Intergovernmental Oceanographic Commission
Workshop Report No. 182

EU/IOC MEDAR/MEDATLAS II Final Workshop

Organised in Co-operation with the Instituto Nationale di Oceanographia e di Geofisica Sperimentale (OGS) and International Centre for Theoretical Physics (ICTP)

Trieste, Italy
10-14 December 2001

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Abstract

The Final Workshop on MEDAR/MEDATLAS II was held in Trieste, Italy between 10 and 14 December 2001, hosted by Abdus Salam International Centre for Theoretical Physics (ICTP). The meeting reviewed the previous three years of intensive and dedicated efforts of data centres in the development of a database of high quality oceanographic and marine data sets for the Mediterranean and Black Seas of water temperature, salinity and chemical parameters. The MEDAR network included 19 NODCs or DNATS of the Mediterranean and Black Seas bordering countries, 3 international Data Centres, 3 modelling Centres and 3 International Organizations. The Workshop was attended by almost 50 scientists, data managers, researchers and students and presentations were made detailing the progress achieved by the participants in data collection and management for the Mediterranean and Black Seas region.

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1. PREFACE

MEDAR/MEDATLAS Project (1998-2001) is an European MAST/INCO concerted action and a regional contribution to IOC/IODE Global Ocean Data Archaeology and Rescue project (GODAR). More than 20 countries cooperated in rescuing, safeguarding and making available hundreds of thousands of marine physical and bio-chemical data.

The MEDAR network included 19 NODCs or DNATS of the Mediterranean and Black Seas bordering countries, 3 international Data Centres, 3 modelling Centres and 3 International Organizations.

The final Workshop on MEDAR/MEDATLAS II took place in Trieste, Italy from 10-14 December 2001 under the auspices of the Abdus Salam International Centre for Theoretical Physics (ICTP).

The Workshop culminated three years of intensive and dedicated efforts of data centres in the development of a database of high quality oceanographic and marine data sets for the Mediterranean and Black Seas of water temperature, salinity and chemical parameters.

To achieve this goal compatible and coherent procedures for data quality control have been developed, objective analysis have been performed and an electronic atlas published on Internet. Sharing the knowledge and know-how among the participants was an important issue of the project. Through the project data centres strengthened their oceanographic data management capacity.

The objectives of the Workshop included:

- review of the results of the MEDAR/MEDATLAS project;
- increase of awareness of the project products and of their usefulness for scientific and technical purposes;
- identification of ways for fostering operational networked data management system;
- formulation of recommendations for further improvement of the Mediterranean and Black Sea data management system.

The Workshop brought together almost 50 participants from 20 countries (Annex 2). Attending were scientists and data managers, researchers and students. Many of them have been directly involved in MEDAR/MEDATLAS implementation. Others were interested in the project products and in the ways of applying two project results for research, industrial, capacity building, and other purposes.

Thirty-three presentations were made at the plenary and poster sessions which gave an opportunity to set better acquainted with the progress achieved by the bordering members States in data collection and management, to share experiences and consider the benefits of the Workshop products to research, industrial and monitoring programmes of the Mediterranean and Black Seas region. A draft of the project CD-ROM containing data, meta-data, analysed data, maps, processing software and documentation was presented and discussed.

2. OPENING OF THE WORKSHOP

The Workshop officially started at 09.00 a.m. on Monday, 10 December 2001 by the Head of the local Organizing Committee, Dr. B. Manca. He welcomed the participants and reviewed the organization of the Workshop. He reminded the participants on the action taken for the Workshop implementation and introduced Prof. Iginio Marson, President of the Istituto Nazionale di Oceanografia e Geofisica Sperimentale – OGS, Trieste Italy, Prof. Giuseppe Furlan, Head of the programme for Training and Research at Italian Laboratory (TRIL) held at the International Centre for Theoretical Physics (ICTP) and Dr. Iouri Oliounine who welcomed the participants on behalf of Dr. Patricio Bernal, the IOC Executive Secretary, respectively.

Dr. I. Oliounine in his welcome address stressed the importance of the GODAR project and its regional components as MEDAR/MEDATLAS for the success of the IOC scientific and monitoring programmes. He emphasized that availability of marine data and data products has a vital role to play for the sustainable development of the Mediterranean and Black Seas Member States, for facilitating decisions on scientific, technical, administrative, political and socio-economic issues related to the exploration, exploitation, management, protection and conservation of the marine environment.

There is a big demand in the MEDAR/MEDATLAS products for planning and implementation of national policy. He expressed a strong belief that the products will be widely used and appreciated by the many users.

Dr. I. Oliounine then referred to a large interest the IOC has in promoting marine science, research and monitoring activities in the Mediterranean and Black Sea region through its coordinating mechanisms such as the Regional Committee for the Black Sea, MedGOOS and others, through multilateral activities such as POEM, MEDALPEX, PRIMO, through the development of a unified programme for the Mediterranean and non-governmental organizations, such as WMO, UNEP, CIESM, IOI and EU.

Finally he expressed deep satisfaction with the results of the MEDAR/MEDATLAS project giving it as exemplary of the EU/IOC cooperation and of the data centres of the region. He reiterated a full support to the project and its future developments from the IOC and its regional bodies and activities.

3. ORGANIZATIONAL ARRANGEMENTS

The Workshop was organized in accordance with the programme presented in Annex 1. The Workshops offered plenary sessions on databases and data products, quality assurance and networking and perspectives with key talks by 20 leading scientists from Europe and North America. They were open to all who wanted to know more about the Mediterranean and Black Seas, the importance of oceanographic data, the MEDAR/MEDATLAS project and its links with related global and regional projects.

Two and a half days were devoted to plenary presentations which included, inter alia, description of strong and weak points of the MEDAR/MEDATLAS network and database; IOC and ICES involvement in the project; results of climatological analysis; needs and perspectives for data products and data management structures from the point of view of major international projects like GODAR, GTSPP, WOCE, MFS; scientific data products and software.

Unfortunately, for personal reasons, Mr. S. Levitus and Mrs. E. Lipiatou were not able to participate at the Workshop. The abstract of Mr. Levitus presentation is presented in the next chapter of this Report.

Half of the day was dedicated to the poster session on national and thematic data management activities. 13 poster presentations were made. Every day some time was allocated to the demonstration of related software created within the project and to training on the MEDAR/MEDATLAS 2001 database and climatology. Finally, round table discussions have been organized to share experiences and ideas, and to prepare recommendations to improve the data exchange and containing updating of the MEDAR/MEDATLAS database. The draft project proposal on the Mediterranean and Black Seas – Distributed Oceanographic Data System (MEDBLACK-DODS) was brought to the participants' attention and comments.

On the third day, Wednesday December 12, a visit to the Instituto Nationale di Oceanografia e di Ecofisica Sperimentale – OGS were given.

The second half of the last day of the Workshop was dedicated to drawing up and approving conclusions and recommendations of the Workshop as they are presented in Chapter 5 of this Report.

Documentation and copies of the presentations and overheads were available during the Workshop. It was also agreed that IOC would publish a workshop report with abstracts of all presentations, conclusions and recommendations in the IOC series of Workshop Reports. The volume of full texts of presentations including poster presentations will be published by OGS in the institute series by the end of 2002.

4. ABSTRACTS OF PRESENTATIONS

This section contains abstracts of 21 key talks and 13 poster presentations. Key talks are arranged in sessions and in order of presentations. Roster presentations are in alphabetical order.

SESSION I: DATABASES AND DATA PRODUCTS

MEDAR/MEDATLAS 2001: A New Mediterranean and Black Sea Oceanographic Database and a Data Management Network

MEDAR Group (presented by Catherine MAILLARD)

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The objective of the MEDAR/MEDATLAS II project (Mediterranean Data Archaeology and Rescue of temperature, salinity and bio-chemical parameters, 1998-2001) is to rescue, safeguard and make available a comprehensive data set of temperature, salinity and bio-chemical parameters collected in the Mediterranean and Black Sea, through a wide co-operation of the Mediterranean countries. This project was carried out in the frame of a European Union MAST concerted action (MAS3-CT98-0174 & IC20-CT98-0103) initiated by a consortium of 20 partners from bordering countries and international organisations. The MEDAR network enlarged during the project implementation and involves now 19 National Oceanographic Data Centres or Designated National Agencies for International Exchange of the bordering countries, 3 International Data Centres, 3 Modelling Centres and 2 Intergovernmental Organisations. It involves also cooperation links with the worldwide GODAR project, National Data Centres from other countries carrying sea work in the Mediterranean and Black Sea and the Operational Mediterranean Forecasting Project (MFSPP). This project follows a first pilot project 1994-1996, which released a first database of temperature, and salinity on Cdrom with observed data, analysed data and maps.

The new data rescue has been focused on the following basic parameters: temperature, salinity, oxygen, phosphate, nitrate, nitrite, ammonium, silicate, pH, alkalinity, chlorophyll, hydrogen sulphide (Black Sea), total phosphorus and total nitrogen. These parameters were recognised to be necessary for the following up of the climate change and the calibration of ocean modes. Preliminary information was also available from the World Ocean Atlas (Levitus et al., 1998) to start the quality control procedure. These data have been searched for and compiled from all the scientific laboratories of the partners' national communities and from the IOC/IODE National Oceanographic Data Centre network outside the Mediterranean and Black Sea (Fig. 1).

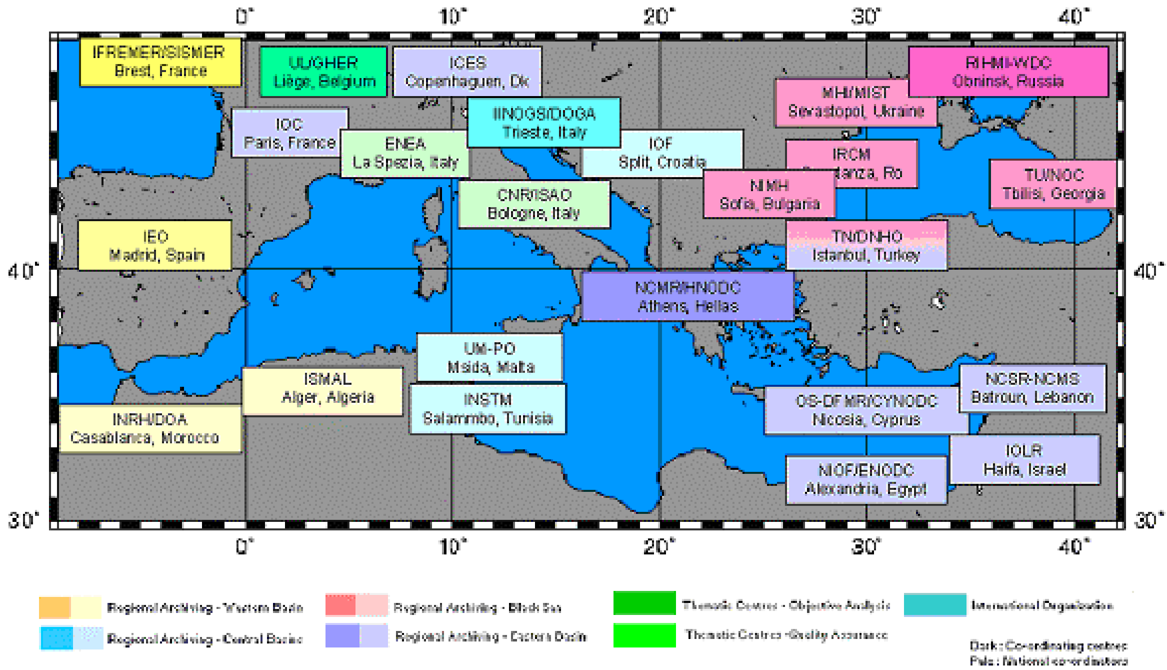

Fig. 1 MEDAR/MEDATLAS Network

The content of the updated database is given in Table I by type of data and Table II for the number of profiles of each parameter.

Table I – MEDAR 2002 Data Type Distribution

Data Type	Number of Profiles
Bottle casts	88453
CTD	36054
XBT + MBT	161890
Thermistors	29
Total	**286248**

Table II – MEDAR 2002 Parameters Distribution

CODE	PARAMETER NAME	No OF PROFILES	CODE	PARAMETER NAME	No OF PROFILES
TEMP	SEA TEMPERATURE	284946	SLCA	SILICATE	15936
PSAL, SSAL	PRACTICAL SALINITY	118509	PHOS	PHOSPHATE	20808
DOX1	DISSOLVED OXYGEN	44989	ALKY	ALKALINITY	2548
NTRA	NITRATE (NO3-N)	10588	PHPH	PH	14548
NTRI	NITRITE (NO2-N)	10561	CPHL	CHLOROPHYLL-A TOTAL	4828
AMON	AMMONIUM	5301	HSUL	HYDROGEN SULPHIDE (H2S)	1843
			NTOT	TOTAL NITROGEN	153
			TPHS	TOTAL PHOSPORUS	2381

Compared to the 1997 release, the volume of available data is doubled. The spatial distribution of the bottle stations and CTD (Fig. 2 and 3) is also improved significantly, except in the middle of the deep basins and on the Lybian shelf. With the addition of the Mbt and Xbt profiles, the temperature observations allow to compute monthly and seasonal climatologies. Salinity and Dissolved Oxygen distributions still allow computing seasonal climatologies, however the southern part of the Mediterranean is not well covered. The coverage of the nutrients decreases dramatically from phosphate, which is considered by the biologists as a control parameter of the biota (20808 profiles, Fig. 3) to total nitrogen (153 available profiles only). H2S is measured only in the Black Sea, in relation with the lack of oxygen in the subsurface layers, even if the deep inflow of Mediterranean water injects some oxygen at depth near the Bosphorus Straits.

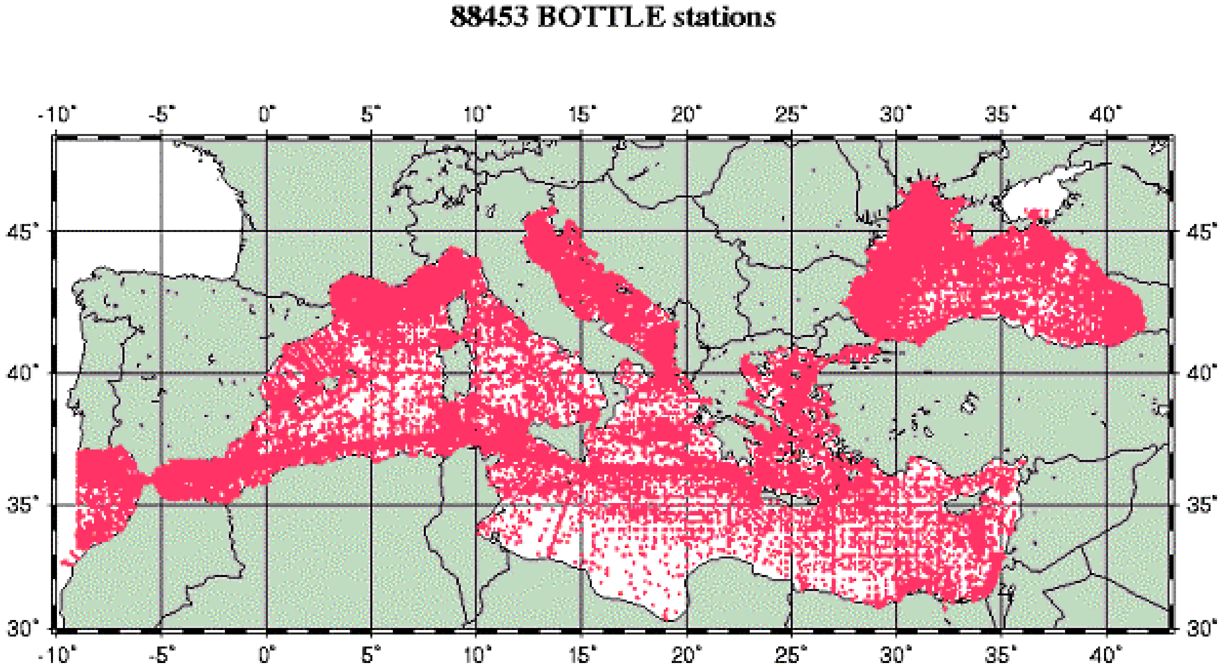

Fig. 2. Distribution of the Bottle stations in MEDAR Database

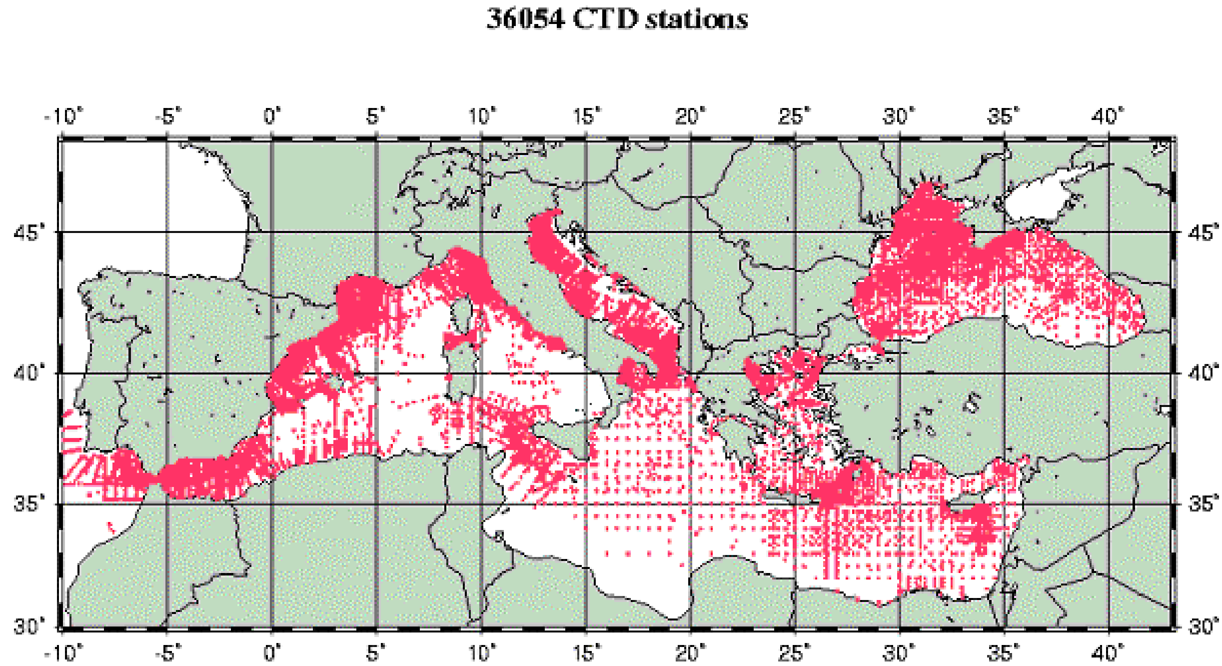

Fig. 3. Distribution of the CTD stations in MEDAR Database

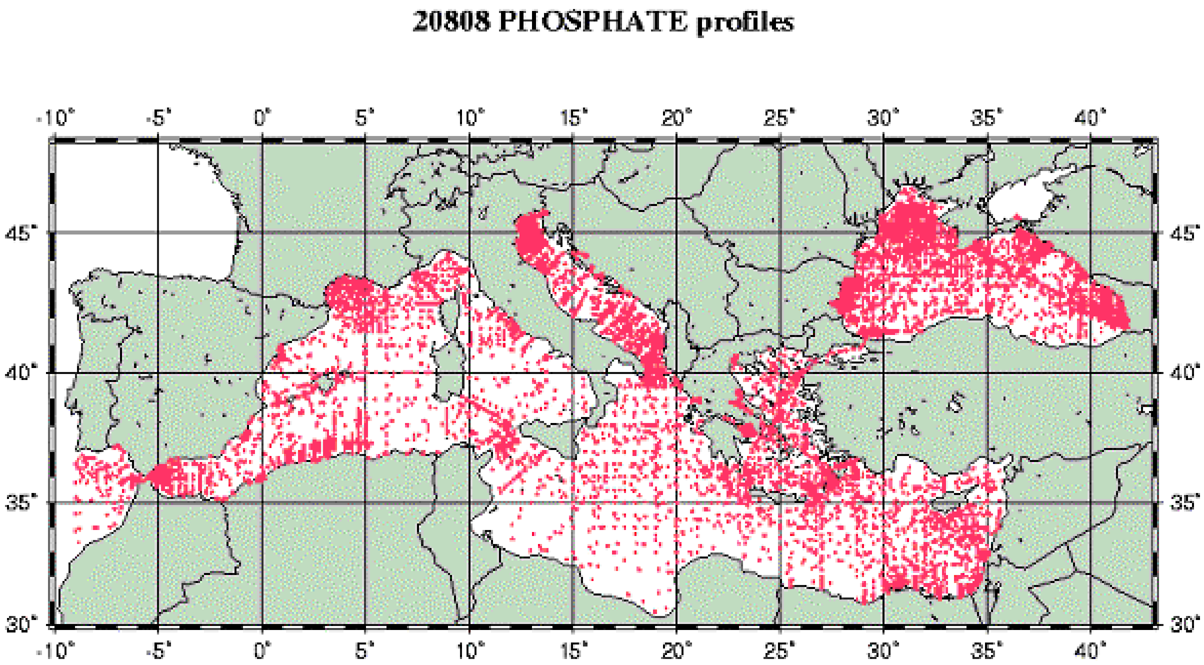

Fig. 4. Distribution of Phosphate profiles in MEDAR Database

These data have been checked for quality by compatible and coherent procedures based on the international standards published by IOC and CEC/MAST (1993) and described in the common MEDAR protocol (MEDAR Group 2001). The methodology includes automatic and visual checks for duplicates, location and date (QC1, fig. 4) and data points (QC2, fig. 5).

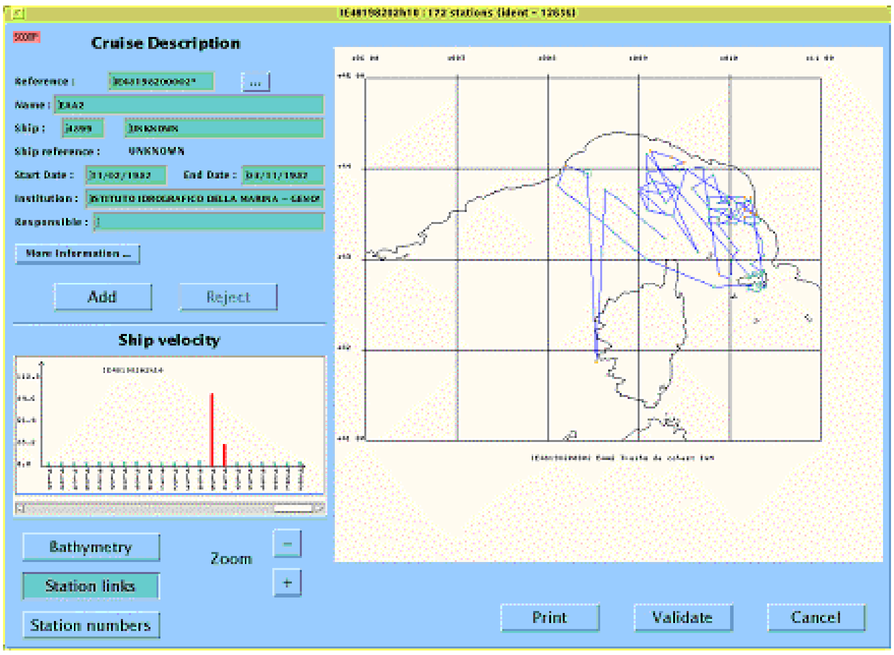

Fig. 5. Check of the location, date and duplicates

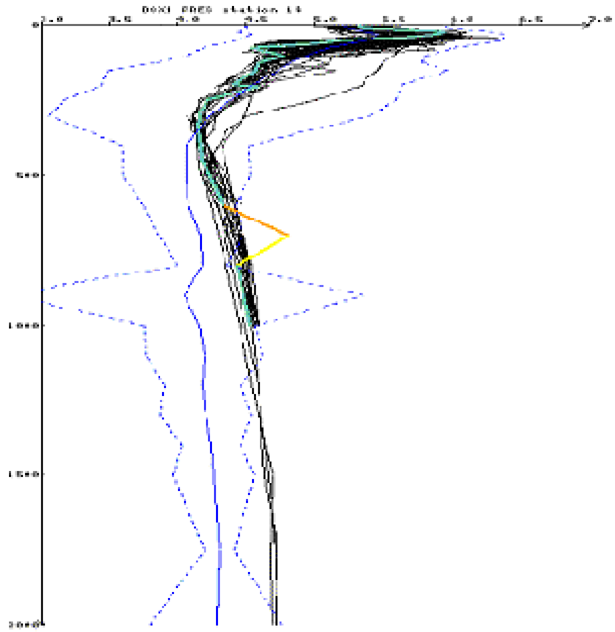

Fig. 6. Check of the data points

This Quality Checking has been made in Four Regional Data Qualification Centres, respectively in Obninks for the Black Sea, Athens for the Eastern Basin, Trieste for the Central Basins and Madrid for the Western Basin, by close cooperation of the national and regional experts. Copies of regional data sets have been assembled at the Assembling Centre, where a final check has been performed for format and duplicates, and some random checks in addition. Remaining problems have been solved in collaboration with the regional centres. One critical problem was the duplicates in the historical data sets. The data without outliers have been interpolated at vertical standard levels and transferred to the Analysis Centre, where an objective analysis has been performed to get reference climatological fields for each parameters at 25 standard levels (IAPSO list + 3 supplementary levels), horizontal maps plotted at 5 standard levels, the deepest at 600 dbar (Fig. 6), 4 North-South and 2 West-East vertical sections (Fig. 7). The monthly climatologies have been computed, however for many parameters the lack of data makes the estimates suspicious and depending on the data availability, seasonal or annual climatologies only will be released. On the contrary, in the following regions where the observations are better distributed, the climatological computations have been made with higher space resolution:

Alboran Sea *Balearic Sea* *Gulf of Lions* *Straits of SicilyAdriatic Sea Aegean Sea* *Bosphorus* *Danube Outflow.*

This represents a very high number of numerical fields and maps, however the results can be robust only when the data density is sufficient.

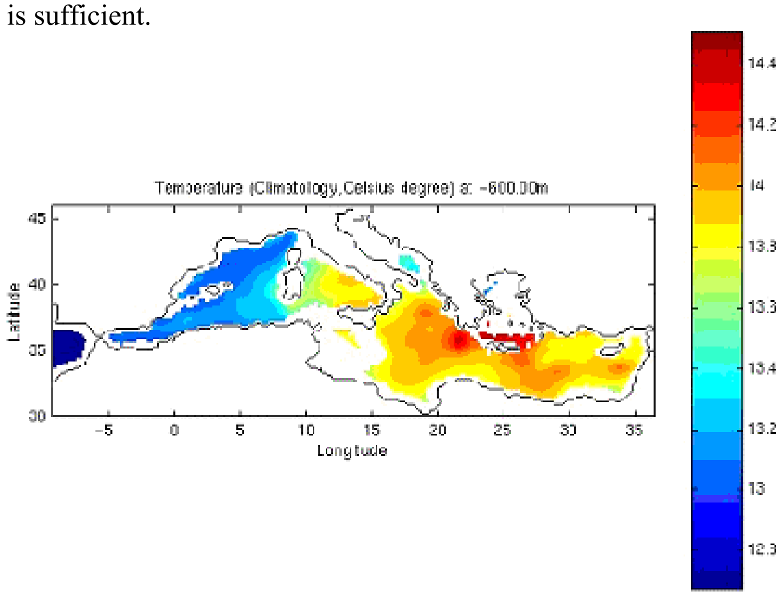

Fig.7. Average temperature Distribution at 600 dbar from MEDAR Database

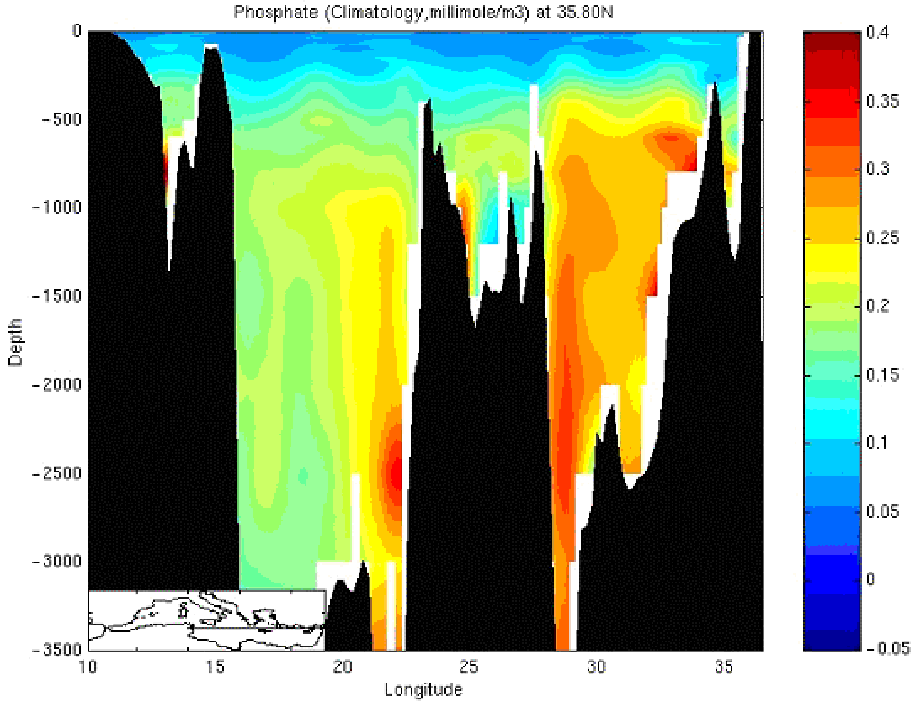

Fig. 8. Average Phosphate Vertical distribution at 35.80 N from MEDAR Database

These results: meta-data, observed data, analysed data, maps and software will be published on a set of four Cdroms (MEDAR Group, 2002) and made available for dissemination at each Data Centre of the network. It is expected that they will provide a useful tools for the various kinds of potential users like modellers and experimental scientists, teachers and engineers, as was already the 1997 product. It is also noticeable that, sharing the knowledge and know-how among the participants was an important supplementary result of the project. MEDAR certainly contributed to enhance the overall capacity of the Mediterranean and Black Sea data centres network, in oceanographic data management, and it is a very important issue, as an important volume of new data is expected in the years to come, both from classical oceanographic cruises and from operational oceanography real time data collection systems.

If the results of the present project seems promising, the data rescue and the network needs to remain active and there remain also gap to fill and new challenges. Data are still missing for several critical nutrients, and the quality checks, which are based on the pre-existing knowledge of the distributions, are limited. It is of paramount importance to integrate recent data collected in field projects carried out during the last past years, and to offer faster access to data to the users. Other data types like surface data, current data, and carbon cycle data should also be integrated in the database. Accordingly a new data management concerted action is in preparation for the 2002-2004 period, with a priority of facilitating the on line data access to the users and to improve the quality control procedure of the nutrients. Still the best data management is not sufficient to produce data in the region void of data, especially in the middle of the basins and along the Southern Mediterranean coasts, and it is hoped that more sea monitoring programmes will be also undertaken in the region.

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MEDAR Group, 2002. MEDAR/MEDATLAS 2001 Database. Mediterreanean and Black Sea cuise Inventory, Observed Data, Analysed Data and Climatological Atlas (4 Cdrom*, in preparation).*

MEDAR/MEDATLAS Global Inventory

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In line with the objectives of the MEDAR/MEDATLAS Task 1 Project the Russian NODC/RIHMI-WDC worked on preparation of the Global oceanographic cruise Inventory. This job was done in several steps:

- preparation of the Preliminary MEDAR/MEDATLAS Ocean Cruise Inventory for the Mediterranean and Black Seas;
- data rescue and inventorying at the national level by organizations, involved in the project;
- preparation of the final MEDAR/MEDATLAS Ocean Cruise Inventory and MEDAR/MEDATLAS Data Base Inventory as well as developing the software and other tools to distribute the cruise metadata.

At the first step of this activity the descriptions of ocean RV cruises currently available in the databases of WDC-A, the Russian NODC/WDC-B, ICES and MEDATLAS I, were reformatted to the Preliminary MEDAR/MEDATLAS Inventory format (cruise reference number, ship, cruise name, organization, dates of observation, types of observation , geographical areas. The “Manual on preparation of the integrated oceanographic data inventory” has been placed on the Web-page of the Russian NODC/RIHMI-WDC - http://www.meteo.ru/nodc/project/manua.htm).

