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# New BioGeoChemical product by Copernicus Marine Service

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and the Copernicus Marine INSTAC Team



Co-funded by the Horizon 2020 Framework Programme of the European Union

# copernicus
The European Earth Observation Programme
http://copernicus.eu

- Atmosphere Monitoring
- Climate Change
- **Marine Service (CMEMS)**
- Land Monitoring
- Security
- Emergency Management

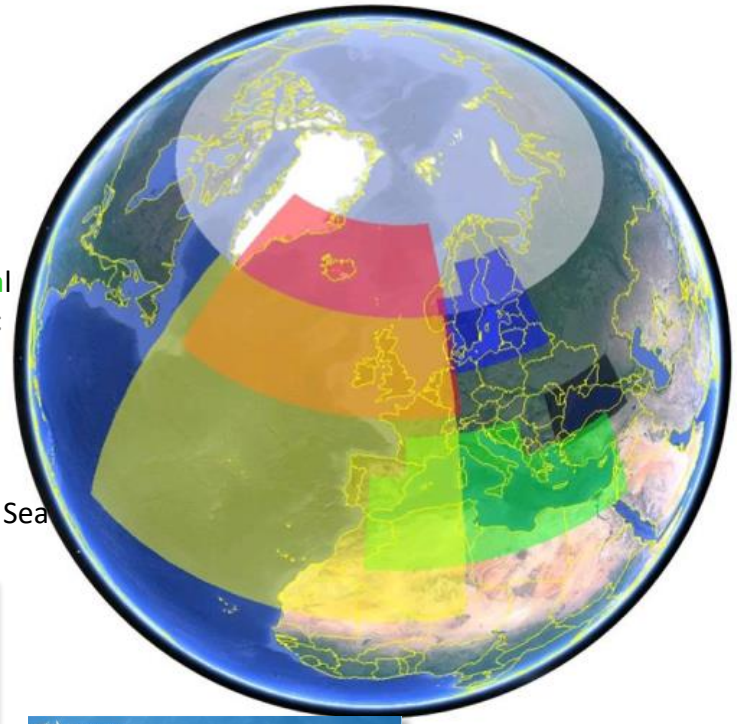
**Data producers**

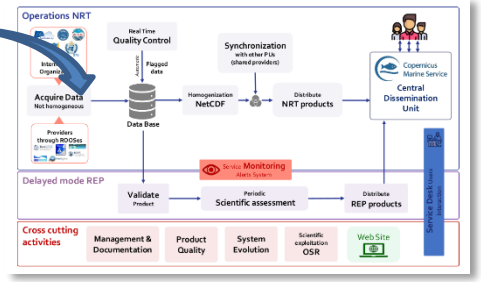
**7 MFCs (Models)**
- GLO MFC
- ARC MFC
- BAL MFC
- NWS MFC
- IBI MFC
- MED MFC
- BS MFC

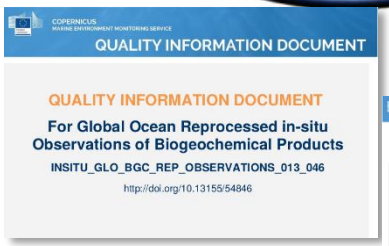
**8 TACs(Observations)**
- In Situ TAC
- 6 Space TACs:
  - SITAC
  - OCTAC …
- 1 Multi Obs.

