Data Quality Control Procedures

Volunteer Observing Ship
Mediterranean Forecasting System
Pilot Project
(VOS MFSPP)

Document:

Data Quality Control Procedures

Classification and Approval

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001	Jun. 11, 99	MGMR All	First draft discussed during the 2nd MFSPP VOS meeting, Toulon 16-17 June, 1999
002	Jul. 23, 99	MGMR	advanced draft
003	Oct. 29, 9	MGMR	Updated after monitoring setup

Content

1. Introduction

The first meeting of the MFSPP project required the implementation of protocols for exchanging data and for quality control, according to the 'MAST Guidelines and Practices' http://www.sea-search.net/.

This document has the aim to allow an assessment of the data's quality and limitations. It takes advantage of the protocols developed in other MAST projects (e.g. MEDATLAS).

Quality control and exchange protocols implemented in VOS MFSPP are considering only XBT data and for deep waters. They are applied to both near-real time and delayed mode data.

VOS MFSPP use the WOCE and TOGA definition:

- near-real time data are considered to be XBT observations coded for transmission on the GTS in the BATHY code forms. From this point of view they can also be defined as low-resolution data
- delayed mode data are considered to be the full resolution data which are processed within a month and submitted to replace the BATHY reports.

The acquisition/transmission system is based on consolidated technologies such as Sippican XBTs and ARGOS. However the VOS - MFSPP is very demanding, since the XBT profile have to be collected every 10-12 nautical miles on nine tracks covering in an appropriate way the Mediterranean Sea. This means that a huge amount of data have to be collected, quality controlled and transmitted for forecasting with a short time delay.

The aim of this report is the description of the quality check procedures implemented for VOS MFSPP and the format adopted for data exchange.

2. On board quality control of real-time data

Two controls will be performed on the XBT data. The first one will be done automatically on board and will be based on the following requirements:

1. No test from 0 to 5 m	
2. Maximum depth	460 m
3. Minimum temperature	2°C
4. Maximum temperature	34.0°C
5. Maximum temperature inversion (0 – 200 m)	4.5°C
6. Maximum temperature inversion (> 200 m)	1.5°C
7. Maximum temperature gradient	3°C/m

The software ARGOS has been changed with respect to that used in the world ocean in order to take into account the major characteristics of the Mediterranean waters: the existence of a relatively warm water at depth (the LIW), the major vertical homogeneity of the temperature profiles, the necessity to have as much points as possible.

LIW temperature increase. Due to the artificial increase of temperature caused by the XBT wire stretching, the old software is containing an 'end of profile check', which automatically eliminate the part of the profile below 200 m having a temperature increase. In the oceans this can be due to strong currents. In the Mediterranean the increase of temperature below 200 m is due to the presence of the relatively warm LIW. The 'end of profile check has been eliminated.

Vertical homogeneity. The old version is controlling the temperature difference between the upper and lower layers which must be greater than 2-10 °C. Also in this case the control was changed in order to provide data in vertically homogeneous areas.

Number of significant points. The old software is providing only those significant points necessary to define the vertical profile, which can be less than 15. The New version is always calculating 15 significant points from surface up to 460 m.

3. Laboratory quality control of the near-real-time data

3.1 Near-real-time data

The profiles are collected by a Sippican system, decimated and transmitted by ARGOS in Toulouse and sent soon after the decoding to ENEA in La Spezia where a second more precise check will be performed, based on regional statistics and upper - lower temperature limits defined by the projects MEDATLAS

http://www.ifremer.fr/sismer/program/medatlas/fr/fr_medat.htm

	Name	Latitude		Longitude		Max	Min
DF1	Algerian Basin North	N42 00.00	N39 18.00	E009 18.00	E004 30.00	30	12
DF2	Gulf Of Lions	N43 36.00	N42 00.00	E006 18.00	E002 48.00	30	10
DF3	Ligurian Sea West	N44 30.00	N42 00.00	E009 24.00	E006 18.00	30	10
DF4	Ligurian Sea East	N44 18.00	N42 48.00	E010 48.00	E009 24.00	30	12
DH1	Aegean Sea	N41 12.00	N35 15.00	E027 18.00	E022 30.00	30	8
DH2	Cretan Passage	N35 15.00	N31 00.00	E027 18.00	E022 30.00	30	12
DH3	Levantine Basin	N37 04.00	N30 42.00	E036 30.00	E027 18.00	30	12
DI1	Sardinia Strait	N39 18.00	N36 48.00	E010 00.00	E008 24.00	30	12
DI3	Sicilia Strait	N38 00.00	N36 00.00	E014 00.00	E010 00.00	30	12
DJ1	Adriatic North	N45 54.00	N41 48.00	E015 48.00	E012 00.00	30	5
DJ2	Adriatic Middle	N43 54.00	N40 36.00	E018 00.00	E015 48.00	30	10

DJ3	Adriatic South	N42 48.00	N40 00.00	E019 48.00	E018 00.00	30	12
DJ4	Ionian 1 (Ne)	N40 00.00	N38 00.00	E022 30.00	E018 00.00	30	12
DJ5	Ionian 2 (South)	N36 00.00	N30 06.00	E022 30.00	E010 00.00	30	12
DJ6	Ionian 3 (Nw)	N40 36.00	N38 00.00	E018 00.00	E016 07.80	30	12
DJ7	Ionian 4 (Middle)	N38 00.00	N36 00.00	E022 30.00	E014 00.00	30	12
DS1	Gibraltar Strait	N37 42.00	N33 00.00	W005 36.00	W009 00.00	26	2
DS2	Balearic Sea	N42 00.00	N38 30.00	E004 30.00	W000 24.00	28	11
DS3	Algerian Basin Sw	N38 30.00	N35 36.00	E004 30.00	W001 00.00	28	12.5
DS4	Algerian Basin Se	N39 18.00	N36 30.00	E008 24.00	E004 30.00	28	12.5
DS5	Alboran Nw	N37 30.00	N36 00.00	W003 00.00	W005 36.00	26	12
DS6	Alboran Sw	N36 00.00	N35 00.00	W003 00.00	W005 36.00	27	12
DS7	Alboran Ne	N37 30.00	N36 00.00	W001 00.00	W003 00.00	27	12
DS8	Alboran Se	N36 00.00	N35 00.00	W001 00.00	W003 00.00	27	12
DT1	Tyrrhenian (Nw) 1	N42 48.00	N39 18.00	E013 48.00	E009 18.00	30	12
DT2	Tyrrhenian (Ne) 2	N41 18.00	N39 18.00	E016 6.00	E013 48.00	30	12
DT3	Tyrrhenian 3	N39 18.00	N38 30.00	E016 18.00	E010 00.00	30	12
DT4	Tyrrhenian 4	N38 30.00	N38 00.00	E015 00.00	E010 00.00	30	12
DT5	Tyrrhenian 5 (Messina)	N38 30.00	N38 00.00	E016 00.00	E015 00.00	30	12

Furthermore, all the data received were processed in order to eliminate temperature values from surface to 5 metres depth, and create new values by interpolation or extrapolation in order to maintain 15 significant points.

3.2 Delayed mode data

For this check it will also be considered the changes occurring along the water column. In order to implement this check, the MODB (Mediterranean Oceanographic Data Base - http://modb.oce.ulg.ac.be/) data were analysed for all the Mediterranean sub-regions, as defined in MEDATLAS.

