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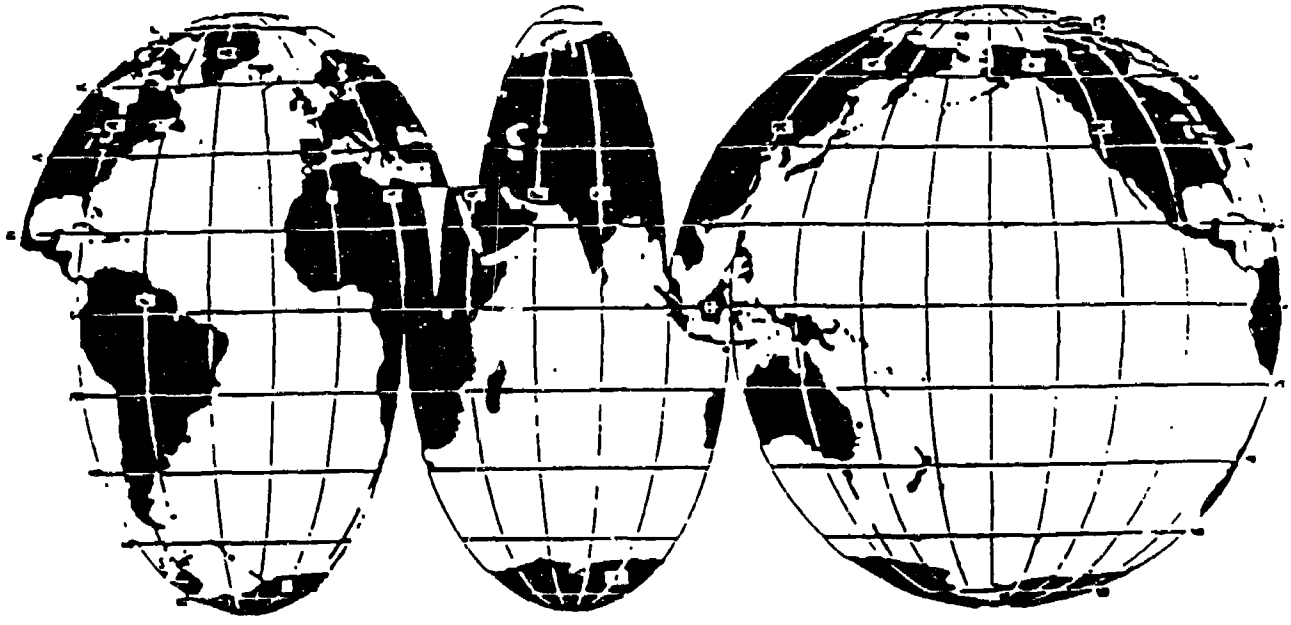
INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION

WORLD METEOROLOGICAL ORGANIZATION

UNITED NATIONS ENVIRONMENT PROGRAMME

GLOBAL OCEAN OBSERVING SYSTEM

STATUS REPORT ON EXISTING OCEAN ELEMENTS AND RELATED SYSTEMS



DECEMBER 1993

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1. GOOS STATUS, ACCOMPLISHMENTS AND FUTURE ACTIONS

1.1. BACKGROUND

1989 IOC (consisting of 123 Member States) initiated a Global Ocean Observing System (GOOS) jointly with WMO and UNEP.

1990 Second World Climate Conference - supported the development of GOOS as a major element of the Global Climate Observing System (GCOS).

1992 UNCED, Agenda 21 - IOC called for Member States to support its initiative, in collaboration with WMO and UNEP, to continue development and implementation of GOOS. Establishment of GOOS Support Office in IOC Secretariat.

1993 First Session of IOC Committee for GOOS (I-GOOS) and Seventeenth Session of the IOC Assembly endorsed *Approach to GOOS* as a major document for GOOS planning and development. A number of GOOS Module Panels underway: Ocean Observing System Development Panel (OOSDP) - work expected for completion by end of 1994; Health of the Ocean Panel (HOOP) - draft report presented to IOC Seventeenth Assembly; Marine Living Resources Panel - established late 1993, 1st meeting, Costa Rica, 7-10 December 1993; Marine Services Panel formation in progress.

1.2 GOOS OBJECTIVES/CONCEPT

(i) GOOS was initiated by IOC, in co-operation with WMO, UNEP and ICSU is a major endeavor in the ocean megascience activities for the next century to address such global issues as global environmental and climate change, as recognized also by UNCED and SWCC, as well as aspects of sustainable development in relation to rational use of ocean resources and integrated coastal zone management.

(ii) GOOS is a multi-disciplinary approach to systematic long-term observations of the World ocean and requires close collaboration of various national agencies and institutions dealing with scientific research, operational services, technology development and exploration and exploitation of marine resources.

It is essential that we start developing GOOS now as a global framework for systematic ocean observations to meet needs for detecting and forecasting climate variability and change; for assessing the health or state of the marine environment and its resources, including the coastal zone; and for supporting an improved decision-making and management process--- one which takes into account potential natural and man-made changes in the environment and their effects on human health and resources. The planning presently encompasses five modules: (i) Climate Monitoring, Assessment and Prediction; this module is common with the ocean component of GCOS-the Global Climate Observing System; (ii) Monitoring and Assessment of Marine Living Resources; (iii) Monitoring of the Coastal Zone Environment and Its Changes; (iv) Assessment and Prediction of the Health of the Ocean; and (v) Marine Meteorological and Oceanographic Operational Services. The major elements of GOOS are operational, oceanographic observations and analyses, timely distribution of data and products, data assimilation into numerical models leading to predictions, and capacity building within participating Member States, especially in developing countries, to develop analysis and application capability. GOOS will be developed in a phased approach: (i) a planning phase including conceptualization, design and technical definition; (ii) operational demonstrations for each of the five modules; (iii) implementation of permanent aspects of the Global Ocean Observing System; and (iv) continued assessment and improvement in the individual aspects of the entire system.

Today we are experiencing unprecedented pressures on our natural resources. Sustainable development of these resources is hindered by our inability to detect emerging environmental problems at an early stage when remedial measures are still possible. Nowhere is this inadequacy so pronounced

as in the marine area. Global energy cycles and the biological processes upon which all life depends are critically influenced by the ocean. Governments collectively are only now beginning to recognize the complexity and interdependence of all aspects of the system. Systematic global observations of the world oceans are required to improve our knowledge and predictive capabilities which will be the basis for more effective and sustained use of the marine environment, with the associated economic benefits.

1.3 GOOS ON-GOING ACTIVITIES

- Integrated Global Ocean Service System (IGOSS) - jointly with WMO
- International Oceanographic Data & Information Exchange (IODE) - in co-operation with ICSU, FAO, and ICES
- IOC Group of Experts on the Global Sea-Level Observing System (GLOSS) - jointly with IAPSO, IHO
- Drifting Buoy Co-operation Panel (DBCP) - jointly with WMO
- Marine Pollution Monitoring - jointly with UNEP
- Coastal Pilot Monitoring Activities on Coral Reefs and Mangroves - jointly with UNEP, WMO and IUCN

1.4 1993 CALENDAR OF EVENTS

- First Session of IOC Committee on GOOS (I-GOOS), Paris, February 1993
- Seventeenth Session of the IOC Assembly, Paris, February-March 1993
- International GOOS Symposium and *ad hoc* J-GOOS Workshop, Tokyo, March 1993
- Seventh Session of the JSC Ocean Observing System Development Panel (OOSDP-VI), Lisbon, April 1993
- Intergovernmental Meeting on the World Climate Programme, Geneva, April 1993
- Sixth Session of the Intergovernmental TOGA Board, Geneva, April 1993
- CEOS Working Group Meeting, Boulder, May 1993
- Coastal Zone '93 (IOC Special Workshop & Symposium), New Orleans, July 1993
- Initial consultations with CMM/WMO on establishment and formulation of the Marine Services Panel, Geneva, July 1993
- Conclusion/signing of J-GOOS Memorandum of Understanding with WMO and ICSU J-GOOS Panel being formed
- First Session of the *Ad hoc* Panel on Marine Living Resources, San José, December 1993

1.5 ORGANIZATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (OECD) EXPERT MEETING, MEGASCIENCE FORUM (Tokyo, September 1993)

The Organization for Economic Co-operation and Development (OECD) in its series on megascience fora decided upon the urging of some member states that oceanography had come to a stage where it would be fruitful to have a forum on this topic. The purpose of this megascience forum expert meeting was to promote international co-operation in the field of oceanography, *viz* the balance of research, technology development and operations. It was recognized that ocean sciences, which include physical, chemical, biological and environmental oceanography, have not yet profited from the intergovernmental push to address adequately global problems in the marine environment. It must also be noted that the present capabilities are far enough advanced to use our knowledge of the role of the oceans to provide forecast of events from seasonal to interannual time scales and to estimate their effects on climate variability.

The meeting of experts recognized that the Global Ocean Observing System (GOOS) initiated by IOC in co-operation with WMO, UNEP and ICSU is a major endeavour in the ocean megascience activities to address such issues as global environmental and climate change, as recognized also by UNCED and SWCC, as well as aspects of sustainable development in relation to rational use of ocean resources and integrated coastal zone management. IOC and GOOS were represented by Dr. M. Glass, the Chairman of I-GOOS, and Dr. W. Scherer, the director of the GOOS Support Office and IOC

1.5.1 Oceanography on the Verge of Transition

Developments in oceanographic science and technology now permit a transition from a mainly science-driven activity to one where a marginal increase in investment will produce substantial benefits to society and the economy. Several Conventions have recognized the central role of understanding and predicting the ocean (Framework Convention on Climate Change, Convention on Biodiversity, Law of the Sea, and documents such as Agenda 21, etc.). The global ocean data sets and predictions can in several cases be incorporated into regional and local services to improve accuracy and economic value (e.g. storm surge prediction, forces on offshore structures were mentioned). The global dimension in ocean observation and modelling will provide the prediction of long-term fluctuations which cannot be predicted on the basis of local observations. A continuous flow of data is required in an operational programme combining remote sensing and *in situ* observations. This objective poses many critical challenges in organization, finance, scientific knowledge and technology. Examples are:

(i) Physical and biogeochemical knowledge have to be linked effectively with ecosystems modelling and social and economic sciences in a multidisciplinary approach to predicting global environmental and climate change. Useful services have to be based on this knowledge, and related to rational use of ocean resources, integrated coastal zone management, and the response to population pressure on the coast.

(ii) Models and observation sampling programmes have to be designed and interfaced at different scales and structures at the local, regional and global levels.

(iii) The need to develop new technological systems such as Acoustic Thermometry of Ocean Change (ATOC), biosensors, automated vehicles and robotic devices to obtain large quantities of data at minimum coast, as well as to transmit and assimilate vast quantities of data via computer networks into computer models, and make the information products rapidly available.

(iv) An operational system initiated in the next few years will require continuing oceanographic research in parallel, to improve understanding of underlying processes, check the accuracy of models and assumptions used in the operational system. Continuing research is also needed to discover new processes and phenomena which have not been anticipated, and hence to improve models. Procedures, techniques and data developed in the phase of pre-operational research will also be useful to advance the study of basic science in the ocean.

1.5.2 Cost-Benefit Analysis

Broad cost-benefit studies show that the range of social and economic benefits from the use of GOOS data products is probably a significant multiple of the cost, but more refined analyses are essential, considering each industry and activity separately. The improved analysis should relate the short-term and long-term impacts of the new operational services to the usual decision horizons of societal and economic institutions, and therefore to their willingness to pay. OECD should be asked to help in these studies.

1.5.3 Megascience Nature of GOOS

GOOS complies with the concept of Megascience on the grounds of its overall cost and scale, the need for global co-ordination and planning, and the timescale of 10-15 years which is needed for implementation. Whilst the main infrastructure and strategy of GOOS must be planned and implemented in a co-ordinated way, many of the components do not need to be centralized. This is especially true of the coastal zone.

1.5.4 Global, Regional and Local Scales

A distinction can be made between the planetary scale global ocean observing system itself, and the local systems and services which add fine-scale data and produce the multi-functional information which should eventually be paid for by users.

1.5.5 Co-ordination at a National and Regional Level

In order for GOOS to achieve its objectives, there must be effective alliances between relevant research and operational agencies and institutions at the national level. Governments should ensure that marine research, space, defence, coast guards, fisheries, coastal protection, to mention but some, co-operate in strong national protection, to mention but some, co-operate in strong national programmes to generate and utilize GOOS data. The transition from a science based discipline to an operational phase will require modification of the relationships between agencies and a restructuring of ocean research at national levels.

At the regional level, similar alliances are needed between the various national projects and programmes to ensure that problems and processes at the regional scale are addressed effectively. Similar collaboration is needed at the global scale. Efforts to organize collaboration in the context of EC and the European Science Foundation were noted with interest. Pacific Rim states are also collaborating to develop operational forecast procedures for the El Nino-Southern Oscillation (ENSO) which has a profound impact on Pacific fisheries and agriculture in the region. Co-operation in the development and use of costly tools will also be called.

Special attention is needed to involve the developing countries in terms of participation in data gathering and the use of data and data products. Mechanisms must be implemented bilaterally, regionally and multilaterally through the international bodies, to ensure that global coverage is attained, while serving also the interest of these countries and building up capacity in terms of manpower and institutions.

1.5.6 Organizational Requirements of an Operational Service

GOOS must make the transition from a concept to implementation in the course of the next 10 years. Design, planning and implementation require a top-down approach to ensure standard procedures and quality of data, especially in regard to the truly planetary scale of the global ocean. At the same time, the approach must not be too centralized, since many existing programmes need to be included in or interfaced with GOOS (for example, the Integrated Global Ocean Services System (IGOSS), the Global Sea Level Service System (GLOSS), etc.), and there must be scope for different countries to deploy optimum resources and inputs within the context of their administrative structures and national programmes. The UN Agencies and Organizations (IOC, WMO, UNEP) and the Scientific Committee for Oceanic Research (SCOR) of ICSU have an essential role in co-ordinating inputs to the design through the Joint Scientific and Technical Committee for GOOS. The oceanographic community, and especially the bodies responsible for the design of GOOS, must convey to the space agencies as early as possible the precise requirements for operational sensors to be flown, in view of the long lead time for planning space missions. Firm understandings and partnerships need to be developed between agencies. OECD is asked to convey this view to its Member governments.

1.5.7 Technology

GOOS can only succeed if there is a substantial investment in new technology. It is not possible to increase the rate of data gathering sufficiently simply by multiplying in number the present systems. New technology is needed in the fields of biosensors, mid-water drifting buoys, cheap disposable instruments, fibre optics technology, acoustic telemetry, acoustic tomography, acoustic thermometry, autonomous underwater vehicles (AUVs), moored buoys and instruments, robotic systems, data telemetry, data assimilation, modelling software, and super-computers custom designed for large models.

1.5.8 Financing and Human Resources

The cost of developing and implementing GOOS will be spread among many nations. At present, the global annual cost of all aspects of marine research and marine technology development is of the order of $10bn, based on aggregating the published reports of national R&D agencies in the major maritime nations. Based on parallels with global meteorological forecasting costs and known satellite costs, and equivalent operational programme for the world ocean would cost of the order of $1-2bn/year.

This represents a marginal increase in expenditure of 10-20% in order to achieve the benefits of exploiting oceanographic knowledge on a global scale in real time, and with long-term predictions. A more detailed case of cost-benefit analysis is required, as stated above.

The OECD Megascience Forum may be asked for assistance in devising coast-sharing models. The following points were especially mentioned:

(i) It will be necessary to differentiate between experimental phases and operational phase costs; and between co-ordination costs, development costs, operational service costs and costs of promoting capacity building in developing countries.

(ii) Operational service costs should be paid for by operational agencies and end user customers, not from science budgets.

(iii) In the transition from science based programmes to development of an operational system, there is a clear need for funds to support pre-operational research, which should not be funded from the existing science budget.

1.5.9 Data Policy

(i) The Meeting noted that the OECD Megascience Forum had already endorsed the principles for the availability and the exchange of data as laid down by CEOS, IOC and the OECD itself, and looked forward to the implementation of these guidelines in an operational system. It welcomed statements by WMO on its intentions to maintain its policy of open and unrestrained exchange of meteorological data.

(ii) There must be respect for the jurisdiction of coastal states arising from the Law of the Sea (UNCLOS). Partnerships should be developed through capacity building and involvement of coastal states in data gathering, and sharing data and data products.

(iii) Special emphasis is needed to ensure a standard high quality of all data in GOOS, with agreed data quality control procedures.

2. GLOBAL SEA-LEVEL OBSERVING SYSTEM (GLOSS)

Major efforts focused on the implementation of the recommendations of the Third Session of the IOC Group of Experts on GLOSS (Paris, 13-15 October 1992) [Document IOC/GE-GLOSS-II/3]. The Report of the Joint IAPSO-IOC Workshop on Sea Level Measurements and Quality Control (Paris, 12-13 October 1992) has been published in the IOC Workshop Report No. 81. It provides information on the methods for measuring sea level and advice on the methods for quality control and processing of sea level values.

The report of the Third Session of the IOC Group of Experts on GLOSS was reviewed and adopted by the First Session of the IOC Committee for the Global Ocean Observing System (I-GOOS) (February 1993) in its recommendation GOOS-I.3. This recommendation was adopted by the Seventeenth Session of the IOC Assembly (March 1993) in its Resolution XVII-5. By this Resolution the Secretary was instructed to arrange, through appropriate means and in consultation with Member States, for the position of a Technical Secretary for GLOSS as part of the GOOS Support Office. The Chairmen of the IOC Regional subsidiary bodies were invited in co-operation with Regional Co-ordinators for GLOSS to promote the development of GLOSS.

In response to the IOC Circular Letter No. 1375 of 31 March 1993 and communication with individual countries 17 countries provided the IOC Secretariat with updated information on status of GLOSS stations and national GLOSS contacts.

Russia reported on 5 more stations to be included in the GLOSS network. A GLOSS station in

Esperanza (Antarctica) was established by joint efforts of Argentina and USA. Several GLOSS stations were established and upgraded in Greenland by Denmark. USA assisted in installing satellite transmitting equipment at 3 GLOSS stations in the Indian Ocean. Total number of such stations equipped with satellite transmitting system in the Indian Ocean - 6. Chile has installed a new tide-gauge in the southern part of the country, where previously there was no coverage.

