

Water quality monitoring service in Belgian Coastal Zone

Sentinel products and Data Cubes



Dimitry Van der Zande - João Cardoso Dos Santos (RBINS / REMSEM)

Royal Belgian Institute of Natural Sciences / OD Nature



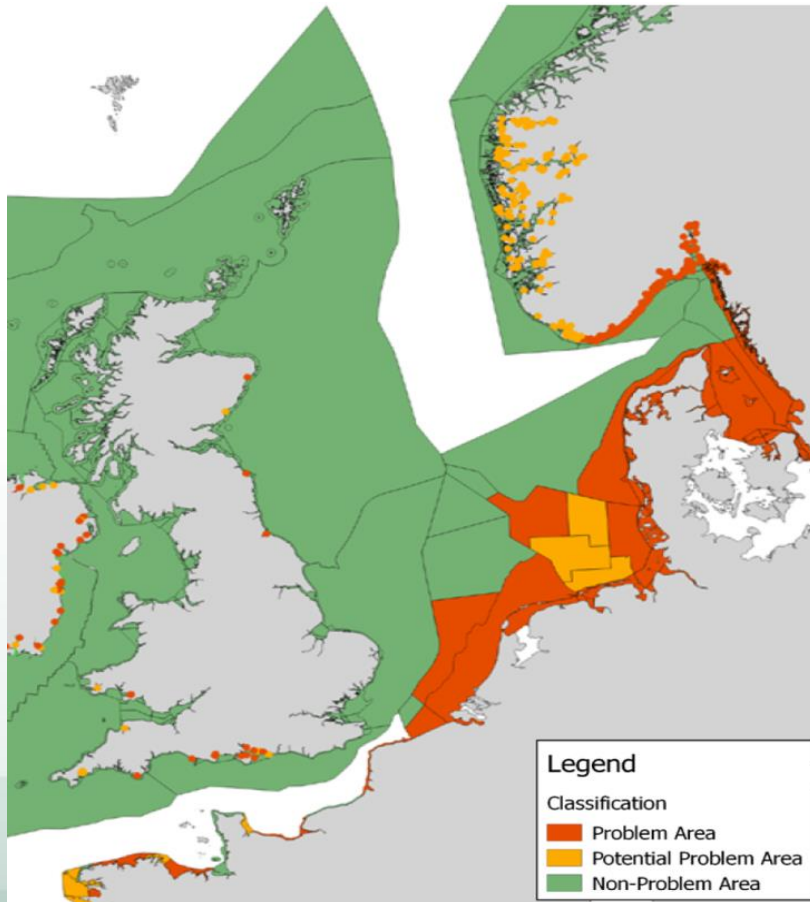
Foto: Kelle Moreau (RBINS)

“centre of excellence in fundamental and applied research of biodiversity and ecosystems in support of the protection and sustainable management of the natural environment.”

Mission:

1. Study biotic and abiotic components of the natural environment
2. Management and improvement of databases and RV Belgica
- 3. Provide scientific expertise including running a monitoring program for the North Sea**
- 4. Represent the Federal state in international bodies (e.g. MSFD, WFD, OSPAR)**

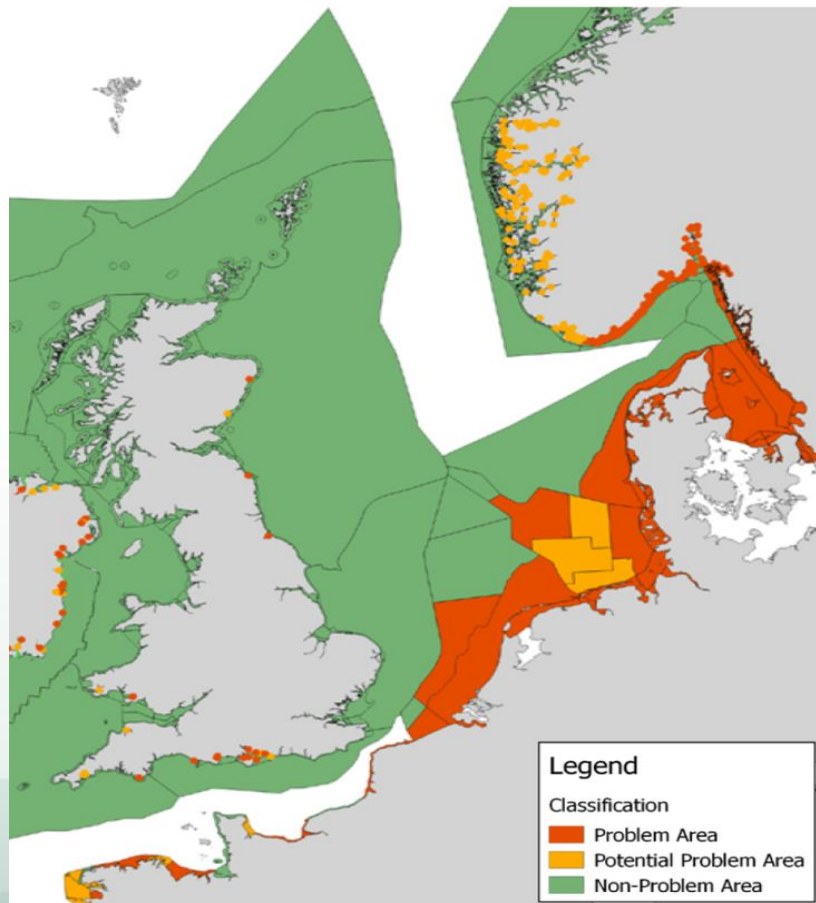
Assessment of eutrophication in the North Sea using satellite products



Map of problem areas for eutrophication in OSPAR region (OSPAR Quality Status Report 2017)

