



In situ

# ENHANCING ACCESS TO IN-SITU HYDROLOGY DATA FOR COPERNICUS

## Copernicus In-Situ Workshop

### 11&12 September 2024



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# Why this workshop?

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**WG on In Situ Observations**  
25-26 October 2023

## Proposal for an “Enhancing the access to hydrology data for Copernicus” workshop

Concept Note v1.0

### Background

In situ water-related observations such as river discharge, water level, water temperature, water quality and soil moisture are essential for the activities carried out by many Copernicus Entrusted Entities. For example, the Early Warning Component of the Copernicus Emergency Management Service uses real time river discharge (collected by the CEMS Hydrological Data Collection Centre HDCC<sup>1</sup>) for statistical post-processing of forecasts. Water level is also collected by the CEMSHDC although not yet used operationally. The Copernicus Land Monitoring Service (CLMS) publishes series of water-related products at global level such as Lake Surface Water Temperature, Lake Water Quality in various resolutions and Lake and River Water Level<sup>2</sup>, which would benefit from an increased access to water level and water quality data for production and validation. Likewise, CLM also requires in situ data for validation activities under the Water, Snow and Ice suite of products. Hydrology-related FRMs (Fiducial Reference Measurements) are necessary to support validistic activities of Sentinel 3 radar altimeter over inland water bodies<sup>3</sup>. Future developments in Copernicus, Climate Change, Marine and Land Monitoring Services may also require enhanced systematic access to this type of data. Furthermore, there is currently a real data need for Machine-Learning (ML) approaches and an opportunity to make more use of conventional and non-convention hydrological data than just with physics-based models, which may shape the future of data requirements for hydrological monitoring and forecasting.

Back in 2019, and recognizing its value across different services, the EEA prepared a report<sup>4</sup> that assessed the hydrological in situ data requirements of Copernicus services as well as its availability at European and global level. The report also highlighted a number of gaps and challenges in the provision of these data.

During the last Copernicus In Situ Observations Working Group meeting, held in October 2023 at EE facilities in Copenhagen (Denmark), representatives from the Entrusted Entities showed interest in discussing together how to improve access to hydrological in situ data, particularly in the so-called “data sparse areas”. This opportunity could also be used to exchange more detailed information about the Entrusted Entities’ requirements, existing licensing agreements and relevant projects in order to find synergies and areas for collaboration.

<sup>1</sup> <https://www.dtu.ac.uk/en/ris/ris-research/ris-report-2022-cems-hydrological-data-collection-centre>  
<sup>2</sup> <https://land.copernicus.eu/produkte/water-bodies>  
<sup>3</sup> <https://sentinel3.eea.europa.eu/en/sentinel3/>  
<sup>4</sup> <https://land.copernicus.eu/produkte/water-bodies/2019-07-24-Hydrological-data-availability-report-1.0.pdf>  
<sup>5</sup> <https://land.copernicus.eu/produkte/water-bodies/2019-07-24-Hydrological-data-availability-report-1.0.pdf>

Therefore, this workshop is organized within the context of the activities of the Cross-Cutting Coordination of Copernicus’ access to in situ data led by the EEA with the support of the COINS consortium (led by EUMETNET). The objectives are to discuss existing and future requirements, and to identify relevant gaps and challenges related to the Copernicus Entrusted Entities’ access to hydrological in situ data at European and global levels. The workshop should identify a series of action points including opportunities for collaboration and inter-service data sharing, including the outline of a potential task to be performed in the context of the EEA cross-cutting coordination activities beyond 2024.

### Scope

The workshop “Enhancing the access to hydrology data for Copernicus” shall bring together experts from the Copernicus Entrusted Entities and other relevant parties with an interest in improving the access to relevant hydrological in situ data for their products and services. The primary objective of the workshop is to build a **shared understanding of the different requirements** and help develop **ideas to collaborate and create synergies** across the activities carried out by the different Entities. The workshop should conclude with action points for future joint activities including the definition of a potential **cross-cutting task within the Copernicus in situ component** led by EEA to address some of the gaps and challenges identified by the Entrusted Entities. As a result of the workshop, the Entrusted Entities may also agree on developing a **white paper** summarizing the main outcomes of the discussions and follow-up actions.

### Agenda

The workshop would be organized by EEA with the support of its COINS Consortium and held **online** over **two half-days** (e.g. morning and/or afternoon sessions). Ideally, they should be consecutive and should take place sometime in Q3 2024 (see poll: <https://docs.google.com/forms/d/1M5Gwz7a1a>)

The workshop could be moderated by the EEA alone or in collaboration with Entrusted Entities. The agenda will comprise **four main sessions**, two each day, separated by a break of 15 minutes:

<b>First day:</b> <b>Introduction,</b> <b>requirements,</b> <b>and challenges</b>	<b>gaps</b>	<b>1<sup>st</sup> session (approx. 2h)</b> • <b>Welcome by EEA and Tour de Table:</b> who’s who and their role within Copernicus Services
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**Concept Note**  
Spring 2024



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# Main objectives of the workshop

- Build a **shared understanding** of Copernicus in-situ requirements for hydrological observations
- Develop ideas to **collaborate and create synergies** across different Copernicus Entrusted Entities
- Propose **joint activities** as part of the coordination activities of the Copernicus In-Situ Component

A **white paper** to be created as a result of this workshop



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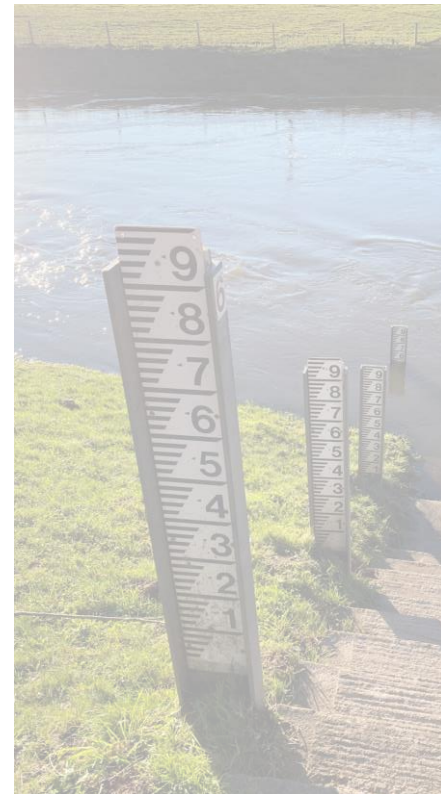
# Agenda