# Copernicus Marine Service
## - A regional approach

- ✓ **Products tailored for specific regions through regional expertise**
- ➢ **Heterogeneous data sources**
  - ✓ **Homogeneous data quality through strong focus on internal consistency**
- ✓ **Documented and transparent**
- ✓ **Free & open data distribution through single data portal** http://marine.copernicus.eu
- ✓ **Supports all sectors of the blue economy**
- ✓ **Long-term commitment from EC**



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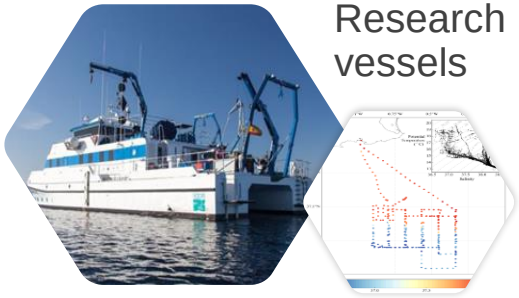
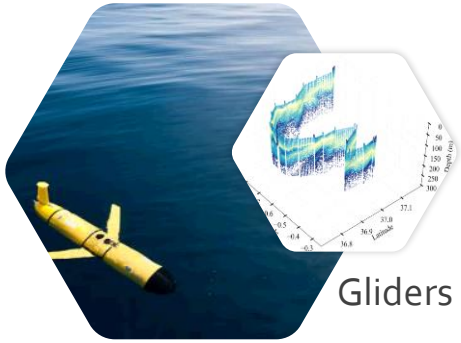
# In Situ Products

