Building a Climate indices dataset for climate change impacts assessment

Christian Pagé, christian.page@cerfacs.fr

Research Engineer and Project Management, CERFACS

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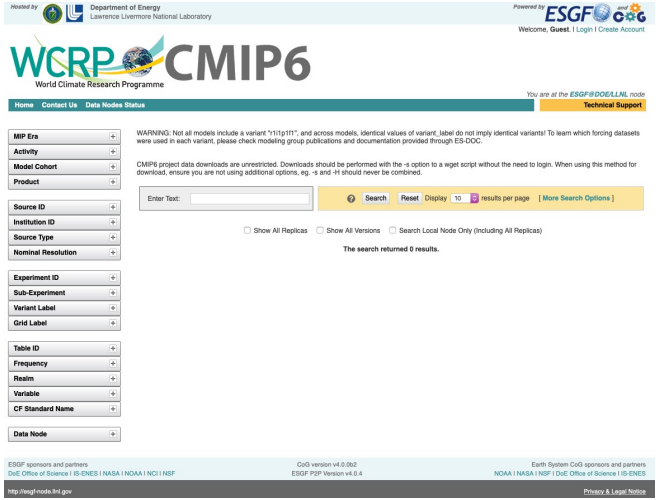
Climate data distribution

- Climate data is distributed using the Earth System Grid Federation (ESGF)

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

- 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

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
  - …

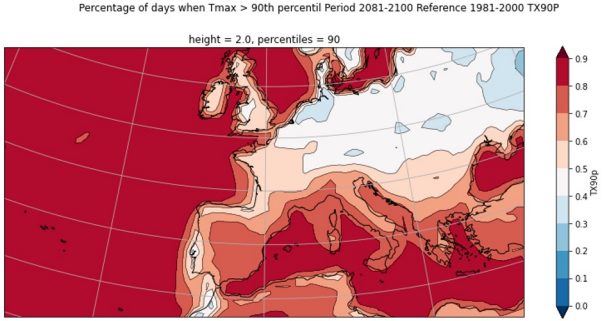
- Users' Stories examples
  - Will there be more droughts in northeast Spain?
  - How likely landslides will occur in this mountainous valley?
  - Which region in my Europe will see the greatest change in heatwave intensity and occurrence?

In the future climate compared to now

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, …



What is a climate index

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

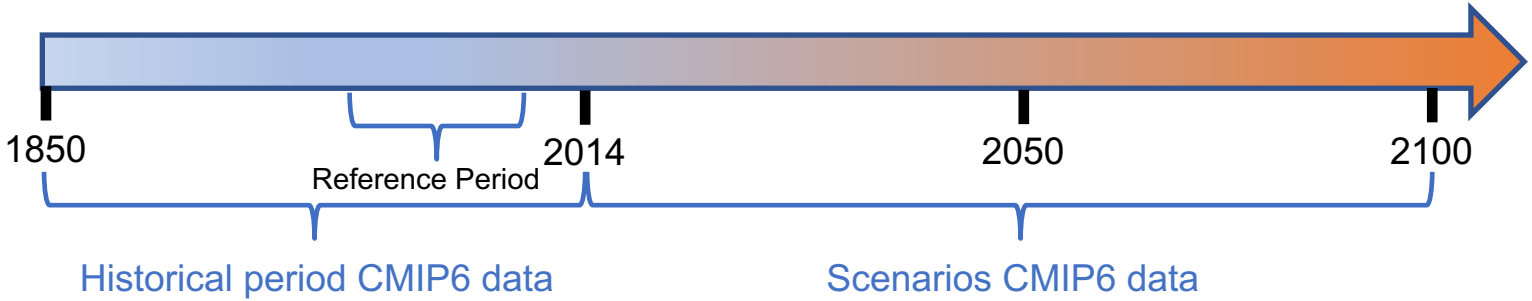
Project

- Pre-generate 50 standard climate indices
  - **CMIP6 (most common experiments used)**
  - *+ERA5*
  - *+CORDEX*
  - *+CMIP5…*

- Core set of simulations
  - **All**: climate models, greenhouse gas scenarios (aka SSPs…), ensemble members, versions
  - Daily time frequency

