

EO Applications for Integrated Maritime and Territorial Spatial Planning in the Baltic – ESA BalticAIMS project

Kerstin Stelzer, Carole Lebreton, Carsten Brockmann, Martin Böttcher, Tonio Fincke,
Norman Fomferra, Uwe Lange, Alicja Balfanz, **Brockmann Consult**
Petra Philipson, Susanne Thulin, **Brockmann Geomatics**
Sampsia Koponen, Jenni Attila, Mikko Kervinen, Hanna Alasalmi, Vesa Keto, Markus
Törmä, **Finnish Environment Institute (SYKE)**

Project basics

- Funded by ESA
- Duration 01/2021 – 01/2023 (24 months)
- Coordinated by
 - Finnish Environment Institute (SYKE) (FI)
- Partners
 - Brockmann Consult (GE)
 - Brockmann Geomatics Sweden (SE)
- Webpage: www.syke.fi/projects/BalticAIMS

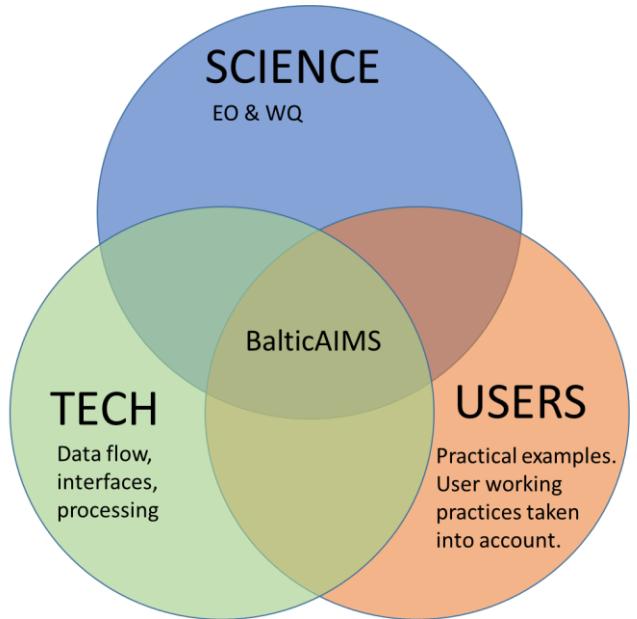
Our motivation

- Provide added value for MSP and human impact related activities from Earth Observation (EO) data
- EO can help by providing information on
 - State of the coastal environment
 - Activities in the catchment areas
- Access to EO data is not convenient for non-expert users and MSP experts. Combining EO observation with GIS and other material is laborious
 - Our objective is to help marine environment monitoring:

demonstrate an *integrated data approach for essential processes of land and coastal water areas to better analyse and visualise the interactions.*