The job resulted in preparation of the first version of the MEDAR/MEDATLAS Preliminary Inventory, which included more than 25, 000 cruises for the Mediterranean and Black seas. The testing of the cruise descriptions has shown, that Preliminary Inventory contains a lot of duplicates. The removal of duplicates was complicated by the fact that the attributes (name of a ship, period of observations, content and amount of observations etc.) of one and the same cruise differ considerably depending on the data source. Special procedures to detect duplicates and to make decisions on their elimination were developed and to enhance efficiency of the job being done the integrated set of cruise descriptions was loaded into the Oracle DBMS.

Once the duplicates were removed, the second version of the MEDAR/MEDATLAS Preliminary Inventory (July, 1999) was distributed among the participants of the project, who used the Inventory for data search at the national level. Based on this search the participants of the project submitted additional cruise descriptions to update the Preliminary Inventory. In 2000 the Preliminary Inventory was accomplished and acquired the status of the MEDAR/MEDATLAS Ocean Cruise Inventory and was placed on: http://www.meteo.ru/nodc/project/project.htm (Fig.1).

To obtain various information and the content and composition of the MEDAR/MEDATLAS data base the metadata from the Cruise Summary Information Files were converted to the XML documents and the software was developed, ensuring metadata selection and visualization by the designated criteria (country, data center, period, geographical area, types of observations (BT, bottle measurements, CTD), parameter) in the form of the tables containing the lists of cruises and in the form of the maps of observations distribution. The software also ensures preparation of the summarized information. All operations are performed dynamically by requests (Fig.2).

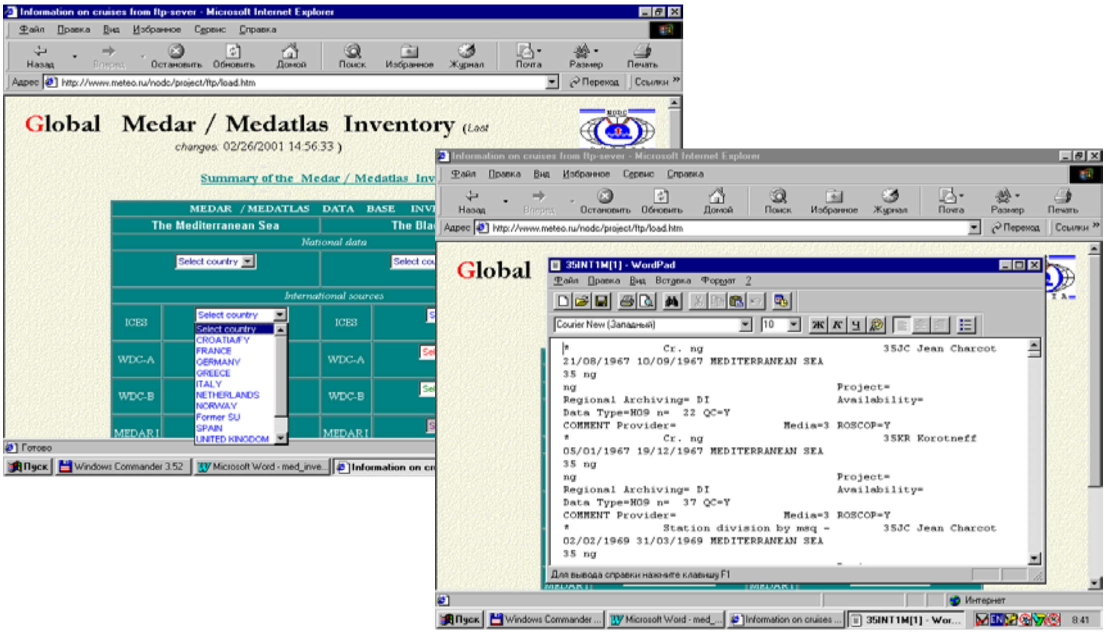

Fig. 1. MEDAR/MEDATLAS Ocean Cruise Inventory on Web

Finally the Global MEDAR/MEDATLAS Inventory has three interconnected levels of metadata representation (Fig 2.).

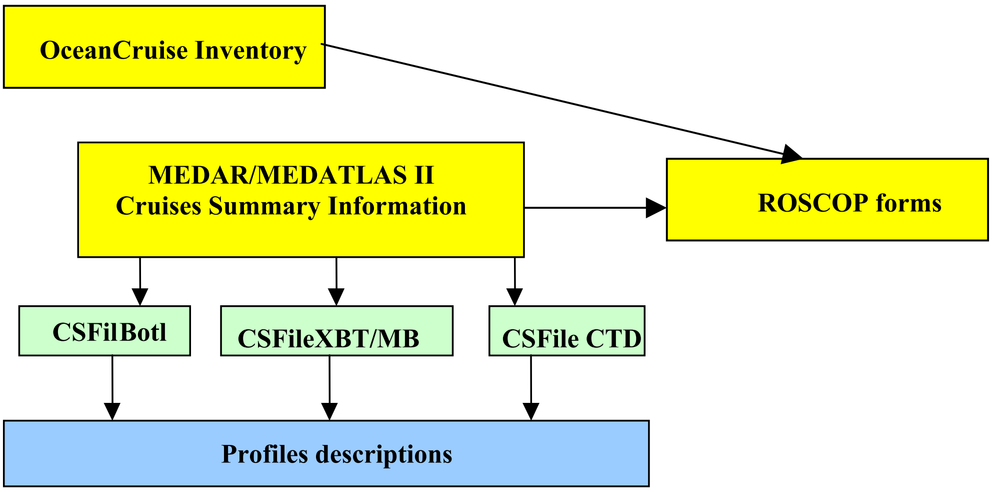

Fig. 2. MEDAR/MEDATLAS II Global Inventory structure

The MEDAR/MEDATLAS II Ocean Cruise Inventory level - description of RV oceanographic cruises performed in the Mediterranean and Black seas. Information on these cruises was obtained in the course of preparation of the Preliminary MEDAR/MEDATLAS II Inventory from various sources: WDC-A, WDC-B, ICES and the countries involved in the MEDAR/MEDATLAS II Project. Only a part of RV cruises placed at this inventory level were included into the MEDAR/MEDATLAS II Database. The metadata format is compatible with the Cruise Summary Information File format of the MEDAR/MEDATLAS Protocol. The inventory includes the ASCII files containing the country/source metadata and is placed at:

- MEDAR/MEDATLAS II WWW page of RIHMI-WDC - http://www.meteo.ru/nodc/project/project.htm;
- MEDAR/MEDATLAS II Project CD-ROM (the copy of RIHMI-WDC WWW page with the same address).

The MEDAR/MEDATLAS II Data Base Inventory level - description of RV cruises, whose data are included into the MEDAR/MEDATLAS II Data base. RV cruise descriptions are given by types of observation (bottle, BT, CTD) in the Cruise Summary Information File format of the MEDAR/MEDATLAS

Protocol and in the developed format for recording headers of ocean stations, BT and CTD profiles. The inventory includes:

- HTML files containing general information on the content of the MEDAR/MEDATLAS II Database (distribution by types of observations, countries, parameters, time, etc.);
- XML files containing descriptions of RV cruises by types of observation;
- XML files containing headers of ocean stations, BT and CTD profiles.

The access to MEDAR/MEDATLAS II Data Base Inventory is provided by the Java software. The inventory is placed at:

- MEDAR/MEDATLAS II WWW page of RIHMI-WDC (only general information, fig.3.)
- MEDAR/MEDATLAS II Project CD-ROM (fig.4.).

The ROSCOP level - description RV cruises included into the MEDAR/MEDATLAS II Data Base, in the ROSCOP form. The ROSCOP forms are received from ICES and the organizations involved in the Project. The ROSCOP forms are placed in a digital form in the ICES format in ftp-files: roscop_med.zip, roscop_black.zip:

- MEDAR/MEDATLAS II WWW page of RIHMI-WDC;
- MEDAR/MEDATLAS II Project CD-ROM (the copy RIHMI-WDC WWW page).

In the MEDAR/MEDATLAS II Data Base Inventory the references to the cruise ROSCOP forms included into the database are available.

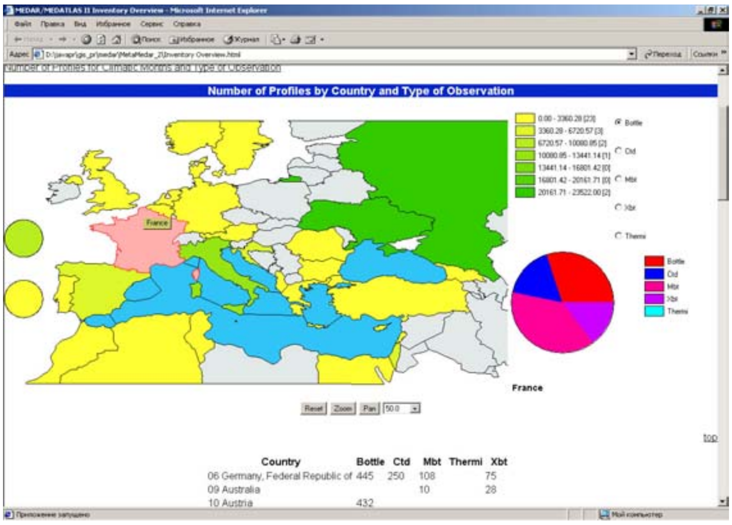

Fig. 3. MEDAR/MEDATLAS II Data Base Inventory on Web - general information

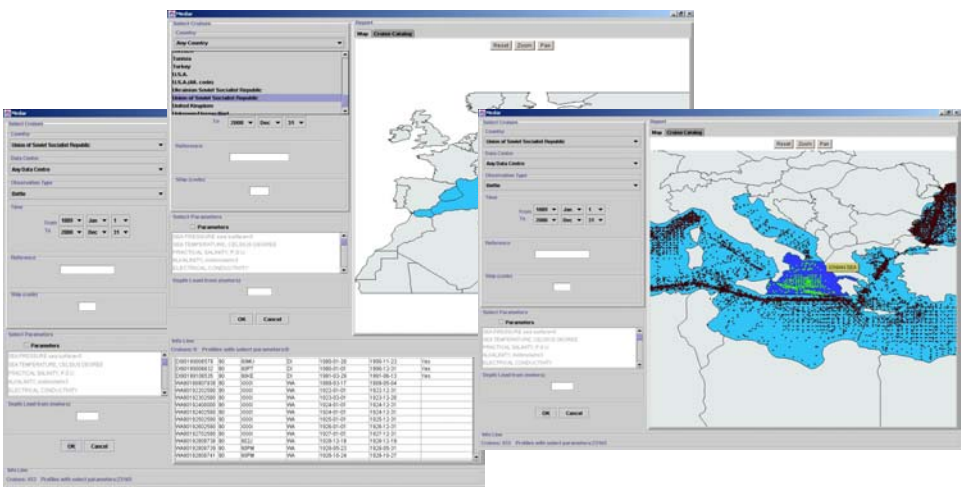

Fig.4. MEDAR/MEDATLAS II Data Base Inventory – search on criteria

On the Contribution of the Eastern Mediterranean Countries to the EU MEDAR/MEDATLAS-II Project

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Earlier efforts for the development of an archive of historical data sets and also for invetorizing the climatological fields of the Mediterranean Sea include those of Miller et al., 1970; Guibout, 1987; Picco, 1990, Levitus, 1982 and Brasseur et al., 1996a, 1996b. More recently the MEDATLAS Project provided an updated, quality controlled data set of temperature and salinity profiles of the Mediterranean Sea and produced a revised climatological statistics for the region (MEDATLAS Consortium, 1997). The MEDAR/MEDATLAS-II Project additionally captured hydro-chemical data and further established the data network of the region.

Almost all countries of the Eastern Mediterranean (Cyprus, Egypt, Greece, Israel, Lebanon, Turkey) participated in the MEDAR/MEDATLAS-II Project and highly contributed to the achievement of its objectives. National cruise inventories were developed which subsequently were used to produce the Global MEDAR/MEDATLAS-II cruise inventory for the Mediterranean Sea. A total of 11.441 new stations were rescued including CTD (4078 stations), bottle (6910 stations) and XBT (453 stations) data. The number of stations made available by each country are as follows: Cyprus (674 CTD Stations), Egypt (77, CTD and 432 bottle stations), Greece (1.346 CTD and 1.935 Stations) Israel (719 CTD and 1.935 bottle stations), Lebanon (42 CTD and 187 bottle stations), Turkey (282 CTD, 798 bottle and 453 XBT stations). Additional data (938 CTD and 200 bottle stations) for the Eastern Mediterranean region were provideed by Ukraine. All data were coded to MEDATLAS Format (MAILLARD et al., 1995; MEDATLAS Group, 1996) were subjected to quality control using a computer programme (SCOOP) for UNIX, developed by IFREMER/SISMER (Cure et al., 1995).

A multiparameter data base of high quality oceanographic and marine data sets for the Easten Mediterranean was developed, within the framework of the MEDAR/MEDATLAS-II, consisting of the following parameters**:** **Water temperature** (11.315 profiles), **salinity** (10.821 profiles), **dissolved oxygen** (4.594 profiles), **Phosphate** (4.594 profiles), **Silicate** (3.976 profiles), **Nitrate** (2.800 profiles), **Nitrite** (2.565 profiles), **Ammonium** (828 profiles), **PH** (2.616 profiles), **Total-P** (82 profiles), **Total-N** (420 profiles), **Chl-a** (395 profiles), **Alkalinity** (87 profiles), **COD** (73 profiles). The above data are new data (made available internationally for the first time) and have been collected from 1947 to 1999. The great majority of the nutrients data are coastal data which have been obtained from 1960 to 1975, while the CTD data cover the period 1975-1999 and provide a fairly good coverage of the eastern Mediterranean region.

The broad range control values for carrying out quality control, of biochemical parameters, using the WOD98 database, the MEDAR/MEDATLAS-II database and the HNODC national database, were updated. Furthermore, a regional Web site (http://hnodc.ncmr.gr/programmes/medar) was developed to provide information and visibility on the MEDAR/MEDATLAS activities in the Eastern Mediterranean region.

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Data Assembling and Quality Control of Physical and Bio-Chemical Parameters in the Central Mediterranean Regions within MEDAR/MEDATLAS II Project

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Comprehensive hydrological observations have been actively conducted in the Mediterranean Sea during the last two decades, accumulating a large amount of multidisciplinary oceanographic data. At the same time, the interpretation and the systematic studies of these data have experienced important variations, which have stimulated further initiatives to rescue historical data useful to investigate the natural and/or anthropogenic impacts on the climatic changes of the marine environment (e.g. warming trend in the Western Mediterranean deep water [1], recent changes in deep water formation and spreading in the Eastern Mediterranean Sea [2], etc). Financial resources were devoted by the European Union to develop research infrastructures and the MEDAR/MEDATLAS II project, a MAST/INCO concerted action, was launched with the objective to rescue, archive and make available quality controlled of *in-situ* hydrographic data (physical and bio-chemical parameters) of the Mediterranean and Black Seas, through a wide cooperation of bordering countries.

A distributed regional data network approach was proposed to link closely the data centres with the scientific institutions in each riparian country, which detain the majority of oceanographic data. Within this initiative, the data assembling of Central Mediterranean Regions (i.e. Adriatic, Ionian, Tyrrhenian and Ligurian Seas), was established through close collaboration with the national marine research laboratories located in Italy, Malta and Croatia, which actively operate in oceanographic data collection by their participation in national and international projects. The rescued data and meta-data have been globally validated and archived by interplay among the scientific laboratories, according to methods and standards established in the common protocol.

At the end, in addition to the updated version of the temperature and salinity data provided within the EU/MAST/MODB/MEDATLAS twin initiatives [3,4], conducted during the period 1994-1996, the MEDAR/MEDATLAS II hydrographic data sets actually include observations of temperature, salinity, dissolved oxygen, nitrates, phosphates, silicates, alkalinity, ammonium, clorophyll-a and pH. The data gathered are classified according to the sampling methods. The total amount of hydrological stations is listed in Table 1.

Table 1. Total number of collections/cruises, hydrological stations and period of measurements assembled at the Regional Centre for the Central Mediterranean Regions within the framework of the MEDAR/MEDATLAS II.

	Cruises	Stations	Years
CTD	87	5941	1986-2000
Bottle *	99	9069	1908-1998
Bottle **	370	2985	1900-1993
XBT	1	39	1997
MBT ***	266	6794	1948-1991

*Bottle stations comprehensive of temperature, salinity and bio-chemical elements.
**Bottle stations rescued from the data sets received from the IOF-Split (Croatia), after checking of duplicates with the already archived historical data set of the Adriatic Sea.
*** Total amount of MBT drops contained in the last release received from the IOF-Split (Croatia). They should be still checked for duplicates with those contained in the MEDATLAS I CD-ROM and quality controlled.

The table 2 lists the total amount of hydrographic stations rescued by the participating countries, which have contributed with the last release of hydrographic data in the Central Mediterranean Regions.

Table 2. Number of hydrological stations supplied by the National Oceanographic Data Centres/National Agencies of the bordering countries of the Central Mediterranean Regions.

	XBT/MBT	CTD	Bottle
OGS Trieste, Italy	39	5599	8940
UM-PO, Malta	0	179	129
IOF Split, Croatia	6794	163	2985
TOTAL	6833	5941	12054

It is worthy to remark that the data sets detained by OGS, Italy derive from scientific cooperation among national and international laboratories, which participated to large scale research projects, designed in the framework of national (e.g. CNR, Progetti Finalizzati di Oceanografia e Fondi Marini, PRISMA, etc.) and international programmes (e.g. POEM, PRIMO, EU/Mediterranean Targeted Project, etc.). They were obtained from the following scientific Institutions:

<u>A. National laboratories:</u>

CNR/IBM, Istituto di Biologia Marina, Venezia, Italy
CNR/IFA, Istituto di Fisica dell' Atmosfera, Roma, Italy
CNR/IGM, Istituto di Geologia Marina, Bologna, Italy
CNR/IOF, Istituto di Oceanografia Fisica, La Spezia, Italy
CNR/IRPEM, Istituto di Ricerca sulla Pesca Marittima, Ancona, Italy
CNR/ITT, Istituto Talassografico, Trieste, Italy
ENEA/CRAM, La Spezia, Italy
IMO, Istituto di Meteorologia ed Oceanografia, Universita' di Napoli "Parthenope", Italy
OGS, Istituto Nazionale di Oceanografia e di Geofisica Sperimentale, Trieste, Italy
SZ, Stazione Zoologica "Anton Dohrn", Napoli, Italy

<u>B. International laboratories:</u>

IOLR, Israel Oceanographic and Limnological Research LTD., Haifa, Israel
IUP, Institut fur Umweltphysik, Universitat Bremen, Germany
METU, Middle East Technical University of Erdemli, Turkey

NCMR, National Centre for Marine Research, Athens, Greece

At the same time, a permanent visibility on the status of the data gathered through the entire period of the project was maintained on WWW pages [5], and the participants/contributors/users were acquainted with the progression of the several project tasks.

The Figure 1 shows the station coverage in the Central and Eastern Regions of the Mediterranean, while the total amount of hydrological stations pertaining to different oceanographic parameters is presented in Table 3. It can be seen the improvement and the increase of the comprehensive oceanographic data in the central regions of the Mediterranean Sea, testifying that both the physical and biochemical core parameters are well considered in occasion of the research projects designed in these regions. The spatial distribution of stations appears suitable to initiate a basin-wide calculation of first order statistics and climatologies concerning with the basic oceanographic fields.

The scale and importance of the main features along the water column has been further investigated by sub-sampling CTD and hydrological casts within separate regions as shown in Figure 2.

Table 4 list the geographic limits of the regions, while Table 5 lists the minimum and maximum values of core parameters found in those regions, by considering all the data contained in the benchmark no. 4 distributed by the global assembling centre. The averaged vertical profiles are studied in more details and the preliminary results are included in the parallel contribute to this work [6]. It appears evident that these studies may represent a preliminary attempt for a better definition of the broad range control values and new climatological vertical profiles for the narrow range check at different levels. The spatial characterization of the main water masses (Atlantic Water, Levantine Intermediate Water, and Bottom Water in the Western and Eastern Mediterranean) in term of the thermohaline properties and biochemical contents will be useful to develop more comprehensive and reliable data quality control procedures for the quality assurance of the already archived and incoming data within programmes of operational oceanography.

Table 3 – Number of casts per type of observations defined according to the ROSCOP code as included in the data set header of the MEDAR/MEDATLAS format.

Code	Type of observation	Nbr	Code	Type of observation	Nbr
B01	Primary productivity	129	H24	Nitrates	4549
B02	Phytoplankton Pigments	1755	H25	Nitrites	3754
H09	Water bottle stations	12054	H26	Silicates	4302
H10	CTD stations	5941	H27	Alkalinity	953
H13	Bathythermograph drops	6833	H28	pH	4948
H16	Transparency (transmissometer)	268	H73	Geochemical tracers (e.g. freons)	129
H17	Optics (l.s. & fluorometers)	1764	H74	Carbon dioxide	18
H21	Oxygen	10794	H75	Total–N	25
H22	Phosphates	5040	H76	Ammonia	3414
H23	Total-P	1369	P01	Suspended matter	589

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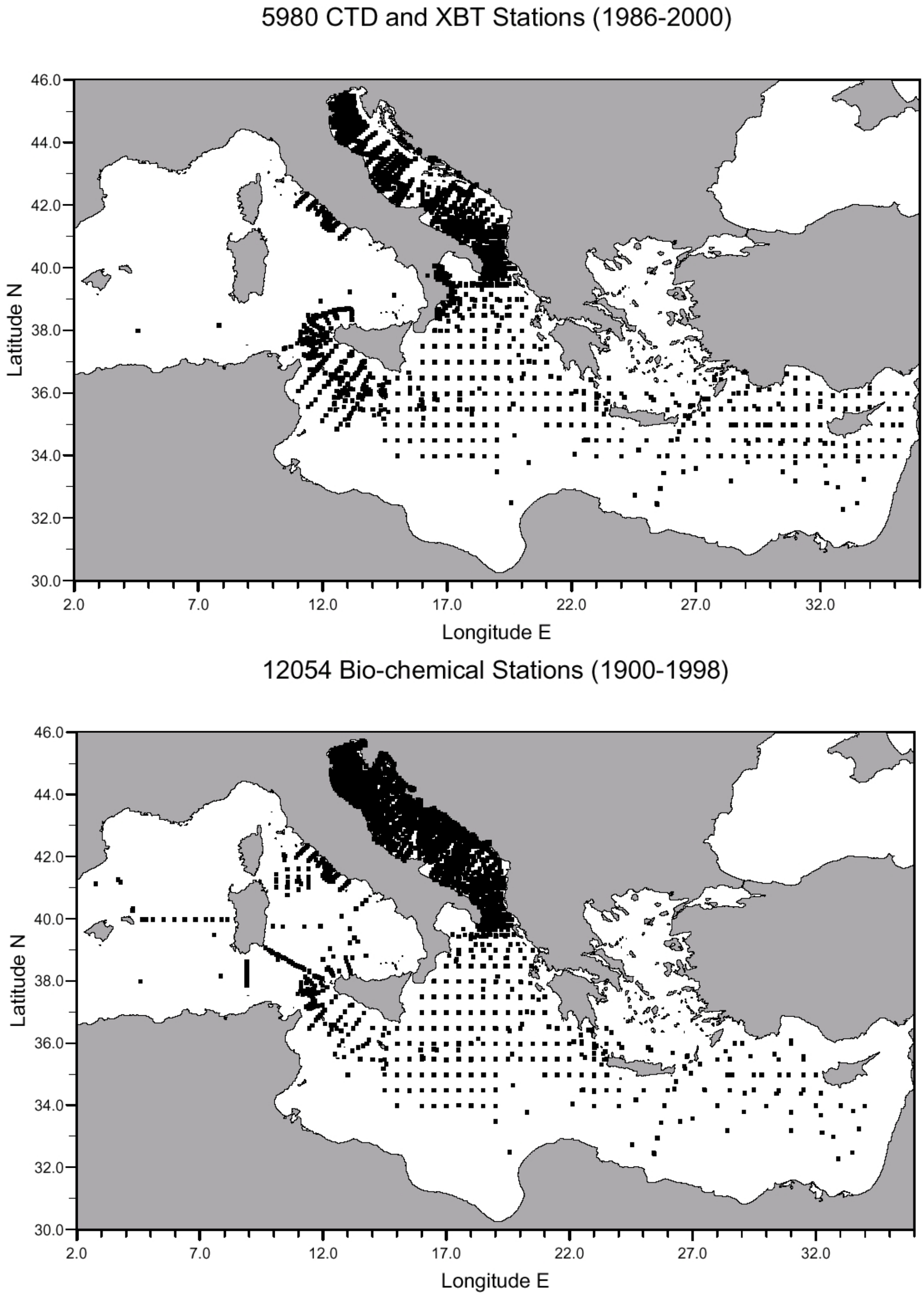

Figure 1. Distribution of CTD stations (upper panel) and bottle stations (lower panel) inventoried and rescued at the Regional Centre for the Central Mediterranean Regions

Table 4 - Geographic Limits of the Central-Eastern Mediterranean regions for broad range values and statistics computations

Code	Region Name	Lat. min	Lat. max	Lon. min	Lon. max	Maximum
DF3	Ligurian West	42 00'	45 00'	06 18'	09 18'	2900
DF4	Ligurian East	42 48'	44 18'	09 24'	10 48'	1050
DI1	Sardinia Strait	36 00'	39 18'	8 24'	10 00'	2660
DI3	Sicily Strait	30 00'	38 00'	10 00'	15 00'	1550
DJ1	Adriatic North	42 00'	46 00'	12 10'	14 30'	150
DJ2	Adriatic Middle	41 18'	46 00'	14 30'	16 16'	270
DJ3	Adriatic South	40 36'	44 00'	16 16'	20 00'	1350
DJ4	Ionian NE	38 00'	40 36'	18 00'	22 30'	3650
DJ5	Ionian South	30 00'	36 00'	15 00'	22 30'	4300
DJ6	Ionian NW	38 00'	40 36'	16 16'	18 00'	2770
DJ7	Ionian Middle	36 00'	38 00'	15 00'	22 30'	5100
DT1	Tyrrhenian 1 NW	39 18'	42 48'	09 18'	13 48'	3100
DT2	Tyrrhenian 2 NE	39 18'	41 18'	13 48'	16 16'	3100
DT3	Tyrrhenian 3 South	38 00'	39 18'	10 00'	16 16'	3100
DH1	Aegean	35 10’	41 12’	22 30’	27 30’	4150
DH2	Cretan Passage	30 00’	35 10’	22 30’	27 30’	4100
DH3	Levantine Basin	30 00’	38 00’	27 30’	36 00’	4400

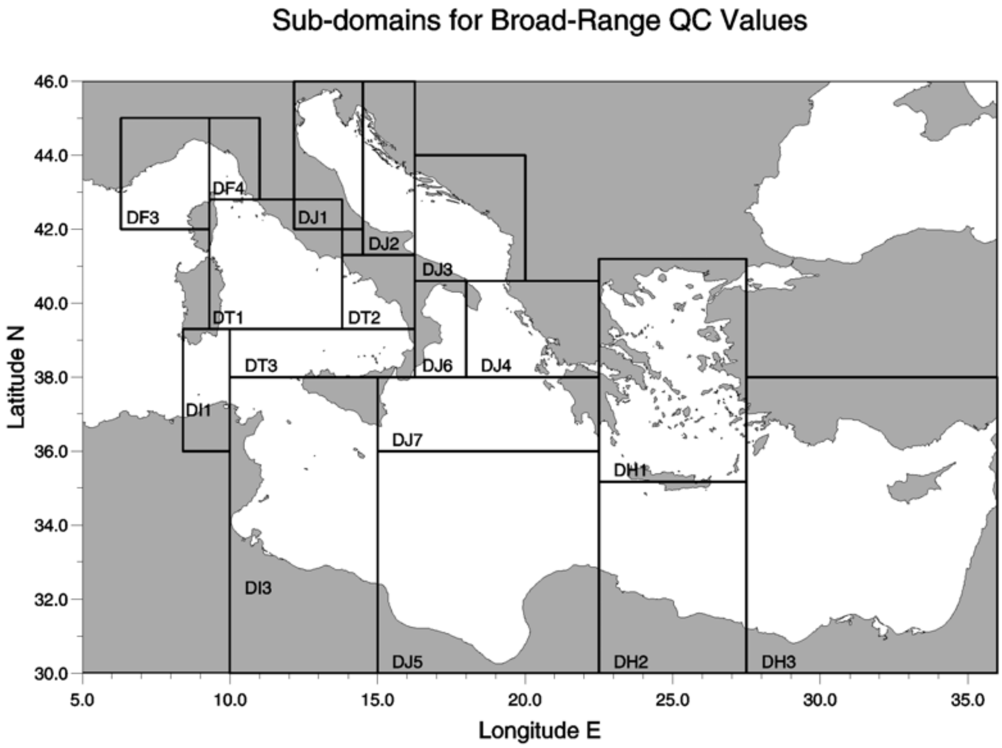

Figure 2. Regional sub-domains in the Central-Eastern Mediterranean for the definition of broad range control values and statistics of oceanographic fields.

Table 5 – Minimum and maximum values of the oceanographic fields (temperature, salinity, dissolved oxygen, nitrate, phosphate and silicate) computed using the complete data set archived in the MEDAR/MEDATLAS II CD-ROM in the indicated regions. The regions are defined in Table 4 and Figure 2.

T\Regions	DF3	DF4	DI1	DI3	DJ1	DJ2	DJ3	DJ4	DJ5	DJ6	DJ7	DT1	DT2	DT3
Minimum	12.989	12.918	13.006	13.818	9.583	11.104	12.761	13.55	13.639	13.554	13.644	13.139	13.110	13.134
Maximum	22.460	23.692	24.128	24.806	24.198	23.223	23.375	24.74	25.712	24.753	25.268	24.362	24.934	24.818
S\Regions	DF3	DF4	DI1	DI3	DJ1	DJ2	DJ3	DJ4	DJ5	DJ6	DJ7	DT1	DT2	DT3
Minimum	37.950	36.957	37.454	37.212	33.836	36.567	36.600	36.69	38.122	37.908	38.157	37.427	37.640	37.563
Maximum	38.530	38.616	38.785	38.778	38.624	38.584	38.723	38.79	38.866	38.916	38.893	38.666	38.714	38.700
D.O.\Regions	DF3	DF4	DI1	DI3	DJ1	DJ2	DJ3	DJ4	DJ5	DJ6	DJ7	DT1	DT2	DT3
Minimum	4.17	4.16	4.00	4.04	4.79	4.71	4.70	4.11	3.47	3.93	4.17	4.09	4.06	4.02
Maximum	5.90	5.97	5.84	5.91	6.54	5.94	5.80	5.79	5.71	5.68	5.79	5.99	5.98	5.80
NO3-N\Regions	DF3	DF4	DI1	DI3	DJ1	DJ2	DJ3	DJ4	DJ5	DJ6	DJ7	DT1	DT2	DT3
Minimum	0.02	0.00	0.00	0.05	0.25	0.43	0.47	0.09	0.07	0.00	0.09	0.00		0.00
Maximum	8.93	5.70	8.07	8.27	12.34	10.05	5.90	4.96	8.26	5.95	5.75	14.07		8.25
PO4-P\Regions	DF3	DF4	DI1	DI3	DJ1	DJ2	DJ3	DJ4	DJ5	DJ6	DJ7	DT1	DT2	DT3
Minimum	0.162	0.060	0.003	0.053	0.021	0.030	0.041	0.017	0.049	0.013	0.060	0.026	0.024	0.047
Maximum	2.385	0.550	0.920	0.470	0.210	0.370	0.288	0.251	0.310	0.294	0.373	0.740	0.840	0.420
SiO4-Si\Regions	DF3	DF4	DI1	DI3	DJ1	DJ2	DJ3	DJ4	DJ5	DJ6	DJ7	DT1	DT2	DT3
Minimum	0.70	0.00	0.57	0.58	1.51	3.10	2.89	1.11	1.17	0.45	0.67	0.74		0.59
Maximum	8.36	5.01	8.83	8.23	7.98	15.52	18.46	9.12	13.31	9.21	9.17	29.86		12.01

Chemical Data Distribution and Ranges in the Western Mediterranean

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Abstract
The completed data set compiled for MEDAR project have been archived and qualified according to the MEDATLAS protocols. The chemical data set is irregularly distributed in the Western Mediterranean. In particular, the Algerian basin is not well covered for any of the chemical parameter. The scattered data (parameter versus pressure) show two main features in most of the chemical parameters; a large variability in the surface layer in which the coastal data could be in part responsible of. Beside this, two layers have to be considered in order to perform the broad ranges quality check with different range values for each layer. Due to the variability along the whole water column the outliers (spikes and gradients) control values needs an expertise manual validation.

