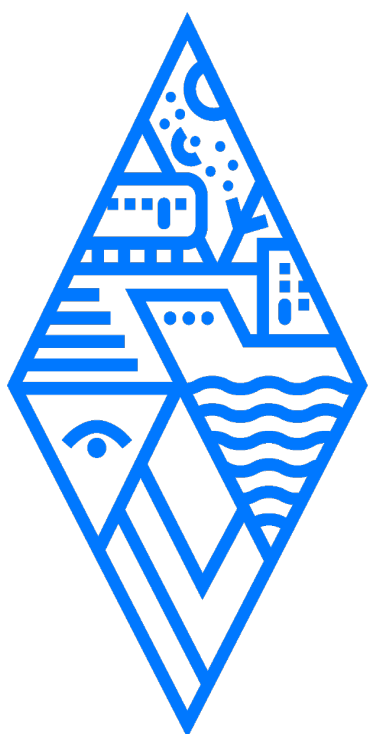




POLARIN

POLAR
RESEARCH
INFRASTRUCTURE
NETWORK

Deliverable 4.7.

Guidance material for research infrastructures

V1, September 2025

www.eu-polarin.eu



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1. SUMMARY

POLARIN is a Horizon Europe project established to organize and coordinate an international network of top-tier polar research infrastructures (RIs) and services. The project brings together an exceptional array of 64 polar RIs, ranging from land-based observatories and Antarctic stations to Arctic research camps, icebreakers, vessels and curated repositories for ice and sediment cores

At the core of these services lies a commitment to Open Science and to the FAIR principles, ensuring that research data is Findable, Accessible, Interoperable and Reusable. Open and FAIR data management is not only a requirement of the Horizon Europe program; it is also a scientific imperative in the age of global environmental crises and multidisciplinary research.

A cornerstone of this effort is the development of the POLARIN Data Hub, a web-based portal that provides stakeholders with unified access to data catalogues, visualization tools, search interfaces (potentially enhanced by AI-driven features) and interoperable services for data publishing and discovery. To move towards this Open Science approach, POLARIN set up a Zenodo Community.

Zenodo is an open-access repository developed by CERN and enable researchers to share and preserve a wide range of research outputs. It accepts publications, datasets, software, presentations, and other research materials from all disciplines. Zenodo assigns DOIs (Digital Object Identifiers) to uploaded items, making them citable and discoverable. Zenodo is free to use and promotes open science by enabling unrestricted access to research results. Zenodo is supported by OpenAIRE (Open Access Infrastructure for Research in Europe) which is a European initiative (funded by European Commission) that provides infrastructure, services, and guidance to support open science and the free sharing of research outputs. OpenAIRE plays a key role in implementing the European Open Science Cloud (EOSC) and promotes the FAIR principles. Moreover, OpenAIRE is directly interconnected with the CORDIS (Community Research and Development Information Service) which is the European Commission's primary public repository for information on EU-funded research projects. The native interoperability between Zenodo, OpenAIRE and CORDIS make all the Zenodo results immediately available and shareable in the CORDIS project page promoting open and free science across Europe and beyond.

Although the POLARIN Zenodo is preliminary designed is designed to manage the official project documents, primarily deliverables, after they are approved by the EC reviewers, it also provides the project an easy and powerful infrastructure to support and facilitate the storage of selected datasets (notably, adopting Open Data and Open Science policies, POLARIN Zenodo as a storage allowance of up to 200GB per item), where data deposit is controlled by the Data Manager and the Steering Committee to ensure completeness and validity, and to support the full data value chain FAIRness.

This deliverable is a Guidance material for research infrastructures on how to use the Zenodo community.

2. Introduction

POLARIN is a Horizon Europe project established to organize and coordinate an international network of top-tier polar research infrastructures (RIs) and services. The project brings together an exceptional array of 64 polar RIs, ranging from land-based observatories and Antarctic stations to Arctic research camps, icebreakers, vessels and curated repositories for ice and sediment cores.

These infrastructures span both hemispheres, from Alaska to the East Antarctic Plateau, enabling unprecedented access to the poles' physical, chemical and biological environments.

POLARIN provides four integrated services to users:

- Challenge-driven Transnational Access (TA) to infrastructures;
- Development and improvement of data services and products;
- Virtual Access (VA) to data and computing resources;
- Training and capacity building for users and operators of polar research infrastructures.

