# OceanTEA – Open Data Publication and Exploration of Ocean Observation Data

Ingo Thomsen & Reiner Jung

Kiel University

Helmholtz Open Science Webinars
Webinar 48 – 24 / 29 January 2019

HELMHOLTZ
Open Science

# Joint Project

**MoLab**

- Palaeoceanography, GEOMAR, Kiel

- **Mo**dularMultidisciplinary Ocean **Lab**oratory
- Collection of time series data

**OceanTEA**

- Software Engineering, Informatics, Kiel University

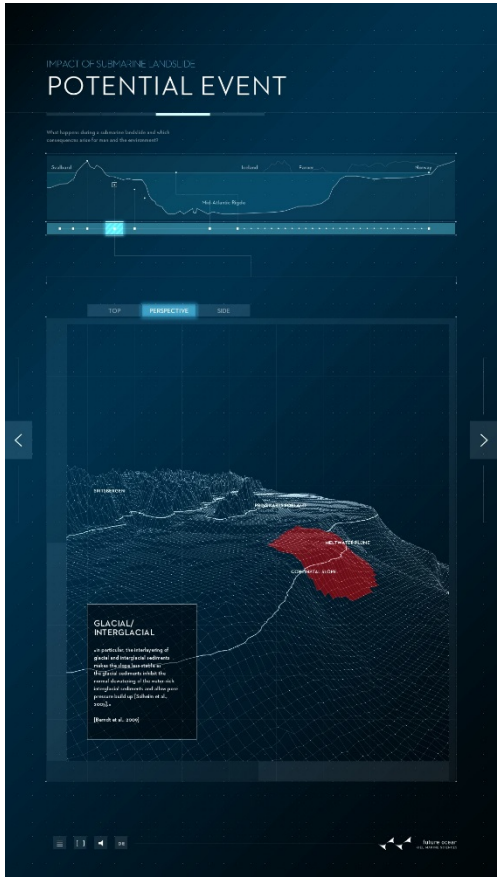
- Software to make MoLab data visually accessible

# Interactive Publications

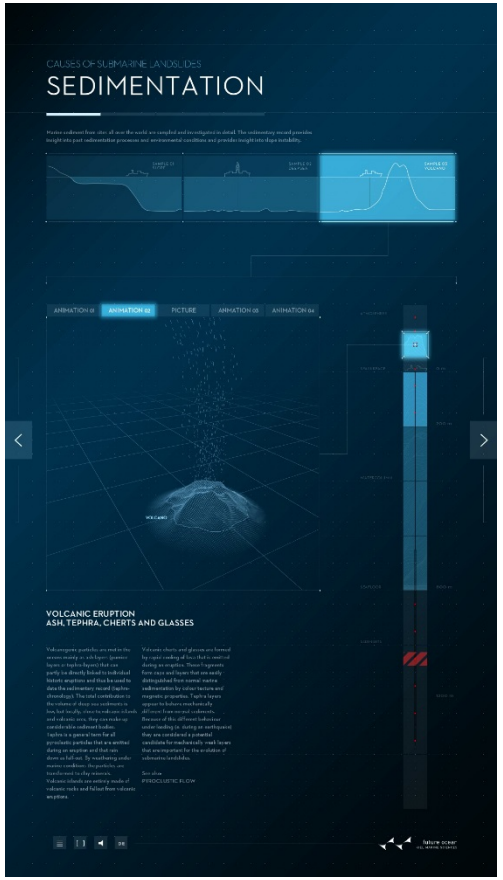
Increased trust and acceptance of scientific results