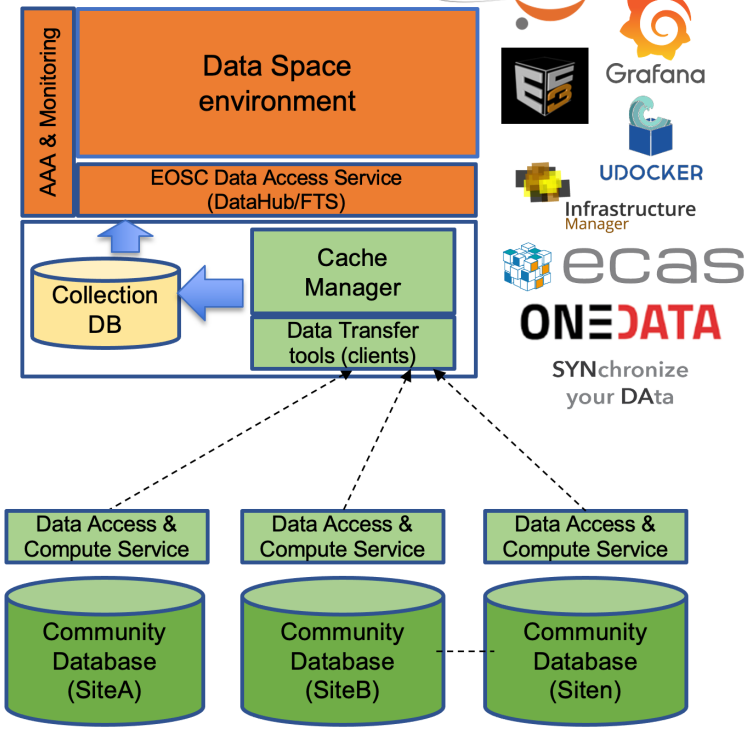
Choices to be made

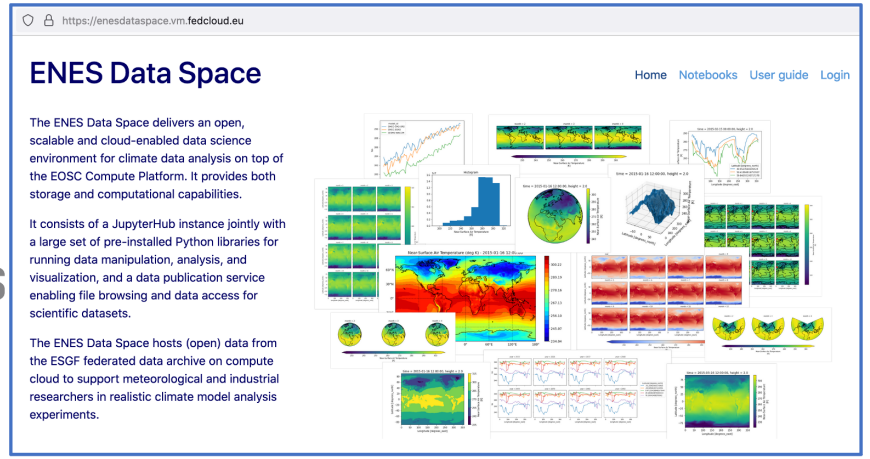
- Reference period for percentiles
  – 1981–2010 (within historical period of climate simulations 1850–2014)

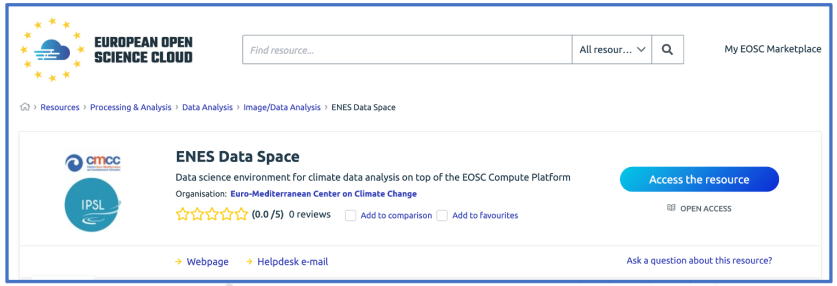


- Standard thresholds of standard indices
  – **Example**: Summer day is a day with maximum temperature ≥ 25°C