## 1. In Situ Observations

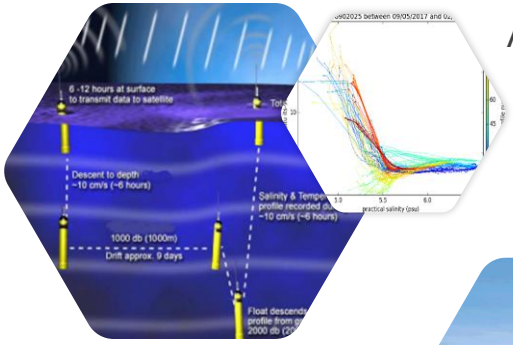
Research vessels



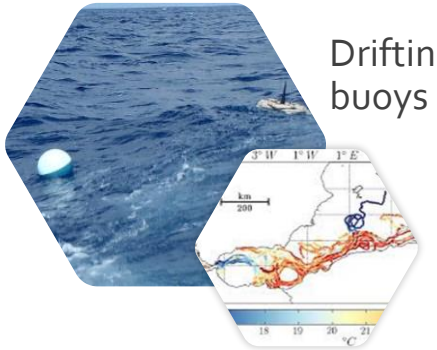
Gliders



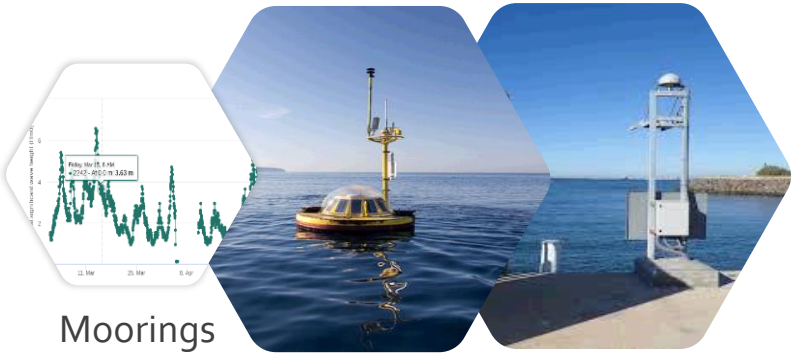
ARGO floats




Drifting buoys



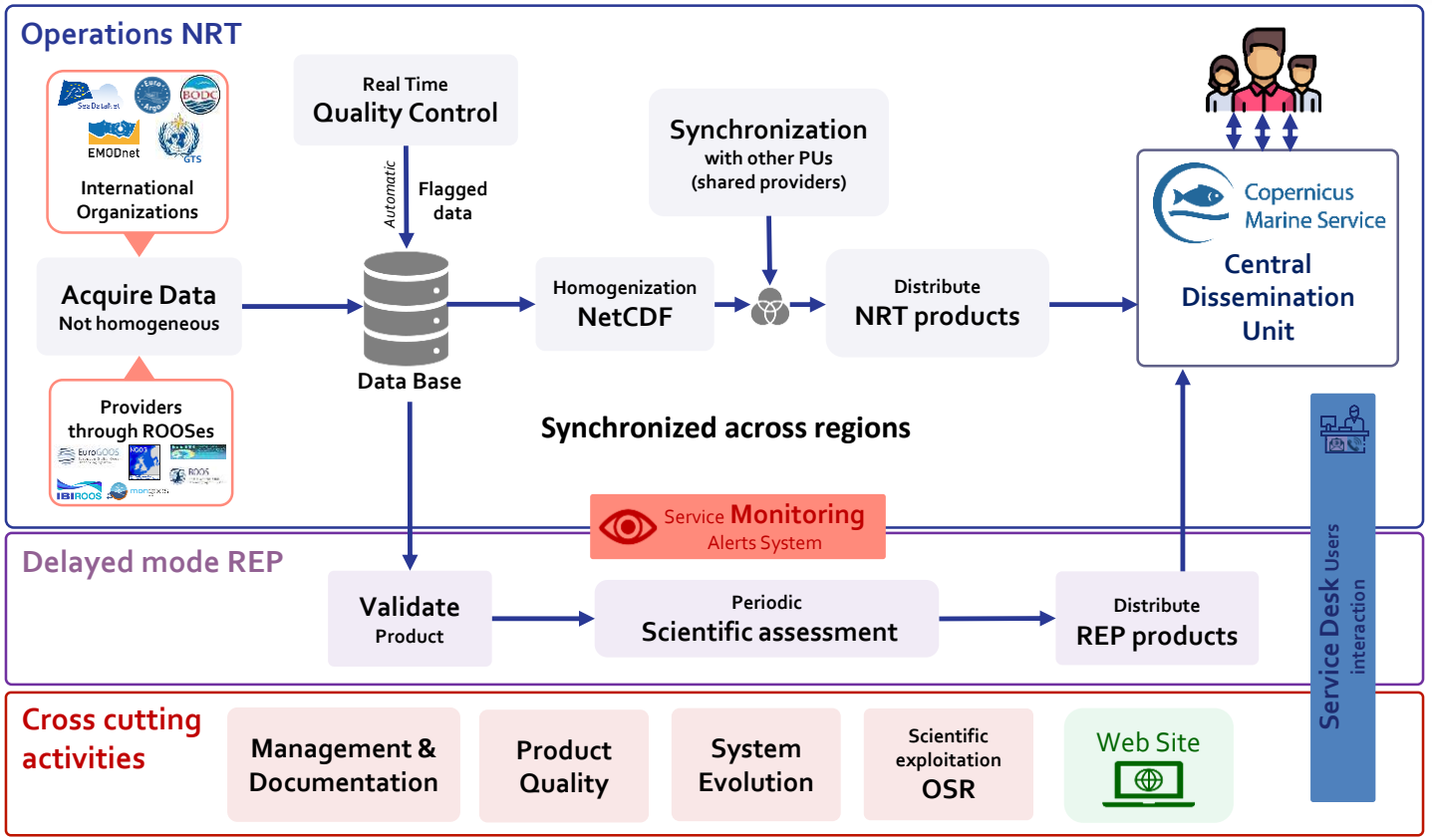
Moorings



HF radars

# In Situ Products

## 2. CMEMS In Situ TAC Data Flow




**Homogeneous directory structure**

# New BioGeoChemistry data product

## Global dataset of quality-controlled in-situ data

- Chlorophyll-*a*
- Oxygen
- Nutrients (Nitrate, Silicate, Phosphate) *online from JULY 2020*

