



living planet symposium | BONN

23-27 May
2022

TAKING THE PULSE
OF OUR PLANET FROM SPACE



Experimentation and Reproducibility with Jupyter Open Science EO Dashboards

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Dr. Manil Maskey | National Aeronautics and Space Administration (NASA)

Dr. Shinichi Sobue | Japan Aerospace Exploration Agency (JAXA)

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Alessandro Scremin, Diego Moglioni | Rhea Group

ESA UNCLASSIFIED – For ESA Official Use Only



→ THE EUROPEAN SPACE AGENCY

- International Cooperation on EO Dashboard between ESA, NASA and JAXA
- @LPS22:
 - Agora NASA-ESA-JAXA Cooperation on EO Dashboard
 - Demo at the Open Earth Forum

EODashboard.org



Demonstrate joint capabilities of NASA-ESA-JAXA to **observe global environmental changes**, communicate findings through **storytelling** for the general public, promote **Open Science** and **engage the community through collaborative features and technology**

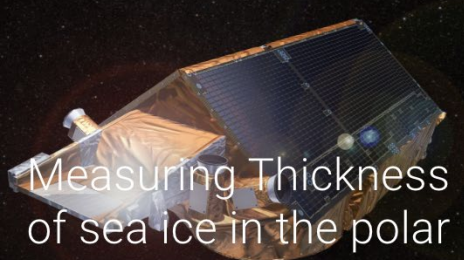
- Open for everyone: decision makers, scientists, EO & data science, students, general public
- Accessible for everyone: storytelling
- Engaging the community: create a challenge, provide a playground
 - **How to use EO data from NASA, ESA, JAXA to reproduce the indicators on EO Dashboard, or produce entirely new indicators?**
- Open Ingredients:
 - **Content**
 - **Data**
 - **Workflows**
 - **Technology**



> 4300 participants
132 countries

1. Create Meaningful Content

CRYOSPHERE NASA ESA JAXA



Measuring Thickness of sea ice in the polar oceans

Read more about monitoring Sea Ice Freeboard & Thickness from Satellite Altimetry.

NASA ESA JAXA

→ START

SHARE

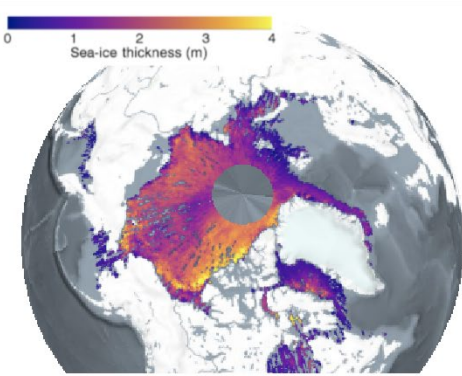
EDC service for ESA | Legal | Privacy eodash v3.0 by EOIX

CRYOSPHERE NASA ESA JAXA

Sea Ice Freeboard and Thickness from Satellite Altimetry

NASA's ICESat-2 and ATLAS

NASA provides data collected over the Arctic Ocean by the Ice, Cloud and land Elevation Satellite-2 (ICESat-2) that show monthly sea ice freeboard from 2018 to the present. Sea ice freeboard is the amount of sea ice and snow



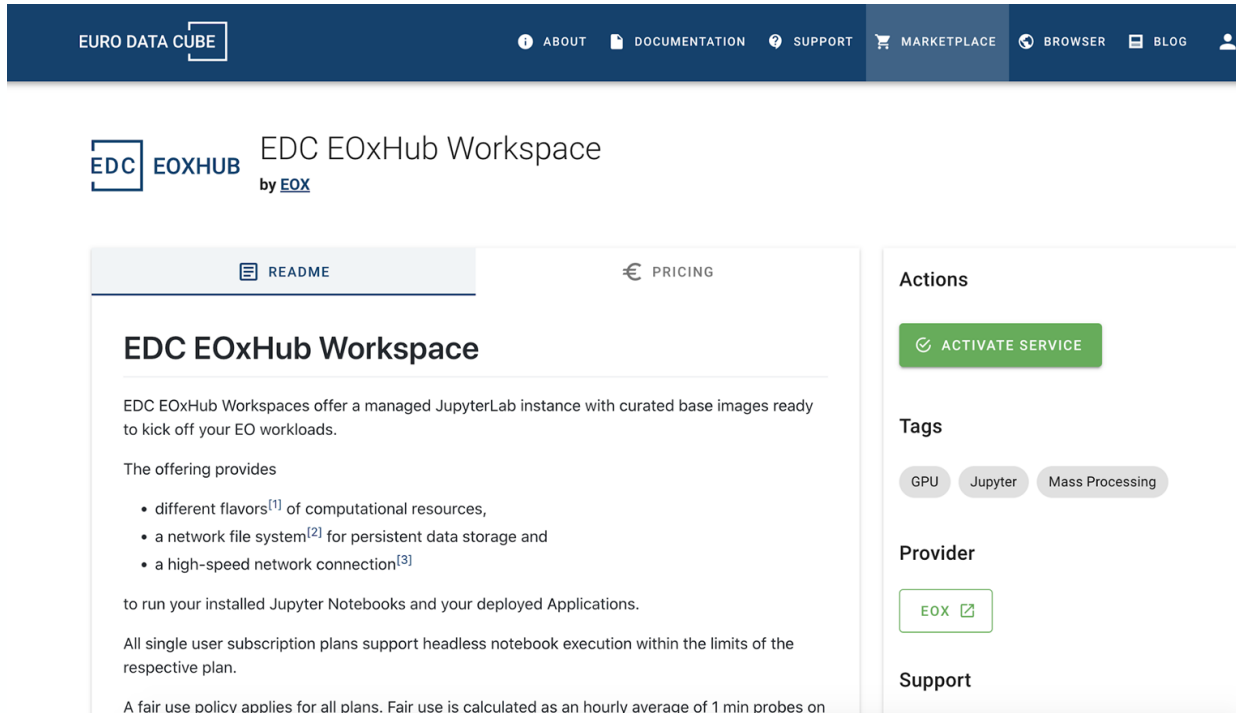
Sea-ice thickness (m)

