VALIDATED LOCAL RISK ACTIONABLE DATA FOR ADAPTATION

Climate Data Services and Tools: Copernicus Climate Change Service Support to Regions

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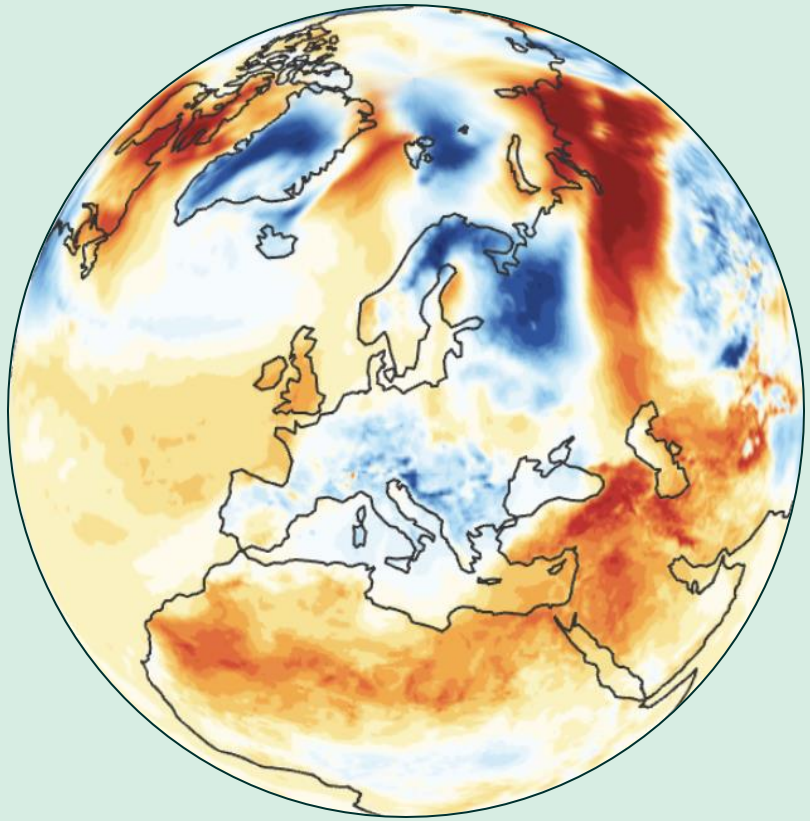
European Centre for Medium Range Weather Forecast

19th November 2024

The project has received funding from the Horizon Europe Framework Programme under grant agreement No 101112837

Presentation Overview

- What is Copernicus?
- C3S overview
- C3S data
- The European Climate Data Explorer – Supporting the ‘Mission for Adaptation’



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COPERNICUS: EUROPE'S EYES ON EARTH

- The Earth observation component of the **EU's Space programme** to benefit all citizens
- Implemented in partnership with the Member States, ESA, EUMETSAT, ECMWF, EU Agencies and Mercator Océan.
- Vast amounts of data from **satellites and ground-based, airborne, and seaborne** measurement systems.
- **Six thematic streams of Copernicus services** to transform data into **value-added information**
- **Free** and openly accessible to users

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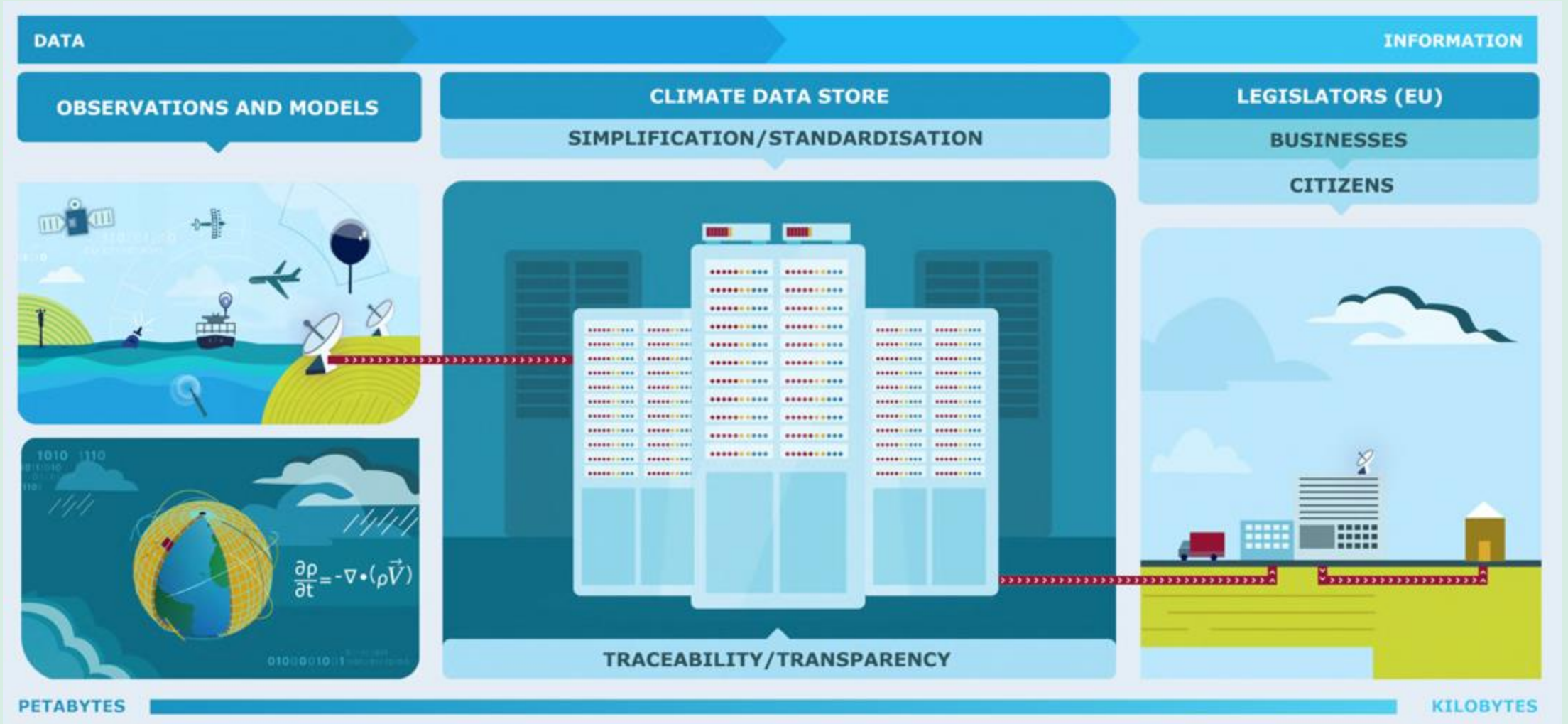
Climate Change

More Than Climate Data..... Climate Information



Typical download: 70 TB /day 276,441 users

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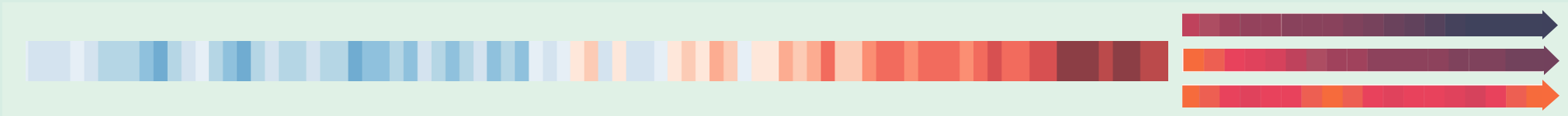
FREE DATA FOR SMART DECISIONS

