



Copernicus - eoSC AnaLytics Engine

C-SCALE: Enabling Copernicus Big Data Analytics through EOSC

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Workflow solutions



- Workflows for **Copernicus** data processing
 - set of processing **steps** from raw data to results
 - configurable, reproducible, open source, portable, interoperable
 - **reusable**: changing spatial and temporal scales
- Goal: provide workflows for **monitoring**, **modelling** and **forecasting** of the **Earth** system
- Workflow solutions come from **C-SCALE Use Cases**

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Workflow solutions



- C-SCALE use cases help **co-design** the C-SCALE infrastructure
 - testing **usability**
 - deriving new **user requirements**
 - providing **continuous feedback** that is implemented as feasible by providers in C-SCALE services
- **6 use cases** identified in the proposal stage of C-SCALE:
 - Aquamonitor
 - WaterWatch
 - HiSea
 - LSDA
 - RETURN
 - Wetland Water Stress Analysis

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Workflow solutions

DISCLAIMER

Some use cases were developed before C-SCALE started and in the project the focused on porting the solution to EOSC.

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Workflow solutions



Aquamonitor **Deltares**

- Aim: Track **land-to-water** (erosion, reservoir construction) and **water-to-land** (accretion, land reclamation, droughts) changes worldwide
- Results: A Jupyter notebook was developed within C-SCALE to help anyone get started with global EO data using **openEO**, and the algorithm is translated and broken down in detail for anyone to apply it to their use case.
 - <https://github.com/c-scale-community/use-case-aquamonitor>

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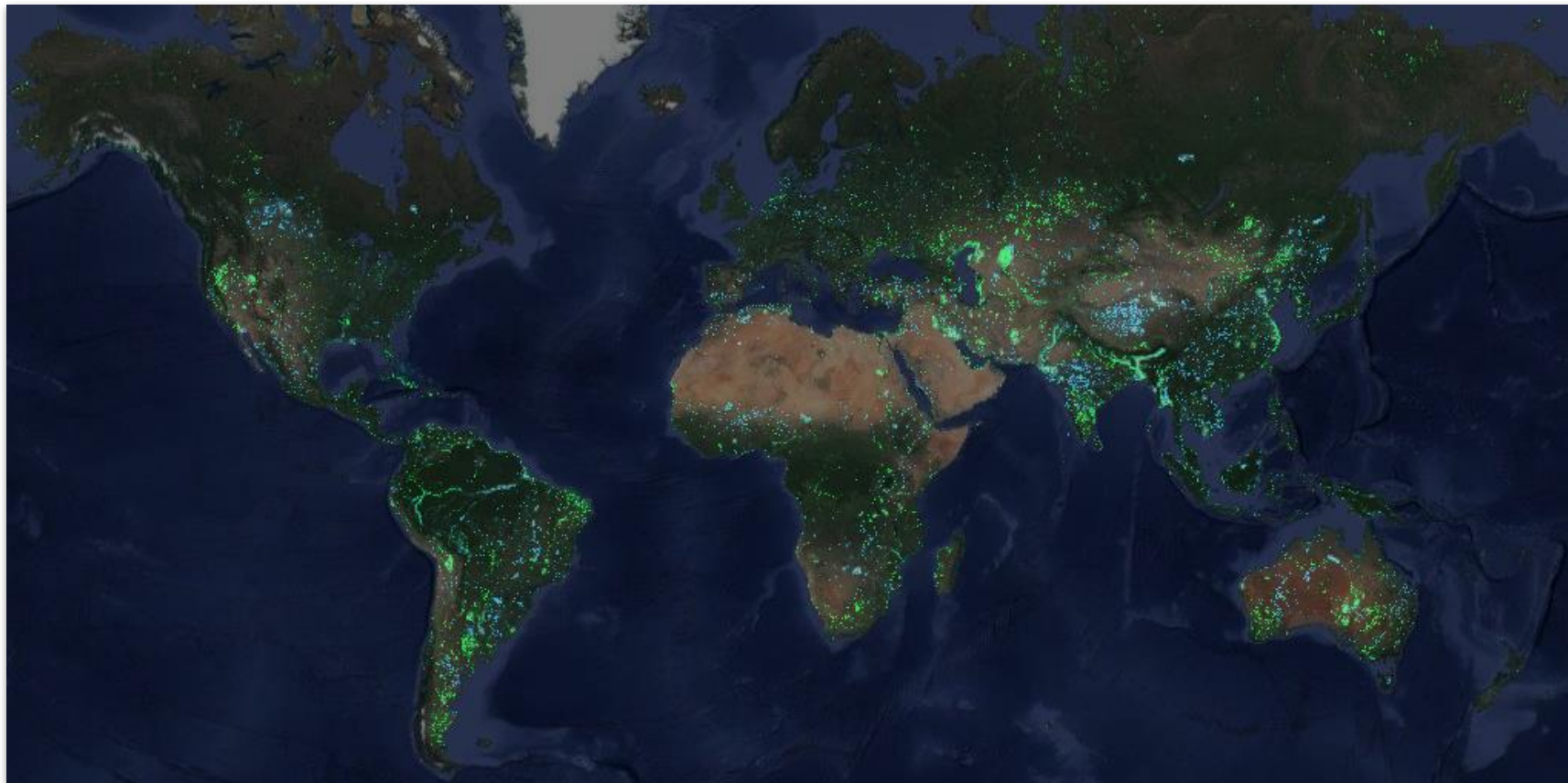


Workflow solutions

Aquamonitor

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<https://aqua-monitor.appspot.com/>



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Workflow solutions

WaterWatch **Deltares**

- Aim: processing of freely-available images from ESA/Copernicus Sentinel satellite to generate information on **water availability for thousands of reservoirs** and makes this information **freely available to anyone**.



