SYNTHESIS QUALITY OVERVIEW DOCUMENT (SQO)

Associated to extended quality information document (QUID): CMEMS-INS-QUID-013-046

QUID Version: 2.7

Associated to Product ID: INSITU_GLO_BGC_DISCRETE_MY_013_046

Issue: 2.7

Contributors to SQO: V.S. Lien, V. Racapé

SQO approval date by the Copenicus Marine Service PQ coordination team: 25/11/2024

CHANGE RECORD

When the quality of the products changes, the QuID is updated and the SQO is updated. A line is added to this table and the version of the SQO document is the same than that of the REFERENCE QUID. The third column specifies which sections or sub-sections have been updated.

Issue	Date	§	Description of Change	Authors	Validated By
2.0	03/04/20	All	Creation of the document	V. S. Lien	
2.1	15/09/20	All	Update of all sections	V. S. Lien	
2.2	12/01/21	All	Update of all sections	V. S. Lien	
2.3	31/08/21	All	Update of all sections	V. S. Lien	S. Tarot
2.4	28/04/22	All	Update of all sections	V. S. Lien	S. Tarot
2.5	04/06/22	All	Update of all sections	V.S. Lien; V. Racapé	S. Tarot
2.6	04/06/23	All	Update of all sections	V.S. Lien; V. Racapé	S. Tarot
2.7	04/09/24	All	Update of all sections	V.S. Lien; V. Racapé	S. Tarot

Contents

Executive summary

The quality of the INSITU_GLO_BGC_DISCRETE_MY_013_046 product from the Copernicus Marine Service distribution is assessed through overall quality and spatial coverage of the following variables:

Chlorophyll

FLU2 (chlorophyll-*a* fluorescence; [mg m^{-3}])

CPHL (chlorophyll-*a* concentration [mg m^{-3}])

Oxygen

DOXY (dissolved oxygen [mmol m-3])

DOX1 (dissolved oxygen [ml l^{-1}])

DOX2 (dissolved oxygen [µmol kg^{-1}])

Nutrients

NTRA (nitrate [mmol m^{-3}])

NTAW (nitrate [µmol kg^{-1}])

SLCA (silicate [mmol m^{-3}])

PHOS (phosphate [mmol m^{-3}])

The particularity of any oceanographic in-situ measurements dataset is that the horizontal and vertical coverage of the dataset varies strongly along time following the technological developments and the international cooperation on observations networks. One should thus ensure that both the vertical coverage and the horizontal coverage fit his needs in terms of sampled ocean variability scales before using the data. Therefore, the horizontal coverage of the dataset for chlorophyll, oxygen, nitrate, silicate, and phosphate variables are shown.

As a measure of the overall quality of the data, the amount of data flagged as “good data” and “bad data”, respectively, during the quality control procedure is shown and discussed.

For additional information regarding the in-depth validation of this product, the calculation of the assessment metrics presented in this product other detailed information in quality and noticeable events please refer to the reference quid document CMEMS-INS-QUID-013-046.

Important notice:

The contents of this document are an assessment based on the best set of observations available for evaluation at the time the operational system was validated. The validation methodology was defined and agreed within Copernicus Marine Service, inheriting the long experience of MyOcean and MERSEA series of projects (Hernandez et al., 2018) The results presented in this report and derived estimated accuracy numbers (EAN) are representative of average error levels over large areas of the ocean. These numbers might be used as a mean error in one given point of the area, but in order to refine error estimates locally, the reader is invited to use complementary information from reference QUIDs (error maps for instance, when available).

1. Chlorophyll

As the distribution of nutrients within the ocean is patchy, so too is the chlorophyll concentration as micro-algae rapidly multiply in number to exploit any region with nutrients and light. This patchiness results in small areas with high chlorophyll concentrations, and larger regions with lower values. Sampling such a system typically results in a highly positively skewed distribution. Chlorophyll data are sorted into three types: CPHL (chlorophyll-*a*), FLU2 (chlorophyll-*a* fluorescence) and CHLT (total chlorophyll). The units for all data types are milligrams per cubic metre (mg m^{-3}). The proliferation of autonomous profilers, such as BGC-Argo, and gliders is greatly increasing the spatial coverage of chlorophyll measurements.