At the core of these services lies a commitment to Open Science and to the FAIR principles, ensuring that research data is Findable, Accessible, Interoperable and Reusable. Open and FAIR data management is not only a requirement of the Horizon Europe program; it is also a scientific imperative in the age of global environmental crises and multidisciplinary research. In this light, POLARIN's data architecture and policy, especially through the work of Work Package 4 (WP4), aim to reduce data fragmentation, improve metadata and data standards and promote tools and services developed under previous EU funded projects (such as ARICE, INTERACT, EuroFLEETS and many others) and support European and international Polar and Ocean data infrastructure (SIOS, SOOS, PANGAEA, ACTRIS, EMODnet, EDITO, etc.).

A cornerstone of this effort is the development of the POLARIN Data Hub (DH) (Figure 1), a web-based portal that provides stakeholders with unified access to data catalogues, visualization tools, search interfaces (potentially enhanced by AI-driven features) and interoperable services for data publishing and discovery.

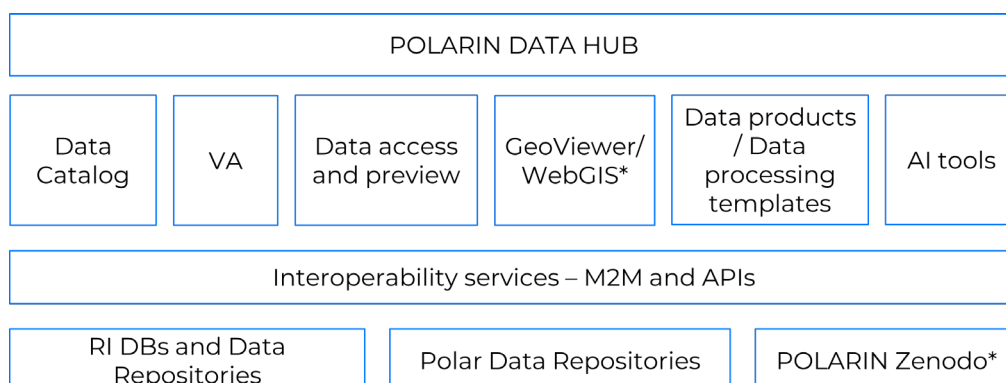


Figure 1. POLARIN Data Hub

A key component of this DH is the POLARIN Zenodo Community. Although the POLARIN Zenodo is preliminary designed is designed to manage the official project documents, primarily deliverables,

after they are approved by the EC reviewers, it also provides the project an easy and powerful infrastructure to support and facilitate the storage of selected datasets (notably, adopting Open Data and Open Science policies, POLARIN Zenodo as a storage allowance of up to 200GB per item), where data deposit is controlled by the Data Manager and the Steering Committee to ensure completeness and validity. As described in deliverable D4.6 the POLARIN Zenodo community also serves as a tool to facilitate the interoperability between the POLARIN produced digital objects and the CORDIS (Community Research and Development Information Service) which is the European Commission's primary public repository for information on EU-funded research projects.

Considering the relevance of this tools (Zenodo and CORDIS), the present deliverable is a Guidance material for research infrastructures on how to use the Zenodo community.

3. POLARIN Zenodo Community

The POLARIN Zenodo Community (ZC) is available at: <https://zenodo.org/communities/eu-polarin>

POLARIN ZC is an Open Pilot Research Project Community, meaning that each digital object can have a file size of up to 200 GB. As such, Zenodo offers not only easy access to public documents (such as approved deliverables) but also represents a potential auxiliary data node within the broader POLARIN data architecture.

The primary use of the POLARIN ZC is:

1. **Managing official project documentation**, particularly the publication of deliverables after validation by the European Commission (EC) reviewers. All publications must first be approved by the POLARIN Steering Committee.
2. **Archiving selected datasets** that are validated and approved for publication by the project's Data Manager and Steering Committee, ensuring quality, consistency and alignment with FAIR principles.

Importantly, given the connection between Zenodo and CORDIS, it is essential to establish a link between every POLARIN digital object and the POLARIN ZC. If a digital object has already been assigned a DOI, this should be referenced in the POLARIN ZC; otherwise, the POLARIN ZC will generate and assign a DOI.

The POLARIN ZC is not for:

- Peer-reviewed articles, since it could be cause of conflict with others publishers
- Confidential deliverables which are for the consortium access only
- Milestones (possibility to publish them only if the authors allow it)
- Progress reports (once approved by the reviewers, they will be publicly available. They will be automatically added by the European Commission to the POLARIN project webpage on Cordis (<https://cordis.europa.eu/project/id/101130949>)).

3.1. How to upload contents in Zenodo

- Log in / Register to Zenodo: <https://www.zenodo.org/login/?next=%2Fdeposit>
- Select “New Upload” from the dashboard (Figure 2) or directly from the POLARIN community (Figure 3) - it is not mandatory to start the upload directly within the community, but it is essential to assign it before publishing the record.

