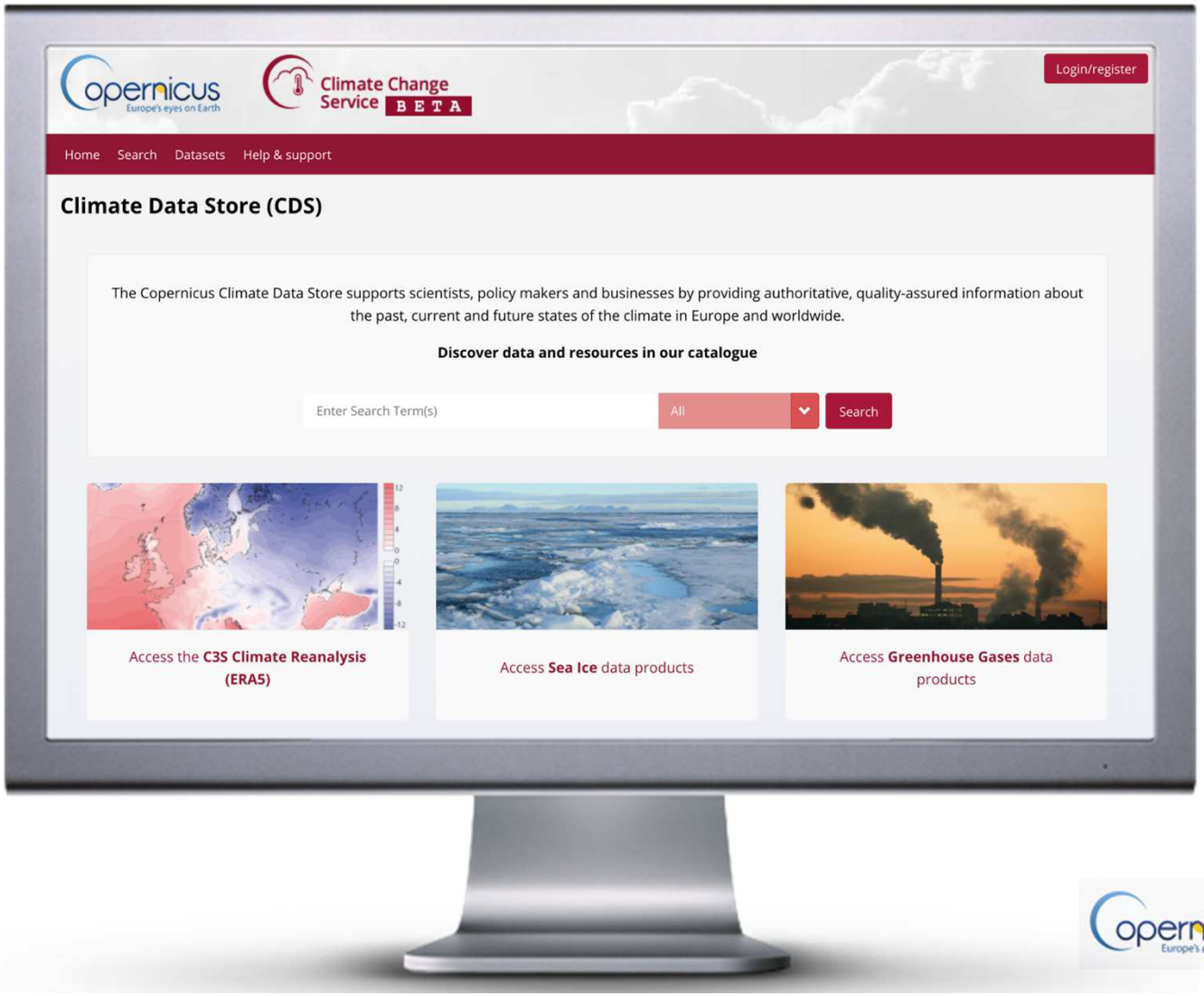
DWD

*Vorläufig gemessener Wert

Copernicus Europe's eyes on Earth | European Commission | ECMWF

Climate Change

Climate Data Store – CDS

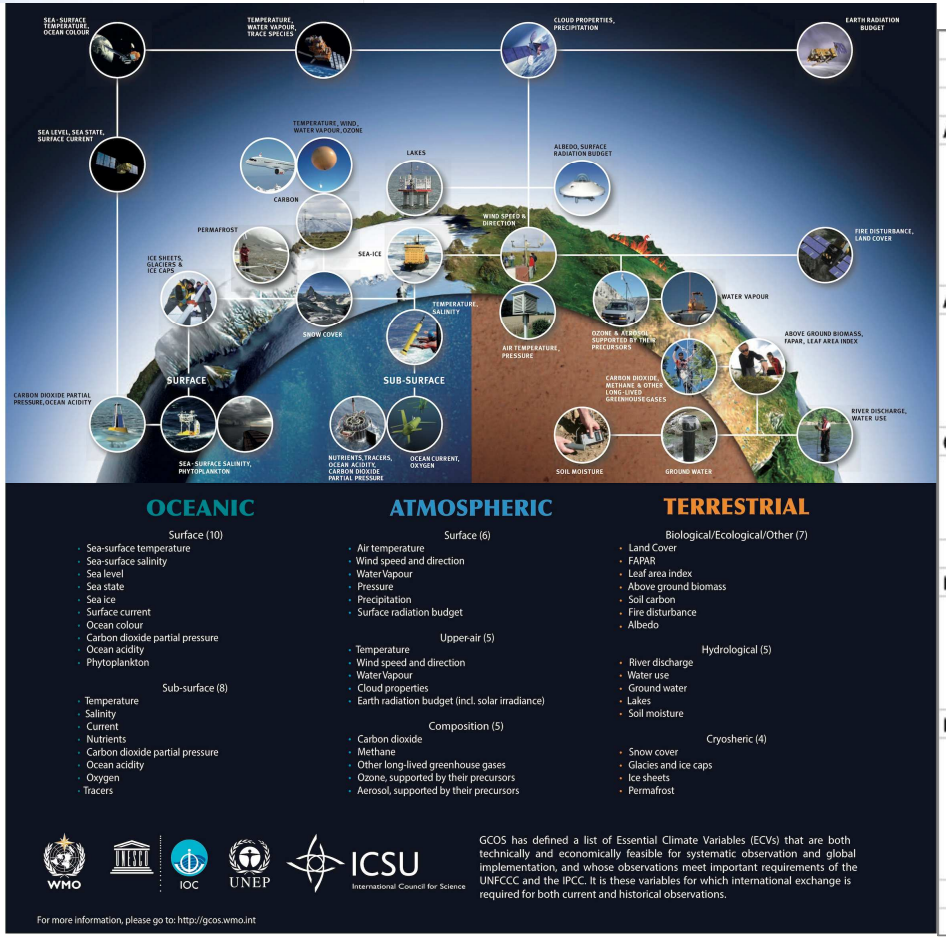


The CDS is designed as a **distributed system**, providing improved access to **existing datasets** through a **unified web interface**

opernicus Europe's eyes on Earth | European Commission | ECMWF

Climate Change

Essential Climate Variables



OCEANIC

Surface (10)
- Sea-surface temperature
- Sea-surface salinity
- Sea level
- Sea state
- Sea ice
- Surface current
- Ocean colour
- Carbon dioxide partial pressure
- Ocean acidity
- Phytoplankton

Sub-surface (8)
- Temperature
- Salinity
- Current
- Nutrients
- Carbon dioxide partial pressure
- Ocean acidity
- Oxygen
- Tracers

ATMOSPHERIC

Surface (6)
- Air temperature
- Wind speed and direction
- Water Vapour
- Pressure
- Precipitation
- Surface radiation budget

Upper-air (5)
- Temperature
- Wind speed and direction
- Water Vapour
- Cloud properties
- Earth radiation budget (incl. solar irradiance)

Composition (5)
- Carbon dioxide
- Methane
- Other long-lived greenhouse gases
- Ozone, supported by their precursors
- Aerosol, supported by their precursors

TERRESTRIAL

Biological/Ecological/Other (7)
- Land Cover
- FAPAR
- Leaf area index
- Above ground biomass
- Soil carbon
- Fire disturbance
- Albedo

Hydrological (5)
- River discharge
- Water use
- Ground water
- Lakes
- Soil moisture

Cryospheric (4)
- Snow cover
- Glacies and ice caps
- Ice sheets
- Permafrost

WMO IOC UNEP ICSU International Council for Science

GCOS has defined a list of Essential Climate Variables (ECVs) that are both technically and economically feasible for systematic observation and global implementation, and whose observations meet important requirements of the UNFCCC and the IPCC. It is these variables for which international exchange is required for both current and historical observations.

For more information, please go to: http://gcos.wmo.int

			C3S_312a				
				C3S_312b			
		GCOS	2017	2018	2019	2020	2021
Atmospheric physics							
	Precipitation	4.3.5		Lot 1			
	Surface Radiation Budget	4.3.6					
	Water Vapour	4.5.3					
	Cloud Properties	4.5.4					
	Earth Radiation Budget	4.5.5					
Atmospheric composition							
	Carbon Dioxide	4.7.1	Lot 6		Lot 2		
	Methane	4.7.2	Lot 6				
	Ozone	4.7.4	Lot 4				
	Aerosol	4.7.5	Lot 5				
Ocean							
	Sea Surface Temperature	5.3.1	Lot 3		Lot 3		
	Sea Level	5.3.3	Lot 2				
	Sea ice	5.3.5	Lot 1				
	Ocean Colour	5.3.7					
Land hydrology & cryosphere							
	Lakes	6.3.4			Lot 4		
	Glaciers	6.3.6	Lot 8				
	Ice sheets and ice shelves	6.3.7					
	Soil moisture	6.3.16	Lot 7				
Land biosphere							
	Albedo	6.3.9	Lot 9		Lot 5		
	Land Cover	6.3.10					
	Fraction of Absorbed Photosyntheti	6.3.11	Lot 9				
	Leaf Area Index	6.3.12	Lot 9				
	Fire	6.3.15					
			2017	2018	2019	2020	2021

