ENVRI-Hub NEXT @ EGU26 GENERAL ASSEMBLY

SHORT COURSE - SC2.18

Harnessing the ENVRI-Hub: data, tools, and services for interdisciplinary research

Live demonstrations, guided practice with curated tools, and participation discussions

Thu, 07 May, 08:30–10:15 (CEST) Room -2.82

www.egu26.eu/session/57896

EPOS EUROPEAN PLATE OBSERVING SYSTEM

LifeWatch ERIC

University of Amsterdam

ENVRI Community - Booth 27 on floor 0

1 **ENVRI Community**

Supported by the EU-funded cluster projects ENVRI, ENVRIplus, ENVRI-FAIR, and currently, by ENVRI-Hub NEXT and ENVRINNOV

4 **Environmental domains**

27 **Research Infrastructures**

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Our Vision

- **Harnessing the Potential of Data**
  - By facilitating easy access and interoperability across subdomains, we will empower researchers to address complex questions and develop groundbreaking solutions.
- **Guiding Light - Essential Climate Variables**
  - The project is guided by the science-based framework of ECVs, a set of critical measurements essential for monitoring climate change and its impacts. This focus allows us to deliver targeted insights and evidence-based solutions.
- **Integration is Key**
  - ENVRI-Hub NEXT champions the integration of ENVRI RIs. By fostering collaboration and synergies, we will provide researchers with a unified platform, enabling them to conduct cross-disciplinary research.

Unified Access

Interoperability

ECV-Focused

Open & Transparent

Cloud-based

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ENVRI Hub

ENVRI Resources | FAQ | About | Feedback | ENVRI Community | Login

Welcome to the Data Access and Services Hub of the European Environmental Research Infrastructures

The Competence Center for the **ENVRI Community**

https://envri-hub.envri.eu/

Search within the ENVRI-Hub website content:

Enter your keywords here

Catalogue of Services

Explore the Research Infrastructures services that provide access to data, metadata, semantic assets, taxonomic information and more, and visualise them on a world map.

Knowledge Base

Search the environmental research infrastructures web-exposed information (web pages, datasets, library and notebooks, web APIs and more).

Training Gateway

Access training resources developed by and for the ENVRI Community.

Catalogue of Data

The ENVRI FAIR Data Point Catalogue.

AI Environmental Expert

Search the environmental research infrastructures web-exposed information (web pages, datasets, library and notebooks, web APIs and more) in a natural language.

Programmatic access to the ENVRI-Hub services

Access the ENVRI-Hub services Applicable Programming Interfaces (APIs) and libraries.

ENVRI Innovation Hub (EIH)

The central platform for driving Innovation in environmental research infrastructures

Science Demonstrators

Access to science demonstrators from the ENVRI community: interactive web services, example notebooks, and more.

Agenda

08:30 – 09:15 | **Setting the scene:** Essential Variables, metadata, and the ENVRI-Hub

- The value of Essential Variables and their metadata harmonisation for Earth science
- The ENVRI-Hub: architecture overview
- Demos
- Q&As

09:15 – 10:00 | **Guided exercise**: Discovering and analysing data through the ENVRI-Hub

- Guided tour of the Analytical Framework Python Library
- Try yourself, isn't it easy?
- A look at the hard way, for comparison
- The Analytical Framework as a workflow element

10:00 – 10:15 | Debrief and wrap-up

Learning objectives

1. Define Essential Climate Variables (ECVs)
2. Describe how metadata harmonisation improves Essential Variables dataset findability, interoperability, and reuse
3. Find Essential Climate Variables datasets on the ENVRI-Hub
4. Work with a Jupyter notebook that queries ENVRI.py for EVs and visualises results
5. Reuse the notebook as a building block in a workflow composition graphical tool

Your trainers and facilitators

Kety Giuliacci | Metadata curator at **INGV**

#metadata #harmonisation #datacuration

Alessandro Turco | IT project Lead at **EPOS ERIC**

#services #productmanagement #userresearch

Zhiming Zhao | Associate Professor of Informatics at **UvA / LifeWatch ERIC**

#knowledgebase #VREs #LLMs

Eleonora Parisi | Training officer at **LifeWatch ERIC**

Koen Greuell | Developer - Cloud-based VREs at **LifeWatch ERIC**

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Vienna, 07 May 2026

What ECVs are and why their metadata harmonisation matters

Kety Giuliacci, INGV

Funded by
the European Union

Setting the scene

- **Earth system observations are rapidly increasing in volume and complexity**
- **Data are produced by multiple Research Infrastructures (RIs)**
- **Examples:**
  - satellite observations (e.g. Copernicus)
  - in-situ measurements (e.g. ocean buoys)
- **→ Need for integration across domains and platforms**

