Product Information Document (PIDoc)

SeaDataCloud Temperature and Salinity Historical Data Collection for the North Atlantic Ocean (Version 2)

SDC_NAT_DATA_TS_V2

HORIZON **2020**

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SDC_NAT_DATA_TS_V2

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SeaDataCloud Temperature and Salinity Historical Data Collection for the North Atlantic Ocean (Version 2)

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Short description

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History

Version	Authors	Date	Comments
V1	C. Coatanoan	14/01/2020	First version of the PIDoc

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Abstract

The SeaDataCloud Temperature and Salinity Historical Data Collection V2 for the North Atlantic Ocean includes open access in situ data on temperature and salinity of water column in the North Atlantic Ocean (from 10°N to 62°N for the east part and including the Labrador Sea for the west part) for period 1890 – 2019. The collection version 2 is a merge between the version 1 from which the delated profiles in the CDI portal were removed (list from Maris) and the collection of the new and updated data integrated after the version 1. The data of the version 1 were retrieved from the SeaDataNet infrastructure at the end of 2017 and the new and updated data were retrieved at the summer 2019 for the data integrated after the 30/10/2017. The dataset format is ODV binary collections [1]. The quality control of the data has been performed with the help of ODV software. Data Quality Flags have been revised and set up using recommended QC procedures defined during SeaDataNet2 in conjunction with the visual expert check.

1. General description of the data collection

The historical data collection V2 of the North Atlantic Ocean contains Temperature and Salinity observations between 10°N and 62°N of latitude for the east part, and including data into the Labrador Sea till 70°N and till gulf of Mexico for the west part. The spatial distribution and the data density maps of Temperature and Salinity observations from the entire data collection are shown in Figure 1(a) and (b). Data distribution maps show a good geographical spread with the best coverage on the eastern part of the domain, mainly close to the areas off Ireland and in the Bay of Biscay (Figure 1(b)). This higher coverage on the east part is also due to a large number of thermosalinograph measurements (Figure 2), which are off the coast of Ireland and represent almost 41.28% of the total dataset. The North Atlantic Ocean historical data set contains just over 10119755 stations for the period 1890-2019. The data collection contains 12327 cruises.

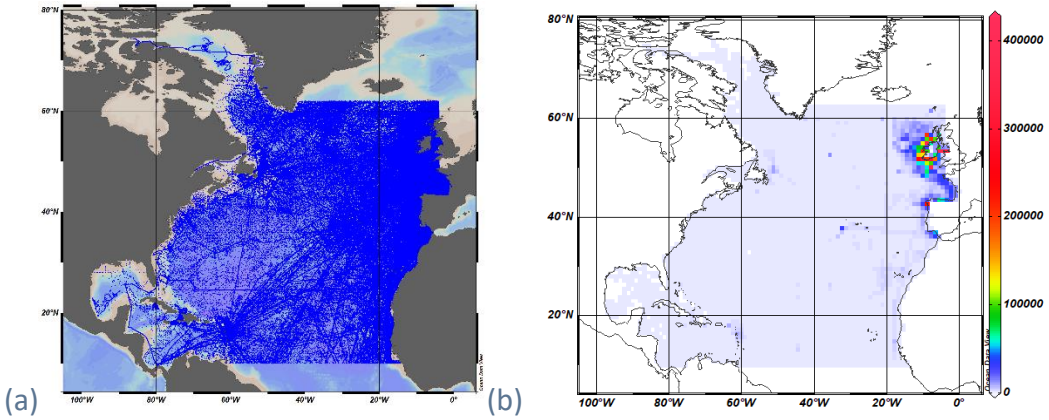


Figure 1. TS stations collection for the North Atlantic Ocean: (a) data distribution map; (b) data density plot showing where most values have been sampled.

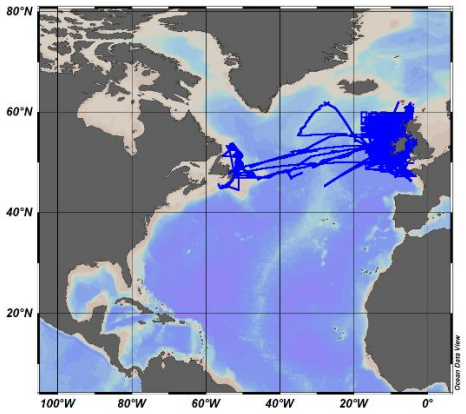


Figure 2. Thermosalinograph distribution from the Marine Institute data center (4177186 stations).

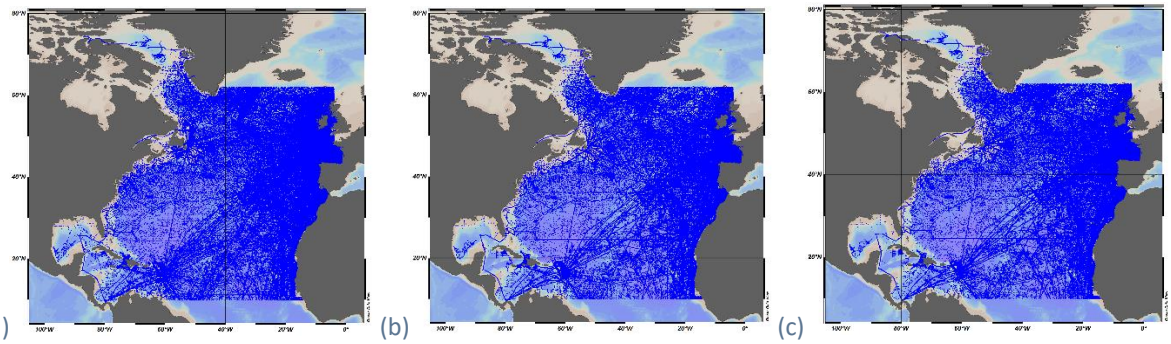
Table 1 shows in details the number of observed stations and its repartition in Temperature stations and Salinity stations and stations that sampled both T and S. Some profiles have Salinity measurements and no Temperature measurements; 35511 stations have no

Temperature measurement. Only 44.79% of the observations have the couple TS that means that most of the data have only temperature observations (most of TSG observations).

PAR	#stations	%
All	10119755	
T	10084244	99.65%
S	4544529	44.90%
TS	4532864	44.79%
Z	10114333	

Table 1. Synthesis table with data statistics

Figure 3 shows the distribution map by parameter (temperature, salinity and couple temperature/salinity). The stations with only temperature data are mainly in the northeast part of the map.



(a) (b) (c)

Figure 3. Spatial distribution of: (a) temperature observations; (b) salinity observations; (c) temperature and salinity observations.

Temporal data distribution is shown in Figure 4a. The distribution in time is poor for the first 80 years, it increases somewhat after 1980 until around end of 1990s where it further increases. In the latest years there is a decrease in data which is caused by a natural time lag between sampling and until data becomes available in the SeaDataCloud system. Figure 4b shows the seasonal distribution of data. Most of the data have been collected during spring, summer and autumn, with a larger peak during summer.

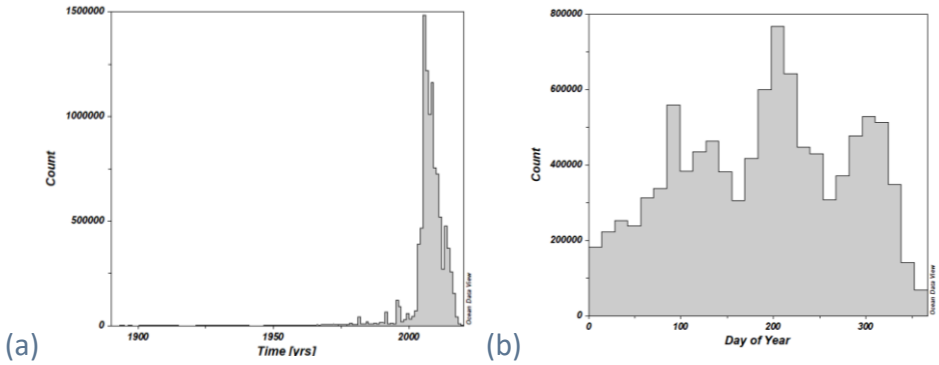


Figure 4. Time distribution for the period 1890-2019 (a), and seasonal distribution over the year (b) for the entire data set.

