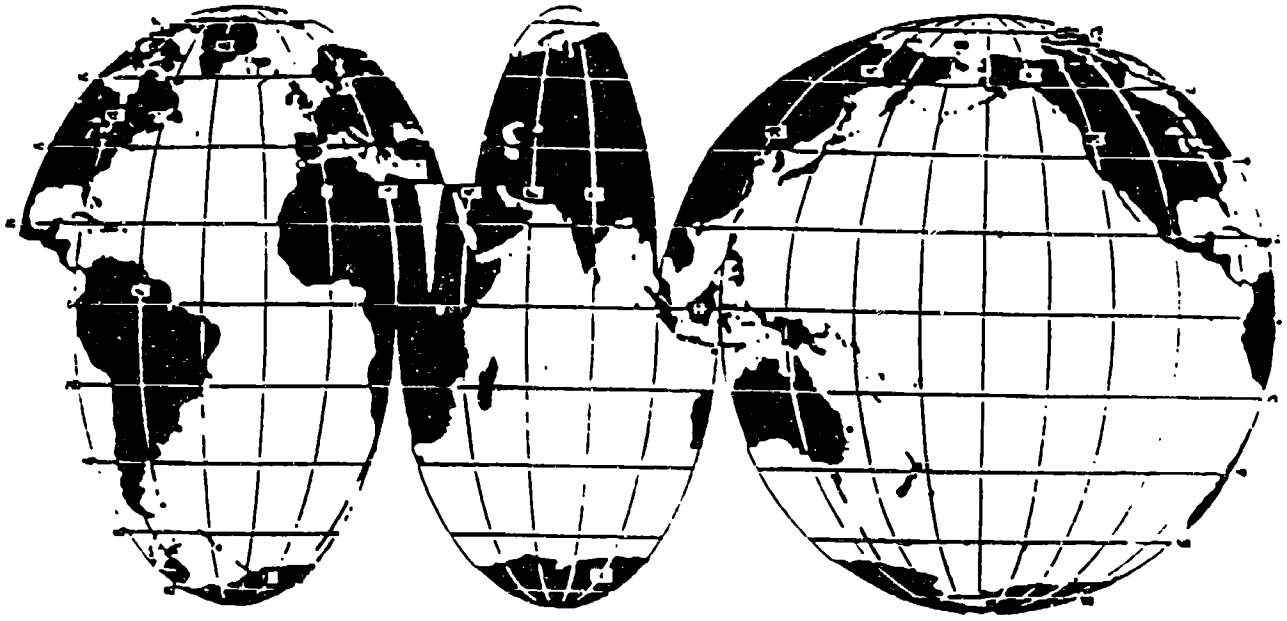
IOC/INF-902

INTERGOVERNMENTAL OCEANOGRAPHIC
COMMISSION (of Unesco)

WORLD METEOROLOGICAL
ORGANIZATION

GLOBAL OCEAN OBSERVING SYSTEM

STATUS REPORT ON EXISTING OCEAN ELEMENTS AND RELATED SYSTEMS



DECEMBER 1992

SC-93/WS/8

TABLE OF CONTENTS

TABLES

FIGURES

PREFACE

The Intergovernmental Oceanographic Commission (IOC) at the Sixteenth Session of its Assembly in March 1991 confirmed its plan to pursue, as a priority, the development of a Global Ocean Observing System in co-operation with the World Meteorological Organization (WMO), United Nations Environment Programme (UNEP) and other appropriate UN organizations. The Eleventh Congress of the WMO in June 1991 initiated the Global Climate Observing System (GCOS) to address requirements for global climate studies and assessments. WMO, IOC, UNEP and ICSU have agreed to jointly sponsor development of this system with the climate module of the Global Ocean Observing System forming the ocean component of the GCOS. Other objectives of GOOS are to address marine living resource needs, coastal zone management and development, the health of the oceans and marine meteorology and oceanographic services.

In March 1992 the IOC Executive Council at its Twenty Fifth session decided to establish the IOC Committee for GOOS to serve as the intergovernmental forum for the Global Ocean Observing System and the Joint GOOS Technical and Scientific Committee (J-GOOS) to provide advice to IOC on design, planning and development of GOOS. Negotiations with ICSU-SCOR, WMO and UNEP are under way to sponsor jointly J-GOOS.

The Global Ocean Observing System was addressed by the United Nations Conference on Environment and Development in June 1992. Chapter 17 of UNCED Agenda 21 (Section E, para.17.102) states that:
" States should consider inter alia supporting the role of the IOC in co-operation with WMO, UNEP and other international organizations in the collection, analysis and distribution of data and information from the oceans and all seas, including as appropriate, through the proposed Global Ocean Observing System, giving special attention to the need for IOC to develop fully the strategy for providing training and technical assistance for developing countries through the Training, Education and Mutual Assistance programme". Agenda 21 also states that "developed countries should provide the financing for the development and the implementation of the proposed GOOS system" (para. 17.109)

Actions and consultations have taken place in 1992 to formulate strategy for GOOS planning and development.

The Ocean Observing System Development Panel (OOSDP) is formulating a conceptual design of a long-term systematic observing system to monitor, describe and understand the physical and biogeochemical properties that determine ocean circulation and the effects of the ocean on seasonal and decadal climate changes, and to provide the observations needed for climate predictions. Their report, due December 1994, will recommend a system intended as the climate module of GOOS and the ocean component of GCOS. Background papers are being prepared and distributed widely for comment that identify 1) the elements of the GOOS as defined by scientific requirements for climate studies, 2) existing capabilities available, and 3) new types of systems that should be encouraged. The first paper, entitled "The Role of Models in an Ocean Observing System" was published in December 1991. The second paper, "Scientific Rationale for Observing the Uptake and Transport of CO_2 by the Ocean", was published in September 1992. Other papers, e.g., "Surface Conditions and Air-Sea Fluxes" and "Enabling Technologies", will be published in 1993. At the request of GCOS, the Panel prepared a paper entitled "Recommended GCOS Requirements for Upper Ocean Observations for ENSO Prediction", in July 1992. The panel also prepared an Interim Report, in December 1992, which identified those observational elements that could be confidently recommended at the halfway point of the Panel's planned life, and described a path to be followed to arrive at future recommendations regarding observations which were still under consideration.

Planning for implementation of pilot activities within the joint IOC-UNEP-WMO Long-Term Global Monitoring System of Coastal and Near-Shore Phenomena Related to Climate Change proceeded in 1992 following decision by the Twenty Fifth session of the IOC Executive Council in March 1992. The pilot projects are considered as a contribution to the coastal module of GOOS and are being developed jointly with UNEP and WMO and IUCN.

IOC, and subsequently GOOS and GCOS accepted invitations to become affiliates of the Committee on Earth Observations Satellites, an international satellite coordination group created in 1984. Its members are those government agencies with funding and programme responsibilities for satellite observations and data management. In order for satellite missions to focus on ocean variables for essential long-term global data sets, oceanographers must form partnerships with such groups. IOC and GOOS are presently participating in a user requirements study being conducted by CEOS.

This report is the third annual report prepared in response to a request by the IOC Executive Council in March 1990. It contains a summary of the ocean observing activity that took place during 1992. Much of the information was prepared by representatives of existing and planned large-scale climate research programmes and those who coordinate IOC and WMO-sponsored ocean observing and data management systems. The first report issued in 1990 should be retained for use with this document as it contains much of the background material upon which this document is based and describes the functions of both relevant research programmes and existing IOC and WMO systems.

1. SHIPS OF OPPORTUNITY[1]

In 1992 an estimated total of 42,225 BATHY messages (temperature versus depth profiles using expendable bathythermographs) and 2623 TESAC messages (temperature, salinity and conductivity measurements taken with Conductivity/Temperature/Depth equipment) were exchanged over the GTS through the IGOSS System. This is an increase over the previous two years. Table 1 indicates the number of subsurface temperature (BATHY) and salinity (TESAC) measurements that were exchanged via the GTS for the period of 1985 through 1992. There is a great interest in the acquisition of this data as can be seen from the numerous monitoring efforts by global programs, national data centers and the Operations Co-ordinator. However, it is becoming obvious that due to financial constraints in some countries the collection of ocean data and its exchange through the GTS is decreasing dramatically. IGOSS has been not been receiving a large portion of the data that was submitted by the former Soviet Union. In 1990 this country provided 32.4% of the total amount of operational data; in 1991 it was still 15.6% and now it is less than 1%. Sub-surface data coverage needs to be increased in the Atlantic, Indian, and Southern Oceans as can be seen in Figure 4. which depicts the location of BATHY data collected for the month of December 1992.

Approximately 270 ships (both research vessels and merchant ships) contributed to the collection of IGOSS data (see Table 2) in 1992. A total of 15 countries actively participated, with six countries transmitting TESAC data. This is a significant improvement over previous years and hopefully indicates renewed interest in the acquisition of this data.

In 1992 XBT coverage for TOGA studies in the Atlantic increased significantly. A few Atlantic TOGA lines are still unoccupied and sampling on others is at less than the required frequencies. The Indian Ocean portion of the TOGA efforts experienced logistical difficulties, and several previously occupied lines are no longer occupied. TOGA Lines in the Pacific are well-covered with the notable exception of the short lines off the western coast of Latin America. Recent statistical studies of time series data show that the requirement for higher density coverage, both in space and in time, along selected cross-equatorial ship-of-opportunity lines is well-justified, and probably essential, to define effectively the large-scale thermal structure of the tropical upper oceans as a time dependent system. In addition, recent experience in assimilating XBT data into operational ocean models confirms the need to sample at these rates in order to prevent aliasing by small-scale variability.

In the North and tropical Pacific and Atlantic Oceans, ships of opportunity supporting WOCE provide monthly and bi-monthly information on the extent and structure of thermal anomalies. When coupled with estimates of winds, air-sea fluxes and sea surface temperature, these data form the basis of the operational models currently being run in the tropical Atlantic and Pacific Oceans. WOCE has designed a high-density XBT sections network in the Pacific which, together with the repeat hydrography, satellite altimetry, surface drifters and mid-depth floats, should describe the seasonal and interannual variability in ocean circulation. High density XBT sections are also required for the meridional heat flux sections in the Atlantic and Indian oceans and of the choke point sections in the Southern Ocean. Groups in Australia and the U.S.A. are committed to beginning these high density sections, but greater resources and a greater number of participating Member States are needed.

IGOSS Data Processing and Services System (IDPSS)

The IDPSS consists of national, specialized and world oceanographic centers 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 Center and six have established one (or more) of the seven IGOSS Specialized Oceanographic Centers (SOC's) and/or World Oceanographic Centers (WOC's). Of these seventeen countries, sixteen prepare 65 sub-surface and 192 surface

[1] Defined as all ships collecting sub-surface temperature data, as well as, in some cases, salinity and/or surface and subsurface current data

IGOSS products. An additional 32 sub-surface and 122 surface IGOSS products are prepared by 31 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.

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 9.

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 129 coastal radio stations have been designated by 34 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.

Ten 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. A summary of the status of WMO Voluntary Observing Ships is given on page 8.

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 1572 drifting buoys, 352 moored buoys, 69 balloons, 70 ships, 481 fixed stations, 433 boats and 403 miscellaneous platforms, an increase of 1993 over the September 1991 total. A discussion of the status of buoy activities is given on page 7.

2. SATELLITES

Recent Missions

JERS-1 was launched in February 1992. It is carrying a SAR (Synthetic Aperture Radar) and an OPS (Optical Sensor) consisting of a VNIR (Visible and Near Infrared Radiometer) and a SWIR (Short Wave Infrared Radiometer). The satellite is presently operational.

The TOPEX/POSEIDON satellite was launched on August 10, 1992 from the European Space Agency's Guiana Space Center in French Guiana. The satellite carries five active instruments onboard, the TOPEX Microwave Radiometer (TMR), the Doppler Orbitography and Radiopositioning Integrated by Satellite (DORIS), the Global Positioning System Demonstration Receiver (GPSDR), the Solid-State Single Frequency Altimeter (SSALT), and the Dual Frequency Altimeter (ALT). Because ALT and SSALT share the same

antenna, they cannot be active at the same time. The precision of the two altimeters (both SSALT and ALT) have met the 2 cm (root-mean-square) specification. The mission is now in its five month verification phase (scheduled for completion in February 1993) in which the altimeter measurement and its various corrections will be calibrated and verified. During the verification phase, the mission's Precision Orbit Determination Team will use the various satellite-tracking data to fine-tune the gravity field model that will be used to compute the missions precise orbit.

Two existing TOGA-TAO thermistor chain moorings, located at 2° S, 164° E and 2° S, 156° E, will be outfitted with additional dedicated instruments especially designed to capture sea level with a 2-cm accuracy at two TOPEX/POSEIDON crossover points. A series of surface-to-bottom temperature and salinity sensors along with mooring lines will provide the steric part of sea-level changes. The barotropic part will be deduced from bottom-pressure sensors.

Future Activities

The SEAwifs satellite is proceeding on schedule for a 31 August 1993 launch. Significant progress has been made on developing the engineering units for the satellite. The flight units are starting to be completed and the flight spacecraft is expected to be complete and ready for environmental testing on 20 March 1993. The SeaStar ground station components are currently coming together with final installation to begin in March 1993 at their appropriate sites.

SeaStar will use the first stretched Pegasus launch vehicle and be the first to be launched by the L-1011. The launch will also be the first out of Vandenberg AFB and the new Pegasus processing facility. The key milestones to watch for schedule assurance are the flight build being completed on 20 March and a successful Pegasus firing next year. Functional tests have been performed on the operational SeaWiFS instrument since early November. These preliminary tests have indicated that the SeaWiFS instrument will meet all of its performance specifications. The bright target recovery for bands 7 and 8 remains the most difficult specification to meet.

Potential SAR missions are as follows

S/C Name	L/Date	Agency	Status
ERS-2	1994	ESA/Europe	approved
Radarsat	1995	CSA/Canada	approved
SAR II	1998	MITI/Japan	proposed
Envisat-1	1998	ESA/Europe	approved
ADEOS IIb	2000	NASDA/Japan	proposed
Radarsat	2002	CSA/Canada	proposed
Envisat-2	2003	ESA/Europe	approved

Four of these SAR missions are newly-announced. Efforts are required to insure that the proposed missions survive the budget process and are approved.

A geodesy mission such as ARISTOTLES along with precise altimetry missions (TOPEX/POSEIDON follow-on) are crucial for ocean applications and neither are assured on the mission schedule for the future.

Committee on Earth Observations Satellites

GOOS was recently accepted as an affiliate member of the Committee on Earth Observing Satellites (CEOS). CEOS has three objectives:

(i) To optimize the benefits of spaceborne Earth observations through cooperation of its members in mission planning and the development of compatible data products, formats, services, applications, and policies.

(ii) To aid both its members and the international user community by inter alia serving as the focal point for international coordination of space-related Earth observations activities, including those related to global change.

(iii) To exchange policy and technical information to encourage complementarity and compatibility among space borne Earth observations systems currently in service or development, and the data received from them; issues of common interest across the spectrum of Earth observations satellite missions will be addressed.

Principle activities of the CEOS of interest to the ocean community have been 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 presentations by the affiliates on their requirements at the CEOS plenary (London, 9-11 December 1992) and the effort will continue into next year toward a unified list of requirements from all of the affiliates. The efforts toward a common data policy will also continue into the next year. CEOS is nearing completion of a three volume set of dossier's on Satellite Missions, Global Environmental Programmes and Space Agency Ground Segment Infrastructure.

Data Policy

Earth observation by satellite is becoming 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 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).

3. GLOBAL SEA LEVEL OBSERVING SYSTEM

The global network of 300 proposed by the GLOSS plan permanent stations forms the primary framework to which regional and national sea-level networks can be related. Some sets of GLOSS stations constitute the TOGA and WOCE sea-level networks. The up-dated status of the GLOSS network accepted by the Group is attached as Table 3.

The following changes in the GLOSS network were agreed upon by the IOC Group of Experts on GLOSS:

- 196 Bahia Scotia - removed
- 48 Pelabuhan - removed
- 301 Palmyra Island - removed
- 285 Nawiliwili - removed
- 287 Kahului - removed
- 184 Jubany - delete
- 56 Hobart - to be replaced by Spring Bay
- 55 Adelaide - to be replaced by Portland
- Thevenard (Australia) - to add.

The IGOSS Sea-Level Programme in the Pacific (ISLP-Pac) collected in 1992 monthly mean sea level values from 89 stations in 32 countries in the Pacific in near-real time. The Specialized Oceanographic Center for ISLP-Pac (operated by the University of Hawaii) produces the maps of the sea level deviation from the long-term mean, maps of the anomalies from the mean annual cycle that have been corrected for the inverted barometer response of the sea surface to atmospheric pressure changes; quarterly updates of the time series of the tropical Pacific upper layer volume; once per year indices of the variability of the tropical Pacific ridge-trough topography and the current indices derived from this topography.

The IGOSS Sea Level Pilot Project for the North and Tropical Atlantic Ocean (ISLPP/NTA) started in 1991 with the objectives to acquire on a monthly basis the monthly mean sea level data from various tide gauges located around and in the North and Tropical Atlantic Basin and to test the feasibility and usefulness of an operational mean sea level network for producing synoptic anomaly charts for the North and Tropical Atlantic Ocean. SOC for ISLPP/NTA is operated by the Canadian Marine Environmental Data Service (MEDS).

The INTERNET network is widely available for provision of IGOSS products.

The status of sea-level submission to PSMSL according the following four categories is as follows:

Category 1: "Operational" stations for which the latest data is 1986 or later;
Category 2: "Probably Operational" stations for which the latest data is within the period 1976-1985;
Category 3: "Historical" stations for which the latest data is earlier than 1976;
Category 4: For which no PSMSL data exist.

Categories	1989	1990	1991	1992
1	105	133	136	158
2	51	50	57	46
3	47	42	36	29
4	103	81	77	73

A new version of the GLOSS Handbook is nearly completed.

Woce Sea Level Network

Conventional sea-level gauges are used in WOCE to calibrate satellite altimeter measurements and to instrument narrow straits and passages where transport can be monitored by measuring changes in difference of surface elevation.

The WOCE Sea Level Center established at the British Oceanographic Data Center has responsibility for assembling, quality controlling and disseminating the comprehensive sea level data set for WOCE. It began its activity in early 1991.

The second WOCE Sea Level Center, to become operational in early 1993, will be operated as the "fast" sea level DAC for WOCE by the University of Hawaii (USA). It will focus on processing sea level from a globally distributed set of stations and making it available to users within 1 to 3 months of data collection.

TOGA Sea Level Network

The TOGA programme requires daily sea level values with an accuracy to 2 cm from the sites stated in the TOGA Implementation plan (includes GLOSS stations in the area from 30° N to 30° S). The TOGA Sea level Center, established at the University of Hawaii, is responsible for collecting, quality controlling, archiving and distributing sea level data from the global tropics. The data holdings of the TSLC presently consist of 1827 station-years of data from 207 stations.

Having established the Pacific Ocean Network virtually to the extent required by the TOGA Implementation Plan, the TOGA Sea Level Center over the past two years has increasingly turned its efforts to developing the required network in and flow of data from the Indian Ocean. The first submission of an Atlantic datasets was made in July 1992.

4. BUOYS

Drifting Buoys

In November 1992 data from a total of 1211 drifting buoys were collected and processed at the Argos Global Processing Centers of Toulouse, France, and Landover, Maryland, USA for distribution in real-time or deferred-time to respective Principal Investigators. These buoys are operated by 16 countries (Australia, Canada, China, Finland, France, Germany, India, Italy, Japan, Korea, New Zealand, Norway, South Africa*,Sweden, United Kingdom and the USA). Brazil, Iceland and Netherlands also deployed a few drifting buoys during 1992.

Of those 1211 drifting buoys, about 45% transmit the data in real time via the Global Telecommunication System (GTS). Compared to last year, the substantial increase of the number of buoys making their data available on the GTS is largely due to the increasing activity of the Surface Velocity Program (SVP) of the World Ocean Circulation Experiment (WOCE) and the Tropical Ocean and Global Atmosphere programme (TOGA) in conjunction with the efforts of the Technical Coordinator of the Drifting Buoy Cooperation Panel (DBCP) to obtain authorization and assist Principal Investigators for GTS distribution of as many buoys as possible.

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 7% of all operational drifting buoys have no sensors and are used as Lagrangian tracers only, 20% don't report onto the GTS because of poor quality data, 5% cannot report on the GTS because of technical obstacles, and 15% 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). Table 5 shows the total number of drifting buoys per country and the portion of those buoys reporting onto the GTS for the period 16 November 1992 to 23 November 1992. For those reporting on the GTS, Figure 7 shows by country, the number of buoys equipped with an operational sensor of each kind. Figure 8 indicates, by Marsden Square, the number of reports received at the Paris Hub during September 1992. Figures 9 through 12 are regional track charts that plot the month's movement of the reported buoys that passed position and quality control checks.

Quality Control Guidelines have been developed for drifting buoy data distributed on the GTS. Principal Meteorological or Oceanographic Centers for data quality control (PMOC) can now report possible problems and suggest appropriate actions (e.g. change a buoy status) via a centralized electronic bulletin board. The guidelines have been successful so far in improving the overall quality of drifting buoy data delivered on the GTS. Centers presently acting as PMOC are: The European Center 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.

The Responsible National Oceanographic Data Center 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 moth by the RNODC/DB is shown in figure 13. In addition, the French National Oceanographic Center operates the IGOSS Specialized Oceanographic Center for Drifting Buoy Data (SOC/DB).

Meteo-France developed and deployed in 1992 6 drifting buoys equipped with thermistor strings capable of regularly making 10 water temperature measurements down to 100 and 150 meters. The buoys are also measuring wind speed and direction, air pressure, and sea surface temperature. Life time of such devices is in the order of one year, and France plans to deploy 35 of such buoys in 1993.

Although the Pacific ocean is now being studied, thanks 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.

Moored Buoys

The TOGA Tropical Atmosphere-Ocean (TAO) array of ATLAS moorings in the tropical Pacific saw continued expansion in 1992. Figure 14 show the status of implementation as of December 1992. All data is transmitted via the GTS. There has been a significant increase in the transmission of data from the TAO Array on the Global Telecommunications System (GTS). Formerly, because of data handling problems, less that 30% of the data from the TAO Array moorings were transmitted on the GTS. With the cooperation of ARGOS and U.S. and Canadian organizations a number of data handling problems were identified and rectified increasing the data throughput to over 85%. Monitoring is continuing and additional improvements are expected.

Proposals to extend the array into the Indian Ocean are being formulated. Long-term commitments of ship-time are required for the maintenance of the array, particularly in the western Pacific and in the Indian Oceans.

5. MARINE METEOROLOGY AND ASSOCIATED COMPONENTS OF THE WORLD WEATHER WATCH

Global Observing System

Table 4 lists, by country, the number of vessels which participated in the WMO Voluntary Observing Ship (VOS) scheme in 1992 - a total of 7362 recruited by 49 countries. Figure 16 depicts the global coverage of marine meteorological reports from the VOS during the month of September 1992, with the total for the month of 119470 representing an average of about 3,800 reports per day received at the main meteorological analysis centers. Such real-time reports were communicated to shore through 323 coastal radio stations (CRS) and 9 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 2947 VOS being equipped with INMARSAT Ship Earth Stations in 1992. With the phased implementation of the Global Maritime Distress and Safety System beginning on 1 February 1992, it is probable that the number of VOS equipped and reporting through INMARSAT will expand rapidly in the next two-five years. 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 format and encoding / decoding software development will be completed in 1992, to allow rapid implementation on VOS and in national Meteorological Services.