- Better traceability
- Better verifiability

- Results are easier to understand
- More accessible to non-scientific audience









*Interactive poster – Muthesius University of Fine Arts/Kiel Marine Science*

# Decentral Data Collection & Exploration


*Source: GEOMAR*

# Working with MoLab data in OceanTEA

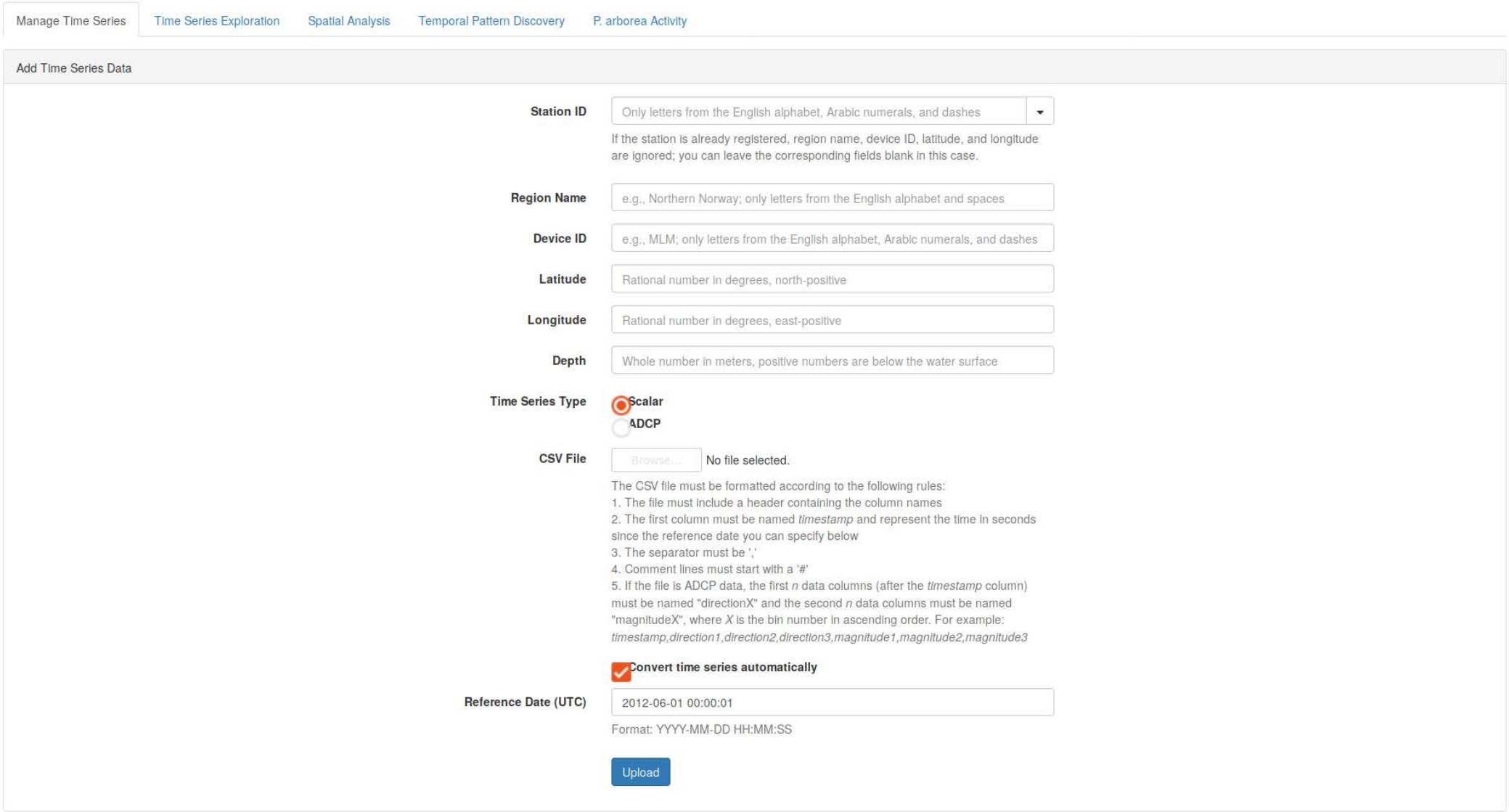
**Management**

- **Offshore**
  Collect and curate data for on site use
- **Onshore**
  Manage institutional data resources
- Demo installation
  *http://oceantea.uni-kiel.de*

