

Common use of new Ferry box-line data in the North sea as a contribution to the next MSFD reporting on Eutrophication

Experiences from JMP EUNOSAT and the NorSOOP project.

9th Ferrybox meeting
24 april 2019, Genua

*Kees Borst (RWS, NL),
Pierre Jaccard and Kai Sørensen (NIVA, NO)*



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

Policy frameworks: OSPAR and EU Marine Strategy Framework Directive

Grant: DG-ENV part of European Maritime and Fisheries Fund
3rd call- *Implementation of the second cycle of the MSFD*

- 2 year project, Febr 2017 – Febr 2019 - **Finished**
- Budget k€ 874 and 80% EU contribution
- 14 partners in all countries bordering the North Sea. RWS leading partner

Norwegian Ships of Opportunity Programme for marine and atmospheric research (**NORSOOP**) (2018-2023)*

** Kai will tell more about that in the next presentation*



Rijkswaterstaat
Ministerie van Verkeer en Waterstaat



Cefas

SMHI



Umwelt Bundesamt

PML | Plymouth Marine Laboratory

INSTITUTE OF MARINE RESEARCH
HAVFORSKNINGSINSTITUTTET

AARHUS UNIVERSITY

NIVA
Norwegian Institute for Water Research

marinescotland

The Scottish Government

NLWKN

- Drivers -

Why do we want joint monitoring?

- *policy*: improving **coherence of assessments** (MSFD, OSPAR). Art 11 reporting: **EC keen on seeing improved coherence in marine regions !!**
- *money*: cost effective monitoring programmes while more data needed
- *technology push*: more/better data through new techniques
- *science*: improve understanding of ecosystem functioning

How can we ensure joint monitoring delivers coherent assessments?

Information cycle

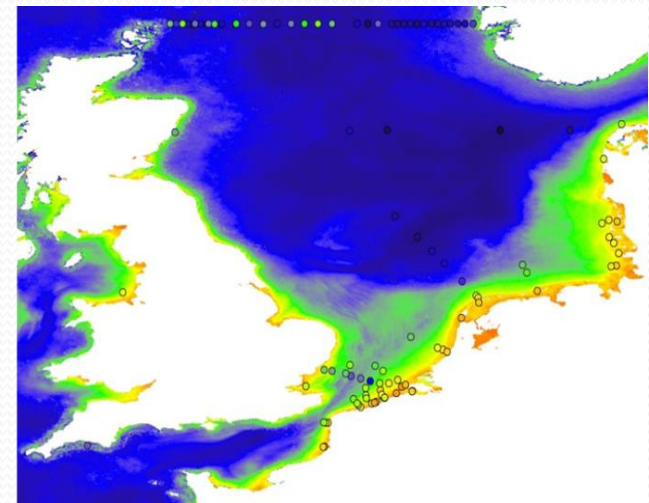
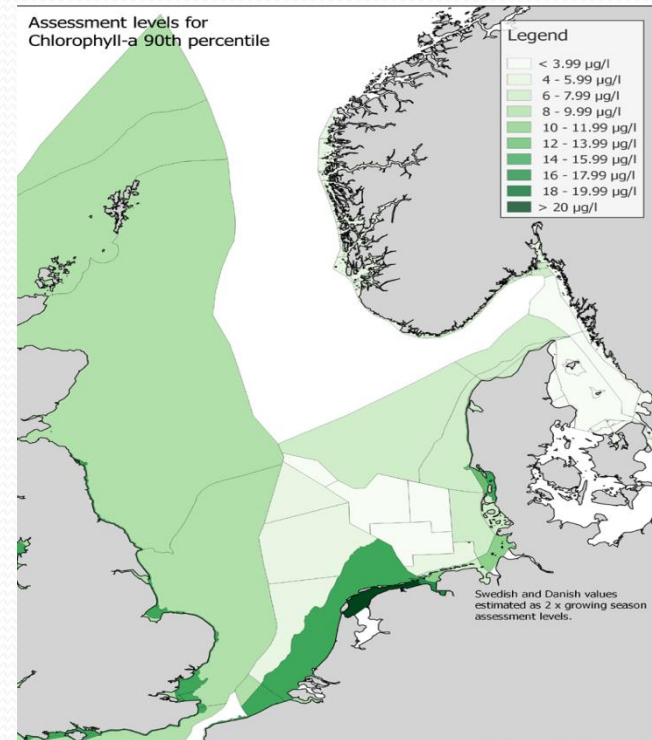
Level of coherence:

- **Coherent**
- **Partly Coherent**
- **National**

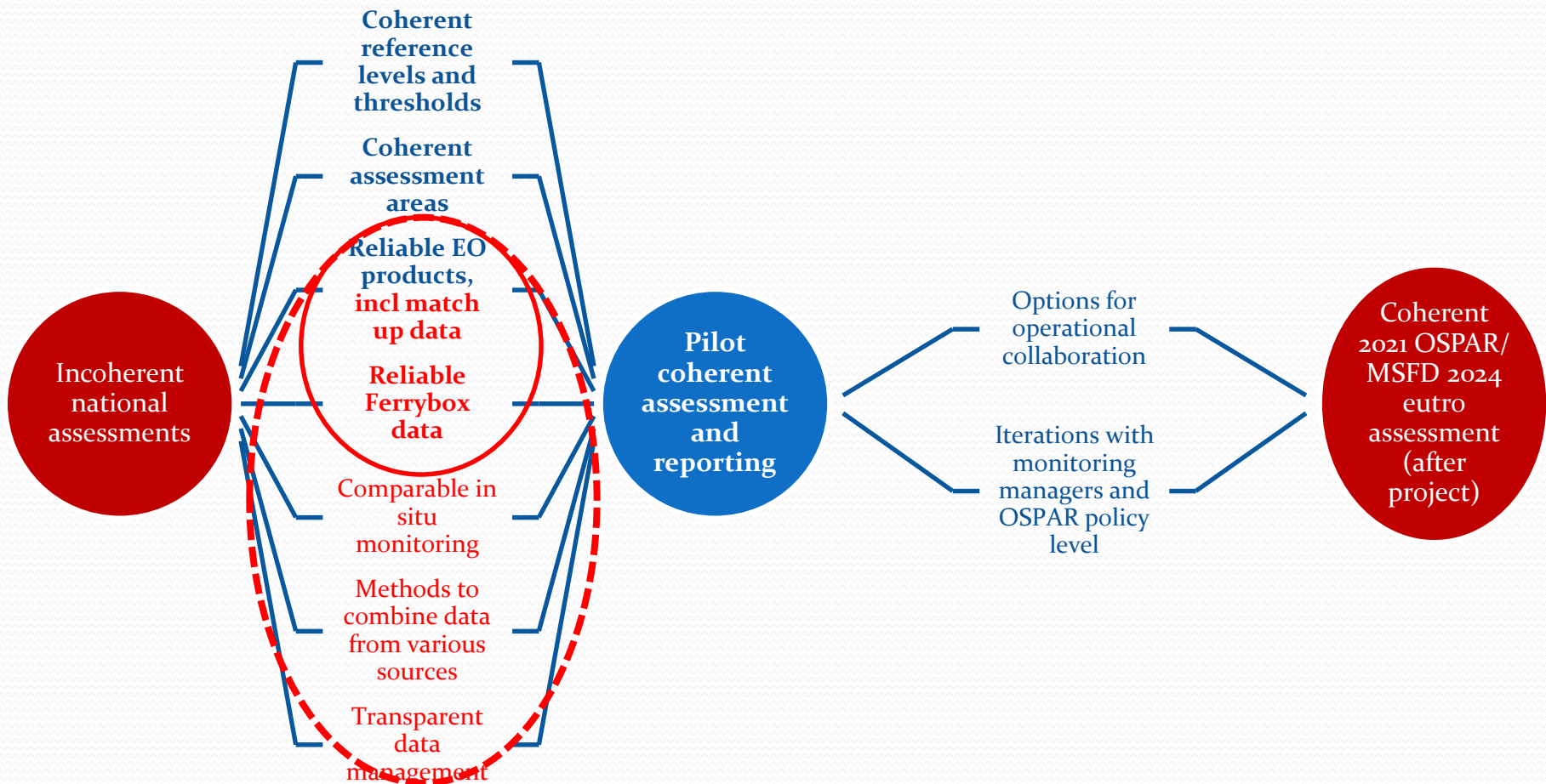


JMP EUNOSAT aims

1. Coherent thresholds for assessments for chlorophyll across North Sea countries
2. Coherent and reliable satellite chlorophyll products for the entire North Sea
3. Options for North Sea wide operational collaboration
(*Programming/ common use of RS / **Ferrybox-lines** etc)*)



Elements for coherent assessment



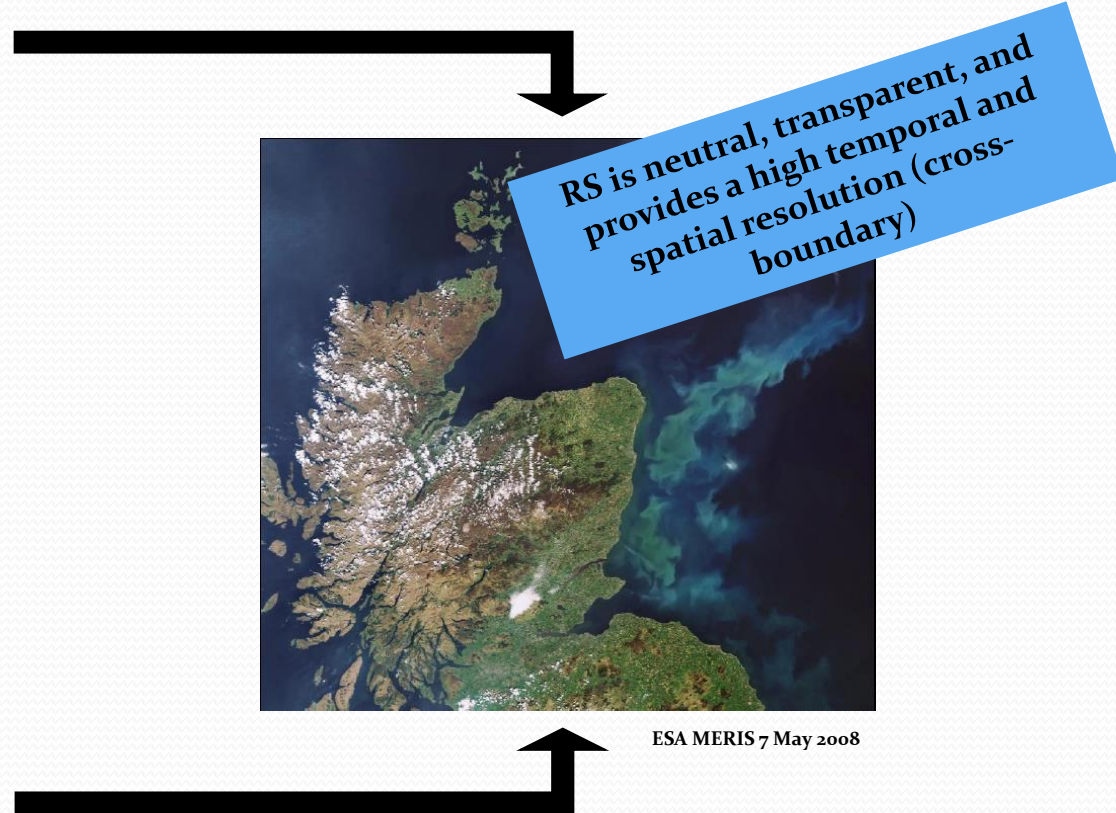
1. Generate coherent satellite-based CHL product



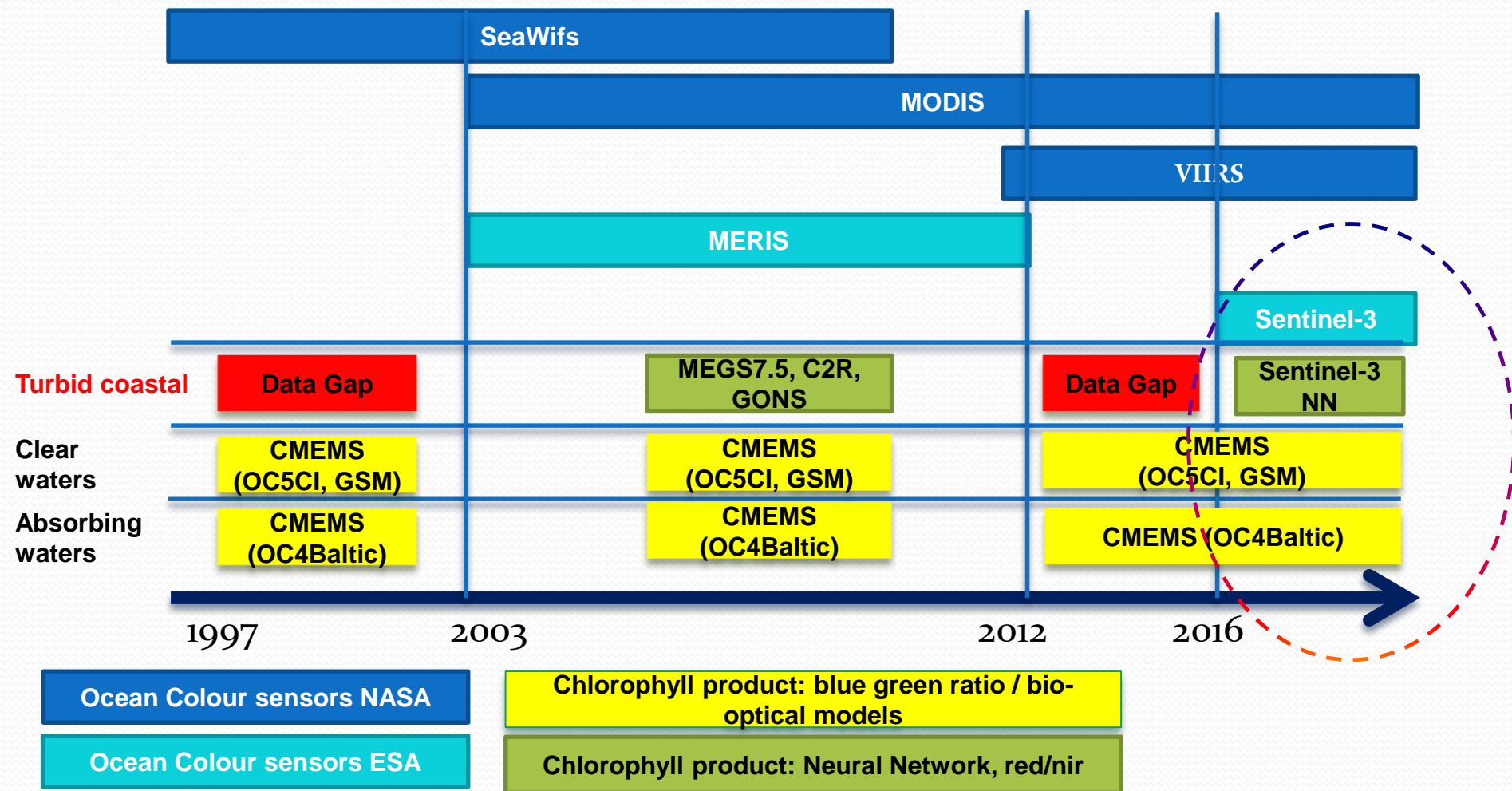
| | |
|------------|----------------|
| SeaWifs | 1997-2010 |
| MERIS | 2002 – 2012 |
| MODIS | 2002 – ongoing |
| Sentinel-3 | 2016 - ongoing |