Global Telecommunications System

The Main Telecommunication Network (MTN) consists of 23 point-to-point circuits linking together three World Meteorological Centers 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 Table 5.

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 centers 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 216 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 centers on the Main Telecommunication Network (all of which have regional functions) the regional meteorological telecommunication networks also require the establishment and operation for telecommunication purposes of 15 RTHs, six Regional Specialized Meteorological Centers not associated with RTHs and 148 NMCs or centers 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:

(i) 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;

(ii) 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);

(iii) 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 centers 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 (MOD) system, is also developing as a complementary means to the point-to-point circuits.

WMO Applications of Meteorology Programme

A new globally coordinated WMO system for the preparation and dissemination of meteorological forecasts and warnings to shipping on the high seas under the Global Maritime Distress and Safety System (GMDSS) of IMO had been implemented provisionally as from 1 February 1992, in accordance with the implementation schedule for the GMDSS as adopted by IMO.

The assessment of implementation status of the system showed that less than 50 percent of the world's oceans were covered by meteorological forecast and warning services broadcast through the International SafetyNET Service (a communications component of the GMDSS). This figure expected to increase to 70 per

cent by the end of 1993 and from 1 February 1992, ships may be legally equipped to receive maritime safety information through SafetyNET. This implies considerable responsibility on the part of national Meteorological services to provide information necessary for the safety of life at sea.

The WMO with other international organizations directly concerned in the GMDSS (IMO, IHO, ICS and INMARSAT) developed a set of interim procedures for the provision of urgent meteorological warning information to those ocean areas not yet covered by a full GFMSS service.

The Marine Climatological Summaries Scheme (MCSS), in place now since 1964, represents a unique example within WMO of the co-ordinated collection, archival and analysis of climatological data on a global scale. Traditionally, the MCSS has provided essential support to the provision of a variety of marine meteorological and oceanographic services. the MCSS has now been revised so as to better serve the interests of global climate studies.

The revised MCSS retains the existing eight Responsible Members, together with their designated areas and responsibilities for processing the data and providing user services. In addition, however, it designates two global collecting centers (United Kingdom Meteorological Office, Deutcher Wetterdienst Seewetteramt), responsible for collecting VOS data from all contributing Members ensuring the applications of first-level quality control, geographically separating data and distributing respective data sets to the other six Responsible Members, and maintaining global data archives. Contributing Members, who will have now to despatch only two data sets instead of up to eight, will submit data every three months. In this way a faster through-ut of data will be achieved, as well as improved quality control an global data archives.

A major project of CMM Working Group on sea ice is the implementation of a Global Digital Sea Ice Data in support of specialized services and also as a fundamental component of ocean modelling and WCP. At the present time two countries have expressed their willingness to receive global sea ice data and to make them available. They are the WDC-A for Glaciology in the USA and the Arctic and Antarctic Research Institute in Russia, which assumed the functions of the WDC-B for sea ice.

The two data centers have established the feasibility of merging digitized sea ice data from various sources and countries into a single data bank, and developed archival and exchange formats and procedures.

At present some countries have started to send the data to the centers, which have exchanged descriptions of newly digitized sea ice data obtained from other countries. Thus the global sea ice data sets and ice drift data from Canada, USA, Russia and Japan for 1972-1990 are archived on diskettes and magnetic tape.

Further work will be directed towards the preparation of a 30-year data set for climate studies.

6. DATA MANAGEMENT

Data management is carried out by the network of World Data Centers, Responsible National Oceanographic Data Centers, National Oceanographic Data Centers and different offices, services and agencies of the countries involved in data exchange with direct coordination with the IOC and WMO member states.

The international marine data base of the Centers now contains data almost 3 million observations, including data for more than one million oceanographic stations; 569,000 bathythermographs; 207,000 biological observations and 670,000 current measurements . The types of data are summarized in figure 17. During 1991 WDC-A received data for a total of 31,181 oceanographic stations, 29,889 bathythermograph observations, 2,378 biological observations and 8,047 current measurements. During 1991-2, WDC-B received data for a total of 13,586 scientific observations, including 3,518 oceanographic stations, 3,557 bathythermograph observations, 1,406 biological observations, and 3,557 current measurements.

Countries Submitting Data to WDC-B
as of 30 June 1992[2]

Argentina	Spain
Australia	Sweden
Belgium	South Africa
Brazil	Russia*
Canada	United Kingdom
Chile	United States*
Colombia	Yugoslavia
Denmark	Korea (Rep. of)
Ecuador	Ivory Coast
Finland*	Nigeria
France	Congo
Germany	Malaysia
Ghana	Malgasy Rep.
Iceland	Morocco
India	Senegal
Indonesia	Thailand
Ireland	Turkey
Israel	Venezuela
Italy*	Cuba
Japan*	Romania
Mexico	Arab Rep. of Egypt
Netherlands	Sierra Leone
New Zealand	Tunisia
Norway	Greece
Pakistan	China (P. Rep.)
Peru	Mauritania
Philippines	Bulgaria
Poland	Angola
Portugal	
* Submitted Data in 1991-92	

Year	WDC-A Number of Stations Received during Period	WDC-B Number of Stations Received during Period
1985.....	30,346	28,692
1986.....	34,659	21,080
1987.....	30,093	36,800
1988.....	34,432	28,240
1989.....	42,075	13,270
1990.....	24,257	17,865
1991.....	31,151	13,518

[2]According to the IODE Manual, the data holdings of all WDC's are essentially the same because the centers exchange data to ensure that this is the case.

Data held in WDCs are identified and described in the catalogues of data holdings. WDC-A, Oceanography, has used its catalogue of data to assist the collocated US NODC in compiling 3 digital files of oceanographic station data and CTD/STD data from ocean measurement programmes that have repetitive sampling at the same location for long time periods. The files include data from 27 North Pacific sections, 56 North Atlantic Sections and 20 sections for the remainder of the World Ocean. Improvements have been made to the PC-based Catalogue database; diskettes are now exchanged on a yearly basis between WDC-B and D. The inter-comparison of WDC-A and WDC-B Catalogues had been performed and an effort was made to obtain the identity and completeness of WDCs archives. WDC-B created an automated catalogue based on a IBM PC/AT compatible system, the content of which is available to other WDCs in printed form, on a diskette, or via electronic communication. WDC-D, Oceanography has compiled and published 2 volumes of data collected by China.

The collection and processing, including quality control, of XBT data is being carried out in cooperation with the Global Temperature-Salinity Pilot Project (GTSPP) which is aimed at alleviating past problems in quality control, duplication and data loss. Seven Member States are now participating actively in the GTSPP and all seven have contributed significantly to the project. Centers in North America, Europe and Asia, are now providing copies of their GTS receipts of BATHY and TESAC data. GTSPP is confident that a high percentage of the available real-time GTS data are being acquired for the databases.

GTSPP Centers provide WOCE Regional Centers with monthly data sets and after quality control are returned via the GTSPP Centers to the WOCE Global Center in Brest, France. In the area of the real-time data flow and the WOCE Upper Ocean Thermal Project data flow the GTSPP has made considerable progress during the intersessional period. The Project has also been successful in documenting this progress through the manuals and reports that were published. In particular, the reports have documented the QC and data management technologies that are being developed and implemented and made these available to Member States of IOC and WMO. The data flow analyses have allowed centers receiving real-time GTS data to discover and fix data routing problems.

WDCs for Marine Geology and Geophysics (WDC-A, MGG - Boulder, USA; WDC-B, MGG - Gelendzik, Russia) compose an integrated part of the IODE System. By the end of 1992, there was a 40% increase in marine geology data holdings and a 30% increase in marine geophysics.

At WDC-A, MGG, data from several thousand additional climatically significant cores from the Southern Oceans are in preparation. Underway geophysics digital holdings at the Center are now 35.2 million MGD77 records covering 11.9 million nautical miles of ship tracks for 3,290 cruises. There are 6.7 million track miles of analog data including 5.3 million track miles of analog seismic reflection data. The WDC-A, MGG is now actively seeking to create a multibeam database. Two new CD-ROMS containing marine geophysical and marine mineral data were produced. The WDC-B created the databases "Sediments, rock and mineral resources" on the basis of the materials of 990 cruises from 32 countries for 94,300 geological stations; "Results of geophysical work" on the basis of the materials from 1,890 cruises of 18 countries and "Results of drilling", based on the materials of "Glomar Challenger".

There was a visible progress in the usage of CD-ROM technology as an inexpensive way to put rare and original data and information into the hands of numerous users. The BODC of UK has recently released a CD-ROM package containing more than 95% of the data collected during 38 cruises of the NERC North Sea Community Research Project in the Southern North Sea in 1988-1991. The dataset covered a wide diversity of data types including 70,000 nautical miles of underway thermosalinograph, fluorimeter and transmissometer data, well over 3000 CTD casts, data from 300 moored instrument deployments, 20 cruises of underway ADCP data, and a wide variety of measurements on some 10,000 water samples including nutrients, suspended matter trace metals, chlorophyll, sulphur compounds, halocarbons and plankton species. Other data included atmospheric chemistry data and data from productivity experiments, sediment cores and AVHRR images. The US NODC made available a CD-ROM with 1.3 million Pacific Ocean temperature-depth and salinity-depth profiles for the period 1900 and 1988. The software which accompanies the disk enables users to access, subset, copy and display profiles.

There was a considerable increase of submission and dissemination of National Oceanographic Programmes among IOC Member States. If in 1989 only 8 NOPs had been received by the Secretariat, in 1992 there were 21 Member States which participated in this important procedure. A number of national oceanographic data centers operating in the framework of IODE has reached 44, terms of references of existing RNODCs on SOC, Formats and ADCP have been modified to reflect better existing realities and to respond more effectively to users' needs.

Several IODE centers have become increasingly involved in supporting the international global science programmes such as WOCE, TOGA, and JGOFS. The RNODC for Drifting Buoys is part of the WOCE Data Assembly Center (DAC) for the WOCE Surface Velocity (Drifting Buoy) Programme. The GTSPP is part of the DACE for the WOCE Upper Ocean Thermal Programme. The BODC operates the WOCE DAC for sea-level and the German DOD is part of the Special Analysis Center (SAC) for the WOCE Hydrographic Programme. All of these centers are operational and are delivering data services and data on a regular basis. Representatives from the science programmes have stated their satisfaction with the response of IODE at several meetings over the past year.

7. OTHER MONITORING ACTIVITIES, TECHNOLOGIES, AND PLANS

7.1 Pilot phase of the Long-Term Global Monitoring System of Coastal and Near-Shore Phenomena Related to Climate Change

Plans for the development of six pilot projects adopted by the 16 session of the IOC Assembly: sea level changes and coastal flooding, coastal circulation, organic carbon accumulation in surface coastal sediments, plankton community structure, coral reef ecosystems, and mangrove communities. were considered and endorsed by the Fifth Session of the IOC Committee on Ocean Processes and Climate and by the Twenty-Fifth Session of the IOC Executive Council (March 1992). Those projects are considered as a contribution to the coastal module of GOOS and being developed jointly with UNEP and WMO. UNEP has provided substantial financial contribution to the development of the projects.

The Oceans chapter [3] of Agenda 21 adopted by the UNCED repeatedly calls for coastal observations for integrated management and sustainable development. In order to address critical uncertainties for the management of the marine environment and climate change, it calls for systematic observations, development of procedures for comparable analysis, information exchange and strengthening of national scientific and technological oceanographic commissions. The importance of international cooperation, fostered by international organizations such as the IOC, is also stressed. This system is a response to the needs identified and actions endorsed.

The system is considered as a complementary activity to the proposed IGBP Core Project entitled Land-Ocean Interactions in the Coastal Zone (LOICZ). LOICZ is being undertaken to develop a predictive understanding of the dynamic behavior of the land-ocean interface, and thus the responses of coastal systems to global change. Its scientific studies will require a coastal observation programme which incorporates a variety of parameters and time and space scales.

Planning for implementation of the GCMS pilot phase is proceeding with priority having been assigned to the coral reef and mangrove projects.

---

[3]Chapter 17, Protection of the oceans, all kinds of seas, including enclosed and semi-enclosed seas, and coastal areas and the protection, rational use and development of their living resources

Coral Reef Ecosystems and Mangrove Communities

A meeting of 18 experts, sponsored by IOC, UNEP, WMO and IUCN, (Monaco, 13-16 December 1991) (Document UNEP-IOC-WMO-IUCN/GCNSMS-II/3) developed action plans for the implementation of these two projects.

Coral Reef Ecosystems

At the Seventh International Coral Reef Symposium (Guam, 22-26 June 1992) the UNEP-UNESCO-IOC-IUCN-SPREP-SCOR-CARICOMP-PACICOMP Workshop was held (25 June 1992) to organize a co-ordinated network of tropical marine labs to monitor reef responses to global changes. Tropical marine scientists from 15 countries expressed interest and agreed to coordinate their existing and planned regional and national activities within the framework of the UNEP-IOC-WMO-IUCN system.

IOC has also sponsored, with UNEP and the Association of Southeast Pacific Environmental Institutions, a Global Task Team on Coral Reefs which held its first meeting (Guam, 27-28 June 1992) in conjunction with the Seventh International Coral Reef Symposium. The Task Team's objectives are to prepare an overview on the impacts of climate change on coral reefs and their ecologically sustainable use and to identify suitable case studies for follow-up activities. The Task Team also agreed to serve as a scientific and technical advisory body to UNEP and IOC for implementation of the pilot phase.

Australian Institute of Marine Science has prepared a Methodology Manual on Monitoring Coral Reefs for Global Change that will be published in the UNEP Reference Manual series in 1993.

Mangrove Communities

UNEP and UNESCO (COMAR) also co-sponsor a Task Team on the Expected Impacts of Climate Change on Mangroves. Following a preparatory meeting, the Task Team at its first meeting (Rio, 1-3 June 1992) decided to conduct an analysis of relevant literature, conduct a pilot study of a minimum of three sites[4] and design and recommend a study and monitoring programme. They agreed to act as an advisory group to design, develop and operate the GCMS. The Task Team proposed that three sites be selected from among those nominated and that site visits be made in order to prepare reports on the suitability of the site and on the specific work plan proposed. Funding is being sought to carry out this activity.

Plankton Structure

IOC is supporting, through a contract with the Sir Alistair Hardy Foundation for Ocean Sciences (U.K.), the development of a monitoring system using continuous plankton recorders. An implementation plan for a pilot project is to be completed by the end of 1992 for consideration by the First Session of the IOC Committee for GOOS (Paris, February 1993). This plan will propose extending the use of the continuous plankton recorder beyond the North Atlantic. The CPR survey is also considered as a pilot activity within the GOOS module on monitoring and assessment of marine living resources.

Coastal Circulation

IOC has arranged for a consultant to develop a project plan for monitoring coastal ocean circulation, initially in the Western Pacific region. This project will be undertaken in conjunction with IOC activities to

---

[4] Low island: Grand Cayman, Tonga
Arid zone: Senegal (Saloum), Pakistan (area between Indus and Maini Hor)
Well-developed Mangroves: Brazil (Maranhao), Thailand (Pangha), Mexico (Usumaciento)

study coastal shelf circulation. The project plan will be reviewed at the second session of the IOC Regional Sub-Commission for WESTPAC in January 1993.

Sea Level Changes and Coastal Flooding

Dr. Shetye, a consultant from NIO, India, has developed a draft operational plan for a pilot project in the Indian Ocean. This plan was considered by the Third Session of the IOC Group of Experts on GLOSS (Paris, 12-16 October) during the special joint IOC-UNEP-WMO session (16 September 1992). As a result the Draft Action plan for implementation of the IOC-UNEP-WMO Pilot Activity on Sea-Level Changes and Associated Coastal Impacts in the Indian Ocean was prepared and published as IOC Document IOC/INF-908. The draft plan was considered by the UNEP-IOC Workshop on Impacts of Sea Level Rise (Dhaka, Bangladesh, 16-19 November 1992) and by the Third Session of the IOC Regional Committee for the Western Indian Ocean (Mauritius, 14-18 December) and it will be considered by the IOC Committee for GOOS (Paris, 16-19 February 1993).

Organic Carbon Accumulation in Surface Coastal Sediments

Consideration is being given to the need for a consultant to conduct a review of existing efforts and propose a project possibly in the Southeast Pacific.

7.2 MARPOLMON INCLUDING MUSSEL WATCH

In 1992, systematic observations of contaminants (sources, types and levels) and the threats posed by them continued in several regions mainly through marine pollution monitoring projects jointly sponsored by IOC, UNEP and other UN Agencies. Regions in which considerable progress was achieved included the Mediterranean (MED-POL), the Wider Caribbean (CEPPOL), IOCEA (WACAF-2), IOCINCWIO (EAF/6), WESTPAC (WESTPAC POL.), ROPME (IPP) and the South West Atlantic (SWATL). The variables monitored include petroleum hydrocarbons (floating/dissolved), herbicides/pesticides, PCB's, trace metals, microbial contaminants, nutrients, aquatic biotoxins, sediment load and marine debris/beach litter. Besides these variables, participating laboratories/countries were encouraged to study the physical oceanographic factors that influence the transport, distribution and fate of contaminants in the coastal and marine environment.

Continuing liaison with national monitoring programmes in industrialized countries notably that of the countries of the former Soviet Union, USA, France, Japan, Canada, Germany and the UK ensured progressive contribution of monitoring results to MARPOLMON.

The formalization and constitution of the Joint-UNEP Intergovernmental panel for GIPME in March 1992 with a view to harmonizing the pollution monitoring and research programmes of IOC and UNEP is expected to give added impetus to IOC regional pollution monitoring programmes particularly in the developing countries.

The first field sampling phase of the IOC-UNEP-NOAA International Mussel Watch Project initiated in 1991 in the Wider Caribbean region was completed in 1992 (see map figure 18). Sample analysis and report preparation have proceeded very well and a review meeting to consider the results and their implications for the health of this regional body of water will be held in the region in April 1993. Plans are at an advanced stage for the initiation of the Asia Pacific phase of the project which will close the Pacific rim. A project planning meeting to be organized in collaboration with the United Nations University is scheduled for January 1993. Discussions have also been started with IOC subsidiary bodies in Africa particularly Eastern Africa for the extension of the Mussel Watch project to that region.

7.3 CONTINUOUS PLANKTON RECORDER

Description of Functions

The Continuous Plankton Recorder (CPR) Survey is a unique multidecadal basin-scale survey of the upper layer mesoplankton in the North Atlantic. It was founded over 60 years ago by the British planktologist Alister Hardy who, having developed the CPR in order to plot the spatial distribution of plankton populations, realized the potential for such devices in long-term monitoring. He postulated that by using commercial "ships of opportunity" to tow CPRs on different routes simultaneously he could "apply methods similar to those employed in meteorology to the study of the changing plankton distribution, its causes and effects".

The primary task of the Survey is to describe the spatial and temporal patterns of distribution of mesozooplankton in much of the North Atlantic. The long time series also provides information on seasonal cycles, hydrographic anomalies, climatic interactions, long-term population changes and biogeographical data. The important features of the CPR survey are that it was in existence before the present rapid increase in atmospheric greenhouse gases and that it operates over a wide scale and is thus less sensitive to localized anthropogenic effects.

STATUS OF PRESENT ACTIVITIES AND FUTURE PLANS

Sampling and Analysis (1992)

Continuous Plankton Recorders (CPR's) were towed on 82 occasions, of which 76 (93%) were suitable for analysis. A total of 21268 miles of valid sampling resulted in 1085 analyzable samples. Of these, 353 have been analyzed. The monthly breakdown is given in the table below. Tows were made on routes currently surveyed in the North Atlantic including: 1. North Sea Routes, 2. Routes around the British Isles, 3. Trans-Atlantic Routes. 4. Routes along the East Coast of North America.

2516 samples taken in 1992 have been allocated for analysis, of which 1674 have been analyzed.

DETAILS OF CPR TOWS, 1ST JULY - 31ST OCTOBER 1992

MONTH	Total Number of Tows	OK	QLA	PART	N/A	QUAL	JAM	SAMPLED MILEAGE	ANALYZABLE SAMPLES
July	20	17	3	4	1	0	0	5401	281
August	19	16	1	2	0	0	2	4928	252
Sept.	22	15	4	1	0	0	3	5768	296
Oct.	21	16	3	1	0	2	0	5165	256
TOTAL	82	64	11	8	1	2	5	21268	1085

Notes

OK:	All tow data and plankton data correct.
QLA:	Some tow data estimated, plankton data used in "Large area" calculations only.
PART:	Only part of tow usable.
N/A:	OK or QLA tow not analyzed due to duplication or other reason.
QUAL:	Plankton data unreliable, may only be used qualitatively. These records are stored.
JAM:	Mechanical failure renders entire tow unusable.

Data Storage, Archiving and Analysis

Weekly backup of working data to optical disk initiated 12-3-92. Plankton data to February 1992 was entered to database in its entirety, along with other records as they became available. The entire data collected during 1991 was analyzed by the end of May 1992. After routine error checking it was incorporated into the long-term time series analysis of the plankton changes in the North Sea and eastern Atlantic. A report on these findings will be outlined in the Annual Report for 1992 but it appeared that the short-term increases in the abundance of species indicative of Atlantic inflow into the North Sea reverted to normal in 1991. Accordingly there appeared to be a check in the recent upward trend of the zooplankton populations sampled by the CPR in the North Sea. It remains to be seen whether this downturn is an isolated event or whether it does represent the onset of a more persistent decline. Only data from future years can establish this point.

