Product Information Document (PIDoc)

SeaDataCloud Temperature and Salinity Historical Data Collection for the Mediterranean Sea (Version 1)

SDC_MED_DATA_TS_V1

HORIZON ***2020***

sdn-userdesk@seadatanet.org – www.seadatanet.org

SeaDataCloud - Further developing the pan-European infrastructure for marine and ocean data management

Grant Agreement Number: 730960

Product Name

SDC_MED_DATA_TS_V1

Extended name

SeaDataCloud Temperature and Salinity Historical Data Collection for the Mediterranean Sea (Version 1)

Product DOI

http://doi.org/10.12770/2698a37e-c78b-4f78-be0b-ec536c4cb4b3

Short description

Authors

Simona Simoncelli, Volodymyr Myroshnychenko and Christine Coatanoan

Dissemination	Copyright terms
Public	

How to Cite

History

Version	Authors	Date	Comments
V1	S. Simoncelli	22/06/2018	Final version
V2	V. Myroshnychenko	31/07/2018	revision

Table of contents

Abstract

The first release of SeaDataCloud Temperature and Salinity Historical Data Collection for the Mediterranean Sea (SDC_MED_DATA_TS_V1) includes open access in situ data of water column temperature and salinity between -9.25 and 37 degrees of longitude, thus including an Atlantic box and the Marmara Sea. The collection has been obtained harvesting all measurements contained within SeaDataNet infrastructure at the end of October 2017 belonging to **27 data providers** (distributors) **111 data originators**. The dataset format is Ocean Data View (ODV) binary collection. The quality control of the data has been performed using ODV 5.0 software. Data Quality Flags have been revised following SeaDataNet2 project QC procedures in conjunction with the visual expert check. The number of the Temperature and Salinity profiles (stations) in the collection is 739784.

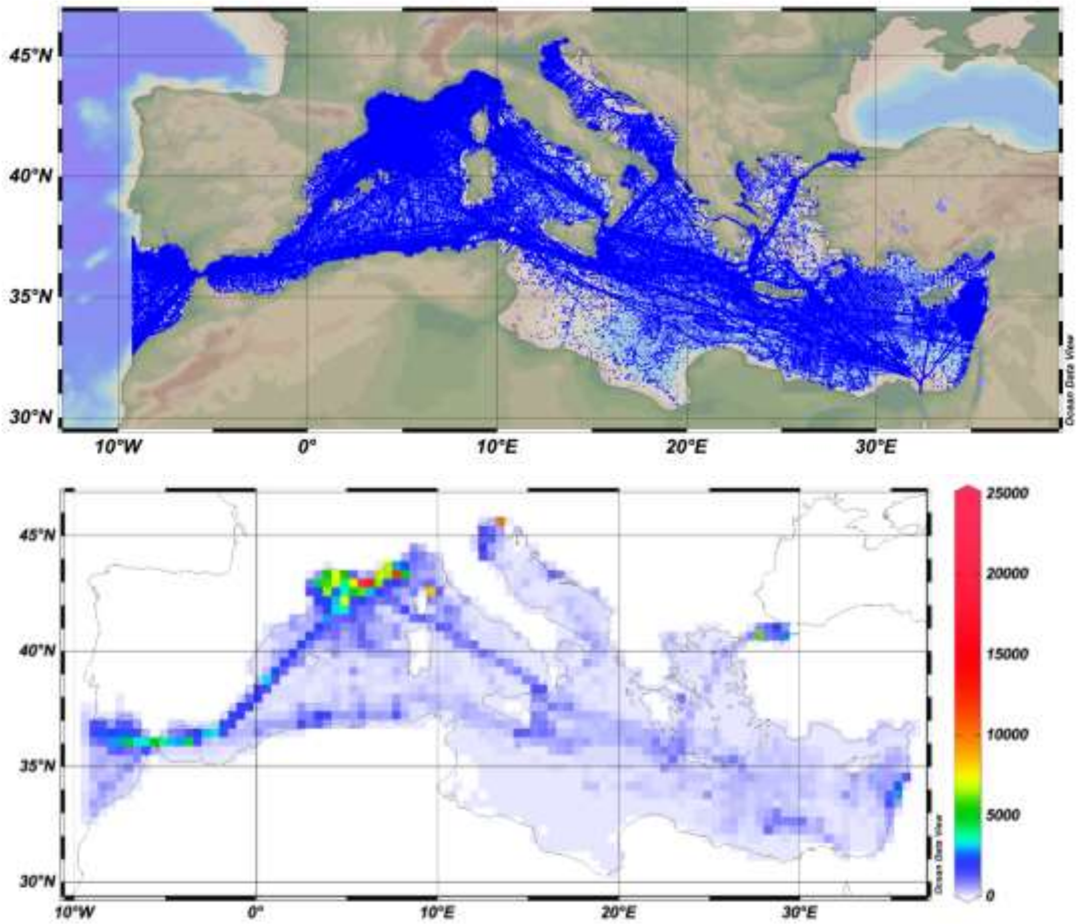
Whenever SDC_MED_DATA_TS_V1 product is used, this PIDoc should be cited in any publication. We also ask users to remember that hard-working scientists made these measurements, often under severe conditions. Further, the data providers normally possess insight on the quality and context of the data not 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.

1. General description of the data collection

The historical data collection of the Mediterranean Sea contains temperature and salinity observations between -9.25 and 37 degrees of longitude, thus including an Atlantic box and the Marmara Sea.

SDC_MED_DATA_TS_V1 collection has been obtained harvesting all measurements contained within SeaDataNet infrastructure at the end of October 2017 belonging to **27 data providers** (distributors) listed in **Annex 2** and **111 data originators** listed in **Annex 3**.

The spatial distribution and the data density of measurement stations are shown in Figure 1. The spatial distribution of data (Figure 1a) presents a good data coverage in the Western Mediterranean basin and the Atlantic box, while in the Eastern Mediterranean still many areas are characterized by few and sparse data, like the coastal areas of Tunisia, Libya, Egypt and Croatia. Data density map (Figure 1b) highlights that observations are more concentrated along the coastal areas of Spain, France and Italy (Ligurian Sea and Northern Adriatic Sea). In the eastern part of the Basin, maximum data concentration is along the Israeli and the Greek coasts. Data density is high also in the Marmara Sea.

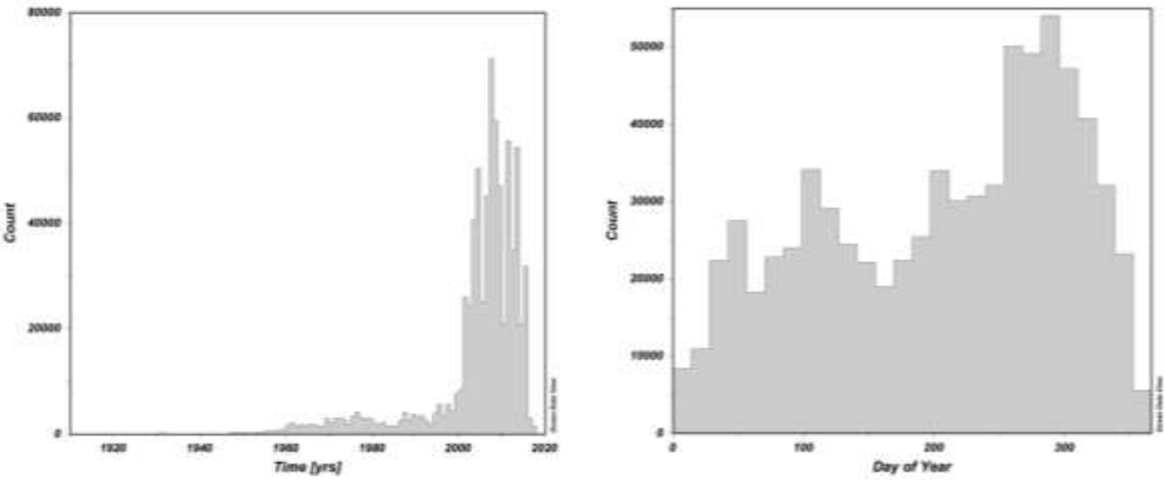


(a)

(b)

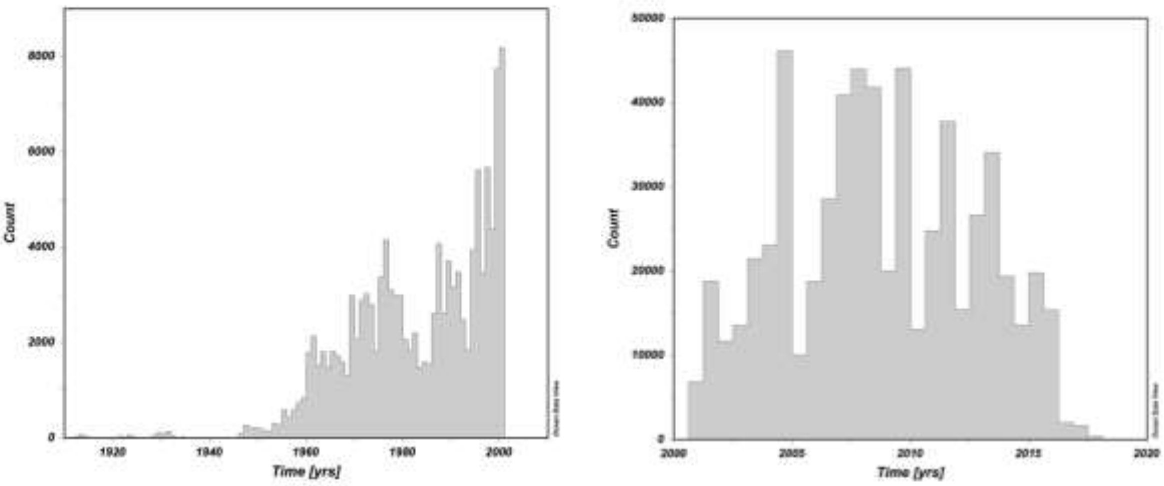
Figure 1 Temperature and Salinity data collection for the Mediterranean Sea in the time period 1900-2017: (a) Data distribution map; (b) Data density map.

Temporal distributions of data are in Figure 2 and Figure 3. Annual distributions (Figure 2a and Figure 3) prove that data are very sparse before 1950 and their number start to increase systematically from the sixties and concentrate mostly in the noughties, due to the advent of new data types (Argo, thermosalinograph). This must be taken into consideration during climatological data analysis. Seasonal distribution of data (Figure 2b) presents a good coverage all year long. A peak in number of data is present at the end of summer beginning of autumn (September, October) and this might be due to surveys dedicated to monitor particular events. This is another aspect to consider carefully for climatological analysis or other applications.



(a) (b)

Figure 2 Temporal data distribution over the time period 1900-2017 in the Mediterranean Sea: (a) annual, and (b) seasonal.



(a) (b)

Figure 3 Temporal data distribution over the time periods: (a) 1900-2000 (b) 2001-2017.

