ENES Data Space: an open, cloud-enabled data science environment for climate analysis

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The European Open Science Cloud (EOSC)

EOSC

- An environment for hosting and processing research data to support **EU science**
- **FAIR Data and Services** for science in Europe

EUROPEAN OPEN SCIENCE CLOUD

EGI-ACE: Advanced Computing for EOSC

- Implement the **Compute Platform of the European Open Science Cloud**
- Deliver **computing platforms**, **data spaces** and **tools** as an integrated solution

The Coupled Model Intercomparison Project (CMIP) and the Earth System Grid Federation (ESGF) data archive

IS-ENES provides the EU contribution to the ESGF

Climate analysis challenges & issues

Several **key challenges** and **practical issues** related to **large-scale climate analysis**

- Input data from **multiple models**
- **Data download is a big barrier** for climate scientists
- **Client-side** & **sequential approaches**
- Several **data analysis tools** and **libraries** needed
- **Strong requirements** in terms of **computational** and **storage resources**

ENES Data Space: main objectives

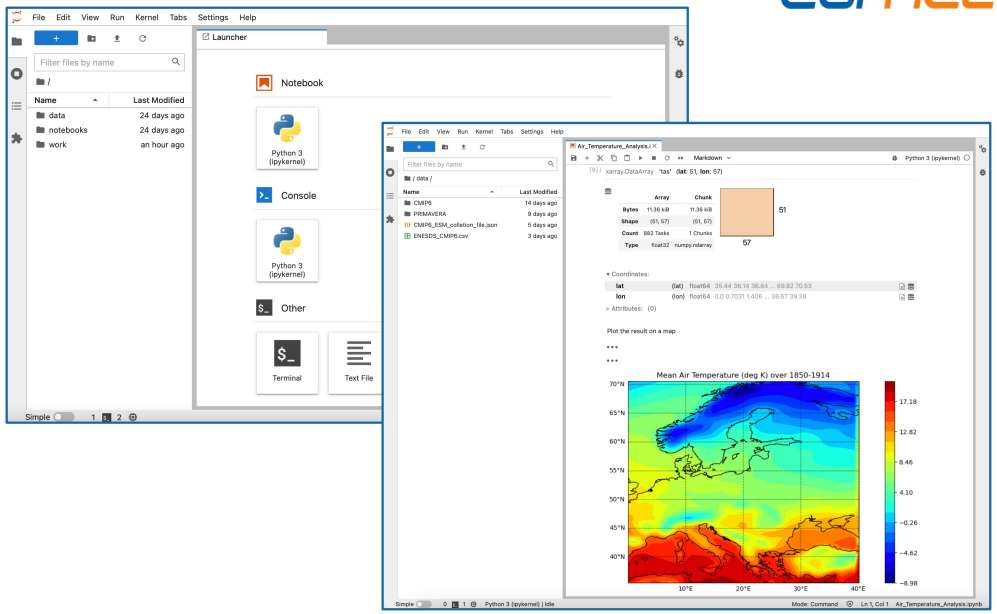
Goal**: Deliver an open, scalable and cloud-enabled **data science environment** for **climate data analysis** on top of the **EOSC Compute Platform

The **ENES *Data Space*** aims at providing an entry point to:

- **Datasets** → most relevant from ESGF; pre-staged
- **Storage** & **Compute** resources → provided by EGI
- **Data Science Software Stack** → to address a wide spectrum of analysis needs
- **IDE** and **Applications** → to devel/share/(re-)use apps → **FAIR** principles
- **Cloud-Enabled** → SaaS for end-users applications; PaaS for data analysis service

Jupyter-based Data Science environment

- **JupyterHub** as entry point to computational environment and resources
- **JupyterLab** instance equipped with a set of **open source Python modules** and **computing frameworks** (xarray, Dask, matplotlib, cartopy, ...)
- **CMIP variable-centric** collections from the **ESGF federated data archive**
  - ~ 8000 datasets, ~ 30 TB
  - **Synda** community tool to download and (one-way) synchronize local data pool



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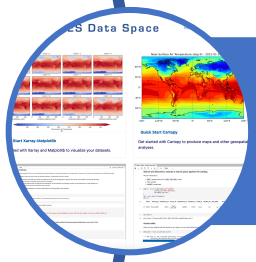
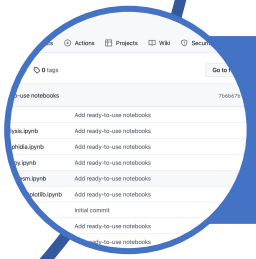
Climate research workflow

