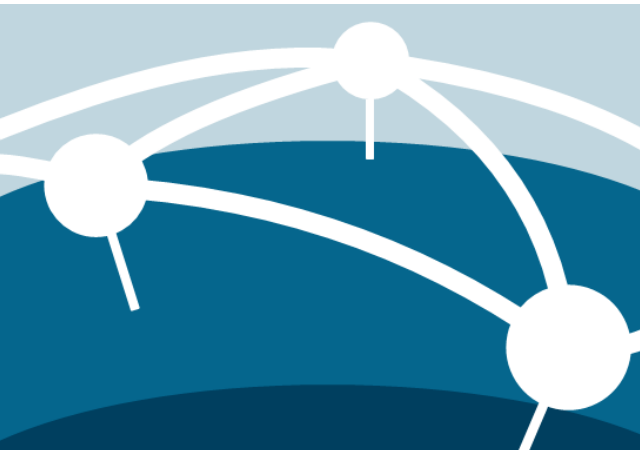


# NFDI4Earth

## Pitching Products and Services of the First Funding Phase

[nfdi4earth.de](https://nfdi4earth.de)

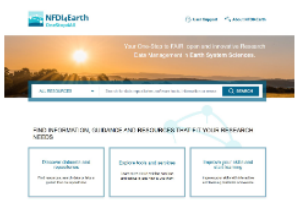

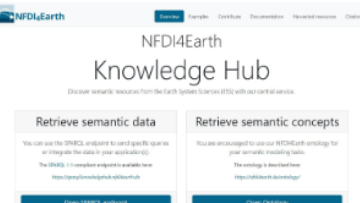



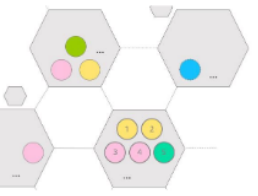






# NFDI4Earth Academy: Bridging Earth System and Data Science



## NFDI4Earth 2021-26

### Serving our Community - Our Products and Activities





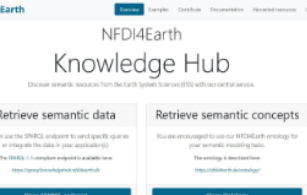

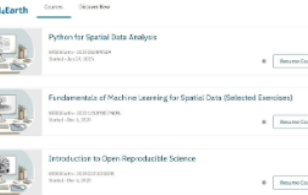



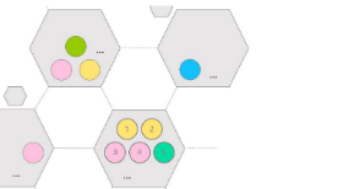





 <p><b>NFDI4Earth OneStop4All</b></p>  <p>Exploring RDM resources</p>	 <p><b>NFDI4Earth User Support Network</b></p>  <p>RDM support from ESS experts</p>	 <p><b>NFDI4Earth Knowledge Hub</b></p>  <p>Semantic data discovery via API</p>	 <p><b>NFDI4Earth EduTrain Portal</b></p>  <p>Open Educational Resources</p>
 <p><b>NFDI4Earth Commitment</b></p>  <p>Advance FAIRness &amp; Openness in ESS</p>	 <p><b>NFDI4Earth Architecture</b></p>  <p>Integrate open community services</p>	 <p><b>NFDI4Earth Label</b></p>  <p>FAIRness and interoperability of services</p>	 <p><b>NFDI4Earth Academy</b></p>  <p>Join or contribute to the training network</p>

# NFDI4Earth Academy: Bridging Earth System and Data Science



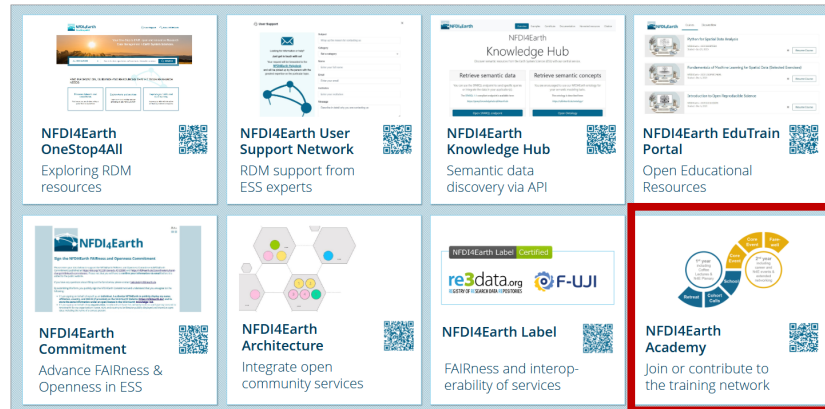
## NFDI4Earth 2021-26

### Serving our Community - Our Products and Activities

 <p><b>NFDI4Earth OneStop4All</b></p> <p>Exploring RDM resources</p> 	 <p><b>NFDI4Earth User Support Network</b></p> <p>RDM support from ESS experts</p> 	 <p><b>NFDI4Earth Knowledge Hub</b></p> <p>Semantic data discovery via API</p> 	 <p><b>NFDI4Earth EduTrain Portal</b></p> <p>Open Educational Resources</p> 
 <p><b>NFDI4Earth Commitment</b></p> <p>Advance FAIRness &amp; Openness in ESS</p> 	 <p><b>NFDI4Earth Architecture</b></p> <p>Integrate open community services</p> 	 <p><b>NFDI4Earth Label</b></p> <p>FAIRness and interoperability of services</p> 	 <p><b>NFDI4Earth Academy</b></p> <p>Join or contribute to the training network</p> 

## NFDI4Earth 2021-26

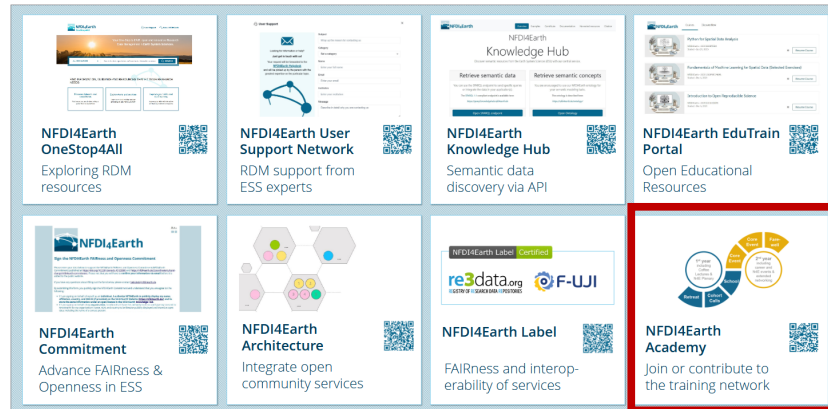
Serving our Community - Our Products and Activities



- **Systematic involvement** of Early Career Scientists in NFDI4Earth
- Support integrating **data-driven methodology**
- Fostering **open research culture**

## NFDI4Earth 2021-26

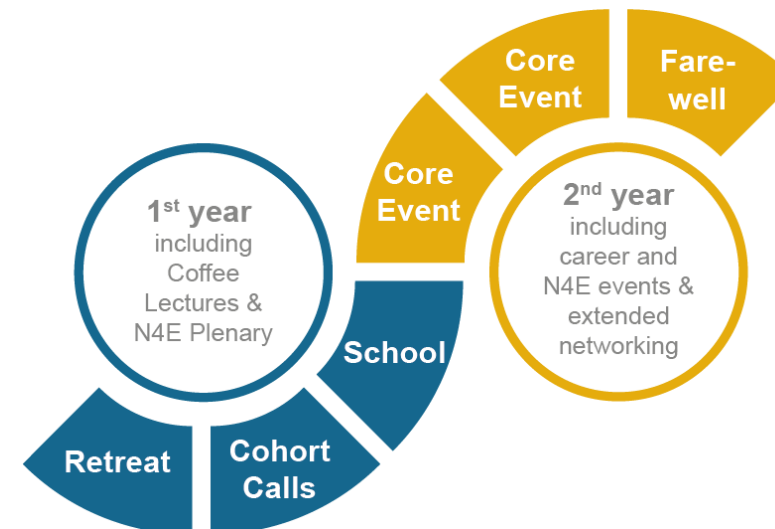
Serving our Community - Our Products and Activities



- **Involvement** of Early Career Scientists in NFDI4Earth
- Support integrating **data-driven methodology**
- Fostering **open research culture**

## Two-year Academy program

- Hands-on events (in-person and online)
- Peer-mentoring environment
- Bottom-up approach for needs-oriented training offers



# Empowering Early Career Scientists Through Engagement

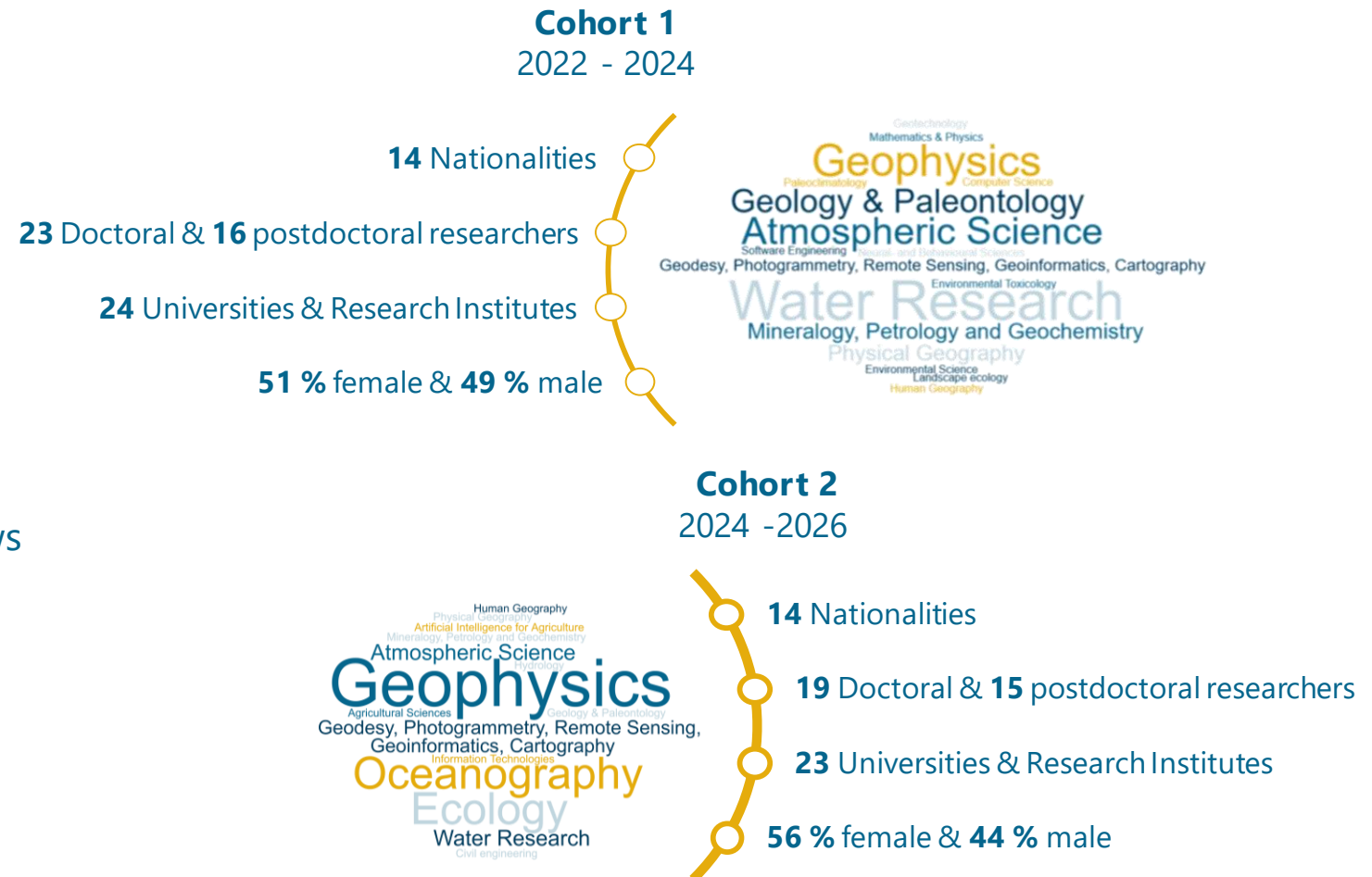


## 45 needs-oriented Academy events

- Networking and Training events on Open and Data Science
- Regular coffee lectures (Ø 50 participants)

## NFDI4Earth community collaborations

- Pilot & Incubator projects of Academy Fellows
- NFDI4Earth Educational Portal
- Specific sessions for Early Career Scientists at NFDI4Earth Plenary



# Engaging beyond the NFDI4Earth



## Cross-consortia events & initiatives such as

- **Cross-consortia hackathon** (with NFDI4Microbiota & NFDI4Biodiversity)
- School on **FAIR research data management** (with NFDI4Microbiota)
- Workshop series on **Introduction to Machine Learning**
- Workshop on **Knowledge Graphs for Scholarly data** (with NFDI4DataScience)
- Workshop series "**Legal aspects of research data management**" (with FAIRagro & NFDI4Biodiversity)

## Involved consortia:



# Engaging beyond the NFDI4Earth



## Cross-consortia events & initiatives such as

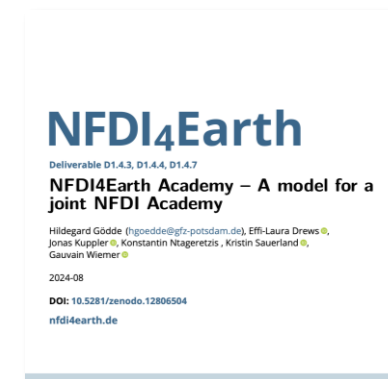
- **Cross-consortia hackathon** (with NFDI4Microbiota & NFDI4Biodiversity)
- School on **FAIR research data management** (with NFDI4Microbiota)
- Workshop series on **Introduction to Machine Learning**
- Workshop on **Knowledge Graphs for Scholarly data** (with NFDI4DataScience)
- Workshop series **“Legal aspects of research data management”** (with FAIRagro & NFDI4Biodiversity)