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
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
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
MARPOLMON	Marine Polution Monitoring
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

Table 1. IGOSS Statistics 1985-1992

(note: Statistics for 1992 are preliminary totals)

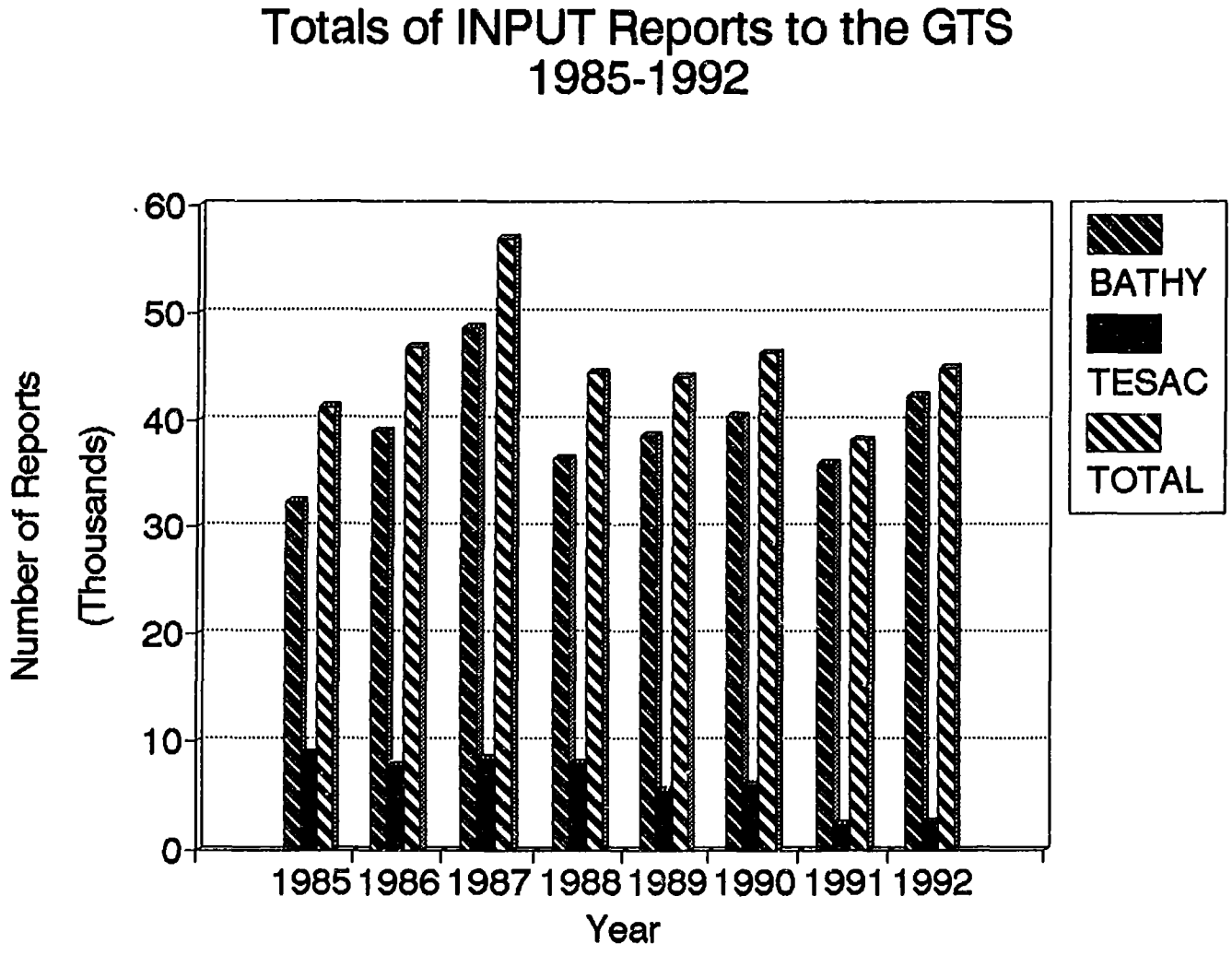


Table 2. Participating Ships of Opportunity (extracted from the WOCE data base)

TWI Line Number: AX01 Greenland - Scotland/Denmark

Country	Call Sign	Ship Name	Period
Germany	DESI	Valdivia	07-09/92
UK	GACA	Cumulus	01-03/92
UK	GACA	Cumulus	04-06/92
UK	GACA	Cumulus	07-09/92
UK	TFEA	Bjarni Saemundsson	07-09/92

TWI Line Number: AX03 Europe - New York

Country	Call Sign	Ship Name	Period
Germany	DAKE	Koeln Atlantic	01-03/92
Germany	DAKE	Koeln Atlantic	04-06/92
Germany	DAKE	Koeln Atlantic	07-09/92

TWI Line Number: AX04 New York - Gibraltar/Lisbon

Country	Call Sign	Ship Name	Period
France	FNOM	Renoir	07-09/92
France	FNPA	Ronsard	07-09/92
USA	WPKD	Sea Land Achiever	01-03/92
USA	WPKD	Sea Land Achiever	04-06/92
USA	WPKD	Sea Land Achiever	07-09/92
USA	WTEG	Mount Mitchell	07-09/92

TWI Line Number: AX05 Europe - Panama Canal

Country	Call Sign	Ship Name	Period
France	FNCZ	Delmas Surcouf	07-09/92
France	FNPA	Ronsard	01-03/92
France	FNPA	Ronsard	04-06/92
USA	ELED7	Pacprince	04-06/92
USA	ZCKP	Star Hong Kong	01-03/92

TWI Line Number: AX07 Gulf of Mexico - Gibraltar

Country	Call Sign	Ship Name	Period
USA	ELED7	Pacprince	01-03/92
USA	ELED8	Pacprincess	01-03/92
USA	ELED8	Pacprincess	04-06/92
USA	KVWA	Texas Clipper	04-06/92
USA	VSBI3	Bibi	07-09/92
USA	WTER	Malcolm Baldridge	04-06/92
USA	WTER	Malcolm Baldridge	07-09/92
USA	ZCKP	Star Hong Kong	04-06/92

TWI Line Number: AX08 New York - Cape of Good Hope

Country	Call Sign	Ship Name	Period
USA	D5NE	Mount Cabrite	01-03/92
USA	J8FN	Vidal	04-06/92
USA	J8FN	Vidal	07-09/92
USA	J8FO	Rosebank	01-03/92
USA	J8FO	Saint Blaize	04-06/92
USA	J8FO	Saint Blaize	07-09/92

TWI Line Number: AX09 Trinidad - Gibraltar

Country	Call Sign	Ship Name	Period
France	FNCZ	Delmas Surcouf	01-03/92
France	FNCZ	Delmas Surcouf	04-06/92

TWI Line Number: AX10 New York - Trinidad/Caracas

Country	Call Sign	Ship Name	Period
USA	ELDM8	Seal Island	04-06/92
USA	ELHL6	Columbus Ohio	04-06/92
USA	KNFG	Sea Wolf	04-06/92
USA	NIKA	Sealift Atlantic	01-03/92

TWI Line Number: AX11 Europe - Brazil

Country	Call Sign	Ship Name	Period
France	3EET4	Seas Eiffel	01-03/92
France	3EET4	Seas Eiffel	04-06/92
France	3EET4	Seas Eiffel	07-09/92
France	FNGS	La Fayette	01-03/92
France	FNGS	La Fayette	04-06/92
France	FNGS	La Fayette	07-09/92
France	FNQM	Suzanne Delmas	01-03/92
Germany	DGLM	Monte Rosa	01-03/92
Germany	DGLM	Monte Rosa	04-06/92
Germany	DGLM	Monte Rosa	07-09/92
USA/UK	VZPM	West Moor	01-03/92

TWI Line Number: AX12 Europe - Antartica

Country	Call Sign	Ship Name	Period
Germany	DBLK	Polarstern	01-03/92
USA/UK	VZPM	West Moor	01-03/92
USA/UK/Chile	ZCAQ9	WestMoor	04-06/92
USA/UK/Chile	ZCAQ9	WestMoor	07-09/92

TWI Line Number: AX15 Europe - Cape of Good Hope

Country	Call Sign	Ship Name	Period
France	3EKW9	Utrillo.	01-03/92
France	3EKW9	Utrillo.	04-06/92
France	3EKW9	Utrillo.	07-09/92
France	C6IO5	Nathalie Delmas	01-03/92
France	C6IO5	Nathalie Delmas	04-06/92
France	C6IO5	Nathalie Delmas	07-09/92
France	FNOM	Ango	01-03/92
France	FNQB	Ile Maurice	01-03/92
France	FNQB	Ile Maurice	04-06/92
France	FNQD	Ile de la Reunion	01-03/92
France	FNQM	Suzanne Delmas	07-09/92
France	FNQM	Ville de Marseille	04-06/92

TWI Line Number: AX17 Rio - Cape of Good Hope

Country	Call Sign	Ship Name	Period
Germany	J8GG4	Horizon	07-09/92
USA	PGEC	Nedlloyd Van Noort	04-06/92
USA	PGEC	Nedlloyd Van Noort	07-09/92

TWI Line Number: AX18 Buenos Aires - Cape of Good Hope

Country	Call Sign	Ship Name	Period
Chile/USA	CBVM	Vina del Mar	01-03/92
USA	PGEC	Nedlloyd Van Noort	04-06/92

TWI Line Number: AX20 Europe - French Guyana

Country	Call Sign	Ship Name	Period
France	DIDA	Ariana	01-03/92
France	DIDA	Ariana	04-06/92
France	DIDA	Ariana	07-09/92

TWI Line Number: AX21 Rio - Pointe Noire/Luanda

Country	Call Sign	Ship Name	Period
Germany	H8CB	Tilly	01-03/92

TWI Line Number: AX22 Argentina - Antarctica

Country	Call Sign	Ship Name	Period
Germany	DBLK	Polarstern	07-09/92

TWI Line Number: AX23 Gulf of Mexico

Country	Call Sign	Ship Name	Period
USA	C6JY6	Melbourne Star	04-06/92
USA	C6JZ2	American Star	01-03/92
USA	DHOU	Puritan	04-06/92
USA	KVWA	Texas Clipper	04-06/92
USA	WTDO	Oregon II	04-06/92
USA	WTED	Chapman	04-06/92
USA	WTEW	Whiting	04-06/92

TWI Line Number: AX26 Lagos - Cape of Good Hope

Country	Call Sign	Ship Name	Period
France	FNQB	Ile Maurice	07-09/92
France	FNQM	Suzanne Delmas	04-06/92
France	FNXW	Saint Roch	01-03/92
France	FNXW	Saint Roch	04-06/92
France	FNXW	Saint Roch	07-09/92
France	FNZB	Saint Roland	01-03/92
France	FNZB	Saint Roland	04-06/92
France	FNZB	Saint Roland	07-09/92
Germany	H8CB	Tilly	01-03/92

TWI Line Number: AX27 Brazil - Cape Horn

Country	Call Sign	Ship Name	Period
USA	C6JZ2	American Star	04-06/92
USA	D5NE	Mount Cabrite	07-09/92
USA	ELHL6	Columbus Ohio	01-03/92
USA	KNFG	Sea Wolf	01-03/92
USA/UK	VZPM	West Moor	01-03/92

TWI Line Number: AX29 New York - Brazil

Country	Call Sign	Ship Name	Period
USA	ELHL6	Columbus Ohio	01-03/92
USA	ELHL6	Columbus Ohio	04-06/92
USA	ELHL6	Columbus Ohio	07-09/92
USA	KNFG	Sea Wolf	04-06/92
USA	KNFG	Sea Wolf	07-09/92

TWI Line Number: AX32 New York - Bermuda

Country	Call Sign	Ship Name	Period
USA	PJJU	Oleander	01-03/92
USA	PJJU	Oleander	04-06/92
USA	PJJU	Oleander	07-09/92

TWI Line Number: AX33 Boston - Halifax, Nova Scotia

Country	Call Sign	Ship Name	Period
USA	DLEZ	Yankee Clipper	07-09/92

TWI Line Number: GRV Global R/Vs

Country	Call Sign	Ship Name	Period
USA	NRUO	Polar Sea	04-06/92
USA	WTER	Malcolm Baldridge	07-09/92

TWI Line Number: IX01 Fremantle - Sunda Straits

Country	Call Sign	Ship Name	Period
Australia	9VUU	Anro Asia	01-03/92
Australia	9VUU	Anro Asia	04-06/92
Australia	9VUU	Anro Asia	07-09/92
Australia	S6FK	Swan Reefer	01-03/92
Australia	S6FK	Swan Reefer	04-06/92
Australia	S6FK	Swan Reefer	07-09/92
Australia	VJBQ	Anro Australia	01-03/92
Australia	VJBQ	Anro Australia	04-06/92
Australia	VJBQ	Anro Australia	07-09/92
Australia	VKLC	Brisbane	07-09/92
Australia	VKPT	Perth	07-09/92
Unknown	VLNB	Torrens	07-09/92

TWI Line Number: IX03 Red Sea - Mauritius/La Reunion

Country	Call Sign	Ship Name	Period
France	3EKW9	Utrillo.	01-03/92
France	3EKW9	Utrillo.	04-06/92
France	3EKW9	Utrillo.	07-09/92
France	C6IO5	Nathalie Delmas	01-03/92
France	C6IO5	Nathalie Delmas	04-06/92
France	C6IO5	Nathalie Delmas	07-09/92
France	FNGB	Marion Dufresne	01-03/92
France	FNQB	Ile Maurice	01-03/92
France	FNQB	Ile Maurice	04-06/92
France	FNQD	Ile de la Reunion	01-03/92
France	FNQD	Ile de la Reunion	07-09/92
France	FNQM	Suzanne Delmas	07-09/92

TWI Line Number: IX06 Mauritius/La Reunion - Malacca Strait

Country	Call Sign	Ship Name	Period
France	ELEH4	Delmas Tourville	01-03/92
France	ELEH4	Delmas Tourville	04-06/92
USA	9VVB	Goldensari Indah	04-06/92
USA	D5NE	Mount Cabrite	01-03/92
USA	PGEC	Nedlloyd Van Noort	04-06/92
USA	PGEC	Nedlloyd Van Noort	07-09/92
USA	PGFE	Nedlloyd Van Diemen	07-09/92

TWI Line Number: IX07 Cape of Good Hope - Persian Gulf

Country	Call Sign	Ship Name	Period
USA	J8FO	Rosebank	01-03/92
USA	J8FO	Saint Blaize	07-09/92

TWI Line Number: IX09 Fremantle - Persian Gulf

Country	Call Sign	Ship Name	Period
Australia	9VBZ	Mahsuri	01-03/92
Australia	9VWM	Mandama	01-03/92
Australia	9VWM	Mandama	07-09/92
Australia	9VWM	New Zealand Star	04-06/92
Japan	JFPQ	Kashimasan Maru	01-03/92
Japan	JFPQ	Kashimasan Maru	04-06/92

TWI Line Number: IX10 Red Sea - Malacca Strait/Singapore

Country	Call Sign	Ship Name	Period
France	FNJT	Korrigan	01-03/92
France	FNJT	Korrigan	07-09/92
France	FNZO	Rabelais	04-06/92
France	FNZQ	Rimbaud	04-06/92
Japan	JFPQ	Kashimasan Maru	01-03/92
Japan	JFPQ	Kashimasan Maru	04-06/92
USA	9VVB	Goldensari Indah	07-09/92
USA	PGFE	Nedlloyd Van Diemen	04-06/92

TWI Line Number: IX12 Fremantle - Red Sea

Country	Call Sign	Ship Name	Period
Australia	GYRW	Encounter Bay	01-03/92
Australia	GYRW	Encounter Bay	04-06/92
Australia	GYRW	Encounter Bay	07-09/92
Australia	GYSA	Flinders Bay	01-03/92
Australia	GYSA	Flinders Bay	04-06/92
Australia	GYSA	Flinders Bay	07-09/92
Australia	GYSE	Nedlloyd Tasman	01-03/92
Australia	GYSE	Nedlloyd Tasman	04-06/92
Australia	GYSE	Nedlloyd Tasman	07-09/92

TWI Line Number: IX21 Cape of Good Hope - Mauritius

Country	Call Sign	Ship Name	Period
USA	D5NE	Mount Cabrite	01-03/92
USA	PGEC	Nedlloyd Van Noort	04-06/92

TWI Line Number: IX22 Fremantle - Timor Strait/Banda Sea

Country	Call Sign	Ship Name	Period
Australia	VJDP	Iron Pacific	01-03/92
Australia	VJDP	Iron Pacific	04-06/92
Australia	VJDP	Iron Pacific	07-09/92
Japan	JDRD	Shoyo Maru	01-03/92

TWI Line Number: IX? Indian Ocean unknown line

Country	Call Sign	Ship Name	Period
France	ELIL9	Navigator	01-03/92
France	ELIS8	Mariner	07-09/92

TWI Line Number: IndSe Indonesia - Seattle

Country	Call Sign	Ship Name	Period
USA	9VVB	Goldensari Indah	01-03/92
USA	YDLR	Bogasari Lima	01-03/92

TWI Line Number: PX01 California - Indonesia

Country	Call Sign	Ship Name	Period
USA	9VVB	Goldensari Indah	01-03/92
USA	9VVB	Goldensari Indah	04-06/92
USA	9VVB	Goldensari Indah	07-09/92
USA	KGWU	Thomas Washington	01-03/92
USA	YDLR	Bogasari Lima	04-06/92
USA	YDLR	Bogasari Lima	07-09/92

TWI Line Number: PX02 Flores Sea - Torres Strait

Country	Call Sign	Ship Name	Period
Australia	9VUU	Anro Asia	01-03/92
Australia	9VUU	Anro Asia	04-06/92
Australia	9VUU	Anro Asia	07-09/92
Australia	VJBQ	Anro Australia	01-03/92
Australia	VJBQ	Anro Australia	04-06/92
Australia	VJBQ	Anro Australia	07-09/92
Japan	JDRD	Shoyo Maru	01-03/92

TWI Line Number: PX03 Coral Sea

Country	Call Sign	Ship Name	Period
Australia	VKCN	Canberra	04-06/92
Australia	VKCN	Canberra	07-09/92
Australia	VKLA	Adelaide	04-06/92
Australia	VKLA	Adelaide	07-09/92
Australia	VKLB	Hobart	04-06/92
France	ELIL9	Navigator	01-03/92
France	ELIL9	Navigator	04-06/92
France	ELIL9	Navigator	07-09/92
France	ELIS8	Mariner	01-03/92
France	ELIS8	Mariner	07-09/92
France	FNZO	Rabelais	07-09/92
France	FNZP	Racine	07-09/92
France	FNZQ	Rimbaud	04-06/92
France	FNZQ	Rimbaud	07-09/92
France	GQEK	Forthbank	01-03/92
France	GQEK	Forthbank	07-09/92
France	HPEW	Pacific Islander	01-03/92
France	HPEW	Pacific Islander	07-09/92
France	ZDAZ6	Explorer	04-06/92
France	ZDAZ6	Explorer	07-09/92
France	ZDBE9	Voyager	01-03/92
France	ZDBE9	Voyager	04-06/92
France	ZDBE9	Voyager	07-09/92
USA	ELBX3	Packing	04-06/92
USA	ELBX3	Packing	07-09/92

TWI Line Number: PX04 Japan - Fiji/Samoa

Country	Call Sign	Ship Name	Period
France	HPEW	Pacific Islander	01-03/92
France	HPEW	Pacific Islander	07-09/92
Japan	7JDU	Natsushima	01-03/92

TWI Line Number: PX05 Japan - Coral Sea

Country	Call Sign	Ship Name	Period
France	ELIL9	Navigator	01-03/92
France	ELIL9	Navigator	04-06/92
France	ELIL9	Navigator	07-09/92
France	ELIS8	Mariner	01-03/92
France	ELIS8	Mariner	04-06/92
France	ELIS8	Mariner	07-09/92
France	HPEW	Pacific Islander	01-03/92
France	HPEW	Pacific Islander	04-06/92
France	HPEW	Pacific Islander	07-09/92
France	ZDAZ6	Explorer	01-03/92
France	ZDAZ6	Explorer	04-06/92
France	ZDAZ6	Explorer	07-09/92
France	ZDBE9	Voyager	01-03/92
France	ZDBE9	Voyager	04-06/92
France	ZDBE9	Voyager	07-09/92
Japan	7JWN	Takuyo	01-03/92
Japan	JGZK	Ryofu Maru	04-06/92
Japan	JITV	Wellington Maru	01-03/92
Japan	JITV	Wellington Maru	04-06/92
Japan	JITV	Wellington Maru	07-09/92
Japan	JRBM	Ogasawara Maru	01-03/92
Japan	JSVY	Shirase	04-06/92
USA/Japan	JBOA	Keifu Maru	04-06/92

TWI Line Number: PX07 Auckland - Seattle/Vancouver

Country	Call Sign	Ship Name	Period
USA	DGZV	Columbus Virginia	01-03/92
USA	DGZV	Columbus Virginia	07-09/92

TWI Line Number: PX08 Auckland - Panama

Country	Call Sign	Ship Name	Period
USA	C6JY6	Melbourne Star	01-03/92
USA	C6JY6	Melbourne Star	04-06/92
USA	C6JY6	Melbourne Star	07-09/92
USA	C6JZ2	American Star	01-03/92
USA	C6JZ2	American Star	04-06/92
USA	C6JZ2	American Star	07-09/92
USA	C6JZ3	Queensland Star	01-03/92
USA	C6JZ3	Queensland Star	07-09/92

TWI Line Number: PX09 Hawaii - Noumea/Auckland

Country	Call Sign	Ship Name	Period
France	C6HL8	Columbia Star	04-06/92
Japan	JNZL	Kaiyo Maru	01-03/92
USA	3DTF	Southland Star	01-03/92
USA	DGVK	Columbus Victoria	01-03/92
USA	DGVK	Columbus Victoria	04-06/92
USA	DGVK	Columbus Victoria	07-09/92
USA	DGZV	Columbus Virginia	01-03/92
USA	DGZV	Columbus Virginia	07-09/92
USA	DHCW	Columbus Wellington	04-06/92
USA	DHCW	Columbus Wellington	07-09/92
USA	ELBX3	Packing	04-06/92
USA	NMEL	Mellon	01-03/92

TWI Line Number: PX10 Hawaii - Guam/Saipan

Country	Call Sign	Ship Name	Period
USA	WPGK	Sea Land Navigator	01-03/92
USA	WPGK	Sea Land Navigator	04-06/92
USA	WPGK	Sea Land Navigator	07-09/92
USA	WSRL	Sea Land Pacific	01-03/92
USA	WSRL	Sea Land Pacific	04-06/92
USA	WSRL	Sea Land Pacific	07-09/92
USA/France	HPAN	Micronesian Commerce	01-03/92
USA/France	KIRH	Sea Land Trader	01-03/92
USA/France	KIRH	Sea Land Trader	04-06/92
USA/France	KIRH	Sea Land Trader	07-09/92
USA/France	KRGB	Sea Land Enterprise	01-03/92
USA/France	KRGB	Sea Land Enterprise	04-06/92
USA/France	KRGB	Sea Land Enterprise	07-09/92

TWI Line Number: PX11 Flores Sea - Japan

Country	Call Sign	Ship Name	Period
Australia	VJDI	Iron Newcastle	04-06/92
Australia	VJDI	Iron Newcastle	07-09/92
Australia	VJDP	Iron Pacific	01-03/92
Australia	VJDP	Iron Pacific	07-09/92
Japan	7KDD	Yoko Maru	07-09/92
Japan	JGZK	Ryofu Maru	01-03/92
Japan	JNZL	Kaiyo Maru	01-03/92

TWI Line Number: PX12 Tahiti - Coral Sea

Country	Call Sign	Ship Name	Period
France	ELIL9	Navigator	04-06/92
France	FITA	Le Noroit	04-06/92
France	FNZO	Rabelais	07-09/92
France	FNZP	Racine	01-03/92
France	FNZP	Racine	07-09/92
France	FNZQ	Rimbaud	01-03/92
France	FNZQ	Rimbaud	04-06/92
France	FNZQ	Rimbaud	07-09/92
France	GQEK	Forthbank	01-03/92
France	GQEK	Forthbank	07-09/92
France	HPEW	Pacific Islander	01-03/92
France	HPEW	Pacific Islander	07-09/92
USA/France	D5NZ	Polynesia	04-06/92
USA/France	OWUO6	Moana Pacific	01-03/92
USA/France	OWUO6	Moana Pacific	04-06/92
USA/France	OWUO6	Moana Pacific	07-09/92

TWI Line Number: PX13 New Zealand - California

Country	Call Sign	Ship Name	Period
USA	DGVK	Columbus Victoria	01-03/92
USA	DGVK	Columbus Victoria	04-06/92
USA	DGVK	Columbus Victoria	07-09/92
USA	DGZV	Columbus Virginia	01-03/92
USA	DGZV	Columbus Virginia	04-06/92
USA	DGZV	Columbus Virginia	07-09/92
USA	DHCW	Columbus Wellington	01-03/92
USA	DHCW	Columbus Wellington	04-06/92
USA	DHCW	Columbus Wellington	07-09/92
USA	ELBX3	Packing	07-09/92

TWI Line Number: PX14 Alaska - Cape Horn

Country	Call Sign	Ship Name	Period
USA	D5NE	Mount Cabrite	04-06/92
USA	D5NE	Mount Cabrite	07-09/92
USA	ELDM8	Seal Island	01-03/92
USA	ELDM8	Seal Island	07-09/92
USA	NRUO	Polar Sea	04-06/92

