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1. Introduction

1.1 A few words from the Chair

Data management within the JGOFS programme was implemented as a network of national initiatives co-ordinated through the Data Management Task Team (DMTT). Finite resources were available and naturally the first priority for these was to address problems at the national rather than the international level.

Consequently, when the generous offer was made by German JGOFS to provide resource for the production of a CD-ROM to benefit the international JGOFS community it was welcomed with open arms. The problem was to identify a project that was feasible but would still significantly benefit the JGOFS scientific community. After considerable thought it was concluded that an ideal project would be the assembly of a basin-scale CTD data set. JGOFS data collection in the Arabian Sea was in full swing at the time of these considerations and consequently this area was chosen for the project.

Once the project specification had been drawn up, the problem of data set assembly was addressed by the DMTT. The successful completion of this exercise through the co-ordinated efforts of the Task Team members gave me a great deal of pleasure.

This CD-ROM contains a significant quantity of profile data from CTD, XBT and SeaSoar instruments. The data are presented in an organised, indexed manner in a common data format with accompanying documentation. They are therefore immediately available to synthesis and modelling activities. Please take full advantage of this rich resource.

Roy Lowry, Chair of the JGOFS Data Management Task Team

1.2 A note from the IPO

The JGOFS International Project Office (IPO) is located at the University of Bergen, Norway. The IPO is the link between the International JGOFS Scientific Steering Committee (SSC) and the National JGOFS Committees. The responsibilities of the IPO are to assist the SSC in planning and carrying out new scientific research, data management, synthesis and modelling activities. It also collates information on national and regional programmes of global change research relating to the project to ensure that there is no unnecessary duplication of effort, so that the project makes effective use of existing knowledge in its analysis of processes and change at global scales. Other responsibilities are to establish links between national oceanographic data centres and the forging and strengthening of links between the marine programs that are part of the International Geosphere-Biosphere Programme (IGBP) and the Scientific Council on Oceanic Research (SCOR), e.g. the Land-Ocean Interactions in the Coastal Zone (LOICZ), Global Ocean Ecosystems Dynamics (GLOBEC) and future Global Ocean Observing System (GOOS).

Dr. Beatriz Baliño, the Assistant Executive Officer of the IPO, assists the Data Management Task Team (DMTT) in the coordination and development of JGOFS data management policies. Specifically, Dr. Baliño helps with tracking JGOFS data gathered by the 20 or so participating countries in the programme. In this regard, she implemented and maintains a Cruise Inventory at the IPO's web page http://ads.smr.uib.no/jgofs/inventory/index.htm. The JGOFS Cruise Inventory is the first viable product to come from the combined efforts of the DMTT and contains JGOFS cruises and related cruises dating back to the first field programme in 1986. The purpose of this inventory, which already contains more than 1000 records, is to provide information on the physical whereabouts of all JGOFS data sets and how to get access to them by establishing hypertext links between each cruise and its measured observations and documentation.

2. Data Format (The Generalised JGOFS Data Format)

2.1 Description

2.1.1 The Naming Convention

This chapter describes the unique naming convention of the directories and the data files. Operating systems like DOS or Win 3.x have an 8-byte restriction on file and directory names. We decided to use the 2-byte IOC ship code combined with the national cruise identifier, e.g. the R/V Meteor cruise no. 32 leg 5 has the national abreviation M325. The composition of our 2-byte ship code and the national cruise numbering will produce in this example the subdirectory name MT325. The data directories are named after the data stored in, *e.g.* CTD, XBT, etc. On some cruises different types of CTDs were used, *e.g.* Neil Brown and Meereselektonik (ME). In these cases two separate folders were created named according to the CTD vendor.

Ship	Country	Code

R/V Tyro	Netherlands	TR
RRS Discovery	United Kingdom	DI
R/V Thomas Thompson	USA	TT
R/V Meteor	Germany	MT
R/V Sonne	Germany	BE
ORV Sagar Kanya	India	SG
??	USA	NV
Kane	USA	NZ
Priboi	USSR	ER
Researcher (NOAA)	USA	WT
Akademik Shirshov	USSR	UM

Table I: International IOC ship codes

2.1.2 Naming the CTD Data Files

The file names start with the internal ship code (Bytes 1-2). The next four bytes (3-6) are reserved for the cast number within the cruise. Byte 7 is the character V which indicates version and the 8th byte is an A for version one. The filename extension CSV denotes comma separated values. The XBT data files have a X instead of a V at byte 7 and if two different CTDs or one CTD and a Sea Soar were used on a cruise the main CTD has a 0 (zero) at byte 3 and the second gear has a 1 (one) at byte 3.