**1<sup>st</sup> day (11 September 9:30-12:30 CEST)**

**Introduction, requirements, gaps and challenges**

**2<sup>nd</sup> day (12 September 9:30-12:30 CEST)**

**Opportunities to address gaps and challenges**





# First day – 11 September

## In situ

### Introduction, requirements, gaps and challenges

Time	Topic	Presenter(s)
9:30 – 9:45	<b>Welcome by EEA and Tour de Table:</b> who's who and their role within Copernicus Services  <b>Introduction to the workshop:</b> background and goals, i.e. what do we want to achieve?	Jose Miguel Rubio (EEA)
9:45 – 10:00	<b>Overview of activities carried out by EEA – Copernicus In Situ Component (COINS):</b> summary of activities carried out by the EEA in its role of coordinator of the Copernicus In Situ Component	Nick Everard, Nathan Rickards (UK CEH, COINS)
10:00 – 10:45	<b>Overview of current and future requirements for in situ hydrological data by the Entrusted Entities (I),</b> including current gaps, challenges and their plans to address them including Q&A.	Entrusted Entities' representatives (ECMWF, JRC – CEMS, FRONTEX)
10:45 – 11:00	<i>Comfort Break</i>	
11:00 – 11:50	<b>Overview of current and future requirements for in situ hydrological data by the Entrusted Entities (II),</b> including current gaps, challenges and their plans to address them including Q&A	Entrusted Entities' representatives (Mol, JRC – CLMS, ESA, SATCEN)
11:50 – 12:10	<b>Water-ForCE roadmap for the water component in Copernicus:</b> presentation of the roadmap with focus on the in situ recommendations regarding access to water-related in situ data.	Carmen Cillero (3edata, Water-ForCE)
12:10 – 12:25	<b>WMO related activities regarding access to hydrology data</b>	Washington Otieno (WMO)
12:25 – 12:30	<b>Wrap-up of the first day</b>	Jose Miguel Rubio Iglesias (EEA)







# Second day – 12 September

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## Opportunities to address gaps and challenges

Time	Topic	Presenter(s)
9:30 – 9:40	<b>Welcome by EEA and objectives of the day</b>	Jose Miguel Rubio (EEA)
9:40 – 10:45	<b>Current opportunities:</b> Initiatives, activities and projects facilitating access to hydrological data: <ul style="list-style-type: none"><li>▪ Global Runoff Data Centre (<i>Simon Mischel</i>)</li><li>▪ Trans-African Hydro-Meteorological Observatory (TAHMO) &amp; TEMBO-AFRICA (<i>Frank Annor</i>)</li><li>▪ vorteX-io (<i>Jean-Christophe Poisson</i>)</li><li>▪ UK Centre for Ecology &amp; Hydrology (<i>Catherine Sefton</i>)</li></ul>	Session moderated by Jose Miguel Rubio (EEA)
10:45 – 11:00	<i>Comfort Break</i>	
11:00 – 12:20	<b>Discussion and way forward</b>	ALL
12:20 – 12:30	<b>Wrap-up and next steps</b>	Jose Miguel Rubio Iglesias (EEA), ALL





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# Tour de Table – who are we?



- Copernicus Entrusted Entities representatives and experts
- Copernicus In-Situ component coordination and in-situ experts
- External speakers



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# INTRODUCTION

## Copernicus In-Situ and COINS activities



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# Why in-situ data?

In Situ data is used both for **production** and **validation** in Copernicus Services, as well as being provided to users as **observations**.

Satellite sensors need to be **calibrated**, and their data products **validated**, using independent in situ data sources.

**Without in situ data, Copernicus simply cannot deliver its data, products and services.**



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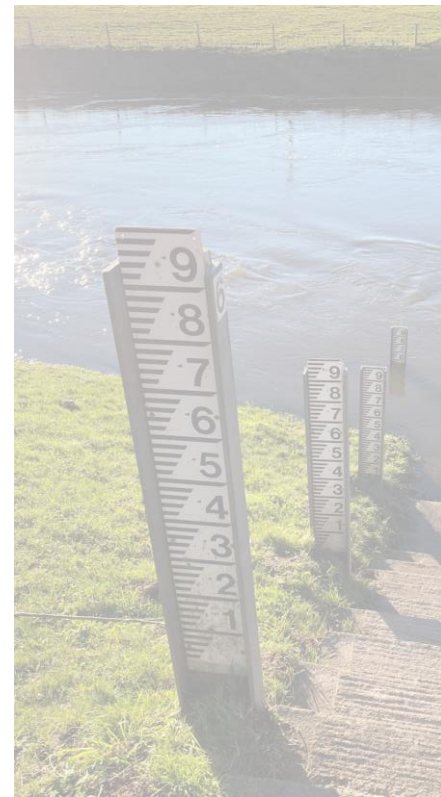


# In-situ water-related observations

## In situ

- Essential for several current Copernicus activities, e.g.:
  - Copernicus Emergency Service – Early Warning
  - Copernicus Land Monitoring Service – Global
  - Sentinel 3 Cal/Val
- Future developments in Copernicus will trigger an increased demand for this data
  - New products, new missions
  - Increased use of ML/AI
- Use of non-conventional hydrological data
  - UAVs, Citizen Science, etc.

**As with most in-situ data in Copernicus, hydrological monitoring is not generally designed for its use in EO products, so it is often not fit-for-purpose!**



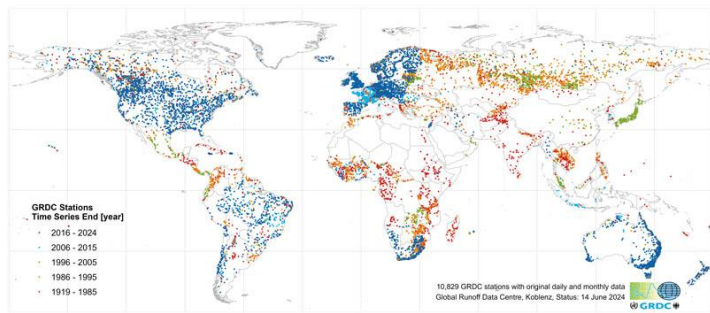


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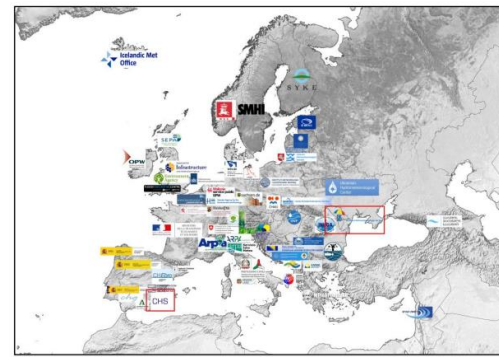
# Where does the in-situ data come from?