	NAME	WINTER		SPRING		SUMMER		AUTUMN	
		0-200	>200	0-200	>200	0-200	>200	0-200	>200
DF1	Algerian Basin North	12:18	12:15	10:25	12:15	12:30	12:16	12:24	12:15
DF2	Gulf Of Lions	10:17	12:14	10:20	12:14	10:26	12:15	10:21	12:15
DF3	Ligurian Sea West	10:16	12:15	10:21	12:15	10:29	12:15	10:21	12:15
DF4	Ligurian Sea East	12:17	12:16	12:22	12:15	12:27	12:15	12:22	12:15
DH1	Aegean Sea	12:25	13:18	12:25	13:18	12:30	13:18	12:27	13:18
DH2	Cretan Passage	12:20	13:17	12:23	13:17	12:31	13:17	12:33	13:17
DH3	Levantine Basin	12:21	12:18	12:28	12:17	12:33	12:18	12:33	12:17
DI1	Sardinia Strait	12:18	12:15	12:22	12:16	12:28	12:15	12:25	12:15
DI3	Sicilia Strait	12:19	12:15	12:22	12:16	12:32	12:16	12:26	13:16
DJ1	Adriatic North	05:28		07:24		10:28		09:23	
DJ2	Adriatic Middle	10:17	12:15	10:21	12:15	11:28	12:15	11:21	12:15
DJ3	Adriatic South	12:18	12:16	12:24	12:16	12:27	12:16	12:22	12:16
DJ4	Ionian 1 (Ne)	12:19	12:16	12:22	12:16	12:30	13:16	12:25	12:16
DJ5	Ionian 2 (South)	12:21	13:17	12:23	13:16	12:30	13:16	12:26	12:17

DJ6	Ionian 3 (Nw)	12:18	12:16	12:23	13:16	12:28	12:16	12:23	12:16
DJ7	Ionian 4 (Middle)	12:19	13:16	12:23	13:16	12:30	13:17	12:26	13:17
DS2	Balearic Sea	11:18	12:15	11:25	12:15	11:30	12:15	11:24	12:15
DS3	Algerian Basin Sw	12:18	12:15	12:21	12:15	12:28	12:15	12:24	12:15
DS4	Algerian Basin Se	12:18	12:15	12:22	12:15	12:28	12:15	12:25	12:15
DS5	Alboran Nw	12:19	12:15	12:21	12:15	12:26	12:15	12:22	12:15
DS6	Alboran Sw	12:19	12:15	12:21	12:15	12:27	12:15	12.23	12.15
DS7	Alboran Ne	12:18	12:15	12:23	12:15	12:27	12.15	12:23	12:15
DS8	Alboran Se	12:18	12:15	12:21	12:15	12:27	12:15	12:23	12:15
DT1	Tyrrhenian (Nw) 1	12:18	12:16	12:23	12:16	12:30	12:16	12:26	12:16
DT2	Tyrrhenian (Ne) 2	12:18	12:16	12:22	12:16	12:29	12:16	12:24	12:16
DT3	Tyrrhenian 3	12:18	12:16	12:22	12:16	12:29	12:15	12:24	12:16
DT4	Tyrrhenian 4	12:18	12:16	12:22	12:16	12:29	12:15	12:24	12:16
DT5	Tyrrhenian 5 (Messina)	12:18	12:16	12:23	12:16	12:28	12:16	12:23	12:16

This control is not yet approved by MEDATLAS/IOC and is intended only as an internal MFSPP – VOS rule, which could be implemented during the project. The performance/implementation of this QC will be discussed also in MEDAR/MEDATLAS project.

Also in the delayed mode data all temperature values above 5 metres depth were eliminated.

4. Transmission Strategy

The transmission unit is composed by a transmitter, a GPS and a software running on a PC. The unit will pick up the data collected by the Sippican system, validate the profile, select significant points, code the data and transmit them via ARGOS.

The position of the XBT launch is provided by interpolating hourly GPS fixes.

Two kind of messages are transmitted trough ARGOS: the message containing 7 GPS fixes and the one containing a pile of 12 XBT decimated profiles.

The strategy is consisting on sending 1 message GPS followed by 4 messages from the data pile. The pile is updated every hour.

5. Format of decimated data

In a general way, the following requirements holds for the decimated data:
a) the values shall be sufficient to reproduce basic features of the temperature profile

b) define the top and the bottom of isothermal layers

ARGOS produces two kind of files: BATHY and Simple Format.

- BATHY

JJXX
10088 1200/ 73848 00015
88888 05190 15181 30183 50170 80145 99901 20136 60134 99902 00133
40133 80133 99903 40133 99904 20133
JPJX

Or

JJXX
DDMMY hhmm/ $Q_cL_aL_aL_aL_a$ $L_oL_oL_oL_oL_o$
8888k zzTTT (…..) 999pp (…..)
JPJX

Where
JJXX is indicating the start of the bathy message,
DDMMY is the day, month, year
hhmm is hour and minute
Qc is the quadrant of the globe (7 for the Mediterranean east of the Greenwich latitude and 1 west of Greenwich)
$L_aL_aL_aL_a$ is the latitude in degrees and minutes
$L_oL_oL_oLo$ is the longitude in degrees and minutes
8888 is indicating the start of the decimated data
k is called indicator for digitisation and is equal to:

7 values are at selected depths (data points fixed by the instruments or selected by any other method)
8 values are at significant depths (data points taken from traces at significant depths)

zzTTT is indicating the depth (a number < 100) and the temperature (to be divided by 10)
999pp is indicating the change and the new depth (in 100 m)

The total depth is then given by summing pp and zz.

In particular the first five number underlined in the example are indicating a temperature of 19.0 °C at a depth of 5 m. The second underlined numbers are indicating a temperature of 13.6°C at 120 m.

In the particular case of the MFSPP project, the number of selected significant points is 15.

- Simple format

```
088
LFPW 171836
BEGIN
21527,TEST27B,19991017183600,15
 38.6609,   8.5884,19991017183715,00
SEATEMP    ,WT_T     ,    0.0,      22.400000,000011
T1         ,WT_T     ,   -4.0,      22.100000,000011
T2         ,WT_T     ,  -18.0,      22.000000,000011
T3         ,WT_T     ,  -26.0,      21.799999,000011
T4         ,WT_T     ,  -30.0,      21.000000,000011
T5         ,WT_T     ,  -34.0,      20.000000,000011
T6         ,WT_T     ,  -39.0,      18.299999,000011
T7         ,WT_T     ,  -40.0,      18.000000,000011
T8         ,WT_T     ,  -47.0,      16.700001,000011
T9         ,WT_T     ,  -55.0,      15.600000,000011
T10        ,WT_T     ,  -67.0,      15.100000,000011
T11        ,WT_T     ,  -72.0,      14.700001,000011
T12        ,WT_T     ,  -93.0,      14.100000,000011
T13        ,WT_T     , -118.0,      13.800000,000011
T14        ,WT_T     , -163.0,      13.700000,000011
END
```

The line after BEGIN gives the number of the transmitter, the name of the project, year, month, day, hour and minutes. The line below gives the position and again the date, the temperature at 15 points is given.

6. Format of the WP1 Web

For data dissemination to MFS community and external users in general, another format has been defined. The near real-time ASCII files are identified by the year, month and day in the following way:

19991106A.DAT

where:
1999 stands for the year
11 for the month
06 for the day
A for data collected from 00.00 to 12.00
(B for data collected from 12.00 to 24.00)

The content of the files is the following:

MFS040008A0210 28 08 20000704 12.1555 40.0988 IBEX MFSPP40
5. 26.8 15. 26.7 20. 26.4 26. 25.1 29. 24.4 32. 23.6 41. 20.2 51. 18.0
60. 16.6 73. 15.3 79. 15.0 101. 14.1 121. 13.9 211. 14.0 251. 13.8

where:
MFS indicates the program
060 indicates the institution responsible for data collection (in this case NCMR)
0 stands for the year (2000)
04 stands for the month
A for data collected from 00.00 to 12.00
(B for data collected from 12.00 to 24.00)
0233 indicates the station number

Then there is the day (19), the month (04) and year (2000), followed by the time (h02.30) and geographical position (in degrees).

C6T2 is the ship call sign

MFSPP60 is
The partners participating to the data collection are 7 and are identified in this way
010 SAHFOS
020 CSIC CEAB
030 CNRS LOB COM
040 CNR IOF
050 OGS
060 NCMR
070 FD LPO

These identification numbers are changed in the files in an appropriate way.

