

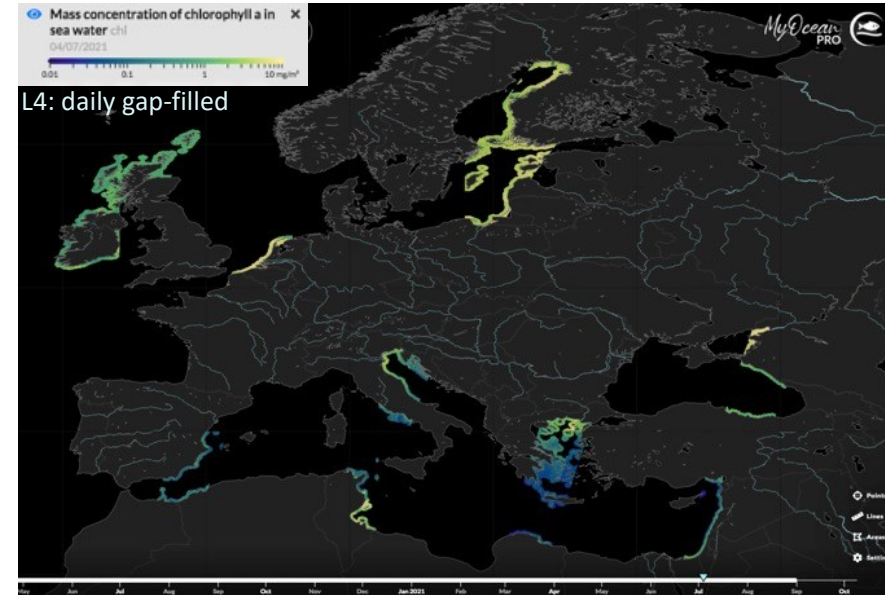
# Der Copernicus Marine High-Resolution Coastal Service: Status und Entwicklungen

Kerstin Stelzer<sup>1</sup>, Dimitry Van der Zande<sup>2</sup>, Carole Lebreton<sup>1</sup>, Martin Böttcher<sup>1</sup>,  
Joppe Massant<sup>2</sup>, Quinten Vanhellement<sup>2</sup>, Kevin Ruddick<sup>2</sup>, Carsten Brockmann<sup>1</sup>

<sup>1</sup>Brockmann Consult GmbH

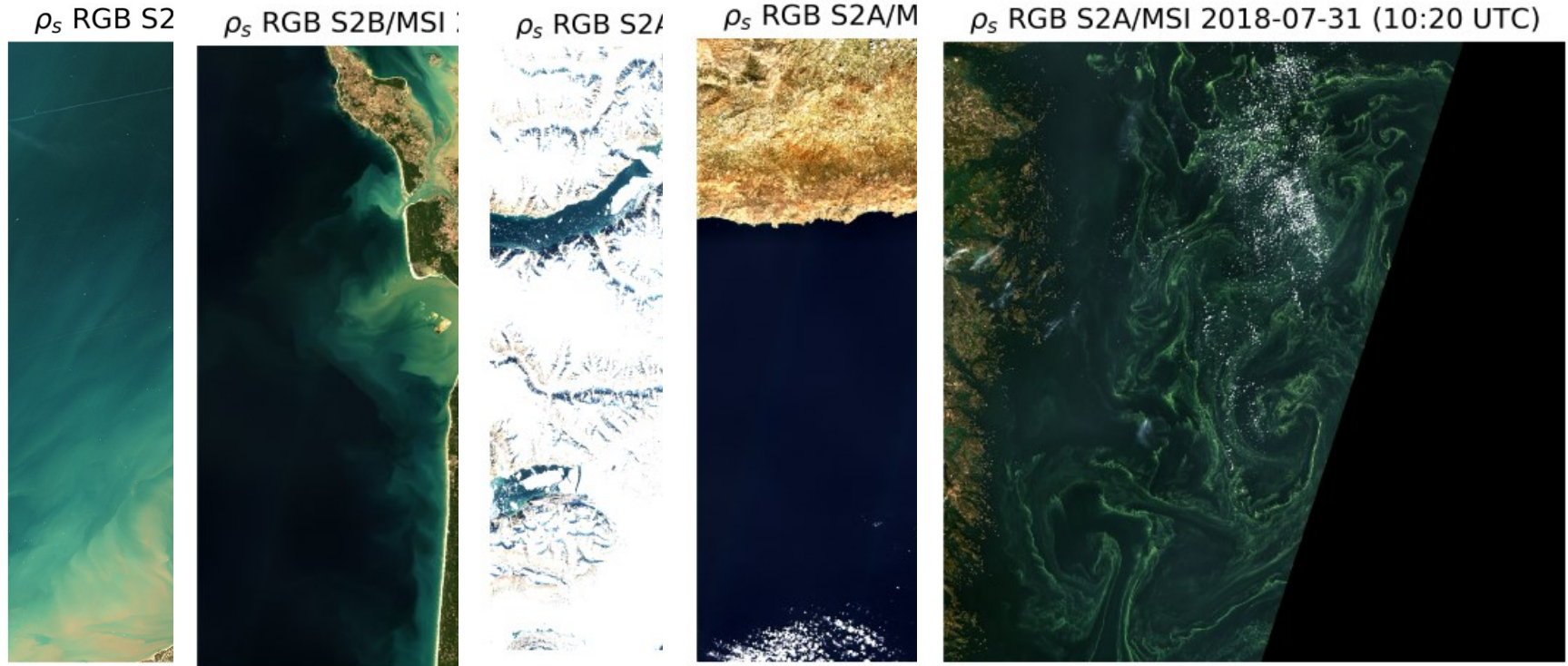
<sup>2</sup>Royal Belgian Institute of Natural Sciences

- **Sensor:** Sentinel-2/MSI (A&B)
- Abdeckung eines **Küstenstreifens von 20 km** für alle europäischen Meere
- **Räumlich Auflösung:** 100m räumliche Auflösung
- **Projektion:** Geografisches Breiten-/Längengitter WGS84 / polarer Lambertian Azimutal Equal Area
- **Zeitliche Auflösung:**
  - Tägliche NRT
  - Monatliche NRT
  - Täglich lückengefüllt (DINEOF) (jeder dritter Monat)
- **Parameter**
  - Wasserreflektanzen -  $RRS(\lambda)$
  - Trübung – TUR
  - Schwebstoff – SPM
  - Partikuläre Rückstreuung -  $BBP(\lambda)$
  - Chlorophyll Konzentration – CHL
- **Produktion:** Cloud-basierte Prozessierungsumgebung, die auf CreoDias läuft