**Hydrological observations** come from a myriad of data providers and networks at national, regional and global level, e.g.:

- National Meteorological and Hydrological Agencies
- River Basin Authorities
- Environmental Protection Agencies and similar institutions
- International organisations, global data centres
- Research initiatives and projects



Global Runoff Data Centre stations with original and monthly data (14 June 2024)



HDCC database European data providers and updates in 2022 (CEMS EFAS)



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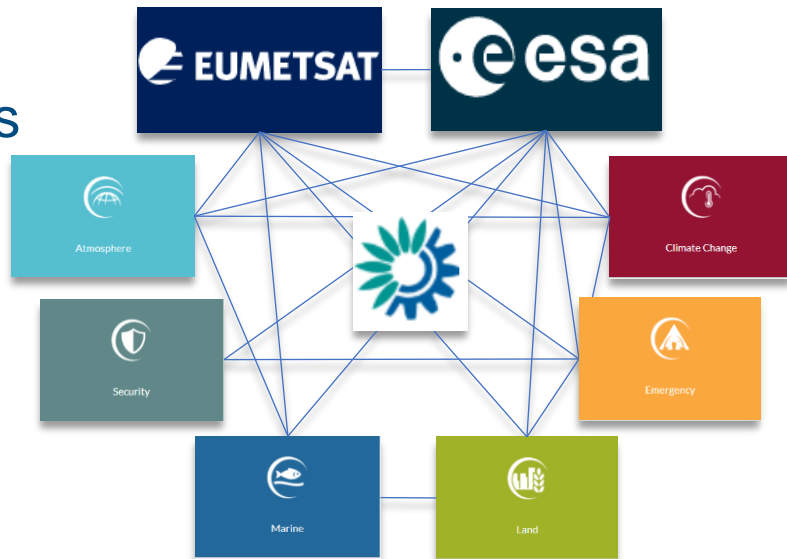


# Copernicus In-Situ Component - Coordination

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Entrusted Entities access and manage in situ data directly according to their operational needs on a day-to-day basis.

The EEA intervenes when a coordinated approach to accessing in situ data is required at a programmatic level: “cross-cutting activities”



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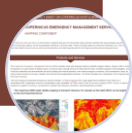


# Cross-cutting coordination activities (2021-2027)

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- State of Play report
- CIS2
- Factsheets

STATE OF  
PLAY



- CORDA
- Access to specific in situ data

DATA  
ACCESS



- Licensing agreements
- Use cases
- Country reports

ENGAGING  
WITH DATA  
PROVIDERS



- In Situ Working groups
- Reports, inventories
- GEO, R&D

SUPPORT  
AND ADVICE



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# State of Play 2024: key issues encountered

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Access conditions  
and use  
restrictions



Insufficient spatial  
coverage



Uncertain  
sustainability of  
critical networks



Fragmentation  
and heterogeneity



Lack of alignment  
with data providers



Insufficient  
acknowledgement



Not long enough  
historical high time  
series



More data needed  
on specific areas



Increasing  
demands in  
frequency and  
resolution



Rapid  
accessibility



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# Hydrology in-situ requirements in CIS<sup>2</sup>

## Capturing data requirements: the CIS<sup>2</sup> database












- Overview of Copernicus in situ data requirements and how these are met
- 15 requirements for in-situ hydrological data identified in CIS<sup>2</sup>
- 36 products identified, mostly in CEMS (Early Warning) and CLMS (Global)
- 32 datasets identified from 73 data providers
- Restrictions are still applicable for many datasets

<https://cis2.eea.europa.eu/>

Requirement group	Product name
Hydrology	EDO Low-Flow Index
	EDO Soil Moisture Anomaly
	EDO Standardized Snowpack Index
	EFAS Notification – EFAS ERCC Overview
	EFAS Notifications – EFAS Flash Flood Notification
	EFAS Notifications – EFAS Formal Flood Notification
	EFAS Notifications – EFAS Informal Flood Notification
	EFAS Seasonal outlook - Overview Map
	ERIC Affected Area
	ERIC Reporting points
	ERICIA Daily precipitation maps
	ERICIA Flash flood hazard maps
	ERICIA Hourly precipitation maps
	European wide, observation-based flood monitoring
	Flood forecasts - Flood Probability < 48h
	Flood forecasts - Flood Probability > 48h
	Flood forecasts - Reporting Points
	Flood forecasts - Threshold level exceedances
	GloFAS Flood Summary
	GloFAS forecast skill product
	GloFAS Rapid Flood Mapping and Rapid Impact Assessment
	GloFAS Reporting Points