- ✓ Novel, automated quality-control procedures identifying data for visual inspection
- ✓ All data are freely available at standard NetCDF4 format
- ✓ Dataset updated two times every year
- ✓ Transparent data handling and quality control (www.marine.copernicus.eu)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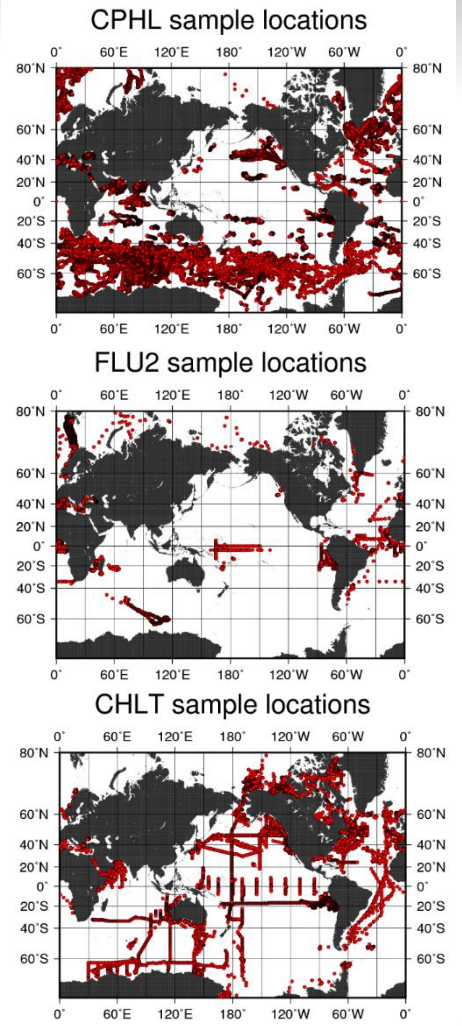
# Data sources Chlorophyll-*a*

Wide range of data sources:

- CTD, ferrybox, bio-argo, gliders, moorings
- Both sample and sensor data

Three parameters included:

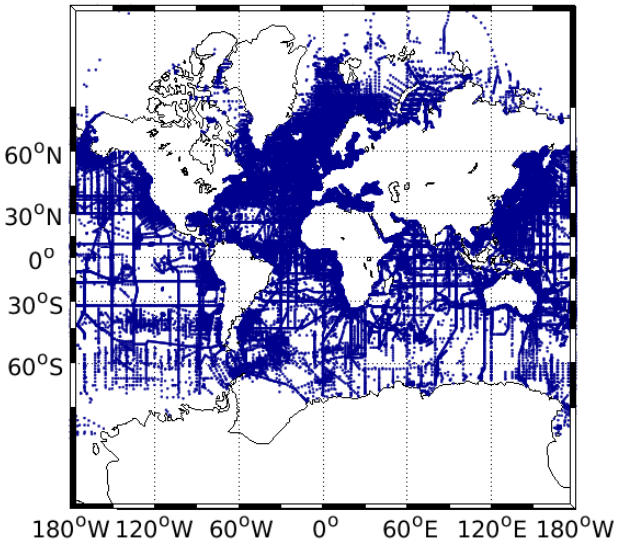
- CPHL (Lab: HPLC and spectromophometry)
- FLU2 (fluometric measurements, but not bio-argo)
- CHLT (total chlorophyll)