TWI Line Number: PX15 Ecquador - Japan

Country	Call Sign	Ship Name	Period
USA	ZCKP	Star Hong Kong	01-03/92

TWI Line Number: PX17 Tahiti/Mururao - Panama

Country	Call Sign	Ship Name	Period
France	FNZO	Rabelais	01-03/92
France	FNZO	Rabelais	04-06/92
France	FNZO	Rabelais	07-09/92
France	FNZP	Racine	01-03/92
France	FNZP	Racine	04-06/92
France	FNZP	Racine	07-09/92
France	FNZQ	Rimbaud	01-03/92
France	FNZQ	Rimbaud	04-06/92
France	FNZQ	Rimbaud	07-09/92
France	GQEK	Forthbank	01-03/92
France	GQEK	Forthbank	07-09/92

TWI Line Number: PX18 Tahiti - California

Country	Call Sign	Ship Name	Period
USA/France	D5NZ	Polynesia	04-06/92
USA/France	D5NZ	Polynesia	07-09/92
USA/France	OWUO6	Moana Pacific	01-03/92
USA/France	OWUO6	Moana Pacific	04-06/92
USA/France	OWUO6	Moana Pacific	07-09/92

TWI Line Number: PX20 California - Panama

Country	Call Sign	Ship Name	Period
Japan	JNZL	Kaiyo Maru	01-03/92
USA	NRUO	Polar Sea	04-06/92
USA	PGDI	Nedlloyd Manila	01-03/92
USA	PGDI	Nedlloyd Manila	04-06/92
USA	PGDI	Nedlloyd Manila	07-09/92
USA	PGDV	Nedlloyd Madras	04-06/92
USA	PGDV	Nedlloyd Madras	07-09/92
USA	ZCKP	Star Hong Kong	01-03/92
USA	ZCKP	Star Hong Kong	04-06/92

TWI Line Number: PX21 California - Peru

Country	Call Sign	Ship Name	Period
USA	KGWU	Thomas Washington	04-06/92
USA	PGDI	Nedlloyd Manila	04-06/92
USA	PGDI	Nedlloyd Manila	07-09/92
USA	PGDV	Nedlloyd Madras	01-03/92
USA	PGDV	Nedlloyd Madras	04-06/92
USA	PGDV	Nedlloyd Madras	07-09/92
USA	WTES	Surveyor	04-06/92

TWI Line Number: PX22 Panama - Valparaiso

Country	Call Sign	Ship Name	Period
Australia	VJDP	Iron Pacific	04-06/92
USA	PGDV	Nedlloyd Madras	04-06/92

TWI Line Number: PX24 Panama - Indonesia

Country	Call Sign	Ship Name	Period
Japan	JNZL	Kaiyo Maru	01-03/92

TWI Line Number: PX25 Valparaiso - Japan/Korea

Country	Call Sign	Ship Name	Period
USA	3EAW7	Andino	01-03/92
USA	3EAW7	Andino	04-06/92
USA	3EAW7	Andino	07-09/92
USA/France	JCOD	Shoyo	07-09/92

TWI Line Number: PX26 TRANSPAC

Country	Call Sign	Ship Name	Period
	CYWK	Endeavour	04-06/92
	JKCF	Unknown2	07-09/92
Japan	JDRD	Shoyo Maru	07-09/92
Japan	JKCF	George Washington Bridge	04-06/92
USA	9VVB	Goldensari Indah	04-06/92
USA	A8VI	Pacduchess	01-03/92
USA	A8VI	Pacduchess	04-06/92
USA	A8VI	Pacduchess	07-09/92
USA	BOAB	Tai He	01-03/92
USA	BOAB	Tai He	04-06/92
USA	BOAB	Tai He	07-09/92
USA	CG2958	Tully	01-03/92
USA	D5BC	Sedco BP 471	07-09/92
USA	D5NE	Mount Cabrite	04-06/92
USA	KGJB	Sea Land Defender	01-03/92
USA	KGJB	Sea Land Defender	04-06/92
USA	KGJB	Sea Land Defender	07-09/92
USA	LADB2	Skaugran	01-03/92
USA	LADB2	Skaugran	04-06/92
USA	LADB2	Skaugran	07-09/92
USA	LAJV4	Skaubryn	01-03/92
USA	LAJV4	Skaubryn	04-06/92
USA	LAJV4	Skaubryn	07-09/92
USA	NMEL	Mellon	04-06/92
USA	PGEC	Nedlloyd Van Noort	04-06/92
USA	PGEC	Nedlloyd Van Noort	07-09/92
USA	PGFE	Nedlloyd Van Diemen	01-03/92
USA	PGFE	Nedlloyd Van Diemen	04-06/92
USA	PGFE	Nedlloyd Van Diemen	07-09/92
USA	WPGK	Sea Land Navigator	01-03/92
USA	WPGK	Sea Land Navigator	04-06/92
USA	WPGK	Sea Land Navigator	07-09/92
USA	WSRL	Sea Land Pacific	01-03/92
USA	WSRL	Sea Land Pacific	04-06/92
USA	WSRL	Sea Land Pacific	07-09/92
USA	WTDM	Miller Freeman	01-03/92
USA	ZCKP	Star Hong Kong	04-06/92
USA	ZCKU	Star Drottanger	07-09/92
USA/France	7JOB	California Ceres	01-03/92
USA/France	7JOB	California Ceres	04-06/92

USA/France	7JOB	California Ceres	07-09/92
USA/France	KIRH	Sea Land Trader	01-03/92
USA/France	KIRH	Sea Land Trader	04-06/92
USA/France	KIRH	Sea Land Trader	07-09/92
USA/France	KRGB	Sea Land Enterprise	01-03/92
USA/France	KRGB	Sea Land Enterprise	04-06/92
USA/France	KRGB	Sea Land Enterprise	07-09/92
USSR	EREC	Priliv	04-06/92

TWI Line Number: PX28 Tahiti - Sydney/Auckland

Country	Call Sign	Ship Name	Period
USA	C6JZ3	Queensland Star	01-03/92

TWI Line Number: PX29 Tahiti - Valparaiso

Country	Call Sign	Ship Name	Period
USA	ELAX5	Copiapo	01-03/92

TWI Line Number: PX30 Brisbane - Noumea

Country	Call Sign	Ship Name	Period
France	FNZO	Rabelais	07-09/92
France	FNZP	Racine	07-09/92
France	FNZQ	Rimbaud	04-06/92
France	FNZQ	Rimbaud	07-09/92

TWI Line Number: PX31 Sydney - Noumea - California

Country	Call Sign	Ship Name	Period
France	C6HL8	Columbia Star	01-03/92
France	C6HL8	Columbia Star	04-06/92
France	C6HL8	Columbia Star	07-09/92
USA	DHCW	Columbus Wellington	01-03/92
USA/France	D5NZ	Polynesia	01-03/92
USA/France	D5NZ	Polynesia	04-06/92
USA/France	D5NZ	Polynesia	07-09/92
USA/France	OWUO6	Moana Pacific	01-03/92
USA/France	OWUO6	Moana Pacific	04-06/92
USA/France	OWUO6	Moana Pacific	07-09/92

TWI Line Number: PX34 Sydney - Wellington

Country	Call Sign	Ship Name	Period
Australia	VKCV	Derwent	07-09/92
New Zealand	ZMCR	Canterby	01-03/92
USA	C6JY6	Melbourne Star	04-06/92
USA	C6JY6	Melbourne Star	07-09/92
USA	C6JZ2	American Star	04-06/92
USA	C6JZ2	American Star	07-09/92
USA	C6JZ3	Queensland Star	07-09/92
USA	DGVK	Columbus Victoria	01-03/92
USA	DGVK	Columbus Victoria	04-06/92
USA	DGVK	Columbus Victoria	07-09/92
USA	DGZV	Columbus Virginia	04-06/92
USA	DGZV	Columbus Virginia	07-09/92
USA	DHCW	Columbus Wellington	04-06/92
USA	DHCW	Columbus Wellington	07-09/92
USA	ELBX3	Packing	07-09/92

TWI Line Number: PX35 Melbourne - Dunedin

Country	Call Sign	Ship Name	Period
Australia	VKCN	Canberra	07-09/92
USA	DGVK	Columbus Victoria	04-06/92
USA	DGZV	Columbus Virginia	07-09/92
USA	DHCW	Columbus Wellington	04-06/92
USA	DHCW	Columbus Wellington	07-09/92

TWI Line Number: PX36 Christchurch - McMurdo

Country	Call Sign	Ship Name	Period
USA	WLDZ	Maurice Ewing	01-03/92

TWI Line Number: PX37 Hawaii - California

Country	Call Sign	Ship Name	Period
Australia	VKCN	Canberra	04-06/92
Australia	VKCN	Canberra	07-09/92
Australia	VKLA	Adelaide	04-06/92
Australia	VKLA	Adelaide	07-09/92
Australia	VKLB	Hobart	04-06/92
USA	DGVK	Columbus Victoria	07-09/92
USA	DHCW	Columbus Wellington	07-09/92
USA	ELBX3	Packing	04-06/92
USA	KGJB	Sea Land Defender	04-06/92
USA	NGDF	Munro	01-03/92
USA	WCGN	Chevron California	07-09/92
USA	WPGK	Sea Land Navigator	01-03/92
USA	WPGK	Sea Land Navigator	04-06/92
USA	WPGK	Sea Land Navigator	07-09/92
USA	WSRL	Sea Land Pacific	01-03/92
USA	WSRL	Sea Land Pacific	04-06/92
USA	WSRL	Sea Land Pacific	07-09/92
USA	WXBR	Chevron Mississippi	01-03/92
USA/France	H9BQ	Micronesian Independance	01-03/92
USA/France	H9BQ	Micronesian Independance	04-06/92
USA/France	H9BQ	Micronesian Independance	07-09/92
USA/France	HPAN	Micronesian Commerce	04-06/92
USA/France	HPAN	Micronesian Commerce	07-09/92
USA/France	KIRH	Sea Land Trader	01-03/92
USA/France	KIRH	Sea Land Trader	04-06/92
USA/France	KIRH	Sea Land Trader	07-09/92
USA/France	KRGB	Sea Land Enterprise	01-03/92
USA/France	KRGB	Sea Land Enterprise	04-06/92
USA/France	KRGB	Sea Land Enterprise	07-09/92

TWI Line Number: PX38 Hawaii - Alaska

Country	Call Sign	Ship Name	Period
USA	WCGN	Chevron California	04-06/92
USA	WCGN	Chevron California	07-09/92
USA	WXBR	Chevron Mississippi	01-03/92
USA	WXBR	Chevron Mississippi	04-06/92

TWI Line Number: PX39 Hawaii - Seattle/Vancouver

Country	Call Sign	Ship Name	Period
USA	9VVB	Goldensari Indah	01-03/92
USA	DGVK	Columbus Victoria	01-03/92
USA	DGVK	Columbus Victoria	04-06/92
USA	DGZV	Columbus Virginia	01-03/92
USA	DGZV	Columbus Virginia	04-06/92
USA	DGZV	Columbus Virginia	07-09/92
USA	DHCW	Columbus Wellington	04-06/92
USA	DHCW	Columbus Wellington	07-09/92
USA	ELBX3	Packing	01-03/92
USA	ELBX3	Packing	04-06/92
USA	ELBX3	Packing	07-09/92
USA	NMEL	Mellon	01-03/92
USA/France	H9BQ	Micronesian Independance	01-03/92
USA/France	H9BQ	Micronesian Independance	04-06/92
USA/France	H9BQ	Micronesian Independance	07-09/92
USA/France	HPAN	Micronesian Commerce	01-03/92

TWI Line Number: PX42 Hawaii - New Guinea/Solomon Is.

Country	Call Sign	Ship Name	Period
Australia	VKCN	Canberra	04-06/92
Australia	VKCN	Canberra	07-09/92
Australia	VKLA	Adelaide	04-06/92
Australia	VKLB	Hobart	04-06/92
USA	ELBX3	Packing	01-03/92
USA	ELBX3	Packing	04-06/92
USA	ELBX3	Packing	07-09/92

TWI Line Number: PX43 Hawaii - Marshall Is. - Guam

Country	Call Sign	Ship Name	Period
USA/France	H9BQ	Micronesian Independance	01-03/92
USA/France	H9BQ	Micronesian Independance	04-06/92
USA/France	H9BQ	Micronesian Independance	07-09/92
USA/France	HPAN	Micronesian Commerce	04-06/92
USA/France	HPAN	Micronesian Commerce	07-09/92

TWI Line Number: PX44 Taiwan - Guam

Country	Call Sign	Ship Name	Period
USA	WPGK	Sea Land Navigator	01-03/92
USA	WPGK	Sea Land Navigator	04-06/92
USA	WPGK	Sea Land Navigator	07-09/92
USA	WSRL	Sea Land Pacific	01-03/92
USA	WSRL	Sea Land Pacific	04-06/92
USA	WSRL	Sea Land Pacific	07-09/92
USA/France	H9BQ	Micronesian Independance	04-06/92
USA/France	H9BQ	Micronesian Independance	07-09/92
USA/France	HPAN	Micronesian Commerce	01-03/92
USA/France	HPAN	Micronesian Commerce	04-06/92
USA/France	HPAN	Micronesian Commerce	07-09/92
USA/France	KIRH	Sea Land Trader	01-03/92
USA/France	KIRH	Sea Land Trader	04-06/92
USA/France	KIRH	Sea Land Trader	07-09/92
USA/France	KRGB	Sea Land Enterprise	01-03/92
USA/France	KRGB	Sea Land Enterprise	04-06/92
USA/France	KRGB	Sea Land Enterprise	07-09/92

TWI Line Number: PX45 SURTROPAC (Noumea - Marshall Is.)

Country	Call Sign	Ship Name	Period
France	FITA	Le Noroit	01-03/92

TWI Line Number: PX46 137E Section

Country	Call Sign	Ship Name	Period
Japan	JGZK	Ryofu Maru	01-03/92
Japan	JGZK	Ryofu Maru	07-09/92

TWI Line Number: PX47 Alaska - California

Country	Call Sign	Ship Name	Period
USA	WCGN	Chevron California	01-03/92
USA	WCGN	Chevron California	04-06/92
USA	WCGN	Chevron California	07-09/92
USA	WXBR	Chevron Mississippi	01-03/92
USA	WXBR	Chevron Mississippi	04-06/92
USA	WXBR	Chevron Mississippi	07-09/92

TWI Line Number: PX49 Japan/Taiwan - Singapore

Country	Call Sign	Ship Name	Period
Japan	JFPQ	Kashimasan Maru	01-03/92
Japan	JFPQ	Kashimasan Maru	04-06/92
USA	9VVB	Goldensari Indah	04-06/92
USA	PGFE	Nedlloyd Van Diemen	04-06/92

TWI Line Number: T-CS Taiwan - Coral Sea

Country	Call Sign	Ship Name	Period
Japan	JITV	Wellington Maru	07-09/92

GOOS SATELLITE DATA REQUIREMENTS

Measurements	Instrument Type	Candidate Sensor	Mission
Earth Radiation (top of the atmosphere)	Wide-Band scanning radiometer	ScaRab, CERES	Meteor, TRMM, EOS, POEM, GEWEX[1]
Liquid Water (Total)	Microwave Imaging Radiometer	SSM/I, MIMR, TRMM microwave imager (TMI)	DMSP, EOS, TRMM, GEWEX[1]
Ocean surface Color	Imaging radiometer (vis)	SeaWIFS, OCTS, MODIS	SeaWIFS, ADEOS, EOS, POEM
Sea surface Temperature	Imaging radiometer or sounder (IR)	AVHRR[2], ATSR, OCTS, MODIS, AIRS, IASI	NOAA, ERS, ADEOS, EOS, POEM
Ocean Surface Wind vector	Microwave Scatterometer	AMI, NSCATT, STIKSCAT	ERS, ADEOS, EOS, POEM
Ocean Wave Height	Radar Altimeter	RA	ERS, EOS, POEM
Ocean Surface Topography	Precision radar altimeter and orbitomtery	Single or 2-frequency altimeter; GPS + water vapor radiometer or DORIS	TOPEX-POSEIDON, ALT[3]
Precise Geoid	Gravity gradiometer		ARISTOTLES[4]
Sea Ice Cover	Microwave imaging radiometer	SSM/I, MIMR	DMSP, EOS, POEM
Sea Ice Texture, edge, and motion	Imaging radar	AMI, SAR	ERS, RadarSat, JERS-1

Table 3. GOOS Satellite Data Requirements

[1] GEWEX dedicated non-sunsynchronous earth observing mission on a 55-60 degree inclined orbit (undetermined)

[2] AVHRR calibration only marginally adequate for sea surface temperature measurements.

[3] TOPEX follow-on high precision ocean altimetry mission (undetermined)

[4] ARISTOTLES gravity mission (Undetermined)

Table 4. List of GLOSS Sea Level Stations

GLOSS Station Index (1992)

No.	Station Name	Country	Latitude	Longitude	Ocean/Sea	R	Op.	Gauge	A/D	Interv.	Exch.	Lev.	Year	Sat.	Inst.	Gauge	No.	Comments
262	Lobito	Angola	12°20'S	013°34'E	Atlantic	N	??										262	????
186	Bahia Scotia	Argentina	60°44'S	044°39'W	Southern	Y	N								None		186	
185	Esperanza	Argentina	63°18'S	056°55'W	Southern	Y	N										185	NOAA will install Jan 1993
184	Jubany	Argentina	62°14'S	058°40'W	Southern	Y	N								None		184	
192	Mar del Plata	Argentina	38°03'S	057°33'W	Atlantic	Y	Y	A	D	6	D	A	1992	Y			192	NOAA installed Feb 1992
190	Puerto Deseado	Argentina	47°45'S	065°55'W	Atlantic	Y	Y	F	A			L	1987	N			190	
191	Puerto Madryn	Argentina	42°46'S	065°02'W	Atlantic	Y	Y	F	A			L	1980	N			191	
181	Ushuaia	Argentina	54°49'S	068°13'W	Atlantic	Y	Y	A	D	6	D	A	1992	Y			181	NOAA installed May 1991
61	Booby Is.	Australia	10°36'S	141°55'E	Indian	Y	Y	FP	D	10				Y			61	Not a good gauge
58	Brisbane (West Inner Bar)	Australia	27°22'S	153°10'E	Pacific	Y	Y	P						N			58	New gauge installed
40	Broome	Australia	18°00'S	122°13'E	Indian	Y	Y	AF						Y			40	New gauge installed
59	Bundaberg	Australia	24°46'S	152°23'E	Pacific	Y	Y	F						N			59	Poor gauge
52	Carnarvon	Australia	24°54'S	113°39'E	Indian	Y	Y	F						N			52	Better gauge at Hillarys
278	Casey	Australia	66°17'S	110°32'E	Southern	Y	N									P	278	Test pressure gauge installed
47	Christmas Is.	Australia	10°25'S	105°40'E	Indian	Y	Y	F		15				N			47	
46	Cocos Is. (Keeling)	Australia	12°07'S	096°53'E	Indian	Y	Y	AF		15				N			46	NOAA installed Aug 1992
62	Darwin	Australia	12°28'S	130°51'E	Indian	Y	Y	AF						Y			62	NOAA installed May 1990
277	Davis	Australia	68°35'S	077°58'E	Southern	Y	N								93/4	P	277	Proposal exists to install
54	Esperance	Australia	33°52'S	121°54'E	Southern	Y	Y	AF						N			54	New gauge good
57	Fort Denison, Sydney	Australia	33°51'S	151°14'E	Pacific	Y	Y	F						N			57	
53	Fremantle	Australia	32°03'S	115°43'E	Indian	Y	Y	F						N			53	
56	Hobart	Australia	42°53'S	147°20'E	Southern	Y	Y	F		5				N			56	NOAA installed May 1991
148	Lord Howe Is.	Australia	31°31'S	159°04'E	Pacific	Y	Y	F		15				N			148	
130	Macquarie Is.	Australia	54°30'S	158°56'E	Southern	Y	N	P?	D	10					93/4	P/A	130	Plans to install in 1993/4
22	Mawson	Australia	67°36'S	062°52'E	Southern	Y	N								92/3	P	22	Proposal to install 1992/3
124	Norfolk Is.	Australia	29°04'S	167°57'E	Pacific	Y	Y	F		15				N			124	
55	Port Adelaide (Outer HB)	Australia	34°47'S	138°28'E	Southern	Y	Y	F	A					N			55	
51	Port Hedland	Australia	20°19'S	118°34'E	Indian	Y	Y	F	AD					N			51	Gauge not very good
60	Townsville	Australia	19°16'S	146°50'E	Pacific	Y	Y	F						N			60	
279	Willis Is.	Australia	16°19'S	149°59'E	Pacific	Y	N	P?									279	Difficult site

No.	Station Name	Country	Latitude	Longitude	Ocean/Sea	R	Op.	Gauge	A/D	Interv.	Exch.	Lev.	Year	Sat.	Inst.	Gauge	No.	Comments
12	Exuma	Bahamas	23°46'N	076°06'W	Atlantic	Y	Y*	F	AD	60	LD	M	1992	N			12	Started 25 March 1992
211	Settlement Point	Bahamas	26°41'N	079°00'W	Atlantic	Y	Y	FPA	AD	6	LMD	A	1992	Y			211	NOAA installed Jan 1992
36	Chittagong	Bangladesh	22°15'N	091°50'E	Indian	N	??										36	????
120	Malakal	Belau	07°20'N	134°28'E	Pacific	Y	Y	F	D	15	MD	L	1990	Y			120	
194	Cananeia	Brazil	25°01'S	047°55'W	Atlantic	Y	Y	F	A	60	LMD	A		N			194	
198	Fernando de Noronha	Brazil	03°52'S	032°25'W	Atlantic	Y	Y	P	D	60				Y*			198	*from end 1992
265	Ilha da Trindade	Brazil	20°30'S	029°18'W	Atlantic	Y	Y	P	D	20	LMD	A	1991	N			265	
196	Itaperica	Brazil	12°52'S	038°41'W	Atlantic	Y	Y	FP	D	60	LMD	A	1991	N			196	
199	Penedo Sao Pedro e Paulo	Brazil	01°00'N	029°23'W	Atlantic	Y	Y	P	D	60				Y*			199	*starting 1992
200	Porto de Itaqui	Brazil	02°34'S	044°22'W	Atlantic	Y	N										200	replace by Ponta de Madeira
197	Porto de Natal	Brazil	05°46'S	035°12'W	Atlantic	N											197	
193	Porto de Ric Grande	Brazil	32°06'S	052°11'W	Atlantic	Y	Y	F	A	60	LMD	A	1991	N			193	
201	Porto de Santana	Brazil	00°03'S	051°10'W	Atlantic	N											201	
195	Rio de Janeiro	Brazil	22°52'S	043°08'W	Atlantic	Y	Y	F	A	60	LMD	M	1992	N			195	
280	Douala	Cameroon	04°03'N	009°41'E	Atlantic	N	??										280	????
226	Alert	Canada	82°30'N	062°20'W	Arctic	N	N										226	
222	Halifax	Canada	44°40'N	063°35'W	Atlantic	N	Y	F	AD	15				Y			222	
153	Little Cornwallis Island	Canada	75°23'N	096°57'W	Arctic	N	N										153	????
224	Nain	Canada	56°32'N	061°41'W	Atlantic	N	Y	P		60				N			224	
155	Prince Rupert	Canada	54°19'N	130°19'W	Pacific	N	Y	F						N			155	????
152	Sachs Harbour	Canada	71°58'N	125°15'W	Arctic	N	N										152	????
223	St John's, Newfoundland	Canada	47°34'N	052°42'W	Atlantic	N	Y	P	AD	15,60				Y			223	
156	Tofino	Canada	49°09'N	125°55'W	Pacific	N	Y	F						N			156	????
254	Porto Grande	Cape Verde	16°52'N	024°59'W	Atlantic	N	??										254	NOAA installed Sep 1991
174	Antofagasta	Chile	23°39'S	070°24'W	Pacific	N	Y	P	A					N			174	
189	Capitan Prat (Antarctica)	Chile	62°29'S	059°38'W	Southern	N	Y	P	A					N			189	
137	Isla de Pascua	Chile	27°09'S	109°27'W	Pacific	N	Y	AP	AD					Y			137	NOAA installed Feb 1992
176	Juan Fernandez	Chile	33°37'S	078°50'W	Pacific	N	Y	P	A					N			176	
178	Puerto Montt	Chile	41°29'S	072°58'W	Pacific	N	Y	P	A					N			178	
180	Puerto Williams	Chile	54°56'S	067°37'W	Pacific	N	Y	P	A					N			180	
179	Punta Arenas	Chile	53°10'S	070°54'W	Pacific	N	Y	P	A					N			179	