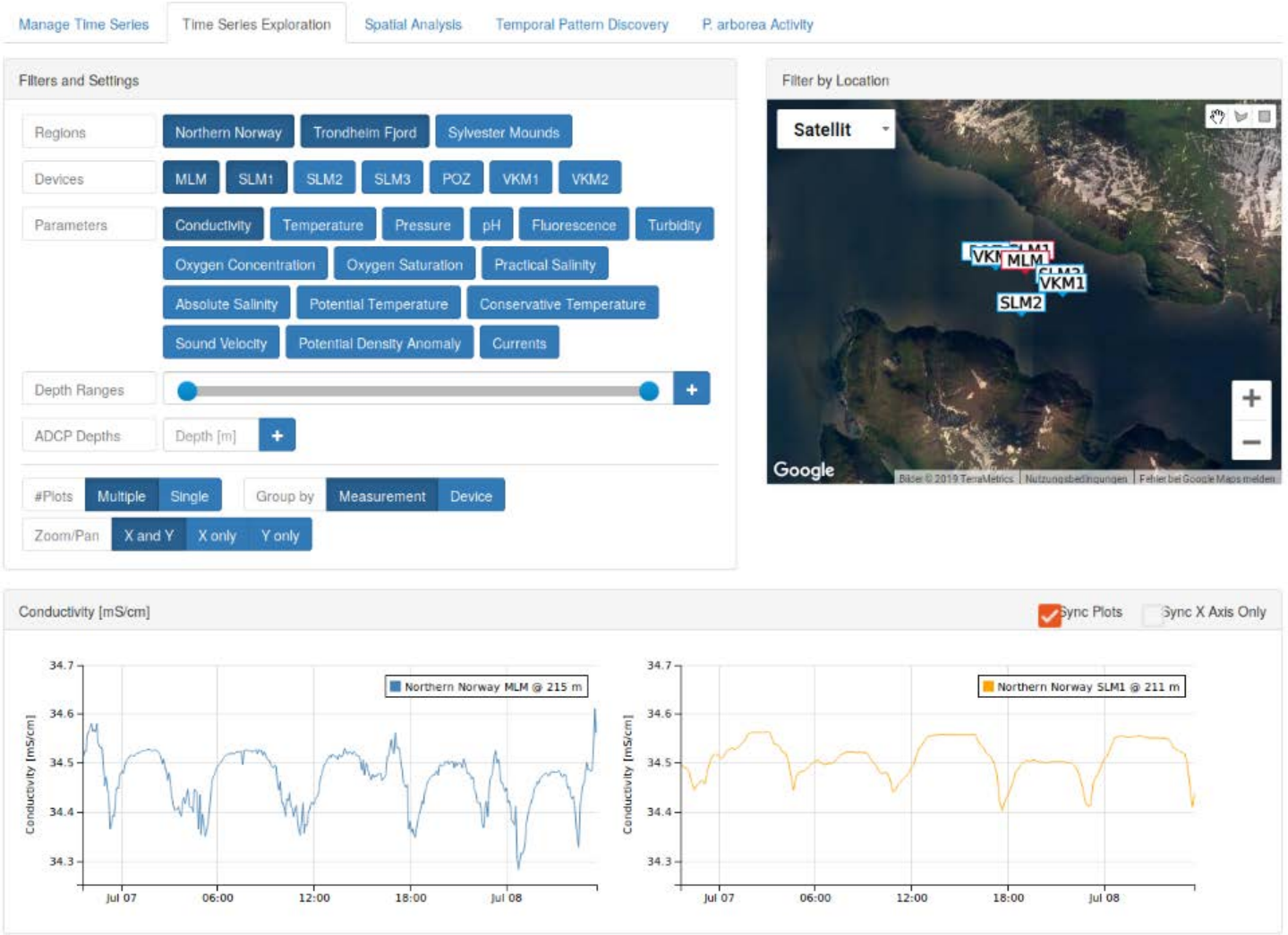
**Exploration**

- Various aspects of working with the collected data
  - Managing Time Series
  - Time Series Exploration
  - Spatial Analysis
  - Temporal Pattern Discovery
  - Cold Water Coral Activity