Sea Level Training Seminar/Workshop for Spanish and Portuguese speaking countries was organized from 1 to 21 February 1993 by the University of Sao Paulo, Brazil with the support of IOC. Trainees from Angola, Argentina, Chile, Mozambique, Sao Tome and Principe and Brazil attended the Seminar. The report of the Training Seminar has been published in the IOC Training Course Reports No. 20. This Seminar focused on analysis and application of sea level data.

In October/November the National Institute of Oceanography, India with the support of IOC provided training for two Vietnamese specialists on sea-level measurements, interpretation and analysis.

The development of the regional GLOSS component was reviewed by the IOC Regional Committee for IOCEA, at its Third Session (Dakar, Senegal, January 1993). IOC was requested to assist the countries of the region in obtaining equipment and support its installation.

IOCEA Regional Co-ordinator for GLOSS, Dr. L. Awosika, assisted the IOC in collecting information from the countries of the IOCEA region on their needs for tide-gauges, donated two years ago and available at present in Germany. The IOC Secretariat approached several countries with the request to assist Togo, Sierra Leone, Gambia and Côte d'Ivoire in installation of the available tide-gauges, through the IOC Voluntary Co-operation Programme.

IOCINCWIO Regional Co-ordinator for GLOSS, Mr. Mika Odido, assisted the IOC in collecting updated information on the status of the GLOSS stations in the countries of the region.

In August 1993, Dr. W. Scherer, Director of the GOOS Support Office, visited Uruguay and Brazil and discussed GLOSS development with national authorities. In September 1993, Dr. D. Pugh, Chairman of the IOC Group of Experts on GLOSS, visited Chile and Argentina and discussed GLOSS development with national authorities.

The second volume of the IOC Manual on Sea Level Measurements and Interpretation (IOC Manual and Guides No. 14) has been prepared by PSMSL with the assistance of experts from Proudman Oceanographic Laboratory (UK) and experts from other countries. It will be printed in the IOC series Manuals and Guides. PSMSL with the participation of experts from the Proudman Oceanographic Laboratory (UK) continued updating the GLOSS Handbook.

The "delayed mode" WOCE Sea Level Data Assembly Centre, operated by BODC (UK) has set up a public access directory containing the WOCE Sea Level Catalogue to allow access over Internet. TOGA Sea Level Centre issued its Annual Report for the year ending July 1993. Specialized Oceanographic Centre for IGOSS Sea Level Programme in the Pacific continued preparation and wide distribution of Pacific maps on a monthly basis showing deviations of sea level from 1975 to 1986 mean sea level and anomaly of sea level corrected for atmospheric pressure. The data presented on those maps can be obtained through the Internet system.

GLOSS definition and October 1993 Status, including updated list of national and international GLOSS contacts were circulated to National/International GLOSS Contacts in December 1993 (IOC Circular Letter No. 1397 of 27 December 1993).

The status of the GLOSS network and data flow will be described below.

2.1 "GLOSS93" DEFINITION

Following the Paris GLOSS GE meeting in October 1992, a large amount of correspondence took place between IOC and national authorities in order to redefine GLOSS as proposed by that meeting.

By Augu . 1993 that process had been completed to a great extent, enabling the definition of 'GLOSS93'. Compared to the old definition of GLOSS, that of the Implementation Plan which we now call 'GLOSS90', there are 18 additions to the network and 16 subtractions, giving a new network of 308 stations.

Of course, updated information on GLOSS is coming into IOC (and PSMSL, TOGA Center etc.) all the time. However, it is important that the 'official' or 'working' GLOSS definition is not changed too often to avoid confusion. No doubt future years will see a 'GLOSS94' and 'GLOSS2000'. The 16 stations OUT and 18 IN are as follows:

OUT
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186 Bahia Scotia (Argentina)	PSMSL code -	
48 Pelabuhan (Indonesia)	PSMSL 560/111	
301 Palmyra Island (USA)	PSMSL 770/001	
285 Nawiliwili (USA)	PSMSL 760/021	
286 Kahului (USA)	PSMSL 760/051	
80 Port Said (Egypt)	PSMSL 330/001	replaced by Hadera
184 Jubany (Argentina)	PSMSL -	
56 Hobart (Aus)	PSMSL 680/201	replaced by Spring Bay
55 Adelaide (Aus)	PSMSL 680/311	replaced by Portland
134 McMurdo (USA)	PSMSL A /061	replaced by Scott Base
211 Bimini (Bahamas)	PSMSL -	replaced by Settlement Point
12 San Salvador (Bahamas)	PSMSL -	replaced by Exuma
179 Punta Arenas (Chile)	PSMSL 850/061	replaced by Diego Ramirez
180 Puerto Williams (Chile)	PSMSL 850/081	ditto
200 Porto de Itaqui (Brazil)	PSMSL -	replaced by Ponta da Madeira
227 Nord (Denmark)	PSMSL -	replaced by Danmarkshavn

Note that this OUT list does not contain other stations that it was agreed in Paris will probably never happen (e.g. Bouvet) but they have not been formally removed.

IN
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307 Won San	PSMSL 625/011	(this was included already in some definitions of GLOSS90)
80 Hadera (Israel)	PSMSL -	replaces Port Said
56 Spring Bay (Aus)	PSMSL 680/199	and /200 replaces Hobart
55 Portland (Aus)	PSMSL 680/231	and /232 replaces Adelaide
308 Thevenard (Aus)	PSMSL 680/440	and /441 New GLOSS station
134 Scott Base (NZ)	PSMSL -	replaces McMurdo
309 Providenya (Russia)	PSMSL -	New GLOSS station
310 Kronstadt-Shepelevo	PSMSL -	"
311 Nakhodka	PSMSL -	"
312 Dikson	PSMSL -	"
313 Tiksi	PSMSL -	"
211 Settlement Point (Bahamas)	PSMSL 941/001	replaces Bimini
12 Exuma (Bahamas)	PSMSL 941/021	replaces San Salvador
180 Diego Ramirez (Chile)	PSMSL -	replaces Punta Arenas and Puerto Williams
314 Walvis Bay (Namibia)	PSMSL 427/001	New GLOSS station
200 Ponta da Madeira (Brazil)	PSMSL -	replaces Porto de Itaqui
227 Danmarkshavn (Denmark)	PSMSL -	replaces Nord
315 Ittoqqortoormiit(Denmark)	PSMSL -	New GLOSS station

All of these 18 IN stations should be considered 'Committed to GLOSS' in the sense of that term used in the Implementation Plan except, so far, for the five Russian stations and Walvis Bay.

2.2 GLOSS STATUS

For the last few years, usually coinciding with a GLOSS GE meeting, the PSMSL has provided a summary of the status of GLOSS from its viewpoint. An 'operational' station from a PSMSL viewpoint means that recent MSL monthly and annual values have been received at Bidston, have been checked as far as possible, and have been included in the databank. For each of the GLOSS stations we have used the year of the last data entered into the databank, if any, to place the station into one of four categories:

Category 1: 'Operational' stations for which the latest data is 1989 or later;
Category 2: 'Probably operational' stations for which the latest data is within the period 1979-1988;
Category 3: 'Historical' stations for which the latest data is earlier than 1979;
Category 4: For which no PSMSL data exist.

Table 1 lists the number of stations which fall into each category for all stations, then for the subset which have been 'committed to GLOSS'. ('Committed to GLOSS' means that formal commitments have been made by national authorities to IOC to keep gauges operational). Also shown are the numbers in each category reported at previous GLOSS meetings with the category definitions adjusted backwards one, two, three etc. years appropriately.

It can be seen that there has been a general modest improvement in the last few years, and a significant improvement in the last year. The reason for this is NOT that we are now defining GLOSS by GLOSS93, whereas before we were using GLOSS90. Indeed, inspection of the 16 OUT and 18 IN stations above will show that we have not biased the statistics positively by the network changes. Also the improvement was already underway by the Paris GE meeting. Rather, the general modest improvement has continued but with the notable contributions in the last year of an Australian dataset to the PSMSL by Bill Mitchell of the NTF, updated Canadian data from Andre Bolduc and even the first ACCLAIM data from the UK.

Table 1
Number of Stations in Each Category (All Stations)

Category	Bidston GE Mtg. June 89	Miami GE Mtg. Oct 90	Vienna IUGG Aug 91	Paris GE Mtg. Oct 92	Nowhere Oct 93
1	105	133	136	158	177
2	51	50	57	46	33
3	47	42	36	29	26
4	103	81	77	73	72
Total	306	306	306	306	308

3. IGOSS ACTIVITIES

Both IOC and WMO have emphasized that GOOS must be built on existing ocean observing programmes and data management systems which, *inter alia*, include the Integrated Global Ocean Services System (IGOSS).

The Integrated Global Ocean Services System (IGOSS) which is jointly co-ordinated by the Intergovernmental Oceanographic Commission (IOC) of UNESCO and the World Meteorological Organization (WMO) has a unique position in promoting and implementing operational oceanography world-wide. The main components of IGOSS are the

(i) IGOSS Observing System (IOS);
(ii) IGOSS Data Processing and Services System (IDPSS);
(iii) IGOSS Telecommunication Arrangements (ITA).

Data are collected on fixed platforms, drifting buoys, research ships, fishing vessels, and merchant ships. They are transmitted through a coastal radio station or a satellite ground station to a National Oceanographic Centre (NOC)/National Meteorological Centre (NMC) for quality control and subsequent input to the Global Telecommunication System (GTS) of WMO.

The variables measured presently are surface and sub-surface temperature, salinity and currents. But IGOSS is also running an operational programme for sea-level measurements in the Pacific Ocean. This programme is being extended to the Indian Ocean. A sea-level pilot programme in the North and Tropical Atlantic Ocean is being developed. Monthly evaluations of the sea-level topography for the Pacific Ocean is prepared by the IGOSS Sea-Level Data Centre in Honolulu.

There is an urgent need for the exchange of more operational ocean data to meet the requirements of the various users of IGOSS data. Member States have been urged to identify additional existing data sources.

Major processing and services projects are OCEAN-PC and GTSPP (Global Temperature/Salinity Pilot Project). These projects are co-sponsored by IOC's Committee on International Oceanographic Data and Information Exchange (IODE).

OCEAN-PC assembles and links existing software into a coherent and user-friendly software package on PC micro-computers; thus facilitating the preparation of oceanographic products in developing and developed countries.

GTSPP is a joint project of data centres and academic institutions. The general tasks of GTSPP are to improve real-time capture of ocean data, to quality control both real-time and delayed mode data, to monitor both real-time and delayed mode data flow, and to prepare and distribute data products.

Another major activity of IGOSS is the publication of an IGOSS Products Bulletin which shows a sampling of the great variety of oceanographic products to which IGOSS data have largely contributed.

IGOSS has demonstrated its ability to provide international co-ordination of ocean data collection, data transmission, quality control, and product preparation. It has provided the means to distribute ocean data and products to users and to conduct technical evaluations of the data observation and data transmission techniques. In this manner, IGOSS has shown its capability to provide the basis for the operational oceanographic components of the Global Ocean Observing System (GOOS).

In support of GOOS, the following operational activities were conducted in 1993: The Sixth Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes was held in Hobart, Australia from 23 to 26 March, 1993. The Meeting discussed present and future activities of the programme and recommended that GOOS Planning Committees consider the SOOP and XBT sampling programmes as very high priority. The IGOSS Operations Co-ordinator is now monitoring XBT sampling and producing a biannual report of sampling based on input from participating member states. This 6 month report is compiled and disseminated by the Operations Co-ordinator in October for the January through July period and in March for the August-December period. In addition, tracking of data by TOGA-WOCE-IGOSS lines has been implemented in this report and several line changes have been recommended (see pp 11, 12, 13).

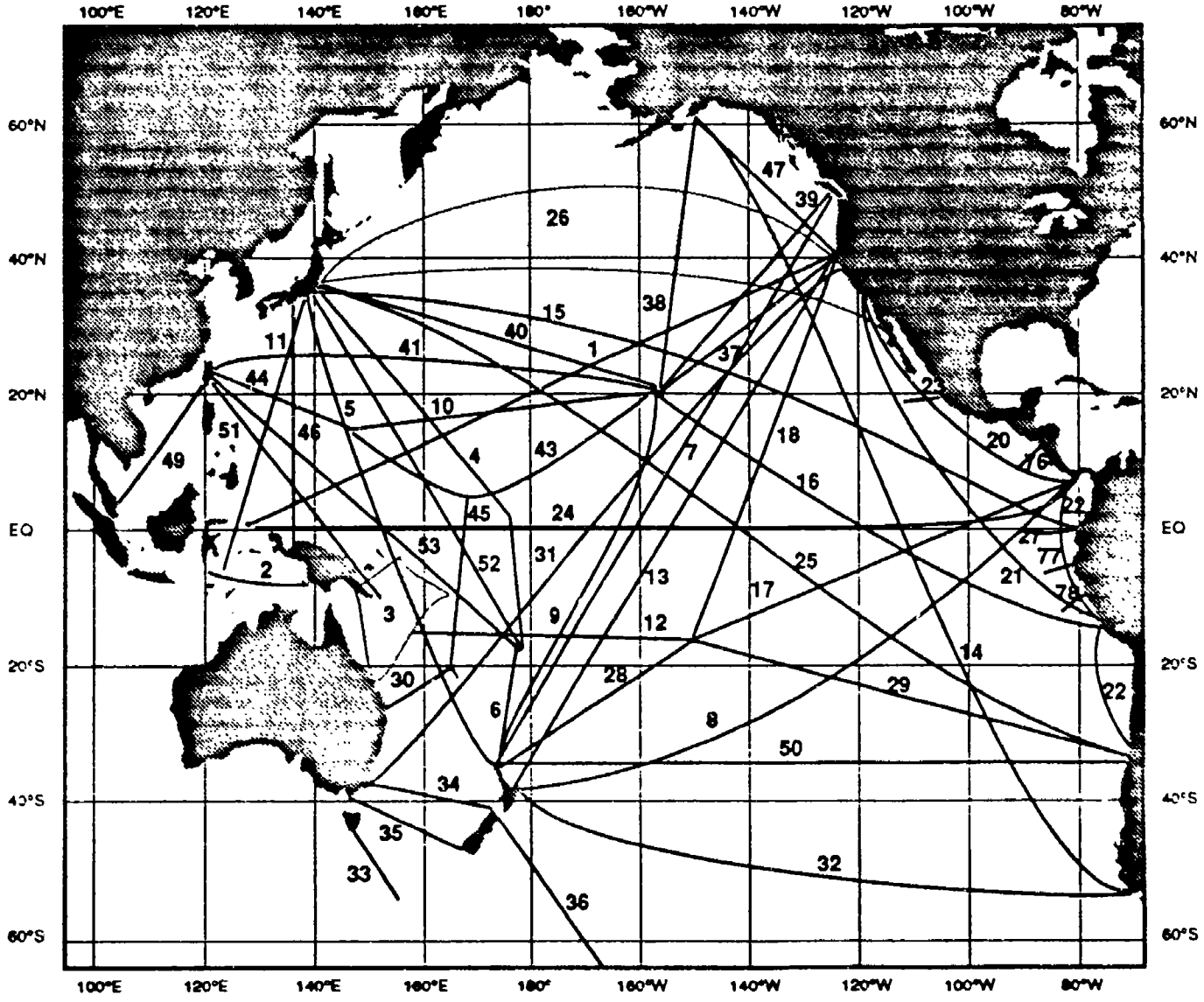
In addition to this monitoring effort, the co-ordinator has been assisting the GTSPP effort in Quality Control monitoring by notifying XBT programme operators of problems discovered through the QC routines conducted by the GTSPP. There has been a positive response to this effort from the operators thus far.

The IGOSS Operations Co-ordinator represented the Global Ocean Observing System at the Fourth International Conference on Southern Hemisphere Oceanography and Meteorology in Hobart in April, 1993. A display presenting the plans and objectives of GOOS along with a paper which was presented to the conference on behalf of the Secretary, IOC. He also presented a paper for the Secretary, IOC on GOOS at the Clean Oceans '93 Conference in Malta.

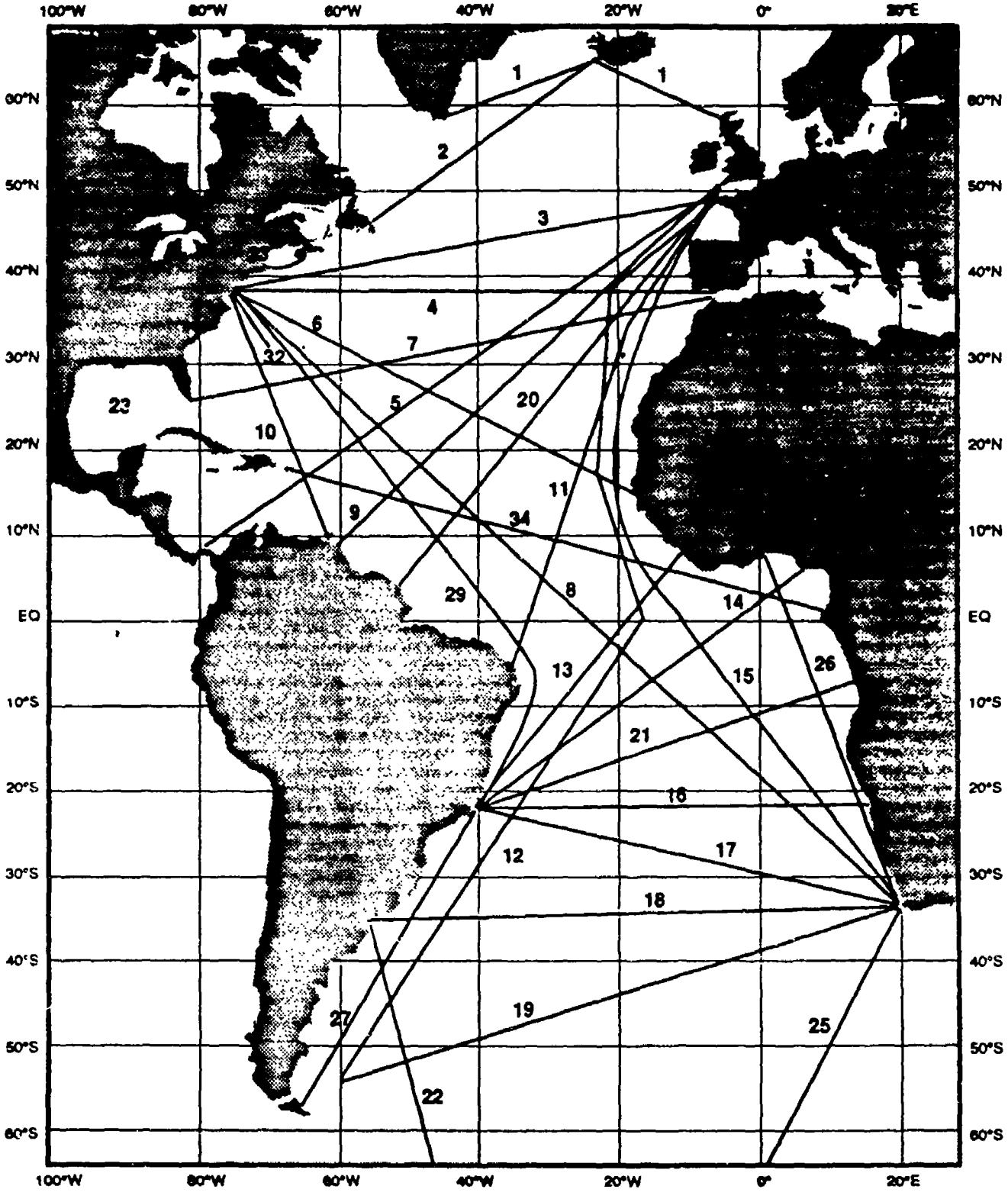
The IGOSS Operations Co-ordinator represented the IOC at the WMO First International Seminar/Workshop for Port Meteorological Officers at the IMO London from 20 to 25 September, 1993. He presented a paper accompanied by a visual presentation on co-operation between PMO's and the IGOSS Ship-of-Opportunity Programme. The seminar recommended that PMO's should co-operate with and assist, whenever possible, oceanographers in the management of the Programme.

