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**Summary.** Integration and synthesis of data from various observatories, expeditions and field trips is essential for an improved understanding of the System Earth. Dealing with societal challenges of climate change, natural hazards and anthropogenic impact on System Earth further requires a coupling of research data with modeling on multiple spatio-temporal scales. Therefore, top level Earth system science requires interoperable information infrastructures crossing silos of various disciplines. Operating such information infrastructures on a sustainable basis is a challenge which needs to be addressed in a joint effort by central actors in the field. At the same time, these activities need to be embedded in the development of national and international activities such as the European Open Science Cloud.

**DataHub**  
Research Field Earth & Environment

**Helmholtz DataHub of the Research Field Earth and Environment**

contributing: HELMHOLTZ Helmholtz centers AWI, FZJ, Geomar, GFZ, Hereon, KIT, and UFZ

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extending: DAM DEUTSCHE ALLIANZ MEERESFORSCHUNG alliance of the leading marine research institutions in Germany

embedded in: nfdi German National Research Data Infrastructure

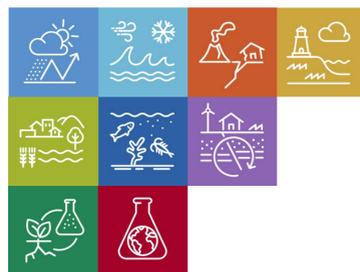
current funding period: 2019 – 2025

**Goals and approach.** The Helmholtz DataHub Earth and Environment is joining efforts in research data management of the Helmholtz Research Centers contributing to the Research Field Earth and Environment. The overarching goal is to build a sustainable data and information infrastructure for Earth system sciences. The infrastructure is realized as an integrated, distributed infrastructure being operated by the contributing partners. Towards this goal, data descriptions and data flows will be homogenized. Technologies for data portals, thematic viewers and data processing are implemented in a coherent and modular way. While the primary goal of the data infrastructure is to serve the national and international community of researchers in Earth system science, also data products for policymakers, media and society are being addressed.

The central point of entry is the joint **Earth Data Portal** which is derived from its predecessor, the **Marine Data Portal**. Thematic viewers are being implemented for serving specific needs of various research communities. Being interlinked with data repositories and related thematic repositories of the contributing centers, a single point of entry emerges, allowing to explore the rich data sources of the contributing partners. The activities are further embedded in the context of building the **German National Research Data Infrastructure** which also serves as the German contribution to the **European Open Science Cloud**.

Visualizations of data portals and thematic viewers, including 'ATMO HUB', 'EARTH DATA', and 'MARINE DATA PORTAL'.

## Our joint research program „Changing Earth - Sustaining our Future“



Eight centers of the Helmholtz Association are aligning their research within a joint research program being organized in nine research topics.

The **DataHub acts as the central competence center** of the research field with regard to the development and operation of sustainable data and information infrastructures.

The central goals of the DataHub therefore are to establish

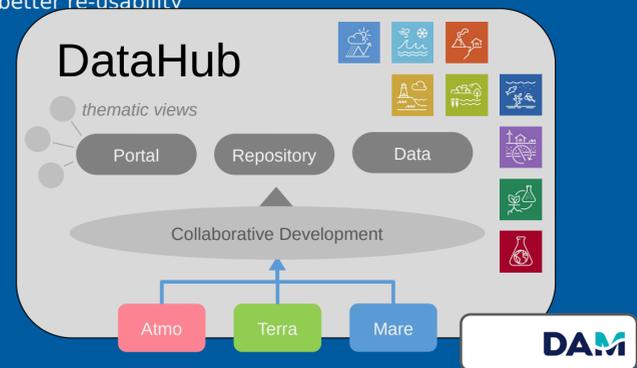
- connectivity in distributed infrastructures,
- homogenization in data descriptions and data flows,
- homogenization in portal and viewer technologies
- joint data products for research, politics and society.



**Technological Approach.** The DataHub is both, integrating existing research data management tools at the participating Helmholtz centers as well as implementing new tools and overarching technology.

Architecture and implementation are hereby driven by the following principles:

- (1) development follows a **co-design approach** to maximize usability for researchers
- (2) the architecture captures a **distributed system**, the components of which are operated by the partners
- (3) there is a central **Identity and Access Management** provided by the Helmholtz Digital Services for Science
- (4) software is developed in a **modular form** to allow for better re-usability



The essential components of the information infrastructure are

- domain oriented **data repositories**
- **thematic viewers** focusing on specific groups of stakeholders
- central **Earth Data Portal** providing one line of central access
- **Spatial Data Infrastructures** operated by the partners
- integrated data flows „**from sensor to archive**“, incorporating research observatories and research expeditions
- modules for **Quality Assurance** and **Quality Control**
- domain specific **data explorers** as a tool for researchers to browse data via visual exploration

Logos: Umwelt Bundesamt, BUNDESMINISTERIUM FÜR UMWELT, KLIMA UND ENERGIE, nfdi, DataHub, AWI, GEOMAR, hereon, KIT, JÜLICH, GFZ, HELMHOLTZ-ZENTRUM POTSDAM, DEUTSCHES GEOLFORSCHUNGSZENTRUM, UFZ, HELMHOLTZ Zentrum für Umweltforschung, emso ERIC, BKG, GDI-DE.

## Example - SeaiCe Portal

Daily updated data of arctic/antarctic seaice coverage. O2a data flow from sensor to data archive. The **SeaiCe Portal** also includes an extensive knowledge area with infographics, maps, animations etc. for media and society. Experts provide background information and assessment of the current situation. Portal builds on the AWI SD Infrastructure.

THE SEA ICE PORTAL - CHRONICLE OF A DISAPPEARING WORLD  
Today, sea ice covers roughly 7 percent of the ocean. It cools the entire planet, affects ocean currents, and offers a habitat for countless species. Due to climate change, sea ice is rapidly disappearing - with consequences for the entire planet. We experts on sea ice. Here we share what we know - hot off the press, scientifically sound, and in accessible language.

## Example - Earthquake Explorer

Near-real-time coverage of global seismic observations. Events are given with detail information for seismological research. The **Earthquake Explorer** is an instance of a generic explorer technology. Other examples include a Flood Event Explorer or a Model Data Explorer. The tool also serves for knowledge transfer into media/society (e.g. during Turkey/Syria quake).

GFZ Earthquake Explorer  
Settings: Language: English, Live updates: No live updates, Location: Europe/Berlin, Events: Last two weeks | All magnitudes, Filters: Magnitude: 5-10, Time range: 2023-02-15 - 2023-02-27

## Example - Waterinformation System Germany (Wis-D)

Stakeholder platform integrating remote sensing data and model data. The **German Drought Monitor** is a data product, building on data aggregated in the DataHub and addressing a specific target audience (e.g. water suppliers). Data can be aggregated for states, counties or arbitrary polygons. Various data types can be compared.

Wis-D interface showing a map of Germany with drought data overlays and a legend.

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