No.	Station Name	Country	Latitude	Longitude	Ocean/Sea	R	Op.	Gauge	A/D	Interv.	Exch.	Lev.	Year	Sat.	Inst.	Gauge	No.	Comments
177	San Felix	Chile	26°17'S	080°07'W	Pacific	N	Y	P	A					Y			177	
175	Valparaiso	Chile	33°02'S	071°38'W	Pacific	N	Y	FP	AD					Y			175	NOAA installed Jul 1991
94	Kaomen	China, People's Rep.	28°05'N	121°17'E	Pacific	Y	Y	F	A		L	A	1991	N			94	
79	Lachutan (Dalian)	China, People's Rep.	38°52'N	121°41'E	Pacific	Y	Y	F	A		L	A	1991	N			79	
283	Lusi	China, People's Rep.	32°08'N	121°37'E	Pacific	Y	Y	F	A		L	A	1991	N			283	
247	Xiamen	China, People's Rep.	24°27'N	118°04'E	Pacific	Y	Y	F	A		L	A	1991	N			247	
78	Zhapo	China, People's Rep.	21°35'N	111°50'E	Pacific	Y	Y	F	A		L	A	1991	N			78	
170	Buenaventura	Colombia	03°54'N	077°05'W	Pacific	Y	Y	F	D	6	L	L	1992	N			170	
207	Cartagena	Colombia	10°24'N	075°33'W	Atlantic	Y	Y	F	D	6	L	L	1992	N			207	
171	Tumaco	Colombia	01°50'N	078°44'W	Pacific	Y	Y	F	D	6	L	L	1992	N			171	
261	Pointe-Noire	Congo	04°47'S	011°50'E	Atlantic	N	??										261	????
143	Penrhyn	Cook Islands	09°01'S	158°04'W	Pacific	Y	Y	F	D	15,4	MD	L	1992	Y			143	
139	Rarotonga	Cook Islands	21°12'S	159°46'W	Pacific	Y	Y	F	D	15,4	MD	A	1992	Y			139	
166	Isla del Coco	Costa Rica	05°33'N	087°04'W	Pacific	N	Y?	P									166	Operational from Oct 1990?
167	Quepos	Costa Rica	09°24'N	084°10'W	Pacific	N	Y	F						N			167	
257	Abidjan	Cote d'Ivoire	05°15'N	004°00'W	Atlantic	N	??										257	????
214	Cabo San Antonio	Cuba	21°54'N	084°54'W	Atlantic	N	Y	F	A				1991				214	
276	Gibara	Cuba	21°07'N	076°07'W	Atlantic	N	Y	F	A				1991				276	
215	Siboney	Cuba	23°05'N	082°28'W	Atlantic	N	Y	F	A				1991				215	
228	Angmagssalik, Greenland	Denmark	65°30'N	037°00'W	Atlantic	Y	Y	P	D		D	L	1991	N			228	
225	Godthaab/Nuuk, Greenland	Denmark	64°10'N	051°44'W	Atlantic	Y	Y	F	P	15	D	L	1973	N			225	
227	Nord, Greenland	Denmark	81°40'N	018°00'W	Atlantic	Y	N								??	P	227	
237	Torshavn, Faroe Islands	Denmark	62°00'N	006°46'W	Atlantic	Y	Y	F	D	15	P	L					237	New gauge due 1993
2	Djibouti	Djibouti	11°36'N	043°09'E	Indian	N	??										2	????
169	Baltra, Galapagos	Ecuador	00°26'S	090°17'W	Pacific	N	Y	FP	D					Y			169	
172	La Libertad	Ecuador	02°12'S	080°54'W	Pacific	N	Y	F	AD	15				Y			172	
80	Port Said	Egypt	31°15'N	032°18'E	Med. Sea	N	??										80	????
1	Port Taufig (Suez)	Egypt	29°55'N	032°33'E	Red Sea	N	??										1	????
182	Acajutla	El Salvador	13°35'N	089°50'W	Pacific	N	??										182	????
117	Kapingamarangi, Carolines	Fed. Micronesia	01°06'N	154°47'E	Pacific	Y	Y	F	D	15,4	MD	L	1990	Y			117	
115	Ponape, Carolines	Fed. Micronesia	06°59'N	158°14'E	Pacific	Y	Y	F	D	15,4	MD	A	1991	Y			115	

No.	Station Name	Country	Latitude	Longitude	Ocean/Sea	R	Op.	Gauge	A/D	Interv.	Exch.	Lev.	Year	Sat.	Inst.	Gauge	No.	Comments
116	Truk Atoll, Carolines	Fed. Micronesia	07°27'N	151°51'E	Pacific	Y	Y	AP	D	6	LMD	A	1992	Y			116	
119	Yap, Carolines	Fed. Micronesia	09°31'N	138°08'E	Pacific	Y	Y	F	D	15,4	MD	L	1990	Y			119	
122	Suva	Fiji	18°08'S	178°26'E	Pacific	Y	Y	AF	D	6	LMD	A	1991	Y			122	NOAA installed Feb 1989
242	Brest	France	48°23'N	004°30'W	Atlantic	N	Y										242	Acoustic gauge in future
165	Clipperton	France	10°17'N	109°13'W	Pacific	N	N										165	No gauge exists
21	Crozet Island	France	46°25'S	051°52'E	Indian	N	N								1993	P	21	
131	Dumont d'Urville	France	66°40'S	140°01'E	Southern	N	N								1993	P	131	
96	Dzaoudzi (Mayotte)	France	12°47'S	045°15'E	Indian	N	Y	F									96	
23	Kerguelen Island	France	49°21'S	070°12'E	Indian	N	Y	P									23	2 months data (Oct 92)
204	Le Robert (Martinique)	France	14°41'N	060°56'W	Atlantic	N	N	F									204	not working
205	Marseille	France	43°18'N	005°21'E	Med. Sea	N	Y	F									205	
123	Noumea,Nouvelle Caledonie	France	22°18'S	165°26'E	Pacific	Y	Y	F	D	15,4	MD	L	1990	Y			123	
142	Nuku Hiva, Marquesas Is.	France	08°56'S	140°05'W	Pacific	Y	Y	F	D	15,4	MD	L	1992	Y			142	
17	Pointe des Galets,Reunion	France	20°55'S	055°18'E	Indian	N	??	F									17	New gauge installed
24	Saint Paul Island	France	38°43'S	077°35'E	Indian	N	N								1993	P	24	Amsterdam Is. instead
202	Cayenne	French Guiana	05°00'N	052°00'W	Atlantic	N	Y	F	A				1980				202	
140	Papeete (Thaiti)	French Polynesia	17°32'S	149°34'W	Pacific	Y	Y	AF	D	15,6	MD	L	1989	N			140	NOAA installed Aug 1990
138	Rikitea, Gambier	French Polynesia	23°08'S	134°57'W	Pacific	Y	Y	F	D	15	MD	L	??	N			138	*Levelled by French
284	Cuxhaven, Steubenhoft	Germany	53°52'N	008°43'E	Atlantic	N	Y	F	A	30				N			284	
258	Tema	Ghana	05°37'N	000°00'E	Atlantic	N	Y	F	D	15				N			258	
255	Conakry	Guinea	09°30'N	013°15'W	Atlantic	N	Y	F									255	
209	Port-au-Prince/Les Cayes	Haiti	18°34'N	072°21'W	Atlantic	N	N										209	destroyed
77	Quarry Bay	Hong Kong	22°18'N	114°13'E	Pacific	Y	Y	F	D	1	LM	A	1991	N			77	
229	Reykjavik	Iceland	64°09'N	021°56'W	Atlantic	N	Y	F	A					N			229	
32	Cochin	India	09°58'N	076°16'E	Indian	N	Y	F	A	60				N			32	
34	Madras	India	13°06'N	080°18'E	Indian	N	Y	F	A	60				N			34	
281	Marmagao	India	15°25'N	073°48'E	Indian	N	Y	F	A	60				N			281	Regularly maintained
29	Minicoy	India	08°17'N	073°03'E	Indian	N	N	F									29	
41	Nicobar	India	07°00'N	093°50'E	Indian	N	N										41	
38	Port Blair	India	11°41'N	092°46'E	Indian	N	N	F									38	
31	Veraval	India	20°54'N	070°22'E	Indian	N	Y	F	A	60				N			31	

No.	Station Name	Country	Latitude	Longitude	Ocean/Sea	R	Op.	Gauge	A/D	Interv.	Exch.	Lev.	Year	Sat.	Inst.	Gauge	No.	Comments
35	Vishakhapatnam	India	17°41'N	083°17'E	Indian	N	Y	F	A	60				N			35	
68	Ambon	Indonesia	03°42'S	128°12'E	Pacific	N	N										68	????
49	Benoa	Indonesia	08°46'S	115°13'E	Indian	N	Y	F						N			49	Info. from Univ. Hawaii
69	Bitung	Indonesia	01°26'N	125°12'E	Indian	N	Y	F						N			69	Info. from Univ. Hawaii
291	Cilacap	Indonesia	07°34'S	108°59'E	Indian	N	Y	F						N			291	Info. from Univ. Hawaii
50	Kupang	Indonesia	10°10'S	123°35'E	Indian	N	N										50	????
45	Padang (Teluk Bayuk)	Indonesia	01°00'S	100°22'E	Indian	N	Y							N			45	Info. from Univ. Hawaii
48	Pelabuhan Ratu	Indonesia	07°00'S	106°30'E	Indian	N	N										48	????
67	Sorong	Indonesia	00°53'S	131°15'E	Indian	N	N										67	????
292	Surabaya	Indonesia	07°13'S	112°44'E	Pacific	N	Y	P						N			292	Info. from Univ. Hawaii
240	Castletownsend	Ireland	51°32'N	009°11'W	Atlantic	Y	N										240	NOAA may consider
239	Malin Head	Ireland	55°22'N	007°20'W	Atlantic	Y	Y	P	A		L	A		N			239	
210	Port Royal, Kingston	Jamaica	17°56'N	076°51'W	Atlantic	N	Y	A									210	
82	Aburatsu	Japan	31°34'N	131°25'E	Pacific	Y	Y	F	AD	0.5	LM	L	1989	N			82	
103	Chichijima	Japan	27°05'N	142°11'E	Pacific	Y	Y	F	AD	0.5	LM	L		N			103	
88	Hakodate	Japan	41°47'N	140°44'E	Pacific	Y	Y	F	AD	0.5	LM	L	1984	N			88	
85	Kushimoto	Japan	33°28'N	135°47'E	Pacific	Y	Y	F	AD	0.5	LM	L	1988	N			85	
89	Kushiro	Japan	42°58'N	144°23'E	Pacific	Y	Y	F	AD	0.5	LM	L	1982	N			89	
86	Mera	Japan	34°55'N	139°50'E	Pacific	Y	Y	F	AD	0.5	LM	L	1991	N			86	
104	Minamitorishima	Japan	24°18'N	153°58'E	Pacific	Y	N										104	
83	Nagasaki	Japan	32°44'N	129°52'E	Pacific	Y	Y	F	AD	0.5	LM	L	1991	N			83	
81	Naha	Japan	26°13'N	127°40'E	Pacific	Y	Y	F	AD	0.5	LM	L	1989	N			81	
87	Ofunato	Japan	39°01'N	141°45'E	Pacific	Y	Y	F	AD	0.5	LM	L	1991	N			87	
95	Syowa	Japan	69°00'S	039°35'E	Southern	N	Y	P									95	????
8	Mombasa	Kenya	04°03'S	039°40'E	Indian	Y	Y	F	A	60	MD	L	1989	N			8	
146	Christmas, Line Is.	Kiribati	01°59'N	157°29'W	Pacific	Y	Y	P	D	15,4	MD	L	1990	Y			146	
147	Fanning, Line Is.	Kiribati	03°51'N	159°22'W	Pacific	Y	N	F	D	15	MD	L	1987	N			147	Not operating at present
145	Kanton, Phoenix Is.	Kiribati	02°49'S	171°43'W	Pacific	Y	Y	F	D	15	MD	L	1990	Y			145	
113	Tarawa, Gilbert Is.	Kiribati	01°22'N	172°56'E	Pacific	Y	Y	F	D	15,4	MD	L	1991	Y			113	
84	Pusan	Korea, Republic of	35°06'N	129°02'E	Pacific	N	Y	F	A					N			84	
271	Fort Dauphin	Madagascar	25°01'S	047°00'E	Indian	N	N										271	Installed not operating

No.	Station Name	Country	Latitude	Longitude	Ocean/Sea	R	Op.	Gauge	A/D	Interv.	Exch.	Lev.	Year	Sat.	Inst.	Gauge	No.	Comments
15	Nosy-Be	Madagascar	13°24'S	048°17'E	Indian	N	Y	F									15	????
293	Chendering	Malaysia	05°16'N	103°11'E	Pacific	N	Y	F	D	5				N			293	
43	Lumut	Malaysia	04°14'N	100°11'E	Indian	N	Y	F	D	5				N			43	
27	Gan	Maldives	00°42'S	073°10'E	Indian	Y	Y	F	D	15,4	MD	L	1991	Y			27	
28	Male	Maldives	04°10'N	073°30'E	Indian	Y	Y	P	A	60	MD	L	1991	N			28	
110	Eniwetok	Marshall Is.	11°22'N	162°21'E	Pacific	Y	N								None		110	
111	Kwajalein	Marshall Is.	08°44'N	167°44'E	Pacific	Y	Y	AF	D	6	LMD	A	1992	Y			111	
112	Majuro	Marshall Is.	07°06'N	171°22'E	Pacific	Y	Y	F	D	15,4	MD	L	1990	Y			112	
252	Nouakchott	Mauritania	18°06'N	016°02'W	Atlantic	N	N										252	
16	Agalega Is.	Mauritius	10°23'S	056°36'E	Indian	Y	N								??		16	*unknown
18	Port Louis Harbour	Mauritius	20°09'S	057°30'E	Indian	Y	Y	F	AD	60,4	MD	L	1992	Y			18	
19	Rodrigues, Port Mathurin	Mauritius	19°41'S	063°25'E	Indian	Y	Y	F	A	60	MD	L	??	N			19	*unknown
267	Acapulco, Gro.	Mexico	16°50'N	099°55'W	Pacific	Y	Y	F	A		L	L	1990	N			267	
161	Cabo San Lucas	Mexico	22°53'N	109°54'W	Pacific	Y	Y	P	A		L		1990	Y			161	
160	Isla Guadalupe	Mexico	28°53'N	118°18'W	Pacific	Y	Y	P	A		L	A	1991	Y			160	Temporarily out
163	Manzanillo, Col.	Mexico	19°03'N	104°20'W	Pacific	Y	N								1992	P	163	NOAA installed May 1992
213	Progreso, Yuc.	Mexico	21°18'N	089°39'W	Atlantic	Y	Y	F	A		L	A	1987	N			213	
164	Puerto Angel	Mexico	15°39'N	096°30'W	Pacific	Y	N	F	A		L	M		N	??	??	164	
162	Socorro Is.	Mexico	18°44'N	111°01'W	Pacific	Y	N								1992	P	162	NOAA installed May 1992
212	Veracruz, Ver.	Mexico	19°12'N	096°08'W	Atlantic	Y	Y	F	A		L	A	1990	N			212	
282	Tan Tan	Morocco	28°30'N	011°03'W	Atlantic	N	??										282	????
10	Inhambane	Mozambique	23°55'S	035°30'E	Indian	Y	NT								1992	F	10	to be installed soon
11	Pemba	Mozambique	12°58'S	040°29'E	Indian	Y	NT								1992	F	11	to be installed soon
37	Akyab (Sittwe)	Myanmar	20°09'N	092°54'E	Indian	N	N										37	
141	Moulmein (Mawlamyine)	Myanmar	16°29'N	097°37'E	Indian	N	N										141	
114	Nauru	Nauru	00°32'S	166°54'E	Pacific	Y	Y	F	D	15,4	MD	L	1991	Y			114	
127	Auckland-Waitemata Harbour	New Zealand	36°51'S	174°46'E	Pacific	Y	Y	FP	AD	10	LD	A	1991	N			127	
132	Balleny Is.	New Zealand	66°35'S	162°50'E	Southern	Y	N								??		132	*unknown
129	Bluff Harbour	New Zealand	46°36'S	168°21'E	Pacific	Y	Y	A	A		L	L	1990	N			129	
128	Chatham Is.	New Zealand	43°50'S	176°30'W	Pacific	Y	Y	P	AD	7	M	L	1991	Y			128	
126	Kermadec Is.	New Zealand	29°50'S	178°15'W	Pacific	Y	N								??	??	126	*unknown

No.	Station Name	Country	Latitude	Longitude	Ocean/Sea	R	Op.	Gauge	A/D	Interv.	Exch.	Lev.	Year	Sat.	Inst.	Gauge	No.	Comments
133	Scott Is.	New Zealand	67°00'S	175°00'E	Southern	Y	N								??*		133	*unknown
101	Wellington Harbour	New Zealand	41°17'S	174°47'E	Pacific	Y	Y	F	D	10	LD	A	1991	N			101	
259	Lagos	Nigeria	06°25'N	003°27'E	Atlantic	Y	Y	AF	AD	60	L	L	1992	N			259	NOAA installed May 1992
118	Saipan	North Mariana Is.	15°14'N	145°44'E	Pacific	Y	Y	F	D	15	MD	L	1990	N			118	
232	Bjornoya (Bear Island)	Norway	74°30'N	019°00'E	Atlantic	N	N										232	????
269	Bouveteya (Bouvet Island)	Norway	54°22'S	003°22'E	Atlantic	N	N										269	????
275	Honningsvaag	Norway	70°59'N	025°59'E	Atlantic	N	Y	F	D	10				Y			275	
230	Jan Mayen Island	Norway	70°55'N	008°43'W	Atlantic	N	N										230	????
235	Maloy	Norway	61°56'N	005°07'E	Atlantic	N	Y	F	D	10				Y			235	
136	Peter Is.	Norway	68°47'S	090°35'W	Southern	N	N										136	????
234	Rorvik	Norway	64°52'N	011°15'E	Atlantic	N	Y	F	D	10				Y			234	
5	Muscat (Qaboos Port)	Oman	23°37'N	058°35'E	Indian	Y	Y	F	A	15,60	LMD	L	1989	N			5	upgrade to satellite
4	Salalah	Oman	17°00'N	054°00'E	Indian	Y	Y	F	D	15,4	LMD	L	1991	Y			4	
295	Gwadar	Pakistan	25°07'N	062°20'E	Indian	N	??										295	????
30	Karachi, Manoro Island	Pakistan	24°48'N	066°58'E	Indian	N	??										30	????
168	Balboa	Panama	08°58'N	079°36'W	Pacific	N	??										168	????
208	Coco Solo	Panama	09°22'N	079°53'W	Atlantic	N	Y	A					1991				208	
63	Alotau	Papua New Guinea	10°19'S	150°27'E	Pacific	N	Y	F	D	15				N			63	Info. from Australia
272	Daru	Papua New Guinea	09°03'S	143°12'E	Pacific	N	N										272	Info. from Australia
65	Rabaul	Papua New Guinea	04°12'S	152°11'E	Pacific	N	Y	F	AD	15				Y			65	Info. from Australia
64	Vanimo	Papua New Guinea	02°41'S	141°18'E	Pacific	N	N										64	Info. from Australia
173	Callao	Peru	12°03'S	077°09'W	Pacific	Y	Y	F	AD	15	D	A	1992	Y			173	
71	Davao, Davao Gulf	Philippines	07°05'N	125°38'E	Pacific	N	Y	F						N			71	
70	Jolo, Sulu	Philippines	06°04'N	121°00'E	Pacific	N	Y	FP						N			70	
72	Legaspi, Albay	Philippines	13°09'N	123°45'E	Pacific	N	Y	F						N			72	
73	Manila, South Harbor	Philippines	14°35'N	120°50'E	Pacific	N	Y	F						N			73	
246	Cascais	Portugal	38°41'N	009°25'W	Atlantic	Y	Y	F	A	60	D			N			246	Acoustic gauge installation?
244	Flores (Azores)	Portugal	39°27'N	031°07'W	Atlantic	Y	Y	P	A	60	D	L	1991	N			244	
250	Funchal (Madeira)	Portugal	32°38'N	016°54'W	Atlantic	Y	Y	F	A	60	D	L	1991	N			250	NOAA reconned
245	Ponta Delgada, Azores	Portugal	37°44'N	025°40'W	Atlantic	Y	Y	F	A	607					1992	A	245	NOAA installed Jun 1992
13	Durban	South Africa	29°53'S	031°02'E	Indian	N	Y	AF	AD	60				N			13	