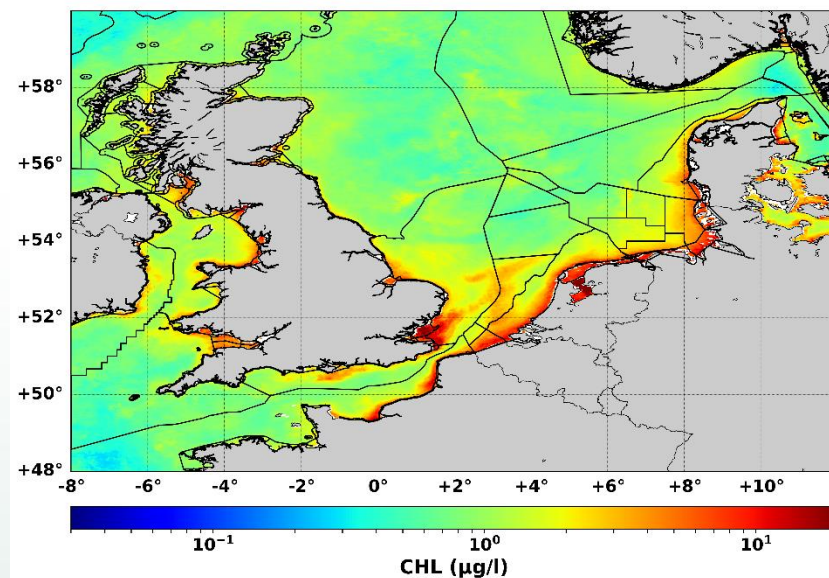
- Mainly based on **in situ data** (Chl, Nutrients)
- Eutrophication assessments performed on **national scale**
- **Differences** between countries in terms of:
 - **defining thresholds** (i.e. models, historical data archives, expert estimates, ...)
 - **monitoring strategies** (i.e. methods used, frequency observations, locations, ...)

Towards joint monitoring and assessment of eutrophication in the North Sea using satellite products



Map of problem areas for eutrophication in OSPAR region (OSPAR Quality Status Report 2017)

Enhance coherence in eutrophication assessments based on chlorophyll, using satellite data



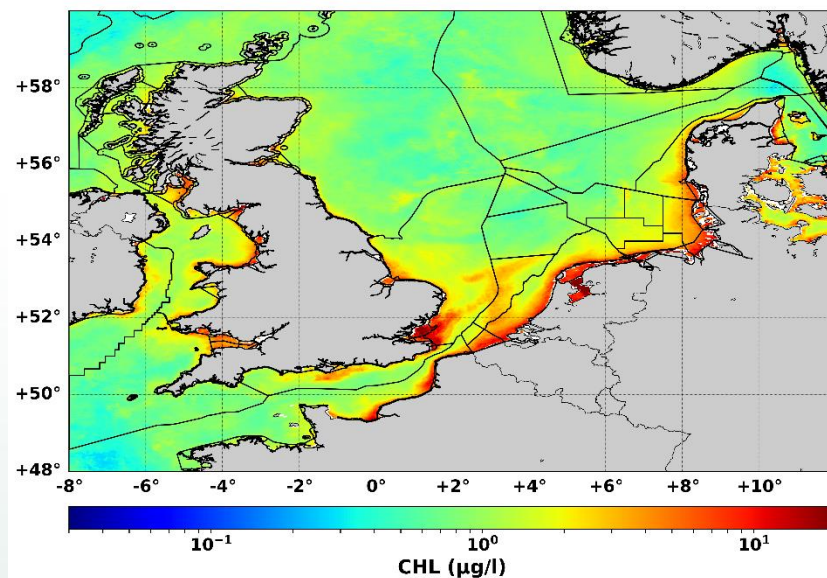
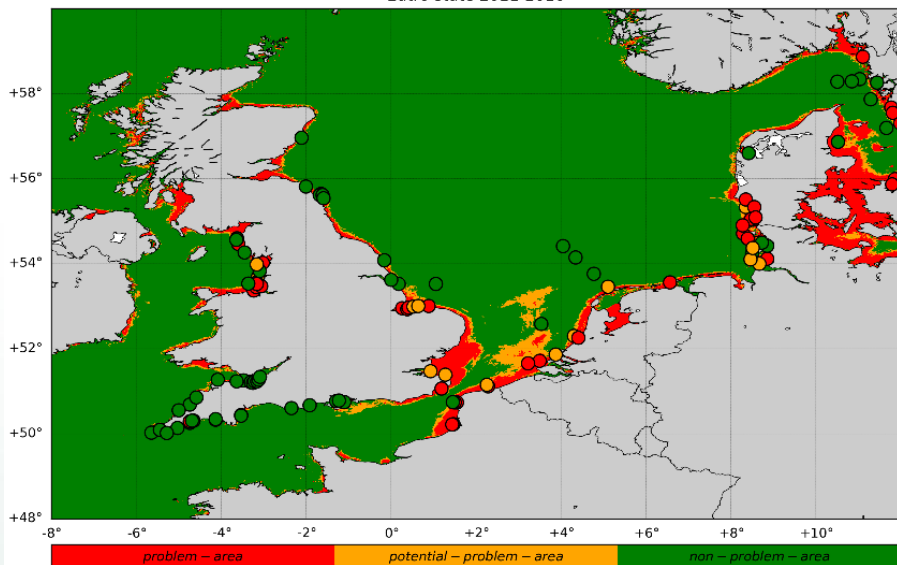
Multi-temporal composit of CHL product covering the whole North Sea

RS is neutral, transparent, and provides a high temporal and spatial resolution (cross-boundary)

Towards joint monitoring and assessment of eutrophication in the North Sea using satellite products

Enhance coherence in eutrophication assessments based on chlorophyll, using satellite data

Eutro state 2011-2016



Map of problem areas for eutrophication in North Sea based on satellite (map) and in situ (circles) data

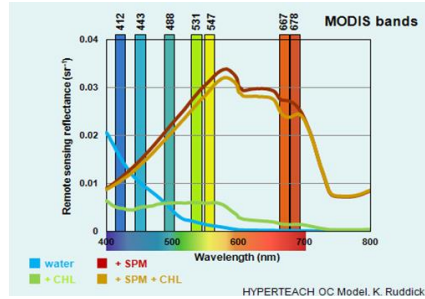
Multi-temporal composite of CHL product covering the whole North Sea

RS is neutral, transparent, and provides a high temporal and spatial resolution (cross-boundary)