Splitting the temporal distribution by parameter (Figure 5) shows a sampling of salinity data mainly during the summer whereas the temperature data sampling shows 3 picks (spring, summer, autumn) with the big one in summer.

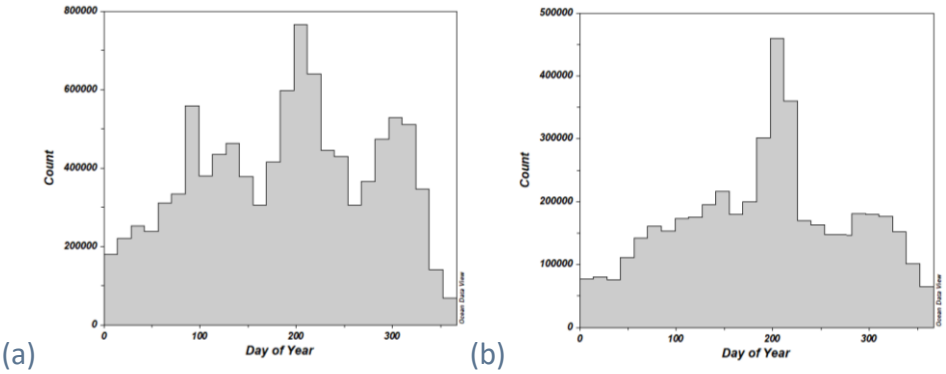


Figure 5. Seasonal distribution for temperature (a) and salinity (b).

In terms of instrument types, 108 versions have been detected in the data collection for the profiles for a total of 10005743 (missing information for 114012 stations). Some versions are very similar and differ by only one sensor.

This table shows in details the different versions of instrument type/gear and their number of stations.

thermosalinographs	5997127
water temperature sensor	786658
dissolved gas sensors;fluorometers;NAVSTAR Global Positioning System receivers;optical backscatter sensors;salinity sensor;thermosalinographs;water temperature sensor	482529
CTD;dissolved gas sensors;fluorometers;salinity sensor;water temperature sensor	426254
continuous water samplers	355722
dissolved gas sensors;fluorometers;NAVSTAR Global Positioning System receivers;salinity sensor;thermosalinographs;water temperature sensor	334581
thermistor chains;water temperature sensor	295272

CTD;fluorometers;NAVSTAR Global Positioning System receivers;salinity sensor;water temperature sensor	179813
fluorometers;salinity sensor;thermosalinographs;transmissometers;water temperature sensor	156846
fluorometers;NAVSTAR Global Positioning System receivers;optical backscatter sensors;salinity sensor;thermosalinographs;water temperature sensor	155002
fluorometers;thermosalinographs	117224
salinity sensor;water temperature sensor	89692
thermosalinographs;water temperature sensor	86615
discrete water samplers	82378
Differential Global Positioning System receivers;fluorometers;salinity sensor;thermosalinographs;water temperature sensor	81846
Expendable bathythermographs	51098
CTD	46137
bathythermographs	42586
Differential Global Positioning System receivers;fluorometers;NAVSTAR Global Positioning System receivers;salinity sensor;transmissometers;water temperature sensor	29246
CTD;salinity sensor;water temperature sensor	27227
CTD;fluorometers;NAVSTAR Global Positioning System receivers;salinity sensor;single-beam echosounders;water temperature sensor	23234
fluorometers;salinity sensor;transmissometers;water temperature sensor	19902
fluorometers;salinity sensor;water temperature sensor	17119
CTD;discrete water samplers	14484
Differential Global Positioning System receivers;fluorometers;salinity sensor;water temperature sensor	13890
anemometers;fluorometers;meteorological packages;NAVSTAR Global Positioning System receivers;platform attitude sensors;radiometers;salinity sensor;single-beam echosounders;thermosalinographs;transmissometers;water temperature sensor	13722
Mechanical bathythermographs	12636
flow meters;fluorometers;salinity sensor;thermosalinographs;transmissometers;water temperature sensor	9572
dissolved gas sensors;salinity sensor;water temperature sensor	8127
autoanalysers;colorimeters;fluorometers;NAVSTAR Global Positioning System receivers;salinity sensor;thermosalinographs;transmissometers;water temperature sensor	4686
CTD;dissolved gas sensors;salinity sensor;water temperature sensor	4587
autoanalysers;colorimeters;dissolved gas sensors;fluorometers;metal analysers;NAVSTAR Global Positioning System receivers;salinity sensor;thermosalinographs;transmissometers;water temperature sensor	4547
flow meters;fluorometers;salinity sensor;thermosalinographs;water temperature sensor	3589

CTD;dissolved gas sensors;fluorometers;salinity sensor;transmissometers;water temperature sensor	3464
autoanalysers;colorimeters;salinometers;unknown	3316
dissolved gas sensors;fluorometers;salinity sensor;water temperature sensor	2705
autoanalysers;colorimeters;fluorometers;metal analysers;NAVSTAR Global Positioning System receivers;salinity sensor;thermosalinographs;transmissometers;water temperature sensor	2627
CTD;dissolved gas sensors;fluorometers;radiometers;salinity sensor;transmissometers;water temperature sensor	1978
salinity sensor	1775
ADVs and turbulence probes;fluorometers;salinity sensor;water temperature sensor	1748
fluorometers;NAVSTAR Global Positioning System receivers;salinity sensor;thermosalinographs;transmissometers;water temperature sensor	1572
autoanalysers;colorimeters	1359
CTD;dissolved gas sensors;fluorometers;in-situ particle sizers;radiometers;salinity sensor;transmissometers;water temperature sensor	1198
CTD;fluorometers;salinity sensor;transmissometers;water temperature sensor	1014
platform attitude sensors;water temperature sensor	814
autoanalysers;colorimeters;Decca Navigator System main chain receivers;fluorometers;salinity sensor;thermosalinographs;transmissometers;water temperature sensor	774
CTD;dissolved gas sensors;salinity sensor;transmissometers;water temperature sensor	726
CTD;fluorometers;optical backscatter sensors;salinity sensor;water temperature sensor	621
ADVs and turbulence probes;salinity sensor;water temperature sensor	598
bathythermographs;water temperature sensor	498
CTD;fluorometers;salinity sensor;water temperature sensor	460
thermistor chains	445
CTD;dissolved gas sensors;fluorometers;optical backscatter sensors;salinity sensor;transmissometers;water temperature sensor	346
CTD;pH sensors;Physical oceanographic models;salinometers;sieves and filters;titrators;water temperature sensor	321
CTD;dissolved gas sensors;fluorometers;optical backscatter sensors;radiometers;salinity sensor;transmissometers;water pressure sensors;water temperature sensor	293
CTD;dissolved gas sensors;fluorometers;radiometers;salinity sensor;transmissometers;water pressure sensors;water temperature sensor	286
CTD;dissolved gas sensors;fluorometers;optical backscatter sensors;radiometers;salinity sensor;transmissometers;water temperature sensor	272
altimeters;CTD;dissolved gas sensors;fluorometers;optical backscatter sensors;salinity sensor;transmissometers;water temperature sensor	229
autoanalysers;salinometers;spectrophotometers;unknown	195

