Building actionable climate products for end users using EGI-ACE resources

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Pan-European digital assets supporting research communities - Benefits & opportunities
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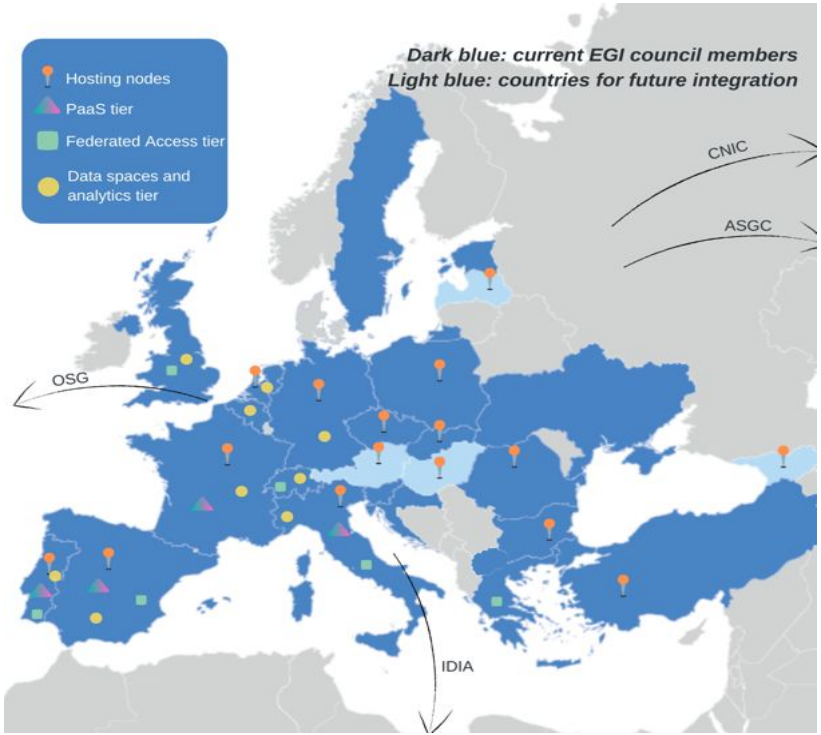
Online

IS-ENES3 has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824084

EGI-ACE Mission

Implement the **Compute Platform of the EOSC** and contribute to the **EOSC Data Commons** by delivering integrated computing, platforms, data spaces and tools as an integrated solution that is **aligned with** major European cloud federation projects and HPC initiatives.

Project Overview



EGI Advanced Computing for EOSC
Grant agreement ID: 101017567

Budget

- Total budget: € 12,009,988
- EC budget: € 8,000,000

Consortium

- Coordinator - Stichting EGI
- 33 Partners, 23 third parties

Effort

- 1472 PMs, 48 FTEs
- **49% Virtual Access** (35 services, 38 providers)

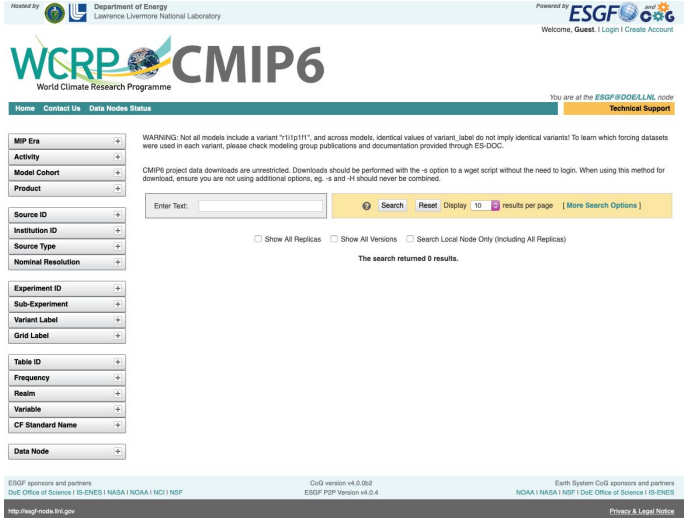
Duration

- Jan 2021 - June 2023 (30 months)

Climate data distribution

- Climate data is distributed using the Earth System Grid Federation (ESGF)
- Data Nodes interface is not straightforward to use for non-expert users
- Available variables are "raw" output from climate models: temperature, humidity, precipitation, …
- Daily, monthly, … frequencies

ESGF represents a multinational effort to securely **access**, **monitor**, **catalog**, **transport**, and **distribute** reference **data** for **climate** research experiments and observations.