Two Things Matter

To define what to observe

- Identify key variables (e.g. Essential Climate Variables)
- Focus scientific efforts on what is relevant for climate analysis

To define how data are described

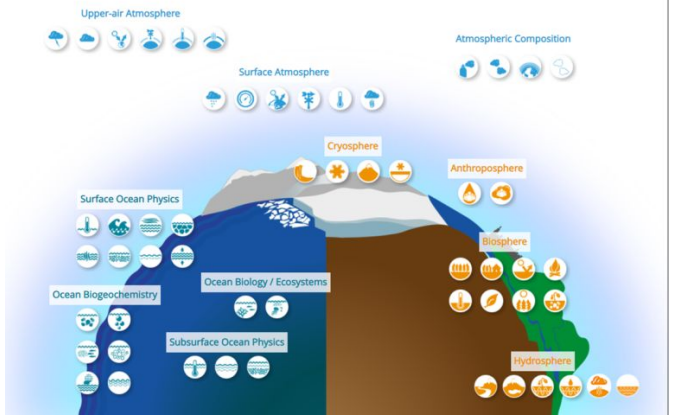
- Use standardised metadata
- Ensure consistency, interoperability, and reuse

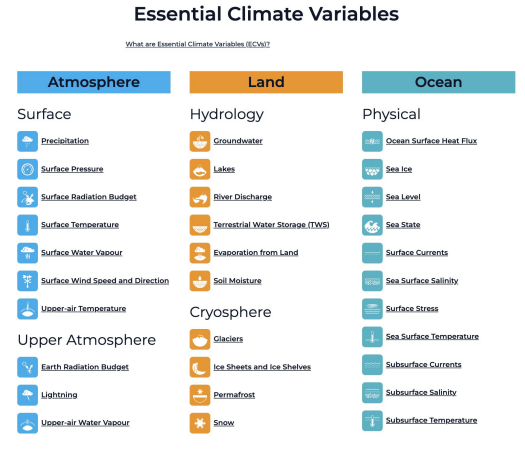
Why variables matter

- It is not feasible to observe everything
- Communities define key variables
- Examples:
  - air temperature
  - sea surface height
  - soil moisture
- → Concept of Essential Variables (EVs) to standardise focus

What are ECVs

- **Defined by Global Climate Observing System (GCOS) :**
  - Essential Climate Variables are physical, chemical, or biological variables defined by the Global Climate Observing System as the minimum set required to monitor Earth's climate. GCOS currently specifies 55 ECVs.
- **Examples:**
  - atmospheric CO_2
  - sea level
  - ocean temperature
- **Used to:**
  - monitor climate change
  - support models and predictions
- **Cover atmosphere, ocean, land**
  - ECVs are organised across three Earth system domains: Atmosphere, Ocean, and Land; enabling comprehensive climate monitoring across all environmental compartments.





What are ECVs

There are two main kind of ECVs:

simple variables	**complex variables**
(like “oxygen concentration”) directly related to observable values	(like “nutrients”) they are a scientific product made by the combination of several (up to hundreds) observables

In ENVRI we classify data and services depending on the ECV (or possibly the ECVs) they contribute to. The assembly of the ECV from the observable data is out of the scope of the hub.

The gap

- **ECVs define what should be observed**
- **But:**
  - datasets stored in different systems
  - metadata follow different schema (e.g., ISO 19115 vs custom schemas)
  - variables described differently (e.g., “temperature”, “temp”)
- **Result:**

  systems cannot automatically recognise they refer to the same concept

  → Limits automated workflows and integration

- **→ ECVs alone do not ensure interoperability**

Why metadata matter

- **Metadata describe:**
  - **what** the data represent (e.g. variable = “temperature”, units= “K”,)
  - **how** they were collected (methods, instruments e.g. sensor type)
  - **where** and **when** (spatial and temporal coverage)
- **They enable:**
  - **data discovery**
  - **correct interpretation**
  - **reuse across domains**
- **Examples of metadata standards:**
  - ISO 19115 (geospatial metadata)
  - CF conventions (climate data)
  - EPOS-DCAT-AP (used in EPOS and adopted by ENVRI-Hub)