Past — Present — Possible futures



OUR CHOICES

C3S PRODUCTS

Observations

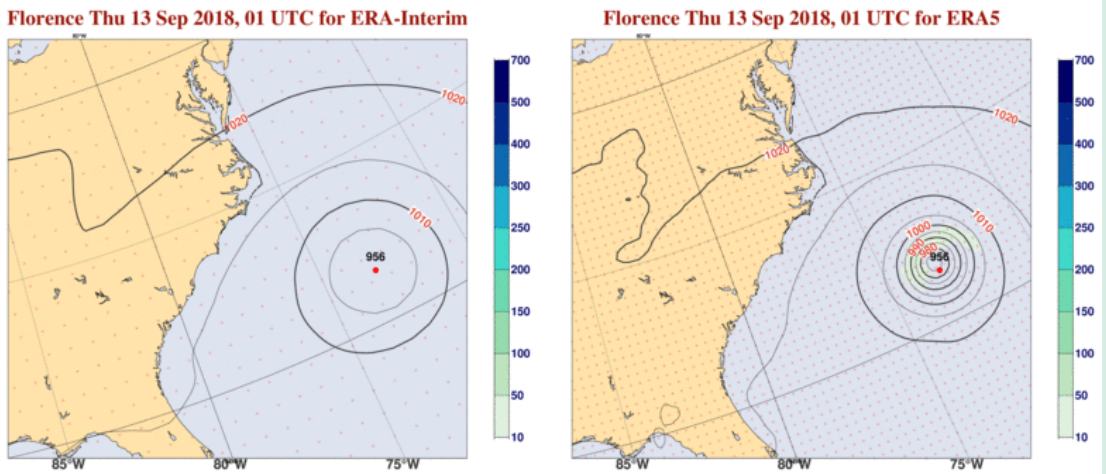
Reanalysis

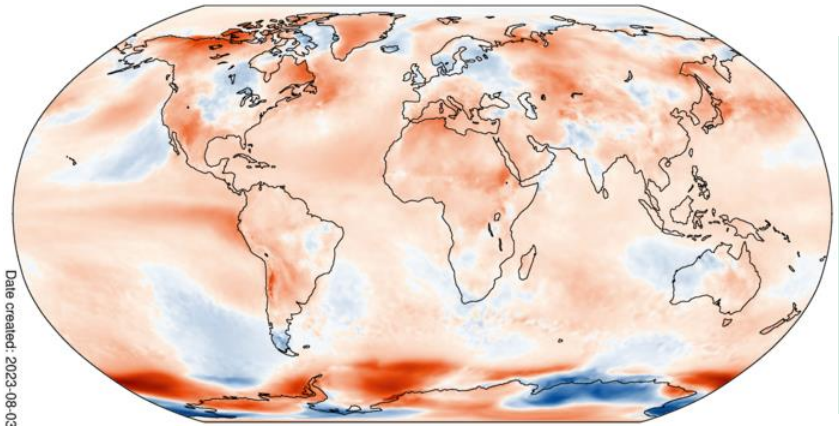
Seasonal to decadal predictions

Climate projections

C3S Global reanalysis: ERA5

ERA5: Full-observing-system global reanalysis for ***the atmosphere***, land and ***ocean waves***





ERA5 Surface air temperature anomaly for July 2023 relative to the July average for the period 1991-2020.

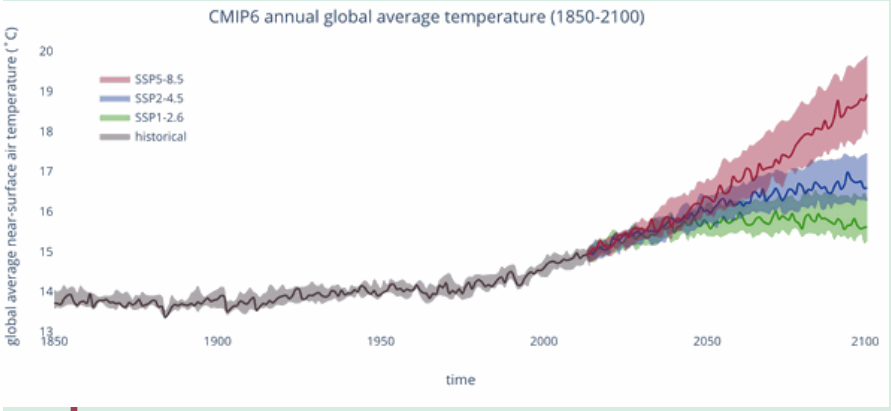
- Most popular dataset in the CDS (over 120,000 Users)
- > **100 TB** daily downloads
- No gaps in space/time, integrator of all observations
- Over 100 billion observations used so far
- Hourly snapshot 31 km resolution up to about 80 km height
- Available from **1940 onwards**
- Daily updates 5 days behind real time
- It relies on external gridded products: SST and sea-ice cover; GHGs, aerosols, TSI, (diagnostic) ozone

https://doi.org/10.1002/qj.3803

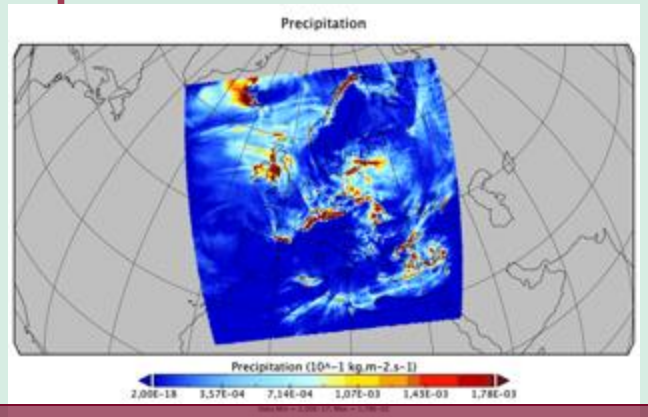
The ERA5 scientific journal paper (2020) has now topped 10,000 citations

Climate projections: Global, Regional & IPCC Climate Atlas

Climate



https://cds.climate.copernicus.eu/cdsapp#!/dataset/projections-cmip6

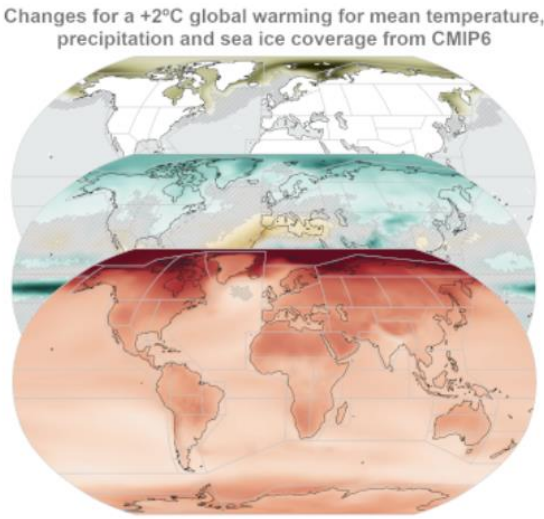


https://cds.climate.copernicus.eu/cdsapp#!/dataset/projections-cordex-domains-single-levels?tab=overview