- <https://c-scale.eu/interoperable-services-enabling-timely-response-to-climate-related-risks/>

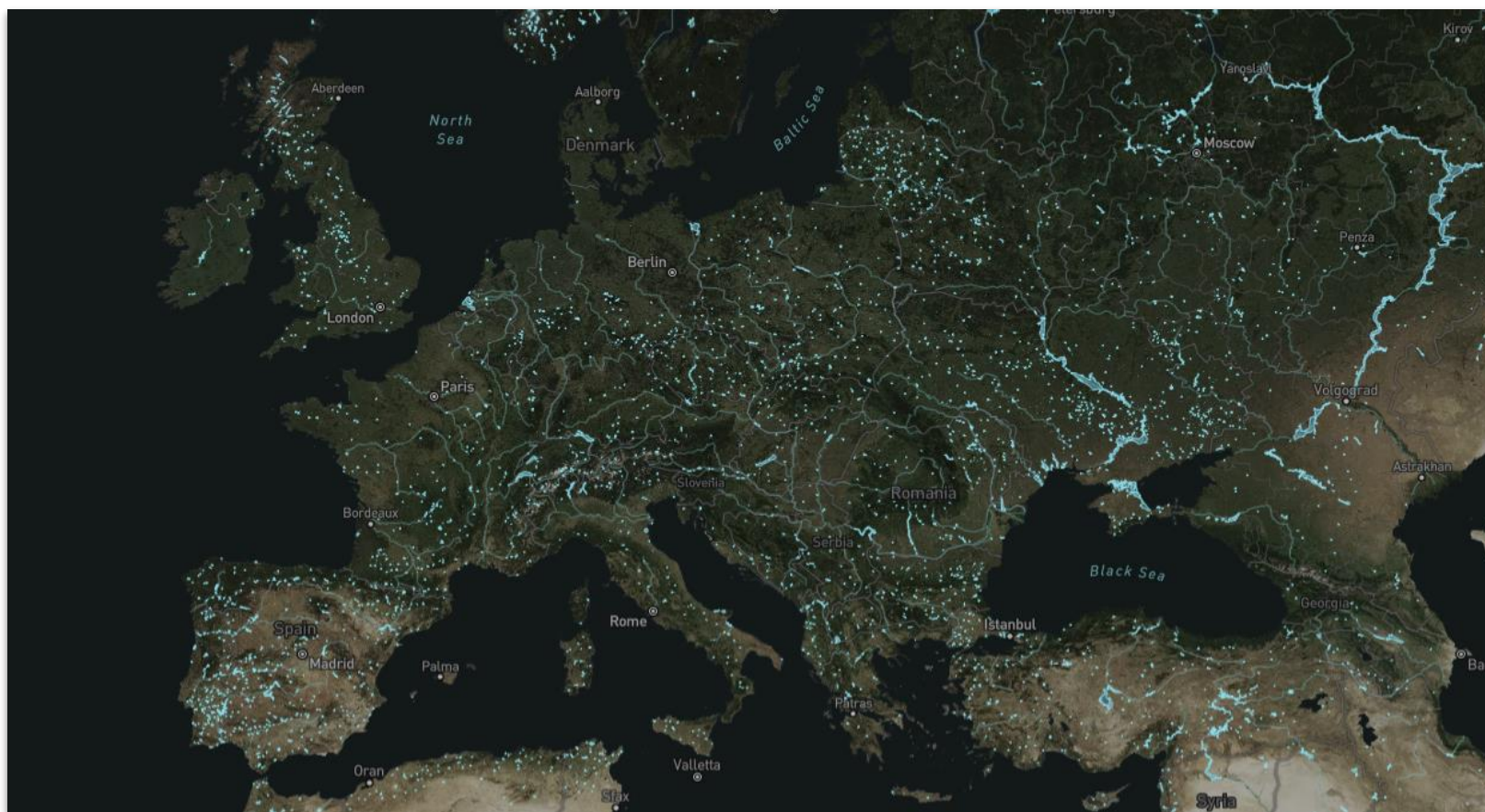
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Workflow solutions

WaterWatch

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<https://www.globalwaterwatch.earth/>



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Workflow solutions

HiSea **Deltares**

- Aim: **Hydrodynamic and water quality modelling**
- Services for **aquaculture** industries:
 - Forecasting for:
 - **oxygen** concentration
 - sea water **temperature**
 - sea **currents**
 - wind and **waves**
- Services for **ports**
 - **Early warning** systems for abnormal water quality parameters
 - Identify location of **contaminating** sources



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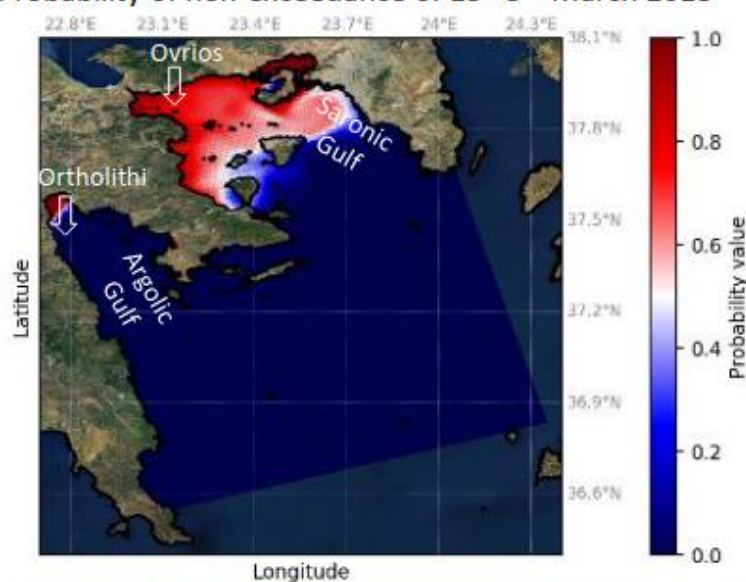
Workflow solutions

