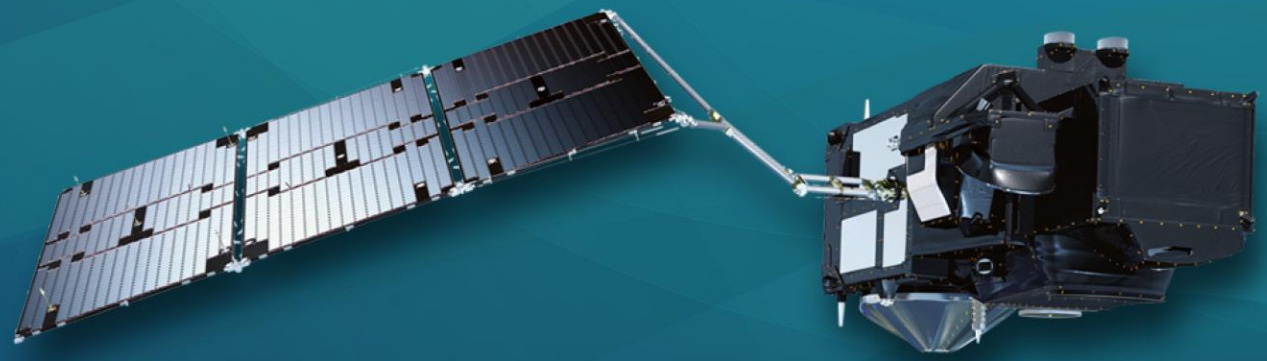
PROGRAMME OF THE EUROPEAN UNION

opernicus Europe's eyes on Earth

EUMETSAT

co-funded with esa



9th Sentinel-3 Validation Team meeting 2026

30 March–01 April 2026 | ESA–ESRIN | Frascati (Rome), Italy

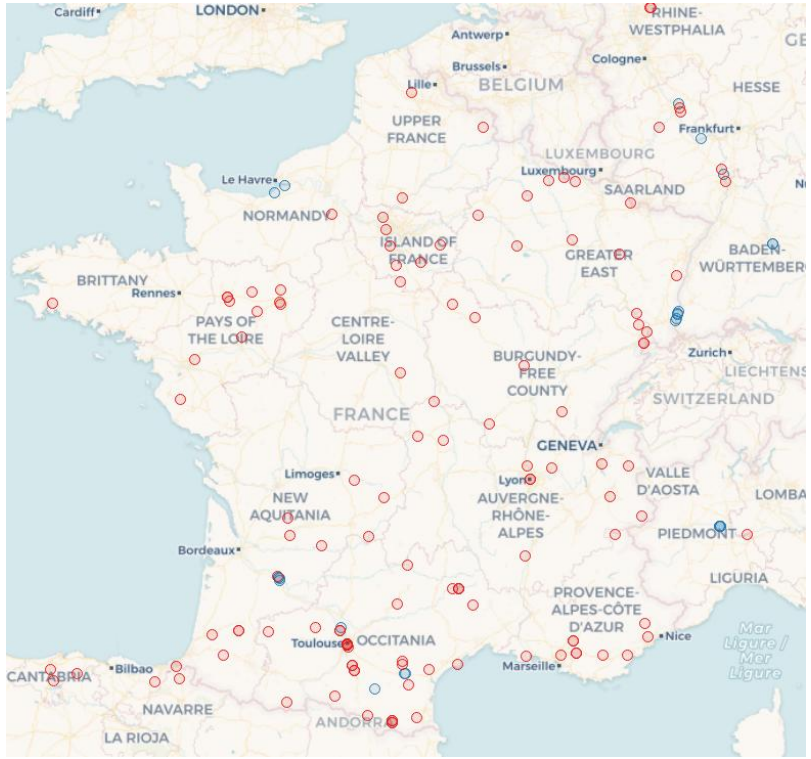
Centralizing in-situ Hydrological measurements for satellite altimetry validation: the INSIGHT platform

esa

NOVELTIS VORTEX-IO

V.Fouqueau[1], J.Hahn[1], P.Gil[1], M.Dechamps-Guillaume[1], E.Le Merle[2], V.Boulenger[2], F.Catapano[3], M.Restano[3]
1 vorteX-io, 2 NOVELTIS, 3 ESA-ESRIN