## Involved consortia:

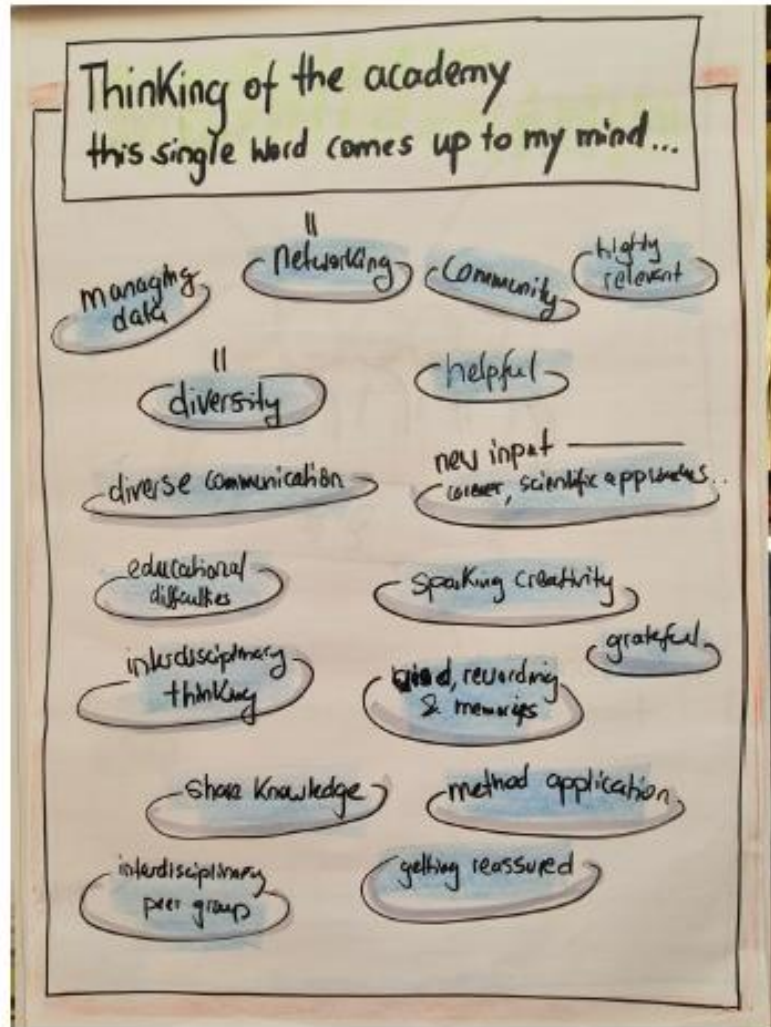


## White paper “NFDI Academy”

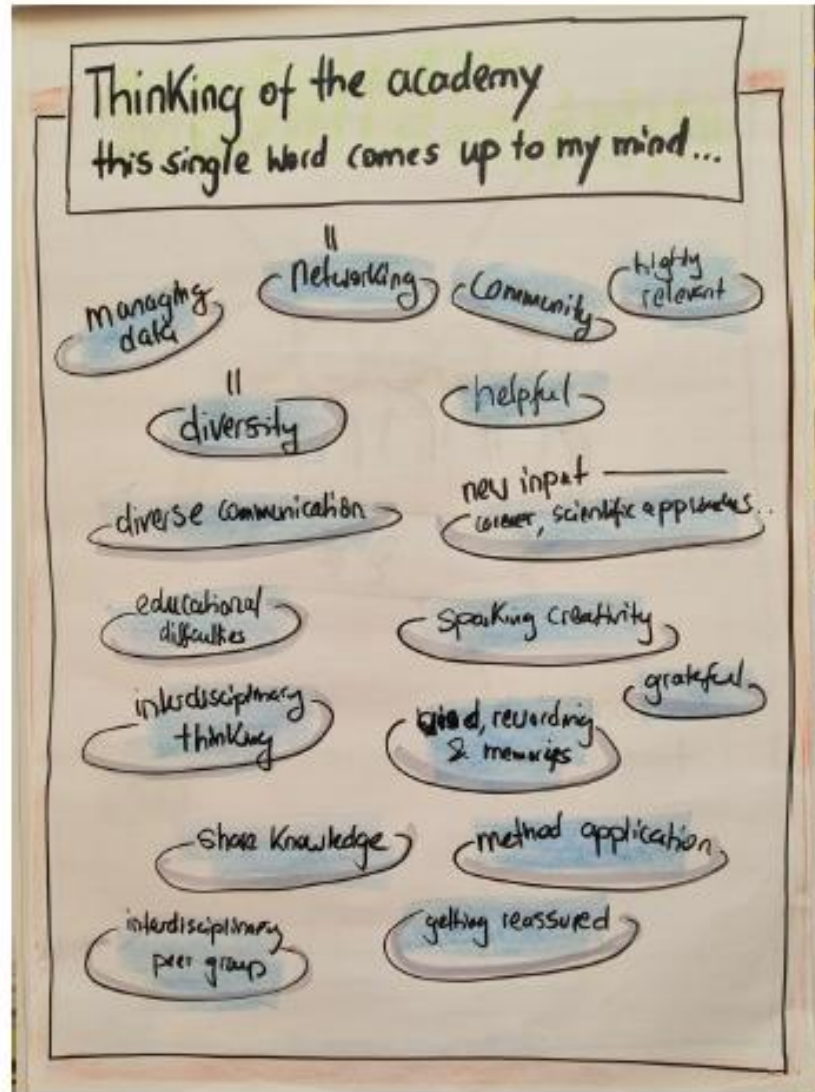
- Strategic development of cross-consortia Academy
- Initial planning with NFDI4Biodiversity



# Feedback / Evaluation results



# Feedback / Evaluation results



# Successfully wrapping up Phase 1






**Thank you!**

**Thank you!**






# EduTrain: An Overview




## N4E Learning Objective Matrix

-  Enabling Micro-Learning and Modularity
-  Designing Courses Systematically
-  Structuring Progression




## N4E Inventory of OER

-  Collection of Quality-Assured OER in ESS
-  Educational Material as FAIR Digital Objects
-  Identifying the Gaps in Existing OER

## N4E Educational Pilots

-  Filling Knowledge Gaps in Existing OER
-  Developing Material on Emerging Topics
-  Community Involvement and Support

## N4E Educational Portal

-  Learner-centered UX
-  Interactive Modules and Notebooks
-  Zero Setup Required

# EduTrain: Learning Objective Matrix

## Open Reproducible Spatio-Temporal Data Analysis

**200**

Learning  
Objectives

**88**

Progression  
Relationships

**50**

Courses  
Defined

**42**

OER  
Mapped

**20**

Learning Units  
Developed

Core Framework



Modular Design

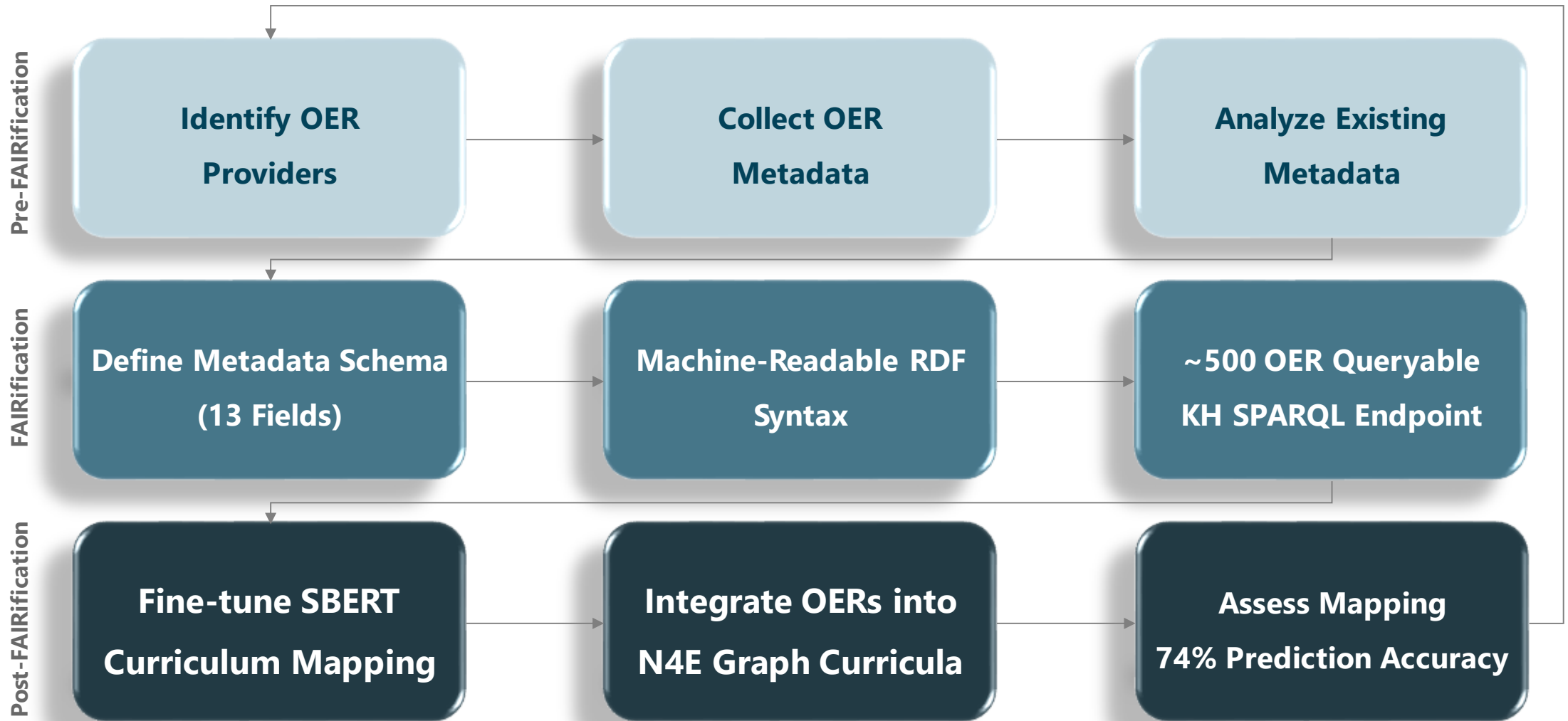


Open Reproducible Methods

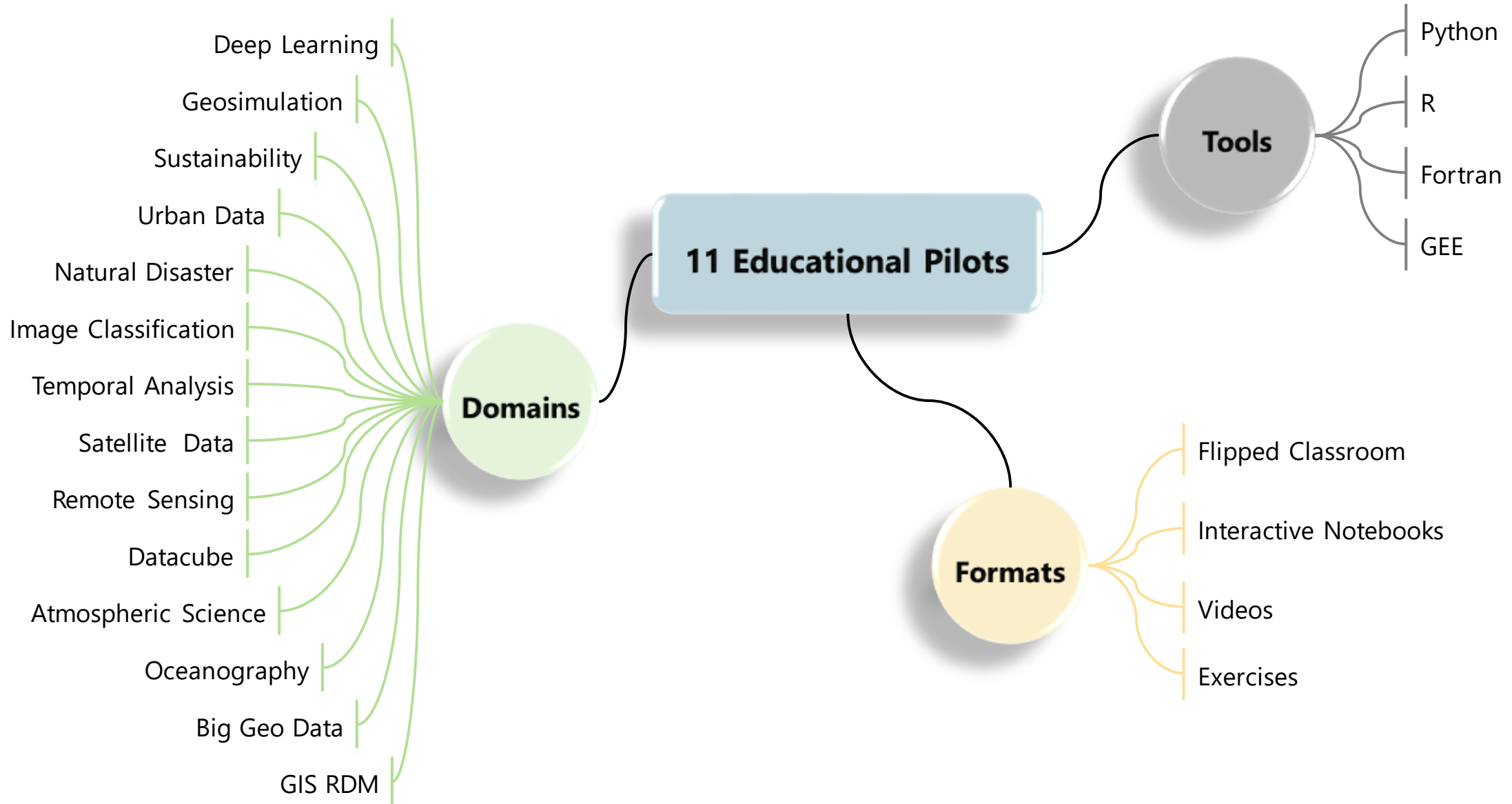


Flexible & Adoptable

# EduTrain: Inventory of FAIR OER



# EduTrain: Educational Pilots



# EduTrain: Educational Portal



30  
ESS  
Courses

292  
Learning  
Units

677  
Learner  
Enrollments

### Modular Courses

#### Python for Spatial Data Analysis

Pick up where you left off Resume course

Expand all

- Python for spatial data analysis
- Getting started 2 min
- Lesson 1: The science behind GIS 155 min
- Lesson 2: Basics of Python 302 min
- Lesson 3: Exploratory data analysis 181 min
- Lesson 4: Vector-based geospatial analysis 177 min
- Lesson 5: Advanced spatial analysis with PySAL 208 min
- Lesson 6: Raster-based geospatial analysis 159 min
- Lesson 7: Terrain analysis 152 min
- Lesson 8: Spatial interpolation (quick tour) 155 min
- Lesson 9: Remote sensing image analysis in Python 365 min
- Lesson 10: Interactive maps 155 min
- Lesson 11: Lidar data visualization 153 min

Course Tools  
Bookmarks  
Launch tour

### Live Jupyter Notebooks

#### Lesson8\_Xarray Last Checkpoint: 10 minutes ago

Data analysis with xarray

This lesson is about how to use xarray to analyze data. It covers the following topics:

- Data access through indexing
- analysis tools
- Illustrations
- Complete examples

Let's start by importing the necessary libraries:

```
[ ]: import xarray as xr
import numpy as np
import matplotlib.pyplot as plt
import requests
import cartopy.crs as ccrs
print ("dependencies imported successfully, no install needed 🎉")
```

We will start learning by working on an example. We will use the HadISST1 data set, which is a gridded data set of globally distributed sea surface temperature and sea ice concentration data. We will use xarray to analyze this data set and answer the following questions:

- What is the global maximum and minimum sea surface temperature for 2019?

1:05

### N4E Guidelines for Course Creators

#### 1 - NFDI4Earth EduPortal:Teacher

NFDI4Earth EduPortal:Teacher is a platform for educators to develop and manage educational resources for teaching Earth System Sciences. The NFDI4Earth educational portal is an instance of the Open edX platform, which is a free and open source learning management system. The platform allows educators to create and manage online courses, quizzes, and other educational resources. Educators can also track student progress and performance, and communicate with students through the platform. The platform is designed to be user friendly and easy to use. The platform is also designed to be flexible and customizable, promoting development of modular content. The platform is designed to be scalable, so it can support a large number of users. The NFDI4Earth EduPortal:Teacher can be accessed at NFDI4Earth EduPortal:Teacher.