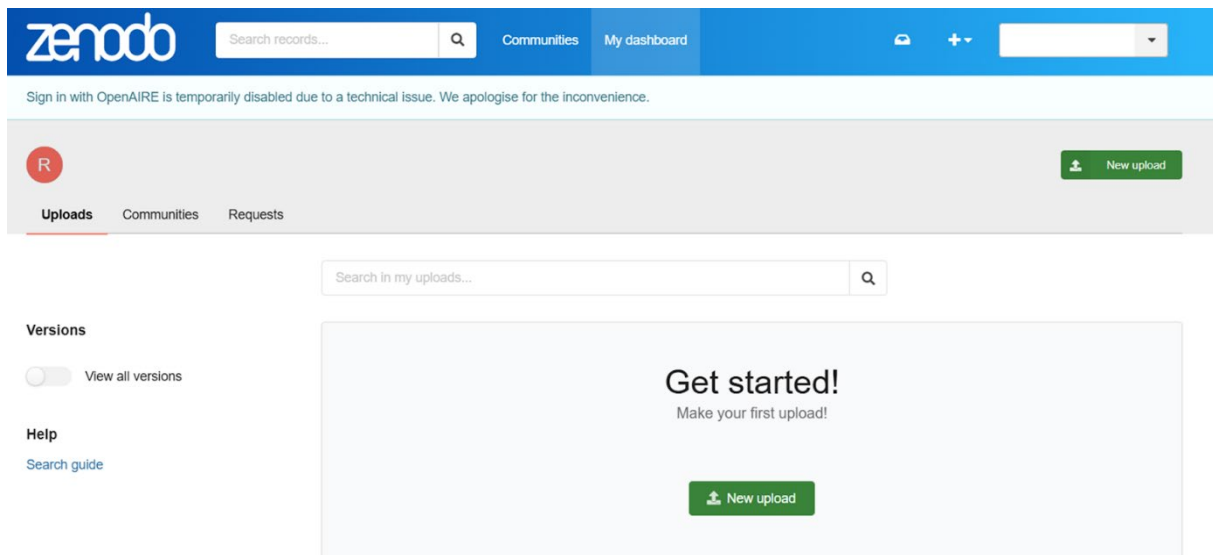


Figure 2. New upload from the dashboard.

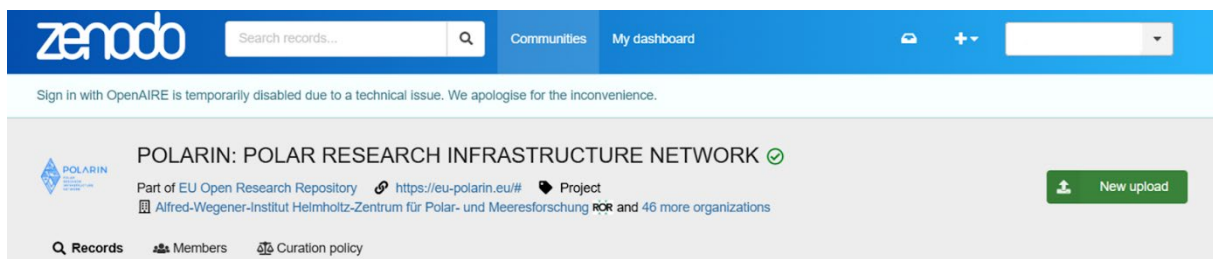


Figure 3. New upload from POLARIN community.

- If you made a new upload from your dashboard, make sure to select the POLARIN community (Figure 4) before uploading the file.

