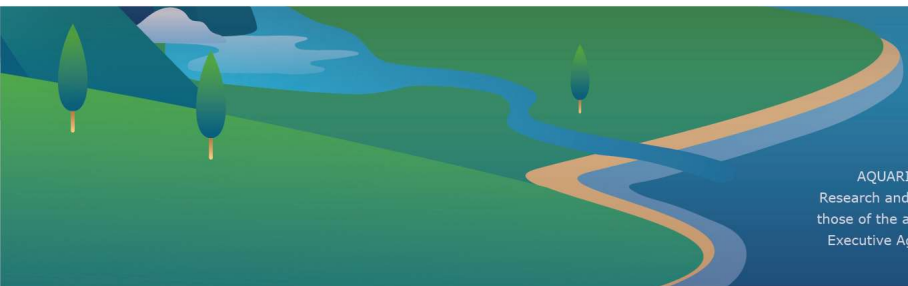
AQUARIUS initial Data Management Plan for STREAM-DANUBE

September 2025



Funded by the European Union

AQUARIUS has received funding from the European Union's Horizon Europe Framework Programme for Research and Innovation under grant agreement No 101130915. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or European Research Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

AQUARIUS initial Data Management

1. Data Summary

Purpose of the data collection

The collected data from incubation experiments will be used to calculate bentho-pelagic fluxes of oxygen, nutrient, DIC / TA, and to calculate reaction rates (primary production, pelagic remineralization, benthic remineralization), which will enable us to define the degree of bentho-pelagic coupling and thus to quantify the contribution of sediments to nutrient retention. Additionally, reaction rates and environmental parameters will enable us to derive parametrizations, which are then available to ecosystem models for validation and model refinement. The SeaReCap project trains colleagues form IO-BAS in implementation of Black Sea models, and our results will be transferred also to the Black Sea modelling community. FerryBox data and local reflectance measurements will be combined with remote sensing data (Sentinel 3) to improve data products, which will improve monitoring of water quality and algae blooms in the Black Sea.

Types and formats of data

- Biological data:
  - Plankton species composition and abundance (csv)
  - Makrozoobenthos species composition and abundance (csv)
- Chemical data:
  - Concentrations of nutrients, dissolved oxygen, pH, pCO2, total alkalinity, fluorescence, CH_4 concentration (csv), SPM (csv)
- Environmental data:
  - Hydrographic parameters (secchi disc depth, temperature, salinity (csv)
- Sediment data:
  - Porosity, chlorophyll-a content, TOC / TN content (csv)
- Metadata:
  - Sampling location, time, depth, and instrument details

Sensor data from CTD, FerryBox, Reflectance measurements, and incubation experiments will be ASCII files of various types (txt, csv, xml), results from laboratory analyses (concentrations of oxygen, nutrients, DIC, TOC, pigments, etc.) of collected samples will be initially generated as spreadsheets (xlsx format).

Data collection and transfer

On-board measurements by CTD (temperature, salinity, pressure, pH, oxygen concentration, fluorescence, pCO_2), Ferrybox (temperature, salinity, pH, oxygen concentration, fluorescence, pCO2, total alkalinity), Secchi disk (Secchi depth), Sun photometer (atmospheric thickness), and oxygen measurements on incubation experiments (O_2 concentration). The data will be collected on board from all instruments and brought back stored on multiple, redundant harddisk drives (HDD).

Results from lab-analyses on samples brought back to institutes of the project team comprise nutrient concentrations, DIC / total alkalinity, elemental composition of SPM, sediment analyses (pigment content, porosity, elemental composition, plankton species composition, makrofauna species composition.

Data processing

- Quality assurance:
  - Outliers, null observations, suspect observations will be flagged according to
  - Ensure consistent use of units
- Harmonization:
  - Standardize headers, metadata, and formats to AQUARIUS standards
- Timeline:
  - Data quality control is planned to be completed within 12 months after the cruise.
- Dataset expected size:
  - The expected size of all collected data is approx. 1 GB
- Data beneficiaries:
  - Marine scientists studying the marine biogeochemical cycles
  - Climate scientists studying marine sources and sinks of CO_2
  - Ecosystem modellers seeking observation data for model development and validation

2. Making data FAIR

2.1 Making data findable, including provisions for metadata

Compliance

Metadata will include key elements:

- Sampling instruments and methods
- Locations (coordinates, depth), times, and environmental parameters
- Observed properties and associated parameters.