File Name	Byte 1-2	Byte 3	Byte 4-6	Byte 7-8
MT**0**001**V**A.CSV	Ship: Meteor	First CTD	Profile 1	first version
MT**1**001**V**A.CSV	Ship: Meteor	Second CTD	Profile 1	first version
MT**0**001**X**A.CSV	Ship: Meteor	XBT file (see byte 7)	Profile 1	first version

Table II: *Examples of* the File Name Definition

3. The Data Format

3.1 The Header Information

Every data file has a header with information about the project, the cruise identifier, date and time of the profile, positioning, water column depth, maximum depth of the profile, parameter and their units. The header for each item is a comma separated list of values , always starting with a cross (#) *e.g.*:

Line No.	Definition	Explanation
1	# Project, JGOFS	
2	# Cruise, R/V Meteor, MT325	Cruise 32 Leg 5
3	# Date (UTC),28/07/1995 22:30	dd/mm/yyyy hh:mi
4	# Latitude (deg + veN), 12.3456	dec deg
5	# Longitude (deg + veE), 65.0005	dec deg
6	# Water depth (m), 3856	
7	# Maximum Pressure (db), 2504	
8	# Pressure, Depth, Temperature, Theta, Salinity, Sigma-theta, Oxygen, Attenuance, Chlorophyll	
9	# db, m, deg C, deg C, PSU, kg/m3, micromoles/litre, per m, mg/m3	

Table III: *Examples of* the Header Definition

3.2 The Data Format

All CTD and Sea Soar data files have the same format (see Line No. 8 , in table III). The parameters are Pressure, Depth, Temperature, Potential Temperature (Theta), Salinity, Density (Sigma-theta), Oxygen, Attenuance, and Chlorophyll (Fluorescense).

Dummy values are used for missing data (Table IV). Null values in the pressure channel are not allowed. The columns are separated by a comma. The following table is the data format summary:

Parameter	Dummy value	Fortran Format
P (Pressure in db)	9999.9	(F6.1)
Z (Depth in m)	9999.9	(F6.1)
T (Temperature in deg C)	9999.999	(F8.3)
Theta (pot. Temperature in deg C)	9999.999	(F8.3)
S (Salinity in PSU)	9999.999	(F8.3)
Sigma Theta (kg/m3)	9999.999	(F8.3)
O2 (Oxygen in microMoles)	9999.99	(F7.2)
Attenuance (per m)	9999.9999	(F9.4)
Chl_a (mg/m3)	9999.999	(F8.3)

Table IV: The Data Format Definition

4. Example

4.1 CTD Data file with all parameters

# Project	JGOFS							
# Cruise	RRS Discovery	DI210						
# Date (UTC)	27/08/1994 22:32							
# Latitude (deg +ve N)	23.9204							
# Longitude (deg +ve E)	59.2519							
# Water depth (m)	3337.6							
#Maximum pressure (db)	478.0							
# Pressure	Depth	Temperature	Theta	Salinity	Sigma-theta	Oxygen	Attenuance	Chlorophyll
# db	m	deg C	deg C	PSU	kg/m3	µM	per m	mg/m3
1.0	1.0	28.195	28.195	36.761	23.658	195.90	0.5220	0.270
3.0	3.0	28.149	28.148	36.752	23.666	192.50	0.5320	0.280

4.2 CTD Data file with missing parameters

In this example the water depth, oxygen and chlorophyll values were missing.

# Project	U.S.JGOFS							
# Cruise	R/V Thomas G. Thompson	TT43						
# Date (UTC)	10/01/1995 19:26							
# Latitude (deg +veN)	20.5665							
# Longitude (deg +veE)	64.6667							
# Water depth (m)	9999.9							
# Maximum Pressure (db)	254.0							
# Pressure	Depth	Temperature	Theta	Salinity	Sigma-theta	Oxygen	Attenuance	Chlorophyll
# db	m	deg C	deg C	PSU	kg/m3	µM	per m	mg/m3
4.0	4.0	24.857	24.856	36.574	24.577	9999.99	0.0480	9999.999
6.0	6.0	24.864	24.863	36.574	24.575	9999.99	0.0490	9999.999

4.3 CTD Data file with missing values

In this example the water depth in the header and the oxygen value for 2.0m were missing. Attenuance and chlorophyll were not measured; the columns were filled up with dummy values.

