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DCS4COP

Coastal Water Data Cube

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

Sentinel data and Sentinel Services provide unprecedented amount of information

- Raw data (Sentinels) and geophysical 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 disseminate results
The DataCube Service Model

- 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

First Instance: Coastal (and inland) Water Data Cube Service
User survey: most important data layers

![Bar chart showing the frequency of data layers for all 28 users (blue) and 8 selected users (red). The y-axis represents frequency in percentage, and the x-axis lists various data layers such as SST, Turb, SPM, Chla, etc.]
Data Layer Validation

- HIGHROC products will be extensively validated
- Validation tools will be part of the cube software
- Copernicus services provide validation documentation
Cube Model - Processing Chains

Cube Sources
- Parameter Retrieval
  - Binning
  - Retrieval

Generic Raw Cubes
- L2C Cube Generation
  - Spatial Reprojection
  - Resampling/Subsetting
  - Formatting

Specific IBU Cubes
- L3 Cube Generation
  - Temporal Integration
  - Post-processing / Gap-Filling
  - Formatting

Cube Services
- Data Access API and Analysis API
- Data Access Service
- Interactive Analysis Service
- Visualisation Service

Existing Data Layers
- L2C (Raw) Cubes
- L3 Cubes
Use Cases

CyanoAlert

Space Based Cyanobacteria Information & Services

H2020 Project, 2016 – 2020
DataCube Application in 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

Swedish Lakes

N-German Lakes

C2RCC CHL (µg/l)

MPH

C2RCC CHL (µg/l)

MPH

FUB

IL (µg/l)

N-German Lakes

C2RCC CHL (µg/l)

MPH

C2RCC CHL (µg/l)

MPH

FUB

IL (µg/l)
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
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

- Satellite: A variety of instruments from ESA and EO4IND
- Sentinel, Copernicus and other custom data
- Water quality monitoring of high-resolution, medium-resolution and low-resolution data on INPANS processing chain
- Established and EPOS data portals and related tools
- Cooperative marine, land and climate service data
- Mobile data from a variety of EPOS services - a user-friendly design

E4DataBee
- It 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 [RIN]
- Can be deployed on DIAS, AWS, Google and private clouds
- Offers individual solutions tailored to customer requirements.

Validation of Data Layers

Cube Processing Model

Technology Stack

Services

Consultancy by EO and ICT experts
Software deployment
Product management: Cloud, Server, Storage

Ecological, water and sealife of communities, ecosystems, water
services, integration of data sources, integration of data sources, deployment of service frameworks