The Co-ordinator also developed code changes for BATHY massages which will include further information on instrumentation and fall rate equations. This recommendation will be submitted to the CBS Working Group on Data Management by Th. R. Keeley of MEDS this February in Geneva.

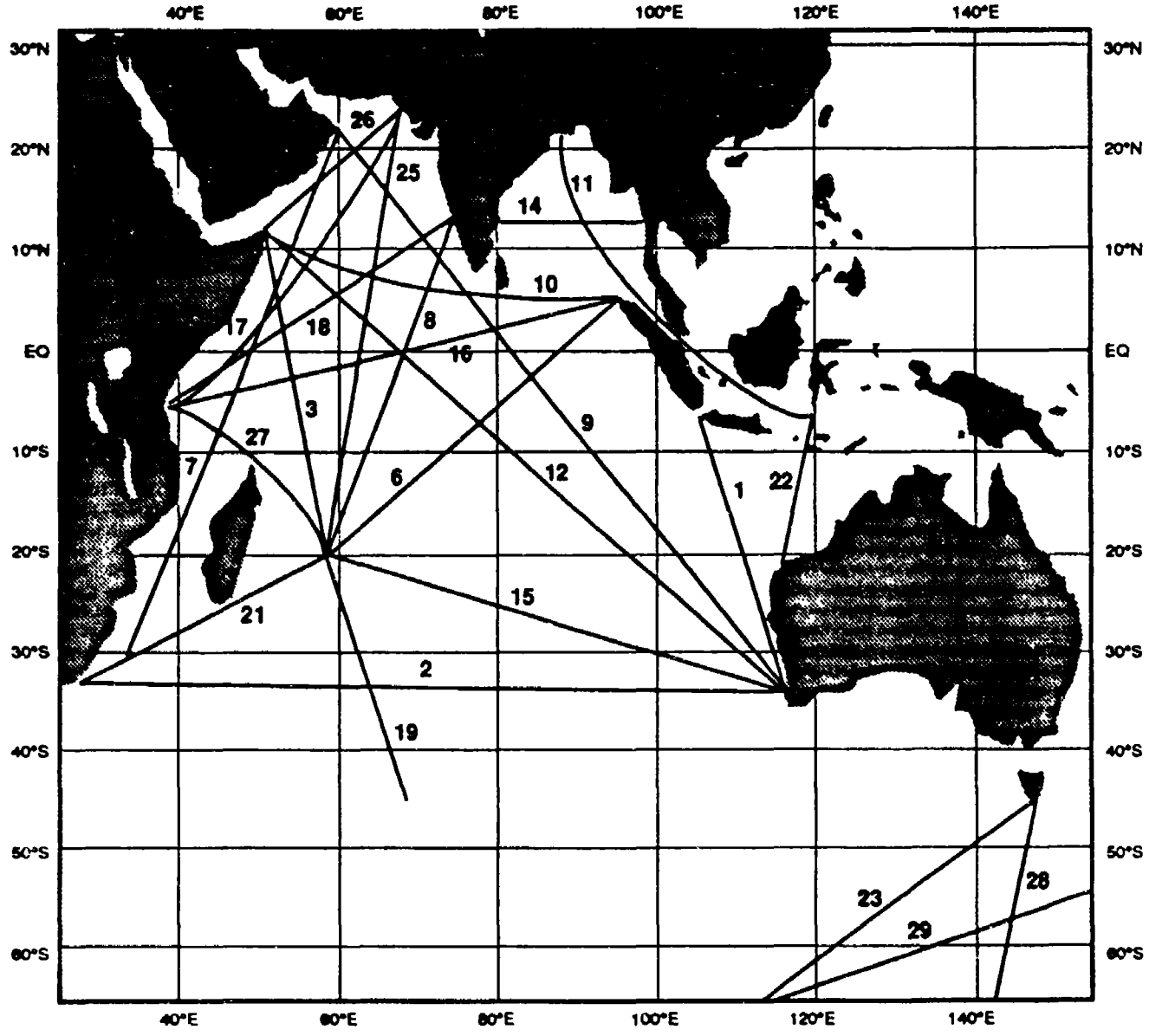
Pacific Ocean TOGA/WOCE/IGOSS Lines



Atlantic Ocean TOGA/WOCE/IGOSS Lines



Indian Ocean TOGA/WOCE/IGOSS Lines



3.1 IGOSS DATA PROCESSING AND SERVICES SYSTEM (IDPSS)

The IDPSS consists of national, specialized and world oceanographic centres for the processing of observational data, the provision of products, services and operational data exchange activities to various marine user groups. Seventeen countries have officially established a National Oceanographic Centre and six have established one (or more) of the seven IGOSS Specialized Oceanographic Centres and/or World Oceanographic Centres. These seventeen countries prepare 73 sub-surface and 190 surface IGOSS products. An additional 23 sub-surface and 130 surface IGOSS products are prepared by 29 other countries.

The first IGOSS Products Bulletin was published in September for the month of June 1991. Although this first issue is an important breakthrough in the dispersal of information through IGOSS, several key improvements need to be made, including standardization of products to make them usable to a wide audience, timely submission of the products to the editors and identification of responsibilities for regular publication of the Bulletin.

IGOSS Products are disseminated promptly through the Global Telecommunications System (GTS) and by radio, radio facsimile, and various electronic and hard-copy mail systems. The IGOSS Products Bulletin, established in 1991, compiles and publishes IGOSS global and regional products as a valuable service to the scientific community and international programmes.

3.2 IGOSS TELECOMMUNICATIONS ARRANGEMENTS

The IGOSS Telecommunication Arrangements continued to consist mainly of telecommunication facilities of the World Weather Watch Global Telecommunications system and other arrangements necessary for the rapid and reliable collection and distribution of observational data and processed information. The status of this system is discussed on page 15.

Some BATHY/TESAC reports collected from ships are transmitted over the International Maritime Mobile Service to the nearest coastal radio station which has been designated to accept the reports free of charge to ships, or through the INMARSAT system. At present 130 coastal radio stations have been designated by 33 Members to receive BATHY/TESAC reports free of charge to the reporting platform. Of these, 50 stations are HF radiotelegraphic coastal stations designated for the reception of reports from platforms on the high seas.

Six Coast Earth Stations are currently operating for the collection of ships' weather reports without charge to ships. Only the CES of Australia, Japan, Saudi Arabia and the USA accept BATHY/TESAC messages at the present time. At the present, INMARSAT is operating on 2947 Voluntary Observing Ships (VOS), which represents about 40 per cent of the total.

3.3 THE ARGOS SYSTEM

The Argos system is used for the collection and transmission of ocean data from fixed or moving platforms equipped with Platform Transmitter Terminals. It has proved particularly useful for the transmission of data from automatic stations such as buoys and from the Indian Ocean where there is no GOES coverage. In September 1992, the Argos service was handling reports from 1075 drifting buoys, 290 moored buoys, 4 balloons and 235 miscellaneous platforms. A discussion of the status of buoy activities is given on page 24. [See page 19].

3.4 MARINE METEOROLOGY AND ASSOCIATED COMPONENTS OF THE WORLD WEATHER WATCH

3.4.1 Global Observing System

Table 2 (pp 20-21) lists, by country, the number of vessels which participated in the WMO Voluntary Observing Ship (VOS) scheme in 1993 - a total of 7316 recruited by 49 countries. See p. 18, depicts the global coverage of marine meteorological reports from the VOS during the month of

September 1993, with the total for the month of 125028 representing an average of about 4,167 reports per day received at the main meteorological analysis centres. Such real-time reports were communicated to shore through 331 coastal radio stations (CRS) and 10 INMARSAT Coast Earth Stations (CES), for insertion onto the GTS for global dissemination. All such communications are free-of-charge to ships, the costs being borne by the national Meteorological Services in the countries concerned. The use of the INMARSAT system for the transmission of ships' reports continues to expand, with more than 3000 VOS being equipped with INMARSAT Ship Earth Stations in 1993 and this number is likely to increase to close to 100 percent of the voluntary observing ships by the year 2000, in view of the formal requirement for the carriage by most ships of INMARSAT equipment as part of the Global Maritime Distress and Safety System of PMO. Efforts are also being made to increase the numbers of CES which have agreements with their national Meteorological Services to receive ships' meteorological and oceanographic reports, free-of-charge to the ships and forward them for GTS distribution.

WMO and INMARSAT are working closely on the development and implementation of compressed formats, for use with the INMARSAT-C system, for the rapid transmission of meteorological and oceanographic reports from ship to shore. By drastically reducing transmission times, the use of such formats will also generate substantial cost reductions to national Meteorological Services for the collection of these reports. It is hoped that distribution of format and encoding / decoding software to national Meteorological Services operating VOS will be completed in early 1994, to allow rapid implementation on VOS.

3.4.2 Global Telecommunications System

The Main Telecommunication Network (MTN) consists of 23 point-to-point circuits linking together three World Meteorological Centres and 15 designated Regional Telecommunication Hubs which are as follows:

- WMCs Melbourne, Moscow and Washington

- RTHs Algiers, Beijing, Brasilia, Bracknell, Buenos Aires, Cairo, Dakar, Jeddah, Nairobi, New Delhi, Offenbach, Toulouse, Prague, Sofia and Tokyo.

All MTN circuits are in operation. The latest information concerning the present operational status of individual circuits and plans for further upgrading is given in Tables 3-4 (pp 22-23).

Nineteen MTN circuits are telephone-type circuits operating at a data-signalling rate of 9600 bit/s or higher using multiplexing facilities. The full X.25 procedures (including packet level) which permit the exchange of data in binary form (for example GRIB or BUFR code form) are implemented on 13 circuits of the MTN. All of the MTN centres are automated.

The regional meteorological telecommunication networks in the six WMO Regions consist of an integrated system of circuits, satellite-based systems and radio broadcasts in accordance with the regional telecommunication plans established by the Regional Associations. The present plans of the network comprise 246 main regional circuits and 22 interregional circuits. (The definitions of the various types of circuits are given in the Manual on the GTS). In addition to the telecommunication centres on the Main Telecommunication Network (all of which have regional functions) the regional meteorological telecommunication networks also require the esteblishment and operation for telecommunication purposes of 15 RTHs, six Regional Specialized Meteorological Centres not associated with RTHs and 148 NMCs or centres with similar functions.

Of the 268 main regional, regional and interregional circuits called for the GTS plan, 221 circuits have been established; the percentage of implementation is therefore 82 per cent. These 221 main regional, regional and interregional circuits have been established as follows:

(a) 78 (35 per cent of the 221 established circuits) are leased telephone-type circuits. Thirty-seven are now operating at 9600 bit/s using multiplexing facilities and 41 others are operating at data-signalling rates higher than 1200 bit/s. The full X.25 procedures (including packet level), which

permit the exchange of data in binary form (e.g., GRIB or BUFR code form), are implemented on 19 of these circuits;

(b) 114 (52 per cent of the 221 established circuits) are leased telegraphic circuits operating at a low data-signalling rate (50 or 75 baud), in some cases 100 or 200 baud);

(c) 29 (13 per cent of the 221 established circuits) are HF circuits operating at a low data-signalling rate (50 or 75 baud). Most of these HF circuits are located in Region I(Africa).

With a view to meeting the needs of ever-increasing volumes of traffic, calling for greater speeds in the relay of data, a number of RTHs and RSMCs and NMCs, or centres with similar functions, have automated their telecommunication functions or have plans to do so. At present, 30 RTHs (including three WMCs and 15 RTHs located on the MTN) and 59 RSMCs (not associated with RTHs) or NMCs are automated.

The collection of observational data from observing stations via the meteorological geostationary satellites (GOS, GOES and METEOSAT) is expanding, particularly in Africa. The use of satellite-based distribution systems, like the METEOSAT data distribution (MDD) system, is also developing as a complementary means to the point-to-point circuits.

3.5 WMO APPLICATIONS OF METEOROLOGY PROGRAMME

For the purpose of the efficient and effective provision of meteorological information for marine pollution emergency response operations on the high seas and in view of the international character of these operations WMO proposed a new Marine Pollution Emergency Response Support System (MPERSS).

The MPERSS uses the same ocean areas as the WMO GMDSS Marine Broadcast System, but does not require routine broadcasts of meteorological information to users on the high seas and proposes that designated Members should be prepared to provide, at a short-notice, specific meteorological/oceanographic information to pre-designated authorities, relevant to limited ocean areas within their overall areas of responsibility and for a limited period of time.

The WMO with other relevant international organizations including in particular, IOC, UNEP and IMO developed the proposed MPERSS, which will be implemented after 1 January 1994 as a trial system.

The WMO Member States continue to use the satellite-based maritime telecommunications systems such as INMARSAT and ARGOS for data collection and transmission.

The WMO co-ordinates closely with INMARSAT officers on the enhanced use of the system for meteorological and oceanographic data collection purposes. In this context the new INMARSAT-C facility had been developed for two-way store and forward telex or data messaging communications from ships. This system would bring about a number of advantages and improvements in procedures for generating and transmitting ships meteorological and oceanographic reports, at considerably lower costs to many national Meteorological Services, than was the case today.

The use of the ARGOS system had continued to expend for the collection and location of environmental data from remote ocean platforms. In addition to date collection and location from drifting and moored buoys, ARGOS also provided facilities for the collection of data from ships and tide-gauge stations and, where appropriate, their encoding into relevant WMO code forms such as SHIP, BATHY, BUFR for global distribution on the GTS. The CLS/Service ARGOS and the DBCP had jointly developed a new ARGOS GTS processing chain, for the management of data within the ARGOS system destined for GTS distribution. This new chain which would be fully operational in 1994, would greatly improve the efficiency and flexibility such data management by ARGOS, with consequent benefits to platform operators and data users alike.

There are continuing and increasing requirements for many WMO Members to provide high quality sea wave data and wave analysis and forecast services to an expending community, such as shipping and offshore industry, coastal engineering, recreation, aquaculture, fisheries, pollution control, etc. In this context WMO has developed the Wave Programme in assisting Members to expand their wave-related services. Many of the initial objectives set out for the Programme when it was first adopted in 184 had already been achieved. The new Wave Programme during the period 1993-1997 has been developed by WMO and will be comprised such elements and activities as wave observations and related marine surface data, wave analysis and forecasting including guidance material and assistance, special related services and new techniques and experiments for measurement of waves and surface wind.

Further, WMO will provide assistance in the creation of new national and international wave programmes providing guidance and assistance to Members in establishing wave related services and in implementing wave models.