Building an operational Earth Observation service



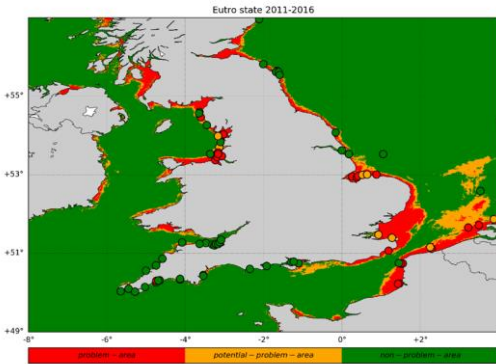
Data acquisition



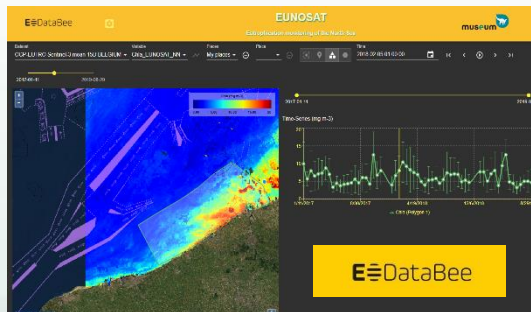
Scientific algorithm development



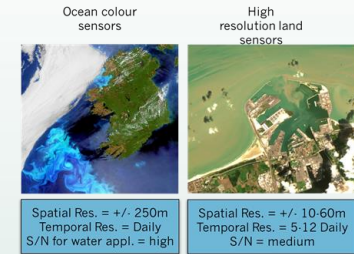
Product Validation



Eutrophication assessment



DataCube development



Product improvement

Ocean colour from space

eutrophication assessments based on chlorophyll, using satellite data



SeaWifs	1997-2010
MERIS	2002 – 2012
MODIS	2002 – ongoing
Sentinel-3	2016 - ongoing



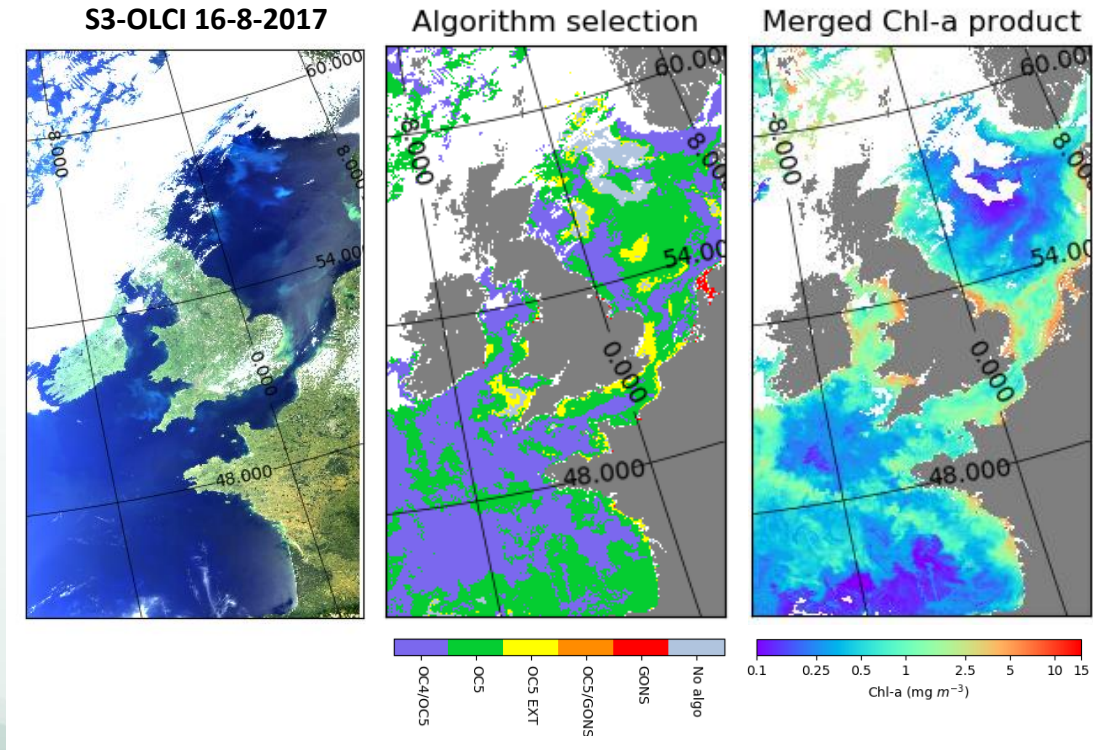
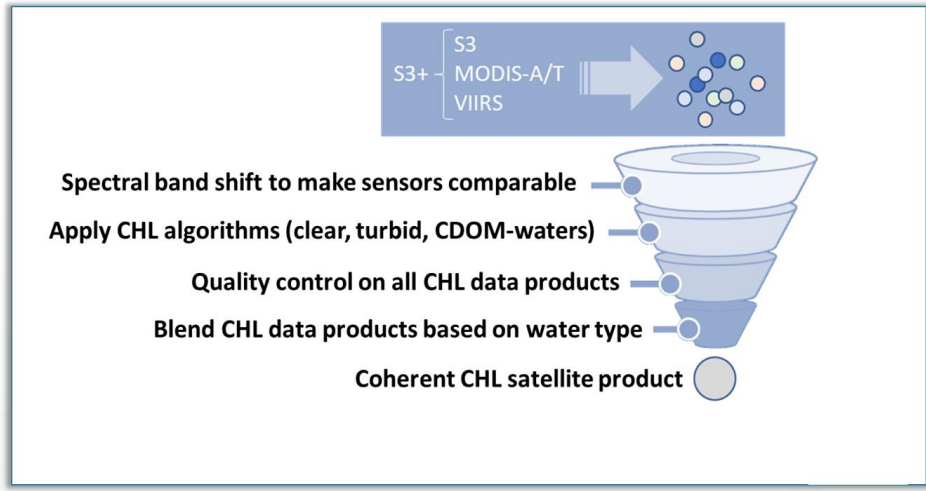
German Bight
Sentinel-3 22-4-2019