Data set distribution
The study have been apply to the complete MEDAR data set for the square area (33º N, 10º W – 45º N, 8º 24'E) that cover the regions of Gibraltar strait, Alboran Sea, Balearic Sea Argelian Basin and Gulf of Lyon as defined in MEDATLAS. The total number of profiles by data type, bottles, ctd, xbt is presented in figure. 1, where it can be see that the number of ctd stations is rather lower than the other types of data. It is because of the CTD measurement starts only after the end of the 70's. In the other hand the number of xbt profiles are much larger than the bottle profiles

Concerning to the geographical distribution, the xbt stations cover rather well the whole area but there are very few ctd stations in the Algerian basin even the sampling is disperse in the Balearic Sea and gulf of Lyon. The distribution of the bottle stations, which is the most important concern to the chemical parameters remaining disperse in the Algerian Sea and not very well sampling in the Balearic sea.

Parameter data set distribution.
To study the chemical parameter we need study only bottle profiles in which the chemical parameters are sampling. In figure 2 the tables and graphs show the number of profiles and samples for each parameter. The number of samples of nitrate, nitrite, silicate and phosphate, pH and chlorophyll-a are very similar. The oxygen is the best sampling not only related to the number of stations but also to the geographic distribution. The are very few sampling for the other parameters or at least very few samples have been rescued.

The geographical distribution (figure 3), of nitrate, nitrite silicate and phosphate are very similar to the bottle profile distribution. Consequently the Algerian basin and some part of Balearic Sea will need better sampling in order to have a good knowledge of the chemical property distribution. By the way, not all the stations are sampling along the whole water column; the bottom layer is even less sampling.

With the visualization of the scattered data (parameter versus pressure) in different colour according to the quality flags and at two different scales, one for the whole column in which it can be seen the large variability in the upper layer (mainly in the surface), and the other, under the surface layer in which the parameter distribution can be observe in more detail.

The statistics of the quality flags (table 1) give more than 95% as good data (quality flag 1, 2). Only for the Nitrates the % is lower. The reason is that in some cases still the doubt about if the parameter is Nitrate or Nitrate+Nitrite. In some parameter the number of quality flag to 3 is a little numerous but some of those flags are because we do not have clear information of the null data that in some cases can be written as 0 value. In relation with the Nitrate, probably in very few cases still not well known if the data value correspond to the Nitrate or Nitrate+Nitrite.

Ranges

One of the purposes of this work is to obtain the ranges in which the chemical properties are enclosed. The data with quality flag 3, 4 (bad or doubtful data within MEDATLAS protocols) have not been taken into account to perform this study. Beside to the visual inspection (figure 4), the number of samples enclosed into different range values for each chemical parameter is also presented for the whole Western Mediterranean. From this preliminary statistic it can be conclude that the ranges in which most of the chemical properties are enclosed have to be separate, a very wide range for the surface data, a rather wide for the upper layer and a more narrow ranges for the bottom layer. A fine statistics need to be perform in order to know if the large variability in the surface occurs not only in the coastal zone but also in the open ocean and to obtain the ranges more precisely by layers and regions; Gibraltar strait, Alboran sea, Algerian basin, Balearic sea and Gulf of Lyon. In fact the nitrates and phosphates distribution shows two different features along the column water that should be correspond to different regions. The result presented here gives valuable information to perform the quality control to the chemical parameters.

Conclusions

The geographical distribution of the profiles is not regular in the Western Mediterranean. There are few stations in the Algerian basin that it does not cover very well the region. In the Balearic sea the number of the stations is much higher but still need a better distribution. The inclusion of the data sampling during MATTER project will improve the distribution but an action has to be taken in order to cover the WM basin. Taking into account the result of the statistics obtained the quality control protocols need to be improving in that concerning to the broad ranges control check of the chemical parameters, and also because of the variability occurs along the water column, the control of outlier needs to paid to much attention.

GRAPHS

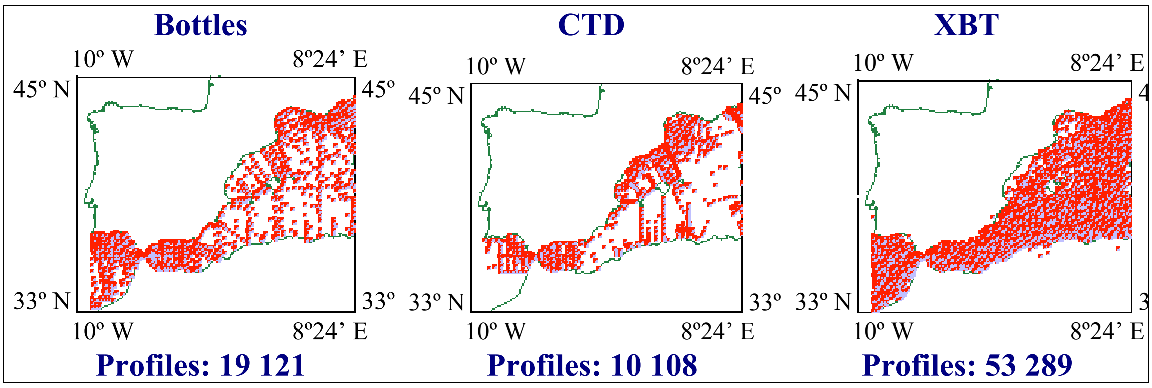
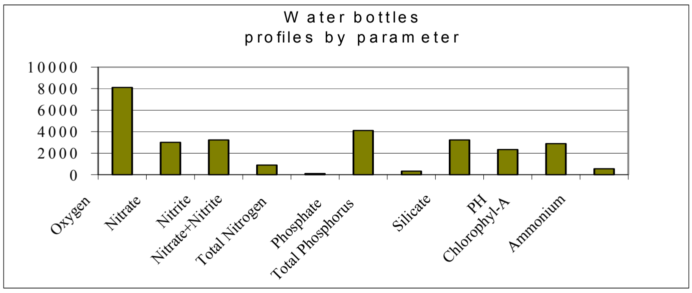
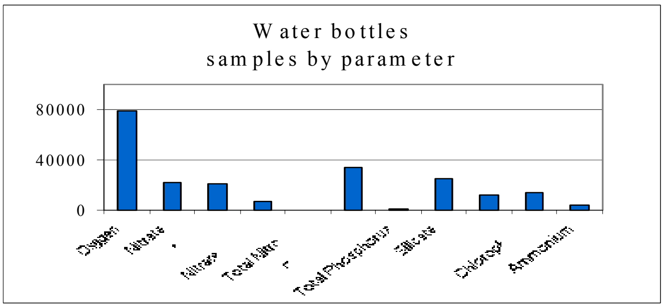


Figure 1. Geographical distribution by data type



	Profiles
Oxygen	8076
Nitrate	3041
Nitrite	3268
Nitrate+Nitrite	933
Total Nitrogen	106
Phosphate	4110
Total Phosphorus	300
Silicate	3224
PH	2295
Chlorophyll-A	2863
Ammonium	560



	Samples
Oxygen	78507
Nitrate	21912
Nitrite	21350
Nitrate+Nitrite	7363
Total Nitrogen	209
Phosphate	33511
Total Phosphorus	997
Silicate	25341
PH	12276
Chlorophyll-A	13530
Ammonium	4249

Figure 2. Number of profiles and samples by parameter

	Samples	QC flag = 1, 2		QC flag = 3	QC flag =4
Nitrate	21912	20489	(93.5%)	1322	101
Nitrite	21349	21272	(99.1%)	4	73
Nitrate+Nitrite	7363	7355	(99.8%)	4	4
Phosphate	33509	32132	(95.8%)	1303	74
Silicate	25342	25316	(99.9%)	21	5
Oxygen	78038	76644	(98.2%)	486	908
Chlorophyll-a	13530	13527	(99.9%)	2	1
T Phosphorus	997	996	(99.9%)	0	1
pH	12276	12264	(99.9%)	2	10

Tabla 1. Quality flags statistics

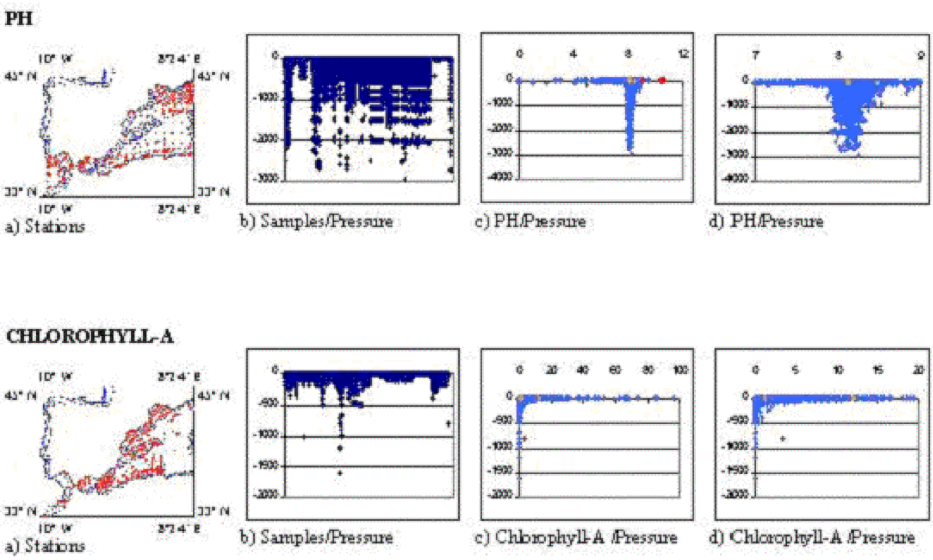


Figure 3. Parameter distribution.

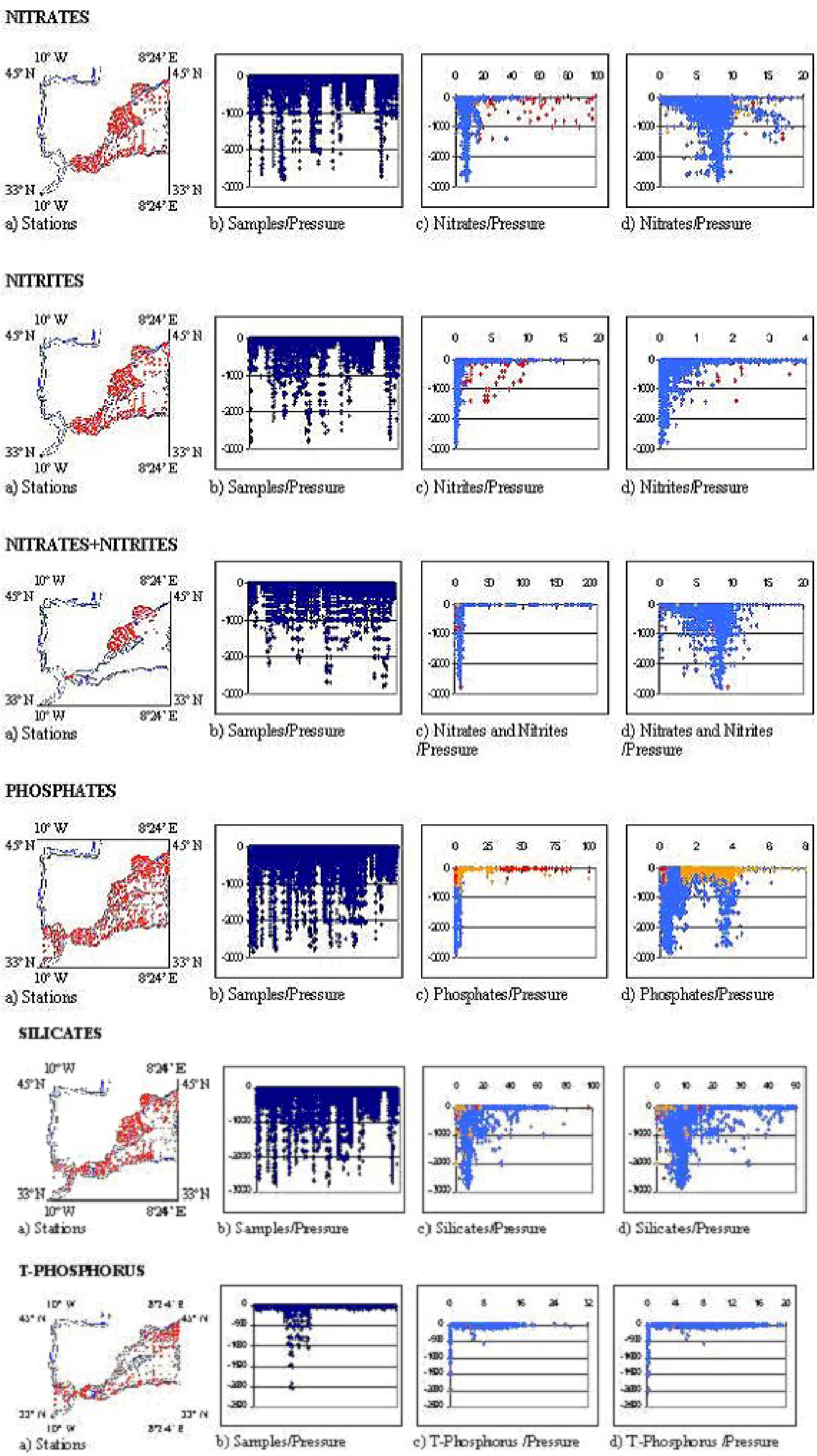
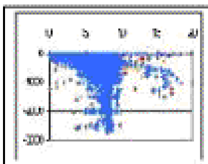
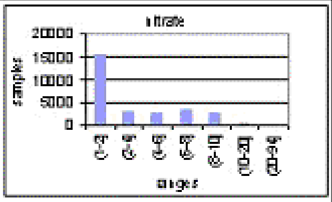
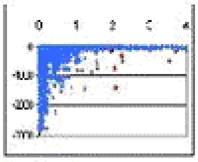


Figure 3. Parameter distribution. Continuation

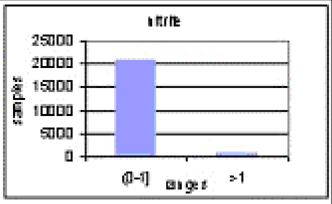


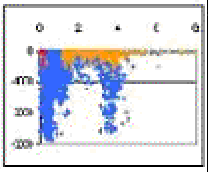
Nitrates	samples
(1-2]	15341
(2-4]	2965
(4-6]	2686
(6-8]	3361
(8-10]	2559
(10-20]	166
(20-24]	108



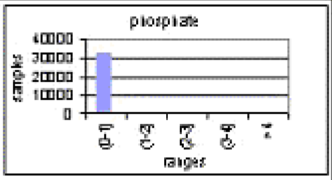


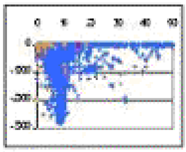
Nitrites	samples
(0-1]	20675
>1	665



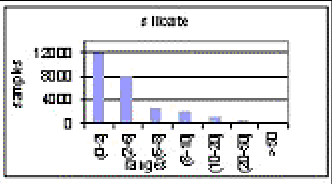


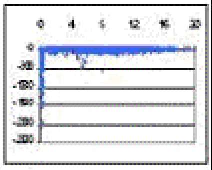
Phosphates	Samples
(1-1]	31967
(1-2]	536
(2-3]	234
(3-4]	529
>4	146



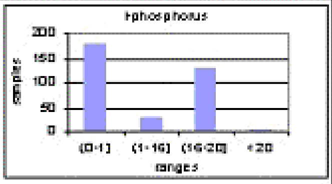


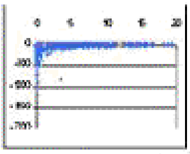
Silicates	Samples
(0-2]	11915
(2-6]	7934
(6-8]	2442
(8-10]	1902
(10-20]	1125
(20-50]	543
>50	65



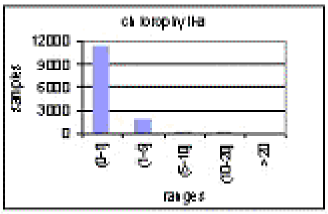


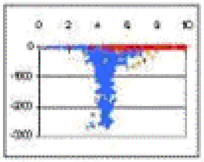
T-phosphorus	Samples
(0-1]	180
(1-16]	31
(16-20]	129
<20	4



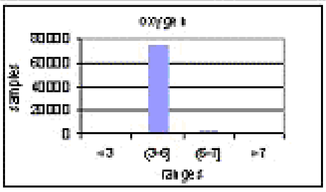


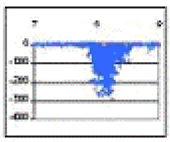
Chlorophyll-a	Samples
(0-1]	11269
(1-5]	1818
(5-10]	295
(10-20]	74
>20	50





Oxygen	Samples
<3	220
(3-6]	73706
(6-7]	3056
>7	154





ph	Samples
(0-7)	95
[7-9)	11581
>9	6

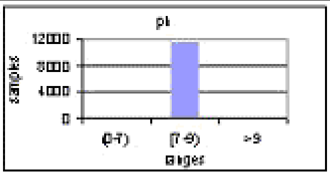


Figure 4. Ranges.

Regional Data Management – Black Sea

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1. Regional Data Assembling

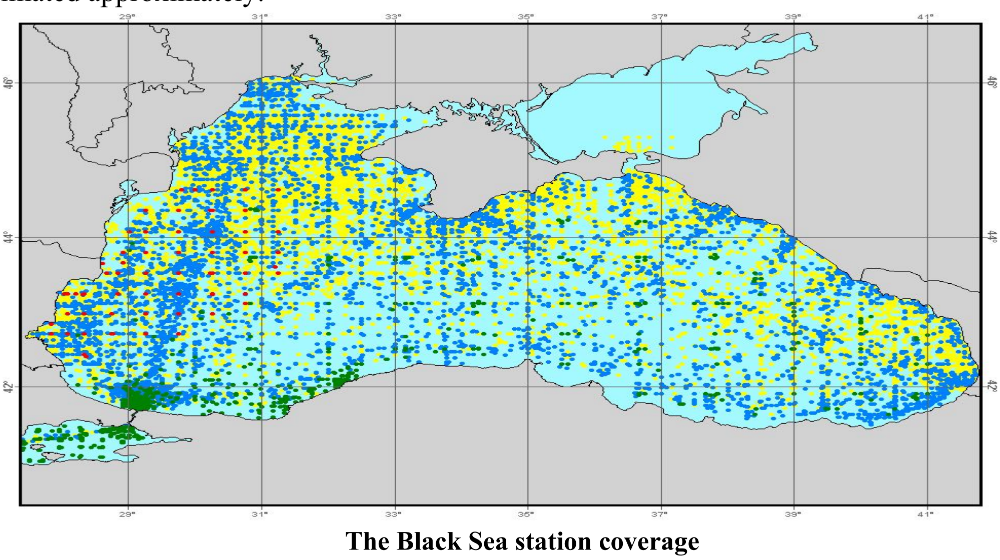
The data for the Black Sea have been received from Russia, Ukraine, Turkey, and Bulgaria and Georgia. All data files were tested for conformity with the MEDATLAS format. The software developed in the Russian NODC and QCMEDAR was applied to test all received data files. Many format violations of the different type were found in the data files of every country; these were carefully considered by the specialists from RIHMI-WDC. Remarks were sent to suppliers and revealed format violations were removed.

As a result, the data sets that are comparable and compatible with the common MEDATLAS protocol for formatting and quality check were obtained. The total quantity of files and stations, and quantity of stations separately for the Black and Mediterranean Seas delivered by every country into MEDATLAS II is presented in the table below.

Table 1. The data delivered for MEDATLAS II by the Black Sea countries

Country	Files	Stations, total	Stations in the Mediter. Sea	Stations in the Black Sea
Bulgaria	2	90		90
Georgia	2	41		41
Russia (national)	352	20933	10234	10699
Russia (WDC-B)	87	1935	1735	200
Turkey	86	1376	11	1365
Ukraine	361	31876	2717	29159
TOTAL:	**890**	**56251**	**14697**	**41554**

The total number of the files presented is 890. The number of cruises in these files is estimated to be more than 1000 since some of the Ukrainian files contain data from several cruises. Some of the files prepared by RIHMI-WDC also contain a mixture of data from several ships. It is very difficult to split these files into separate cruises since the data are mixed and original sources are inaccessible. Therefore the number of cruises can only be estimated approximately.



The Black Sea station coverage

Table 2.3 and Fig.3 show the number of profiles of each parameter in the data. It can be seen that the data prepared by the Black sea countries contain all core parameters considered in the

MEDATLAS Protocol. The most representative hydrochemical parameters are dissolved oxygen, phosphates and silicates. Also of note are more than one thousand profiles of hydrogen sulphide. Unfortunately, such parameters as pheophytin, chlorophyll and total nitrogen are only presented by observation from single cruises.

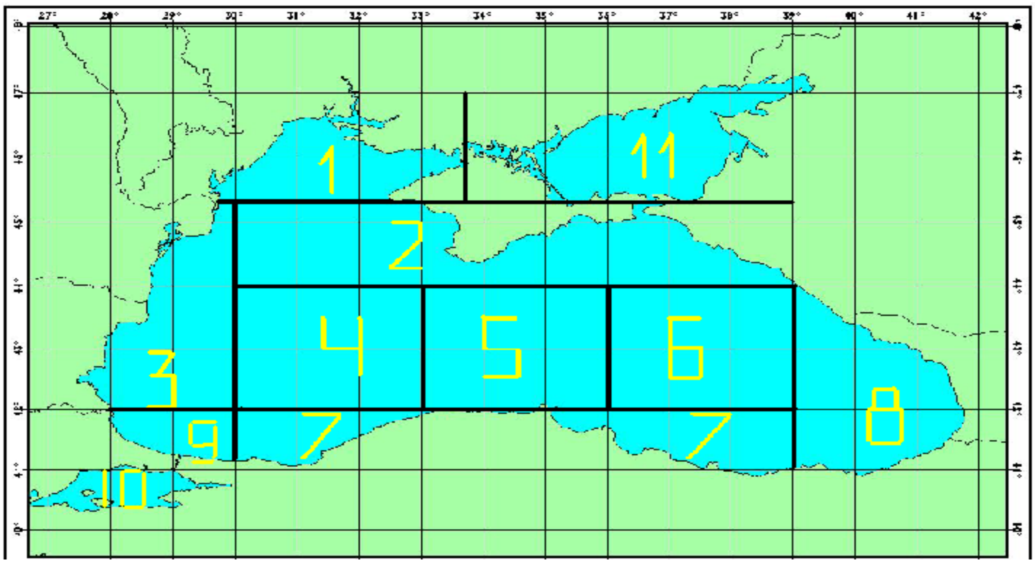
Table 2. Number of profiles for parameters, delivered by BS region countries for MEDATLAS II

DataCentre	PRES	TEMP	PSAL	DOX1	PHPH	ALKY	NTRA	NTRI
Ukraine	31876	31860	30391	10130	1339	161	0	1184
Russia	20225	20217	18930	9414	3945	789	709	1234
Turkey	1376	1376	1356	950	22	0	0	0
Bulgaria	90	90	90	0	0	0	0	0
Georgia	41	41	41	0	0	0	0	0
TOTAL	53608	53584	50808	20494	5306	950	709	2418

DataCentre	AMON	NTOT	PHOS	TPHS	SLCA	HSUL	CPHL	PHTP
Ukraine	613	0	6323	881	4653	1055	27	0
Russia	53	19	3013	172	1683	887	0	225
Turkey	0	0	0	0	0	0	0	0
Bulgaria	0	0	0	0	0	0	0	0
Georgia	0	0	0	0	0	0	0	0
TOTAL	666	19	9336	1053	6336	1942	27	225

2. Regional Data Quality Check

Along with solving the problem for the complete database formation, much attention was given to quality control.
The software **"Kenarm"** developed in RIHMI-WDC was used for data entry and quality check at the preliminary stage of national data processing. The **QCMEDAR** software for data quality check has been adjusted for Black Sea data. The broad and local range values for 9 subregions of Black Sea, for the Marmara Sea and Sea of Azov were developed.



Comparison of data set with cruise reports and manuscripts and editing of data from more then 400 Russian cruises has been made. The data of many oceanographic stations and parameters missed in the course of entering and processing data in previous years are restored now. By means of comparing data with original reports the correction of errors caused by inattentive manual entering has been executed.

A special attention has been paid to co-ordinate of the stations. In order to check co-ordinate on addition to automatic calculation of the ship velocity and validation of the ship location relative to the coastline every ship route was displayed at the screen and analysed. If co-ordinate error took place both in the data set and in the original table in many cases there was a possibility to use other material – special list of co-ordinate attached to the report or the tables of other data type (MBT for example if the bottle data was under consideration).

A significant problem in preparing data sets was to remove data duplicates. Russian data were checked for duplicates as follows. The data from each cruise were chronologically arranged and the information on the stations with the same date and time was automatically placed in the file of errors. A decision on removing duplicates or on correcting date and time was taken in an expertise way. Unfortunately, in some of the nonstandard files representing a mixture of data from several ships, this algorithm is not good enough and these were precisely the files with duplicated stations detected only by IFREMER.

This made it necessary to develop the program of revealing duplicated stations with the allowance for possible discrepancies in coordinates and observation dates associated with technological peculiarities of data transformation in different centers and possible errors in data. Such a program has been developed in RIHMI_WDC. The program is based on the comparison of temperature values measured at two stations; therefore it allows revealing duplicates even with the erroneous date and coordinates of stations.

Table 3 shows some of the final indicators of data quality. The table presents the number of values and samples of parameters for the Black Sea, the number (Q3) and percentage (Q3%) of dubious values of parameters, the number (Q4) and percentage (Q4%) of false values of parameters.

Table 3. The number of dubious (Q3) and false (Q4) values regarding the total number of parameters for the Black Sea

Parameters	Samples	Q3	Q3 %	Q4	Q4 %
TEMP	966009	5406	0.6	4531	0.5
PSAL	935089	6850	0.7	5605	0.6
DOX1	101246	3299	3.3	29	0.0
PHPH	29777	321	1.1	225	0.8
ALKY	6606	6	0.1	34	0.5
NTRA	4590	14	0.3	94	2.0
NTRI	6586	23	0.3	158	2.4
AMON	2826	0	0.0	25	0.8
NTOT	146	0	0.0	0	0.0
PHOS	43816	286	0.7	208	0.5
TPHS	2796	0	0.0	147	5.3
SLCA	39815	0	0.0	259	0.7
HSUL	11889	0	0.0	0	0.0
CPHL	35	0	0.0	0	0.0
PHTP	1039	0	0.0	0	0.0

Judging from the data in this Table it may be said that the data presented are of a good quality. The portion of dubious values (Q3) revealed by the spike criterion is no more than 1% for most of the parameters. 3.3% for oxygen is attributed to extreme sensitivity of the criterion which needs tuning rather than to the dubious values measured. This was confirmed by the comparison of the data with original sources. To some extent, this conclusion may also be extended to the criteria for temperature, salinity, phosphates and ph.

3. Identification of the former Soviet Union data taken from MEDATALAS I CD

Significant volume of work was done on identification of the names of ships in files MEDATALAS 1, containing the data received on ships of former Soviet Union (in

MEDATALAS I data have got from USA NODC) and their partial replacement by the data of Russian NODC.

There were 186 data files of the FSU in the MEDATALAS I non-duplicated by the new ones delivered to MEDATLAS II. 80 data files among them had known ID (ship names) and 106 files possessed of UNKNOWN ID.

All of these data files were compared with the data placed on the technical media in RIHMI-WDC. To do this work the program for duplicates check mentioned above was applied. It allows to indentify profiles even with the erroneous date and coordinates of stations in data.

59 files with UNKNOWN ID were identified by means of comparing with Russian NODC database. The ID (ship name and code, name of originator) was inserted in 2 data files, 57 other ones were completely replaced by new data of 18 cruises from RIHMI-WDC.

MEDAR/MEDATLAS 2001 Database Product

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The MEDAR/MEDATLAS II results are published on a 4-CDrom package (meta-data, observed data, atlas sections and maps, gridded analysed data), all auto mount to facilitate the data and meta-data dissemination by the data managers and the data use by non-specialist users.

For the observed data set, which represents a volume of about 700 Mbytes, a software tool has been developed to handle such a large volume and to perform the necessary pre-processing of the data requested by the project tasks. Accordingly, this software SELMEDAR allows:

1) To select data in geographical areas with limits created with the mouse and according to various other criteria including the quality flags of the numerical values;
2) To extract data at three possible formats: the fully documented MEDATLAS format, a simple table format and a WOCE/ODV compatible format;
3) To interpolate data at IOC/IAPSO standard levels and/or any other level defined by the user;
4) To visualise the profiles from one or several cruises in superposed or waterfall plots.

This software can be run on most of the PC platforms. It is expected that it will contribute to add value to the Mediterranean database and allow the Mediterranean community to make use of further software tools developed in other international projects like WOCE.

The GODAR and WOD Projects: Past, Present, and Future

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1 Introduction

The *Global Oceanographic Data Archaeology and Rescue* (GODAR) *Project* was established in 1993 by the Intergovernmental Oceanographic Commission of the United Nations. The following definitions are useful for understanding the reason for, and goals of, this project:

"Data Archaeology": the process of seeking out, restoring, evaluating, correcting, and interpreting historical data sets;
"Data Rescue": the effort to save data at risk of being lost to the science community by digitizing manuscript data and copying data on older, failing electronic media, and then archiving these data into an internationally available electronic database.

Before electronic computers came into general use, oceanographic data were recorded in manuscripts, data reports, and card index files. With the advent of electronic data storage oceanographic observations were increasingly recorded on magnetic media such as tapes and disks. Unfortunately, all these media are subject to degradation over time with the loss of unique having occurred in some instances. The goal of the GODAR project has been to identify oceanographic data that are at risk of being lost due to media decay and to "rescue" as many of these data as possible by digitizing them and integrating them into international historical archives. The final step is to distribute these archives internationally without restriction via write_once media such as CD_ROMs and via on_line servers as well.

The *World Ocean Database* (WOD) *Project* was established in 2001 by the Intergovernmental Oceanographic Commission of the United Nations. The goal of this project is to develop the most comprehensive, authoritative, global ocean profile-plankton databases possible by:

a) encouraging more rapid exchange of modern ocean data not transmitted via the Global Telecommunication System as part of the IOC GTSPP Project,
b) development of regional, scientifically quality-controlled oceanographic databases, atlases, and regional quality control procedures for evaluating oceanographic data.

Prior to the adaption of the IOC WOD project, NODC/WDC, Silver Spring began efforts to acquire modern ocean data in a more timely manner with much cooperation from IOC Member States.

2 GODAR and WOD Project Results

NODC/WDC plans to update the *World Ocean Database 1998* (WOD98*)* shortly. As of November, 2001, data in the following amounts have been processed since publication of WOD98, and will be made available as part of the *"World Ocean Database 2001*" (WOD01) during April 2002:

a) 690,000 OSD casts
b) 330,000 MBT profiles
c) 240,000 XBT profiles
d) 120,000 CTD casts
e) 37,000 Towed CTD casts
f) 73,000 Profiling Float casts, e.g. PALACE, MARVOR
g) 183,000 Fixed Platform (e.g. TAO...).

These data were processed as part of the GODAR project and also as part of the NODC "Global Ocean Database" project. WOD01 is an integrated database containing physical and chemical oceanographic profile data as well as data of plankton observations. The database will be distributed via CD_ROM and the Internet.

The first data resulting from the GODAR project were released as part of *World Ocean Atlas 1994* (WOA94). More than one million temperature profiles previously unavailable were distributed as part of the atlas CD_ROM series. More than 900 sets of WOA94 atlases and 450 WOA94 CD_ROM sets were distributed internationally without restriction since release of WOA94.