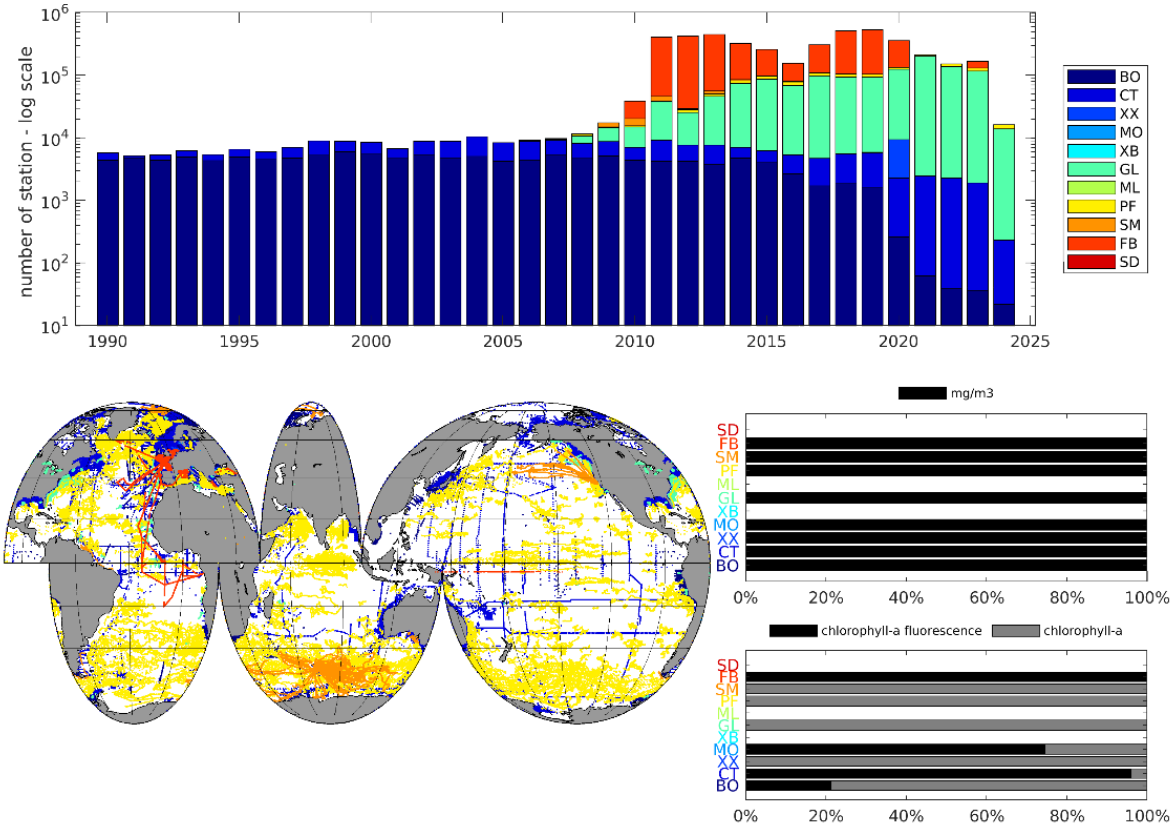

Figure 1. *Temporal (top) and spatial (bottom, left) distribution of chlorophyll stations including at least one measurement flagged as "good data" (QC flag equals 1 or 2), per instrument type during the period Jan 1990 – Jan 2021. Proportion of each variable of chlorophyll displayed by instrument (bottom, right). CT: CTD; BO: Bottle; GL: Glider; SM: Sea Mammals; ML: Mini Loggers; FB: Ferry Boxes; MO: Moorings; SD: Sail Drones; XB: XBT; XX: Unknown; PF: (Profiling) Floats.*