Gridded monthly climate projection dataset underpinning the IPCC AR6 Interactive Atlas

Dataset | Global | Atmosphere (surface) | Atmosphere (upper air) | Climate projections

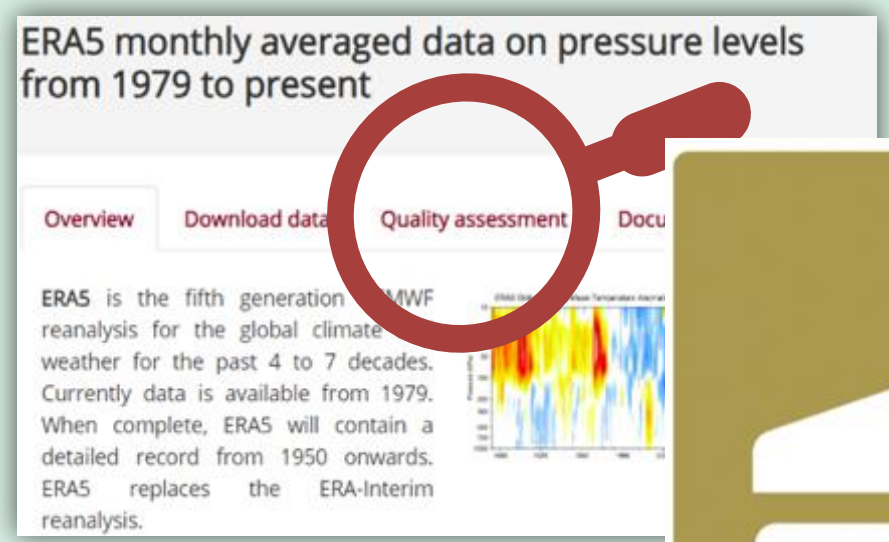
This catalogue entry provides gridded data from global (CMIP5 and CMIP6) and regional (**CORDEX**

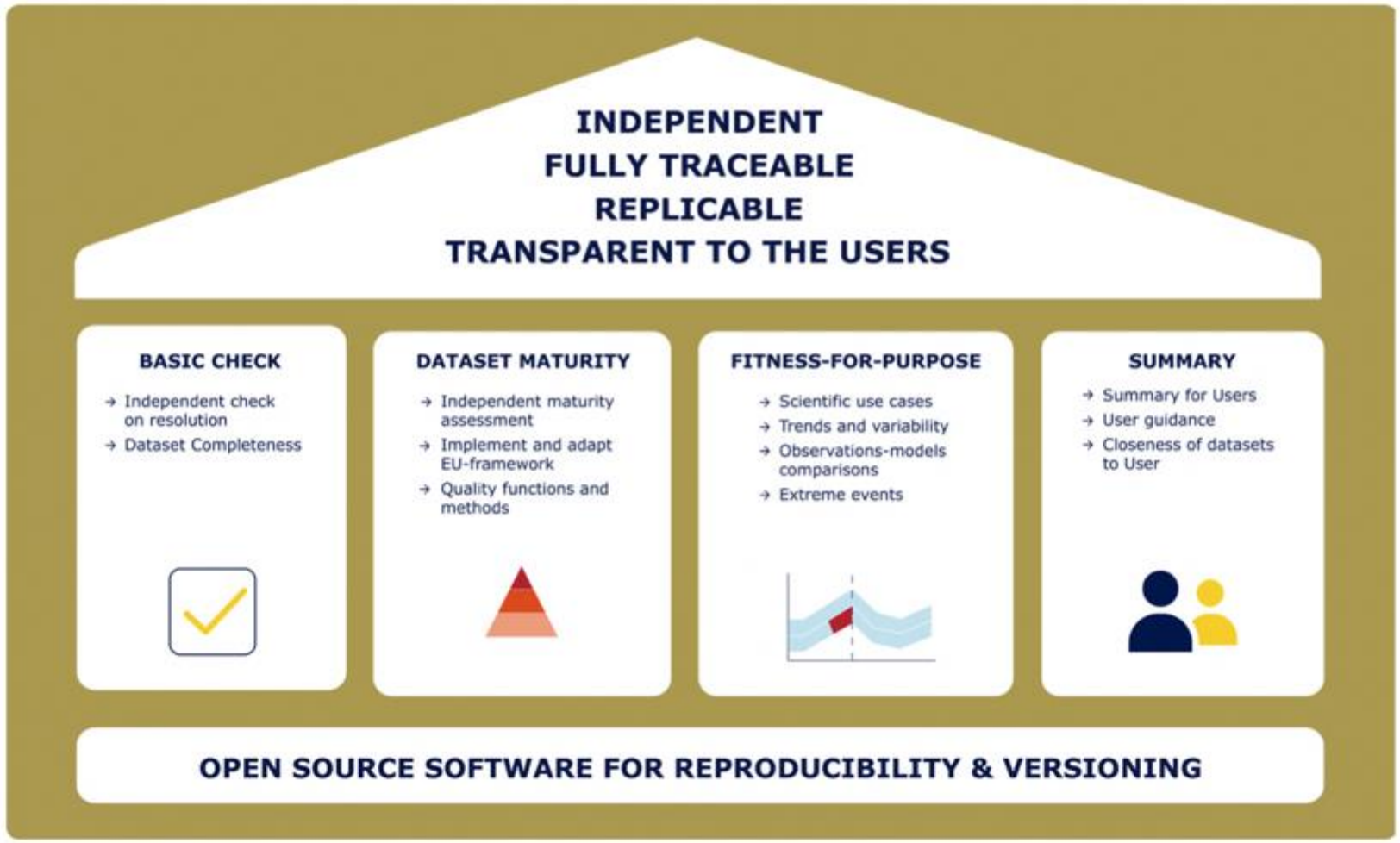


A novel tool (data and viewer) for IPCC AR6 for flexible **spatial** and **temporal** analyses of observed and projected climate change information