CTD;dissolved gas sensors;fluorometers;salinity sensor;transmissometers;water pressure sensors;water temperature sensor	179
altimeters;CTD;dissolved gas sensors;fluorometers;optical backscatter sensors;salinity sensor;transmissometers;water pressure sensors;water temperature sensor	170
CTD;dissolved gas sensors;fluorometers;nutrient analysers;radiometers;salinity sensor;transmissometers;water temperature sensor	143
CTD;discrete water samplers;fluorometers;optical backscatter sensors;salinity sensor;water pressure sensors;water temperature sensor	141
altimeters;CTD;dissolved gas sensors;fluorometers;optical backscatter sensors;radiometers;salinity sensor;transmissometers;water temperature sensor	139
CTD;fluorometers;radiometers;salinity sensor;transmissometers;water temperature sensor	136
CTD;fluorometers;optical backscatter sensors;salinity sensor;water pressure sensors;water temperature sensor	99
altimeters;CTD;dissolved gas sensors;fluorometers;salinity sensor;transmissometers;water temperature sensor	92
expendable CTDs	84
CTD;dissolved gas sensors;fluorometers;optical backscatter sensors;salinity sensor;transmissometers;water pressure sensors;water temperature sensor	78
unknown	75
dissolved gas sensors;fluorometers;salinity sensor;transmissometers;water temperature sensor	73
altimeters;CTD;dissolved gas sensors;fluorometers;radiometers;salinity sensor;transmissometers;water temperature sensor	67
altimeters;dissolved gas sensors;fluorometers;optical backscatter sensors;radiometers;salinity sensor;transmissometers;water pressure sensors;water temperature sensor	65
atmospheric gas analysers;meteorological packages;salinity sensor;thermosalinographs;water body temperature sensor;water temperature sensor	59
altimeters;CTD;dissolved gas sensors;fluorometers;optical backscatter sensors;radiometers;salinity sensor;transmissometers;water pressure sensors;water temperature sensor	56
CTD;fluorometers;radiometers;salinity sensor;transmissometers;water pressure sensors;water temperature sensor	55
CTD;dissolved gas sensors;fluorometers;optical backscatter sensors;salinity sensor;water temperature sensor	42
CTD;radiometers;salinity sensor;transmissometers;water temperature sensor	40
dissolved gas sensors;fluorometers;optical backscatter sensors;radiometers;salinity sensor;transmissometers;water pressure sensors;water temperature sensor	40
CTD;dissolved gas sensors;fluorometers;radiometers;salinity sensor;water temperature sensor	38
CTD;dissolved gas sensors;fluorometers;radiometers;salinity sensor;water pressure sensors;water temperature sensor	35
expendable CTDs;salinity sensor;water temperature sensor	32
CTD;fluorometers;optical backscatter sensors;salinity sensor;transmissometers;water temperature sensor	29

altimeters;CTD;fluorometers;optical backscatter sensors;salinity sensor;transmissometers;water temperature sensor	29
CTD;dissolved gas sensors;fluorometers;salinity sensor;water pressure sensors;water temperature sensor	23
CTD;fluorometers;salinity sensor;water pressure sensors;water temperature sensor	19
CTD;dissolved gas sensors;fluorometers;optical backscatter sensors;radiometers;salinity sensor;water temperature sensor	16
CTD;fluorometers;radiometers;salinity sensor;water pressure sensors;water temperature sensor	15
salinity sensor;satellite tracking system;water temperature sensor	15
CTD;salinity sensor;transmissometers;water pressure sensors;water temperature sensor	14
CTD;dissolved gas sensors;radiometers;salinity sensor;transmissometers;water temperature sensor	11
autoanalysers;bench fluorometers;colorimeters;salinometers;unknown	7
CTD;transmissometers	6
altimeters;CTD;dissolved gas sensors;salinity sensor;water pressure sensors;water temperature sensor	6
autoanalysers;colorimeters;CTD;salinity sensor;salinometers;titrators;water temperature sensor	6
dissolved gas sensors;fluorometers;optical backscatter sensors;salinity sensor;transmissometers;water pressure sensors;water temperature sensor	5
dissolved gas sensors;fluorometers;radiometers;salinity sensor;water pressure sensors;water temperature sensor	4
sound velocity sensors;water temperature sensor	4
CTD;fluorometers;salinity sensor;transmissometers;water pressure sensors;water temperature sensor	3
CTD;discrete water samplers;transmissometers	2
salinometers	2
CTD;salinity sensor;water pressure sensors;water temperature sensor	1
altimeters;CTD;dissolved gas sensors;fluorometers;salinity sensor;transmissometers;water pressure sensors;water temperature sensor	1
autoanalysers;colorimeters;CTD;salinity sensor;salinometers;water temperature sensor	1
autoanalysers;colorimeters;salinometers;titrators;unknown	1
autoanalysers;colorimeters;salinometers;titrators;unknown;water temperature sensor	1
autoanalysers;colorimeters;salinometers;unknown;water temperature sensor	1
transmissometers	1

Just looking at the numbers of data by type of instruments and by grouping certain main categories, the thermosalinographs and CTD are the most representative (Figure 6).

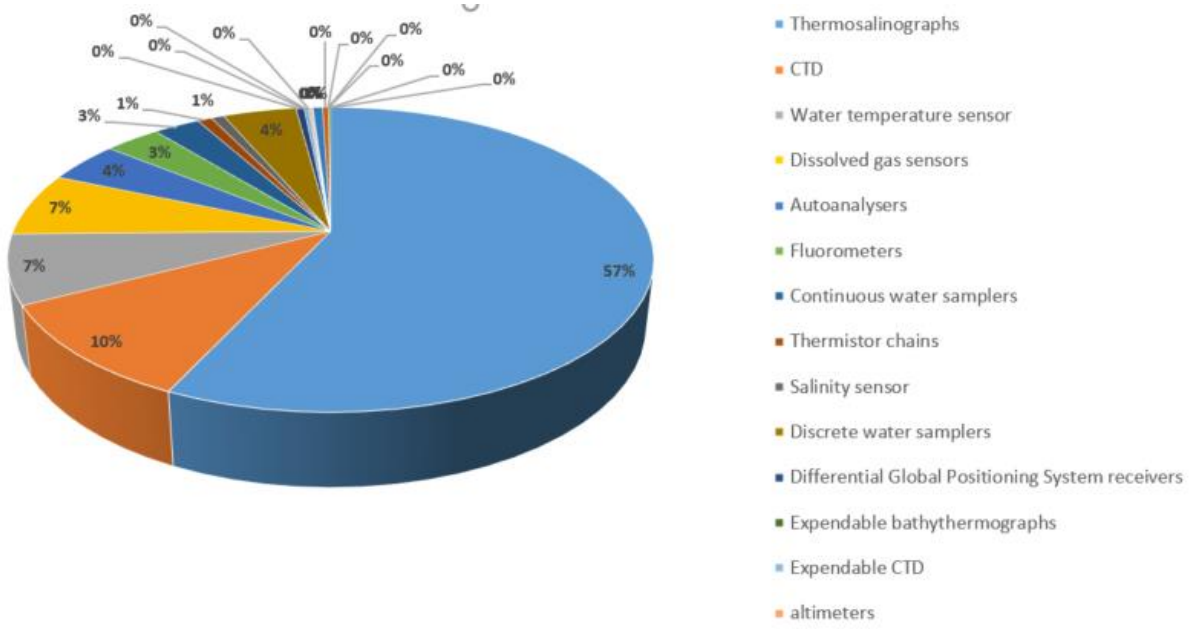


Figure 6. Pie chart for the instrument type sorted by main categories.

2. Quality Control Procedure

After a general description of the historical data set a visual control of all observations allowed to assess their quality and to identify the principal criticalities for possible future applications and users. This quality control has only been performed on the data collection that has been extracted for the new and updated profiles, submitted after the date where the version 1 had been extracted.

The large variability of both salinity and temperature for the North Atlantic Ocean makes sometimes the quality control difficult, thus the data set has been split into sub-sets for the QC visualization, either in time or in space (sub-regions) or both combined, with a smaller variation than the whole dataset. The data set has been split into 6 sub-regions for the QC visualization (Figure 7) following the water masses characteristics, with similar hydrodynamic. In some sub-region, a new selection has been applied to take into account some time periods to decrease the number of stations to quality check.

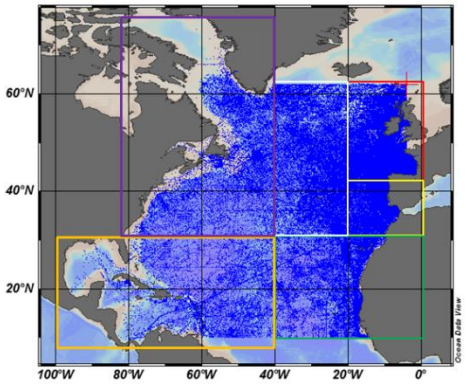


Figure 7. Regional subsets to individually check the QC on the data.