METEO-FRANCE/SMISO

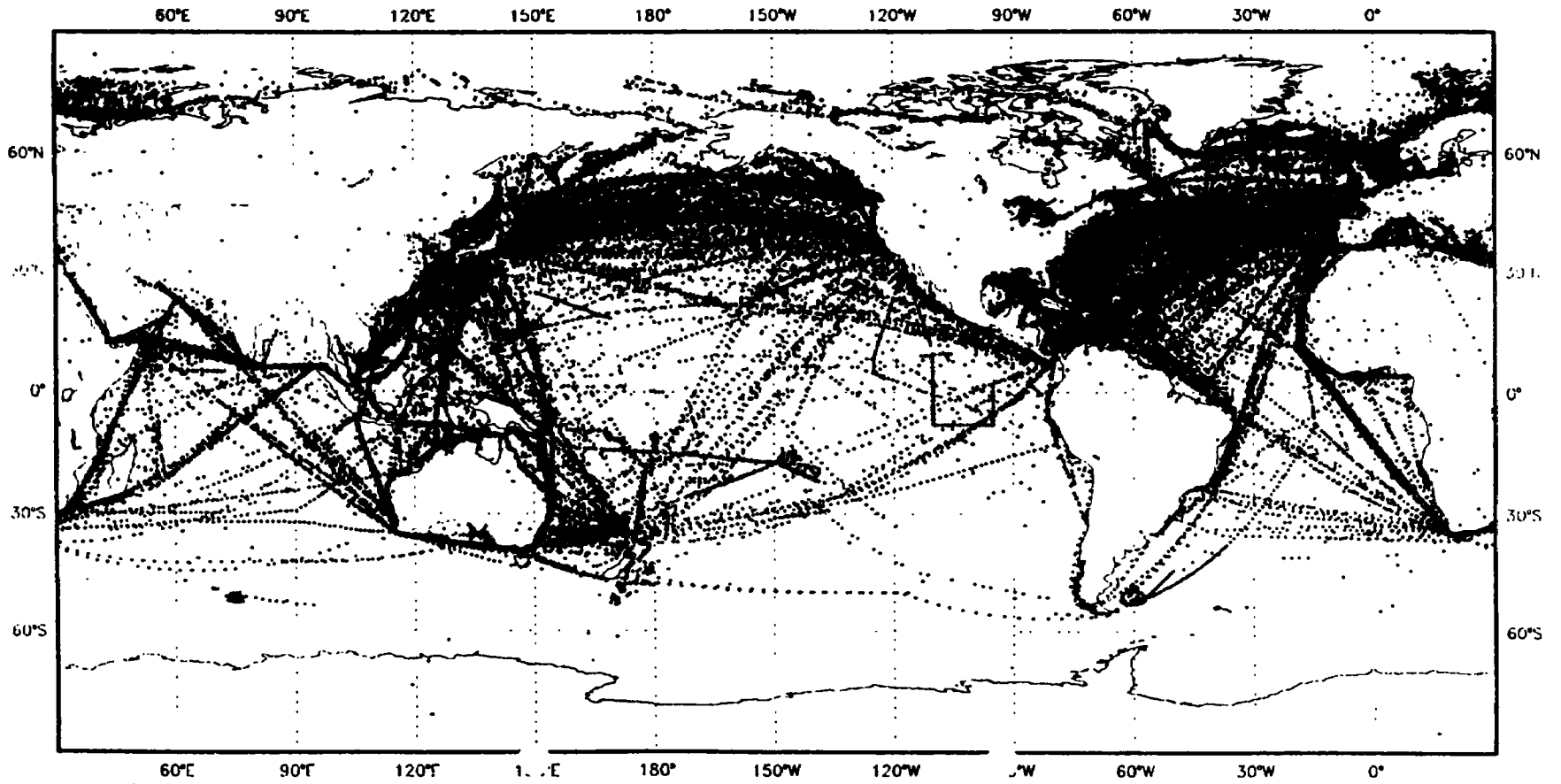
FRENCH MET OFFICE/IGOSS

Carte de pointage des observations recues en Septembre 1993

Mapping position plot chart of data received during September 1993

Messages : SHIP

Total : 125028



MAGICS 4.0 NOS/VE - IGOSS23 5 October 1993 12:46:20

METEO-FRANCE/SMISO

FRENCH MET OFFICE/IGOSS

Repartition par carre Marsden des observations recues en Septembre 1993

Marsden square distribution chart of data received during September 1993

Messages : DRIFTER

Total : 78505

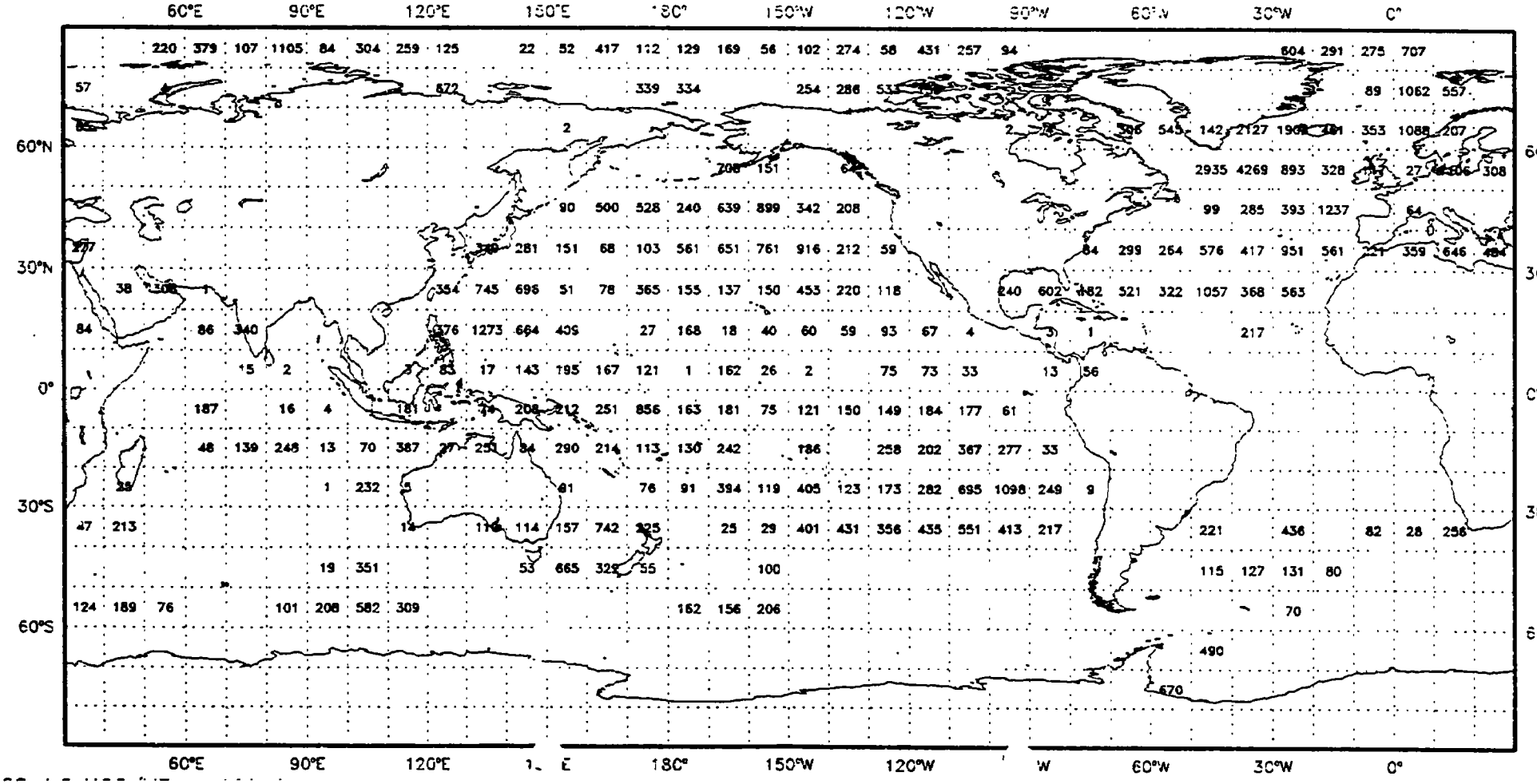


TABLE - TABLEAU 2

LIST OF COUNTRIES and SUMMARY TABLE of Selected, Supplementary and Auxiliary Ships participating in the WMO Voluntary Observing Scheme

LISTE DES PAYS et TABLEAU RÉCAPITULATIF des navires sélectionnées, supplémentaires et auxiliaires participant au système de navires d'observation bénévoles de l'OMM

COUNTRY / PAYS		SELECTED SHIPS / NAVIRES SÉLECTIONNÉS			SUPPLEMENTARY SHIPS / NAVIRES SUPPLÉMENTAIRES			AUXILIARY SHIPS / NAVIRES AUXILIAIRES	COUNTRY TOTALS / TOTAUX PAR PAYS
		Merchant ships (1) / Navires marchands	Trawlers / Chalutiers	Total	Merchant ships / Navires marchands	Trawlers / Chalutiers	Total		
1		2	3	4	5	6	7	8	9
Argentina	Argentine	28	-	28	-	-	0	-	28
Australia	Australie	100	-	100	3	-	3	2	105
Bangladesh	Bangladesh	6	-	6	1	-	1	-	7
Belgium	Belgique	66	-	66	-	-	0	-	66
Brazil	Brésil	7	-	7	172	-	172	148	327
Bulgaria	Bulgarie	6	-	6	28	-	28	-	34
Canada	Canada	134	1	135	-	-	0	298	433
Chile	Chili	2	-	2	-	-	0	-	2
China	Chine	47	-	47	-	-	0	-	47
Croatia	Croatie	37	-	37	16	-	16	3	56
Cuba	Cuba	5	-	5	-	-	0	-	5
Democratic People's Republic of Korea	République populaire démocratique de Corée	3	-	3	10	-	10	-	13
Denmark	Danemark	15	-	15	4	-	4	17	36
Finland	Finlande	-	-	0	13	-	13	-	13
France	France	140	-	140	-	-	0	-	140
Germany	Allemagne	468	12	480	44	1	45	39	564
Greece	Grèce	10	-	10	-	-	0	23	33
Hong Kong	Hong-kong	73	-	73	19	-	19	1	93
Iceland	Islande	-	-	0	24	-	24	6	30
India	Inde	17	-	17	176	-	176	35	228
Indonesia	Indonésie	-	-	0	14	-	14	16	30
Ireland	Irlande	8	-	8	-	-	0	-	8
Israel	Israël	38	-	38	-	-	0	-	38
Italy	Italie	13	-	13	-	-	0	-	13

TABLE - TABLEAU 2

1		2	3	4	5	6	7	8	9
Jamaica	Jamaïque	1	-	1	-	-	0	-	1
Japan	Japon	119	-	119	17	-	17	-	136
Kenya	Kenya	-	-	0	1	-	1	13	14
Malaysia	Malaisie	32	-	32	33	-	33	28	93
Netherlands	Pays-Bas	128	-	128	72	-	72	-	200
New Zealand	Nouvelle-Zélande	37	-	37	3	-	3	13	53
Norway	Norvège	25	-	25	-	-	0	-	25
Pakistan	Pakistan	9	-	9	2	-	2	5	16
Philippines	Philippines	34	-	34	8	-	8	7	49
Poland	Pologne	60	-	60	64	-	64	48	172
Portugal	Portugal	15	-	15	-	-	0	-	15
Republic of Korea	République de Corée	-	-	0	63	-	63	-	63
Saudi Arabia	Arabie saoudite	15	-	15	83	-	83	2	100
Singapore	Singapour	48	-	48	-	-	0	-	48
*South Africa	*Afrique du sud	34	-	34	-	-	0	-	34
Spain	Espagne	47	-	47	-	-	0	6	53
Sri Lanka	Sri Lanka	7	-	7	-	-	0	-	7
Sweden	Suède	34	-	34	-	-	0	39	73
Switzerland	Suisse	1	-	1	-	-	0	-	1
Tanzania, United Republic of	Tanzanie, République-Unie de	4	-	4	3	-	3	14	21
Thailand	Thaïlande	2	-	2	-	-	0	-	2
Former Union of Soviet Socialist Republics	Ancienne Union des Républiques socialistes soviétiques	1632	-	1632	-	-	0	-	1632
United Kingdom of Great Britain and Northern Ireland	Royaume-Uni de Grande-Bretagne et d'Irlande du Nord	495	4	499	1	-	1	8	508
United States of America	Etats-Unis d'Amérique	434	-	434	432	-	432	659	1525
Former Yugoslavia	Ancienne Yougoslavie	59	-	59	67	-	67	-	126
TOTALS	**TOTAUX**	4495	17	4512	1373	1	1374	1430	7316

Note:
(1) Includes special ships / Navires spéciaux inclus

* The Government of the Republic of South Africa has been suspended by Resolution 38(Cg-VII) from exercising its rights and enjoying its privileges as a Member of WMO.
Le Gouvernement de la République sud-africaine est suspendu, aux termes de la résolution 38(Cg-VII), de l'exercice de ses droits et de la jouissance de ses privilèges en tant que Membre de l'OMM.

Table 3

STATUS OF IMPLEMENTATION OF GTS AND ADDITIONAL CIRCUITS

1. The status of implementation of GTS and additional circuits is given in the following tables.

2. General definitions:

- END1: for one end of the circuit,
- END2: for the other end of the circuit,
- GTSTYP: for the type of GTS or additional circuit,
- SUPTYP: for the constitution of the circuit (support type),
- SPEED: for the speed of transmission (total),
- C1SPEED: for the speed of channel 1,
- C1TYPEDAT: for the type of data in channel 1,
- C1PROC: for the procedures adopted in channel 1,
- C1NVC: for the number of Virtual Circuits in channel 1,
- C1TYPVC: for the type of Virtual Circuits in Channel 1,
- C2.....: same set of definitions for channel 2,
- C3.....: same set of definitions for channel 3.

3. The type of GTS or additional circuit is given in column **GTSTYP**:

- A: for circuits of the Main Telecommunication Network (MTN),
- B: for main regional circuits,
- C: for regional and supplementary regional circuits,
- D: for interregional and supplementary interregional circuits,
- X: for additional circuits.

4. The constitution of the circuit is given in column **SUPTYP**:

- Cab: for cable circuits,
- Sat: for satellite circuits,
- Mcw: for microwave circuits,
- HF: for HF circuits,
- N/O: for circuits not in operation.

5. For circuits with only one channel or circuits on which several channels are multiplexed, the total speed of the circuit is given in column **SPEED**:

6. For each channel of multiplexed circuits, **C1TYPDAT, C2TYPDAT** and **C3TYPDAT,** the following information concerning the type of data exchange is provided:

- A: for alhanumeric data,
- A+B: for alphanumerical and binary data,
- B: for binary data,
- CDF: for coded digital facsimile (code T4),
- CDFA: for coded digital facsimile (code A),
- D: for alphanumerical and/or binary data,
- D/F: for transmission on a time sharing basis on the same channel,
- F: for analog facsimile,
- NCDF: for non-coded digital facsimile,
- R: for radar data,
- M: for miscelaneous.

7. For each channel of multiplexed circuits, **C1PROC, C2PROC** and **C3PROC,** the following information concerning the type of adopted procedure is provided:

- X.25: for operation of the three layers of X.25 procedures (physical, link and packet layers),
- LAPB: for only operation of of the physical and link layer of X.25 procedures,
- ARQ: for ARQ procedures,
- WMOH: for WMO error-control procedures based on the hardware system,
- WMOS: for WMO error-control procedures based on the software system.

STATUS OF IMPLEMENTATION OF GTS CIRCUITS
MAIN TELECOMMUNICATION NETWORK

END1	END2	GTSTYP	SUPTYP	SPEED	C1SPEED	C1TYPDAT	C1PROC	C1NVC	C1TYPVC	C2SPEED	C2TYPDATA	C2PROC	C2NVC	C2TYPVC	C3SPEED	C3TYPDATA	C3PROC
Toulouse	Algiers	A	Cab	9600	4800	CDF				2400	A	X.25			2400		
Offenbach	Beijing	A	Sat	9600	4800	NCDF				2400	D	X.25	1	VC	2400		
Beijing	Tokyo	A	Sat	9600	4800	NCDF				4800	A	LAPB					
Bracknell	Moscow	A	Cab	9600	2400	NCDF				2400	A+B	X.25					
Bracknell	Toulouse	A	Cab	64000	4800	CDF	X.25			19200	D	X.25			2400	R	
Bracknell	Washington	A	Cab	64000	19200	A+B	X.25	2	PVC	4800	CDF	X.25					
Brasilia	Washington	A	Sat	9600	4800	A	X.25	1	PVC	4800							
Buenos Aire	Washington	A	Sat	9600	4800	A	X.25	1	PVC	4800							
Moscow	Cairo	A	Cab	100		A											
Cairo	Nairobi	A	HF	75		A											
Cairo	New Delhi	A	Sat	100		A											
Toulouse	Dakar	A	Sat	9600	4800	CDF				2400	D	X.25			2400		
Offenbach	Jeddah	A	Sat	9600	4800	NCDF				2400	D	X.25	1	PVC	2400		
Melbourne	Tokyo	A	Sat	9600	4800	NCDF				4800	A+B	X.25	2	PVC			
Moscow	New Delhi	A	Sat	2400	2400	A	LAPB										
Moscow	Prague	A	Cab	4800	2400	NCDF				2400	A	LAPB					
Moscow	Sofia	A	Cab	9600	4800	NCDF				2400	A	X.25	1	PVC	2400		
Offenbach	Nairobi	A	Sat	9600	2400	NCDF				2400	A	LAPB			2400		
New Delhi	Tokyo	A	Sat	9600	4800	NCDF	X.25	1	PVC	4800	D	X.25	2	PVC			
Offenbach	Prague	A	Cab	9600	4800	NCDF				2400	A	X.25			2400		
Offenbach	Toulouse	A	Cab	64000	4800	CDFA				2400	NCDF				9600	D	X.25
Prague	Sofia	A	Cab	9600	2400	NCDF				2400	A	WMOH			2400	NCDF	
Tokyo	Washington	A	Sat	9600	4800	NCDF	X.25	1	PVC	4800	A+B	X.25	2	PVC			

Table 4

4. DRIFTING BUOYS

In November 1993 data from a total of 1529 drifting buoys were collected and processed at the Argos Global Processing Centres of Toulouse, France, and Landover, Maryland, USA for distribution in real-time or deferred-time to respective Principal Investigators. These buoys are operated by 19 countries (Australia, Brazil, Canada, China, Finland, France, Germany, Iceland, India, Italy, Japan, Korea, Netherlands, New Zealand, Norway, Portugal, South Africa[1], United Kingdom and the USA).

Of those 1529 drifting buoys, about 37.3% transmit the data in real time via the Global Telecommunication System (GTS).

Most of the buoys measure at least Sea Surface Temperature data, and approximately 150 measure Air Pressure. Almost all of those measuring air pressure report on the GTS. Approximately 10% of all drifting buoys have no sensors and are used as Lagrangian tracers only, 20% do not report onto the GTS because of poor quality data, 20% are not inserted on the GTS because permission was not granted (buoys principally from research programmes, for which data are being released only after formal publication of related studies) and 13% for unknown reasons. Table 1 shows the total number of drifting buoys per country and the portion of those buoys reporting onto the GTS for the period 11 November 1993 to 21 November 1993. For those reporting on the GTS, Figure 1 shows by country and for the period 15-21 November 1993, the mean number of observations transmitted on GTS per day for different geophysical variables. Figure 2 indicates, by Marsden Square, the number of reports received at the Paris Hub during October 1993. Figures 3 through 6 are regional track charts that plot the month's movement of the reported buoys that passed position and quality control checks.

At the tenth session of CBS (Geneva, November 1992), the Quality Control Guidelines for drifting buoy data as proposed by the DBCP have been formally incorporated as part of the World Weather Watch (WWW). Nine Principal Meteorological or Oceanographic Centres for buoy data quality control (PMOC) from six different countries are participating in the guidelines on a regular basis: the European Centre for Medium-Range Weather Forecasts (ECMWF), the United Kingdom Meteorological Office, Meteo France, the National Data Buoy Center of NOAA (USA), the Ocean Products Center of NOAA (USA), the Meteorological Center of New Zealand Ltd., the Australian Bureau of Meteorology, the Icelandic Meteorological Office and the Japan Meteorological Agency. PMOCs can make status change proposals via an electronic bulletin board, for these buoys which report bad quality data onto the GTS.