HiSea

Deltares

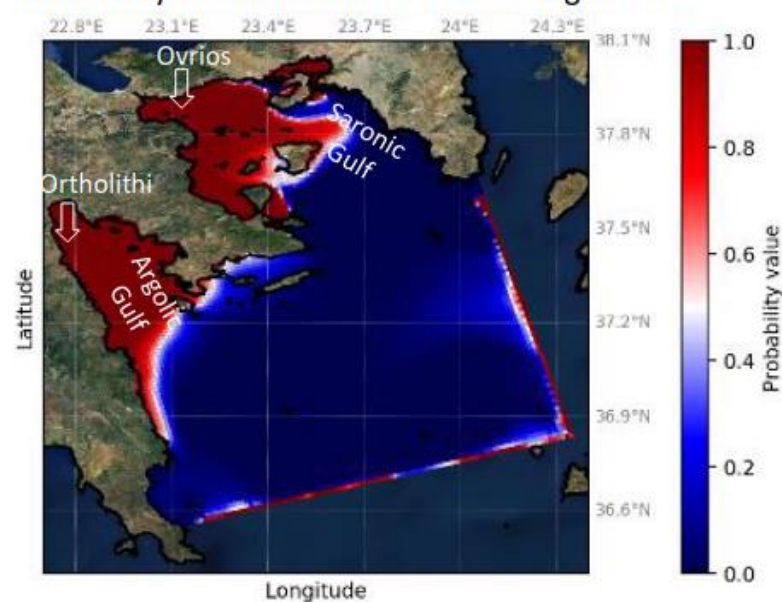
<https://hiseaproject.com/>

Probability of non-exceedance of 15 °C – March 2018



Saronic gulf show higher probability of non-exceedance of 15 °C than Argolic gulf.

Probability of exceedance of 26 °C – August 2018



Both gulf areas show a higher probability of exceedance of 26 °C.

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Workflow solutions



LSDA

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- Aim: **seasonal river discharge forecasts** for any river basin in the world.
- Why: With increasing **droughts** and increased **water use** worldwide there is a great need to understand and predict **river conditions and water availability** on a seasonal time scale.

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Workflow solutions



RETURN



- Aim: Quantify **tropical forest recovery capacity** at unprecedented spatial and temporal scales using Sentinel-1 satellite data.
- Why: Recent extreme **droughts** combined with accelerating **human exploitation** are pushing tropical forests to the point where they cannot recover, making them vulnerable to large unprecedented **wildfires**.

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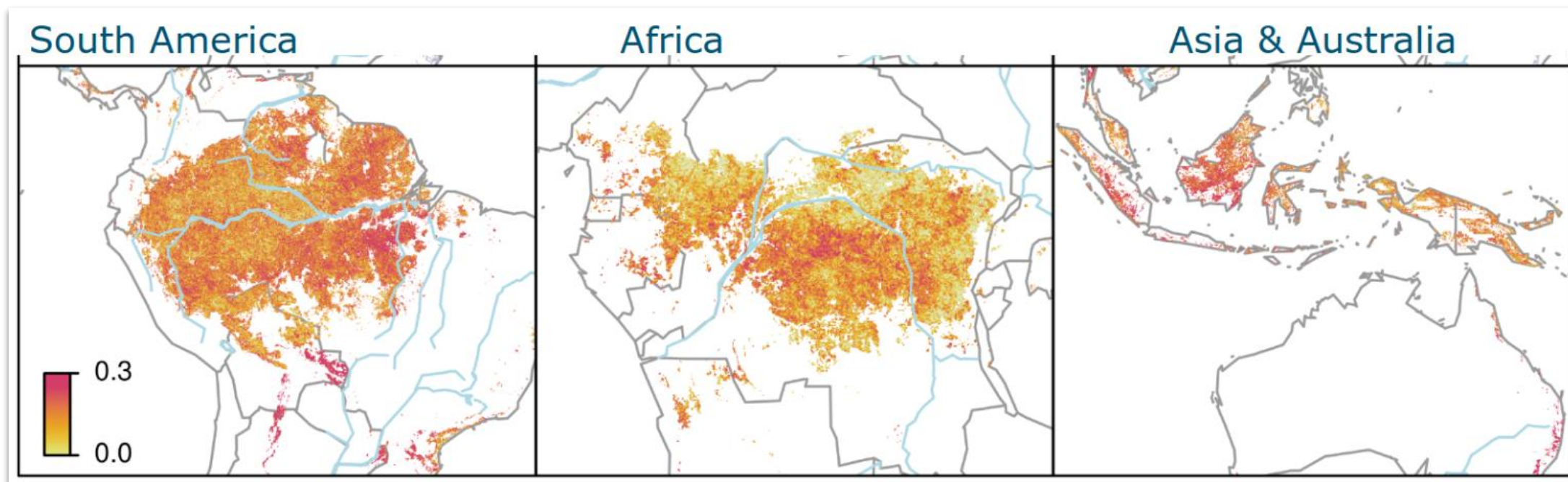
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Workflow solutions



RETURN



<https://www.surf.nl/en/agenda/seminar-enabling-copernicus-big-data-analytics-through-european-open-science-cloud>

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Workflow solutions



Wetland Water Stress Analysis



TECHNISCHE
UNIVERSITÄT
WIEN
Vienna University of Technology

- Aim: Identify **healthy wetland** (permanently humid / saturated with water) to **protect** them worldwide.
- Why: Protected, healthy wetland is a **methane sink**. They become a **methane source** under stress (droughts) so avoiding stressed wetlands has directly a short-term influence on the rate of climate change.