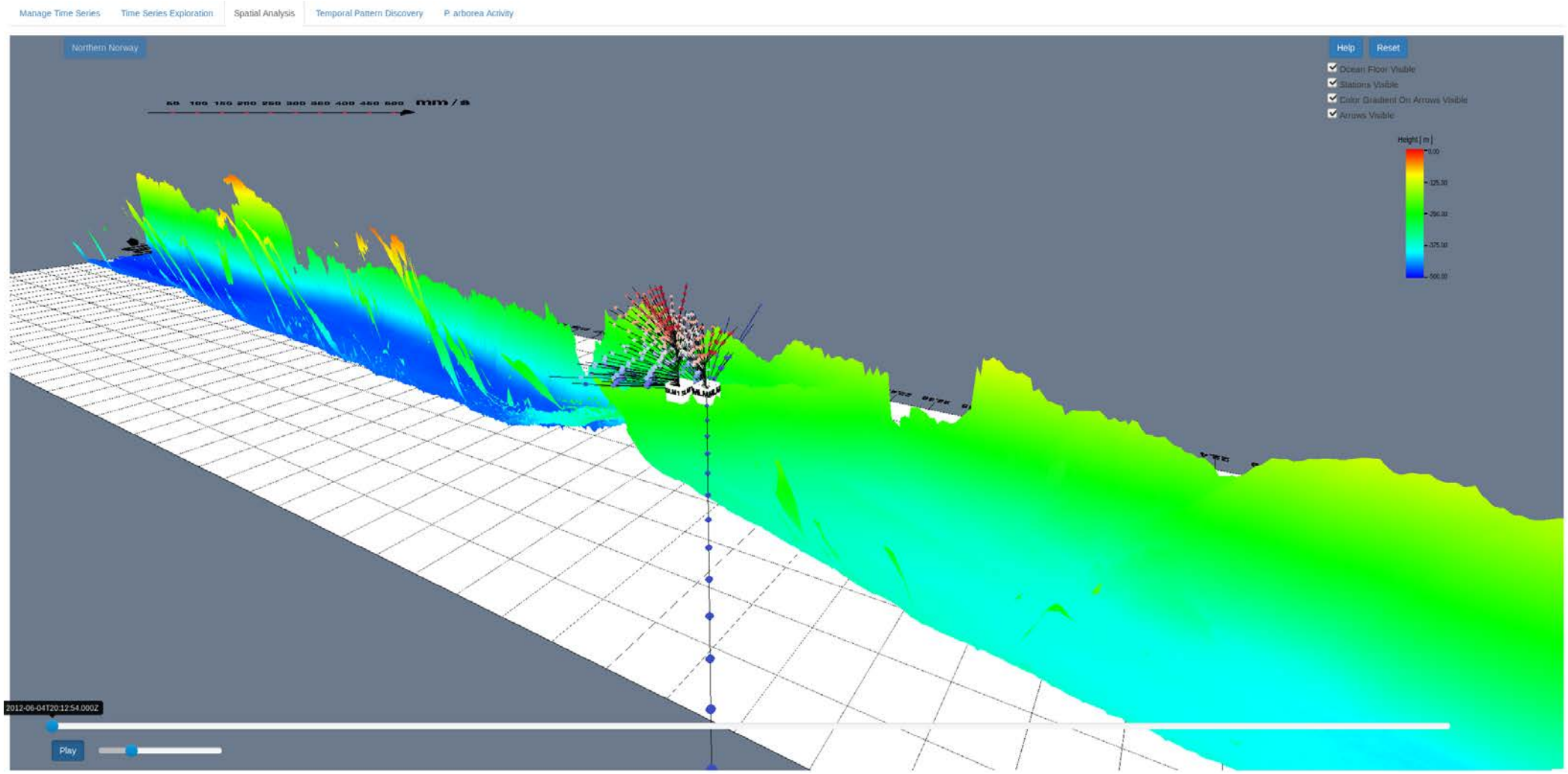
# Managing Time Series



# Time Series Exploration

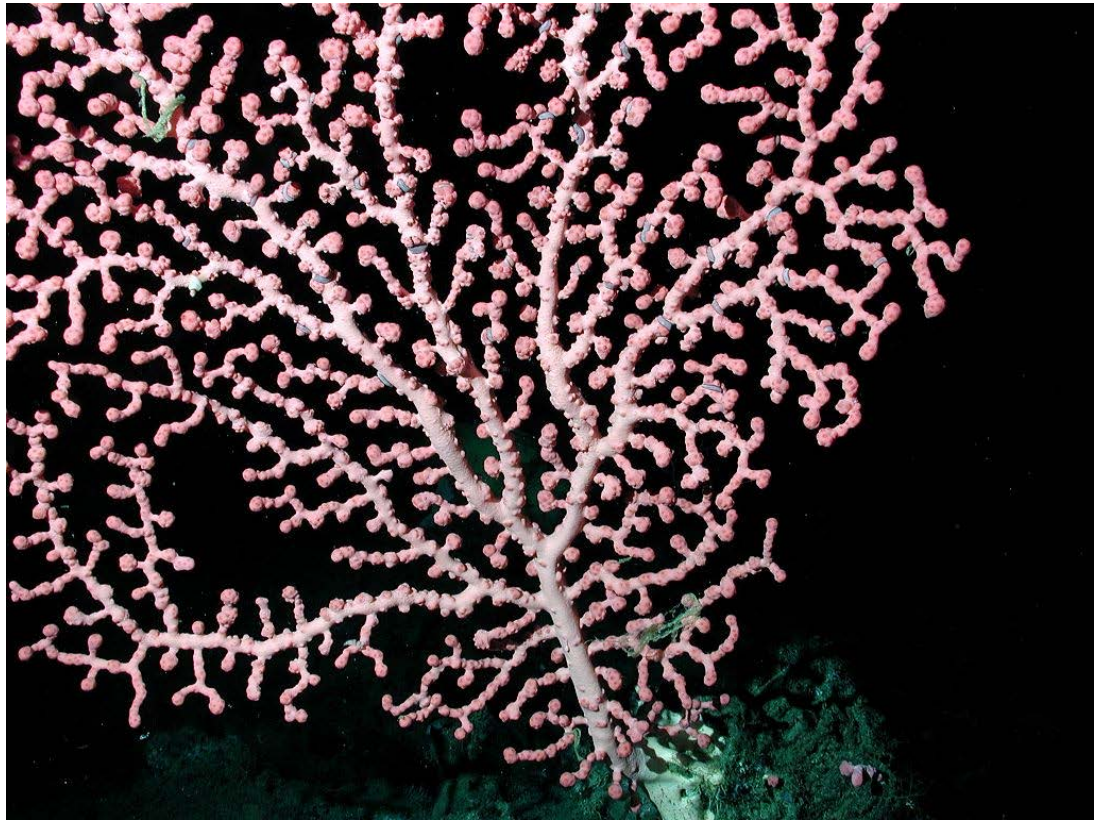


# Spatial Analysis



# Modeling Polyp Activity of Paragorgia arborea using Supervised Learning*

- Cold water corals off the Norwegian coast
  - HD images
  - Time Series Data
- Polyp behaviour (extended/retracted)
- Modelling activity using machine learning



**Johanson, A., Flögel, S., Dullo, W. C., Linke, P. und Hasselbring, W. (2017), DOI 10.1016/j.ecoinf.2017.02.007*