The guidelines have been successful so far in improving the overall quality of drifting-buoy data delivered on the GTS. For example, during the period 1 July 1992 to 30 June 1993, 134 drifting buoys reporting on the GTS had their status changed thanks to PMOC proposals.

The Responsible National Oceanographic Data Centre for Drifting Buoy Data (RNODC/DB) is located in Canada. The data is maintained in a data base structure. The number of buoys and DRIFTER messages archived per month by the RNODC/DB is shown in Figure . In addition, the French National Oceanographic Centre operates the IGOSS Specialized Oceanographic Centre for Drifting Buoy Data (SOC/DB).

Since February 1993, a new system for processing GTS data is operated at the Argos Global Processing Centres of Landover, USA, and Toulouse, France. It allows GTS distribution of data from platforms which were previously excluded because of technical obstacles. Other GTS code forms than DRIFTER, such as HYDRA, SYNOP, SHIP, BATHY, TESAC and BUFR can now be handled.

The Global Drifter Center (GDC, La Jolla, USA) successfully designed and tested (25 prototypes tested in 1993 in co-operation with the DBCP) a low-cost barometer drifter which meets both

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[1] The Government of the Republic of South Africa has been suspended by Resolutions 38 (Cg-VII) and 2/74/4 (Twentieth Session of the General Conference of UNESCO) from exercising its rights and enjoying its privileges as a Member of WMO and Member State of IOC, respectively.

meteorological and oceanographic communities requirements. Common programmes will be very cost-effective for both communities and will be integrated into the GOOS.

Although the Pacific ocean is now being studied, largely due to WOCE and TOGA programmes, the DBCP stressed the lack of drifting buoy data of any kind in the South Atlantic Ocean, the Indian Ocean, and the Southern Ocean.

Table 1: Number of Drifting Buoys by Country and those reporting via the GTS, as of November 1993 (based on actual transmissions between 11 and 21 November 1993, DBCP).

ORGANIZATION	COUNTRY	TOTAL	GTS
Atlantic Oceanographic and Meteorological Lab. (NOAA)	USA	300	194
Scripps Institution Of Oceanography	USA	251	117
Minerals Management Service (DOI)	USA	111	0
U.S. Naval Oceanographic Office	USA	106	59
Pacific Marine Environmental Laboratory (NOAA)	USA	64	17
Meteo France	France	61	26
University Of Kiel	Germany	56	0
EPSHOM	France	45	0
NATO Saclant ASW Research Centre	Italy	39	21
National Data Buoy Center (NOAA)	USA	37	17
Maritime Safety Agency	Japan	35	10
Woods Hole Oceanographic Institute	USA	28	6
Naval Postgraduate School	USA	27	0
LODYC	France	26	0
Atmospheric Environment Service	Canada	22	17
Institute Of Ocean Sciences	Canada	20	1
Meteorological Office	United Kingdom	20	15
Bureau Of Meteorology	Australia	18	11
Department Of Fisheries And Oceans	Canada	18	0
Weather Bureau	South Africa	17	17
University Of Lisbon	Portugal	17	0
OCEANOR	Norway	15	0
Science Applications International Corporation	USA	15	3
Navy-NOAA Joint Ice Center	USA	14	1
Horizon Marine, Inc.	USA	12	0
US Coast Guard, International Ice Patrol	USA	12	5
IFREMER	France	11	7
Nederlands Instituut Voor Onderzoek Der Zee	Netherlands	11	0
Tokai University	Japan	11	0
CSIRO	Australia	10	0
Norwegian Polar Institute	Norway	10	1
University Of Hannover	Germany	10	8
INPE	Brazil	7	0
Norwegian Meteorological Institute	Norway	6	4
Meteorological Service Of New Zealand, Inc.	New Zealand	6	6
Christian Michelsen Research	Norway	5	2
South China Sea Sub-Bureau Of NBO	China	5	0
Japan Marine Science And Technology Center	Japan	4	0
National Institute Of Oceanography	India	4	0
Japan Meteorological Agency	Japan	3	3
Marine Biological Association	United Kingdom	3	1
North American CLS	USA	3	0
University Of Hamburg	Germany	3	0
Commissariat a L'Energie Atomique	France	2	0
Finnish Institute Of Marine Research	Finland	2	0
Icelandic Meteorological Office	Iceland	2	1
Korean Ocean Research And Development Institute	Korea	2	0
Marine Environmental Data Service	Canada	2	0
Northwest Research Associates, Inc.	USA	2	0

Defense Systems, Inc.	USA	2	0
Pohang Regional Marine & Port Administration	Korea	2	0
University Of Oregon	USA	2	0
Antarctic Division - Department Science And Technology	Australia	1	0
Bermuda Biological Station For Research, Inc.	USA	1	0
Bedford Institute Of Oceanography	Canada	1	0
Fisheries Agency	Japan	1	0
Groupe D'Etudes Et Recherches En Detection Sous-Marine	France	1	0
Hokkaido University	Japan	1	0
Institute Of Marine Research	Norway	1	0
Royal Netherlands Meteorological Institute	Netherlands	1	1
National Fisheries Research And Development Agency	Korea	1	0
Norwegian Hydrotechnical Laboratory	Norway	1	0
University Of Alaska	USA	1	0
Texas A&M University	USA	1	0
University Of Tokyo	Japan	1	0
TOTAL		**1529**	**571**

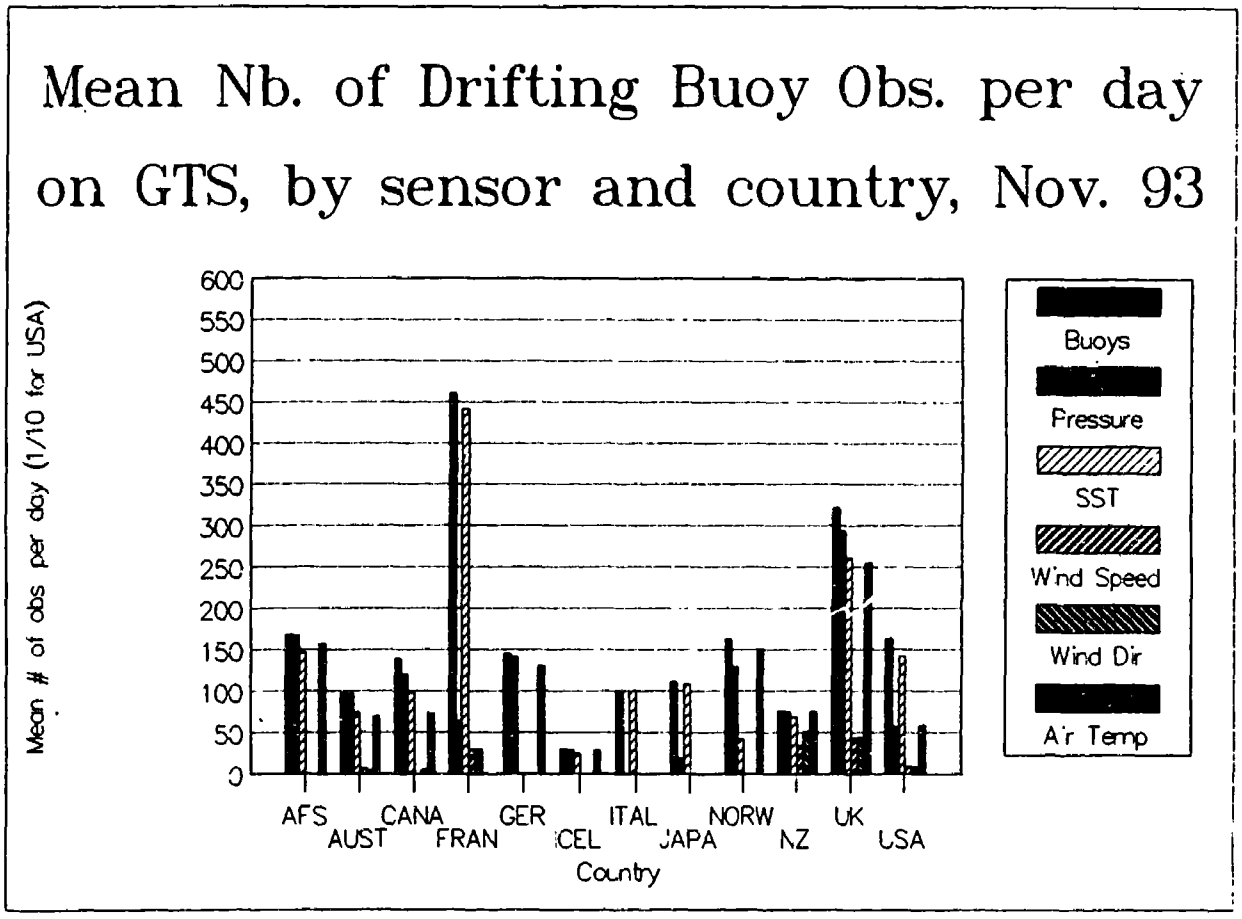


Figure 1: By country and by geo-physical variable, mean number of drifting buoy observations per day received at Paris Hub from the GTS during the period 15 to 21 November 1993 (sources DBCP).

METEO-FRANCE/SMISO

FRENCH MET OFFICE/IGOSS

Repartition par carre Marsden des observations recues en Octobre 1993

Marsden square distribution chart of data received during October 1993

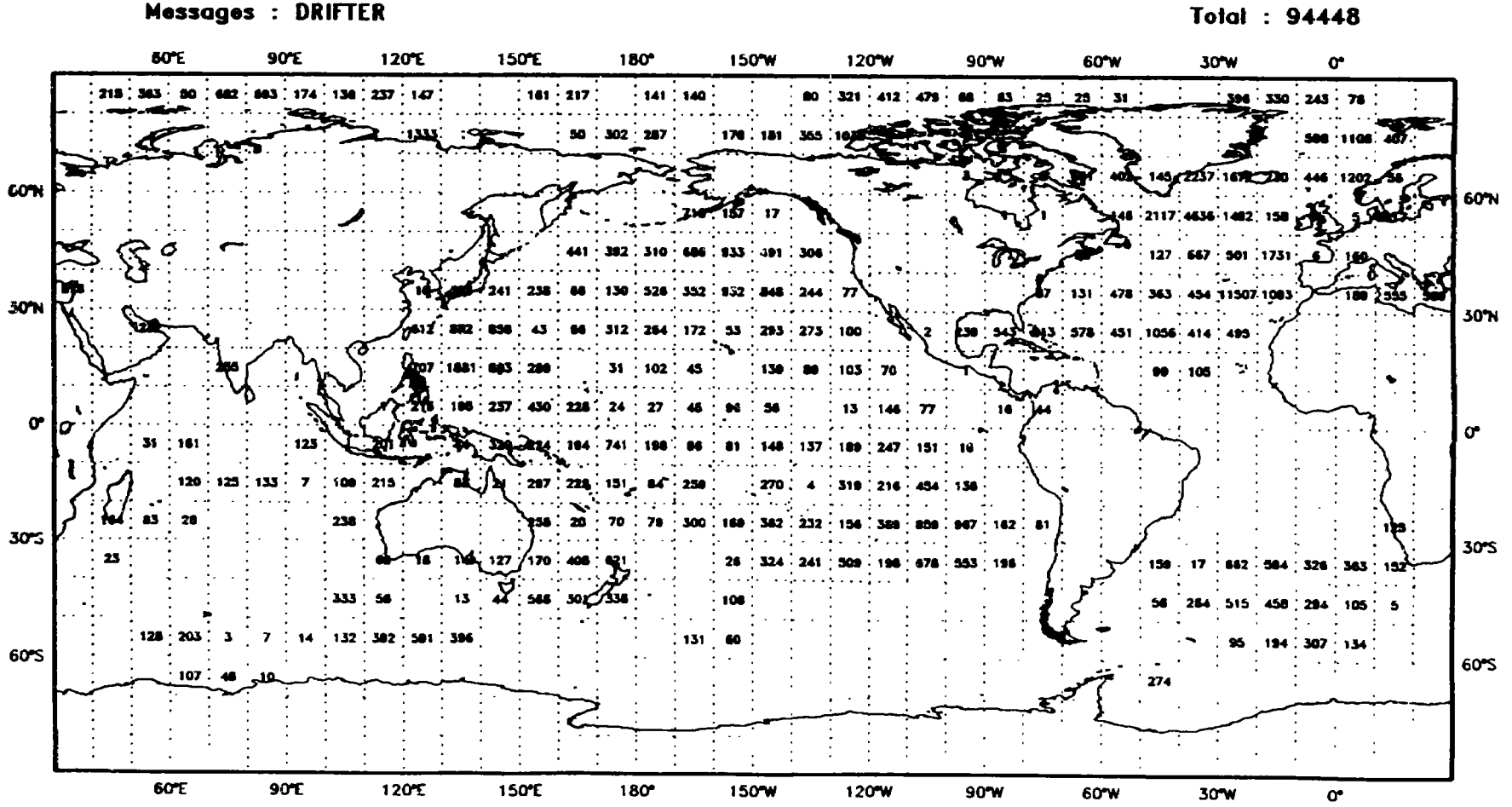


Figure 2: Number of DRIFTER reports by Marsden Square, received at Paris Hub during October 1993 (sources IGOSS SOC/DB).

Figure 3: Regional Track chart for the Arctic basin, plotting movement of drifting buoys that passed position and quality control checks during October 1993 (sources RNODC/DB-MEDS).

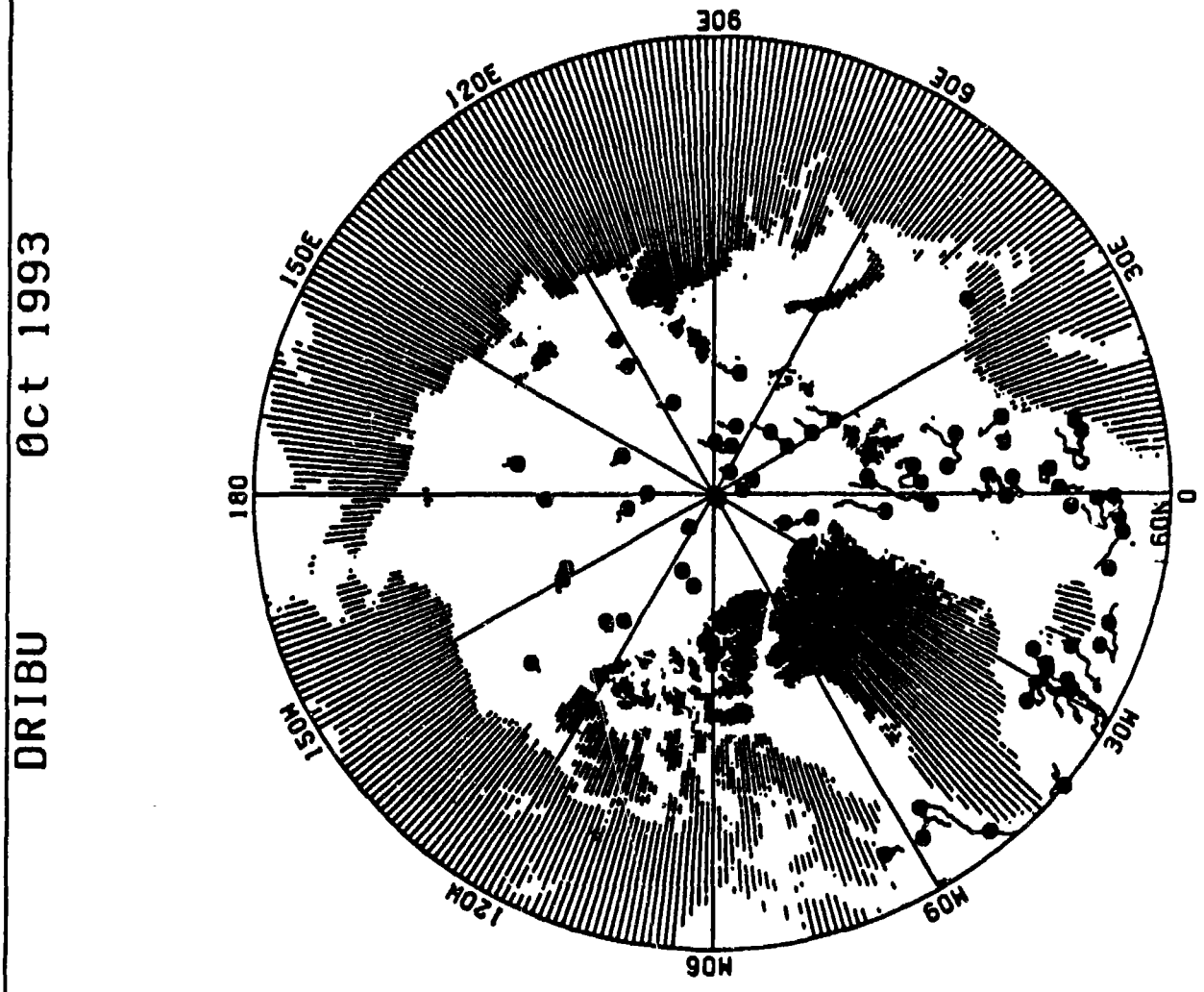


Figure 4: Regional Track chart for the Pacific Ocean, plotting movement of drifting buoys that passed position and quality control checks during October 1993 (sources RNODC/DB-MEDS).