Metadata will adhere to AQUARIUS standards and be submitted via EMODnet or SeaDataNet portals.

Documentation

Generally, lineage and processing steps will be documented in the AQUARIUS TA data summary log using the provided app.

Lineage information will be documented according to the ocean best practices for FerryBox as described in Mantovani, C., Pearlman, J. and Simpson, P. (eds) (2023) JERICO-S3 Deliverable 5.2. Electronic Handbook for Mature Platforms: Mooring - HF Radar - FerryBox – Glider. Version 1.1. IFREMER for JERICO-S3, 195pp. (JERICO-S3-WP5-D5.2.-310123-V1.1). DOI: 10.25607/OBP-1945

The project team will document the specific steps taken for quality controlling the data. For example, quality control of pCO_2 data will be controlled according to the methods described in Macovei et al. 2020: Long-term intercomparison of two pCO2 instruments based on ship-of-opportunity measurements in a dynamic shelf sea environment, Limnol Oceanogr Methods, 19: 37-50, DOI: 10.1002/lom3.10403.

Naming convention

We will use this convention for file names of data that will be shared / submitted to databases: [Projekt ID]_[cruise]_[parameter]_[station (if applicable)]_[date in YYYYMMDD].[suffix].

As for an example: STREAM-DANUBE_MN280_chlorophyll_20250910.csv

2.2. Making data openly accessible

Embargo policy

A temporal embargo will ensure data analyses and publications. The embargo will be lifted either after the publication of a manuscript that is based on these data or at the latest at the end of the Aquarius-RI project.

Meta data repository

Metadata and data will be submitted to EMODnet data repository and will be archived also at the Helmholtz Coastal Data Center (HCDC).

Specialized / exotic data formats

The original data from e.g. Ferrybox, Nutrient Autoanalyzer will not be published or submitted to repositories. Instead, the data will be converted to standard data formats (txt, csv) that can be accessed using standard software.

2.3. Making data interoperable

Standards

- Use AQUARIUS standards for metadata and data, including controlled vocabularies for QA/QC.
- Parameters will be expressed in SI units.

Documentation during TA activities

- Sampling metadata, calibration details, and procedural descriptions will be logged and aligned with AQUARIUS guidelines.

Input for the AQUARIUS TA Data Summary Log

- carried out using the application developed by MARIS, which will be preloaded on a tablet of the research team. The PI and the team members will oversee the daily logging of essential metadata, including station coordinates, sampling time, depth, instruments used, and procedural details.

2.4. Increase data re-use

Licensing, Embargo

Data will be CC-BY-4.0 License.

A temporal embargo will ensure data analyses and publications. The embargo will be lifted either after the publication of a manuscript that is based on these data or at the latest at the end of the Aquarius-RI project.

3. Other research outputs

Digital results

Next to the collected/generated data, no other digital output will be generated.

Physical results

No physical outputs will be generated.

4. Allocation of resources

Efforts according to Aquarius Funding Terms & Conditions

- Updating the initial Data Management Plan (DMP)
- Taking part in WP5 data management training activities
- Using the app during TA activities to complete the AQUARIUS TA Data Summary Log
- Completing a Cruise Summary Report (CSR)
- Transforming the original metadata and data to the AQUARIUS prescribed standards
- Performing QA-QC
- Making data FAIR and ready for inclusion in AQUARIUS repositories, thereby supported by AQUARIUS expert data centres.

Responsible person

The person responsible for data management is Andreas Neumann (Helmholtz-Zentrum hereon)

5. Data security

Provisions

The initially collected data will be transported on redundant HDDs back to hereon, GeoEcoMar, and IO-BAS. At hereon, the data will be stored within the hereon IT infrastructure, which includes regularly scheduled backups according to industry standard procedures.

6. Ethical aspects

Compliance to ethical and scientific standards

The project will comply with the principles of the OSPAR Code of conduct for responsible marine research (OSPAR 08/24/1, Annex 6). We will further adhere to the GDPR for personal and sensitive data.

7. Other issues

Additional national/ sectoral/ departmental procedures for data management

The project data and metadata will follow established, internal procedures established by HCDC at hereon, which ensure standard FAIR data principles.