No.	Station Name	Country	Latitude	Longitude	Ocean/Sea	R	Op.	Gauge	A/D	Interv.	Exch.	Lev.	Year	Sat.	Inst.	Gauge	No.	Comments
20	Marion Is.	South Africa	46°52'S	037°52'E	Indian	N	Y	A	D	10							20	Intermittant data only
76	Port Elizabeth	South Africa	33°58'S	025°38'E	Indian	N	Y	AF	D	60				N			76	
268	Simonstown	South Africa	34°11'S	018°26'E	Atlantic	N	Y	AF	D	60				N			268	
260	Sao Tome	Sao Tome & Principe	00°25'N	006°35'E	Atlantic	N	Y	P									260	ORSTOM pressure gauge
253	Dakar	Senegal	14°38'N	017°27'W	Atlantic	N	Y	P						Y			253	NOAA installed Sep 1991
14	Aldabra	Seychelles	09°30'S	046°20'E	Indian	N	N										14	Replace by Farquar?
273	Port Victoria	Seychelles	04°40'S	055°28'E	Indian	N	N	F									273	Pier reconstruction
256	Aberdeen Point	Sierra Leone	08°30'N	013°14'W	Atlantic	N	??										256	????
44	Keppel Harbour	Singapore	01°28'N	103°50'E	Indian	N	Y	F	A	60				N			44	
66	Honiara	Solomons	09°26'S	159°57'E	Pacific	Y	Y	F	D	15,4	MD	L	1988	Y			66	
6	Hafun	Somalia	10°27'N	051°15'E	Indian	N	N										6	No gauge
7	Mogadishu	Somalia	02°01'N	045°20'E	Indian	Y	N	F	A	60	MD	L	1989	N			7	No recent data
249	Ceuta	Spain	35°54'N	005°19'W	Atlantic	N	Y	F	A	60				N			249	
243	La Coruna	Spain	43°32'N	008°24'W	Atlantic	N	Y	F	A	60				N			243	
251	Las Palmas, Canary Is.	Spain	28°08'N	015°25'W	Atlantic	N	Y	F	A	60				N			251	
33	Colombo	Sri Lanka	06°56'N	079°51'E	Indian	Y	Y	F	A	60	MD	L	1989	N			33	
233	Goteborg-Torshamnen	Sweden	57°41'N	011°48'E	Atlantic	Y	Y	F	A	60	LD	L	1984	N			233	
9	Mtwara	Tanzania	10°17'S	040°11'E	Indian	N	N										9	No gauge
297	Zanzibar	Tanzania	06°09'S	039°11'E	Indian	Y	Y	F	D	10	MD	L	??*	N			297	*unknown
39	Ko Lak	Thailand	11°47'N	099°49'E	Pacific	Y	Y	F	A	10	L	M	1991	N			39	
42	Ko Taphao Noi	Thailand	07°50'N	098°26'E	Indian	Y	Y	F	A	10	L	M	1992	N			42	
125	Tongatapu	Tonga	21°10'S	175°15'W	Pacific	N	??										125	????
203	Port of Spain	Trinidad and Tobago	10°39'N	061°31'W	Atlantic	N	??										203	????
121	Funafuti, Ellice Is.	Tuvalu	08°23'S	179°13'E	Pacific	Y	Y	F	D	15,4	MD	L	1990	Y			121	
300	Montevideo	Uruguay	34°54'S	056°15'W	Atlantic	N	??										300	????
263	Ascension	U.K.	07°55'S	014°25'W	Atlantic	Y	Y	P	D	60	LMD			N	1992	F	263	Not levelled
221	Bermuda, St.Georges Is	U.K.	32°22'N	064°42'W	Atlantic	Y	Y	P	D	6	LMD	A	1991	Y			221	NOAA installed May 1989
26	Diego Garcia	U.K.	07°17'S	072°24'E	Indian	N	Y	F	D	15				Y			26	NOAA installed Aug 1990
305	Falkland Is., Malvinas	U.K.	51°45'S	057°56'W	Southern	Y	Y	P	D	15	LMD			Y			305	Not levelled
188	Faraday	U.K.	65°15'S	064°16'W	Southern	Y	Y	FP	AD	60,15	LMD	L	1992	N			188	Real time data link soon?
248	Gibraltar	U.K.	36°07'N	005°21'W	Atlantic	Y	NT								1992	F	248	

No.	Station Name	Country	Latitude	Longitude	Ocean/Sea	R	Op.	Gauge	A/D	Interv.	Exch.	Lev.	Year	Sat.	Inst.	Gauge	No.	Comments
236	Lerwick	U.K.	60°09'N	001°08'W	Atlantic	Y	Y	FP	AD	15	LMD	L	1989	N			236	
241	Newlyn	U.K.	50°06'N	005°33'W	Atlantic	Y	Y	FP	AD	15	LMD	L	1989	N			241	
306	Signy, South Orkney Is.	U.K.	60°42'S	045°36'W	Southern	Y	Y	P	D	15	LMD			Y			306	Not levelled
296	South Caicos	U.K.	22°00'N	072°00'W	Atlantic	Y	Y	A	D	6	LMD	A	1991	Y			296	
187	South Georgia	U.K.	54°15'S	036°45'W	Atlantic	Y	N								•	P	187	Depends on new BAS base
238	Stornoway	U.K.	58°12'N	006°23'W	Atlantic	Y	Y	FP	AD	15	LMD	L	1989	N			238	
264	St. Helena	U.K.	15°58'S	005°42'W	Atlantic	Y	Y	P	D	15	LMD			Y			264	Not levelled
266	Tristan da Cunha	U.K.	37°03'S	012°18'W	Atlantic	Y	Y	P	D	15	LMD			Y			266	Not levelled
302	Adak	U.S.A.	51°52'N	176°38'W	Pacific	Y	Y	FPA	AD	6	LMD	A	1991	Y			302	
219	Duck, N.C.	U.S.A.	35°11'N	075°45'W	Atlantic	Y	Y	FPA	D	6	LMD	A	1991	Y			219	
289	Fort Pulaski, GA	U.S.A.	32°02'N	080°54'W	Atlantic	Y	Y	FPA	AD	6	LMD	A	1991	Y			289	
107	French Frigate, Shoal H	U.S.A.	23°52'N	166°17'W	Pacific	Y	Y	F	A	15							107	
217	Galveston (Pier 21), TX	U.S.A.	29°19'N	094°48'W	Atlantic	Y	Y	FPA	AD	6	LMD	A	1991	Y			217	
149	Guam, Marianas	U.S.A.	13°26'N	144°39'E	Pacific	Y	Y	FPA	D	6	LMD	A	1991	N			149	
287	Hilo, HI	U.S.A.	19°44'N	155°04'W	Pacific	Y	Y	FPA	AD	6	LMD	A	1991	Y			287	Remove from GLOSS list
108	Honolulu, HI	U.S.A.	21°18'N	157°52'W	Pacific	Y	Y	FPA	D	6	LMD	A	1991	Y			108	
109	Johnston Island	U.S.A.	16°44'N	169°32'W	Pacific	Y	Y	FPA	AD	6	LMD	A	1991	Y			109	
286	Kahului, HI	U.S.A.	20°45'N	156°28'W	Pacific	Y	Y	FPA	AD	6	LMD	A	1991	Y			286	
216	Key West, FL	U.S.A.	24°33'N	081°48'W	Atlantic	Y	Y	FPA	AD	6	LMD	A	1991	Y			216	
159	La Jolla (Scripps Pier)CA	U.S.A.	32°52'N	117°16'W	Pacific	Y	Y	FPA	AD	6	LMD	A	1991	Y			159	
303	Massacre Bay, Attu Is.	U.S.A.	52°50'N	173°12'E	Pacific	Y	N								??*		303	*none planned, no pier
134	McMurdo	U.S.A.	77°51'S	166°40'E	Southern	Y	N								??*		134	*none planned
218	Miami, Haulover Pier	U.S.A.	25°54'N	080°07'W	Atlantic	Y	Y	FPA	AD	6	LMD	A	1991	Y			218	Hurricane damage 1992
106	Midway Island	U.S.A.	28°13'N	177°22'W	Pacific	Y	Y	FPA	AD	6	LMD	A	1991	Y			106	
285	Nawiliwili, HI	U.S.A.	21°57'N	159°22'W	Pacific	Y	Y	FPA	AD	6	LMD	A	1991	Y			285	Remove from GLOSS list
290	Newport, RI	U.S.A.	41°30'N	071°20'W	Atlantic	Y	Y	FPA	AD	6	LMD	A	1992	N			290	
74	Nome	U.S.A.	64°30'N	165°30'W	Pacific	Y	N								1992	P	74	Gauge installed Jul 1992
144	Pago Pago, Samoa	U.S.A.	14°17'S	170°41'W	Pacific	Y	Y	FPA	AD	6	LMD	A	1991	Y			144	
183	Palmer (Antarctica)	U.S.A.	64°46'S	064°03'W	Southern	Y	N								??*		183	*none planned
301	Palmyra	U.S.A.	05°52'N	162°06'W	Pacific	Y	N										301	Remove from GLOSS list
288	Pensacola, FL	U.S.A.	30°24'N	087°13'W	Atlantic	Y	Y	FPA	AD	6	LMD	A	1991	N			288	

No.	Station Name	Country	Latitude	Longitude	Ocean/Sea	R	Op.	Gauge	A/D	Interv.	Exch.	Lev.	Year	Sat.	Inst.	Gauge	No.	Comments
151	Prudhoe Bay, AK	U.S.A.	70°23'N	148°30'W	Arctic	Y	Y	PA	D	6	LMD	A	1991	Y			151	
158	San Francisco, CA	U.S.A.	37°48'N	122°28'W	Pacific	Y	Y	FPA	AD	6	LMD	A	1991	Y			158	
206	San Juan, Puerto Rico	U.S.A.	18°28'N	066°07'W	Atlantic	Y	Y	PA	D	6	LMD	A	1991	Y			206	
100	Sand Point, AK	U.S.A.	55°20'N	160°30'W	Pacific	Y	Y	FPA	AD	6	LMD	A	1991	Y			100	
150	Seward, AK	U.S.A.	60°07'N	149°26'W	Pacific	Y	Y	FPA	AD	6	LMD	A	1991	Y			150	
154	Sitka, AK	U.S.A.	57°03'N	135°20'W	Pacific	Y	Y	FPA	AD	6	LMD	A	1991	Y			154	
157	South Beach, OR	U.S.A.	44°38'N	124°03'W	Pacific	Y	Y	AF	AD	6	LMD	A	1991	Y			157	
102	Unalaska, AK	U.S.A.	53°53'N	166°32'W	Pacific	Y	Y	FPA	AD	6	LMD	A	1991	Y			102	
220	Ventnor, NJ	U.S.A.	39°20'N	074°29'W	Atlantic	N	??										220	Atlantic City reinstalled 1991
105	Wake Island	U.S.A.	19°17'N	166°37'E	Pacific	Y	Y	FPA	AD	6	LMD	A	1991	Y			105	
231	Barentsburg (Spitsbergen)	Russia	78°04'N	014°15'E	Arctic	N	Y	F									231	
97	Kaliningrad	Russia	54°57'N	020°13'E	Baltic	N	Y										97	
91	Leningradskaya	Russia	69°30'S	159°23'E	Southern	N	N										91	
25	Mirny	Russia	66°33'S	093°01'E	Southern	N	N										25	
294	Molodezhnaya	Russia	67°40'S	045°50'E	Southern	N	N										294	
274	Murmansk	Russia	68°58'N	033°03'E	Atlantic	N	Y	F									274	
92	Nagaevo Bay	Russia	59°44'N	150°42'E	Pacific	N	Y	F									92	
270	Novolazarevskaya	Russia	70°46'S	011°50'E	Southern	N	N										270	
93	Petropavlovsk-Kamchatsky	Russia	52°59'N	158°39'E	Pacific	N	Y	F									93	
135	Russkaya	Russia	74°46'S	136°51'W	Southern	N	N										135	
99	Russkaya Gavan	Russia	76°14'N	062°35'E	Atlantic	N	Y										99	
98	Tuapse	Russia	44°06'N	039°04'E	Black Sea	N	Y	F									98	
90	Yuzhno Kurilsk	Russia	44°01'N	145°52'E	Pacific	N	Y	F									90	
298	Aves Is.	Venezuela	15°39'N	063°35'W	Atlantic	N	??										298	to be installed 19927
299	La Orchila	Venezuela	11°48'N	066°08'W	Atlantic	N	??										299	to be installed 19927
75	Qui Nhon	Viet Nam	13°46'N	109°13'E	Pacific	Y	Y	F	A	60	L	A	1991	N			75	India helping to improve
3	Aden	Yemen, P.D.R.	12°47'N	044°59'E	Indian	N	??										3	????
304	Socotra Island	Yemen, P.D.R.	12°30'N	054°00'E	Indian	N	??										304	????

KEY TO COLUMN HEADINGS AND CODES

Heading	Explanation	Code & Meaning
R	Reply to March 1992 questionnaire	Y Yes N No
Op.	Site operational during the first half of 1992	Y Yes N No
Gauge	Gauges operating at site	F Float P Pressure A Acoustic
A/D	Analogue or digital recording	A Analogue D Digital
Interv.	Digitising interval (minutes)	
Exch.	Hourly data stored	L Listings M Magnetic Tape D Magnetic disk/diskette
Lev.	Levelling frequency	A Annually L Less than annually M More than annually
Year	Year levelling last carried out	
Sat.	Data transmitted by satellite	Y Yes N No
Inst.	Installation date of new gauge	
Gauge	Type of gauge to be installed	F Float P Pressure A Acoustic
No.	GLOSS No.	
Comments	Suggested improvements to site	

Table 5. Number of Drifting Buoys by Country and Those reporting via the GTS, as of November 1992 (based on actual transmissions between 13 and 23 November 1992, DBCP).

ORGANIZATION	COUNTRY	Total	GTS
NOAA, Atlantic Oceanographic and Meteorological Laboratory	USA	281	194
Scripps Institution of Oceanography	USA	203	127
US Naval Oceanographic Office	USA	90	53
NOAA, Pacific Marine Environment Laboratory	USA	62	14
SACLANT Center	Italy	52	18
University of Kiel, IFM	Germany	40	0
Maritime Safety Agency	Japan	40	0
Institute of Ocean Sciences	Canada	38	5
Minerals Management Service	USA	29	0
National Data Buoy Center	USA	28	23
Meteorological Office	United Kingdom	24	12
Atmospheric Environment Service	Canada	21	13
Norsk Polarinstitutt	Norway	18	2
Weather Bureau	South Africa*	17	17
University of Hannover	Germany	16	9
IFREMER	France	16	10
Meteo France	France	15	12
Department of Fisheries and Oceans	Canada	15	0
Tokai University	Japan	14	0
US Coast Guards, International Ice Patrol	USA	14	3
Science Applications International Corporation	USA	12	2
OCEANOR	Norway	12	0
Horizon Marine, Inc.	USA	12	0
Woods Hole Oceanographic Institution	USA	11	1
Marine Biological Association	United Kingdom	11	4
New Zealand Meteorological Service	New Zealand	10	8
CSIRO	Australia	10	0
Bureau of Meteorology	Australia	10	4
Southwest Fisheries Science Center	USA	6	0
Sanyo Hydrographic Survey	Japan	5	0
Korean Ocean Research and Development Institute	Korea	5	4
Joint Ice Center	USA	5	5
University of New Foundland	Canada	4	0
University of Hamburg	Germany	4	2
South China Sea sub-bureau of NBO	China	4	0
NOAA-HAZMAT	USA	4	0
Meteorological Institute	Norway	4	2
Navy Postgraduate School	USA	4	0
Fisheries Agency	Japan	4	0
University of Washington	USA	3	0
Texas A&M University	USA	3	0
National Institute of Oceanography	India	3	0
Others	/	32	3
TOTAL		1211	547
(% of TOTAL)			(45.2)

* 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.

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	58	-	**58**	12	-	**12**	-	**70**
Australia	Australie	87	-	**87**	4	-	**4**	2	**93**
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**
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	142	-	**142**	-	-	**0**	-	**142**
Germany	Allemagne	471	11	**482**	47	1	**48**	38	**568**
Greece	Grèce	8	-	**8**	-	-	**0**	24	**32**
Hong Kong	Hong-kong	68	-	**68**	12	-	**12**	1	**81**
Iceland	Islande	-	-	**0**	24	-	**24**	7	**31**
India	Inde	17	-	**17**	174	-	**174**	35	**226**
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**

1		2	3	4	5	6	7	8	9
Jamaica	Jamaïque	1	-	**1**	-	-	**0**	-	**1**
Japan	Japon	103	-	**103**	13	-	**13**	-	**116**
Kenya	Kenya	-	-	**0**	1	-	**1**	13	**14**
Malaysia	Malaisie	36	-	**36**	31	-	**31**	30	**97**
Netherlands	Pays-Bas	146	-	**146**	84	-	**84**	-	**230**
New Caledonia	Nouvelle-Calédonie	1	-	**1**	-	-	**0**	-	**1**
New Zealand	Nouvelle-Zélande	39	-	**39**	3	-	**3**	13	**55**
Norway	Norvège	24	-	**24**	-	-	**0**	-	**24**
Pakistan	Pakistan	9	-	**9**	2	-	**2**	5	**16**
Philippines	Philippines	34	-	**34**	8	-	**8**	7	**49**
Poland	Pologne	62	-	**62**	62	-	**62**	48	**172**
Portugal	Portugal	15	-	**15**	-	-	**0**	-	**15**
Republic of Korea	République de Corée	-	-	**0**	68	-	**68**	-	**68**
Saudi Arabia	Arabie saoudite	15	-	**15**	83	-	**83**	2	**100**
Singapore	Singapour	46	-	**46**	-	-	**0**	-	**46**
*South Africa	*Afrique du sud	34	-	**34**	-	-	**0**	-	**34**
Spain	Espagne	47	-	**47**	-	-	**0**	6	**53**
Sri Lanka	Sri Lanka	14	-	**14**	-	-	**0**	-	**14**
Sweden	Suède	38	-	**38**	-	-	**0**	39	**77**
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	1704	-	**1704**	-	-	**0**	-	**1704**
United Kingdom of Great Britain and Northern Ireland	Royaume-Uni de Grande-Bretagne et d'Irlande du Nord	477	2	**479**	2	1	**3**	3	**485**
United States of America	Etats-Unis d'Amérique	446	-	**446**	372	-	**372**	656	**1474**
Former Yugoslavia	Ancienne Yougoslavie	95	-	**95**	83	-	**83**	-	**178**
TOTALS	**TOTAUX**	4594	14	**4608**	1330	2	**1332**	1422	**7362**

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 7. Status of Implementation of GTS Circuits and Plans

1. The status of inplenentation of GTS circuits and plans are given in following tables under columns (a) to (h). For each circuit identified by its two ends in column (a), the tables include two lines: the present status is given in the first line and the plan(s) in the second line.

2. The type of GTS circuit is given in column (b):

- 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.

3. The constitution of the circuit is given in column (c):

- Cab: for cable circuits,
- HF: for HF circuits,
- Mcw: for microwave circuits,
- Sat: for satellite circuits.

4. For circuits on which several channels are multiplexed, the total speed of the circuit is given in column (d).

5. For the circuit or for each channel of the multiplexed circuits, the following information is provided in four columns under (e) to (f);

(a) speed of transmission
(b) type of data exchanged:
- A: for alphanumerical 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

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

(d) in case of use of X.25 procedures, number and type of virtual circuits.

6. Remarks (only in English) are given in column (h).

STATUS OF IMPLEMENTATION OF GTS CIRCUITS AND PLANS/ETAT DE MISE EN OEUVRE DES CIRCUITS DU SMT ET PLANS

(a) Circuit	(b)	(c)	(d)	(e) Channel A/Canal A				(f) Channel B/Canal B				(g) Channel C/Canal C				(h) Remarks/Remarques
Algiers Toulouse	A	Cab	9600	4800	CDF			2400	A	X.25		2400				On channel A, use of Code A for CDF -
Beijing Offenbach	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	Sat	9600	4800	NCDF			2400	A	X.25		2400				
Bracknell Toulouse	A		64000	4800	CDF	X.25		4800	D	X.25		2400	R			NCDF exchanged on two additional channels at 4800 bit/s
Bracknell Washington	A		64000	9600	A+B	X.25	2 PVC	4800	NCDF CDF	X.25						
Brasilia Washington	A	Sat	9600	4800	A A+B	X.25	1 PVC 2 PVC	4800	CDF	X.25						
Buenos Aires Washington	A	Sat	9600	4800	A A+B	X.25	1 PVC 2 PVC	4800	CDF	X.25						
Cairo Moscow	A	Cab		100	A											- X.25
Cairo Nairobi	A	HF		75	A											Operational difficulties X.25
Cairo New Delhi	A	Sat		100	A											- X.25

STATUS OF IMPLEMENTATION OF GTS CIRCUITS AND PLANS/ETAT DE MISE EN OEUVRE DES CIRCUITS DU SMT ET PLANS

(a) Circuit	(b)	(c)	(d)	(e) Channel A/Canal A				(f) Channel B/Canal B				(g) Channel C/Canal C				(h) Remarks/Remarques
Dakar Toulouse	A	Sat	9600	4800	CDF			2400	D	X.25		2400				On channel A, use of codes A and T.4 for CDF -
Jeddah Offenbach	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	 9600	2400 4800	A D	LAPB		 4800	 NCDF							 Use of X.25 procedures
Moscow Prague	A	Cab	9600	2400	NCDF			2400	A	LAPB X.25		2400				
Moscow Sofia	A	Cab	9600	4800	NCDF			2400	A	WMOS X.25		2400				
Nairobi Offenbach	A	Sat	9600	2400	NCDF			2400	A	LAPB X.25		2400				
New Delhi Tokyo	A	Sat	9600	4800	NCDF	X.25		4800	D	X.25						
Offenbach Prague	A	Cab	9600	4800	NCDF			2400	A	LAPB X.25	1 VC	2400				
Offenbach Toulouse	A		64000	4800	CDFA CDF			2400	NCDF			9600	D	X.25		Radar data exchanged on additional X.25 channel at 4800 bit/s
Prague Sofia	A	Cab	9600	2400	NCDF			2400	A	WMOH X.25		2400	NCDF			

STATUS OF IMPLEMENTATION OF GTS CIRCUITS AND PLANS/ETAT DE MISE EN OEUVRE DES CIRCUITS DU SMT ET PLANS

(a) Circuit	(b)	(c)	(d)	(e) Channel A/Canal A				(f) Channel B/Canal B				(g) Channel C/Canal C				(h) Remarks/Remarques
Tokyo Washington	A	Sat	9600	4800	NCDF	X.25	1 PVC	4800	A+B	X.25	2 PVC					