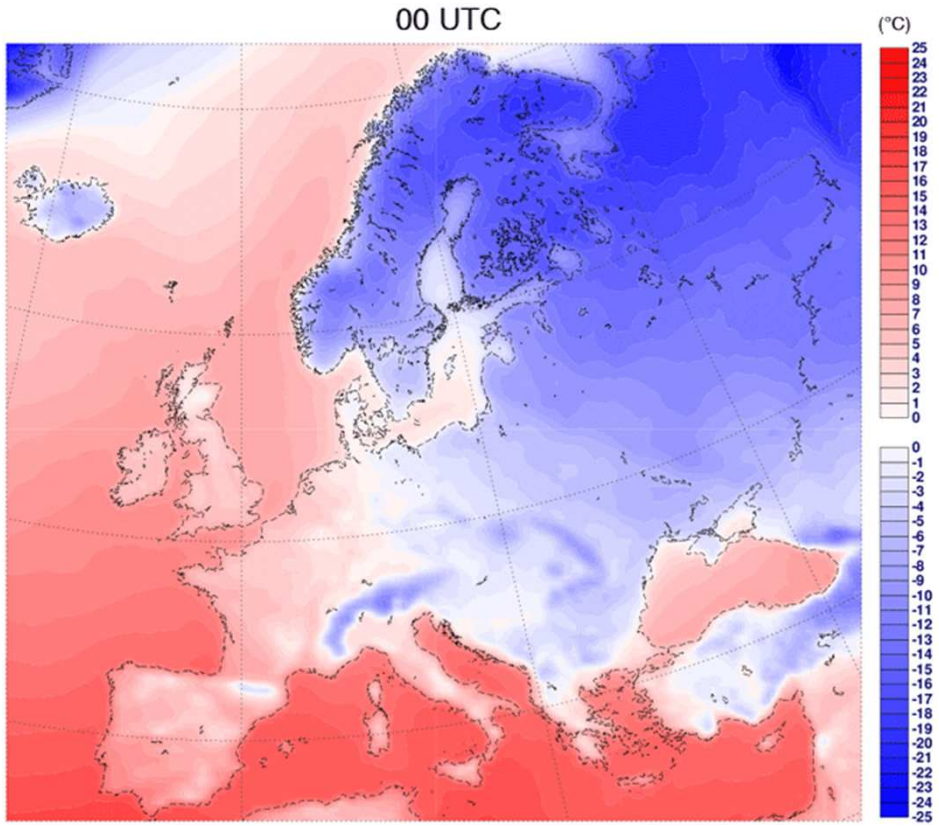
Copernicus Europe's eyes on Earth | European Commission | ECMWF

Climate Change

Climate reanalysis: ERA5

- Atmosphere/land/wave parameters
- 31 km global resolution, 137 levels
- Hourly output from 1979 onward

- Using 2016 ECMWF forecast system
- Using improved input observations
- Ensemble data assimilation method
- Uncertainty estimates for all ECVs

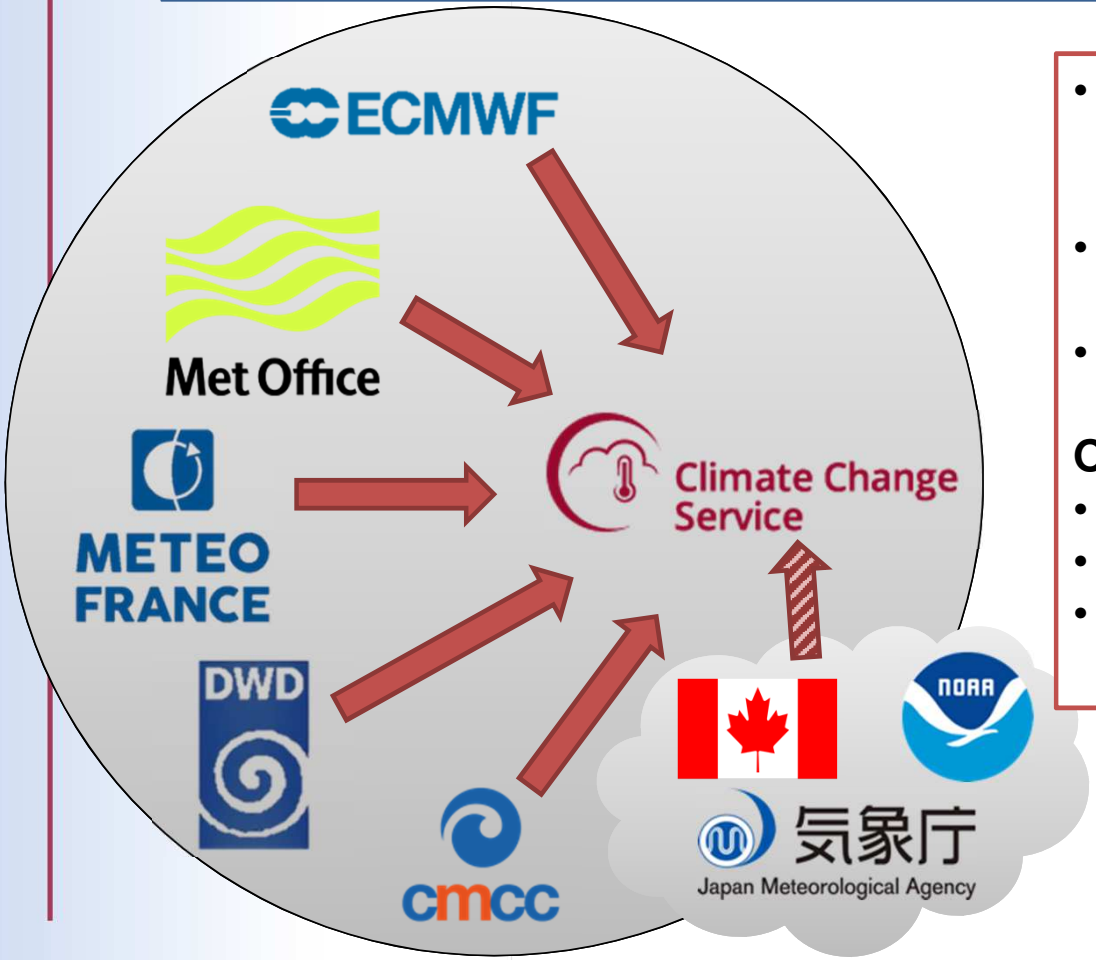


Copernicus Europe's eyes on Earth | European Commission | ECMWF

Climate Change

C3S seasonal forecasts - Introduction

Aim: to generate **seasonal forecast** products based on the **best information available**, to an **operational schedule**, and make them **publicly available**.



- Issued every month on the 13th (likely to be moved closer to the 10th)
- Large ensembles (members: ~50 forecast, ~25 hindcast)
- Common reference period (1993-2016)

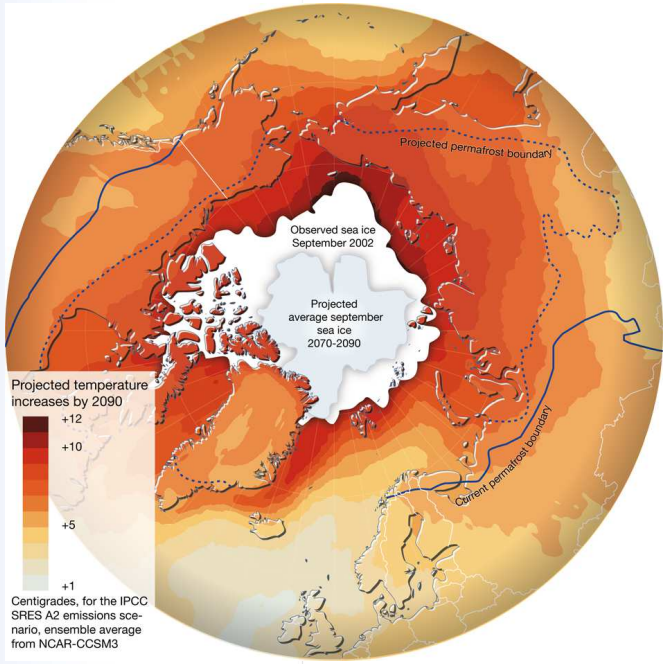
Output

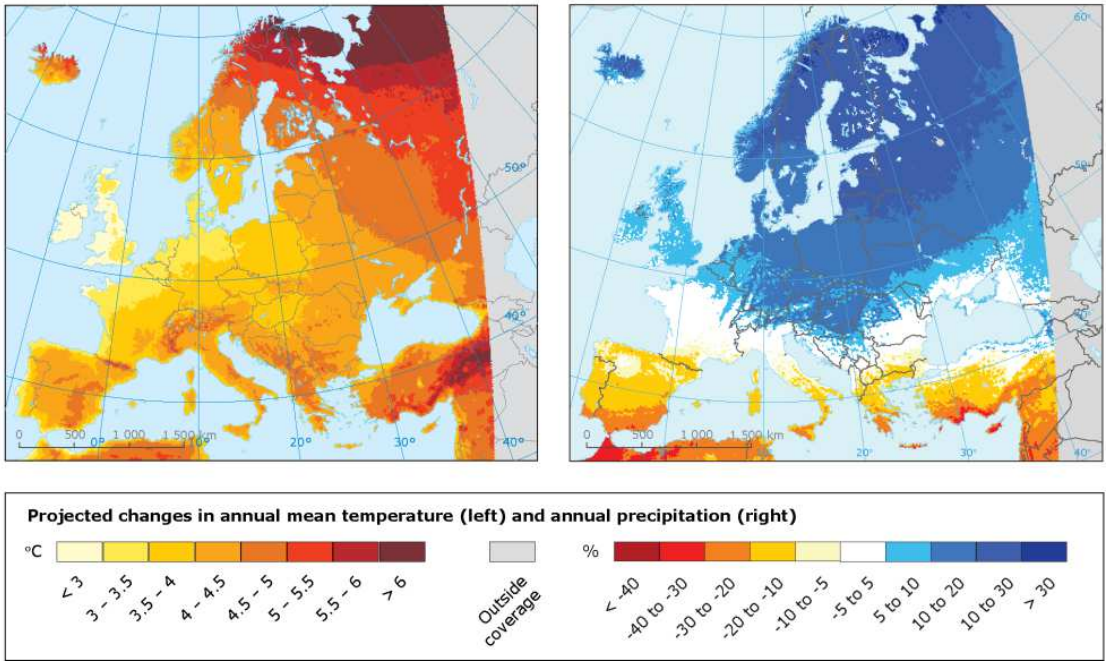
- on common horizontal resolution (1*1 degree)
- ~30 single-level variables (every 6h or 24h)
- 5 variables in pressure levels (every 12h) (11 levels from 925hPa to 10hPa)

Copernicus Europe's eyes on Earth | European Commission | ECMWF

Climate Change

Service: Providing users with timely access to climate change scenarios produced with state-of-the-art climate models (CMIP, CORDEX)



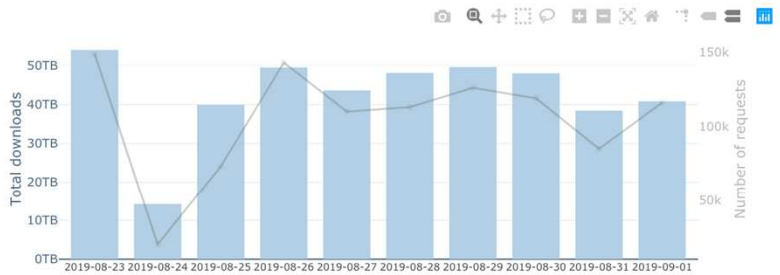


Copernicus Europe's eyes on Earth | European Commission | ECMWF

Climate Change

Registered users	Queued users	Running users	Queued requests	Running requests	At
20,273	16	78	607	145	09:13 UTC | 02/09/2019