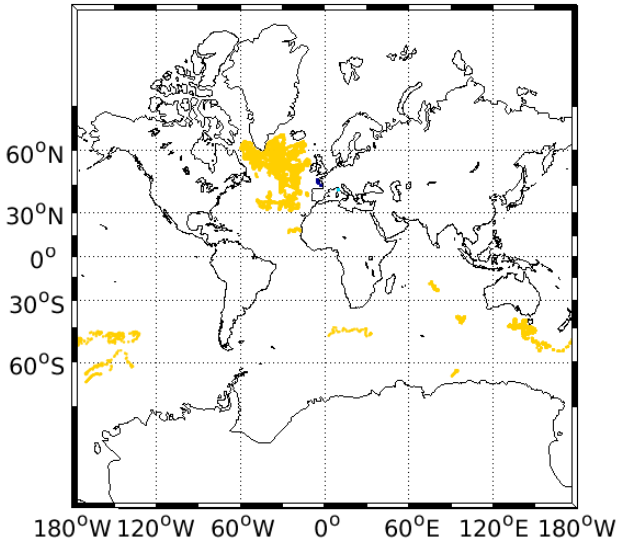
# Data sources
# Oxygen

1950-2019

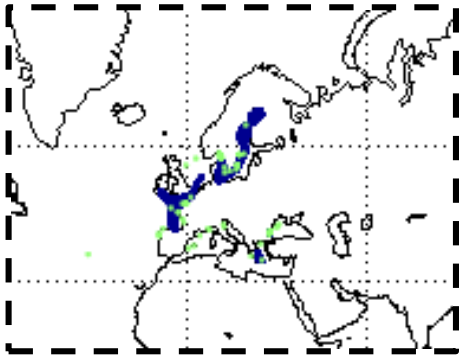
**CTD-BOTTLE PROFILES**




**FLOAT/Mini log/mooring**




**Mooring/Ferry box TS**



**Nomenclature**
**three parameters included**

| | |
|---|---|
| DOX1 | mL/L |
| DOXY | µmol/L |
| DOX2 | µmol/kg |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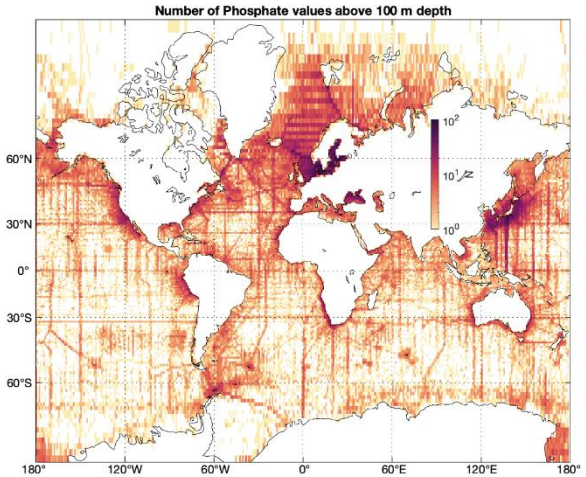
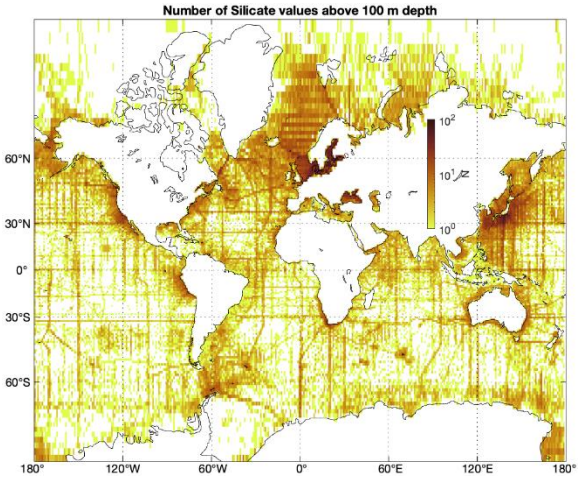
# Data sources
# Nutrients

**Data sources:**

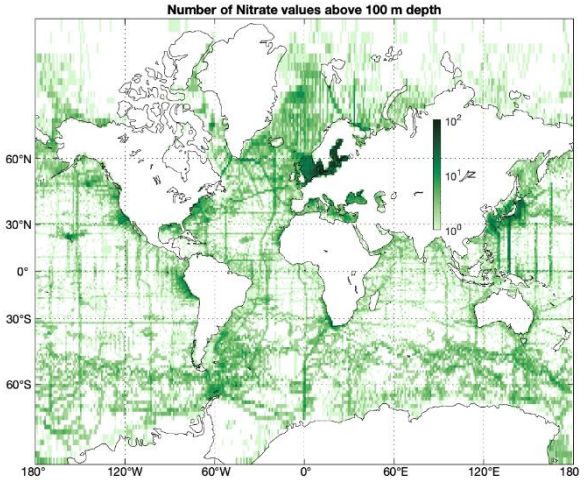
CTD – bottle, profiling floats, moored buoys, glider, ferryboxes