#### 1.1 - Setting up a new course

In Studio Home, click on the "+" New Course" button. Fill in the course information, including the course name, organization, course number, and course run and click "Create". Following the guidelines below when creating a course is recommended.

#### 1.1.1 - Course Name

Recommendations below are appreciated for choosing a course name [5].

- Limit the course name to 70 characters. Many of the most effective course titles have 50 or fewer characters.
- Use this case for the course title, capitalizing the first letter of each major word.
- If the course is part of a sequence, create a title that includes both sequence and course information, formatted as "Sequence name: Part 1 - Course", e.g., "Introduction to Python - 1 - Syntac".
- Select a course title that clearly indicates the course subject matter.
- Make sure the course title follows search engine optimization (SEO) guidelines.
- Make sure the course title targets a great audience.

#### 1.1.2 - Organization

All content that has been developed or produced with the aid of NFDI4Earth funding and financial support must be NFDI4Earth as the affiliated organization.

#### 1.1.3 - Course Number

The course number is derived from a combination of the course creation date followed by the initials of the course name. For example, if a course titled "Sample Course" was created on April 19, 2022, the corresponding course number would be 20220419SC.

#### 1.1.4 - Course Run

Default: SKY-Phase

#### 1.2 - Course settings

After creating a new course in Studio, course settings should be configured. To access the basic course settings, in course page, click on:

Settings → Schedule & Dates

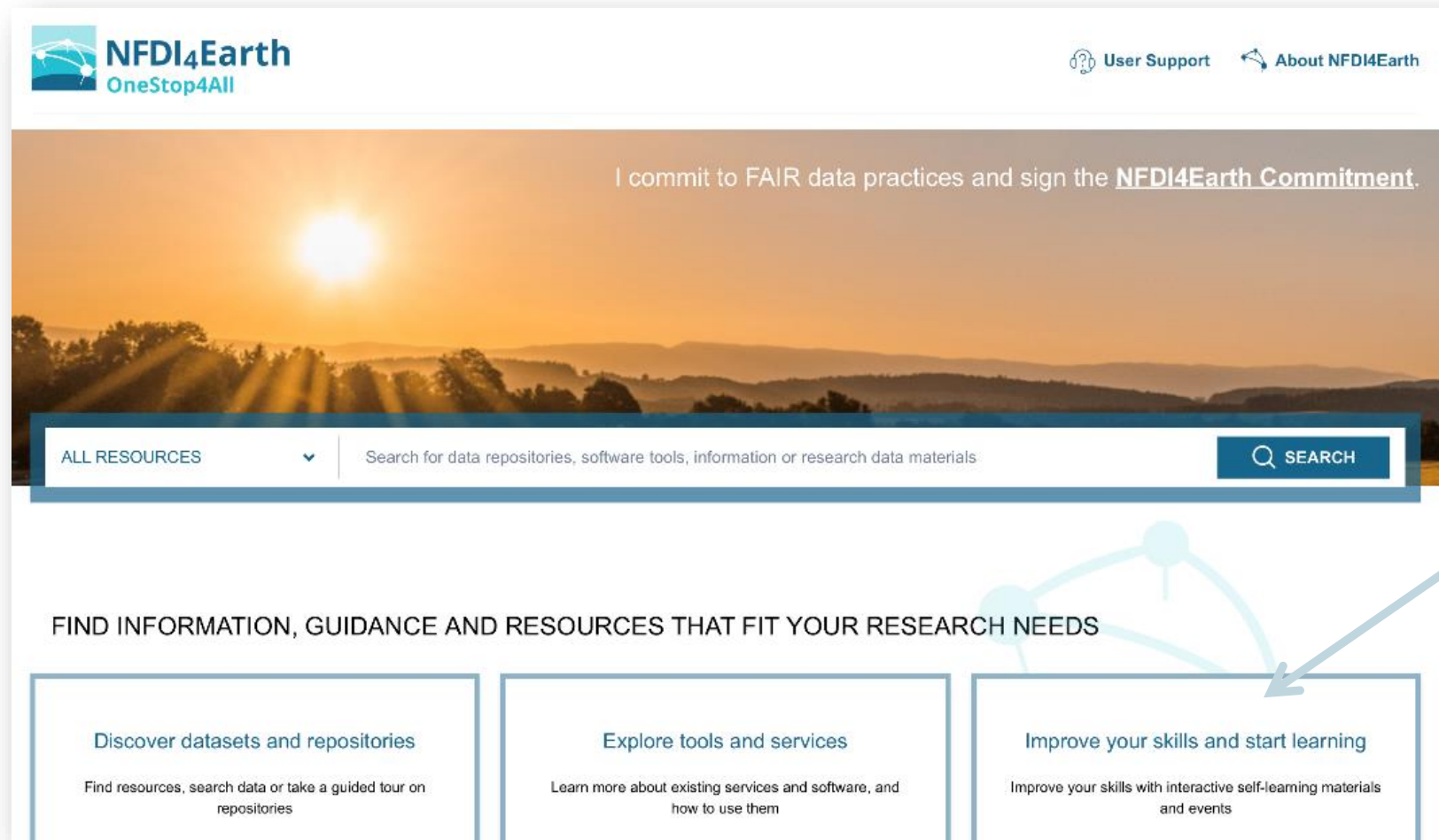
#### 1.2.1 - Course pacing

### Raw Material Available for Reuse

- Analysis of urban transformation processes - Part 1 0
- Analysis of urban transformation processes - Part 2 0
- Analysis of urban transformation processes - Part 3 0
- Artificial Intelligence Basics and Geographical Applications 0
- Cubes and Clouds - Cloud Native Open Data Science for Earth Observation 0
- Fortran Accelerated 0 - Part 1 0
- Fortran Accelerated 0 - Part 2 0
- Foundations of Research Data Management for GIS 0
- Fundamentals of big spatial data 0
- Fundamentals of machine learning for spatial data-selected exercises 0
- Guidelines 0
- How to create publishable netCDF data 0
- Image pre-processing and feature generation and classification in remote sensing 0
- Image processing and analysis-selected exercises 0
- Introduction to Earth data science 0
- Introduction to Python 0
- NetCDF compression 0

# OneStop4All – Our Community Portal

- Central service to support researchers in realizing FAIR research data management
- Single entry point to diverse community resources



The screenshot shows the NFDI4Earth OneStop4All portal homepage. At the top left is the logo. On the right, there are links for 'User Support' and 'About NFDI4Earth'. Below the header is a banner with a sunset landscape and the text 'I commit to FAIR data practices and sign the [NFDI4Earth Commitment](#).' Below the banner is a search bar with a dropdown menu set to 'ALL RESOURCES' and a 'SEARCH' button. Below the search bar is the heading 'FIND INFORMATION, GUIDANCE AND RESOURCES THAT FIT YOUR RESEARCH NEEDS'. Underneath are three main content boxes: 'Discover datasets and repositories' (with subtext 'Find resources, search data or take a guided tour on repositories'), 'Explore tools and services' (with subtext 'Learn more about existing services and software, and how to use them'), and 'Improve your skills and start learning' (with subtext 'Improve your skills with interactive self-learning materials and events'). A light blue network diagram is overlaid on the page, with an arrow pointing from the 'Improve your skills and start learning' box to the 'Learning Resources' icon on the right.



Datasets



Repositories

**\* GUIDED \***



Software & Services



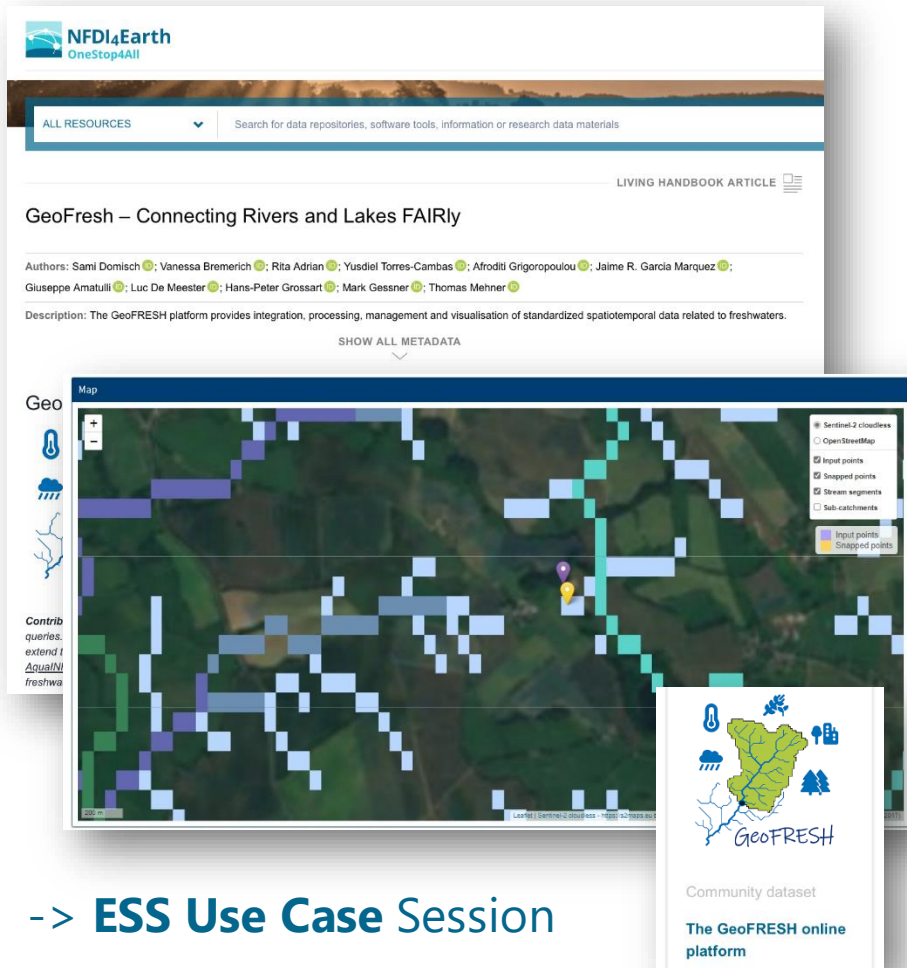
Learning Resources

...

**LIVE DEMO @ Software Marketplace today**

# OneStop4All – Our Community Portal

- To share community data and software showcases
- And participate in NFDI4Earth

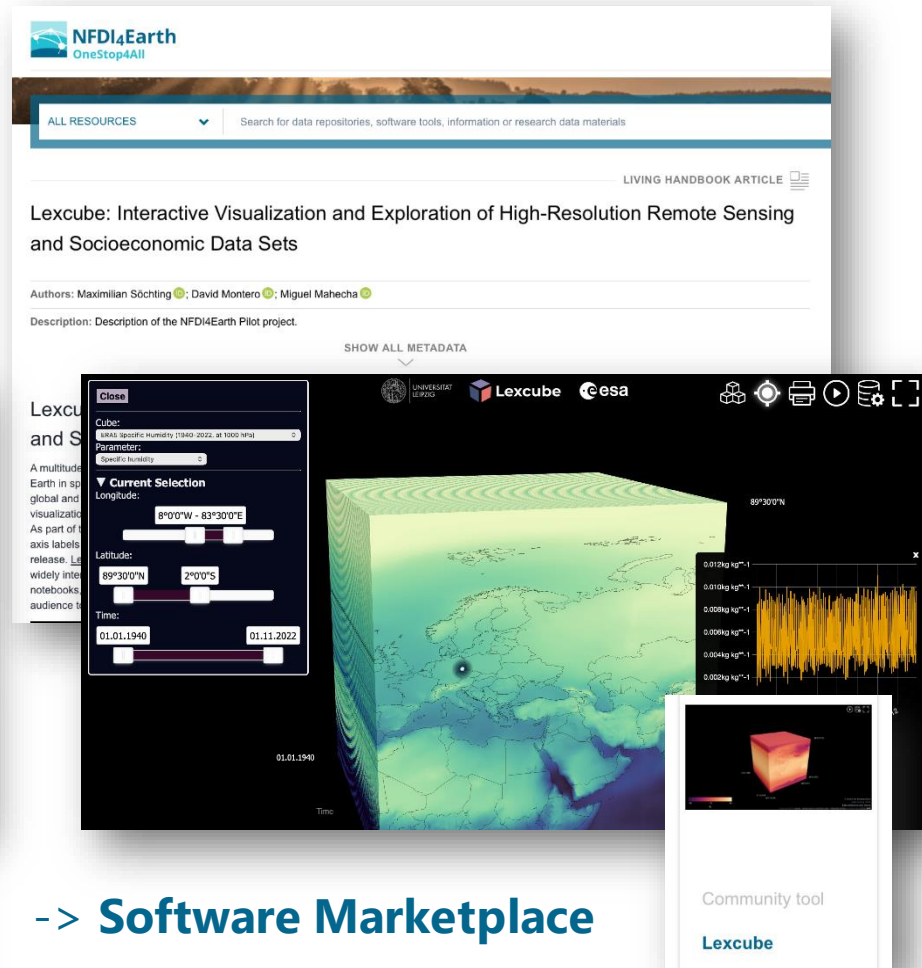


**GeoFresh – Connecting Rivers and Lakes FAIRly**

Authors: Sami Domisch, Vanessa Bremerich, Rita Adrian, Yusdiel Torres-Cambas, Afroditi Grigoropoulou, Jaime R. Garcia Marquez, Giuseppe Amatulli, Luc De Meester, Hans-Peter Grossart, Mark Gessner, Thomas Mehner

Description: The GeoFRESH platform provides integration, processing, management and visualisation of standardized spatiotemporal data related to freshwaters.

Community dataset  
The GeoFRESH online platform



**Lexcube: Interactive Visualization and Exploration of High-Resolution Remote Sensing and Socioeconomic Data Sets**

Authors: Maximilian Söchting, David Montero, Miguel Mahecha

Description: Description of the NFDI4Earth Pilot project.