Table 1 *Distribution of stations per depth interval and Copernicus Marine Service region.*

CHLOROPHYLL	Copernicus Marine Service Region						
	AR	**BO**	**BS**	**IR**	**GL**	**MO**	**NO**
0 - 500 dbar	65.70%	99.99%	93.58%	84.98%	78.41%	76.13%	76.98%
500 - 1000 dbar	23.35%	0.01%	4.97%	9.08%	17.58%	15.89%	15.11%
1000 – 1500 dbar	4.42%	0.00%	1.36%	1.96%	1.30%	3.01%	3.10%
1500 – 2000 dbar	2.77%	0.00%	0.09%	1.64%	0.93%	2.41%	2.21%
2000 – bottom	3.76%	0.00%	0.00%	2.34%	1.78%	2.56%	2.60%
TOTAL	7313508	4194853	396106	25748872	298307910	25441797	9839082

2. Oxygen

Oxygen measurements consist of both discrete samples using the winkler method for titration, and sampling using automated sensors. Using discrete samples typically limits the coverage in time and space, whereas the inclusion of oxygen sensors within the Argo programme (BGC-Argo) has greatly enhanced the spatiotemporal coverage in the ocean basins (Figure 2), although rigorous quality control is required. This re-processed product only considers delayed-mode quality-controlled oxygen data from Argo, in addition to applying a regional range test and a maximum saturation test.