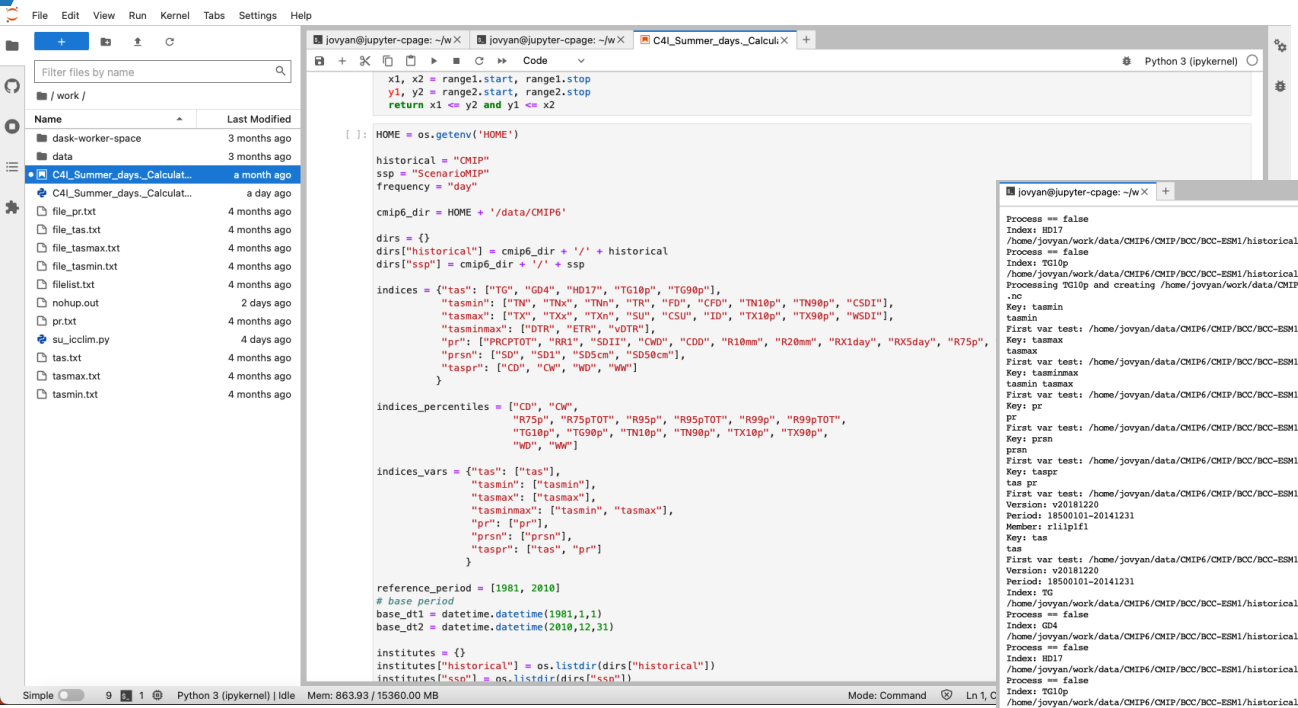
Computations

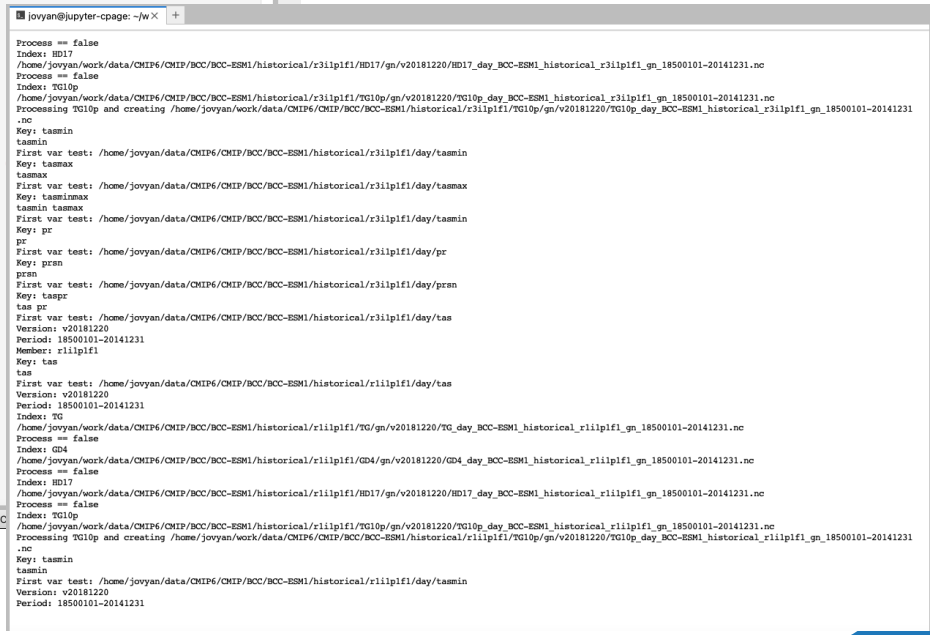






Running on EGI-ACE resources





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

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…