Earth Observation of Coastal Oceans

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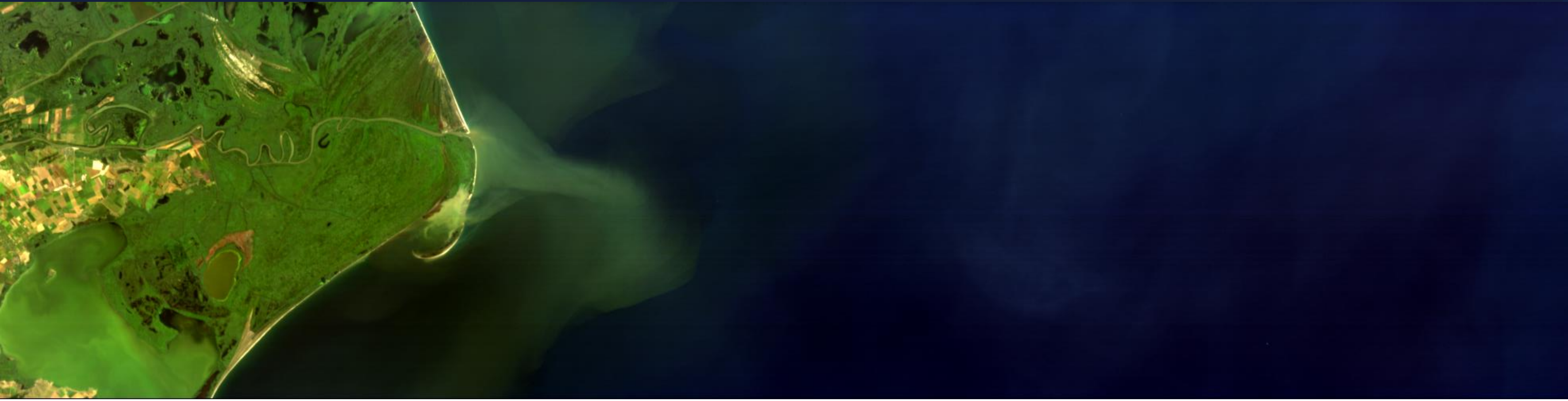

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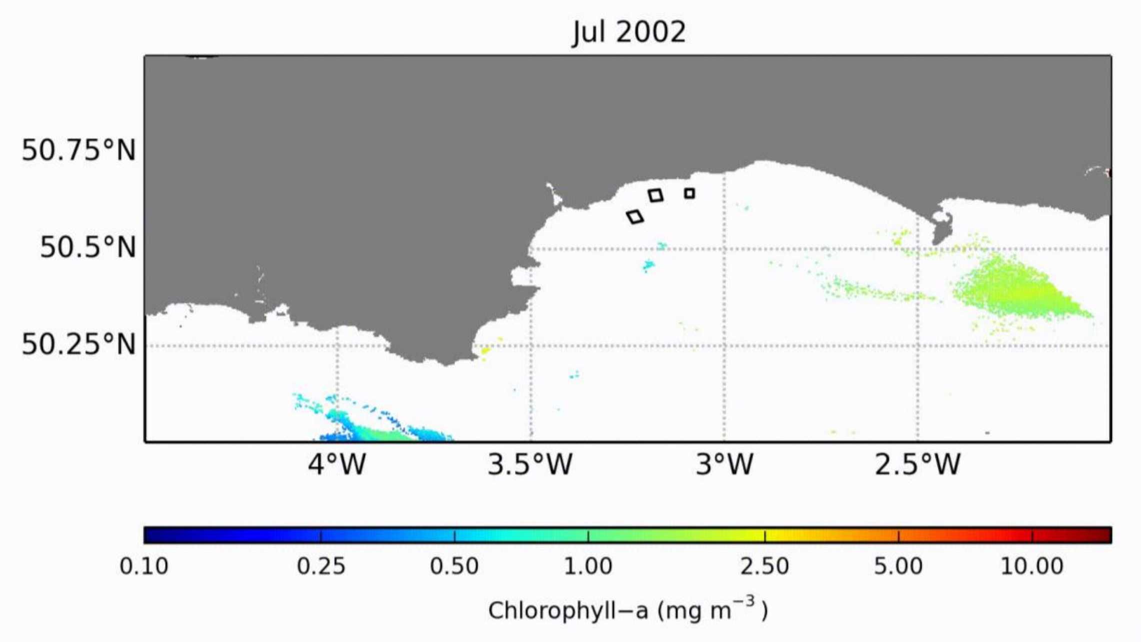
Earth observation of coastal waters: Challenges & Opportunities

- variable in-water optical conditions
- Inconsistent performance of algorithms
- Continentality and optical heterogeneity
- Insufficient validation of current products in specific areas