Another data selection by EDMO_CODE had also been used to focus on some anomalies (the same QC procedure has been applied per data centre to detect their eventual systematic errors and data anomalies).

Considering the data, the density was calculated and plotted to find unstable profiles. Displaying the θS plot with ispoycnals can also help to identify problems with the data. Visual inspection was the most used practice to identify the outliers, spike, unstable profiles and stations on land. The same procedure was applied for all data, considering only the quality flag 0, 1 and 2; since it is well known that quality controlled data still can contain errors. Some checks concerning the QF on the missing data has also been investigated.

Checking bottom water is a bit easier because it is not affected by the seasonal temperature cycles and it has stable salinity concentrations.

The quality control work followed the best practices that were defined during the project SeaDataNet 2:

- **Checks of the data coverage, by sub-region when necessary** (distribution for T, S, TS couples), by time periods, by layers (distinction between surface, intermediate and bottom layers);

- TS scatter plots of the entire dataset: T versus Z, S versus Z, θS diagram with isopycnal levels for all the QF<3 (check the outliers and change the QF to 4); sometimes the outliers were the missing data values with not appropriate QF;
- By sub-region, scatter plot of observations with QF=1 (good) with a secondary plot showing the density;
- By sub-region, scatter plot of observations with QF=2 (probably good) with a secondary plot showing the density;
- Scatter plot observations with QF=0 (no quality check): only change the bad data with QF4;
- Identification of stations falling on land;
- Identification of stations having unreal depth (depth values<0);

The most useful and powerful quality control used was visual inspection of subsets of data in ODV to discover spikes, outliers, unstable profiles and stations on land.

ODV is also used to check with the surface plots (on depth or potential density anomaly), the quality of the data. The distribution of the data on a defined depth or density allows showing point with strange value (Figure 8 and Figure 9).

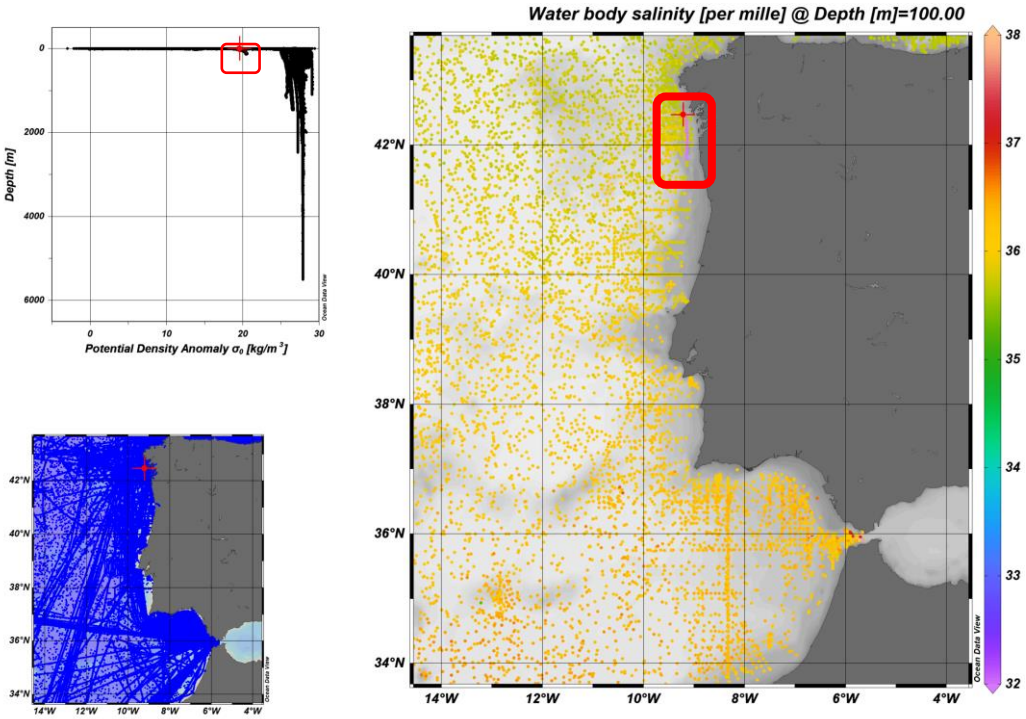


Figure 8. Salinity distribution (QC 0-1-2) on the depth 100m before correction.

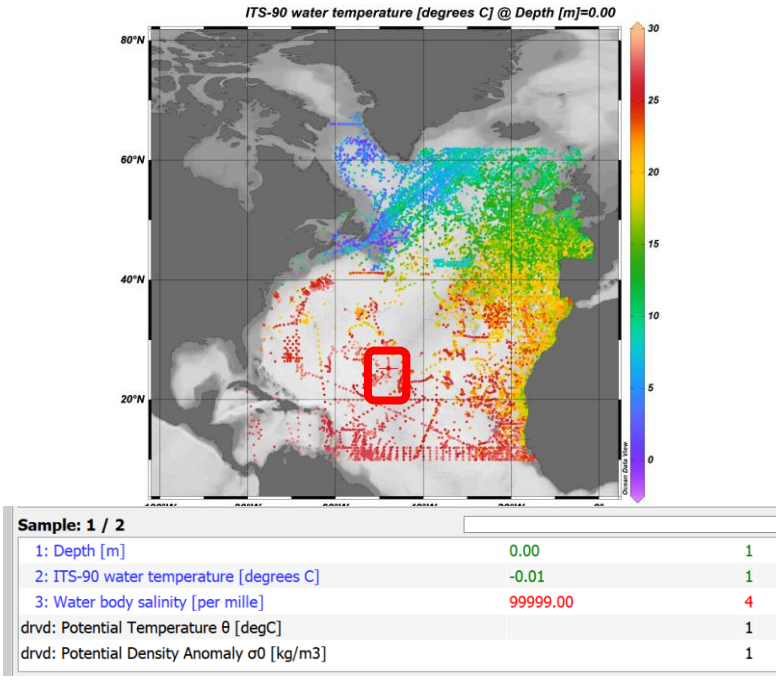


Figure 9. On top, Temperature distribution at the surface and on bottom, corresponding bad temperature for the station (plus symbol in the red square) having a wrong temperature value.

3. Quality assessment results

All data have been quality controlled according to the criteria defined in chapter 2. This procedure was applied only on the data collection corresponding to the new and updated data collection (2575292 stations) since the V1 was already quality controlled. 2741 stations from IMR have been removed due to the problem of data quality following a submission made by Emodnet Chemistry (datasetcreation : 20171222). 226 stations have been removed due to duplicates and 10 stations were on land. 4 stations from profiling float have been removed due to wrong position (in the Bay of Biscay instead of Mediterranean Sea).

On the remaining 2572311 stations Figure 10, 29085 salinity values and 15622 temperature values were flagged as suspicious/bad, flag 3 and 4. This is about 0.07% of the total amount of salinity values and 0.026% of the total amount of temperature values, further details can be seen below in Table 2 and Table 3.

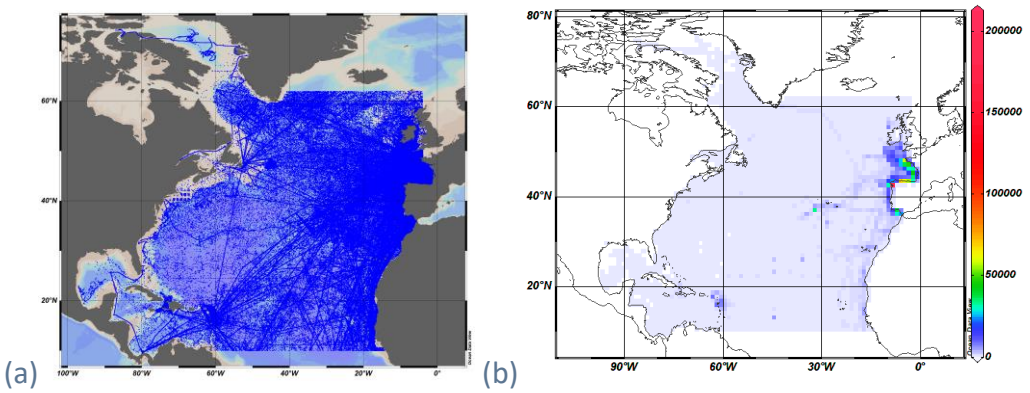


Figure 10. TS stations collection (new and updated) for the North Atlantic Ocean: (a) data distribution map; (b) data density plot showing where most values have been sampled.

