DCS4COP

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 776342.

Coastal Water Data Cube

Ease the integration, preparation and processing of various data sources for coastal downstream applications

Brockmann Consult

Cefas

NIVA
Norsk institutt for vannforskning

museum
Operational Directorate Natural Environment
OD Nature I OD Natuur I DO Nature

Starlab
Living Science

University of Hull

LOV
Sorbonne Université
Créateurs de futurs depuis 1257
cnrs

vito

Technological Potential and Barriers

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Sentinel data and Sentinel Services provide unprecendented amount of information

- Raw data (Sentinels) and geophyiscal information (Services)
- Dense time series
- Very broad range of thematics (land, marine, atmosphere, …)
- Information Technology is providing means to process large data volumes
- Opportunities to address new scientific challenges
- Opportunities to address new markets

- Requires expert knowledge
  - IT & Thematic know-how
- Difficult to access data
  - ESA, Eumetsat, nat. Collab.GS, CMEMS, CLMS, C3S, DIAS, AWS, GC/GEE, …
- Difficult to manage data and information
- Unknown product quality
- Difficult to dissemintate results

The DataCube Service Model

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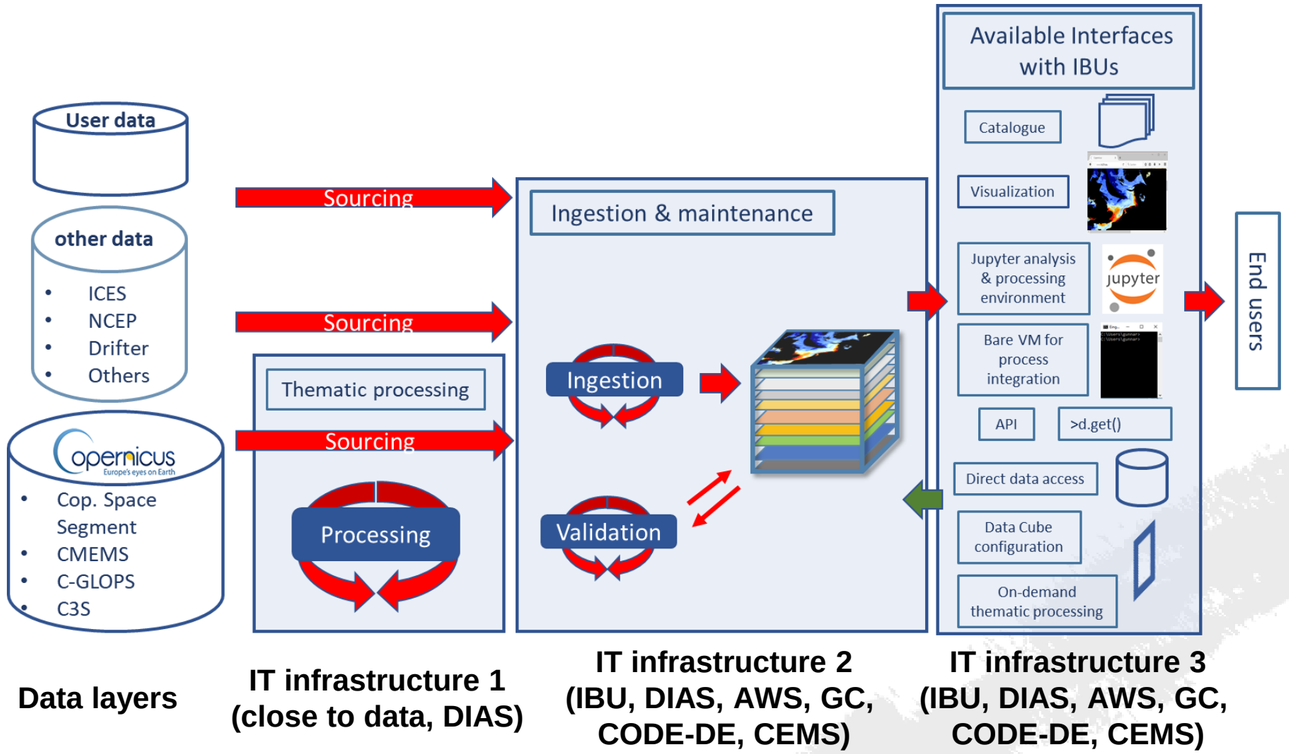
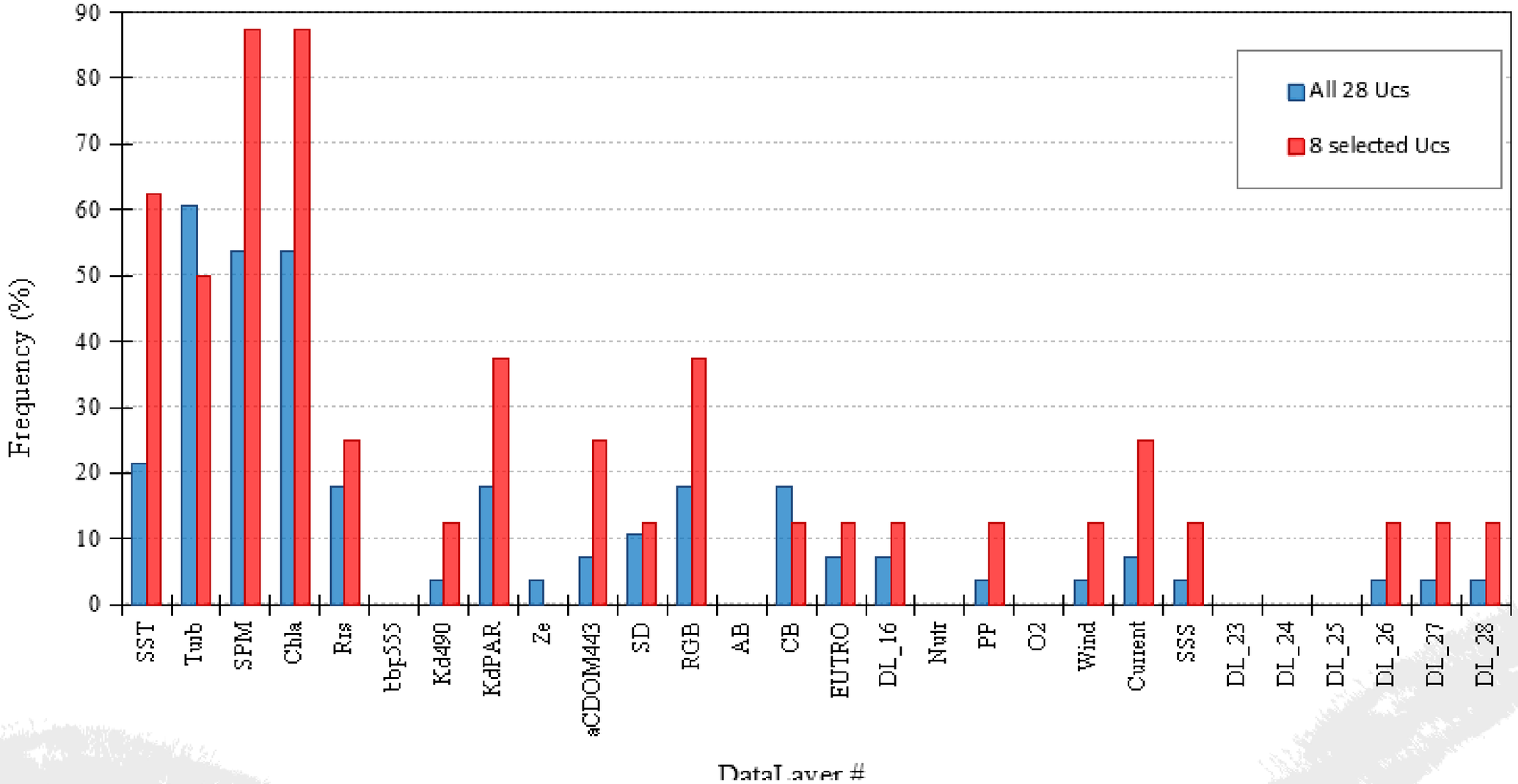
- Integrating Sentinel data, Copernicus Service data and user supplied data in a data DataCube-based system
  - System = Software + Configuration Service + Thematic Expertise Service
  - Users = Intermediate business users (IBU) = value adders, monitoring admin., research org., …
- **Enabling technology for IBUs**