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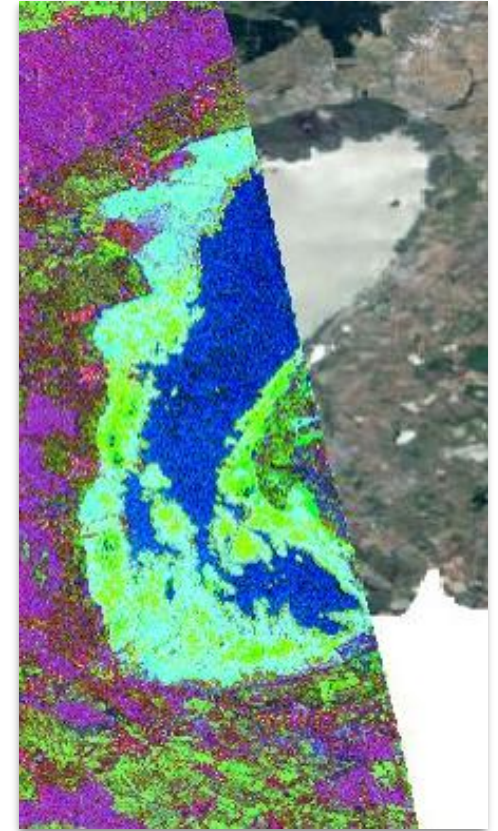
Deltares



Workflow solutions

Wetland Water Stress Analysis

- Wetlands have specific **soil and soil moisture dynamic**
- **Harmonic model** developed by Bauer-Marschallinger et.al captures this dynamic
- Wetlands show up in **RGB composites** of these model parameters
- Goals
 - Develop a **classification model** based on harmonic parameters for **Sentinel-1**, similar to Schlaffer et. al.
 - Improve harmonic model using data driven approaches for more **accurate detection**



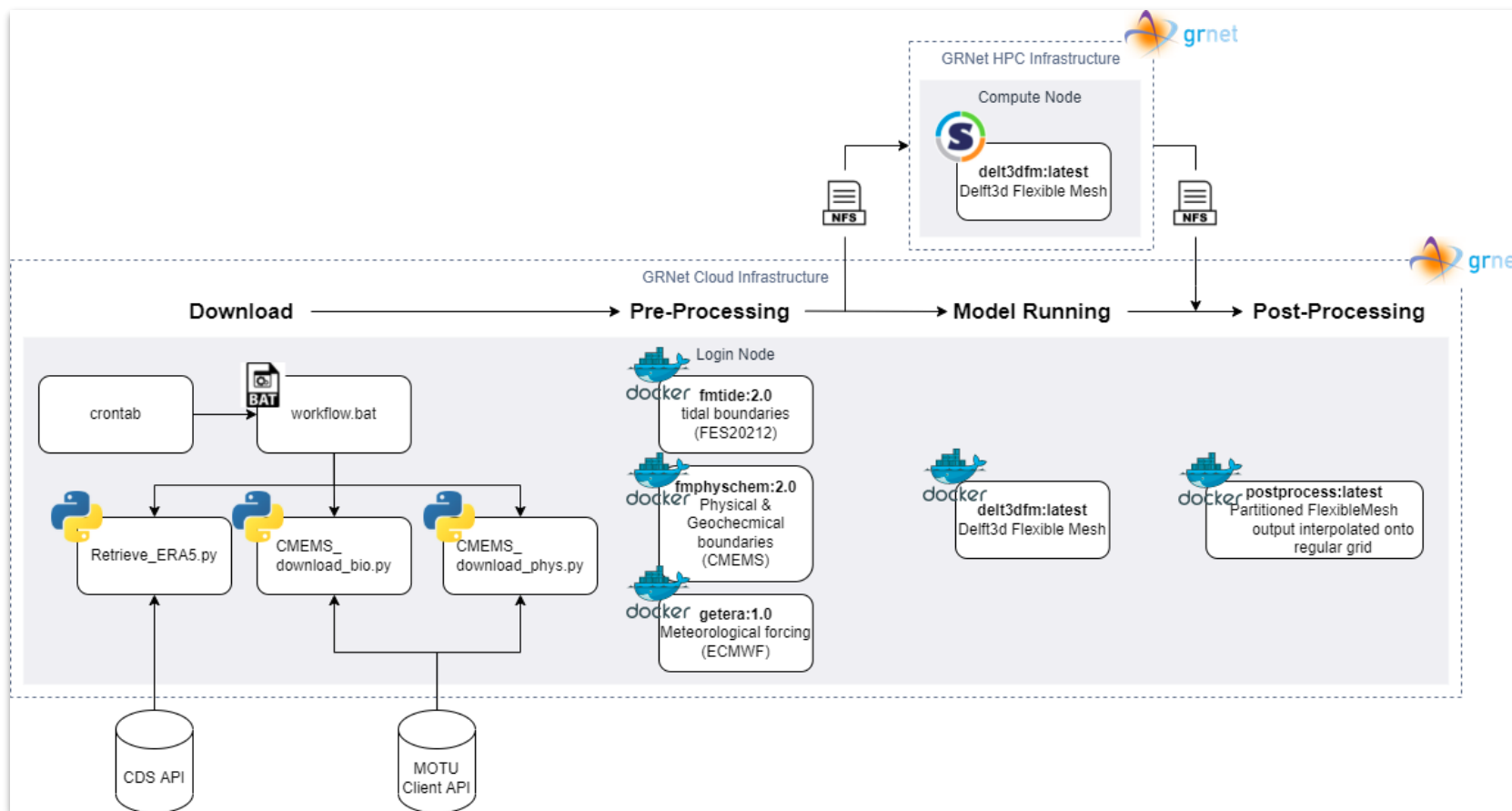
Bauer-Marschallinger, Bernhard, et al. "Satellite-Based Flood Mapping through Bayesian Inference from a Sentinel-1 SAR Datacube." Remote Sensing 14.15 (2022): 3673.
Schlaffer, Stefan, et al. "Mapping wetlands in Zambia using seasonal backscatter signatures derived from ENVISAT ASAR time series." Remote Sensing 8.5 (2016): 402.