Clear water Algae (CHL) Turbid waters



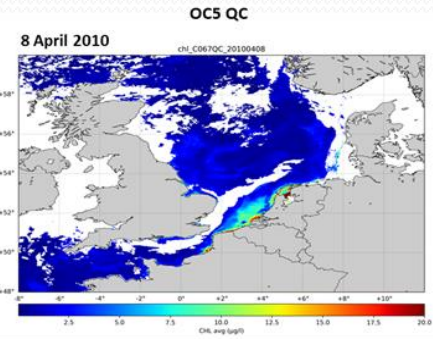
Ocean Colour sensors and CHL algorithms for ALL water types



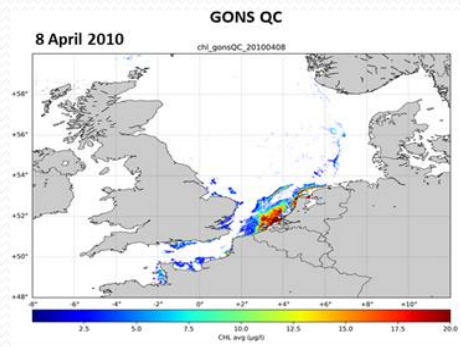
Generate coherent satellite-based (merged) CHL product

Clear waters

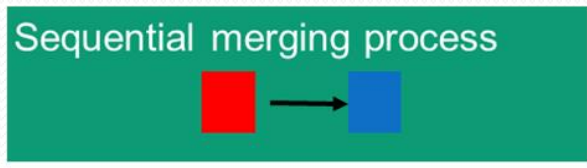
Turbid waters



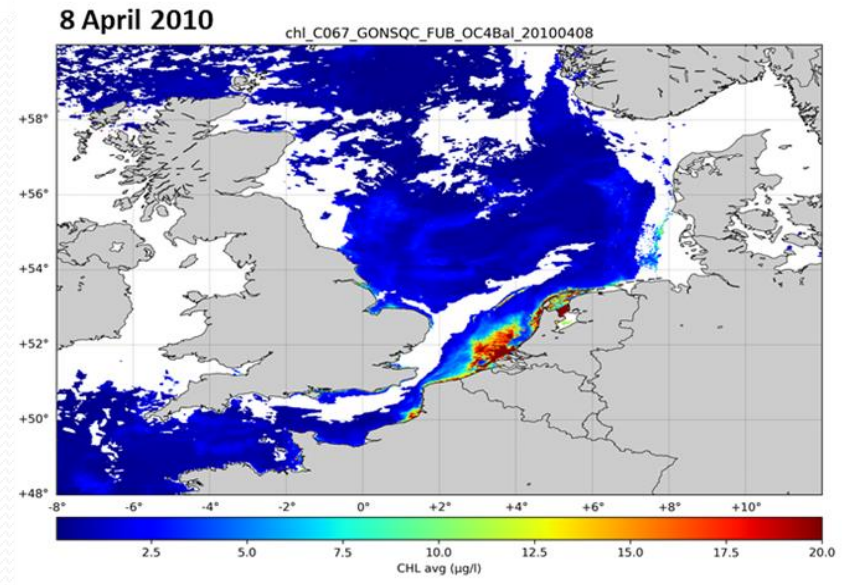
CLEAR water



TURBID water



- Spectral band shift to make sensors
- Apply CHL algorithms (clear, turbid,
- Quality control on all CHL data
- Blend CHL data products based on
- Coherent CHL satellite product