EODataBee

First Instance:
Coastal (and inland) Water Data Cube Service

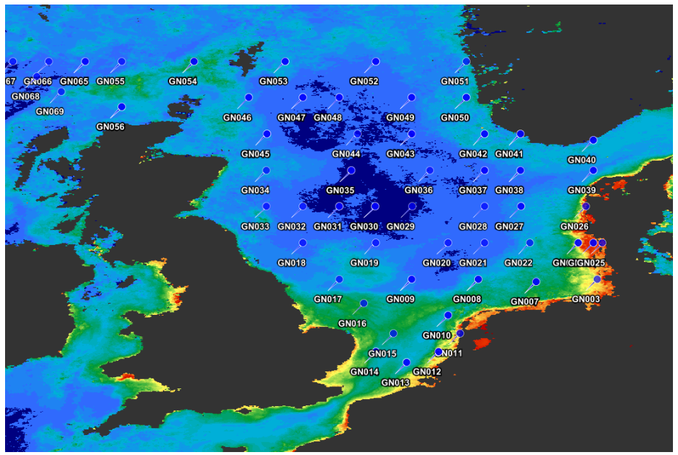


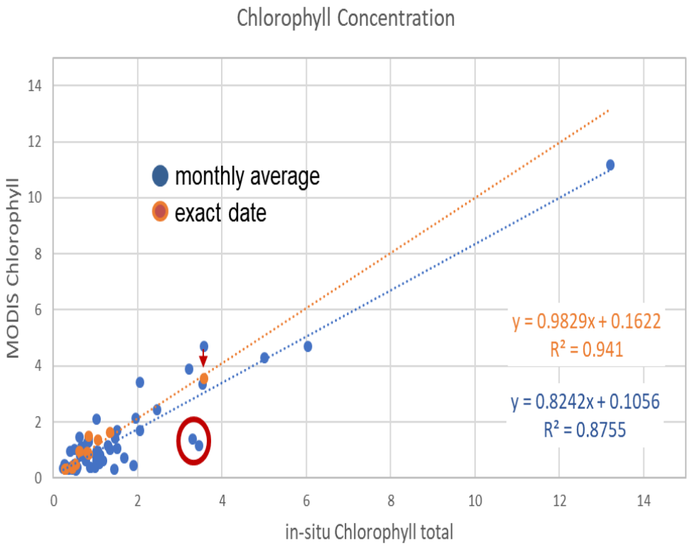
User survey: most important data layers

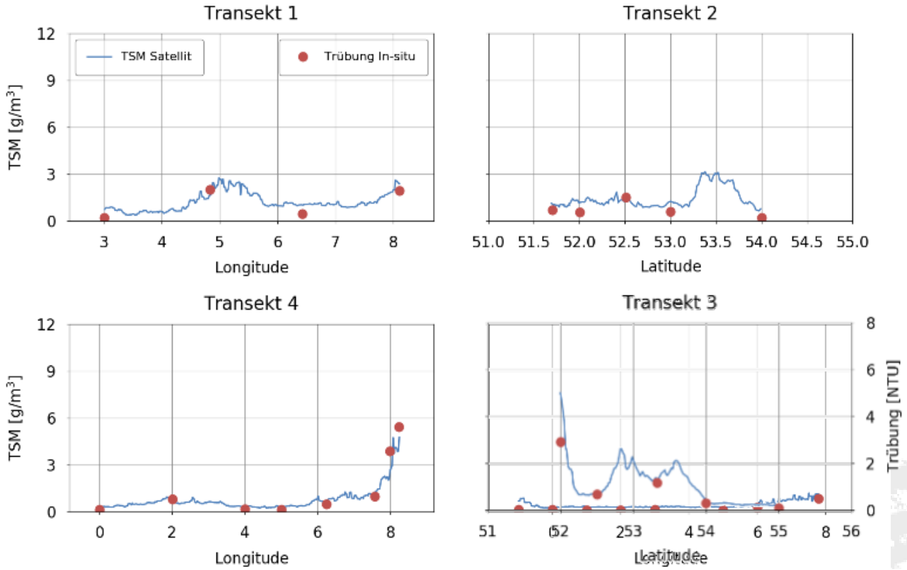