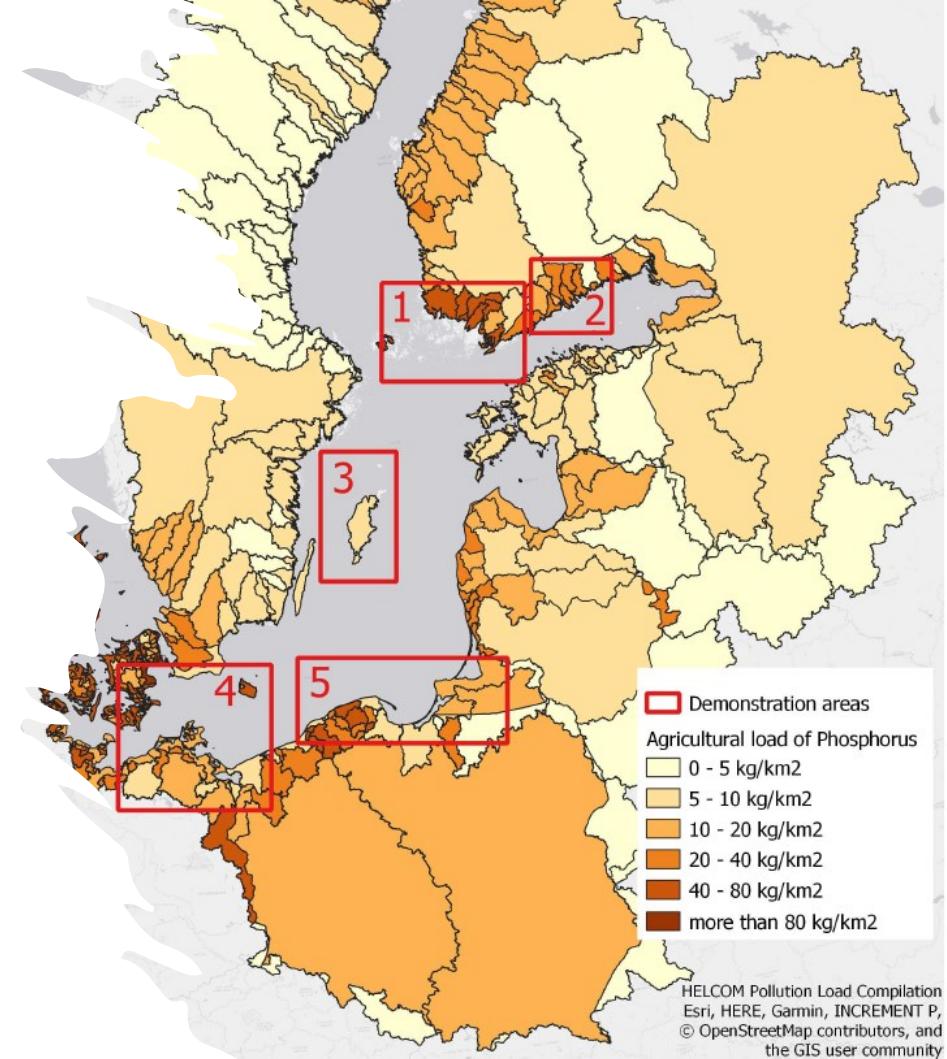


In practice



→ Create data access, visualization and analysis systems and tools for selected demo areas in the Baltic Sea

- GIS material relevant for MSP, human impacts and pressures
- In situ water quality (monitoring stations, Alg@line ferrybox, automated stations)
- EO and model datasets



Showcases and user stories

A: EO based information to be used in user legacy systems for spatial planning

B: Monitor the effects of **nutrient flow** from the drainage basin to the coastal waters

C: Monitoring the impacts of **coastal activities**

D: Combination of Coastal Zone mapping and CMEMS coastal water quality material

E: Monitoring of **temperature anomalies**
→ upwelling & input of heat

A1: Material to support the review of MSP Plans

A2: Human impact

A3: Hotspots

B1: Impact of agriculture

B2: PLC subgroup

B3: Monitoring of nutrient reduction measure

C1: Dredging Helsinki

C3: HELCOM dredging & dumping

C2: Water quality coastal Finland

C4: HELCOM human pressures

D1: Wind park

D2: Aquaculture footprint

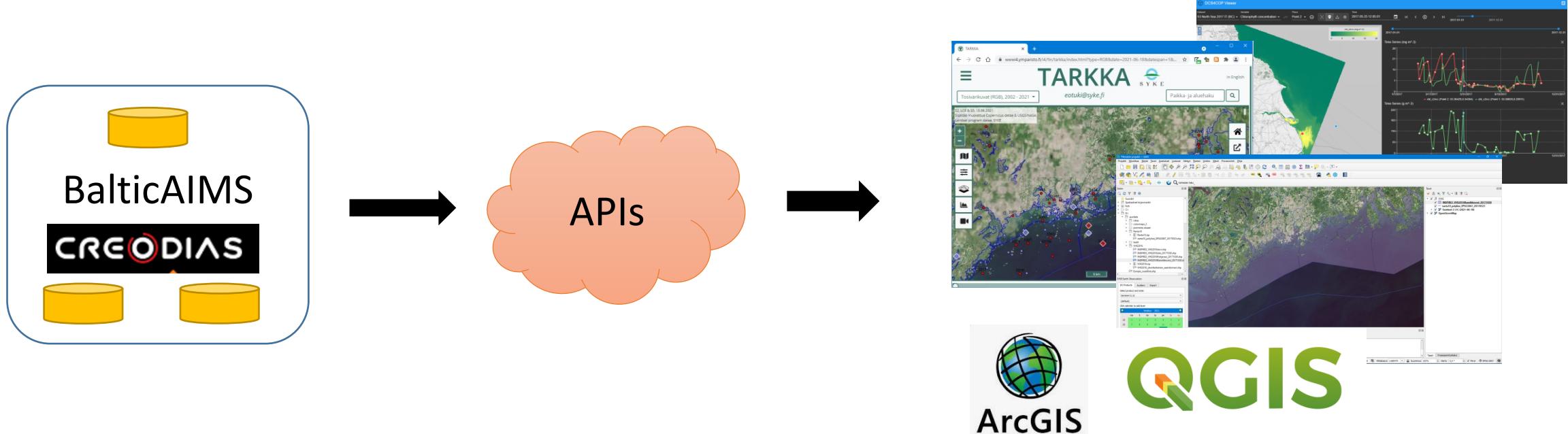
D3: Coastal land use

E1: Helsinki city coastal water temperature

E2: Climate change

BalticAIMS data flow

- Demonstration system utilizes data sources (backend) connected to three interfaces, where you can explore the data through APIs



How to reach the available material?

Public viewer to familiarize with the datasets:

Browser-based, ready to use Graphical User interface

BALTIC AIMS interface



- EO**
- RGB
 - EO turbidity
 - Cases, where human impact are clear
 - Seasonal (summer, spring turbidity, chl-a)
 - Algae blooms
 - Wintertime RGBs