Apr 2021

Measuring Thickness of sea ice in the polar oceans 1 / 3 →

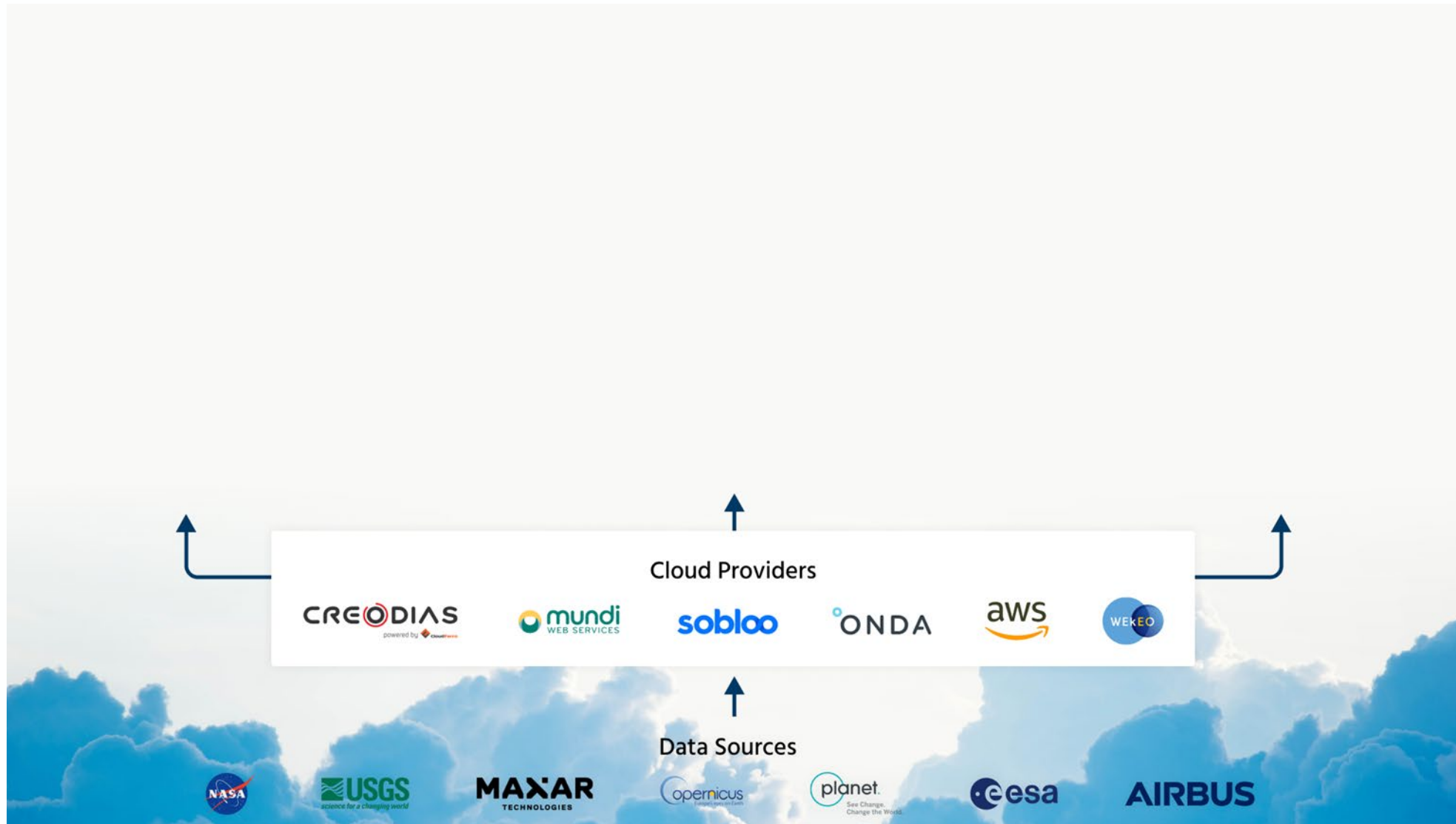
- Guided by Science Teams
- Exploiting curated datasets and products
- Using well described workflows and algorithms
- Implemented and scaled on EO Platforms
- Made accessible through tutorials