Data Layer Validation

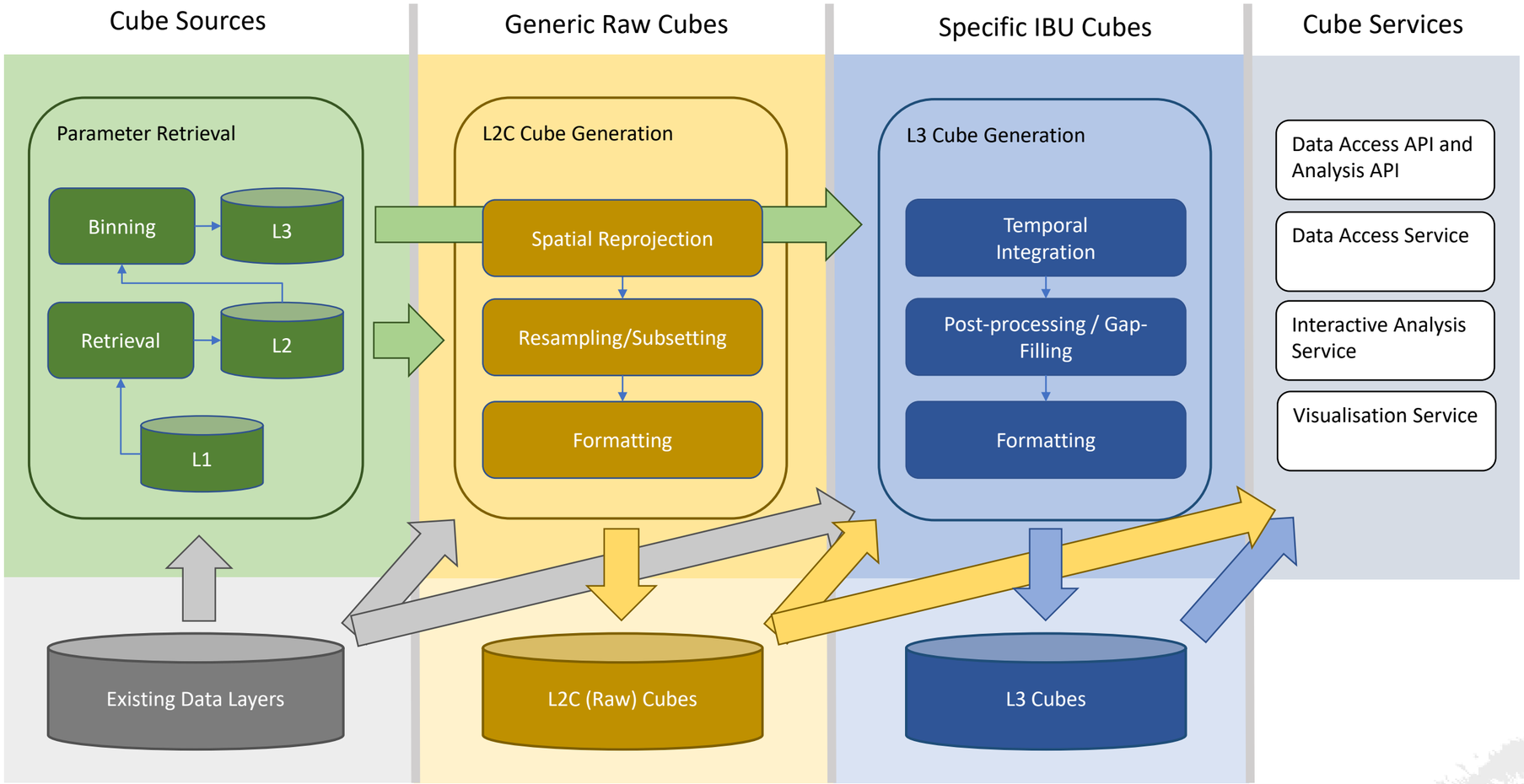
- HIGHROC products will be extensively validation
- Validation tools will be part of the cube software
- Copernicus services provide validation documentation