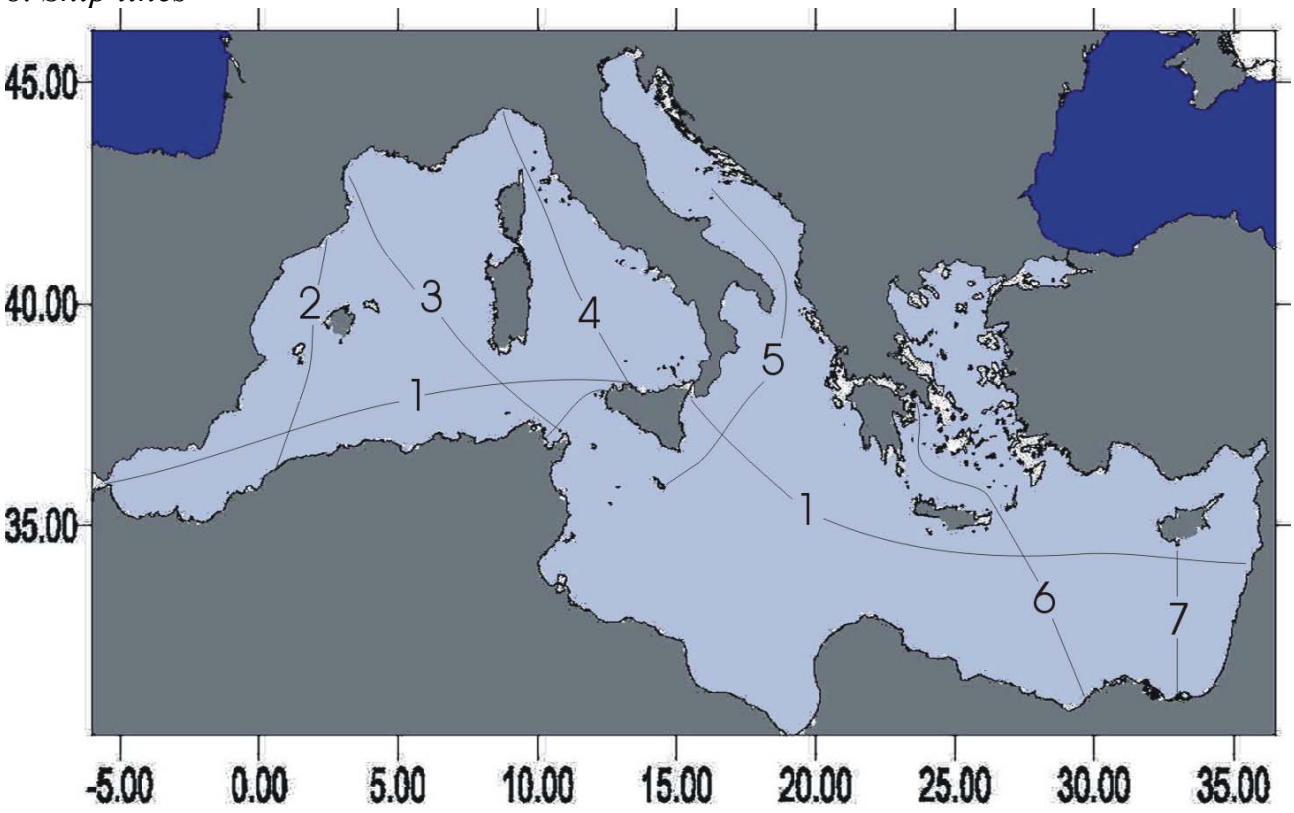
7. Format of the full resolution data

The data files are organised by cruises. The profiles are organised in the Medatlas, which is presented in appendix 3, downloaded from the Sismer web site.

The scheme of the XBT data flow has been presented in the VOS-MFSPP User Guide n. 1. During the 1st VOS MFSPP meeting in S. Teresa (February 1999) 9 tracks were defined. During the 1st Data Management meeting in Rome (March 1999) it was decide to name each XBT track as follows: MFSPPxxx, where xxx represents the number of the track.

Ex: MFSPP030 for the line Sète (France) – Tunis (Tunisia).

8. Ship lines



The final design of the MFSPP - VOS programme is schematically shown in the figure above. More in particular these are the starting and end ports of the various tracks:

Institution	Ship name	Track number	Initial and last port
SAHFOS	City of Dublin	1.1	Palermo - Gibraltar
SAHFOS	City of Dublin	1.2	Haifa - Messina
CSIC CEAB	Isabella	2.1	Barcelona - Mostaganem
CSIC CEAB	Isabella	2.2	Barcelona - Skikda
CNRS LOB COM	Cap Canaille	3.1	Sete - S.Antioco
CNRS LOB COM	Cap Canaille	3.2	Tunis - S. Antioco
CNR IOF	Excelsior	4.0	Genova - Palermo
OGS	Lipa	5.0	Ploze - Malta
NCMR	Mariska	6.0	Pyreus - Alexandria
FD LPO	Princesa Victoria	7.0	Limassol - P. Said

The time schedule of the monitoring system is the following:

1. training period (September - November): once a month;
2. pre-top period (December - February): twice a month (dates to be decided during the first MFSPP annual meeting)

3. top period (March - May): twice a month.

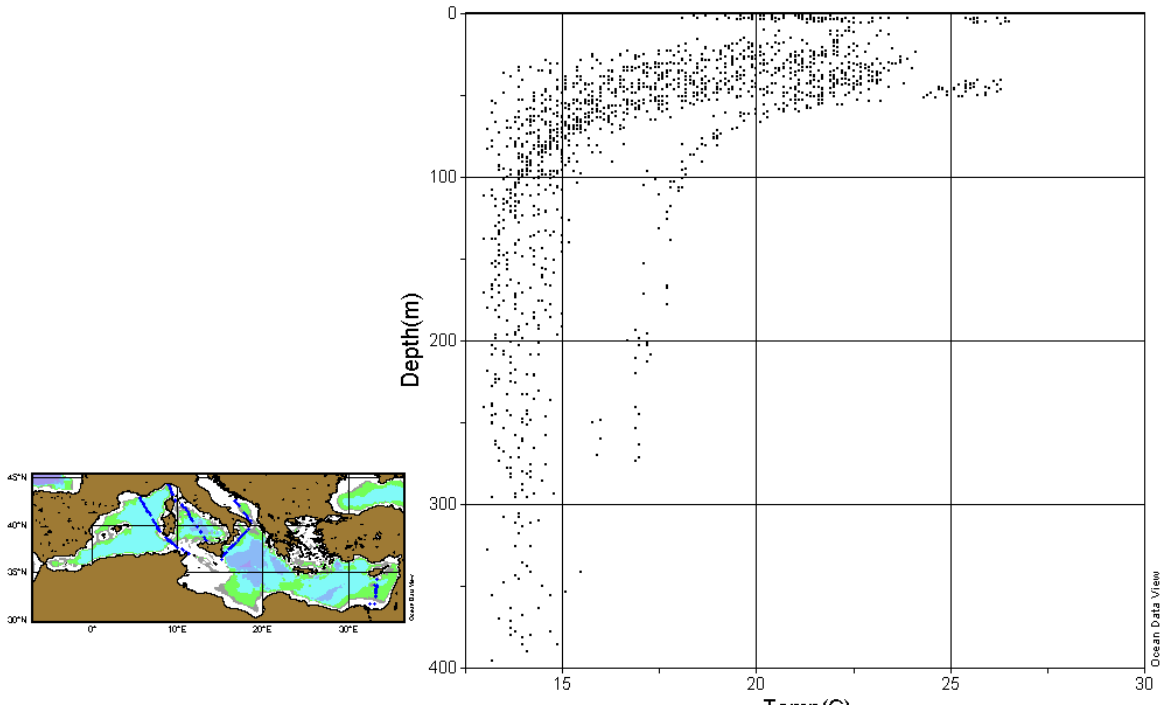
The long route managed by SAHFOS (Haifa-Messina and Palermo-Gibraltar) will be done once a month for the entire project period.

The lines 2.1 and 2.2 are two alternative tracks. Data are collected on the base of ship availability on one track or the other.

8. Data distribution

A web page has been prepared in order to give the basic information on the work package 1. It allow to download the data in a user-friendly way.

The web allow also to download a software for the graphical representation of the data (geographic coverage, vertical section, scatters, etc.).



Appendix 1
Code Lists

Mediterranean data centres codes

Belgium GHER	BG
Denmark ICES	DI
France IFREMER	FI
France SHOM	FS
Greece NCMR	GN
Italy OGS	IO
Italy ENEA	IE
Italy IRPEM	II
Spain UIB	SB
Spain IEO	SI

Appendix 2
IOC Country Codes

CY Cyprus
35 France
36 Greece
48 Italy
29 Spain
74 United Kingdom
99 Unknown/Unspecified

Appendix 3. The MEDATLAS Format (from the Sismer web site).