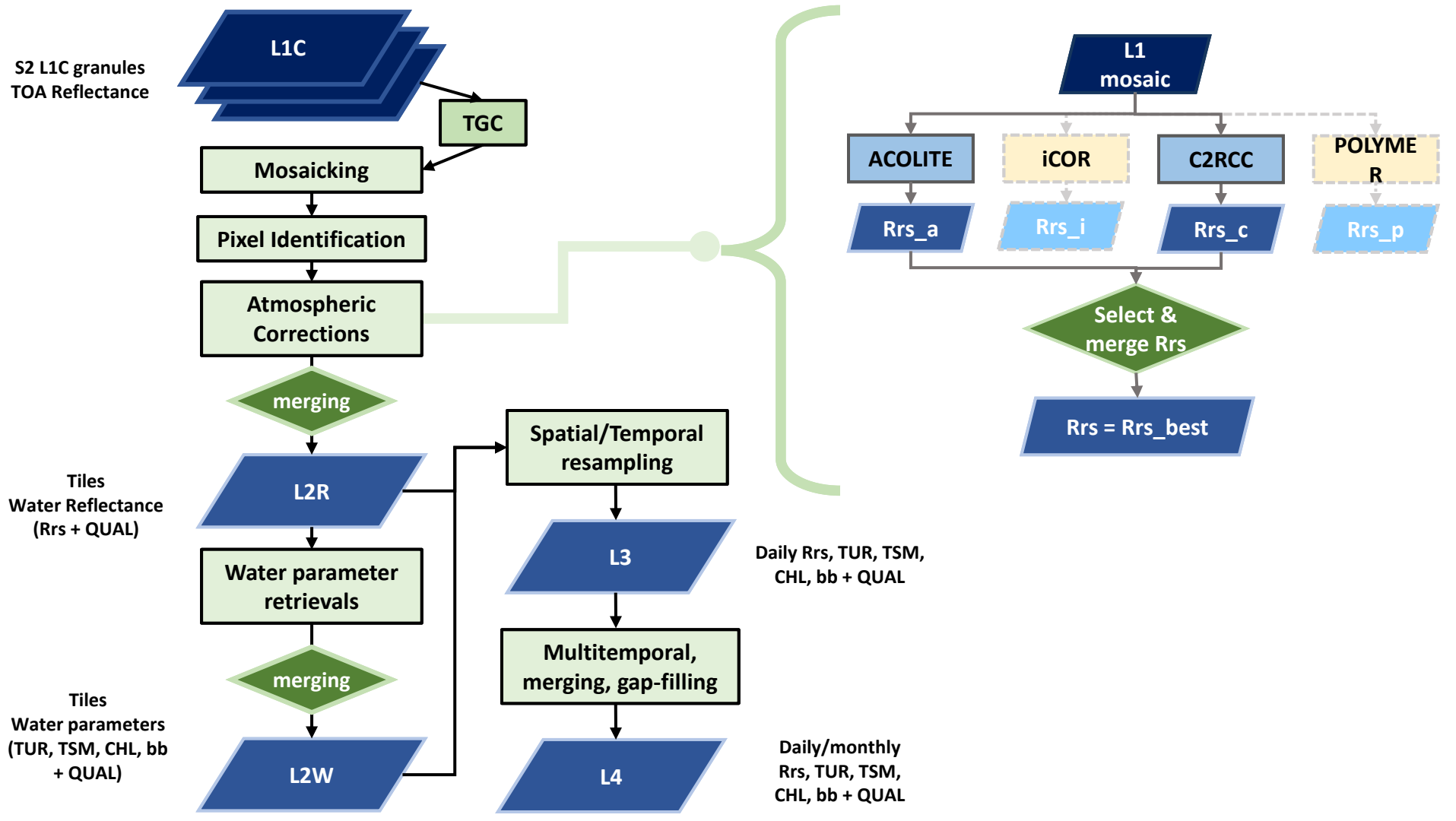


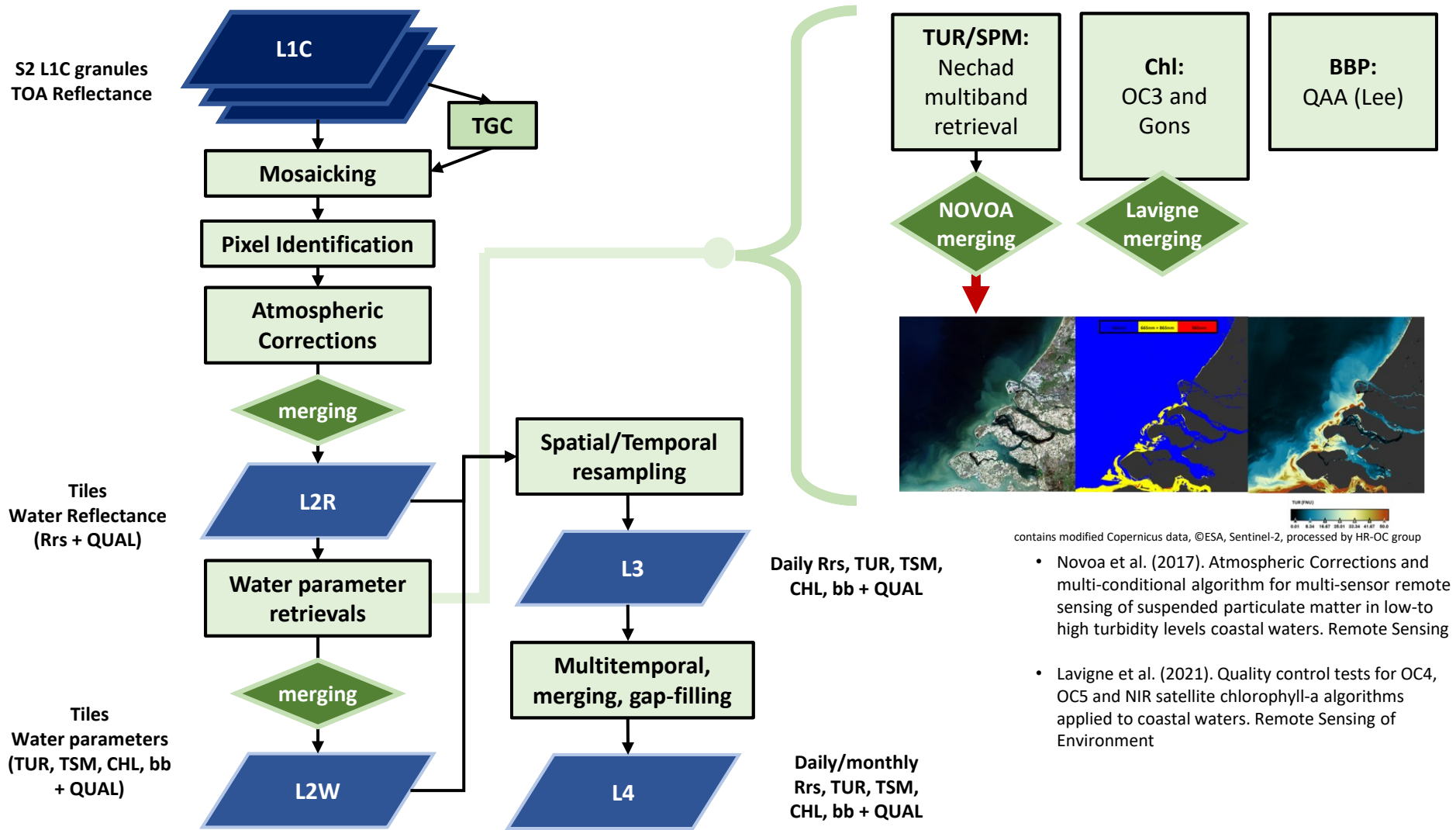
<https://cmems.lobelia.earth/>

# OC-TAC HROC Prozessor: Umgang mit verschiedenen Wassertypen

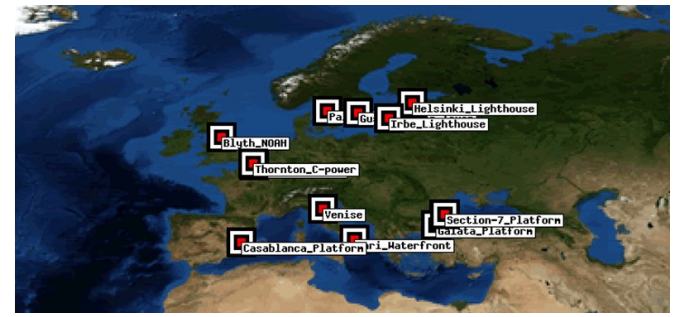
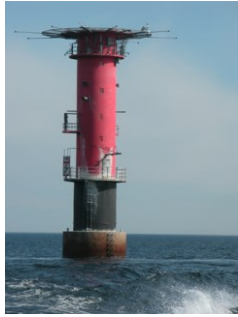


contains modified Copernicus data, ©ESA, Sentinel-2, processed by HR-OC group





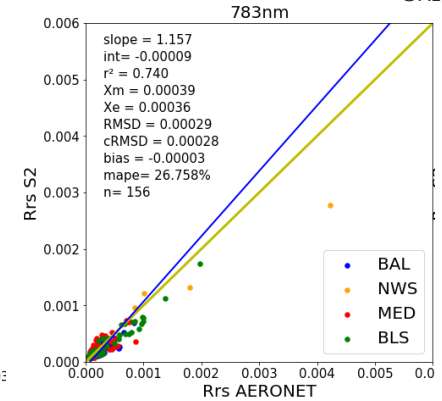
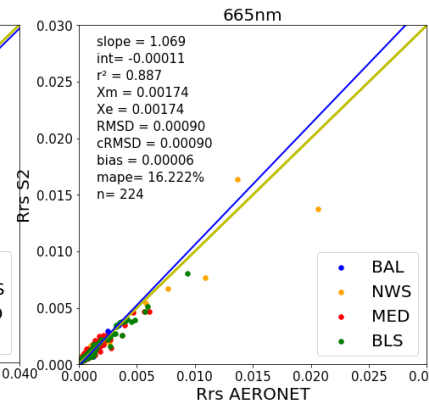
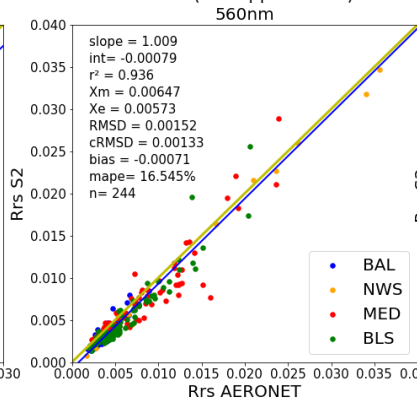
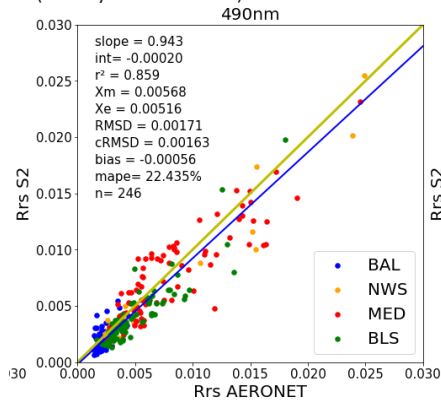
## AERONET-OC Stations



©RBINS (Dimitry Van der Zande)

©ISPRA (Giuseppe Zibordi)