Evaluation & Quality Control framework

Climate Change





https://climate.copernicus.eu/ensuring-quality-performance-c3s

C3S Data User Journey

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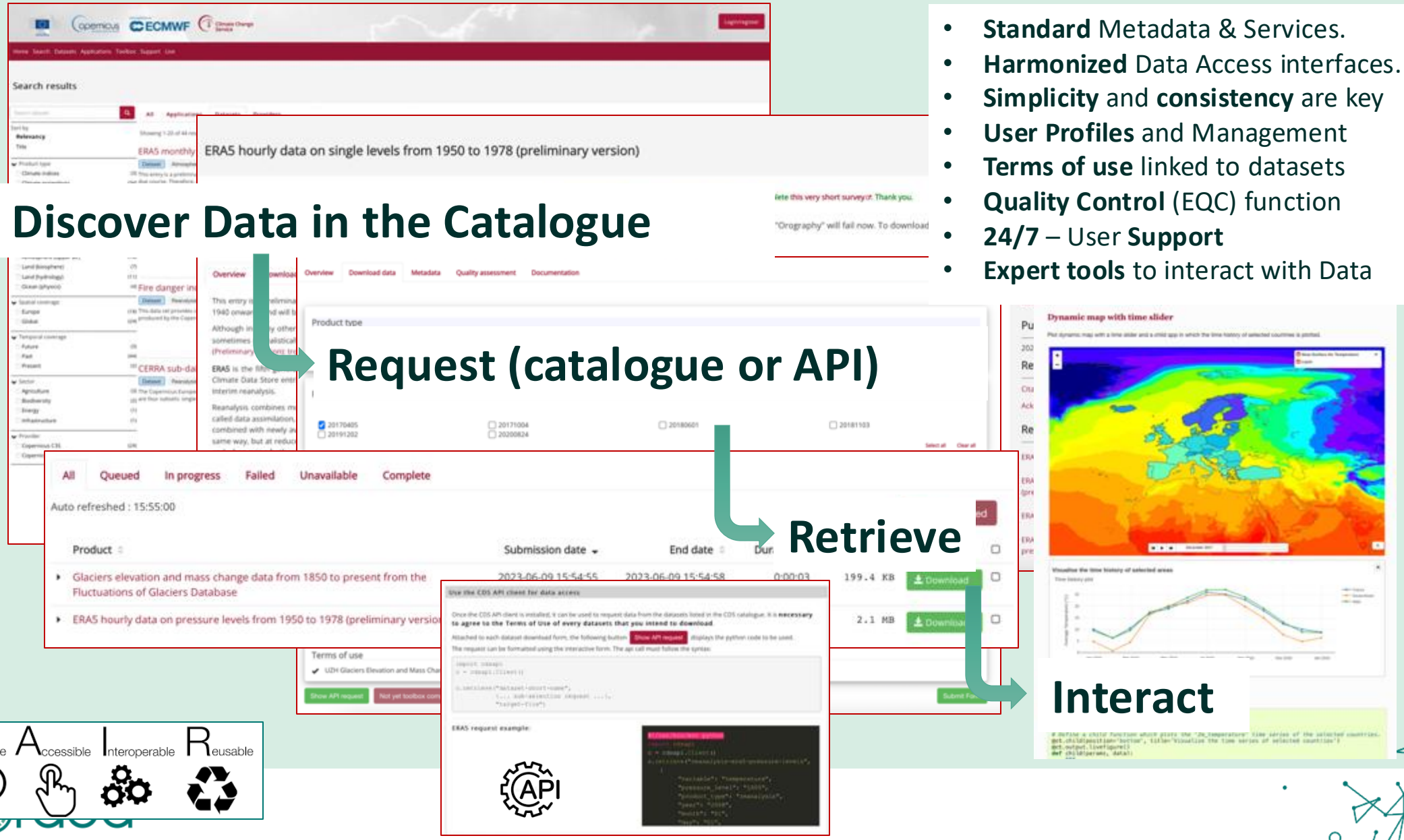
- **Standard** Metadata & Services.
- **Harmonized** Data Access interfaces.
- **Simplicity** and **consistency** are key
- **User Profiles** and Management
- **Terms of use** linked to datasets
- **Quality Control** (EQC) function
- **24/7** – User **Support**
- **Expert tools** to interact with Data



Findable Accessible Interoperable Reusable

The European Climate Data Explorer

https://apps.copernicus-climate.eu/c3s-apps/ecde/

The Copernicus Climate Change - EEA Interface (European Climate Data Explorer)

Driven by the European Environment Agency (EEA) requirements to support climate change adaptation and the Mission for Adaptation & national initiatives across the EU and partner countries

EEA expressed user requirements through stakeholder consultation.

Support national, subnational climate and transnational adaptation planning
Developed for EEA member states and transnational regions that have access to incomplete climate data

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European Environment Agency

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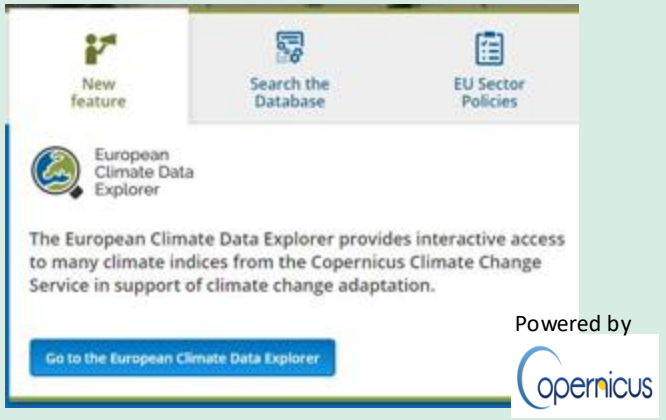
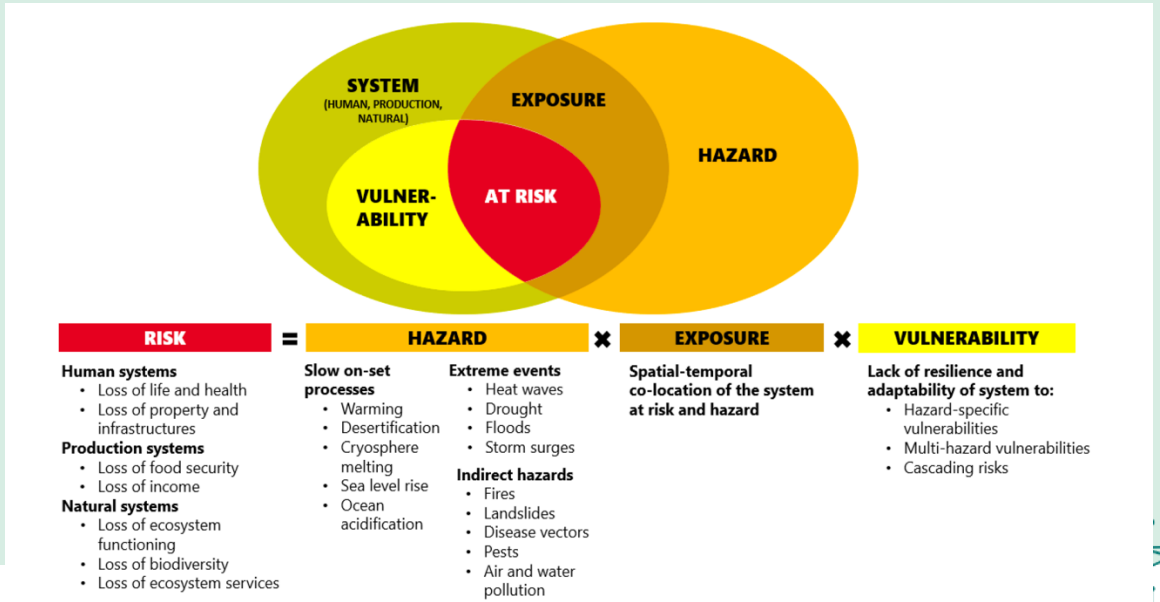
OVERVIEW OF THE C3S – EUROPEAN ENVIRONMENT AGENCY ACTIVITY TO SUPPORT CLIMATE ADAPTATION

- ECDE indices are relevant for adaptation planning at the European and national level