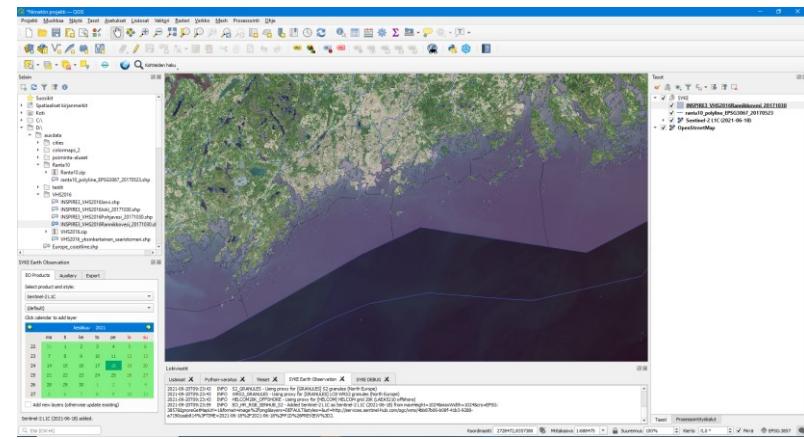
- GIS**
- Available GIS material on coastal activity
 - GIS material, where human impacts identified from EO material are identified (TBD)

- Stations**
- Coastal stations (WQ)
 - Automated temperature network



www.syke.fi/TARKKA/en

Access the data in GIS applications

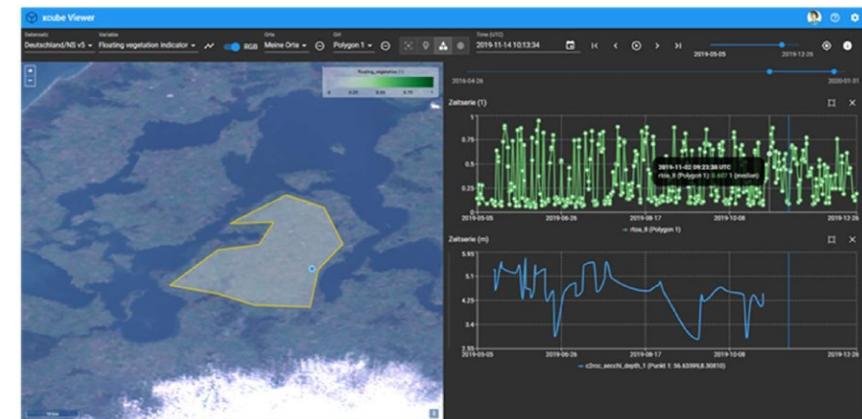


QGIS



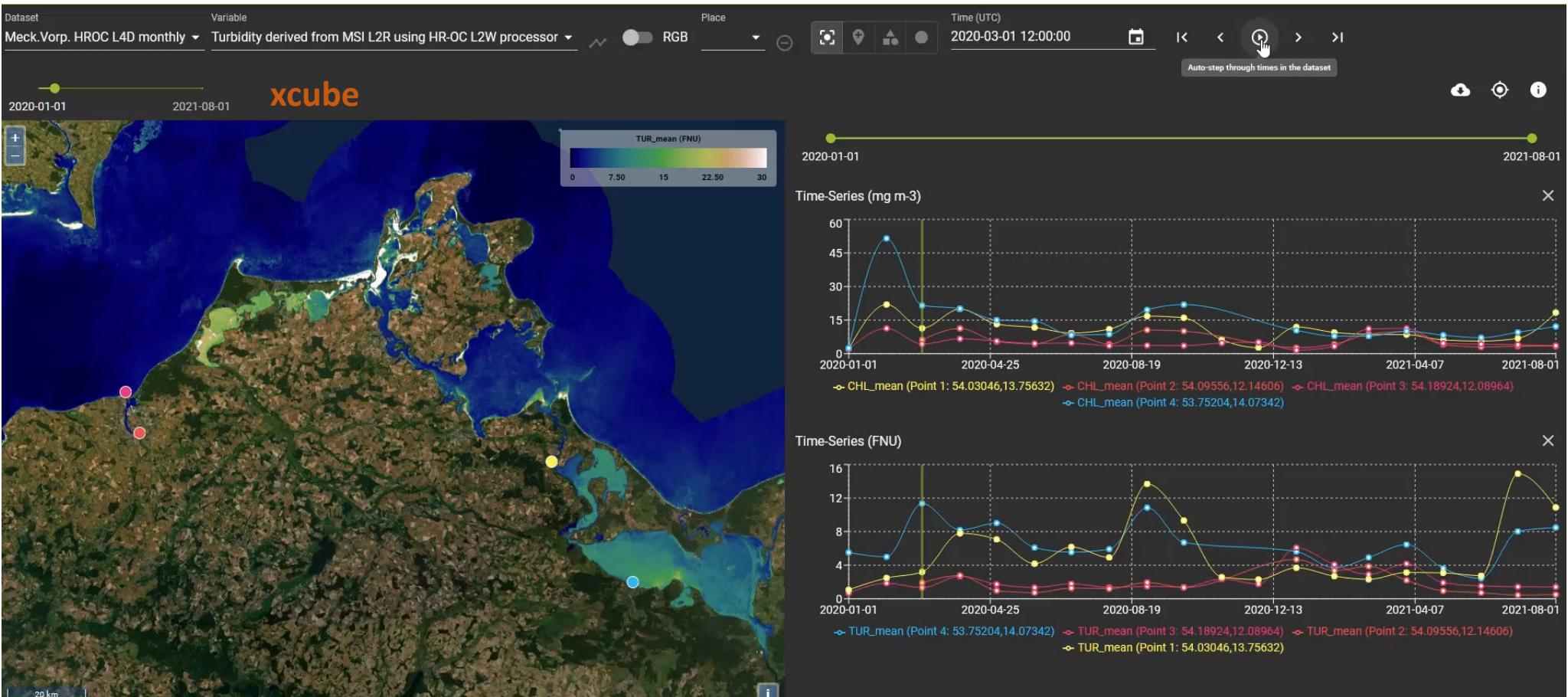
ArcGIS

xcube viewer (browser based)