General presentation



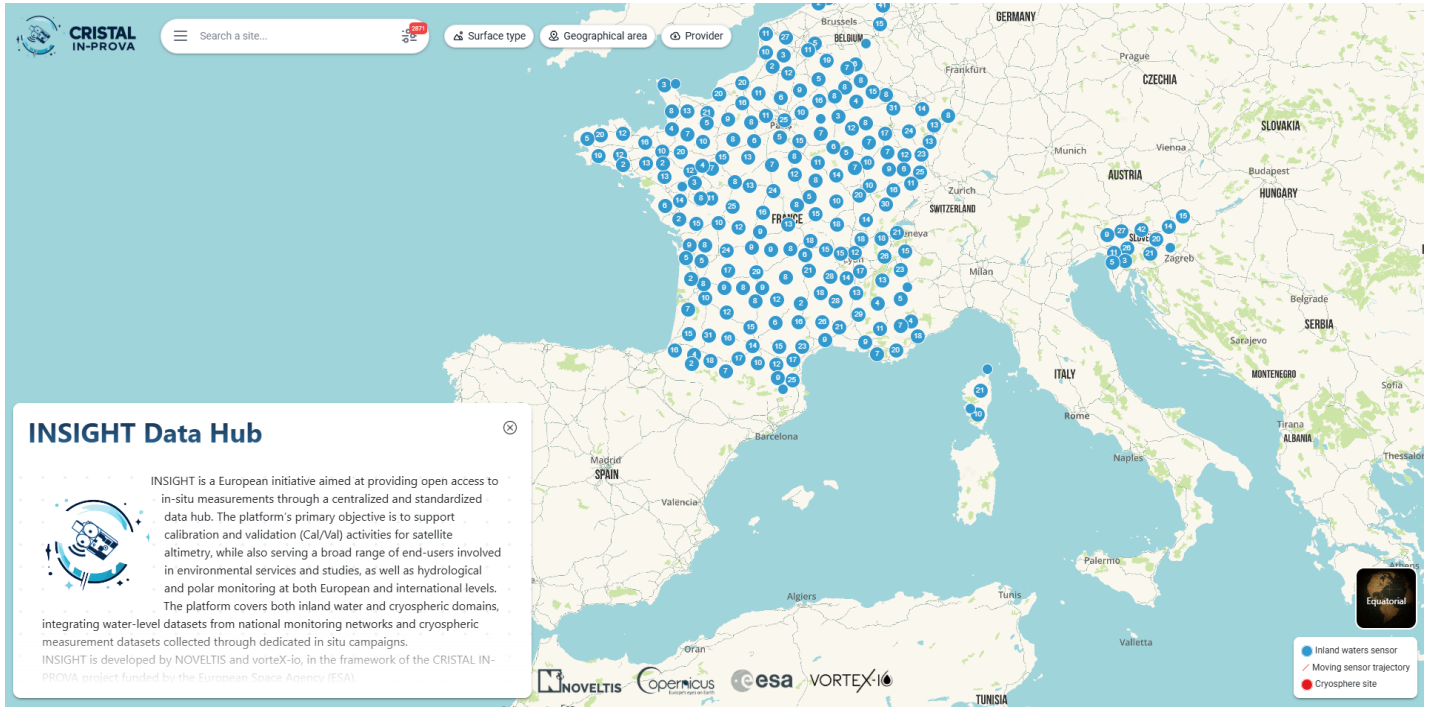
Opportunity sites in France from St3TART-FO project

A need for a standardized in-situ validation dataset

- For Calibration and Validation activities (Cal/Val), the work to **collect, uniformize in-situ validation dataset** is long and repetitive
- Part of this work **has been conducted in St3TART-FO project** for the 3 surfaces (Inland Waters, Sea Ice and land Ice)
- **St3TART-FO opportunity validation dataset is not directly generalizable** for other altimetry mission
- Future missions as **CRISTAL**, will require a similar dataset with a **different spatial and temporal coverage**
- The Cal/Val altimetry community can benefit from the availability of a **global and standardized validation dataset**