2. Provide Access to Data & Compute

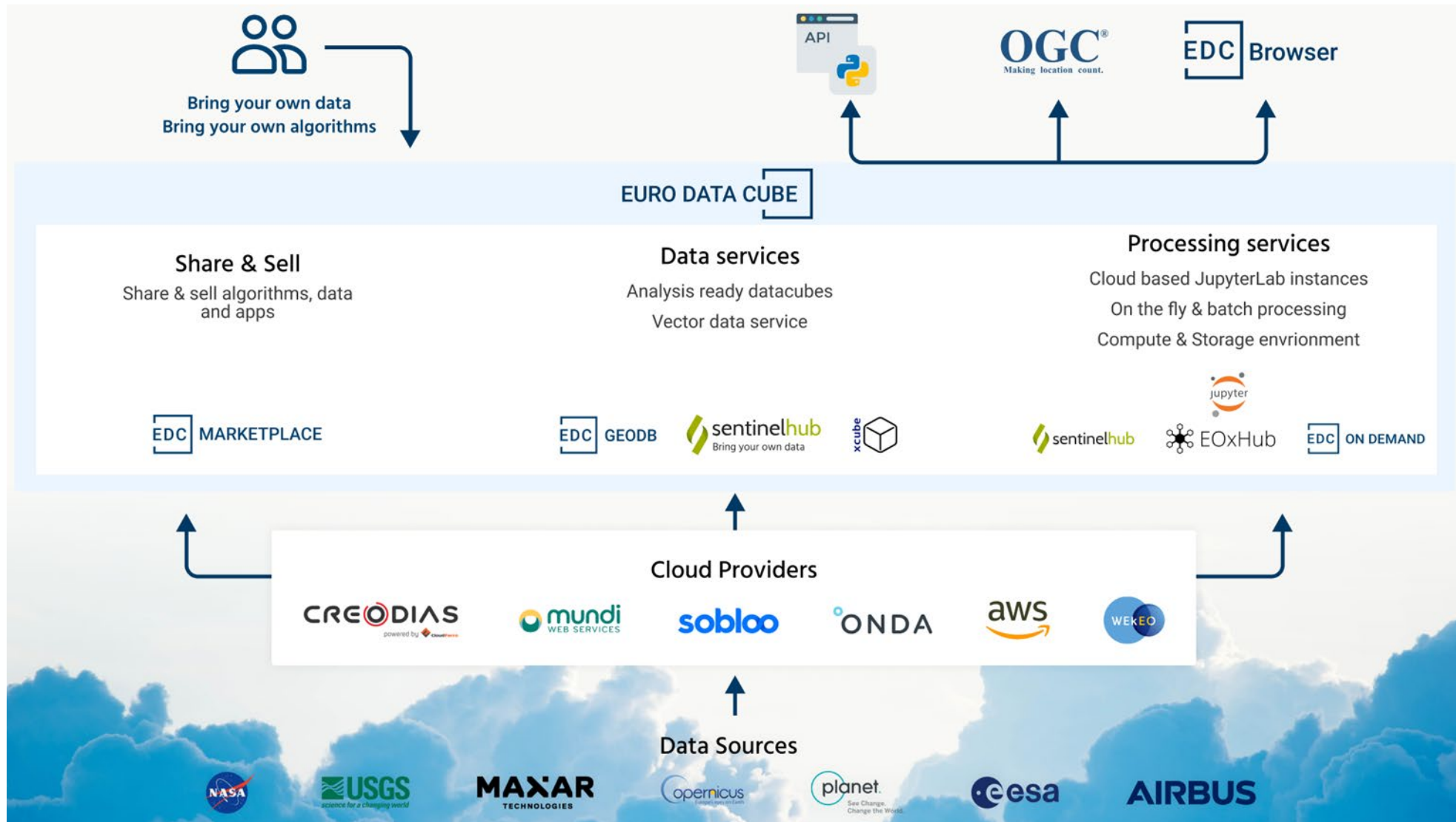


- Provide preconfigured hosted **workspaces**
- + a collection of **Jupyter Notebooks**
- To **reproduce** sample scientific workflows entirely or partially:
 - Accessing data located in distributed systems
 - Analysing data
 - Generate indicators
- And expand with own data (**BYOD**)
- Provide guidance to **scale up and integrate** into the dashboard (**BYOA**)









<https://collections.eurodatacube.com> & <https://browser.eurodatacube.com>

Euro Data Cube Public Collections

EURO DATA CUBE

About

This registry exists to help people discover and share collections that are available via Euro Data Cube

See [all usage examples for collections listed in this registry](#) tagged with **dashboard hackathon**.

Search collections (currently 10 matching datasets)

You are currently viewing a subset of data tagged with **dashboard hackathon**.

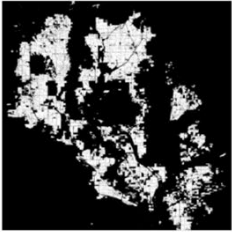
Add to this registry

If you want to add a collection or example of how to use a collection to this registry, please follow the instructions on the [Euro Data Cube Public Collections GitHub repository](#).

Unless specifically stated in the applicable collection's documentation, collections available through the Euro Data Cube Public Collections are not provided and maintained by Euro Data Cube. Collections are provided and maintained by a variety of third parties under a variety of licenses. Please check collection licenses and related documentation to determine if a collection may be used for your application.