Accessing data: **xcube viewer**, QGIS, Jupyter Notebooks, TARKKA+

One year monthly averages TUR (2020)



QGIS Demonstration Material for Users and Partners

Step by step Word document based on one User Story

Step by step Power Point presentation for visual demonstrations

BalticAIMS User story B2 – Workflow

1 Collect data from different web services

1.1 Background EEA WMS: Country layer ¹⁾

1.2 BalticAIMS GeoDB WFS ²⁾: Agricultural loads of Phosphorus (kg / km²) using Helcom PLC style

1.3 xcube WMTS ³⁾ turbidity data:

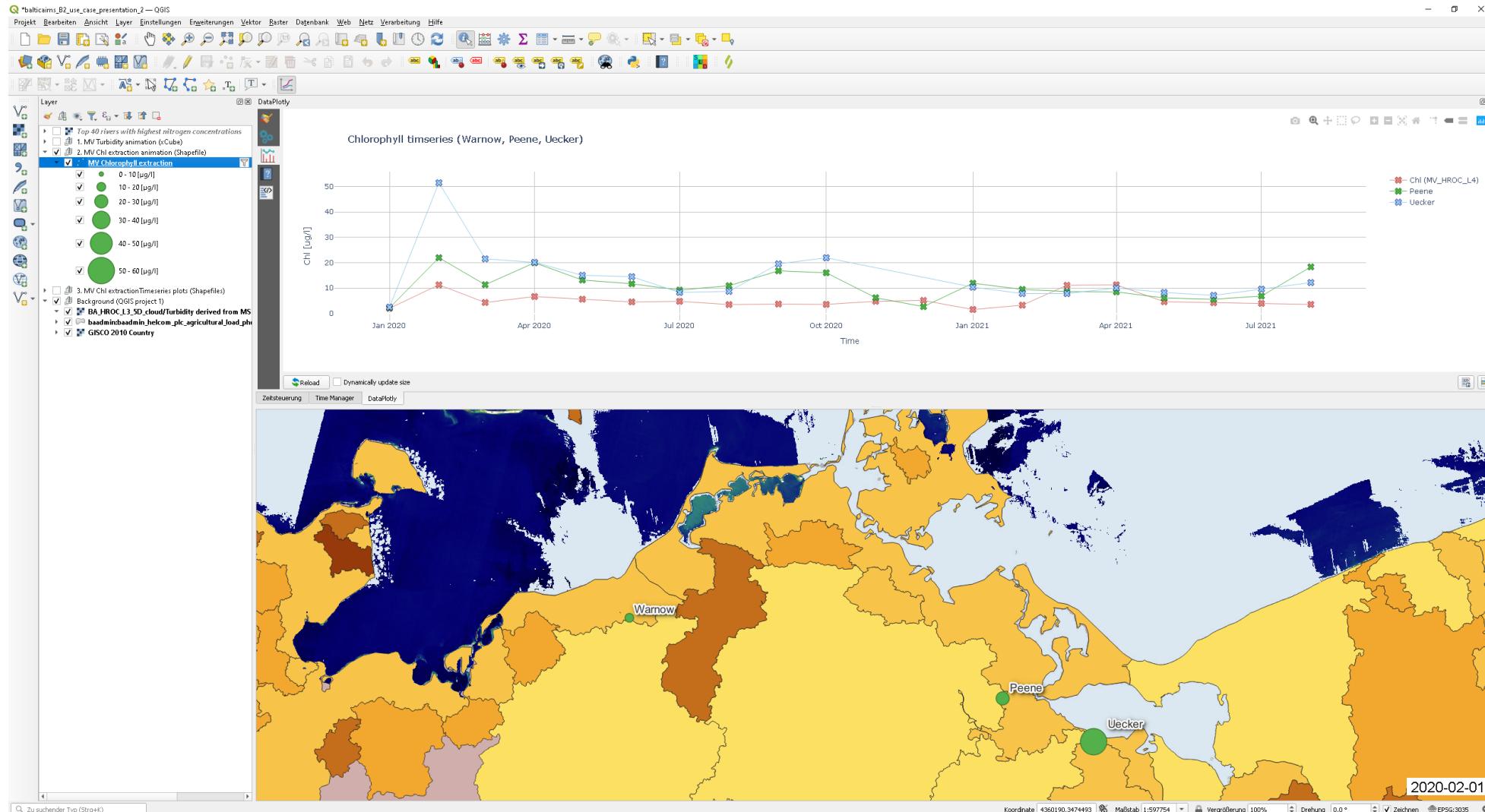
1.4 Helcom PLC (ArcGIS-Rest service) :