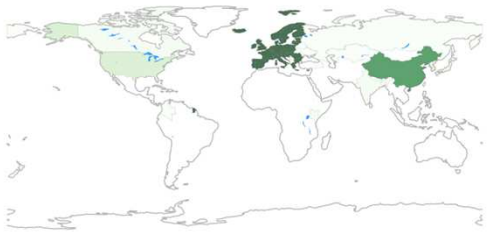
Daily downloads in Terabytes



Requests completed

Last 1h	4,242	2.3TB
Last 2h	8,016	4.5TB
Last 3h	10,950	6.2TB
Last 6h	18,283	12.1TB
Last 12h	32,916	21.5TB
Last 24h	100,300	44.7TB

Countries (Running or queued)



Top 5 (Running or queued)

European Union/EFTA	24
China	19
United States of America (the)	6

EU/EFTA (Running or queued)

Datasets Top 8 (Running or queued)

1. ERA5 hourly data on single levels from 1979 to present
2. ERA5 complete
3. ERA5 hourly data on pressure levels from 1979 to present
4. ERA5-Land hourly data from 2001 to present
5. CMIP5 daily data on single levels

Copernicus Europe's eyes on Earth | European Commission | ECMWF

Climate Change

Climate Data Store - implementation

- **Ongoing physical implementation**:
  - On-Premises Private **Cloud** :
    - CloudFerro
      - **34** compute servers x 2 cpu x 12 cores@ 2.2 GHz and 192 GB RAM per server
      - 4 compute server x 2 CPUs x 8 cores @ 2.6 Ghz and 64 GB RAM per server
      - **100** TB SSD and **900** TB HDD

Copernicus Europe's eyes on Earth | European Commission | ECMWF

Climate Change

Global Services

AGRICULTURE & FORESTRY

WATER MANAGEMENT

TRANSPORT

European Services

FISHERIES

TOURISM

HEALTH

COASTAL AREAS

2016 2017 2018 2019 2020 2021

Proof of concept

Operational Phase

Agriclass

Global Agriculture (WenR)

Global Impacts (SMHI)

Global Shipping (OSM)

European Fisheries (PML)

European Tourism (TEC)

European Health (VITO)

European Storm Surges (Deltares)

Previous C3S GA March 2017

CDS / Toolbox launched

Present

Copernicus Europe's eyes on Earth

European Commission

ECMWF

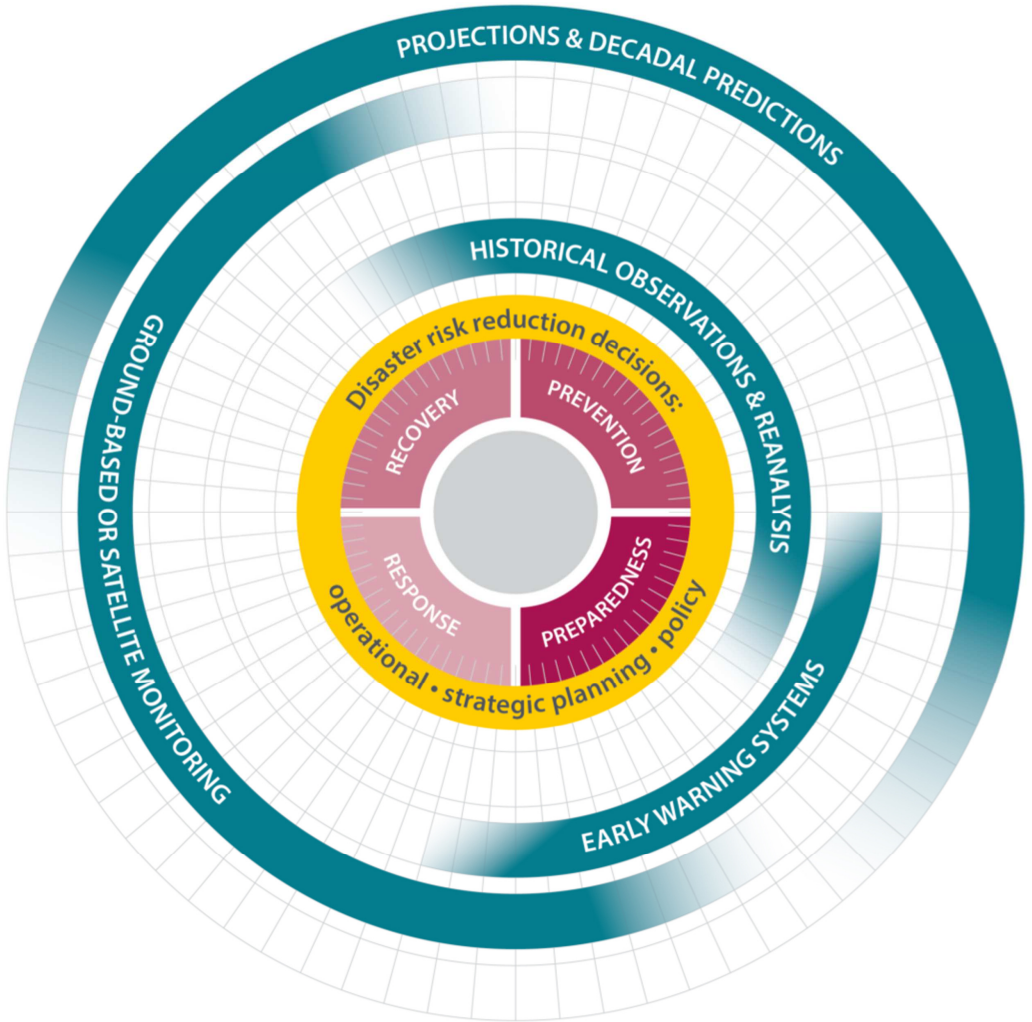
Climate Change

Climate Services for Disaster Risk Reduction Workshop

29-30 January 2018, Bologna

Day 1 – 29 January 2018	
12:30-13:30	Registration and light lunch
13:30-13:35	Welcome (Jaroslav Mysiak – CMCC/ PLACARD)
13:35-13:45	Opening: Workshop objectives (Rob Swart – WUR/ PLACARD)
13:45-14:00	How should climate services be developed in Europe to effectively support DRR? (Interviewer: Rob Swart – WUR/PLACARD)
	· ERA4CS (Roger Street – UKCIP/ ERA4CS) (5')
	· PLACARD (Mário Pulquerio – FFCUL/ PLACARD) (5')
	· C3S (Carlo Buontempo – ECMWF) (5')

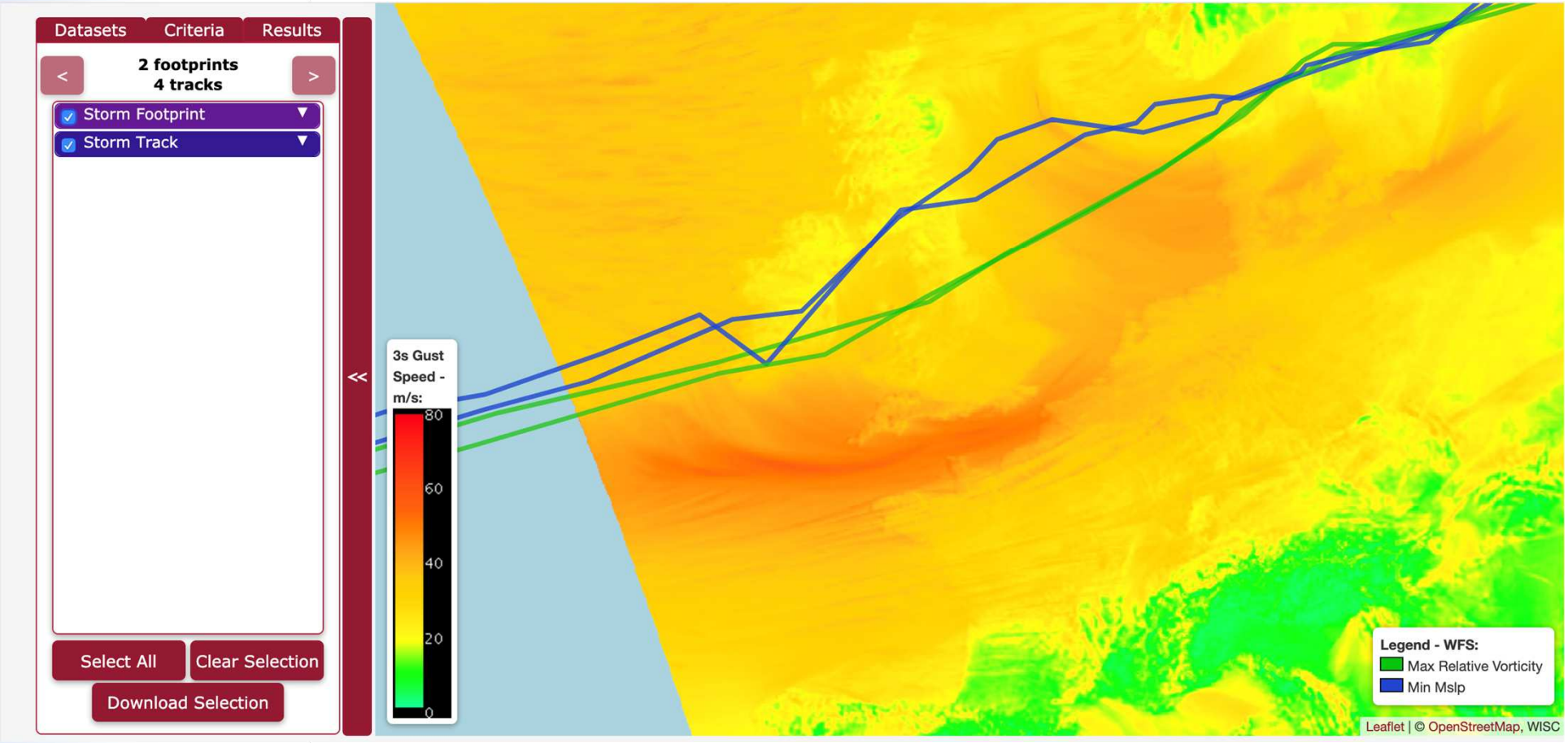
Copernicus Europe's eyes on Earth | European Commission | ECMWF