*Spatial coverage of Phosphate. Number of samples (N) above 100 m water depth in 1°x 1° grid cells.*




*Spatial coverage of Silicate. Number of samples (N) above 100 m water depth in 1°x 1° grid cells.*




*Spatial coverage of Nitrate. Number of samples (N) above 100 m water depth in 1°x 1° grid cells.*

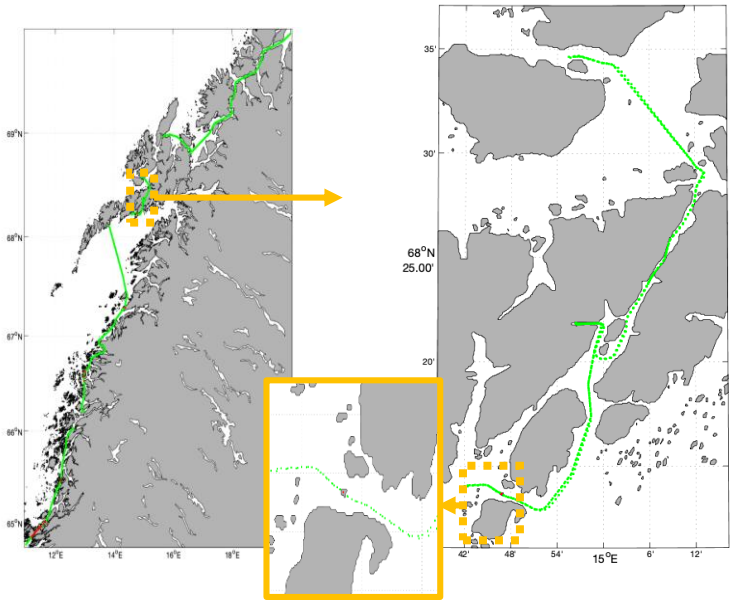
# Quality control Metadata

Metadata are quality controlled and flagged accordingly prior to data quality control:

- ✓ Impossible date or location test
- ✓ Position on land test
- ✓ Negative pressure test
- ✓ Temperature and salinity quality flag test (for parameters where *T* & *S* are needed for QC

| Code | Meaning | Comment |
|---|---|---|
| 0 | No QC performed | - |
| 1 | Good data | All QC tests passed |
| 2 | Probably good data | - |
| 3 | Bad data that are potentially correctable | These data are not to be used without scientific correction |
| 4 | Bad data | Data have failed one or more of the tests |
| 5 | Value changed | Data may be recovered after transmission error |
| 6 | Not used | - |
| 7 | Nominal value | Data were not observed but reported (e.g., an instrument target depth) |
| 8 | Interpolated value | Missing data may be interpolated from neighbouring data in space or time |
| 9 | Missing value | The value is missing |