Table 1 summarizes the number of observed temperature and salinity stations and stations having both measurements contained in SDC_MED_DATA_TS_V1 collection. Temperature stations represent 99.6% of total stations, salinity stations represent 90.2% of total stations while measurements containing both temperature and salinity are 89.9% In terms of number of samples it should be noticed the increased difference among temperature and salinity monitoring system.

Table 1 Number of stations and samples for temperature and salinity and TS measurements contained in SDC_MED_DATA_TS_V1 collection and their relative percentages.

par	# stations	%	# samples
total	739784		
T	737102	99,6	41223938
S	667232	90,2	28518744
TS	665388	89,9	28119926

Figure 4 shows Temperature (a), Salinity (b) and TS couples data distribution. Salinity observations are less and sparser than temperature ones. Both maps show the presence of data along ship tracks, along coastal transects, and regular monitoring arrays.

Figure 5 presents the temporal distribution of temperature (a), salinity (b) and (c) both TS measurements. Temperature and salinity observations show a similar temporal distribution with very few measurements before 1950 and a steep increase after the year 2000, due to the introduction of new instruments.

The seasonal distributions in Figure 6 are also similar but with more temperature than salinity measurements in autumn.

The vertical distributions of observations in Figure 7 display that temperature only measurements are mainly sampled in the surface layer. In fact temperature measurements exceed of a factor 1e6 salinity measurements near the surface.

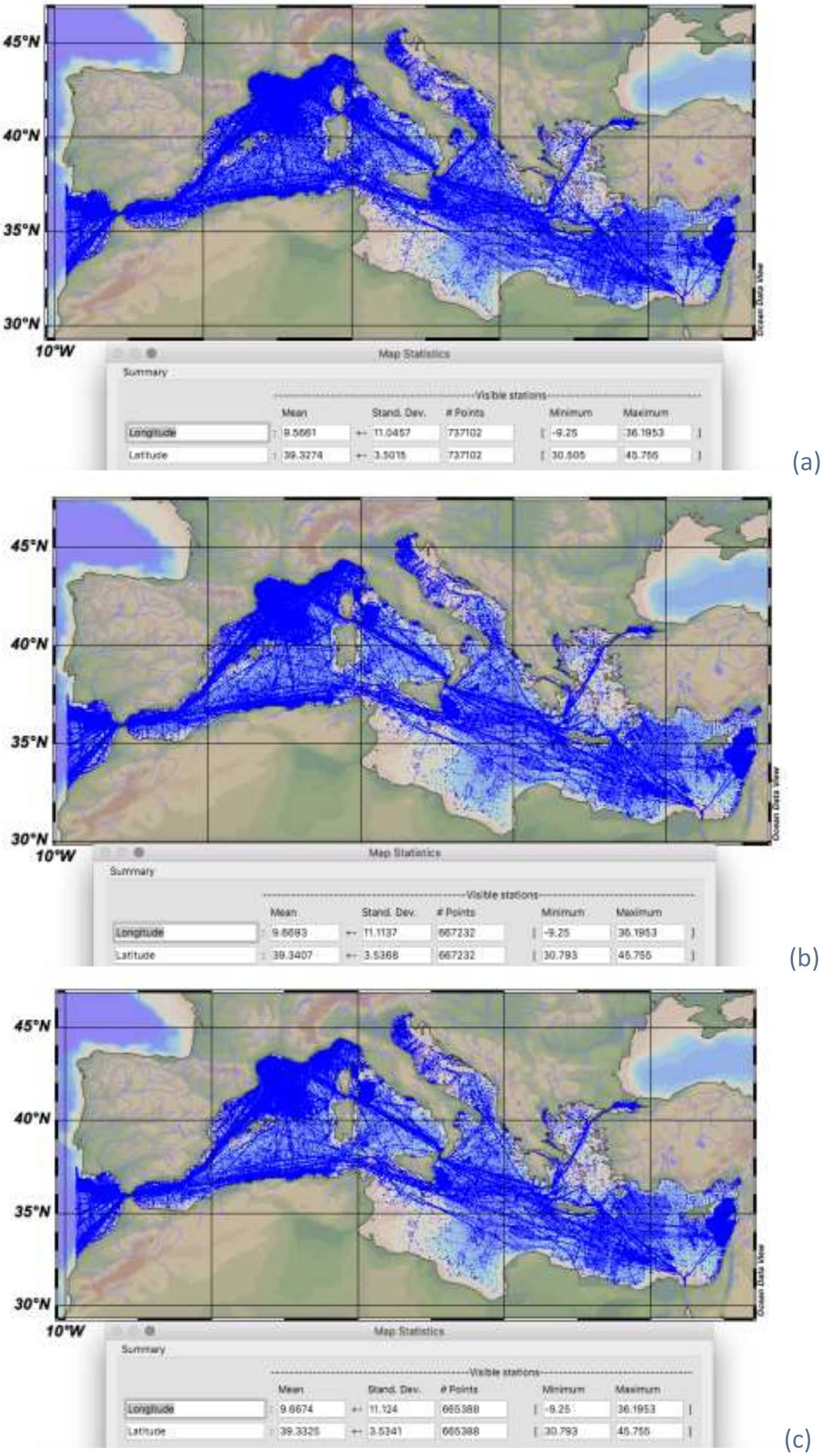
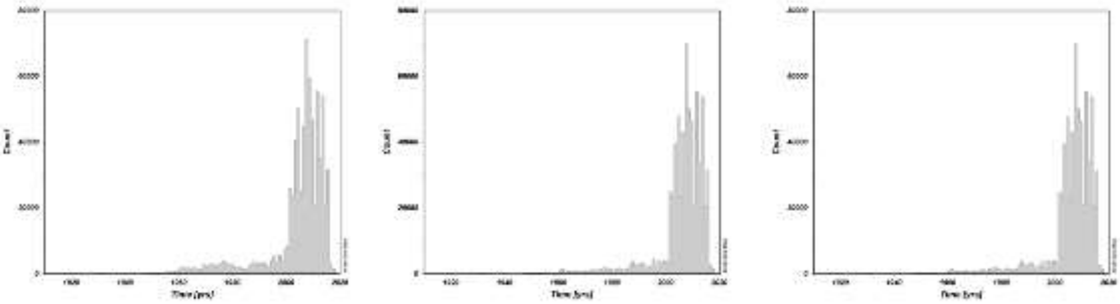
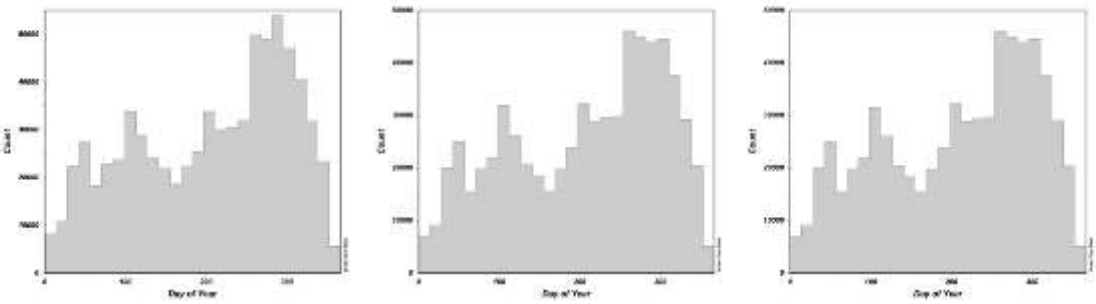


Figure 4 Station distribution map for the Mediterranean Sea 1900-2017: (a) Temperature; (b) Salinity; (c) TS couples.



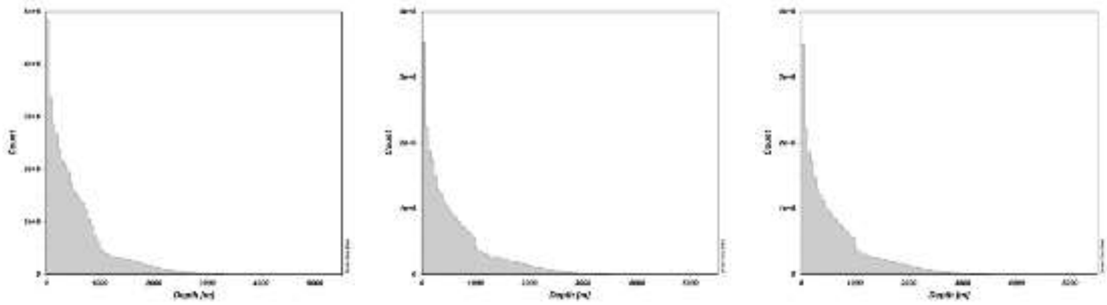
(a) (b) (c)

Figure 5 Temporal distribution of (a) Temperature, (b) Salinity observations and (c) TS measurements.



(a) (b) (c)

Figure 6 Seasonal distribution of (a) Temperature, (b) Salinity and (c) TS couples of observations.



(a) (b) (c)

Figure 7 Vertical distribution of (a) Temperature, (b) Salinity and (c) TS couples of observations.

The statistics related to data quality flags are summarized in **Table 2**. The percentage of data not checked by data providers (QF=0) ranges from 3.0% of depth measurements to 4.5% of salinity measurements. 97% of temperature and depth records are flagged as good (QF=1) or probably good (QF=2), while for salinity the percentage is equal to 94.6. Bad (QF=4) or probably bad (QF=3) data are less then 1% for the three parameters, and almost absent are samples with flags from 5 to 9.

Table 2 Quality Flag statistics related to depth, Temperature and Salinity parameter expressed in percentages.

%	QF=0	QF=1-2	QF=3-4	QF=5-9
Depth	3.0	96.9	0.1	0.0
Temperature	2.7	97.0	0.3	0.0
Salinity	4.5	94.6	0.9	0.0
Depth&T&S	3.0	94,4	0.3	0.0

2. Quality Control Procedure

The quality check (QC) analysis has been performed following the QC guidelines in Annex 1 and the SeaDataNet Quality Flags schema at http://vocab.nerc.ac.uk/collection/L20/current/.

The first steps were dedicated to correct data anomalies from specific EDMO_CODE (data providers):

- EDMO_CODE 486 → all measurements flagged as 0 were changed to 2;
- EDMO_CODE 840 → all measurements with temperature and salinity values equal to 0 were wrongly flagged 0, thus the corresponding QF were set to 4;

The second phase of analysis was dedicated to the data with QC=0. The adopted strategy was to substitute 0 with 2 (probably good) following these steps:

1. To select all measurements with QF=0 for depth&T&S and assign QF=2;
2. To select T measurements with QF=0 assign QF=2;
3. To select S measurements with QF=0 assign QF=2;

Data with QF=1 and 2 are then analysed to detect data anomalies starting from a gross range check and spikes detection by visual inspection.

Depth

→ negative depth values (QF=1) have been flagged 4

→ Vertical profiles with depth parameters with QF=0 but having their relative temperature and salinity parameters with QF=1 have been flagged as 2.

Temperature

→ range check T<2°C and T> 33°C assigned to QF=4;

→ identification of spikes assigned to QF=4;

Salinity

→ range check S>42 assigned to QF=4;

→ identification of spikes assigned to QF=4.