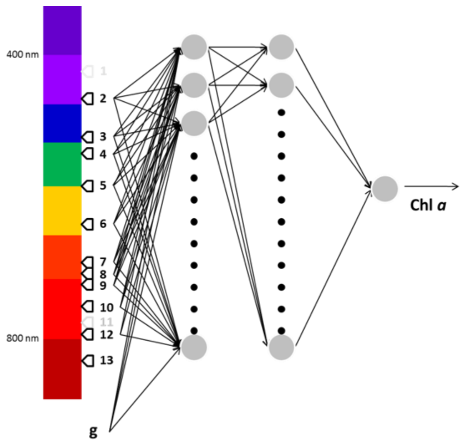


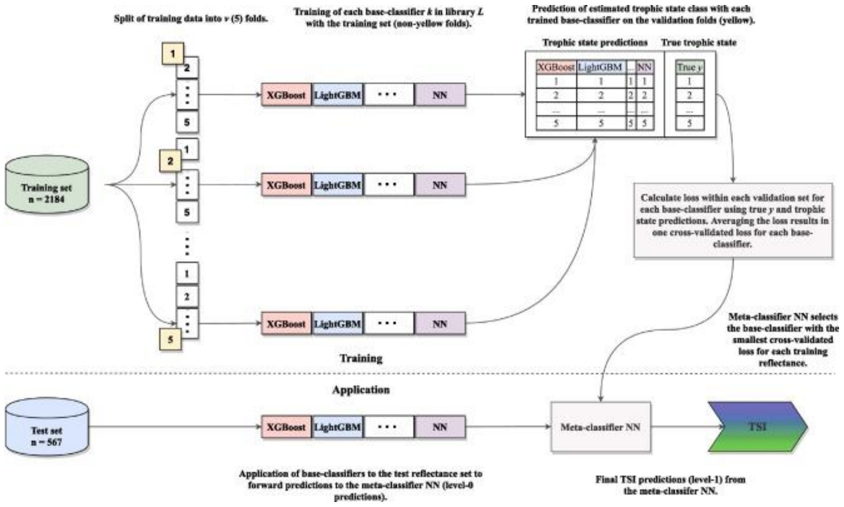
- Sufficiently long record
- Innovative EO-based information
- Business opportunities

Innovating in algorithm development for optically complex waters

- Neural networks for Chla of coastal waters and super-learners for assessing trophic status

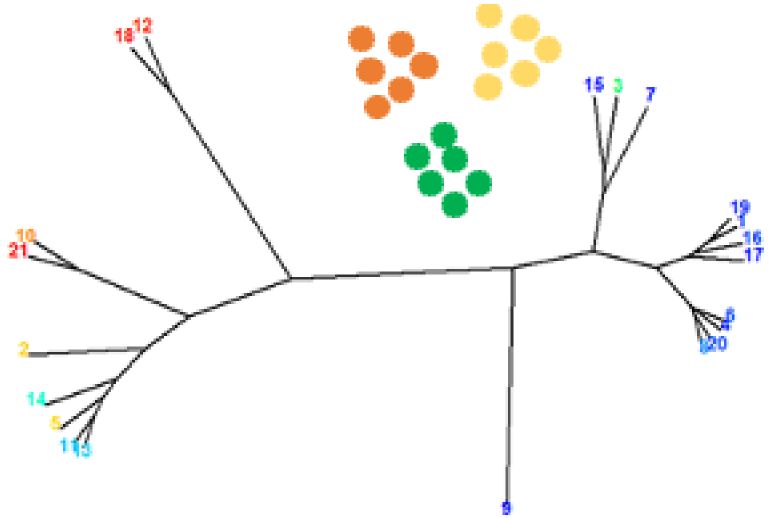
Werther et al 2021 ISPRS J Photo and Rem Sens
Spyrakos et al 2011 Rem Sens of Env





- Optical water types of coastal and inland waters. Currently used in Copernicus Land services, ESA CCI+ and other global services

Spyrakos et al 2018 Limn and Ocean
Neil et al 2019 Rem Sens of Env
Warren et al 2019 Rem Sens of Env
Pahlevan et al 2021 Rem Sen of Env



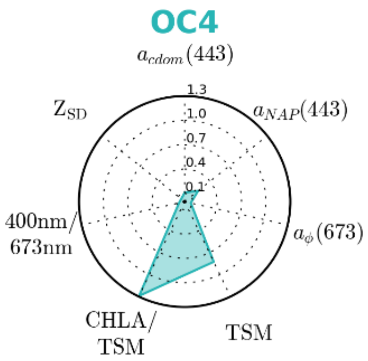
Need for validation / uncertainty characterisation of EO products

- LIMNADES: Database for EO-based product development and validation in coastal and inland waters

limnades.stir.ac.uk
>50,000 measurements from ~3500 stations
~85 % of measurements in Europe and North America
Supported by GEO Aquawatch
https://www.geoaquawatch.org/be-a-limnades-beta-tester/
Interoperability (H2020 MONOCLE)