The second set of data resulting from the GODAR project were released as part of WOD98 which was a United Nations *International Year of the Ocean Product*. Several hundred paper atlas CD_ROM sets have been distributed since release of WOD98. All data and products associated with WOD98 are available on-line from the NODC/WDC Home Page (www.nodc.noaa.gov)

Products based on WOD98 include the *World Ocean Atlas 1998* (WOA98) series. This series contains objectively analyzed fields of temperature, salinity, nutrients, and chlorophyll. In addition, statistics of standard level values for climatological compositing periods (seasons and months) are presented for both one_degree and five_degree gridboxes. A novel feature of this series is that it includes more than 41,000 color figures (GIF images) which are available on CD_ROM and on_line via the NODC/WDC home page (www.nodc.noaa.gov).

The availability of GODAR products has been advertised through the world wide web as well as in numerous journals, newsletters and bulletins.

Six regional GODAR workshops were held worldwide that encompassed all countries that make oceanographic measurements.

In total the attendance of these meetings was approximately 150 oceanographic data managers and scientists. The dates and locations of these meetings are:

a)	GODAR	I	Obninsk, Russia	May, 1993
b)	GODAR	II	Tianjin, China	March, 1994
c)	GODAR	III	Goa, India	December, 1995
d)	GODAR	IV	Malta	April, 1995
e)	GODAR	V	Cartagena, Colombia	April, 1996
f)	GODAR	VI	Accra, Ghana	March, 1997.

A workshop report was produced for each meeting that summarized meeting results and which included reports of representatives from each country. Most importantly the country reports identified data that existed in manuscript form in each country, as well as data that existed in electronic form.

In July 1999 an *International GODAR Review Meeting* was held in Silver Spring Maryland, U.S.A. The meeting concluded that the GODAR Project has been a great success to date and that the list of variables to be included under the GODAR Project should be expanded to include sea level.

The success to date of the GODAR Project is due to outstanding cooperation by IOC Member States, specifically the many ocean data centers and staff who mange oceanographic data.

3 The Future

The GODAR project will continue. Substantial amounts of profile-plankton data identified in the six Regional GODAR Meetings as well other manuscript data identified by various individuals and institutions from the international scientific community exist and the purpose of GODAR is to locate and digitize all ocean profile-plankton data that exist only in manuscript form or on failing electronic media. In order for the scientific community to study the role of the ocean in climate change (and for many other scientific purposes as well). There is no place in the world ocean that we can say that we have “enough” data. The study of the earth’s heat balance, freshwater balance, and biogeochemical cycles (*e.g.*, carbon cycle) require substantially more data than are available now. For example, scientists studying biogeochemical cycles are requesting global, monthly, climatological ocean nutrient fields. We barely have enough ocean nutrient data to produce seasonal fields for most of the world ocean. Estimation of the interannual-to-decadal variability of the heat content of the world ocean, a critical diagnostic for climate change studies, requires additional data, particularly for traditionally data sparse regions such as the southern ocean.

The *World Ocean Database Project* will convene an international meeting in about 18 months devoted to the subject of quality control of oceanographic data. Development of regional atlases and quality control procedures similar to MEDAR/MEDATLAS products will be encouraged. In particular, it is important to start characterizing ocean variability of historical data in the form of statistical frequency distributions.

Long-Term Oceanographic Data Oraganizating System (LODOS)

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Collecting and disseminating oceanographic data are known to be the most important functions of the Oceanographic Data Centers. In between these two works, there are tedious procedures that the data go through. Oceanographic Data Managers apply strict quality control procedures to select the reliable data sets and flag the wrong and corrected ones. Building interactive databases and exporting the data to the data center is another job. After the data is stored, there comes LODOS to:

- Do a query with respect to the given conditions,
- Visualize the selected files,
- Process the data and conduct statistical analysis for the customer,
- Converting it to a common format and
- Provide hard or soft copies of oceanographic data products.

Use of Microsoft ACCESS 2000 for the Storage and Processing of Bottle and CTD Data from Mediterranean Cruises.

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Introduction

As a result of the European Union Marine Science Technology programme, most of the oceanographic cruise information, accumulated by all countries during the entire period of the Mediterranean investigation, were examined and archived in a uniform MEDATLAS format (http://www.ifremer.fr/medar/formats.htm). In the abstract we present a desktop database system, which is able to load this ensemble of the historical information and to convert it to a cost effective, flexible and user-friendly instrument for oceanographic investigations. The graphic interface of the system is based on the integration of widespread commercially available software packages such as Microsoft Excel and Golden Software Inc. Surfer. The system is also capable of importing data in the Sea-Bird (http://www.seabird.com) format and of exporting selected cruises to the MEDATLAS format and the generic ODV (Schlitzer, 2001) spreadsheet format.

MEDACC Properties

At present MEDACC contains the data from the following sources:

a) cruises collected within the framework of project MEDATLAS I (excluding bathythermograph observations) - 185 MB

b) East-Mediterranean cruises conducted during 1986 through 1995 within the framework of projects POEM and GOIN (Hecht and Gertman, 2000) - 56 MB.
c) East-Mediterranean cruises conducted by Israel within the framework of national projects within the period 1979 to 1995. - 20 MB.

The current total number of cruises loaded in MEDACC is 1591 (54644 casts). The data distribution of oceanographic parameters in the tables of observations is presented in figure 2.

The speed of data loading is approximately 80 MB per hour on IBM PC Pentium III 450 MHz, 256 MB RAM.

The present MEDACC.MDB file is about 0.5 GB. According to ACCESS 2000 documentation (Shank, at al. 999), the maximum size of MDB file could be 2GB, which is considerably more than the expected size of the Mediterranean Data Base resulting from the implementation of the MEDATLAS II project.

Oceanographic Oriented Graphic Interface
The following tools are included in the present version of MEDACC for data analysis:
- plotting of vertical distribution of parameters for separate cast or for a group of casts.
- plotting of vertical and horizontal sections of temperature, potential temperature, salinity, density and potential density.
- plotting of the distribution of temperature and salinity on isopycnic surfaces.
- plotting TS-diagram for a single cast or an ensemble of casts.
- plotting of dynamic topography.

The plots are obtained by using various software objects, which support COM-based technologies (Chappell, 1996):
- Microsoft Graph object;
- Microsoft Excel object;
- Golden Software Inc. Surfer32 object;
- Golden Software Inc. Scripter32 object.

The first two objects are invoked by VBA procedures. The last two objects are invoked via launching of Scripter32. It is necessary to point out that, before launching Scripter32, the data are selected by VBA procedures and are saved in temporary directories as ASCII files.

The VBA procedure creates the script file using an appropriate Scripter32 basic (BAS) file from C:\Maps folder as a template. As a result of Scripter32 implementation, the Surfer32 is launched and creates the graphic image, which can be edited by Surfer32 tools. The output files are named according to the time of their creation and can be used for further processing.

All MEDACC tools have similar GUI (Fig.2) and are launched via appropriate forms:
- The **CastVertDistr** form allows selecting casts via cruise name or directly via ***ID_Cast*** field and plotting the vertical distribution of any oceanographic parameters present in the cast.
- The **GroupVertDistr** form allows selecting a group of casts according to space and time frames or according to a cruise name. The selected data is imported into an Excel Workbook and plotted as shown in Fig. 3.
- The **TS_Diagram_Building** form allows plotting classical TS diagram for a single cast or a group of casts. One could also depict the TS properties for a group of casts at a given depth.
- The **MapBuilding** form allows selecting temperature, salinity or density (calculated during the selection) for a given level and for time and space frames as well as plot the isolines and cast position. Missing data at the given level are replaced by vertical

linear interpolation. Horizontal interpolation for creating the isolines is carried out by Surfer32 interpolation procedure with parameters defined in a script-template file.

- The **Par_on_Isop** form makes a plot similar to that of the **MapBuilding** form with one difference - the spatial distribution is plotted on a given density level.
- The **SectionBuilding** form allows plotting vertical distribution of temperature, salinity or density for a group of casts. This group of casts should be set by ***ID_Cast*** list in the **Cast2Section** table. An active map, developed in the VB environment, is used for required cast selection. Data gridding is performed by bilinear interpolation. Bottom profile for the section building is extracted from DBDB1 ($1/60^o$ x $1/60^o$) bathymetric data set (US Naval Oceanographic Office).

Conclusions

Our experience in developing MEDACC validates the claim that Microsoft ACCESS is convenient and reliable software for developing a desktop system for the management and analysis of oceanographic information. VBA language is a useful facility to connect between different graphic packages (Excel, Graph, Surfer) and to create a user-friendly oceanographic-oriented graphic interface.

The MEDACC relational structure allows creation of an unrestricted number of uniform tables with different seawater parameters obtained by a vertical profiler or a bottle cast.

We have used the MEDACC, which included about 70% of the available Mediterranean data, for some oceanographic investigations and found it to be a very efficient and effective tool.

Acknowledgements

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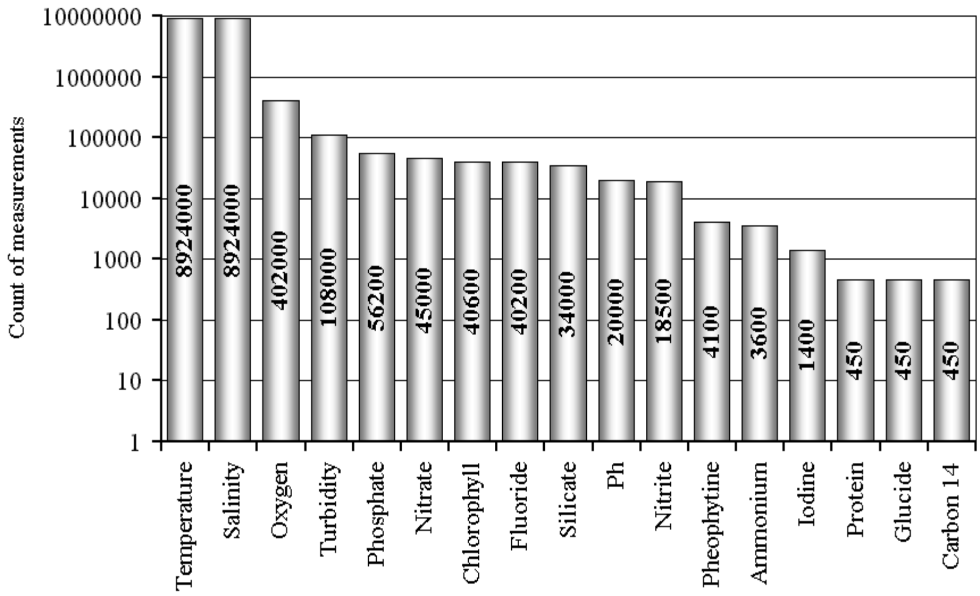

Fig.1. Distribution of measured data in the tables of observations.

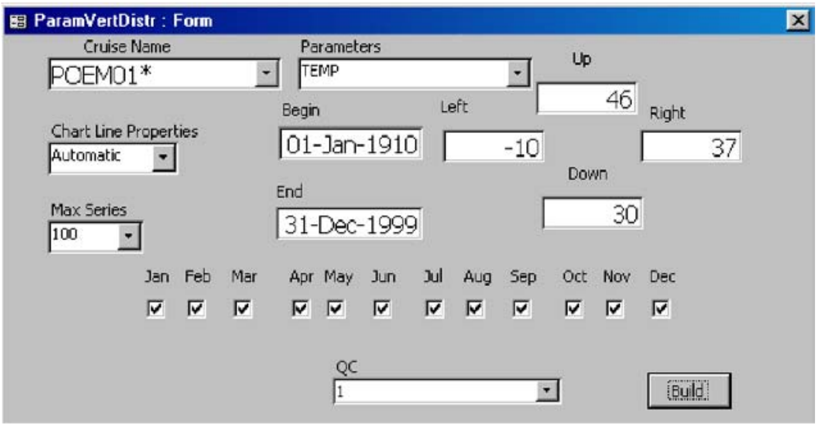

Fig. 2. Controls for data selection on the GroupVertDistr form.

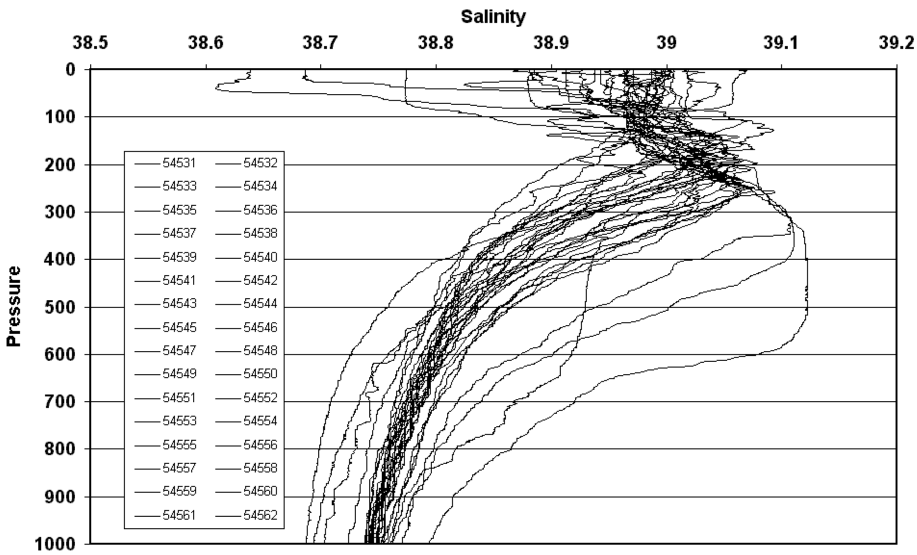

Fig. 3. Vertical distribution of salinity plotted by Excel via GroupVertDistr form. Each cast could be easily identified via its ID_Cast.

Ocean Data View: An interactive tool for quality control, analysis and visualization of oceanographic data.

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Ocean Data View (ODV) is a software package for the interactive exploration and visualization of oceanographic and other geo-referenced data. ODV runs on Windows 9x/2000/NT/XP PCs and SUN Solaris workstations. It will soon be available for Linux, Unix and Mac OSX platforms, in addition to Windows computers. ODV data collections can then be shared between different platforms without re-writing (platform independence). Among other applications, you can use ODV to produce:

- property/property plots of selected stations,
- scatter plots for all valid stations,
- color sections along arbitrary cruise tracks,
- color distributions on general iso-surfaces,
- temporal evolution plots of property fields,
- differences of property fields between repeats,
- geostrophic velocity sections.

ODV either draws original data points or gridded fields based on the original data. Gridded fields can be color-shaded and/or contoured. ODV supports five different map projections and can be used to produce high quality cruise maps. ODV graphics can be printed on any printer or may be exported to PostScript, GIF, and EMF files.

The ODV data format allows dense storage and direct data access. Even extensive data collections containing thousands of stations can easily be maintained and explored on inexpensive desktop and notebook computers. Data extracted from the Medar/Medatlas II CD-ROMs as well as data from the World Ocean Circulation Experiment (WOCE), the NODC World Ocean Atlas 1994, the NODC World Ocean Database 1998 and the Nemo Oceanographic data server at Scripps Institution of Oceanography can be directly incorporated into the ODV system.

ODV can be used free of charge for scientific purposes. The software, numerous optional packages and extensive datasets ready to be used by ODV may be downloaded from http://www.awi-bremerhaven.de/GEO/ODV.

SESSION II: QUALITY ASSURANCE

International standards applied to MEDAR/MEDATLAS – IOC/ICES Methodolgy

H. D. Dooley
ICES Service Hydrographique

The foundations of the international oceanographic data management community that we see today were established in the late 1960s following the establishment of the World Data Centre system under ICSU and the IODE system under IOC. Standards for data exchange were implicit in this development. IOC provided important building blocks on which to base these standards, mainly with respect to providing the capacity to document and exchange oceanographic data in a standard (common) way. This activity went very much in parallel with the efforts of Unesco's Division of Marine Science, which promoted standardisation in analytical and analyses techniques, in terminology and units and in the calculation of derived values.

MEDAR and its predecessor, MEDATLAS I set out to embrace the need to ensure the maintenance of the standards that were established by IOC and IODE and traditionally upheld by the ICES Service Hydrographique. This was natural given that these projects had a principal objective of strengthening the IODE system at a regional level at least. But to what extent has the project been successful in adhering to these standards? If not, does it matter given that very few of the international data management community have even attempted to adhere to international standards in any case?

This presentation will attempt to examine the extent to which MEDAR has been able to embody standardisation, given that very little of it exists in practice. It will in particular examine whether or not MEDAR has been able to adopt the existing standards in full, or whether it has been forced (obliged) to develop its own "regional or project-level" standards. It will also propose what other elements of data exchange require more rigid standardisation (including elements such as data flags and parameter and methodology codes) which might become more urgently required as data centres take the path towards distributed data systems including the concept of a Global, internet based virtual data centre. A final question will be "Has MEDAR standardised enough already to allow for a smooth transfer to such a new system at the Global level?"

GTSPP Experience: Real-time and Delayed Mode Quality Assurance

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GTSPP was planned in the late 1980's, and began operations using real-time data in 1990 and delayed mode data in 1991. A strong emphasis in the Project was to develop standardized data quality assurance procedures as they apply principally to temperature and salinity profiles. There are a number of key factors that GTSPP instituted, which advanced data quality management practices. These factors include co-operation between data centers and scientists in assuring data quality, an agreed set of algorithms for automated checking of the data, visual scrutiny of the profiles, widely available documentation of the procedures applied, inclusion of both test results and tests applied in the data file, and a processing history of the data. But data quality assurance encompasses more than these measures. It also includes acquisition of as much high resolution data as possible, removal of duplicates, compensation for systematic errors in data, etc. In the end, the challenge is to demonstrate quantitatively the value added to a data collection by all of these practices. This paper reviews the actions taken by GTSPP to add value to the data, and looks to examine weaknesses in order to provide advice to future programs.

Software for Quality Control of Oceanographic Data in the Mediterranean and Black Sea (Implementation for PC)

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New version of the software for quality control of oceanographic data for PC platform (Fig. 1) was developed at the Instituto Español de Oceanografía. Source codes were rewritten and more friendly graphics user interface was introduced. Besides, some new modules were included both to convert data from external sources (spreadsheet ASCII formats) into MEDATLAS format for exchange and quality control according to the MEDAR/MEDATLAS II protocols (1) and to export data to flat format files compatible with widespread free and commercially available software, such as database managers, spreadsheets, graphics, statistics and other analysis packages.

New in this version
In order to make easier the process of transcoding of data to MEDATLAS format new *"Input Data"* module (Fig.2) was developed. Metadata (header information) are introduced via specific dialog box. It is possible now to create quickly cruise files by importing data automatically from one or two previously prepared ASCII spreadsheets that have very simple format. Only needed parameters can be chosen interactively and their free form names can be associated with existent GF3 codes.

A comparison test of Unix-based SCOOP software (2) with previous version of Windows-based QCMEDAR v1.1 software showed same results (quality flags) when performing QC because both are based on the same quality check procedures and on the same seawater properties algorithms (3,4). Nevertheless the version 1.1 could not detect some errors in the format of input data after manual editing of MEDATLAS files. New module *"CheckFormat"* (Fig.3) that helps to detect such types of errors before performing full QC is included in v2.0 of QCMEDAR. This module can be used also as stand-alone application and can be called at any time of the quality control. Additional helpful functions of CheckFormat are:

- possibility to sort profiles (stations) by date and time
- automatic control with the option of eliminating parameters in the files that have no data, i.e. when the columns contain only default values.

Two new modules *"MedODV"* and *"FlatOutput"* serve to export oceanographic data presented in MEDALAS format to different column-type ASCII files that can be used by other analysis or visualization software, p.e. Excel, Grapher, Surfer, etc.

"MedODV" program (Fig.4) converts data to specially formatted spreadsheet ASCII format, suitable for importing into Ocean Data View (ODV) software. ODV (http://www.awi-bremerhaven.de/GEO/ODV) is a free computer program for the interactive exploration and graphical display of oceanographic profile data (bottles, CTD, XBT, etc.). When exporting the quality flags are recalculated to the corresponding values used by ODV. Multiple selection of files is supported. User interface allows to select the list of parameters to export from those available within selected input file(s) or from the whole list of GF3 codes.

All modules composing the QC system can be used as stand-alone applications. The QCMEDAR software will be included and distributed as a product within the final CD-ROMs of the MEDAR/MEDATLAS II MAST Concerted Action. It will also be available for downloading to MEDAR partners through IEO web/ftp server (www.ieo.es/medar).

Together with the programs all other necessary files to perform QC control and visualization will be included: MEDATLAS(5) and LEVITUS(6) climotology, ETOPO5 (7) and GEBCO bathymetry, the standards IOC/GF3 and ICES codes.

System environment and history

All programs run on PCs under Windows 9x/Me/NT/2000/XP. The source code is Fortran 95 with Win32 API calls implemented in CVF v6.6 (Compaq Visual Fortran) compiler. CVF (http://www5.compaq.com/fortran/visual/index.html) is a complete development system that includes MS Visual Studio, QuickWin package and combines unbeatable speed of Fortran language in number-crunching tasks with the possibility to create friendly user interface for the programs. Some visualization and input modules were written in Java.

The first version of the Input Data & Quality Control software for PC (MEDATLAS project) appeared at 1996 and was written in MS Fortran 5.1 under DOS operating system.

According to the new requirements of the MEDAR/MEDATLAS II a new version, named QCMEDAR (8) appeared in 1999 for the Quality Control. This version was also written in MS Fortran 5.1 under DOS operating system.

This version (v2.0) of the software for Win32 environment was prepared in 2001 and includes many improvements and additional features. Compaq Visual Fortran (formerly DIGITAL Visual Fortran) compiler was chosen for the task of porting of existing code to Windows environment and for converting it to the latest Fortran 95 standard.

Conclusions

Developed tools proved to be very robust, flexible and reliable during everyday tasks of QC of oceanographic data. The fact that no any commercial programs and special skills are required from the end user together with minimal hardware requirements and preparedness of software routines to process data from any geographical zones on the Earth add new value and make it interesting for the scientists in other countries.

This product is also an example of the possibility to reuse reliable legacy Fortran codes (there are huge quantities of such codes in scientific and engineering organizations) and to adapt them to modern user interface.

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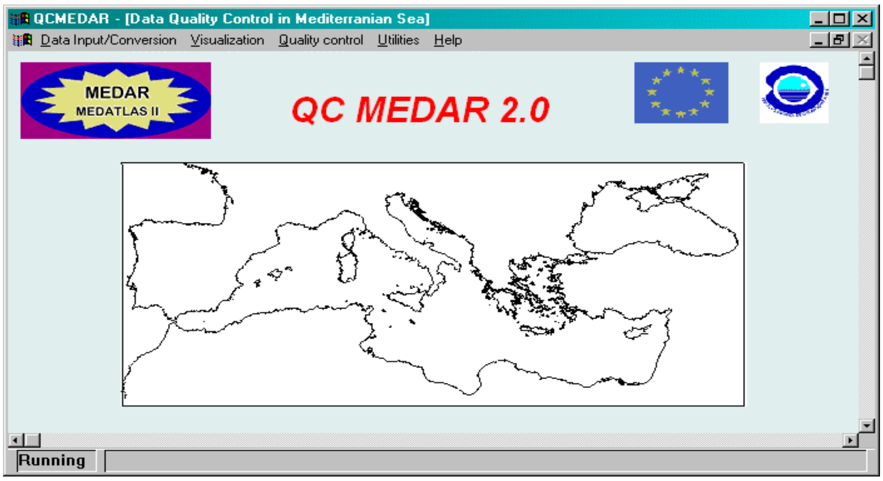

Fig. 1: "Main menu"

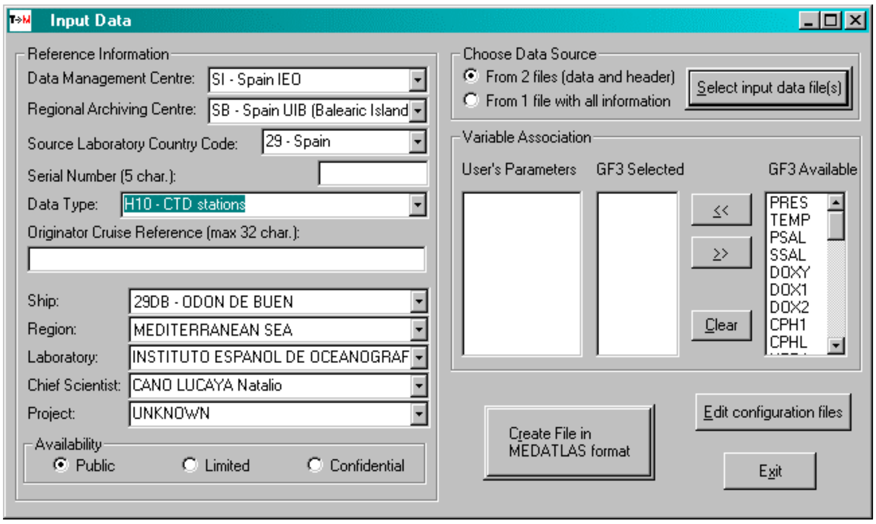

Fig. 2: "Input data"

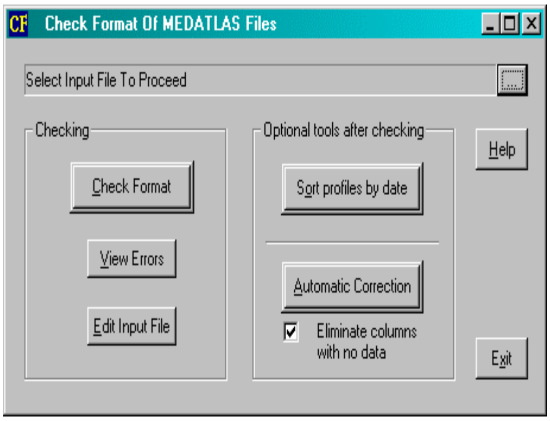

Fig. 3: "Check format"

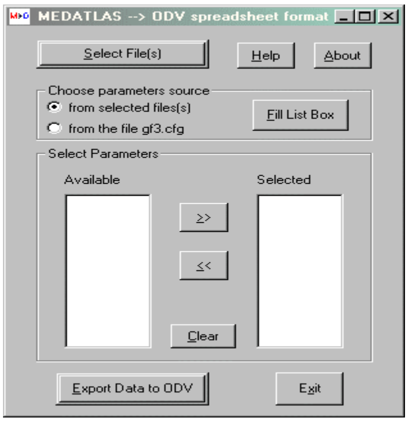

Fig. 4: "MedODV"

SESSION III: NETWORKING AND PERSPECTIVES

Oceanographic Data Management within MEDAR/MEDATLAS II Project: Thematic and Regional Distributed Network

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The MEDAR/MEDATLAS II project (1998-2001) provided comprehensive data sets and climatologies for several oceanographic parameters (physical and bio-chemical) collected in the Mediterranean and Black Sea, through a wide co-operation of the bordering countries. The qualification and safeguarding of existing oceanographic data and related information was an important issue of the project. It aimed to enhance the overall capacity of MEDAR/MEDATLAS II IODE/IOC network, sharing the know-how in oceanographic data management among the participants, in the perspective of the forthcoming operational oceanography.

The circulation of information as well as the promotion of MEDAR project was made by developing a network of MEDAR thematic and regional Web-sites and by providing links between several international programs. The network is composed of National Oceanographic Data Centers or Designed National Agencies (NODC/DNA) distributed in 20 international countries, 4 Regional Data Centers, a Global Assembling Center and the Analysis Center (Fig.1). The distributed network was opened to public throughout the project Web server (1), providing access to hydrological data and information detained by National Centers as well as links to all international organization contributing to the project (Fig.2).

The global MEDAR/MEDATLAS II cruise inventory was developed by the Russian NODC/World Data Center-B, in collaboration with the Regional Data Centers, that sent all available information concerning the rescued cruises in the Mediterranean and Black Sea regions, and ICES. A review of the project and bibliographical references completed the information released by the National Data Centers. The global MEDAR/MEDATLAS II cruise inventory was published on Internet (2), with tools to select the cruise reports by country (Fig 3). Furthermore, to give visibility to the data sets rescued in the Regional Data Centers within the framework of the project, four Regional MEDAR/MEDATLAS II Web sites were developed at HNODC/NCMR, Greece (4), OGS/DOGA, Italy (5), IEO, Spain (6) and RIHMI/WDC, Russia (7). Active hyperlinks to other project servers and to all partners that were interested to maintain visibility of proper Web pages and inventories were created. Links with MEDAR Coordinating Center, giving information on data exchange format, protocol on quality assurance, data archiving and dissemination were provided as well. The Regional Data Centers home page gave access to specific information on:

1. Cruise Inventory at the Regional Center;
2. Data-sets inventory of the observations archived at the Regional Center.

The data were collected at national level and sent to one of the four Regional Data Centers. Here they were globally qualified according to the project protocol for Quality Control. The data sets were not directly accessible from the Web, but they were archived at the Regional Center on separated disc storage and available to other partners and/or contributors via 'FTP protocol communication' according to the Code on Data Management in MAST Project. Finally, the data sets were integrated by the Global Assembling Center, in the common MEDAR/MEDATLAS II database.

The global MEDAR/MEDATLAS II database was used by the Analysis Center and climatological fields were computed at standard levels by using the variational inverse model on the benchmarks and on the final database. Several improvements to the variational inverse model analysis included error computation, coordinate transformation, and statistics. The gridding and analysis tools have been reviewed. The preliminary results were available on Internet (3) together with the new release of the analysis tool.

The final objective, expected by all MEDAR/MEDATLAS II actions, is to contribute to the safeguarding of the existing data, to the further exploitation of the experimental fieldwork, and the improvement of the overall level of data quality. The decentralized character of the informative thematic and regional network increased the flexibility and the communication between data managers, the data sources and all Mediterranean and Black Sea partners. Nevertheless, the integration of different archiving systems would facilitate the data flow and speed the access to assembled data and information.