*NOAA/Monterey Bay Aquarium Research Institute, (Public domain, via Wikimedia Commons)*

# Paragorgia Arborea Activity

Model Properties

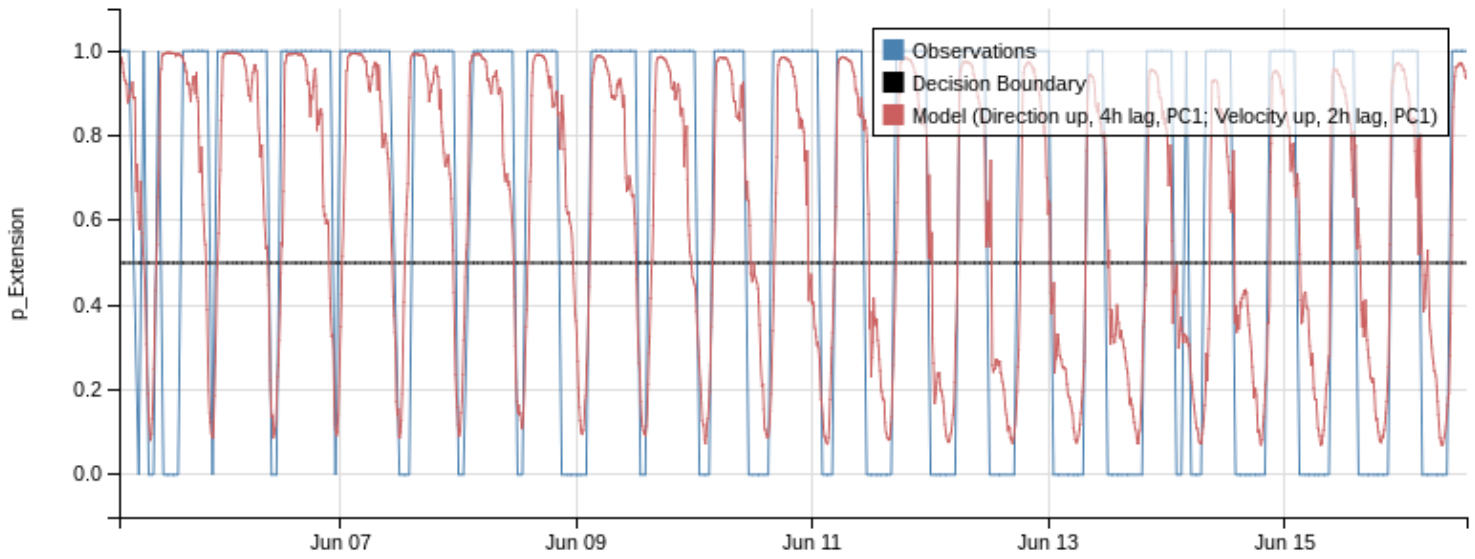
**Features**

- [x] Temperature (cons.)
- [ ] Temperature (cons.), 2h lag
- [ ] Temperature (cons.), 3h lag
- [ ] Temperature (cons.), 4h lag
- [x] Salinity (abs.)
- [ ] Salinity (abs.), 2h lag
- [x] Direction down, PC3

Add Model | Add Best 1F Model | Add Best 2F Model | Add Best 6F Model | Clear Features | Clear Models