→ Without metadata, data cannot be correctly interpreted

From concept to practice → ENVRI-Hub

ENVRI-Hub integrates multiple RIs:	• Metadata profiles for interoperability: **EPOS-DCAT-AP**
ECVs metadata harmonisation:	• controlled vocabularies: **NERC Vocabulary Server (NVS)** • semantic frameworks: **I-ADOPT**
→ Enables consistent interpretation across infrastructures	

Example workflow:

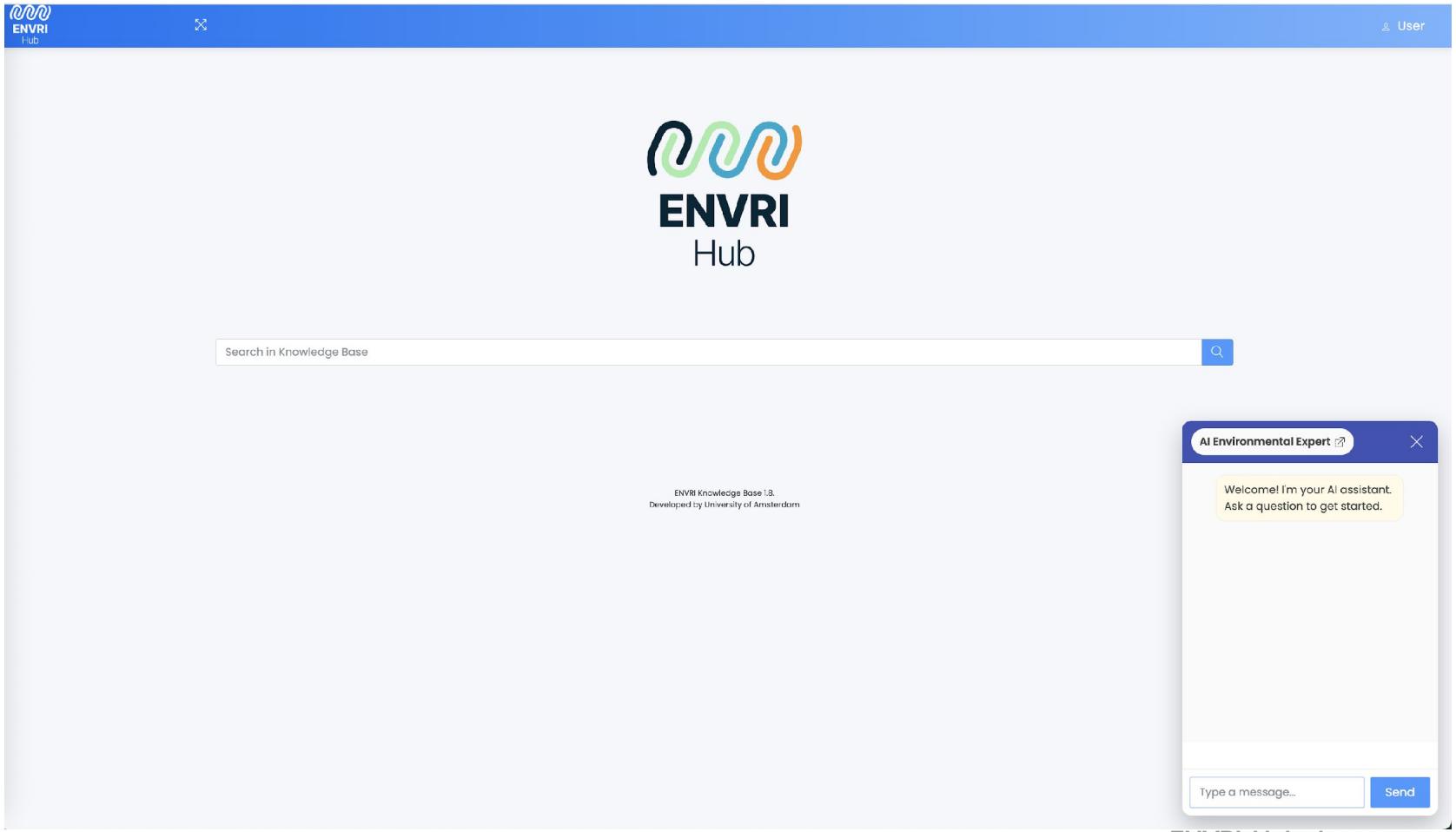
- discovery → retrieve → analyse

Tools:

- **Knowledge Base** (discovery and contextualization)
- **Catalogue of Services** (refined discovery and data retrieve)
- **Analytical Framework** (data analysis and processing)

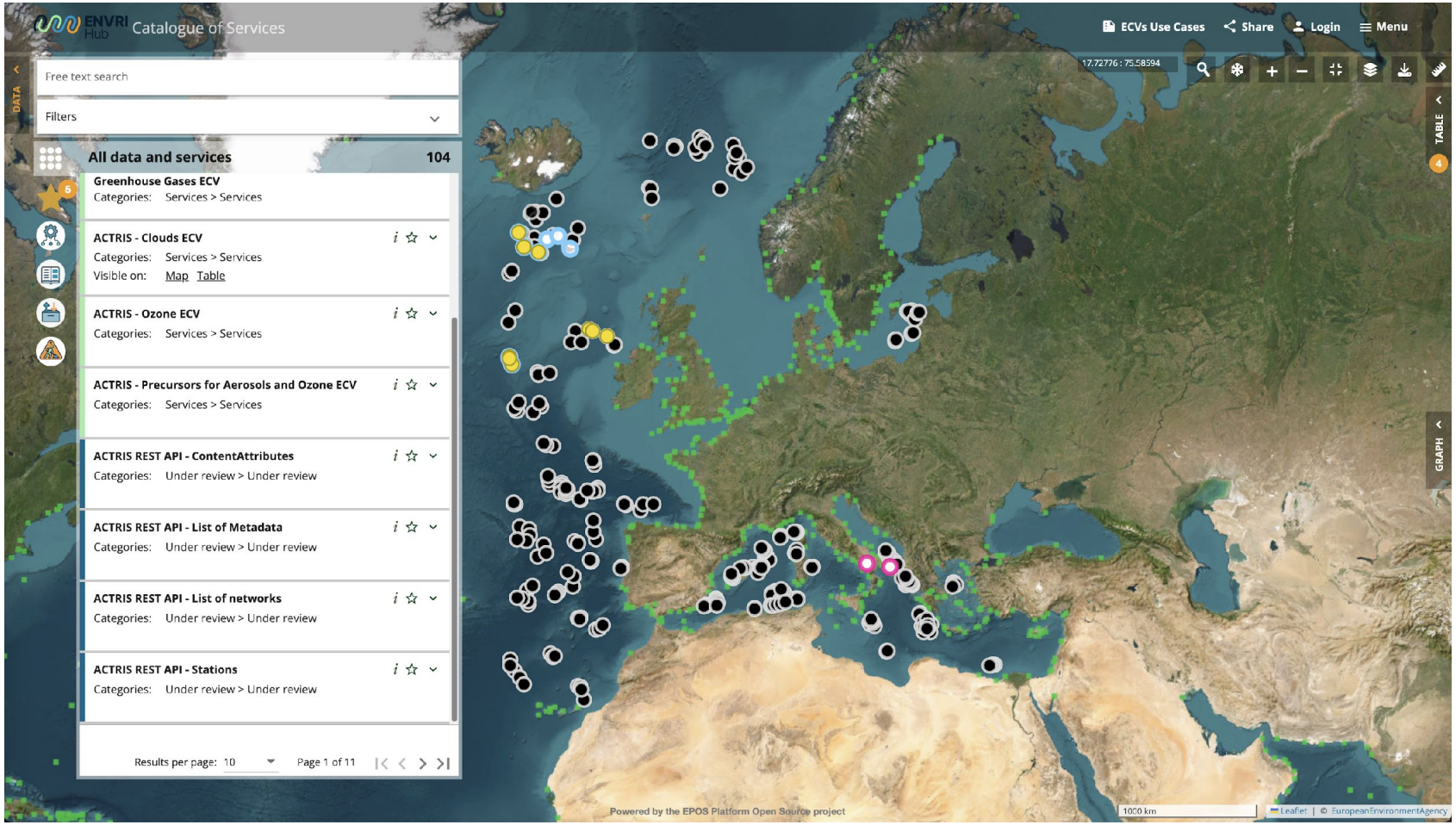
KnowledgeBase

Powered by advanced AI, it enables dialogue-based natural-language searches to quickly locate datasets, publications, code and in general all assets available through ENVRI-Hub.