Figure 1. Standard Track Lines - Atlantic

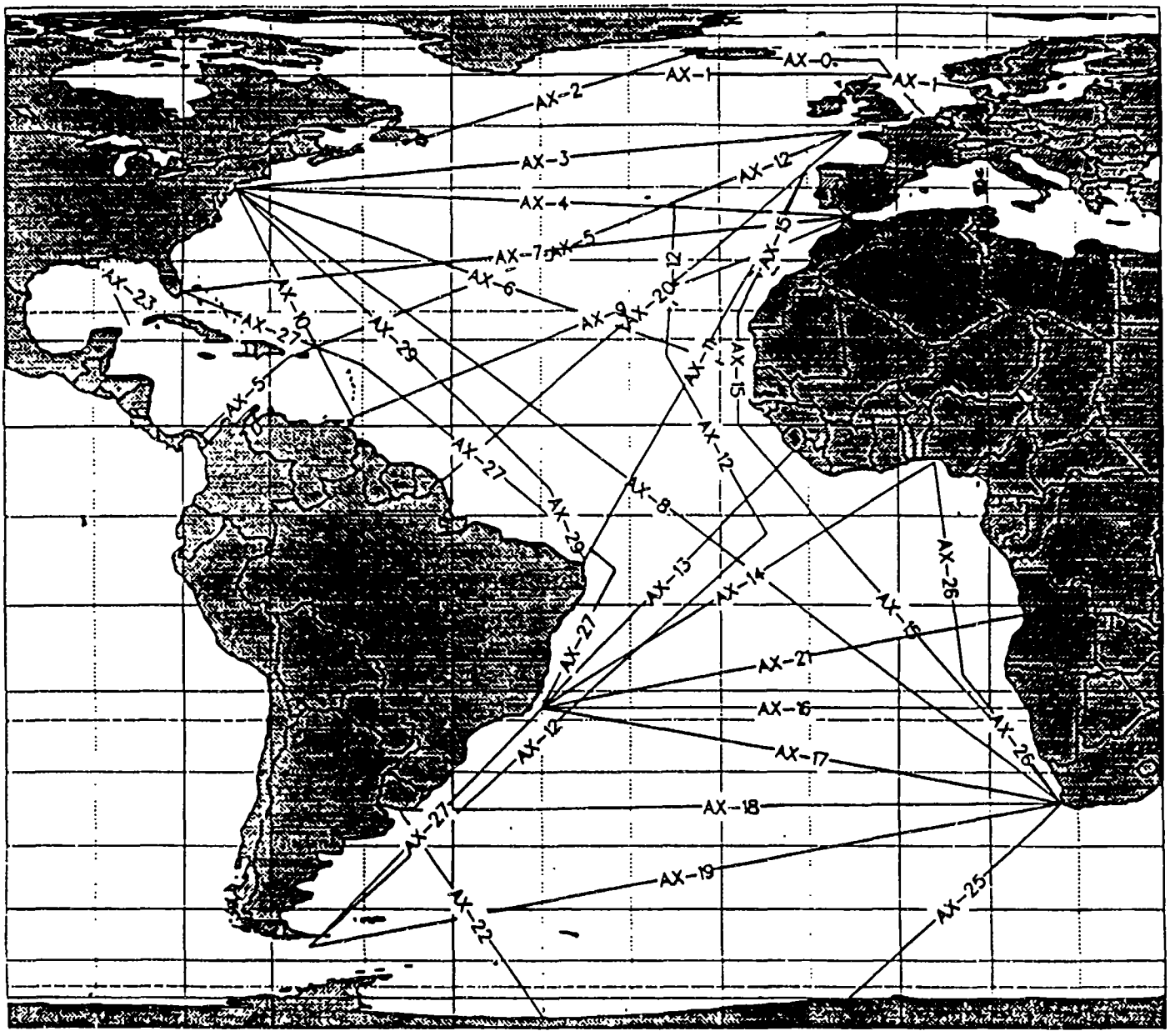


Figure 2. Standard Track Lines - Pacific

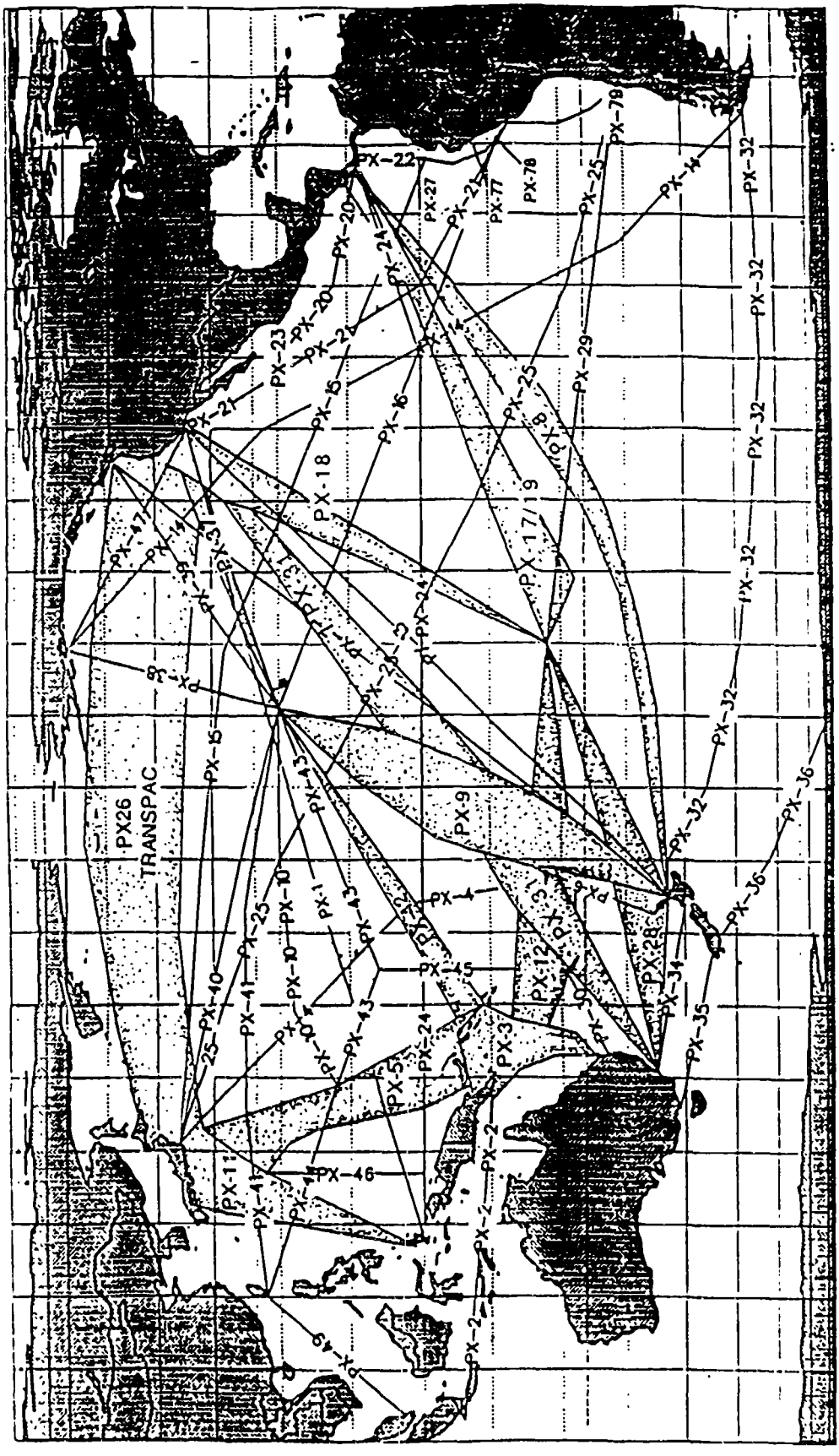
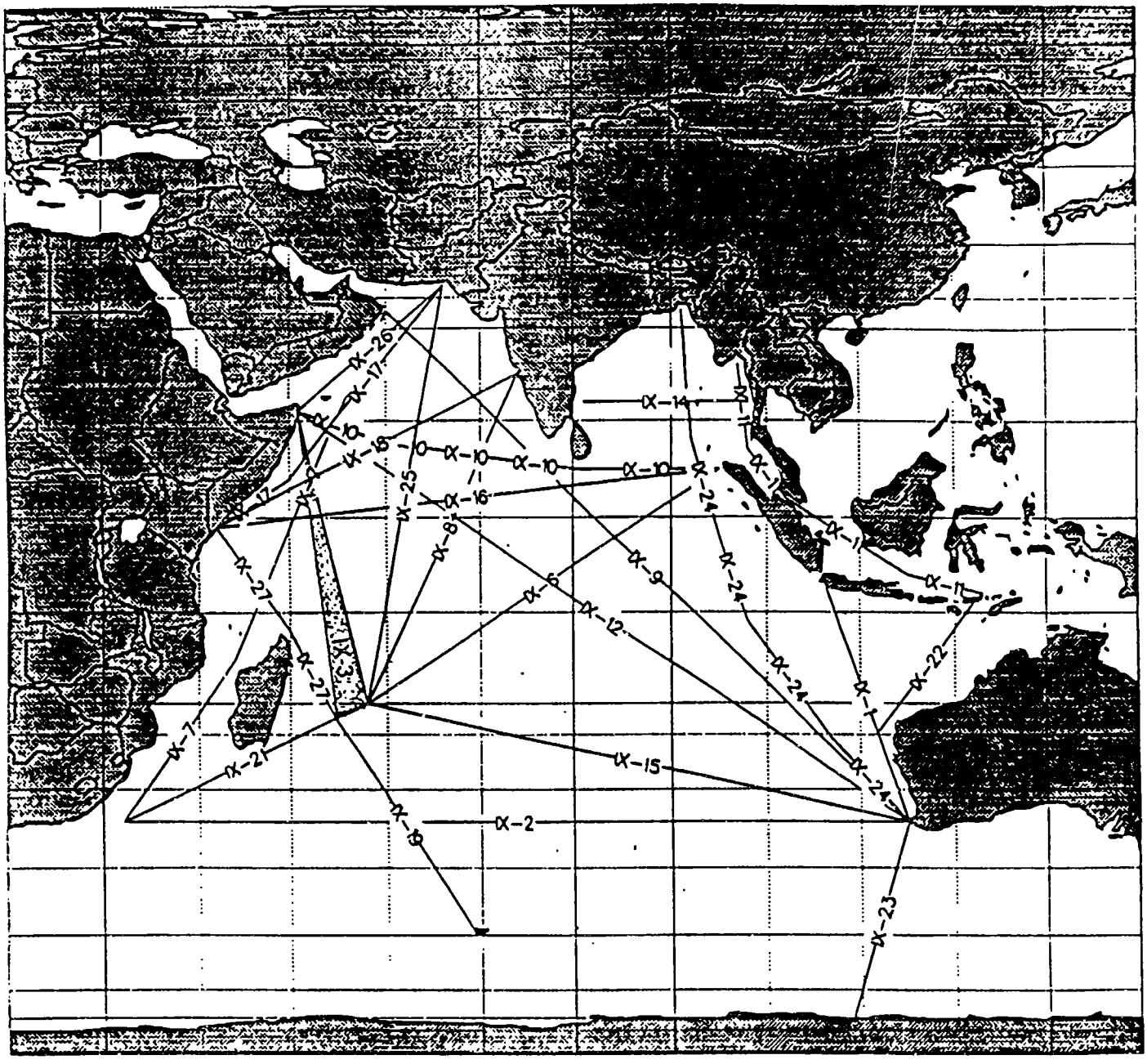
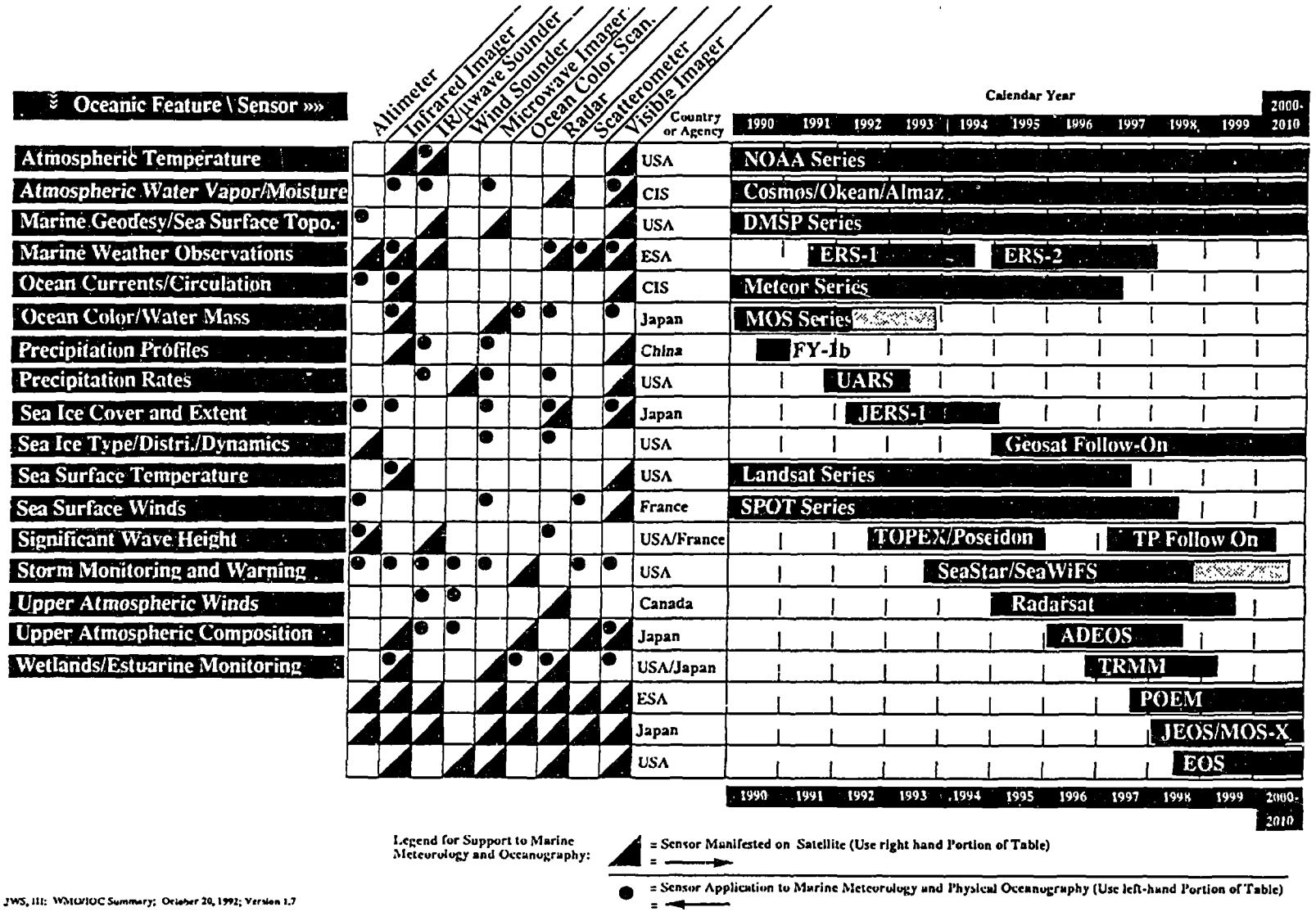


Figure 3. Standard Track Lines - Indian



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



JWS, III: WMO/IOC Summary; October 20, 1992; Version 1.7

Figure 4. Current and Planned Satellite Systems in Support of Marine Meteorology and Oceanography (1990-2000)

Figure 5. Map of GLOSS Sea Level Stations

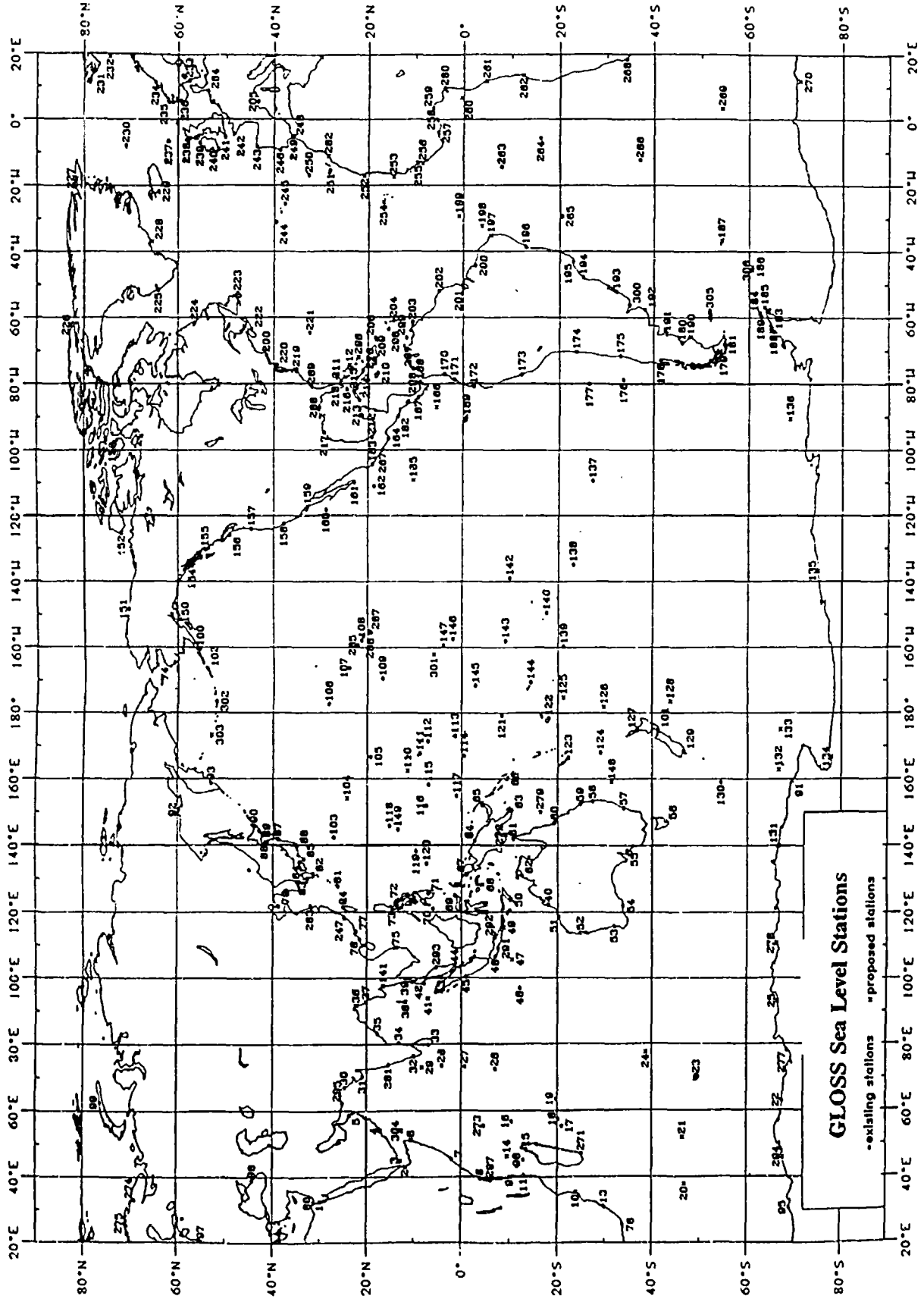


Figure 6. Map of WOCE Sea Level Stations

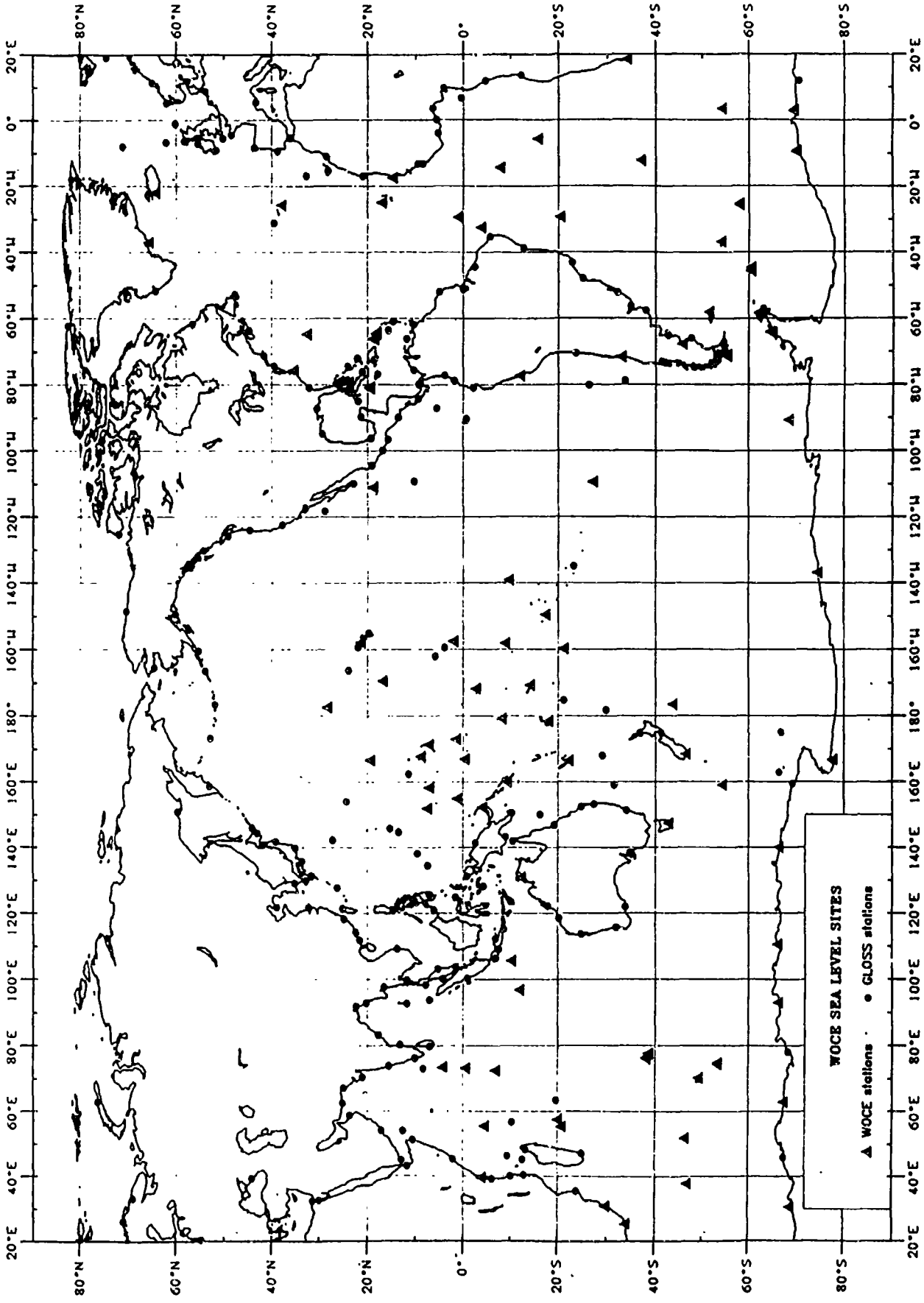


Figure 7. Number of drifting buoy sensors reporting on the GTS by country, November 1992 (sources DBCP).

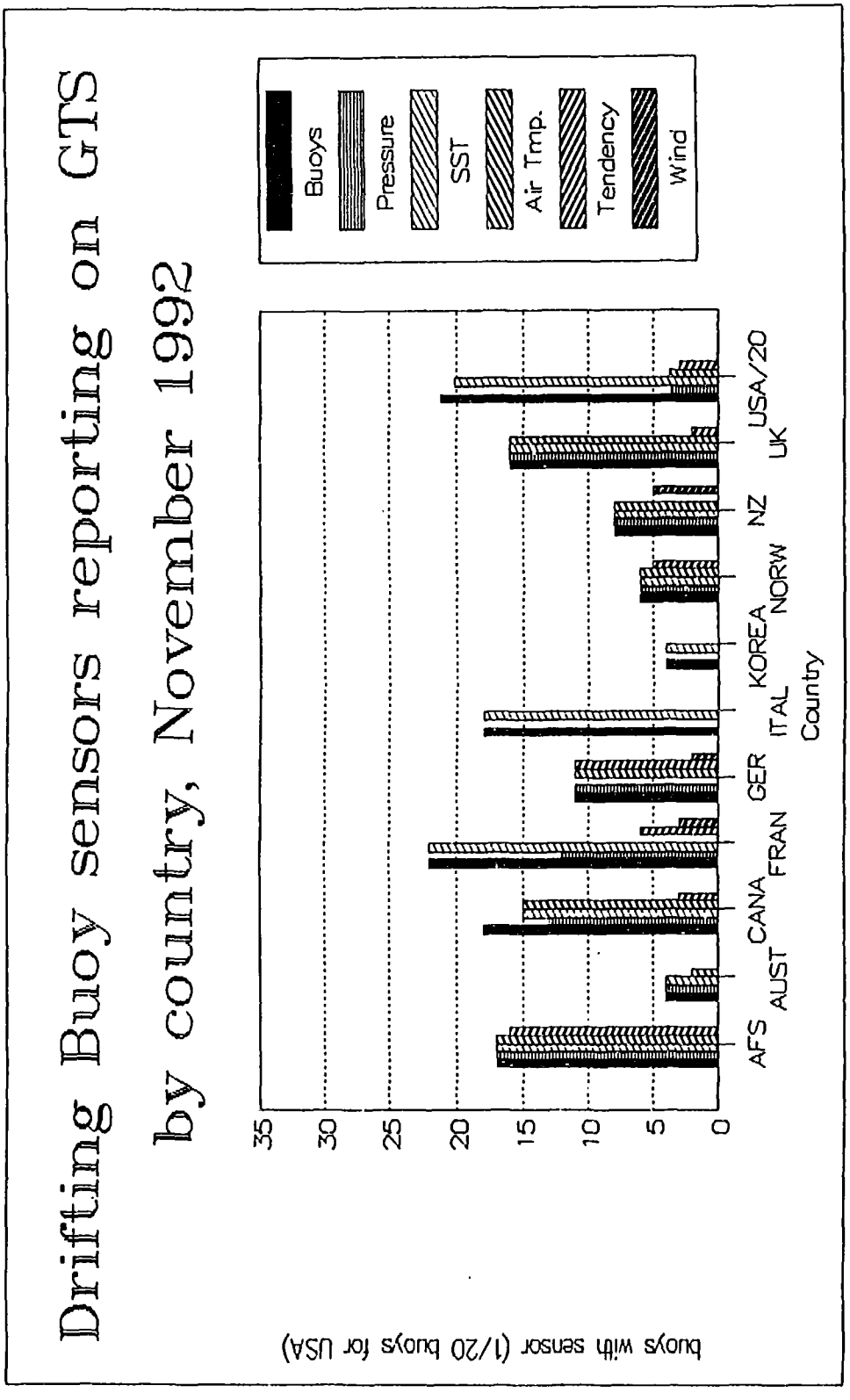


Figure 8. Number of DRIBU reports by Marsden Square, received at Paris Hub during October 1992 (sources IGOSS SOC/DB).