INSIGHT is a European initiative

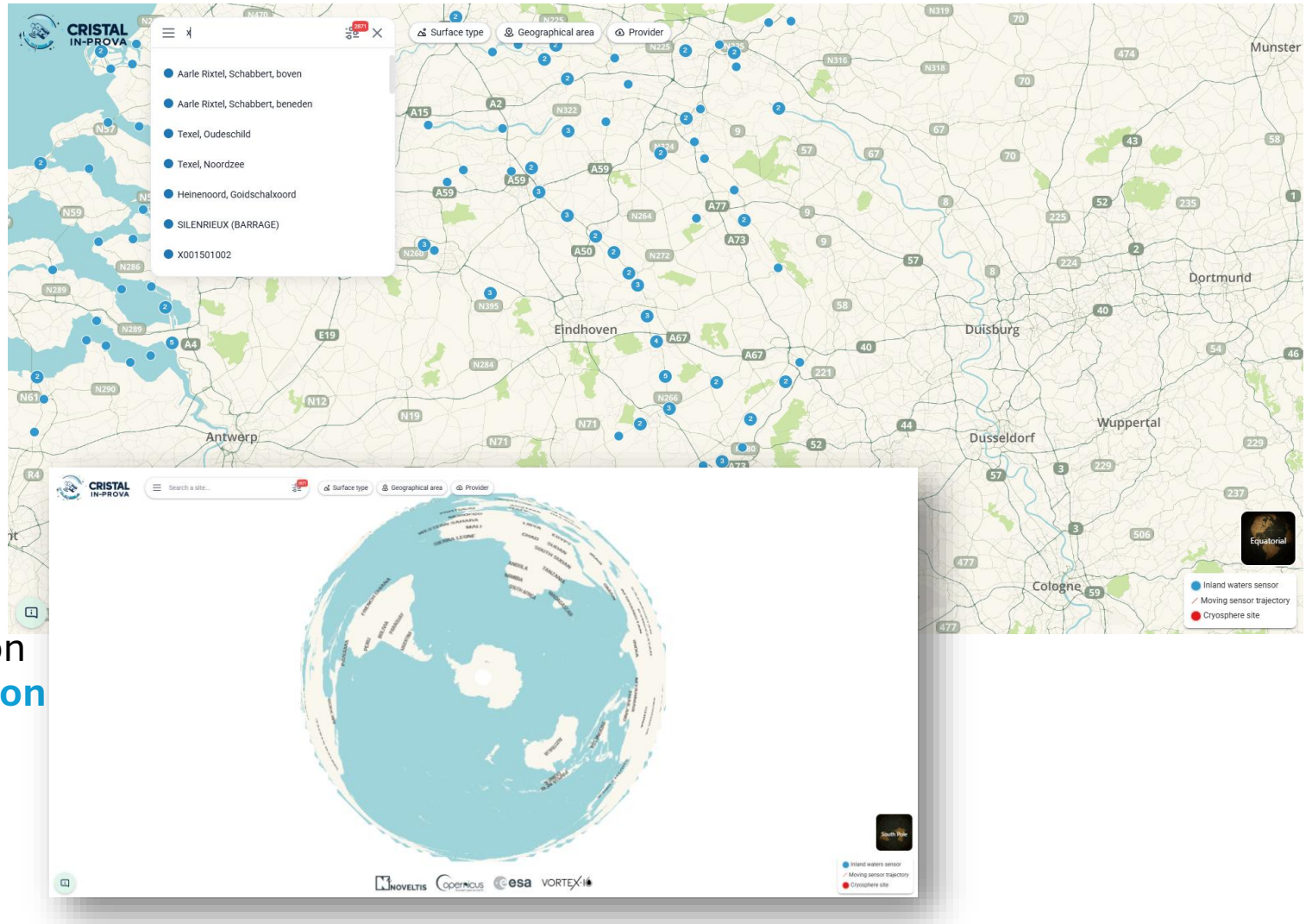
- Developed in the framework of the **CRISTAL IN-PROVA** project funded by **ESA**.
- Aim at providing open access to **in-situ measurements** through a centralized and standardized data hub.
- Support **calibration and validation** (Cal/Val) activities for **satellite altimetry**.
- Serving a broad range of end-users involved in **environmental services**, **hydrological**, and **polar** monitoring at both European and international levels.