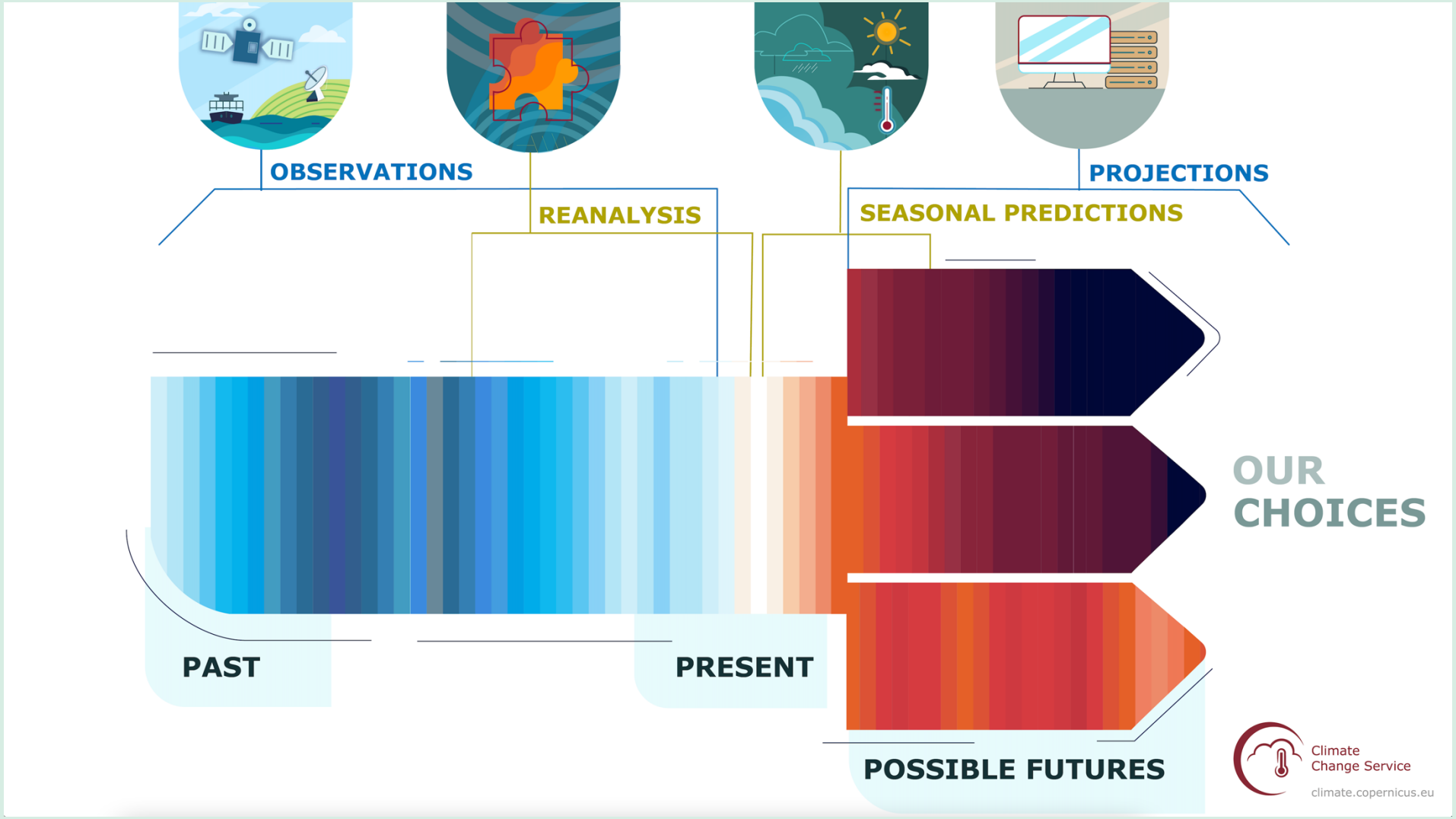
- Indices cover the hazard categories introduced by the IPCC and the European Topic Centre on Climate Change Impacts, Vulnerability and Adaptation (ETC-CCA)
  - Heat & Cold
  - Wet & Dry
  - Snow & Ice
  - Coastal



- Simplified access via Climate Adapt

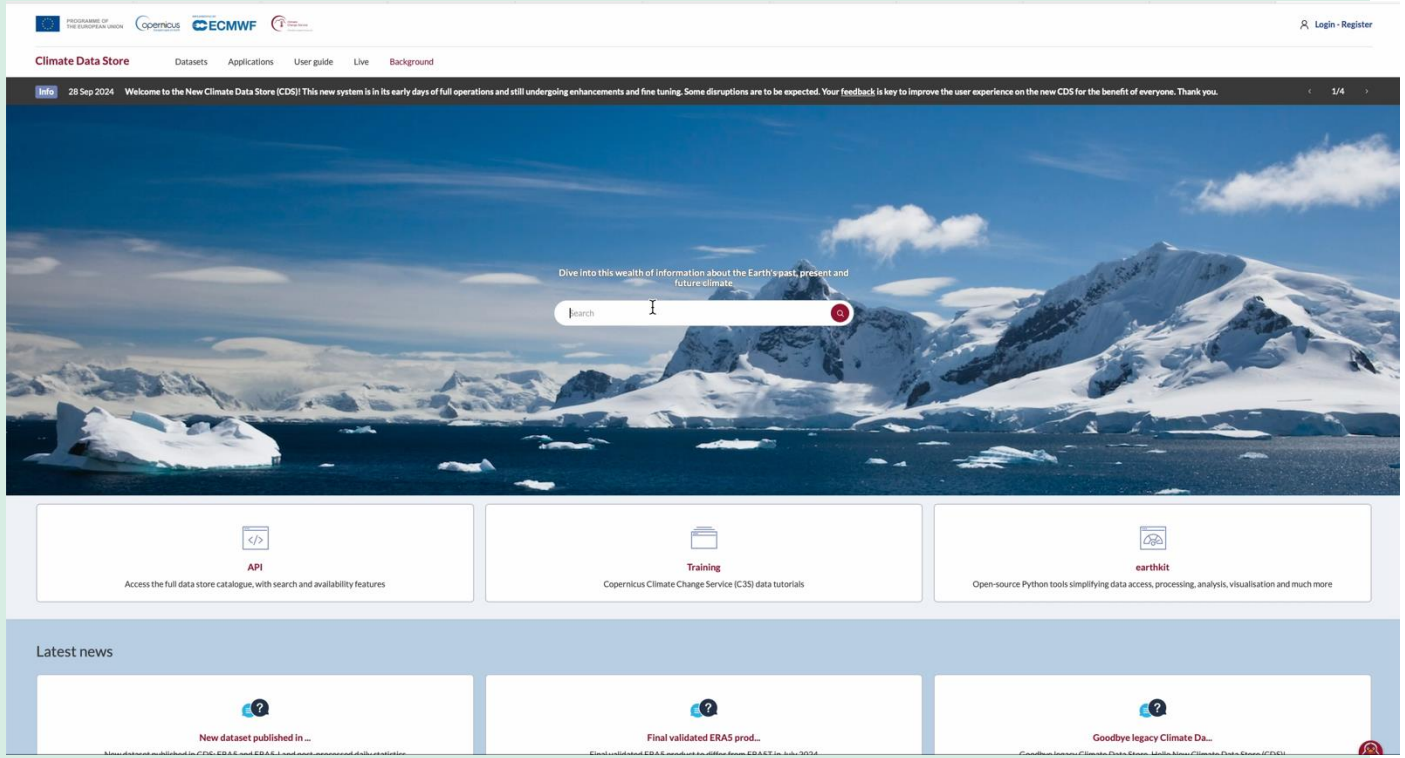
The Climate Data Store – EEA requirements for information on past, present and (possible futures)