# Project	NIOP							
# Cruise	R/V Tyro	TRC2						
# Date (UTC)	18/02/1993 04:35							
# Latitude (deg +veN)	11.6383							
# Longitude (deg +veE)	52.2317							
# Water depth (m)	9999.9							
# Maximum Pressure (db)	1371.0							
# Pressure	Depth	Temperature	Theta	Salinity	Sigma-theta	Oxygen	Attenuance	Chlorophyll
# db	m	deg C	deg C	PSU	kg/m3	µM	per m	mg/m3
1.0	1.0	26.346	26.346	36.037	23.677	208.008	999.9999	9999.999
2.0	2.0	26.460	26.460	36.036	23.677	9999.99	999.9999	9999.999
3.0	3.0	26.449	26.449	36.036	23.771	208.352	999.9999	9999.999

4.4 Sea Soar Data file

# Project	JGOFS							
# Cruise	RRS Discovery	DI209						
# Date (UTC)	10/08/1994 15:58							
# Latitude (deg +ve N)	19.1530							
# Longitude (deg +ve E)	59.2519							
# Water depth (m)	9999.9							
# Maximum pressure (db)	29.0							
# Pressure	Depth	Temperature	Theta	Salinity	Sigma-theta	Oxygen	Attenuance	Chlorophyll
# db	m	deg C	deg C	PSU	kg/m3	µM	per m	mg/m3
5.0	5.0	24.612	24.611	36.002	24.218	9999.99	9999.9999	1.970
13.0	13.0	24.610	24.607	36.003	24.220	9999.99	9999.9999	1.990

4.5 XBT Data file

4.	5.	6.
7. # Cruise	8. R/V METEOR	9. MT325
10. # Date (UTC)	11. 19/07/1995 00:20	12.
13. # Latitude (deg +ve N)	14. 1.500	15.
16. # Longitude (deg +ve E)	17. 65.000	18.
19. # Water depth (m)	20. 9999.9	21.
22. # Maximum pressure (db)	23. 1846.5	24.
25. # Pressure	26. Depth	27. Temperature
28. # db	29. m	30. deg C
31. 0.0	32. 0.0	33. 28.58
34. 1.0	35. 1.0	36. 28.58

5. History

The idea to produce an international JGOFS Arabian CTD CD-ROM was born at a meeting between Roy Lowry (DMTT chair), Thomas Mitzka (German JGOFS data manager) and Bernt Zeitzschel at Kiel in March 1996. A draft specification was scribbled on paper over the next few days and quickly developed into a draft proposal. This was presented to the JGOFS SSC at Bad Münstereifel in April 1996 and permission to go ahead with the project was obtained.
During 1996 Beatriz Balino from the IPO completed the list of cruises to be included on the product. The foundation for successful international co-operation was laid on the DMTT meeting at BODC in

January 1997. Here all DMTT members and officials from the IPO discussed the project the first time. This meeting led to the version 1.0 of the Arabian Sea CD-ROM draft specification. This paper was the framework and the primary concept for the data collection, describing the generalised JGOFS data format, the protocols and dates of data delivery. It was decided to collect the data and prepare the master CD-ROM at Kiel, Germany. Responsibility for the distribution of the final CTD data product would then be passed to the IPO.

During 1997 further comments and ideas from the DMTT members and JGOFS scientists were merged into the draft version 1.1. At the Ocean data symposium at Dublin in October 1997, a second DMTT meeting fixed the final draft and developed an internal data delivery timetable. This document was distributed to all DMTT members. At the beginning of 1998 the data were reformatted and transferred to Kiel.

The data from the Netherlands Indian Ocean Programme (NIOP), the Indian JGOFS Programme, the German JGOFS, PAKOMIN and BIGSET Programmes were formatted and documented (it was a compilation of originator information in most cases) at Kiel. The conversion of the data documentation into various formats and the creation of this HTML framework was also undertaken at Kiel.