Street et al 2018:
https://www.sciencedirect.com/science/article/pii/S2212420918309373?via%3Dihub

Climate Change

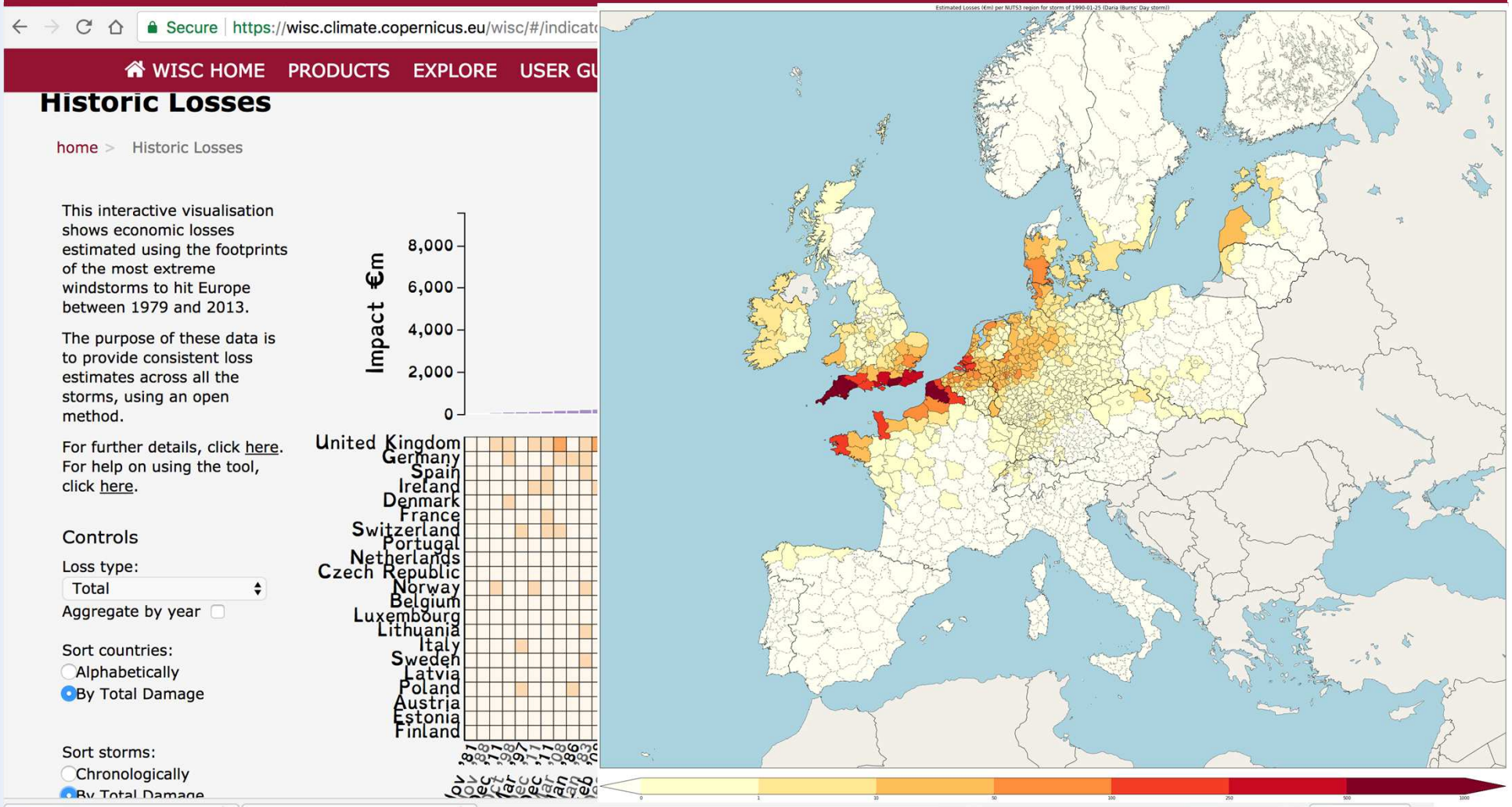
Daria



Copernicus Europe's eyes on Earth
European Commission
ECMWF

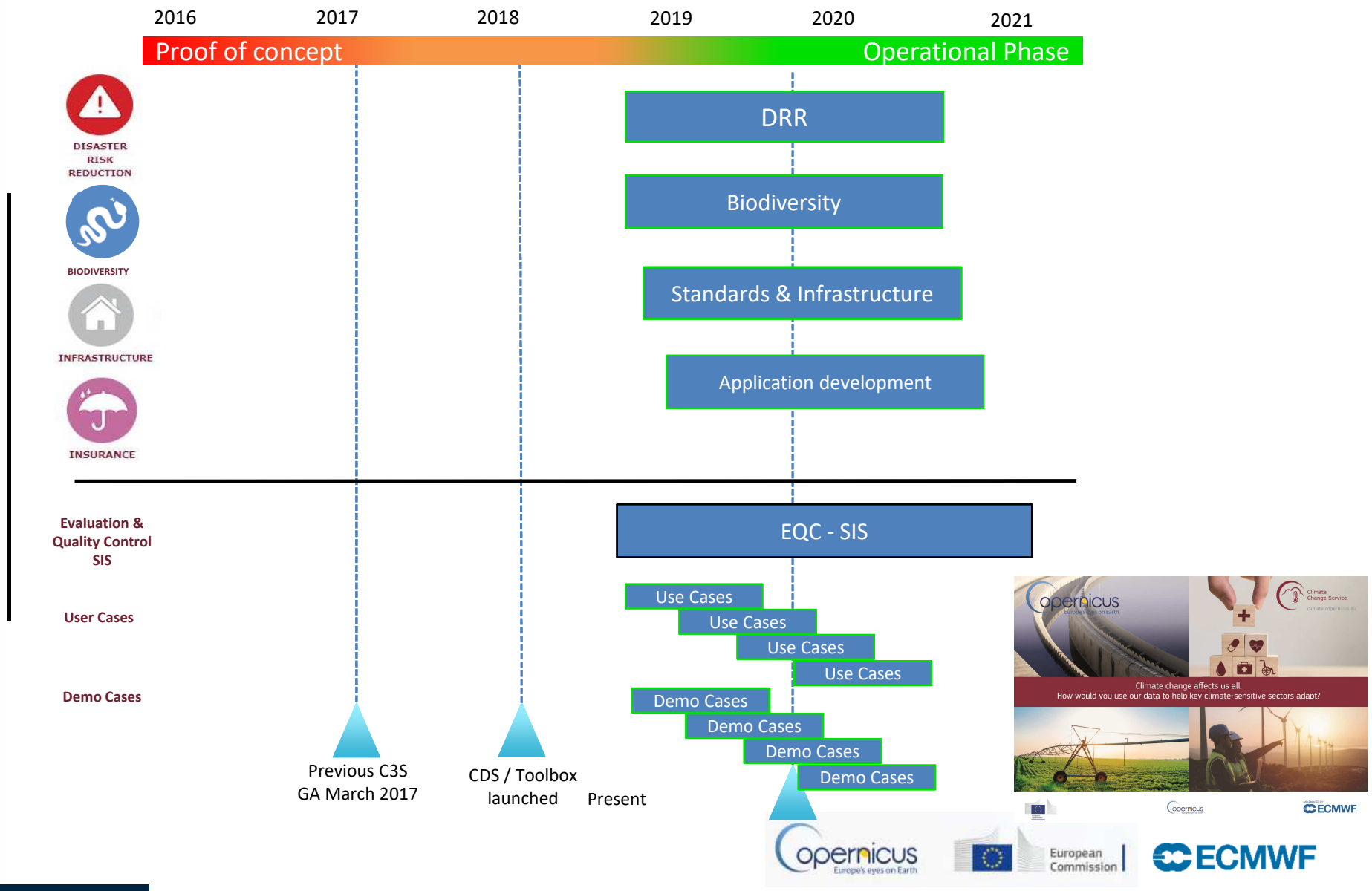
Climate Change

Wind storms for the insurance sector



Copernicus Europe's eyes on Earth | European Commission | ECMWF

Climate Change



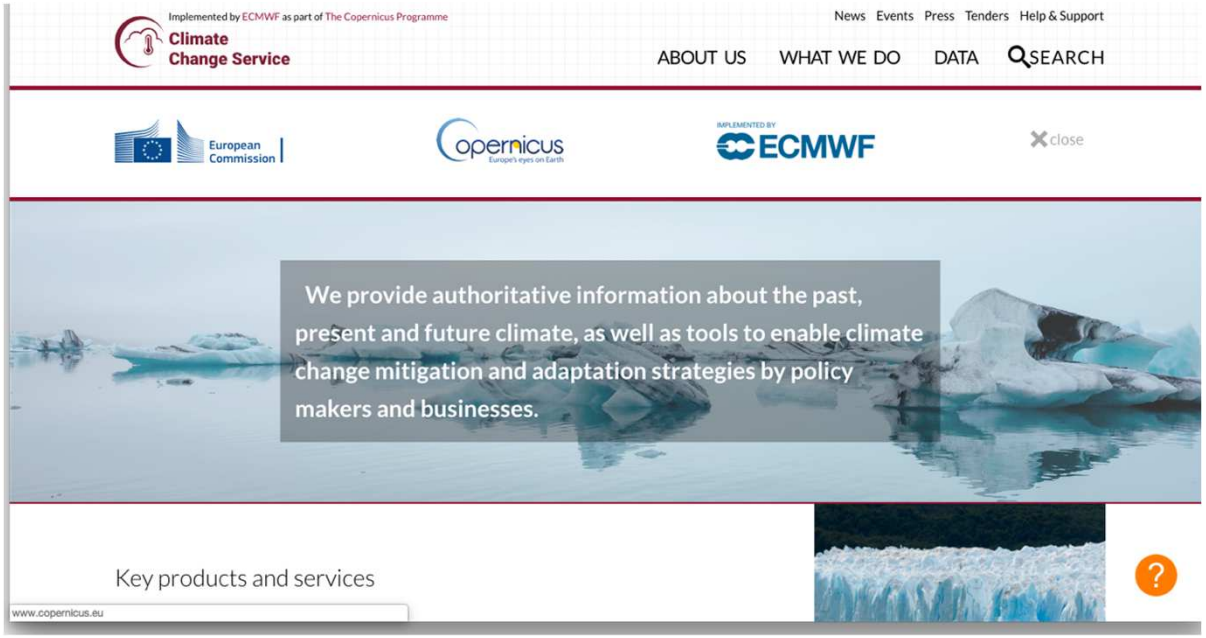
Climate Change

Questions?

climate.copernicus.eu

For more info:

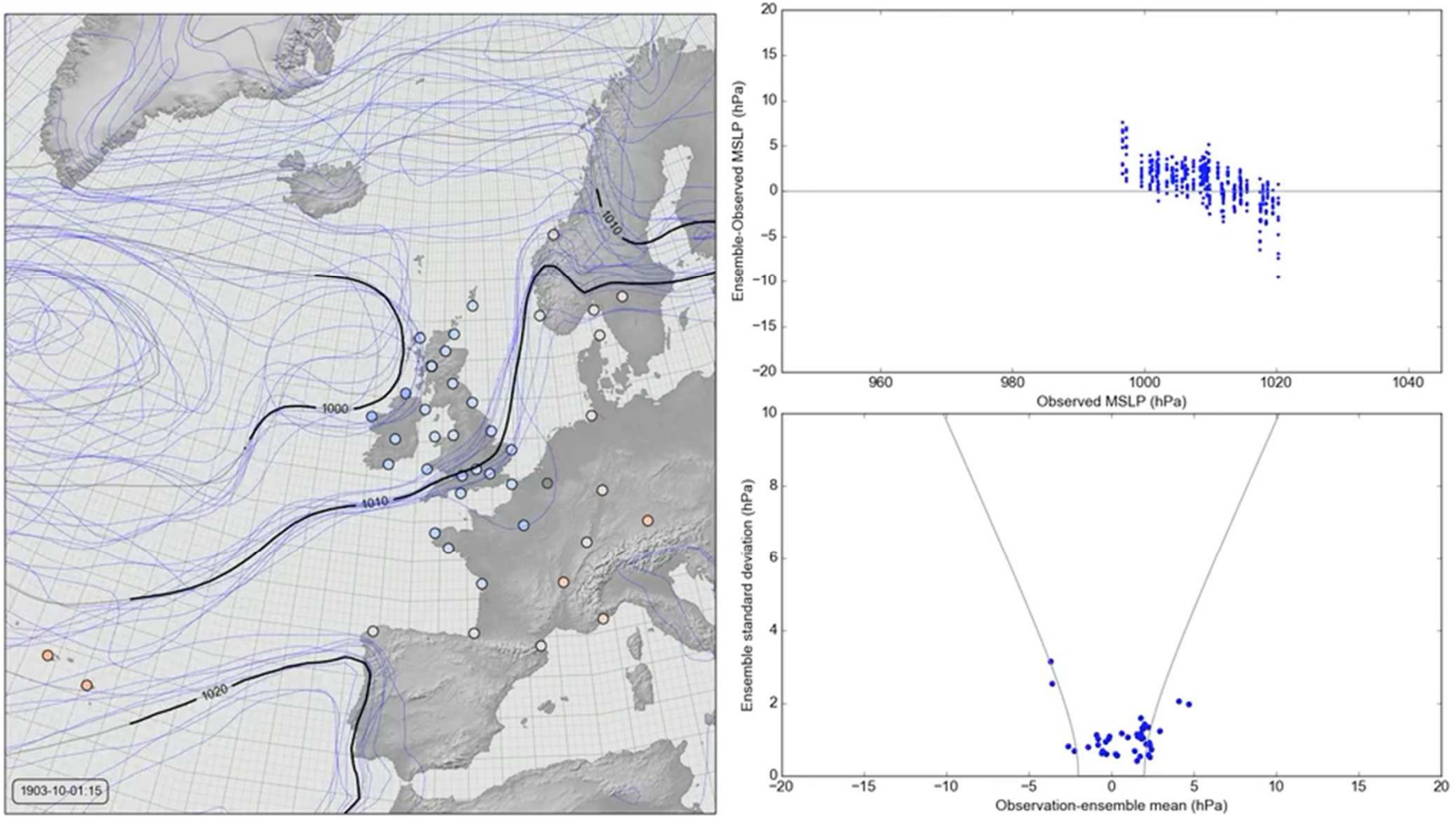
copernicus-support@ecmwf.int



Carlo.Buontempo@ecmwf.int

Twitter: @carlo_tuitter

opernicus Europe's eyes on Earth
European Commission
ECMWF



Credits: Philip Brohan (Met Office)
Retrieved from https://vimeo.com/267422379 on June 27 2019

Climate Change

Data rescue

Implemented by ECMWF as part of The Copernicus Programme
Climate Change Service

Login/Register

HOME ABOUT REGISTRIES TOOLS SEARCH

C3S Data Rescue Service

Key products and services

Data Rescue Projects

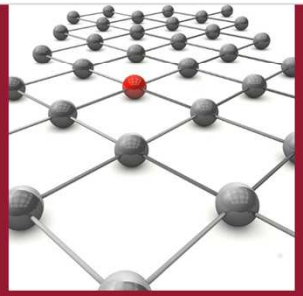
Interactive Map

Land Surface Observations Metadata Inventory

Upper Air Observations Metadata Inventory
(Fixed platforms)

Upper Air Observations Metadata Inventory
(Moving platforms)

Marine Observations Metadata Inventory



Metadata Exchange Tool

Forum

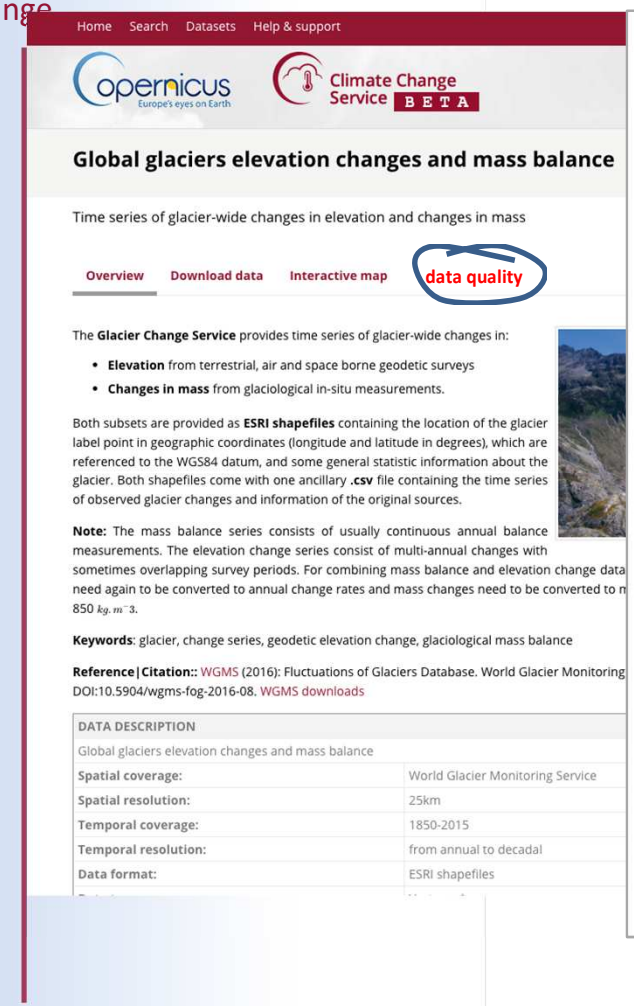
Copernicus Europe's eyes on Earth

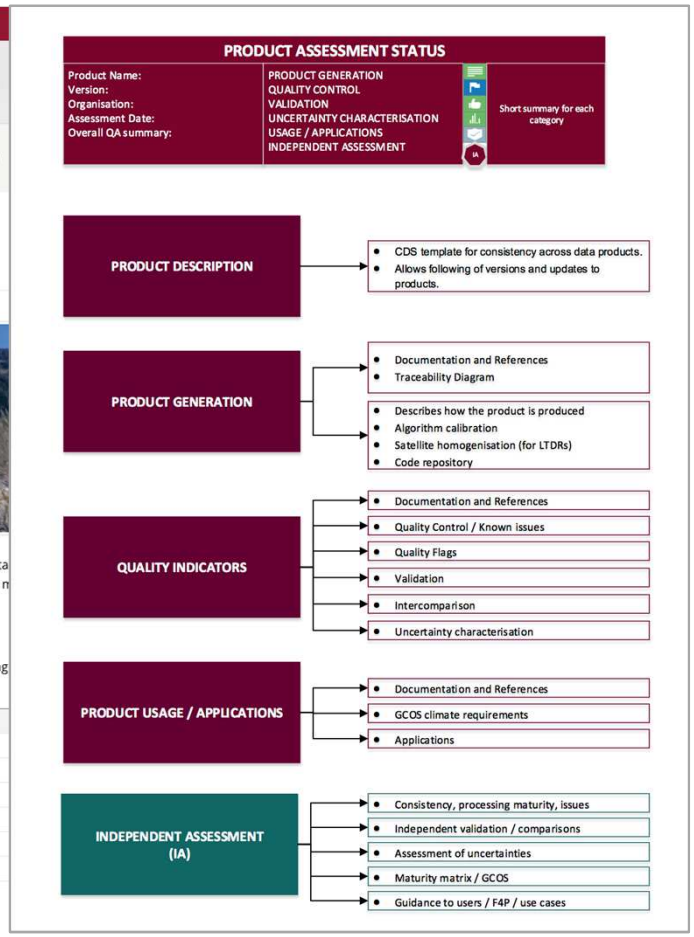
European Commission

ECMWF

Evaluation and Quality Control (EQC) for the CDS

Climate Change





Quality of data

- Assessments
- User guidance
- Gaps and limitations

Quality of tools

- Fitness for purpose
- Best practices

Quality of service

- Speed, responsiveness
- System availability, …

opernicus Europe's eyes on Earth | European Commission | ECMWF

https://climate.copernicus.eu

Change Service

ABOUT US WHAT WE DO DATA SEARCH

European Commission | Copernicus Europe's eyes on Earth | IMPLEMENTED BY ECMWF | close

Key products and services

Climate Change

Conclusions

- The environmental challenge opens a number of new research questions that can only be tackled by an interdisciplinary approach.
- The scale of the environmental challenges we face is such that we need a step change our way of dealing with climate, pollution and weather data.
- Copernicus services are making an unprecedented amount of environmental data operationally available in a free and unrestricted manner.
- The data is not information without users and context.
- Whilst the generation of the underpinning data can be operationalized and centralized the tailoring and contextualization is best done downstream.