©AERONET OC

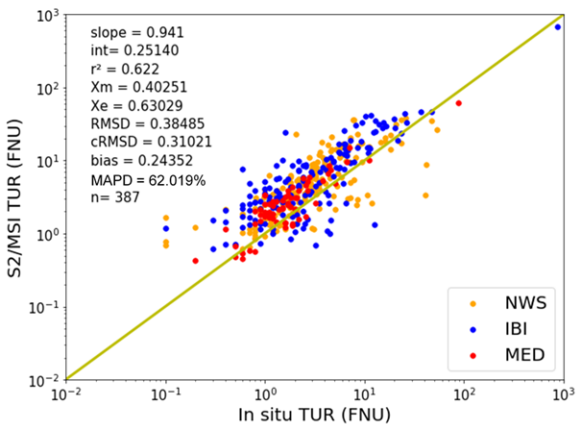




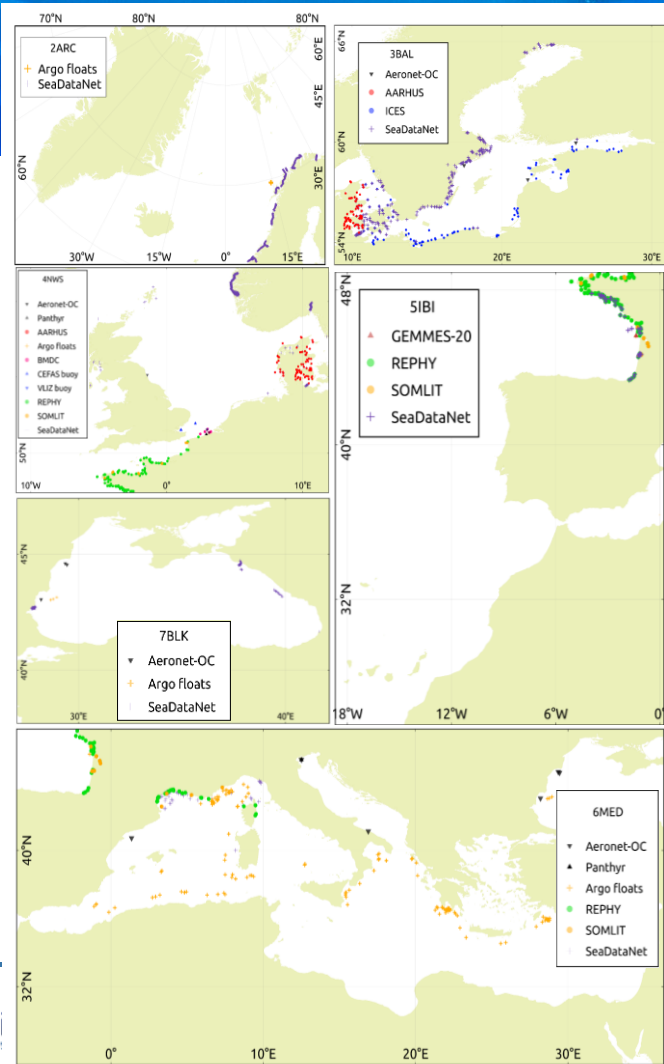
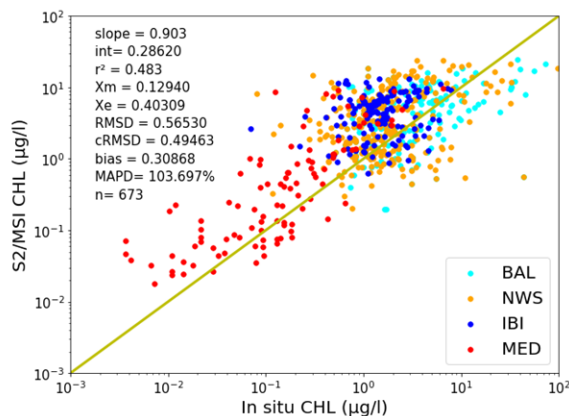
Copernicus  
Marine Service

# OC-TAC HROC Validierung Wasserprodukte

## Trübung



## Chlorophyll-a



**Jährliche Weiterentwicklung des Dienstes**, um ihn auf dem neuesten Stand der **Technik** zu halten

2022

2023

2024

## Produktverbesserung:

- verbesserte Wolkenschattenerkennung
- Erkennung von Bodenreflexionen

## Streifen reduzieren:

Top of Atmosphere Glint Korrektur (TGC)

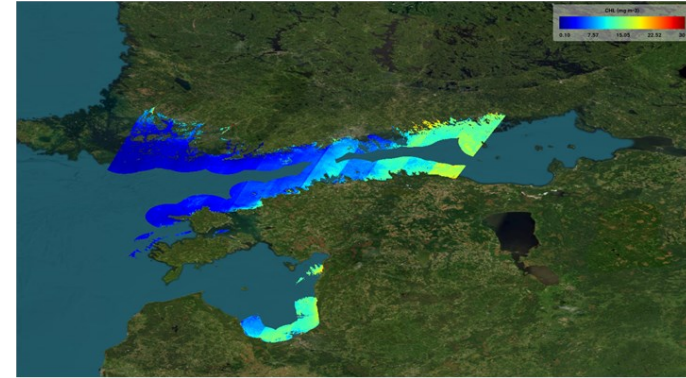
## Überarbeitung der OC-Algos:

- bestehende Algorithmen neu parametrisieren (z.B. RRS Merge)
- Erhöhung der Kohärenz zwischen S3- und S2-Produkten erreichen.

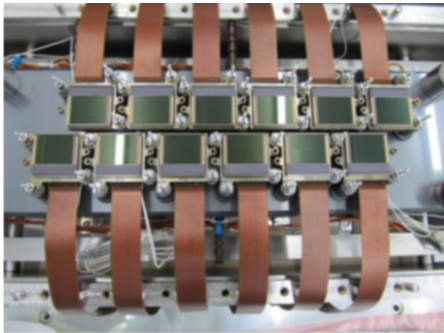


## Verringerung der durch die Detektorausrichtung verursachten Streifenbildung in Produkten:

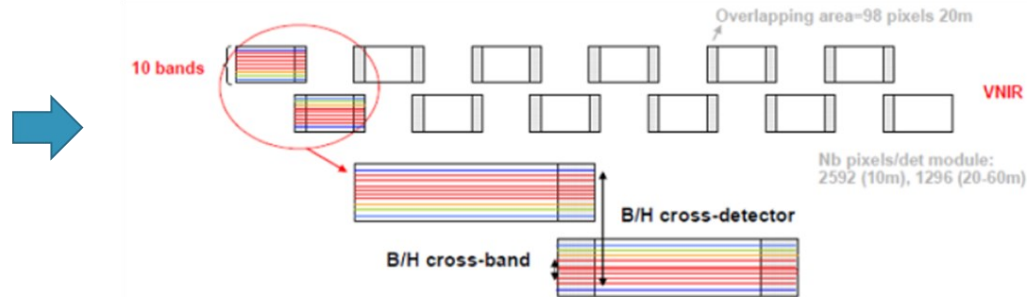
- Die Konstruktion des Sentinel-2-Sensors führt zu starken Änderungen des relativen Azimutwinkels zwischen benachbarten Detektoren, was zu sichtbaren Artefakten führt.
  - beeinflusst nicht nur die Werte der Parameter, sondern auch das Flagging
- Verbesserung der Produkte durch Anpassung der RTOA, insbesondere für Glintbereiche.



contains modified Copernicus data, ©ESA, Sentinel-2, processed by HR-OC group  
CHL products generated from band ratio algorithms show camera banding effects