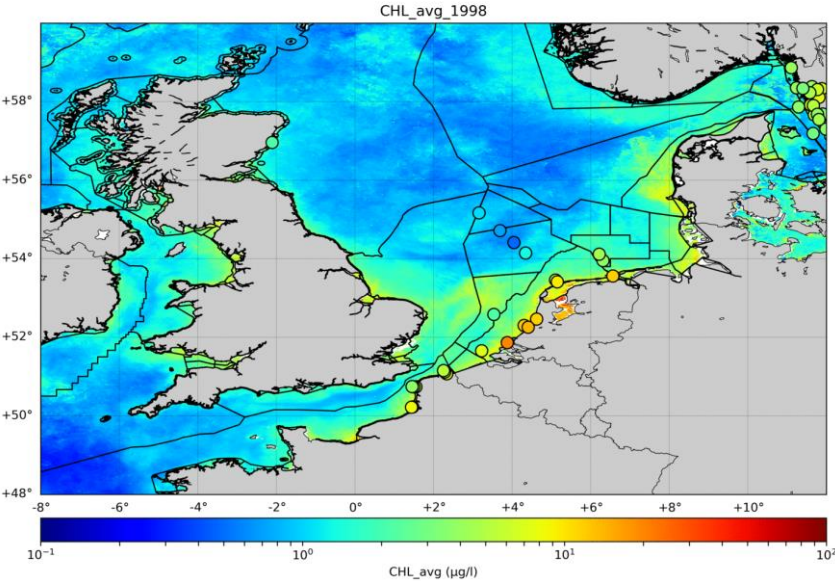


MERGED

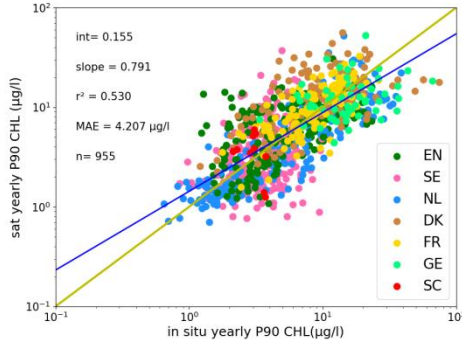
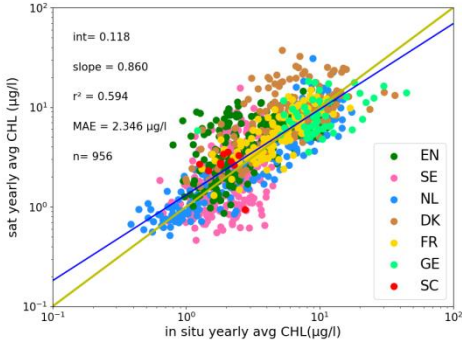
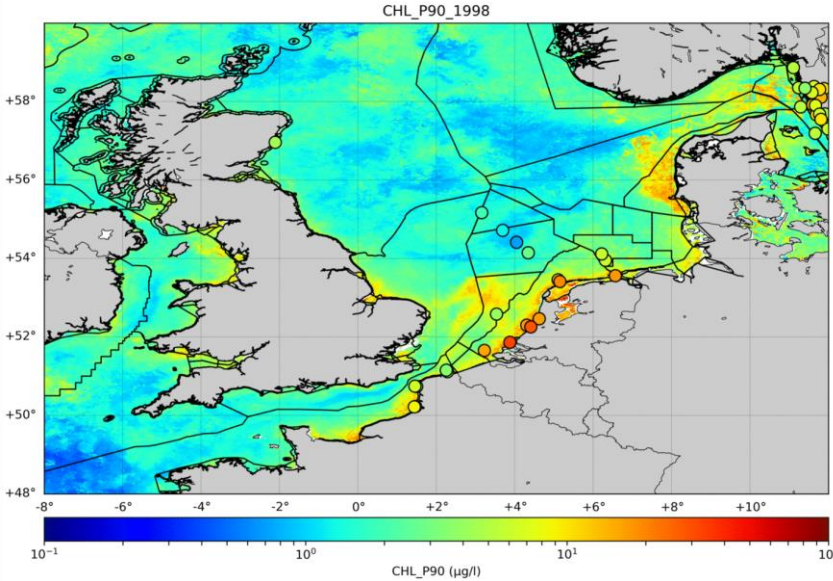
Evaluation of suitability of sat CHL products

Quality controlled coherent multi-mission CHL products for Greather North Sea area
1998-2017 compared to in situ data (dots)