The suspicious values consist mainly of spikes, outliers and unstable density profiles, but there are also some other problems:

- Some profiles appear to be more salty, due to wrong position.

- Few values have negative depths (Argo profiles) or wrong position.

- Some measurements contain values 0; corresponding certainly of missing values (the QC 1 has been updated to 4).

- Some salinity measurements contain QF0 but it is due to a wrong QC mix between psal and ssal measurements during aggregation. Those data have been checked to determine wrong value (QF changed to 4 in this case) but QF0 has been kept and will be used to produce the climatology.

- Few measurements appear to be “on land”, or close to rivers.

The list of the QC changes will be included in the quality control feedback that will be sent to the different SeaDataCloud partners.

PAR	TOT	QF0	QF1	QF2	QF3-9
T	59089121	6079	57823663	106102	1153277
%		0.01	97.85	0.18	1.95
S	41256336	13464	40054306	187076	1001490
%		0.03	97.08	0.45	2.43

Table 2. Quality Flags statistics (measurements) for the initial data collection (without QC procedure) but after removing duplicates, some IMR data and stations with wrong position.

PAR	TOT	QF0	QF1	QF2	QF3-9
T	59088767	6078	57807800	105990	1168902
%		0.01	97.83	0.18	1.98
S	41255982	7718	40030772	186917	1030575
%		0.02	97.03	0.45	2.50

Table 3. Quality Flags statistics (measurements) after the quality check procedure.

The following figures show the distribution of the parameters versus depth. Figure 11 shows the temperature versus depth scatter plots before quality control for all the QF, for the QF1 and QF0.

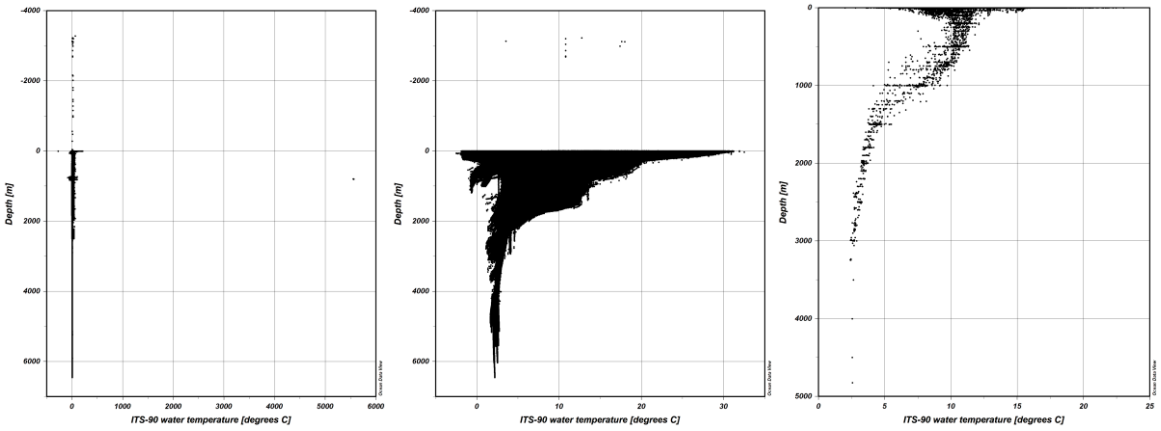


Figure 11. Temperature versus depth scatter plot of the North Atlantic data collection covering the time period 1890-2019: (a) all Temperature data Quality Flags; (b) QF=1; (c) QF = 0 (no quality control).

Figure 12 shows the salinity versus scatter plots before quality control for all the QF, for the QF1 and QF0.

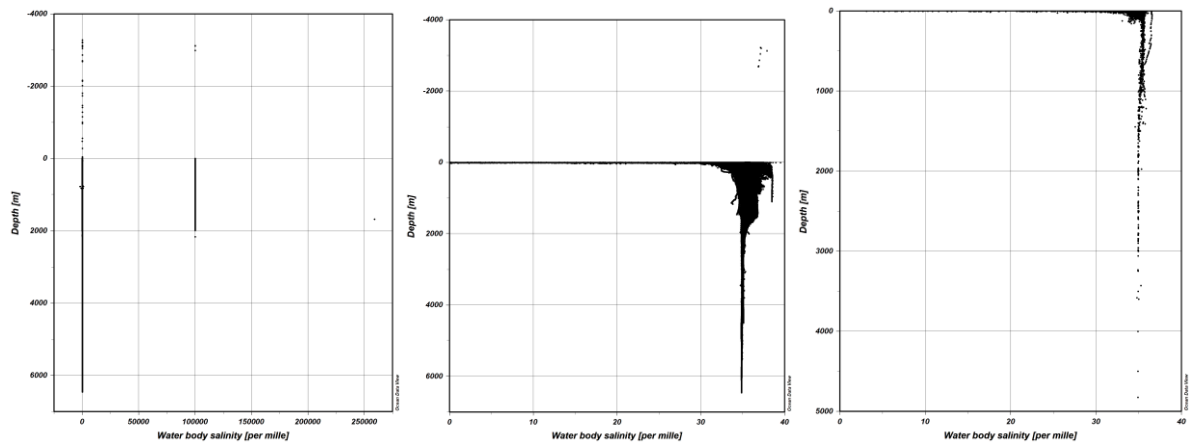


Figure 12. Salinity versus depth scatter plot of the North Atlantic data collection covering the time period 1890-2019: (a) all Salinity data Quality Flags; (b) QF=1; (c) QF = 0 (no quality control).

Plots in Figure 11 and Figure 12 show that among data with good quality flag (QF=1) there are still some wrong values (negative depth) which correspond to QF=3 on the depth. Some obvious outliers were easy to detect and remove from the good dataset. Figure 13 displays the parameters versus depth of good quality data after QC analysis. Figure 14 presents the θS diagram plots and Figure 15 shows the vertical distribution of the potential density anomaly before and after the quality control procedure.

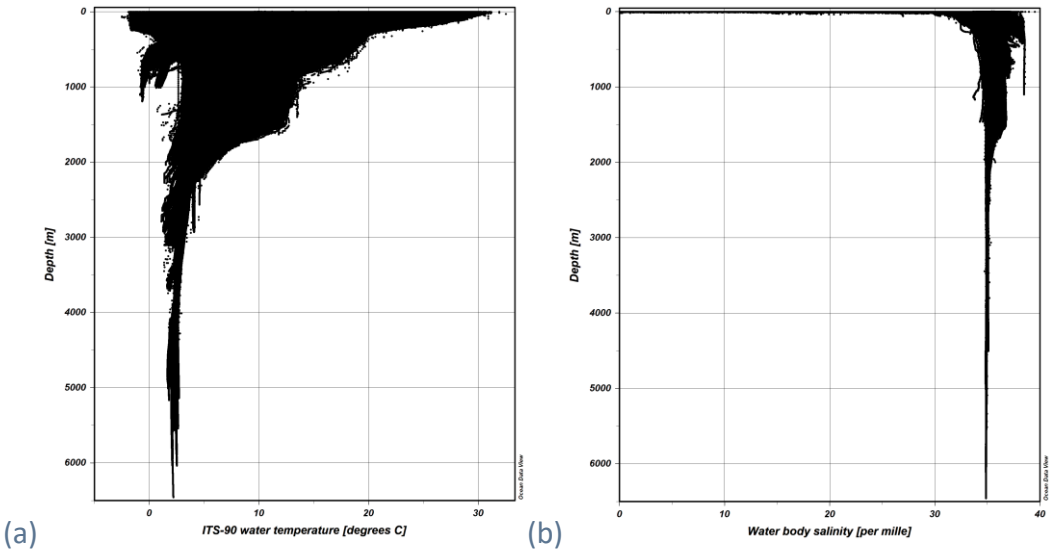


Figure 13. North Atlantic data collection (1890-2019) considering only data with QF = 1 (good): (a) Temperature versus depth; (b) Salinity versus depth.