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Workflow solutions

HiSea Workflow

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Workflow solutions

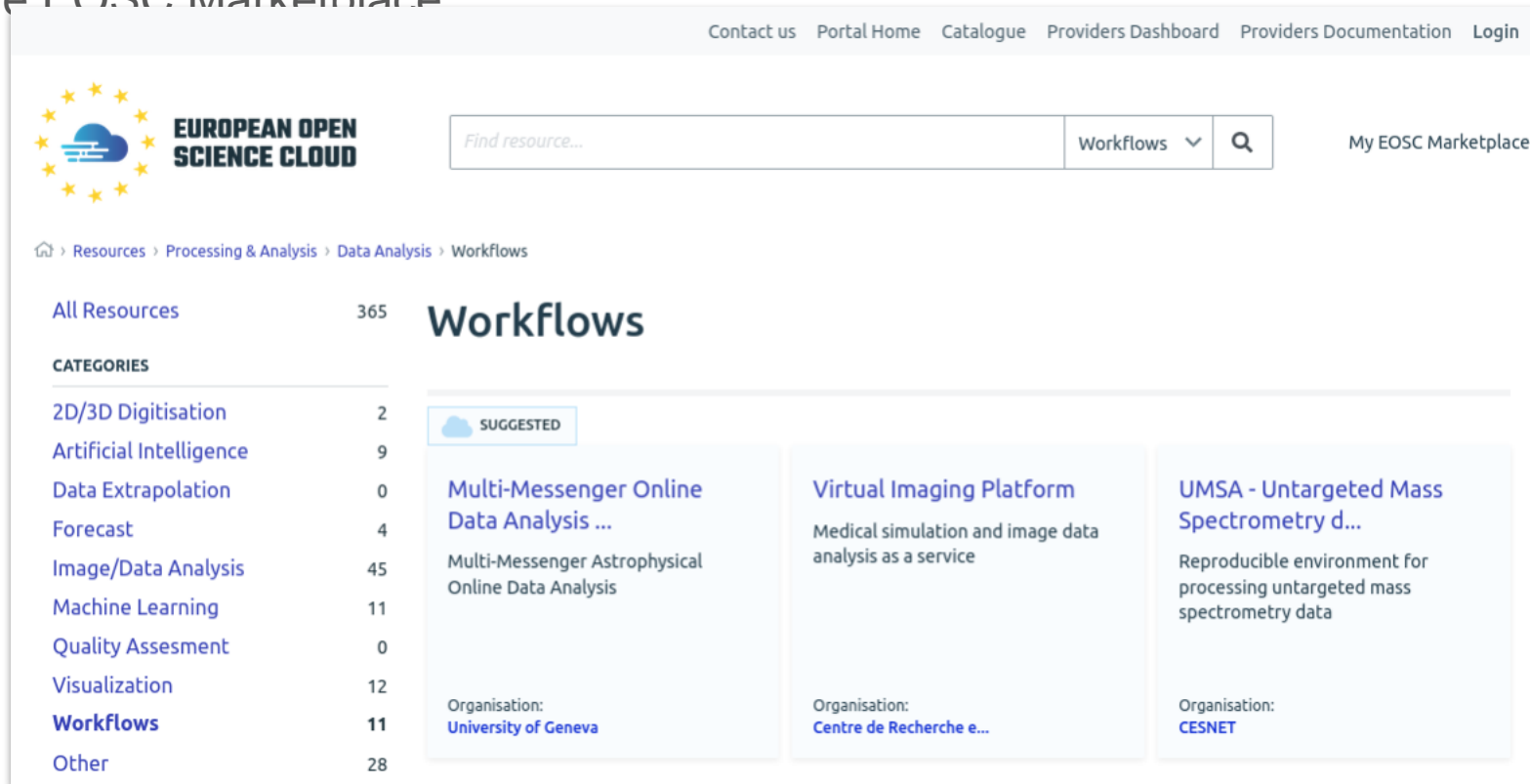
Challenges to the C-SCALE infrastructure

Use case	Scope	Providers
HiSea	This use case tests the interoperability, scalability and performance of combining cloud and HPC compute and data resources in its workflow.	GRNET , CloudFerro/CREODIAS
Aquamonitor	This use case compares the performance of accessing and processing Sentinel-2 data on remote change monitoring object storage and local object storage.	INDC , INFN
RETURN	This use case explores methodologies to create interoperable and scalable analysis ready data cubes.	SURE , EODC
WaterWatch	In a real-time application, this use case quantifies the redistribution delays (latency) of Sentinel surface water area data offered via the ESA DataHub Relays that are part of the federated infrastructure.	CESNET , VITO
LSDA	This use case compares the performance and scalability of ensemble forecasting on HTC and ensemble forecasting cloud compute and data resources.	SURE , EODC
Wetland Water Stress Analysis	This use case tests the performance of connecting data cubes hosted on distributed infrastructures in a single workflow compared to using data cubes hosted on a single infrastructure.	EODC , CloudFerro/CREODIAS

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Workflow solutions

Onboarding into the EOSC Marketplace



The screenshot shows the EOSC Marketplace interface. At the top, there's a navigation bar with links: Contact us, Portal Home, Catalogue, Providers Dashboard, Providers Documentation, and Login. Below this is the European Open Science Cloud logo and a search bar with the placeholder text "Find resource...". To the right of the search bar is a dropdown menu for "Workflows" and a "My EOSC Marketplace" link. The main content area is titled "Workflows" and shows a list of categories on the left and a grid of suggested workflows on the right. The categories list includes: 2D/3D Digitisation (2), Artificial Intelligence (9), Data Extrapolation (0), Forecast (4), Image/Data Analysis (45), Machine Learning (11), Quality Assessment (0), Visualization (12), Workflows (11), and Other (28). The suggested workflows include: Multi-Messenger Online Data Analysis ... (Organisation: University of Geneva), Virtual Imaging Platform (Medical simulation and image data analysis as a service, Organisation: Centre de Recherche e...), and UMSA - Untargeted Mass Spectrometry d... (Reproducible environment for processing untargeted mass spectrometry data, Organisation: CESNET).