ALOS-2 PALSAR-2 ScanSAR Reference Rice Paddy Field Map

dashboard hackathon JAXA open data raster rice paddy SAR sentinel hub




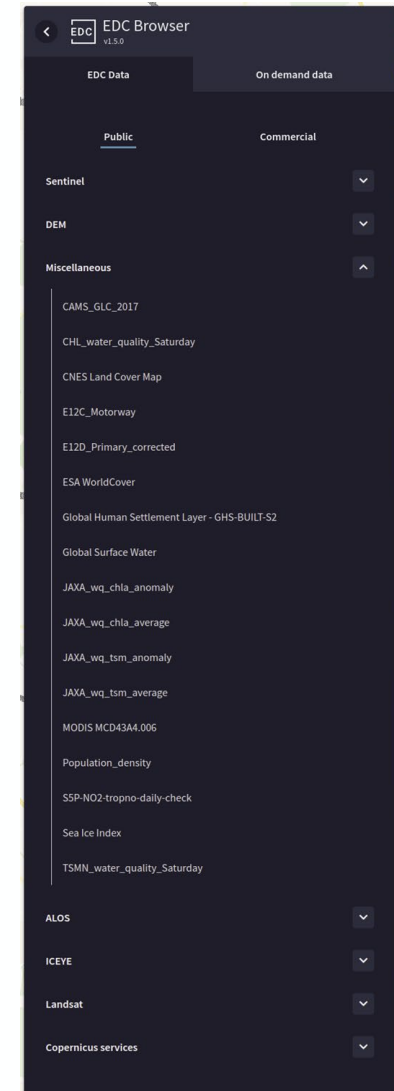
This collection contains reference rice paddy field maps derived from [ALOS-2 ScanSAR](#) geometrically corrected (orthorectified) data in selected AOIs between 2019 and 2020 for NASA/ESA/JAXA EODashboard Hackathon. The reference map is described in the digital code as 255: rice paddy field, 0: others.

[Details →](#)

ALOS-2 PALSAR-2 ScanSAR for Agriculture

dashboard hackathon JAXA open data raster SAR sentinel hub





EDC Browser v1.5.0

EDC Data On demand data

Public Commercial

Sentinel

DEM

Miscellaneous

- CAMS_GLC_2017
- CHL_water_quality_Saturday
- CNES Land Cover Map
- E12C_Motorway
- E12D_Primary_corrected
- ESA WorldCover
- Global Human Settlement Layer - GHS-BUILT-S2
- Global Surface Water
- JAXA_wq_chla_anomaly
- JAXA_wq_chla_average
- JAXA_wq_tsm_anomaly
- JAXA_wq_tsm_average
- MODIS MCD43A4.006
- Population_density
- S5P-NO2-tropno-daily-check
- Sea Ice Index
- TSMN_water_quality_Saturday

ALOS

ICEYE

Landsat

Copernicus services

Leverage the power of existing EO specific

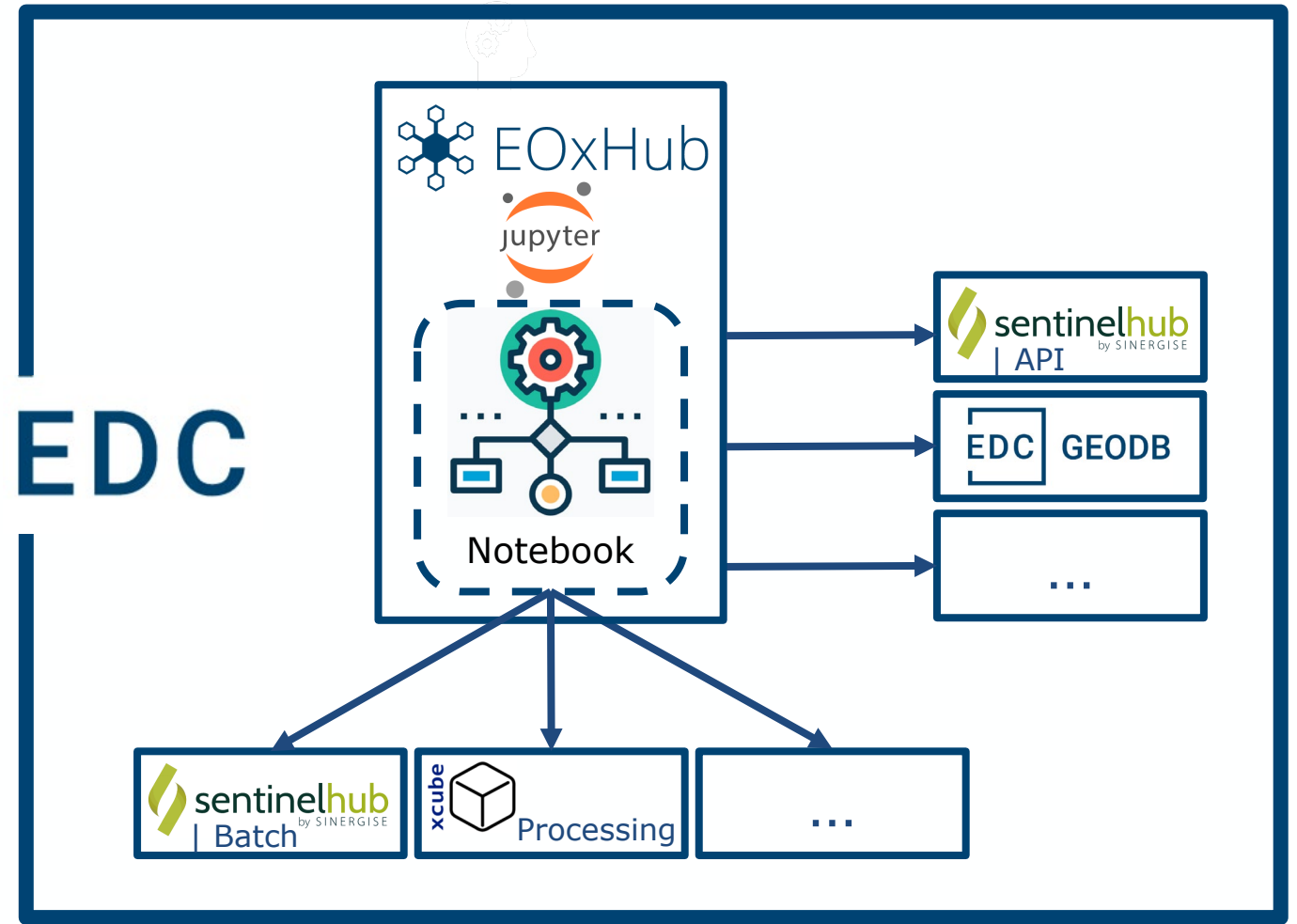
- **API services** like Sentinel Hub, GeoDB and
- **Large-scale processing environments** like Sentinel Hub Batch, xcube-gen Processing