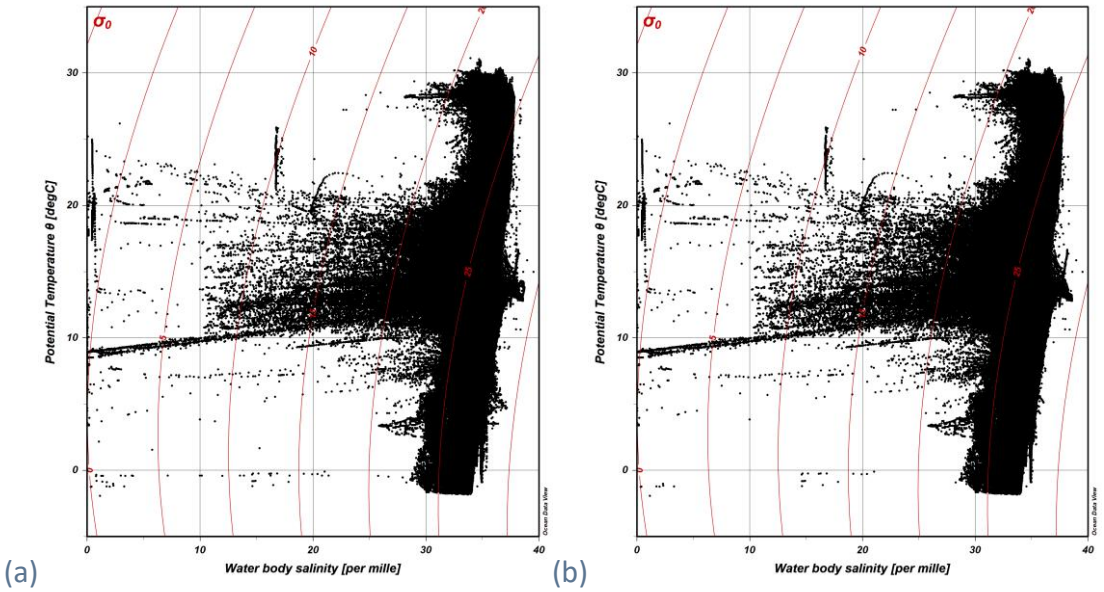


Figure 14. North Atlantic data collection: θS diagram (QF=1) showing data before (a) and after (b) quality control.

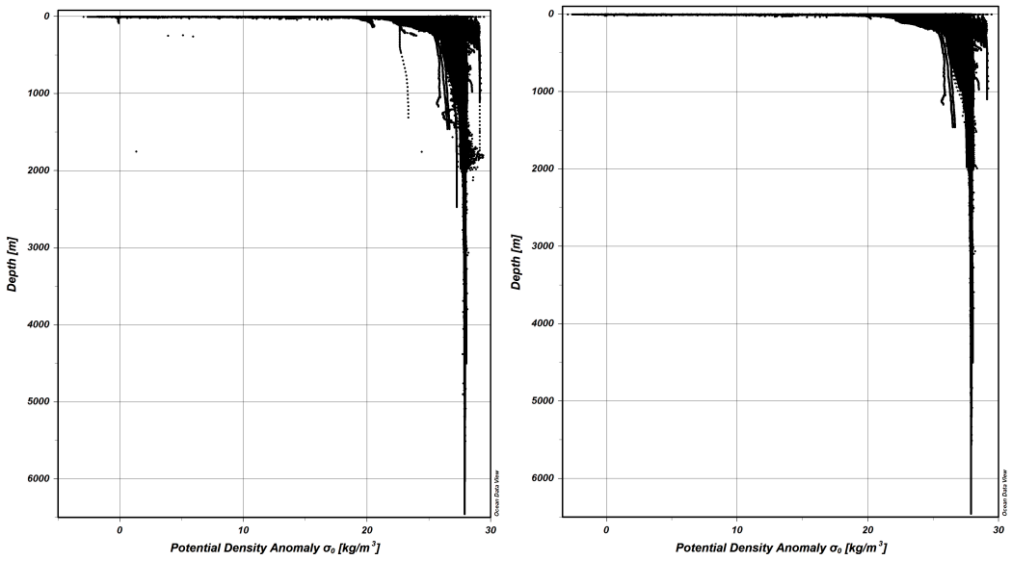


Figure 15. North Atlantic data collection considering only data with QF = 1 (good). Potential Density Anomaly: (a) before correction and (b) after correction.

The final version integrates the version 1 minus the profiles that have been removed from the CDI portal and the version of the new and updated data. In the Table 4, the statistic values are presented for the final quality controlled version :

PAR	TOT	QF0	QF1	QF2	QF3-9
T	88659080	35769	87156029	107040	1360242
%		0.04	98.30	0.12	1.54
S	61210089	21313	59652354	191032	1345390
%		0.03	97.45	0.32	2.20

Table 4. Quality Flags statistics (measurements) after the quality check procedure for the final version V2.

4. Technical Specifications

Product Format

Ocean Data View (ODV) collection.

Data Policy

No limitation on usage; however for data access the registration is required at http://www.marine-id.org/.

Product Usability

The collection contains unique large array of QC-ed data on Temperature and Salinity for the North Atlantic Ocean for periods 1890-2019. This dataset can be used as to support the general oceanographic studies, such as investigation of variability of physical properties as well as applications, such as circulation models. For the north/northeast limits, it will be useful to take into account the North Sea and Artic collections for better investigations on the water masses circulation on those oceanic areas.

Whenever SDC_NAT_DATA_TS_V2 product is used, this PIDoc should be cited in any publication. We also ask users to remember that hard-working scientists made these measurements, often under severe conditions. Further, the data providers normally possess insight on the quality and context of the data not always shared with the SeaDataCloud team. Hence, inviting data providers and product leaders to collaborate in scientific investigations that depend on their data and data products is considered good and fair practice. Importantly, this will promote further sharing of data and will be beneficial to science.

Changes since previous version

The previous version of the product (SDC_V1) was released in the end of February 2018 in the framework of the SeaDataNet2 project and it is available at SEXTANT Catalogue (http://sextant.ifremer.fr/en/web/seadatanet) under the name “North Atlantic Ocean - Temperature and Salinity Historical Data Collection SeaDataCloud V1” (https://doi.org/10.12770/970bb3ba-aaf6-4066-9656-87c85da41dbb).

Comparing the SDC_NAT_DATA_TS_V1 to the SDC_NAT_DATA_TS_V2 collection over the same spatial domain in Table 4 it shows a small data increase (+11.3%), mainly for salinity measurements (27% of increase).

#stations	Total	T	S	TS
SDC_V1	9091773	9074128	3572113	3568979
SDC_V2	10119755	10084244	4544529	4532864
% of increase	+11.3%	+11.13%	+27.22%	+27.01%

Table 4. Data statistics of previous (SDC_V1) and current (SDC_V2) version of the North Atlantic Ocean historical data collections, in term of stations.

Annex 1 - QC Best Practices

- The basic QC analysis steps applied during SeaDataNet2 Project using ODV were:
- **Data coverage**;
- **Data distribution maps** per Temperature, Salinity and TS couples;
- **Data density maps** (domain binning);
- **Time coverage and time distribution** → histograms with annual, seasonal and monthly data distribution;
- TS scatter plots of the entire dataset;
- Scatter plot of observations with QF=1 (good) and QF=2 (probably good);
- Scatter plot observations with QF=0 (no quality check);
- **Gross range check** to detect observations with temperature and salinity out of reasonable values;
- Visual control of scatter-plots to identify wrong profiles (outliers);
- Identification of stations falling on land;
- Identification of stations having unreal depth;
- Identification of wrong or missing data;
- Stability check on density

Additional checks are advisable per specific:

- **areas** with similar hydrodynamic characteristics;
- **layers** (surface, intermediate, bottom);
- **time periods** (decades, or specific periods i.e. Eastern Mediterranean Transient, Western Mediterranean Transition, Norther Ionian Reversal);
- **Instrument type** → consistency issue of historical data;

Duplicate Check is another important step when performing SDC data integration with external data sources for climatologies and new data products generation.