<https://marketplace.eosc-portal.eu/services/c/data-analysis-workflows>

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C-SCALE Community



How to become part of the C-SCALE Community

- Forum
- Documentation
- Training and support
- Scientific publications
- News articles
- Open Call

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C-SCALE Community



Forum: <https://github.com/c-scale-community/discussions/discussions>

A screenshot of the C-SCALE community discussions forum interface. The top section is a blue header with the text "General" and "Welcome to the C-SCALE community discussions!". Below this is a search bar with the placeholder text "Search all discussions". To the right of the search bar are three dropdown menus: "Sort by: Latest activity", "Label", and "Filter:". Below the search bar is a "Categories" section with a list of categories: "View all discussions", "General", "Ideas", "Polls", "Q&A", and "Show and tell". To the right of the categories is a "Discussions" section with a list of three discussions. Each discussion entry includes an upvote button, a discussion icon, the title, the author's name, the start date, the category, the author's profile picture, and the number of replies.

General

Welcome to the C-SCALE community discussions!

backeb

Search all discussions

Sort by: Latest activity

Label

Filter:

Categories

- View all discussions
- General
- Ideas
- Polls
- Q&A
- Show and tell

Discussions

- Welcome to the C-SCALE community discussions!**
backeb started on Apr 13, 2021 in General 11 replies
- Candidates for the Copernicus Medal 2023**
sebastian-luna-valero started on Aug 24 in General 1 reply
- Remote Sensing – Deployable Analysis Environment (RS-DAT) demonstration**
sebastian-luna-valero started on Oct 6 in General 0 replies

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Documentation: <https://wiki.c-scale.eu/C-SCALE>

Welcome to the C-SCALE documentation

C-SCALE's purpose is to federate Earth Observation service providers and offer users the possibility to access, process, analyse and share Copernicus data, tools, resources and services through the [EOSC Portal](#) . Please visit the [C-SCALE](#) website to learn more about the mission and vision.



[C-SCALE Users](#)



[Data Inventory](#)



[C-SCALE Service Providers](#)

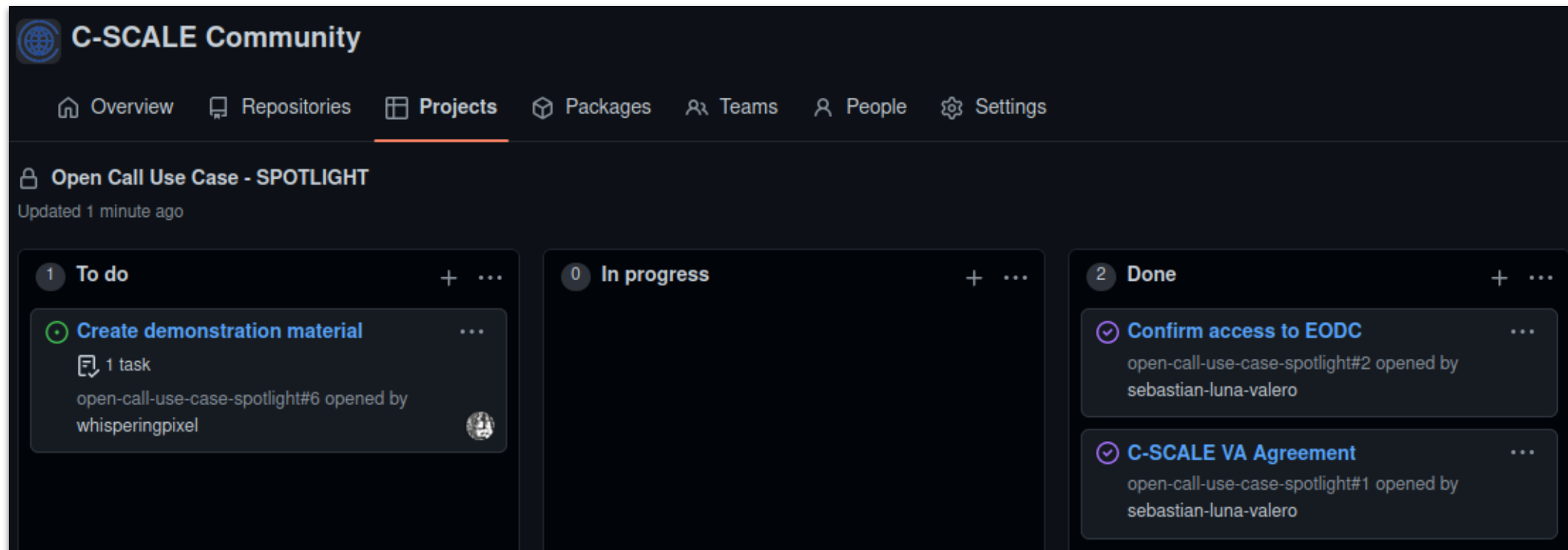
Would you like to contribute to the docs? [Let us know!](#)