Cube Model - Processing Chains



Use Cases

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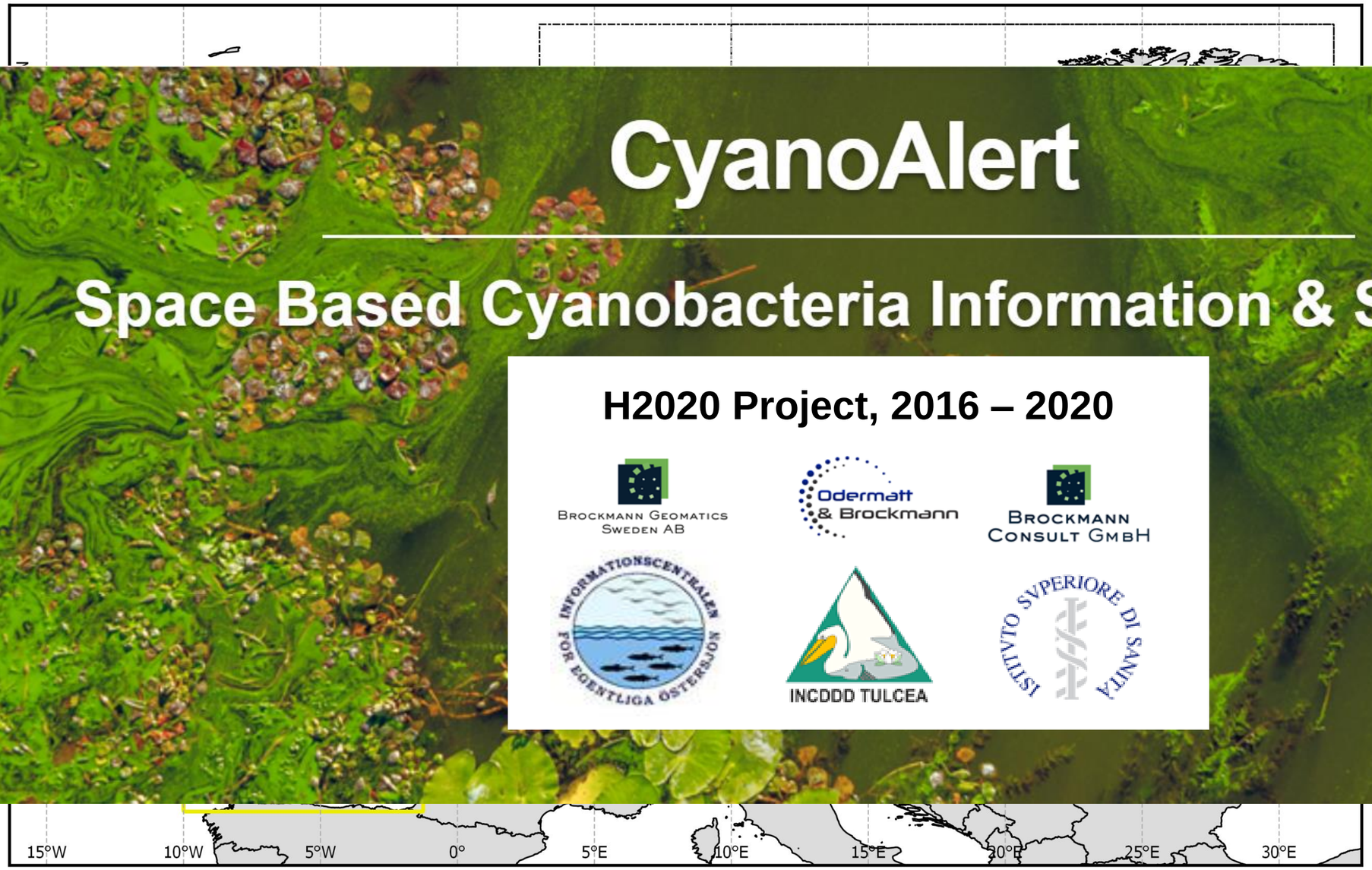