MEDATLAS FORMAT

OBJECTIVES

Vertical profiles of temperature and salinity nutrients, are basic core parameters which have been widely exchanged since the beginning of oceanography. A common format is necessary to exchange data originating from dispersed sources, to merge them in an integrated data set, and to be able to use any processing software. It is important, to insure the data quality and to avoid the duplicates, not only to archive the data points, but also to keep information (meta-data) about the source and the processing of the data : cruise, laboratory, parameter accuracy, methodology, time and location etc.. According to the ICES/IOC GETADE recommendations (see references), a good exchange format must fulfil the following requirements :
1) To facilitate the reading of the data, (and not to optimise the data archiving on the magnetic medium, neither to speed up the data processings).
2) To be independent of the computer.
The consequence of these two points is that an auto-descriptive ASCII format will be preferred.
3) To keep track of the history of the data including the data collection and the processing. Then each cruise must be documented.
4) To allow the processing of profile independently. Therefore the date, time and geographical co-ordinate must be reported on each profile header.
5) To be flexible and accept (almost) any number of different parameters.
6) The real numbers (floating numbers must remain in the same way as they have been transmitted, not transcoded into integer numbers). The number of decimals must implicitly indicate the accuracy of the measurements.
These requirements have been taken into account in the MEDATLAS exchange format which has been designed by the MEDATLAS and MODB consortia, in the frame of the European MAST II programme. The profiles measured with the same instrument (eg. bottles, CTD, XBT..) during the same cruise, are grouped within the same file which includes :

- **a cruise header based on the international ROSCOP information;**
- **a profile (station) header including the cruise reference, the originator station reference within the cruise and the time and location .**
- **the data points of the profile.**

The sequence 'profile header + data records ' is repeated for each profile. The main fields are described further on.

CRUISE SUMMARY FORMAT

BP = **Beginning Position,** SL = **string length,** NDT= **Number of data types (ROSCOP)**
NCO = **Number of comment lines (textual information on the cruise)**

LINE	FIELD	DESCRIPTION	BP	SL	TYPE

1	1st character	*	1	1	char
	cruise	MEDATLAS reference	2	13	char
	name	originator cruise name/ref.	16	32	char
	ship code	standardised WDCA/ICES/IOC code	49	4	char
	ship name	full ship name	54	25	char
2	start date	DD/MM/YYYY	1	10	char
	end date	DD/MM/YYYY	12	10	char
	region	GF3 table	23	35	char
3	country	Source laboratory country code	1	2	char
	address	Laboratory, institution, town	4	75	char
4	name	chief scientist full name	1	40	char
	key word	'Project='	42	8	char
	project	name of the project	50	28	char
5	key	'Regional Archiving='	1	19	char
	data centre	regional archiving centre code	21	2	char
	key word	'Availability='	42	13	char
	availability	Data Availability code (P/L/C)	55	1	char
5+1	key word	'Data Type='	1	10	char
	data type	ROSCOP code	11	3	char
TO	key word	'n='	15	2	char
	number	number of profiles for the type	17	4	num
5+NDT	key word	'QC='	22	3	char
	QC	Y/N (Yes or No)	25	1	char
6+NDT	key word	'COMMENT'	1	7	char
.....	.....	.....			
5+NDT+NCO	key word	any other cruise information	1	80	char

EXAMPLE

```
*FI35199406006 SUIVILION 09                      35EU EUROPE
26/06/1994 05/07/1994 MED. WESTERN BASIN
35 CNRS, Universites de Perpignan, Paris VI et Aix-Marseille II
DURRIEU de MADRON Xavier                 Project=Prog National Oceano Cotiere
Regional Archiving= FI                   Availability=P
Data Type=H10 n=  45 QC=Y
Data Type=H17 n=  45 QC=N
COMMENT
CTD casts were completed using the SEABIRD 9/11 plus CTD probe of the
Observatoire Oceanologique de Banyuls. The CTD data wewe recorded into 24 HZ
time-series during data acquisition.
The Pressure, temperature and conductivity channels wewe calibrated in
laboratory. Ligth transmission was measured with a 25 cm optical pathlength
Seatech transmissiometer.
No calibration in situ.
```

PROFILE HEADER FORMAT

NP = **number of observed parameters incl. the reference (pressure);** BP =**Beginning Position**
NCO = **number of comment lines in the header;** SL = **string length**

LINE	FIELD	DESCRIPTION	BP	SL	TYPE
1	start character	*	1	1	char
	reference	MEDATLAS ref. (cruise+station+cast)	2	18	char
	key word	'Data Type='	21	10	char
	data type	ROSCOP code	31	3	char
2	date	'*DATE=', DDMMYYYY	1	14	char
	time	'TIME=',HHMN	16	9	char
	latitude N/S	'LAT=', N or S	26	5	char
	lat. degrees	latitude degrees (0 to 90)	31	2	char
	lat. minutes	latitude minutes.hundredth	34	5	char
	longitude E/W	'LON=', E or W	40	5	char
	long. degrees	longitude degrees (0 to 180)	45	3	char
	long. minutes	minutes.hundredth	49	5	char
	key word	'DEPTH='	55	6	char
	bottom depth	bottom depth in metres	61	6	num
	key word	'QC='	68	3	char
	time flag	QC flag on date and time	71	1	num
	lat. flag	QC flag on latitude	72	1	num
	long. flag	QC flag on longitude	73	1	num
	depth flag	QC flag on bottom depth	74	1	num
3	key word	*NB PARAMETERS= '	1	15	char
	nb. of columns	number of measured parameters (NP)	16	2	num
	key word	'RECORD LINES='	19	13	char
	number of lines	number of observations records (NL)	32	5	num
4	1st character	*	1	1	char
	title column p	GF3 code for parameter p	2	4	char
TO	parameter p	parameter full name (IOC def.)	7	30	char
	unit p	('IS/IOC unit')	37	30	char
3+NP	key word	'def.='	68	5	char
	default val.	string of '9'.string of '9' same format as the parameter p	73	nlen(np)	num
4+NP	key word	'*GLOBAL PROFILE QUALITY FLAG='	1	29	char
	profile QC	global quality flag for the profile	30	1	num
	key word	'GLOBAL PARAMETERS QC FLAGS='	32	27	char
	profile QC	global quality flags for the NP parameters	50	NP	num
5+NP	collect hist.1	'*DC HISTORY='method, instrum. etc	1	80	char
6+NP	collect hist.2	'*', continuation	1	80	char
7+NP	archv. hist.1	'*DM HISTORY', data mangt. history	1	80	char
8+NP	archv. hist.2	'*', end of data management	1	80	char
9+NP	comment 1	'*COMMENT ', free comment	1	80	char
TO 8+NP+NCO	comments n	'*', end of comments	1	80	char

9+NP+NCO	surface obs. 1	'*SURFACE SAMPLES=', samples	1	80	char
10+NP+NCO	surface obs. 2	'*', end of surface samples	1	80	char

---

EXAMPLE

```
*FI351994060060B020 Data Type=H10
*DATE=30061994 TIME=0900 LAT=N42 34.00 LON=E003 17.00 DEPTH=88     QC=1111
*NB PARAMETERS=04 RECORD LINES=00090
*PRES SEA PRESSURE sea surface=0    (DECIBAR=10000 PASCALS)        def.= -999.9
*TEMP SEA TEMPERATURE               (CELSIUS DEGREE)               def.= 99.999
*PSAL PRACTICAL SALINITY            (P.S.U.)                       def.= 99.999
*TUR2 TURBIDITY-attenuation coeff   (m-1)                          def.= 99.999
*GLOBAL PROFILE QUALITY FLAG=1 GLOBAL PARAMETERS QC FLAGS=1110
*DC HISTORY=
*
*DM HISTORY
*
*COMMENT
* Depth Above Bottom     :   0.000000
*SURFACE SAMPLES=
*
```

Each parameter p can have any length nlen(p), but this length must be constant in the profile, and the decimal points at a constant position. The separators are blanks of one character (or more), after each parameter value. The quality flags are grouped after the last separator, with no blank between them.
The position of the first character of parameter p in the record line is then :
bp(p)=nlen(1)+ ..+ nlen(p-1) + p
and the position of the first quality flag :
bp(q1)= bp(NP) + nlen(NP) + 1
nlen(p)=**number of digits of parameter p;** NP **= number of measured parameters (columns)**
NL=**number of observations records (lines)**
hheader **= NP+NCO +11 = total number of header lines;** NCO **= number of comment lines**
BP **=Beginning Position,** SL **= string length**