Climate Change



European Climate Data Explorer Data Access

- Data published in new CDS June 2024
- Global warming levels published later in ’25
- Gridded data and data aggregated NUTS 0 – 2
- Available as NETCDF datasets
- Time series from Individual models
- 30 Climate Impact Indicators
- Designed for data users



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European Environment Agency

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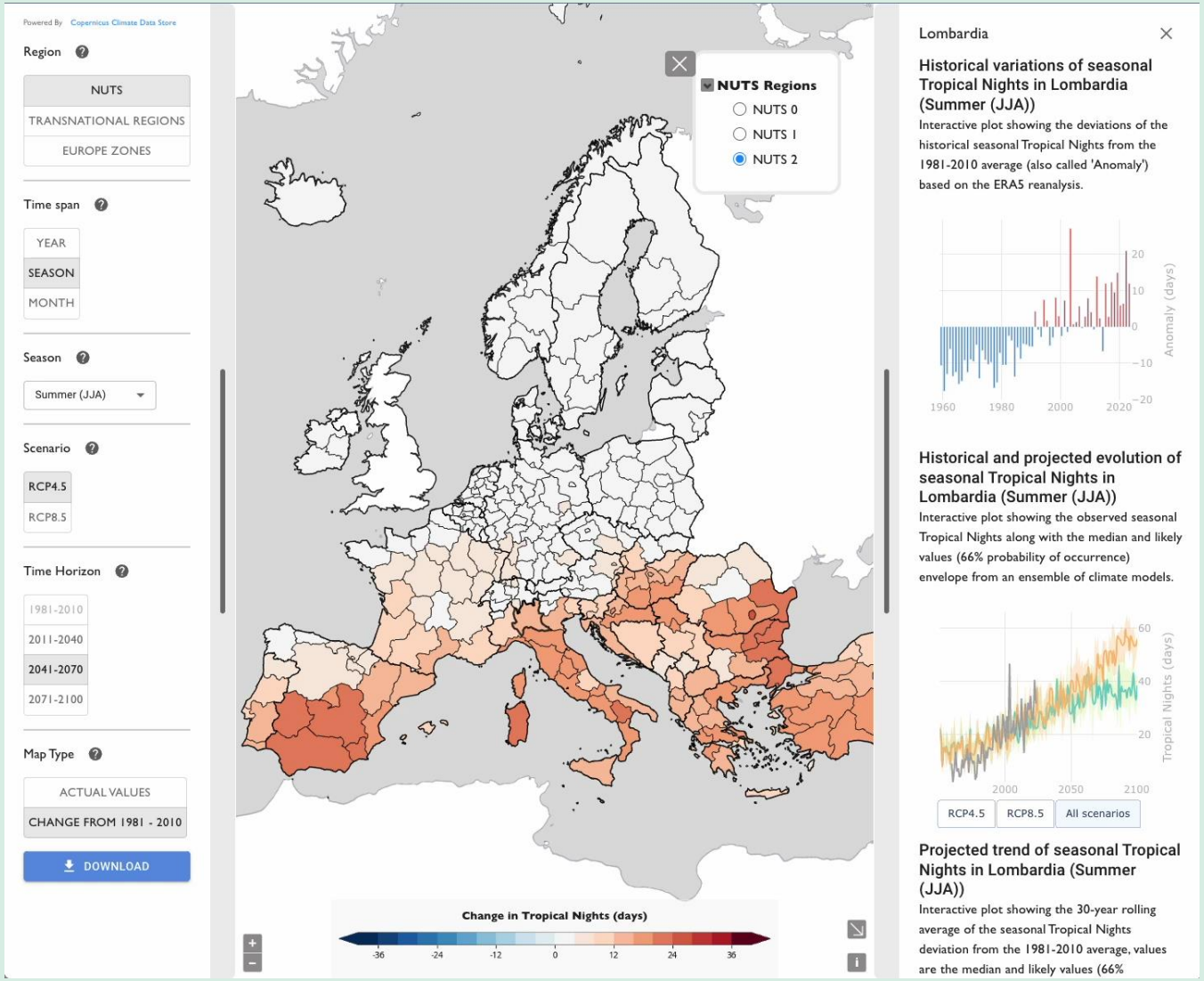
Supporting European Institutions – The European Environment Agency



European Climate Data Explorer (ECDE) allows exploration the C3S Climate Impact Indicators at the Pan European scale, down to EUROSTAT NUTS 2 (242 European regions)

The ECDE provides:

- Access to key climate hazard information derived from an ensemble of bias-adjusted EURO-CORDEX projections (updated when next gen of CORDEX available via CDS)
- 30 CII published in CDS (Q2 2024) and via App (Q3 2024)
- Consistency in reference periods, future periods and emission scenarios across indices
- Information for Europe's transnational regions
- For many indicators (16/30), **yearly updates** - using C3S ERA5 reanalysis to monitor climate hazards (and ultimately risk assessments)

Thank you

Climate-adapt.eea.europa.eu European climate data explorer overview

VALIDATED LOCAL RISK ACTIONABLE DATA FOR ADAPTATION

Copernicus and Urban Adaptation: Insights from SPACE4Cities

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The project has received funding from the Horizon Europe Framework Programme under grant agreement No 101112837

Climate change hazards in the news

CREDIT

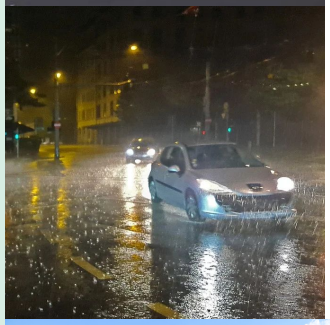
contains modified Copernicus Sentinel data (2024), processed by ESA