Load Helcom PLC style :
E:\vergabe\daten\BalticAIMS\WorkingArea\workspace_08\Copernicus\coastal_zone\baekdrift_wlcom_plc_agricultural_load_phosphorus\wlcom_mads_phosphorus_agriculture.qml

1.3 xcube WMTS ³⁾ turbidity data:

1.4 Helcom PLC (ArcGIS-Rest service) :

Accessing data: xcube viewer, QGIS, Jupyter Notebooks, TARKKA+



Can be made
compatible
with ArcMAP

EO water quality demonstration materials

Table 4. Water quality parameters and data sources

Parameter	Available data sources
Chl-a	EO, monitoring stations, automated ferrybox, models
Turbidity	EO, monitoring stations, automated riverine observations
Sediment concentration	EO, monitoring stations
Nutrient concentrations and dynamics	EO, monitoring stations, automated riverine stations, models
Statistical characterization of coastal water features including pollution and algal bloom event	All data sources. EO with coastal hot spot detection and algal bloom index (SYKE), CyanoAlert (BC, BG)
Other anomalies 1. Oxygen concentration 2. Anomalous salinity 3. Anomalous temperature	1. Automated ferrybox and station sampling, model data 2. EO*, Automated ferrybox and station sampling 3. EO, automated ferrybox and station sampling

* Here we will utilize the results available from the Baltic+ Salinity dynamics project.

Accessing data: xcube viewer, QGIS, Jupyter Notebooks, TARKKA+



What's up EO map viewer Gallery Projects More info

<https://testbed.ymparisto.fi/eo-tarkka/>

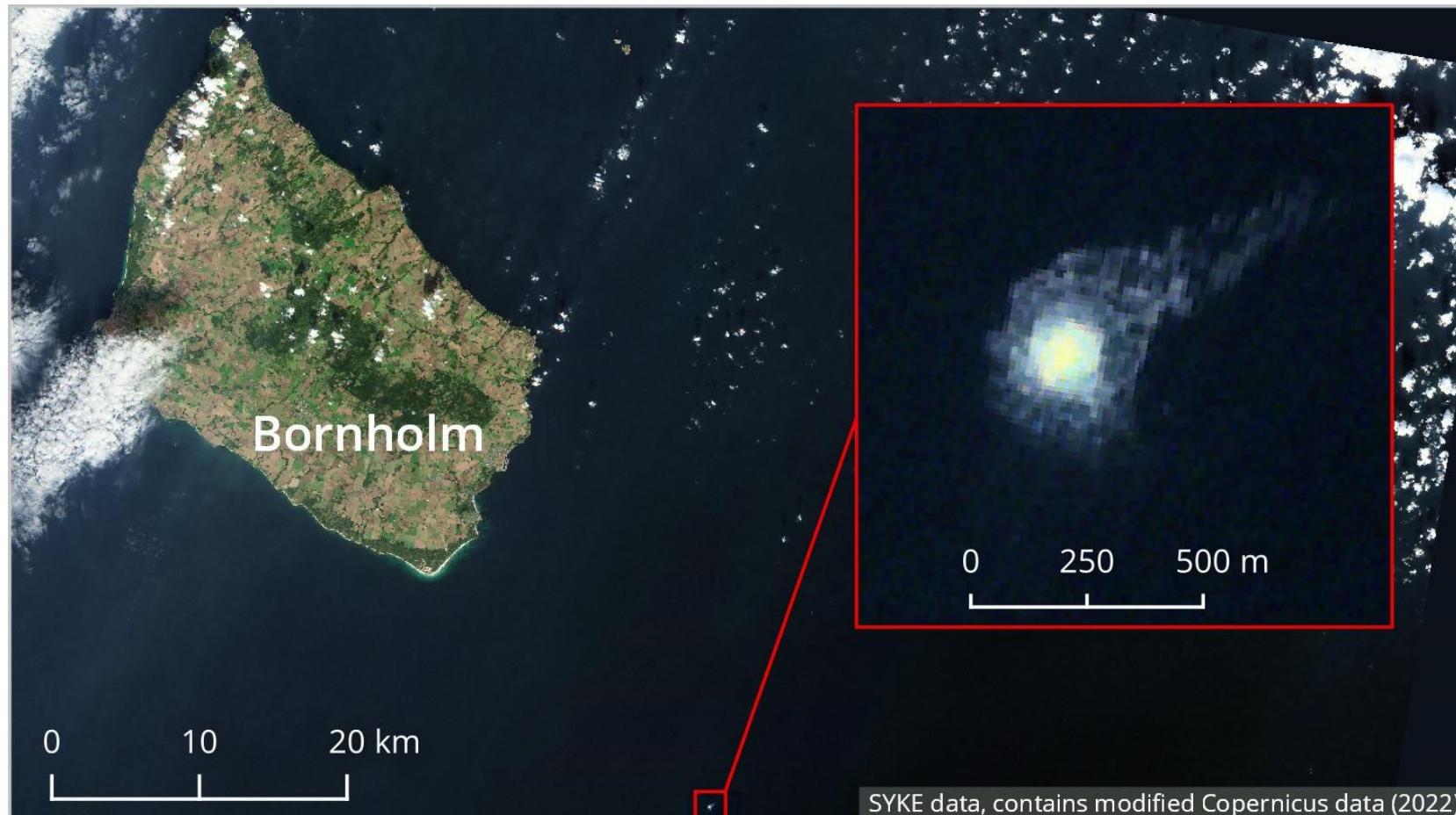
Welcome to the TARKKA+ — improved and versatile version of SYKE EO service! Check our new functionalities and wait for some further improvements coming up