National Data Providers
Data Provider Networks
All Data Providers

hydrology

Country	Name	Website	Type	Requirement groups
 Austria	Technical University (TU) of Vienna	<a href="https://www.tuwien.at/austria/">https://www.tuwien.at/austria/</a>	Institutional	Hydrology
 Austria	Federal Ministry of Agriculture, Forestry, Environment and Water Management - Bundesministerium für Landwirtschaft, Regionen und Tourismus	<a href="https://www.bmlft.gv.at/">https://www.bmlft.gv.at/</a>	Public	Meteorology, Hydrology
 Austria	Central Institute for Meteorology and Geodynamics Zentralanstalt für Meteorologie und Geodynamik	<a href="https://www.zamg.ac.at/">https://www.zamg.ac.at/</a>	Institutional	Meteorology, Hydrology, Cryosphere, Terrestrial
 Bulgaria	National Institute of Meteorology and Hydrology - Bulgaria	<a href="http://www.meteo.bg/en">http://www.meteo.bg/en</a>	Public	Meteorology, Hydrology
 Bulgaria	National Institute of Meteorology and Hydrology Bulgarian Academy of Sciences		Research	Ocean
 Czech Republic	Czech Hydrometeorological Institute		Institutional	Meteorology, Hydrology
 Czech Republic	Academy of Sciences of the Czech Republic Institute of Rock Structure and Mechanics Department of Geofactors	<a href="http://www.geomech.iirm.cas.cz">http://www.geomech.iirm.cas.cz</a>	Research	Other, Hydrology
 Estonia	Estonian Meteorological and Hydrological Institute	<a href="http://www.imeteo.ee/en/">http://www.imeteo.ee/en/</a>	Public	Meteorology, Hydrology
 Finland	Finnish Environment Institute	<a href="https://www.miljo.fi/en-US">https://www.miljo.fi/en-US</a>	Public	Meteorology, Hydrology, Ocean
 Finland	Finnish Meteorological Institute (FMI)	<a href="https://en.fmi.fi/interactio/4/4/home">https://en.fmi.fi/interactio/4/4/home</a>	Public	Cryosphere, Ocean, Meteorology, Hydrology
 France	Météo-France	<a href="http://www.meteo.fr">http://www.meteo.fr</a>	Public	Meteorology, Hydrology

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# Reports on water-related observations

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### Lake Water Quality In-Situ Data Requirements and Availability | Copernicus In Situ

Inherent Optical Properties required for development of satellite EO water quality products 3. ... Water quality data required for calibration/validation (cal/val) of satellite EO water quality products 4. ... Citizen science data that has the potential to support cal/val of satellite EO water quality products ...

21 Dec 2021 Topics: Various other issues

Source: In Situ / resources / reports-folder / lake-wat ...

### Review of global in situ data for lakes and reservoirs | Copernicus In Situ

Lakes and reservoirs are vital components of global water resources. ... Yet, there is persistent lack of comprehensive data on their water storage over time due to limited access to in situ measurements ... This data is essential for accurate modelling of hydrological systems, simulation of current operations, and forecasting future water demand and use ...

31 Mar 2023 Topics: Various other issues

Source: In Situ / resources / reports-folder / review-o ...

### Hydrological In Situ Data Requirements and Data Availability | Copernicus In Situ

The requirements for in situ data for validation of satellite-based data products relating to water / hydrology currently produced across the Copernicus services were identified, largely in discussion ...

5 Dec 2019 Topics: Various other issues

Source: In Situ / resources / reports-folder / hydrolog ...

### Global Hydrological In Situ Data Review | Copernicus In Situ

This report summarises these activities carried out by COINS in 2020-2021, with specific focus on water quantity data, in particular river levels and river flows ... This report complements a separate, more detailed, report on lake water quality data (Carvalho et al. 2021) ...

21 Dec 2021 Topics: Various other issues

Source: In Situ / resources / reports-folder / global-h ...

### An end-to-end procedure for creating a 'new' hydrography layer | Copernicus In Situ

Firstly, the open datasets/OpenStreetMap and Global Surface Water were collected, analysed and then integrated with each other. ... The potential stream networks were delineated from the DEM and the presence of water was detected from the analysis of a stack of Sentinel-2 images ...

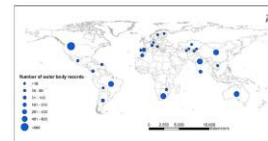
8 Nov 2021 Topics: Various other issues

Source: In Situ / resources / reports-folder / an-end-t ...

### Improving access to sub-daily rain gauge data | Copernicus In Situ

The number of rain gauge stations reported by EUMETNET members, providing sub-daily or daily

### Review of global in situ data for lakes and reservoirs



Version: 1.0  
Date: 31/03/2023

This report has been produced under the Framework Service Contract EEA/RS/20/001 Lot 1 for Services supporting the European Commission's (EC) cross-cutting coordination of the Copernicus programme's in-situ data activities - Observational data

EAAD/RS/20/001 Lot 1  
Lake Water Quality  
Issue: 1.1  
Date: 27 December 2021

Framework Service Contract EEA/RS/20/001 Lot 1 for Services supporting the European Commission's (EC) cross-cutting coordination of the Copernicus programme's in-situ data activities - Observational data

### Lake Water Quality In-Situ Data Requirements and Availability

Date: 21/12/2021

BROCKMANN CONSULT

UK Centre for Ecology & Hydrology

EAAD/RS/20/001 Lot 1  
Improving Access to Sub-daily Rain Gauge Data  
Issue: 1.1  
Date: 27 December 2021

Framework Service Contract EEA/RS/20/001 Lot 1 for Services supporting the European Commission's (EC) cross-cutting coordination of the Copernicus programme's in-situ data activities - Observational data

Improving Access to Sub-daily Rain Gauge Data  
Gerard van der Schrier, Aart Overeem, Giel Verrier

Issue: version 2  
Date: May 7, 2023

EuroGOOS  
EUMETNET  
NEMO

<https://insitu.copernicus.eu/library/reports>



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# Some conclusions from previous in-situ reports

- Actions to be pursued in the context of monitoring, data standardization and exchange & data collation and coordination
- Improve access to RT information, especially outside Europe/North America
- CEMS EFAS HDCC an effective system which has a big potential for other services
- Promotion of use of standard web interfaces to share data (especially outside of Europe/NA)
- More info needed on river and lake level, water quality and soil moisture in-situ measurements
- Shape a long-term vision for supporting satellite product development and validation



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# Observations: support by COINS Consortium

The **COINS Consortium** is led by three organisations:

**EUMETNET**, a grouping of 33 European National Meteorological Services <https://www.eumetnet.eu/>



**NILU**, the Climate and Environmental Research Institute NILU: a research institute with expertise in atmospheric composition, climate change, air quality, environmental toxicology, health effects, sustainable systems, circular economy, and digitalisation <https://www.nilu.com/>



**EuroGOOS**, the European Global Ocean Observing System: 46 members comprising the European component of the Global Ocean Observing System <https://eurogoos.eu/>