2.1. QC analysis per sea regions

In order to detect data anomalies more efficiently by visual inspection the data domain has been subdivided in 17 regions according to the definition in Figure 8 adopted by the CMEMS MED-MFS for evaluating the Mediterranean Forecasting System (http://marine.copernicus.eu/documents/QUID/CMEMS-MED-QUID-006-013.pdf). The Marmara Sea has been analyzed separately as region 18.

The number of stations per region (Figure 9) first highlights that the northwest Mediterranean (region 3) is the most sampled region with the highest number of stations. While regions 7 (Sicily Channel/Tunisian waters) and 10 (Southern Adriatic Sea) are the ones having the smallest number of temperature and salinity observations.

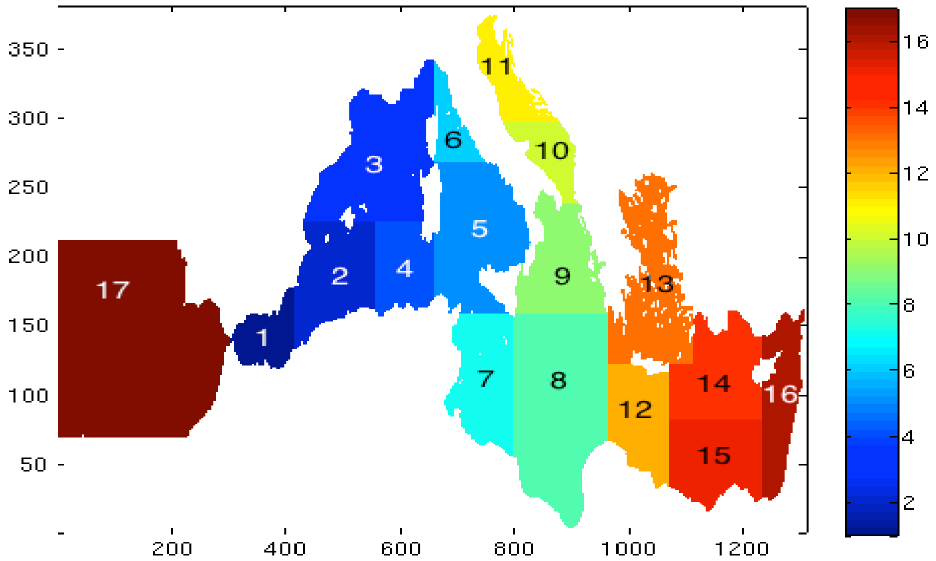


Figure 8 **The Mediterranean Sea sub-regions subdivision.**

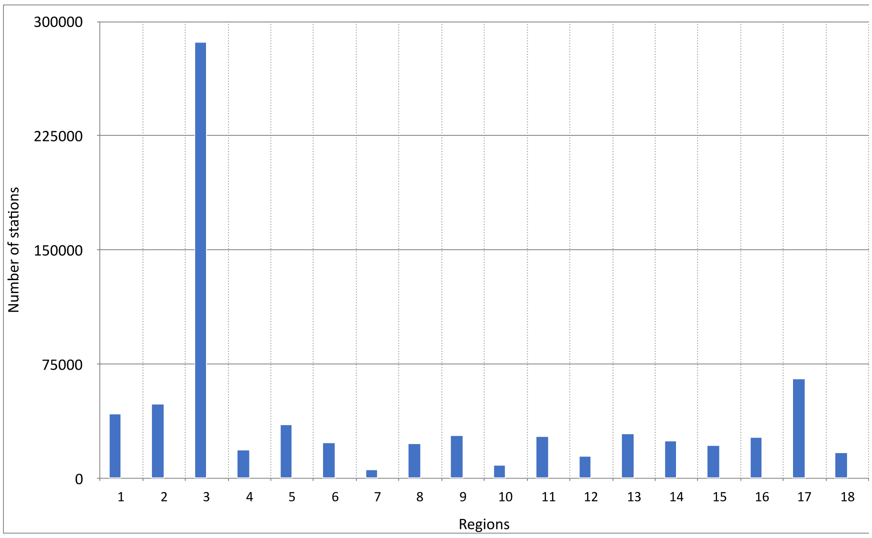


Figure 9 Number of stations per sub-region (Figure 8).

2.2. QC analysis per depth layer

The QC analysis has been conducted also per depth layer according to the layers definition: 0-30, 30-150, 150-300, 300-600, 600-1000, 1000-2000, 2000-3000, 3000-5500[m]. In particular the TS diagrams per each layer have been analyzed to detect data anomalies, the results are presented in Section 3.

2.3. Instrument type analysis

The QC analysis was performed also by instrument type in order to study their monitoring space-time coverage. Table 3 summarizes the number of stations per instrument type according to the analysis of metadata associated to the data. The 3% of data is missing the instrument type information, thus actions are needed in order to complete this crucial metadata. It follows an analysis of space-time distribution of the data from the principal instrument types: thermosalinographs, bathythermographs, CTDs.

Thermosalinograph data have been sampled in 555269 stations distributed in space as in Figure 10. Data density is maximum in the north-western Mediterranean and the Atlantic Box. The data temporal distribution (Figure 11) shows the start of underway data in 2001 with maximum number of stations in fall season. This data type represents the 75% of the entire data set in terms of number of stations, but this is due to the fact that they are underway data and each sample (lon,lat,depth and variable) constitutes a station, as managed by ODV.

SDC_MED_DATA_TS_V1 contains 52031 **CTD** stations distributed as in Figure 12. CTD data are sparse in the Tyrrhenian Sea, the Sicily Channel, the Ionian Sea and the Middle Adriatic. The data become available from the fifties and peak around year 2000, with maximum data availability during summertime (Figure 13).

56558 stations have been monitored by **bathythermographs** and their location is shown in Figure 14. The data density map shows the main ships of opportunity routes along with bathythermograph measurements have been performed. The maximum data concentration is in the north western Mediterranean (Ligurian Sea and Gulf of Lion), the Tyrrhenian Sea, along the Spanish coast towards Gibraltar Strait, from Sicily to the Southern Adriatic. In the Levantine basin the data are sparser than in the western Mediterranean. The time distributions of bathythermograph stations (Figure 15) presents the first monitored stations from the fifties until early eighties, when these type of measurements reduces to then restart in middle nineties. The seasonal distribution displays a minimum number of measurements during the summer time.

In Figure 16 are displayed the stations measured by **discrete water samplers** (bottles), mainly sampled starting from late forties but with the highest number of data between the sixties and the nineties (Figure 17).

Table 3 Number of stations divided by instrument/gear type.

Instrument/Gear Type	# stations	%
CTD	52031	7
bathythermograph	56558	8
discrete water sampler	32258	4
thermosalinograph	555269	75
thermistor chains	22	0
continuous water sampler	1577	0
salinity sensor; water temperature sensor	19852	3
salinometers	100	0
salinity sensor	143	0
water temperature sensor	1	0
none info	21973	3
	TOT=739784	

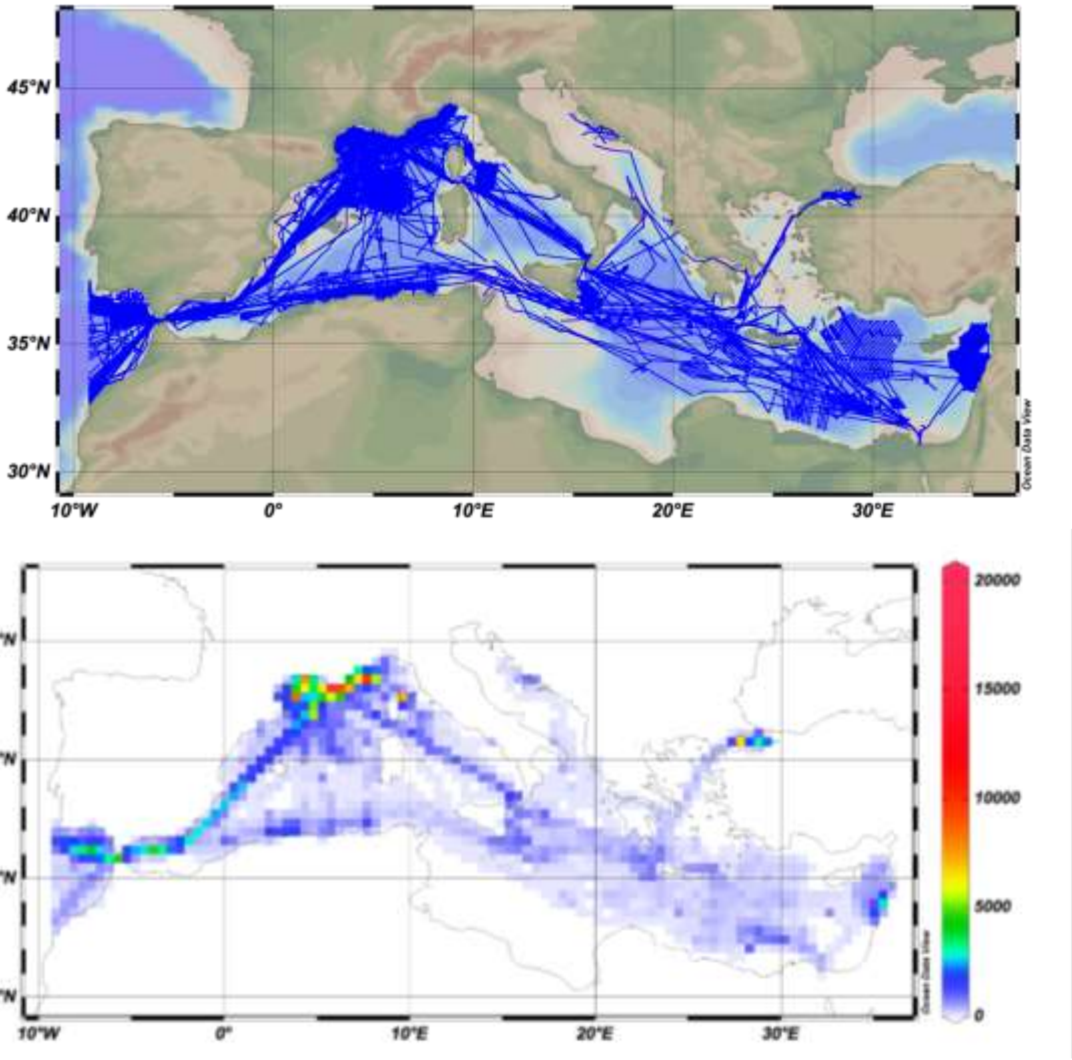


Figure 10 Thermosalinographs stations contained in the SDC_MED_DATA_TS_V1 collection.