HIGHROC priority sites S2plus chain

CyanoAlert

Space Based Cyanobacteria Information & Services

H2020 Project, 2016 – 2020

Brockmann Geomatics Sweden AB

Odermatt & Brockmann

Brockmann Consult GmbH

Informationscentralen för Egentliga Östersjön

INCDDD TULCEA

Istituto Superiore di Sanità

DataCube Application in CyanoAlert

CyanoAlert

- Processing of large data sets within CyanoAlert
- Generation of dedicated lake data cubes
- Reduction of number of parameters according to user requirements
- Enabling an easy temporal and spatial analysis of the data set
- Generation of monitoring indicators using data cube API
- Generate indicators for exceptional cyanobacteria occurrence

Current status product validation

CyanoAlert

Swedish Lakes

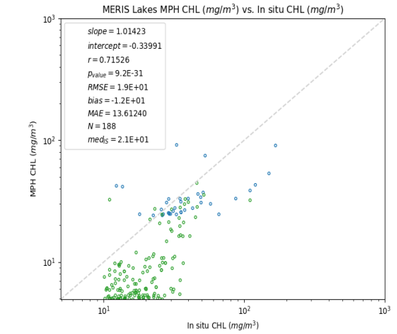
N-German Lakes

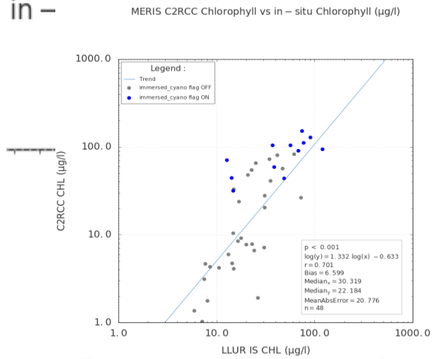
C2RCC CHL (µg/l)