General presentation

INSIGHT is a European initiative

- The platform covers both **inland water** and **cryospheric** domains
  - Water-level datasets from national monitoring networks
  - Cryospheric measurement datasets collected through dedicated in-situ campaigns

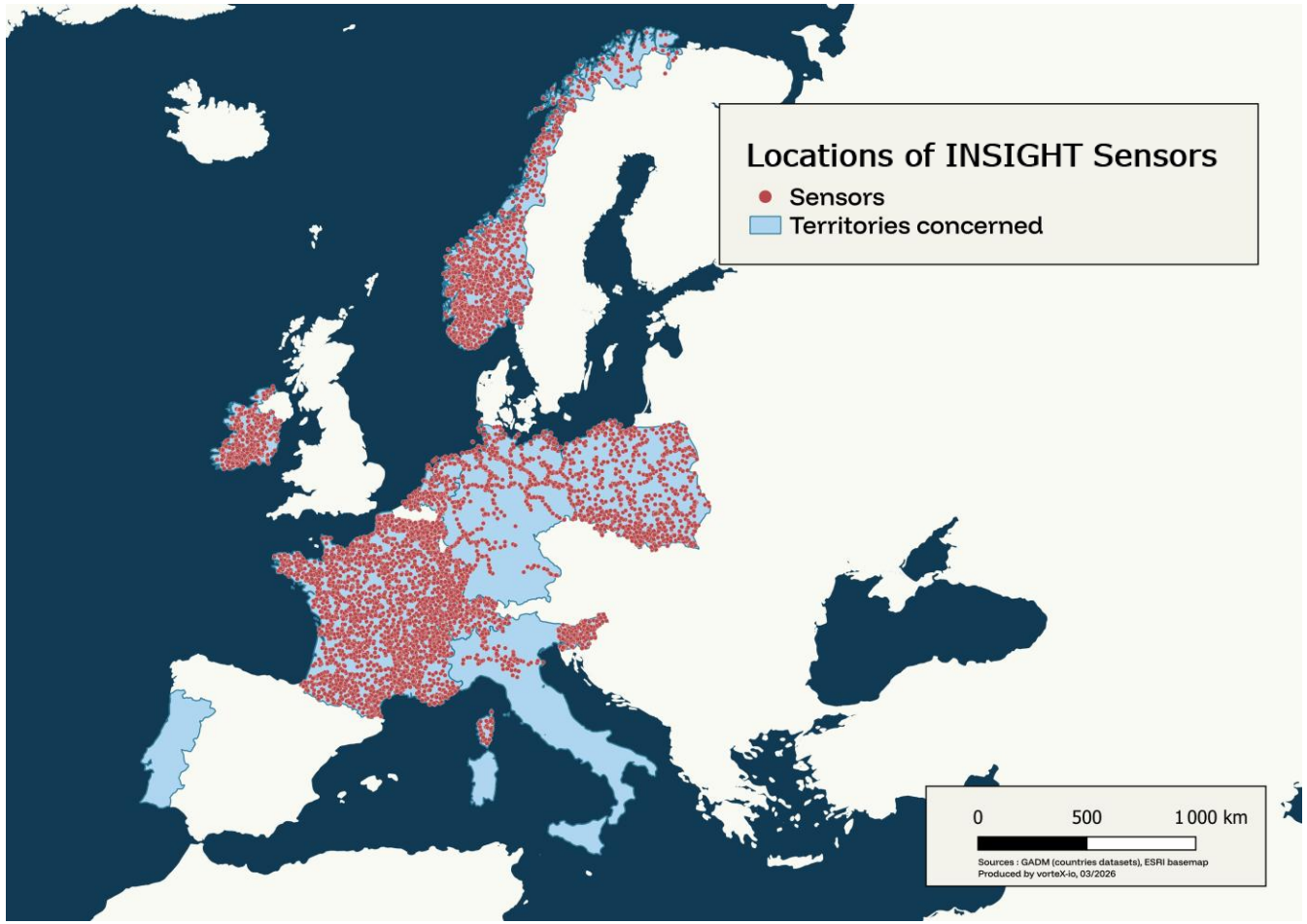


- The following presentation will be focused on **hydro dataset collection and uniformization**