Copernicus Europe's eyes on Earth | European Commission | ECMWF

COPERNICUS CLIMATE CHANGE SERVICE

Sectoral Information System to Support Disaster Risk Reduction

ITT Ref: C3S_430

Climate Change

Paola Mercogliano

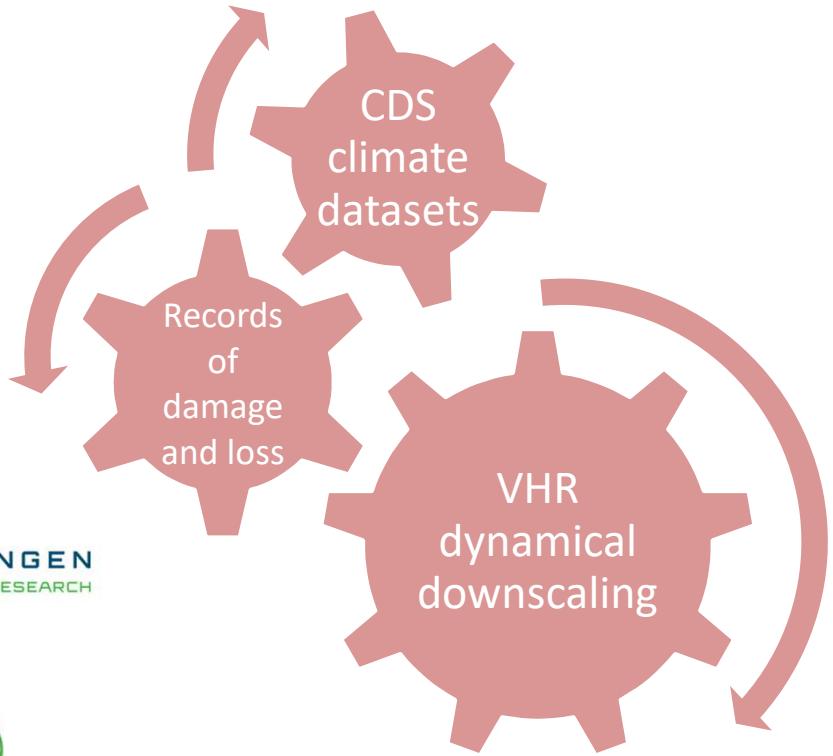
European Commission | Copernicus Europe's eyes on Earth | ECMWF

3th September 2019

Climate Change

Objective

Development of a Copernicus Climate Change Service for Disaster Risk Reduction (DRR) for Pluvial Flood Risk Assessment in Urban Areas



cmcc Centro Euro-Mediterraneo sui Cambiamenti Climatici

WAGENINGEN UNIVERSITY & RESEARCH

Koninklijk Nederlands Meteorologisch Instituut
Ministerie van Infrastructuur en Waterstaat

geco

European Commission | Copernicus Europe's eyes on Earth | ECMWF

Climate Change

Objective

Development of a Copernicus Climate Change Service for Disaster Risk Reduction (DRR) for Pluvial Flood Risk Assessment in urban areas

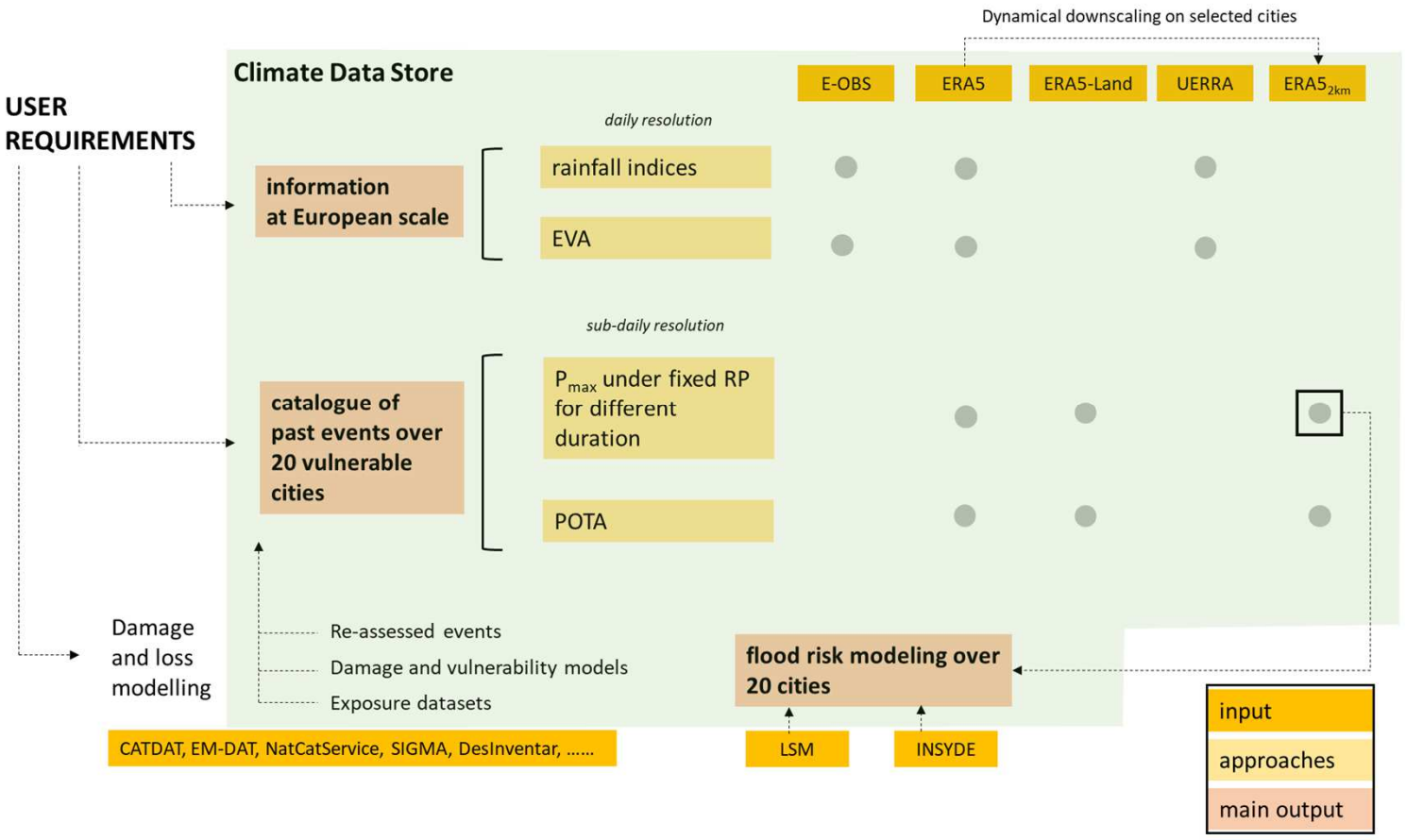
- **Data about extreme precipitation indices and indicators at European scale**
- **Catalogue of past precipitation events occurred in European demonstration pilot cities (including additional information such as damages and losses)**
- **Pluvial flood risk analysis on European demonstration pilot cities**

Demonstrating the service value by combining high-resolution, probabilistic description of extreme precipitation, exposure datasets and damage/vulnerability models into a **comprehensive pluvial flood risk assessment**

European Commission | Copernicus Europe's eyes on Earth | ECMWF

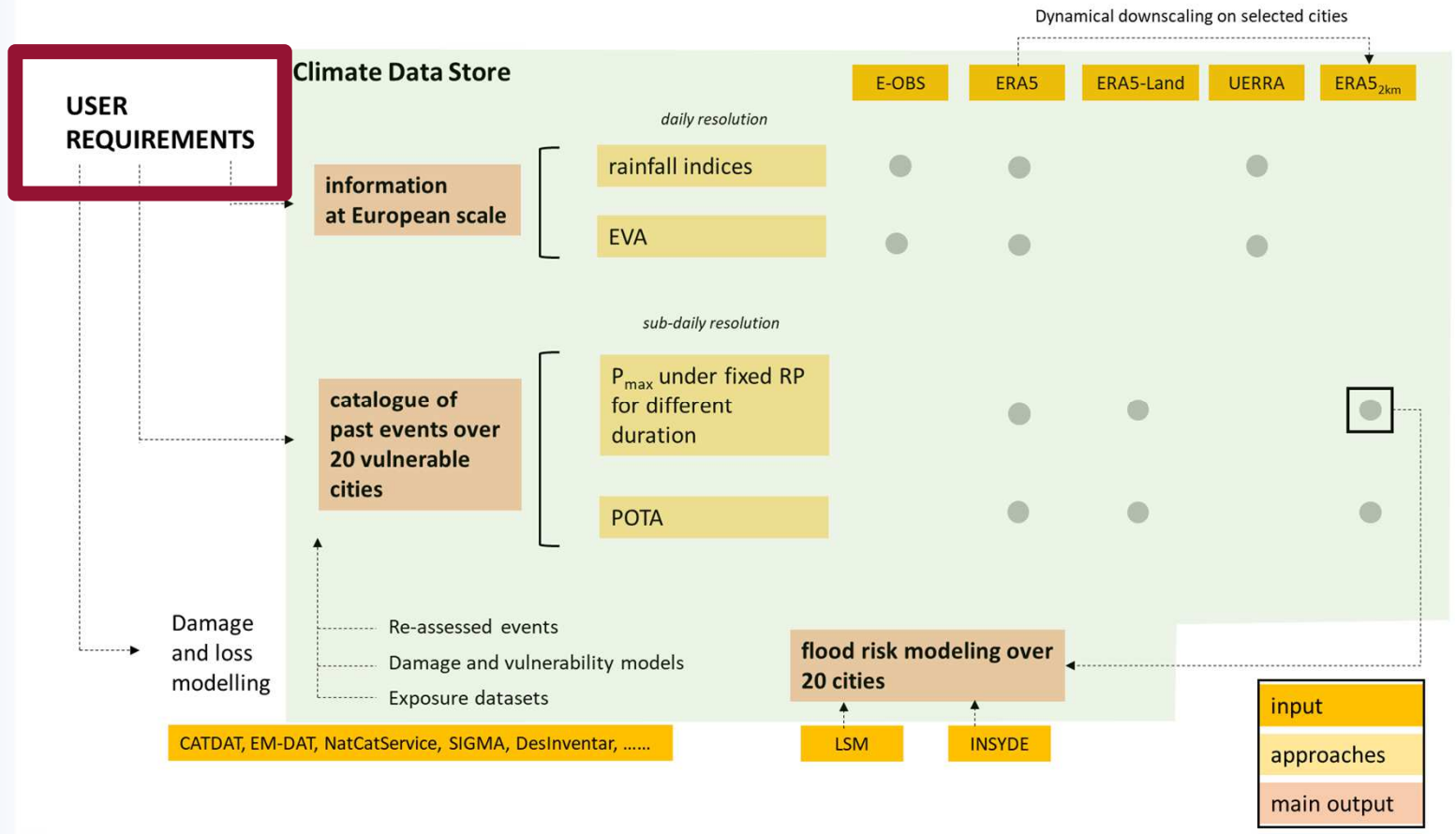
Climate Change

Conceptual Overview of the Workflow



Climate Change

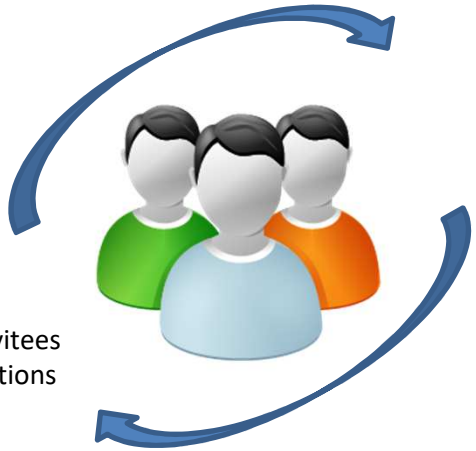
Conceptual Overview of the Workflow



Climate Change

User Requirements

User Champions Group



- Public administrations and city councils
- Civil protection and risk management actors
- Insurers and financial organizations
- Business companies

- Workshops
- Discussion between partners, Copernicus representatives and selected additional invitees
- Engagement of a high level policy organizations

List of indicators

Activities:

- Desk review of the available material from C3S and other relevant projects
- Large scale consultation
- Participation in the Global Platform for DRR
- Synthesis of user requirements

It will follow a dedicated talk by C.Jacob

European Commission | Copernicus Europe's eyes on Earth | ECMWF

Climate Change

Climate Data Integration

Climate data integration has the main goal to develop a strong connection between already available data and data *ad-hoc* produced to improve the spatial and temporal resolution of precipitation data currently available for pluvial flood analysis.