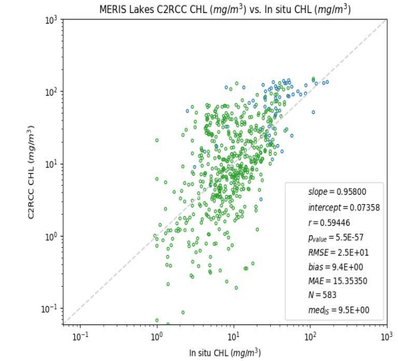
C2RCC

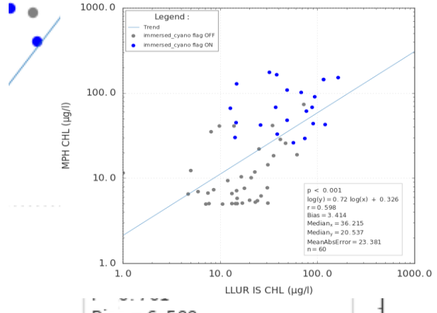
MPH

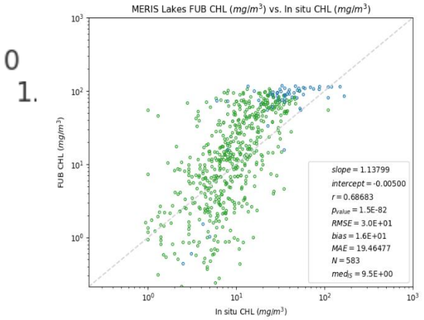
FUB

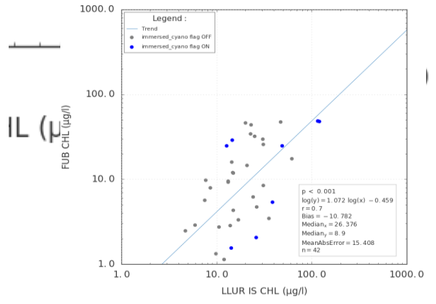


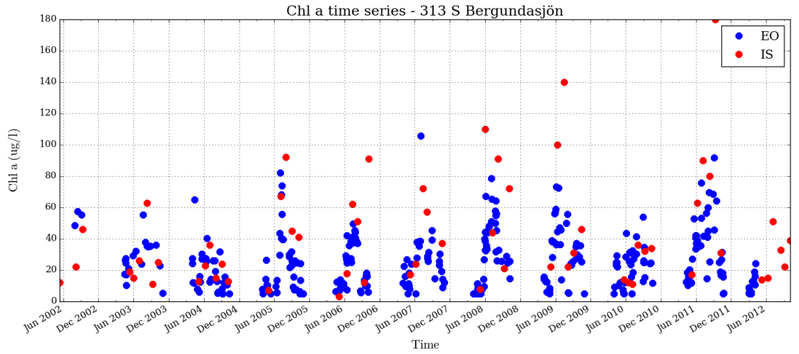


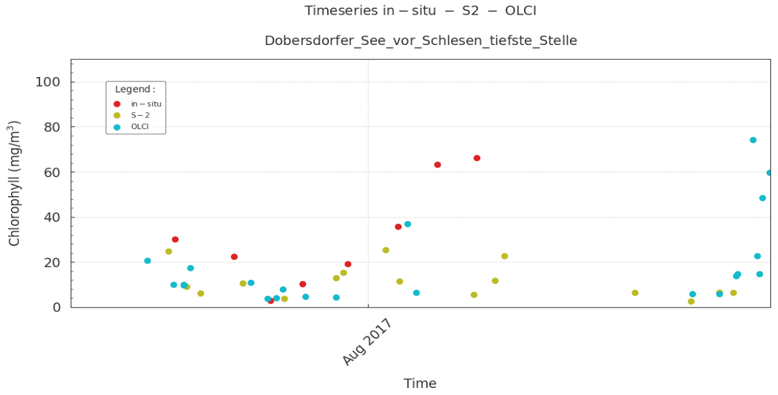




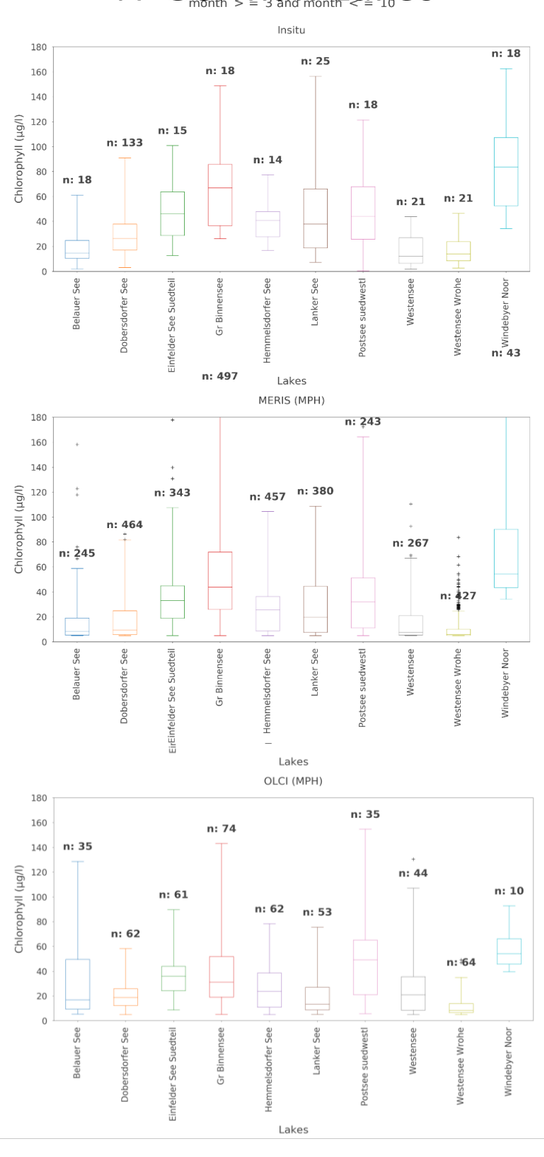








N-German Lakes



In-situ

MERIS MPH

OLCI MPH

Service Elements

- **Consultancy by EO and ICT experts**
- **Software Components**
  - product data access, pre-processing, thematic processing (HIGHROC, user supplied), data cube access, validation tools, visualisation
- **Configuration**
  - Selection and adaption of software components, selected data sources, Integration of user supplied processing components
- **Deployment on selected hardware**
  - Software as a Service (SaaS)
  - Processing as a Service (PaaS)
- **Technical support & training**

