Incorporating Remote Sensing in Marine Ecological Assessments (North Sea)

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Deltares
Enabling Delta Life

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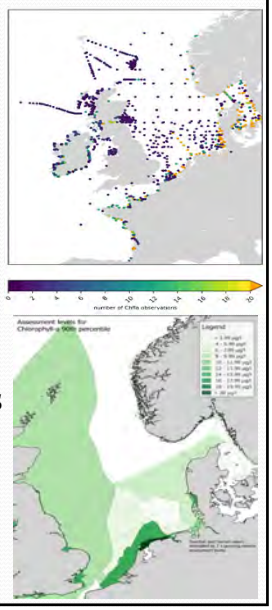
Background

OSPAR and MSFD eutrophication assessments are incoherent between countries due to:

- Incoherent monitoring data
- Incoherent threshold levels

EU urged OSPAR countries to improve this and elaborate transparent and coherent methods



https://www.informatiehuismarien.nl/projecten/algaeevaluated/

Joint Monitoring Programme of the Eutrophication of the North Sea with Satellite data (JMP-EUNOSAT)

- 2-year project (2017 – 2019)
- Coordinated by RWS (L. Enserink)
- with partners from all OSPAR member states

- Three objectives:

1. Coherent monitoring data, using satellite data (RBINS)
2. Coherent threshold levels for phytoplankton and nutrients (Deltares)
3. Improve international collaboration on assessments (Aarhus University)

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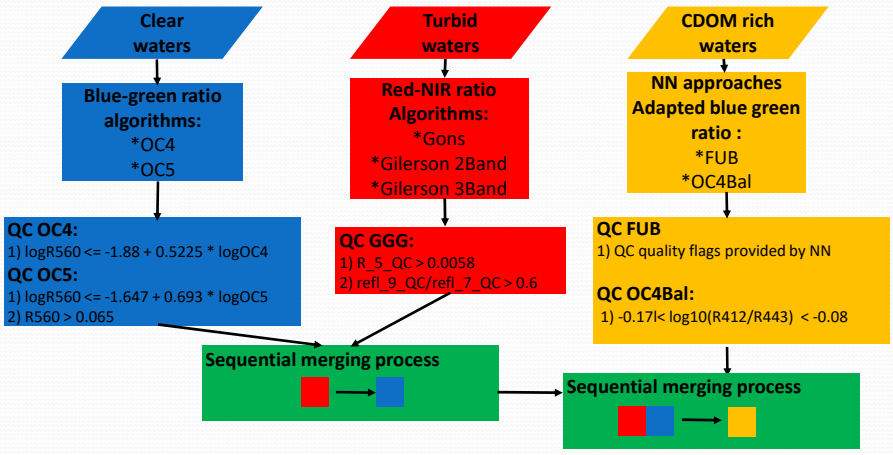
Coherent monitoring data

- In-situ data differ in frequency, depth and analysis method
- Satellite data make spatially coherent observations
- But different algorithms available to estimate chlorophyll-a, suited for different areas
- RBINS combined algorithms in a coherent way, with optimal algorithm for each situation.
- Results validated with in-situ data (normally used for assessments) to build confidence in satellite data

JMP-EUNOSAT combination of algorithms



(Van der Zande, et al., 2019, Journal Of Operational Oceanography 12)

New assessment areas

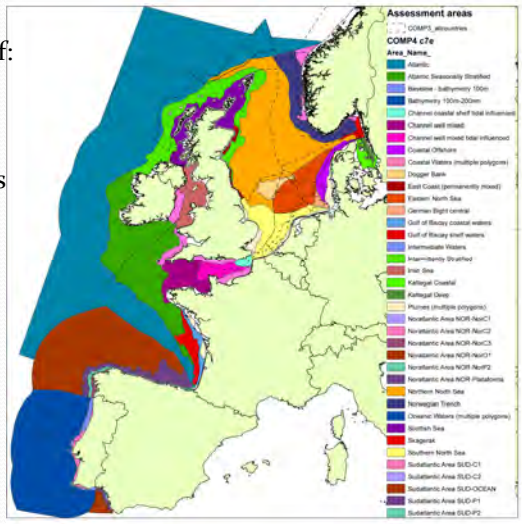
Based on cluster analysis of spatial patterns in satellite data of:

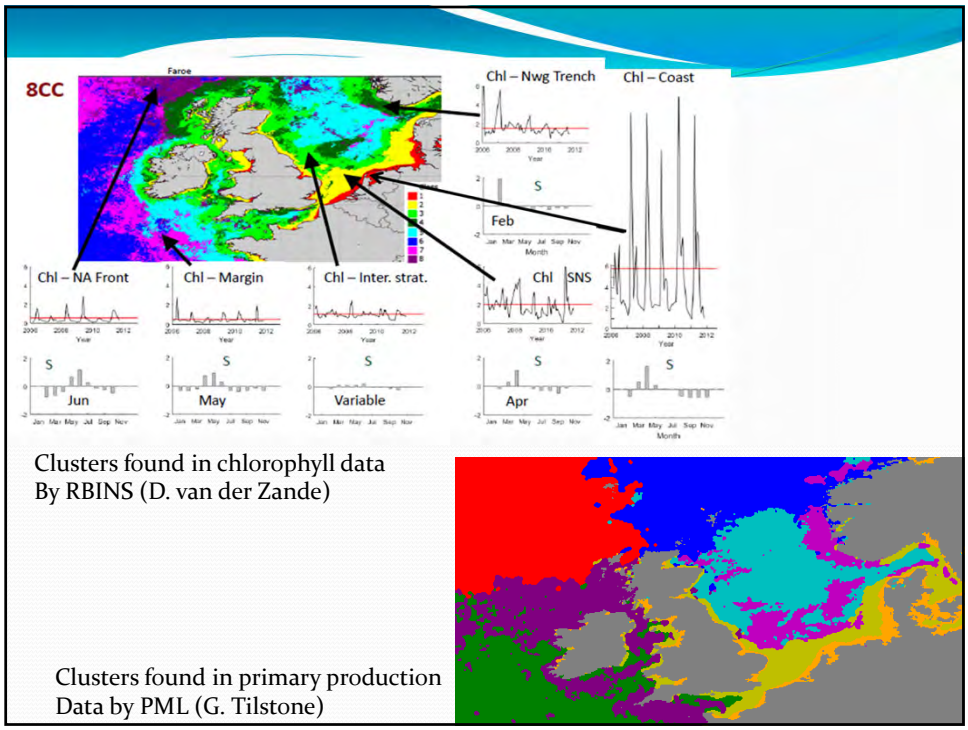
- chlorophyll-a and
- primary productivity

Clusters approximated by isolines in Deltares model data of:

- Duration of stratification
- Water depth
- Salinity

Fine-tuning with expert from OSPAR member states





Clusters found in chlorophyll data
By RBINS (D. van der Zande)

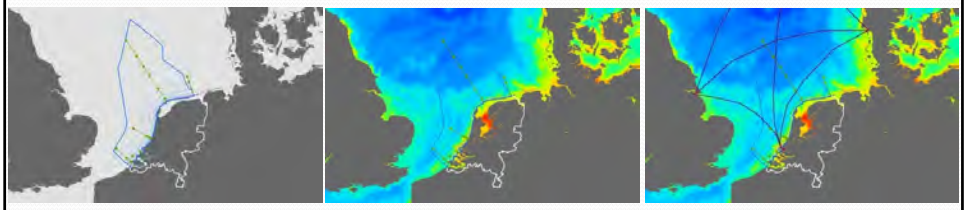
Clusters found in primary production
Data by PML (G. Tilstone)

Steps taken after JMP-EUNOSAT project

- Decision by OSPAR to use satellite data and new assessment areas and thresholds for next assessment
- Joint acquisition of Sentinel-3 data JMP-EUNOSAT-style by OSPAR countries, to be used for assessments by ICES
- Further elaboration of threshold levels and how to apply them in joint OSPAR model comparison effort
- New EU-project to extend approach to biodiversity (NEA-PANACEA)
- Adaptation of monitoring strategy by RWS