*Changes of model properties are immediately visualized*

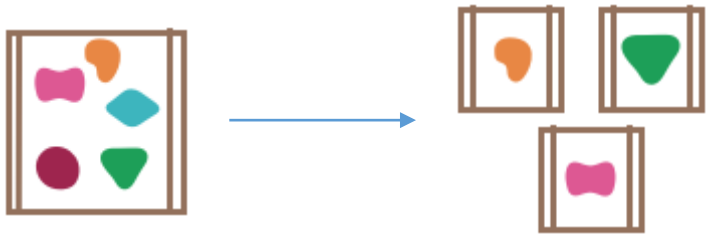
Predictions



# Implementation

**Microservices**

- Development technique:
  Not one monolithic application,
  but loosely coupled services

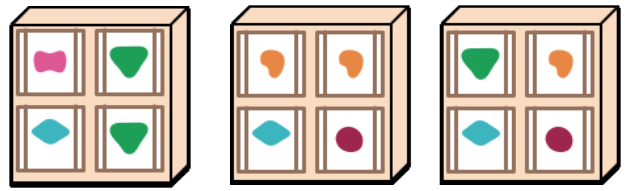


- Each service has its own storage,
  API and possible GUI

*Graphics: https://martinfowler.com/articles/microservices.html*

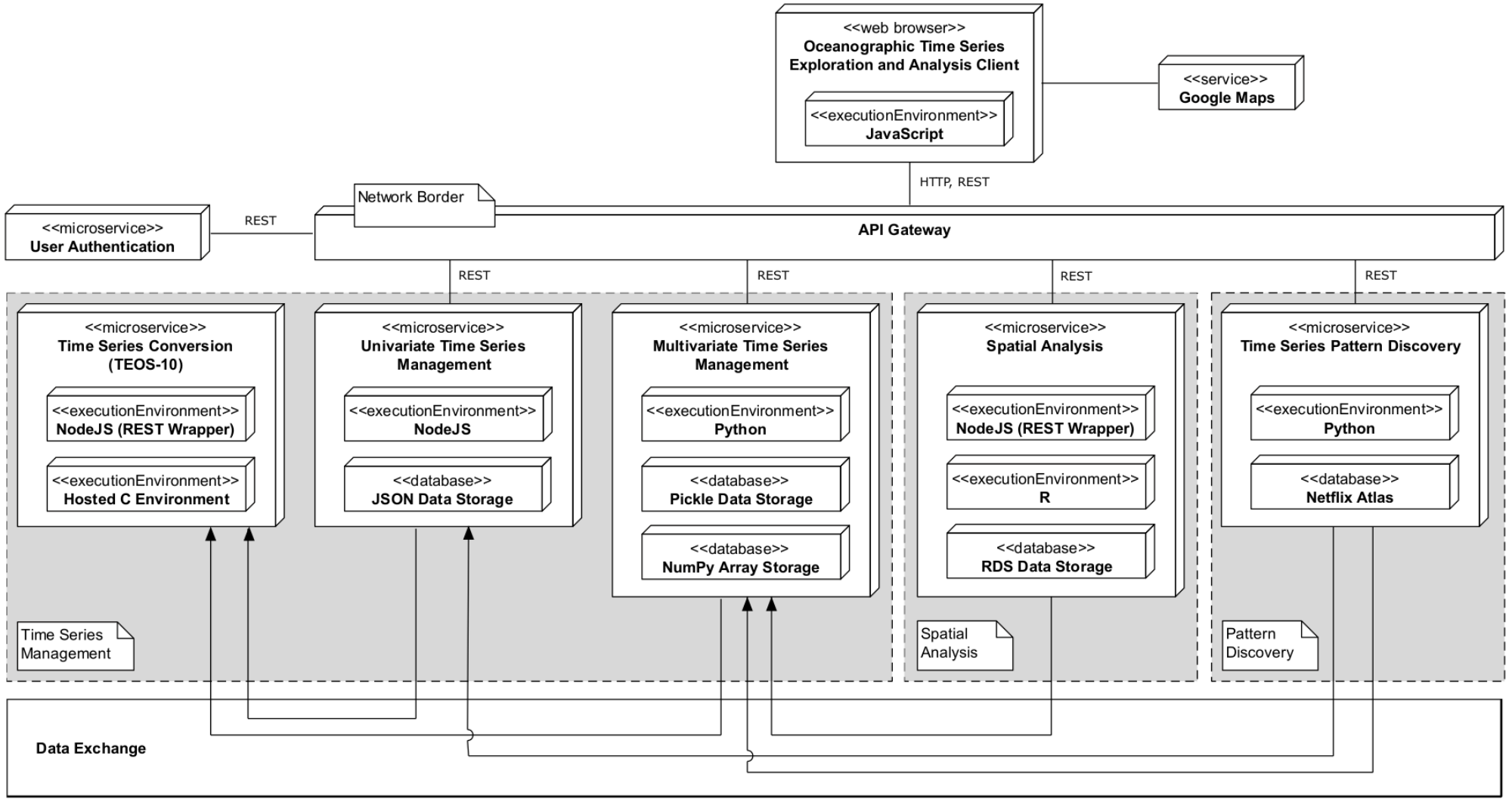
**Docker**

- Virtualization software
  - Virtual Machine
    Simulation of complete computer
    incl. OS for running a application
  - Docker
    Integrated into OS of a node,
    running app in separate processes