Research challenges

- **Assuring quality data layers (products)**
  - Large effort
  - Automation of tests need to be developed
  - Qualified reference data and community agreed protocols are needed

- **Priorities for data cube software**
  - On-the-fly production
  - Python & xarray
  - Performance, costs
  - Processing as a services versus software as a service
  - Costs for flexibility (which IT infrastructures to support, storage models, …)

- **Fair economic model**
  - Cost efficient for user (IBU), low financial risk
  - Revenues for service providers, low financial risk
  - Sustainability is key to become accepted

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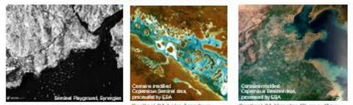
DATA CUBE SERVICE FOR COPERNICUS

A novel EO data interaction capacity

Ease the integration, preparation and processing of numerous data sources for EO downstream applications

- **Sentinel 1, 2 and 3** products from ESA and EUMETSAT
- Landsat-8, Proba-V and other satellite data

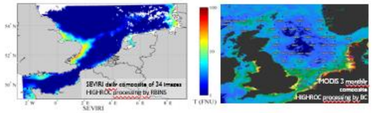


Sentinel-1 GRD image SW of Istanbul, 18.01.2018

Sentinel-2A Lake Amadeus, Australia. 19 December 2015.

Sentinel-3A Yangtze River outflow, 29.04. 2017.

- Water quality processing of **high resolution**, **medium resolution** and **geostationary data** from **HIGHROC** processing chain
- **Validated** HIGHROC data and validation tools
- User provided, **individually configured processing chains**



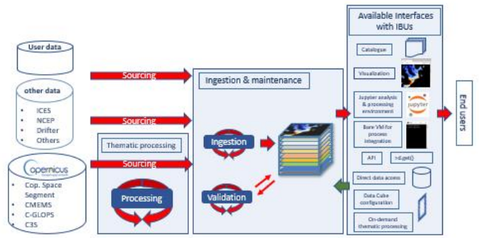
- **Copernicus Marine, Land and Climate** Service data
- **In-situ data** from open service (ICES, NCEP, ...)
- User's **local storage**

Copernicus Marine Service, DMI Ocean Models (BSHcmod)

Ferryboix on Colour Line ferry. FerryBox operated by NIVA

Copernicus Land Monitoring Service. Land cover of Maastricht and its surroundings (Urban Atlas 2012)

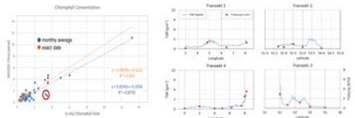
EODataBee



EODataBee

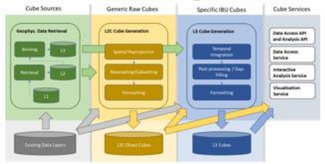
- is a **Data Cube service for analysis-ready EO and related data**
- provides **expert services** by water colour and ICT professionals **for institutional, research, and commercial users** (IBUs)
- can be deployed on **DIAS, AWS, Calvalus** and **private clouds**
- offers **individual solutions** tailored to customer requirements.

Validation of Data Layers



Validation of Data Layers before entering the data cube. Comparison of satellite derived chlorophyll concentration (HIGHROC processing) with in-situ reference data in statistical analysis (left) and transect comparison (right).

Cube Processing Model



Technology Stack

- **Object Storage** (OBS) with zarr as high performance storage format
- Simple and efficient data access via HTTP and URL
- Tailored **CF conventions** to match needs of **ARD** applied to data cubes
- Use **THREDDS data server** catalogue metadata (super set of CF)
- Python **xarray** package as reference API for data analysis & processing
- **Jupyter Hub** providing a virtual laboratory for remote processing

Services

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Technical support & training

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