Clear water Algae (CHL) Turbid waters

Generate coherent satellite-based CHL product

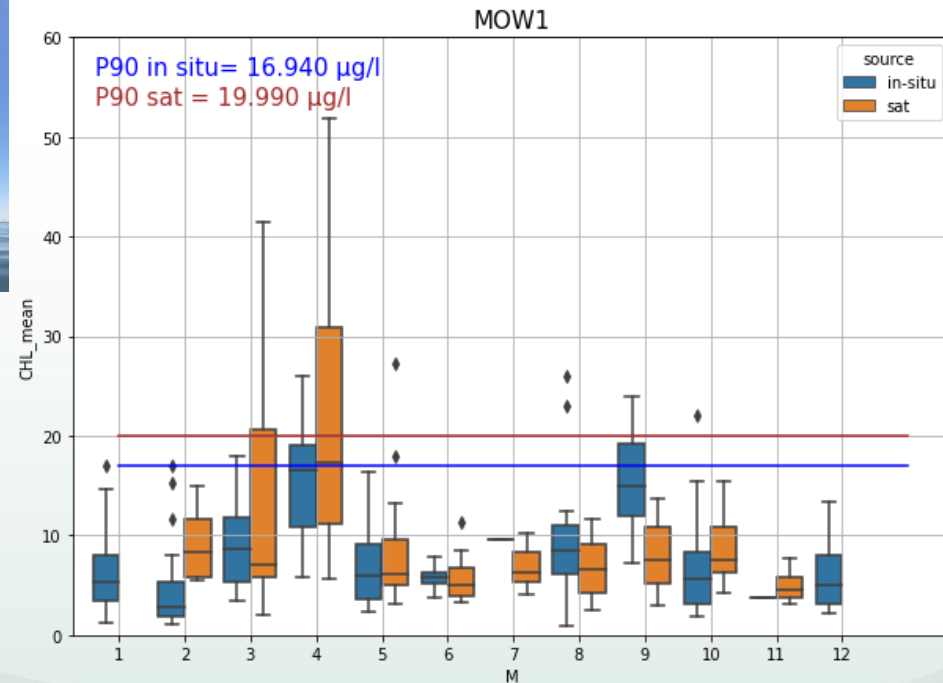
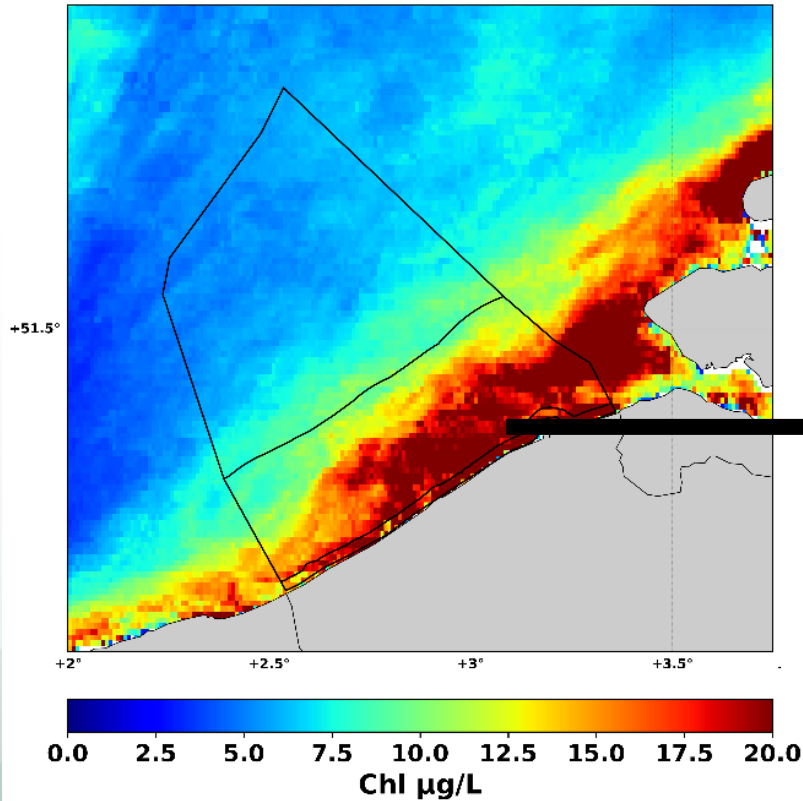
Merge different CHL products together into an *Analysis Ready* product



Eutrophication assessment Belgian Coastal Zone for WFD

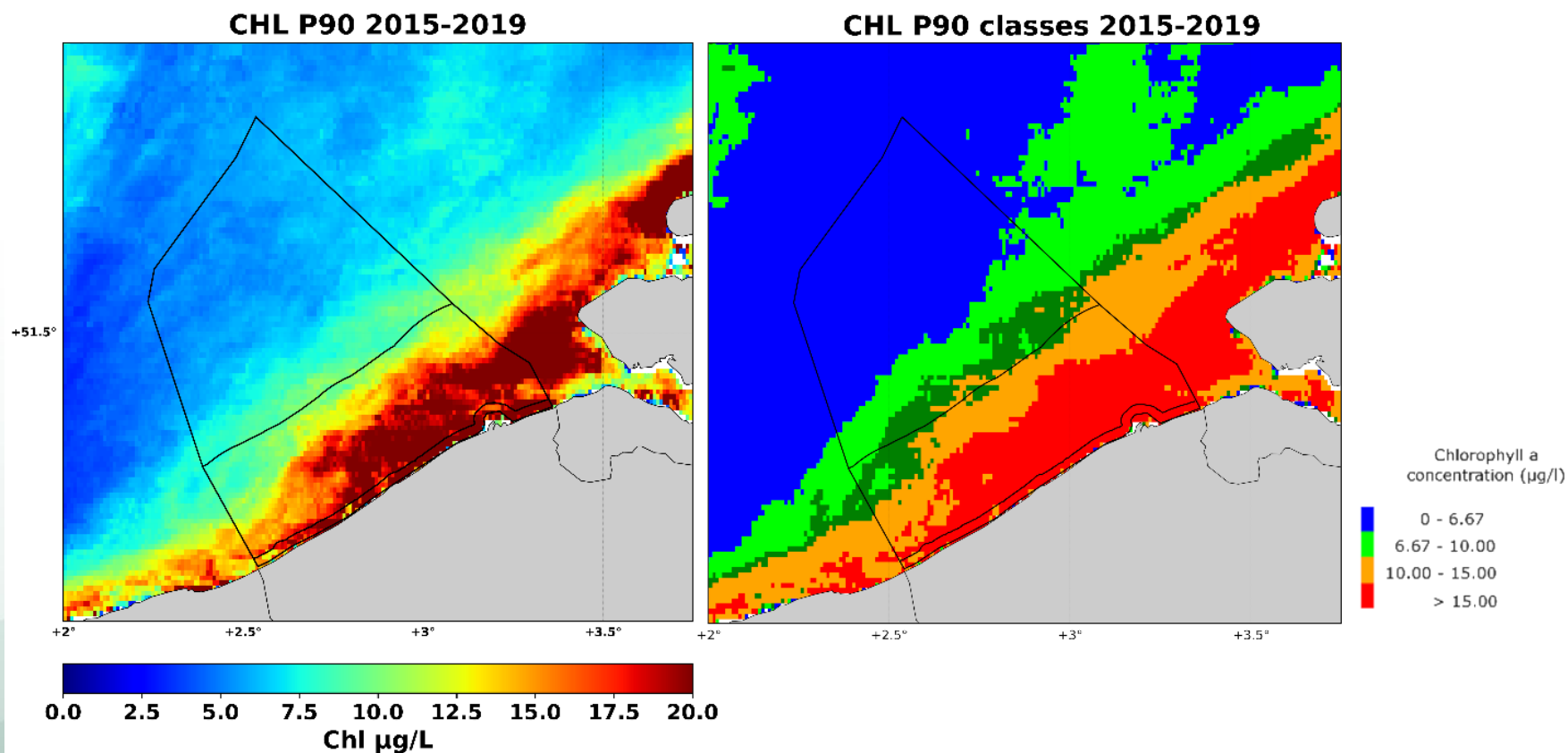
Multi-mission & multi-algorithm CHL products together into an *Analysis Ready* product
(reported Oct 2020)