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Training and support

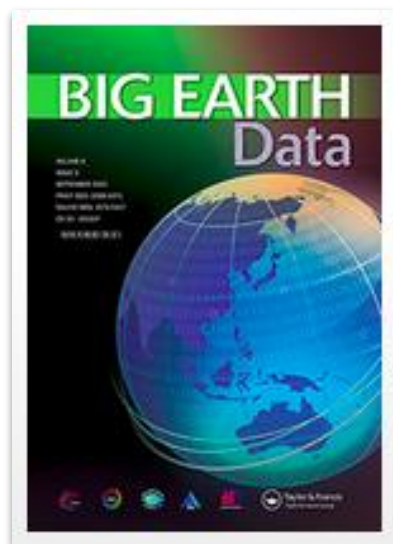


The screenshot displays the C-SCALE Community web application. At the top, a navigation bar includes links for Overview, Repositories, Projects (which is the active tab), Packages, Teams, People, and Settings. Below the navigation bar, the main section is titled 'Open Call Use Case - SPOTLIGHT' with a sub-header 'Updated 1 minute ago'. The interface features a Kanban board with three columns: 'To do' (1 item), 'In progress' (0 items), and 'Done' (2 items). The 'To do' column contains a task 'Create demonstration material' with a sub-note 'open-call-use-case-spotlight#6 opened by whisperingpixel'. The 'Done' column contains two completed tasks: 'Confirm access to EODC' (noted as 'open-call-use-case-spotlight#2 opened by sebastian-luna-valero') and 'C-SCALE VA Agreement' (noted as 'open-call-use-case-spotlight#1 opened by sebastian-luna-valero').

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Scientific publications: <https://doi.org/10.1080/20964471.2022.2094953>




Technical note

An open compute and data federation as an alternative to monolithic infrastructures for big Earth data analytics

Björn Backeberg , Zdeněk Šustr , Enol Fernández , Gennadii Donchyts , Arjen Haag , J. B. Raymond Oonk , Gerben Venekamp, Benjamin Schumacher , Stefan Reimond & Charis Chatzikyriakou  ...show less

Received 25 Feb 2022, Accepted 23 Jun 2022, Published online: 13 Jul 2022

Download citation

 <https://doi.org/10.1080/20964471.2022.2094953>

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News articles: <https://c-scale.eu/news/>

The screenshot shows the C-SCALE website's news section. At the top is a dark blue navigation bar with the C-SCALE logo and links for About, Services, Case Studies, Documentation, Community, and News. Below the navigation bar, the word "NEWS" is prominently displayed. To the right of the news items is a "News archive" link. The main content area features four news items, each with a thumbnail image and a brief description:

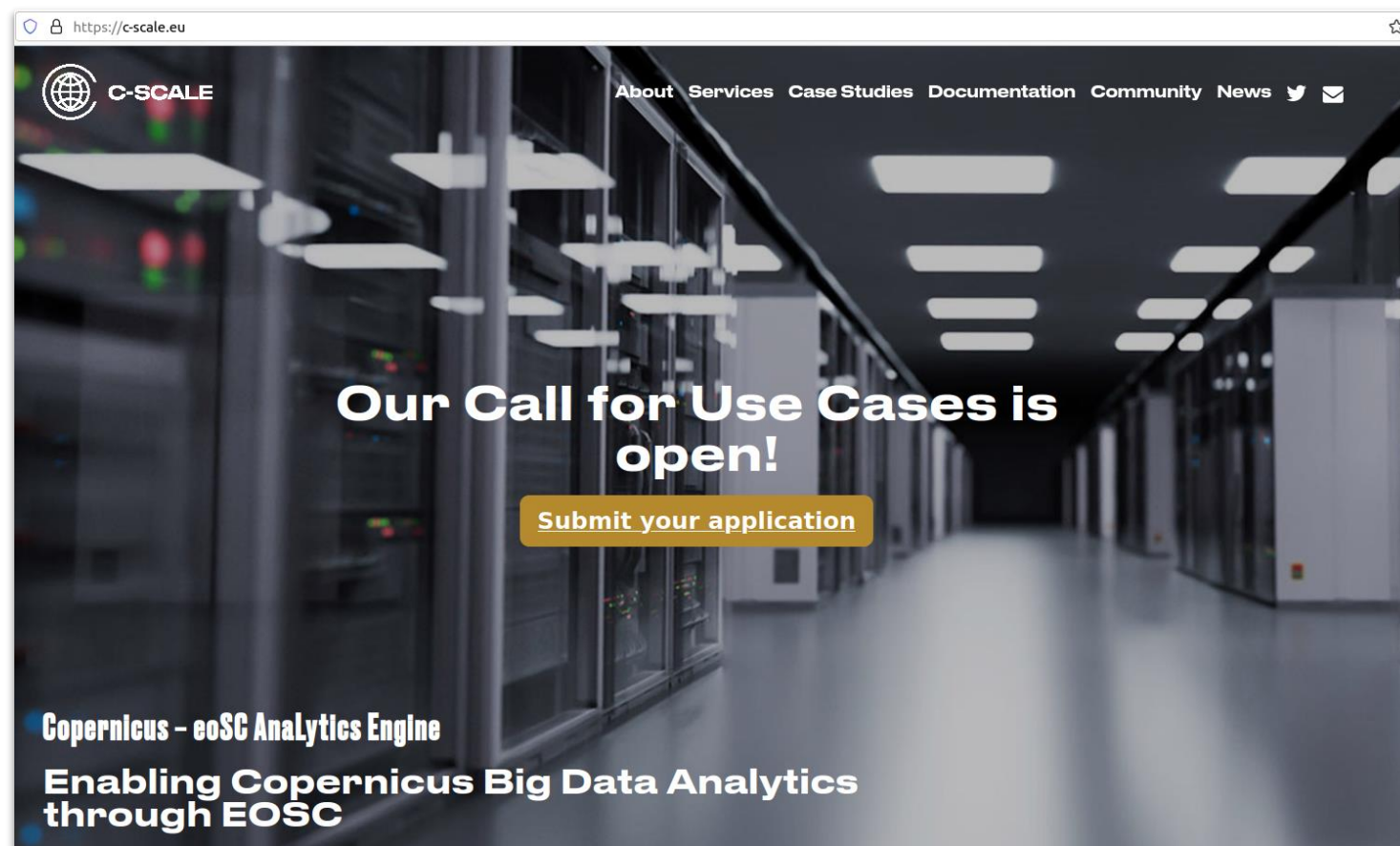
- EOSC DIH Expression of Interest for Business Pilots: 3rd Round**
Deadline extended to 28th October. Join the Webinar 27th October 2022 10am CEST.
- What is C-SCALE and what it offers to its users and potential providers? Check our new flyers**
C-SCALE has recently published two new flyers summarising what C-SCALE is and what it offers to its users and potential service and infrastructure providers. For users Download our flyer for U
- Open Call for Talks**
Deadline: 23rd September, 17:00 CEST
#EOSSymposium22
- Interoperable services enabling timely response to climate-related risks**
Published last Friday in Nature Scientific Reports, a new study identified and analysed 71,208 small and medium reservoirs using Global Water Watch (GWW), which provides free, globally-accessible, near