ENES Data Space

Data Search & Discovery

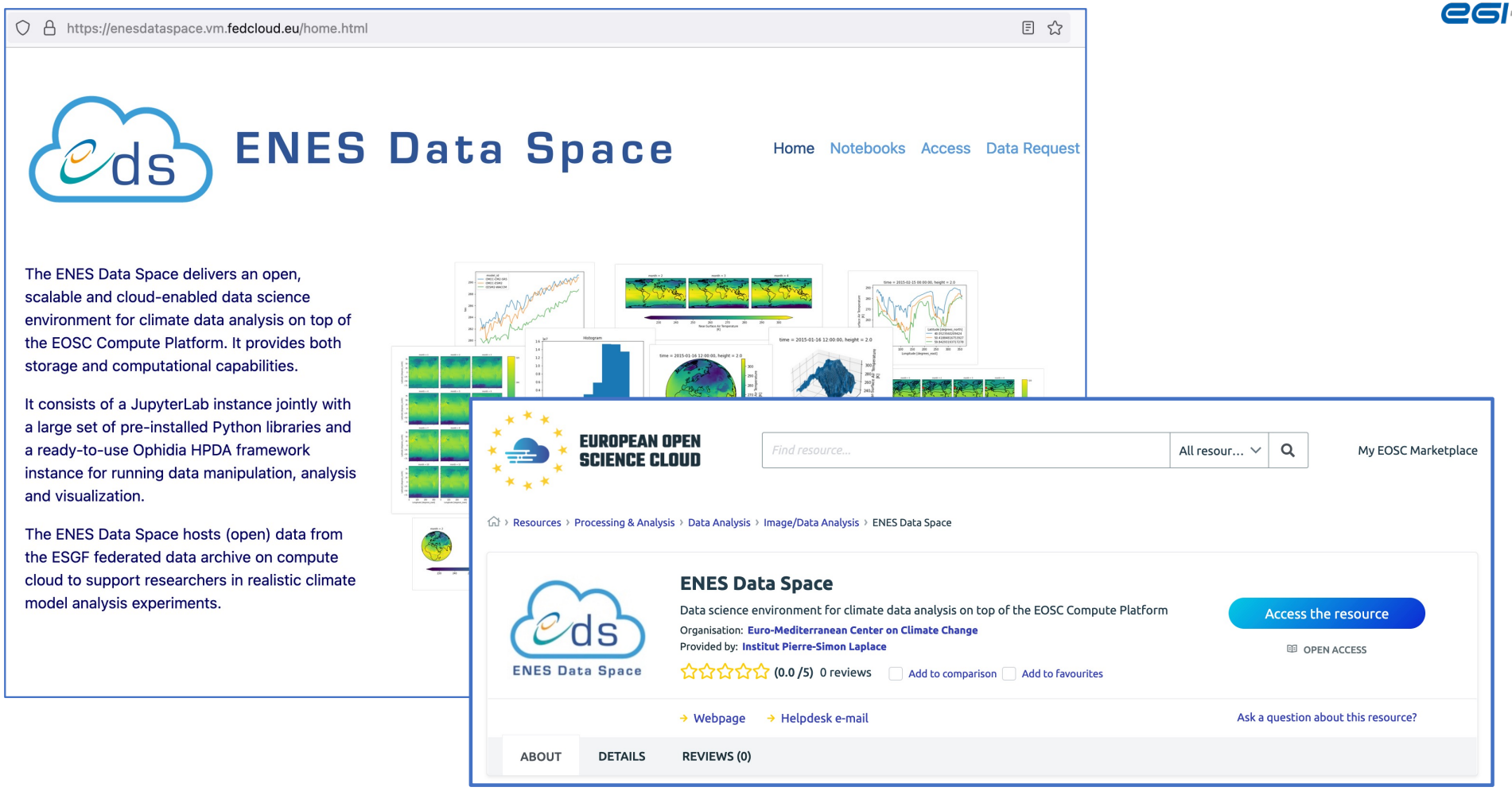


Data Analysis & Visualization



Reusability & Sharing

ENES Data Space portal



https://marketplace.eosc-portal.eu/services/enes-data-space/

Conclusions and future plan

Conclusions

- The **ENES Data Space** represents a domain-specific implementation of the data space concept
- It provides a single entry-point to **compute capabilities** co-located with a **local data store** hosting a specific data selection from ESGF

Future plan

- Keep enhancing the ENES Data Space
  - **Additional datasets** based on users needs
  - Integration of **new community tools and libraries**
  - Improve **Reusability & Sharing**
- Support scientific **use cases** selected from open calls
- **Training** and **dissemination** activities

Useful links

EGI-ACE: https://www.egi.eu/projects/egi-ace/

ENES Data Space: https://enesdataspace.vm.fedcloud.eu/

ENES portal: https://portal.enes.org/

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Thank you!

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Website: **www.egi.eu/projects/egi-ace**

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