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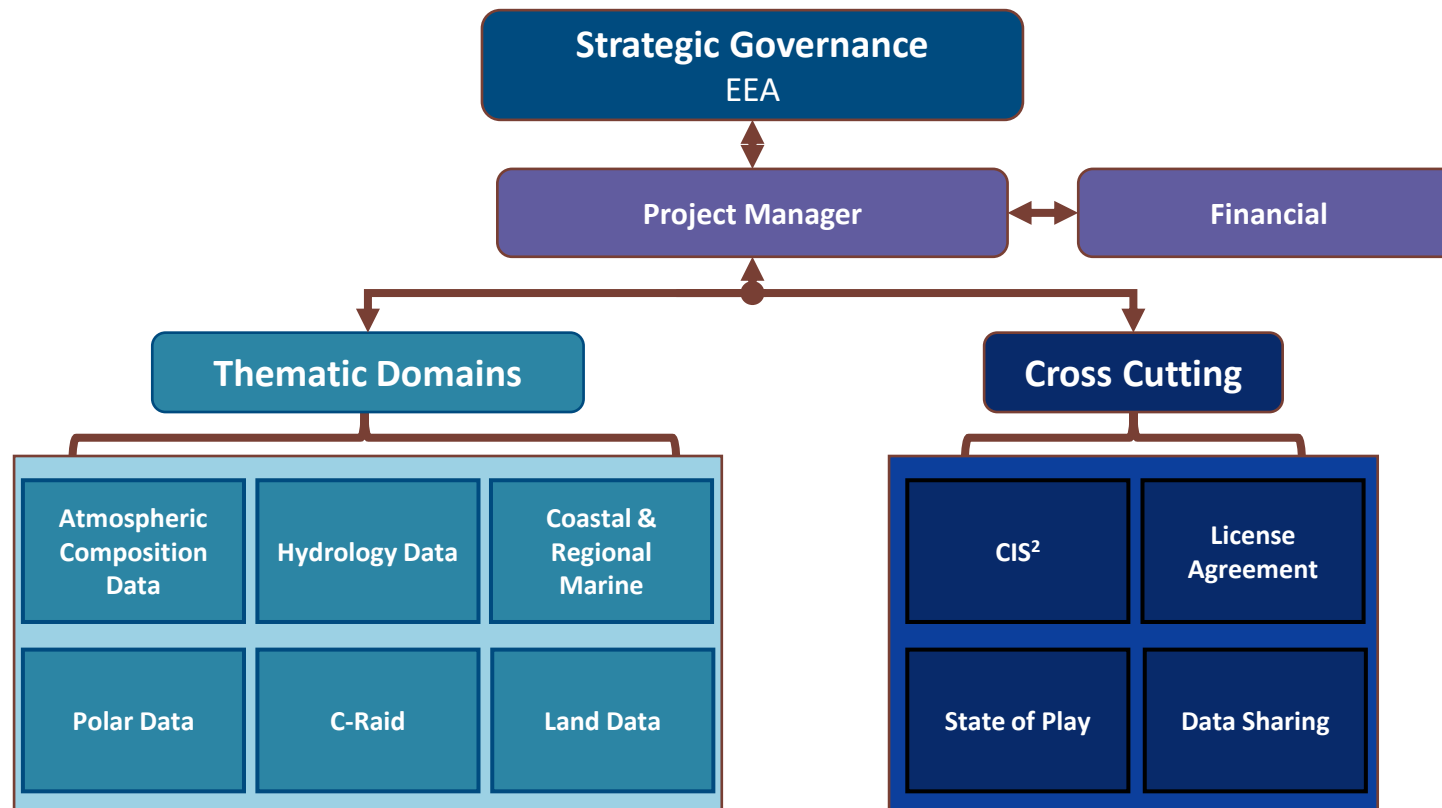


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# COINS Consortium (2020 – 2024)

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# Lets come back at 11:10



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# Water-ForCE roadmap for Copernicus' water component



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# WMO related activities



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# ENHANCING ACCESS TO IN-SITU HYDROLOGY DATA FOR COPERNICUS

## Copernicus In-Situ Workshop

### 11&12 September 2024



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# Welcome to the 2<sup>nd</sup> Day

**Opportunities for  
collaboration to address  
gaps and challenges**



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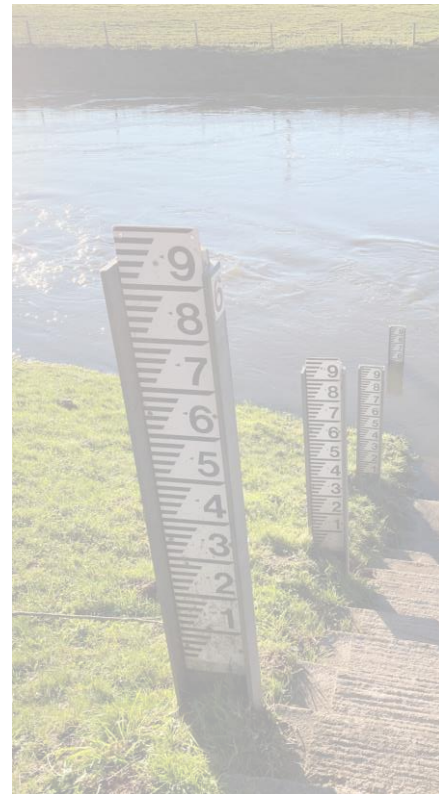


# Second day – 12 September

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## Opportunities to address gaps and challenges

Time	Topic	Presenter(s)
9:30 – 9:40	<b>Welcome by EEA and objectives of the day</b>	Jose Miguel Rubio (EEA)
9:40 – 10:45	<b>Current opportunities:</b> Initiatives, activities and projects facilitating access to hydrological data: <ul style="list-style-type: none"><li>▪ Global Runoff Data Centre (<i>Simon Mischel</i>)</li><li>▪ Trans-African Hydro-Meteorological Observatory (TAHMO) &amp; TEMBO-AFRICA (<i>Frank Annor</i>)</li><li>▪ vorteX-io (<i>Jean-Christophe Poisson</i>)</li><li>▪ UK Centre for Ecology &amp; Hydrology (<i>Catherine Sefton</i>)</li></ul>	Session moderated by Jose Miguel Rubio (EEA)
10:45 – 11:00	<i>Comfort Break</i>	
11:00 – 12:20	<b>Discussion and way forward</b>	ALL
12:20 – 12:30	<b>Wrap-up and next steps</b>	Jose Miguel Rubio Iglesias (EEA), ALL