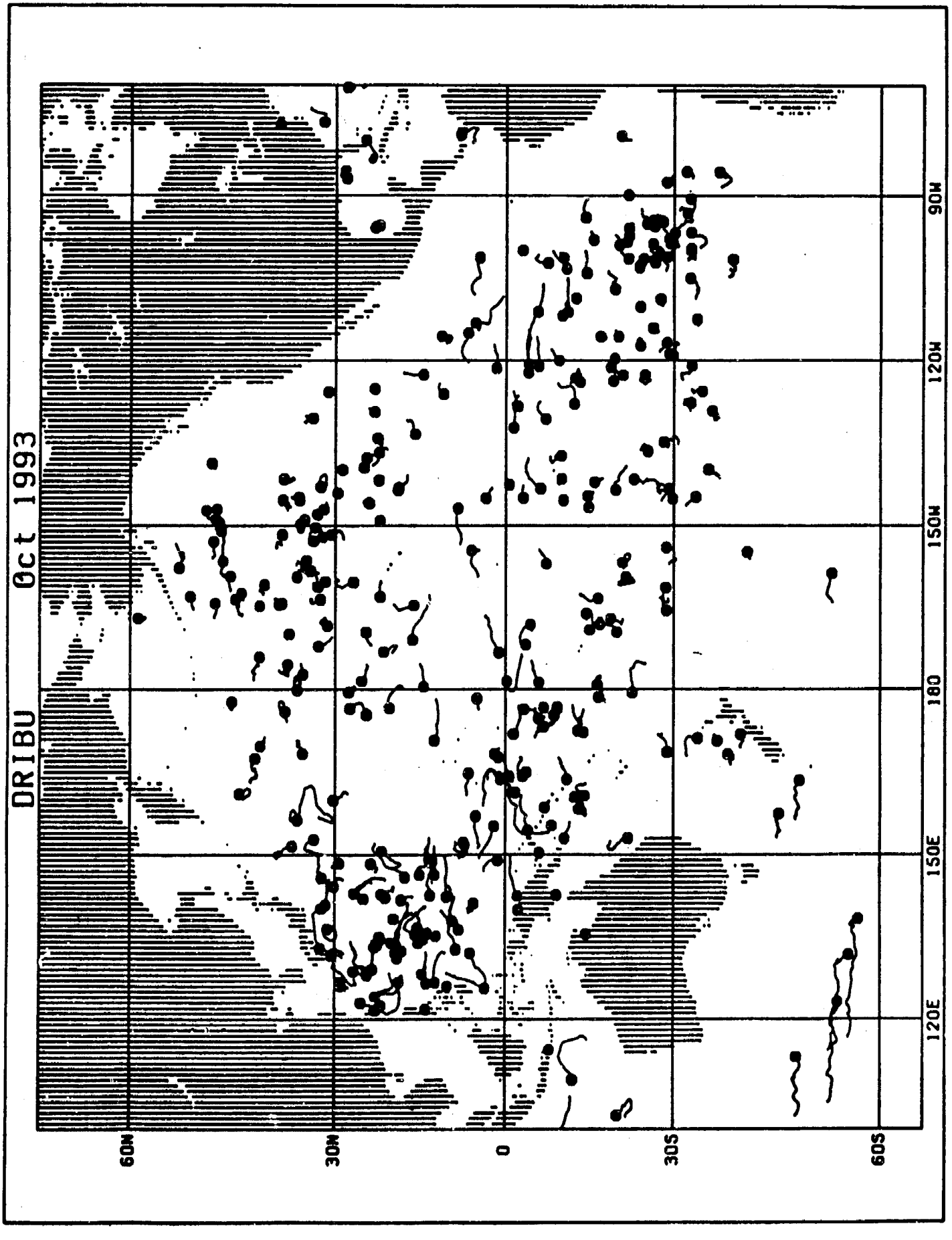


Figure 5: Regional Track chart for the Atlantic and Indian Ocean, plotting movement of drifting buoys that passed position and quality control checks during October 1993 (sources RNODC/DB-MEDS).

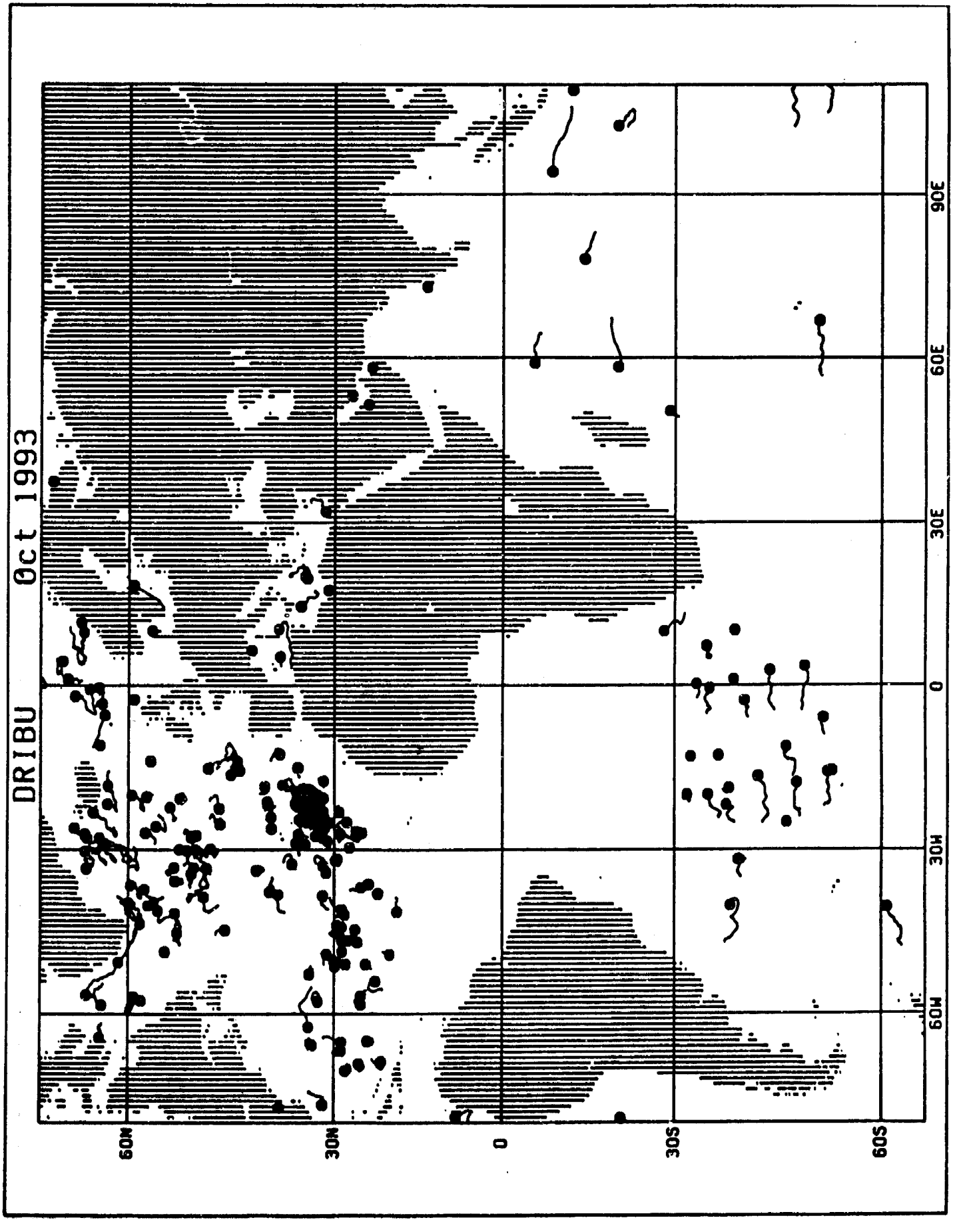


Figure 6: Regional Track chart for the Antarctic, plotting movement of drifting buoys that passed position and quality control checks during October 1993 (sources RNODC/DB-MEDS).

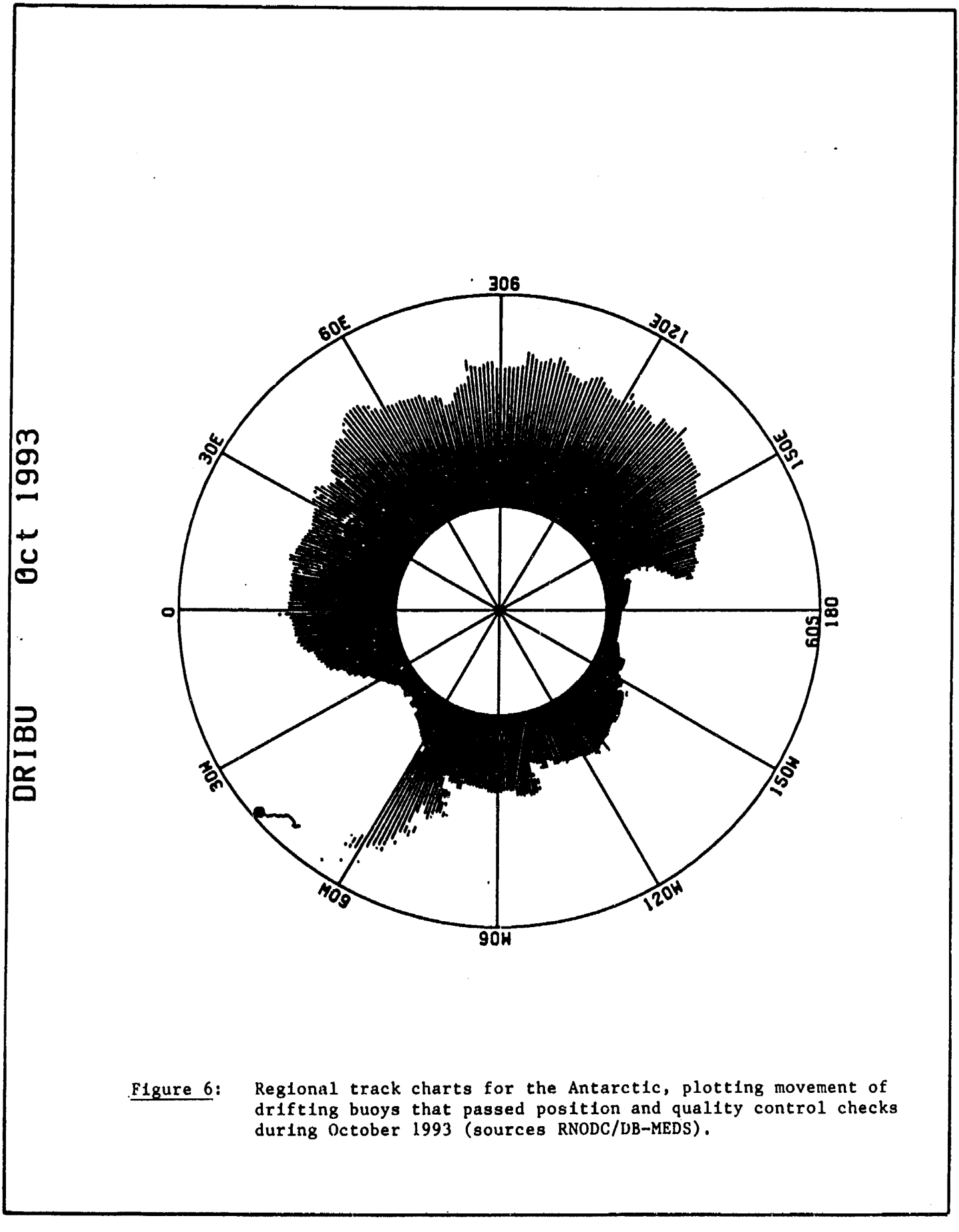


Figure 6: Regional track charts for the Antarctic, plotting movement of drifting buoys that passed position and quality control checks during October 1993 (sources RNODC/DB-MEDS).

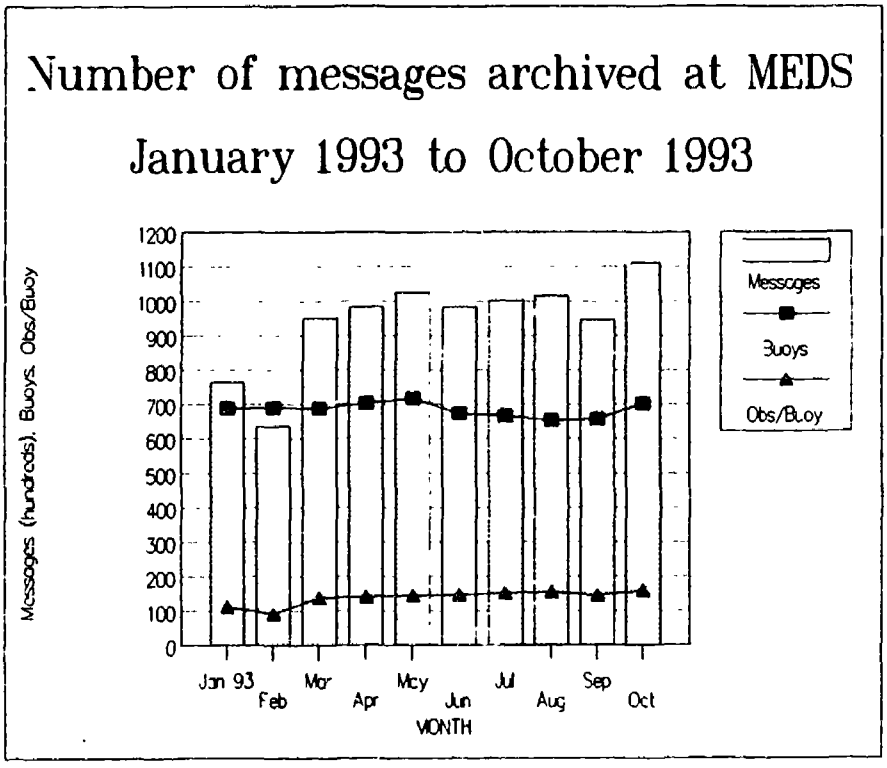


Figure 7: Number of buoys and number of DRIFTER messages archived at the RNODC/DB per month for the period January 1993 to October 1993 (sources RNODC/DB-MEDS).

5. SATELLITES

5.1 RECENT MISSIONS

Recent missions emphasized the need for adequate backup measures: in June, NOAA I (13) failed in orbit and was declared lost. There is no immediate effect on current capabilities from this failure and the present configuration will be maintained until NOAA J is launched in September of 1994. In July, LandSat 6 failed to reach orbit due to a booster failure. Present resources including SPOT remain operational. Landsat 7 is presently scheduled for launch in March of 1998. GOES I is scheduled for launch in 1994 which will bring the U.S. back up to two GOES Satellites. GOES J is on track for launch in April 1995. MeteoSat was successfully launched in November 1993 but recently has been experiencing problems with the lens of it imager in the water vapor/IR range. The effect that this problem will have on the mission is still under study.

5.2 FUTURE ACTIVITIES

The Seawifs satellite continues on schedule for a June 1994 launch. GOES I is scheduled for launch in mid 1994 and NOAA J is currently on schedule for a September 1994 launch.

The ARISTOTLES Gravity mission was cancelled and NASA is currently pursuing a geoidal mission called GAMES. The concept being used is different than that which was to have been used in ARISTOTLES and involves three smaller satellites. Further study is required to resolve whether the concept will prove feasible. A geoidal mission as well as a follow-on TOPEX-POSEIDON mission continue to be crutial for GOOS activities.

5.3 COMMITTEE ON EARTH OBSERVATIONS SATELLITES

Principle activities of the CEOS of interest to the ocean community continue to be the efforts of CEOS to develop a data policy for Climate Change Research and to develop a list of requirements for satellite data utilizing input from the CEOS affiliates. Efforts this year in the development of requirements made significant progress culminating with the publication of the CEOS Affiliates Dossier of Satellite requirements. This dossier concentrated on adopting standard sensor definitions and the identification of common sensor requirements across the user spectrum represented by the affiliates (see p. 36). Efforts in the next year will work toward establishing temporal and spacial requirements for these sensors. CEOS has completed and is expected to maintain a three volume set of dossier's on Satellite Missions, Space Agency Ground Segment and Data Products and the Relevance of Satellite Missions to Global Environmental Programmes.

5.4 DATA POLICY

Earth observation by satellite is an essential tool in the management of the Earth's ocean resources, and for the study and monitoring of climate. Space-derived information is also of increasing value for the implementation of public policy with regard to the ocean, especially in coastal areas. While the potential and importance of Earth observation to contribute to the understanding and management of the Earth's resources are very high, there are at present potentially incompatible or conflicting policies regarding the management, supply and exchange of data. A data policy is required that meets the needs for understanding, monitoring and managing the Earth's ocean resources.

Many nations and international organizations are formulating their data policies with regard to remotely sensed data. The users of this data need to keep abreast of the developments and be proactive in the promotion of the free and open exchange of remotely sensed data for ocean monitoring and management. GOOS is active in the global activities in this regard both through CEOS and through other forums dealing with the development of data policy such as the World Meteorological Organization (WMO).