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MEDAR Analysis Center: http://modb.oce.ulg.ac.be/Medar
HNODC/NCMR (Greece) Regional Data Center: http://hnodc.ncmr.ariadne-t.gr/programmes/medar/
OGS/DOGA (Italy) Regional Data Center: http://doga.ogs.trieste.it/medar/
IEO (Spain) Regional Data Center: http://www.ieo.es/medar/
RIHMI/WDC (Russia) Regional Data Center: http://www.meteo.ru/nodc/project/project.htm

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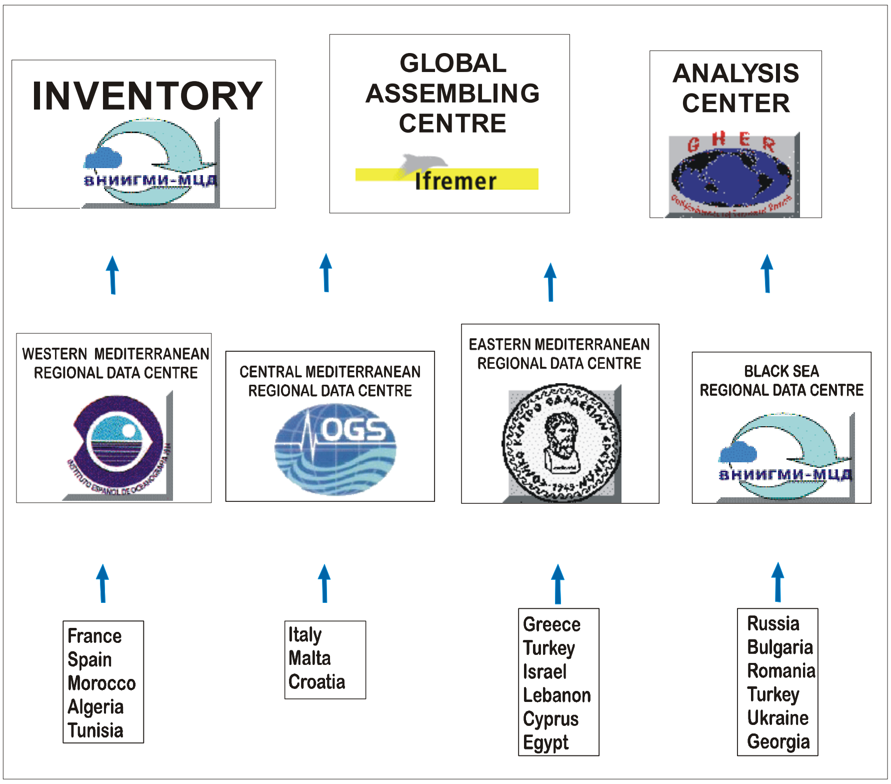

NODC and DNA are respectively the National Oceanographic Data Centres & Designated National Agencies for International Oceanographic Data and Information Exchange (IOC/IODE)

MEDAR Thematic Centres

Co-ordinating Centre	WDCB - MEDAR Inventory Regional Centre for Black Sea	Quality Assurance
Regional Centre for Western Basins	Regional Centre for Central Mediterranean	Regional Centre for Eastern Basins
Climatological Analysis Centre	Qualification centre for climatologies - T/S	Qualification centre for bio-chemicals

Fig. 1: MEDAR/MEDATLAS II thematic network

Fig. 2: Coordinating and Regional Center Web-sites Home Page

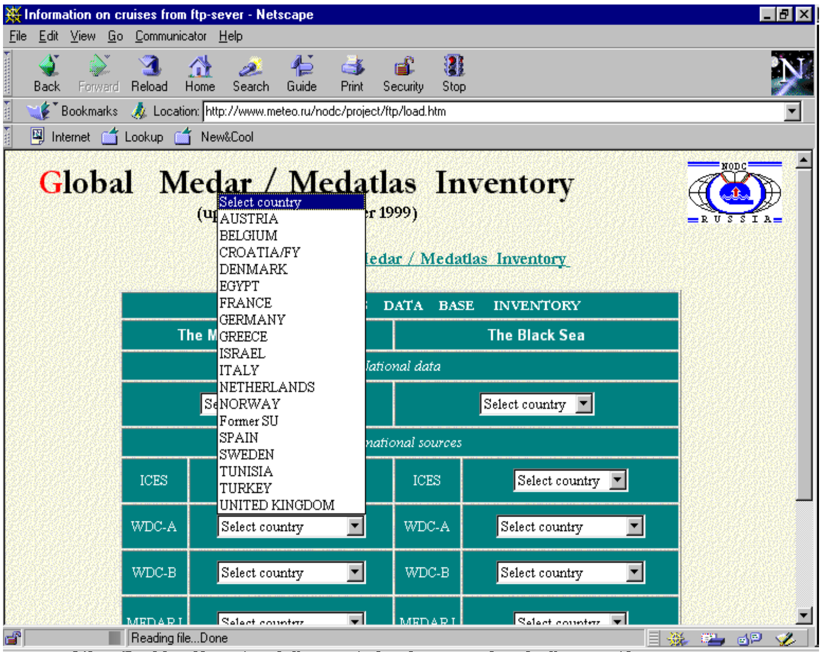

Fig. 3: On line tool for retrieving cruise information

IOC/IODE Websites

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The IOC web site was opened in September 1995 as one of the first UNESCO web sites. The initial emphasis was on users services and included on-line information products such as the Ocean Pilot, the Ocean Experts Directory, an on-line publication service, list of acronyms, international marine meeting list, electronic mailing lists and ocean software

IODE's individual web presence started in 1997 and the first version of the IODE web site was built based on the IODE programme structure (as was done for all other IOC programmes). The IODE site was redesigned in 1999 with an emphasis on services and products such as marine scientists and institutions (GLODIR), marine science related web sites (OceanPilot), marine science related Internet discussion lists, marine science related conferences and meetings, scientific publications, marine science libraries and ocean data

At the 8th Session of the IODE Group of Experts on Technical Aspects of Data Exchange (GETADE-VIII) in March 2000, it was agreed that the structure of the IODE web site should better reflect the IODE services and products, rather than the organizational structure of the IODE Programme. A redesigned site was launched in July 200 and included new corporate branding. A new domain name registered: **http://iode.org** and the original URL **http://ioc.unesco.org/iode** can also be used. The current web site provides individual pages with detailed information and links to IODE products/projects such as:

- GODAR: Global Oceanographic Data Archaeology and Rescue
- GLODIR: Global Directory of Marine (and Freshwater) professionals
- ASFA: Aquatic Sciences and Fisheries Abstracts
- MEDI: IODE's metadata system
- ODINAFRICA: Ocean Data and Information Network for Africa
- OceanTeacher: Comprehensive reference tool for ocean data and information managers
- Marine XML: XML standard development project
- OceanPortal: the one-stop shop for ocean data and information.

The future for the IODE web site will be a move away from static web pages to dynamic pages. The site will be database driven which will allow direct user contributions. In this way, the users will maintain the site content.

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IODE site. http://iode.org
GLODIR site. http://ioc.unesco.org/glodir
OceanPortal site http://oceanportal.org

Mediterranean ocean forecasting system: conceptual basis and first phase of implementation

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The Mediterranean Forecasting System Pilot Project (1998-2001) has been completed and every week a ten days forecast is released on the Web (http://www.cineca.it/mfspp). This is realised with a networking of Near Real Time observing and modelling centres started within the project and working operationally from January 2000. The network consists of:

1. three data centres that provide in situ and satellite data for initialisation of model forecasts. The observations are released with a time delay of one to three days through the internet;
2. a meteorological data centre for the collection and transmission of atmospheric forcing fields;
3. a central modelling and data assimilation centre which executes the forecasts.

The satellite data consist of sea level anomalies and sea surface temperatures (SST) while the in situ data are temperature profiles acquired on Voluntary Observing System ship tracks at biweekly frequency. All this data is assimilated to produce an initial condition for the forecast that is coupled asynchronously to atmospheric forecast surface fields. Skill scores indicate that forecast beats persistence after the first day in all Mediterranean regions and RMS error in SST is maintained lower than 0.5 ^{0}C for the ten forecast days.

Perspectives from EUROGOOS Users

N. Flemming
EUROGOOS Office, UK

Perspectives from Black Sea GOOS Users

V.N. Eremeev, A.M. Suvorov

The report concerns the concept, goals and approach of the "Black Sea Global Oceanographic Observing System", Marine Service Module of the Black Sea GOOS (data management, marine observations and services, assessment of the Black Sea and users needs and requirements for data and products, the benefit to the Black Sea countries, the risk of no action, customers, guiding principles, components of the strategy, resources, strategic plan for marine service module, short-term and medium-term objectives), regional management and analysis module (coastal and open sea analysis), training and technology transfer, relationship with other international science and data management programs, implementation plan (observations, data exchange, data analysis system, modeling).

The MedGOOS first project: MAMA - Mediterranean network to Assess and upgrade the Monitoring Activity in the basin

Silvana Vallerga,
MedGOOS Chairperson, CNR & IMC, Oristano, Italy

The MedGOOS was launched in 1997 by UNESCO Intergovernmental Oceanographic Commission (IOC) as a regional activity of the Global Ocean Observing System. In 1999 sixteen Agencies from thirteen Countries signed the Memorandum of understanding defining the terms of co-operation to implement operational ocean forecasting in the basin. MedGOOS works in full synergy with EuroGOOS, benefiting of its achievements.

The thematic network MAMA, funded by EC EESD Programme, participated by Institutions of twenty-two Mediterranean Countries and international organisations, is the first basin wide joint activity of the MedGOOS. MAMA builds upon the results of research projects such as MEDAR/MEDATLAS and MFSPP.

The specific objectives of MAMA are:

- build the basin-wide network for ocean monitoring and forecasting, linking all the Mediterranean countries, broadening the MedGOOS members network;
- identify the gaps in the monitoring systems and in the capability to measure, model and forecast the ecosystem in the whole basin;
- build capacities for scientific and technical expertise in the setting up and running of observing platforms, in managing data, in modelling and forecasting the marine ecosystem;
- design the initial forecasting system from the basin scale down to the coastal zone;
- raise awareness on the benefits of ocean forecasting at local, regional and global scales, involving stakeholders;
- disseminate results, products and demonstration applications to show the benefits of GOOS in the region.

The expected long-term results are to:

- strengthen the co-operation of all the Mediterranean countries towards the development of the Mediterranean operational forecasting system operating at basin and local scales;
- upgrade the scientific and technical skills of human resources and the research infrastructure needed for the basin wide management of the coastal and shelf area;

- establish the platform for a Mediterranean virtual data and information centre as a basis for operational interagency exchange, merging data and information, to produce added value oceanographic information.

A Hydrographic and Bio-Chemical Climatology of the Mediterranean and the Black Seas

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The Mediterranean Sea and the Black Sea have been studied actively for several decades, generating huge amounts of data which remain in danger to be lost if not archived. New multivariate sensors, in growing number and spatio-temporal resolution produce crucial information which require careful and but efficient integration.. This information is becoming an essential part of the numerous toolkits used by oceanographers, engineers, managers, navies and authorities to continuously monitor the ocean state and variability, to infer possible climate changes, *etc.*

The aim of the MEDAR/MEDATLAS II project is to archive and rescue multi-disciplinary in-situ hydrographic and bio-chemical data of the Mediterranean and the Black Seas through a wide cooperation of countries. The growing interplay between scientific disciplines requires multi-disciplinary integration of this information which includes, among many other parameters, temperature and salinity, dissolved oxygen, hydrogen sulfure, alkalinity, phosphate, ammonium, nitrite, nitrate, silicate, chlorophyll and pH.

The project was divided into several tasks. First, a global inventory was compiled using existing data sets of the core parameters and their cruise reports from the WDC-A, the WDC-B, the ICES and the MEDATLAS I inventories. Duplicates were eliminated by careful cross-checking. Secondly, the data sets were assembled regionally for the Western, Central and Eastern Region and the Black Sea sub-areas., trans-coded in the common ASCII human readable MODB/MEDATLAS format and quality checked by regional experts. Finally, a global integration ensured the assembling and consistency of the regional data sets. The vertical profiles were interpolated on 25 standard vertical levels, chosen according to the vertical distribution of the data.

Raw in-situ data sets are difficult to interpret and higher level products are required to offer a more complete and synthetic view of the Mediterrenean and Black Sea bio-chemical systems. The computation of climatological or gridded fields is also justified by the need to provide initial or boundary conditions to numerical models (Beckers et al. 2001) and is subject to the choice of an adequate analysis method.

Instead of using the classical objective analysis scheme (OA) (*e.g.* Bretherton 1976), gridded fields have been computed using the Variational Inverse Model (Brasseur 1991, Brasseur and Haus 1991, Brasseur et al. 1996, Brankart and Brasseur 1996, Brankart and Pinardi, 2001, Rixen et al. 2001), shown to be statistically equivalent to OA.

The basic idea of variational analysis is to determine a continuous field approximating the data and exhibiting small spatial variations. In other words, the target of the analysis ϕ is defined as the smoothest field that respects the consistency with the observed values over the domain of interest. It is also referred to as a spline interpolation method. Expressed in mathematical terms, the analysis is obtained as the minimum of a variational principle (in a two-dimensional, horizontal space)

$$J[\phi] = \sum_{i=1}^{N_d} \mu_i \left[d_i - \phi(\mathbf{x}_i)\right]^2 + \|\phi - \phi_b\|^2$$

$$\|\varphi\|^2 = \int \left(\nabla\nabla\varphi : \nabla\nabla\varphi + \alpha_1 \nabla\varphi \bullet \nabla\varphi + \alpha_0 \varphi^2\right) d\mathbf{x}$$

The integral extends over the whole domain. The first contribution in J represents the distance between the data and the target field at the exact position of the observations. The weights μ_ι are determined according to the confidence in the data. In principle, the weights could be adjusted to every observation individually, but in practice it is impossible to decide whether one observation is more reliable than another.

The second contribution in J is a measure of the smoothness of the target field. The coefficients α_1 and α_2 fix the weights of the lower derivatives in the smoothing operator. In practice, all observation at a given level are selected to perform the minimization in a horizontal plane. The reconstruction of a three-dimensional scalar field is then obtained as a superposition of several analyses at different depths. This reduction is made possible because the data profiles describe the vertical structure of the sea reasonably well and do not produce hydrostatic instabilities.

The reference field ϕ_b (or background field) has been computed by a semi-normed analysis (leaving out the underived term in J) (Brankart and Brasseur 1996). It has indeed been shown that in data-void areas this method produces more realistic fields than using a simple constant value or a linear regression of the data. The variational principle is solved using a finite element technique. The main advantage is a numerical cost almost independent of the number of data analysed. The mesh also easily takes into account the complexity of the basin geometry by automatically prohibiting correlations across land barriers. A preprocessing quality check was applied to the raw data in order to eliminate values out of 3 standard deviations on bins 10 times bigger than the analysis grid. This method ensures that a significant part of the bull's eyes are removed in the analyses.

By converting the dimensional weights into non-dimensional quantities, and imposing that the correlation function be the Modified Bessel function of order 1, the calibration of the free parameters μ, α_1 and α_2 reduces to the choice of a characteristic length scale L and a signal-to-noise ratio ($S/N=\varepsilon^2/\sigma^2$), which represents the ratio of the standard deviation of the signal ε to the standard deviation of observational errors σ. A Generalized Cross-Validation (GCV) technique has been implemented to compute the statistical parameters L and S/N out of the raw data (Brankart and Brasseur 1996). The method consists in successively eliminating one measurement from the full database and performing analyses with the remaining data. The variance of the misfits between these reconstructed fields and the corresponding eliminated data is then considered as a statistical indicator of the quality of the analysis, with respect to S/N and L. In practice, for climatological analyses, the quality of the analysis is not very sensitive to the correlation length and has thus been fixed *a priori*, according to a reasonable choice of features to be represented in the domain of interest.

By analogy with OA, the statistical error field is obtained by using the stiffness matrix K of the analysis and two transfer operators T_1 and T_2 (Rixen et al. 2001)

$$e^2(x) = \varepsilon^2(x) - T_1(x) K^{-1} T_2(x) c(x)$$

where c is the correlation function, i.e. the Modified Bessel function of order 1.

Gridded fields have been produced for both entire Mediterranean and Black Seas basins and several additional sub-basins including the Alboran Sea, the Balearic Sea, the Gulf of Lions and the Ligurian Sea, the Sicily Strait, the Adriatic Sea, the Aegean Sea, the Marmara Sea and the Danube shelf area at climatic, seasonal and monthly scale when relevant. Inter-annual and decadal variability of T/S for both basins has been computed as well. It should be noted that for a given temporal scale, *all* data have been used, but the observational error standard deviation has been modified according to Brankart and Pinardi (2001), by imposing a temporal correlation length: 3 months for a seasonal analysiss, 1 month for a monthly analysis, 10 years for a decadal analysis and 1 year for an annual analysis.

The resulting atlas is made available free of charge at *http://modb.oce.ulg.ac.be/Medar* and on CD-Rom, where the fields are found in *Netcdf* format (compressed with the *gzip* tool), and figures in *Jpeg* format. Results are organised in a 'tree' way: first identify the domain, then the parameter, then the relevant period.. Colorbar ranges for analysis fields have been set using the mean value of the corresponding field +/- 1.5 standard deviation. Colorbars for error fields are simply bounded by the maximum value, i.e. the background field error standard deviation, obtained by GCV. Vertical sections go down to the deepest level where data were available. Stations plots are only indicative, as ALL the data are used, but weighted according to the temporal scale of the analysis period. The corresponding stations amounts for approximately 97% of the data that have been used for the analysis. Two examples of the Mediterranean and the Black Sea are shown below.

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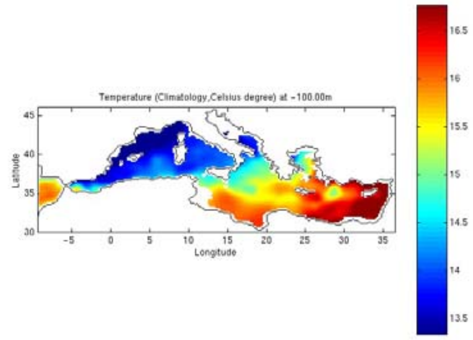
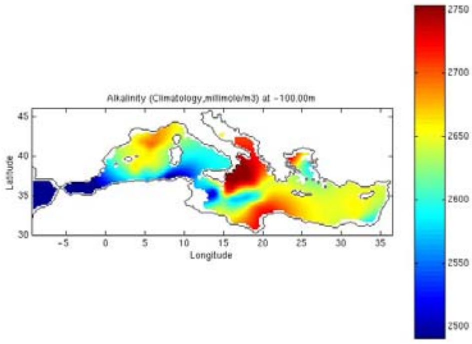
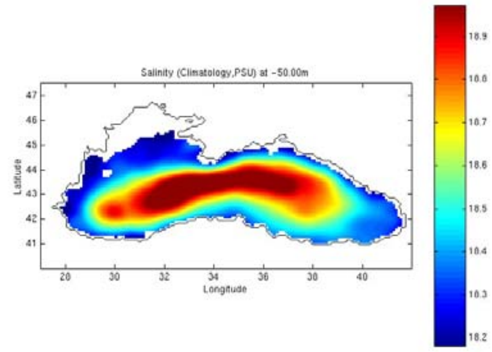
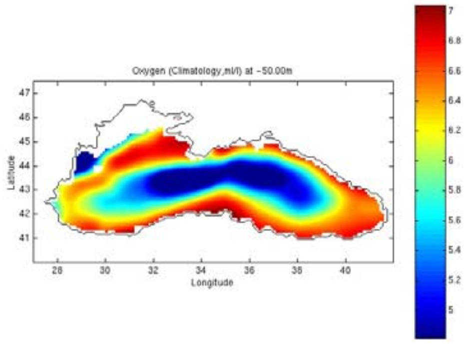
GRAPHS









New Challenges in Oceanography Data Management of the Mediterranean and Black Seas

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The Mediterranean oceanographic data management community has been working in a concerted way since the beginning of the last decade. The EU/MODB (Mediterranean Ocean Data Base) initiative provided a comprehensive data set of temperature and salinity for the Mediterranean Sea. This work was further developed by the EU/MEDATLAS Project, which produced the presently most complete data set including a Climatological Atlas of temperature and salinity for the Mediterranean region. This data product made available through a set of three CD-ROMs is internationally accepted today as a powerful tool, especially for the marine science community. The MEDAR/MEDATLAS II Project (funded under the EU-MAST III Programme, from 1998-2001) established common formats, and quality control standards and practices, which are being used today by many countries of the Mediterranean and Black Seas. In addition the MEDAR/MEDATLAS-II Project enabled the development of a multi-parameter database of high quality oceanographic and marine data sets for the Mediterranean and Black Seas.

In all the above-mentioned initiatives the approach followed for data and metadata management is a centralized one. Data and metadata coming from various sources were accumulated for two or three years as a centralized data and metadata holding and then at the end of the Project were made accessible to the user community through a set of CD-ROMs or

Web sites. In recent years and due to the technology development there are more and more supporters of the view that such an approach today is clumsy, slow and inflexible and by no means meets the needs for fast access to data and metadata. The **”virtual” ocean data centre approach is the innovative vision of marine data management, internationally.** This provides new challenges in oceanographic data and information management of the Mediterranean and Black Seas, based on a decentralized **(“virtual”)** model. Data will be retained at data sources (national or regional archiving systems). A user request addressed to a **Distributed Oceanographic Data System (DODS) for the Mediterranean and Black Seas**, via an Internet-accessible “virtual” data centre, will consist of a series of requests addressed to individual data sources. In this case data will not be duplicated, and their immediate availability will be guaranteed. However, since data sources are independent, their integration requires sophisticated methods and navigation tools to facilitate access to data from decentralized data sources. This make necessary the development and use of techniques and tools, many of which have a strong innovative character. However, technology, in particular web technologies evolving meta-language systems (including the Extensible Markup Language XML), now provide effective solutions.

The **Mediterranean and Black Seas DODS (MEDBLACK-DODS)** is a rather sophisticated experiment, but feasible at least for the more advanced regional data centres. This approach provides better opportunities for all national data archiving systems, with the appropriate data management facilities, to be connected in such a network and thus contributing to the development of a new generation of marine data management infrastructure for the Mediterranean and Black Seas, which will be based on a unified data exchange environment. Ultimate goal will be that each country or institute will retain “physical ownership” of its own data, taking care of updates to its data (e.g., after quality control cycles), be responsible for its continuous archival and documentation, and have control over access to the data. Achieving this objective will imply the end of ‘conventional’ oceanographic data centres as we know them today. Instead the distributed system will offer opportunities for much faster access as required by operational needs, the elimination of data duplication (the problem of the same data being available in different forms in different data sets).

POSTER SESSION

Hydrology and Trophic Level of the Algerian Coastal Waters

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The marine ecosystem represents a very complicated environment, especially the coastal marine waters which are modified by other external elements like continental discharges and waste supplies. These supplies, which can be large, can deeply disturb the chemical balance of the coastal waters. The consequence of these extern discharges is especially important whether the geographical and hydrodynamic conditions are not sufficient for the dilution and the dispersion of the continental matter.

Since 1988, several Algerian waters have been investigated. The study of every experimental site shows some special characteristics for the hydrodynamics and for the nutrient concentrations.

During the 2001 summer season, a new cruise has been carried out. Measurements of the physical and chemical parameters (temperature, salinity, oxygen, pH, nutrients...) have been performed on a network of 151 stations spread over the whole Algerian littoral. This work is part of the program MEDAR / MEDATLAS II.

The survey made in this work used an approach founded jointly on the hydrological casts and chemical analysis. The examination of the results permitted to underline the hydrodynamic features and the particularity of concentrations levels in nutrients elements.

The first conclusion is the obvious direct incidence of the Algerian current. Its instability is at the basis of the observed resurgence in the surveyed gulfs and bays. On the other hand, the biological signature remains very little representative, concerning the fertility level of the waters and its correlation to the hydrodynamic structures (upward motion), is less good than the one depicted classically in the Algerian basin (Arnone et La Violette, 1986; Taupier - Letage, 1988; Millot et *al.*, 1989).

This underproduction of waters can be assigned on the one hand to the sensitivity of the phytoplankton to the abrupt changes of conditions of the medium and on the other hand by the "gazing" pressure. Like this a redfield ratio lower (≈5–12) than what it is classically admitted for the set of the oceans (Minster and Boulahdid, 1987; Coste et *al.*, 1995) and even for the Mediterranean (Raimbault and *al.,* 1993; Raimbault and *al.*, 1995; Diaz and *al.*, 2001). This report stays however very variable to the scale of studied gulfs and bays indicating a difference in the availability of concentration of nutritive elements from a point to another.

Finally, through a survey very limited in time, but pioneering one, one could not draw a definitive conclusion. Nevertheless, the opportunity that offers this attempt while estimating the level of water trophic globally, is sufficient at the reassure environmentalists, but also to create the concern of a potential pollution owed to the continental contribution.

Key Words: hydrobiology, Algerian coastal waters, nutrients, Redfield ratio.

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Climatological Vertical Profiles in the Central Mediterranean Regions Using the Complete Data Sets of MEDAR/MEDATLAS II Data Base

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The objective of the MEDAR/MEDATLAS II was to rescue, safeguard and make available a comprehensive data set of oceanographic parameters collected in the Mediterranean and Black Sea.

This work is focused to compute climatological vertical profiles on Central Mediterranean Regions, dealing with physical and chemical parameters as: temperature, salinity, dissolved oxygen, NO3-N, PO4-P, SiO4-Si [2].

Taking into account the knowledge from physical processes in these regions and trying to have more accurate “image”, 34 standard levels has been defined (0, 5, 10, 20, 30, 40, 50, 75, 100, 125, 150, 200, 250, 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1300, 1400, 1500, 1750, 2000, 2500, 3000, 3500, 4000, 4500, 5000) which summarise the major part of standard levels defined in: IAPSO, Climatological Atlas of World Ocean, 1998 Edition [4] and MEDAR protocols [5].

The interpolation method used on observed levels is Reiniger et Ross weight parabolic [6], recommended by IOC and ICES [3].

Processing and analysis of dissolved oxygen have been conducted making distinction between methods of sampling (i.e., bottle and CTD) due to the possible uncertainties on sensors fitted on CTD profilers.

The months allocated to seasons are: 1st – 3rd for winter / 4th – 6th for spring / 7th – 9th summer / 10th – 12th for autumn [1,7]. A special attention has been paid for graphical representation of parameters range (min. – max.) and depths.

The results are presented on graphical and table format having a seasonal slide succession. Each parameter is represented by mean profile, associated standard deviation and number of samples.

The conclusions will contribute to a better definition of data quality control procedures of incoming data. In addition, the climatological analysis of data fields on selected area is a prerequisite for well understandings of basic processes occurring in Central Mediterranean Regions.

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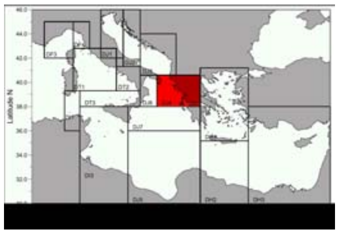

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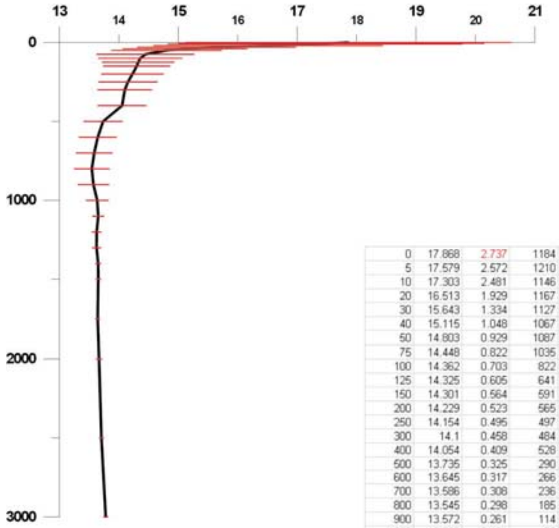
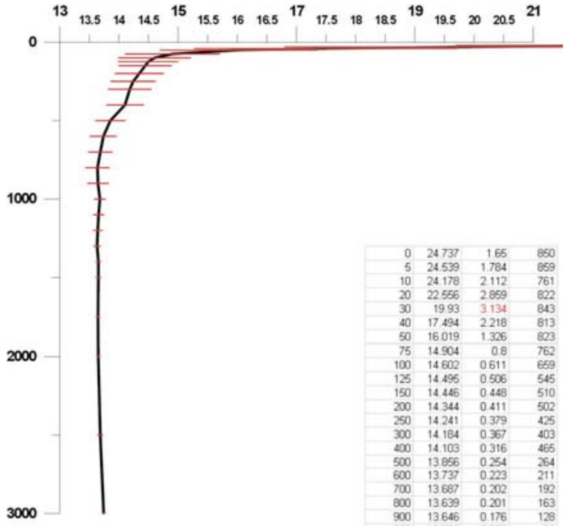


0	17.868	2.737	1184
5	17.579	2.572	1210
10	17.303	2.481	1146
20	16.513	1.929	1167
30	15.643	1.334	1127
40	15.115	1.048	1067
50	14.803	0.929	1087
75	14.448	0.822	1035
100	14.362	0.703	822
125	14.325	0.605	641
150	14.301	0.564	591
200	14.229	0.523	565
250	14.154	0.495	497
300	14.1	0.458	484
400	14.054	0.409	528
500	13.735	0.325	290
600	13.645	0.317	266
700	13.586	0.308	236
800	13.545	0.298	185
900	13.572	0.261	114
1000	13.636	0.191	79
1100	13.653	0.098	44
1200	13.627	0.081	34
1300	13.625	0.072	26
1400	13.652	0.044	29
1500	13.654	0.043	33
1750	13.644	0.042	30
2000	13.667	0.052	28
2500	13.707	0.039	16
3000	13.778	0.038	6

SUMMER



0	24.737	1.65	850
5	24.539	1.784	859
10	24.178	2.112	761
20	22.556	2.859	822
30	19.93	3.134	843
40	17.494	2.218	813
50	16.019	1.326	823
75	14.904	0.8	762
100	14.602	0.611	659
125	14.495	0.506	545
150	14.446	0.448	510
200	14.344	0.411	502
250	14.241	0.379	425
300	14.184	0.367	403
400	14.103	0.316	465
500	13.856	0.254	264
600	13.737	0.223	211
700	13.687	0.202	192
800	13.639	0.201	163
900	13.646	0.176	128
1000	13.678	0.092	96
1100	13.658	0.09	82
1200	13.643	0.08	71
1300	13.632	0.061	50
1400	13.653	0.043	57
1500	13.654	0.044	57
1750	13.646	0.035	54
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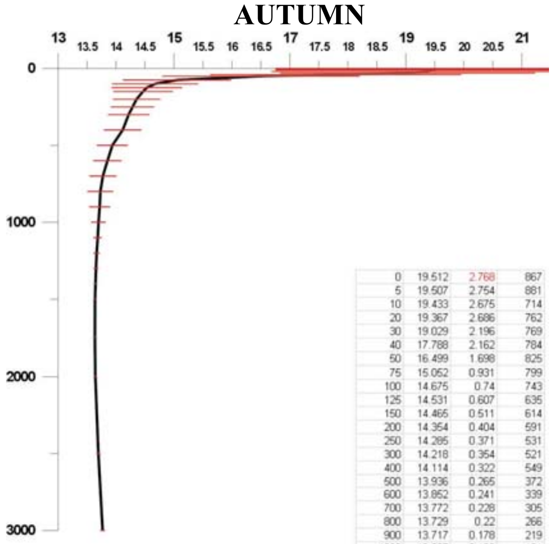
2500	13.686	0.045	26
3000	13.743	0.024	13

AUTUMN



0	19.512	2.768	867
5	19.507	2.754	881
10	19.433	2.675	714
20	19.367	2.686	762
30	19.029	2.196	769
40	17.788	2.162	784
50	16.499	1.698	825
75	15.052	0.931	799
100	14.675	0.74	743
125	14.531	0.607	635
150	14.465	0.511	614
200	14.354	0.404	591
250	14.285	0.371	531
300	14.218	0.354	521
400	14.114	0.322	549
500	13.936	0.265	372
600	13.852	0.241	339
700	13.772	0.228	305
800	13.729	0.22	266
900	13.717	0.178	219
1000	13.697	0.123	191
1100	13.684	0.066	168
1200	13.665	0.05	133
1300	13.653	0.039	121
1400	13.645	0.025	64
1500	13.638	0.026	119
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3000	13.768	0.039	14

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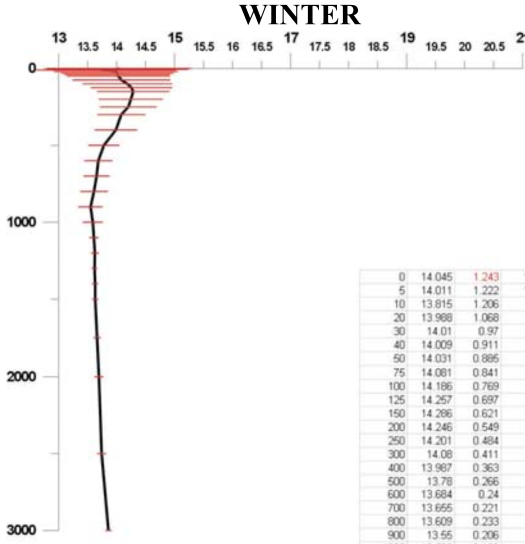

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20	13.988	1.068	895
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40	14.009	0.911	787
50	14.031	0.885	846
75	14.081	0.841	819
100	14.186	0.769	756
125	14.257	0.697	717
150	14.286	0.621	693
200	14.246	0.549	653
250	14.201	0.484	568
300	14.08	0.411	521
400	13.987	0.363	523
500	13.78	0.266	352
600	13.684	0.24	316
700	13.655	0.221	314
800	13.609	0.233	249
900	13.55	0.206	106
1000	13.589	0.168	56
1100	13.608	0.078	39
1200	13.626	0.065	32
1300	13.62	0.046	21
1400	13.629	0.05	13
1500	13.63	0.047	17
1750	13.663	0.059	20
2000	13.695	0.075	16
2500	13.741	0.074	13
3000	13.859	0.053	5

SALINITY
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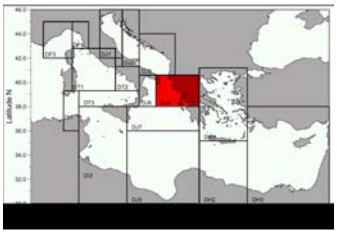