Annex 2 – Data providers

Edmo code	ORIGINATOR	CDIs & Stations
396	Marine Institute (396)	5040953
486	IFREMER / IDM / SISMER - Scientific Information Systems for the SEA (486)	1326325
48	Proudman Oceanographic Laboratory (48)	1078000
353	IEO/ Spanish Oceanographic Institute (353)	653263
2133	Proudman Oceanographic Laboratory (2133)	359273
2424	National Oceanography Centre, Liverpool (2424)	316321
540	Shom (540)	182715
2489	Marine Technology Unit. Mediterranean Marine and Environmental Research Centre (2489)	164921
44	Scottish Association for Marine Science (44)	121513
47	Plymouth Marine Laboratory (47)	92020
43	British Oceanographic Data Centre (43)	88522
2091	Scottish Office Agriculture and Fisheries Department - Aberdeen Marine Laboratory (2091)	63961
511	UNIVERSITE DE PARIS VI / GEOSCIENCES AZUR - SITE DE VILLEFRANCHE / OOV (511)	60568
6	University of East Anglia, School of Environmental Sciences (6)	56197
20	University of Wales, School of Ocean Sciences (20)	52275
2002	Southampton Oceanography Centre (2002)	40450
931	Odessa Branch of SOI (State Oceanographic Institute) (931)	38821
353	IEO/Spanish Oceanographic Institute (353)	37847
1054	IFREMER (1054)	34883
17	National Oceanography Centre, Southampton (17)	33738
1850	Federal Maritime and Hydrographic Agency (1850)	28566
2	University of Cambridge Department of Earth Sciences (2)	16044
440	IRD /CENTRE DE BRETAGNE (440)	14409
1802	University of Southampton School of Ocean and Earth Science (1802)	14126
2561	National Marine Facilities Sea Systems (2561)	13785
2489	CSIC-UTM/ Marine Technology Unit (2489)	13531
919	Polar Scientific Research Institute of Fishery and Oceanography (919)	9773
682	Atlantic Scientific Research Institute for Marine Fishery and Oceanography (682)	9363
2117	Institute of Oceanographic Sciences Deacon Laboratory (2117)	7457
490	Laboratory of Oceanography of Villefranche (LOV) / IMEV (490)	6913
1051	UNKNOWN (1051)	6833
1160	Institute for Marine Science (IFM), University of Kiel (1160)	6389
2118	Institute of Oceanographic Sciences Wormley Laboratory (2118)	4899
38	Fisheries Research Services, Aberdeen Marine Laboratory (38)	4754

837	Laboratory of Physical Oceanography/ UNIVERSITE DE BRETAGNE OCCIDENTALE (UBO) (837)	4670
2134	Institute of Oceanographic Sciences, Bidston Laboratory (2134)	4431
900	Administration Of Fish Searching And Research Fleet for the Western Basin (900)	4163
2530	Scottish Marine Biological Association (2530)	4062
541	IFREMER / EMH-DEPARTEMENT ECOLOGIE ET MODELES POUR L'HALIEUTIQUE (541)	3895
13	University of Plymouth, Institute of Marine Studies (13)	3845
727	Marine Hydrophysical Institute (727)	3636
494	Laboratory of Oceanography and Climate : Experiments and numerical Approaches - UMR 7159 (494)	3331
1351	Institute of Marine Research (1351)	2738
630	NIOZ Royal Netherlands Institute for Sea Research (630)	2560
487	LABORATORY of PHYSICAL OCEANOGRAPHY (LPO) UMR 6523 CNRS-IFREMER-IRD-UBO (487)	2508
4614	ERIC Euro-Argo (4614)	2438
684	Arctic and Antarctic Research Institute, Roshydromet (Saint-Petersburg) (684)	2287
2135	Marine Scotland Science (2135)	2244
590	IHPT, Hydrographic Institute (590)	2184
2092	Department of Agriculture and Fisheries for Scotland - Aberdeen Marine Laboratory (2092)	2145
2195	DTU Aqua – National Institute of Aquatic Resources, Technical University of Denmark (2195)	2059
1404	IEO/ Vigo Oceanographic Centre (1404)	1925
4024	Complete Laboratory Solutions (4024)	1902
1401	IEO/ Santander Oceanographic Centre (1401)	1863
3014	University of Plymouth School of Marine Science and Engineering (3014)	1852
2529	Dunstaffnage Marine Laboratory (2529)	1689
903	Murmansk Hydrometeorological Administration of Roshydromet (903)	1189
1068	ISTPM (IFREMER NANTES) (1068)	1140
2076	Université Laval (2076)	1012
838	EPOC - Geology and Oceanography Department (838)	994
848	IFREMER / CENTRE DE BRETAGNE (848)	916
1772	University of Liverpool Department of Oceanography (1772)	723
188	LABO ATMOSPHEREs, MILIEUX, OBSERVATIONS SPATIALES (LATMOS) (188)	722
1403	IEO/ La Coruna Oceanographic Centre (1403)	719
520	IRD CENTRE DE NOUMEA (520)	628
1468	Bangor University School of Ocean Sciences (1468)	598
1056	IFREMER / STATION DE LA TREMBLADE (1056)	519
1625	IFREMER / STATION DE LORIENT (1625)	515
28	Centre for Environment, Fisheries and Aquaculture Science, Lowestoft Laboratory (28)	480
2090	Scottish Office Agriculture Environment and Fisheries Department - Aberdeen Marine Laboratory (2090)	451

1880	Ifremer / Crela (1880)	425
518	IFREMER STATION DE LA ROCHELLE-L'HOUMEAU (518)	421
1016	IFREMER / DYNECO- Coastal Environment Dynamics department (1016)	420
1145	IRD / CENTRE OF ABIDJAN (1145)	417
2947	GEOMAR Helmholtz Centre for Ocean Research Kiel (2947)	392
4517	Department of Agriculture, Environment and Rural Affairs (4517);Marine Institute (396)	270
24	Defence Evaluation Research Agency (24)	255
4554	Scottish Environment Protection Agency, Angus Smith Building (4554)	247
549	CEA / Laboratory of climatolocical and environmental Sciences(LSCE) (549)	239
1046	LABORATORY OF SCIENCES OF MARINE ENVIRONMENT (LEMAR) (1046)	237
513	COM - Physical and Biogeochemical Oceanography Laboratory (LUMINY) (513)	221
3927	UBO/ Marine Observatory of the European University Institute of the Sea (IUEM) / OSU (3927)	203
1548	Napier University School of Life Sciences (1548)	201
1570	Thünen-Institute of Sea Fisheries (TI-SF) (1570)	200
1066	IRD / CENTRE DE PAPEETE (1066)	191
441	IFREMER / DYNECO/PELAGOS-LABORATOIRE D'ECOLOGIE PELAGIQUE (441)	185
421	University of Liege, Laboratory of Oceanology (421)	170
501	MUSEUM NATIONAL D'HISTOIRE NATURELLE / LABORATOIRE D'OCEANOGRAPHIE PHYSIQUE (501)	157
484	IFREMER / EEP / LEP-DEEP ENVIRONMENT LABORATORY (484)	151
556	UNIVERSITE DE BRETAGNE OCCIDENTALE (UBO) / LAB. D'OCEANO. CHIMIQUE LOC - IUEM (556)	150
521	Roscoff Marine Station, Sorbonne Université and CNRS (OSU-SBR) (521)	146
3272	Scottish Environment Protection Agency, Edinburgh Office (3272)	146
309	Canary Institute of Marine Sciences (309)	140
756	Far Eastern Regional Hydrometeorological Research Institute (756)	139
1804	University of Southampton Department of Oceanography (1804)	133
539	IFREMER / STH/LBH-LABORATOIRE BIOLOGIE HALIEUTIQUE (539)	131
795	IFREMER / Dpt Technologicals Research and Development (795)	117
510	IFREMER / DYNECO / PHYSED -LABO PHYSIQUE HYDRODYNAMIQUE ET SEDIMENTAIRE (510)	110
1385	Agri-Food and Biosciences Institute (1385)	107
1002	Aquitaine Observatory of Sciences of the Universe – University of Bordeaux (OASU) (1002)	105
920	Primorsky Territorial Office on Hydrometeorology and Environmental Monitoring of Roshydromet (920)	105
691	National Institute of Fisheries Research (INRH) (691)	102
1427	Queen's University Belfast School of Biological Sciences (1427)	101
1801	University of Southampton School of Ocean and Earth Science (1801)	101
1406	IEO/ Cadiz Oceanographic Centre (1406)	98