LINE	FIELD	DESCRIPTION	BP	SL	TYPE
nheader	start character	*	1	1	char
	title 1	'PRES' or ref. parameter	2	4	char
	separator	blank	6	nlen(1)-4	blank
	title 2	GF3 code parameter 2	bp(2)	4	char
	separator	blank	bp(p-1)+4	nlen(p-1)-3	
	title par. P	GF3 code parameter p	bp(p)	4	char
	title NP	GF3 code parameter NP	bp(np)	4	char
nheader	parameter 1	parameter 1 in IS units	1	nlen(1)	num
+1	separator	blank	bp(2)-1	1	
to	parameter 2	parameter 2 in IS units	bp(2)	nlen(2)	num
+NL	separator	blank	bp(np)-1	1	
.....					
	parameter NP	parameter NP in IS units	bp(np)	nlen(np)	num

```
          separator        blank                       bp(q1)-1  1
          QC Flag 1        Quality Flag parameter 1    bp(q1)    1           num
         ..............................................................
          QC Flag NP       Quality Flag parameter NP   bp(q1)+np 1           num

nheader   def. val. par.1  '-999.9' or string of '9'   1         nlen(1)     num
+NL+1     separator        blank                       bp(2)-1   1
(Last     def. val. par.2  string of '9'as in header   bp(2)     nlen(2)     num
line     ..........................................
of the    def. val. par.NP string of '9'as in header   bp(NP)    nlen(NP)    num
profile)  separator        blank                       bp(q1)-1  1
          QC Flag 1     '9' (Def. val.Quality Flag)    bp(q1)    1           num
         ....................................
          QC Flag NP    '9' (Def. val.Quality Flag)    bp(q1)+np 1           num
```

EXAMPLE

```
*PRES TEMP   PSAL   TUR2
   0.0 19.441 37.596  0.525 1110
   1.0 19.441 37.596  0.525 1110
   2.0 19.441 37.596  0.525 1110
   3.0 19.306 37.595  0.526 1110
   4.0 19.234 37.592  0.530 1110
   5.0 19.208 37.591  0.532 1110
   6.0 19.188 37.591  0.531 1110
   7.0 19.169 37.593  0.530 1110
   8.0 19.067 37.599  0.525 1110
   9.0 18.848 37.610  0.525 1110
  10.0 18.621 37.603  0.530 1110
  11.0 18.501 37.595  0.537 1110
..............................
..............................
-999.9 99.999 99.999 99.999 9999
```

DESCRIPTION OF THE MAIN FIELDS

Files

All the profiles measured with the same instrument (eg. bottles, CTD, XBT..) is grouped within the same file. The data file begins with a short cruise descriptor based on the ROSCOP information forms. The profiles are attached behind an each of them begins with a profile header giving all the necessary environmental information on the observations. Each observed parameter represent a separate column. There is no limitation to the number of parameters (columns) but the number of parameters within the same cruise must be constant. If a parameter is missing in one station, the corresponding column must be fulfilled by default values.

Records

The records consists in data collected at the same level. The record (line) length is not limited for observed data but reasonable (<120) number of characters in the lines is recommended.

Missing data

For missing data, the default characters are :
- in character strings : 'X' as many times as the missing string length or 'UNKNOWN'
- in numbers : 9 or -9 at the same format as the expected numbers.

Latitude and Longitude

In order to avoid ambiguity, N/S and E/W will be specified for latitude and longitude instead of signs.

Pressure/depth vertical reference parameter

- Pressure is the reference co-ordinate (first column) for the vertical profiles.
- When the pressure is not explicitly defined (mainly the oldest historical data sets), the vertical co-ordinate is supposed to be pressure in decibars (which makes no significant differences on historical data).
- The first colum parameter which is the reference (the pressure for vertical profiles) must be recorded in increasing order.

Temperature and Salinity and other parameters

- Temperature, salinity and any archived parameters are observed parameters. The calculated parameters like density or potential temperature are not archived.
- Other measured parameters like nutrients are archived with the GF3 parameter code as the column title. The parameter code is related to the same unit, normaly the International Systm (IS). A different unit corresponds to a different parameter code.

History and information on the data processing

In order to maintain some flexibility with the format and not to loose existing complementary information on the data processing, meteorological observations etc. not taken into account in the format, three specific fields terminate each header profile :
***DC HISTORY for the information linked to the data collection at sea (like instrument, calibration)**
***DM HISTORY for the information linked to the data management and archiving (like the source latitude if the sign has been changed)**
***COMMENT for all optional data and meta data like time and location at the end of the profile, meteorological observations. Avoid to repeat character strings already used (ex use LATEND= and not LAT=). The number of *COMMENT lines is not limited.**

REFERENCES

ICES/IOC 1995. GETADE Formatting Guidelines for Oceanographic Data Exchange (Preliminary report)
UNESCO 1989. A General Formatting System for Geo-reference Data. IOC.
Manuals and Guides N0. 17
UNESCO 1991. Manual on International Oceanographic Data Exchange. Manuals and Guides N0. 9