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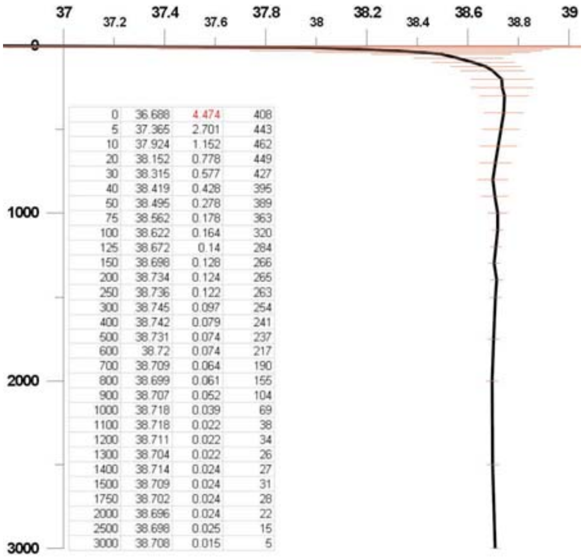
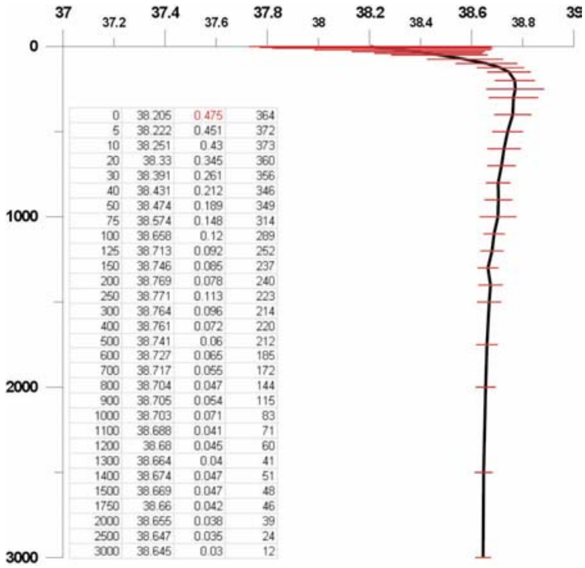


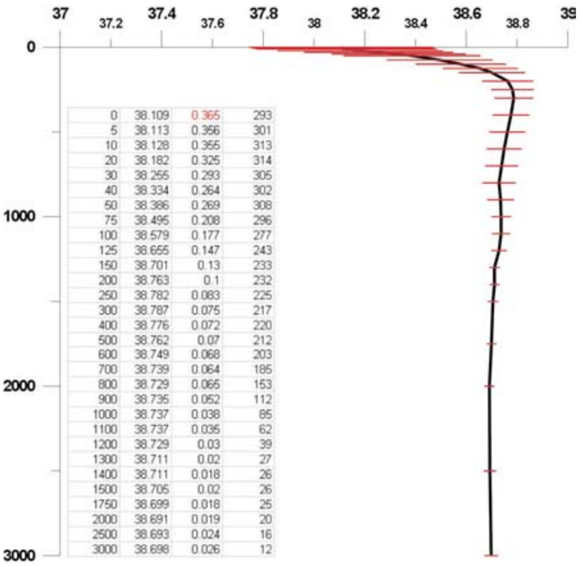
0	36.688	4.474	408
5	37.365	2.701	443
10	37.924	1.152	462
20	38.152	0.778	449
30	38.315	0.577	427
40	38.419	0.428	395
50	38.495	0.278	389
75	38.562	0.178	363
100	38.622	0.164	320
125	38.672	0.14	284
150	38.698	0.128	266
200	38.734	0.124	265
250	38.736	0.122	263
300	38.745	0.097	254
400	38.742	0.079	241
500	38.731	0.074	237
600	38.72	0.074	217
700	38.709	0.064	190
800	38.699	0.061	155
900	38.707	0.052	104
1000	38.718	0.039	69
1100	38.718	0.022	38
1200	38.711	0.022	34
1300	38.704	0.022	26
1400	38.714	0.024	27
1500	38.709	0.024	31
1750	38.702	0.024	28
2000	38.696	0.024	22
2500	38.698	0.025	15
3000	38.708	0.015	5

SUMMER



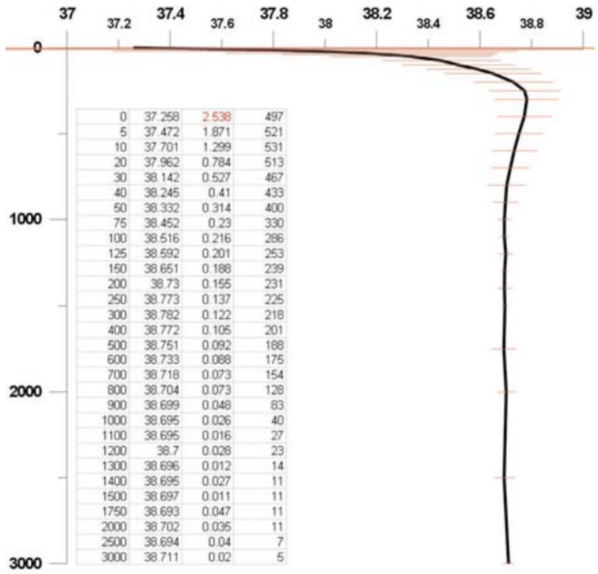
0	38.205	0.475	364
5	38.222	0.451	372
10	38.251	0.43	373
20	38.33	0.345	360
30	38.391	0.261	356
40	38.431	0.212	346
50	38.474	0.189	349
75	38.574	0.148	314
100	38.658	0.12	289
125	38.713	0.092	252
150	38.746	0.085	237
200	38.769	0.078	240
250	38.771	0.113	223
300	38.764	0.096	214
400	38.761	0.072	220
500	38.741	0.06	212
600	38.727	0.065	185
700	38.717	0.055	172
800	38.704	0.047	144
900	38.705	0.054	115
1000	38.703	0.071	83
1100	38.688	0.041	71
1200	38.68	0.045	60
1300	38.664	0.04	41
1400	38.674	0.047	51
1500	38.669	0.047	48
1750	38.66	0.042	46
2000	38.655	0.038	39
2500	38.647	0.035	24
3000	38.645	0.03	12

AUTUMN



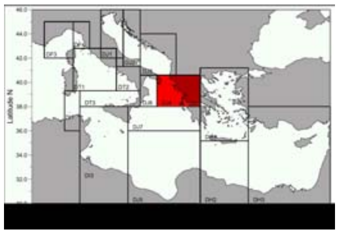
0	38.109	0.365	293
5	38.113	0.356	301
10	38.128	0.355	313
20	38.182	0.325	314
30	38.255	0.293	305
40	38.334	0.264	302
50	38.386	0.269	308
75	38.495	0.208	296
100	38.579	0.177	277
125	38.655	0.147	243
150	38.701	0.13	233
200	38.763	0.1	232
250	38.782	0.083	225
300	38.787	0.075	217
400	38.776	0.072	220
500	38.762	0.07	212
600	38.749	0.068	203
700	38.739	0.064	185
800	38.729	0.065	153
900	38.735	0.052	112
1000	38.737	0.038	85
1100	38.737	0.035	62
1200	38.729	0.03	39
1300	38.711	0.02	27
1400	38.711	0.018	26
1500	38.705	0.02	26
1750	38.699	0.018	25
2000	38.691	0.019	20
2500	38.693	0.024	16
3000	38.698	0.026	12

WINTER

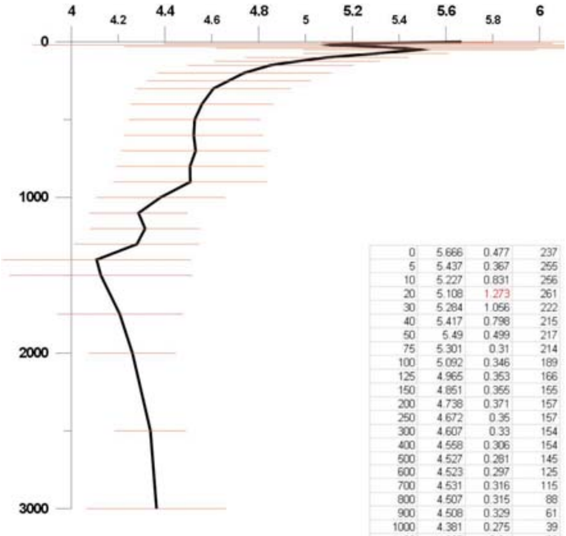


0	37.258	2.538	497
5	37.472	1.871	521
10	37.701	1.299	531
20	37.962	0.784	513
30	38.142	0.527	467
40	38.245	0.41	433
50	38.332	0.314	400
75	38.452	0.23	330
100	38.516	0.216	286
125	38.592	0.201	253
150	38.651	0.188	239
200	38.73	0.155	231
250	38.773	0.137	225
300	38.782	0.122	218
400	38.772	0.105	201
500	38.751	0.092	188
600	38.733	0.088	175
700	38.718	0.073	154
800	38.704	0.073	128
900	38.699	0.048	83
1000	38.695	0.026	40
1100	38.695	0.016	27
1200	38.7	0.028	23
1300	38.696	0.012	14
1400	38.695	0.027	11
1500	38.697	0.011	11
1750	38.693	0.047	11
2000	38.702	0.035	11
2500	38.694	0.04	7
3000	38.711	0.02	5

DISSOLVED OXYGEN
bottle (ml/l)
Ionian NE

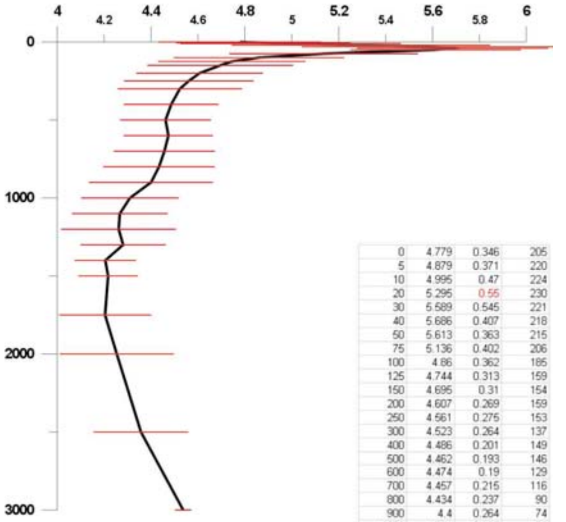


SPRING



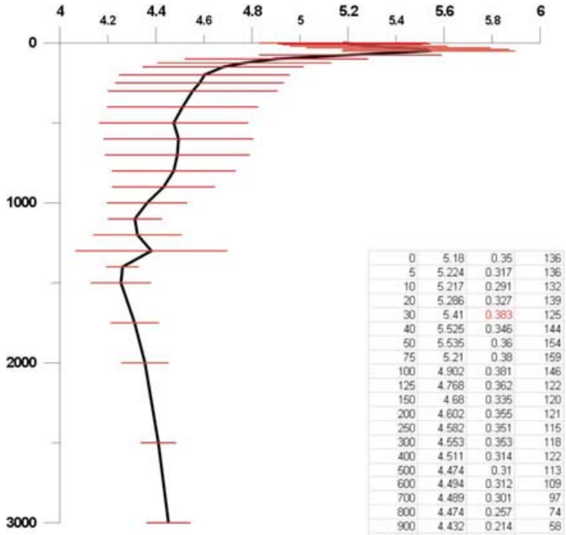
0	5.666	0.477	237
5	5.437	0.367	255
10	5.227	0.831	256
20	5.108	1.273	261
30	5.284	1.056	222
40	5.417	0.798	215
50	5.49	0.499	217
75	5.301	0.31	214
100	5.092	0.346	189
125	4.965	0.353	166
150	4.851	0.355	155
200	4.738	0.371	157
250	4.672	0.35	157
300	4.607	0.33	154
400	4.558	0.306	154
500	4.527	0.281	145
600	4.523	0.297	125
700	4.531	0.316	115
800	4.507	0.315	88
900	4.508	0.329	61
1000	4.381	0.275	39
1100	4.287	0.21	20
1200	4.315	0.234	15
1300	4.28	0.267	9
1400	4.108	0.402	16
1500	4.126	0.39	21
1750	4.207	0.267	19
2000	4.261	0.186	15
2500	4.338	0.153	12
3000	4.364	0.297	5

SUMMER



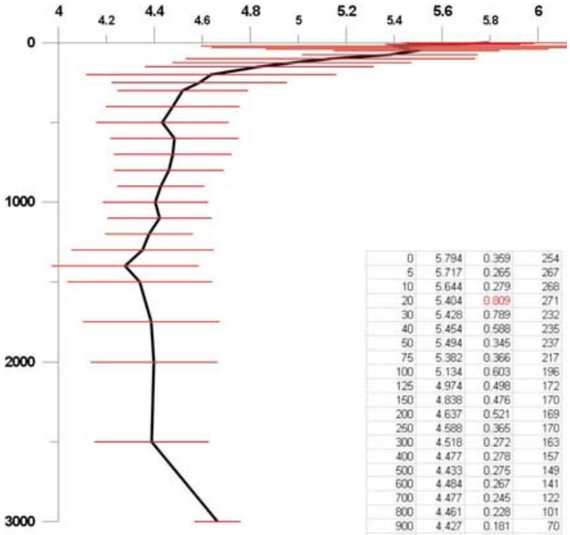
0	4.779	0.346	205
5	4.879	0.371	220
10	4.995	0.47	224
20	5.295	0.55	230
30	5.589	0.545	221
40	5.686	0.407	218
50	5.613	0.363	215
75	5.136	0.402	206
100	4.86	0.362	185
125	4.744	0.313	159
150	4.695	0.31	154
200	4.607	0.269	159
250	4.561	0.275	153
300	4.523	0.264	137
400	4.486	0.201	149
500	4.462	0.193	146
600	4.474	0.19	129
700	4.457	0.215	116
800	4.434	0.237	90
900	4.4	0.264	74
1000	4.31	0.207	50
1100	4.267	0.203	41
1200	4.262	0.244	30
1300	4.281	0.181	15
1400	4.205	0.13	25
1500	4.217	0.126	24
1750	4.204	0.196	25
2000	4.254	0.243	18
2500	4.357	0.201	11
3000	4.537	0.034	3

AUTUMN



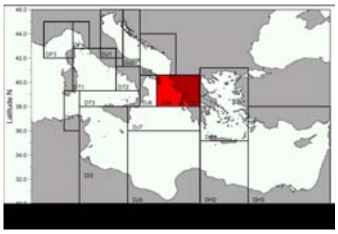
0	5.18	0.35	136
5	5.224	0.317	136
10	5.217	0.291	132
20	5.286	0.327	139
30	5.41	0.383	125
40	5.525	0.346	144
50	5.535	0.36	154
75	5.21	0.38	159
100	4.902	0.381	146
125	4.768	0.362	122
150	4.68	0.335	120
200	4.602	0.355	121
250	4.582	0.351	115
300	4.553	0.353	118
400	4.511	0.314	122
500	4.474	0.31	113
600	4.494	0.312	109
700	4.489	0.301	97
800	4.474	0.257	74
900	4.432	0.214	58
1000	4.363	0.167	38
1100	4.312	0.112	26
1200	4.323	0.183	11
1300	4.381	0.316	7
1400	4.261	0.067	7
1500	4.254	0.125	8
1750	4.311	0.1	10
2000	4.354	0.098	8
2500	4.41	0.073	6
3000	4.452	0.091	5

WINTER

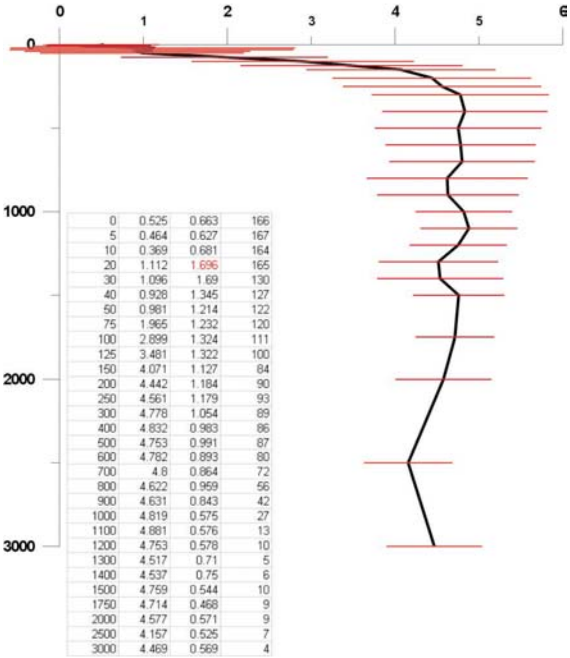


0	5.794	0.359	254
5	5.717	0.265	267
10	5.644	0.279	268
20	5.404	0.809	271
30	5.428	0.789	232
40	5.454	0.588	235
50	5.494	0.345	237
75	5.382	0.366	217
100	5.134	0.603	196
125	4.974	0.498	172
150	4.838	0.476	170
200	4.637	0.521	169
250	4.588	0.365	170
300	4.518	0.272	163
400	4.477	0.278	157
500	4.433	0.275	149
600	4.484	0.267	141
700	4.477	0.245	122
800	4.461	0.228	101
900	4.427	0.181	70
1000	4.404	0.219	35
1100	4.422	0.216	22
1200	4.378	0.182	17
1300	4.351	0.296	10
1400	4.278	0.306	6
1500	4.339	0.301	8
1750	4.387	0.284	8
2000	4.398	0.264	9
2500	4.389	0.238	7
3000	4.663	0.095	3

NO3-N
(millimole/m^3)
Ionian NE

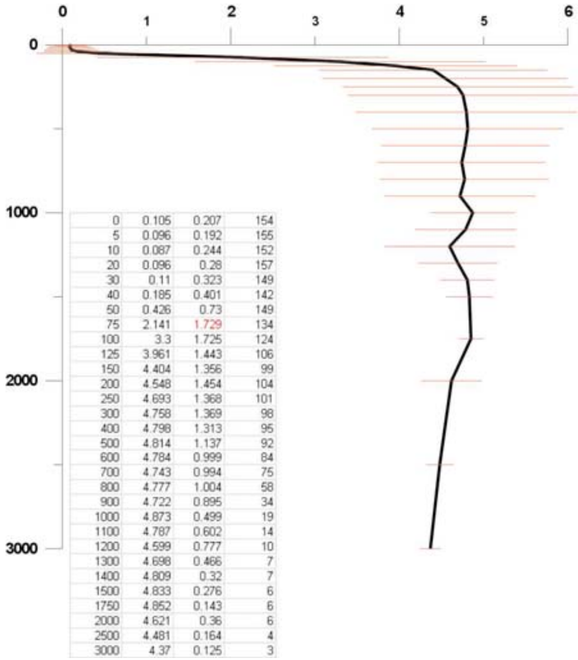


SPRING



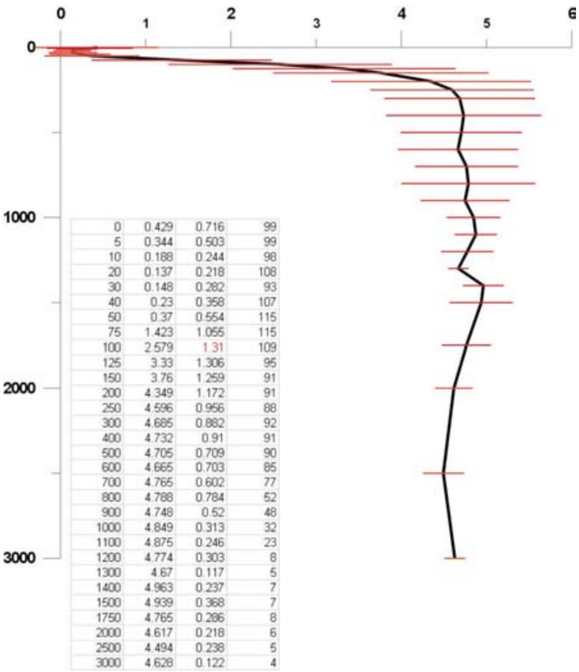
0	0.525	0.663	166
5	0.464	0.627	167
10	0.369	0.681	164
20	1.112	1.696	165
30	1.096	1.69	130
40	0.928	1.345	127
50	0.981	1.214	122
75	1.965	1.232	120
100	2.899	1.324	111
125	3.481	1.322	100
150	4.071	1.127	84
200	4.442	1.184	90
250	4.561	1.179	93
300	4.778	1.054	89
400	4.832	0.983	86
500	4.753	0.991	87
600	4.782	0.893	80
700	4.8	0.864	72
800	4.622	0.959	56
900	4.631	0.843	42
1000	4.819	0.575	27
1100	4.881	0.576	13
1200	4.753	0.578	10
1300	4.517	0.71	5
1400	4.537	0.75	6
1500	4.759	0.544	10
1750	4.714	0.468	9
2000	4.577	0.571	9
2500	4.157	0.525	7
3000	4.469	0.569	4

SUMMER



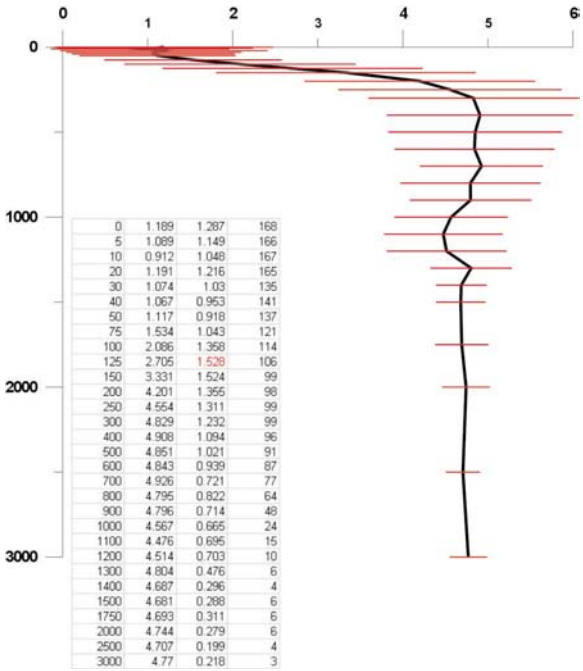
0	0.105	0.207	154
5	0.096	0.192	155
10	0.087	0.244	152
20	0.096	0.28	157
30	0.11	0.323	149
40	0.185	0.401	142
50	0.426	0.73	149
75	2.141	1.729	134
100	3.3	1.725	124
125	3.961	1.443	106
150	4.404	1.356	99
200	4.548	1.454	104
250	4.693	1.368	101
300	4.758	1.369	98
400	4.798	1.313	95
500	4.814	1.137	92
600	4.784	0.999	84
700	4.743	0.994	75
800	4.777	1.004	58
900	4.722	0.895	34
1000	4.873	0.499	19
1100	4.787	0.602	14
1200	4.599	0.777	10
1300	4.698	0.466	7
1400	4.809	0.32	7
1500	4.833	0.276	6
1750	4.852	0.143	6
2000	4.621	0.36	6
2500	4.481	0.164	4
3000	4.37	0.125	3

AUTUMN



0	0.429	0.716	99
5	0.344	0.503	99
10	0.188	0.244	98
20	0.137	0.218	108
30	0.148	0.282	93
40	0.23	0.358	107
50	0.37	0.554	115
75	1.423	1.055	115
100	2.579	1.31	109
125	3.33	1.306	95
150	3.76	1.259	91
200	4.349	1.172	91
250	4.596	0.956	88
300	4.685	0.882	92
400	4.732	0.91	91
500	4.705	0.709	90
600	4.665	0.703	85
700	4.765	0.602	77
800	4.788	0.784	52
900	4.748	0.52	48
1000	4.849	0.313	32
1100	4.875	0.246	23
1200	4.774	0.303	8
1300	4.67	0.117	5
1400	4.963	0.237	7
1500	4.939	0.368	7
1750	4.765	0.286	8
2000	4.617	0.218	6
2500	4.494	0.238	5
3000	4.628	0.122	4

WINTER



0	1.189	1.287	168
5	1.089	1.149	166
10	0.912	1.048	167
20	1.191	1.216	165
30	1.074	1.03	135
40	1.067	0.953	141
50	1.117	0.918	137
75	1.534	1.043	121
100	2.086	1.368	114
125	2.705	1.528	106
150	3.331	1.524	99
200	4.201	1.355	98
250	4.554	1.311	99
300	4.829	1.232	99
400	4.908	1.094	96
500	4.851	1.021	91
600	4.843	0.939	87
700	4.926	0.721	77
800	4.795	0.822	64
900	4.796	0.714	48
1000	4.567	0.665	24
1100	4.476	0.695	15
1200	4.514	0.703	10
1300	4.804	0.476	6
1400	4.687	0.296	4
1500	4.681	0.288	6
1750	4.693	0.311	6
2000	4.744	0.279	6
2500	4.707	0.199	4
3000	4.77	0.218	3

MEDAS System for Archiving, Visualisation and Validation of Oceanographic Data

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E-mail: dadic@izor.hr

Marine environmental database of the Adriatic Sea (MEDAS) based on the ORACLE RDBMS was developed. It serves for data management that includes processing of different types of oceanographic parameters (physical, chemical and biological) including archiving, validation, visualisation and presentation of data in row and graphic form. System has capabilities of capturing historical as well as real time data. Special subsystem was developed for data validation of the classical oceanographic parameters in the frame of the MEDAR/MEDATLAS program and interface for transcoding of data from/to different formats received from eleven national and international sources.

As result of data analysis by this subsystem many duplications, uncertainty and erroneous historical data of classical oceanographic parameters were recognized (Table 1). For example, about 49.7% of BOT data was duplicated, 3.2% outside climatological range, 0.7% of oceanographic stations was attributed to wrong position, and about 17.4% of BOT data attributed as MBT data.

Based on the data analysis four different sub-regions of the Adriatic Sea with similar oceanographic properties and 41 standard oceanographic levels as suitable for climatological analysis were recognized.

Interpolation of data on standard oceanographic levels was done by third order Newton method of finite differences modified by Reinger and Ross proposal.

Ordinary Kriging method and semi-variogram were used for spatial analysis of data. Satisfied results of climatological analysis were obtain if distance among stations is less then 7.5 km in all regions except Croatian channel waters and areas close to river mouths.

MEDAS database with web interface represents the useful tool that performs quality control of the oceanographic data and various analyses, especially in the climatological domain.

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Russo A., and A. Artegiani, 1996. Adriatic Sea Hydrography. Scientia Marina 60, Supl. 2: 33-43.
Zore-Armanda M., M. Bone, V. Dadić, M. Morović, D. Ratković, L. Stojanovski and I. Vukadin, 1991. Hydrographic properties of the Adriatic Sea in the period from 1971 through 1983. Acta Adriat. 32 (1): 1-547.

Table 1. Number of classical oceanographic data received from different sources and number of unique and correct after inter-comparison and validation

Data source	Temperature (°C)				Salinity (psu)		Oxygen (ml/l)	pH
	BOT	MBT	XBT	CTD	BOT	CTD		
Croatia	27934	25693	0	834	22524	834	5394	2138
Italy	8372	0	0	275	5612	275	974	293
USA	6618	2137	2436	162	4517	162	1094	895
Greece	0	0	0	1356	0	1356	0	0
MEDAR-I	9488	1142	553	2241	8488	2241	0	0
MODAB	4036	638	0	174	2504	2174	0	0
Russia	3840	375	0	0	1314	0	0	0
France	1398	0	0	0	1225	0	185	63
Total	61686	29985	2989	5042	46184	7042	7647	3389
Unique and correct data	31279	16428	2737	1352	28722	3841	5840	2925
(%)	50.7	54.8	91.5	26.8	62.2	54.5	76.3	86.0

Oceanographic Data Management Activities in Malta

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The PO-Unit is the national entity responsible for fundamental research in coastal meteorology, hydrography and physical oceanography with a main emphasis on the experimental study of the hydrodynamics of the sea in the vicinity of the Maltese Islands. Formerly established under the Malta Council for S&T, the PO-Unit now operates under the University of Malta and constitutes the research arm of the IOI-Malta Operational Centre.

In the absence of a national oceanographic data centre, the PO-Unit promotes IODE products and activities in Malta. It provides support to local entities involved in marine research and monitoring, to collect and maintain oceanographic data according to international standards. The PO-Unit plays the role of keeping track of ocean observations made in the vicinity of the Maltese Islands. Data collected by individual scientists, local agencies and governmental departments is primarily kept under the respective sources, and under different, often incompatible formats. The PO-Unit aims to identify these data holdings and to bring the data under one database with standardized formats.

The PO-Unit is a partner in the Medar/Medatlas II Project. The data submitted to the project consist of CTD profiles collected in the period 1992-1994 as indicated in Table 1. They total to 179 profiles collected during 5 surveys at different seasons with the intention of studying the water column structure and identifying the physical processes pertaining to the northern coastal stretch of the islands over a range of spatial and temporal scales. The survey in 1992 was the first ever physical oceanographic survey conducted by a CTD profiler in Maltese coastal waters. The survey was conducted under the framework of the nationally funded Coastal Environment Research Project (CERP) with stations concentrated inside and in the vicinity of two coastal embayments – Mellieha Bay and St.Paul's Bay. The subsequent surveys covered stations (refer to Fig.1) within an area of about 60 km^2 on the NW coastal area of the Maltese Islands.

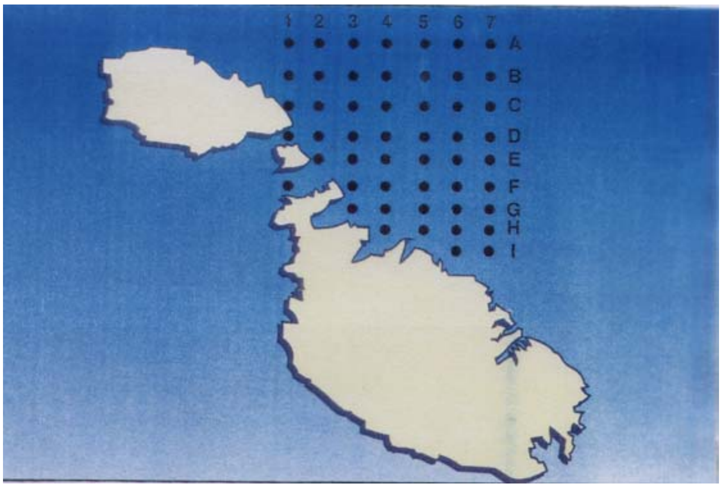

Fig.1 Station positions in the oceanographic surveys during 1993/94

Water quality data collected on a routine basis at a number of fishfarm sites by the Malta Centre for Fisheries Science (ex National Aquaculture Centre) has been also submitted to the project. This consists of two sets of data (Table 2) at two sites in the South Comino Channel and Hofra z-Zghira (Delimara Point) respectively. The parameters measured on a monthly basis at depths of 1, 10 and 20m are:

- salinity
- temperature
- pH
- dissolved oxygen
- turbidity
- chlorophyll a
- Nitrate-N
- Phosphate-P

The Malta Blue Pages

The Physical Oceanography Unit is launching a data driven website as a first phase towards establishing an online data repository center for a number of data sources in the field of oceanography in Malta. This web-based oceanographic database, to be called the *Malta Blue Pages,* will be hosted within the CapeMalta website of the PO-Unit. The *Malta Blue Pages* is developed on methodologies using state-of-the-art server-side technologies and makes use of RealTime^{TM} Publishing Systems for remote maintenance and updating of the database over the Internet.

The Structure of *the Malta Blue Pages* is on three levels:

LEVEL 1	The Introductory Page
LEVEL 2	The Data Description Level
LEVEL 3	The Search Interface Level

Level 1 defines the objectives of the Malta Blue Pages and describes its structure. In particular this level will present documentation on meta-data handling, standard data formats and quality control procedures.

Level 2 contains the meta-data files, consisting of the following types:

- Cruise summaries
- Monitoring summaries
- Inventories
- Data sets

Each of these consists of standard description files. Inventories will be in the form of maps showing station locations or cruise tracks.

At Level 3 the user will be able to

- browse the database
- query the database, and
- download the selections

The overall area of interest of the database will cover the geographical area defined between Longitudes 13Deg to 16Deg and Latitudes 34.5Deg N to 37.5Deg N. The user will be presented with a map showing the detailed coastline of the area and depth contours at 50m, 100m, 200m and 500m in different colours. The user can further select to zoom on a number of 9 predetermined areas. At browsing level the user will choose a sub-map, a particular parameter and instrument/method.

The user will be presented with general statistics on data holdings pertaining to a particular sub-map and a particular parameter and instrument type/method. The statistics will consist of:

- total number of profiles for each parameter
- number of stations according to type of instrument or method
- number of profiles according to year
- number of stations according to season
- number of cruises
- list of station positions

At query level the user will be allowed to make the same type of search as above, but according to user defined Lat/Lon extent. The selected profiles will be automatically accessed and selected from the database, prepared in the form of output files for downloading. These files will be in Medatlas format.

Besides offering a service to the local scientific community, the initiative is aimed to enhance the visibility of the PO-Unit as the leading national entity for oceanographic data management and to attract further data in the repository.