Hydrological National networks

Project network coverage

- **12 networks considered** in this project :
  - France, Switzerland, Belgium (Wallonia), Netherlands, Germany, Poland, Norway, Ireland, Portugal, Italy (AIPO) and Slovenia.
  - An additional network is **under selection**
- It includes around **7178** sensors
- **Most of the sensors** are deployed on **rivers**, few on lakes



Product Description Document

Literature review to define the specifications of the uniformized hydro standard

- Review of different **open-source hydrological data provision initiatives**
  - GRDC
  - INSPIRE Directive
  - CF Metadata
- We defined a **common standard** for hydrological data dissemination
- This standard ensures **scientific rigor and interoperability** for the hydro dataset

Key points of this literature review

- Field names **harmonized across all retrieved datasets** for each surface.
- **Dates of measurements in UTC**. **Units** and vertical references normalized to **a standard format**
- Missing data and metadata fields will be systematically **flagged as NULL values.**
- We will provide the attributes defined by the **INSPIRE directive,** complemented by **additional relevant attributes**

Meeting with national network managers

- We **contacted all the agencies** in charge of the management of the hydrological networks considered in this project **with the support of ESA and EEA.**
- These discussions ensure that the INSIGHT platform respects **the distribution licenses of the different providers**
- This led to **direct contacts with technical teams** from national network managers to request **additional metadata** that are not currently provided
- The different agencies expressed interest in the **INSIGHT project**

Network	Contact taken	Meeting organized
France	✅	❌
Switzerland	✅	✅
Belgium	✅	✅
Netherlands	✅	✅
Germany	✅	SOON
Poland	❌	❌
Norway	✅	SOON
Ireland	❌	❌
Portugal	❌	❌
Italy (AIPO)	❌	❌
Slovenia	✅	✅

Data uniformization → Altimetric reference

Specifications from the literature review for altimetric reference

Three spatial reference frameworks will be provided:

- **The original national CRS**, used for national analyses, with altimetric values referenced to the **national geoid vertical datum**
- The European **CRS ETRS89**, ensuring interoperability and compliance with the **INSPIRE directive**
- A global geocentric reference frame aligned **with WGS84**, including ellipsoidal heights for **satellite altimetry** and **Cal/Val activities**

Limitations seen in certain networks

- For some networks, **the conversion grids from local geoid height to ellipsoidal height** have not been identified yet (Slovenia)
- We plan to discuss this specific point with the hydrological network managers
- Some hydrological sensors do not have **any known reference**, but only relative values, or have a reference without specifying **the local CRS**
- For these sensors **we will not be able to provide** the **WGS84** altimetric reference