Climate Dataset	Precipitation Data Resolutions
E-OBS	Time resolution: 24 hours Spatial resolution: 28 km
ERA5	Time resolution: 1 hour Spatial resolution: 31 km
ERA5-Land	Time resolution: 24 hours Spatial resolution: 9 km
UERRA	Time resolution: 24 hours Spatial resolution: 5.5km

ERA5 reanalysis dataset
Spatial resolution: 31km
Temporal resolution: 1-hour

$ERA5_{2km}$ downscaled dataset
Spatial resolution: 2km
Temporal resolution: 1-hour

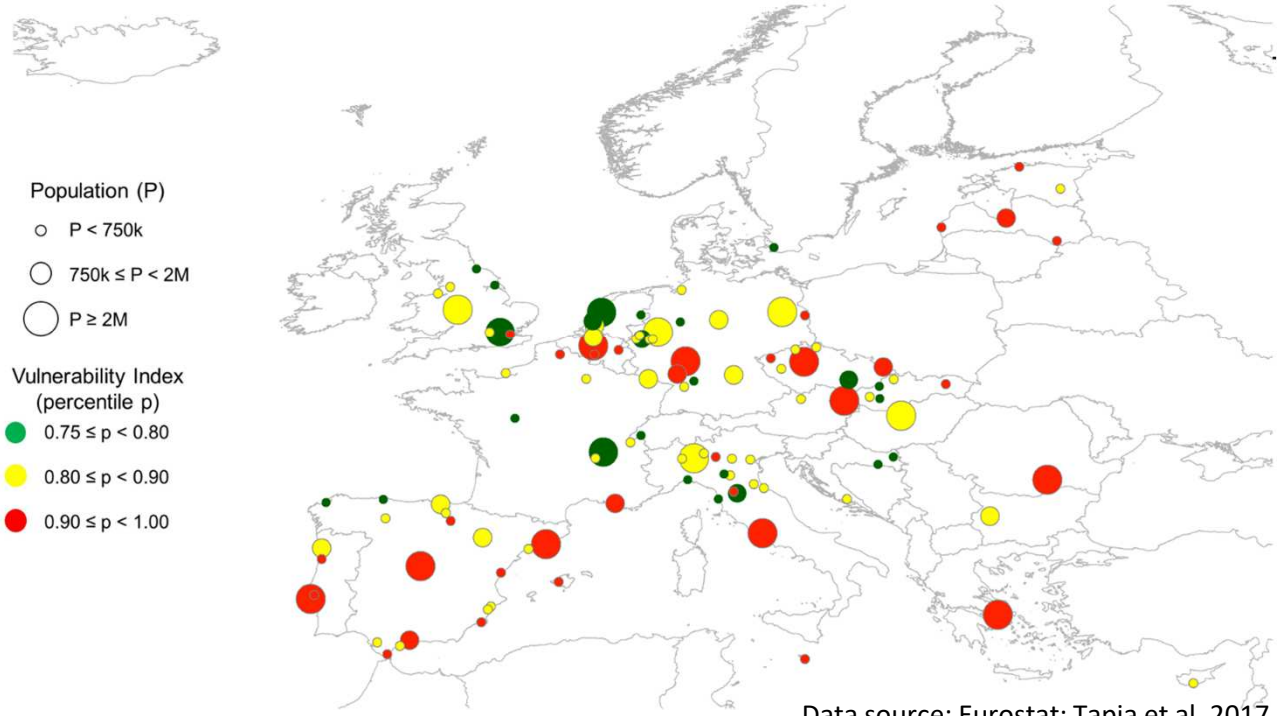
European Commission | Copernicus Europe's eyes on Earth | ECMWF

Climate Change

Criteria for cities selection

ERA5$_{2km}$ will cover about 20 of the most vulnerable cities in Europe to urban pluvial flooding

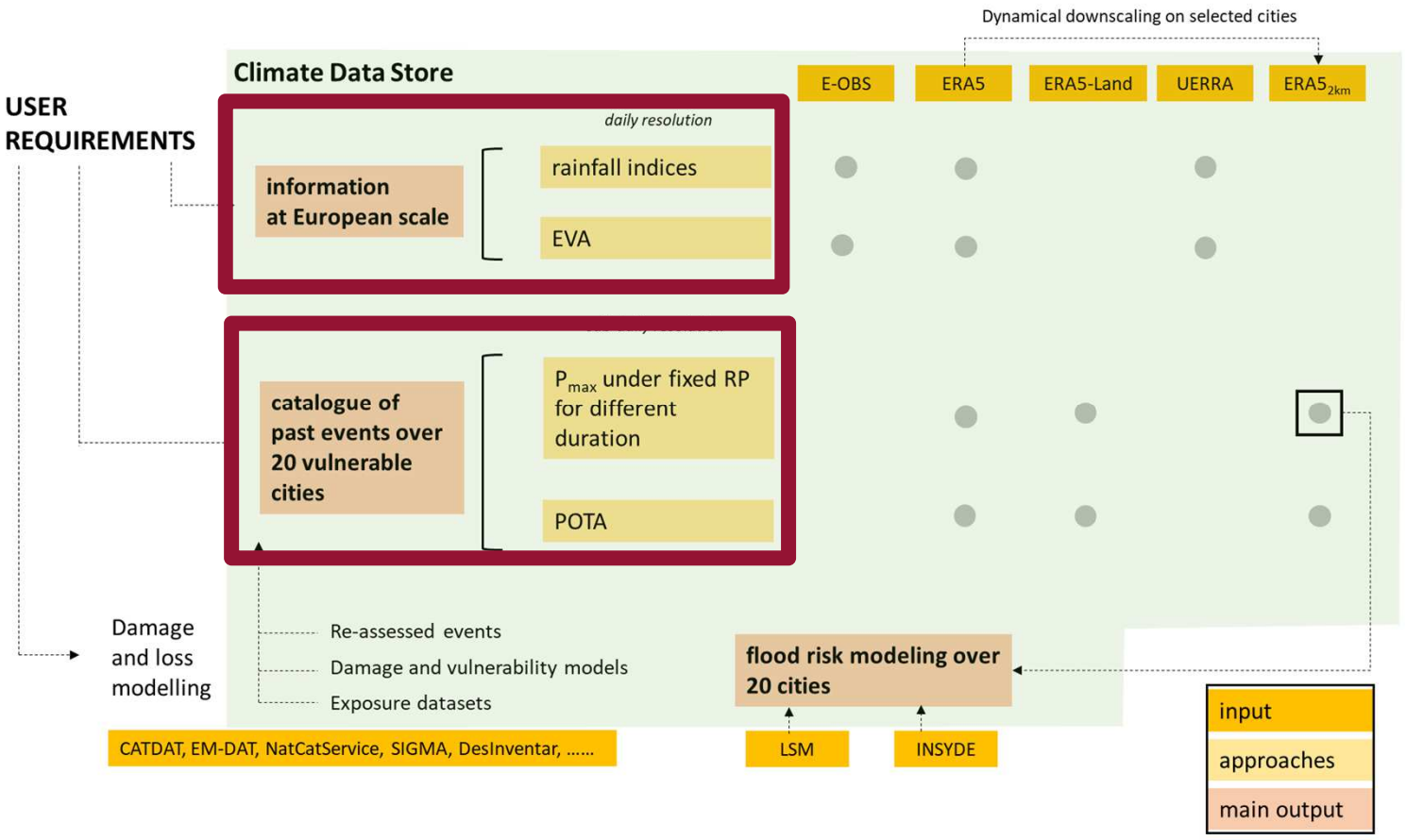
- The list of the cities will be defined within the User's Requirement activities.
- The map shows the candidate cities based on their vulnerability and population



Data source: Eurostat; Tapia et al, 2017

Climate Change

Conceptual Overview of the Workflow



Climate Change

Analysis of the extreme weather events (product at European level)

1) Extreme weather indices (EWIs): following the ETCCDI definitions, a set of weather indices will be calculated for characterizing the main features of precipitation patterns at European scale. These indices will be computed on fly giving the opportunity to define computational domain (e.g. a specific country) and time window (a single day, a specific year, …)

2)Extreme Value Analysis (EVA): Extreme Value Theory (EVT) will be applied for modelling the stochastic behavior of high return period/extremes events (in terms of Intensity, Duration, Frequency – IDF Curves). In this case, daily dataset will be adopted.

European Commission | Copernicus Europe's eyes on Earth | ECMWF

Climate Change

Analysis of the extreme weather events (products for the 20 cities)

1) Extreme Value Analysis (EVA): Extreme Value Theory (EVT) will be applied for modelling the stochastic behavior of high return period/extremes events (in terms of Intensity, Duration, Frequency – IDF Curves). In this case, sub-daily dataset will be adopted.