Tables

Table 1. CTD Stations in Maltese Coastal Waters

Survey	No. of stations
August 92	26
August 93	56
March 94	21
August 94	40
November 94	36

Table 2. Stations and month of water quality measurements

South Comino Channel	1996: Jan; Apr; May; July; August; Oct-Dec 1997: Jan; Feb; Apr; Dec
Hofra z-Zghira	1996: Mar; May; July; Nov 1997: Jan; Mar; May 1998: Jan; Feb; Apr; May; July

Redfield and Mixing Ratio in the Mediterranean Sea

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The objective of this work is to select reference data basis in order to define some quality criteria for chemical parameters of the Mediterranean sea. A significant subset of MEDAR/MEDATLAS data has been analysed.

The Mediterranean was divided in regions, on the base of the physical division carried out by MEDATLAS I, and on data availability. Statistics were calculated and property-property plots done, in order to select only high quality data.

After the assessment of data quality, mean values and standard deviation were calculated for each area, as well as the Redfield ratios. The data show a significant spatial variability of these ratios, which were found in agreement with previous analysis carried out by different authors. Furthermore, by applying the Takahashi et al. method (1985), we have calculated the characteristics of the original water masses in the different sub-basins and linked these to the mesoscale variability (end members).

The Mediterranean waters are the results of a mixing of two extreme water masses formed in the Alboran Sea and in the Levantine Basin. The percentages of these end members in the Mediterranean sub-basins' waters have been calculated.

MEDAR/MEDATLAS II-Eeastern Region Thematic Web Site

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Abstract

The objective of the MEDAR/MEDATLAS II project is to rescue, safeguard and make available a comprehensive data set of oceanographic parameters collected in the Mediterranean and Black Sea, through a wide co-operation of the Mediterranean and Black Sea countries. To increase the quality assurance of the collected data, the data management structure was divided in four Regional Qualifications Centres. In order to promote the database and the Mediterranean data management and provide a visibility of the regionally assembled data, the Regional Centres developed the following WWW servers (Fig. 1):

- Western Basin - IEO Data Centre (http://www.ieo.es/medar)
- Central Basin - OGS/DOGA Data Centre (http://doga.ogs.trieste.it/medar)
- Eastern Basin - NCMR/HNODC (http://hnodc.ncmr.gr/programmes/medar)
- Black Sea - RIHMI-WDC (http://www.meteo.ru/nodc/project/project.htm)

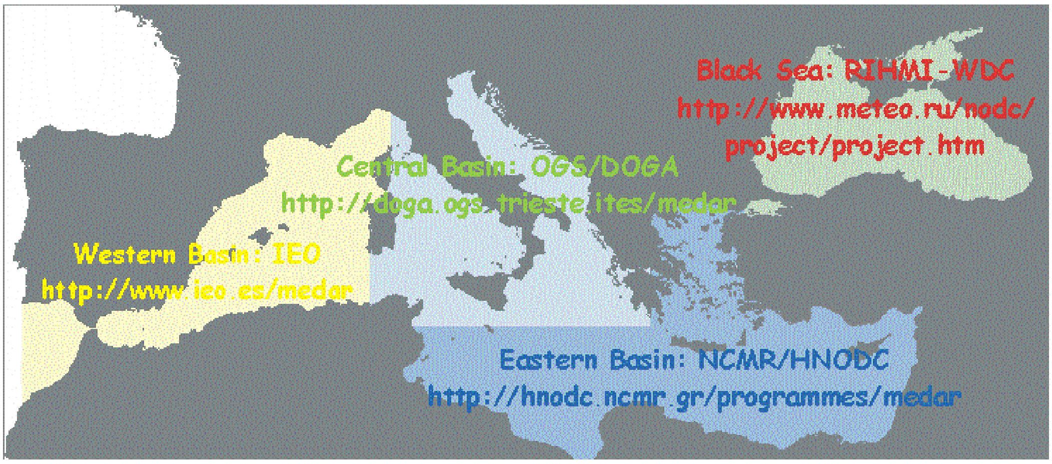

Fig. 1. MEDAR/MEDATLAS II Regional Websites

Hellenic National Oceanographic Data Centre (HNODC) through his website provides general information about the MEDAR/MEDATLAS project and the work performed during the Project implementation.

The structure of the website is presented at the HomePage **"http://hnodc.ncmr.gr/programmes/medar"** (Fig. 2) including a menu with links to different topics and a general description of the Project.

HNODC was responsible for the Eastern Region assembling and the quality control of the national data sets of seven countries: Cyprus, Egypt, Greece, Israel, Lebanon, Turkey and Ukraine. The cruise inventories of each country are published in the Cruise Inventory Page (Fig. 3) containing information about the cruise name, ship name, start-end date of the cruise, region, data type, number of stations, etc, as well as link to the Global MEDAR/MEDATLAS Cruise Inventory developed by the All Russian National Oceanographic Data Center- World Data Centre B.

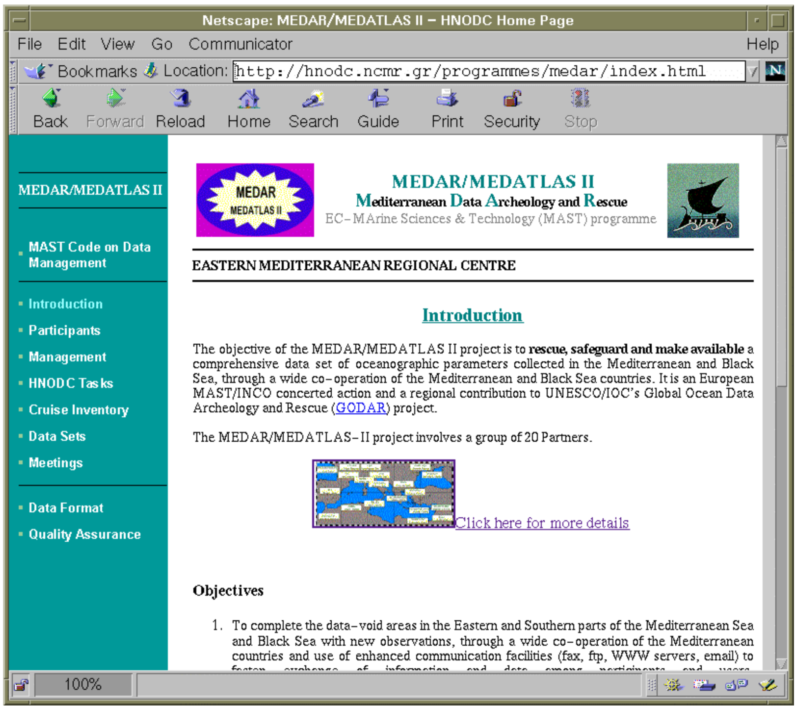

Fig. 2. MEDAR/MEDATLAS II HNODC Home Page

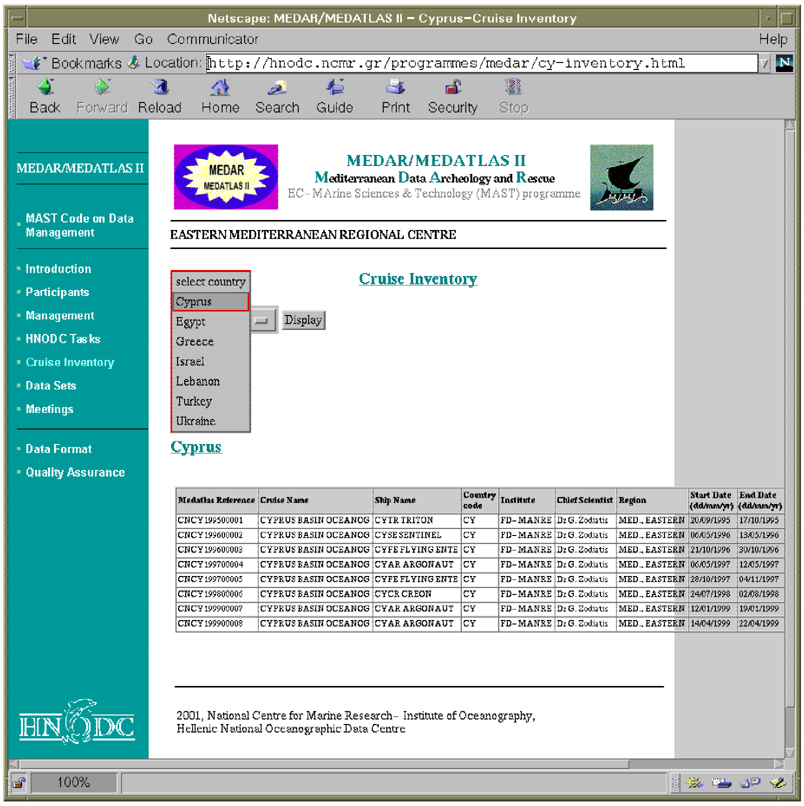

Fig. 3. MEDAR/MEDATLAS II Cruise Inventory

Progress in Oceanographic Data Rescue and Archive in Eastern Mediterranean Sea within MEDAR/MEDATLAS II Project

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Abstract
The Eastern Mediterranean Sea has been the subject of an intensive oceanographic research activity, during the last fifteen years. Large-scale research projects (e.g., POEM, Mediterranean Targeted Project, etc.) provided comprehensive data sets, enhanced our understanding on processes and phenomena in the region. At the same time revealed the need for the existence of an archive of historical observational data.

The MEDATLAS I Project provided an updated, quality controlled data set of temperature and salinity profiles of the Mediterranean Sea and produced a revised climatological statistics for the region (MEDATLAS Consortium, 1997). This initiative is supplemented by the MEDAR/MEDATLAS II Project and extended to other data types (chemical data, biological data). Within the framework of the last two projects an effort was made by the Hellenic National Oceanographic Data Centre (HNODC) for the rescue of oceanographic data and the development of an oceanographic data archive of the Eastern Mediterranean region.

At present, the total amount of hydrological data gathered consist of 40000 temperature and salinity profiles of which 14000 are CTD data (Fig.1) and 26000 water bottle data (Fig.2). Of them, around 2500 bottle data and 7500 CTD profiles were made available to the HNODC by Hellenic marine research laboratories and in particular by the Institute of Ocenography of the National Centre for Marine Research. Historical data sets were obtained by various large data sources, such as ICES, WDC-A, MODB, etc. in the frame of MEDATLAS I Project.

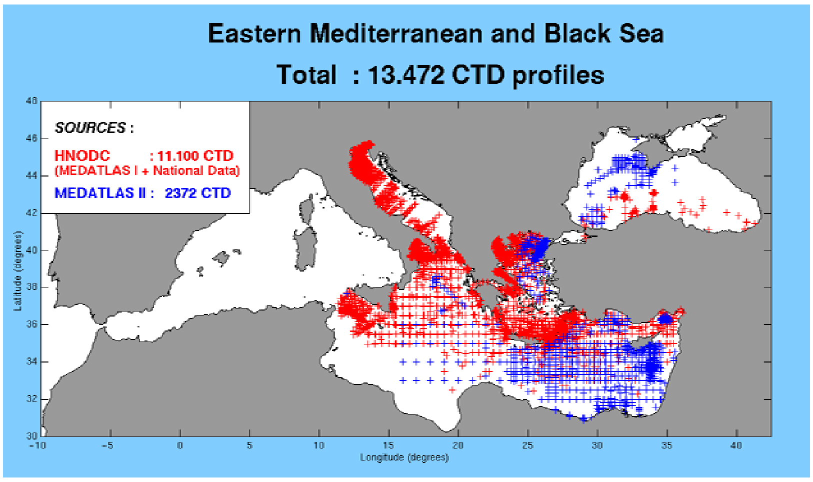

Fig.1

Within MEDAR/MEDATLAS II, HNODC was responsible for the data assembling at the Eastern Region (East Ionian, Aegean Sea, Levantine Basin), submitted by participants in the project from seven different countries (Cyprus, Egypt, Greece, Israel, Lebanon, Turkey and Ukraine). This data set consists of 4000 CTD, 6900 Bottle and 450 XBT profiles.

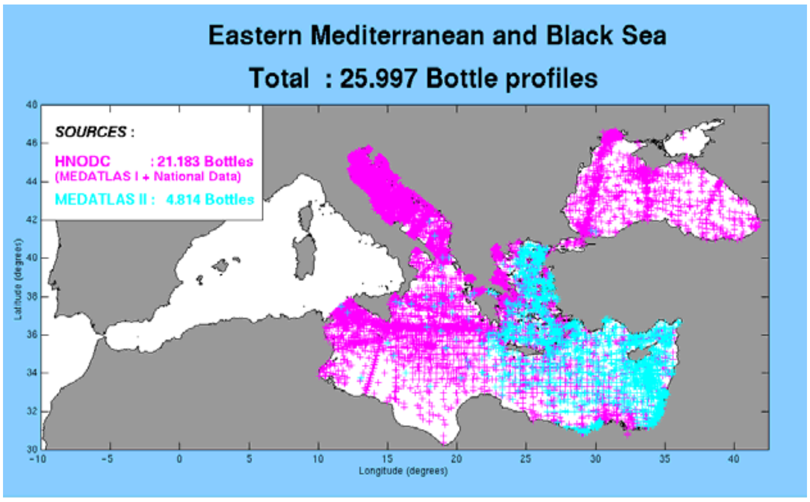

Fig.2

In addition to the above, a total of 40000 MBT and 42000 XBT profiles have been obtained (Fig.3, Fig.4). These were collected by the hydrographic Service of France, from the navies of various countries and made available to the MEDATLAS I Project.

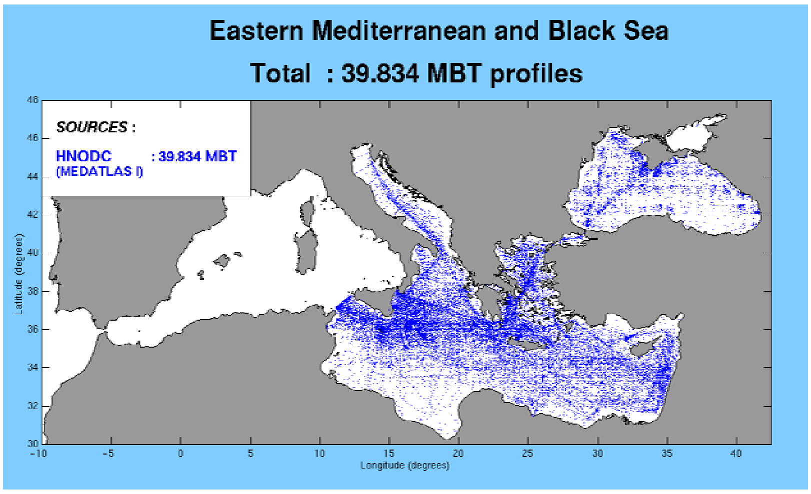

Fig.3

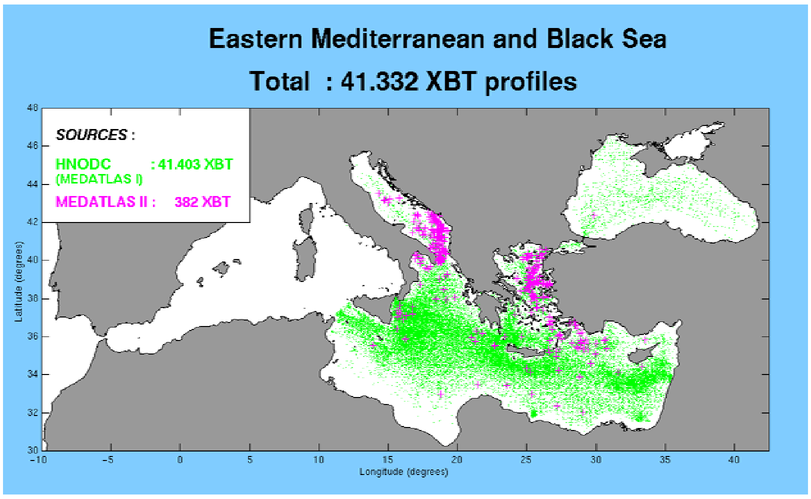

Fig.4

Concerning chemical data, a total of 12000 stations have been obtained, up to now (Fig.5). Of them, 8700 were made available to the HNODC by various Hellenic laboratories and MEDATLAS I and 3300 by MEDAR/MEDATLAS II Project. The chemical data set consists mainly of oxygen, phosphate, silicate, nitrate, nitrite, ammonium and pH measurements.

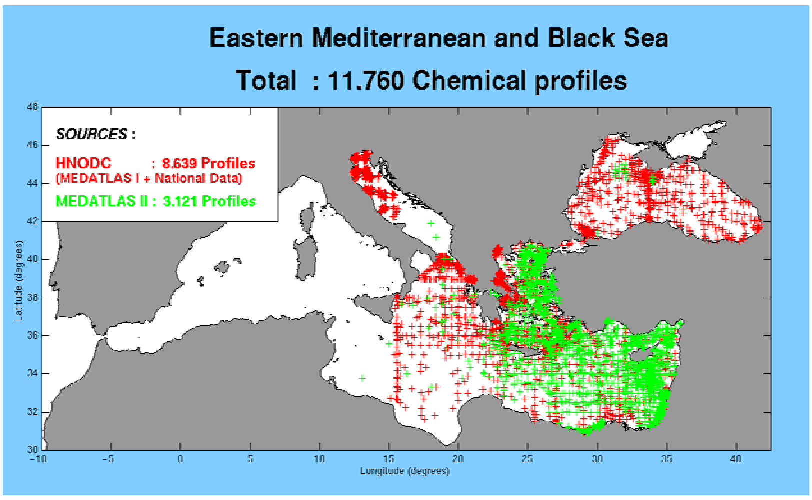

Fig.5

For both, the hydrological and chemical data sets, inventories have been developed. Furthermore, all the data sets have been transcoded to the MEDATLAS Format (MAILLARD et al., 1995; MEDATLAS Group, 1996) and have been subjected to quality control using the SCOOP software for UNIX, developed by IFREMER/SISMER (Fig.6, Fig.7) (CURE et al., 1995).

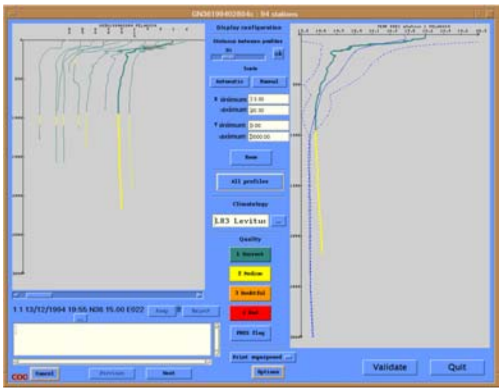

Fig. 6: Automatic and visual check of metadata

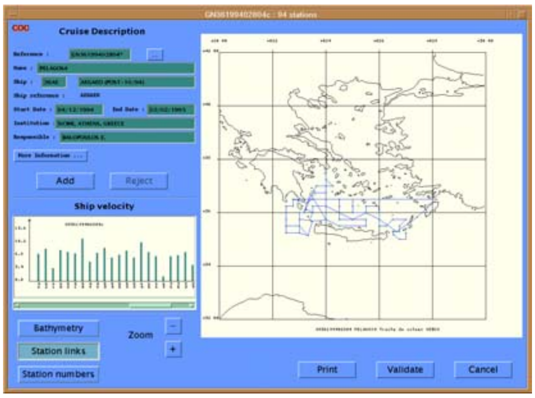

Fig. 7: Automatic and visual check of data points

To manage the various data sets, an oceanographic data base has been developed at the HNODC. The ORACLE RDBMS, related development tools (DEVELOPER-2000, pro-C, etc.) and third-generation programming languages (C, FORTRAN) have been used for the data base development. A programming interface, enabling access through www, which is under development, will provide the scientific community with a fast, reliable and efficient way for accessing the data base.

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Report for Lebanon within MEDAR/MEDATLAS II Project

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Abstract

The data of Lebanon consists of 229 CTD and Bottle stations covering the period from 1965 to 1998. There is one station per cruise for both CTD and Bottle data and these cruises will be grouped in categories of Data type. Most of the stations are beyond the narrow continental shelf; some others are limited to the shelf itself. These data provide good time series for Temperature, Salinity, Dissolved Oxygen, Nitrates, Phosphates, Chlor-a and PH. All data were successfully checked for QC

As direct consequences of MEDAR/MEDATLAS II for Lebanon is the decision taken by the LNCSR to settle a National Oceanographic Data Center, to meet the requirements for Data Management and Data Base System.

Introduction

We began in Lebanon conducting oceanographic research in 1965. These studies were supported by LNCSR in collaboration with other Institutes: American University of Beirut (AUB), Lebanese University (L.U) and National Centre for Marine Science (NCMS/NCSR). Most of oceanographic data, collected during the period 1965-1998 were introduced in this project and passed to the World Data Center A and B. All these oceanographic data, in addition to some others currently collected will be rescued and archived. For this purpose we participated at MEDAR/MEDATLAS II project since started 1rst December 1998. The workshop of Trieste that took place at the Abdussalam ICTP was the last meeting of MEDAR Group. The following objectives were achieved:

1) Compiling, safeguard and make available historical data sets of the following parameters: Temperature, Salinity, Oxygen, Phosphate, Nitrate, Nitrite, Silicate, Total Nitrogen, Total P, Ammonia, Chlorophyll-a, H2S, pH.
2) Archiving data sets comparable and compatible by using the common MEDATLAS protocol for formatting and quality checking, in accordance with the internationally agreed upon standards published by UNESCO/IOC, ICES and MAST.
3) Preparing and disseminating qualified value added products by using efficient gridding and appropriate mapping methodology.
4) Publishing the observed data, maps and related documentation on CD for further scientific, educational, industrial and governmental use.

Achievments

The cruise Inventory (Tab.1) include all sampling and measurements series undertaken in Lebanon at the Laboratory of Oceanography, Lebanese University and National Center for Marine Sciences .The data sets consists of 229 CTD and Bottle stations covering the period from 1965 to 1998. There is one station per cruise for both data. The geographic distribution of the oceanographic stations collected in Lebanon and their annual distribution per data type are shown (Fig.1). Most of the stations are limited to the shelf and continental slope with a depth down to 1200 m. These cruises provided data for: Temperature, Salinity, Dissolved Oxygen, Nitrate, Phosphate, Chlorophyll-*a* and PH values. The vertical profiles reach the level of 200 m depth.

Table 2. A short summary of the Lebanese cruises transcoded to MEDATLAS format

Casts	Cruises	Stations	Period	Parameters	Validated, QC
CTD Data	42	42	1986-1994	T, S, Oxygen	Yes
Bottle Data	187	187	1965-1998	T, S, O2, NO3, PO4, Chl, PH	Yes

We did use the electronic STD and Oxygen probes to measure in situ the temperature, depth, salinity, dissolved Oxygen and pH. Some times we used Bathythermograph to record the vertical profiles of temperature and thermocline layer. The reversing bottles were used to collect water samples for chemical analysis and chlorophyll-a content. Because of technical constraints, the vertical casts were limited up to 200 m depth.

Methods of Data Rescue

The procedure of data rescue was accomplished as follow:

a) Original Data were available in Excel format
b) Data were loaded into the ACCESS data base by means of special procedure
c) Data were transcoded from Excel to MEDATLAS format in using appropriate necessary software at HNODC

d) A preliminary oceanographic data inventory, along with cruise inventory was sent to RIHMI-WDC at Obninsks, Russia for control and integration in the whole data inventory.
e) All data sets were checked for MEDATLAS format and quality at the QC workshop at the NCMR/HNODC in Athens.
f) A web site was dedicated to MEDAR/MEDATLAS project and has been placed on the LNCSR home page and may be updated as necessary: http//www.cnrs.edu.lb/MEDAR-MEDATLAS/Lakkis

Participation in Project Meetings

1. A preliminary meeting in Istanbul occurred in 24-20May 1997 to discuss about the implementation of MEDAR/MEDATLAS II Project and formation of the group of participant countries. I presented a paper on the possibility of Lebanese participation in the project.
2. The Kick-Off meeting which took place in Paris on March 22-24, 1999 at the "Institut Oceanographique" in Paris.
3. The QC Workshop took place in Athens from November 29-10 December 1999. We used appropriate software for QC check of our data.
4. The Workshop of Cyprus, Nicosia 12-15 December 2000;
5. Final Workshop of, Trieste 10-15 December 2001

Conclusion and Forthcoming Actions

1. Oceanographic data of Lebanon are archived rescue and archived within MEDAR/MEDATLAS II project.
2. A NODC in Lebanon will be established at the National Center for Marine Sciences of the NCSR
3. It is decided to continue national cruises within frame of national Programmes or/and regional and Mediterranean collaboration.

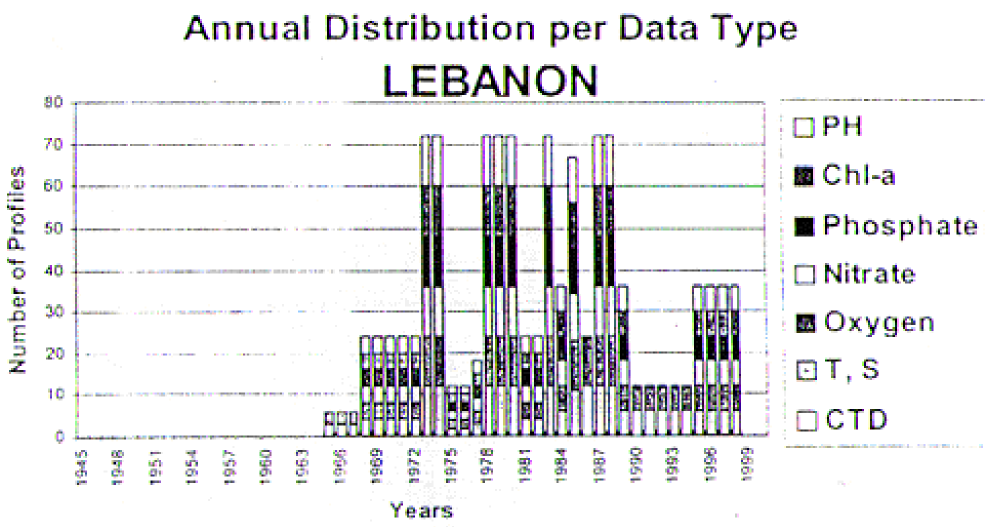

Fig. 1- Annual Distribution per Data Type of Medar-Medatlas II

Table 1- Cruise Inventory

MEDATLAS CRUISES INVENTORY

Symbols: LU= Leb.University; AUB= American University of Beirut; LNCSR=Lebanese National Council for Scientific Research; LPME=Lab.of Plankton & Marine Ecology; SETA III= National research vessel; ATOLL II=Private sailing boat; Unknown=Fisheries boat

Month	Year	Cruise	Program	Ship	Tools	Station	Lat.	Long.	Depth	Labor.	Parameters	Profile	Level	
August	1965	Leb.1	Hydrobiology	Unknown	Bottles	C3	33º57	35º28	500m	AUB	T/S/O	3	200-0	Lakkis
Septemb.	1966	Leb.2	Hydrobiology	Unknown	"	"	"	35º28	500m	AUB	T/S/O	3	200-0	Lakkis
August	1967	Leb.3	Hydrobiology	Unknown	"	"	"	35º28	500m	AUB	T/S/O	3	200-0	Lakkis
F M A N	1968	Leb.4	Plankton	Unknown	"	A3	33º58'	35º29	800	AUB	T/S/O/Chl pH,NO3,PO4	4	200-0	Lakkis
F M A N	1969	Leb.5	Hydrobiology	Unknown	"	B3	33º59	35º29	700	AUB	"	4	200-0	Lakkis
F M A N	1970	Leb.6	Hydrobiology	Unknown	"	G3	34º00	35º30	1100	AUB	"	4	200-0	Lakkis
F M A N	1971	Leb.7	Hydrobiology	ATOLL II	"	Tr	34º33	35º34	300	AUB	"	3	200-0	Lakkis
F M A N	1972	leb.8	Hydrobiology	ATOLL II	"	Si	34º25	35º32	500	AUB	"	4	200-0	Lakkis
JFMAMJ	1973	Leb.9	Hydrobiology	ATOLL II	Bot.&Bathyth.	By3	34º12	35º30	850	AUB	"	6	200-0	&Goedicke
JASOND	"	"	Hydrobiology	ATOLL II	"	"	"	"	"	"	"	6	"	Lakkis
JFMAMJ	1974	Leb.10	Hydrobiology	ATOLL II	STD&Bottles	"	"	"	850	AUB	"	6	200-0	&Goedicke
JASOND	"	"	"	"	"	"	"	"	"	"	"	6	"	&Goedicke
March,Jul	1975	Leb.11	Plankton	SETA III	STD	J3	34º06	35º30	850	NCSR-LU	T/S/O	2	200-0	Lakkis
March,Ap	1976	Leb.12	Plankton	SETA III	"	"	"	"	850	NCSR-LU	"	2	200-0	Lakkis
Jun,Jul.A	1977	Leb.13	Plankton	SETA III	"	"	"	"	850	NCSR-LU	"	3	200-0	Lakkis
JFMAMJ	1978	Leb.14	Plankton	SETA III	STD&Bottles	"	"	"	850	NCSR-LU	T/S/O/Chl PH,NO3,PO4	6	200-0	Lakkis
JASOND	"	"	"	"	"	"	"	"	"	"	"	6	"	"
JFMAMJ	1979	Leb.15	Hydrobiology	SETA III	"	G3	34º00	"	1100	"	"	6	"	"
JASOND	"	"	"	"	"	"	"	"	"	"	"	6	"	"
JFMAMJ	1980	Leb.16	Hydrobiology	SETA III	"	"	"	"	1100	"	"	6	"	"
JASOND	"	"	"	"	"	"	"	"	"	"	"	6	"	"
FMAN	1981	Leb.17	"	"	"	"	"	"	"	"	"	6	"	"
FMAN	1982	Leb.18	Plankton	"	"	J3	34º06	"	850	"	"	6	"	"

JFMAMJ	1983	Leb.19	"	"	"	"	"	"	"	"	"	6	"	"
JASOND	"	"	"	"	"	"	"	"	"	"	"	6	"	"
FAJAOD	1984	Leb.20	"	"	"	"	"	"	"	"	"	6	"	"
JFMAMJ	1985	Leb.21	Hydrobiology	"	"	By3	34º12	35º30	"	"	"	6	"	“
JASOND	"	"	"	"	"	"	"	"	"	"	"	6	"	“
JFMAMJ	1986	Leb.22	"	"	STD	J3	34º06	"	"	"	T/S/O	6	"	“
JASOND	"	"	"	"	"	"	"`	"	"	"	"	6	"	“
JFMAMJ	1987	Leb.23	"	"	"	"	"	"	"	"	"	6	"	“
JASOND	"	"	"	"	"	"	"	"	"	"	"	6	"	“
JFMAMJ	1988	Leb.24	Plankton	"	"	G3	34º00	35º30	850	"	"	6	"	“
JASOND	"		"	"	"	J3	34º06	"	"	"	"	6	"	“
JMMJSN	1989	Leb.25	"	"	"	"	"	"		"	"`	6	"	“
FAJAOD	1990	Leb.26	"	Unknown	"	By3	34º12	"	"	"	"	6	"	“
FAJAOD	1991	Leb.27	"	"	"	Tr	34o33	35o34	300	LPME/LN CSR	"	6	"	“
JMMJSN	1992	Leb.28	"	"	"	Tr	34º03	35º32	"	"	"	6	"	“
FAJAOD	1993	Leb.29	"	"	"	J3	34º06	35º30	850	"	"	6	"	“
JMMJSN	1994	Leb.30	"	"	"	"	"	"	"	"	"	6	"	“
FAJAOD	1995	Leb.31	"	"	"	Si	34º25	35º32	500	"	"	6	"	“
JMMJSN	1996	Leb.32	"`	"	"	Si	"	"	"	"	"	6	"	“
FAJAOD	1997	Leb.33	"	"	"	By3	34º12	35º30	850	"	"	6	"	“
JMMJSN	1998	Leb34	"	"	"	"	"	"	"	"	"	6	"	“

CORIOLIS/ARGO Data Centre: Real Time Data Management in the Mediterranean SEA

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A data management structure has been developed for managing the real time or near-real time data collected by operational oceanography programmes. This data structure, the CORIOLIS data centre, currently received data automatically sent by ARGO lagrangian floats, research vessels or transmitted through the GTS. Automatic and visual quality checks are performed before disseminating these data to modelling centres and other users. Data flagged with high level of problems (out of scale, vertical instability, constant profiles etc.) are not transmitted on the GTS.