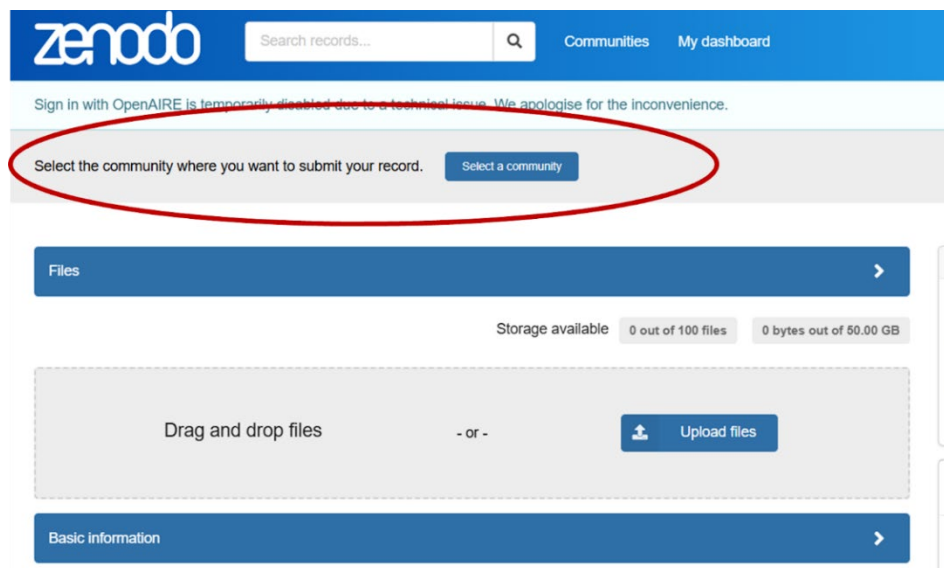


Figure 4. Select the POLARIN community.

- d) In the **Files** section, either drag and drop your files or click *Upload files*, then press *Start upload* to begin the process (Figure 5).

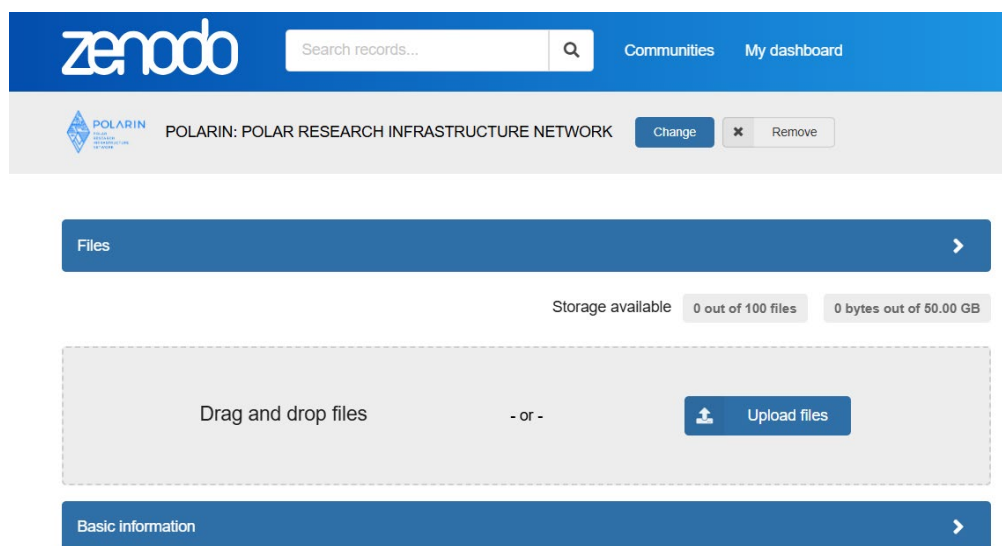


Figure 5. Upload files.

- e) In the **Basic Information section**, make sure you complete all the mandatory fields (*):
- Digital Object Identifier (DOI) (Figure 6. DOI.): If you already have a DOI, select YES and write it. If you do not have one, ZENODO will automatically assign a DOI to your research output. This is critical for ensuring your work is uniquely identifiable and interoperable within the OpenAIRE ecosystem. Ensuring that your information remains up to date allows others to access and use the latest version of your research outputs.
 - Resource Type (Figure 7): select the categories that best matches the content you are uploading.
 - Title (Figure 8): Ensure that it is clear, concise, and accurately describes the content.
 - Publication date (Figure 9)

- e. Creators (Figure 10): If you do not have an ORCID id, please register for one at <https://orcid.org>. Ensure that all author names and institutional affiliations are correctly formatted.
- f. Description (Figure 11): Insert the abstract here. Ensure it is clear, concise, and accurately describes the content.
- g. Licenses (Figure 12): Select an Open Access license (e.g., CC-BY, CC0). Zenodo is OpenAIRE-compliant by default, but choosing the right license ensures your content is widely accessible.

Digital Object Identifier *

Do you already have a DOI for this upload? ☒ Yes ☐ No

Copy/paste your existing DOI here...

A DOI allows your upload to be easily and unambiguously cited. Example: 10.1234/foo.bar

Figure 6. DOI.

Dataset

- Event
- Image
- Image / Diagram
- Image / Drawing
- Image / Figure
- Image / Other
- Image / Photo
- Image / Plot
- Lesson
- Model
- Other
- Physical object
- Poster
- Presentation

Dataset

Figure 7. Resource type.

Title *

Additional title * **Type *** **Language**

Alternative title

Select language

+ Add titles

Figure 8. Insert title.