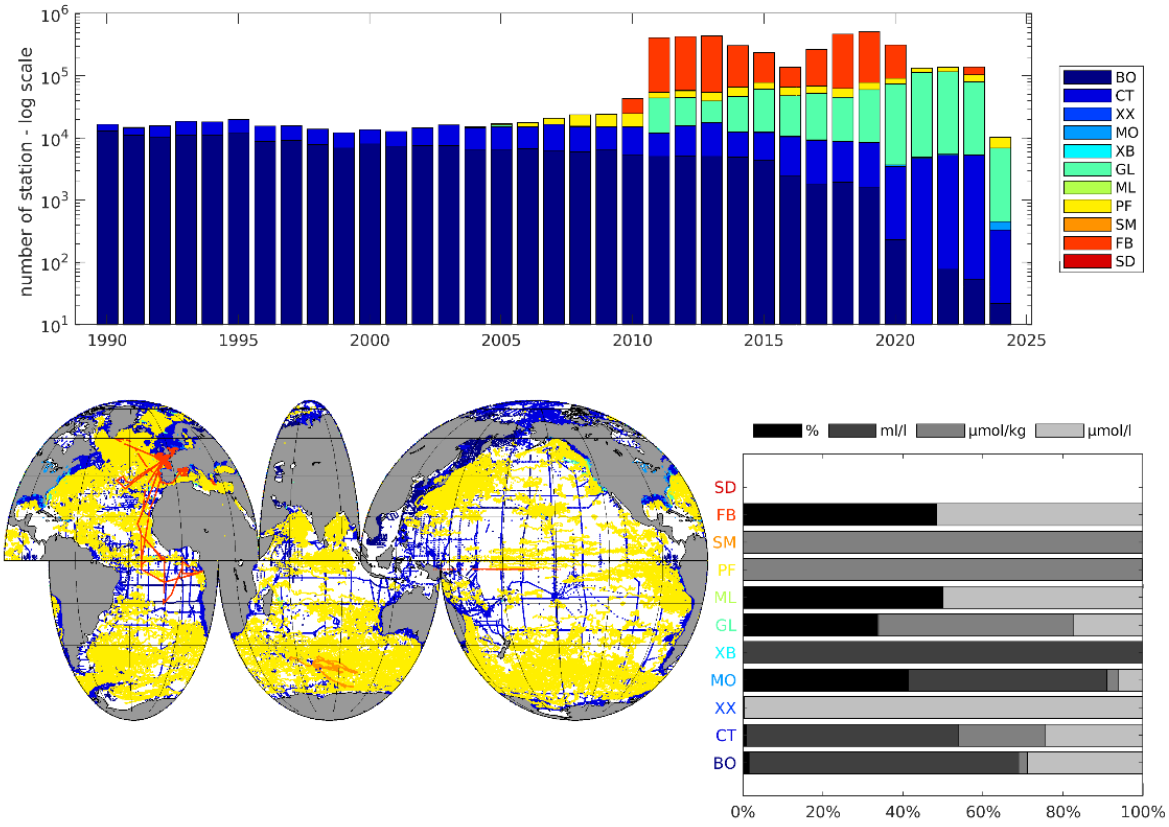

Figure 2. *Temporal (top) and spatial (bottom, left) distribution of oxygen stations including at least one measurement flagged as "good data" (QC flag equals 1 or 2), per instrument type during the period Jan 1990 – Jan 2021. Proportion of each variable of oxygen displayed by instrument (bottom, right). CT: CTD; BO: Bottle; GL: Glider; SM: Sea Mammals; ML: Mini Loggers; FB: Ferry Boxes; MO: Moorings; SD: Sail Drones; XB: XBT; XX: Unknown; PF: (Profiling) Floats.*

Table 2 *Distribution of stations per depth interval and Copernicus Marine Service region.*

OXYGEN	**Copernicus Marine Service Region**						
	AR	**BO**	**BS**	**IR**	**GL**	**MO**	**NO**
0 - 500 dbar	59.96%	99.95%	96.28%	48.15%	43.24%	48.41%	67.72%
500 - 1000 dbar	24.15%	0.05%	2.79%	11.03%	14.60%	16.12%	10.32%
1000 – 1500 dbar	5.57%	0.00%	0.84%	9.16%	9.35%	10.34%	6.97%
1500 – 2000 dbar	3.98%	0.00%	0.09%	8.39%	8.00%	8.61%	5.65%
2000 – bottom	6.34%	0.00%	0.00%	23.27%	24.81%	16.52%	9.34%
TOTAL	19493781	8658326	732811	36494352	203196900	16142322	23671068

3. Nutrients

Sampling of nutrients data is mostly confined to a few hotspot shelf areas around the world, while relatively few observations exist in the ocean basins (Figure 3). Nutrients sampling is mostly conducted through discrete water sampling, which explains the relatively low data coverage in space and time. However, automated sampling is increasing, e.g., through BGC-Argo, which has the potential to greatly increase the spatiotemporal coverage of nutrients sampling in the ocean basins, although reliability and accuracy of such measurements may still be an issue.