Appendix 4. Fortran code for XBT Q.C. and transformation into Medatlas

```
      PROGRAM ATLAS
C PROGRAM FOR xbt DATA EXCHANGE IN THE MEDITERRANEAN FORECASTING SYSTEM
C CHANGES XBT DATA FROM 'SIPPICAN' FORMAT TO MEDATLAS EXCHANGE FORMAT
C -------------------------------------------------------------------------
C THE TOTAL FILE IS COMPOSE BY:
C CRUISE SUMMARY
C FULL RESOLUTION PROFILE
C-------------------------------------------------------------------------
C QUALITY CHECK IS PERFORMED FOLLOWING THE MEDATLAS PROTOCOLS
C (OVERALL QC, INCREASING DEPTH,  TEMPERATURE RANGE)
C -------------------------------------------------------------------------
C NZ       NUMBER OF MEDITERRANEAN DIVISION SUB-BASINS
C NUMPAR   NUMBER OF PARAMETERS (DEPTH INCLUDED) NVAR=NUMPAR-1
C P(1,K)   VECTOR CONTAINING THE PROFILE DEPTH
C P(IV,K)                                OTHER MARINE PARAMETERS
C T(IV,NZ) PARAMETERS' RANGES IN EACH SUB-BASIN
C IQP(IV), IQT QUALITY FLAGS FOR DEPTH AND TEMPERATURE
C
C CHECK IN THE OUTPUT FORMAT THE NUMBER OF VARIABLES TO BE WRITTEN
C
      PARAMETER(NZ=29)
      PARAMETER(NUMPAR=2)
      PARAMETER(NVAR=1)
      PARAMETER(NTZ=1500)
      DIMENSION P(NUMPAR,NTZ),IQP(NUMPAR,NTZ)
      DIMENSION TMAX(NVAR,NZ),TMIN(NVAR,NZ)
      DIMENSION RLO1(NZ),RLO2(NZ),RLA1(NZ),RLA2(NZ)
      DIMENSION IFLAS(NUMPAR)
C-------------------------------------------------------------------------
      CHARACTER*12 INFILE
      CHARACTER*5 ENEA
C
C PARTICULAR CASE FOR mfspp ------------------------------|
C                                                         |
C                                                        V
      CHARACTER*6 IDEPTH
      IDEPTH='      '
C-------------------------------------------------------------------------
      P(1,1500)=-999.9
      P(2,1500)=99.999
      DO K=1,NUMPAR
      IQP(K,1500)=9
      ENDDO
      ENEA='*IE48'
C-------------------------------------------------------------------------
C PARAMETER LIMITS BY REGION
C
      OPEN(20,FILE='C:\MFS\CLIM.DAT',STATUS='OLD',READONLY)
C-------------------------------------------------------------------------
C INPUT FORMAT WITH NUMPAR=2
      DO NNZ=1,NZ
      READ(20,22) RLO1(NNZ),RLO2(NNZ),RLA1(NNZ),RLA2(NNZ),
     &TMAX(1,NNZ),TMIN(1,NNZ)
 22   FORMAT(2X,4(1x,F5.2),3X,(1X,F4.1,1x,f4.1))
      ENDDO
```

```
C-------------------------------------------------------------------------------
C START THE FILES READING
C
      OPEN(50,file='OUTA.DAT',status='unknown')
      WRITE(*,*) ' NUMBER OF PROFILES TO BE INCLUDED'
      READ(*,*) NPF
C
C LOOP ON THE FILES
C
      DO 1000 IMAN=1,NPF
C
      WRITE(*,*) 'INPUT FILE'
      READ(*,*) INFILE
      OPEN(10,defaultfile='c:\mfs\xbtda',file=INFILE,status='old',readonly)
C-------------------------------------------------------------------------------
C DEFINE THE DATA COLLECTING CENTERS
C FOR MFSPP USE (CHANGE WHERE APPROPRIATE) ------------------------------------
C
      IF(IMAN.GT.1) GO TO 1001
      WRITE(*,*) ' INSTITUTE CODE'
      WRITE(*,*) '                  1 = SAHFOS      011, 012'
      WRITE(*,*) '                  2 = CSIC-CEAB   020'
      WRITE(*,*) '                  3 = LOB-COM     030'
      WRITE(*,*) '                  4 = CNR-IOF     040'
      WRITE(*,*) '                  5 = OGS         051, 052'
      WRITE(*,*) '                  6 = NCMR        060'
      WRITE(*,*) '                  7 = FD-LPO      070'
      READ(*,*) ISTC
      WRITE(*,*) ' TRANSECT NUMBER DEFINITION (3 DIGITS)'
      READ(*,*) NT
C
C
60    FORMAT(A5,'0MFSPP',I3.3,
     X' MEDITERRAEAN FORECASTING SYSTEM')
C
611   FORMAT('01/09/1999 31/05/1999 MEDITERRANEAN SEA')
C
61    FORMAT('74 SAHFOS, Plymouth, England',/
     *'WALNE Anthony                          Project= MFSPP')
C
62    FORMAT('29 CSIC, Centro de Estudios Avanzados de Blanes ',/
     *'CRUZADO Antonio                        Project= MFSPP')
C
63    FORMAT('35 CNRS LOB COM, Antenne de Toulon ',/
     *'MILLOT Claude                          Project= MFSPP')
C
64    FORMAT('48 CNR, Istituto Oceanografia Fisica, Italy',/
     *'GASPARINI Gianpietro                   Project= MFSPP')
C
65    FORMAT('48 OGS, Dipartimento di Oceanografia, Italy',/
     *'GACIC Miroslav                         Project= MFSPP')
C
66    FORMAT('36 NCMR Oceanography Department, Greece',/
     *'TZIAVOS Christos                       Project= MFSPP')
C
67    FORMAT('CY FD Laboratory of Physical Oceanography',/
     *'ZODIATIS George                         Project= MFSPP')
C
```

```
671   FORMAT('Regional Archiving= IE                    Availability=L')
C
68    FORMAT('Data Type=H13 n=',I4,' QC=Y')
69    FORMAT('COMMENT')
691   FORMAT('DM=TEMP controlled with MODB release 4')
C
C END OF THE CRUISE SUMMARY DESCRIPTION
1001  CONTINUE
C
C READ XBT FILES ----------------------------------------------------------------
C
10    FORMAT(17X,I2,1X,I2,1X,I4)
      READ(10,*)
      READ(10,*)
      READ(10,10) IMONTH,IDAY,IEARS
C--------------------------------------------------------------------------------
C
C CRUISE SUMMARY REPORT FOR MFSPP AND ENEA USE - VOS PROGRAMME
      IF(IMAN.GT.1) GO TO 1002
      WRITE(50,60) ENEA,IEARS,IMONTH,IDAY,NT
      WRITE(50,611)
C--------------------------------------------------------------------------------
      IF(ISTC.EQ.1) WRITE(50,61)
      IF(ISTC.EQ.2) WRITE(50,62)
      IF(ISTC.EQ.3) WRITE(50,63)
      IF(ISTC.EQ.4) WRITE(50,64)
      IF(ISTC.EQ.5) WRITE(50,65)
      IF(ISTC.EQ.6) WRITE(50,66)
      IF(ISTC.EQ.7) WRITE(50,67)
C--------------------------------------------------------------------------------
      WRITE(50,671)
C
      WRITE(50,68)NPF
      WRITE(50,69)
      WRITE(50,691)
C
1002  CONTINUE
      READ(10,10) IHOURS,MINUT,ISEC
      READ(10,*)
      READ(10,20) LATITU,RLAMIN
      READ(10,20) LONGIT,RLOMIN
C
 20   FORMAT(17X,I2.2,1X,F5.2)
C
      DO L=1,23
      READ(10,*)
      ENDDO
      WRITE(*,*) ' END LABEL READING'
c-------------------------------------------------
      NUMREC=0
C  READ TEMPERATURE AND DEPTH DATA
C
      DO K=1,10000
      READ(10,*,END=999) (P(IV,K),IV=1,NUMPAR)
      ENDDO
 999  CONTINUE
      NUMREC=K-1
      WRITE(*,*) NUMREC
```

```
C
C-----------------------------------------------------------------
C SET QUALITY CODES
C
      IQC1=9
      IQC2=9
      IQC3=9
      IQC4=9
      IFLAG=0
C-------------------------------------------------------------------------------
C CHECK DATE
C
C     MONTH,IDAY,IEARS
C      IF((IDAY.GT.1.AND.IDAY.LT.31.AND.IMONTH.GT.9.AND.IMONTH.LT.12.
C     1.AND.IEARS.EQ.1999)         .OR.
C     2 (IDAY.GT.1 .AND. IDAY.LT.31 .AND. IMONTH.GT.1 .AND. IMONTH.LT.5.
C     3 AND.IEARS.EQ.2000))IQC1=1
C
C CHECK POSITION
C
      RLAT=FLOAT(LATITU)+RLAMIN/60.
      RLONG=FLOAT(LONGIT)+RLOMIN/60.
      write(*,*) rlat,rlong
      IF(RLONG.GT.-6.0.AND.RLONG.LT.36.0 ) IQC3=1
      IF(RLAT.GT.30.0.AND.RLAT.LT.46.0 )   IQC2=1
C-----------------------------------------------------------------
C   CHECK POSITION AND TEMPERATURE RANGE
C
      DO NNZ=1,NZ
      IF(RLAT.GE.RLA1(NNZ).AND.RLAT.LE.RLA2(NNZ).AND.
     &RLONG.GE.RLO1(NNZ).AND.RLONG.LE.RLO2(NNZ)) GO TO 44
      ENDDO
44    IFLAZ=NNZ-1
C-------------------------------------------------------------------
C   CHECK THE PARAMETER RANGE
C
C     0 NO QC
C     1 CORRECT
C     2 INCONSISTENT
C     3 DUBIOUS
C     4 FALSE
C     5 INTERPOLATED/MODIFIED
C
      DO K=1,NUMREC
      IF(K.GT.1) GO TO 889
      IF(P(1,1).LT.P(1,2)) IQP(1,1)=1
      GO TO 888
889   CONTINUE
      IF(P(1,K).GT.P(1,K-1)) IQP(1,K)=1
888   CONTINUE
      DO IV=2,NUMPAR
      IF(P(IV,K).GT.TMIN(IV-1,IFLAZ).AND.P(IV,K).LE.TMAX(IV-1,IFLAZ))
     X IQP(IV,K)=1
      IF(P(IV,K).LT.TMIN(IV-1,IFLAZ).OR.P(IV,K).GT.TMAX(IV-1,IFLAZ))
     X IQP(IV,K)=4
      DIFF=ABS(P(IV,K)-P(IV,K-1))
      IF(P(1,K).GT.200.AND.DIFF.GT.0.1) IQP(IV,K)=4
      ENDDO
```

```
      ENDDO
C
      NOKP=0
      NOKT=0
C
C CHECK THE GLOBAL PROFILE ----------------------------------------------------
C
      ITOTD=NUMREC*NUMPAR*0.8
      IQTP= NUMREC*0.8
      DO IV=1,NUMPAR
      DO K=1,NUMREC
      IF(IQP(IV,K).EQ.1) NOKP=NOKP+1
      IF(IQP(IV,K).EQ.1) NOKT=NOKT+1
      ENDDO
      IF(NOKP.GT.IQTP) IFLAS(IV)=1
      IF(NOKP.LT.IQTP) IFLAS(IV)=2
      ENDDO
      IF(NOKT.GT.ITOTD) IFLAG=1
      IF(NOKT.LT.ITOTD) IFLAG=2
C
C ---------END OF QUALITY CONTROL-------------------------------------------------
C
C----------WRITE MEDATLAS FORMAT-------------------------------------------------
C
C PROFILE HEADER ----------------------------------------------------------------
C
      WRITE(50,100) ENEA,NT,IEARS,
      1IDAY,IMONTH,IEARS,IHOURS,MINUT,
     1LATITU,RLAMIN,LONGIT,RLOMIN,IDEPTH,IQC1,IQC2,IQC3,
     2IQC4,NUMPAR,NUMREC,IFLAG,IFLAS(1),IFLAS(2)
C
 100  FORMAT(A5,'0MFSPP',I3.3,I4.4,'0',1x,'Data Type=H13',/,
     1'*DATE='I2.2,I2.2,I4.4,1X,'TIME=',I2.2,I2.2,'LAT=N',I2.2,1X,F5.2,
      21X,'LON=W',I3.3,1X,F5.2,1X,'DEPTH=',A6,1X,'QC=',4(I1),/,
      3'*NB PARAMETERS=',I2.2,1X,'RECORDS LINES=',I5.5,/,
      4'*PRES SEA PRESSURE, SEA SURF=0      (DECIBAR)',/,
      5'*TEMP SEA TEMPERATURE               (CELSIUS DEGREE)',/,
      6'*GLOBAL PROFILE QUALITY FLAG=',I1,1X,'GLOBAL PARAMETERS QC FLAGS=
     7',2(I1),/,
      8'*DC HISTORY=XBT Sippican',/,
      9'*',/,
      9'*DM HISTORY',/,
      9'*',/,
     $'*COMMENT=',/,
     $'*',/,
     $'*SURFACE SAMPLES=',/,
     $'*',/,
     $'*PRES TEMP')
C OUTPUT FORMAT WITH NUMPAR=2 -------------------------------------------------
      DO K=1,NUMREC
      WRITE(50,300) (P(IV,K),IV=1,NUMPAR),(IQP(IV,K),IV=1,NUMPAR)
 300  FORMAT(F6.1,1X,F7.3,1X,2(I1.1))
      ENDDO
      WRITE(50,300) (P(IV,1500),IV=1,NUMPAR),(IQP(IV,1500),IV=1,NUMPAR)
      CLOSE(10)
1000  CONTINUE
      STOP
      END
```