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Gap between Users needs and available data

- Often significant gaps between distributed datasets and users' needs:
  - Assessing climate change anomalies
  - Evaluating climate extremes
  - Understanding climate change impacts
  - …

- Users' Stories examples
  - Will there be more droughts in northeast Spain?
  - How likely landslides will occur in this mountainous valley?
  - Which region in my Europe will see the greatest change in heatwave intensity and occurrence?

In the future climate compared to now

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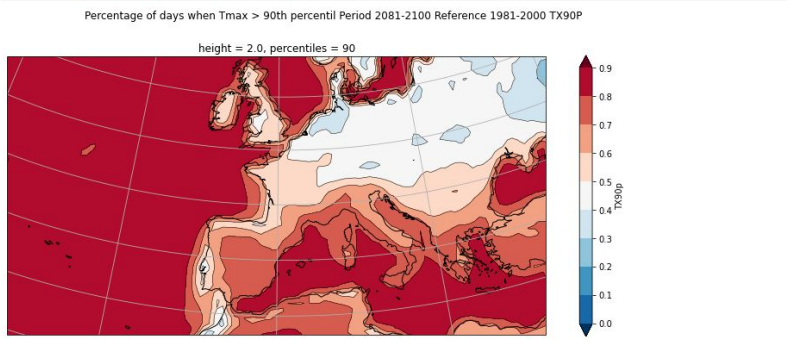
What is a climate index

- A Climate Index is derived from basic climate variables such as temperature, humidity, precipitation, wind, …
  – Warm days (*days with mean temperature > 90th percentile of daily mean temperature*) – **TG90p**
  – Summer days (*days with max temperature ≥ 25 °C*) – **SU**

- Most of Climate Indices are standardized within the international community
  – ETCCDI, ECA&D, ET–SCI, …



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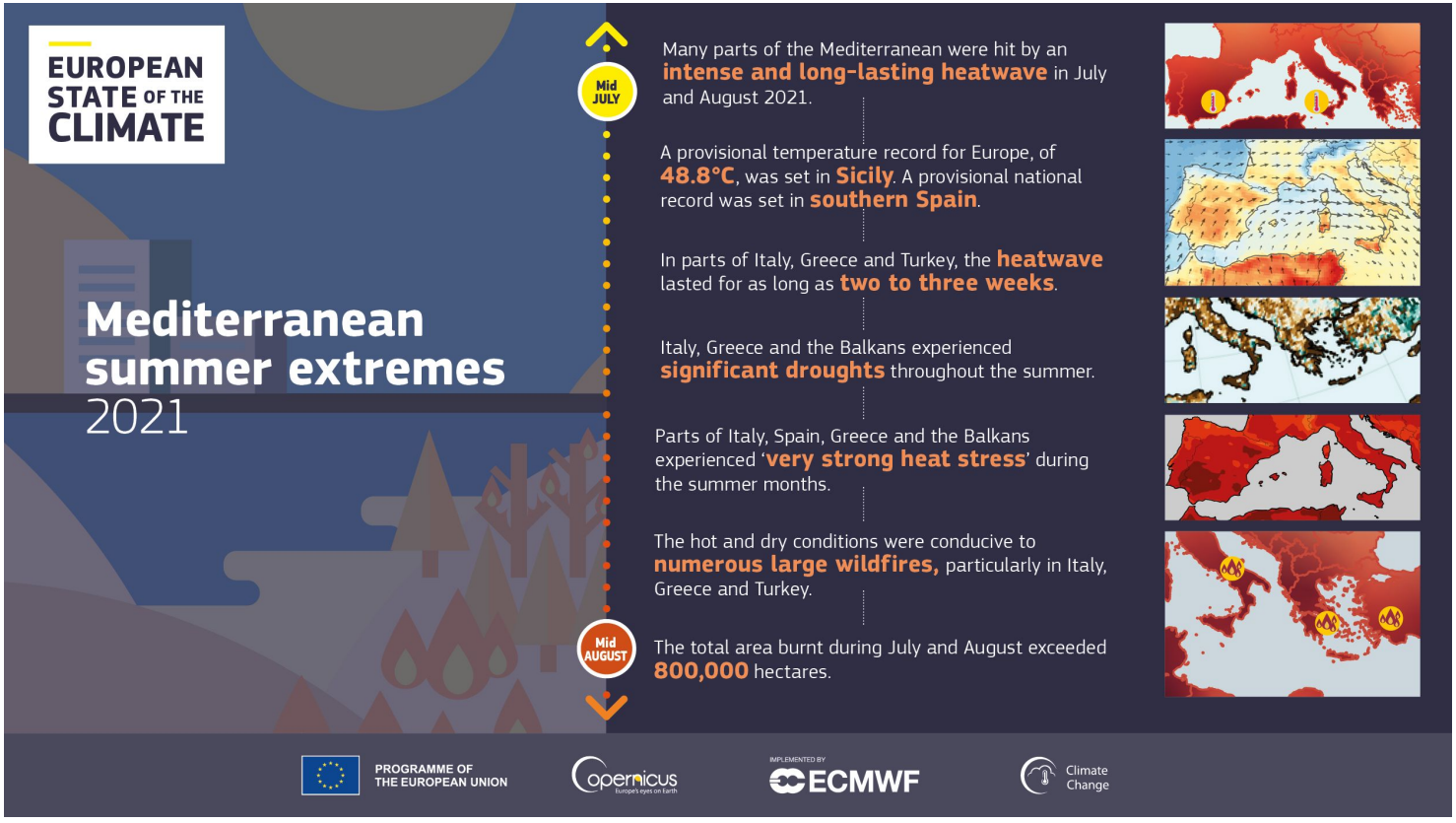
What is a climate index