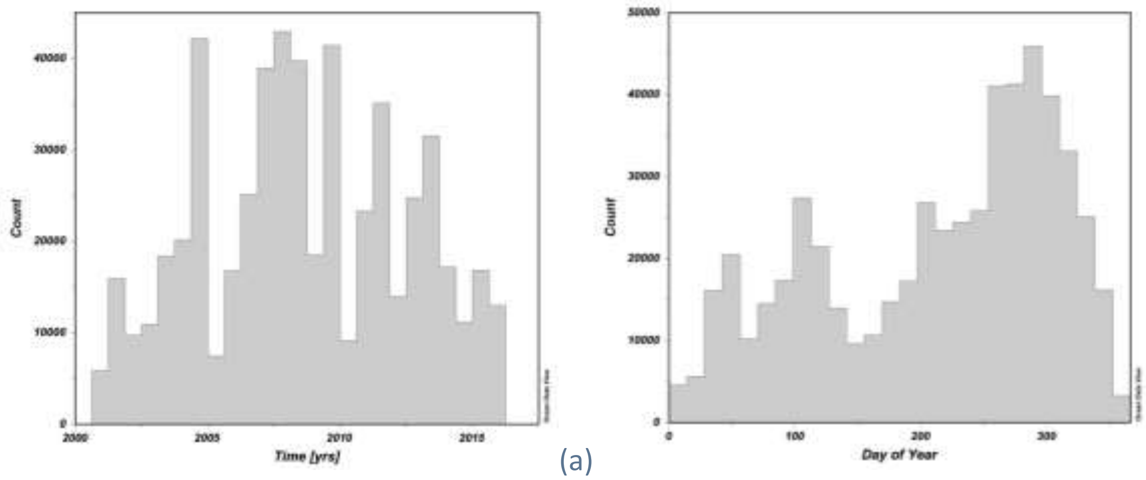


Figure 11 Time distributions of thermosalinographs stations in the SDC_MED_DATA_TS_V1 collection: (a) annual and (b) seasonal.

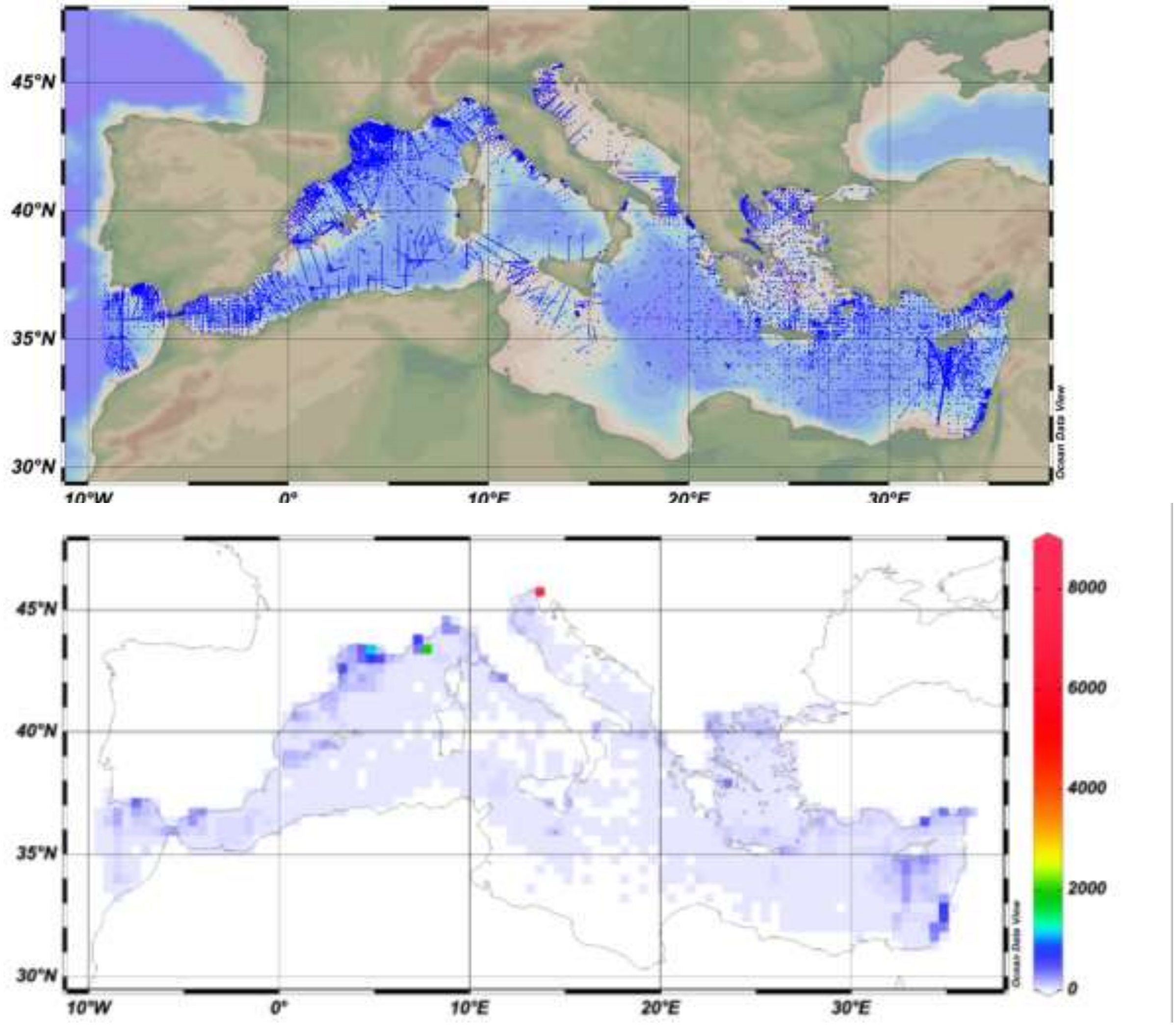


Figure 12 CTD stations contained in the SDC_MED_DATA_TS_V1 collection.

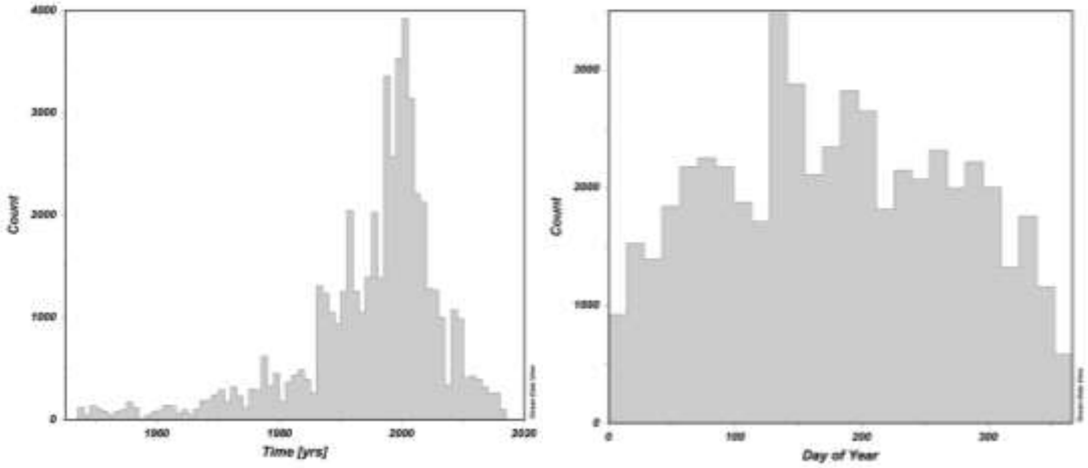


Figure 13 Time distributions of CTD stations in the SDC_MED_DATA_TS_V1 collection: (a) annual and (b) seasonal.

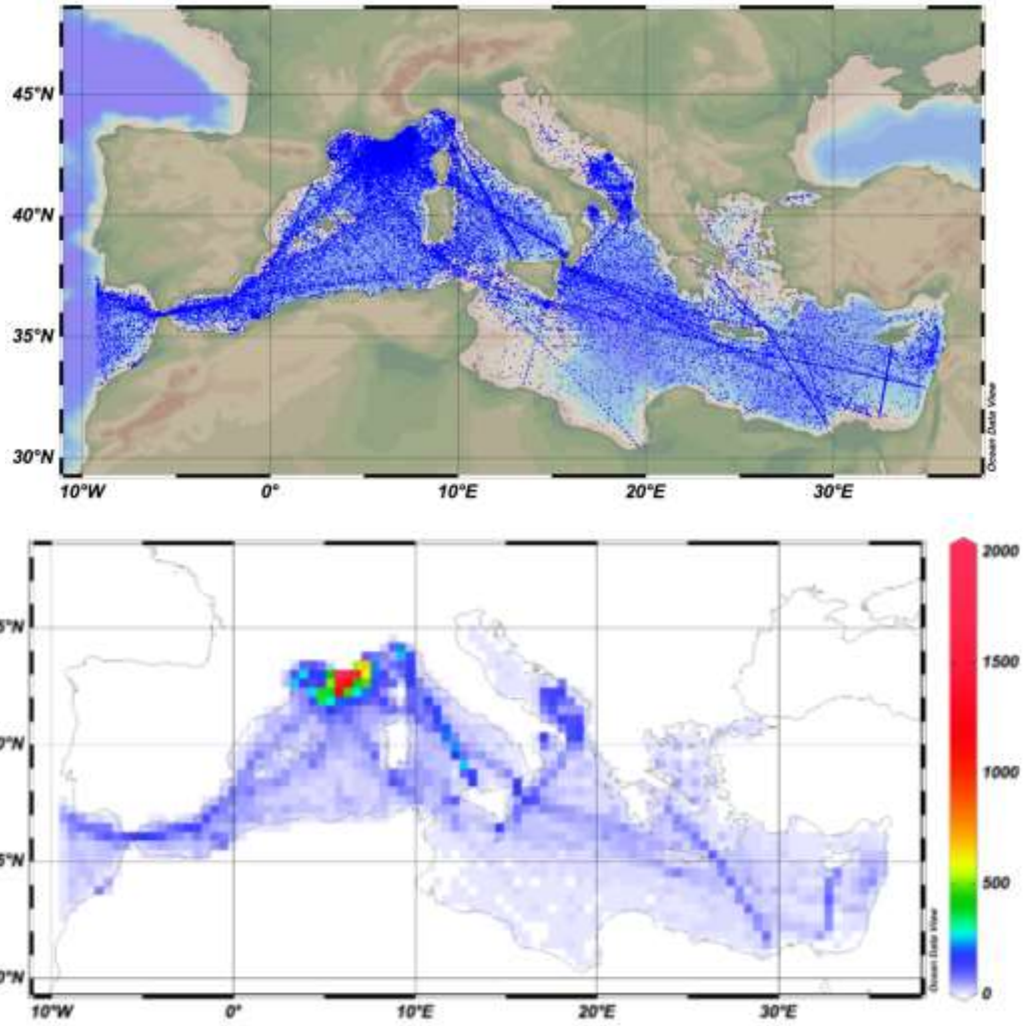


Figure 14 Bathythermograph stations contained in the SDC_MED_DATA_TS_V1 collection: (top) data distribution map; (bottom) data density map.