*Quality control flags*




**POTENTIAL ON-LAND POSITION TEST**

Based on the GSHHS dataset

# Quality control Chlorophyll-*a*

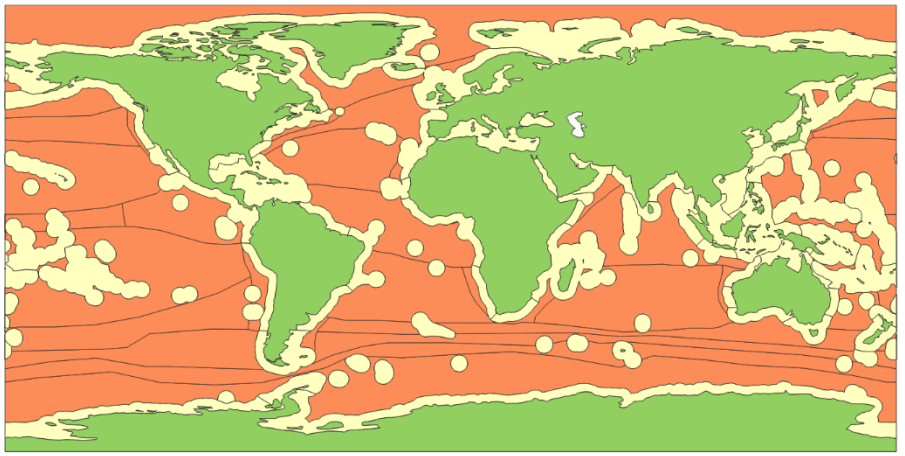
Ocean is divided into coastal and pelagic regions (Spalding et al., 2007)

Also divided into euphotic zone (0-200 m) and deeper ocean (>200m)

- Euphotic zone further divided into:
  - 0-100 m
  - 100-200 m

No physical constraints on chl-*a,* use statistical approach

- Calculates 99$^{th}$ percentile (3 std) and data inside regional percentile pass test and flagged as “1 – good”; data outside percentile flagged as “4 – bad data”



*Map showing coastal (yeallow) and pelagic (orange) regions. Based on Spalding et al., 2007*

- Only data flagged as 0, 1, or 2 were used in calculation of percentiles – all values larger than 20 mg m$^{-3}$ were omitted
- Data not sorted by season – but effect of partitioning data into season assessed in the validation procedure
- Chose 99$^{th}$ percentile over 95$^{th}$ percentile after validation against satellite (Gregg & Conkright, 2001) and ship-based datasets (O’Reilly, 2017)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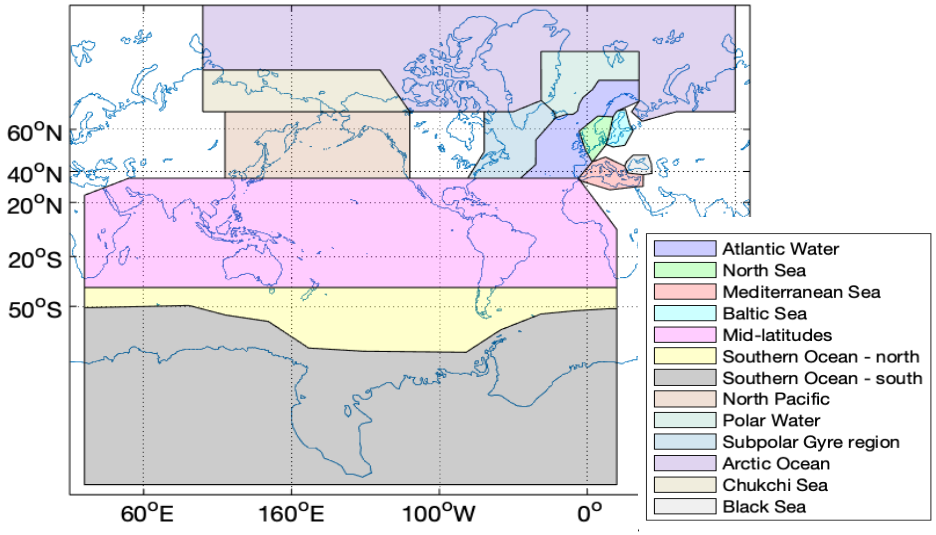
# Quality control Oxygen

- ✓ Ocean divided into regions and applying a regional range test
  - datapoints outside pre-defined range visually inspected
- ✓ Saturation test – allows super-saturation in upper layer