    → faster and more flexible
- A Docker container per service



computing nodes

# The OceanTEA Architecture

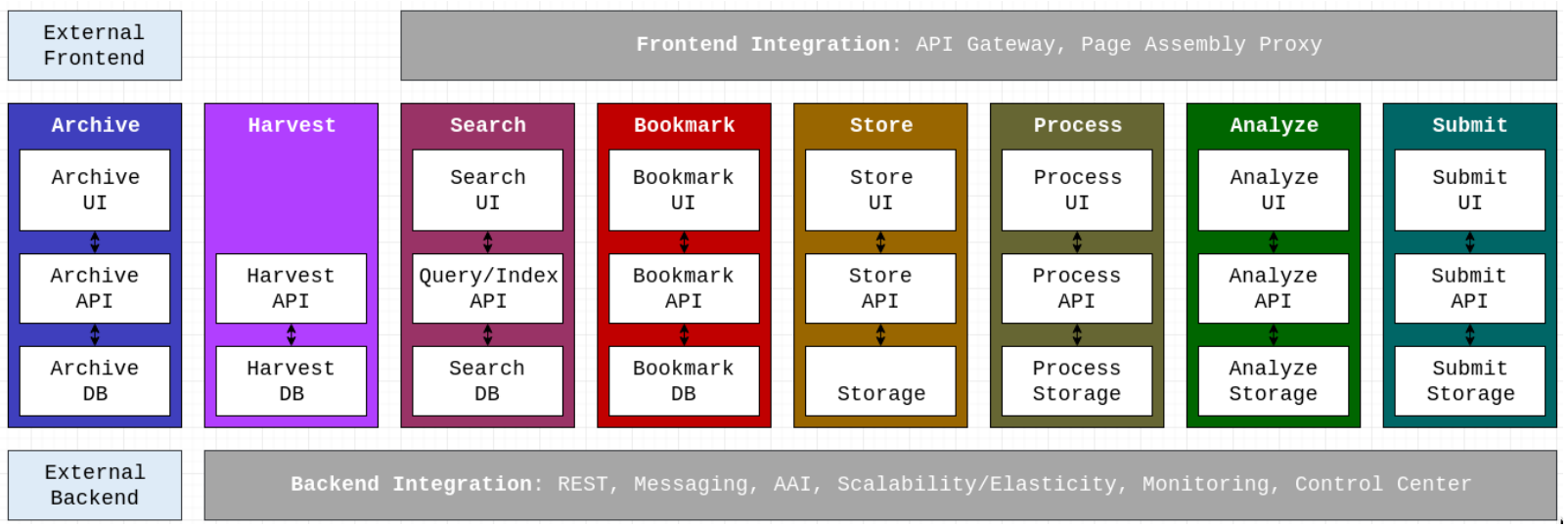


# What is GeRDI?

- Generic Research Data Infrastructure
- Services to support various research workflows
  - Metadata based search and bookmarking
  - Enable cross-disciplinary search of existing research data repositories
  - Processing and analysis of research data
    (E.g. cloud computing environments like an Jupyter Hub)
- Requirements in cooperation with various communities
  - Digital Humanities, Bioinformatics, Hydrology, Ecological Economics, Linguistics, …
  - And Palaeoceanography