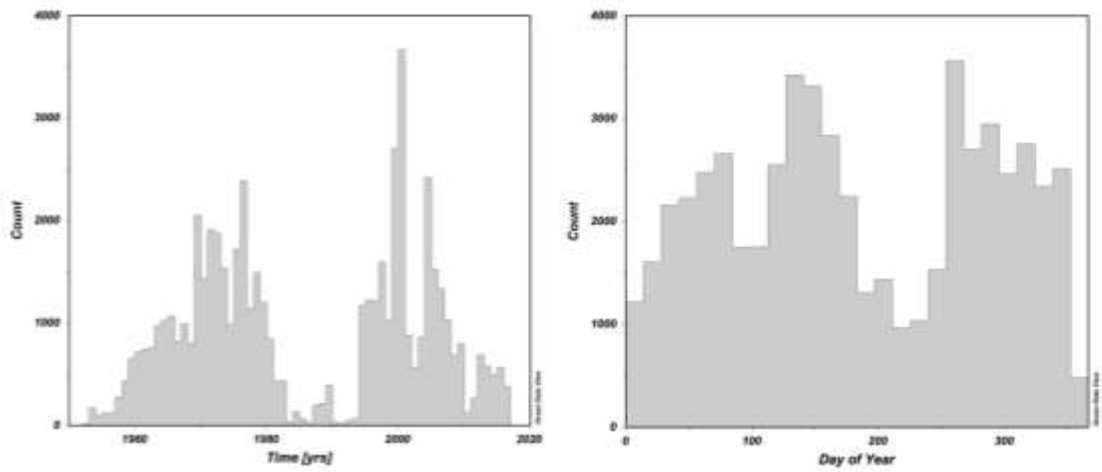


Figure 15 Time distributions of bathythermograph stations in the SDC_MED_DATA_TS_V1 collection: (a) annual and (b) seasonal.

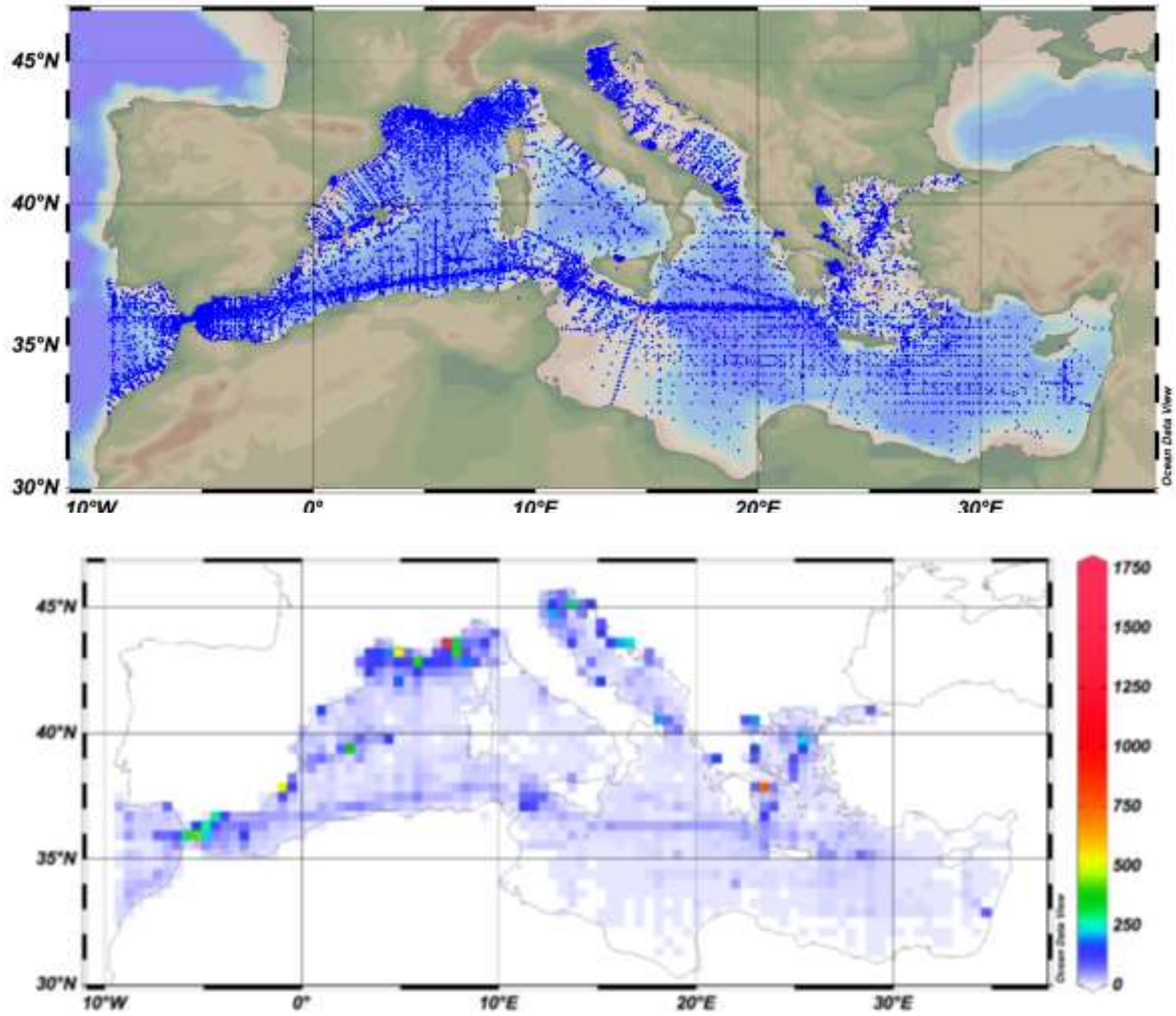


Figure 16 Stations contained in the SDC_MED_DATA_TS_V1 collection measured by discrete water samplers: (top) data distribution map; (bottom) data density map.

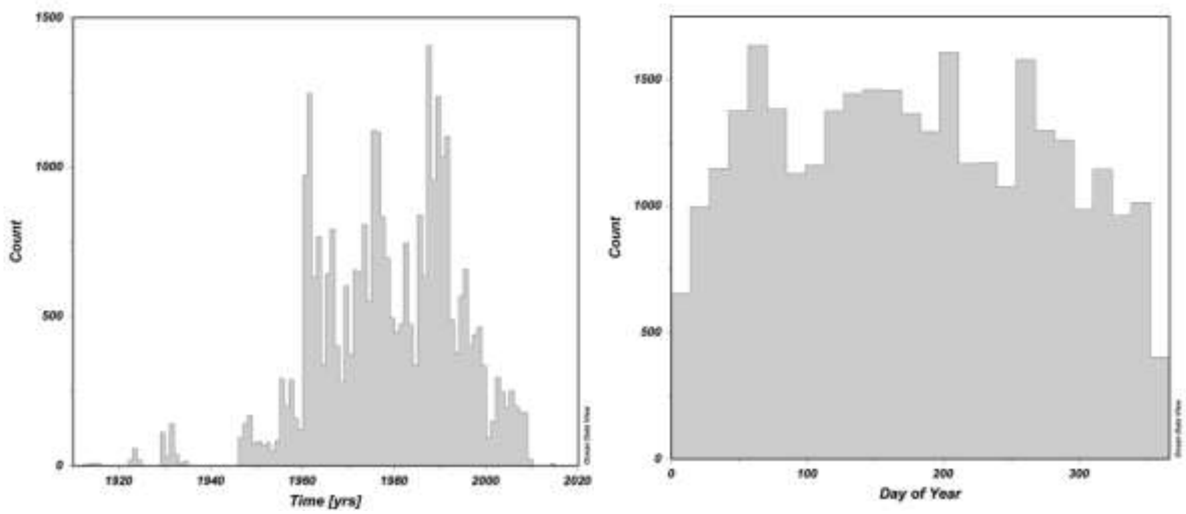


Figure 17 Time distributions of stations measured by discrete water samplers in the SDC_MED_DATA_TS_V1 collection: (a) annual and (b) seasonal.

3. Quality assessment results

Figure 18 presents the TS diagrams per each sub-region (Figure 8) after the QC analysis, the colors indicates the measurement's depth.

Region 1 (**Alboran Sea**) shows temperature ranging between 12 and 28°C and salinity values comprise between 35 and 39.

In the **South West Mediterranean** (western part region2) temperatures range between 12 and 28°C and salinities between 36 and 39. In the **South West Mediterranean** (eastern part, region 4), range between 12 and 28°C and salinities between 36.5 and 39.

In the **North West Mediterranean** (region 3) the variability of temperatures (7-29°C) and salinity (0-39) is larger due to the atmospheric forcing and the river influence.

The **Tyrrhenian Sea** presents in the southern part (region 5) salinities mainly ranging between 37 and 39 and temperature between 10 and 30°C, while in northern part (region 6) the salinity can reach 30 due to the river influence.

The **Adriatic Sea** presents very low salinities in its northern part (region 11) under the influence of Po River and other minor rivers. Temperatures as well have a large range of variability from 5 to 29°C. In the Southern Adriatic (region 10) salinities are larger than 30, but mainly goes from 36 to 39, while temperature are larger than 7°C.

The northern **Ionian Sea** (region 9) presents TS characteristics similar to region 10, but very low salinities are present due to sampling along the Greek coastline. In the Southern Ionian (region 8) temperatures are warmer than 10°C and salinity is higher than 37.

Region 7 shows a larger number of measurements along the Sicily Channel than the Tunisian coast, its temperature ranges between 12 and 29°C and salinity between 37 and 39.

The **Aegean Sea** (region 13) presents low salinities (20-35) due to the inflow of waters coming from the Black Sea through the Dardanelles.

The water entering the **Levantine Sea** (region 12 Cretan Passage and region 15 central southern part) presents increasing salinities from 37.5 to 40. In its eastern part (region 16) low salinity values appear along the Turkish coast.

The **Atlantic box** (region 17) diagram shows temperatures ranging from 2 to 27 degrees. The lowest temperature values are measured below 2500m. Salinity ranges approximately from 34 to 38.5. Bottom salinity is about 35. At the surface some low salinity value is due to the sample location close to river mouths along the Spanish coast. Surface salinity values are among 36 and 37.

In the **Marmara Sea** (region 18) both temperature and salinity are characterized by a large variability. Low salinity waters (20-25) flow at the surface from the Black Sea towards the Aegean Sea while salty Mediterranean waters enters the Dardanelles flowing below 120-150m of depth (halocline).