 Publication date *

2024-11-05

In case your upload was already published elsewhere, please use the date of the first publication. Format: YYYY-MM-DD, YYYY-MM, or YYYY. For intervals use DATE/DATE, e.g. 1939/1945.

Figure 9. Publication date.

 Creators *



Add creator

Add creator

☒ Person ☐ Organization

Search for persons by name, identifier, or affiliation...

Family name *

Family name

Given names

Given names

Identifiers

e.g. ORCID, ISNI or GND.

Affiliations

Search or create affiliation

Role

Select role

✕ Cancel

✓ Save and add another

✓ Save

Figure 10. Add creators.

 Description

Paragraph

B

I





























































Add description

Figure 11. Insert description.

 Licenses

 Creative Commons Attribution 4.0 International

The Creative Commons Attribution license allows re-distribution and re-use of a licensed work on the condition that the creator is appropriately credited. [Read more](#)

Edit

Remove



Add standard



Add custom

Figure 12. Insert license.

- a. Under the **Recommended Information** section, complete with the following information:
1. **Contributors** (Figure 13): If you do not have an ORCID ID, please register one here <https://orcid.org>. Ensure that all author names and institutional affiliations are correctly formatted. This ensures proper attribution of the work in OpenAIRE.
 2. **Keywords** (Figure 14): Use controlled vocabularies or standardized terms for subject categories (e.g., keywords from recognized scientific thesauri as Global Change Master Directory). This helps harmonize your data across repositories and increases compatibility with OpenAIRE's indexing system.
 3. **Dates** (Figure 15): use this field to update the date of submission, update and other relevant temporal information regarding your research output.
 4. **Version** (Figure 16): Since 2017, Zenodo offers DOI versioning, allowing you to create a new DOI for each version of your research output. This makes it easier for users to cite the latest version of your work in their publications.

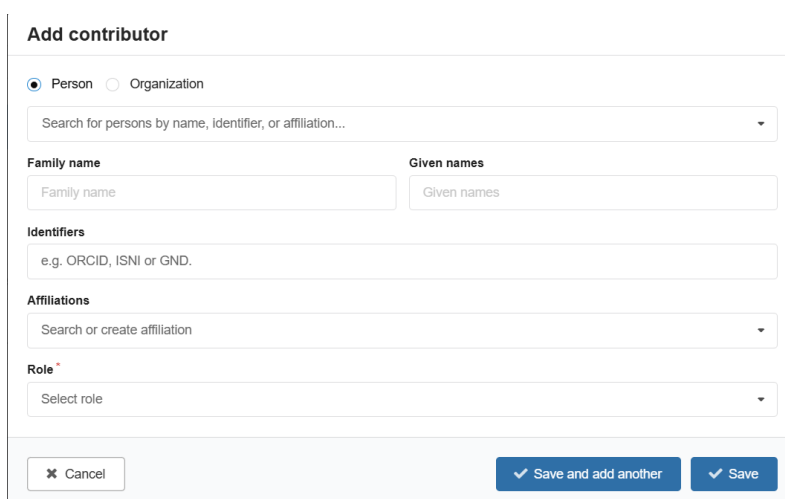


Figure 13. Add contributors.

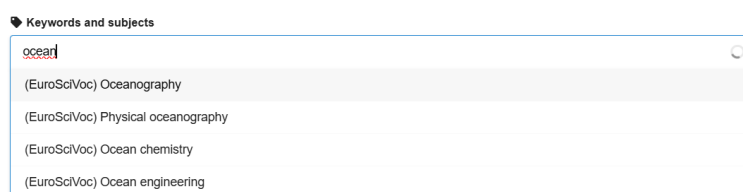


Figure 14. Add keywords.

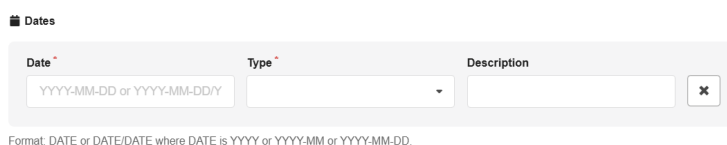


Figure 15. Insert the date of submission.

semver.org, but any version string is accepted.'" data-bbox="270 840 728 878"/>

Figure 16. Add last version.

 Awards/Grants

	Add		Add custom
---	-----	---	------------

Figure 17. Add POLARIN Grant Agreement number.