for your EO enabled workflows.

Use the EOxHub Workspace offering with its

- **Cloud based execution runtime**

for **interactive** exploitation using JupyterLab as well as **headless** invocation via its WPS 2.0 based API.



EURO DATA CUBE

- Dashboard
- EDC Euro Data Cube
- About
- Documentation
- Support
- Marketplace
- Browser
- Blog
- My Contributions
- Settings
- Account
- Billing

My Workspace

EOxHub - Promotional Plan
valid through 2022-06-15

Usage

| Resource | Current Usage | Limit |
|-----------------|----------------------|-------|
| Storage | 60.8MB | 5GB |
| Memory | 0.2GB (last hour) | 4GB |
| CPU | 0 of 1 | - |
| Network Traffic | 0.6GB (last 30 days) | 600GB |

Deployed Apps

- JupyterLab
access URL: <https://edc-jupyter.hub.eox.at> active

My data products (+)
No items found

My API service subscriptions (+)

- EDC Sentinel Hub - Free Trial
valid through 2022-06-15 active
- EDC GeoDB - Free Trial
valid through 2022-06-15 active

- https://eurodatacube.com/marketplace/infra/edc_eoxhub_workspace
- Managed JupyterLab
- Curated base images
- Different flavours of computational resources
- Run Jupyter Notebooks
- User deployed Applications e.g. EO Browser

EURO DATA CUBE

Dashboard

EDC Euro Data Cube

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Deployed Apps

- JupyterLab

access URL: <https://edc-jupyter.hub.eox.at> active

File Edit View Run Kernel Diagram Tabs Settings Help

Filter files by name

| Name | Last Modified |
|----------------------|---------------|
| result-data | a day ago |
| estimate_costs.ipynb | a day ago |
| notebook.ipynb | a day ago |

Notebook

EDC 2022.02 (Python3)

File Edit View Run Kernel Diagram Tabs Settings Help

Filter files by name

Notebook

EDC 2022.02 (Python3)