Yearly mean

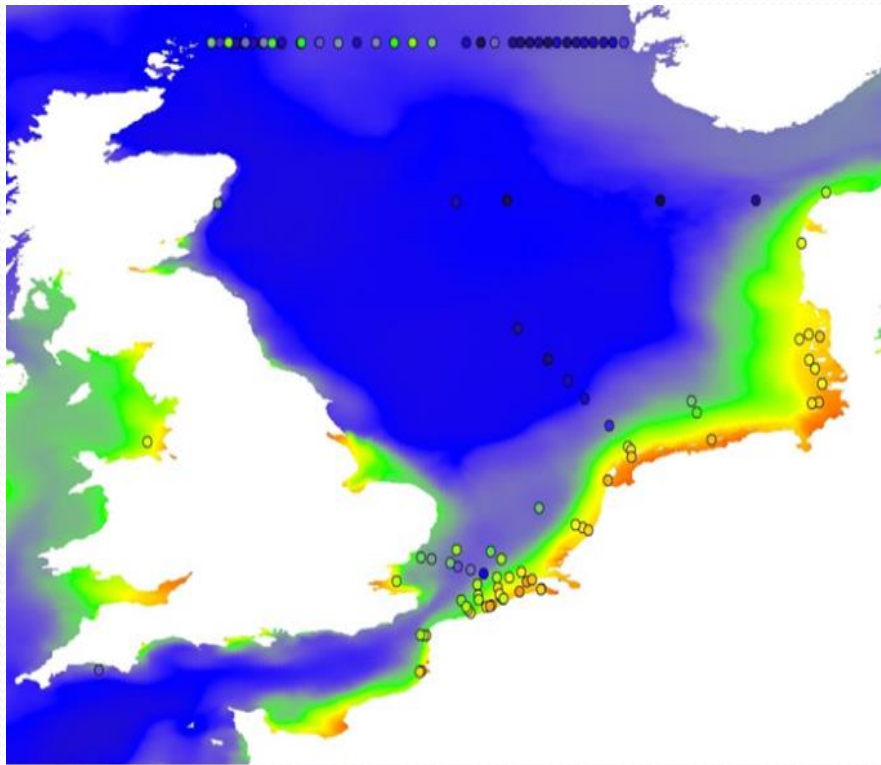


Yearly P90

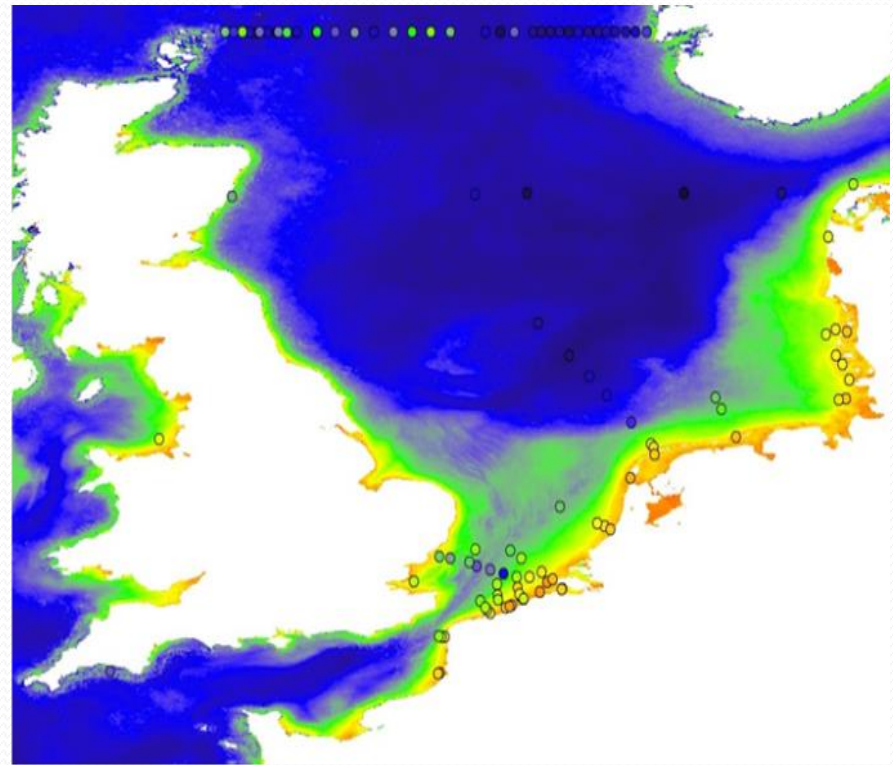


Validation of growing season mean chlorophyll-a concentrations

Model results 2009 - 2013



Satellite data 2005 - 2010

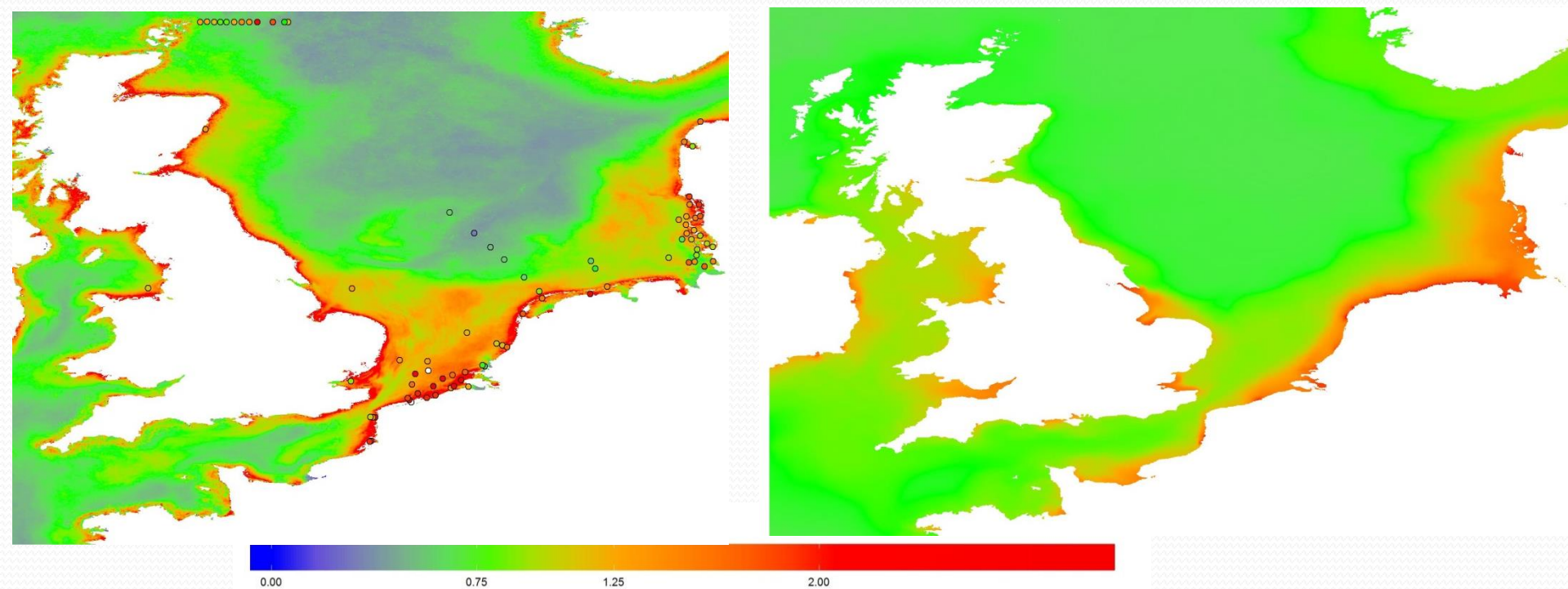


summer_chlfa ($\mu\text{g/l}$)



(In situ data are represented as circles)

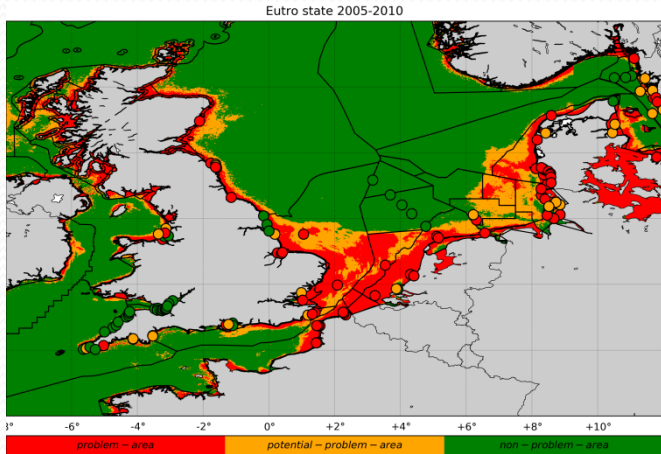
New assessment results



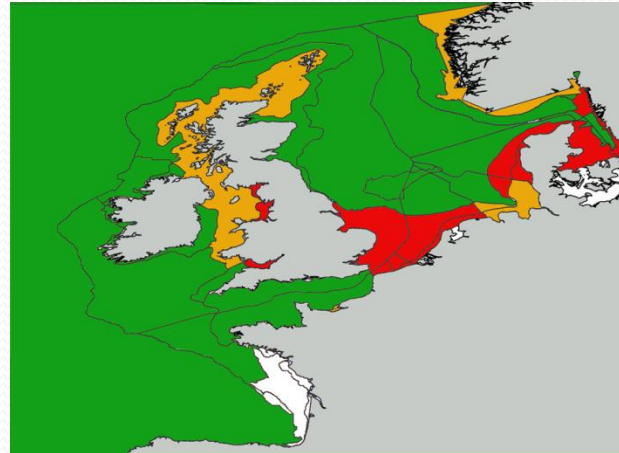
Assessment with satellite data (map) and in-situ data (circles)

Assessment with model data for recent years, Assuming only nutrient inputs from rivers and no stratification

Foreseen form of assessment



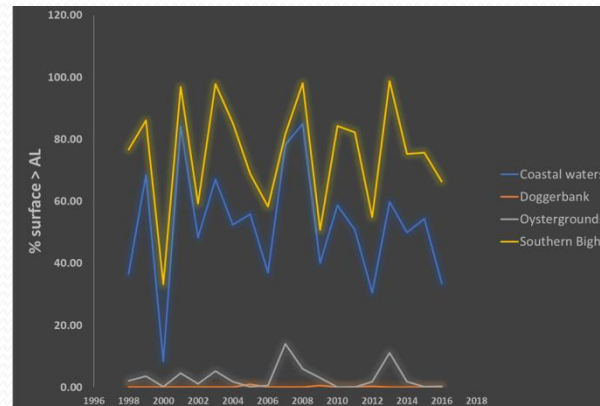
1. High resolution map of satellite and in-situ 6-y season means divided by local assessment level