- g) Under **Funding section** (Figure 17): Since Zenodo's mission is to collect EC-funded data, the repository provides a way to look up Grant Information. In Zenodo, you must manually add the awards or grants funding your research. For **POLARIN**, search for the project by entering the Grant Agreement number: **101130949** in the search field.
- h) Under **Related works section** (Figure 18): if your publication is linked to other resources (e.g., datasets, software, or supplementary materials), ensure they are properly linked using the related identifiers feature (e.g., DOI). This helps OpenAIRE trace all related outputs from your project. Moreover, it not only provides context for your data but also makes it easier for others to cite your work in their publications.

Related works

Relation *	Identifier *	Scheme *	Resource type	
Select relation...				X

+ Add related work

Figure 18. Add other resources linked to the publication.

4. Brief guide to publishing data for the polar research community

This paragraph summarizes the main recommendations from the guideline developed through the joint effort of the Standing Committee on Antarctic Data Management (SCADM), the Arctic Data Committee (ADC), and the Southern Ocean Observing System (SOOS). The guideline is designed to provide researchers with practical advice on publishing data. As already highlighted, its central and most essential principle is the use of high-quality metadata.

Many distinct types of metadata have been defined, but there are two important types. Firstly, metadata that helps others find your data. This might be called 'Discovery metadata' and includes things like the title, author, and keywords.

Secondly, metadata that helps other use of data. This might be called 'Usage metadata' or 'Contextual metadata' and helps others access and understand data. This metadata may be captured in a catalogue record, in a file associated with the data or within the data itself.

4.1. Make resources FAIR

4.1.1. Publish in a recognized repository

To make sure that your data will be findable, accessible, interoperable, and reusable (FAIR), we recommend using a recognised and trusted repository that focuses on your specific field of research. These specialised repositories are likely to offer better advice and support than general-purpose ones that rely on automatic submissions. For polar research, many nations have national polar/Arctic/Antarctic data centres you can approach.

Finding a repository:

- The Standing Committee for Antarctic Data Management provides a list of [National Antarctic Data Centres](#).
- You can search the [Registry for Research Data Repositories](#).
- The National Oceanic and Atmospheric Administration provide [a list of Data Centres and Institutions holding Arctic Datasets](#).
- You can also use the list of institutions in the [Mapping the Polar Data Ecosystem](#) tool.
- Publishers may also provide a list of preferred repositories such as the [list provided by Scientific Data](#).

4.1.2. Describe your data to make it easy for someone to find and assess the relevance

Discovery metadata refers to metadata elements that are generally indexed and searched in data catalogues. This typically includes fields such as: the title, abstract, authors (or creators), keywords, but may also include temporal and spatial information.

Tip 1: Ensure these elements include the terms that potential users might use when searching for data such as yours.

Tip 2: Structure the title and abstract information to make it easy for someone to assess whether the data it describes will be relevant to them.

Title

- Keep it brief and simple
- Follow the 'What, Where, When' structure
- Avoid use of acronyms unless they are also written in full
- Describe the data and not the project or activity that produced them