Community tool  
Lexcube

-> ESS Use Case Session

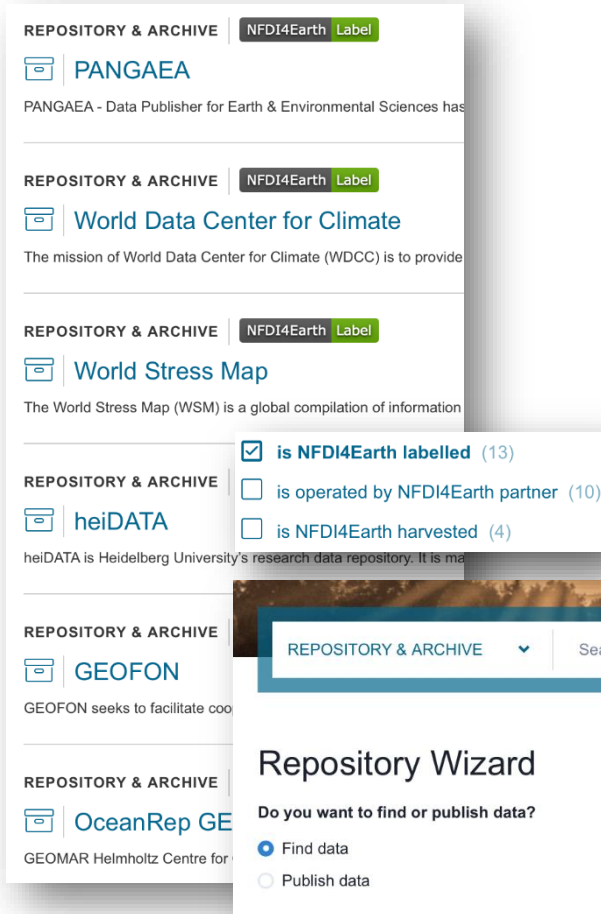
-> Software Marketplace



# OneStop4All – Our Community Portal

- Makes NFDI4Earth products and services visible, e.g.:

Interoperability **Label** for repositories



REPOSITORY & ARCHIVE | NFDI4Earth Label

PANGAEA  
PANGAEA - Data Publisher for Earth & Environmental Sciences has

REPOSITORY & ARCHIVE | NFDI4Earth Label

World Data Center for Climate  
The mission of World Data Center for Climate (WDCC) is to provide

REPOSITORY & ARCHIVE | NFDI4Earth Label

World Stress Map  
The World Stress Map (WSM) is a global compilation of information

REPOSITORY & ARCHIVE | NFDI4Earth Label

is NFDI4Earth labelled (13)  
 is operated by NFDI4Earth partner (10)  
 is NFDI4Earth harvested (4)

REPOSITORY & ARCHIVE | NFDI4Earth Label

heiDATA  
heiDATA is Heidelberg University's research data repository. It is ma

REPOSITORY & ARCHIVE | NFDI4Earth Label

REPOSITORY & ARCHIVE | NFDI4Earth Label

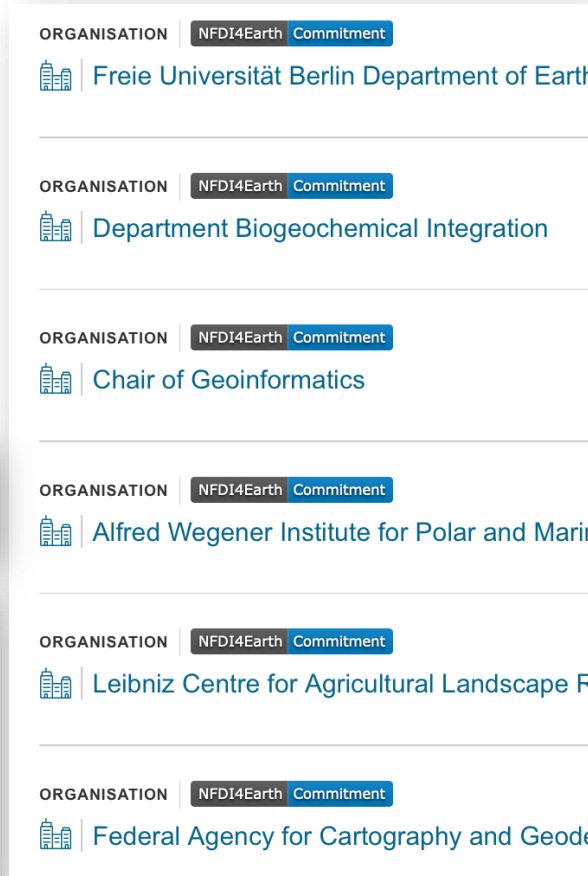
GEOFON  
GEOFON seeks to facilitate coop

REPOSITORY & ARCHIVE | NFDI4Earth Label

OceanRep GE  
GEOMAR Helmholtz Centre for

Repository Wizard  
Do you want to find or publish data?  
 Find data  
 Publish data

FAIRness & openness  
**Commitment**



ORGANISATION | NFDI4Earth Commitment

Freie Universität Berlin Department of Earth

ORGANISATION | NFDI4Earth Commitment

Department Biogeochemical Integration

ORGANISATION | NFDI4Earth Commitment

Chair of Geoinformatics

ORGANISATION | NFDI4Earth Commitment

Alfred Wegener Institute for Polar and Mar

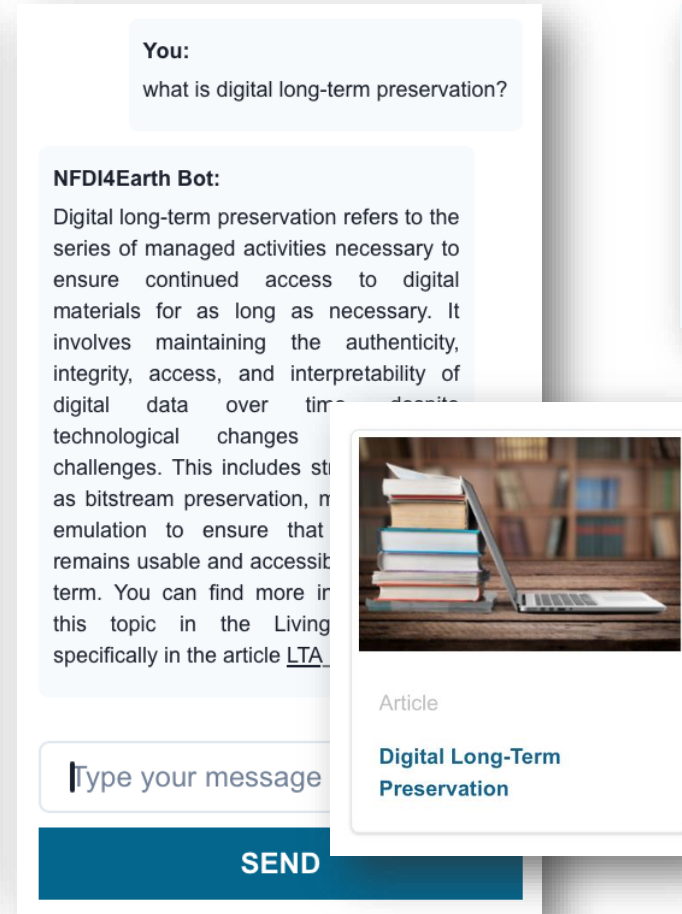
ORGANISATION | NFDI4Earth Commitment

Leibniz Centre for Agricultural Landscape R

ORGANISATION | NFDI4Earth Commitment

Federal Agency for Cartography and Geode

RDM articles from the  
**Living Handbook**



You:  
what is digital long-term preservation?

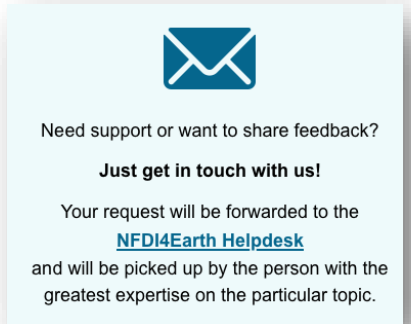
NFDI4Earth Bot:  
Digital long-term preservation refers to the series of managed activities necessary to ensure continued access to digital materials for as long as necessary. It involves maintaining the authenticity, integrity, access, and interpretability of digital data over time despite technological changes challenges. This includes st as bitstream preservation, n emulation to ensure that remains usable and accessit term. You can find more in this topic in the Living specifically in the article [LTA](#)

Article  
Digital Long-Term Preservation

Type your message

SEND

**User Support Network**



Need support or want to share feedback?  
**Just get in touch with us!**  
Your request will be forwarded to the [NFDI4Earth Helpdesk](#) and will be picked up by the person with the greatest expertise on the particular topic.

-> next pitches

# OneStop4All – Our Community Portal



- Embedded in a strong ecosystem, e.g.:

Identity & access management

Curation & software developments

Processing & analysis

Feedback & support

ALL RESOURCES

Back to Discover the NFDI4Earth Label

Manage repositories

**LOGIN**

Please log in to view your account.

NFDI4Earth OneStop4All

dataset x

Gridded surface elevation changes from multi-mission satellite altimetry 1978-2017 (2019)

Schröder, Ludwig; Horwath, Martin; Dietrich, Reinhard; van den Broeke, Michiel R; Ligtenberg, Stefan R

<https://doi.org/10.1594/PANGAEA.897390>

Abstract: Here we provide a 10x10km grid of monthly changes (SEC) of the Antarctic ice sheet from our multi-mission combination. Covering the period 1978-2017, the dataset includes measurements from CryoSat-2, ICESat, and Geosat up to their specific maximum latitude (88°S for CryoSat-2). After a consistent recalibration of the inter-mission offsets, we obtain monthly SEC with respect to the reference epoch 09/2010. Validated against the related publication and prove that the observation modes have been successfully combined to a consistent time series. For coastal East Antarctica, even 5m reliable information and, hence, allow to analyze four different changes. The uncertainty estimates, provided for each altimeter measurement noise, the uncertainty due to the series, the error estimate of the inter-mission offsets at final gridding procedure. These uncertainty estimates are in decimeter at the plateau up to more than a meter in coastal areas. The temporal component, causing the larger uncertainty at the plateau up to more than a meter in coastal areas.

Authors: Ludwig Schröder; Martin Horwath; Reinhard Dietrich; Veit Helm; Michiel R van den Broeke; Stefan R M Ligtenberg

Keywords: ecology; Zooplankton; Satellite altimetry

SHOW ALL METADATA

ABSTRACT

Discover Tools

search tools

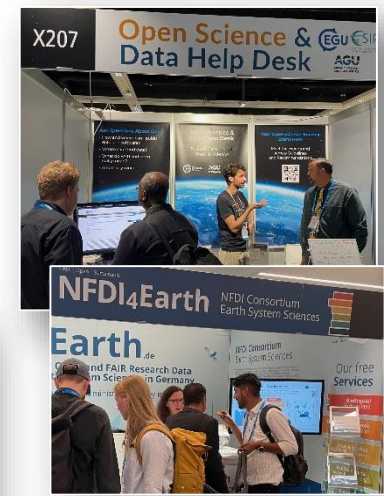
NFDI4Earth OneStop4All Importer downloads content via

6.05 GB 51 6

74: Gridded surface elevation changes from multi-mission satellite altimetry 1978-2017

Add Tags

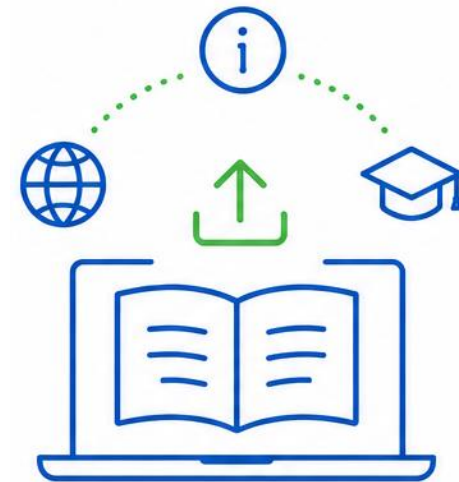
DATA TERRA Galaxy EUROPE eosc



# Idea of the Living Handbook

Dominik Hezel & Jie Xu

- NFDI4Earth owned, text-based repository
- Integrated in the OneStop4All → no need to leave the NFDI4Earth webpage
- Home for NFDI4Earth related information
- Home for RDM in the ESS related information
- Wiki-inspired updates



ALL RESOURCES ▾
hpc

SEARCH

← BACK TO RESULT LIST
LIVING HANDBOOK ARTICLE
← RESULT 8 OF 104 →

## Artificial Intelligence (AI)

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Authors: [Claudia Mueller](#); [Stephan Frickenhaus](#)

---

Description: This article describes Artificial Intelligence (AI) as a building block of the NFDI4Earth Synthesis Architecture, assigned to the Community Services pillar.

---

Subject areas: Geology and Palaeontology; Geodesy, Photogrammetry, Remote Sensing, Geoinformatics, Cartography; Mineralogy, Petrology and Geochemistry; Human Geography

---

Keywords: [research data management](#) [data archiving](#) [data disposal](#) [long-term archiving](#) [repository](#) [HPC](#) [Spatial data infrastructure](#) [PID](#) [ontology](#) [community services](#) [data portal](#) [metadata catalog for datasets](#) [overarching architecture](#) [registry for infrastructures and services](#) [terminology](#) [Basic IT Services](#)

---

Type: [LHBArticle](#)

---

Audiences: Data curator; Data collector; Data user; Policy maker; Service provider

SHOW LESS

## Artificial Intelligence (AI)

Artificial Intelligence (AI) includes machine learning, deep learning and generative AI. This is a field of computer science dedicated to developing machines capable of performing tasks that traditionally require human intelligence. Such tasks include learning from experience, recognizing patterns, solving problems, making decisions, understanding natural language, and even demonstrating forms of creativity. AI systems are designed to mimic or simulate human cognitive functions to a degree that enables them to handle complex tasks across diverse domains. In Earth system science, machine learning and deep learning algorithms are particularly valuable for analyzing high-dimensional datasets, helping researchers uncover intricate patterns and dependencies within Earth's systems.

### AI in Earth System Science:

Machine learning has been extensively applied to identify and characterize differences in minerals or mineral deposits. Deep learning has been applied in areas such as precipitation forecasting and storm tracking, enabling meteorologists to improve both the accuracy and lead time of their predictions. Traditional Earth System Models (ESMs) are computationally intensive and require substantial time and resources to run simulations. By approximating certain processes, the efficiency of these models can be improved, making simulations faster and more accessible. This allows scientists to explore climate scenarios more quickly and obtain results in shorter timeframes.

In addition, deep learning plays a crucial role in processing large datasets, modeling nonlinear systems, and enhancing prediction accuracy for environmental monitoring, climate change projections, and ecosystem management. From an infrastructure perspective, AI capabilities can also be provided as services—for example, OpenAI's ChatGPT. Similar services for AI-driven models are being developed by Helmholtz, such as the [Helmholtz Foundation Model Initiative](#).