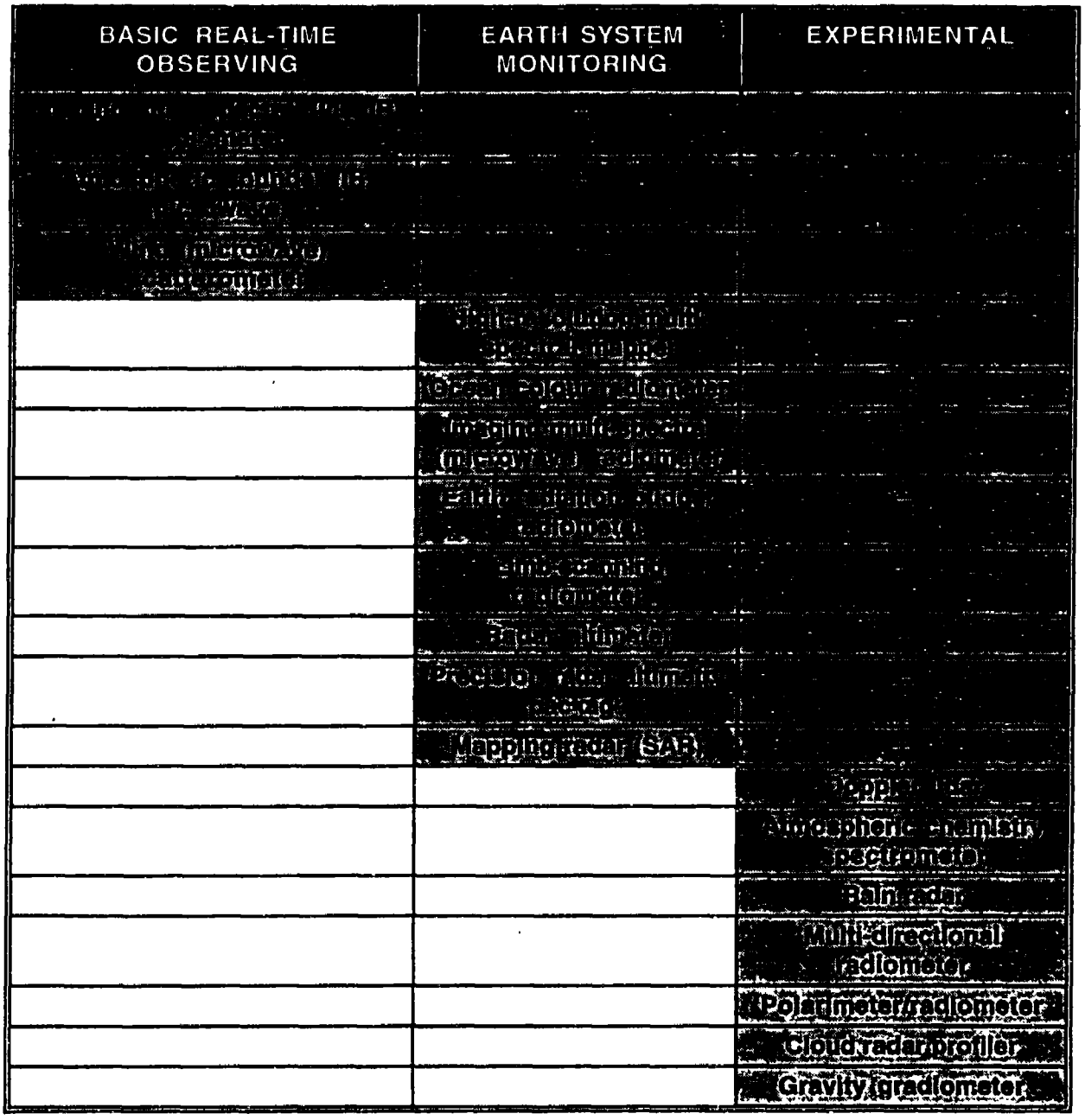
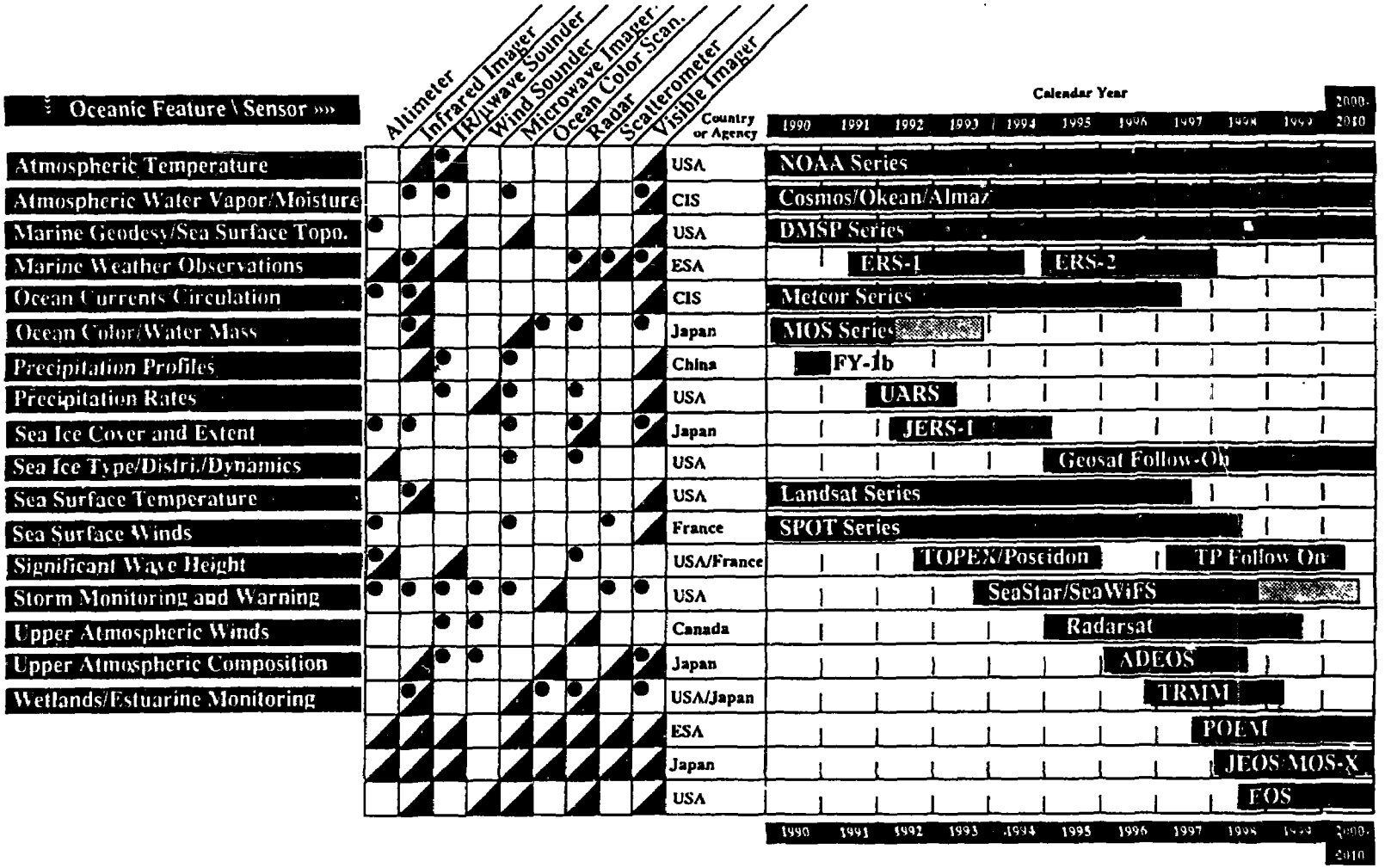


Figure A-1
CEOS Affiliates' requirements

IOC Satellite Data Requirements		
Measurement	Instrument type	Candidate sensor
Surface radiation, heat and water fluxes(1)	(undetermined)	(undetermined)
Ocean colour	Ocean colour radiometer	SeaWiFS, OCTS, MODIS, MERIS, EOS-COLOR, GLI
Sea surface temperature (SST)	Imaging multi-spectral (IR) radiometer Atmospheric sounder (IR) Multi-directional radiometer	AVHRR(2), OCTS, MODIS, MERIS, VTIR AIRS, IASI, HIRS ATSR
Ocean surface wind vector	Wind (microwave) scatterometer	AMI, NSCAT
Ocean wave height	Radar altimeter	RA, ALT
Ocean surface topography	Precision radar altimetry package(3)	Single or 2-frequency altimeter; GPS + water vapour radiometer or DORIS
Precise geoid	Gravity gradiometer(4)	
Sea ice cover	Imaging multi-spectral (vis, IR, microwave) radiometer	AVHRR, MODIS, MERIS, SSM/I, MIMR, OCTS, GLI, AMSR
Sea ice texture, edge and motion	Mapping radar (SAR)	AMI, SAR, RADARSAT

(1) Surface radiation fluxes and surface heat and water fluxes are derived from a variety of instruments through a comprehensive data assimilation process
(2) AVHRR calibration only marginally adequate for sea surface temperature measurements
(3) Follow-on high precision ocean altimetry mission (undetermined)
(4) Gravity Mission (undetermined)

CURRENT AND PLANNED SATELLITE SYSTEMS IN SUPPORT OF MARINE METEOROLOGY AND OCEANOGRAPHY (1990 THROUGH 2010)



Legend for Support to Marine Meteorology and Oceanography:

= Sensor Manifested on Satellite (Use right hand Portion of Table)

= Sensor Application to Marine Meteorology and Physical Oceanography (Use left-hand Portion of Table)

JWS, III: WMO/IOC Summary; October 28, 1991, Version 1.7

Current and Planned Satellite Systems in Support of Marine Meteorology and Oceanography (1990-2000)

6. GOOS' RELATIONSHIP TO THE GLOBAL CLIMATE OBSERVING SYSTEM

The meeting was convened in Abindgdon, UK, on Monday 1 November 1993. Represented were the JSTC, the sponsors, i.e., IOC, UNEP, WMO, and ICSU, the Commissions of WMO, and observers from Australia, Germany, UK and the USA. The IOC was represented by the Director of the GOOS Support Office, the chair of I-GOOS (first day only) and the IOC liaison to GCOS (days 2 & 3).

The IOC opening statement included reaffirmation of the GCOS-GOOS interrelationship regarding the overlap between these two programmes, as follows:

> *"We wish to reaffirm the position agreed upon by IOC and WMO that there is a common part of GOOS and GCOS, i.e. the overlap between the climate module of GOOS and the ocean component of GCOS. We must present to the Government and funding agencies one common proposal, to be designed and planned by the Joint GOOS-GCOS Implementation Panel based upon the final report of the OOSDP. Administrative co-ordination of the Panel needs to be carried out by one of the two offices in close collaboration with the other. For this purpose, we have seconded a professional to the GCOS office in Geneva to affirm and to guarantee the feasilibity of this effort. Since IOC, by definition, has strong links with the Governments, we are ready to help the acceptance and implementation of an agreed upon module by having it endorsed and brought to the attention of Governments through the Intergovernmental GOOS Committee".*

As far as any ocean related implementation was concerned, it would have to be done by GOOS. This was so agreed upon toward the end of the meeting. It was also agreed that a brochure on the short term climate variation, the El Nino/ENSO phenomenon, would hsow IOC/GOOS as a co-sponsor. During the discussions GOOS was lauded for having a clearer separation of the design and planning efforts from the implementation and oversight responsibilities.

A number of short term "Working Groups" were established concerning: data and data management, cost/benefit and socio-economic impact studies, satellite/space observations, and communications. Regarding GOOS, three issues need watching and involvement:

(i) Bringing to the next I-GOOS planning session the request for the establishment of a cross-cutting GOOS implementation panel, which includes the implementation of the GOOS-GCOS commonalities;

(ii) The establishment of a Joint GOOS/GCOS design panel as a follow-on to the OOSDP; and

(iii) The interactions/establishment of common design with the new initiated GTOS programme.

As a result of this meeting a number of issues were clarified relating to the GOOS/GCOS interactions:

(i) The implementation issue was decided, i.e. GOOS has been asked to ensure the responsibility for the implementation of the commonality;

(ii) Design responsibilities will be shared

7. OCEAN OBSERVING SYSTEM DEVELOPMENT PANEL (OOSDP)

The OOSDP continued on its accelerated pace in 1993 with two meetings (in April in Lisbon and in November in Halifax) with a view to completing its work on schedule in December 1994. To make it possible to cope with the large intersessional workload, the IOC issued a contract with the Chairman, Worth Nowlin, to provide needed financial support for the unusually large commitment of time required. First drafts have been written for nearly all the major chapters of the Final Report and several have been rewritten to reflect evolving new knowledge.

The IOC-JGOFS CO_2 Advisory Panel met in Plymouth in June and adopted a plan to inventory CO_2 data known to exist in the possession of institutions and individuals in various countries. Progress was also made in implementing a plan to conduct an international intercalibration test, in June 1994 at Scripps Institution of Oceanography (SIO), of ocean CO_2 measuring systems to ascertain the cause of discrepancies in the data acquired with different systems. The Panel has also undertaken a review of the CO_2 literature in order to prepare a state-of-the-knowledge document on sources and sinks of ocean CO_2. This is being done in response to an invitation from the Secretary IOC as a follow-up to UNCED in respect to the specific request to IOC in Chapter 17 of Agenda 21.

8. HEALTH OF THE OCEAN PANEL

Between 23 and 26 February, 1993, the First Meeting of the *Ad hoc* Panel for the Health of the Ocean Module of GOOS (HOTO) was convened at UNESCO Headquarters in Paris. The motivation was to redress the perceived disciplinary imbalance in the development of GOOS which tended to favour the physical-climatological aspects to the detriment of the marine chemical and biological aspects.

The meeting elaborated and refined a draft document entitled "The Strategic Development of the Health of the Ocean Module for GOOS" which had been prepared earlier by a select committee of officers of GIPME and circulated to interested parties.

The updated document and report of the meeting received the approval of the XVIIth IOC Assembly (25 February - 13 March 1993). This document has been further revised through work by correspondence and would be the main working document at the second meeting of the *Ad hoc* Panel of HOTO (Paris, 10-15 February 1994) to which representatives of groups such as GLOBEC, IGEC, LOICZ, IGAC have been invited. It is expected that a HOTO Panel would be formally constituted during 1994.

Progress was recorded in the regionally based operational aspect of GIPME, The Marine Pollution Monitoring System (MARPOLMON), which is expected to contribute data to the GOOS Data Bank.

Routine monitoring activities for a variety of contaminants (eg. pathogens, heavy metals, pesticides and hydrocarbon residues etc.) and oceanographic conditions continued in regions such as the Mediterranean (MEDPOL), IOCEA (WACAF/2 Phase II), Caribbean (CEPPOL), IOCINCWIO (EAF-5 and 6), Black Sea (COMSBLACK), ROPME [IPP]) with data and results achieved being reported to the Secretariat.

9. LIVING MARINE RESOURCES (LMR)

A meeting of the *Ad hoc* Panel for Monitoring and Assessment of Marine Resources Module of GOOS was held in San José, Costa Rica, 7-10 December 1993.

The purpose of the Panel is to define and design a Module for the Monitoring and Assessment of Living Marine Resources (LMR) of the Global Ocean Observing System. As part of an earth observing system, the LMR Module should be oriented to applied-operational design and logistics. It should be pragmatic and produce observations on the state of living resources and the ecosystems within which they exist. The observations should be subjected to appropriate analyses that yield conclusive answers to significant questions. The scope of the Module should be global and focused on long-term and broad-scale monitoring. It should be reflective of the concerns and objectives of UNCED regarding climate change, both natural and/or man induced, and biodiversity. Further, it should concentrate on the monitoring of species abundance and trends in the context of regime shifts, ecosystem changes and resource sustainability.

The LMR Module will be concerned with augmenting and adding to the regional programmes and expanding to a global effort. This will be done in several ways. First, information will be provided for globally focused bodies, like FAO, and regional bodies to conduct assessments of LMR and their

environment. Second, the Module will provide specific data for use as inputs to regional and global models that can be used to detect or predict ecosystem changes, such as regime shifts. Third, critical issues or events can be focused on by the production of information products such as "red flag" reports.

There are several reasons why regime shifts deserve the focus of this Module within GOOS. These "regime shifts" can be defined as substantial qualitative changes in an ecosystem which often are characterized by changes in the dominance or replacement of certain fish species along with associated zoo- and phytoplankton populations. First, these shifts account for a major portion of the temporal variation of ecosystem components as well as variation among the components themselves. Second, they imply broadly correlated and persistent changes rather than short term changes in one or two species at one or two locations. Third, adverse risk is amplified for resource based and related social systems affected by the magnitude of regime shifts.

Small pelagic fishes, such as sardines, anchovies and sprat, are excellent candidates for monitoring within the LMR Module of GOOS. Their annual catches are among the world's largest, they occur in the major ocean basins including the waters of many of the developing countries, and their variations are suggestive of regime shifts. There are valuable time series documenting decadal scale shifts for pelagic clupeoid species in boundary current regions. Therefore, the Panel recommends the establishment of pilot projects to monitor small pelagics in the Humboldt Current region and the Arabian Sea.

Critical coastal ecosystem are areas with important economic resources and that provide substantial recreational activities. In addition, they are probably some of the most vulnerable ecosystems due to their close proximity to the land-sea interface and anthropogenic influences. Some of these ecosystems, such as coral reefs, mangroves and seagrass beds are an economic necessity to tropical developing countries because they contribute most of the protein to the diets of the growing populations as well as contributing to incomes through tourism. The Panel acknowledged the importance of these systems and recommends the long-term monitoring of coral reefs as a priority of the LMR Module of GOOS.

Fishery assessments require data on biological characteristics, harvesting statistics and fishing activity. Fishery independent statistics also are desirable. The frequency of data collection in heavily exploited fisheries should be annually. The spatial scale of fishery monitoring should be sufficient to conduct assessments at the "stock" level (a group of interbreeding animals) and a "management unit" level (a fishery subject to a uniform set of regulations).

The LMR module should facilitate the routine assessment of important fishery resources on a global and regional scale because: (1) LMR are often global commodities such that the local status of resources often has global significance. (2) The effects of climate variability often are seen only on regional or global scales. (3) There is widespread interest on the part of governments, international policy makers and the public about the overall condition of fisheries.

The Panel recommends the following concerning fisheries monitoring and assessments: 1. Routine assessments of fisheries on regional and global scales need to be improved by addressing inadequacies in national efforts and making appropriate institutional arrangements to conduct co-ordinated assessments. 2. Lack of funding for resource assessments in developing countries is an acute problem that needs to be addressed. 3. FAO's activities in regional and global assessments, monitoring critical habitats, and assisting developing countries need to be augmented and integrated with this Module of GOOS. 4. Integration and co-operation with the World Bank's Global Environmental Fund (GEF) activities for Large Marine Ecosystems (LME) are desirable.

Major applications for plankton monitoring information within GOOS are in resource and climate evaluations. Inter-annual variability of many resource species (i.e. recruitment) may be associated with or driven by tropodynamic linkages with plankton. In turn, plankton variability may be directly driven by linkages with physical (environmental-climate) forcing factors. In addition, plankton monitoring provides an independent baseline estimate of natural variability in the marine environment.

The Panel concurs that the overall goal of the Module for plankton monitoring is to characterize broad scale status and trends in zooplankton species composition and biomass. This should be done at the level of basin scale coverage and a range of time scales from seasonal to continuous multi-decadal.

The Panel suggested that the next meeting be held at La Paz, Mexico, July 1994. This will be in conjunction with a GLOBEC.INT meeting on small pelagic fisheries, a recommended focal topic for the Module.

The Panel elected J. Alheit as chairman. Election of a vice-chairman was rescheduled for the next session of the Panel.

10. OCEAN SCIENCE IN RELATION TO LIVING RESOURCES

The Assembly, at its Seventeenth Session (Paris, 25 February-11 March 1993), recognized that a focus for the OSLR programme needs to reflect new realities of global climate change, biodiversity and sustainable resources, and that OSLR needs provide scientific support to the development of the Global Ocean Observing System (GOOS). The Assembly therefore decided (through Resolution XVII-2) to reorganize the OSLR Programme initially into two main components, including TEMA. These are Ecosystem Dynamics and Living Resources (EDLR), and Global Ocean Observing System (GOOS) Support. The EDLR component will be composed of GLOBEC, guided by an IOC-SCOR Scientific Steering Committee; Harmful algal Blooms (HAB), governed by its IOC-FAO Intergovernmental Panel and advised by ICES and SCOR; and IREP. The GOOS Support component will be composed of IOC participation in the UN-GEF-Large Marine Ecosystem (LME) and continued support for the Continuous Plankton Recorder (CPR).