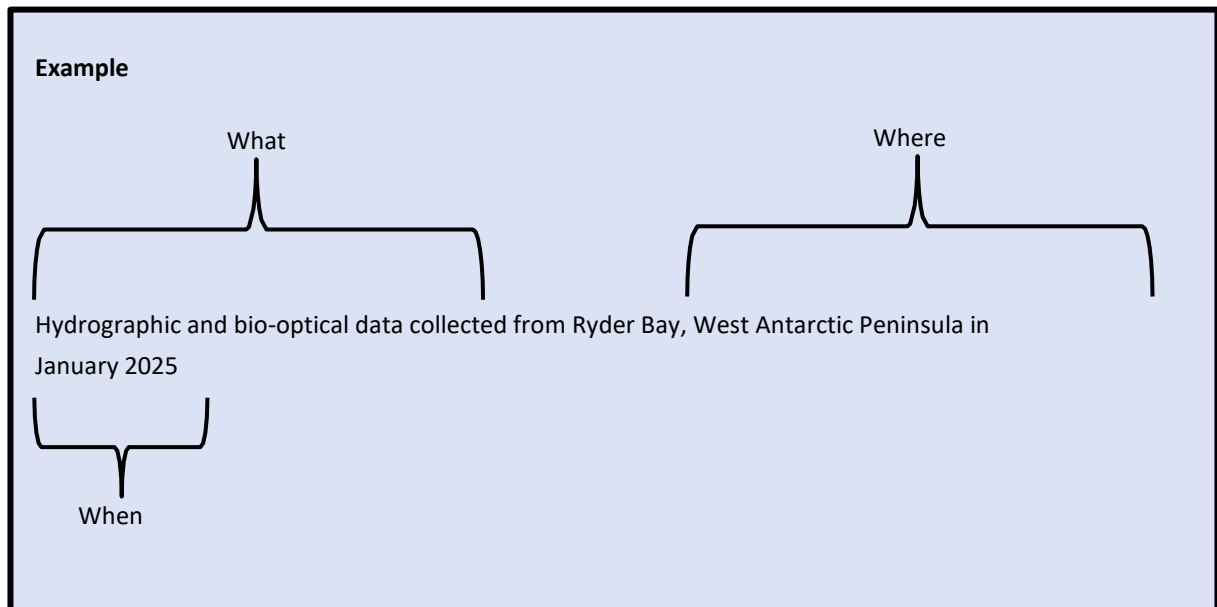


Figure 19. Metadata

Abstract

- Provide a clear summary of the dataset in plain language for a non-expert user
- Use short concise sentences and consider using the ‘what, where, when, how, why, who’ framework to construct a comprehensive abstract:
 - ✓ What does the data contain
 - ✓ Where were the data collected
 - ✓ When were the data collected
 - ✓ How were the data collected
 - ✓ Why were the data collected
 - ✓ Who was involved (in the collection, management, publishing, and funding)
- Avoid use of acronyms unless they are also written in full
- Describe the data and not the project or activity that produced them
- Treat this as a stand-alone paragraph, where others should be able to determine exactly what was accomplished from this paragraph alone.

Example

This data release includes sensor data collected from Conductivity Temperature Depth (CTD) casts **[WHAT]** during a field campaign to Ryder Bay **[WHERE]** in January 2025 **[WHEN]** as part of the NERC funded SiCLING project (Silicon Cycling in Glaciated Environments), led by Dr K. Hendry from the British Antarctic Survey **[WHO]**. Four CTD casts **[HOW]** were carried out within the Bay. This research aims to investigate the release of biologically important nutrients and trace elements from glacial sediments in polar coastal environments, and the biogeochemical impact of ongoing glacier retreat **[WHY]**.

Funding:

NERC Pushing the Frontiers grant SiCLING (NE/X014819/1) **[WHO – funder]**.

Authors

- These may be called data creators, contributors, researchers, or Principal Investigators
- Provide a list of the people involved in the production of the data. This should include data collectors, processors, analysts, and anyone else that contributed to the production of these data.
- Think about who should be credited if the data are reused and cited
- Include permanent identifiers for people if you have them such as ORCIDs (Open Researcher and Contributor ID)

Keywords

- Keywords enable you to provide other terms that users might use if they were searching for your dataset that do not appear in titles or abstracts. They can be free text but often are terms

taken from controlled vocabularies. Controlled vocabularies provide a consistent way of describing your data and help users find data that are all about the similar things.

- Your chosen repository will be able to advise on keywords and use of controlled vocabularies.

Here are controlled vocabularies that you might come across:

- [Global Change Master Directory \(GCMD\) Earth Science and Earth Science Services Keywords](#)
- [ASFA Thesaurus](#)
- [INSPIRE Keywords](#) (these cover themes and topics)
- The [ICES Platform Codes](#)
- [SeaVox Platform Categories](#)
- Gazetteers for [marine regions](#) or place names such as the [Composite Gazetteer of Antarctica](#)

Time and Place

Including information in your metadata about where and when your data relate to is useful for catalogues that enable users to search using these parameters. This makes it easier for people to find data from a certain location or time. How you provide these may depend on the repository you are submitting to but standards exist for how to describe both time (ISO 8601) and geographic information and services (ISO 19115).

4.2. How to make your data easy for others to use

4.2.1. Include link to the data from the metadata

If a direct link to a resource is available, a web address (URL) that links to the resource should be provided. The URL should be accompanied by a title and function of the online resource, i.e. what the URL represents and what function it performs (e.g. download data, information about data, search for data). If a direct link cannot be provided, then a link to a contact point for requesting more information about the resource should be provided.

4.2.2. Include link to the data from the metadata

A license lets users understand the terms of use of the data. This will include what they can do with the data, whether it can be passed on to others and often stipulate that you have to acknowledge/credit the source. More information about licenses and options can be found on the '[How to FAIR](#)' website. For open data, a Creative Commons license such as CC-BY is often used.

4.2.3. Include statements

This allows anyone who reuses your data to know how to reference use of your data. It also gives you a way of referencing the data in your publications. If your repository provides a DOI for your dataset then this should appear in the citation.

Your chosen repository is likely to provide you with a citation. If, however, you need to create your own then it should include creator(s) or contributor(s), date of publication, title of dataset, publisher, identifier (e.g. DOI) or URL of source, version (if appropriate), date accessed (if appropriate)

4.2.4. Provide data in open formats

An open format is one that does not depend on a particular piece of software to open it. Ideally use a format which is machine-readable and self-describing such as netCDF ([Unidata | NetCDF](#)) for gridded data.