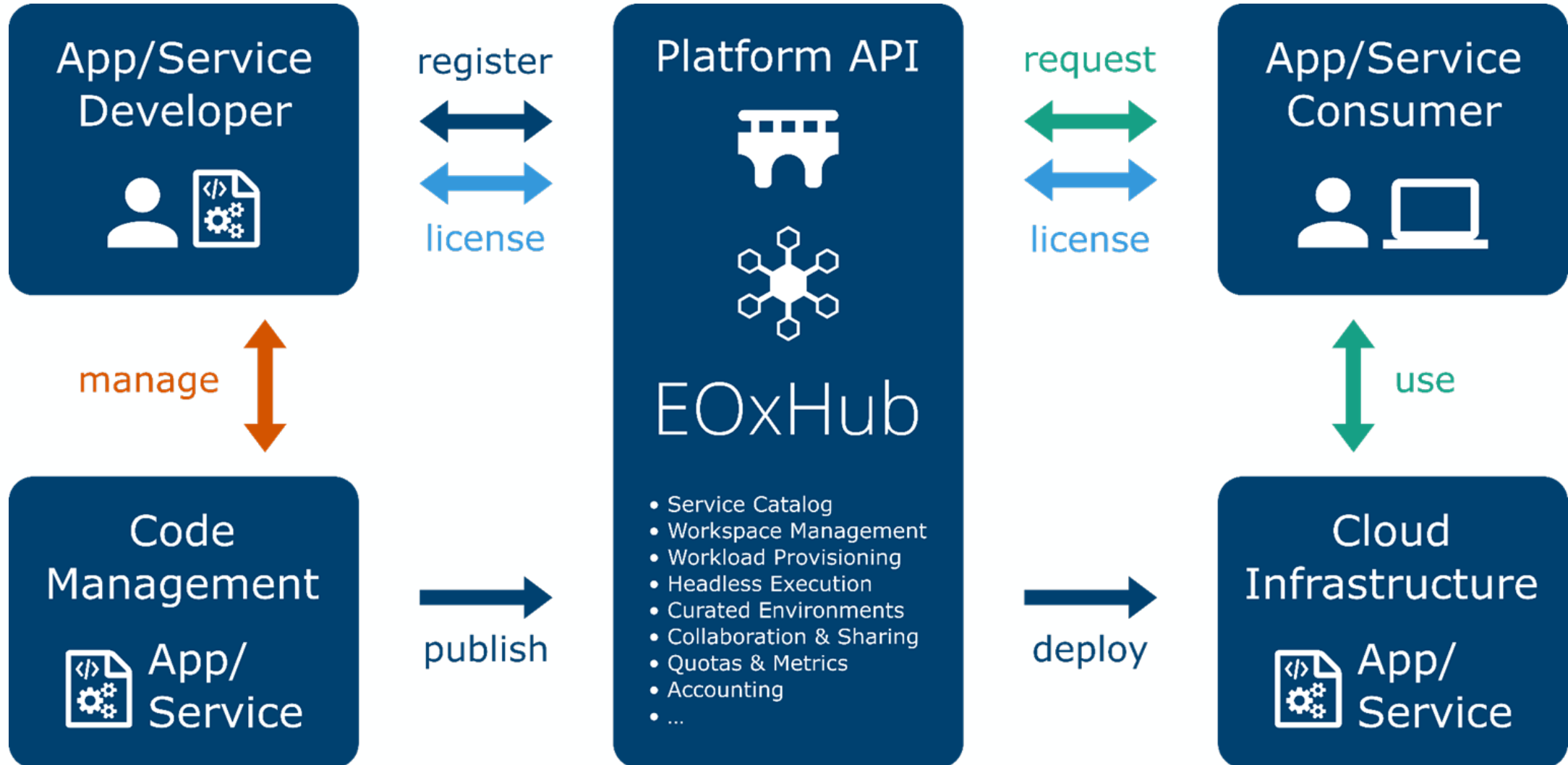
Console

Other

- Terminal
- Diagram
- Text File
- Markdown File
- Python File
- Show Contextual

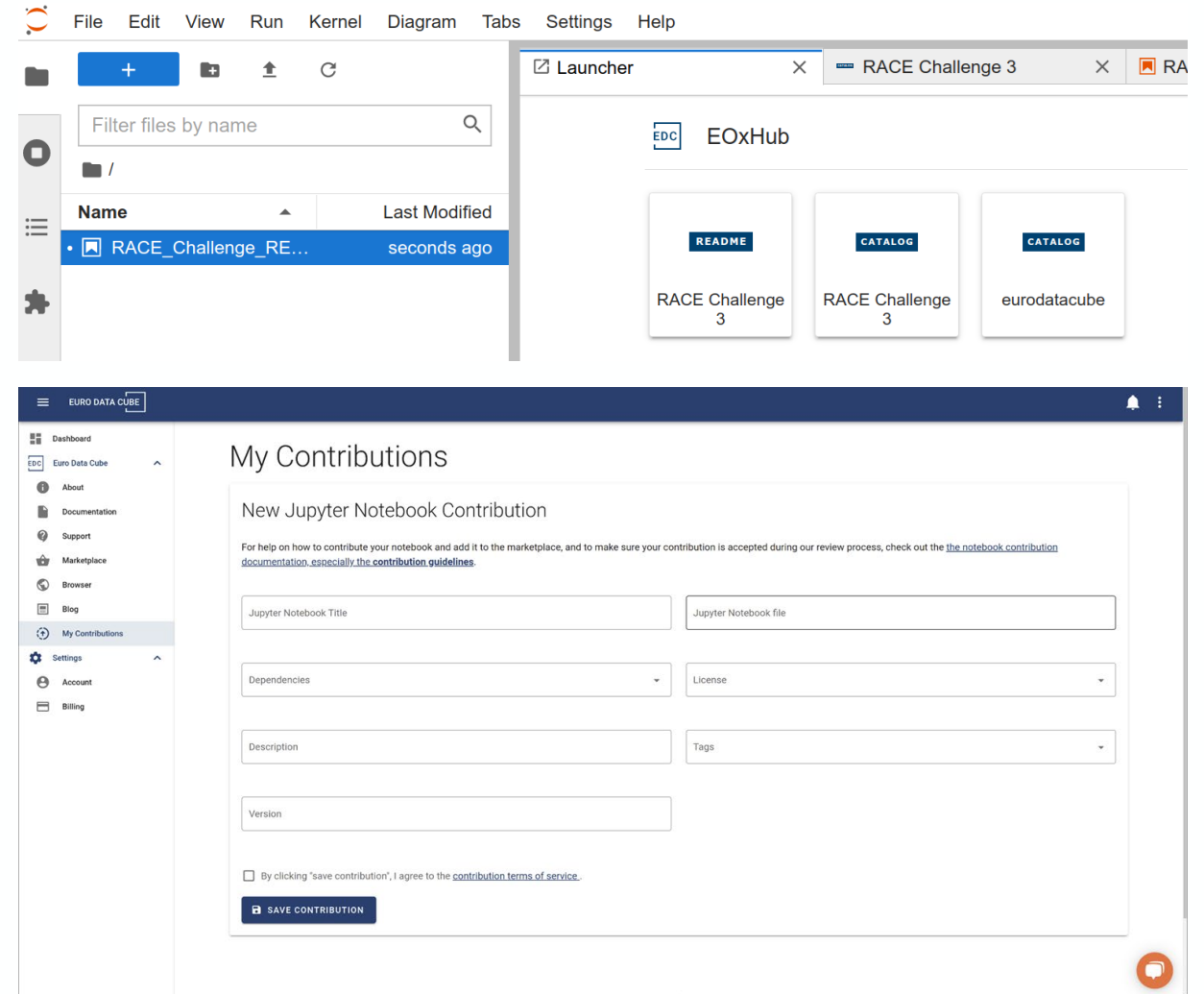
EOxHub

- eurodatacube
- eurodatacube



- Enabling ad-hoc teams
- Curated list of sample notebooks
- Dedicated tutorial notebooks for hackathons
- Community contributed notebooks
- Automatic testing with base images and updates
- EDC EOxHub Workspace for Indicator
 - Experimentation
 - Upscaling

Submit your notebook



The top screenshot shows a JupyterLab interface. The left sidebar contains a file browser with a search bar and a table of files. The main workspace shows a 'Launcher' window with three notebooks: 'RACE Challenge 3' (README), 'RACE Challenge 3' (CATALOG), and 'eurodatacube' (CATALOG).