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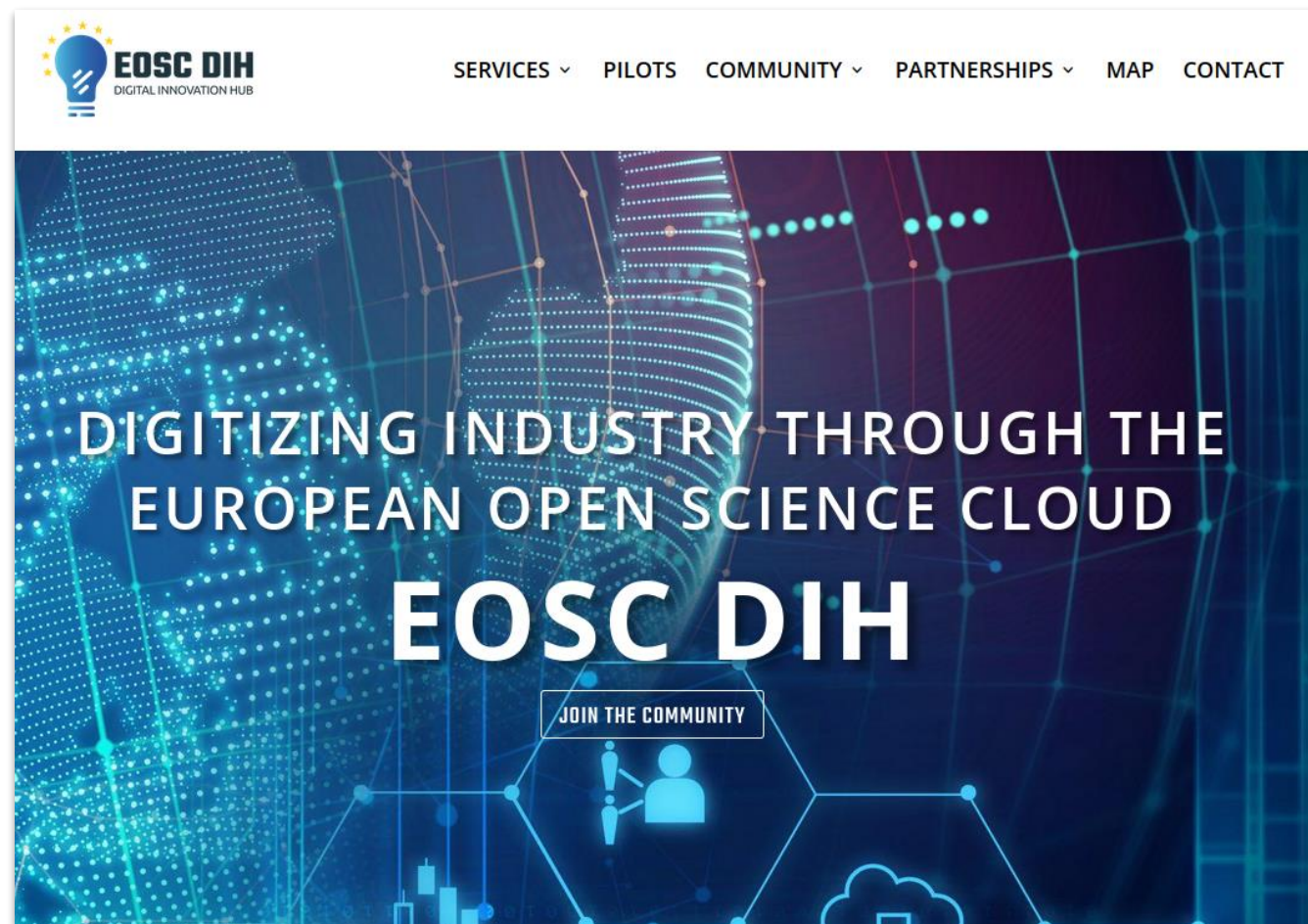
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Join us!

- Cloud Computing



- High-Throughput Computing



- Copernicus Data providers



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C-SCALE Community



- Onboarded
 - SAR On The Fly
 - SPOTLIGHT
 - In SAR cubes
 - Coastmonitor
- Onboarding
 - energie.family
 - ubicube
 - TAMA
 - ITAINNOVA
 - KappaZeta
 - BioCarbon

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Thank you for your attention.

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 <https://c-scale.eu>

 [@C_SCALE_EU](https://twitter.com/C_SCALE_EU)

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