



**Towards a Digital Twin of the Ocean - Challenges and  
Lessons Learned from Ocean Data Infrastructures**

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# Digital Twin of the Ocean

- Help to better understand marine social-ecological systems
- Goals, e.g.
  - \_ Make ocean observations available
  - \_ Enable better forecasting and modelling
  - \_ Support decision making
- Impacts, e.g.
  - \_ Economy
  - \_ Environmental protection
- In this presentation: Collection, management, and processing of ocean observation data

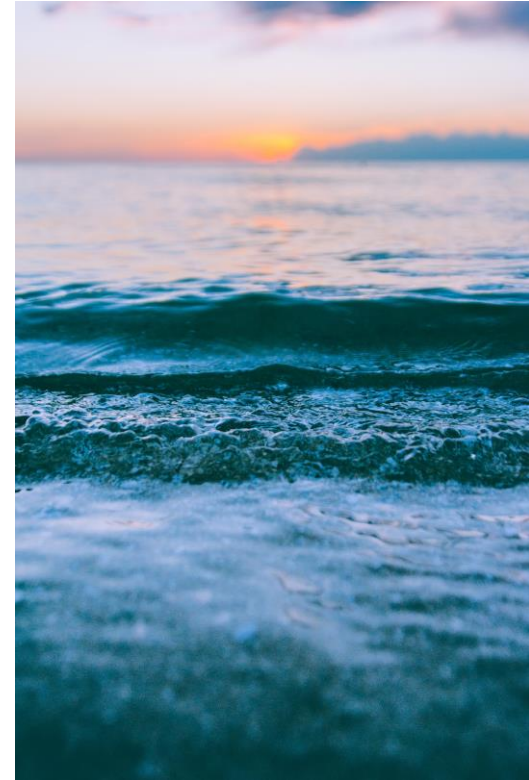
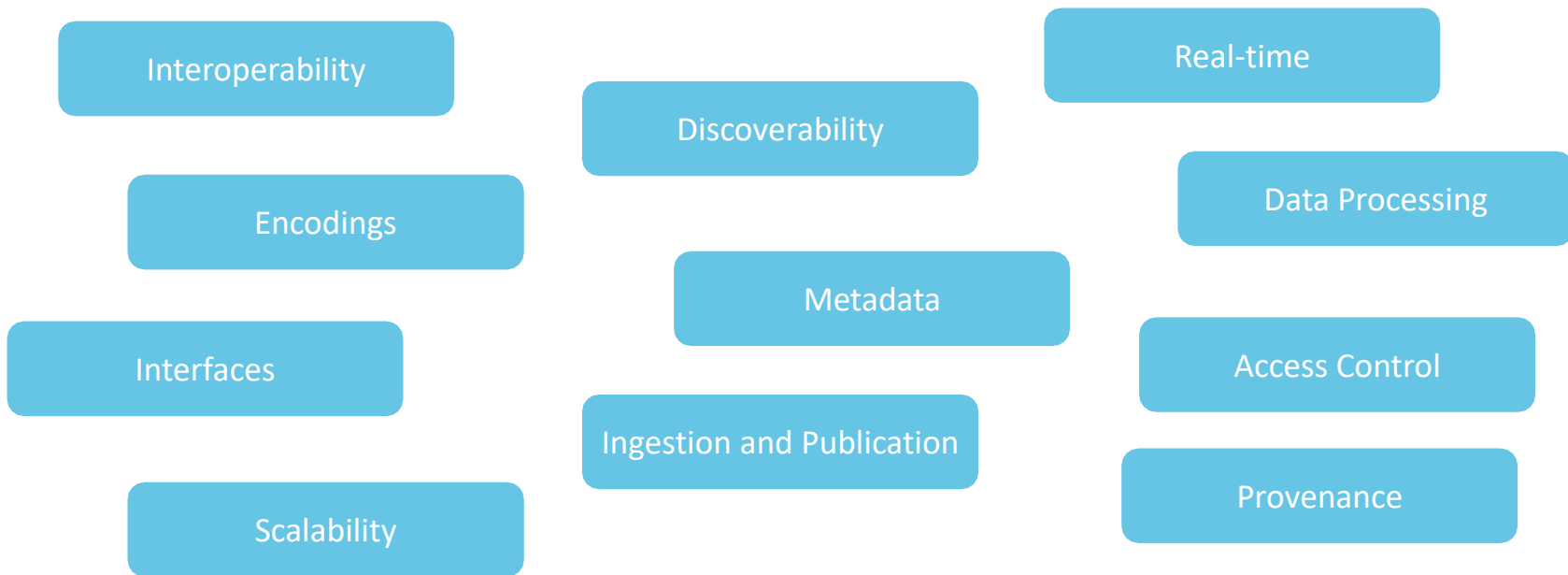