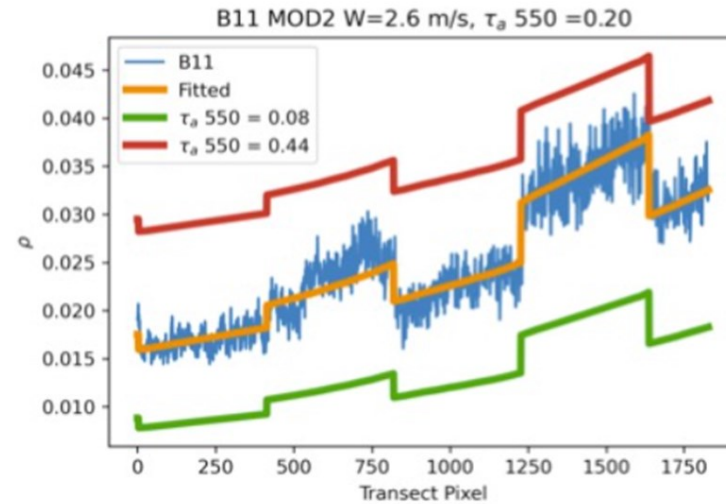
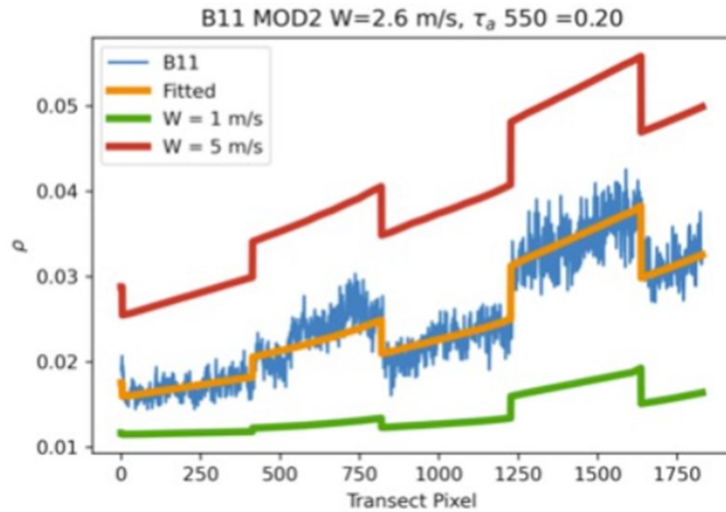
12 detectors of the MSI  
VNIR focal plane



Bands are ordered according to resolution on the MSI detectors: B2, B8, B3, B4 (10 m bands), B5, B6, B7, B8A (20 m bands), B1, B9 (60 m bands).

# Top of Atmosphere Glint Korrektur (TGC)

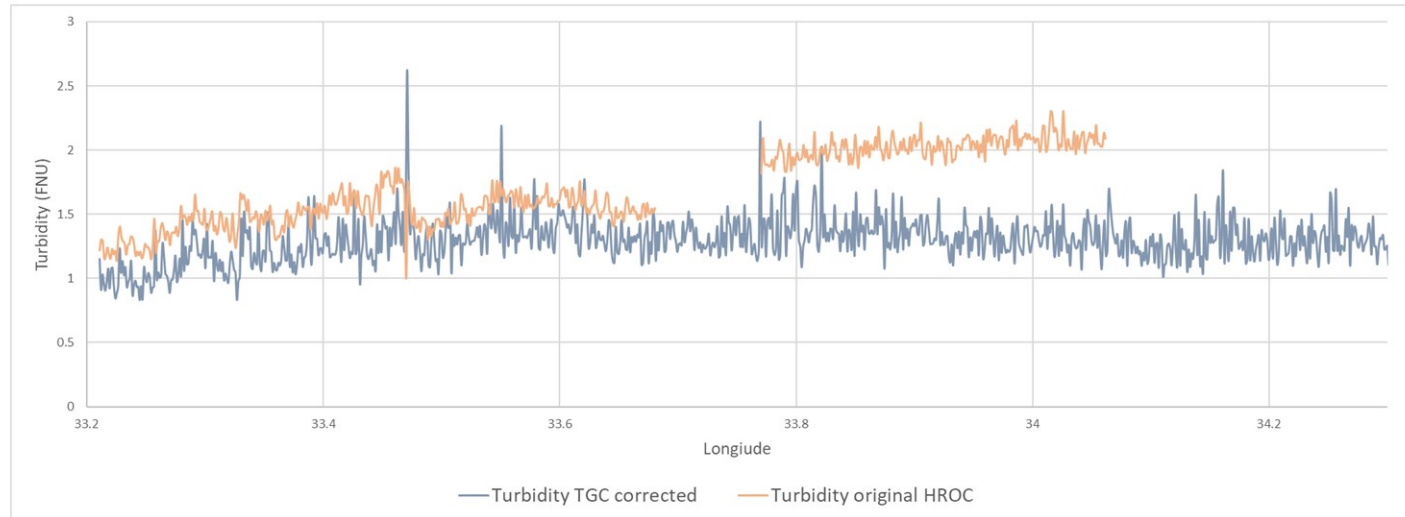
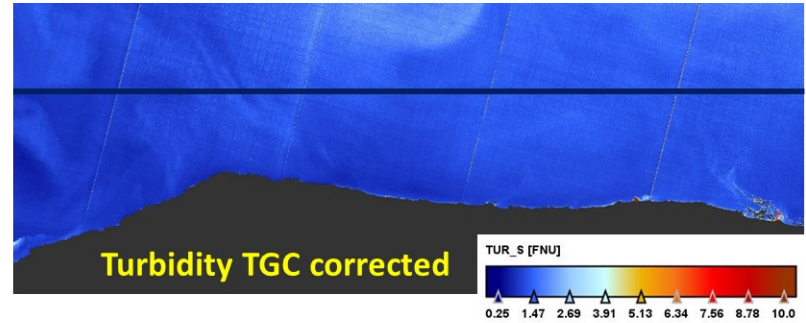
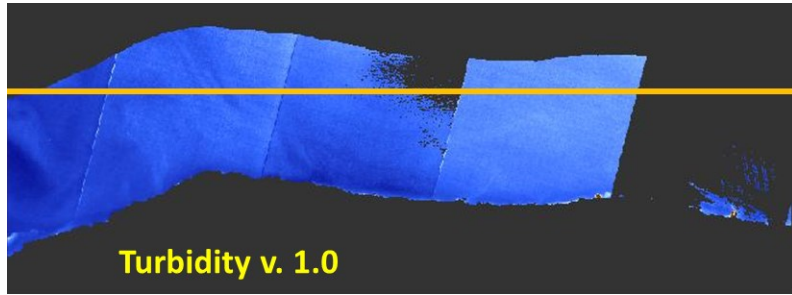
- Das Signal in B11 kann verwendet werden, um die spektrale Form und Intensität des Glints pro Band und pro Detektor zu modellieren, indem die atmosphärische Durchlässigkeit (Aerosoltyp+ Konzentration) und die Windgeschwindigkeit für das Oberflächensignal unter Berücksichtigung der spezifischen Sichtgeometrie berücksichtigt werden
- Dieses Glint-Signal wird vom TOA-Signal subtrahiert, wodurch auch der Banding-Effekt entfernt wird.