CHL P90 2015-2019



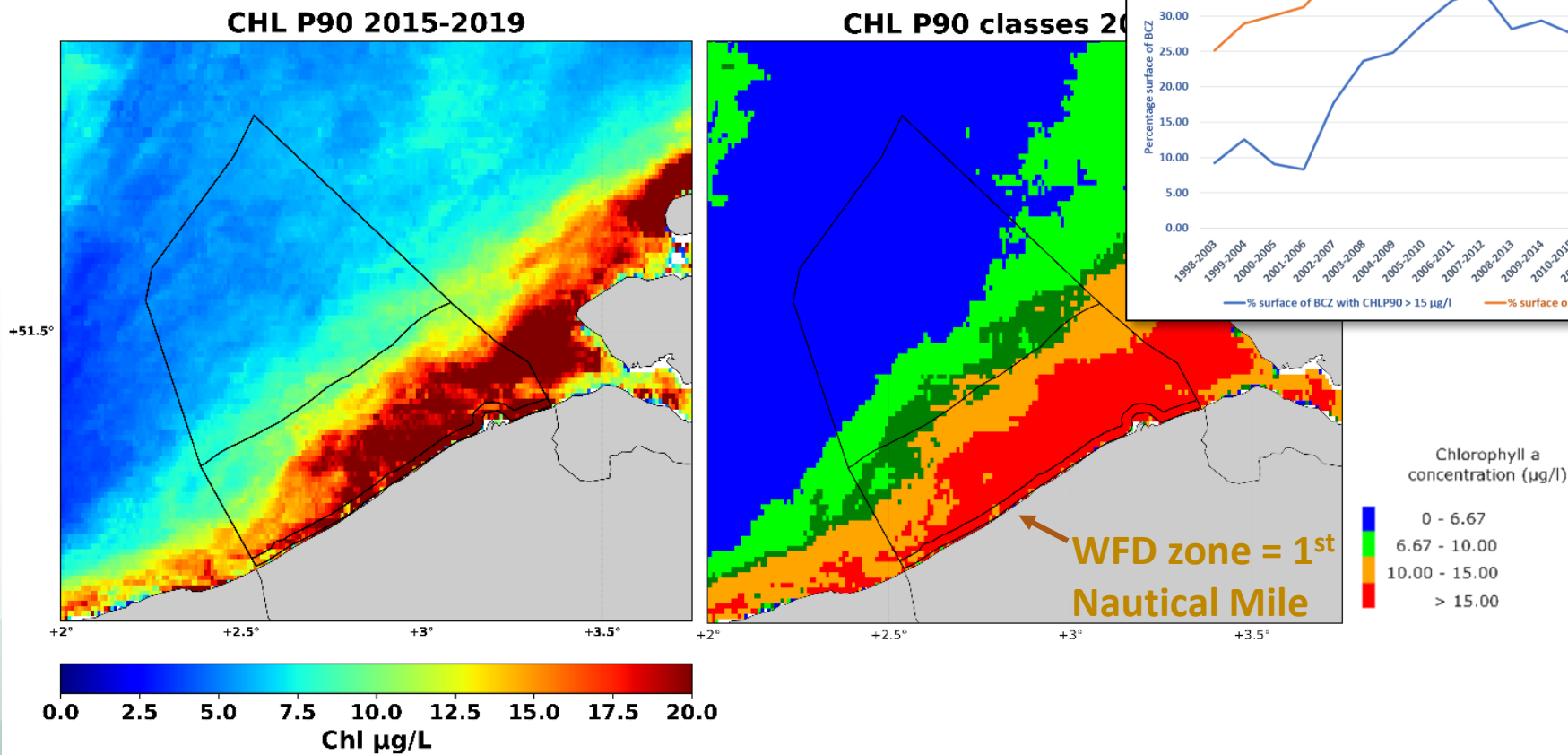
Eutrophication assessment Belgian Coastal Zone for WFD

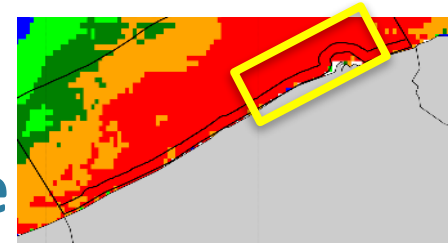
Multi-mission & multi-algorithm CHL products together into an *Analysis Ready* product
(reported Oct 2020)



Eutrophication assessment Belgian Coastal Zone for WFD

Multi-mission & multi-algorithm CHL products together into an *Analysis Ready* product (reported Oct 2020)



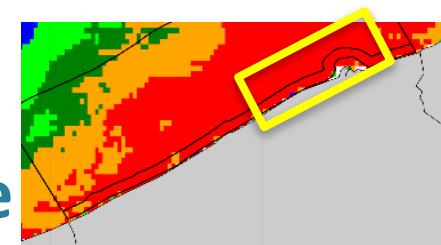


Eutrophication assessment Belgian Coastal Zone

Introduction of Sentinel-2 MSI products for near shore observations



Figure 1 Sentinel-2A/MSI Rayleigh-corrected RGB composite of the Belgian coastal zone on 2016-05-01 (10:53 UTC). Common sampling stations are annotated.