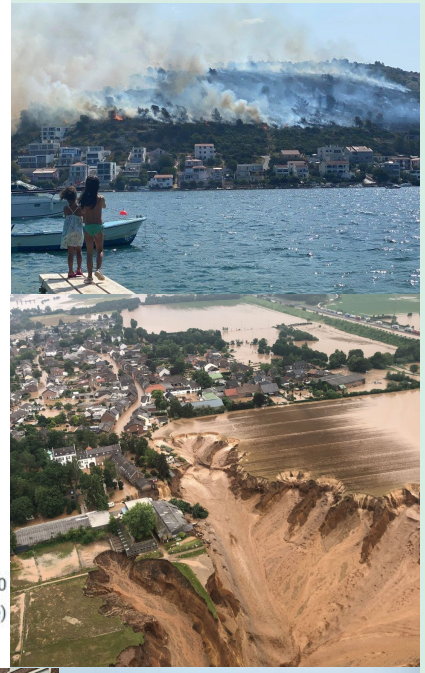
Climate change hazards in the news

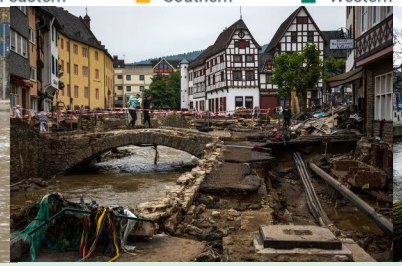
CREDIT

contains modified Copernicus Sentinel data (2024), processed by ESA

Climate change hazards in EU cities

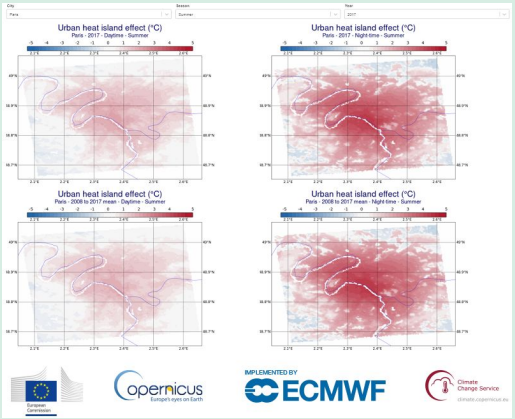






EU policy on (urban) adaptation and Copernicus

EUROPEAN CLIMATE LAW → EU MISSIONS ADAPTATION TO CLIMATE CHANGE → EU ADAPT



Credit: Copernicus Climate Change Service, ECMWF.

Urban Adaptation Support Tool

Covenant of Mayors for Climate & Energy EUROPE

[European Covenant of Mayors and EEA](#).

1. Preparing the ground for adaptation
2. **Assessing climate change risks and vulnerabilities**
3. Identifying adaptation options
4. **Assessing and selecting adaptation options**
5. Implementing adaptation
6. **Monitoring and evaluating adaptation**

(Image credit: P. Nin)

Copernicus for adaptation

Avoid maladaptations like

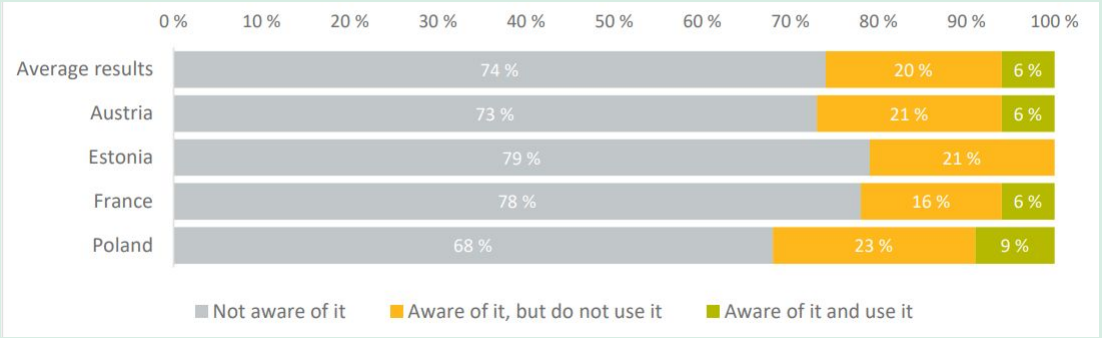
- Adaptation strategy based on old data
- Forget 2050 or 2100 projections of temperature increase
- Unevaluated adaptation solutions

Local authorities would rather assess:

- Temperature decrease with Copernicus 3S
- Green areas with CLMS
- **…**

But there is a BUT: Copernicus awareness

"Is your municipality aware of Copernicus, and does your municipality use it?"



European Court of Auditor Special report 15/2024: Climate adaptation in the EU

EU tools to start using Copernicus for adaptation

Non-financial support

EU MISSIONS
ADAPTATION TO CLIMATE CHANGE

SPACE 4Cities

Covenant of Mayors for Climate & Energy EUROPE

SMART & GREEN CITIES
esa

Smart Cities Marketplace

nereus
network of european regions using space technologies

Fundings

CLIMAAX
climate ready regions

PCP WISE

Life

EUROPEAN UNION
European Regional Development Fund

UIA URBAN INNOVATIVE ACTIONS

If you need **climate information/intelligence**, like climate services.

If you need (free) **data:**

Climate ADAPT
SHARING ADAPTATION KNOWLEDGE FOR A CLIMATE-RESILIENT EUROPE

Sentinels
ESA Urban TEP
Eurostat
DRMKC Risk Data Hub
EUCRA
PESETA IV

Copernicus
Europe's eyes on Earth

Climate Change Service
climate.copernicus.eu

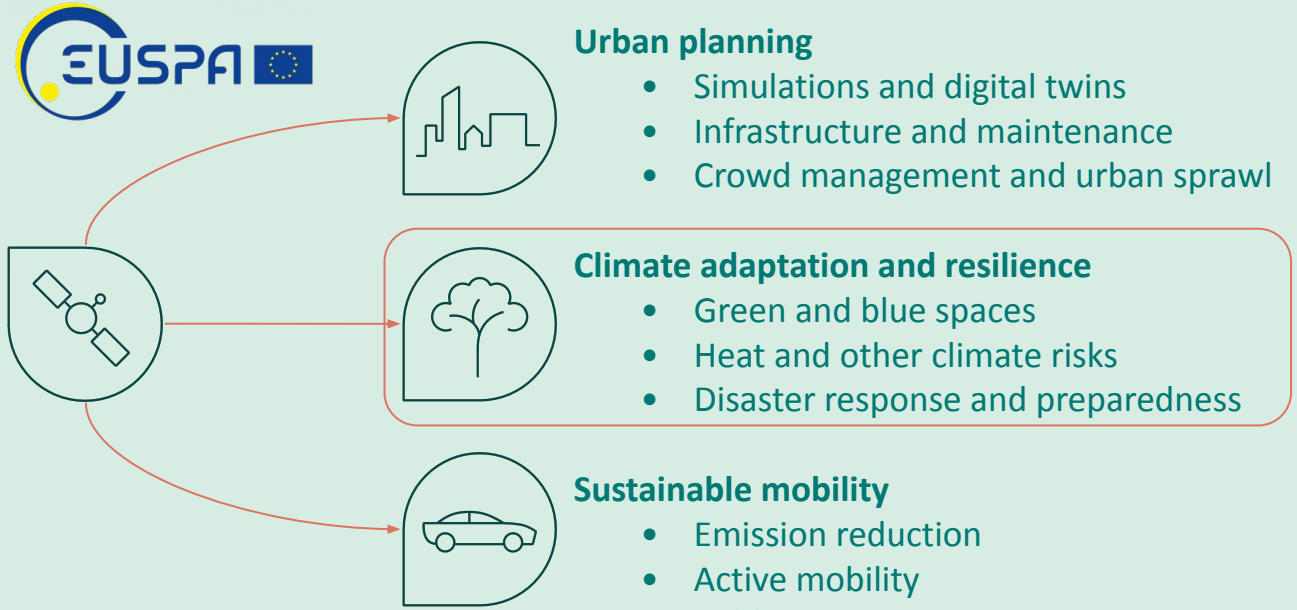
Atmosphere Monitoring Service
atmosphere.copernicus.eu

Land Monitoring Service

Copernicus Marine Service

Emergency Management

SPACE4Cities: addressing the public procurement gap



Urban planning
- Simulations and digital twins
- Infrastructure and maintenance
- Crowd management and urban sprawl

Climate adaptation and resilience
- Green and blue spaces
- Heat and other climate risks
- Disaster response and preparedness

Sustainable mobility
- Emission reduction
- Active mobility
- Public transportation

A unique project:
- First PCP action to allow **Copernicus** and **Galileo combination**
- First PCP action to explicitly fund **climate adaptation solutions**

Aerospace Valley conducted the open consultation during the last 5 months:
- **200+ providers** ready to work with Copernicus/Galileo for adaptation;
- **50+ local authorities** interested in adaptation with Copernicus.