LIMNADES

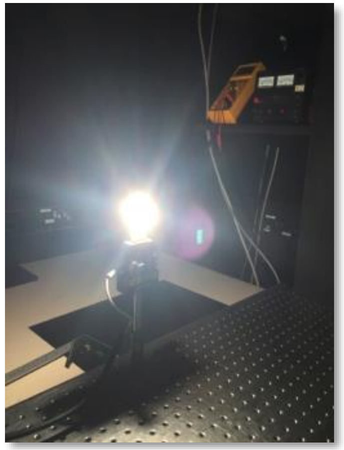
GEO AQUA WATCH



- Characterising uncertainty of EO-based products

Liu et al (in press) Rem Sen of Env
Werther et al (sub) Rem Sen of Env

- Dedicated field campaigns and instruments characterisation



From challenges to products (H2020 CoastObs)

- Chlorophyll-a
- Total suspended matter
- Turbidity
- Sea surface temperature
- Shoreline mapping
- Intertidal seagrass mapping
- Phytoplankton primary production
- Harmful algae bloom indicator
- Statistics / aggregation
- Indicators for WFD reporting
- Harmful algae forecasts
- Shellfish culture potential
- Phytoplankton bloom phenology
- Sediment plume morphology
- In situ data for validation

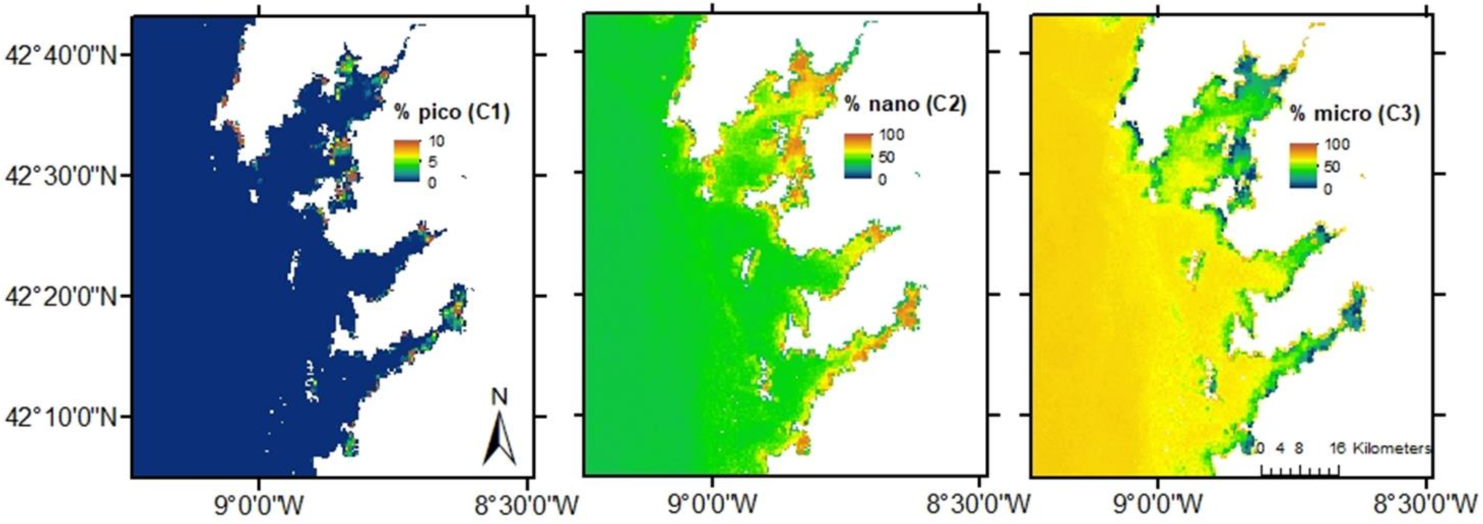
Phytoplankton size classes

Sentinel-3 OLCI

Venice lagoon/Adriatic
Rias Baixas
Dutch estuaries

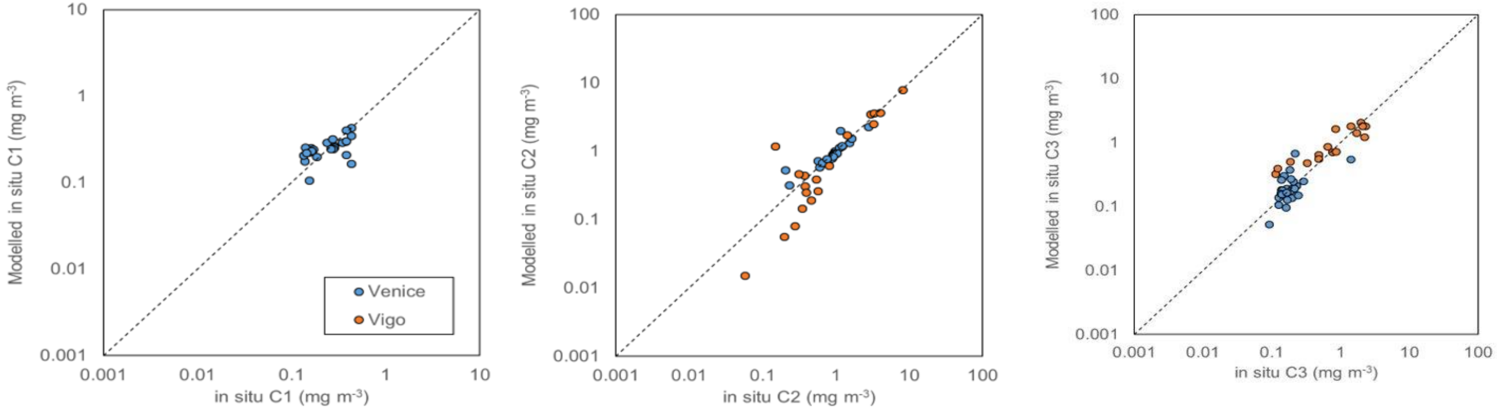
200 stations

PSC: calibrated abundance-based model



Greater % pico- and nano- at river inlets

Greater % micro-phytoplankton offshore



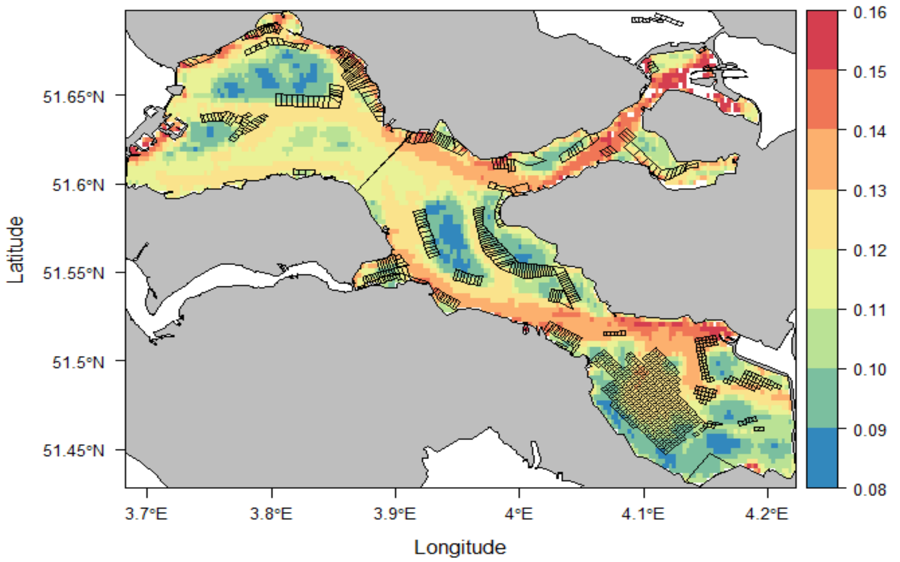
Modelling mussel growth potential

- Analyse spatial distribution of long-term averages of food quality and quantity for a spatial suitability analysis:

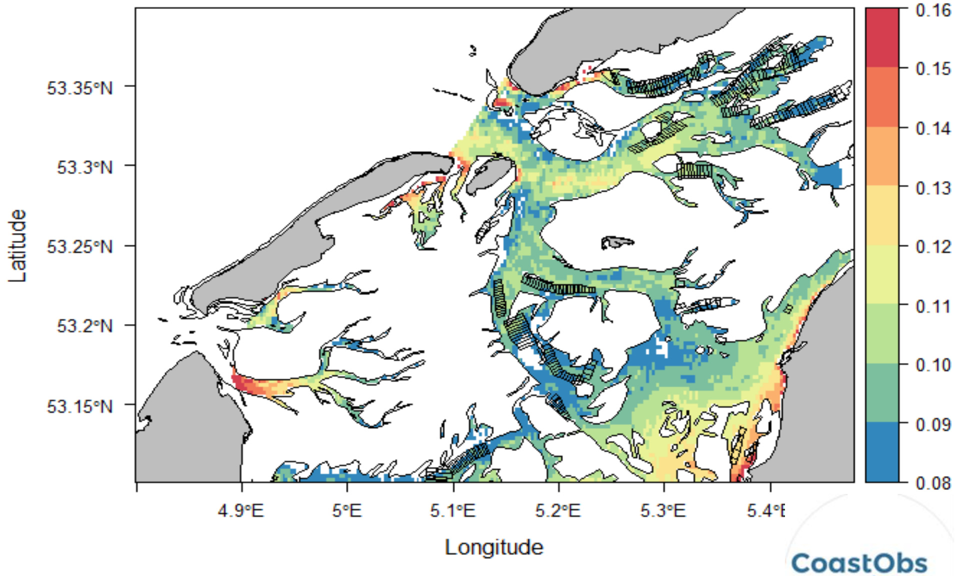
→ **Based on long-term aggregates of S3 food quality & quantity**