AOT und W berechnet  
pro Granulat

Fitting results varying the wind (left) and  $\tau_a$  (right).

# Auswirkungen von TGC auf L2-Wasserprodukte (TUR)





Copernicus  
Marine Service

# Das CMEMS Portal: Wo sind die Produkte?



Copernicus  
Europe's eyes on Earth

Copernicus  
Marine Service

Services Opportunities Access Data Use Cases User Corner About

## Copernicus Marine Service

Providing free and open marine data and services to enable marine policy implementation, support Blue growth and scientific innovation.

Access Data >

DATA

### OCEAN PRODUCTS

A robust ocean data catalogue, to download or visualise data including hindcasts, nowcasts and forecasts.

EXPERTISE

### OCEAN STATE REPORT

Extensive annual analysis on the state of the ocean over nearly 20 years and severe/notable annual events.

TRENDS

### OCEAN MONITORING INDICATORS

Essential variables monitoring the health of the ocean over the past quarter of a century.

EXPLORATION

### OCEAN VISUALISATION

Dive into our 4D digital oceans through our 3 visualisation tools for beginner, intermediate and advanced users



National Copernicus Forum 2024



PROGRAMME OF  
THE EUROPEAN UNION



implemented by



## Copernicus Marine Data Store



Home > Marine Data Store

### Filters

#### FREE-TEXT SEARCH

FAVOURITES ★ 0

#### TIME RANGE ▲

dd / mm / yyyy  dd / mm / yyyy

Covering full interval

WITH DEPTH 37

#### DEPTH RANGE ▲

#### UNIVERSE ▲

Blue Ocean 191

White Ocean 40

Green Ocean 78

#### MAIN VARIABLES ▲

Carbonate system 19

Mixed layer thickness 17

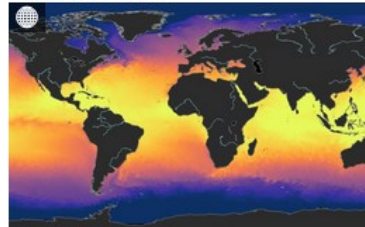
Nekton 1



### Products 277

## Modelle Ergebnisse Fernerkundungsprodukte

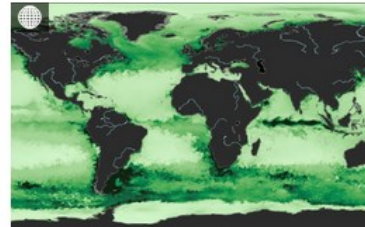
#### MOST POPULAR



#### Global Ocean Physics Analysis and Forecast

GLOBAL\_ANALYSISFORECAST\_P... 001\_024  
Models

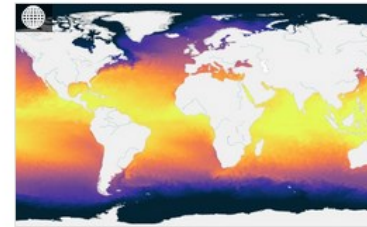
Global, 0.083° × 0.083° × 50 levels  
1 Nov 2020 to 24 Mar 2024, hourly, daily,...  
Mixed layer thickness, salinity, sea ice, sea surface height, temperature, velocity, wave...



#### Global Ocean Biogeochemistry Analysis and Forecast

GLOBAL\_ANALYSISFORECAST\_B... 001\_028  
Models

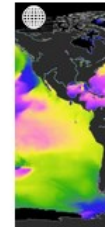
Global, 0.25° × 0.25° × 50 levels  
1 Oct 2021 to 22 Mar 2024, daily, monthly  
Carbonate system, nutrients, optics, oxygen, plankton



#### Global Ocean Physics Reanalysis

GLOBAL\_MULTIYEAR\_PHY\_001\_030  
Models

Global, 0.083° × 0.083° × 50 levels  
1 Jan 1993 to 24 Oct 2023, daily, monthly  
Mixed layer thickness, salinity, sea ice, sea surface height, temperature, velocity



#### Global Ocean and Forecast

GLOBAL\_ANALYSISFORECAST\_P... 001\_024  
Models

Global, 0.083° × 0.083° × 50 levels  
1 Oct 2021 to 24 Mar 2024, hourly, daily,...  
Mixed layer thickness, salinity, sea ice, sea surface height, temperature, velocity, wave...

#### NEW IN COPERNICUS MARINE

## Filters ✕

### FREE-TEXT SEARCH

### FAVOURITES ★ 0

### TIME RANGE ▲

Covering full interval

### WITH DEPTH 2

### DEPTH RANGE ▲

### UNIVERSE ▲

Blue Ocean 1

Green Ocean 3

### MAIN VARIABLES ▲

Carbonate system 2

Nutrients 2

Optics 4

Oxygen 3

Plankton 5

Salinity 1

Sea surface height 1

Temperature 1

Velocity 1

Wave 1

### AREA ▲

Atlantic: Iberia-Biscay-Ireland 3

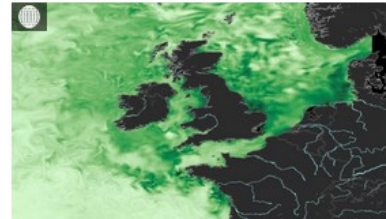
Atlantic: NW European Shelf 3

Atlantic: North 5

### INDICATORS & TRENDS ▼

### FEATURE TYPE ▼

## Products 5



### Atlantic - European North West Shelf - Ocean Biogeochemistry...

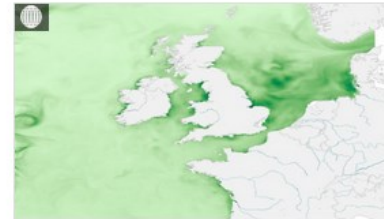
NWSHELF\_ANALYSISFORECAST\_BGC\_004\_002