2. Summary color per assessment area

| zone | CHL_mean ($\mu\text{g/l}$) | average threshold ($\mu\text{g/l}$) |
|-------------------------------------|------------------------------|---------------------------------------|
| # 1:Atlantic | 0.84 | 2.36 |
| # 2:Atlantic Perm. Strat. (no data) | | |
| # 3:Atlantic Seas. Start. | 0.68 | 1.36 |
| # 4:Atlantic Seas. Start | 0.88 | 1.59 |
| # 5:Channel Fr | 1.66 | 1.87 |
| # 6:Channel UK | 1.36 | 1.62 |
| # 7:Coastal No | 1.86 | 2.03 |
| # 8:Coastal IR | 1.66 | 2.18 |
| # 9:Coastal UK south | 1.43 | 1.92 |
| # 10:Coastal UK North | 1.69 | 1.86 |
| # 11:Coastal BE | 9.36 | 5.83 |
| # 12:Coastal NL | 9.66 | 6.92 |
| # 13:Coastal GE | 7.88 | 7.91 |
| # 14:Coastal DK | 6.50 | 4.29 |

3. Table representation



4. Time series of interesting areas

5. Text explaining observed trends in specific areas

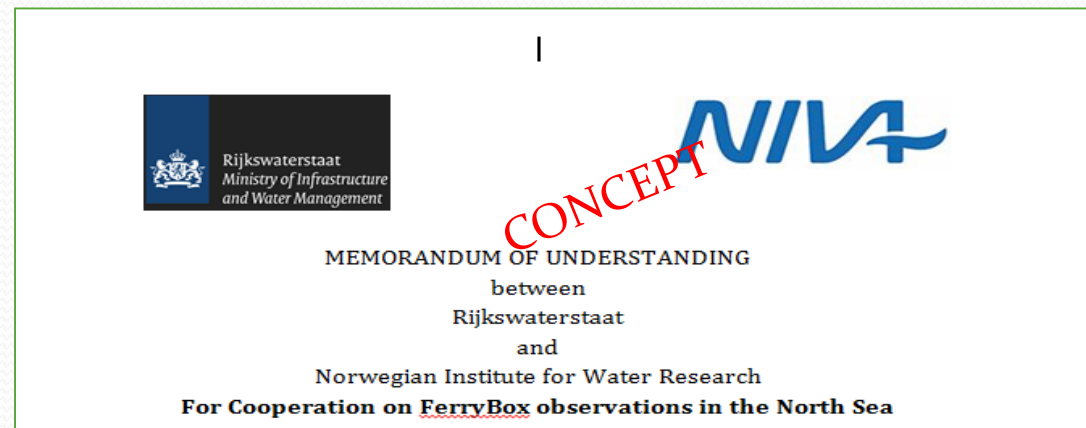
Joint monitoring approaches

- Satellite data do not replace in-situ data
- High spatial and temporal resolution of satellite data allows for reduction of in-situ monitoring effort
- Ships of opportunity (Ferrybox) monitoring for validation and additional variables.
- Primary production can also be monitored with satellites and Ferryboxes.
- Transparent joint assessment (OSPAR/ ICES COMPEAT) showed need for harmonisation of sampling design.

OSPAR interested in adopting this approach for next assessment (QSR 2023), after further refinement. Discussed in OSPAR ICG-EUT and HASEC

Start of new Ferrybox Line during JMP-Eunosat (as katalysator)

- RWS and NIVA **revives** the use of a FerryBox-system between Norway – Netherlands (*in the past pilot with Transcarrier*) during the JMP EUNOSAT project
- An agreement was set up with the cargo ship company “Seacargo” which have several routes in the North Sea.
- We plan now to use the cargo ship **“SC Connector”** that operate between Bergen (NO) – Odda (NO) - Tananger (NO) - Immingham (UK) - Rotterdam (NL)
- We have made a concept **MOU** between RWS and NIVA, to sign it before summer and hope to have the FerryBox-line operational second half of 2019.



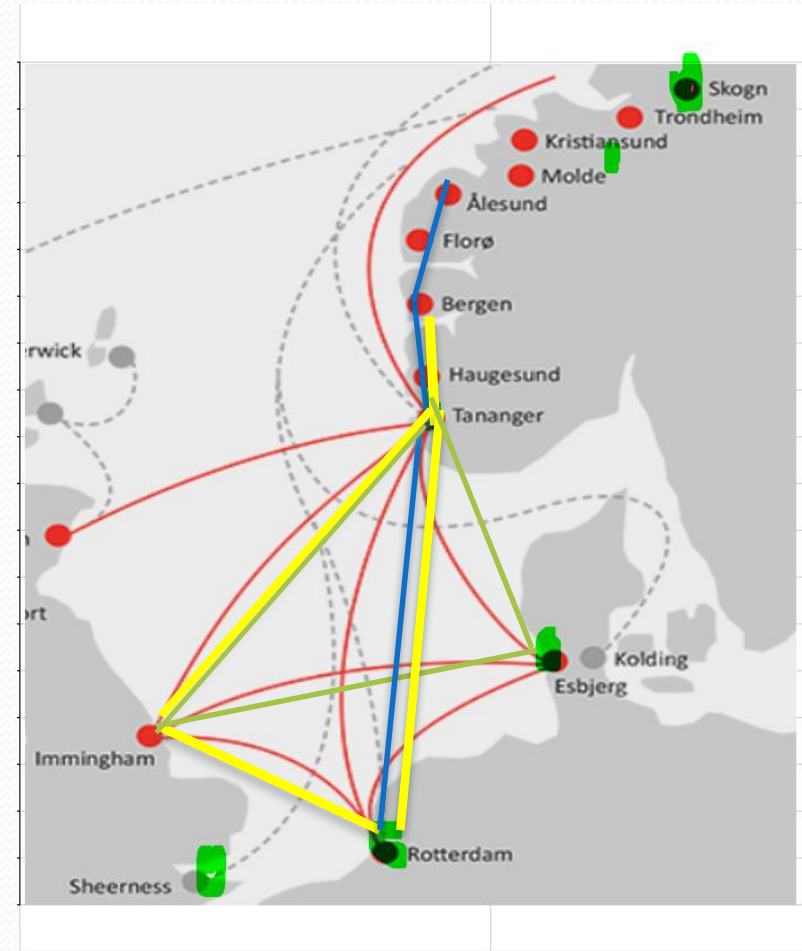
Furthermore:

- We will use the datamanagement system in NorSOOP and export data to the European data network that already exists.
- We will start with the following standard sensors like
 - Temperature
 - Oxygen
 - Chl-a fluorescence
 - Programmed automatic water sampler (making samples during a satellite pass !!)
 - Salinity
 - Turbidity
 - cDOM fluorescence
- For the second phase we foresee to bring also onboard more advanced sensors and analyzers.
- For satellite product validation above water radiance sensor can be installed later. The ship has a good design to try such installation. .
- Further development, testing etc. also in JERICO-3
- We hope other countries/partners could join this initiative