Opportunities for both stakeholders types:
- **2.87M€ for providers** to develop solutions;
- **10 replicator local authorities** that will benefit from the solution.

Q&A

THANK YOU

FORUM VIRIUM HELSINKI

Green elements and climate adaptation in urban space: A case from Regions4Climate project

Heli Ponto
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Climate adaptation

Climate change impact

- The probability of extreme weather conditions has increased in Europe.

Risk and Uncertainty

- The effects are visible everywhere.
- Potential risks may occur unexpectedly.
- Climate risks are not distributed equally; some are disproportionately affected.

Adaptation and response

- Adaptation is inevitable.
- New innovations, technologies and attitudes are needed.

What is Forum Virium Helsinki?

- A non-profit innovation company of the City of Helsinki.
- Established in 2005.
- Three programmes: smart city, smart mobility and data.
- Employs 60 top experts.
- Annual project funding of EUR 4–6 million.
- The company is financed by the City of Helsinki and the EU.
- Customer satisfaction 4,4 / 5.
- Employee satisfaction 4,2 / 5
- Impact:
  - New companies and R&D
  - Smart city solutions
  - Open data

Regions4Climate: Helsinki-Uusimaa demo

Aim to support socially just climate adaptation

EU Horizon funding

- 12 regional demonstrations.
- Helsinki-Uusimaa demo is led by FVH.
- Digital twin demo to understand heat and flooding and social vulnerability.
- Different data sets included, e.g. buildings, landcover, green elements, socio-economic, heat index etc.
- Satellite data used to visualise surface temperatures for buildings, and heat impact.

FORUM VIRIUM HELSINKI

Regions 4Climate

Funded by the European Union

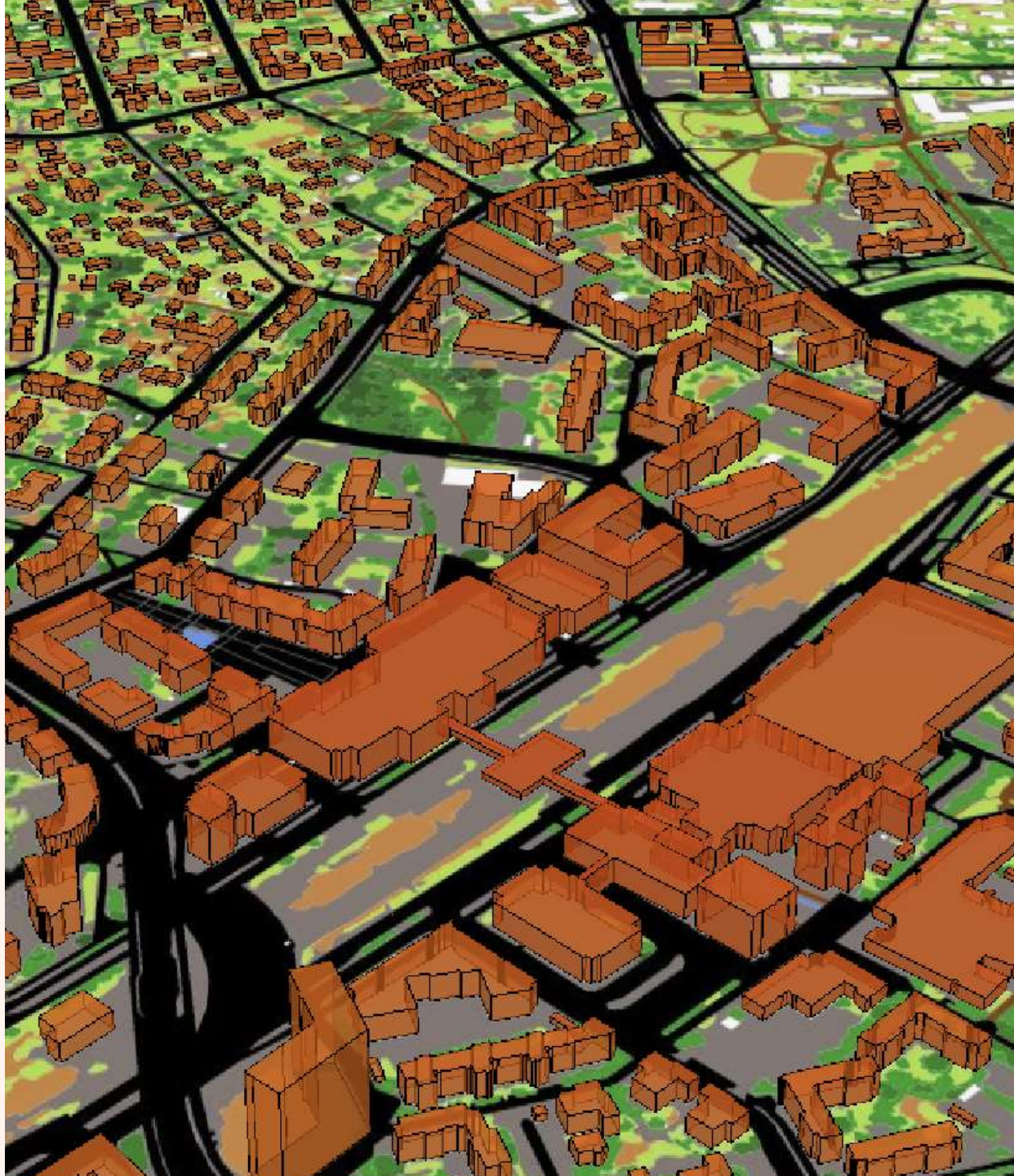
Satellite data

Pros

- Relatively easy to calculate.
- Openly available.
- Thanks to services like the Sentinel Hub, data easy to use and retrieve.

Cons

- Resolution problems with open data.
- Data availability: data not available on cloudy days and not every day.
- Data coverage limited in some constellations in northern latitudes.



Helsinki perspective: thermal satellite data

R4C application/demo has raised plenty of interest among city's stakeholders.

- Socioeconomic data combined with heat data is a way to popularise climate adaptation and heat vulnerability.
- Demo underlines nature-based solutions (NBS) and the role of green elements.
- Interest in combining different hazards into the same view.

On satellite data value

Data availability: satellite thermal data currently the only constantly updated thermal dataset with whole city coverage

Data integration: combining satellite data with other data sources (e.g. socioeconomic indexes) offers new insights to complex phenomena.

Affordability: with open satellite data, no significant data acquisition costs in prototyping applications

BUT: true application of satellite data products in cities will need new service development, with high emphasis on use case and ease of use!

Thank you!

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