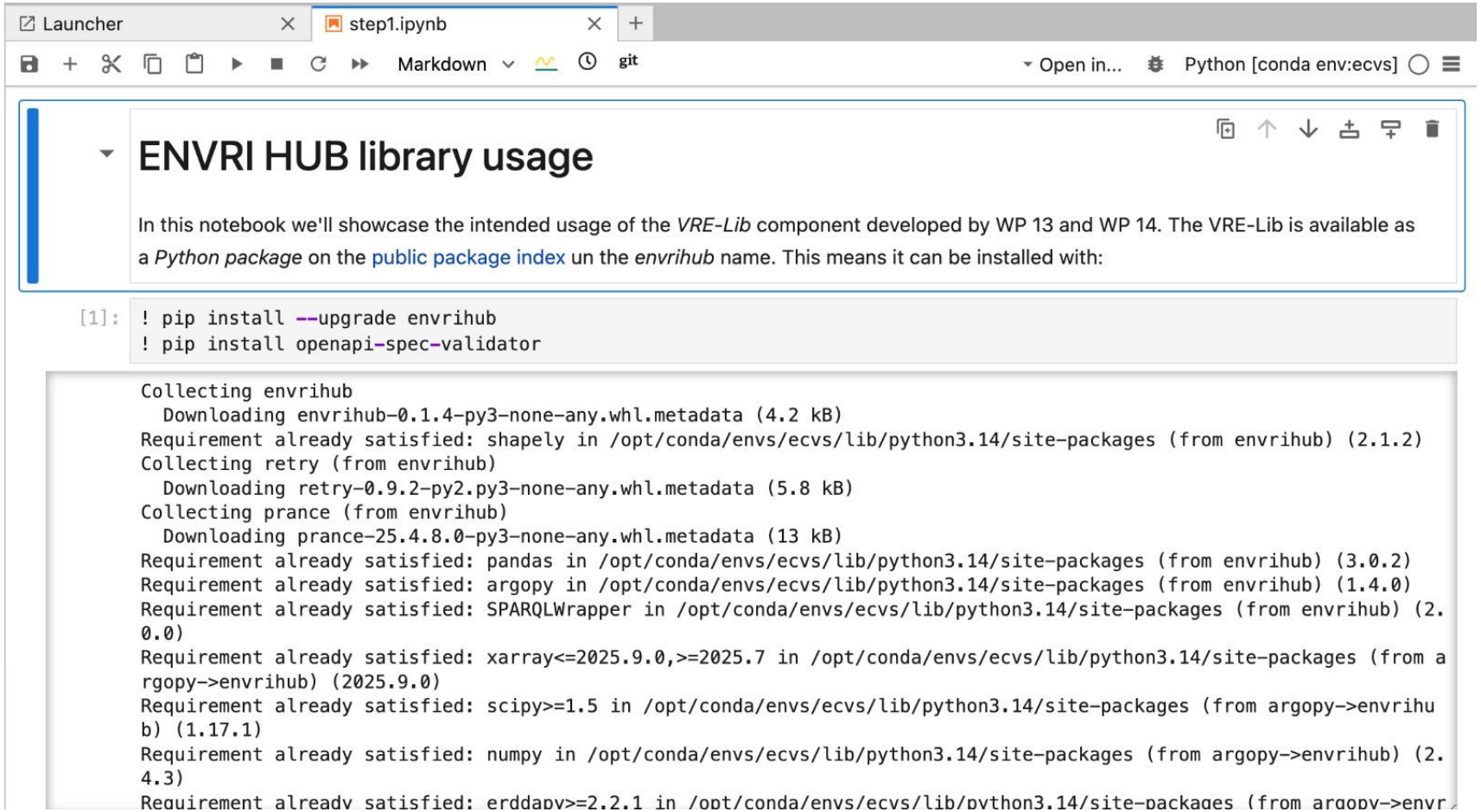
Catalogue of Services

It offers intuitive interfaces and API access libraries, streamlining the discovery of data and services across Europe's research infrastructures.



Analytical Framework

Supported by two harmonised Python libraries, allowing programmatic access to the Catalogue of Services and to the environmental research infrastructure's datasets.



Take-home message

- **ECVs define what to observe**
- **Metadata define how data are described**
- **Harmonisation enables:**
  - integration across formats and systems
  - machine-readable workflows
  - cross-domain science

→ Without harmonised metadata, ECV-based data remain fragmented

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Thank you!

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