Models

Multi-area, 0.027° × 0.027° × 50 levels

1 May 2019 to 16 Mar 2024, daily, monthly

Carbonate system, nutrients, optics, oxygen, plankton



### Atlantic- European North West Shelf - Ocean Biogeochemistry...

NWSHELF\_MULTITYEAR\_BGC\_004\_011

Models

Multi-area, 0.111° × 0.067° × 24 levels

1 Jan 1993 to 1 Dec 2023, daily, monthly

Carbonate system, nutrients, optics, oxygen, plankton



### North West Shelf Region, Bio-Geo-Chemical, L3, daily observation

OCEANCOLOUR\_NWS\_BGC\_HR\_L3\_... 009\_203

Satellite (L3)

Multi-area, 0.1 × 0.1 km

1 Jan 2020 to 12 Mar 2024, daily

Optics, plankton



### North West Shelf Region, Bio-Geo-Chemical, L4, monthly means and...

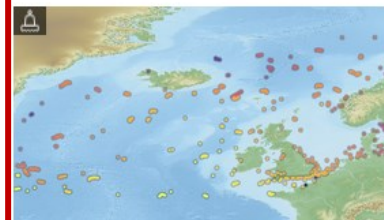
OCEANCOLOUR\_NWS\_BGC\_HR\_L4\_... 009\_209

Satellite (L4)