From these pages you can get a feeling of what the new TARKKA+ will look like. TARKKA+ has been designed to provide access to satellite data (EO = Earth Observation). We'll add new functionalities and materials during the coming weeks and months. Below are examples of TARKKA's observations. The latest observations are updated in the image carousel below. The front page of TARKKA+ has introductory images on various themes, which will be supplemented with materials during 2022 - and beyond.

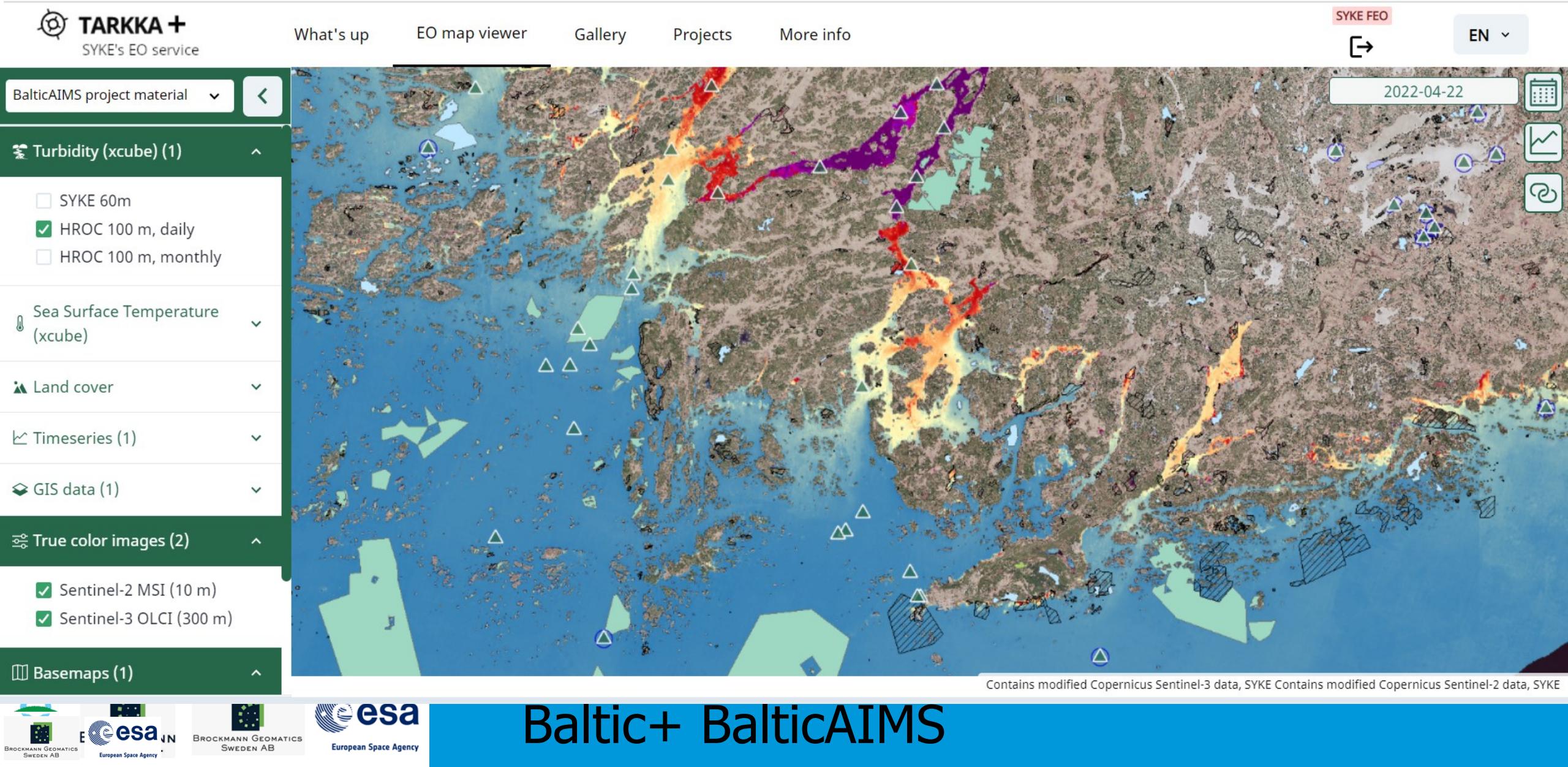
Please contact our support if you have questions or comments: eotuki@syke.fi

The official version of TARKKA: <https://syke.fi/tarkka/en>

Current observations



Frontends: xcube viewer, QGIS, Jupyter Notebooks, TARKKA+



Access data: xcube viewer, QGIS, Jupyter Notebooks, TARKKA+

The screenshot displays the TARKKA+ EO map viewer interface, which integrates various environmental data layers and analytical tools.