Spatial suitability -> Example growth potential mapping based on long term aggregates

Eastern Scheldt



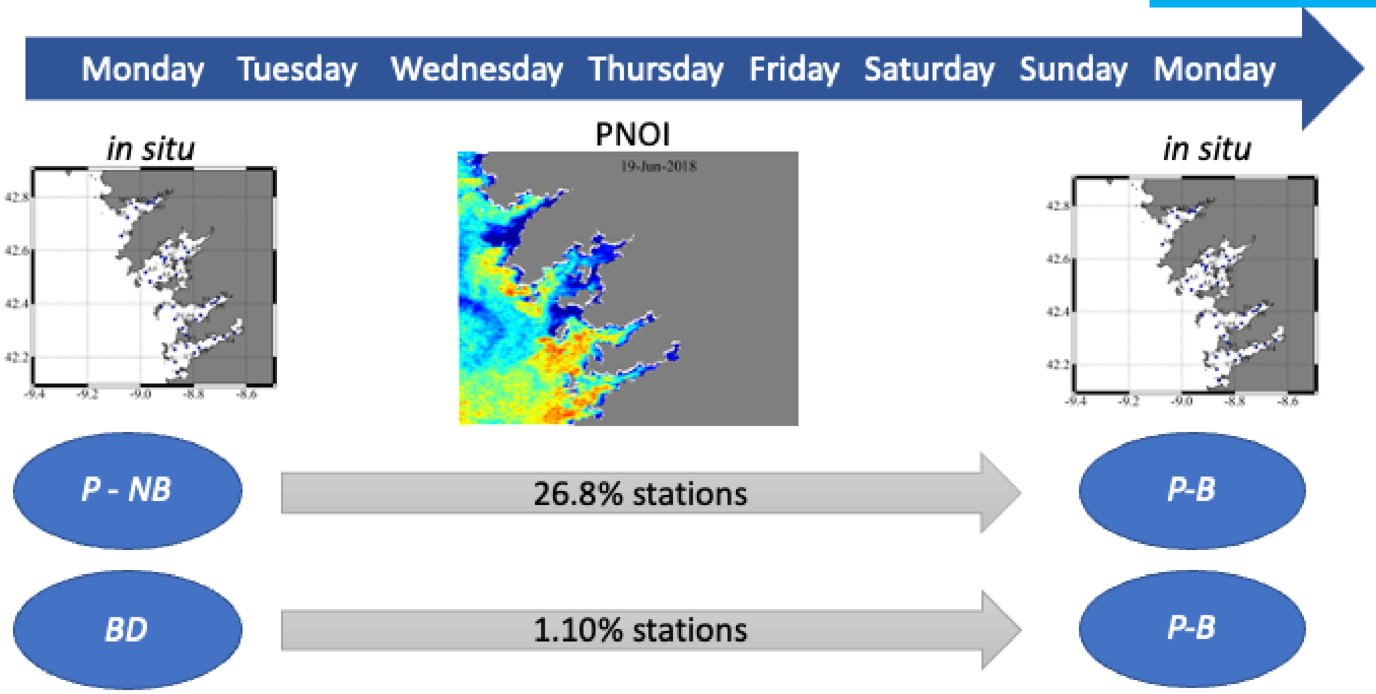
Wadden Sea



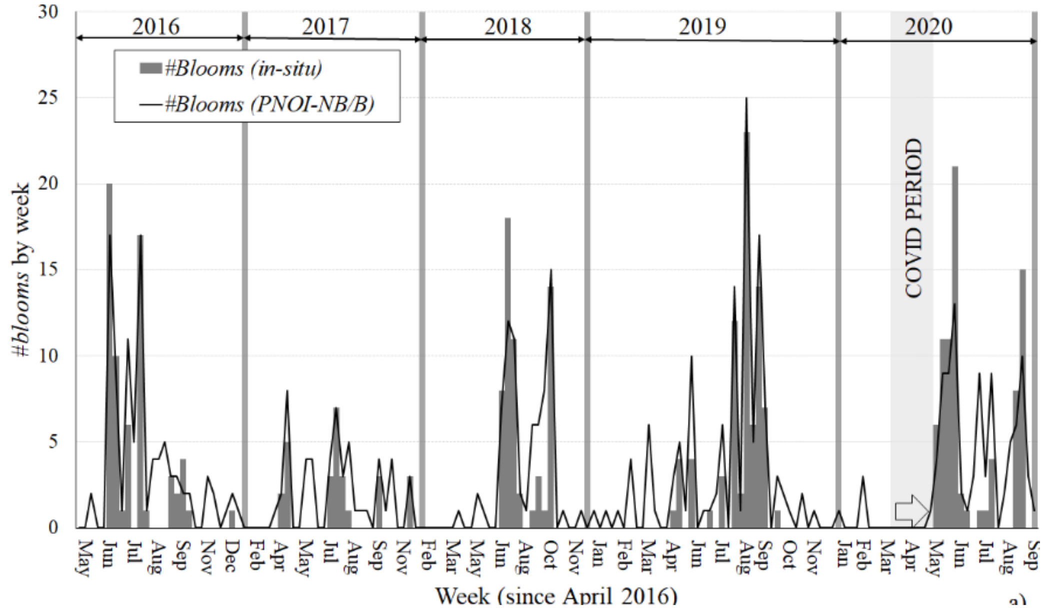
CoastObs

HAB detection & prediction

- *Pseudo-nitzschia* spp. blooms detection from OLCI data using support vector machines (SVM) – PNOI algorithm
- PNOI and Sentinel- OLCI data to fill in the observational gap in in-situ monitoring



Example above: OLCI/PNOI between weekly in-situ monitoring
Example below: OLCI/PNOI during limited monitoring due to COVID