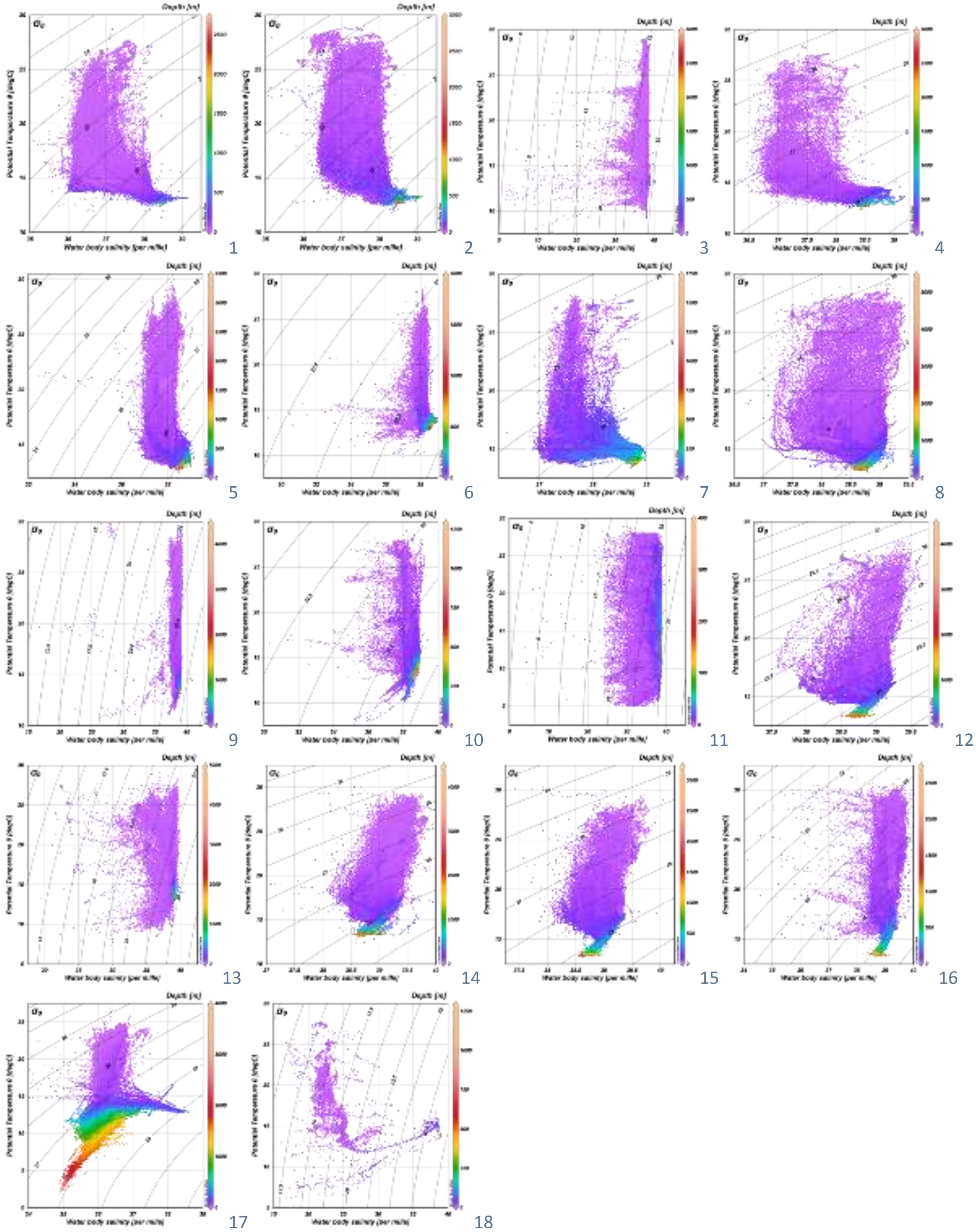


Figure 18 TS diagrams per each Mediterranean Sea sub-region, as defined in Figure 8.

Figure 19 presents the TS diagrams over the entire Mediterranean region per vertical layer. Below 300m (panel d) Western and Eastern Mediterranean waters are distinct, with Western Mediterranean waters colder and fresher than the Eastern Mediterranean one. Very low salinity values are present above 30m of depth (layer a) due to the river influence along the coast.

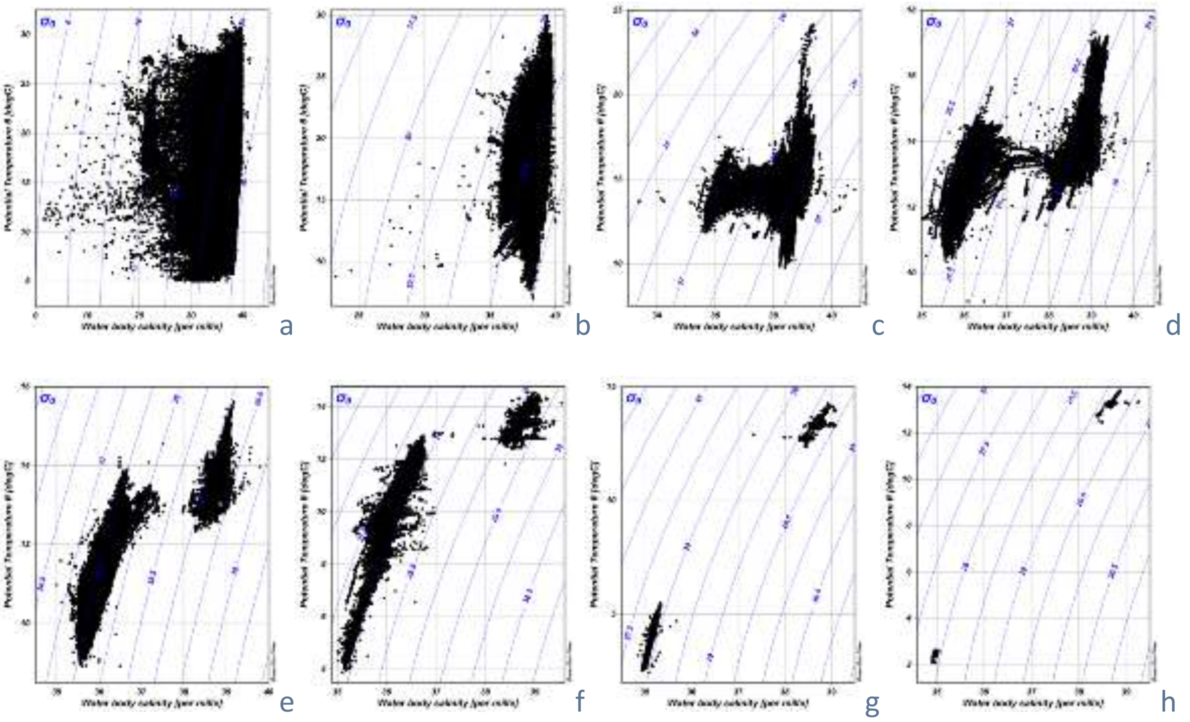
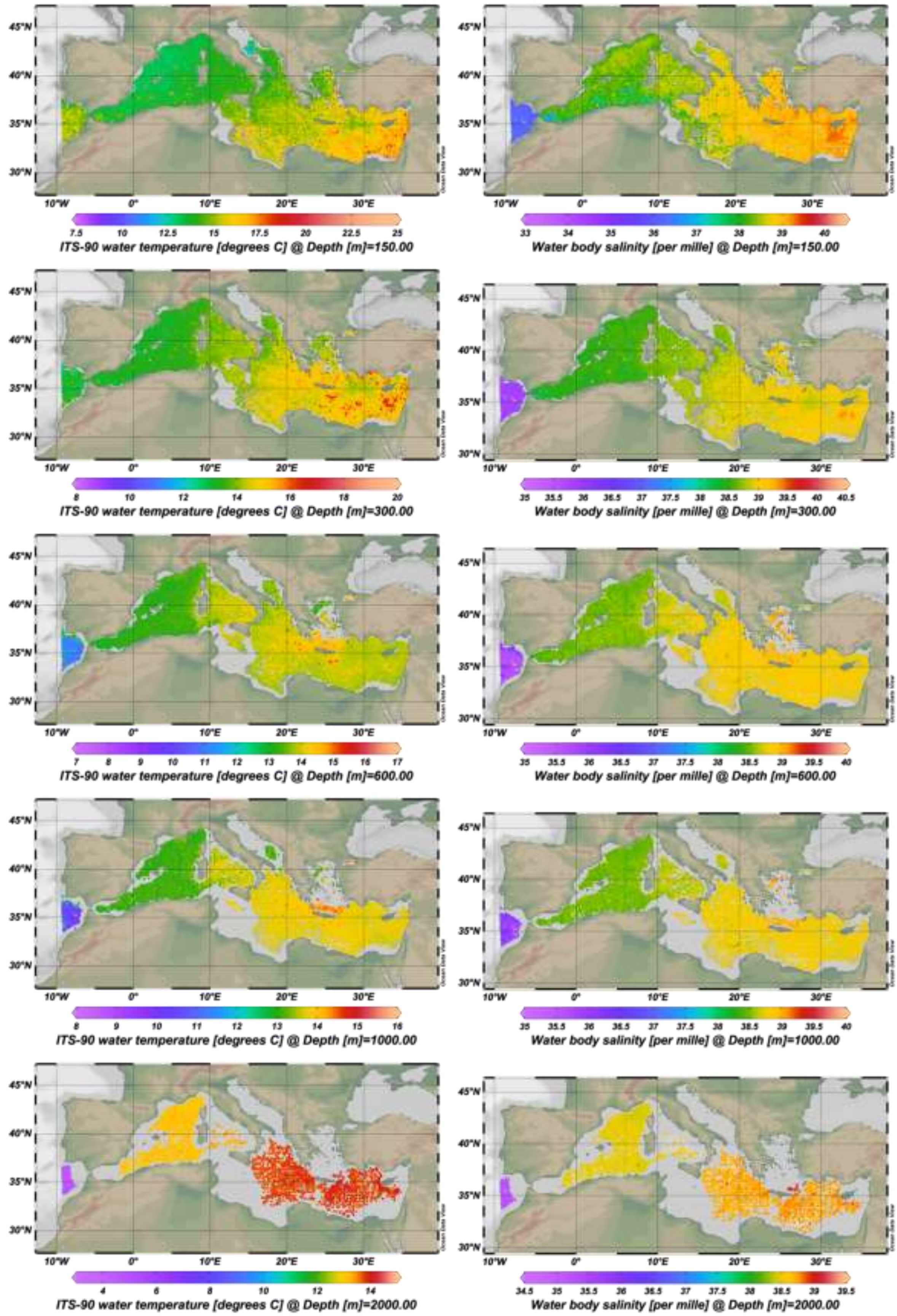


Figure 19 TS diagrams of data with QF=1,2 per each vertical layer: a) 0-30, b) 30-150, c) 150-300, d) 300-600, e) 600-1000, f) 1000-2000, g) 2000-3000, h) 3000-5500[m].

Temperature and salinity observations at specific depth (150, 300, 600, 1000, 2000m) are displayed in Figure 20. The number of observations reduces going deeper, with very few observations at 4000m. Temperature is colder and salinity is fresher in the Western Mediterranean than in the Eastern basin, due to the influence of Atlantic Waters. Some data anomalies are present both in temperature and salinity fields but further investigation is needed before discarding them because the Eastern Mediterranean Transient (1992-1993) and the Western Mediterranean Transition (2005-2006) changed the main water mass properties in time.