Data products are prepared: files at two exchange formats ASCII/MEDATLAS and NetCdf, graphs, geographical distribution maps and weekly analysis for several projects. These products are disseminated on WWW and ftp.

In the Mediterranean, fully qualified Xbt data collected during the MFSPP project are available with the CORIOLIS tools. Other available data from the operational oceanography (profiles from ARGO floats, XBT data retrieved from the GTS and full resolution real time data from research vessels). Theses data are integrated in delayed mode in the MEDATLAS database.

COASTBASE: An Informative System to Facilitate the Access to Dispersed Marine Data-Bases

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Introduction

Availability of data and information is the base for any research and sound environmental assessment. Data collected in the framework of coastal and marine research as well as monitoring programmes are scattered throughout different institutes, archived in different systems with different formats and metadata models. This often hampers an efficient data flow and exchange among these organisations and a wider user community, with the results that relevant data and information are lost for environmental assessment, other research programmes, and policy making. Several programs have been devoted to promote standardisation and to facilitate data flow; some of them aim at gathering dispersed data into a unique-centralised database or to compile catalogues and directories. Nevertheless, after the end of the project, additional efforts are required to maintain the developed product, with the risk that the achieved results, if not regularly updated, might lose their value.

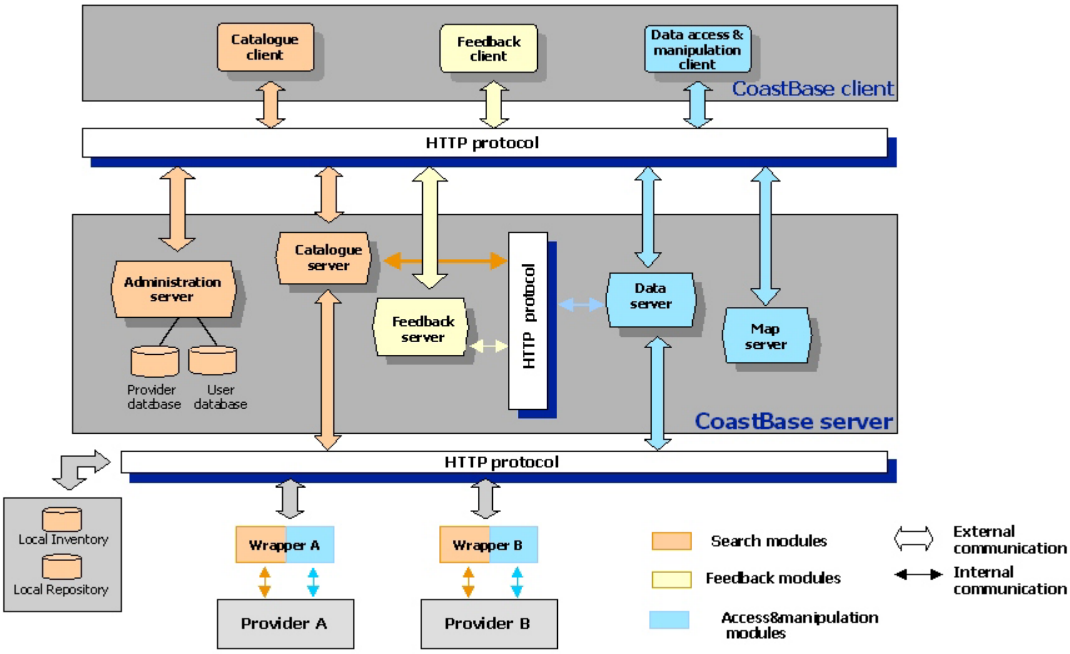
Main object of CoastBase project is to develop a system prototype to facilitate the search and access to dispersed marine and coastal information. The approach of CoastBase is to leave data and information where they are, archived in their informative system and catalogued according their meta-data model. The innovative aspect of CoastBase is that there is neither a centralized database for the data nor for the metadata: instead, the existing Internet access points for the sources to be connected are used. The user queries are dispatched at run-time to the sources. In order to overcome the technical heterogeneity, wrappers that translate the queries into queries native to the source, adapt the access protocol, translate the results into

XML and transform the structure to fit the CoastBase domain model are employed. CoastBase architecture is based on object-oriented technologies using IT standards (Java, XML, CORBA), is internet-accessible, modular and open to allow other application domains. XML is used not only for data exchange, but also for schema description, querying, transformation, visualisation and communication.

The System Architecture

The system architecture can be described as composed by four main functional blocks: the Coastbase client, the virtual catalogue, the data acess and manipulation, and the feedback.

- The CoastBase client (based on HTML and Java) provides uniform, multilingual and interactive access to all CoastBase services.
- The virtual catalogue represents the core of the system, allows to locate data and information. A user-friendly interface helps the user to formulate the query. Different selection criteria are possible, kind of data (raw data, maps, images, texts), time period, geographical area by selecting the name of country through a list or by a map-based selection. GEMET.2 thesaurus, which was developed to create a directory of environmental information for the European Environmental Agency, is used to select the terms. EDMED (www.sea_search.net/) metadata standard is also incorporated. Existing metadata catalogs are wrapped and integrated via mediators. The selected metadata can be also stored for later processing.
- The data access and manipulation services are responsible for transforming and aggregating the data. They also have to address security problems.

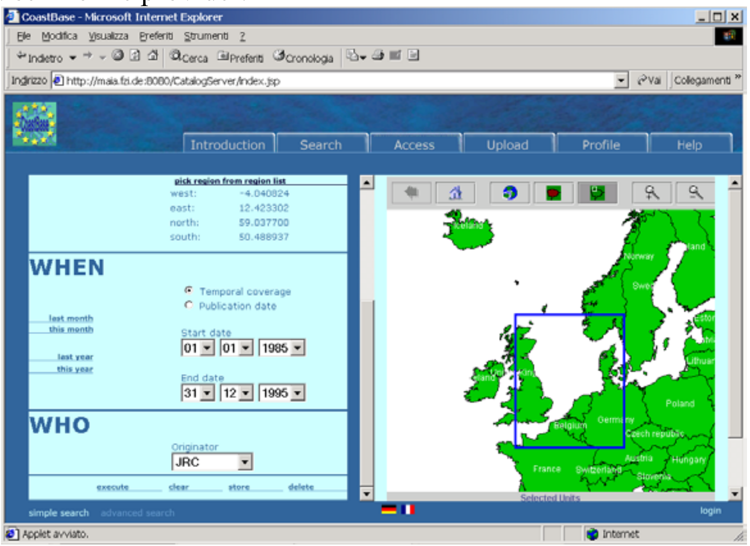


The system architecture

The data access server is invoked directly by the catalog server for the authorised data access requests. *Data Server* permits to access and retrieve the data, to download the product in the desired format and unit by the conversion of the requested data, provides aggregation and manipulation functions (production of maps, trends, statistical analysis). *Map Server* allows the visualization of geo-referenced data (rasters, vectors) on a map, performs conversion between different co-ordinate systems, implements a limited number of map projections, implements basic GIS functionality such as overlay, panning, zooming, and provides possibility to download data in GIS format for external visualisation. *Local Inventory and Repository* can be used for storing the uploaded products together with their metadata.

Products are stored as files in a file system; any type of data can be stored, but only products as a whole can be retrieved.

- The feedback module permits the data providers to track what happens with their information and it also aims at improving communication between user and data provider. Each data access request is logged automatically at the Coastbase server and sent to the provider.



The user interface

Four different data sources are at the moment connected to the prototype: ICES, the data handling for OSPARCOM and HELCOM, which provides maps obtained form aggregated data; IMR, the Norwegian NODC, providing raw data; RIKZ sharing the DONAR data-base which contains eutrophication data for the Dutch coasts; JRC-SAI which makes available satellite images of ocean colour and tools for visualisation and elaborations. Texts, reports and links to other information sources are uploaded on CoastBase server. To demonstrate CoastBase to a broad range of users, test cases taking into account different environmental scenarios have been prepared.

COASTBASE - The European Virtual Coastal and Marine Data Warehouse. An open system architecture for integrated distributed coastal and marine information search and access-
The project is supported by the European Commission within the V Framework Programme- Research and Technology Development DG Information Society
IST-1999-11406. It was launched on January 2000 by a consortium of eleven organisation. Coordinator is:
RIKZ -National Institute for Coastal and Marine Management- -The Hague, (NL);
Partners
ENEA-National Agency for New Technologies, Energy and the Environment-Roma (I)
EUCC- The European Union for Coastal Conservation, Leiden (NL)
FZI- Forschungszentrum Informatik an der Universitat - Karlshue (D)
ICES- International Council for the Exploration of the Sea- Copenhagen (DK)
IMR -Institute of Marine Research - Bergen- (N)
JRC- Joint Research Centre of EU -Space Application Institute- Ispra (I)
MATRA- Matra Systemes & Information- Toulouse (F)
MELS- Ministry of Lower Saxony- Hannover (D)
MIG- Marine Institute- Gdansk (PL)
PETA-Information Training Local Development- Athens (GR)
http://www.coatsbase.org

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Estimation of Long-Term Variability of Oceanographic Parameters of the Black Sea

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In framework of MEDAR/MEDATLAS II Project considered to be European MAST/INCO concerted action and a regional contribution to UNESCO/IOC Global Ocean Data Archaeology and Rescue (GODAR) Project the hydrological and hydrochemical database for the Black Sea was significantly supplemented.

On the material of the database created a long-term variability have been studied for the following parameters:

- upper boundary of the H_2S zone;
- lower boundary of oxic waters;
- depth of isopycnal σ=16.20;
- temperature and salinity for different levels under Cool Intermediate Layer.

An attempt was made to estimate a behavior of the above mentioned parameters for the years when there were no correspondent observation in the Black Sea by setting a connection between those and some environmental parameters reflecting global climatic variations and having longer set of measurements, such as:

- Rossby index of atmospheric circulation;
- A number of days with various form of atmospheric circulation in accordance with A.A. Girs;
- Observations of sea level at certain posts of the Azov-Black Sea Basin.

The accomplished investigation of the long-term variability allowed to come to the following conclusions:

- In the long-term variability of all investigated characteristics of the marine environment and atmosphere there are variations with periods equal to 3-5, 7-8, 11-12, 23-25 and by reckoning 90-100 years.
- A connection between the variability of the all parameters mentioned above and the atmosphere circulation characteristics and sea-level changes is significant.
- Phase shifts were found in the multi-annual course of the above-mentioned parameters in comparison to that of the parameters of atmospheric circulation and sea level observations.

Thus, the results of the long-term variability investigation allow to understand better the processes taking place and to increase accuracy and reliability of estimates of the Black Sea climatic parameters.

Information Resources of Marine Institutes and Centres of Ukraine: The Contribution into MEDAR/MEDATLAS II Project

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At modern stage of the World Ocean study information support of investigation based on advanced computer technologies becomes of particular importance. In Ukraine a great attention is paid to work on rescuing and archiving of oceanological observation data and creation of oceanological data banks. The Ukrainian institutes and centres of the marine profile accumulated a considerable experience in this field in framework of both national and international programs.

The Marine Hydrophysical Institute of the National Academy of Science of Ukraine as Designated National Agency takes active part in IODE IOC UNESCO program to insure safeguarding of the national data collected by the different institutes and it is a focus point for national and international exchange. Participation of Ukraine in MEDAR/MEDATLAS II Project is considered to be a logical continuation of its activity in this field.

Marine Hydrophysical Institute of the Ukrainian National Academy of Sciences co-ordinates the national contribution for the EC MEDAR/MEDATLAS II concerted action (MAS3-CT98-0174 & ERBIC20-CT98-0103) to develop a quality database of oceanographic data through a wide co-operation with the other participants of the project. MHI worked over the MEDAR/MEDATLAS II Project in accordance to MEDAR/MEDATLAS II Technical Annex and in close cooperation with other Ukrainian Marine Institutions: Institute of Biology of Southern Seas (IBSS) (Sevastopol); Southern Scientific Research Institute of Marine Fisheries and Oceanography (SSRIMFO) (Kerch); Marine Branch of Ukrainian Research Hydrometeorological Institute (MB of UkrRHMI) (Sevastopol); Odessa Branch of the Institute of Biology of Southern Seas (OB of IBSS) (Odessa), Ukrainian Scientific Center of the Ecology of Sea (UkrSCES) (Odessa).

In total, data obtained from more than 34000 oceanographic stations accomplished in the Black and Mediterranean Seas were prepared by the Ukrainian institutes in framework of the Project (see Table). It is a weighty part of the entire volume of data prepared during MEDAR/MEDATLAS II Project fulfillment.

The experience accumulated during the MEDAR/MEDATLAS II Project realization shows fruitfulness of the joint efforts of different countries on rescuing and archiving of observed oceanological data and expedience of their continuation in this direction as well.

Table. Number of stations prepared by the Ukrainian institutions in framework of MEDAR/MEDATLAS II Project (after data duplicates were deleted)

Institution	Bottle stations	CTD-stations	MBT-stations	Total
IBSS	68	2963		3031
MB OF UKRNIGMI	8218	74		8292
MHI	450	5342		5792
OB OF IBSS	1276			1276
UGNIRO	10302		86	10388
UKRNCES	1891	3486		5377
	22205	11865	86	34156

Oceanographic Data Management in the SE Levantine Basin, MEDAR/MEDATLAS II Project

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The Cyprus NODC participates in the MEDAR/MEDATLAS-II project in order to develop a quality database of oceanographic data in the Mediterranean Sea, through a wide co-operation of the bordering Mediterranean and Black Sea countries. The project is a European MAST/INCO concerted action and a regional contribution to UNESCO/IOC´s Global Ocean Data Archaeology and Rescue (GODAR) project.

The data from national oceanographic activities of the OS/DFMR, main marine research institution in Cyprus and from European and other international research activities in the SE Levantine Basin, as for example the MFSPP and CYCLOPS projects, were used in order to make these archived oceanographic data sets comparable and compatible with the existing format of the MEDATLAS 1997 database. For this purposes, common MEDATLAS protocol for formatting and data quality checking were used, in accordance with the internationally agreed standards published by UNESCO/IOC, ICES and MAST.

The following deliveries were done by the CYNODC towards the realisation of the MEDAR/MEDATLAS-II objectives:

1. The available oceanographic data were subject to quality control before were archived in national format.
2. A contribution of the MEDAR/MEDATLAS-II inventory has been insured by sending a corrected inventory to WDC-B.
3. A first benchmark of data have been delivered on regional QC centre in Athens (HNODC), to check the compatibility of the data reformatting and organisation with the MEDAR/MEDATLAS system.
4. All the data sets were transcoded in the common MEDATLAS format.
5. The data were checked for quality (QC) by implementing automatic (objective), QC-MEDAR and SCOOP software, and visual (subjective) checks.

Moreover, within the framework of the MEDAR/MEDATLAS -II project, a friendly user software was developed for transcoding the national data format into the MEDATLAS one. The initial code of the software was based on a previous code from HNODC.

The updated oceanographic database, the climatological statistics and the methodology implemented to process and exchange these data will constitute a basic capacity of the CYNODC and of the other Mediterranean NODCs/DNAs to meet the requirements of the forthcoming operational oceanography. The new data set of the MEDAR/MEDATLAS-II may serve as a database for the oceanographic forecasting activities, particularly for the needs of the national and regional efforts in the protection of the marine environment in the Levantine Basin, Eastern Mediterranean Sea.

5. CONCLUSIONS AND RECOMMENDATIONS

The MEDAR/MEDATLAS II project, funded under the EU-MAST III Programme (MAS3-CT98-0174 & ERBIC20-CT98-0103), implemented during the 1998-2001 period, has substantially increased the Mediterranean and Black Sea data release both in quality and quantity, and the overall data management practises. Such regional data management concerted actions started in 1994 with the European MAST II MEDATLAS and MODB pilot Projects, under the umbrella of a regional action for IOC/GODAR (Global Ocean Data Archaeology and rescue) programme. In the first pilot projects, the data rescue was focused on temperature and salinity. In MEDAR/MEDATLAS II, bio-chemical parameters have been integrated in the joint database, and thanks to a wider international cooperation, the volume of rescued data has doubled. It is noticeable that the methodology for data formatting and checking has been developed and the computation of the statistical climatological fields improved accordingly. As the 1997 release was internationally considered as a success, it is expected that this new data product, which will be distributed through a set of four CD-ROMs, will be even more recognized as a powerful tool, for the marine science and engineering communities.

The discussions at the meeting pointed out that there are still gaps to fill in and that further actions should be undertaken to develop and update the database and to improve the timely data access to users. Some actions like investigating the areas with sparse data coverage and like decreasing the period of confidentiality are beyond the capacities of the data centres, but should be reported to responsible organisations.

The workshop noted further that the standard protocol developed by MEDAR from the IOC and MAST manual had been successfully implemented. However, it recognised that various aspects of these protocols deviated significantly from protocols being established elsewhere.

The workshop therefore recommended that IOC be invited to examine this problem (through the GETADE Group) with a view to establishing a global framework for data management protocols, and that any further project should closely examine protocols of international data management projects with a view of improving standardisation.

In addition, it was agreed that data management activities could be enhanced in the following areas:

1) Offering a fast and integrated access to the most recent data sets released by the scientific and operational teams. A 3-4 year periodical data update is necessary, but not sufficient to get access to the most recent available data released. New communication technologies should be used to get on line access through WWW to distributed databases. However, for compatibility and security reasons, the few existing on line systems cannot be simply installed in the Data Centres. Appropriate software interfaces have to be developed or adapted, with the heterogeneous local computer systems and the ongoing development of standards for data and meta-data exchange have to be taken into account.
2) Improving the quality control protocol of the nutrients both for observed and gridded data. It is a critical point, as the methodology is not yet well established. Presently coastal zone and deep sea are generally processed by comparison with the same range values, and the Redfield ratio and other possible tests are not yet implemented. These tests should be done and the reference range values adjusted by taken into account recent data of good quality, like those released by the EU MTPII-MATER project and feed back from the present release of statistical climatological gridded values.
3) Coping better with the problem of the circulation of duplicate data sets between world data centre, national data centres or even within the same historical data set. This has been a difficult problem for the integration of all the data. The quality control protocol

4) Assessing the sensibility of the objective analysis in regions void or poor in data. In the present project, an optimal compromise was searched for resolution, smoothing and robustness. It seems to remain some work to do to get better estimates of the time and space correlation functions.
5) Integrating other data type like current time series and carbon cycle which are also important for the ocean monitoring and not yet included in the published databases. However this appeared as a longer-term priority in the actions list.
6) Search for a better inter-project coordination. To some extend it is met with the objective of the "clusterization" promoted by EU (IMPACTS) and the already links of MEDAR with IOC/GODAR, IODE and GTSPP. The presentations from representatives of the international GODAR, GTSPP, WOCE data management, and EU MAMA and IMPACTS/CYCLOPS projects made during the workshop and the past workshops, had already the objective of enhancing cooperation and coordination between these related projects. However it appeared difficult to avoid some overlapping in the objectives of several new initiatives and incompatibilities between protocols for data and information exchange of existing projects. IODE practices and protocols should be more widely promoted and enhanced cooperation would aim to avoid duplication of work and to encourage mutual support.

In conclusion it appeared of paramount importance to maintain and enhance this regional network and its data management activity to insure more timely safeguarding to data and to facilitate the public access to a comprehensive database of good quality. Considering the lack of data for several critical nutrients, it is important to integrate data collected during recent field projects, and to offer faster access to data to the users. National and international organisations should be invited to support a new concerted action for improving the data safeguarding and the data circulation to meet the requirement of the climate module of GOOS and produce useful tools for the scientific and technical development and capacity building of the region. Further actions should be encouraged to make more observations in the data void areas, especially in the middle of the basins and along the Southern Mediterranean coasts, and it is hoped that more sea monitoring programmes will be undertaken in this perspective, with an appropriate data management to insure quality, coherence and safeguarding of the collected data.

It was agreed that the use of XML would be one of the next challenges in the exchange of oceanographic data. Recommendations were made to explore ways in which XML can be used for data exchange and to interact with the groups, especially ICES-IOC Working Group on Marine XML.

6. CLOSING OF THE WORKSHOP

The workshop was closed on Thursday 13 December 2002 at 17.30 Hours.

ANNEX I

WORKSHOP PROGRAMME

Monday, December 10	**Opening and Session 1: Databases and Data Products**
08.30	Registration
09.00	Welcome – Official Opening
09.30	MEDAR/MEDATLAS Project C. Maillard
10.10	MEDAR/MEDATLAS Global Inventory N. Mikhaïlov
10.40	*Coffee break*
11.00	Regional Data Management – Eastern Mediterranean E. Balopoulos
11.30	Regional Data Management – Central Mediterranean B. Manca
12.00	Regional Data Management – Western Mediterranean M.-J. Garcia
12.30	Regional Data Management – Black Sea N. Mikhaïlov
13.00	*Lunch at Adriatico Guesthouse Cafeteria*
14.30	MEDATLAS 2001 Database product G. Maudire
15.00	World Ocean Database: Climatologies and Statistics S. Levitus,R. Gelfeld
15.30	Tools and Products – Data Quality Control M.-J. Garcia
16.00	*Coffee break*
16.30	Long-term Oceanographic Organizing System (LODOS) M. Ozyalvac, A. Turker
17.00	Tools and Products – Regional Database system I. Tsetik
17.30	Tools and Products – Ocean Data Visualization R. Schlitzer
19.30	*Ice breaker at Adriatico Guesthouse*

Tuesday, December 11	**Session II: Quality Assurance**
09.00	International Standards applied to MEDAR/MEDATLAS – IOC/ICES Methodology H. Dooley
09.30	GTSPP Experience for QC – Real Time and Delayed mode R. Keeley
	Session III: Networking & Perspectives
10.00	MEDAR/MEDATLAS Websites A. Giorgetti
10.30	IOC/IODE Websites G. Reed
11.00	*Coffee break*
11.30	Observational and Climatological Data Flow within MFSPP Users N.Pinardi
12.00	Perspectives from EUROGOOS Users N. Flemming
12.30	Perspectives from MEDGOOS Users S. Vallerga
13.00	*Lunch at Adriatico Guesthouse Cafeteria*
14.30	Perspectives from BLACK SEA GOOS Users V. Eremeev
15.00	IMPACTS Cluster and New EC On going Initiatives E. Lipiatou
15.30	CYCLOPS P. Carbo
16.00	*Coffee break*
16.30	MEDATLAS III New Actions E. Balopoulos
17.00 to 18.00	Round Table – New topics presentation and discussion with the objective to prepare conclusions and recommendations. Creation of a drafting group.

Wednesday, December 12	**Session IV: Scientific visit and presentations at OGS**
09.00	*Departure by bus for a Visit to OGS (selected lectures concerning currently oceanographic research activities and research infrastructures)*
12.30	*Lunch at SalviaRosmarino Restaurant*
14.30	*Half-day excursion to visit the 'Grotta Gigante'*
20.00	Social Dinner offered by OGS

Thursday, December 13	**Session V: Poster and Training Session**
09.00	Poster Session, short presentations
10.00	Software demonstration & Training on the MEDAR/MEDATLAS 2001 database
11.00	*Coffee break*
11.30	MEDAR/MEDATLAS 2001 Climatolgical fields and Atlas, J.M. Beckers
12.00	Demonstration & training on the climatology Poster Session continue Poster Session, short presentations
12.30	End of Poster Session continue Poster Session, short presentations
13.00	*Lunch at Adriatico Guesthouse Cafeteria*
	Session VI: Round Tables & Conclusion
14.30	Continuation of the Round table discussions
15.15	Presentation of the results of the round table discussions.
16.00	*Coffee break*
16.30	Adoption of conclusions and recommendations Closure of the Workshop
17.00	**Steering Committee** *(members)*
19.30	*Departure by bus for Farewell Dinner in a typical "Triestine Osmizza"*

ANNEX II

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ANNEX III

OPENING ADDRESSES

Address By Prof. Iginio Marson, President, Istituto Nazionale di Oceanografia e di Geofisica Sperimentale – OGS, Trieste, Italy

Ladies and Gentlemen, Dear Colleagues

I welcome participants to the Final Workshop of the EU MEDAR/MEDATLAS II project on behalf of Istituto Nazionale di Oceanografia e di Geofisica Spermentale - OGS, a public research institute (government body) responsible for the promotion and realisation of researches on applied oceanography and geophysics under the purview of the Ministry for Universities, Scientific and Technological Research in Italy.

The OGS has a permanent staff of 135 researchers and technicians and 25 researchers with fixed-term contracts and pursues its research activity in three departments related to:

- Marine environment, by focusing particularly on its interaction with the atmosphere and lithosphere;
- Geophysics of lithosphere with application to energy and geodynamics;
- Seismic, volcanic, geologic and hydrologic risks with the aims of prevention, civil protection and optimisation of land use.

Most of the internal OGS research is conducted by these departments which are supported by administrative and research infrastructures. In addition, these organizations also conduct research done under external "third-party" contracts with private industries, or through contracts with the European Union or within the framework of other international research projects. The departments are the foci of the OGS's permanent activity, however research groups and study centres are formed in collaboration with universities, other governmental agencies, or private bodies.

The development of new or improved techniques for marine and, in general, for geophysical data acquisition, processing, interpretation, management is the base of the Earth Sciences. The OGS pursue this objective taking a long-term view of the future of ocean and solid-earth. Long-term implies more years ahead and co-ordinated efforts at the national and European level, which mean the major challenges of ocean and solid-earth monitoring due to the peculiarity of the geophysical data as non-renewable resources.

I encourage the participants to this workshop to generate new ideas and to reach consensus about new goals on oceanographic data management on the perspective of ocean monitoring and forecasting. The Mediterranean Sea is important in its own resources and also for its probable role that the outflow of Mediterranean water plays for North Atlantic Ocean dynamics. Managing the marine resources and following up the environmental changes in the Mediterranean Sea waters requires the availability of long times series of observations. Optimum observing systems, data collection and archiving are necessary to insure the availability of such data, along with their dissemination among the scientific community.
Data are actually collected in a range of areas and disciplines during the research projects. Standardisation, integration and archiving of these data are essential to the success of the projects at all stages. However, retrospective studies, by accessing and rescuing historical data to reconstruct physical and biological changes, provide the required means in identifying long term trends in ecosystem structure and relating them to the global change for future researches.

The historic data are exclusively available from national research organisms actively involved in assisting with historic and current aspects of scientific data collection. They co-ordinate and manage rigorously quality control of the data – especially that of core measurements – that are important in dealing with concurrent global changes and the future of the Earth Systems. Modern data management tasks would include developing and implementing of data communication tools for accessing to the existing in situ data sets, integrating technologic facilities able to provide large quantity of data available from remote sensing, and finally gaining the complete confidence of data originating from ocean climate model simulations.
National data management facilities should work closely with existing network of international data management systems and collaborate with them creating potential linkages with other possible regional and individual programmes. Individual researchers should network by electronic means to the national foci who should give free access to data and information tools.

Operational and policy requirements are increasing the demand of better quality of oceanographic data, particularly important for the management of the coastal zone. This will require developments of accurate protocol for data validation giving the high level of variability in these areas. Together with the development of ocean observing system, systems of data management must be considered for collection, checking and archiving; along with the developing of discipline and practice for data dissemination can help coordinated observing system programmes.

There are notable strengths in creating such infrastructures, and some evident gaps within some national structures still exist. We are co-operating in providing the definition and the development of the National Oceanographic Data Centre in Italy. This will allow co-operation with analogues National Data Centre in Europe providing ocean data in the most economical manner and without duplication, as well as data dissemination facilities using the latest technologies in data communication.

I wish the participants a fruitful meeting and discussion of the EU MEDAR/MEDATLAS II project results and to identify Grand Challenges in global oceanographic data management activities which could be to big for national resources and need to be developed at the European level, at least.

Address By Prof. Giuseppe Furlan, Head of the ICTP programme for Training and Research in Italian Laboratories (TRIL)

Ladies and Gentlemen, dear Colleagues and Distinguished Guests,

It is my privilege to welcome you today to the Abdus Salam International Centre for Theoretical Physiscs for the final meeting on "MEDAR/MEDATLAS II Workshop".

On behalf of the ICTP Director M.A. Virasoro and of the staff, I wish you a fruitful and pleasant stay in Trieste. My thanks also go to the OGS friends, in particular to B. Manca and the President, I. Marson, for a continued collaboration which has been developed with several modalities during these years.

Since some of you could be new to the Centre, I take this opportunity to give a quick description of the motivations, activities and achievements of the ICTP over more than three decades.

Before doing it let me stress that Physics is concerned with providing solutions to problems: it's therefore central in understanding the global environment and in predicting the transformations of our planet. The ICTP is therefore involved per se with the scientific aspects of the ennvironmental problem, from mathematical ecology to montitoring technologies.

The International Centre for Theoretical Physics (ICTP) is a unique institution in the United Nations family, with the mandate to foster the advancement of Physics, Mathematics and scientifically grounded High Technologies, devoting special attention to the situation in the Developing Countries. It's becoming quite clear nowadays that the capability of a country to participate in the development's process depends basically on the level of preparation of his people and on the quality of innovation they are able to bring. Creation and mastery of Applied and Fundamental Science, its utilisation to all levels of the economic and social structure are becoming decisive elements of development and of improved standard of life.

These objectives were defined by the farsighted view of its former Director, Nobel Laureate Prof. Abdus Salam who has always stressed that "...Science must be broad-based in order to be effective for subsequent applications: the Science of today is the Technology of tomorrow " and that "...the widening gap in Economics and Influence between the countries of the South and the North is also a Science and Technology gap ". These ideas have shaped the action of the Center through the years.

The ICTP was officially established in Trieste (Italy) in 1964 by a seat agreement between the Italian Government (the main donor), the International Atomic Energy Agency (IAEA, Vienna) and UNESCO (Paris). Since then it has accomplished its task through a vigorous multi-disciplinary programme of production and distribution of knowledge, carried out with active research groups and with training-for-research activities.

Good Science (in 1979 Prof. Salam was awarded the Nobel Prize for Physics) and side by side international collaboration have been the features characterizing the task (aim, scope) of the ICTP. In this spirit, more than 80,000 scientists have visited the Center since its inception (almost 40 years). The figures for 2000 are 3262 visitors (50% from Developing Countries, representing 114 countries).

The programmes of the ICTP encompass a large range of scientific disciplines from very sophisticated subjects like the Physics of Elementary Particles and Cosmology to more practical topics like Medical Physics or Soil Physics. In a broad sense, the fields covered are:

Fundamental Physics, Condensed Matter, Mathematics, Physics of Weather and Climate, in which permanent research groups operate throughout the year, while small units exist in other research lines like, Structure and Non Linear Dynamics of the Earth, Aeronomy and Radiopropagation, Synchrotron Radiation together with the Microprocessor Laboratory.

Simultaneously, a vigorous programme of courses, workshops, conferences and the like is also devoted to the above and other topics in the realm of Environmental Sciences, Physics and Technology including Energy, Life Sciences, Mathematical Economics and so on. About 40 meetings are conducted at the ICTP each year. Furhtermore, since a few years, the ICTP offers a Diploma Course in Condense Matter Physics, High Energy Physics and Mathematics, designed as a year-long pre-Ph.D prgramme.

The ICTP offers good Computing facilities, an excellent Library rich of about 57.000 books and 900 journals, a Printing Shop and so on. More than 200 visitors, at a time, can be accomodated on the hosting premises.

Apart from the above facilities and from a devoted and efficient staff, a unique, exceptional feature is represented by the stimulating cultural atmosphere due to the simultaneous presence of in-house scientists of different disciplines and countries.

From the very beginning, appropriate schemes were devised, guaranteeing the regular participation of scientists working in Developing Countries in the main ICTP activities (Associate Membership, Federation Agreement, etc.).

In addition, a well-established programme exists, the ICTP Programme for Training and Research in Italian Laboratories (TRIL), which offers scientists participating in the ICTP activities the opportunity to carry out long- training periods at University research laboratories, governmental and industrial institutions, operating in different branches of Physics. This scheme is particularly attractive because in this way the ICTP can count on an active network of more than 300 laboratories which, beside providing experimental training, represent for selected individuals and their home institutions potential high-level partners for scientific collaboration. Since its inception (1983) more than 1300 grants have been awarded to 900 fellows from 70 countries.

The support from the Italian scientific community, OGS in primis, has been instrumental in making the initiative a great success and we count on enlarging it to a European context through the collaboration of all the scientists, like you, who share our ideals and concerns.