1015	Oceanologic Observatory of Banyuls (University of Paris VI) / OSU (1015)	96
1065	IRD / CENTRE DE MONTPELLIER (1065)	95
4517	Department of Agriculture, Environment and Rural Affairs (4517)	93
907	Navy Main Administration of Navigation and Oceanography, Ministry of Defence (907)	88
685	P.P.Shirshov Institute of Oceanology, RAS (685)	85
1902	University of Bordeaux I / Laboratory for Physical and Toxico Chemistry (ISM) (1902)	83
1039	CEA / INSTITUT DE RADIOPROTECTION ET DE SURETE NUCLEAIRE (1039)	82
532	CNRS / Microbiology, Geochemistry and Marine Ecology Laboratory (532)	81
791	IFREMER / STH-DEPARTEMENT SCIENCES ET TECHNOLOGIES HALIEUTIQUES (791)	77
1147	IRD / CENTRE OF HANN (1147)	76
240	Université Libre de Bruxelles, Laboratory of Chemical Oceanography and Water Geochemistry (240)	75
430	Vrije Universiteit Brussels, Faculty of Sciences, Department of Chemistry, Laboratory of Analytical and Environmental Chemistry (430)	74
279	CSIC-IIM/ Institute of Marine Research (279)	71
1001	IFREMER / STATION D'ARCACHON (1001)	71
1879	La Rochelle University / Littoral Environnement and Societies (LIENSs) - UMR 7266 (1879)	68
298	IEO/ Oceanographic Centre of Canary Island (298)	67
1063	IRD / CENTRE DE LA MARTINIQUE (1063)	67
1771	University of Liverpool Department of Earth Sciences (1771)	67
2524	University of Hamburg, Department of Chemistry (2524)	66
519	Institute of Earth Physics of Paris (519)	63
527	IFREMER / RBE Department / Biogeochimical end Ecotoxicological Resarch Unit (Nantes) (527)	61
533	IFREMER / STATION DE LA TRINITE (533)	52
721	IFREMER / STATION DE SETE (721)	52
1380	Woods Hole Oceanographic Institution: Department of Physical Oceanography (1380)	52
1780	Faroese Fisheries Laboratory (1780)	50
1571	Thünen-Institute of Fisheries Ecology (TI-FI) (1571)	50
1398	ULPGC/ University of Las Palmas de Gran Canaria. Faculty of Marine Science. (1398)	49
1925	Universite de Pau / IPREM multidisciplinary research institute for the environment and materials (1925)	48
990	Federal Research Centre for Fisheries (Hamburg) (990)	47
1803	University of Southampton Department of Oceanography (1803)	46
1715	University of Rostock, Institute of Biosciences (1715)	45
396	Complete Laboratory Solutions (4024);Marine Institute (396)	42
1915	Universite D'Angers / Laboratoire Des Bio-Indicateurs Actuels Et Fossiles (Biaf) (1915)	39
1405	IEO/ Malaga Oceanographic Centre (1405)	38
4548	Environment Agency North West Regional Office (4548)	34

1094	UNIVERSITE DE PAU / LAB.CHIMIE BIO INORGANIQUE & ENVIRONNEMENT (1094)	33
1167	Ukrainian scientific center of Ecology of Sea (UkrSCES) (1167)	27
1077	University of Bordeaux I / Marine Biology Institut (1077)	27
992	The Leibniz Institute of Marine Sciences at the University of Kiel (IFM-GEOMAR) (992)	25
1075	University of Bordeaux I / IGBA Talence (1075)	25
545	Swedish Meteorological and Hydrological Institute (545)	22
1368	Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research (1368)	20
836	IRD ANTENNE INSTITUT OCEANOGRAPHIQUE (IRD) (836)	20
946	V.I. Il'ichevs Pacific Oceanological Institute, Far Eastern Branch, Russian Academy of Sciences (946)	20
7	University of Edinburgh, Department of Geology and Geophysics (7)	19
1811	Bedford Institute of Oceanography (1811)	18
2120	James Rennell Centre for Ocean Circulation (2120)	17
120	OGS (Istituto Nazionale di Oceanografia e di Geofisica Sperimentale), Division of Oceanography (120)	17

Below, the pie charts (Figure 16) for the data originators in the North Atlantic Ocean:

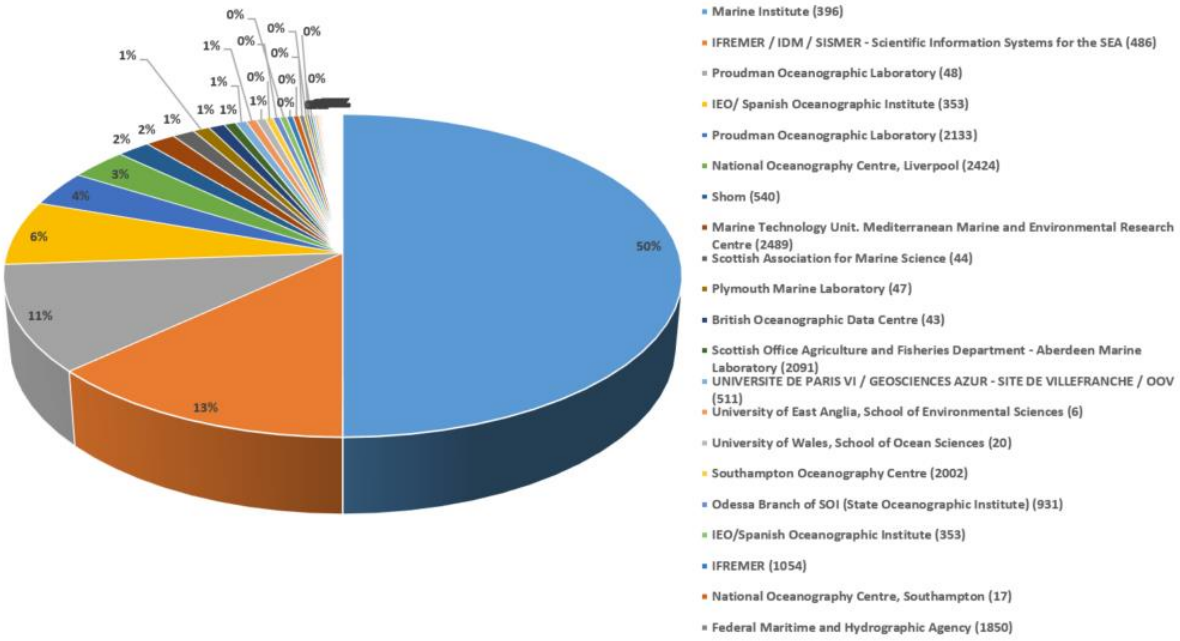


Figure 16. Data originators with more than 1000 stations in the dataset.

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List of acronyms

Acronym	Definition
ARC	Arctic ocean
BAL	Baltic Sea
BLS	Black Sea
CDI	Common Data Index
CLIM	Climatology
CMEMS	Copernicus Marine Environment Monitoring Service
DATA	Aggregated Dataset
DIVA	Data-Interpolating Variational Analysis (software)
DOI	Digital Object Identifier
EC	European Commission
EDMO	European Directory of Marine Organisations (SeaDataNet catalogue)
GLO	GLobal Ocean
IOC	Intergovernmental Oceanographic Commission
IODE	International Oceanographic Data and Information Exchange (IOC)
MED	Mediterranean Sea
NAT	North Atlantic Ocean
NWS	North West Shelf
ODV	Ocean Data View Software
QC	Quality Checks
QF	Quality Flags
SDC	SeaDataCloud
SDN	SeaDataNet
TS	Temperature and Salinity
WOA	World Ocean Atlas
WP	Work Package