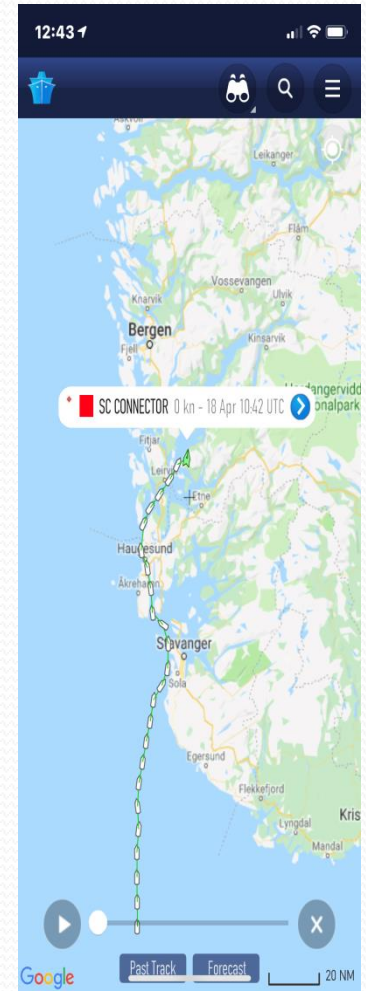
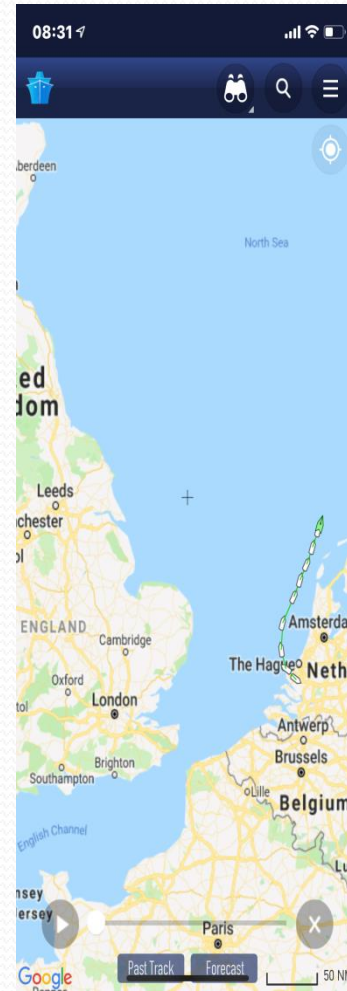
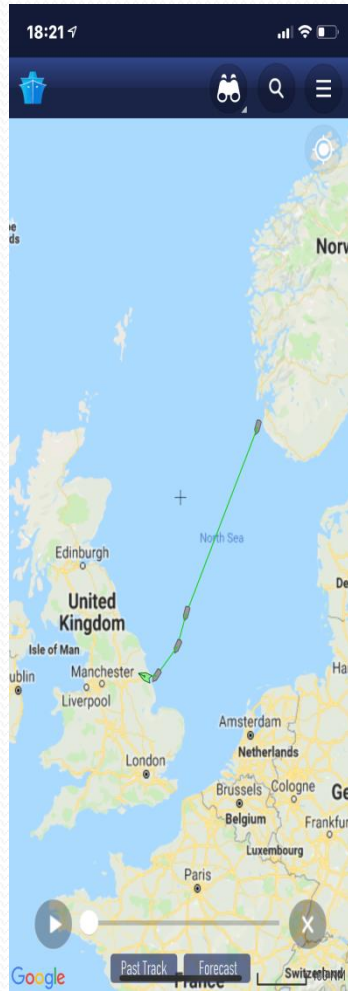
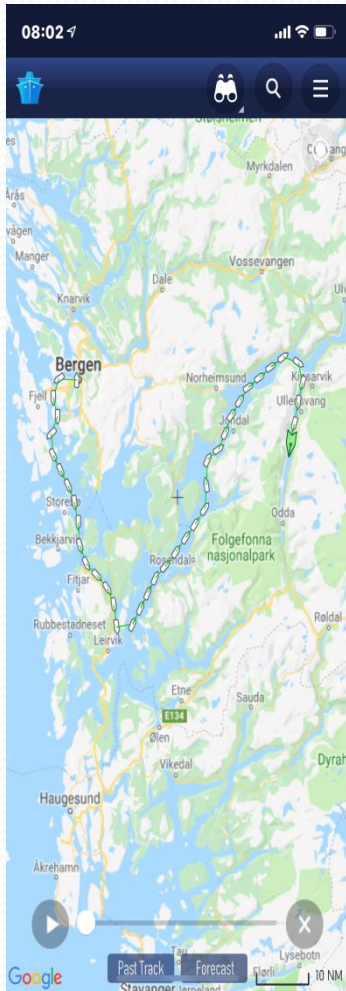
SeaCargo Lines in the North Sea covering NO, UK, NL, DK

Transfighter **Connector** Ahtela

| | SUNNDAL TRADE | | SC CONNECTOR | | AHTELA | |
|-----|---------------|-------------|--------------|-------------|-----------|-------------|
| | TRANSFIGHTER | | IMMINGHAM | 0700 - 1500 | HUSOY | 0300 - 0400 |
| MON | ROTTERDAM | 0700 - 1500 | | | BERGEN | 1000 - |
| | ALUCHEMIE | 1800 - | | | | |
| TUE | ALUCHEMIE | - 0200 | ROTTERDAM | 0700 - 1500 | | |
| | | | | | BERGEN | - 2100 |
| WED | | | | | KARMOY | 0700 - 1400 |
| | | | | | TANANGER | 1700 - 1900 |
| THU | | | TANANGER | 0200 - 0400 | | |
| | SUNNDALSØRA | 1100 - | HUSNES | 1000 - 1500 | ESBJERG | 1500 - 1800 |
| | | | BERGEN | 1900 - 2200 | | |
| FRI | SUNNDALSØRA | - 0600 | ODDA | 0700 - 1800 | | |
| SAT | | | HUSOY | 0300 - 0500 | IMMINGHAM | 0000 - 1500 |
| | TANANGER | 0900 - 1300 | KARMOY | 0600 - 0900 | | |
| | | | TANANGER | 1200 - 1600 | | |
| SUN | | | | | TANANGER | 2200 - 2400 |



Some of the SC Connector route taken from Marine Traffic the last days.



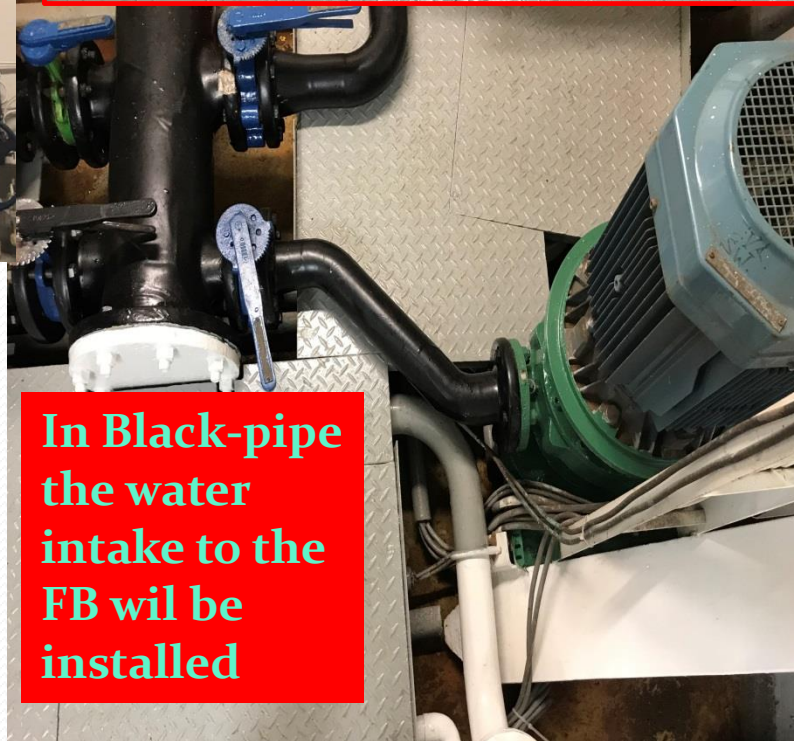


Entrance to the room where the FB will be installed.
Photo taken inside the room.