6. The Structure of the CD-ROM:

The data are sorted by cruises. The directory names are a combination of the international IOC ship codes and the national cruise mnemonic. Whenever more than one gear was used on the same cruise, each gear has a separate sub-directory. The documentation of the cruise data set is available in the same directory as the data. Four different formats were chosen for the documentation:

- CTDDATA.DOC (WORD 6.0)
- CTDDATA.RTF (Rich Text Format)
- CTDDATA.ANS (Plain ASCII Text)
- CTDDATA.TXT (Text only)

In the root directory you will find the INVENTORY files. These data files are available as spreadsheets, and comma and tabulator separated values files.

- INVENT50.XLS (EXCEL 5.0)
- INVENT97.XLS (EXCEL 97)
- INVENTOR.CSV (COMMA SEPARATED VALUES, ASCII)
- INVENTOR.TXT (TABULATOR SEPARATED VALUES, ASCII)

These Inventory files will help you find the CTD profiles of interest.

The following columns are search- and sortable:

PROJECT, CRUISE, DATE, TIME , LATITUDE, LONGITUDE, WATER DEPTH, MAXIMUM PRESSURE, RELATIVE PATH TO FILE

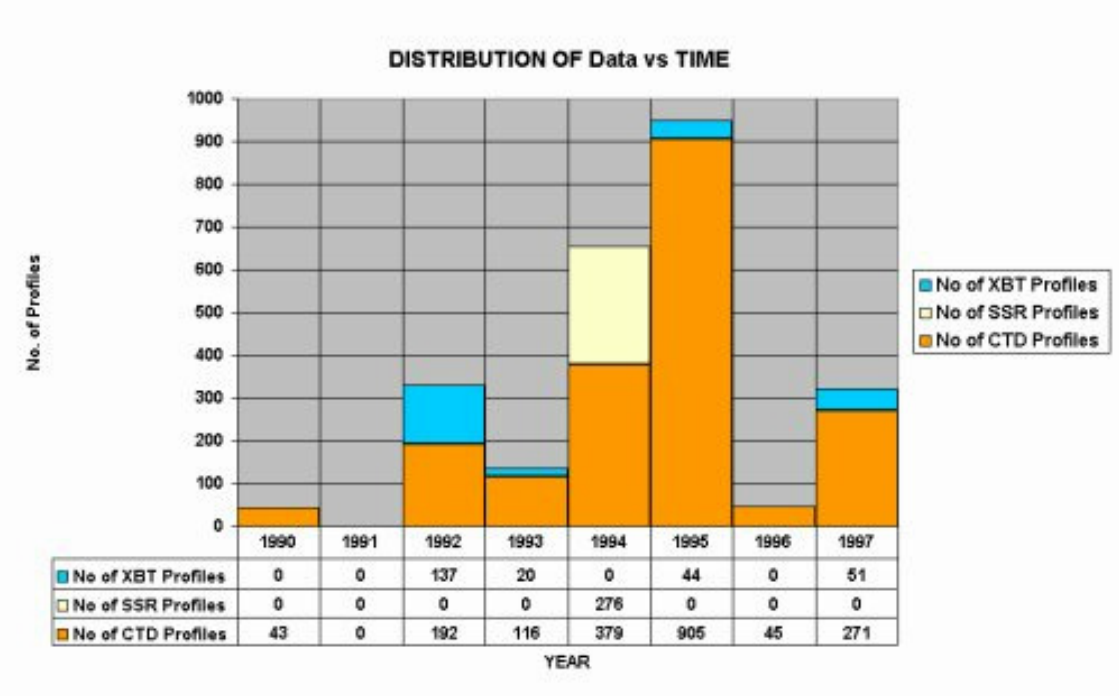
7. Statistics of this Product

SUMMARY, ALL DATA 1990 – 1997

The following table summarises the data contents on this CD-ROM with regard to the occurrence of the profiles over the years. The last row gives the sum of the profile counts in a column.

YEAR	No of CTD Profiles	No of SSR Profiles	No of XBT Profiles	Total No of Profiles/Year
1990	43	0	0	43
1991	0	0	0	0
1992	192	0	137	329
1993	116	0	20	136
1994	379	276	0	655
1995	905	0	44	949
1996	45	0	0	45
1997	271	0	51	322
	1951	276	252	2479

GRAPHICAL PRESENTATION



8. Acknowledgements

The data presented on this CD-ROM represent the work of many scientists both at sea and back in the laboratory. The efforts of the following groups and individuals are duly acknowledged.