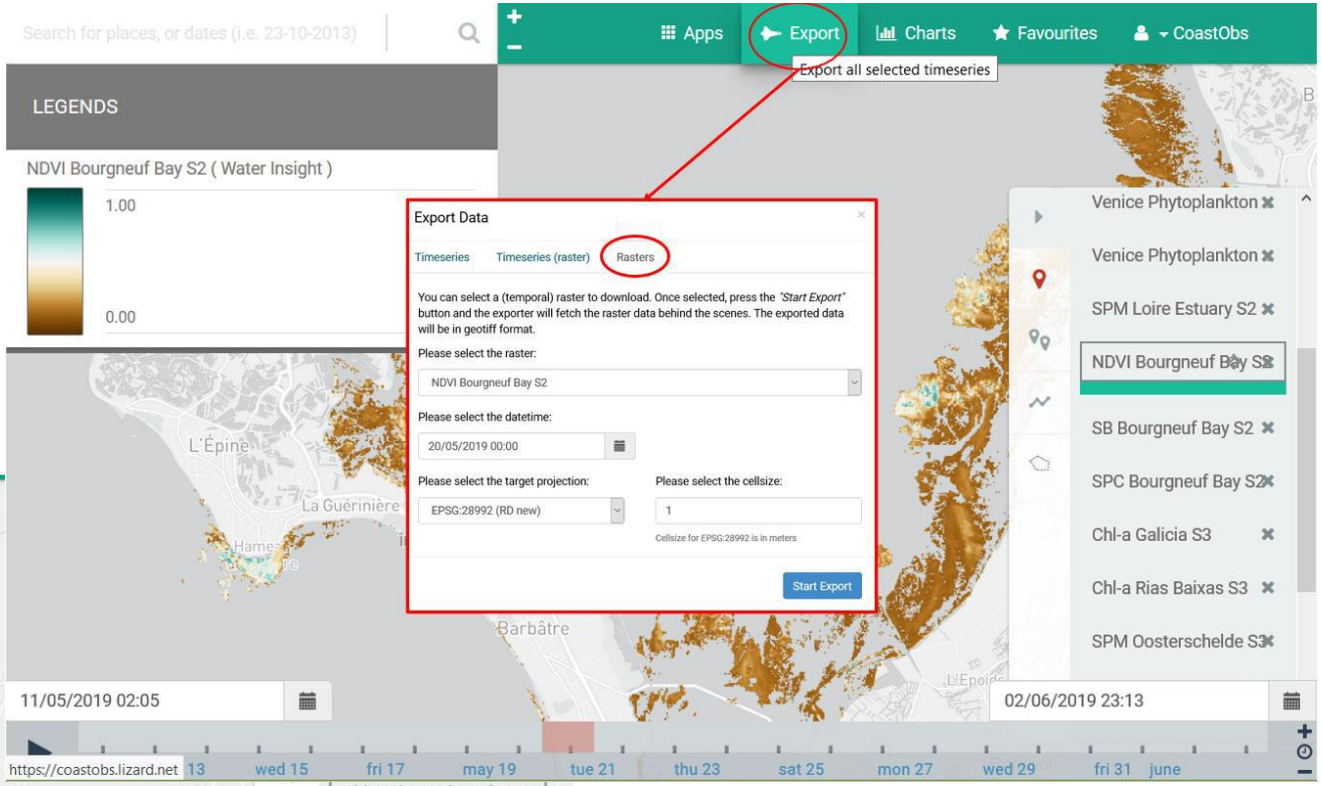


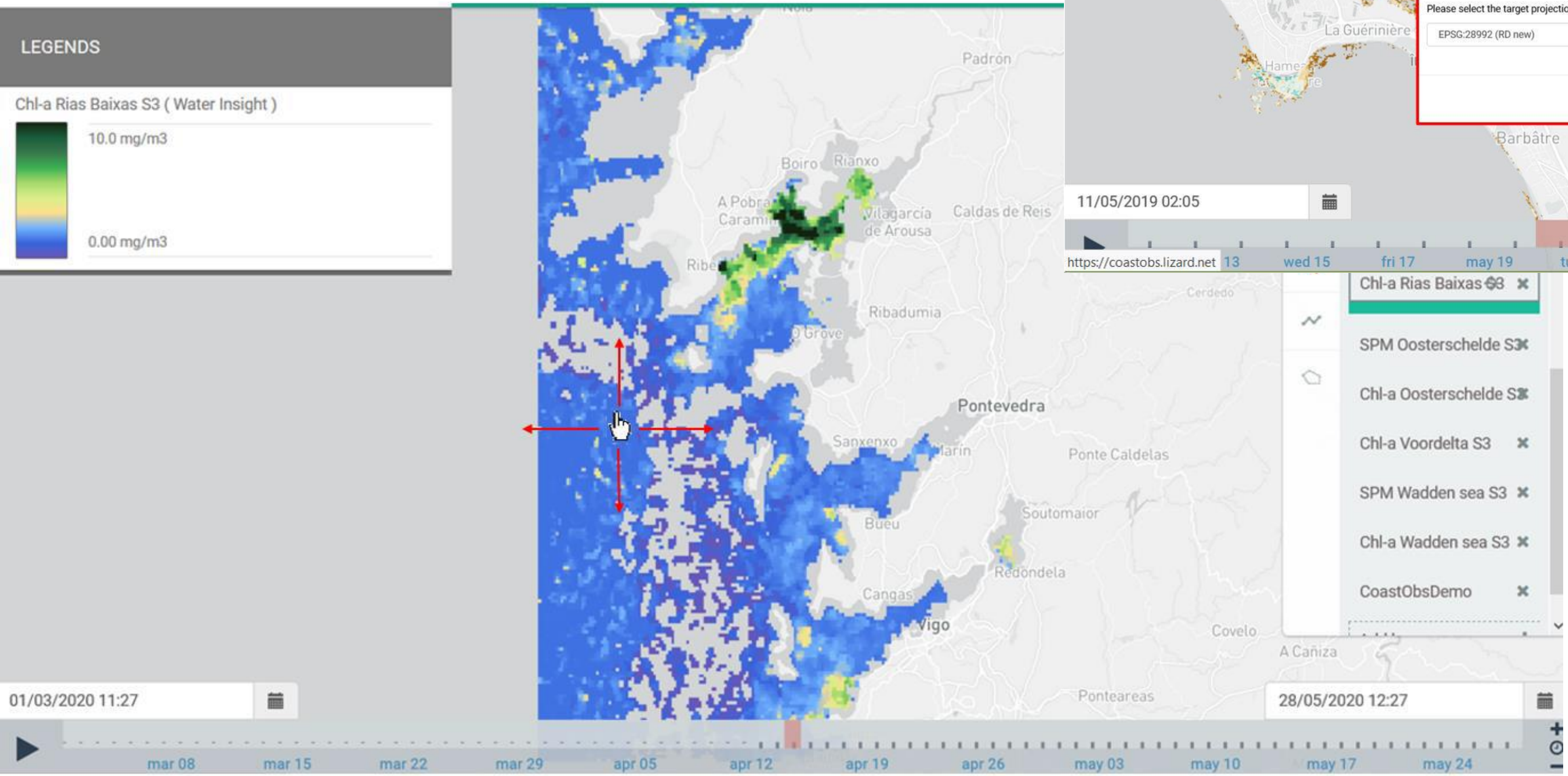
Gonzalez Vilas et al (sub) Rem Sen of Env
Bellas Alaez et al (2021) Int. J. Geo-Inf.