Metadata provision for hydro data

Main metadata for Hydro dataset

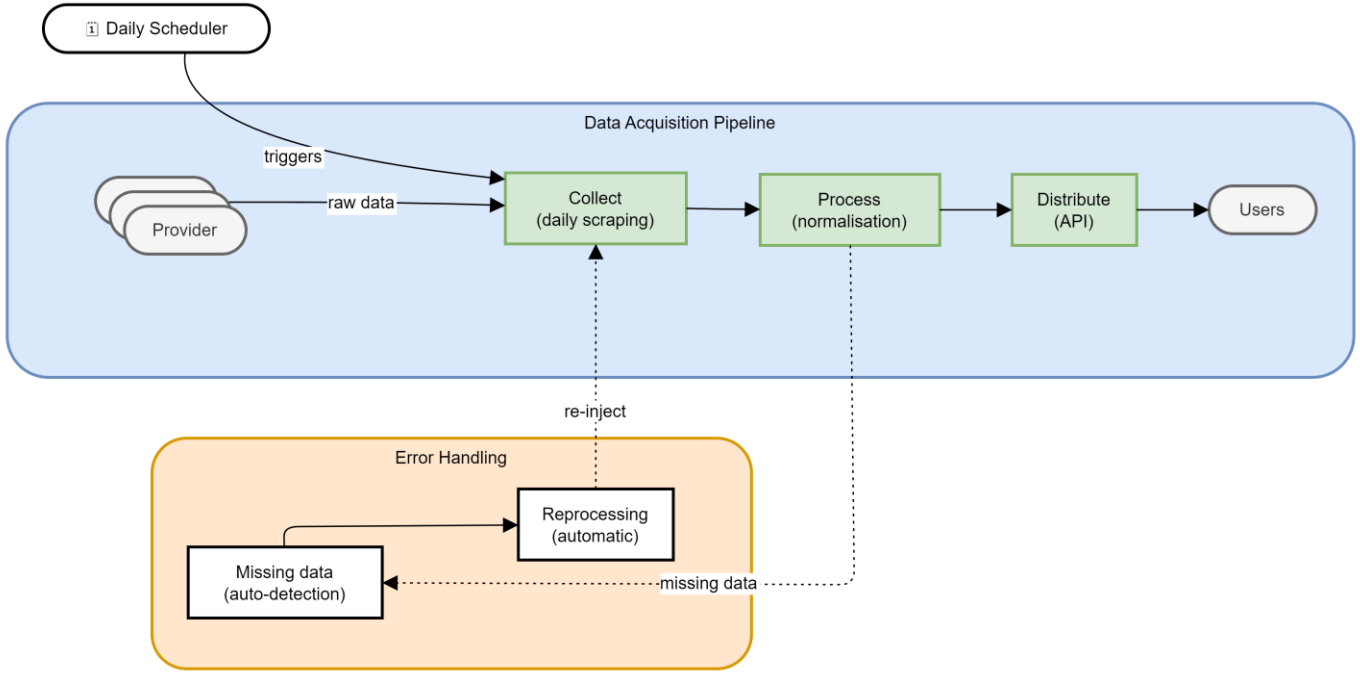
- An **ideal metadata list** was defined before data acquisition
- However, some **information can be unavailable** for some networks/sensors, we collect as much as possible
- Key metadata include
  - **Licensing** according to provider policy
  - **Waterbody information** (River name, river basin)

Quality indicators

- To ensure the best use of the Hydro dataset we aim to **distribute reliable quality indicators**
- **Quality indicators are not available everywhere**, and not at the **same format**
  - When **available we will distribute original quality indicators** and harmonized ones
  - **Aberrant values** will be flagged as suspicious
  - **No quality evaluation** based on time-serie statistical analysis will be **conducted within INSIGHT** project
  - **We cannot substitute** original **expertise** from data providers