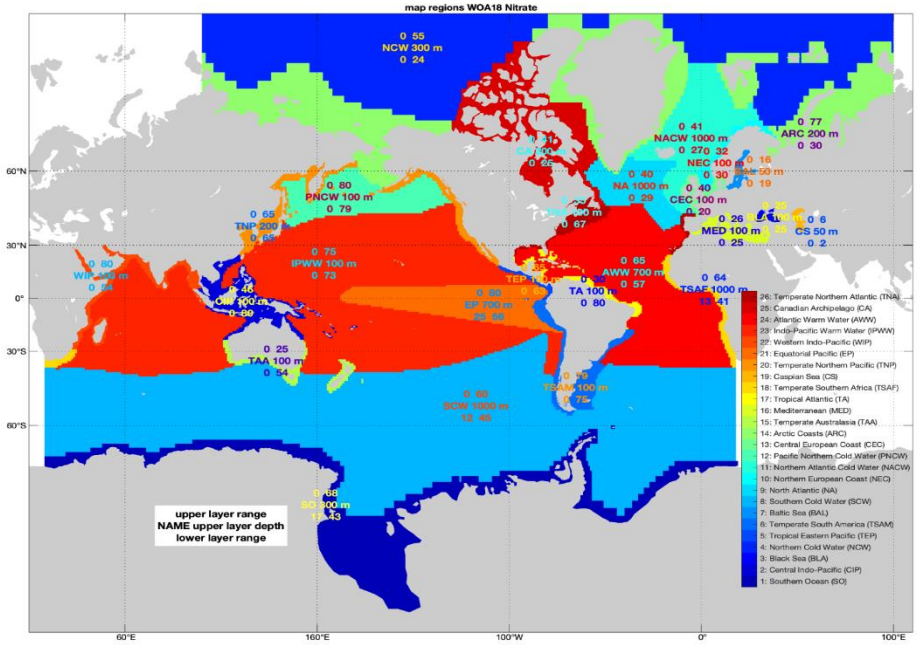

*Regions for the regional range test*

| Depth (m) | Oxygen saturation |
|---|---|
| Z < 10 | 150 % |
| 10<Z<100 | 130% |
| 100<Z<150 | 115% |

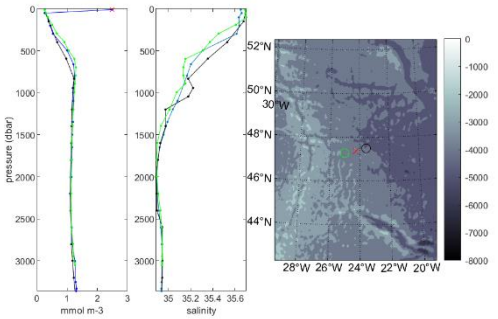
*Super-saturation allowed for different depth ranges in the saturation test*

# Quality control Nutrients

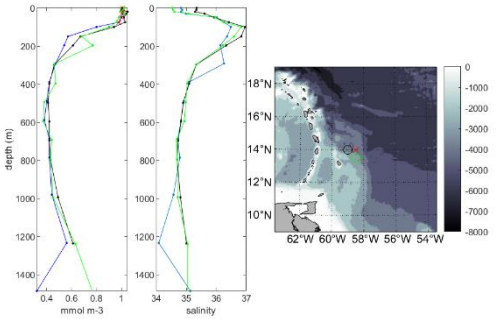
- ✓ Ocean divided into regions and applying a regional range test
  - datapoints outside pre-defined range visually inspected
- ✓ Profile test
  - surface values exceeding intermediate-depth values visually inspected




*Regions for the regional range test*




*Example of data rejected after visual inspection advised by profile test*




*Example of data accepted after visual inspection advised by profile test*

# The Copernicus Symbiosis
# Your Data Improves The Products We Provide You!

## Copernicus Marine Environment Monitoring Service

- ✓ Products tailored for specific regions through regional expertise
- ✓ Homogeneous data quality through strong focus on internal consistency
- ✓ Documented and transparent (http://marine.copernicus.eu)
- ✓ Free & open data distribution through single data portal
- ✓ Long-term commitment from EC
- ✓ Supports blue economy
- ✓ Growing user base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