10.1 HARMFUL ALGAE

The Assembly, at its Seventeenth Session (Paris, 25 February-11 March 1993), through Resolution XVII-2, instructed the Secretary IOC to establish a Programme Office for the Harmful Algal Bloom Programme. The Office has been established and is presently staffed with two Associate Experts seconded by Denmark.

The Assembly approved (Resolution XVII-2) the continuation of the IOC-FAO Intergovernmental Panel on Harmful Algal Blooms. The Second Session of the joint IOC-FAO Panel took place in Paris from 14 to 16 October 1993. The co-sponsorship of FAO involves no financial commitment at this stage.

Having revisited the Programme Plan, discussed priorities, and endeavored to identify and commit resources, the Panel adopted a set of recommendations which summarized its findings. These are recorded in Document IOC-FAO/IPHAB-II/3.

The Panel established three Task Teams to work intersessional on specific tasks. The subjects of the Task Teams are: Aquatic Biotoxins; Taxonomy; Management and Monitoring. The Task Team on Aquatic Biotoxins includes GEEP, GEMSI and GESREM representatives.

A comprehensive training programme on harmful algae is under development as the TEMA component of the Harmful Algal Bloom Programme. The training programme includes taxonomy, toxin chemistry, design and implementation of monitoring systems, management and mitigation techniques, and individual training.

As the first activity within the training component of the Harmful Algal Bloom Programme an IOC-Danida Training Course on the Taxonomy of Harmful Marine Phytoplankton, was held at the University of Copenhagen, 16-28 August 1993, cosponsored by Danida (Denmark). More than 125 applications were received for the 15 seats available.

The IOC quarterly newsletter "Harmful Algae News" has a growing number of subscribers. As of

1 October 1993 the total number of subscribers was more than 1700. Dr. T. Wyatt has agreed to continue as the Editor. During 1993 an Editorial Team composed of regional co-editors was established in order to support the Editor in his efforts to make HAN a broad newsletter scientifically and geographically.

The ICES-IOC Study Group on the Dynamics of Algal Blooms met from 8-11 February 1993, Charleston USA, and had a 2 day joint meeting with the ICES Working Group on Shelf Seas Oceanography. The Study Group reviewed the progress in the implementation and/or continued the planning of physical-biological interaction investigations in the selected pilot study areas (Gulf of Maine, Skagerrak-Kattegat, Iberia). The 81st Statutory Meeting of ICES, September 1993, approved that the Study Group was re-established as the Working Group on Harmful Algal Bloom Dynamics (Chairperson: Ms. B. Reguera, Spain). The Working Group is co-sponsored by IOC.

The SCOR-IOC Working Group 97 on the Physiology of Harmful Algal Blooms met in La Rochelle, 23-24 October 1993. The Group planned for a major advanced scientific workshop in 1994 or 96 to review state of the art and to identify areas of future research crucial to the understanding of the ecophysiology of harmful algae.

10.2 THE CONTINUOUS PLANKTON RECORDER

The Assembly, at its Seventeenth Session (Paris, 25 February-11 March 1993), decided to continue to support the Continuous Plankton Recorder (CPR) (Document SC/MD/101). The IOC supported the CPR with a contract of US $ 30.000 a year in the biennium 92/93.

10.3 GLOBAL OCEAN ECOSYSTEM DYNAMICS

A International GLOBEC Sampling and Observation Systems Working Group Meeting was held in Paris, 30 March-2 April 1993, to discuss sampling strategies and requisite technologies for various GLOBEC studies (e.g. local process studies, regional studies, and basin scale studies). These will be relevant for GLOBEC modelling efforts. The Report will be published by SCOR.

10.4 LARGE MARINE ECOSYSTEMS

In co-operation with the US National Oceanic and Atmospheric Administration (NOAA), the World Conservation Union (IUCN), and the Kenya Marine Fisheries Research Institute (KMFRI), IOC/OSLR co-convened an International Symposium and Workshop on "Status and Future of Large Marine Ecosystems (LME) of the Indian Ocean", Mombasa Kenya, 28 March-2 April 1993. The Symposium and Work Shop prepared a set of recommendations in relation to Large Marine Ecosystems in the Western Indian Ocean. The Recommendations are reported in the Summary Report of the Symposium.

10.5 IREP-SARP

An IOC Workshop on Sardine/Anchovy Recruitment Project (SARP) in the Southwest Atlantic was held in Buenos Aires, Argentina, 16-19 December 1993. The Workshop was a follow up to the joint cruise on the *METEOR* in 1989, involving Argentina, Brazil, Germany, Sweden, and Uruguay. The Workshop prepared a science plan for 1994.

10.6 IREP-PREP

An IOC in-country consultancy mission was carried out in Papua New Guinea, Indonesia, Malaysia, Thailand and the Philippines, 28 February-4 April 1993, to improve data quality by visiting field sites and observing the current sampling methods, training with the PREP database, and to advise on data analysis and report production. The Mission concluded that PREP activities should be continued and identified specific action to be taken.

10.7 SEAGRASS BED SURVEY

Through a worldwide survey information has been compiled on ongoing activities related to research on, management of, and training on seagrass beds. The aim of the survey is to help co-ordinate efforts within the field through the publication of a directory on seagrass bed activities. The survey should be seen as a specific response to Agenda 21 and as a step towards a better management of coastal ecosystems.

10.8 INTERNATIONAL MUSSELWATCH

The initial phase of the International Musselwatch has been successfully concluded with samples from some 80 stations around the South American continent having been analyzed for chlorinated pesticides and PcB. (PAH analyses were added at a later stage and these results will soon be available). A full interpretation of the data is under preparation, however, the general concentrations of organochlormes in bivalve tissues are relatively low around much of the coastline. Elevated levels at certain sites correspond to concentrations currently found at many North American sites and the causes of these higher levels and their possible effects on the environment is an area requiring further research at the national or sub-regional level.

One out-growth of the International Musselwatch in the South American continent and Caribbean has been the establishment of a large network of active, qualified environmental scientists and institutes. Efforts are now underway to seek funding to support follow-up activities using this network. The proposed follow-up activities are not simply restricted to chemical monitoring of contaminants and may be expanded to other topics including biological effects measurements, harmful algal blooms and coastal zone management issues.

The next phases of the International Musselwatch related to GIPME will focus on two major regions: Asia and Pacific (comprising the three sub-regions Northwest Pacific, ASEAN and the South Pacific) and the Indian Ocean. Again it is envisaged that a series of regional planning workshops will identify scientists and laboratories to design the sampling programme and point sampling sites. The suite of analyses will continue to be primarily restricted to organochlorine pesticides and PCB congeners. There is some interest in adding PAH and certain toxic trace metals to the list of the capacity and funding is identified. In collaboration with GEEP it has further been proposed that collections of digestive glands of bivalves may be a useful extension to examine histopathological makers of effects and would not burden the sampling programme.

11. GOOS COASTAL PILOT MONITORING SYSTEM

Several coastal pilot monitoring activities have been initiated within the framework of the UNEP-IOC-WMO Long-Term Global Monitoring System of Coastal and Near-Shore Phenomena Related to Climate Change. They are recognized by the IOC Committee for GOOS (Rec. GOOS-I.4) as an important contribution to the GOOS module which addresses Monitoring of the Coastal Zone Environment and its Changes. Although these projects are supported jointly by IOC, UNEP and WMO and now also IUCN the resources available do not permit their full and timely implementation, and concern is being expressed on this account.

11.1 IOC-UNEP-WMO-IUCN PILOT ACTIVITY ON MONITORING CORAL REEF ECOSYSTEM

The UNEP-IOC-ASPEI Global Task Team on the Implications of Climate Change on Coral Reefs has prepared an action plan for the implementation of the project and acts as an expert advisory body to both UNEP and IOC on scientific and technical aspects of the Pilot Activity. The Report of the First Meeting of the UNEP-IOC-ASPEI Global Task Team on the Implications of Climate Change on Coral Reefs (Guam, 27-28 June 1992) was submitted to the First Session of the IOC Committee for GOOS in February 1993, and the Seventeenth Session of the IOC Assembly in March 1993. Recommendation of the IOC Committee for GOOS on Coastal Monitoring Pilot Activities (Rec. GOOS-I.4) was endorsed by the IOC Assembly in its Resolution XVII-5.

The Methodology Manual on Coral Reef Monitoring has been prepared and published by UNEP on behalf of the co-sponsoring agencies.

IOC has issued a Circular Letter No. 1370 in January 1993 to Member States to identify their interests in participation in the Pilot Activity and identify national laboratories and scientists for the project. By November 1993, 26 countries had expressed their interest and designated national laboratories (Australia, Bahrain, Barbados, Colombia, Cook Islands, Ecuador, Egypt, Fiji, Germany, Israel, Kenya, Kuwait, Maldives, Mauritius, Principality of Monaco, Papua New Guinea, Puerto Rico, Senegal, Seychelles, Singapore, Solomon Islands, United Republic of Tanzania, Thailand, Trinidad and Tobago, United Kingdom, United States of America and SPREP).

Second meeting of the Global Task Team on Coral Reefs was held in Miami, USA, 2-4 June 1993 under the chairmanship of the Task Team Co-ordinator, Dr. C. Wilkinson (Australia). The Task Team reviewed preparation of the overview "The Implications of Climate Change for Sustainable Use of Coral Reefs" and the status of the Coral Reef Pilot Monitoring Activity. The Task Team emphasized the need for close co-operation of the Global Pilot Activity with existing regional coral reef monitoring programmes, such as the CARICOMP network of Caribbean marine laboratories, and encouraged the development of others now in the planning stages, such as the Pacific Coastal Marine Productivity Programme (PACICOMP).

The Task Team identified some key priority areas that require urgent consideration for the implementation of the Pilot Activity. They include:

(a) designation of a responsible programme office for the Project;
(b) establishment of a receiving data base with a standardized format;
(c) initiation of training courses on a regional basis;
(d) determination by participating organizations the qualitative status of their coral reef resources.

In August 1993 the IOC sent to all designated national contacts for the Pilot Activity the Summary Reports of the First and Second Meeting of the Global Task Team, the Manual on Coral Reef Monitoring and the list of national contacts for the Project and invited them to report on ongoing and planned monitoring activities. The summarized replies will be circulated by IOC to participating laboratories and scientists.

In November 1993, IUCN on behalf of all the co-sponsors published the brochure "Reefs at Risk" which includes the pilot monitoring plan and strategy consideration.

Available resources of IOC and UNEP are not sufficient to provide substantial support for the project and its success will depend much on the partnership among participating countries, particularly in assisting with data management and analysis and organizing training activities. The plan also requires active involvement of IOC regional bodies in the implementation of the Pilot Activity.

The Secretary IOC made a brief statement on the programme at the Coral Reef Consultative Meeting in Washington, DC, 10 January 1994, at which meeting the brochure "Reefs at Risk" was also made available. The strategy interest in the co-operation between the intergovernmental and non-governmental bodies is explicitly emphasized.

11.2 IOC-UNEP-WMO PILOT ACTIVITY ON MONITORING OF SEA LEVEL CHANGES AND ASSOCIATED COASTAL IMPACTS

The Draft Implementation Plan for the Pilot Project in the Indian Ocean (Doc. IOC/INF-908) was submitted to the First Session of the IOC Committee for GOOS (February 1993) and the Seventeenth Session of the IOC Assembly (March 1993). Following Recommendation (GOOS-I.4) of the IOC Committee for GOOS, the IOC Assembly by Resolution XVII-5 endorsed the implementation of the Pilot

Activity.

In August 1993, the IOC issued Circular Letter No. 1387 inviting countries of the Indian Ocean region to participate in the Pilot Activity and designate national laboratories/institutions to serve as a Cell for Monitoring and Analysis of Sea-Level (CMAS) and national contacts.

By January 1994, Bangladesh, India, Kenya, Madagascar, Malaysia, Maldives, Mauritius, and Mozambique, have designated their laboratories as CMAS and national contacts.

Upon request of the IOC, the Permanent Service for Mean Sea Level (PSMSL) provided the IOC Secretariat with monthly sea-level data on a PC diskette for the Indian Ocean stations which has been sent to all CMAS for initial analysis.

The development of the Sea Level Pilot Monitoring Activity, including activities of CMAS was considered at the IOC-UNEP-WMO-SAREC Planning Workshop on An Integrated Approach to Coastal Erosion, Sea Level Changes and Their Impacts, held in Zanzibar, United Republic of Tanzania, 17-21 January 1994.

11.3 PILOT ACTIVITY ON MONITORING PLANKTON COMMUNITY STRUCTURE

The Draft Plan for the Pilot Phase of the Monitoring Scheme for Plankton Community Structure was prepared and IOC jointly with UNEP continues its support for the development of monitoring system using the continuous plankton recorder (CPR) approach, in close collaboration with the Sir Alistair Hardy Foundation for Ocean Sciences (UK). This work is being carried out as a joint efforts with the IOC Programmes on OSLR and HAB.

11.4 PILOT ACTIVITY ON MONITORING OF MANGROVES COMMUNITIES

The Action Plan for the implementation of the pilot project has been prepared. The UNEP-UNESCO Task Team on the Impacts of Expected Climate Change on Mangroves deals with the planning and execution of a global long-term mangrove ecosystem monitoring programme.

11.5 PILOT ACTIVITY FOR COASTAL CIRCULATION MONITORING

A proposal has been prepared to begin with a pilot programme in the East China Sea as a field test for other regions. This was reviewed by WESTPAC Sub-Commission, and will be included as appropriate in the regional GOOS development.

ANNEX

LIST OF ACRONYMS

ADEOS	Advanced Earth Observing System
ALACE	Autonomous Lagrangian Circulation Explorer
AOML	Atlantic Oceanographic and Meteorological Laboratory (U.S.)
ASEAN	Association of Southeast Asian Nations
BATHY	Bathymetric (temperature vs. depth profile) (Code Form)
BUFR	Binary Universal Form for Data Representation
CCCO	Committee on Climatic Changes and the Ocean
CDF	Coded Digital Facsimile
CES	Coast Earth Station
Cg (WMO)	WMO Congress
CLS	Collecte/Localisation/Satellite (Service Argos)
CPR	Continuous Plankton Recorder
CRS	Coastal Radio Station
CSIRO	Commonwealth Scientific Industrial and Research Organization (Australia)
CTD	Conductivity-Temperature-Depth
DBCP	Data Buoy Co-operation Panel
DMSP	Defense Meteorological Satellite Programme
DRIBU	Drifting Buoy (Code Form)
EDC	Error Detection and Correction Procedures
EOS	Earth Observing System
ERS	Earth Remote-Sensing Satellite
ESA	European Space Agency
FY	Feng-Yuen
GCOS	Global Climate Observing System
GEOSAT	GEOdetic SATellite
GLOSS	Global Sea Level Observing System

GOES	Geostationary Operational Environmental Satellite
GOOS	Global Ocean Observing System
GRIB	Gridded Binary
GTS	Global Telecommunications System
GTSPP	Global Temperature-Salinity Pilot Project
HF	High Frequency
IAEA	International Atomic Energy Agency
IDPSS	IGOSS Data Processing and Services System
IFM	Institut für Meereskunde
IFREMER	Institut Français de Recherche pour l'Exploitation de la Mer
IGBP	International Geosphere-Biosphere Programme
IGOSS	Integrated Global Ocean Services System
INMARSAT	INternational MARitime SATellite Organization
IOC	Intergovernmental Oceanographic Commission (of UNESCO)
IODE	International Oceanographic Data and Information Exchange
ISLP-Pac	IGOSS Sea Level Programme in the Pacific
ISLPP-NTA	IGOSS Sea Level Pilot Project in the North and Tropical Atlantic
JEOS	Japan Earth Observing System
JERS	Japan Earth Resources Satellite
JSC	Joint Scientific Committee (of the World Climate Research Programme)
LME	Large Marine Ecosystem
LOICZ	Land-Ocean Interaction in the Coastal Zone
MEDS	Marine Environmental Data Service (Canada)
MOS	Marine Observation Satellite
MTN	Main Telecommunication Network
NASA	National Aeronautics and Space Administration (U.S.)
NATO	North Atlantic Treaty Organization
NCDF	Non-Coded Digital Facsimile
NMC	National Meteorological Centre

NOAA	National Oceanic and Atmospheric Administration (U.S.)
NODC	National Oceanographic Data Centre
OOSDP	Ocean Observing System Development Panel
OPC	Ocean Processes and Climate (IOC Committee)
ORSTOM	Institut Français de Recherche Scientifique/Space pour le Développement en Coopération
PC	Personal Computer
PMEL	Pacific Marine Environmental Research Laboratory (U.S.)
PP	Polar Platform
PSMSL	Permanent Service for Mean Sea Level (U.K.)
RAFOS	Sound Fixing and Ranging Floats
RNODC	Responsible National Oceanographic Data Centre
RSMC	Regional/Specialized Meteorological Centre
RTH	Regional Telecommunications Hub
SAR	Synthetic Aperture Radar
SIGRID	Format for the Archival of Sea-Ice Data in Digital Form
SOA	State Oceanic Administration
SOOP	Ship of Opportunity Programme
SPOT	Satellite Pour l'Observation de la Terre
SST	Sea Surface Temperature
TAO	Tropical Atmosphere-Ocean
TESAC	TEmperature, SAlinity, and Conductivity (Code form)
TOGA	Tropical Oceans and Global Atmosphere
TOPEX	Ocean Topography Experiment
TRMM	Tropical Rainfall Measurement Mission
UARS	Upper Atmosphere Research Satellite
UNEP	United Nations Environment Programme
UNESCO	United Nations Education, Scientific and Cultural Organization
VIS/IR	VISible/InfraRed
VOS	Voluntary Observing Ship

WCRP	World Climate Research Programme
WDC	World Data Centre
WMC	World Meteorological Centre
WMO	World Meteorological Organization
WOCE	World Ocean Circulation Experiment
XBT	EXpendable BathyThermograph