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# Initiatives and projects facilitating access to in-situ hydrology data



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**Lets come back  
at 11:15**



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# Discussion and way forward



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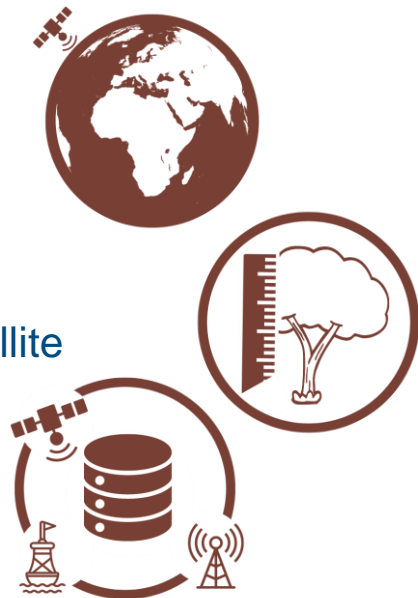
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# Evolution of Copernicus In-Situ

- Expanding **product portfolio** and growing user demands
  - Higher resolution, longer time series, better spatial/time coverage, improved timeliness (NRT), use of AI/ML
- Growing and evolving **space component**
  - Additional requirements for high accurate in-situ data for satellite Cal/Val (including Fiducial Reference Measurements)
- Complex **in-situ data provider** landscape
  - Need alignment with Copernicus requirements
- **EO Strategic Research and Innovation Agenda**
  - Demands for new products and services



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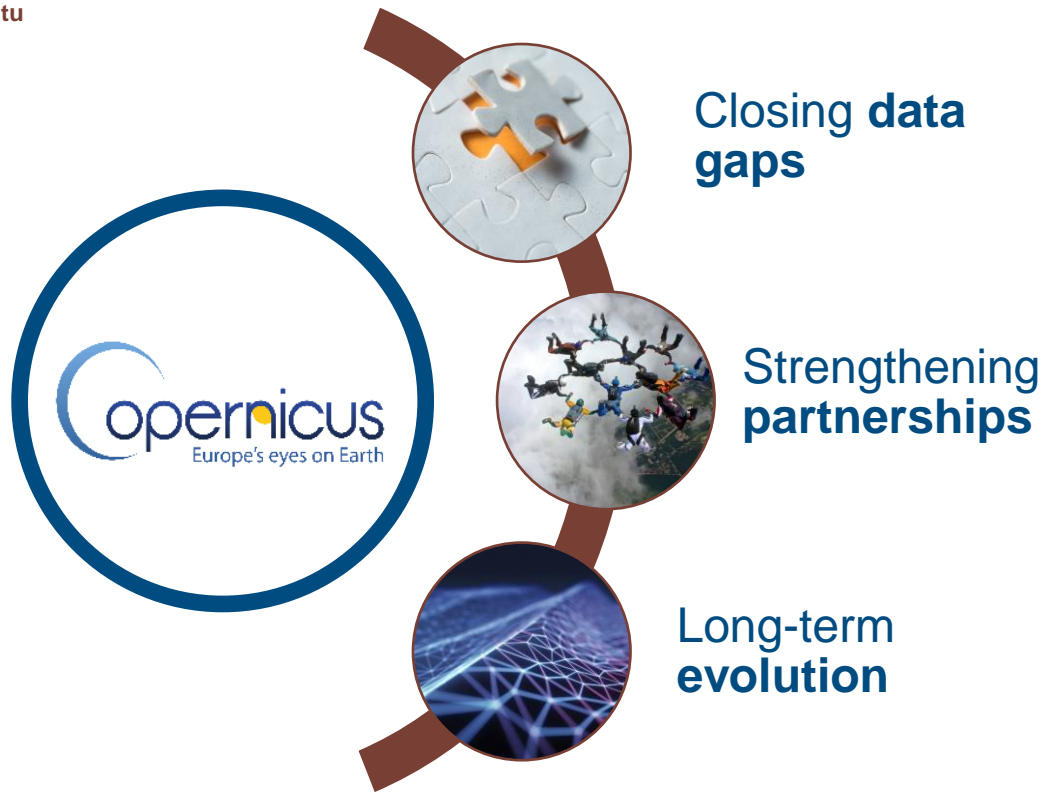


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# Evolution of Copernicus In-Situ

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EEA foresees three priorities for cross-cutting work – that includes **hydrological observations**



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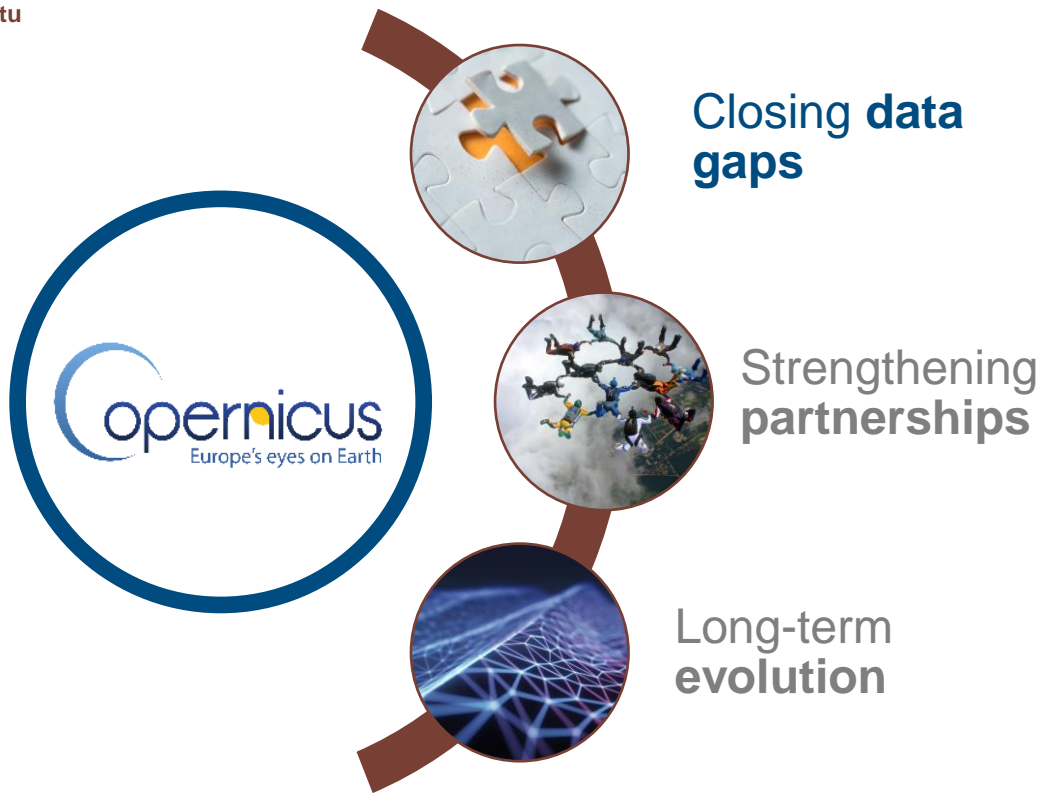
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# Evolution of Copernicus In-Situ - Hydrology