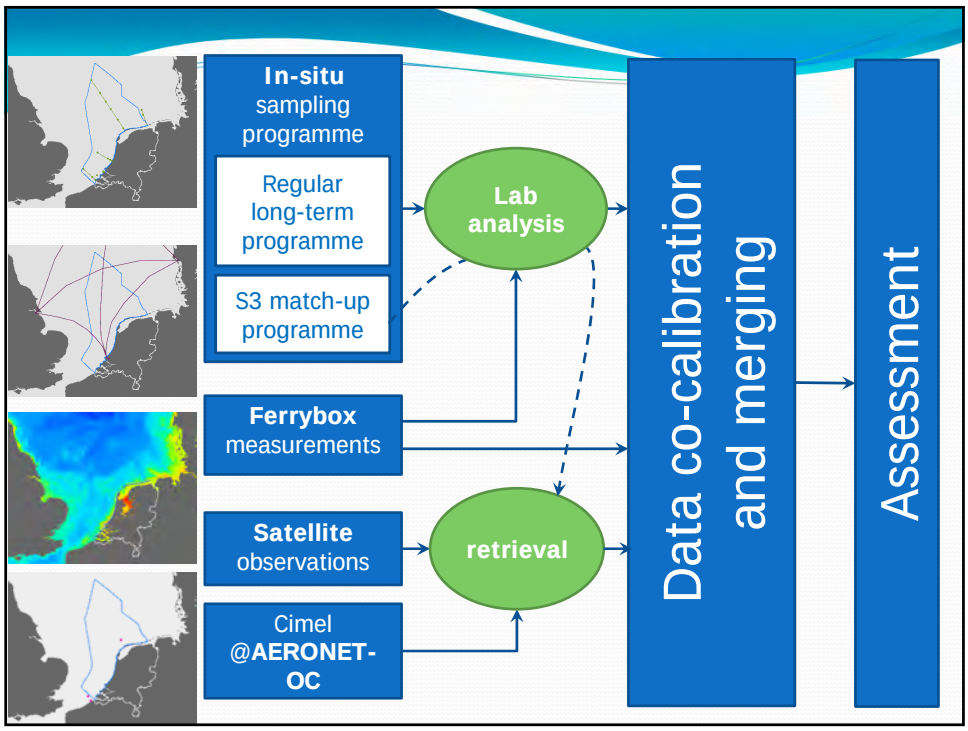
Eutrophication monitoring strategy

Reliable assessment of the state of the North Sea by using innovative measurements and analyses:



MWTL + **satellite data** + **ferrybox** measurements

In-situ data chlorophyll primarily for validation,
In-situ data nutrients (still) for assessment

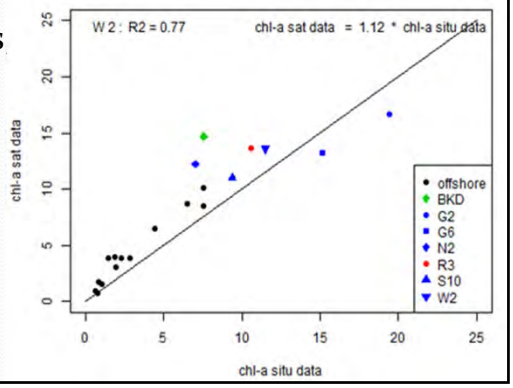


Validation of standard product

Standard chlorophyll product provided by ESA performs reasonnably well for Dutch waters, even for coastal locations, where use of the product is not recommended.

But structural positive bias
So possible false negative
Assessments

Good local validation of vital importance



New monitoring activities

- Match-up sampling since 2018 [validation]
- Aeronet-OC [calibration/validation]
- Ferrybox

➢ Evaluation of existing monitoring strategy

Lessons learnt

- Changing from in-situ data to satellite data requires extensive communication and validation to build confidence in satellite data by new end-users
- End users may require new work flows for the use of satellite data compared to traditional data
- The good spatial and temporal resolution of satellite data makes it worth the effort