Left Sidebar:

- EO**:
 - daily true color
 - turbidity (HIROC & SYKE)
- True color images (z)**:
 - ✓ Sentinel-2 MSI (10 m)
 - ☐ Landsat-8/9 OLI (30 m)
 - ✓ Sentinel-3 OLCI (300 m)
- Turbidity**:
 - Water surface temperature
 - Surface algal blooms
 - Total phosphorus
- Additional GIS data (1)**:
 - Dredging dump areas (xcube)
 - Reference stations
 - ✓ Nature reserves
 - WFD water bodies (Finland)
 - Drainage basins (proposition, Finland)
- Timeseries**:
 - Stations sites
 - Water bodies
 - River monitoring stations
 - Lake Pien-Saimaa automated observations
- MSP material**:
 - ✓ Lagoon data
- Project WQeMS**
- Basemaps (1)**

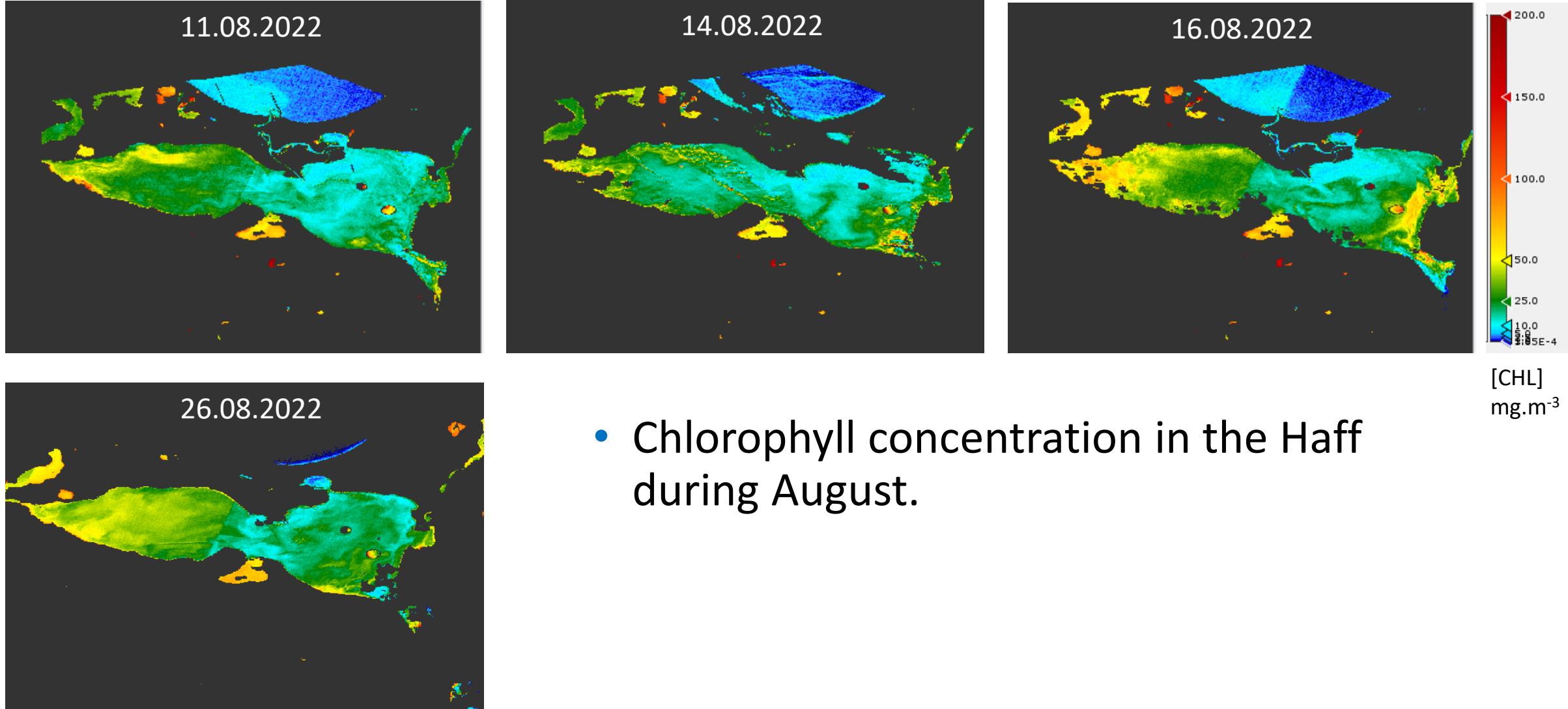
A red arrow points from the "Lagoon data" checkbox in the MSP material section to the "Lagoon data" checkbox in the EO time series section.

Map Area:

- Complementary GIS material relevant to MSP**: A callout box pointing to a layer in the sidebar.
- Station sampling WQ & automated observations**: A callout box pointing to the EO time series section.
- EO time series in lagoon areas**: A line graph showing Turbidity levels over time (2016-05-15 to 2021-10-14) across different lagoon areas. The Y-axis ranges from 0.0 FNU to 4.0 FNU. The X-axis shows dates at 6-month intervals. The graph highlights significant spikes in turbidity, particularly around 2017-2019 and 2021.