Eutrophication assessment Belgian Coastal Zone

Introduction of Sentinel-2 MSI products for near shore observations

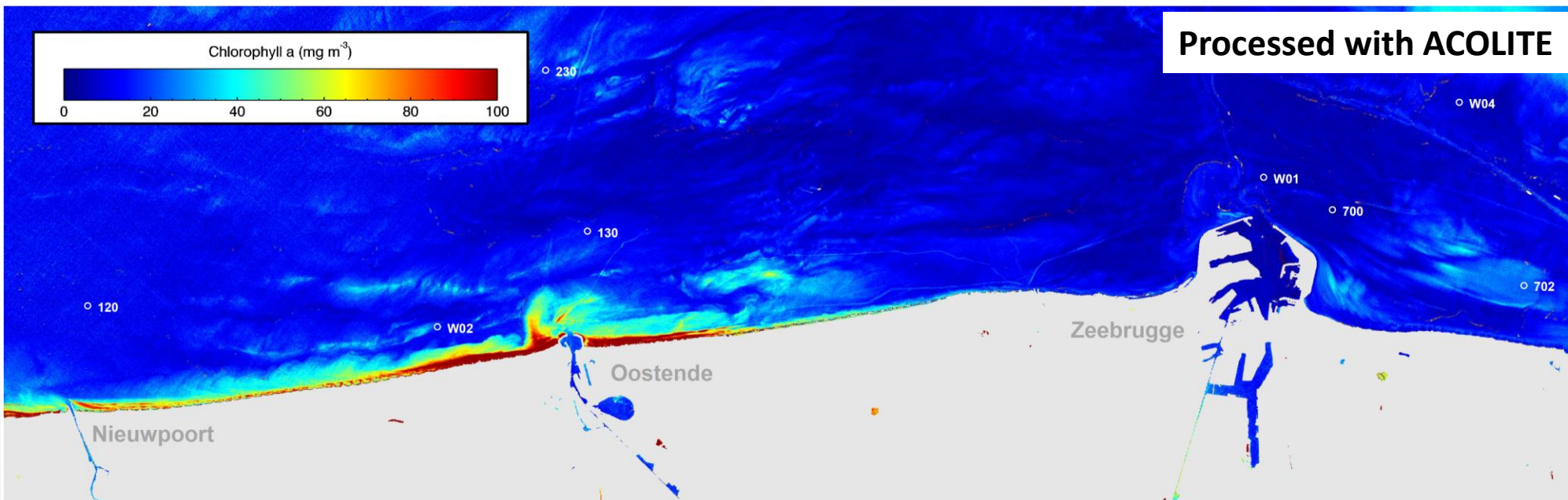


Figure 2 Chlorophyll a concentration derived using the algorithm of Gons (2005), showing an intense bloom between Nieuwpoort and Oostende

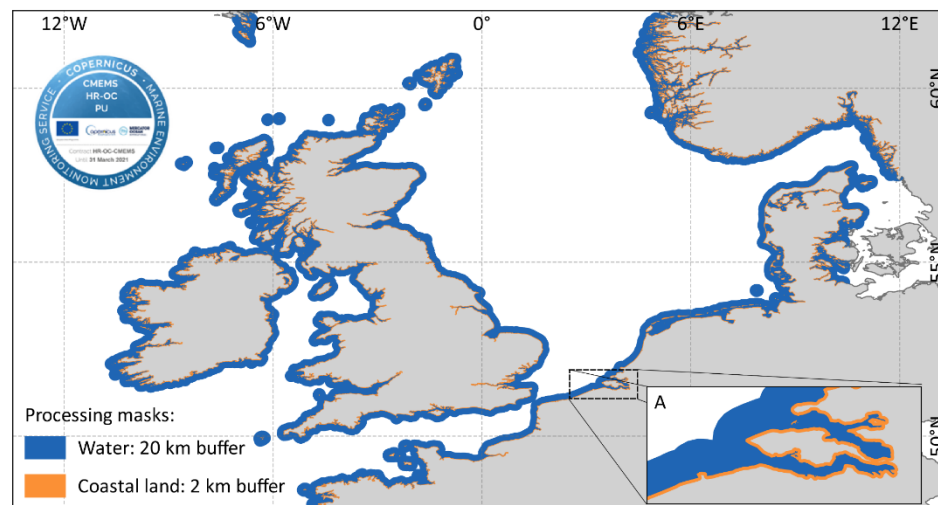
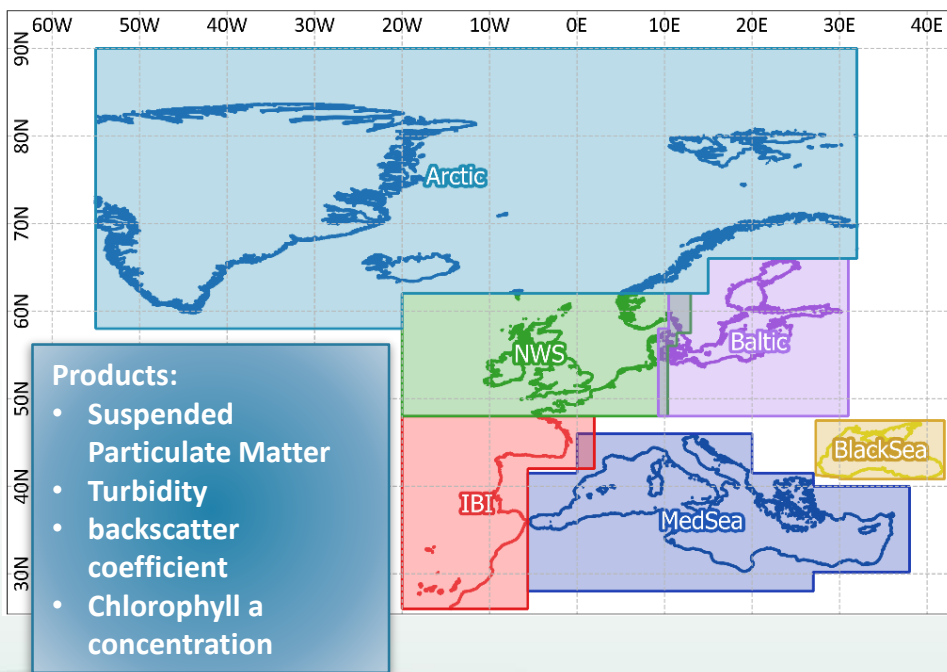
Monitoring strategy evolution:

- ensure data compatibility between S3, S2 and in situ data sets
- Integrate S3 and S2 into one comprehensive CHL product (BE Multi-Sync project)
- Upscale approach to all EU Marine regions for CMEMS High-resolution service



CMEMS High Resolution service

The HR-OC Production Unit will be responsible for the delivery of high resolution Ocean Colour Level-3 and Level-4 products for European regional seas based on the use of Sentinel-2 data



Technological Potential and Barriers...

Sentinel data and Sentinel Services provide unprecedented amount of information

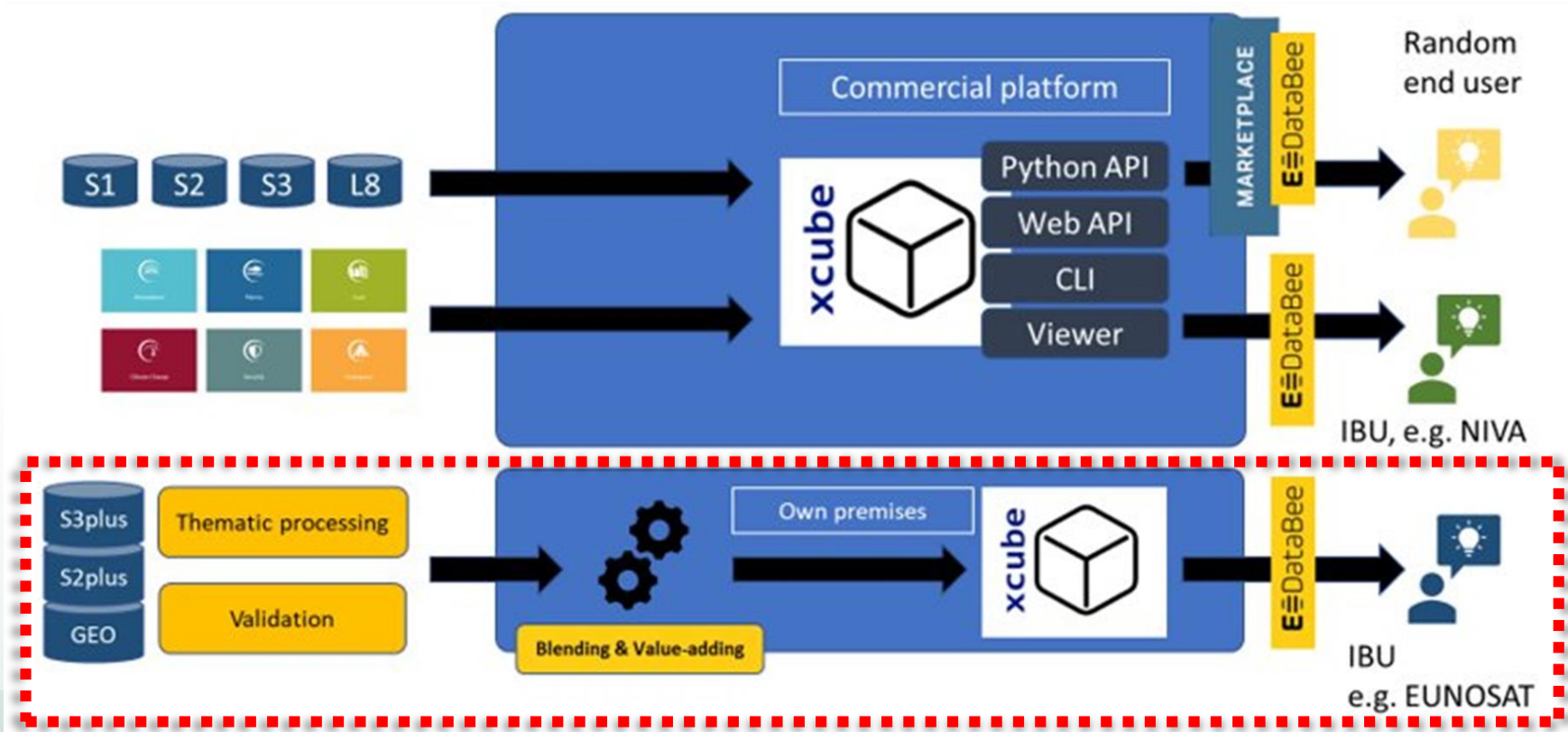


Data cube development

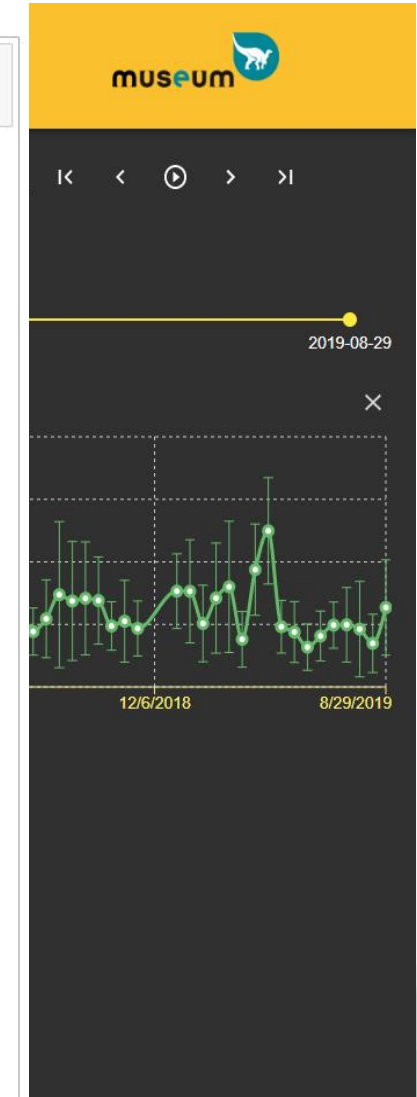
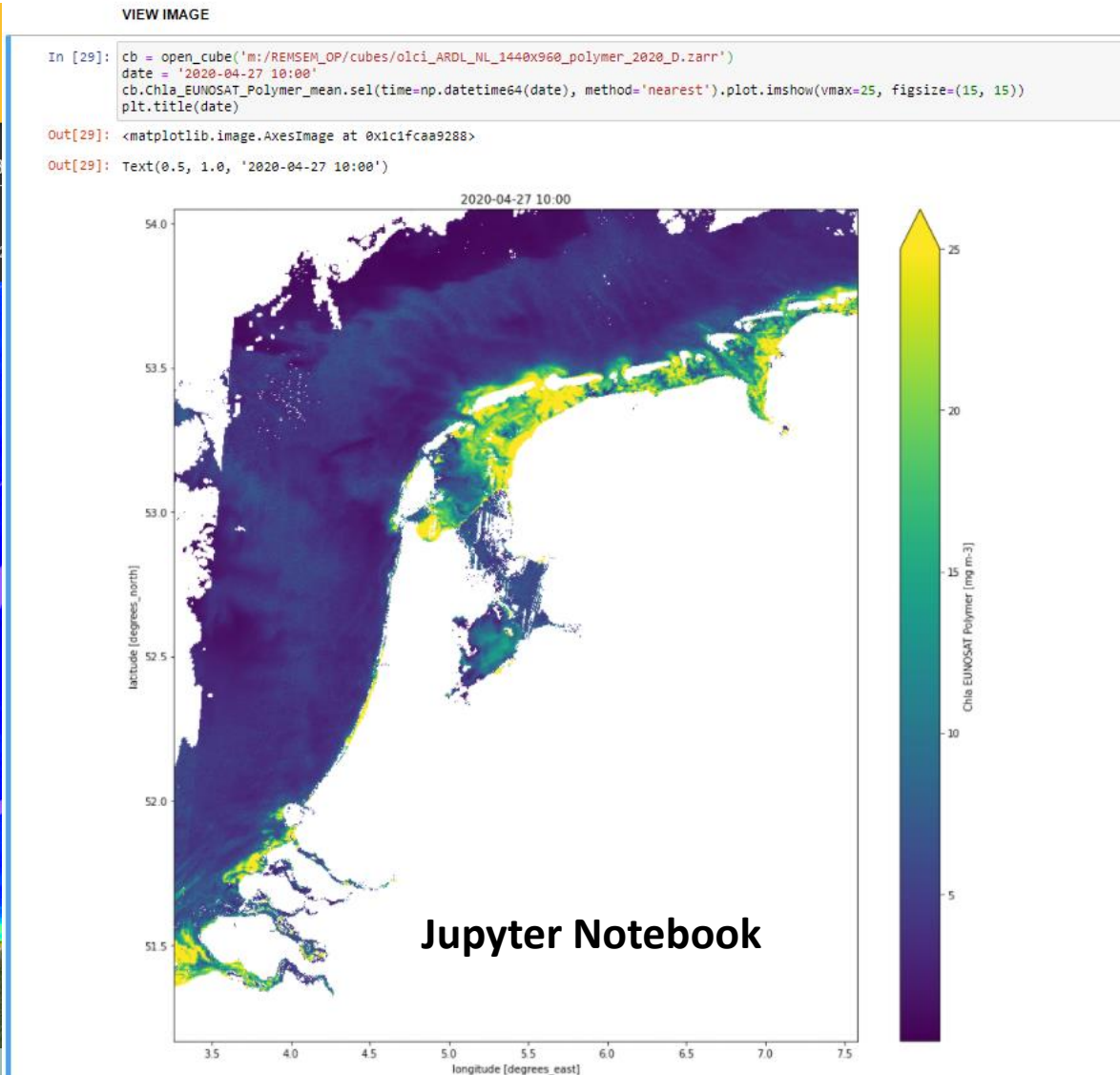
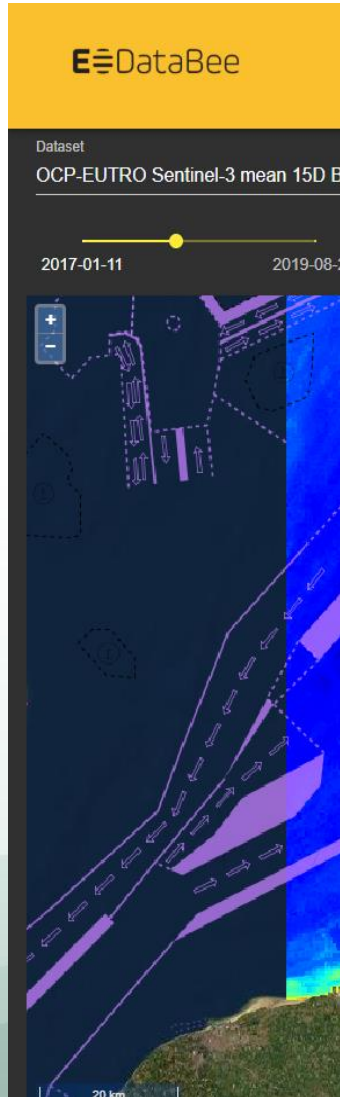
Thematic processing

xcube software

EODATABEE service



Data cube deployment (xcube, open source)



Take Stay home messages

- With the COPERNICUS Sentinel program there is a guarantee of operational EO data availability for 20 years (up to 2036) which increases the willingness of end users to adopt this technology

- To ensure high quality satellite products, each step of the production chain needs to be optimized: Atmospheric correction, algorithm QC and selection, product improvement, data dissemination/interaction

- Belgium has integrated EO WQ monitoring in federal MSFD/WFD reporting for Belgian Part of the North Sea and is looking into assisting in a North Sea wide Joint Monitoring Program (OSPAR).

- CMEMS High-Resolution service aims at providing Sentinel-2 products for coastal applications early 2021 to support coastal ecosystem monitoring

- Data cube systems (e.g. xcube) break down technical barriers facilitating the transformation of EO data into actionable information



Thank you



Harbour of Zeebrugge, Pléiades, 0.5-2M resolution