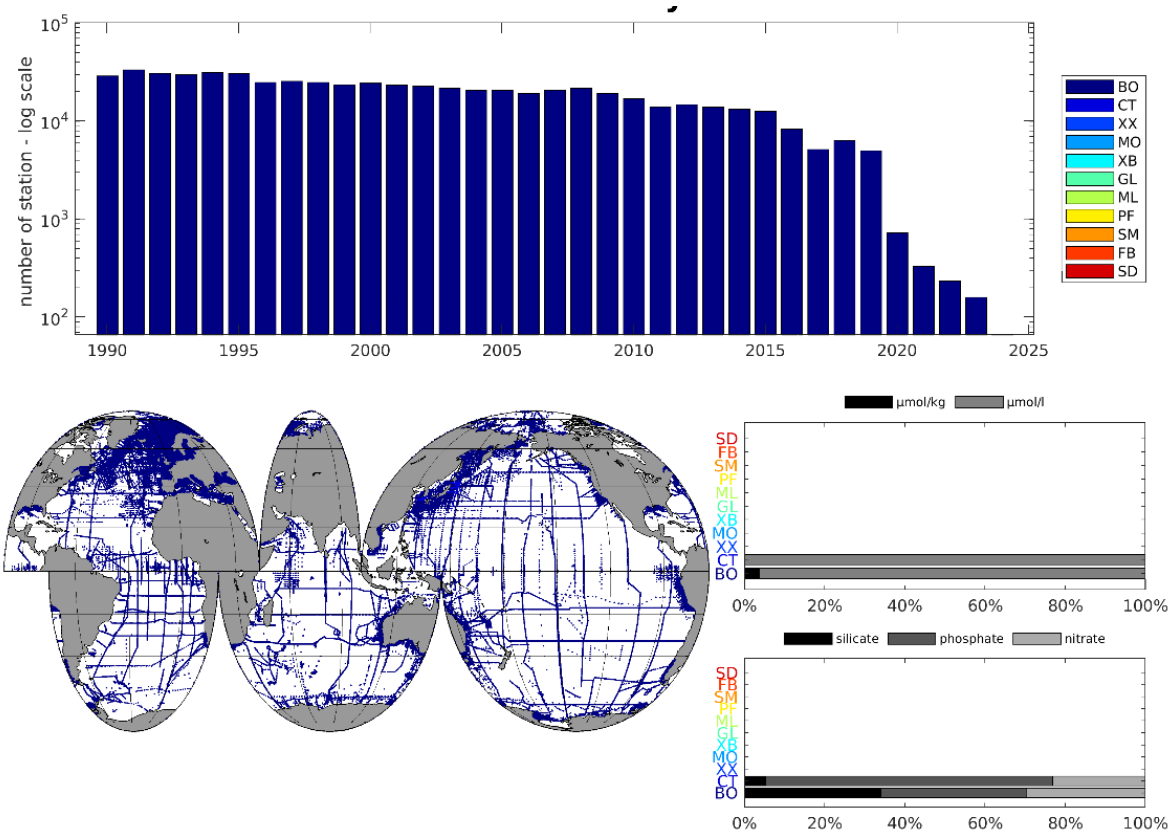

Figure 3. *Temporal (top) and spatial (bottom, left) distribution of nutrients stations including at least one measurement flagged as "good data" (QC flag equals 1 or 2), per instrument type during the period Jan 1990 – Jan 2021. Proportion of each variable of nutrients displayed by instrument (bottom, right). CT: CTD; BO: Bottle; GL: Glider; SM: Sea Mammals; ML: Mini Loggers; FB: Ferry Boxes; MO: Moorings; SD: Sail Drones; XB: XBT; XX: Unknown; PF: (Profiling) Floats.*

Table 3 *Distribution of stations per depth interval and Copernicus Marine Service region.*

NUTRIENTS	Copernicus Marine Service Region						
	AR	**BO**	**BS**	**IR**	**GL**	**MO**	**NO**
0 - 500 dbar	88.03%	99.85%	98.36%	76.61%	79.57%	88.40%	89.92%
500 - 1000 dbar	5.54%	0.15%	0.91%	6.73%	6.62%	6.04%	4.27%
1000 – 1500 dbar	2.82%	0.00%	0.41%	4.29%	3.63%	2.54%	2.23%
1500 – 2000 dbar	1.55%	0.00%	0.23%	3.38%	2.56%	1.30%	1.40%
2000 – bottom	2.05%	0.00%	0.09%	9.00%	7.62%	1.72%	2.18%
TOTAL	1958113	2227430	191450	769768	8212403	308174	2326692

References

Hernandez, F., et al., 2018: Measuring performances, skill and accuracy in operational oceanography: New challenges and approaches. In "New Frontiers in Operational Oceanography", E. Chassignet, A. Pascual, J. Tintoré, and J. Verron, Eds. GODAE OceanView, 759-796, doi:10.17125/gov2018.ch29.

Jaccard, P., et al., 2018: Quality Information Document for Global Ocean Reprocessed In-Situ Observations of Biogeochemical Products. doi: 10.13155/54846