Appendix 5. The geographical, temperature and salinity limits for the Mediterranean sub-areas.

n.	geographical limits				temp.		Sal.			
1	4.50	9.30	39.30	42.00	30.0	12.0	39.0	36.0	DF1	Algerian N
2	2.80	6.30	42.00	43.60	30.0	10.0	39.0	34.0	DF2	G. Lions
3	6.30	9.40	42.00	44.50	30.0	10.0	39.0	36.0	DF3	Ligurian W
4	9.40	10.80	42.80	44.30	30.0	12.0	39.0	33.0	DF4	Ligurian E
5	22.50	27.30	35.25	41.20	30.0	12.0	40.0	34.0	DH1	Aegean
6	22.50	27.30	31.00	35.25	30.0	12.0	40.0	36.0	DH2	Cretan Passage
7	27.30	36.50	30.70	37.07	30.0	12.0	40.0	36.0	DH3	Levantine
8	8.04	10.00	36.80	39.30	30.0	12.0	39.0	36.0	DI1	Sardinia Channel
9	10.00	14.00	36.00	38.00	30.0	12.0	39.0	36.0	DI3	Sicily Strait
10	12.02	15.80	41.80	45.90	30.0	5.0	39.0	19.0	DJ1	Adriatic N
11	15.80	18.00	40.60	43.90	30.0	10.0	39.0	30.0	DJ2	Adriatic M
12	18.00	19.80	40.00	42.80	30.0	12.0	39.0	36.0	DJ3	Adriatic S
13	18.00	22.50	38.00	40.00	30.0	12.0	40.0	36.0	DJ4	Ionian NE
14	10.00	22.50	30.10	36.00	30.0	12.0	40.0	36.0	DJ5	Ionian S
15	16.13	18.00	38.00	40.60	30.0	12.0	39.0	36.0	DJ6	Ionian NW
16	14.00	22.50	36.00	38.00	30.0	12.0	40.0	36.0	DJ7	Ionian M
17	-9.00	-5.60	33.00	37.70	26.0	2.0	38.7	34.0	DS1	Gibraltar
18	-0.40	4.50	38.50	42.00	28.0	11.0	39.0	35.5	DS2	Balearic
19	-1.00	4.50	36.60	38.50	28.0	12.5	39.0	36.0	DS3	Algerian SW
20	4.50	8.40	36.50	39.30	28.0	12.5	39.0	36.3	DS4	Algerian SE
21	-5.60	-3.00	36.00	37.50	26.0	12.0	38.7	35.5	DS5	Alboran NW
22	-5.00	-3.00	35.00	36.00	27.0	12.0	38.8	35.5	DS6	Alboran SW
23	-3.00	-1.00	36.00	37.50	27.0	12.0	38.8	36.0	DS7	Alboran NE
24	-3.00	-1.00	35.00	36.00	27.0	12.0	38.8	36.0	DS8	Alboran SE
25	9.30	13.80	39.30	42.80	30.0	12.0	39.0	36.0	DT1	Tyrrhenian NW
26	13.80	16.10	39.30	41.30	30.0	12.0	39.0	36.0	DT2	Tyrrhenian NE
27	10.00	16.30	38.50	39.30	30.0	12.0	39.0	36.0	DT3	Tyrrhenian 3
28	10.00	15.00	38.00	38.50	30.0	12.0	39.0	36.0	DT4	Tyrrhenian 4
29	15.00	16.00	38.00	38.50	30.0	12.0	39.0	36.0	DT5	Messina

```
// This is a MK12 EXPORT DATA FILE  (EDF)
//
Date of Launch:  07/20/1997
Time of Launch:  11:56:46
Sequence #    :  1
Latitude      :  0 0.000N
Longitude     :
Serial #      :  0
//
// Here are the contents of the memo fields.
//
//
// Here is some probe information for this drop.
//
Probe Type       :  T-7
Terminal Depth   :  760 m
Depth Coeff. 1   :  6.691
Depth Coeff. 2   :  -0.00225
//
Raw Data Filename:  C:\MFS\XBTDA\T7_PROV1.RDF
//
Display Units    :  Metric
//
// This XBT export file has not been noise reduced or averaged.
//
// Sound velocity derived with assumed salinity: 30.00 ppt
//
Depth (m) - Temperature (°C) - Sound Velocity (m/s)
0.7   27.67 1535.32
1.3   26.47 1532.57
2.0   26.01 1531.48
2.7   25.85 1531.11
3.3   25.77 1530.93
4.0   25.73 1530.84
4.7   25.69 1530.78
5.4   25.67 1530.74
6.0   25.65 1530.69
6.7   25.63 1530.66
7.4   25.62 1530.65
8.0   25.61 1530.62
8.7   25.61 1530.63
9.4   25.59 1530.61
10.0  25.59 1530.61
.............
752.0 13.77 1509.28
752.7 13.77 1509.28
753.3 13.77 1509.31
753.9 13.77 1509.31
754.5 13.77 1509.33
755.1 13.77 1509.33
755.7 13.77 1509.34
756.4 13.77 1509.35
757.0 13.77 1509.35
757.6 13.77 1509.37
758.2 13.77 1509.37
758.8 13.77 1509.39
759.4 13.77 1509.40
760.0 13.77 1509.41
```

Appendix

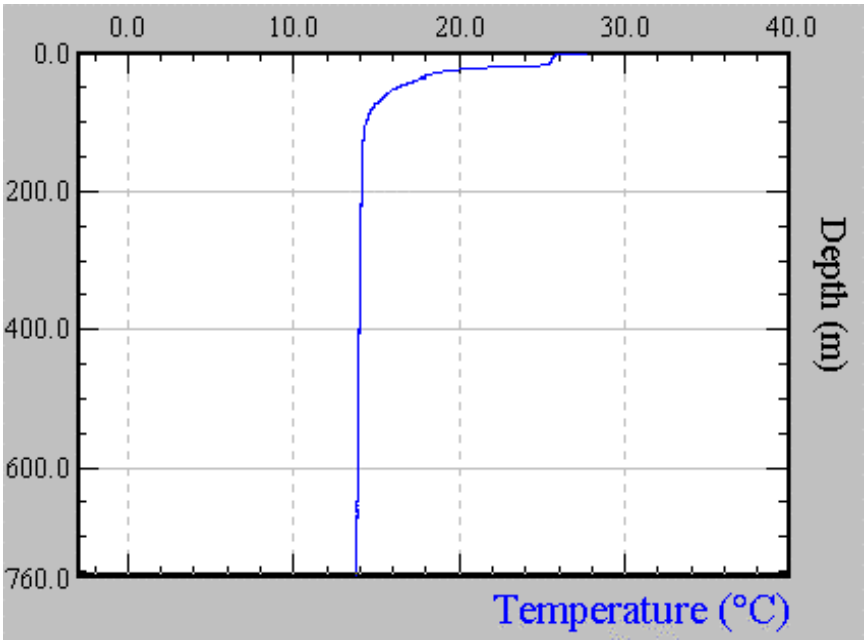
Definition of the Argos message

In order to increase the accuracy of the temperature and depth data, a new XBT message format has been defined. Also other information have been added, such as:

- the kind of probe used
- the version of the ARGOS transmitter
- checksum in order to verify the validity of the ARGOS message as it arrives in Toulouse (it is compared with that calculated on the message through the GTS chain treatment)

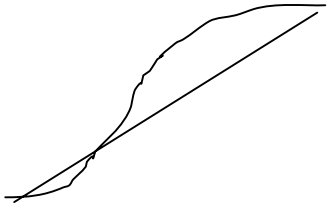
Selection of significant points in the profile

Since it is impossible to transmit a full resolution profile (having data every 60 cm) due to the fact that ARGOS transmit only 256 bits, a decimation software was originally developed by CLS and ORSTOM. The figure show an example of temperature profile obtained from a XBT probe.

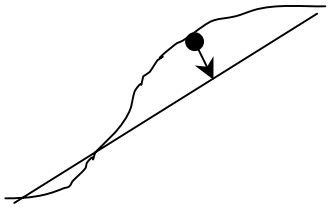


The determination of the significant points has been done with the method of the 'cord', on applying the following algorithm:

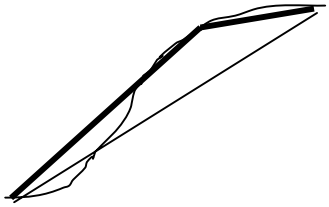
- two extreme points of the profile are chosen, the first and the last, and connected by a line.



The point having the maximum distance from the line is selected



Starting from this point other two lines are defined and again the same choice is done for another significant point



The algorithm is repeated until 15 significant points are selected, the first being the sea surface temperature.

Code of the significant points

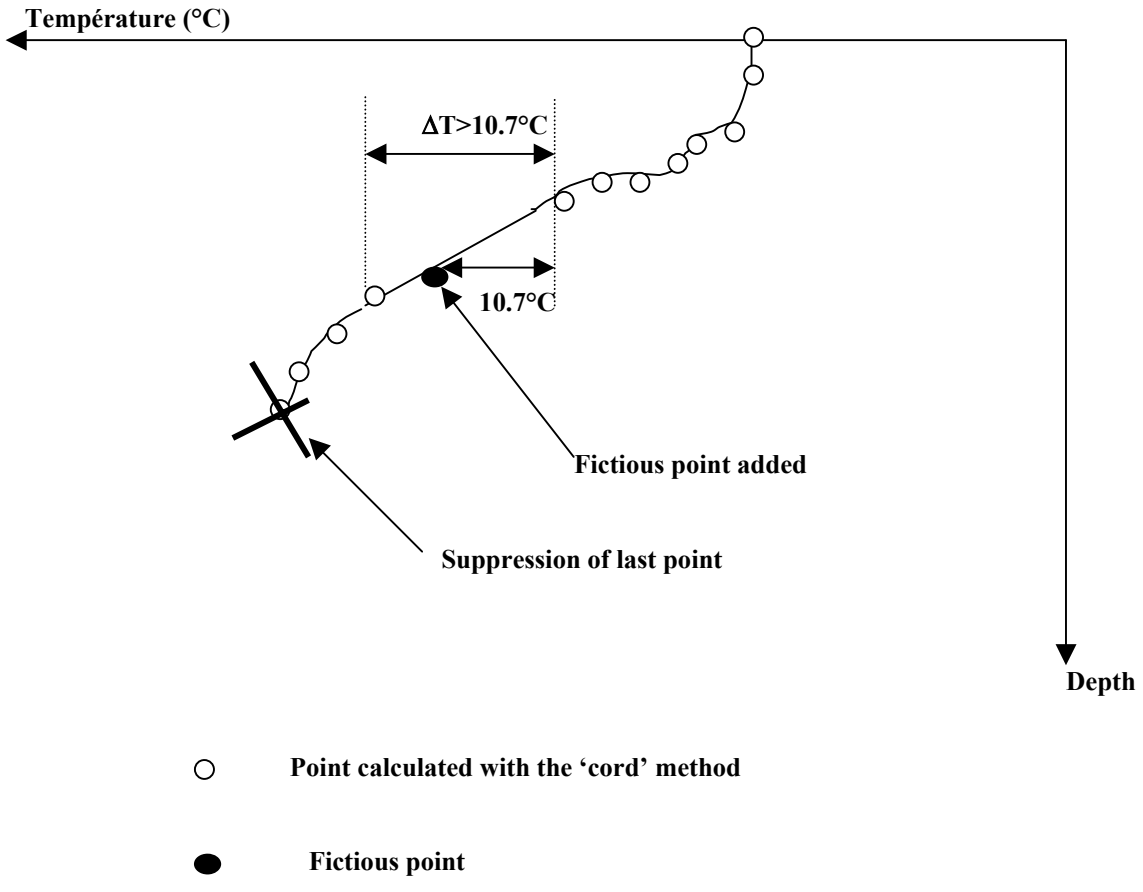
	Unité	précision	Bits (nb)	max	Etendue mesure
Type			**4**		
date	**Minute**	**2min48s**	**8**	**255**	**0 → 714**
latitude	**Minute**	**4min42**	**6**		
longitude	**Minute**	**4min42**	**6**		
SST	**°C**	**0.1333**	**8**	**255**	**-2 → + 34.1**
profondeur	**Mètres**	**2**	**8**	**255**	**2 → 514**
température	**°C**	**0.1333**	**8**	**255**	**-2 → +34.1**
total			**256**		

In the new code for data transmission position and temperature, depth data are part of two different messages. The objective is to reach an higher accuracy in data transmitted.

The temperature data are not absolutes but relatives, that means that only the sea surface temperature is transmitted as an absolute value an the other as difference to the previous one.

$$\Delta T = Temperature(i-1) - Temperature(i)$$

Normally $\Delta T > 0$ since the temperature decreases with depth up to the Levantine layer. Negative inversions can occur (warm currents). It is assumed that the range of temperature variation is comprised between –2 and 10.7 °C. This allow to encode the variation in tens of degree centigrade on 7 bits



In the case the distance between two successive points having a difference of 10.7 °C is too big, a fictious point is added in between, in order to maintain 15 significant points.

New format of XBT message

Version XBT 1 bits	Type sonde 2 bits	Date 10 bits	SST 9 bits	Prof(i) 9 bits	ΔTemp(i) 7 bits	CRC 10bits

14 couples (Prof(i), ΔTemp(i))

Version XBT : version of XBT transmission
Type sonde : probe type :

00 : probe T4
01 : probe T6

10 : probe T7

Date : Acquisition time over 24 hours. The precision is 2 min (24 * 60 / 2 = 1440 < 1024 * 2 = 2048)

SST : Sea surface temperature (–2°C +49.2°C). Code over 9 bits and precision of 0.1°C

Prof(i) : Starts from the second point and is coded in absolute value up to 460 m.

ΔTemp(i) : the temperature are defined as difference with respect to the previous value. The variations comprised between –2°C and +10.7° have an accuracy of 0.1°C

CRC (checksum) : is used to validate a message. The CRC coming from the transmitter is compared with the CRC obtained from GTS.

	Unité	**précision**	**Bits (nb)**	**max**	**Etendue mesurée**
Version XBT			**1**		
Type sonde			**2**		
Date	**Minute**	**2min**	**10**	**719**	**0 → 1438**
SST	**°C**	**0.1**	**9**	**511**	**-2 → + 49.2**
Prof(i)	**Mètres**	**1m (p<560m)** **2m (p>560m)**	**9**	**511**	**0 → 760**
Δtemp(i)	**°C**	**0.1°C**	**7**	**127**	**-2 → +10.7**
CRC			**10**		
Total			**256**		