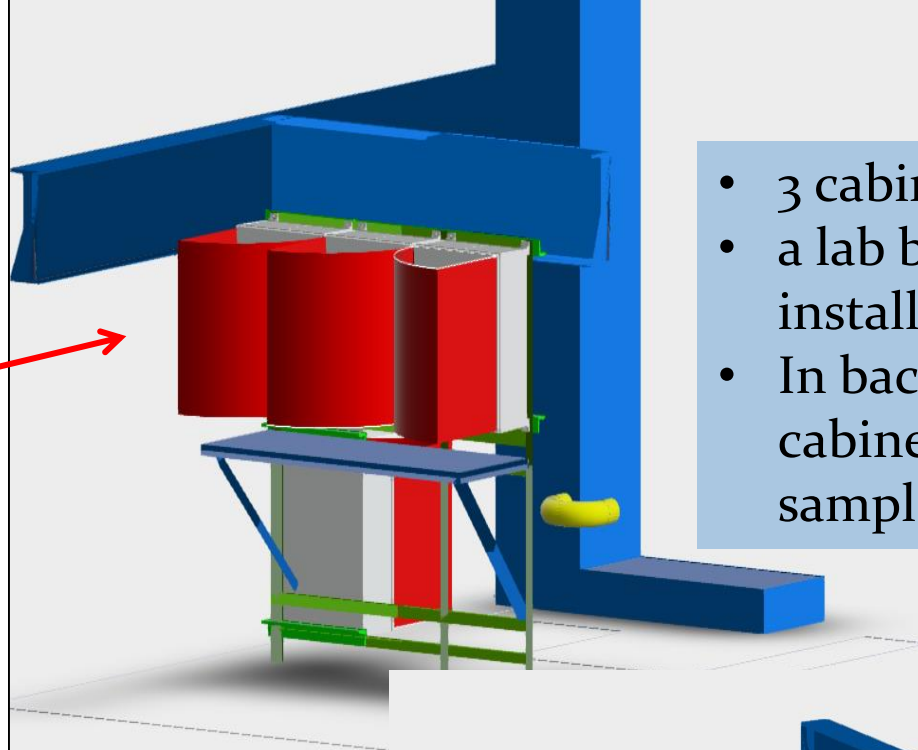
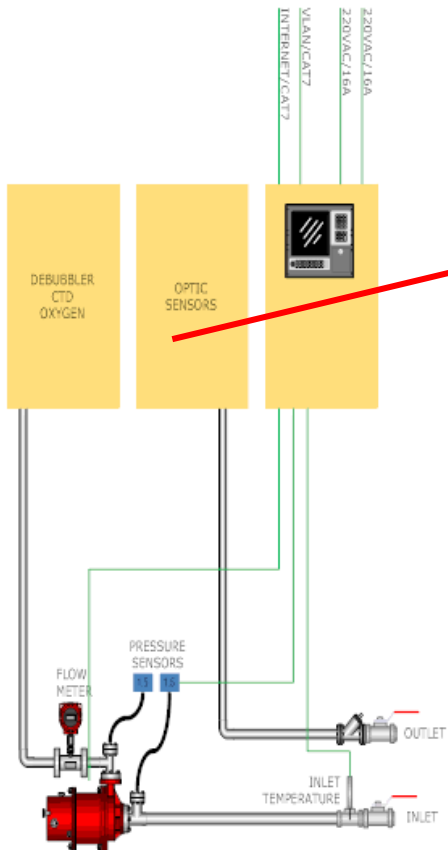
impressions



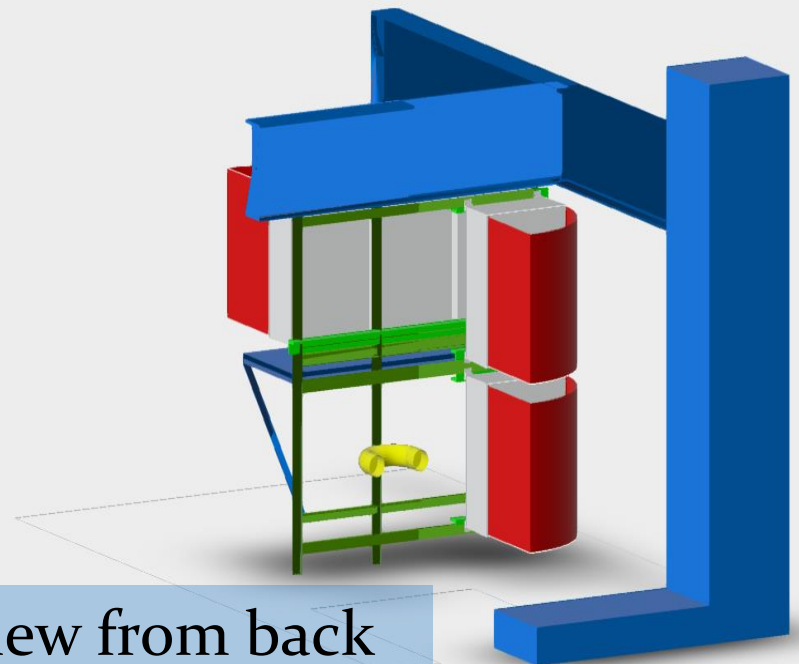
In front we will build up the cabinets
Water intake from the sea chest



In Black-pipe
the water
intake to the
FB wil be
installed



- 3 cabinet door shown
- a lab bench can be installed
- In back place for more cabinets and water sampler



View from back

220VAC/16A

CAT7/VLAN

BRIDGE
INSTRUMENT
ROOM

Data from
Ferrybox

NAVIGATION
WEATHER
SIGNAL



Newest NIVA-FB version installed on MS Norønna will be used at SC Connector

Left: Electronic and PC cabinett
Mid wet optical cabinet

Mid: Optical cabinet with Chl-a
Fluorescence, cDOM Fluro.,
Turbidity and other optional
optical sensors

Right: The wet camber with CTD,
O₂ and debubler cabinett

Under: The flowmeter, space for
sampler, pipes down to pump and
water intake with inlet temp
sensor.

Thank you!

Kees and Kai



The JMP Eunosat Projectteam