ITS-90 water temperature [degrees C] @ Depth [m]=150.00
Water body salinity [per mille] @ Depth [m]=150.00
ITS-90 water temperature [degrees C] @ Depth [m]=300.00
Water body salinity [per mille] @ Depth [m]=300.00
ITS-90 water temperature [degrees C] @ Depth [m]=600.00
Water body salinity [per mille] @ Depth [m]=600.00
ITS-90 water temperature [degrees C] @ Depth [m]=1000.00
Water body salinity [per mille] @ Depth [m]=1000.00
ITS-90 water temperature [degrees C] @ Depth [m]=2000.00
Water body salinity [per mille] @ Depth [m]=2000.00

(a)

(b)

(c)

(d)

(e)

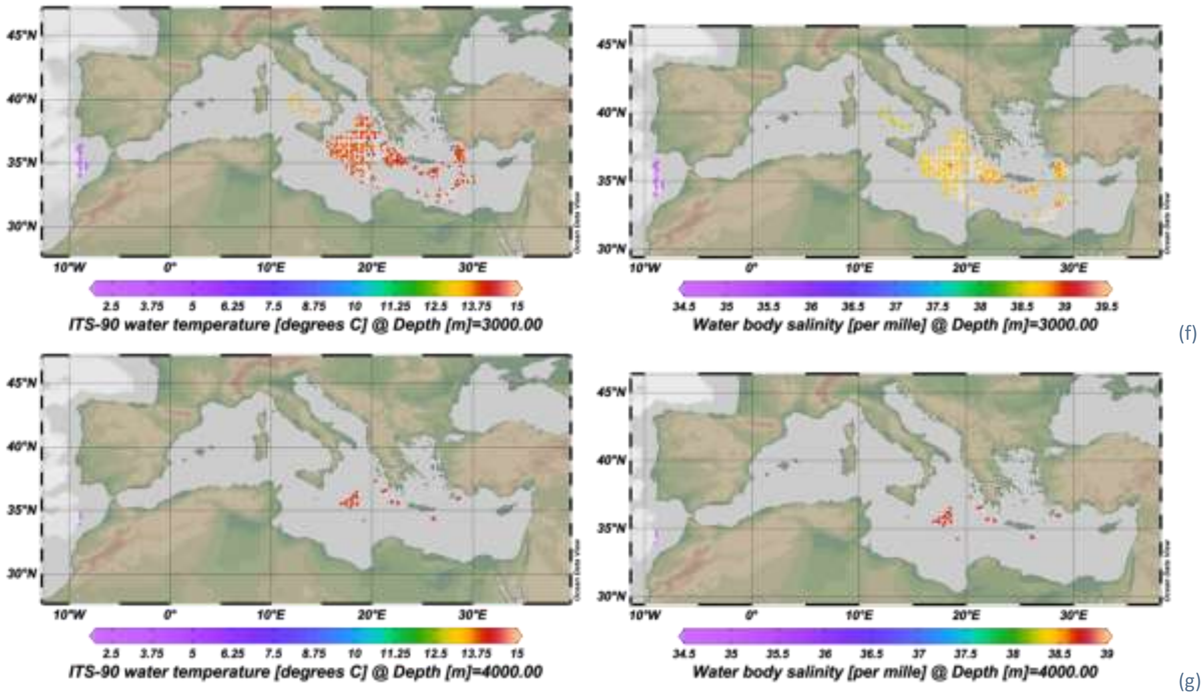


Figure 20 Temperature (left) and salinity (right) measurements with QF=1,2 at specific depth: a) 150m; b) 300m; c) 600m; d) 1000m; e) 2000m; f) 3000m; g) 4000m.

Figure 21 displays the scatter plots of temperature and salinity measurements with QF=1,2 over the entire SDC_MED_DATA_TS_V1. Some data appear still out of the data cloud but they have not been identified as obvious anomalies, they might have been sampled near the coast, during particular events or over peculiar circulation features.

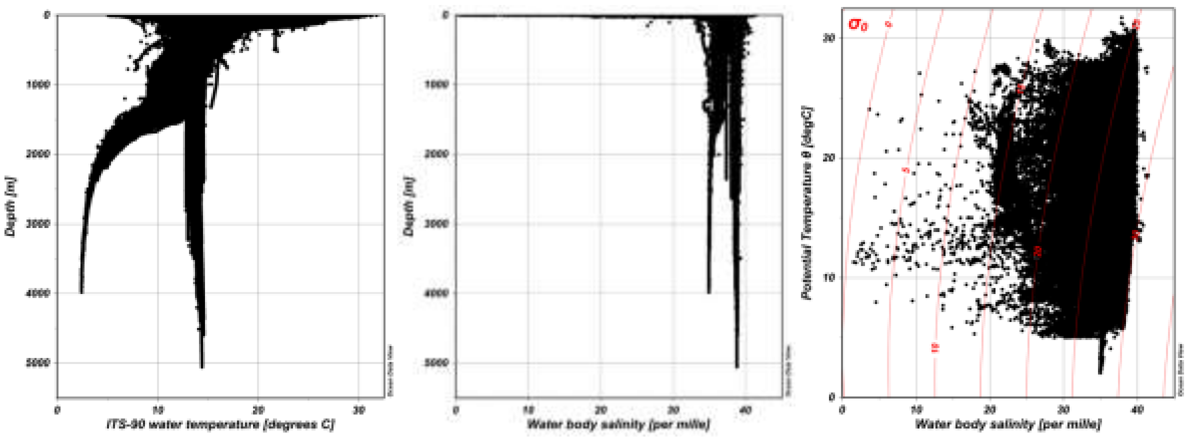


Figure 21 Scatter plots of good (QF=1, 2) observations after QC: (left) temperature versus depth (middle) salinity versus depth and (right) salinity versus potential temperature.

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 a unique and validated data set of Temperature and Salinity for the Mediterranean Sea sampled with different instruments. Data consistency among different data types should be kept in mind for any long term study or climatology computation. Data gaps are present and they must be considered for any application. Please consider that the SDC_MED_DATA_TS_V1 data set contains:

- underway data at reduced resolution, since only one sample over seven have been included in this data collection. New releases will keep the original data resolution.
- XBT data without any depth correction.

This data set can be used to support:

- Analysis of the variability of the basin hydrodynamic properties;
- To support operational oceanography in modelling activities, like data assimilation, model validation and model initialization.

Whenever SDC_MED_DATA_TS_V1 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 (SDN2_V2) was released at the end of 2015 in the framework of the SeaDataNet2 project and it is available at SEXTANT Catalogue (http://sextant.ifremer.fr/en/web/seadatanet) under the name “Mediterranean Sea-Temperature and salinity observation collection V2” (http://doi.org/10.12770/8c3bd19b-9687-429c-a232-48b10478581c, *Simoncelli et al. 2015*).

Table 4 compares the number of stations in SDC_MED_DATA_TS_V1 and SDN2_V2 collections over the same spatial domain over the time period 1900-2015. There is a large increase in the number of stations (+245%), mainly for salinity (+385%). The huge increase of stations is due also to the ingestion of thermosalinograph data. Table 5 presents comparative statistics in terms of number of samples, instead of stations, and it shows an increase which goes from 40% of T&S samples to 51% of only temperature samples. This encouraging increase in data availability in the Mediterranean region would allow to ameliorate the quality of deriving data products.

Table 4 Number of stations in SDN_V2 and SDC_MED_DATA_TS_V1 collections over the time period 1900-2015, the relative percentages of temperature, salinity and T&S stations, the total increase of number of stations in percentage from SDN2_V2 to SDC_V1.

1900-2015 # stations	SDN2_V2	Relative %	SDC_V1	Relative %	Total increase (%)
Total	212887		734957		**+245,2**
T	210914	99,1	732275	99,6	**+247,2**
S	136713	64,2	662785	90,2	**+384,8**
T&S	135339	63,6	660941	89,9	**+388,4**

Table 5 Number of samples in SDN_V2 and SDC_MED_DATA_TS_V1 collections over the time period 1900-2015 and the total increase in percentage from SDN2_V2 to SDC_V1.

1900-2015 # samples	SDN2_V2	SDC_V1	Total increase (%)
T	26416759	39825670	**+50,8**
S	19507279	27428938	**+40,6**
T&S	19335811	27030144	**+39,8**

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.

Table 6 lists the Quality Flags (QF) adopted by SeaDataNet and their definition. QF assigned by the data centers are modified by the regional products' leaders when/if a data anomaly is detected. The data anomaly is reported to the data center asking for correction in the central CDI.

Key	Entry Term	Abbreviated term	Term definition
0	no quality control	none	No quality control procedures have been applied to the data value. This is the initial status for all data values entering the working archive.
1	good value	good	Good quality data value that is not part of any identified malfunction and has been verified as consistent with real phenomena during the quality control process.
2	probably good value	probably_good	Data value that is probably consistent with real phenomena but this is unconfirmed or data value forming part of a malfunction that is considered too small to affect the overall quality of the data object of which it is a part.
3	probably bad value	probably_bad	Data value recognised as unusual during quality control that forms part of a feature that is probably inconsistent with real phenomena.
4	bad value	bad	An obviously erroneous data value.
5	changed value	changed	Data value adjusted during quality control. Best practice strongly recommends that the value before the change be preserved in the data or its accompanying metadata.
6	value below detection	BD	The level of the measured phenomenon was too small to be quantified by the technique employed to measure it. The accompanying value is the detection limit for the technique or zero if that value is unknown.
7	value in excess	excess	The level of the measured phenomenon was too large to be quantified by the technique employed to measure it. The accompanying value is the measurement limit for the technique.
8	interpolated value	interpolated	This value has been derived by interpolation from other values in the data object.
9	missing value	missing	The data value is missing. Any accompanying value will be a magic number representing absent data.
A	value phenomenon uncertain	ID_uncertain	There is uncertainty in the description of the measured phenomenon associated with the value such as chemical species or biological entity.

Table 6 List of SeaDataNet Quality Flags. Quality flags are used to describe the data value; no changes are made to the original data values. (https://www.seadatanet.org/content/download/596/3118/file/SeaDataNet_QC_procedures_V2_%28May_2010%29.pdf?version=1)

Annex 2 - Data Providers

It follows the list of 27 data centres that provide data in the Mediterranean domain, with their relative **EDMO code** (https://www.seadatanet.org/Metadata/EDMO-Organisations) and country.