[VISIT METADATA SOURCE](#)

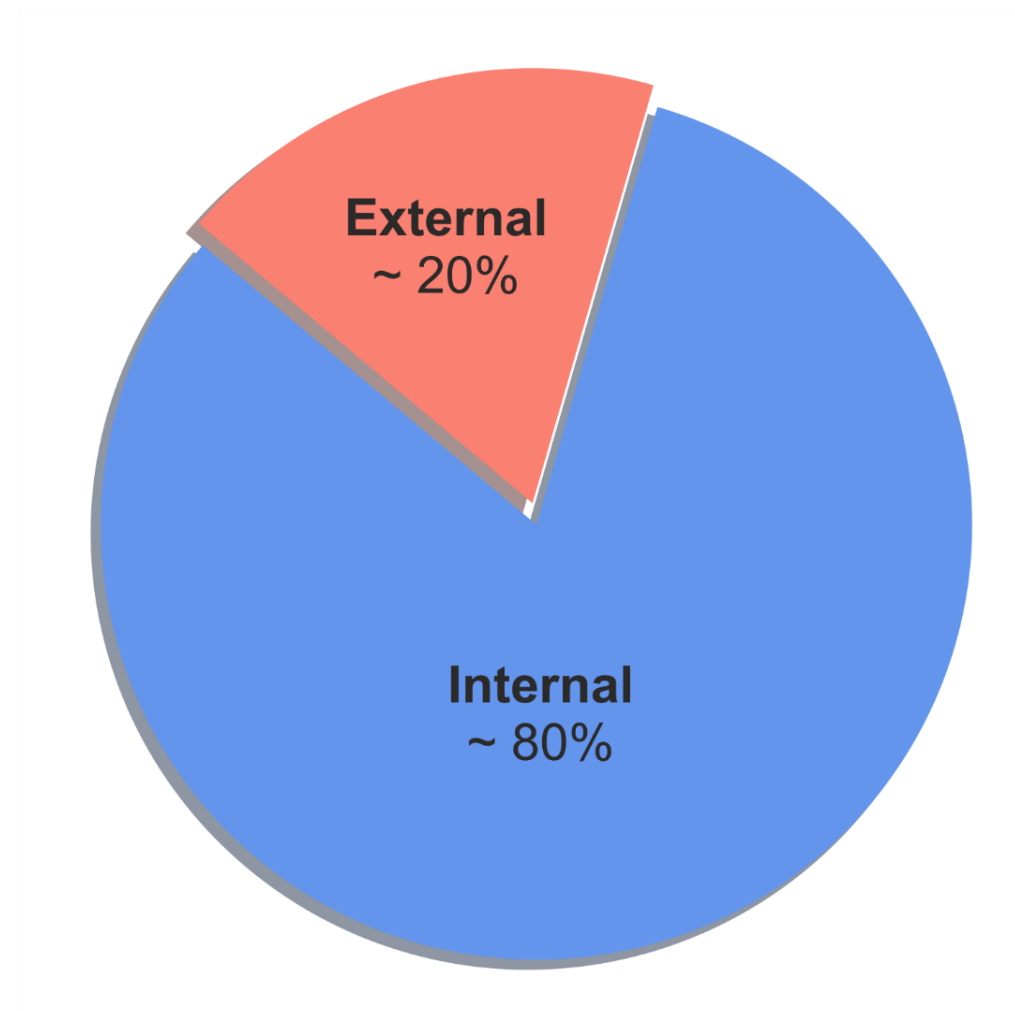
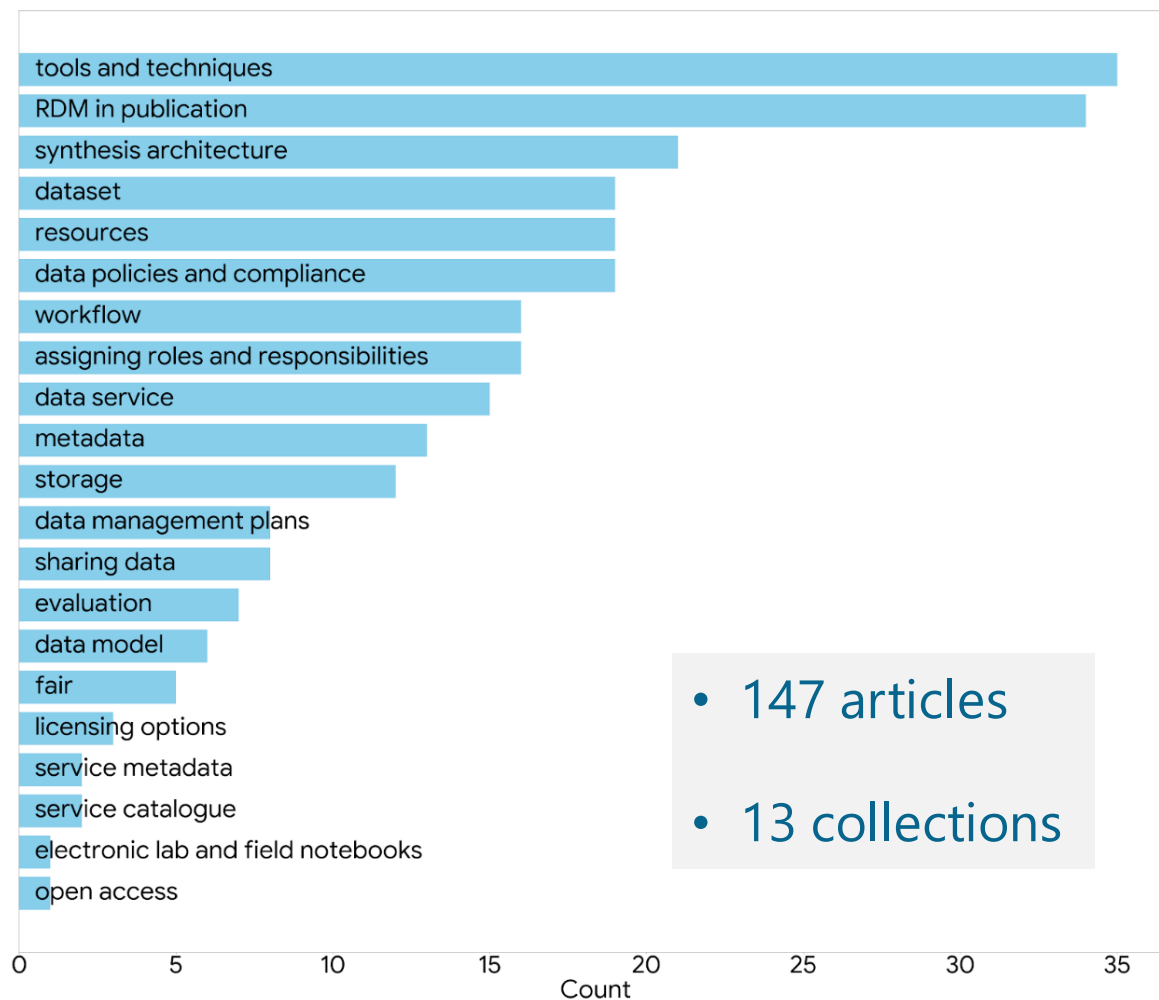
LAST UPDATE: 09/09/2025

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- [Processing Tools](#)
- [Semantics Service/ Ontology](#)



# Living Handbook - Article Statistics



# Living Handbook - The basis for our Bot

## ASK OUR BOT

**NFDI4Earth Bot:**

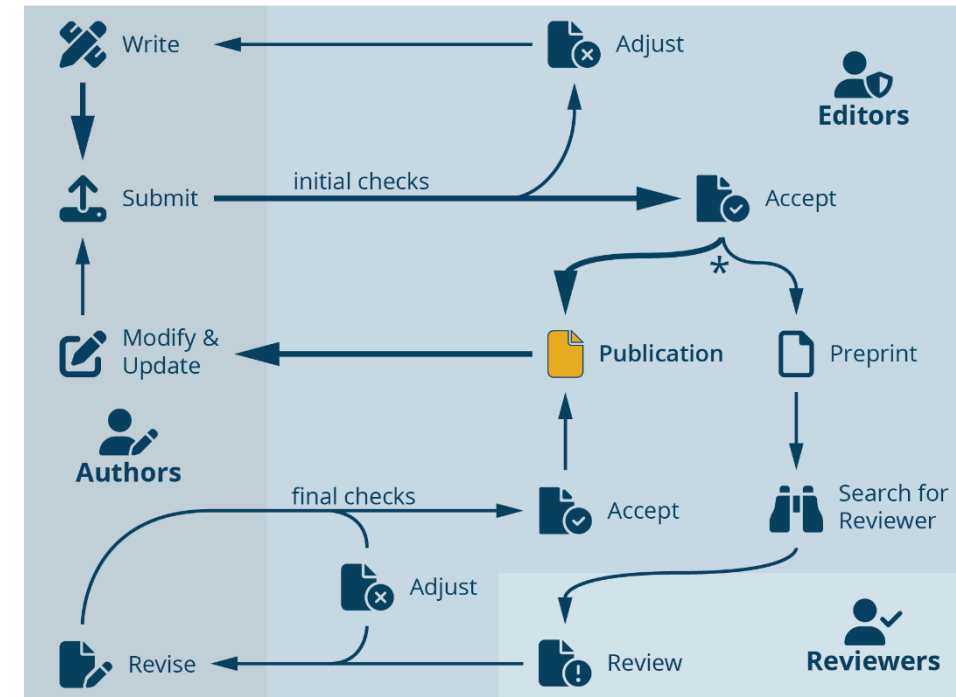
Hello! I'm here to answer your questions about NFDI4Earth and research data management in Earth System Sciences. Please note that I currently provide information only from articles in the Living Handbook and cannot answer questions about specific resources or datasets. As I am still in beta testing, technical issues may occur. What information are you looking for?

**SEND**

# Achievements & Relevance vs. Issues

- Almost 150 articles
- High quality articles
- Basis for chatbot

*yes!*



- Complex review process
- Hard to receive more articles
- Hard to track all urls

## Executive Editor



Jie Xu  
Institut für Geowissenschaften,  
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Dresden



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Research and  
Sustainability (CEN)



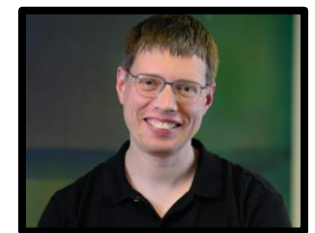
Ivonne Anders  
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Klimarechenzentrum



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Universität Tübingen



Ira Gerloff  
Leibniz-Institut für  
Angewandte Geophysik



ex-member  
Thomas Rose



Auriol Degbelo



Ralf Klammer  
Technische Universität

# The Living Handbook is moving to a new measure!



Andrea Lammert,  
DKRZ



Ivonne Anders,  
DKRZ

## **Measure 3.2: User Support Network** Integration and Support of the 4Earth Community

**... and we switch to TA2 for phase 2**

# NFDI4Earth Training Schools



**Measure 2.4**

# User Support Network

## Community support

### Living Handbook

#### Frequently asked questions (FAQ)

Please find below a list of all FAQs compiled by the NFDI4Earth User Support Network.

##### Research Data Management

- How can I publish my data?
- What are the FAIR principles?
- What is a research data management plan?
- How do I cite research data correctly?
- Why does publishing data in FAIR repositories take so long compared to Zenodo?
- What license should I use for publishing my data?
- What are metadata, and why is it important to add metadata to datasets?
- What is a DOI? Or a PID?
- How can I find a suitable repository for my data?
- How do I decide which data I should keep and archive and which I can delete?
- What is the difference between sharing, publishing and long-term storage of research data?

##### NFDI4Earth

- What is NFDI4Earth?
- What does the NFDI4Earth offer?
- How can I contribute to the NFDI4Earth?
- Where does the content in the NFDI4Earth come from?

### Pilot collaboration



### Internal structure

NFDI4Earth Label

... Feedback, Label and ServicePortfolio

# User Support Network

## Community involvement

Newsletter: Question of the Quarter



NFDI4Earth / USN visibility



CoRDI, Data Science Symposium,  
RDA-DE, ...

## Projects



## Highlights

- Ticket System operational in 2022



- extended network external and internal

[← BACK TO RESULT LIST](#) [LIFE 60-HANDBOOK ARTIKEL](#)

### Become a helpdesk expert

Authors: Heide Wittenberg, Klaus Dettlaff

Description:

NFDI4Earth aims to a network that supports FAIR and open research data management practices in the Earth System Sciences. Here, we provide a overview of those to create an expert in our user support network.

Keywords: [FAIR practices](#), [openness](#), [networks](#), [user support](#)

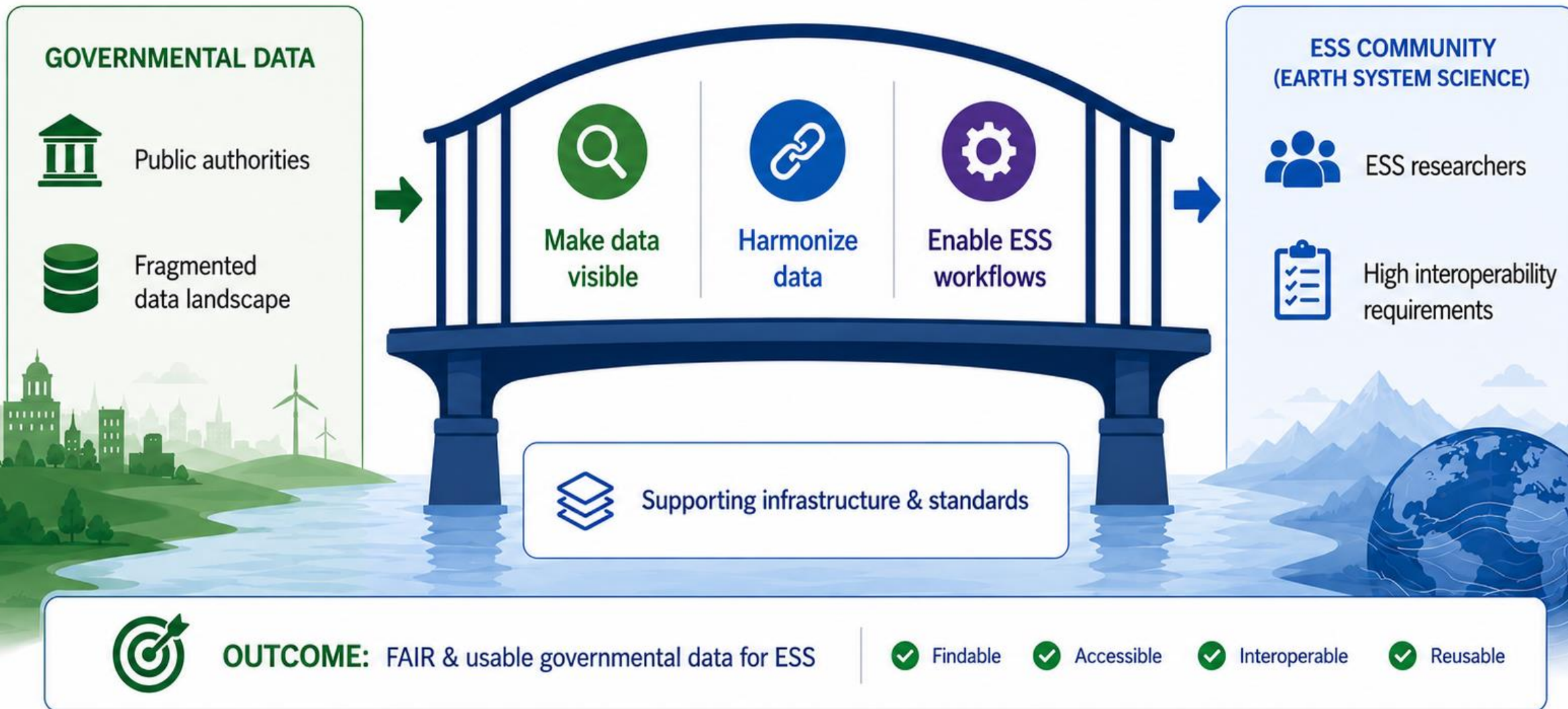
Type: [LIFE Handbook Article](#)



## Geo-Chem-Life Science Helpdesk-Network



# Governmental Data and Advancing Tools



# Governmental Data and Advancing Tools: Key Results

## Structural Impact:

- Mapping of governmental data landscape
- Use case-based data requirements

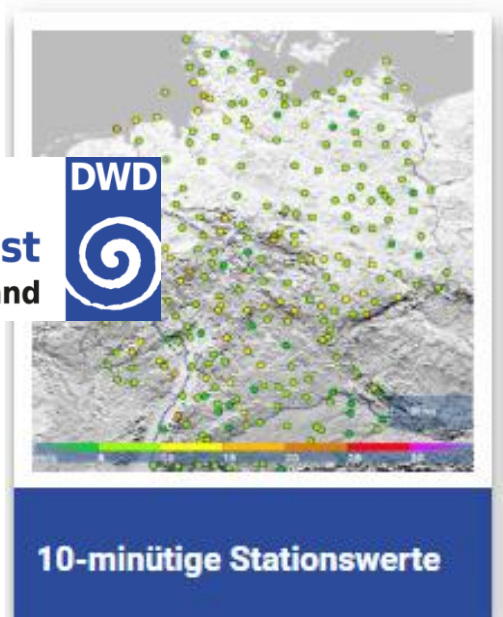
## Scientific Usability:

- COSMO-REA6 data cube development
- High-Value Data integration tests

## Strategic Collaboration:

- Cooperation with authorities
- Exchange with GDI-DE & umwelt.info

Deutscher Wetterdienst  
Wetter und Klima aus einer Hand



 **Geoportal.de**  
suchen. finden. verbinden.

Support  
GDI-DE

Startseite Harvesting

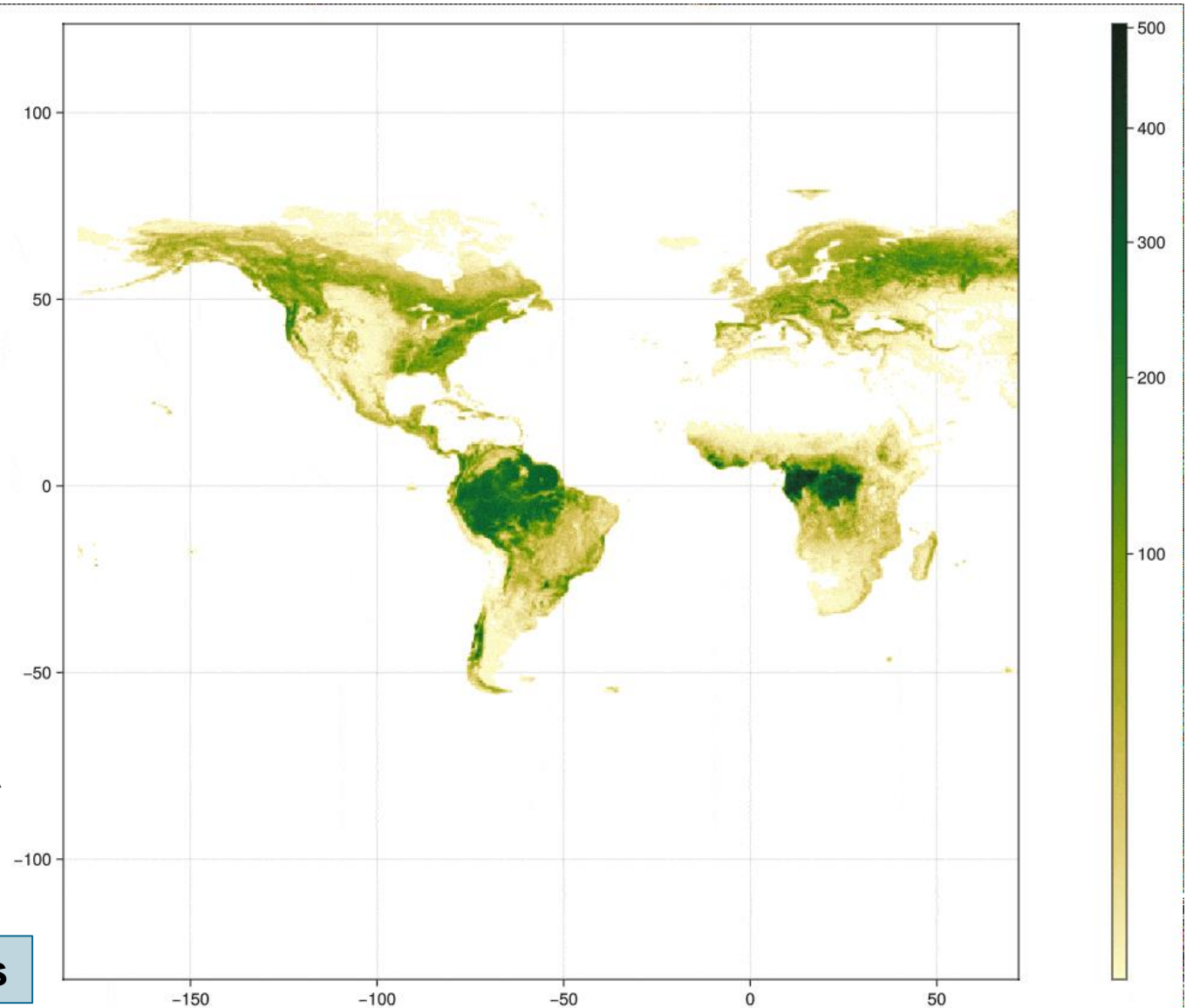
Hier finden Sie eine Übersicht über die letzten Harvesting-Vorgänge. Bitte kontaktieren Sie uns, falls Sie ein Logfile benötigen.

Bezeichnung	URL	Status	Intervall	Letztes Harvesting	GDK-DE geharvestet	nicht schemakonform	UUID-Duplikate hinzugefügt	entfernt	unverändert	aktualisiert
BASL_W1	inspire.bast.de	active	20:35 WED	2023-11-22T20:35:00	3	3	0	0	0	3
BB	geoportal.brandenburg.de	active	10:00 FRI	2023-11-24T10:00:00	18822	21000	2195	0	1378	9 17124 320
BBSR_W1	bbsr-geodienste.de	active	05:27 TUE	2023-11-21T05:27:00	69	79	0	10	0	0 69 0
BGR_W1	geoportal.bgr.de	active	03:30 TUE	2023-11-21T03:30:00	933	933	0	0	38	0 821 74
BKG_Ingrid_W1	mis.bkg.bund.de	active	22:15 *	2023-11-23T22:15:00	288	288	0	0	0	0 287 1
BKG_W1	(intern)	active	22:17 *	2023-11-23T22:17:00	109	109	0	0	0	0 109 0
BMEL_W1	gdi-catalog.bmel.de	active	05:00 WED	2023-11-22T05:00:00	61	61	0	0	0	0 61 0
BSH_W1	www.geoseportal.de	active	07:00 FRI	2023-11-24T07:00:00	1539	1684	6	139	0	0 40 1499
BW inspireidentifiziert dataset	www.geoportal-bw.de	active	04:00 THU	2023-11-16T04:00:00	72465	116685	1356	42856	1415	1073 70404 663
BW inspireidentifiziert services	www.geoportal-bw.de	active	04:00 SAT	2023-11-18T04:00:00	84224	112905	21	28658	1728	904 81835 663
BW komplett	www.geoportal-bw.de	active	04:00 SUN	2023-11-19T04:00:00	150446	346243	2068	153464	6591	6459 179981 4150
Bayern_W1	geoportal.bayern.de	active	08:00 MON,TUE,WED,THU,FRI,SUN	2023-11-24T08:00:00	1146					
Berlin	gdi.berlin.de	active	18:20 TUE,THU	2023-11-23T18:20:00	2972	2978	36	0	2	1 2960 11
BIG	geoportal.bifg.de	active	23:30 MON,TUE,WED,THU,FRI,SUN	2023-11-23T23:30:00	208	233	25	0	2	0 208 0
BIN	geodienste.bfn.de	active	06:04 *	2023-11-24T06:04:00	248	248	0	0	0	0 248 0
BIS	www.imis.bfs.de	active	17:00 THU	2023-11-23T17:00:00	50	67	17	0	0	0 50 0
Bremen	metaver.de	active	18:15 TUE,THUSUN	2023-11-23T18:15:00	570	571	1	0	0	0 570 0
CODE-DE	(intern)	inactive	22:17 *	2023-02-01T15:25:06	3	3	0	0	3	0 0 0
DB_Netz	(intern)	inactive	22:17 *	2022-11-22T08:37:53	3	3	0	0	0	0 3 0

# Governmental Data and Advancing Tools: Technological Key Outputs

- FAIR Publishing of a large dataset
- Benchmarks on data formats
- Open Source contributions:  
PyramidScheme.jl

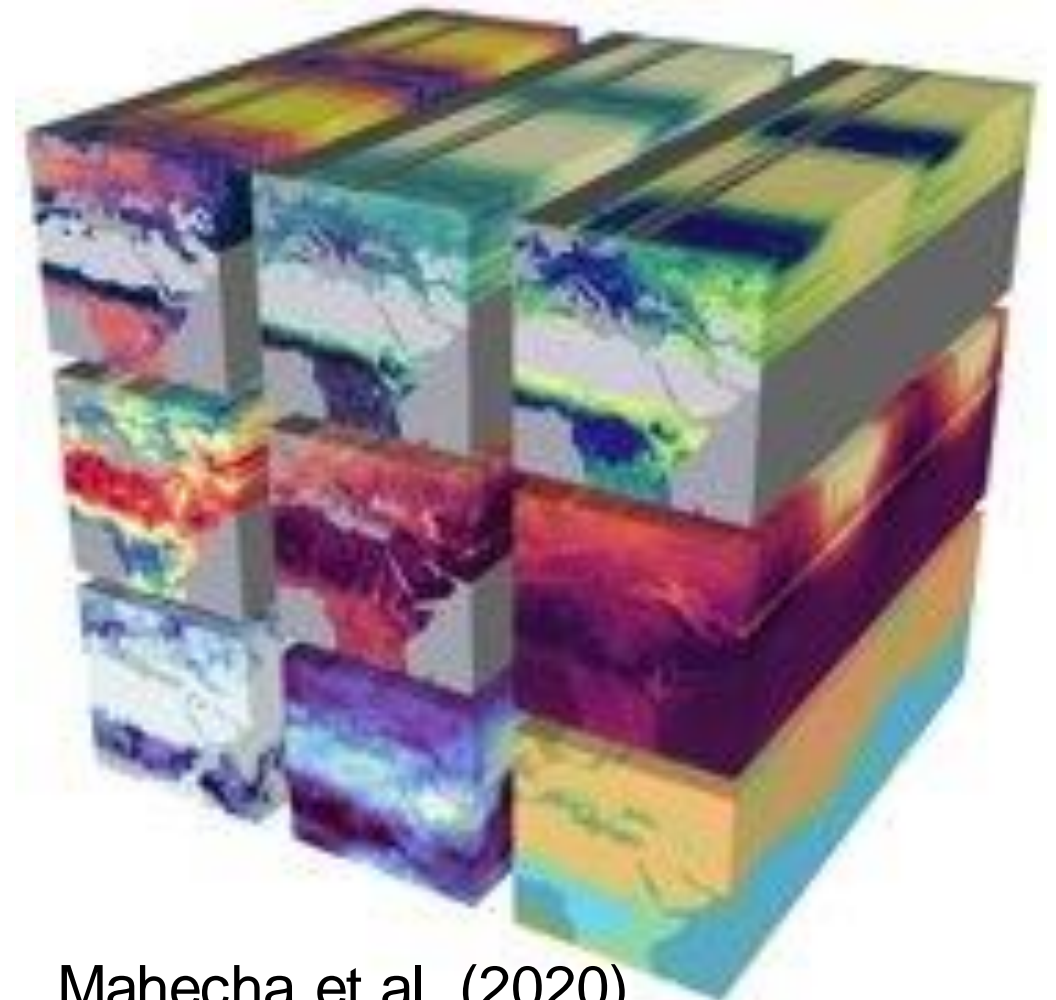
**Global 100 m biomass example** generated via  
PyramidScheme.jl



**Seamless zoom across spatial scales**

# Governmental Data and Advancing Tools: Methodological Key Outputs

- Use case-driven **OneStop4All** data search workflows
- **Cross-language** workflows
- Harmonised raster & vector **data cubes**
- Scalable & reusable **analysis workflows**



Mahecha et al. (2020)





<https://doi.org/10.5194/esd-11-201-2020>

# Governmental Data and Advancing Tools: Community Outputs & Dissemination







- **Workshops & Hackathons:**  
High-Value Data & NFDI4Earth  
Academy events
- **Community & institutional  
collaboration:**  
Pangeo & cross-NFDI gov data  
cooperation
- **Training & knowledge transfer:**  
Tutorials in R, Python and Julia +  
guidance reports

## Report on data made available for research by governmental authorities

Availability of Government Data for Research Purposes

Astrid Ziemann  ([astrid.ziemann@tu-dresden.de](mailto:astrid.ziemann@tu-dresden.de)), Alois Georg Wieshuber ,  
Tim Schürmann , Stefan Krämer, Maximilian Berthold ,  
Frank Kratzenstein

## Overview of data cube technologies and review of other emerging technologies

Felix Cremer  ([fcremer@bgc-jena.mpg.de](mailto:fcremer@bgc-jena.mpg.de)), Hannes Dröse , Yomna Eid ,  
Fabian Gans , Sibylle Hassler , Arne Osterthun , Edzer Pebesma 

# Service Management and Architecture

- Repositories and Data Portals – cooperation with re3data
- RDM Services – Metadata and collection of services
- NFDI4Earth Synthesis Architecture and the NFDI Overall Architecture

# Service Management and Architecture

## Repositories and Data Portals – cooperation with re3data

- re3data uses a standardised set of metadata
- re3data assigns DOIs (Digital Object Identifiers) to repositories
- NFDI4Earth uses re3data as main source for repository metadata

## The NFDI4Earth part

- Supported in keeping repository metadata up to date
- Reported outdated and not existing repositories (to be marked accordingly)
- Suggested ESS relevant repositories for registration with re3data
- Supported repository providers in the registration process

The logo for re3data.org, with "re3" in blue and green and "data.org" in black.