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- ✓ Data sparse regions
- ✓ Follow up implementation of Open Data Directive/HVD
- ✓ Access to historical/NRT data
- ✓ Alternative data sources and new actors



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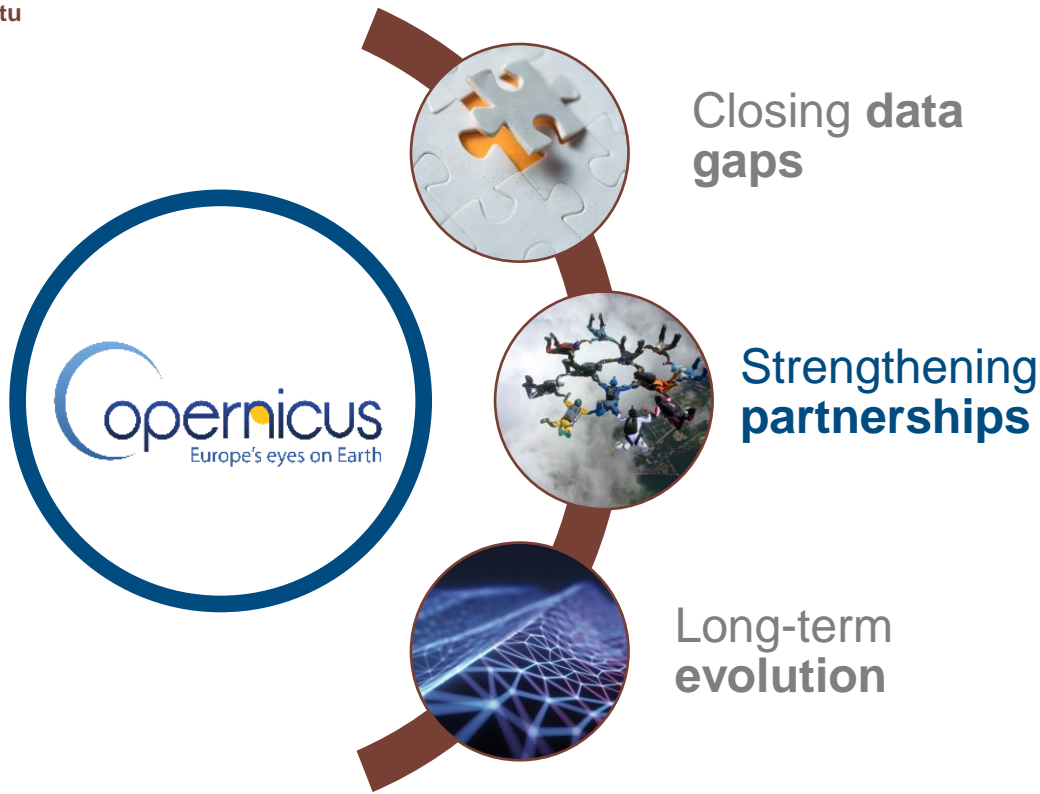


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# Evolution of Copernicus In-Situ - Hydrology

In situ



- ✓ Data sparse regions
- ✓ Follow up implementation of Open Data Directive/HVD
- ✓ Access to historical/NRT data
- ✓ Alternative data sources and new actors
- ✓ **Strengthen collaboration with networks**
- ✓ **International arrangements with relevant countries**
- ✓ **Collaborate with UN initiatives**



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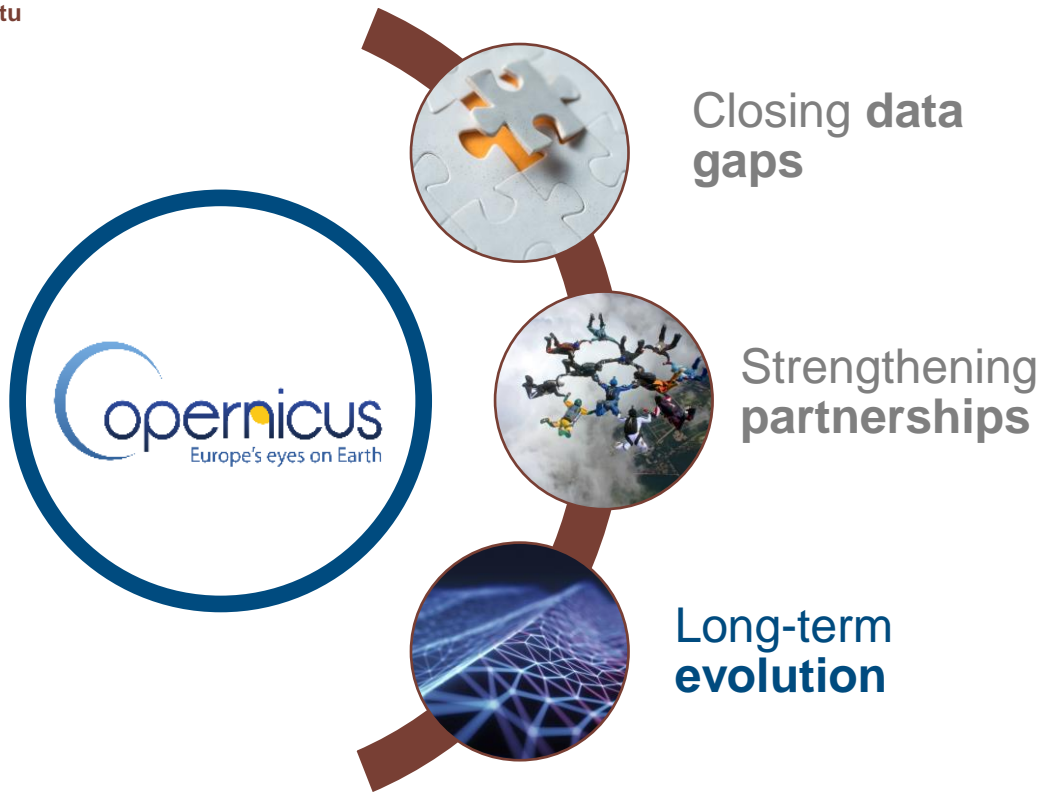