Formats likely to be accessible in the future are:

- Non-proprietary
- Open, with documented standards
- In common usage by the research community
- Using standard character encodings (i.e., ASCII, UTF-8)
- Uncompressed (space permitting)

Examples of suitable format choices:

- Image: JPEG, JPG-2000, PNG, TIFF, geoTIFF
- Tabular data: CSV, (TXT), XML
- Gridded data: NetCDF, HDF5, GRIB
- Audio: AIFF, WAV
- Spatial vector data: Shapefile (.shp), GeoPackage (.gpkg), GeoJSON

4.2.5. Ensure others are able to understand your data and its limitations

It is important to provide rich usage metadata to ensure that potential users can understand the methodology used to collect your data, any processing or analysis undertaken, the instrumentation used and any quality control procedures. Where this information goes, will depend on the repository chosen and the metadata fields available. If you cannot include the information in the catalogue record, then add a README text file which contains the relevant information.

4.2.6. Check your data headings

Make sure that the headers that you have used for tabular or gridded data clearly describe what the data are and include all relevant [units of measure](#). For spatial data, state which coordinate system was used. Where possible, use defined or standard conventions for the variables in your data (e.g. [CF Conventions](#) or [NERC Vocabulary Server parameter codes](#)). This enables your data to be combined with other data that measure the same variables.

4.3. Open Data Guidance - Check List

USER CHECKLIST

Use this before publishing your dataset to check it meets FAIR principles

✓ Repository Selection

- ☐ Deposit your data in a **recognized, trusted repository**.
- ☐ Verify that the repository supports polar research data and offers metadata guidance.

✓ Discovery Metadata

- ☐ Provide a **clear, concise title** following the "What, Where, When" structure.
- ☐ Write a **plain-language abstract** using the "What, Where, When, How, Why, Who" framework.
- ☐ List all relevant **authors/contributors** (with ORCIDs if available).
- ☐ Add **keywords** from a controlled vocabulary where possible (e.g., GCMD, NVS, INSPIRE).
- ☐ Include **temporal (ISO 8601)** and **spatial information (ISO 19115 or repository standard)**.

✓ Usage/Contextual Metadata

- ☐ Describe **data collection methods**, processing steps, instruments used, and quality control applied.
- ☐ Include this information either in the metadata record or in a **README file**.

✓ Licensing & Accessibility

- ☐ Apply an appropriate **open data license** (e.g., Creative Commons CC-BY).
- ☐ Ensure a **direct URL or DOI** is provided for the dataset.

✓ Citation

- ☐ Provide a recommended **citation statement**, including:
 - ☐ Creator(s)
 - ☐ Year
 - ☐ Title of the dataset
 - ☐ Publisher or repository
 - ☐ DOI or URL
 - ☐ Version (if applicable)
 - ☐ Access date (if applicable)

✓ Data Formats & Standards

- ☐ Use **open, non-proprietary file formats** (e.g., CSV, netCDF, PNG, TIFF).
- ☐ Ensure **column headings** are clear, include units, and follow standard conventions (e.g., CF Conventions).
- ☐ Specify the **coordinate system** for spatial data (e.g., WGS84).
- ☐ Avoid proprietary or compressed file formats unless necessary.

✓ Final Check

- ☐ Review your submission for clarity, completeness, and adherence to your repository's standards.

4.4. Metadata Compilation Guideline from NADC

A dedicated metadata compilation guide has been developed by the National Antarctic Data Center (NADC) in the framework of the Italian National Antarctic Research Program (PNRA), providing detailed instructions for describing datasets within a standardized and interoperable framework. The document, titled “Guida alla compilazione dei metadata” (v2.01, September 2024), is publicly accessible at <https://www.pnra.aq/it/guida-alla-compilazione>.

While this guide is specific to the PNRA context, it reflects broader best practices applicable across many data infrastructures that rely on GeoNetwork for metadata cataloguing.

5. References

- Deliverable D4.1 – POLARIN DMP
- Deliverable D4.6 – POLARIN DMP
- Guidelines for uploading research outputs to OpenAIRE and the use of POLARIN Zenodo Community
- Programma Nazionale di Ricerche in Antartide (PNRA)¹
- POLARIN Zenodo Community²
- A brief guide to publishing data for the polar research community

¹ <https://www.pnra.aq/it>

² <https://zenodo.org/communities/eu-polarin/records?q=&l=list&p=1&s=10&sort=newest>