**Registry of Research  
Data Repositories**

## Suggest a repository

### re3data.org Registration Policy

To be registered in re3data.org a research data repository must

- be run by a legal entity, such as a sustainable institution (e.g. library, university)
- clarify access conditions to the data and repository as well as the terms of use
- **have focus on research data**

# Service Management and Architecture

## Repositories and Data Portals – Updated repository entries since 2024

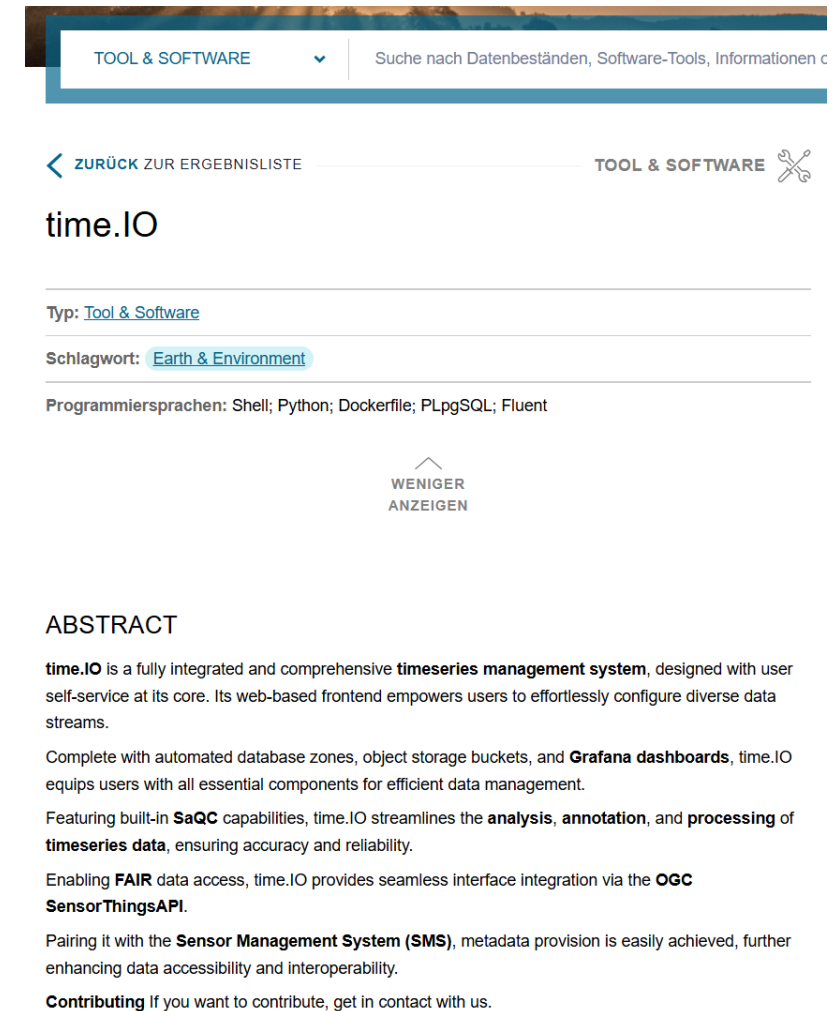
Updates	Number of repositories
ROR (persistent identifiers for research organisation)	16
General updates (URL, Keywords, API info etc.)	26
Metadata field 'enhanced publication' lacked clear explanation – better explanation added	All

# Service Management and Architecture

## RDM Services – Metadata and collection of services

- Developed and refined a RDM service schema with 34 attributes of which 5 are mandatory
- Conducted a metadata collection of services via a survey
  - 75 questions sent out, yielding 29 valid responses
- Mapped most entries successfully to the service schema
- Integrated the information into the Knowledge Hub and OneStop4All
- New services can be suggested via the **NFDI4Earth Helpdesk**\*

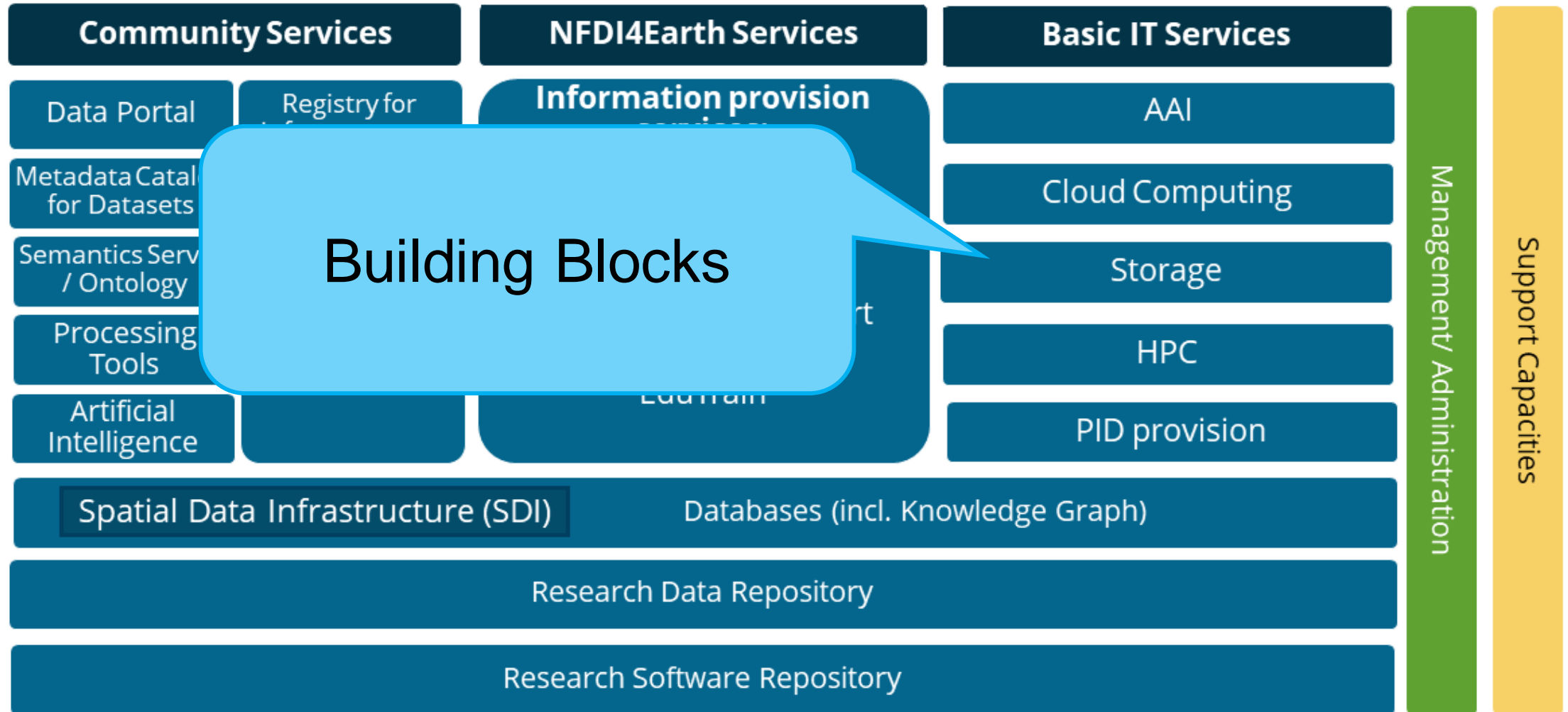
(\*[https://onestop4all.nfdi4earth.de/result/lhb-docs-N4E\\_Suggest\\_A\\_Service.md](https://onestop4all.nfdi4earth.de/result/lhb-docs-N4E_Suggest_A_Service.md))



The screenshot shows a search result for 'time.IO' on the NFDI4Earth website. The page includes a navigation bar with 'TOOL & SOFTWARE' and a search bar. Below the search bar, there are links for 'ZURÜCK ZUR ERGEBNISLISTE' and 'TOOL & SOFTWARE'. The main content area displays the service name 'time.IO', its type 'Tool & Software', and keywords 'Earth & Environment'. It also lists programming languages: Shell, Python, Dockerfile, PLpgSQL, and Fluent. A button labeled 'WENIGER ANZEIGEN' is visible. The 'ABSTRACT' section describes 'time.IO' as a fully integrated and comprehensive timeseries management system, designed with user self-service at its core. It mentions features like automated database zones, object storage buckets, and Grafana dashboards. It also highlights built-in SaQC capabilities, FAIR data access, and integration with the OGC SensorThingsAPI. The abstract concludes by mentioning its pairing with the Sensor Management System (SMS) and a call to action for contributing.