Multi-area, 0.1 × 0.1 km

4 Jan 2020 to 31 Oct 2023, daily, monthly

Optics, plankton



### Atlantic- European North West Shelf- Ocean In-Situ Near Real Tim...

INSITU\_NWS\_PHYBGCWAV\_DISCRET...013\_036

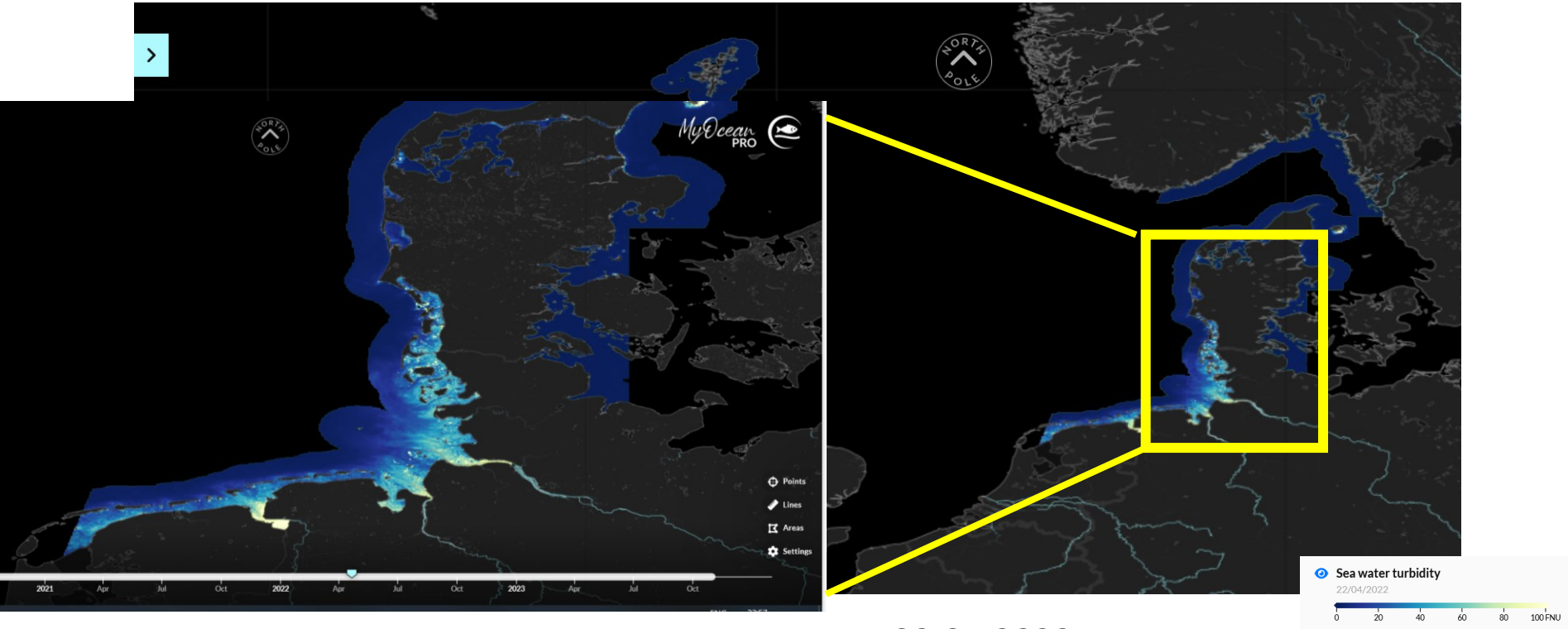
In-situ

Multi-area

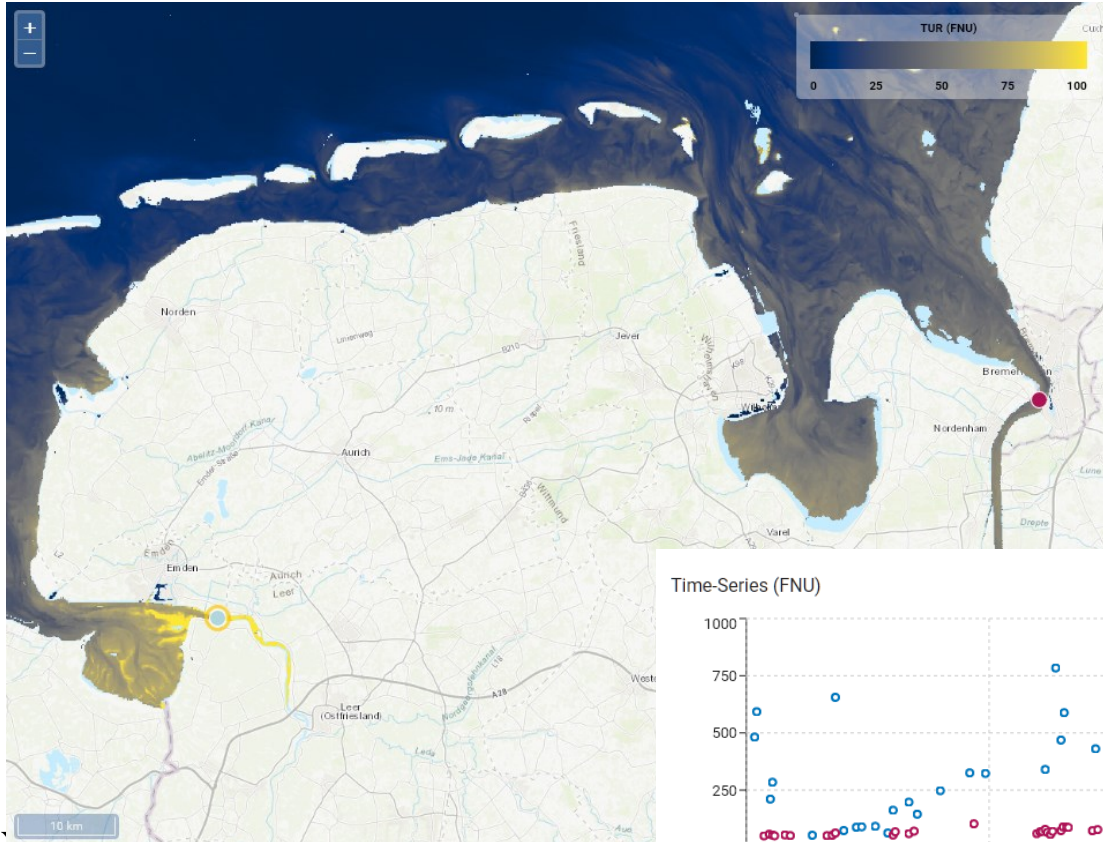
5 Feb 2024 to 6 Mar 2024, instantaneous

Oxygen, plankton, salinity, sea surface height,

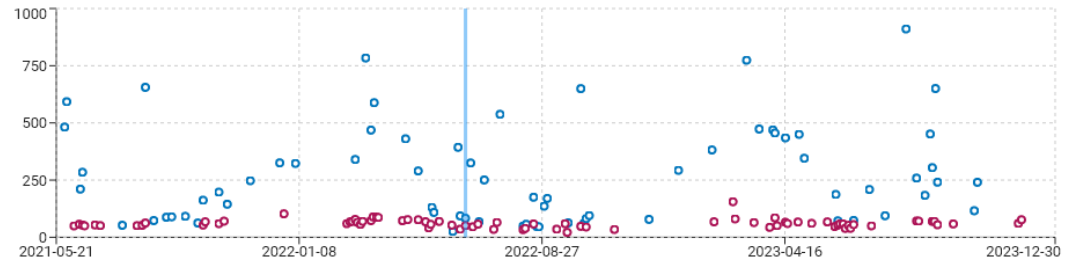
# OC-TAC HROC Beispiel Produkt – Trübung Deutsche Bucht



22.04.2022



Time-Series (FNU)





# The Copernicus High-Resolution Coastal Products

## Parameters

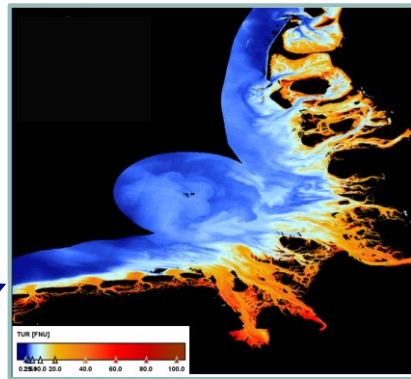