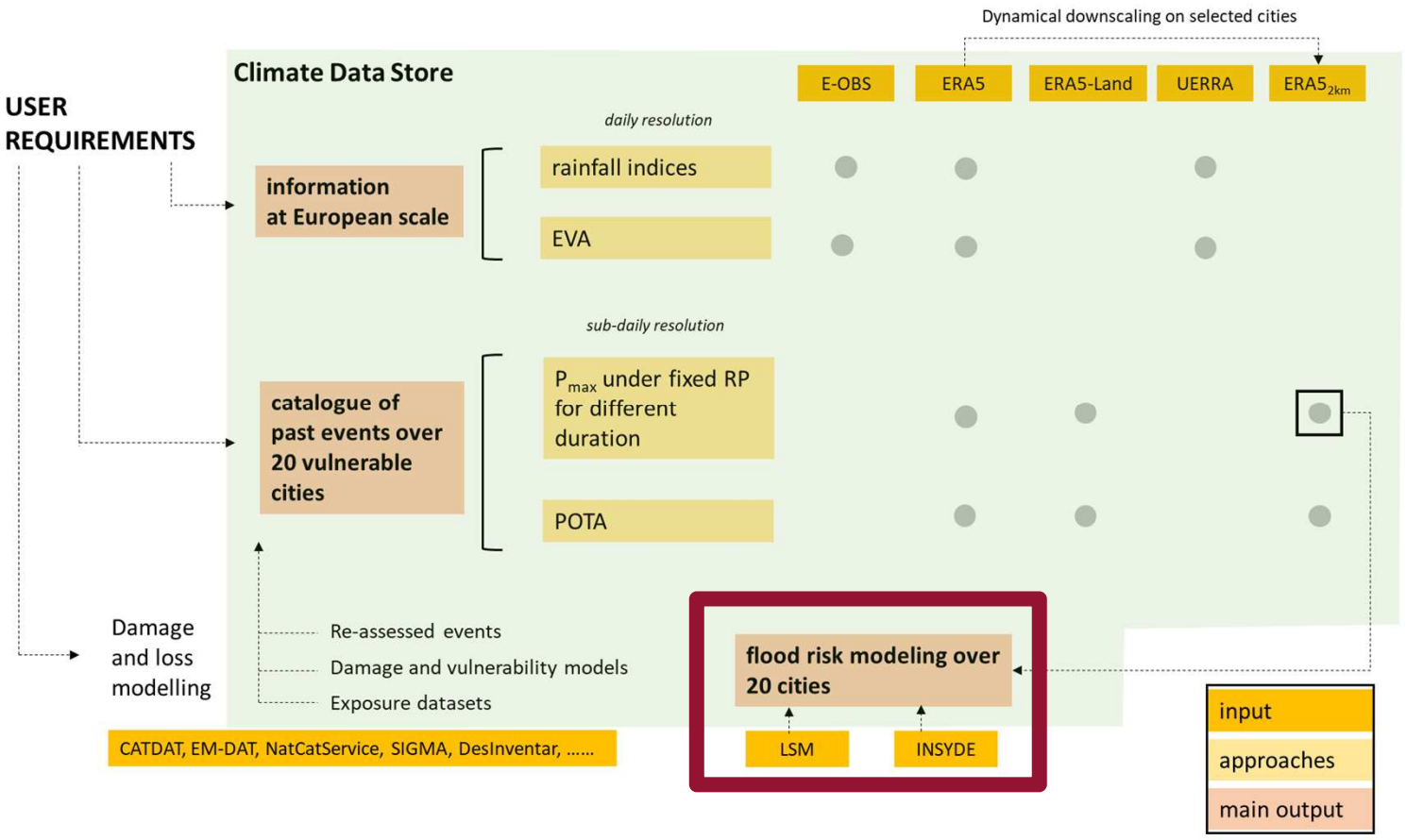
2) Peaks Over Threshold Analysis (POTA): the events exceeding a defined threshold will be evaluated. Such a threshold will be used as filter to build the catalogue of past precipitation events for a target city. The filter elements will be the city, the duration, the period.

When available, the catalogue will present recorded impacts from public accessible repositories (EMDAT, Emergency Database, the Copernicus Emergency Services, etc.)

European Commission | Copernicus Europe's eyes on Earth | ECMWF

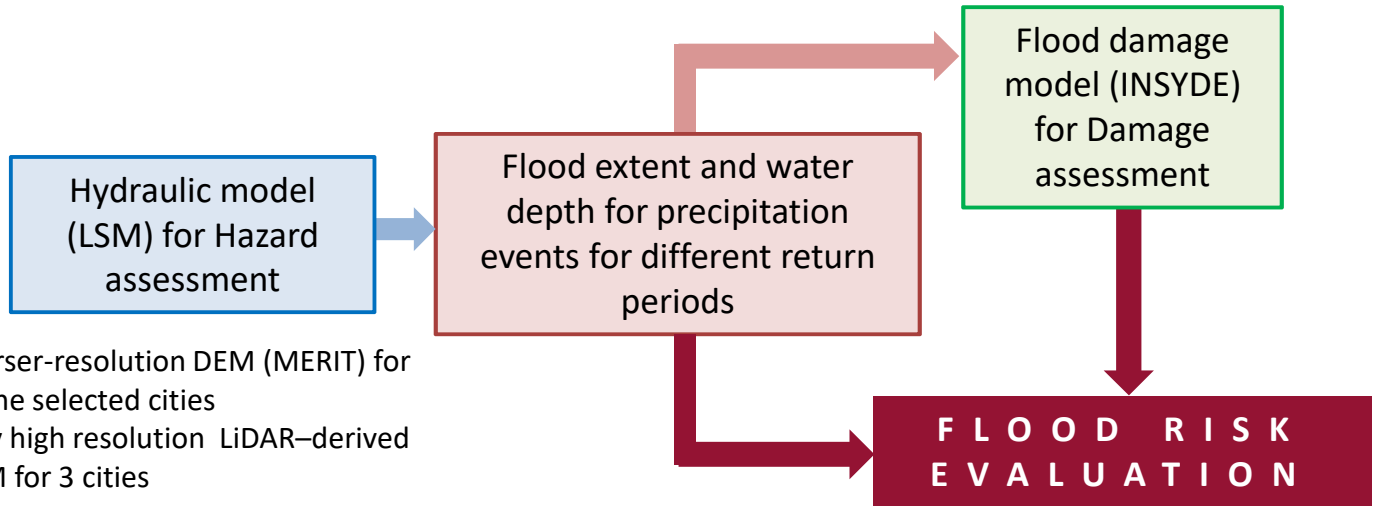
Climate Change

Conceptual Overview of the Workflow



Climate Change

Case studies – pluvial flood hazard and risk assessment



- ✓ Coarser-resolution DEM (MERIT) for all the selected cities
- ✓ Very high resolution LiDAR–derived DEM for 3 cities

The risk assessment will cover all cities for which the ERA-5 will be downscaled to 2km resolution. In order to estimate the expected annual damage, the evaluation is based on the application of a pluvial flood hazard model and on the economic assessment of the investigated cities.

European Commission | Copernicus Europe's eyes on Earth | ECMWF

Climate Change

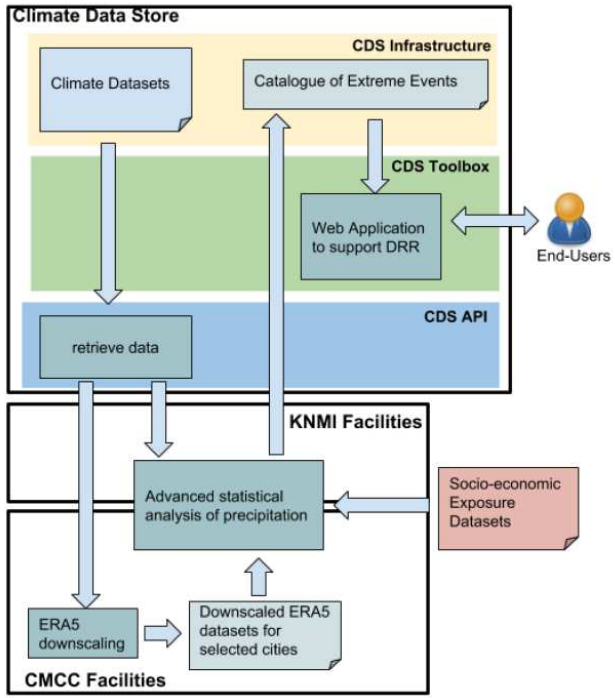
ICT solutions

High level Architecture

Development of a Service Web Portal to be integrated in the Copernicus Web Portal

High collaboration with ECMWF developers

Engagement of stakeholders, champions, end-users



End Users will be enable to:

- Access and download data and documents
- Access, process and visualize extreme events stored in the catalogue
- Set/change values of some parameters

European Commission | Copernicus Europe's eyes on Earth | ECMWF

Thank you for your attention

Paola MERCOGLIANO
Email: paola.mercogliano@cmcc.it

https://climate.copernicus.eu/

http://copernicus.eu/

Climate Change

Climate Change

User engagement

Copernicus Sectoral Information System for Disaster Risk Reduction (C3S_430)

Claire Jacobs, Jaroslav Mysiak

European Commission | Copernicus Europe's eyes on Earth | ECMWF

Climate Change

Climate services for DRR: Data gaps

- Historical observations
- Event catalogue

European Commission | Copernicus Europe's eyes on Earth | ECMWF

Climate Change

Objectives

Inventory of user requirements

- Review existing work
- Large scale user consultation, mobilise network (side events, interviews)
- Compatible with URDB

Define the scope of the service to support DRR

- System requirements
- Case studies for demonstration of service
- Service continuation

European Commission | Copernicus Europe's eyes on Earth | ECMWF

Climate Change

Define scope of service and demonstration

- **Specification of service** based on user interactions
- **Case studies** (end to end applications) with added value to demonstrate the service is fit-for-purpose
- **Confirmation** by means of:
  - -Review by key users
  - -Presentation to targeted audience science- policy events

Scope of the service refined and identified cases to demonstrate value

European Commission | Copernicus Europe's eyes on Earth | ECMWF

Climate Change

Mechanisms for uptake of the service

Describe arrangements that foster **uptake of the service**

- Value-added services based on data Copernicus C3S
- Commitments of representatives in case study areas

Business model to allow the service to continue

European Commission | Copernicus Europe's eyes on Earth | ECMWF

Climate Change

Target groups and relevant networks

Target groups

- Public administration & city councils; ICLEI, Covenant of Mayors
- Civil protection and humanitarian aid
- Insurers and financial organisations
- High-level policy organisations (EFDRR, DRMKC, EEA, ..)
- Copernicus EMS

Projects/networks

- H2020: CLARA, CLARITY, INSURANCE, REISIN, LODE (DG ECHO), LIFE: FRANCA, RAINBO
- Climate-KIC (SAFERPLACES)
- C3S HEALTH
- PLACARD Platform

European Commission | Copernicus Europe's eyes on Earth | ECMWF

Climate Change

Timeframe

- August-September: Introduce project, establish key contacts, desk review
- September-November: Workshop sessions (side events), targeted interviews
- December: Description of service and case studies

European Commission | Copernicus Europe's eyes on Earth | ECMWF

Climate Change

Thank you for your attention

Claire.Jacobs@wur.nl
Jaroslav.mysiak@cmcc.it

https://climate.copernicus.eu/
http://copernicus.eu/

Copernicus Europe's eyes on Earth | European Commission | ECMWF