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icclim: a flexible tool, but still

- Tool: **icclim**, *an open source python software package to calculate climate indices*
- Simple and flexible API and interface, fast processing

- Difficult for users to process a sufficient numbers of climate projections to calculate those climate indices
  - Assess Uncertainties
  - Explore several Greenhouse Gas Emission Scenarios
  - Impossibility to download all required input data
  - Even with all data available, very time consuming and complex to calculate all what's needed

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Project

- Pre-generate 50 standard climate indices

CMIP6 (most common experiments used)

- Core set of simulations

– **All**: climate models, greenhouse gas scenarios (aka SSPs…), ensemble members, versions

– Daily time frequency

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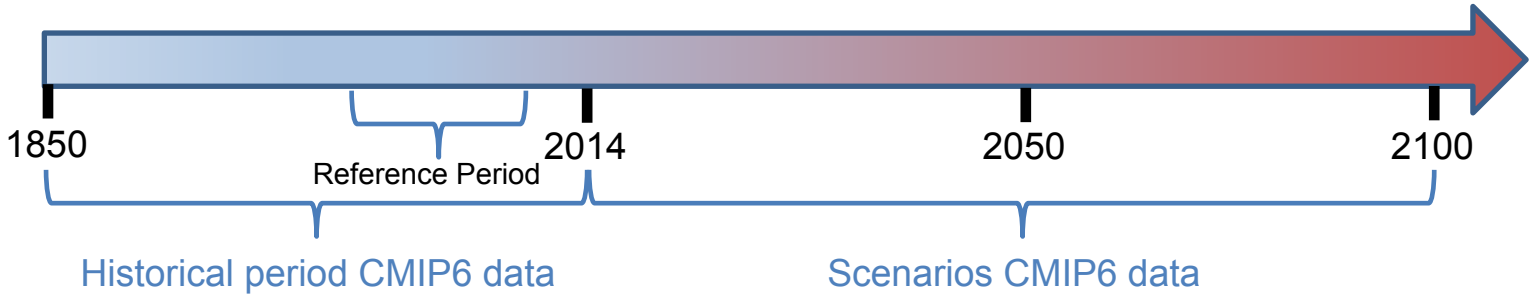
Choices to be made

- Reference period for percentiles
  – 1981–2010 (within historical period of climate simulations 1850–2014)



- Standard thresholds of standard indices
  – **Example**: Summer day is a day with maximum temperature ≥ 25°C