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# Evolution of Copernicus In-Situ - Hydrology

In situ



- ✓ Data sparse regions
- ✓ Follow up implementation of Open Data Directive/HVD
- ✓ Access to historical/NRT data
- ✓ Alternative data sources and new actors
- ✓ Strengthen collaboration with networks
- ✓ International arrangements with relevant countries
- ✓ Collaborate with UN initiatives
- ✓ **In-situ needs of relevant Next Generation/Expansion missions**
- ✓ **Research to operations**



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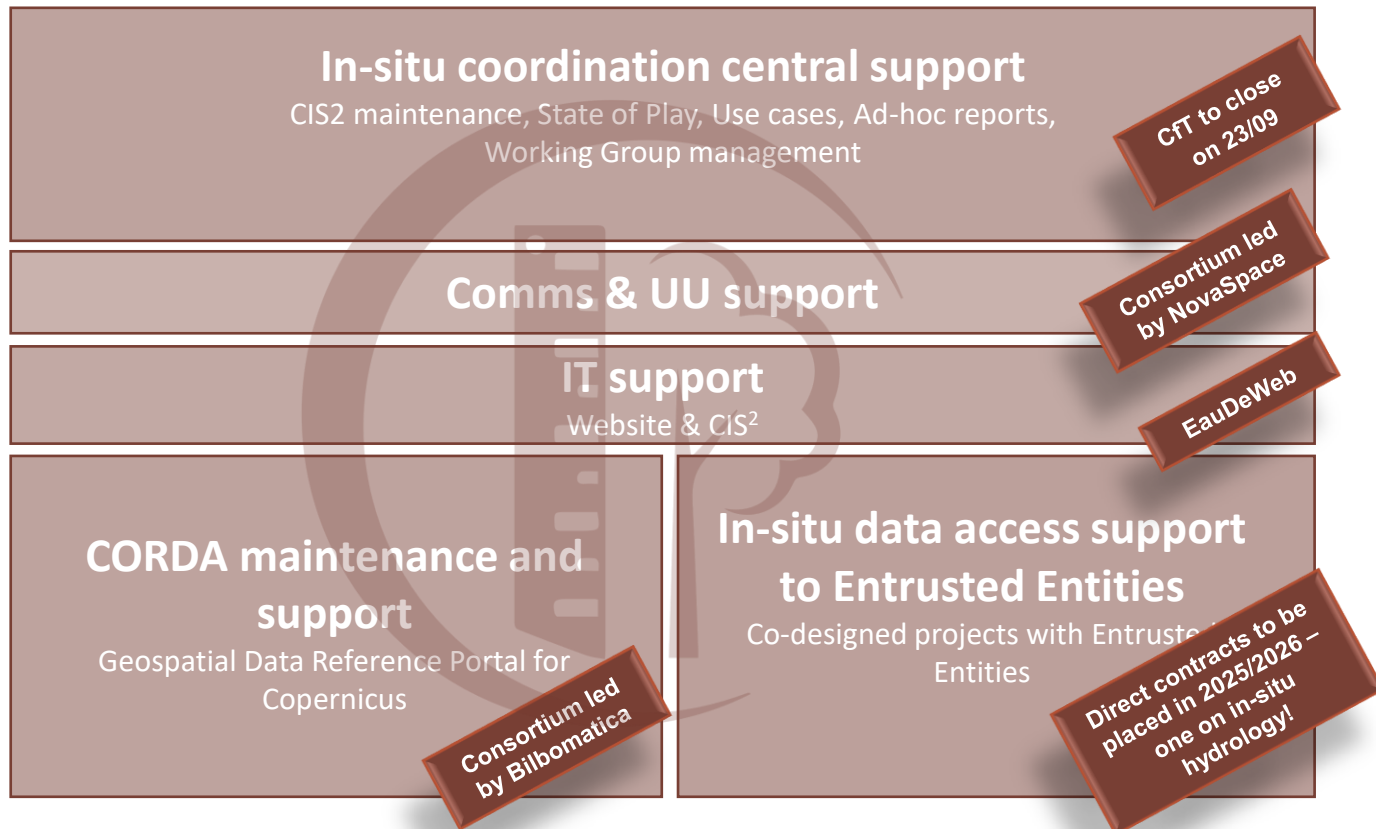


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# Evolution of In-Situ support at EEA



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# Ideas for discussion



- **Data standards and accessibility**  
What can we do to improve the situation within the Copernicus context? How?
- **Near-Real-Time (NRT) data**  
Should we focus on expanding the availability of NRT data through a common effort?
- **Synergies across our activities**  
How can better exploit potential synergies across our activities? Should we meet on a regular basis?
- **Cross-cutting coordination activities**  
Should we plan a joint data access project/activity as part of EEA's coordination activities to advance on these topics?



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# Next steps

- Consolidation of inputs into a draft report **by early October**
- Comments to the draft **around mid-October**
- Final version published **by end October**
- Follow-up discussions during **Q4 2024 & Q1 2025**
  - Working Group on In-Situ expected to take place around Jan/Feb 25
- Consolidated proposal for joint activity **by Q2 2025**



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**MANY THANKS FOR YOUR  
CONTRIBUTIONS!!!!**



**[insitu.copernicus.eu](https://insitu.copernicus.eu)**  
**[copernicus.insitu@eea.europa.eu](mailto:copernicus.insitu@eea.europa.eu)**