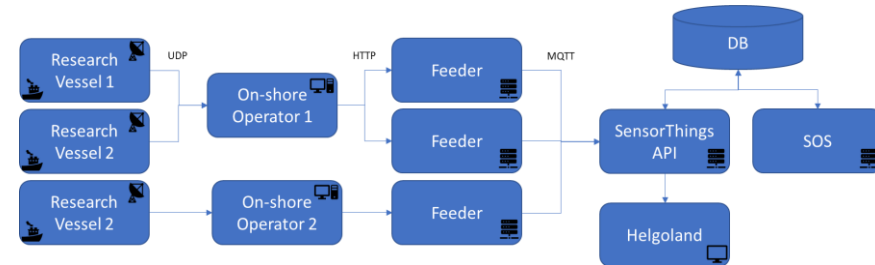
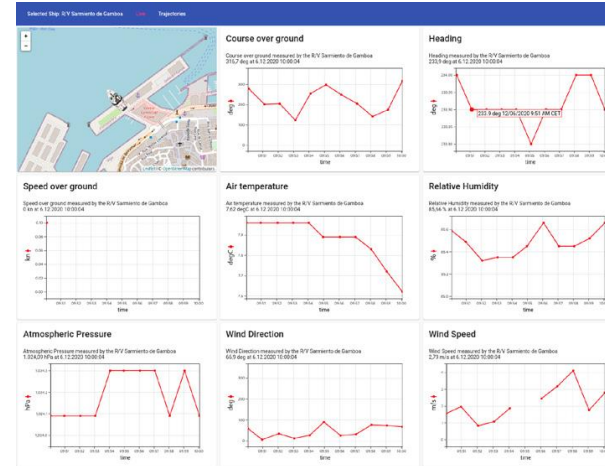
Photo by [Linda Xu](#) on [Unsplash](#)

# Challenges



# Example: EMODnet

- European Marine Observation and Data Network (EMODnet)
  - Making marine data, products and metadata available to public and private users
- EMODnet Data Ingestion portal
  - Streamlining data ingestion
- Current trend:
  - Improving the publication of near real-time observation data streams





# Example: INSPIRE

- Infrastructure for Spatial Information in the European Community
  - \_ Focus on environmental policies
  - \_ Requirements towards
    - > Interoperability
    - > Data sharing
  - \_ Full implementation to be achieved in 2021
- Current trend:
  - \_ Explore the use of lightweight APIs and encodings: REST/JSON

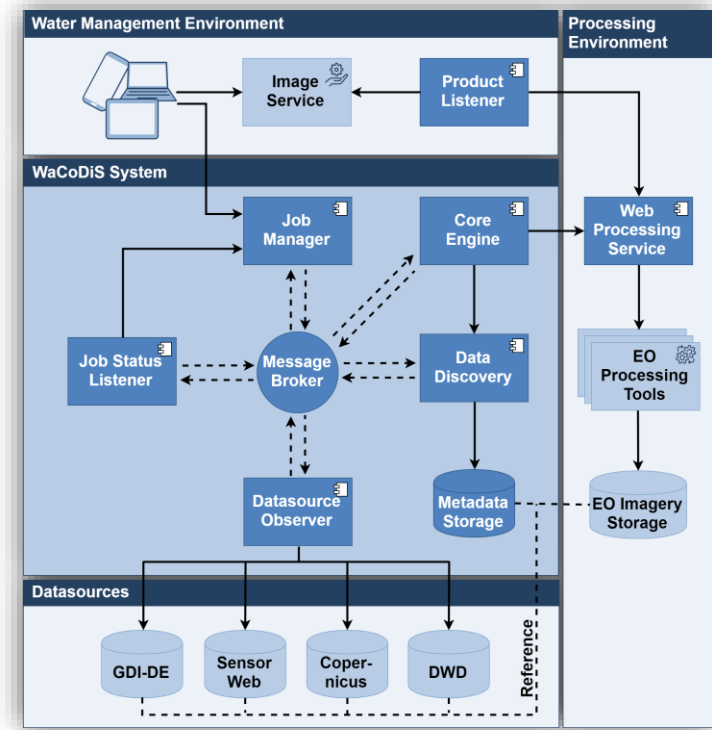
The screenshot shows the OGC website with a dark header containing the OGC logo and navigation links: CONTEXT, API SPRINTS, VIDEOS, BLOGS, DOCUMENTS, GET IN TOUCH. The main content area is a grid of six API category cards:

- Features**: Approved Standard. OGC API - Features - Part 1: Core and Part 2: Coordinate Reference Systems by Reference are both publicly available.
- Common**: OGC API - Common provides those elements shared by most or all of the OGC API standards to ensure consistency across the family. The candidate standard will soon be released for public review.
- Maps**: OGC API - Maps offers a modern approach to the OGC Web Map Service (WMS) standard for provision map and raster content.
- Records**: OGC API - Records updates OGC's Catalog Services for the Web by building on the simple access to content in OGC API - Features.
- Processes**: OGC API - Processes allows for processing tools to be called and combined from many sources and applied to data in other OGC API resources through a simple API.
- Coverages**: OGC API - Coverages allows discovery, visualization and query of complex raster stacks and data cubes.

Source: OGC

# Example: Copernicus

- European Union's Earth observation program
- Provide global, continuous, high quality Earth observation data
- Huge amounts of data → specific challenges
- Important aspects
  - \_ Cloud infrastructures
  - \_ Efficient data processing
- Example: WaCoDiS

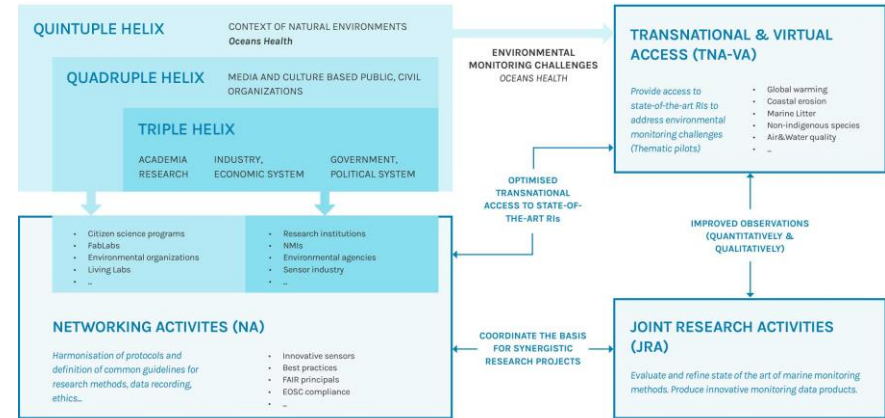


Source: WaCoDiS Project



# Example: MINKE

- Framework for quality of oceanographic data
- Focus on metrological aspects
- Support the development of marine measurement networks
  - \_ Data quality/accuracy
  - \_ Completeness
- Important aspects:
  - \_ Multi-level monitoring strategies
  - \_ Data quality
  - \_ Uncertainty information



Source: MINKE Project (<https://minke.eu/>)

# Outlook and Summary

- Several existing infrastructures to share information about the Ocean
- Valuable foundation for creating a digital twin of the ocean
- Important ongoing (research) activities
  - \_ Interoperability
  - \_ Handling (near) real-time data
  - \_ Lightweight interfaces and encodings
  - \_ Cloud infrastructures
  - \_ Integrating different kinds of observation data
    - > Remote and in-situ
    - > Advanced sensor systems and low-cost platforms
    - > Real-time streams and data archives

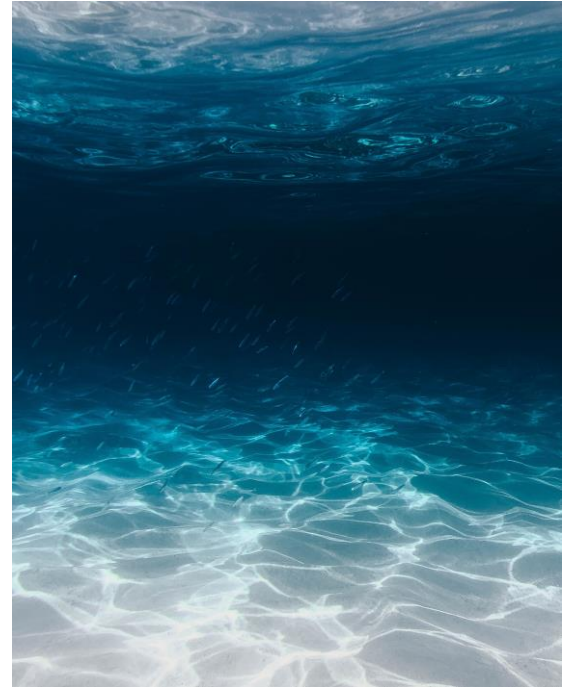


Photo by [Silas Baisch](#) on [Unsplash](#)



# Thank you for your attention!

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