EDMO_code	Institute	Country
43	British Oceanographic Data Centre	UK
120	OGS (Istituto Nazionale di Oceanografia e di Geofisica Sperimentale), Division of Oceanography	Italy
134	Institute of Marine Sciences, S.S. of Lerici (CNR-ISMAR-SP)	Italy
136	ENEA Centro Ricerche Ambiente Marino - La Spezia	Italy
149	CNR, Institute of Atmospheric Sciences and Climate (ISAC) (Rome)	Italy
269	Hellenic Centre for Marine Research, Hellenic National Oceanographic Data Centre (HCMR/HNODC)	Greece
353	Spanish Oceanographic Institute (IEO)	Spain
396	Marine Institute (MI)	Ireland
486	IFREMER / IDM / SISMER - Scientific Information Systems for the SEA	France
540	SHOM	France
590	IHPT, Hydrographic Institute (IHPT)	Portugal
630	NIOZ Royal Netherlands Institute for Sea Research (NIOZ)	Netherland
681	All-Russia Research Institute of Hydrometeorological Information - World Data Centre (RIHMI-WDC) National Oceanographic Data Centre (NODC)	Russia
691	National Institute of Fisheries Research (INRH)	Morocco
696	Institute of Marine Sciences, Middle East Technical University	Turkey
700	Institute of Oceanography and Fisheries (IOF)	Croatia
708	International Ocean Institute - Malta Operational Centre (University Of Malta)/Physical Oceanography Unit	Malta
711	Cyprus Oceanography Center (OC-UCY)	Cyprus
727	Marine Hydrophysical Institute	Ukraine
730	International Council for the Exploration of the Sea (ICES)	Denmark
731	Department of Navigation and Hydrography and Oceanography, Turkish Navy	Turkey
802	Istanbul University, Institute of Marine Science and Management	Turkey
840	Institute of Biology of the Southern Seas, NAS of Ukraine	Ukraine
963	Israel Oceanographic and Limnological Research (IOLR)	Israel
1232	Institut National des Sciences et Technologies de la Mer – INSTM	Tunisie
2432	Institute of Marine Biology (IMBK) (IMBK - IBMK)	Montenegro
3234	PANGAEA - Data Publisher for Earth & Environmental Science	Germany

	(PANGAEA)	

Annex 3 – Data Originators

It follows the list of **data originators** with the relative EDMO code (https://www.seadatanet.org/Metadata/EDMO-Organisations), number of shared stations and country.

EDMO_code	# stations	Institute	Country
17	17	National Oceanography Centre, Southampton	UK
43	135	British Oceanographic Data Centre	UK
47	2	Plymouth Marine Laboratory	UK
48	312	Proudman Oceanographic Laboratory	UK
108	4041	CNR, Istituto di Scienze Marine (Sezione di Venezia - ex IBM)	Italy
120	20864	OGS (Istituto Nazionale di Oceanografia e di Geofisica Sperimentale), Division of Oceanography	Italy
126	489	SACLANT Undersea Research Centre (SACLANTCEN)	Italy
127	1520	CNR, Institute of Marine Science (ISMAR) (Trieste)	Italy
128	75	CNR, Istituto per lo Studio della Dinamica delle Grandi Masse	Italy
134	2899	CNR, Institute of Marine Science U.O.S. of Pozzuolo di Lerici (SP)	Italy
136	11381	ENEA Centro Ricerche Ambiente Marino - La Spezia	Italy
138	34	University of Genova - Laboratory of Marine Geology and Sedimentology, Dpt for the Study of the Territory and Resources	Italy
144	1134	CNR, Institute of Marine Science (ISMAR) - Ancona	Italy
145	142	CNR, Institute of Marine Science (ISMAR) - Bologna	Italy
149	591	CNR, Institute of Atmospheric Sciences and Climate (ISAC) (Rome)	Italy
164	8056	Hellenic Centre for Marine Research, Institute of Oceanography (HCMR/IO)	Greece
234	900	Università degli Studi di Napoli 'Parthenope' - Istituto di Meteorologia e Oceanografia	Italy
237	584	Stazione Zoologica Anton Dohrn of Naples	Italy
238	643	Marine Biology Laboratory of Trieste	Italy
280	2284	ICM-CSIC/ Institute of Marine Sciences (ICM-CSIC/)	Spain
334	432	Baleares Islands University. Environmental Biology Department. UIB	Spain
353	4536	IEO/Spanish Oceanographic Institute	Spain
396	180	Marine Institute	Ireland
440	60	IRD /CENTRE DE BRETAGNE	France
484	5	IFREMER / EEP / LEP-DEEP ENVIRONMENT LABORATORY	France
485	37	IFREMER / GM-MARINE GEOSCIENCES	France
486	443723	IFREMER / IDM / SISMER - Scientific Information Systems for the SEA	France
490	11743	LABORATORY OF OCEANOGRAPHY of VILLEFRANCHE (LOV) / OOV	France
501	924	MUSEUM NATIONAL D'HISTOIRE NATURELLE / LABORATOIRE D'OCEANOGRAPHIE PHYSIQUE	France
513	1074	COM - Physical and Biogeochemical Oceanography Laboratory (LUMINY)	France
515	1434	UNIVERSITY OF PERPIGNAN / CEFREM	France
527	14	IFREMER / RBE Department / Biogeochimical end Ecotoxicological Resarch Unit (Nantes)	France

529	55	Developmental Biology Research Laboratory (LBDV)	France
532	237	CNRS/Microbiology, Geochemistry and Marine Ecology Laboratory	France
540	125571	Shom	France
549	172	CEA / Laboratory of climatolocical and environmental Sciences(LSCE)	France
552	56	CNRS/Laboratory of studies on Spatial Geophysics and Oceanography (LEGOS)	France
560	21	CEREGE	France
590	759	IHPT, Hydrographic Institute	Portugal
630	395	NIOZ Royal Netherlands Institute for Sea Research	Netherlands
682	244	Atlantic Scientific Research Institute for Marine Fishery and Oceanography	Russian Federation
685	210	P.P.Shirshov Institute of Oceanology, RAS	Russian Federation
691	198	National Institute of Fisheries Research (INRH)	Morocco
696	3796	Institute of Marine Sciences, Middle East Technical University	Turkey
700	1020	Institute of Oceanography and Fisheries	Croatia
702	687	Center for marine research - Rudjer Boskovic Institute	Croatia
708	179	International Ocean Institute - Malta Operational Centre (University Of Malta) / Physical Oceanography Unit	Malta
709	128	Malta Centre for Fisheries Sciences	Malta
711	3474	Cyprus Oceanography Center	Cyprus
721	461	IFREMER / STATION DE SETE	France
727	164	Marine Hydrophysical Institute	Ukraine
731	288	Department of Navigation and Hydrography and Oceanography, Turkish Navy	Turkey
756	22	Far Eastern Regional Hydrometeorological Research Institute	Russian Federation
795	1	IFREMER / Dpt Technologicals Research and Development	France
802	88	Istanbul University, Institute of Marine Science and Management	Turkey
819	32	IFREMER / CENTRE DE TOULON	France
838	5	EPOC - Geology and Oceanography Department	France
840	2098	Institute of Biology of the Southern Seas, NAS of Ukraine	Ukraine
848	2	IFREMER / CENTRE DE BRETAGNE	France
900	59	Administration Of Fish Searching And Research Fleet for the Western Basin	Russian Federation
902	133	Moscow State University, Geography Department	Russian Federation
903	47	Murmansk Hydrometeorological Administration of Roshydromet	Russian Federation
920	1	Primorsky Territorial Office on Hydrometeorology and Environmental Monitoring of Roshydromet	Russian Federation
931	6828	Odessa Branch of SOI (State Oceanographic Institute)	Ukraine
946	6	V.I. Il'ichevs Pacific Oceanological Institute, Far Eastern Branch, Russian Academy of Sciences	Russian Federation
957	186	Institute Mediterranean Of Advanced Studies (IMEDEA)	Spain
963	5399	Israel Oceanographic and Limnological Research (IOLR)	Israel
1004	328	Hellenic Navy Hydrographic Service (HNHS)	Greece
1015	1817	Oceanologic Observatory of Banyuls (University of Paris VI)/OSU	France
1016	4	IFREMER / DYNECO- Coastal Environment Dynamics department	France
1017	46	Societe ACRI S.A	France
1020	557	CNRS / COM - Physical and Biogeochemical Oceanography Laboratory (Toulon)	France
1043	476	COM - Physical and Biogeochemical Oceanography Laboratory	France

		(Endoume)	
1052	4	IFREMER / GENAVIR BREST	France
1054	7533	IFREMER	France
1068	22	ISTPM (IFREMER NANTES)	France
1130	3965	ARPA Emilia-Romagna - Struttura Oceanografica Daphne	Italy
1145	6	IRD / CENTRE OF ABIDJAN	Côte d'Ivoire
1167	140	Ukrainian scientific center of Ecology of Sea (UkrSCES)	Ukraine
1232	67	Institut National des Sciences et Technologies de la Mer – INSTM	Tunisia
1338	4445	Italian Navy Hydrographic Office	Italy
1339	107	Commissione Permanente per lo Studio dell'Adriatico, Venezia	Italy
1393	130	Centre for Advanced Studies of Blanes (CEAB-CSIC)	Spain
1401	37	IEO/ Santander Oceanographic Centre	Spain
1403	185	IEO/ La Coruna Oceanographic Centre	Spain
1405	886	IEO/ Malaga Oceanographic Centre	Spain
1406	98	IEO/ Cadiz Oceanographic Centre	Spain
1407	942	IEO/ Murcia Oceanographic Centre	Spain
1409	261	IEO/ Balearic Islands Oceanographic Centre	Spain
1715	2	University of Rostock, Institute of Biosciences	Germany
1842	8	IRDN / LERCM - Toulon	France
1850	2143	Federal Maritime and Hydrographic Agency	Germany
1888	8	IFREMER / RBE / Biogeochimical end Ecotoxicological Resarch Unit (Brest)	France
1915	26	Universite D'Angers / Laboratoire Des Bio-Indicateurs Actuels Et Fossiles (Biaf)	France
1941	696	CNRS / Center of Oceanology of Marseille (COM) La-Seyne-Sur-Mer	France
1942	4	Universite de Toulon / Lab. De Sondages Electromagnetiques (Lseet)	France
2002	27	Southampton Oceanography Centre	UK
2195	111	DTU Aqua – National Institute of Aquatic Resources, Technical University of Denmark	Denmark
2432	708	Institute of Marine Biology (IMBK)	Montenegro
2489	25175	UTM-CSIC/Marine Technology Unit (UTM-CSIC)	Spain
2947	18	GEOMAR Helmholtz Centre for Ocean Research Kiel (GEOMAR)	Germany
3051	705	Hellenic Centre for Marine Research (HCMR)	Greece
3928	201	Oceanological Observatory of Villefranche sur Mer	France
4606	24	IFREMER / LERPAC - Toulon	France
4614	135	ERIC Euro-Argo	France
1051	13339	UNKNOWN	

References

*Simoncelli S., Coatanoan C., Myroshnychenko V., Sagen H., Bäck Ö., Scory S., Grandi A., Schlitzer R., Fichaut M. (2015). **Second release of the SeaDataNet aggregated data sets products**. WP10 Fourth Year Report - DELIVERABLE D10.4. http://doi.org/10.13155/50382*

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 Organizations (SeaDataNet catalogue)
GLO	Global Ocean
IOC	Intergovernmental Oceanographic Commission
IODE	International Oceanographic Data and Information Exchange (IOC)
MED	Mediterranean Sea
MFC	Monitoring and Forecasting System
NAT	North Atlantic Ocean
NWS	North West Shelf
ODV	Ocean Data View Software
QC	Quality Check
QF	Quality Flag
SDC	SeaDataCloud
SDN	SeaDataNet
TS	Temperature and Salinity
WOA	World Ocean Atlas
WP	Work Package