The U.S. JGOFS contributions included on this CD-ROM were collected, processed and quality assured by Dr. Louis Codispoti of Old Dominion University and Dr. John Morrison of North Carolina State University under a grant from the National Science Foundation. The hydrographic team were: Peter Becker, Michael Kuhland, Linda Prosperie and Bret Wheless from Old Dominion University; Francesco Bignami, Jeffrey Kinder and Richard Kohrman from North Carolina State University; Kenneth Bottom, Dennis Guffy, C. Pollock, R.V. Pittman, Erik Quiroz and Logan Respess from Texas A&M University; Tony Burke, Michael Grogan, Katherine Krogsland, William Martin, William Peterson, James Postel, Michael Realander and George White from the University of Washington; Scott Hiller, Leonard Lopez, Douglas Masten, Stacey Morgan, Barry Nisly, Maureen Noonan, Ronald Patrick, James Schmitt, James Wells and Richard Williams from the Scripps Institution of Oceanography; and Robert Masserini, Keven Riskowitz and Howard Rutherford from the University of South Florida.
The German data on this CD-ROM have been provided / processed by:

R/V Sonne 90 - U.v.Rad - BGR Hannover
R/V Meteor 31 leg 2&3 - F.Wehner - IfM Kiel
R/V Meteor 32 leg 3 - J.Ruickholt / D. Wilhelm - IO Warnemuende/ IfM Kiel
R/V Meteor 32 leg 5 - J. Waniek, T.Mitzka / J.Waniek - IfM Kiel
R/V Meteor 33 leg 1 - N. Delling - IfM Hamburg
R/V Sonne 117 - U.Wolf / W.Barkmann - IO Warnemuende
R/V Sonne 118 - O.Pfannkuche / R.Luff - GEOMAR Kiel
R/V Sonne 119 - V.Ittekkot / R.Heuermann - IfBM Hamburg / Carl-von-Ossietzky University
R/V Sonne 120 - J.Waniek, T.Mitzka / K.Petuhov - IfM Kiel

The Indian data were collected and processed by National Institute of Oceanography, Dona-Paula Goa India and the Physical Research Laboratory, Ahemdabad, India.

The Dutch data were collected and processed by scientific and technical personnel from the Netherlands Institute for Sea Research (NIOZ), Texel, the Netherlands.

The UK data for Discovery cruise 209 were collected and processed by scientific and technical personnel from the Southampton Oceanography Centre. The remaining cruises were collected by technical personnel from Research Vessel Services and worked up by the staff of the British Oceanographic Data Centre.

The Russian and additional American data were provided by the Canadian Marine Environmental Data Service (MEDS) through the Global Temperature-Salinity Pilot Project (GTSPP), an IOC / WMO project and a joint venture by nine participating member states of IOC. The four cruises of CTD data (UM90 and ER90 from USSR ships, and WT95 and NZ96 from USA ships) were made available to the scientific community through the GTSPP, as TESAC messages transmitted in near real-time through the GTS. Subsequent quality control was undertaken by MEDS.

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National Science Foundation (NSF), USA
Office of Naval Research (ONR), USA
National Aeronautics and Space Administration (NASA), USA
Department of Energy (DOE), USA
National Environmental Research Council (NERC), UK
Defence Evaluation and Research Agency, UK.
Bundesministerium für Bildung und Forschung (BMBF), Germany
Department of Ocean Development (GOVT), India
The Netherlands Marine Research Foundation (SOZ), Netherlands
Department of Fisheries and Oceans (DFO), Government of Canada

I am most grateful to all the scientists involved in the international JGOFS programme for delivering their data and preparing parts of the data set documentation to the international JGOFS data management system.

A key role in this project was undertaken by the Data Management Task Team, chaired by Roy Lowry from the BODC, UK. Thank you very much to the DMTT members and the JGOFS IPO for their professional and always constructive co-operation, their contributions and suggestions. I also want to thank Markus Klindworth, a young student of the Physical Department, for programming, helping to bring all data into the correct format and preparing the HTML framework with JAVA.

Again, thank you very much to everybody supporting this work,

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