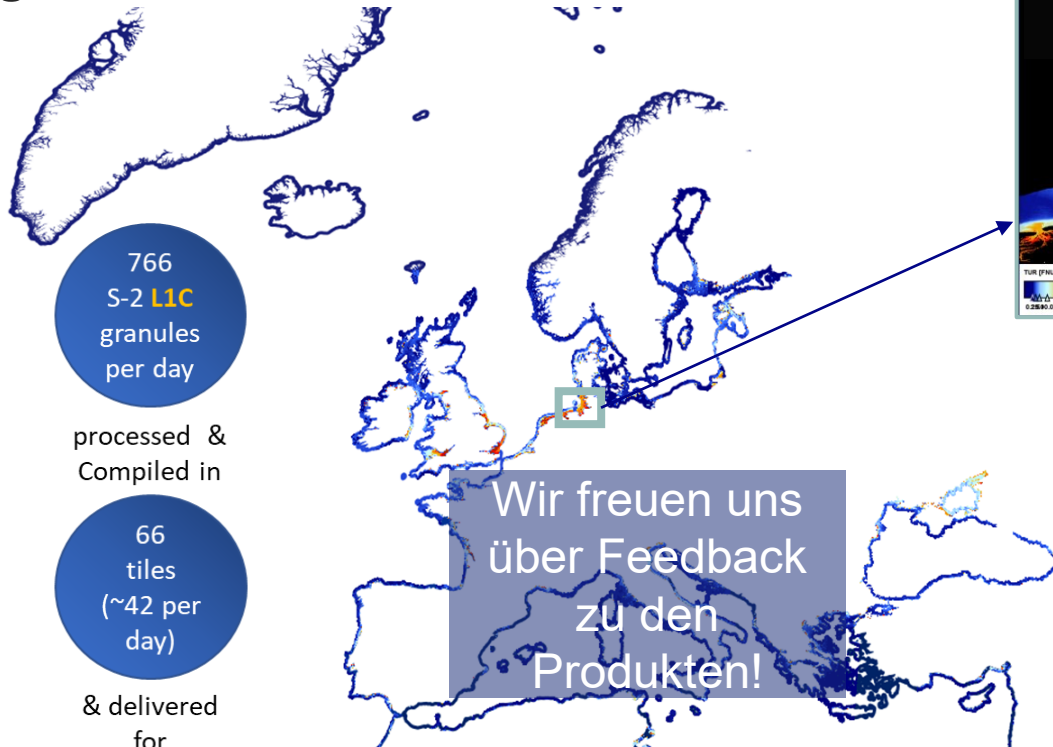
- RRS
- BBP
- Chlorophyll
- Turbidity
- Suspended Matter

## Products

- Daily L3 NRT
- Monthly L4
- Daily gap-filled L4
- 100m resolution
- Input data: Sentinel-2 MSIL1C

## Availability

- 01.01.2020-ongoing
- NRT one day after acquisition



## Data Access

- Register @ <https://resources.marine.copernicus.eu>
- Research catalogue
- Download via ftp (nrt.cmems-du.eu)

## Algorithms

Merging algorithm approaches for atmospheric correction and in-water retrieval to address the different coastal water types of the European Seas