CoastObs

The CoastObs portal

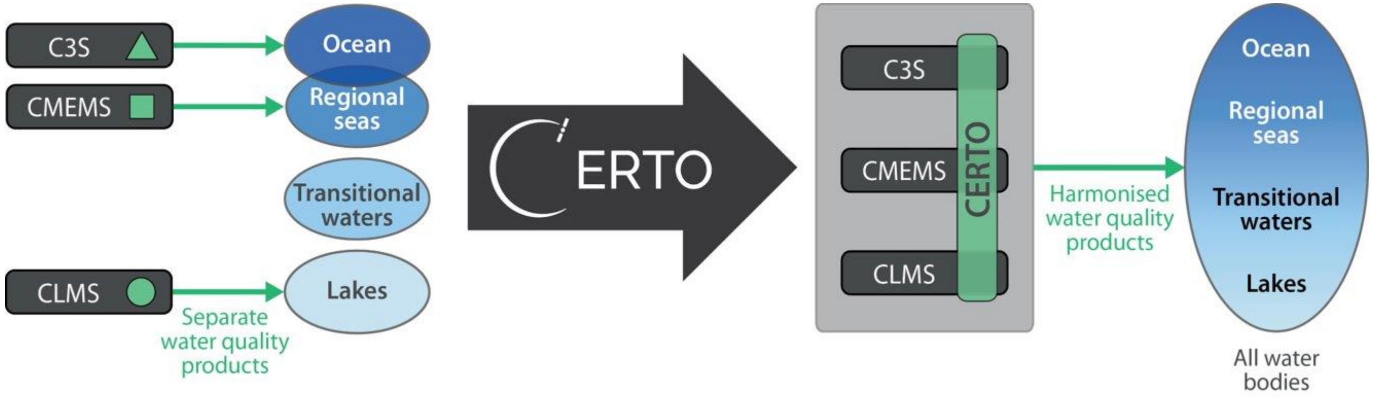
coastobs.lizard.net/viewer



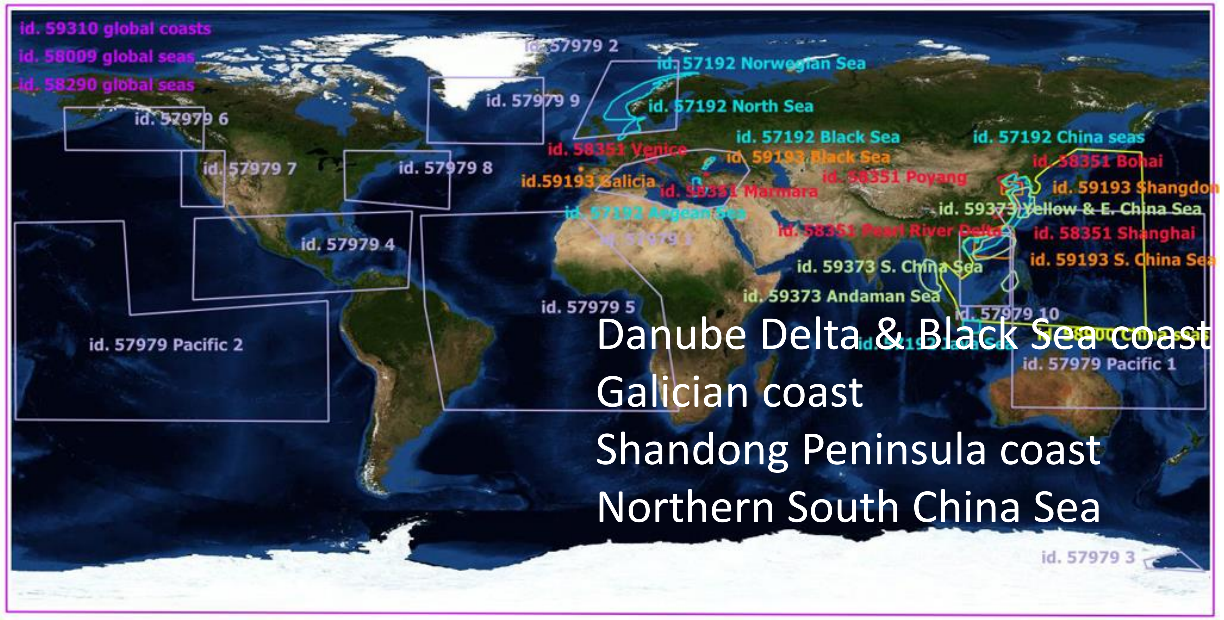


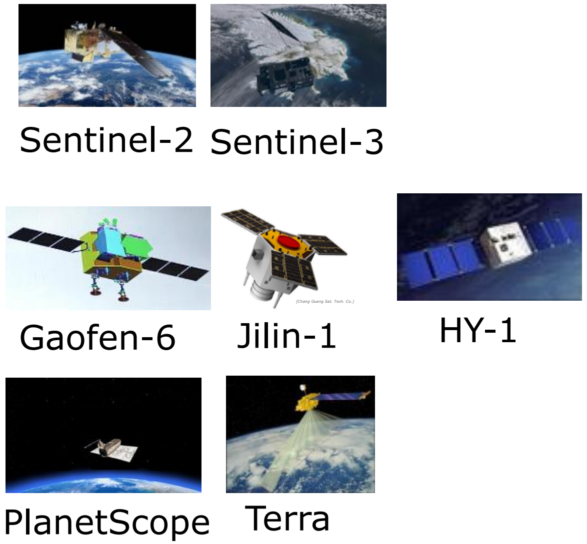
Harmonised Copernicus products & international cooperation

- Harmonise Copernicus water products across services



Copernicus Evolution: Research for harmonised Transitional water Observation (CERTO)





- Develop user-relevant EO-based products and services using ESA and NRSCC data

Some points for discussion

(Current) funding

Forth-Era

People

Andrew Tyler, Peter Hunter, Matthew Blake, Caitlin Riddick, Jesus Torres Palenzuela, Luis Gonzalez Vilas