Data acquisition methodology

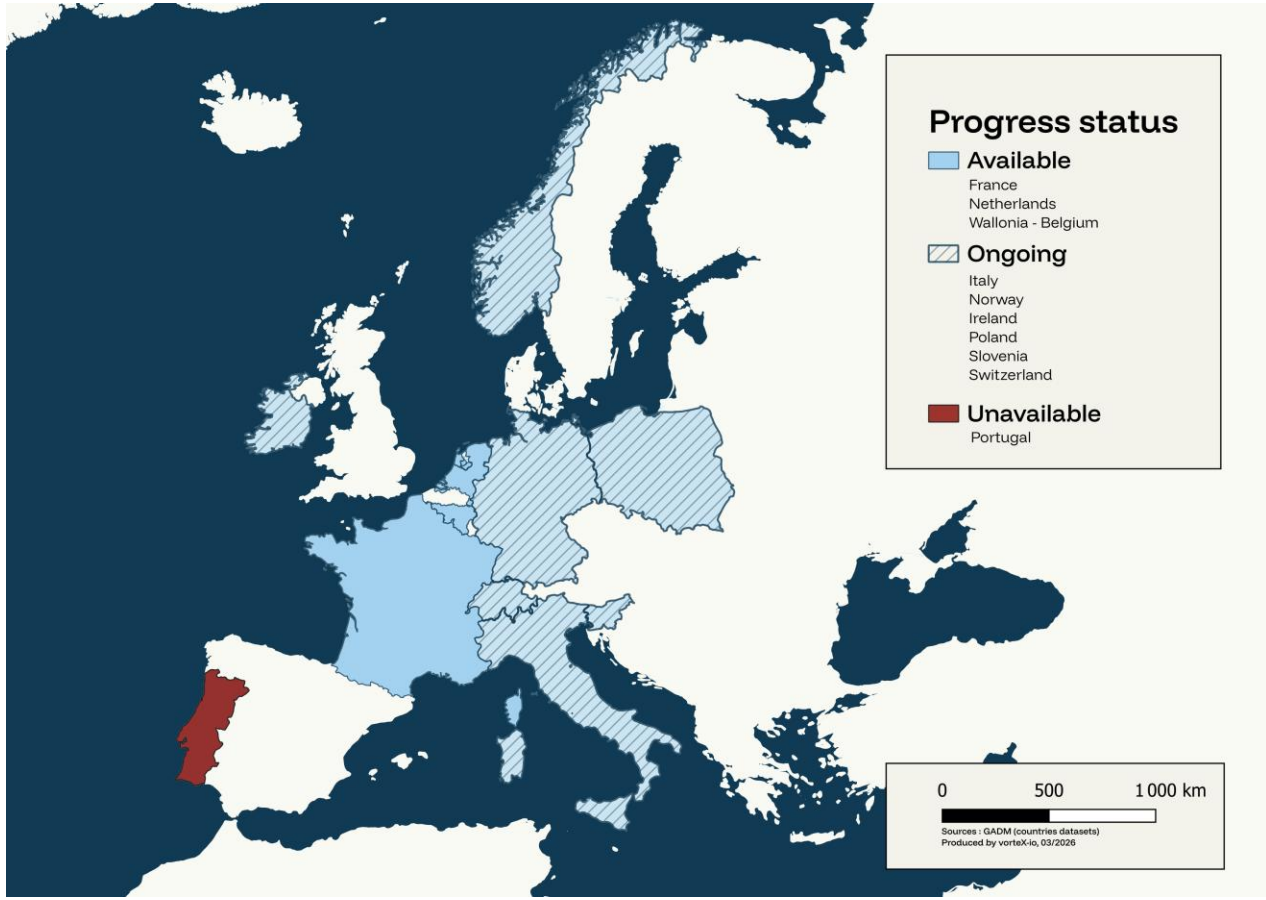
- We developed a **daily data acquisition** and normalization process for each network (**12 networks → 12 distribution standards**)
- **Strict monitoring** of each process has been set up as the data is **not acquired by stable API** for every provider. It is mandatory to ensure long term support and maintenance
- **A retry mechanism** automatically collects missing data until **3 days in the past**
- **We store the original data** prior to any conversion
- It allows us to **re-execute all standardization steps** if needed



Hydro INSIGHT infrastructure

Data acquisition methodology - Development status

- We are ready for **complete data ingestion on 3 networks**
  - All request infrastructure is now in place
  - Tested on a subset of stations
  - Ready for daily ingestion and **10-year history** request
- Work is on-going on **7 networks**
  - The code is under development
  - Now under testing on a subset of stations
- **Issue with Portugal hydrological Network**
  - The in-situ data are not available anymore
  - Considering alternative networks (Spanish regional network, Hungary …)



A project to cover the Cal/Val needs

Project specifications on the data

- **Data timeliness**
  - The **data collection** is performed **every day**
  - The data will be available after a 1-day maximum timeliness
- **Retention time / data history access**
  - We store the data to ensure **long-term access**
  - We will request and store **10 years of data history** when available to enable **long term validation activities**

Future user needs and feedbacks

- We plan to develop a platform that meet your needs and serves **the Cal/Val altimetry community**
- We plan to **organize workshops** with future users to **collect feedbacks** on the validation datasets needed and the platform evolutions that can be covered by the project
- A form has been launched to **collect your needs** and your intended use
  - It will give us **guidelines to ensure platform relevance**
  - The feedbacks will **pave the way for platform evolution**

Conclusion

- The **INSIGHT platform** is an initiative to diffuse standardized **hydrology in-situ datasets to support Cal/Val activities**
- We plan to **open access to a beta version** of the platform during **the end of July 2026**
- The platform is planned to be **fully operational** and open to users by **the end of October 2026**
- We need feedbacks on this project and **collect your requirements** on in-situ measurements to ensure that this **initiative benefits to the whole altimetry Cal/Val community**

QR code to access the form

Answer needed by the 3rd April