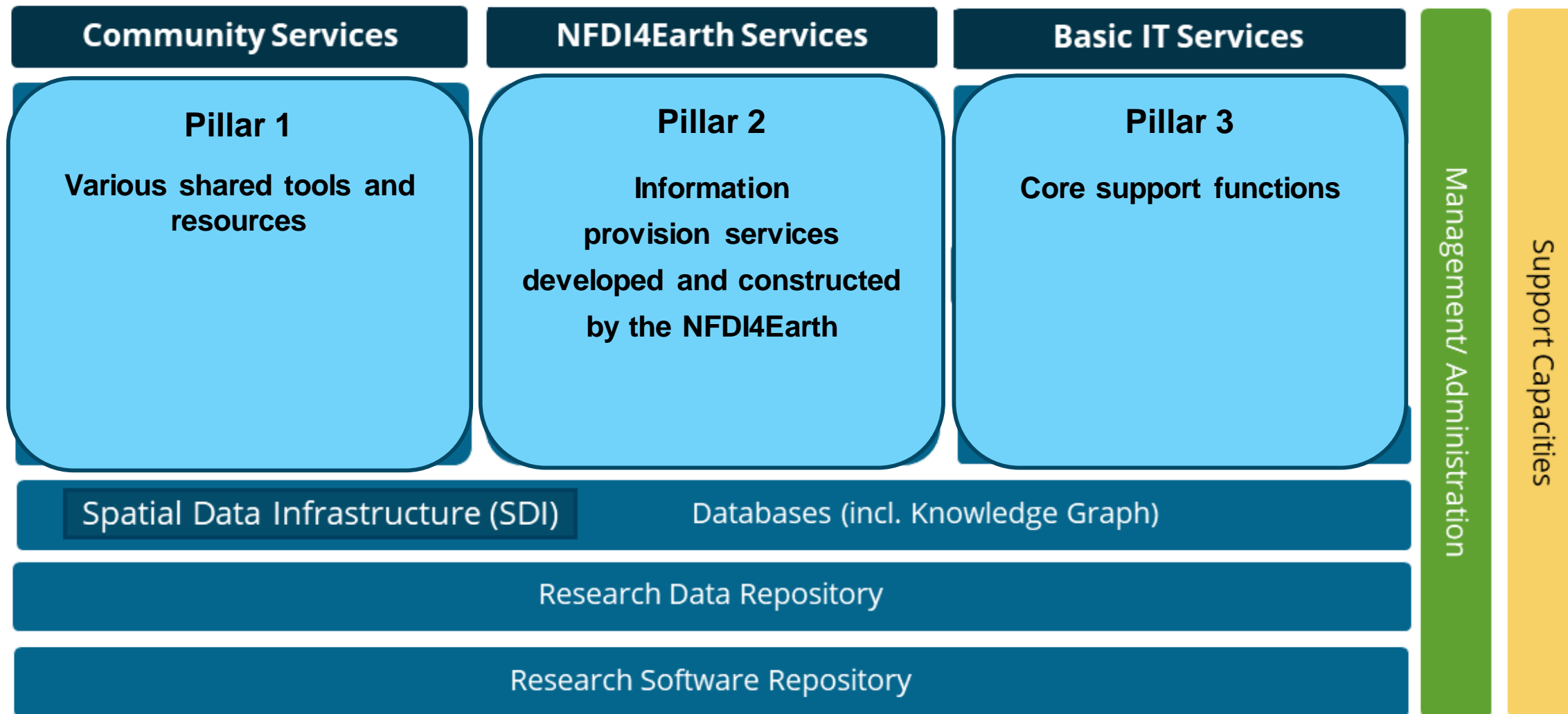
# Service Management and Architecture

## NFDI4Earth Synthesis Architecture and the Overall Architecture (NFDI OA)



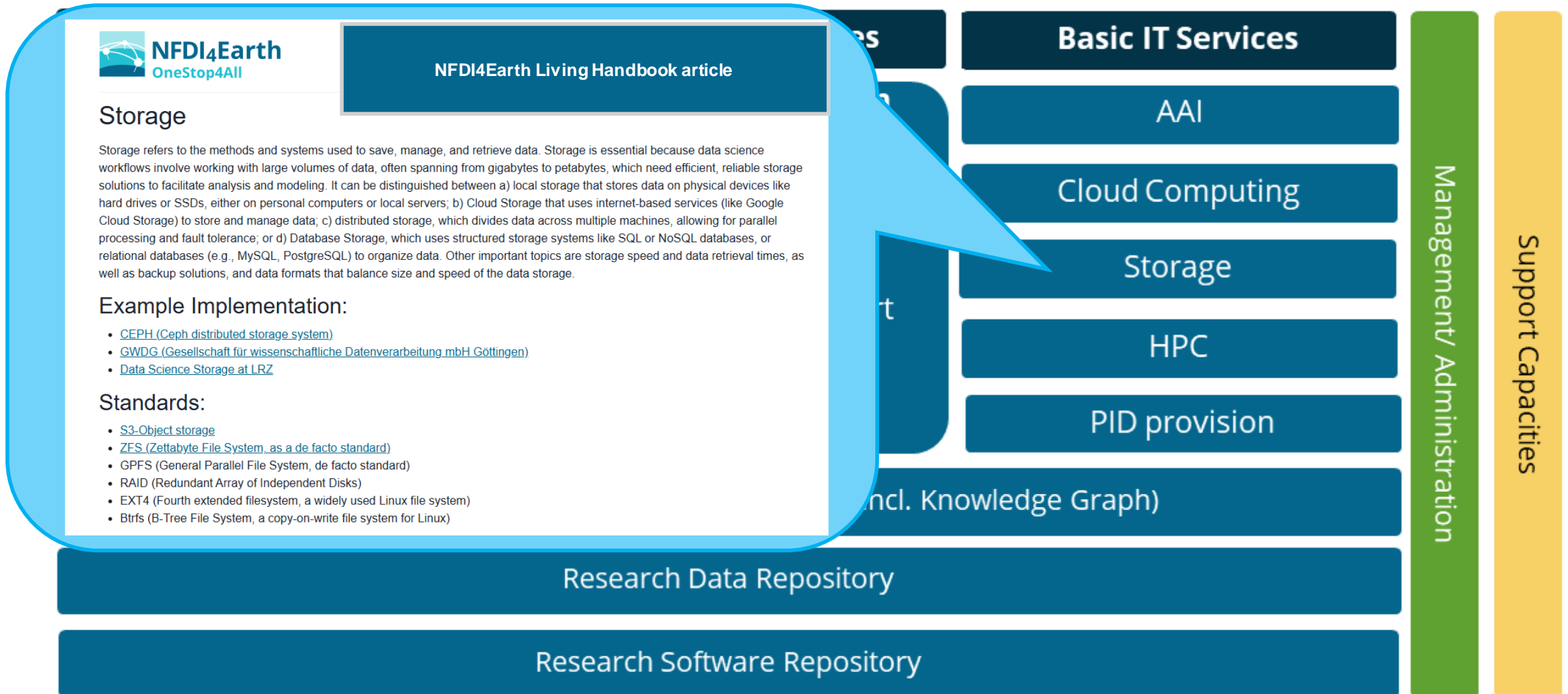
# Service Management and Architecture

## NFDI4Earth Synthesis Architecture and the Overall Architecture (NFDI OA)



# Service Management and Architecture

## NFDI4Earth Synthesis Architecture and the Overall Architecture (NFDI OA)



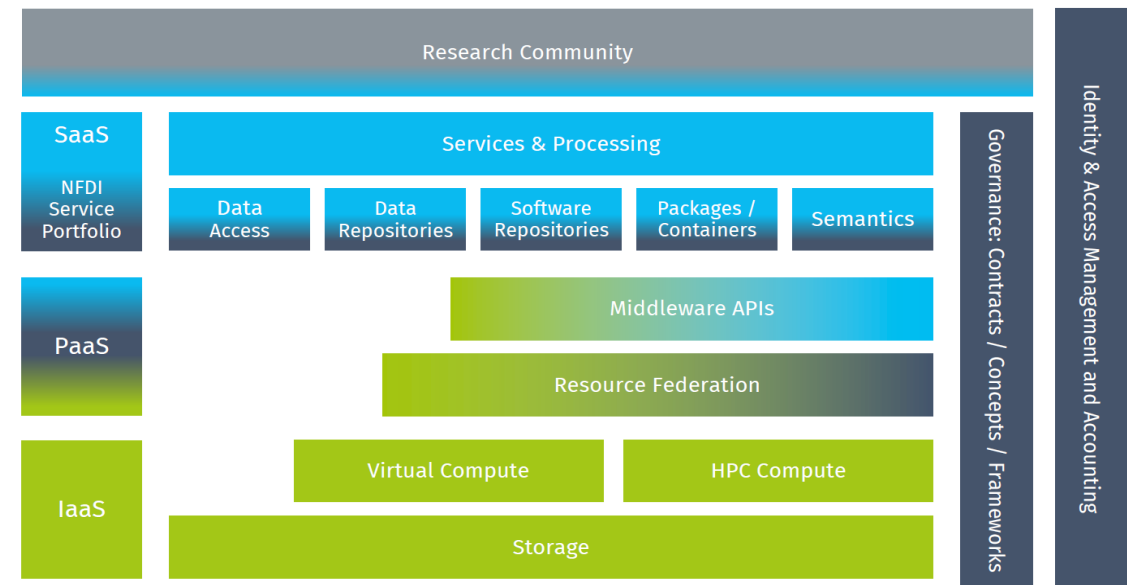
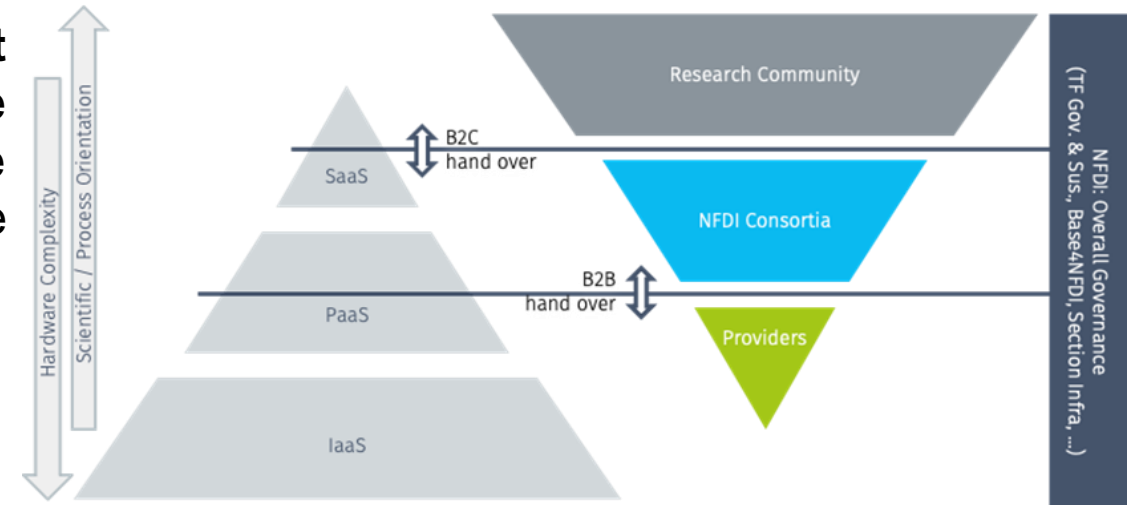
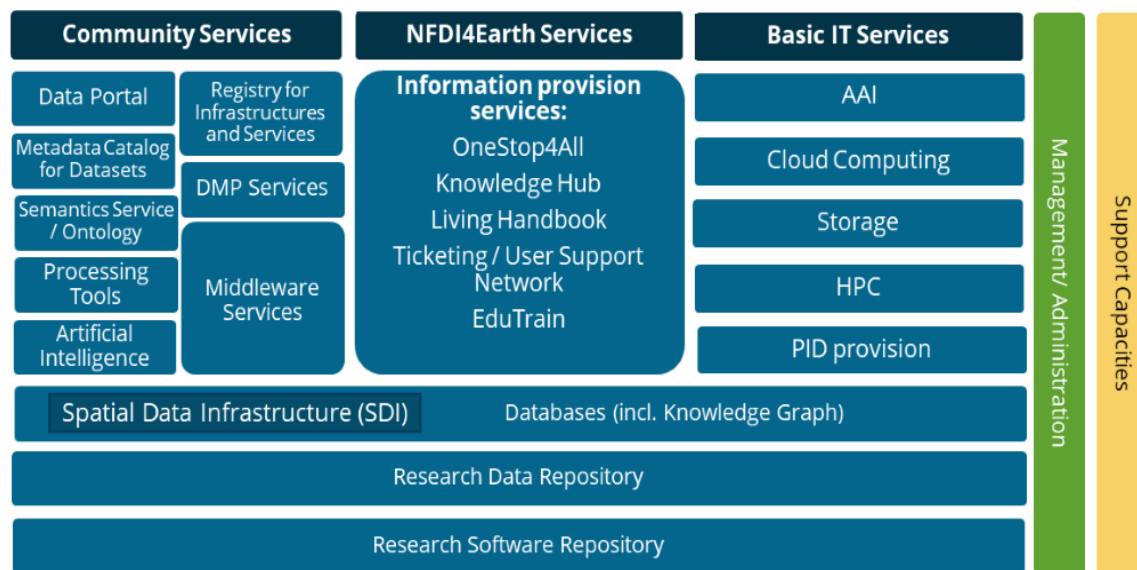
# Service Management and Architecture

NFDI4Earth Synthesis Architecture and the Overall Architecture (NFDI OA)



**NFDI OA concept**  
**SaaS** - Software as a Service  
**PaaS** - Platform as a Service  
**IaaS** - Infrastructure as a Service

**NFDI4Earth concept**  
*with more services, in particular semantic/thematic ones*



Providers      NFDI Consortia      NFDI      Layered Architecture Map

# Knowledge Hub

A linked data service for ESS resources



- 900k+ **Datasets**
  - 400k+ **Data services**
  - 500+ **Learning resources**
  - 200+ **Software**
- 180+ **Data repositories**
  - 170+ **Publications**
  - 90+ **Metadata standards**
  - 70+ **RDM services**

## Data providers



RDF Quad Store  
+ Digital Object storage



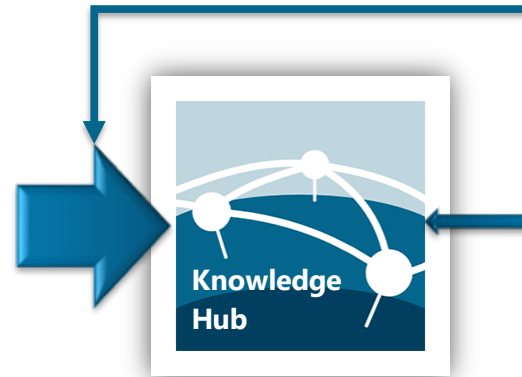
# Knowledge Hub



## Data ingestion



**Harvesting**  
Aggregators and resource providers



## Curation within NFDI4Earth project

e.g., RDM service provider survey



## Integration in the NFDI4Earth community

- Building on existing **services** of **NFDI4Earth partners**
- **Collaboration** through **joint** development, metadata curation, publications

### Example I: Joint development and metadata curation

Integration of resources offered by umwelt.info via DataHub



### Example II: Joint publication

Recommendation paper for metadata provision in ESS



# Knowledge Hub

## SPARQL API

Query endpoint for data exploration and retrieval of interconnected metadata



## NFDI4Earth Ontology

Describes entities of research data infrastructures

Builds on widely adopted community standards, e.g.,

**nfdicore Ontology**



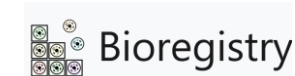
**DCAT-AP.de**

**Schema.org**

Engagement in NFDI working groups, e.g.,  
Taskforce Metadata  
Search and Harvesting  
Knowledge Graphs



Findable via



# Knowledge Hub

## Focus 2025/26: Streamlining and consolidation

### Harvest & query performance

Efficiency of data population and retrieval operations

### Metadata curation

E.g., duplicate detection

### Schema enrichment

Extension of existing classes

### Metadata provider access

Enabling providers to insert and maintain metadata within the system

## Further efforts and work in progress

### Metadata inference

Automated completion of missing or incomplete metadata fields

### Schema expansion

E.g., integration of workflows



### Service resilience

Automatic monitoring of processing pipelines



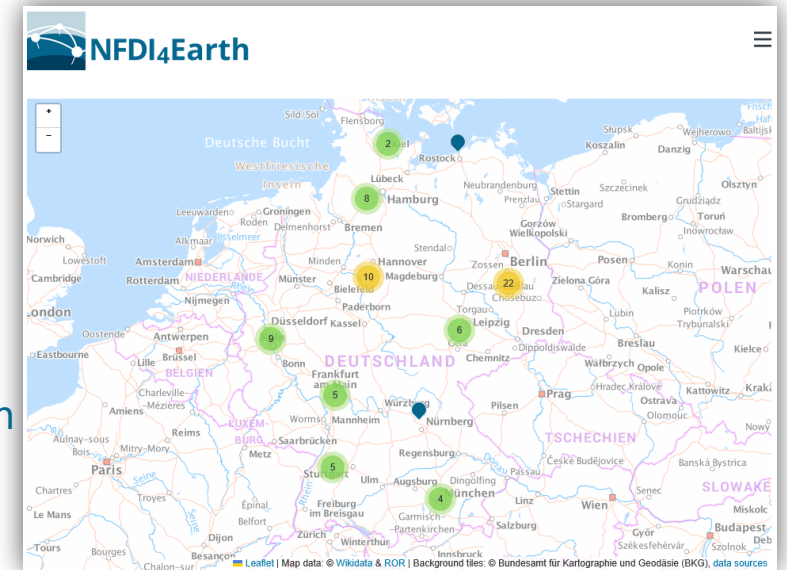
### Natural language querying

Enabling metadata search and exploration using natural language



### Discovery of related resources

Enabling exploration of semantic and structural connections between resources



Consortium map, powered by data from the Knowledge Hub

See you at the Software Marketplace!



# NFDI4Earth Label

- **Goal:** assess and improve the level of **interoperability** and **trustworthiness** of **research data repositories** in the **ESS**
- **Process:**
  - (M) **Automated assessment** based on **re3data** repository information
  - (M) **Manual self assessment**, information on the repository not available via re3data
  - (O) **Automated FAIR assessment** of a random sample of repository datasets using **F-UJI**
- 13 repositories awarded



<a href="#">DEIMS-SDR</a>	2025-08-22	
<a href="#">Biodiversity Exploratories Information System</a>	2025-09-01	
<a href="#">PANGAEA</a>	2025-09-18	
<a href="#">World Data Center for Climate</a>	2025-09-05	
<a href="#">Edmond</a>	2025-11-07	
<a href="#">World Stress Map</a>	2025-11-20	
<a href="#">heiDATA</a>	2025-12-18	
<a href="#">GEOFON</a>	2026-01-12	
<a href="#">OceanRep GEOMAR Repository</a>	2025-08-22	
<a href="#">Edaphobase</a>	2026-02-06	
<a href="#">GFZ Data Services</a>	2026-02-19	
<a href="#">ioerDATA</a>	2026-03-16	
<a href="#">UFZ Spatial Data Catalog</a>	2026-05-20	

# FAIRness & Openness Commitment

We commit to advance FAIRness and Openness in Earth System Sciences.

We value data infrastructures and data experts.

8 institutions | 5 organisations/groups | 70+ individuals

Sign the commitment now: [nfdi4earth.de/commit](https://nfdi4earth.de/commit)

Add the **badge** to your website: [nfdi4earth.de/member-area/materials](https://nfdi4earth.de/member-area/materials)

## Collaborations

FAIRagro & NFDI4Energy  
CC-BY-US ([cc-by-us.gitlab.io](https://cc-by-us.gitlab.io))



# FAIRness & Openness Commitments Workshop

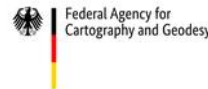
Joint workshop with FAIRagro & EGU presentation

## "FAIRness and Openness Commitments as a catalyst for cultural change in research organisations"

Together:

13 institutions  
8 groups

Nüst, D., Sennhenn, A., Seegert, J., Hübner, A., Vahabi, K., Hachinger, S., Möller, M., Hoffmann, C., Bernard, L., Anderson, J. M., Fischer, S., Reichstein, M., Weynants, M., Keßler, C., Koch, K., Wenz, K.-P., van Dam, N., and Regierer, B.: FAIRness and Openness Commitments as a catalyst for cultural change in research organisations, EGU General Assembly 2026, Vienna, Austria, 3–8 May 2026, EGU26-6870, <https://doi.org/10.5194/egusphere-egu26-6870>, 2026.



Chair of Geoinformatics, TUD Dresden University of Technology

Department of Earth Sciences, Freie Universität Berlin

Department Biogeochemical Integration at the Max Planck Institute for Biogeochemistry

Faculty of Geosciences, University of Münster

University of Kassel Faculty of Organic Agricultural Sciences



# FAIRness & Openness Commitments Workshop



Institutional and group signatories of different **types**: unis, research orgs, associations, departments, federal research institutes, Helmholtz/Leibniz/MP

Heterogenous maturity **levels** re. policies, resources, stage of cultural change

**Agenda**: Introduction, 3 discussion blocks, shared minutes



Outcomes: **activities and challenges** in advancing RDM in line with the commitments:

Shared activities | Special activities | Primary challenges | **Proposed activities**:

- Develop and maintain an **annotated, researcher-facing version of the Commitments**
- Curate and **share** implementation plans across signatories
- Build the **evidence base for incentives** — and approach external stakeholders
- **Differentiate guidance** on the Commitments by organisation type but keep document stable
- Anticipate and shape the **role of AI/LLMs**
- Provide repetitive, structural **communication** support > long-term perspective!
- Solve the **orientation** problem in the tool ecosystem > team effort!

# FAIRness & Openness Commitment

Continue the discourse with us!

- Annotated version & exchange between **institutions**
- Academic rewarding systems > **poster**

**You can take action to recognise FAIR and Open research data practices**

**... as member of an institution or academic society**

**... as editor and reviewer**



Be the change



**Incorporating FAIR and Open research data practices in academic rewarding systems**

NFDI4Earth researchers hold positions of influence in various roles to raise awareness for inclusion of FAIR and open research practices in research assessment schemes.

Here we present how researchers can take action!

**FORP = FAIR and open research data practices**

**You can take action**

- ...in your institution**
  - address FORP in job advertisements, interviews, or professorship appointments.
  - promote FORP in discussions on good scientific practice, and contribute to weighing good practices higher than typical, traditional indicators.
  - advocate for FORP to be incorporated into your institution's policies/regulations on research evaluation.
  - get involved in the local CoARA or DORA teams. If your institution is not yet a member of CoARA / signer of DORA, encourage the relevant bodies in your institution to get involved.
- ... in your academic society**
  - propose that your society signs a declaration like DORA, or the NFDI4Earth Commitment, or joins CoARA.
  - initiate a working group on FORP and their possible integration into research assessment for your community.
- ... as journal editor and article reviewer**
  - advocate to the journal's owners for the journal to have a robust and up-to-date data policy and to ensure compliance with that policy.
  - give positive recognition to FORP when writing reviews for articles.
- ... as reviewer of grant applications**
  - propose up-to-date policies to the funders if funder policies are inadequate about FORP.
  - leverage FORP if you are a member of formal bodies within funders, such as a DFG review board (Fachkollegium).

Support FAIR and open research data practices by signing the NFDI4Earth FAIRness and Openness Commitment

Recommended reading: Integrating FAIR and Open research data management practices in academic rewarding systems

*Thank You !*



<https://www.nfdi4earth.de/>

Funded by

**DFG** Deutsche  
Forschungsgemeinschaft  
German Research Foundation

through project no. 460036893 within the  
German National Research Data  
Infrastructure (NFDI, <https://www.nfdi.de/>).