Top Right: SYKE FEO, EN, 2022-04-25, a date selector, and a zoom-in/out icon.

Algal Bloom in the Haff lagoon (DE) – August 2022



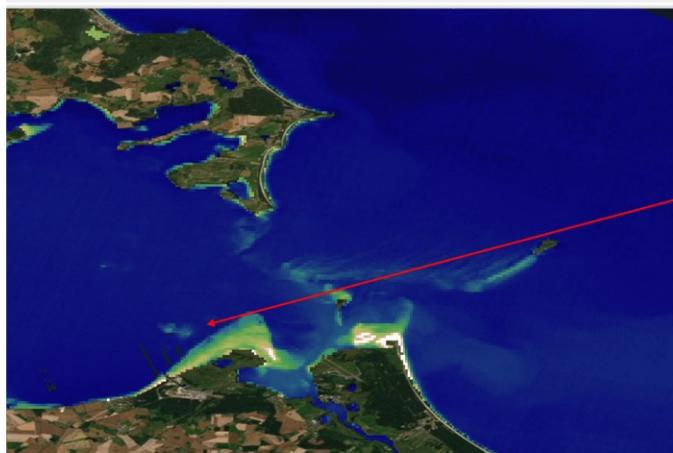
Additional applications related to other user stories

Element	sub-element	Data description	Status/Metadata
Coastal infrastructure	coastal defense structures	Locations and types of the coastal protection structures. (2016)	http://metadata.helcom.fi/geonetwork/srv/eng/catalog.search#/metadata/2d47c5ea-4590-465f-a462-60ef59d3d7d3
	Ports/harbors	Commercial Ports of Baltic Sea (2016). HELCOM Maps and databases	http://metadata.helcom.fi/geonetwork/srv/eng/catalog.search#/metadata/e2a3a104-a7aa-49c9-be2c-47845b3a322f
	Pipelines	Underwater pipelines in the Baltic Sea Region HELCOM (2015).	http://metadata.helcom.fi/geonetwork/srv/eng/catalog.search#/metadata/5260249e-5850-431a-b130-3a096abac852
	Physical disturbance layer**	Pressure layer combines all human activities that cause physical disturbance or damage to seabed (2018).	http://metadata.helcom.fi/geonetwork/srv/eng/catalog.search#/metadata/05e325f3-bc30-44a0-8fob-995464011c82
	Physical loss pressure layer. **	Physical loss pressure layer combines all human activities that cause physical loss of seabed (2018).	http://metadata.helcom.fi/geonetwork/srv/eng/catalog.search#/metadata/eaoefofa-0517-40a9-866a-ce22b8948c88
	Urban infrastructure	Described in detail in text above.	

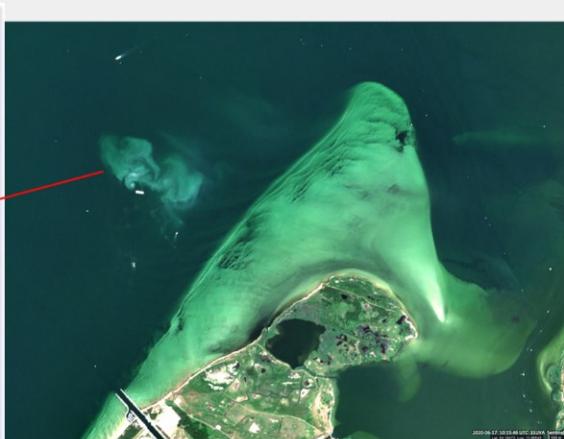
transport infrastructure	Model results of Environmental impact caused by spill of soluble chemicals and oil from ships of all sizes.	Grid showing model results of environmental impact caused by spill of soluble chemicals and oil from ships of all sizes.	Brisk-project based data, (http://www.brisk.helcom.fi/) various versions available, TBD in WP1 based on user requirements e.g. http://metadata.helcom.fi/geonetwork/srv/eng/catalog.search#/metadata/a4b66b03-fdef-4boc-bff2-f2241303f12a
	Energy structures		HELCOM material GIS available for e.g. <ul style="list-style-type: none"> • wind farms, • fossil fuel energy production • input of heat, hydropower dams • oil and gas refineries



Dredging Activities: example East Rügen
2020.06.17 10:15:46 UTC visible in TUR data



Screenshot from xcube viewer



Google Earth Image

• regional load
regional over all

al s		National/international GIS databases	Finland: regional information on dredging available (database), case studies are possible and already exist, high interest in commercial EO use & co-operation in Finland
	Dredging	HELCOM: Pressures and human activities: dredging sites (points, areas and lines available) National complementary database available at least in Finland	The dataset contains dredging sites reported by HELCOM Contracting Parties. Reporting of dredging sites is not mandatory according to the HELCOM Guidelines for Management of Dredged Material at Sea , but several Contracting Parties report information about dredging activities.

Thank you for your attention

- Webpage: www.syke.fi/projects/BalticAIMS
- TARKKA: <https://testbed.ymparisto.fi/eo-tarkka/>
- Contact: sampa.koponen@syke.fi , carole.lebreton@brockmann-consult.de