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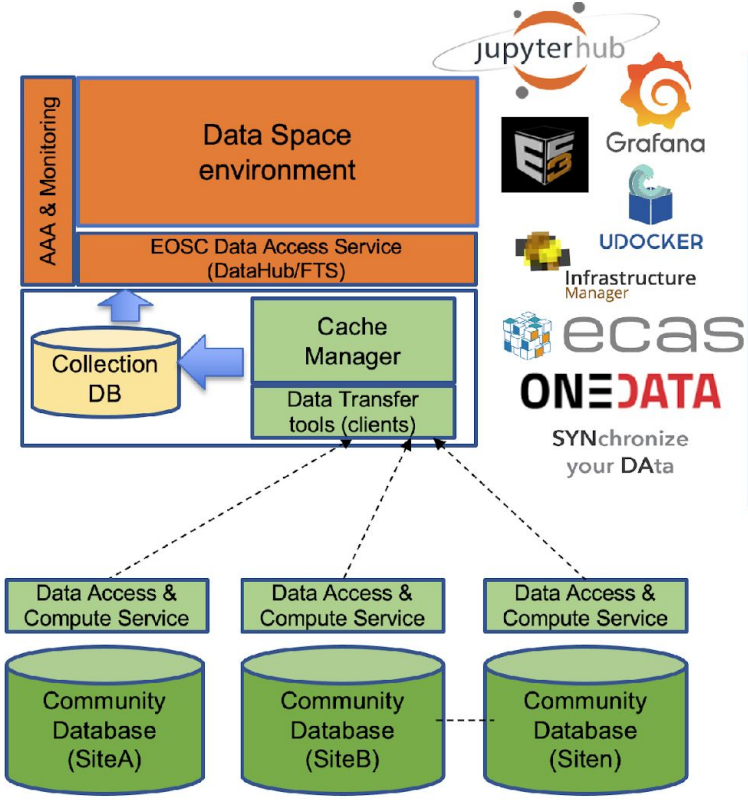
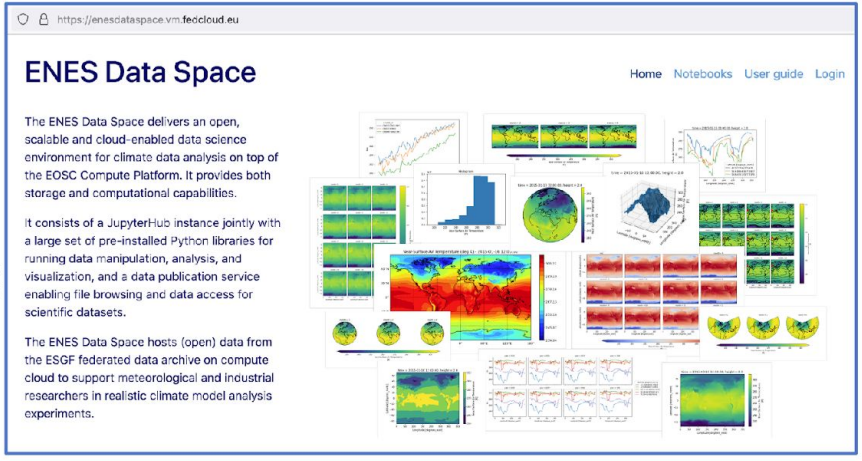
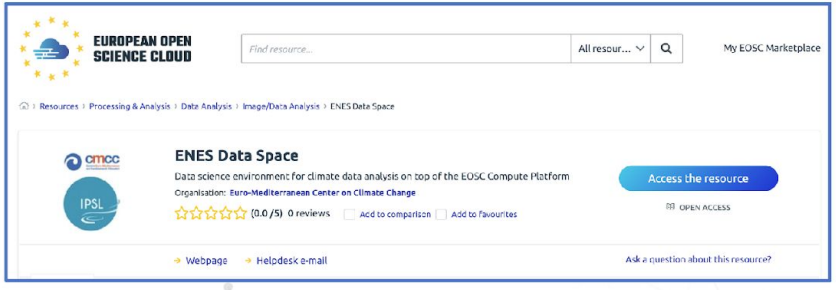
Computations