# GeRDI

- Architecture also based on microservices and Docker

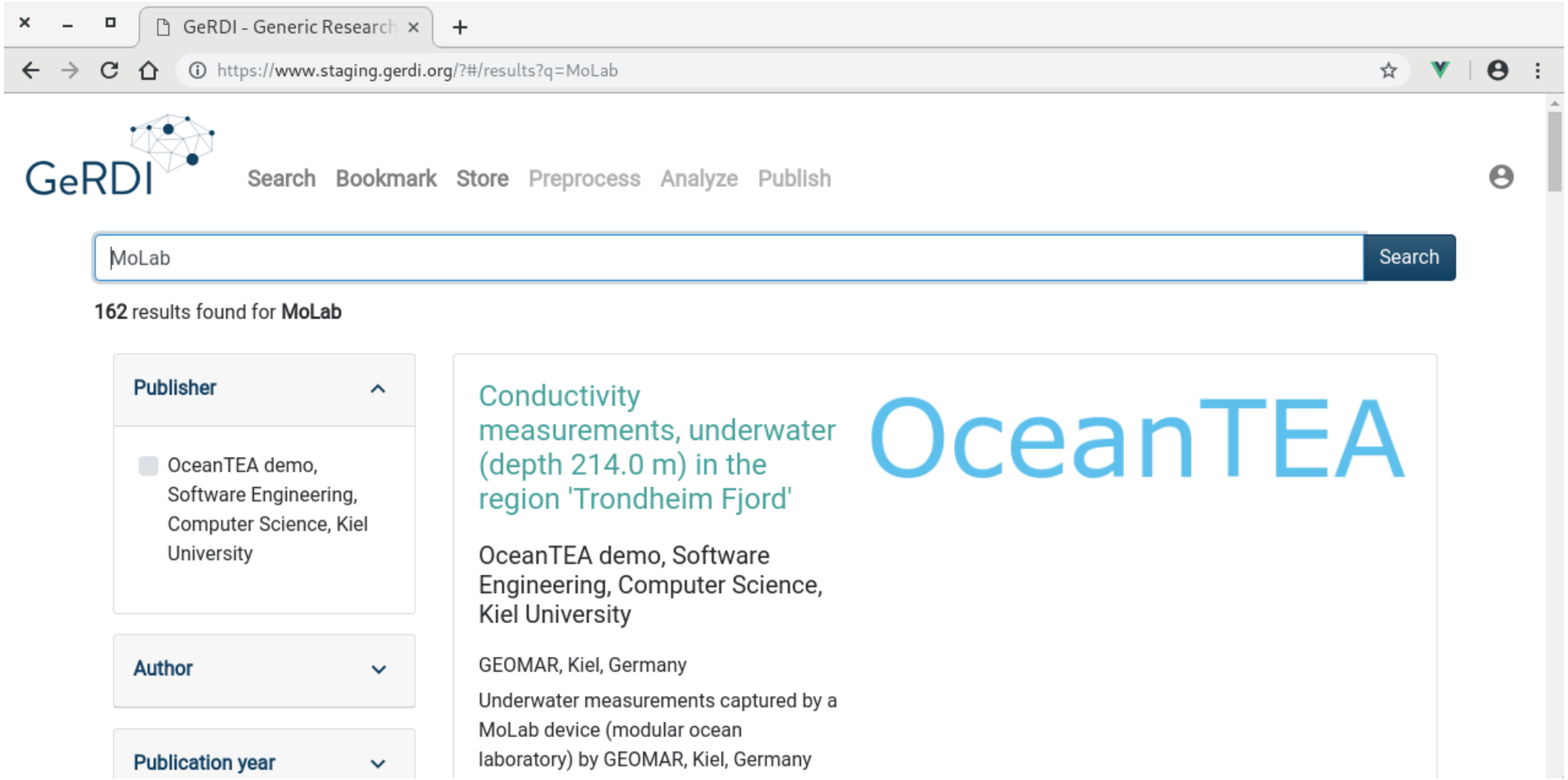



- Project and current release

  *https://www.gerdi-project.eu*

  *http://staging.gerdi.org*

# GeRDI


GeRDI - Generic Research
https://www.staging.gerdi.org/?#/results?q=MoLab
GeRDI
Search
Bookmark
Store
Preprocess
Analyze
Publish
MoLab
Search
162 results found for MoLab
Publisher
OceanTEA demo, Software Engineering, Computer Science, Kiel University
Author
Publication year
Conductivity measurements, underwater (depth 214.0 m) in the region 'Trondheim Fjord'
OceanTEA
OceanTEA demo, Software Engineering, Computer Science, Kiel University
GEOMAR, Kiel, Germany
Underwater measurements captured by a MoLab device (modular ocean laboratory) by GEOMAR, Kiel, Germany

# Where do we go next?

**Interactive publication**

- Easy publication of Jupyter notebooks using Docker
  - Support for Jupyter dependency management
  - Easy to use tool to create Docker images based on Jupyter notebooks
- Standalone web applications
  - Presentations, Exhibitions
  - Offshore usage
  - Additions to publications

**Connection to GeRDI**

- Recreation of OceanTEA in the context of GeRDI
- Extending functionality as exemplary application of a research workflow