The bottom screenshot shows the 'EURO DATA CUBE' website. The 'My Contributions' section is active, displaying a form for submitting a new Jupyter Notebook contribution. The form includes fields for 'Jupyter Notebook Title', 'Jupyter Notebook file', 'Dependencies', 'License', 'Description', 'Tags', and 'Version'. A checkbox indicates agreement to the 'contribution terms of service', and a 'SAVE CONTRIBUTION' button is at the bottom.

Integrate upscaled indicators

Open Source software project <https://github.com/eurodatacube/eodash>

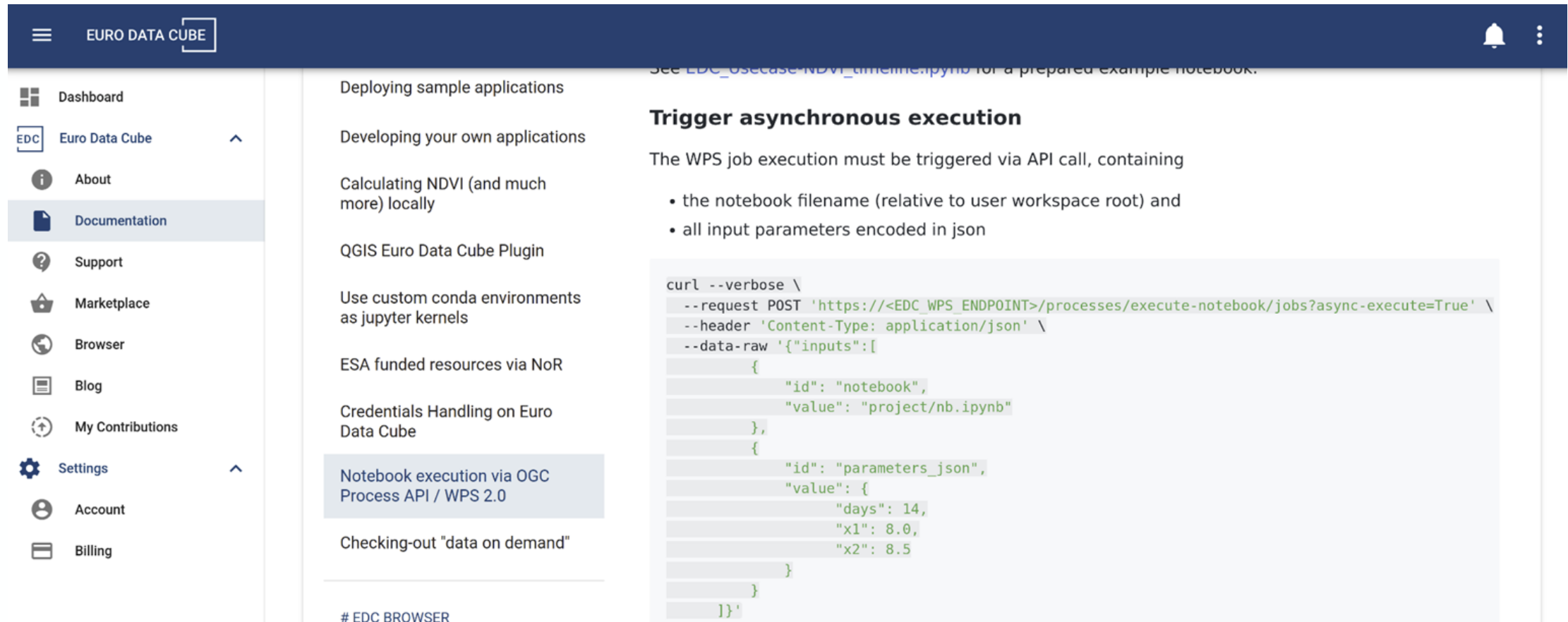
The screenshot displays the GitHub repository page for `eurodatacube/eodash`. At the top, there is a navigation bar with links for Product, Team, Enterprise, Explore, Marketplace, and Pricing, along with a search bar and Sign In/Sign up buttons. Below this, the repository name and public status are shown, along with notification, fork, and star counts.

The main content area is divided into several sections:

- Repository Overview:** Shows the current branch (staging), 27 branches, and 3 tags. It includes buttons for "Go to file" and "Code".
- Commit History:** A table listing recent commits, including a feature commit by `lubojr` and several other updates to files like `.github`, `app`, and `README.md`.
- README.md Preview:** A preview of the repository's README, featuring a "Welcome to eodash" heading, a DOI link, and a description of the software's purpose in powering the RACE dashboard and Earth Observing Dashboard.
- Repository Statistics (About):** Provides information about the software, including its role in the RACE dashboard and Earth Observing Dashboard, and links to `race.esa.int` and `eodashboard.org`. It also lists the license (MIT), star count (48), and fork count (31).
- Releases:** Shows the latest release, `v3.0`, which was published 12 days ago.
- Contributors:** Displays a list of 16 contributors, with 5 more contributors listed below.