http://is.enes.org/

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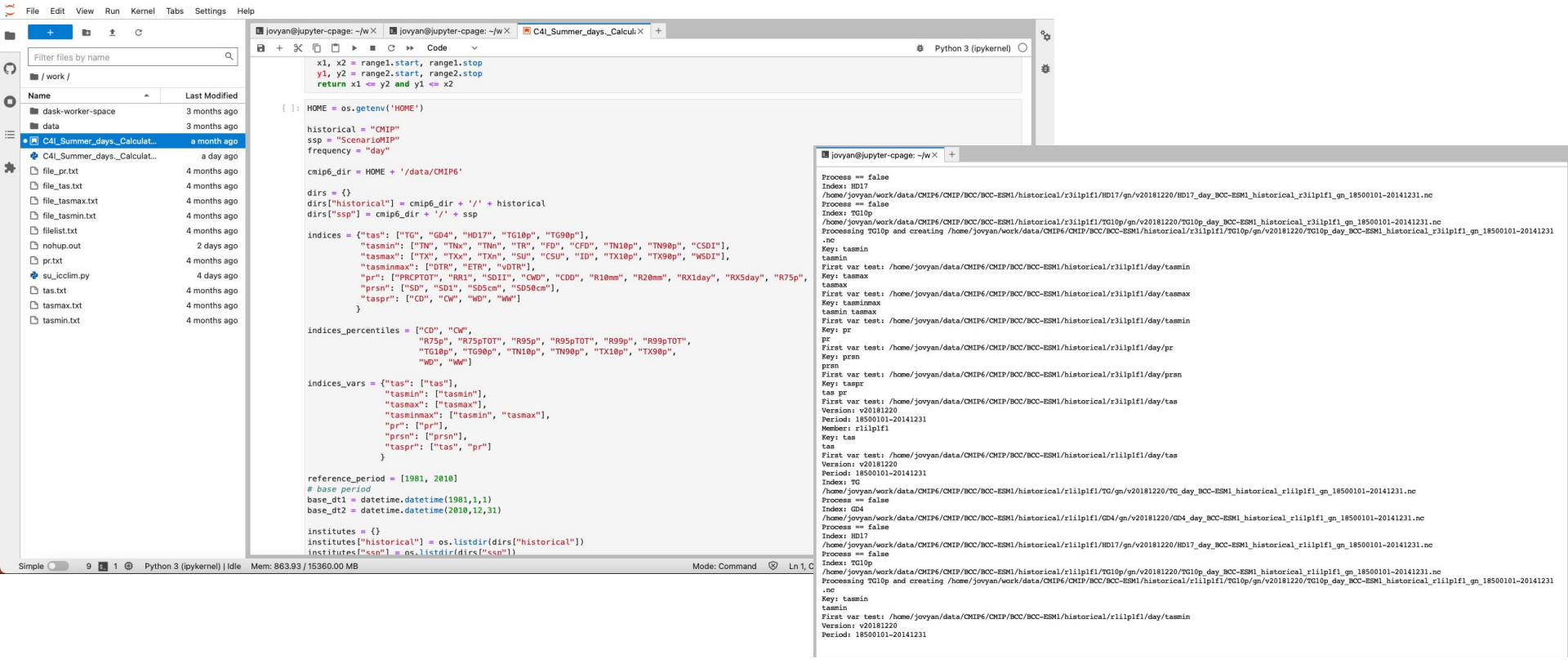
Running on EGI-ACE resources



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Timeline

- Delays in initial planning
  - Delay in starting the action
  - Several Technical adjustments and Support actions in August (thanks CMCC!)
  - Complex processing script (parsing proper datafiles)
  - September extremely busy (project on hold)

- Current actions
  - Small adjustments to script
  - Not optimized: significant time to aggregate input files as xarray datasets and some pre-processing
  - Calculations in progress

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Timeline

Significant step toward more actionable climate data information

- Future actions
  - Validate calculations (end of 2022 – beginning of 2023)
  - Decide on where to store database permanently
    - NetCDF, zarr, Commercial and Public Clouds, …
  - Make it accessible within the IS-ENES C4I platform
  - Use database to support Horizon Europe interTwin project
  - Disseminate information about this climate indices database

- Possible extensions
  - ERA5, and other re-analyses
  - CORDEX
  - CMIP5
  - CMIP7, Future CORDEX…

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