Continuously update data of integrated indicators

<https://eurodatacube.com/documentation/headless-notebook-execution>



The screenshot shows the Euro Data Cube documentation interface. The left sidebar contains navigation links: Dashboard, Euro Data Cube, About, Documentation (highlighted), Support, Marketplace, Browser, Blog, My Contributions, Settings, Account, and Billing. The main content area is titled 'Trigger asynchronous execution' and includes a list of bullet points and a code block for a curl command.

Deploying sample applications

Developing your own applications

Calculating NDVI (and much more) locally

QGIS Euro Data Cube Plugin

Use custom conda environments as jupyter kernels

ESA funded resources via NoR

Credentials Handling on Euro Data Cube

Notebook execution via OGC Process API / WPS 2.0

Checking-out "data on demand"

EDC BROWSER

See `EDC_usecase-NDVI_timecube.ipynb` for a prepared example notebook.

Trigger asynchronous execution

The WPS job execution must be triggered via API call, containing

- the notebook filename (relative to user workspace root) and
- all input parameters encoded in json

```
curl --verbose \  
  --request POST 'https://<EDC_WPS_ENDPOINT>/processes/execute-notebook/jobs?async-execute=True' \  
  --header 'Content-Type: application/json' \  
  --data-raw '{"inputs":[  
    {  
      "id": "notebook",  
      "value": "project/nb.ipynb"  
    },  
    {  
      "id": "parameters_json",  
      "value": {  
        "days": 14,  
        "x1": 8.0,  
        "x2": 8.5  
      }  
    }  
  ]}'
```

Contribute Indicator to Open Data



Register Bring Your Own Data

Publish at <https://github.com/eurodatacube/public-collections>

Product Team Enterprise Explore Marketplace Pricing

Search Sign in Sign up

eurodatacube / public-collections Public

Code Issues 1 Pull requests 5 Actions Projects Wiki Security Insights

main 26 branches 0 tags

dthiex Merge pull request #189 from Dorothyrono/main ✓ 1fa7467 29 days ago 963 commits

| File | Commit Message | Time Ago |
|-------------------|---|---------------|
| .husky | added husky for pre commit test | 7 months ago |
| _build | Improve formatting | 3 months ago |
| collections | update collection ids and endpoint | 2 months ago |
| .gitignore | Add _tmp and _output to .gitignore, add missing metadata. | 8 months ago |
| CONTRIBUTING.md | better phrasing of endpoint description in CONTRIBUTING.md | 3 months ago |
| LICENSE | Initial import | 14 months ago |
| README.md | Update README.md | 13 months ago |
| buildspec.yml | Output dir is being deleted by gulpfile. Must ensure the file will... | 9 months ago |
| gulpfile.js | cleanup | 6 months ago |
| package-lock.json | add script to test stac validity | 4 months ago |
| package.json | build sources before tests | 4 months ago |
| stac-json.test.js | cleanup | 6 months ago |

README.md

Euro Data Cube Public Collections

A repository of publicly available collections that are available for access through Euro Data Cube.
Note that collections in this registry are available via Euro Data Cube, but owned and maintained by different providers.

About

Containing meta-data about the data collections available within Euro Data Cube, both core ones as well as the ones provided by users

collections.eurodatacube.com/

Readme

Apache-2.0 license

6 stars

4 watching

8 forks

Releases

No releases published

Contributors 20

+ 9 contributors

Languages

- JavaScript 64.1%
- Handlebars 25.9%
- CSS 9.9%



Share Indicator Algorithm

Bring Your Own Algorithm https://eurodatacube.com/documentation/offer_algorithms_for_on_demand_data_generation

Available as Insights On Demand on EDC marketplace

<https://eurodatacube.com/marketplace/data-products/on-demand>

Support reproducible science

- Support Open and Reproducible Science approach
- Powered by Jupyter Notebooks
- Indicator experimentation, upscaling, and integration in dashboard
 - EO Dashboard Hackathon
 - RACE Challenges
- Enabling ad-hoc teams and community engagement
- On top of readily available indicator data and EO data

- Providing EODASH as an Open Science and educational resource
 - <https://eodashboard.org>
 - <https://race.esa.int>

The screenshot displays two dashboard views from EODASH. The top view, titled 'Frankfurt, Airports: airplanes traffic', shows a bar chart of 'Number of flying planes' from July 2017 to July 2020. The chart is divided into 'Low Restrictions' (light red) and 'High Restrictions' (dark red) periods. A legend indicates 'Number of flying planes' (blue bars). To the right, there are satellite images and a diagram showing 'Satellite direction' (green arrow) and 'Airplane direction' (red arrow). The bottom view, titled 'Europe, Number of Trucks (Beta)', shows a map of Europe with a color scale for 'Average Number of trucks' (0 to 90). A legend indicates 'Number of trucks detected' (blue bars), 'Low Restrictions' (light red), and 'High Restrictions' (dark red). A bar chart shows the number of trucks detected in 2017, 2018, 2019, and 2020. The dashboard includes navigation menus, a newsletter sign-up, and a footer with 'EDG service for ESA | Legal | Privacy' and 'eodash v3.0.0 by EODASH'.

Thank you!