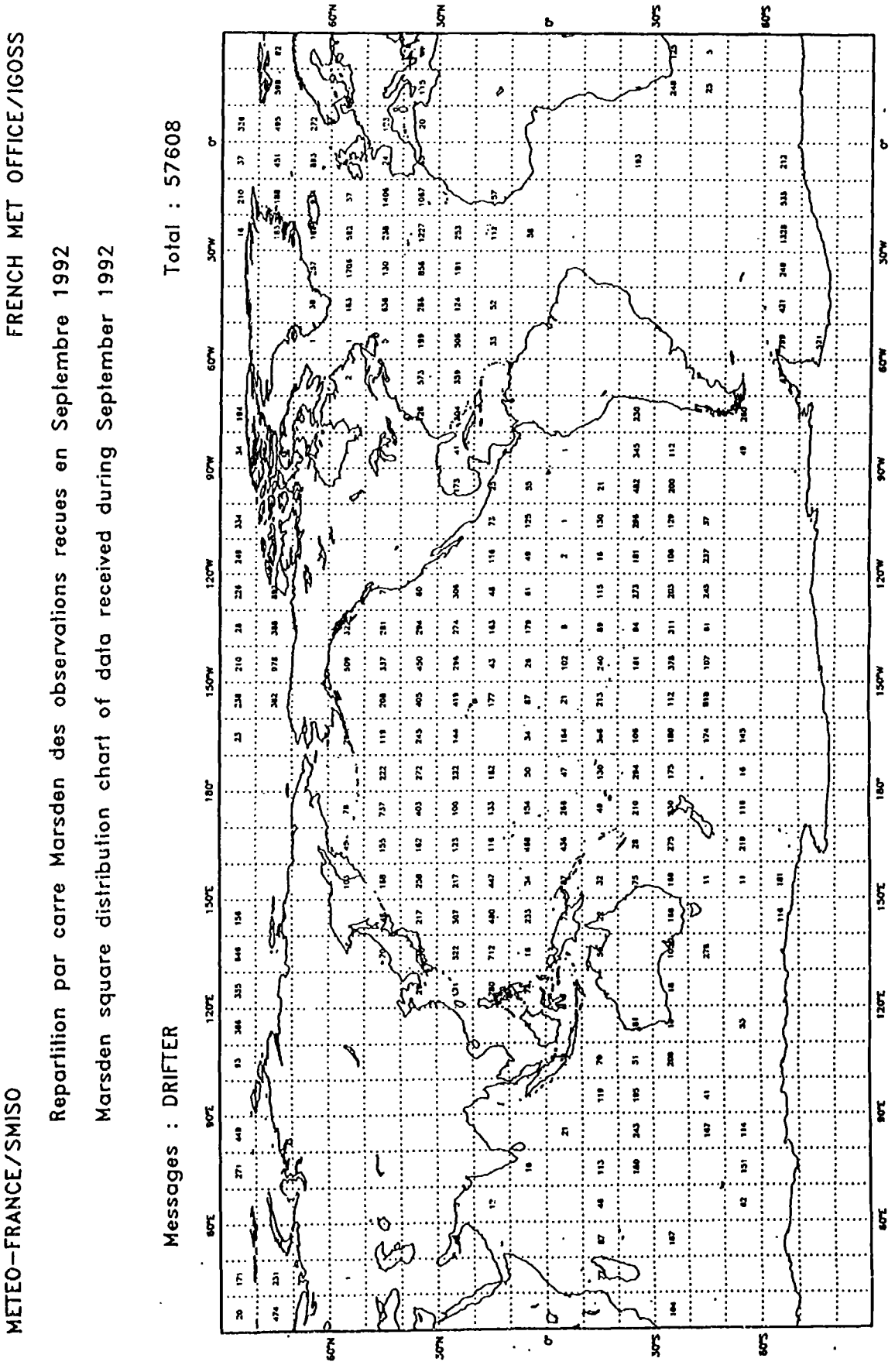


Figure 9. Regional Track chart for the Arctic basin, plotting movement of drifting buoys that passed position and quality control checks during September 1992 (sources RNODC/DB-MEDS).

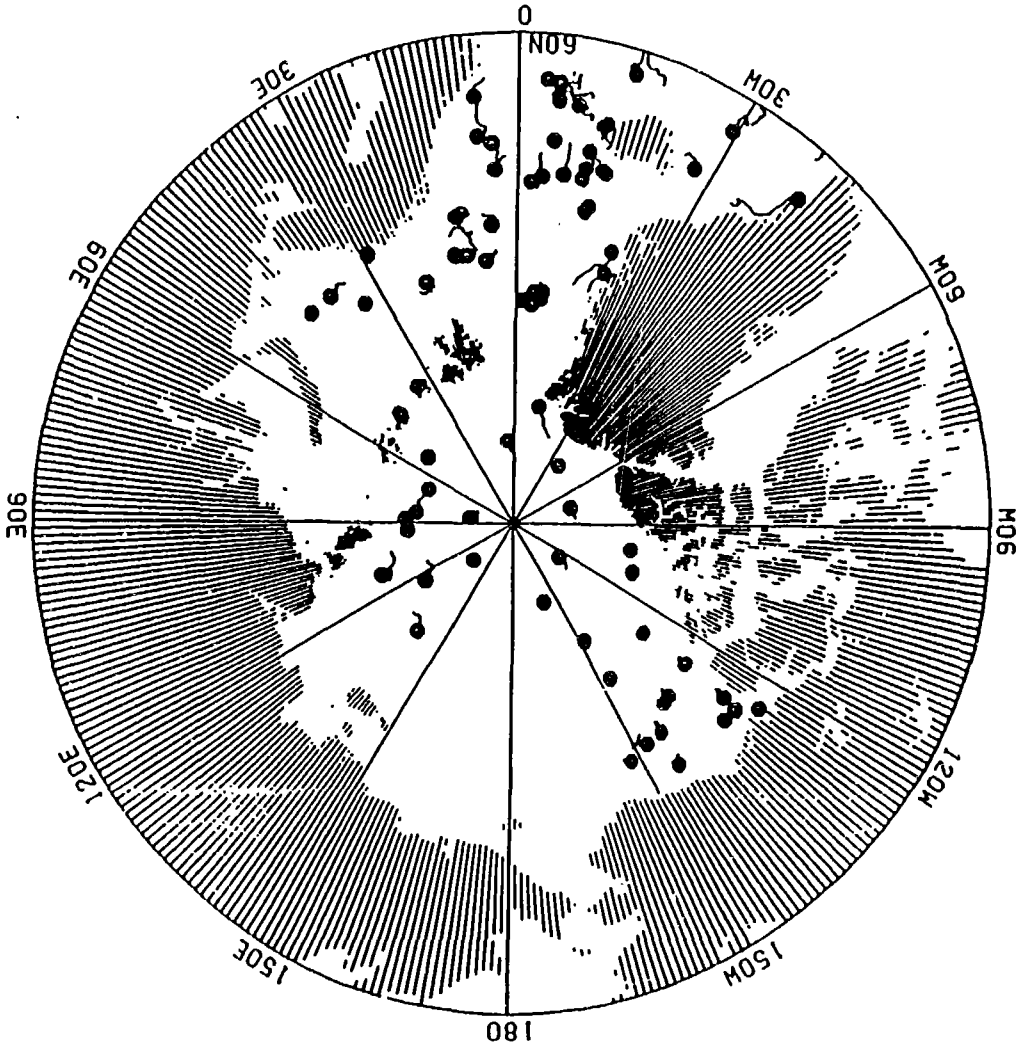


Figure 10. Regional Track chart for the Pacific Ocean, plotting movement of drifting buoys that passed position and quality control checks during September 1992 (sources RNODC/DB-MEDS).

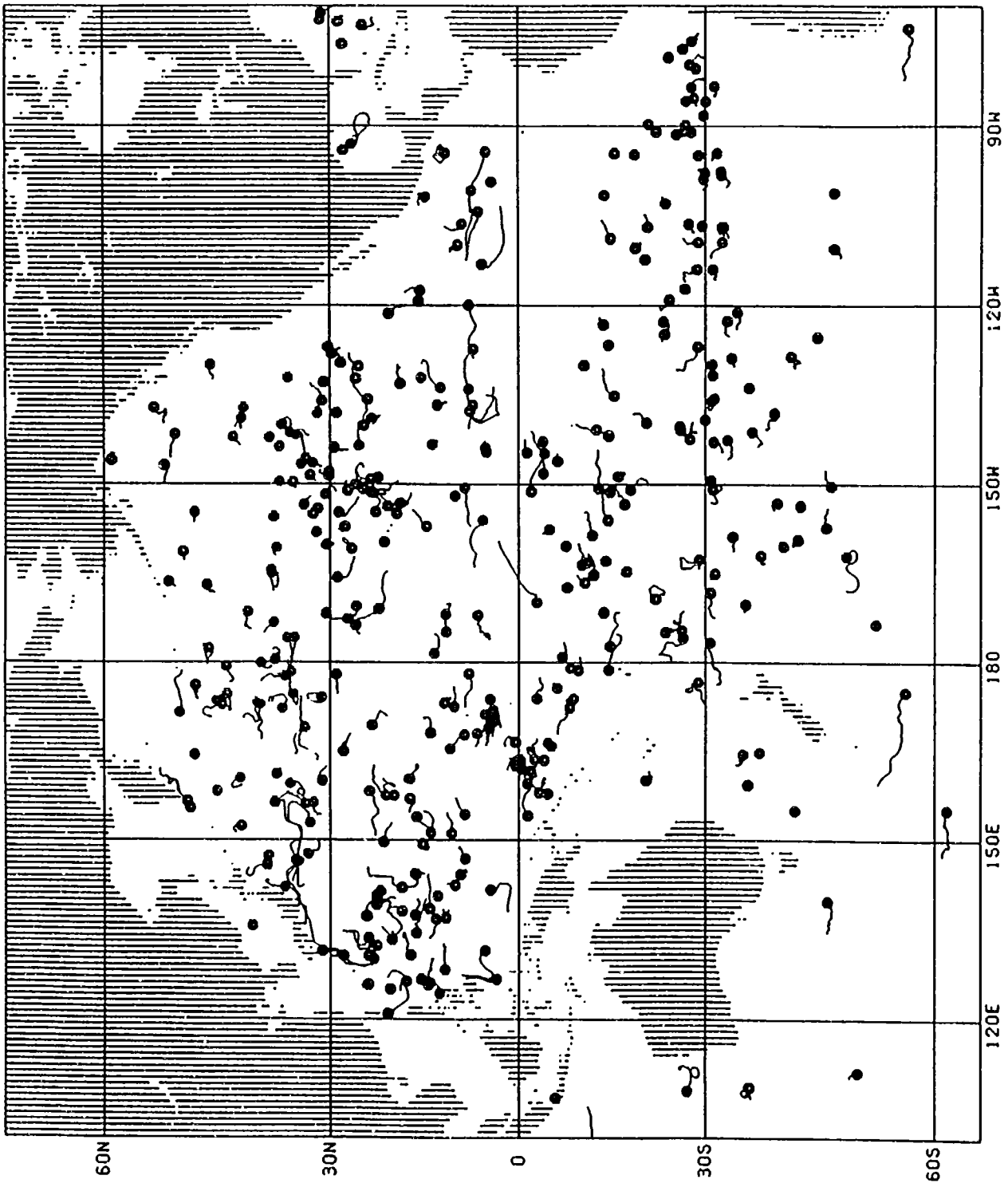


Figure 11. Regional Track chart for the Atlantic and Indian Ocean, plotting movement of drifting buoys that passed position and quality control checks during September 1992 (sources RNODC/DB-MEDS).

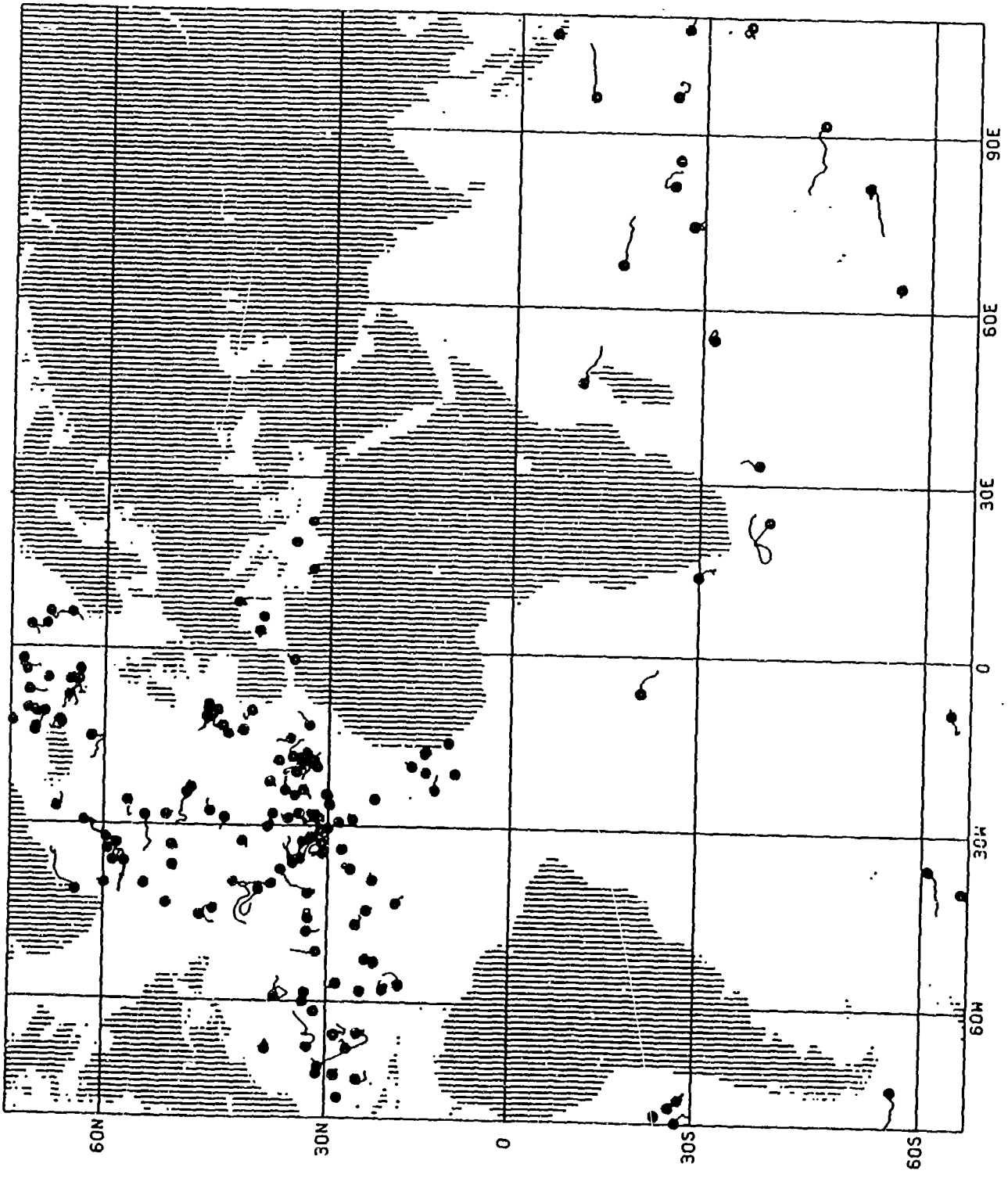


Figure 12. Regional Track chart for the Antarctic, plotting movement of drifting buoys that passed position and quality control checks during September 1992 (sources RNODC/DB-MEDS).

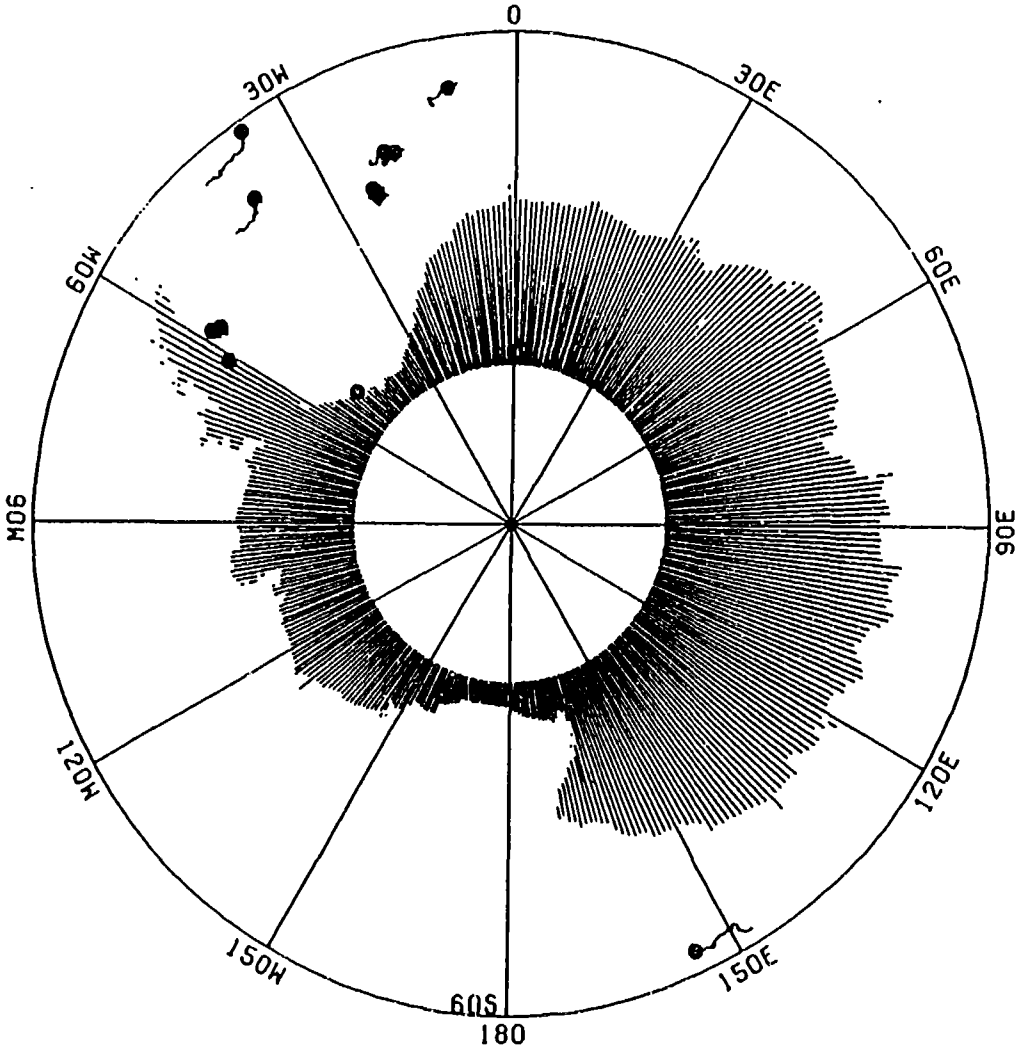
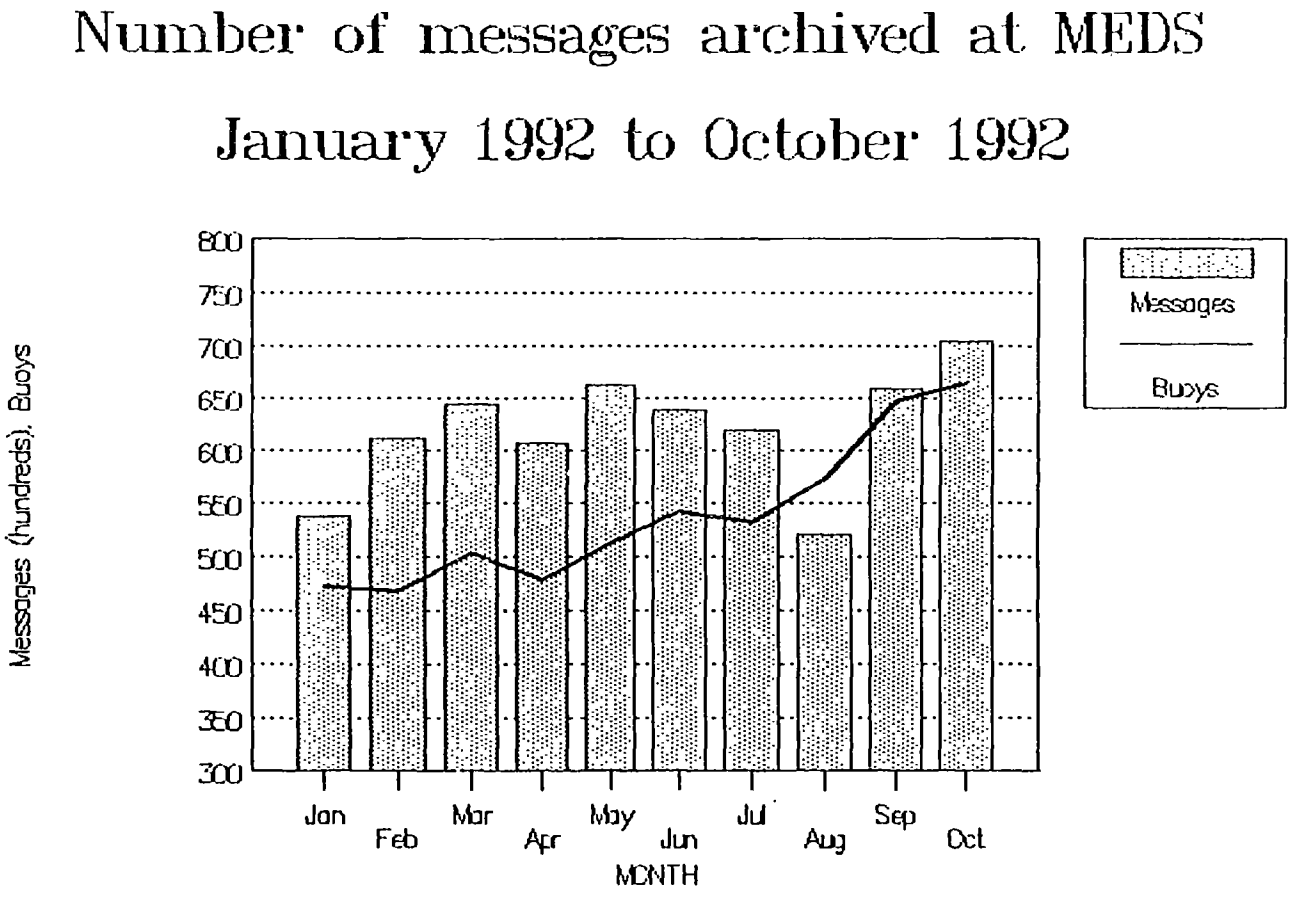
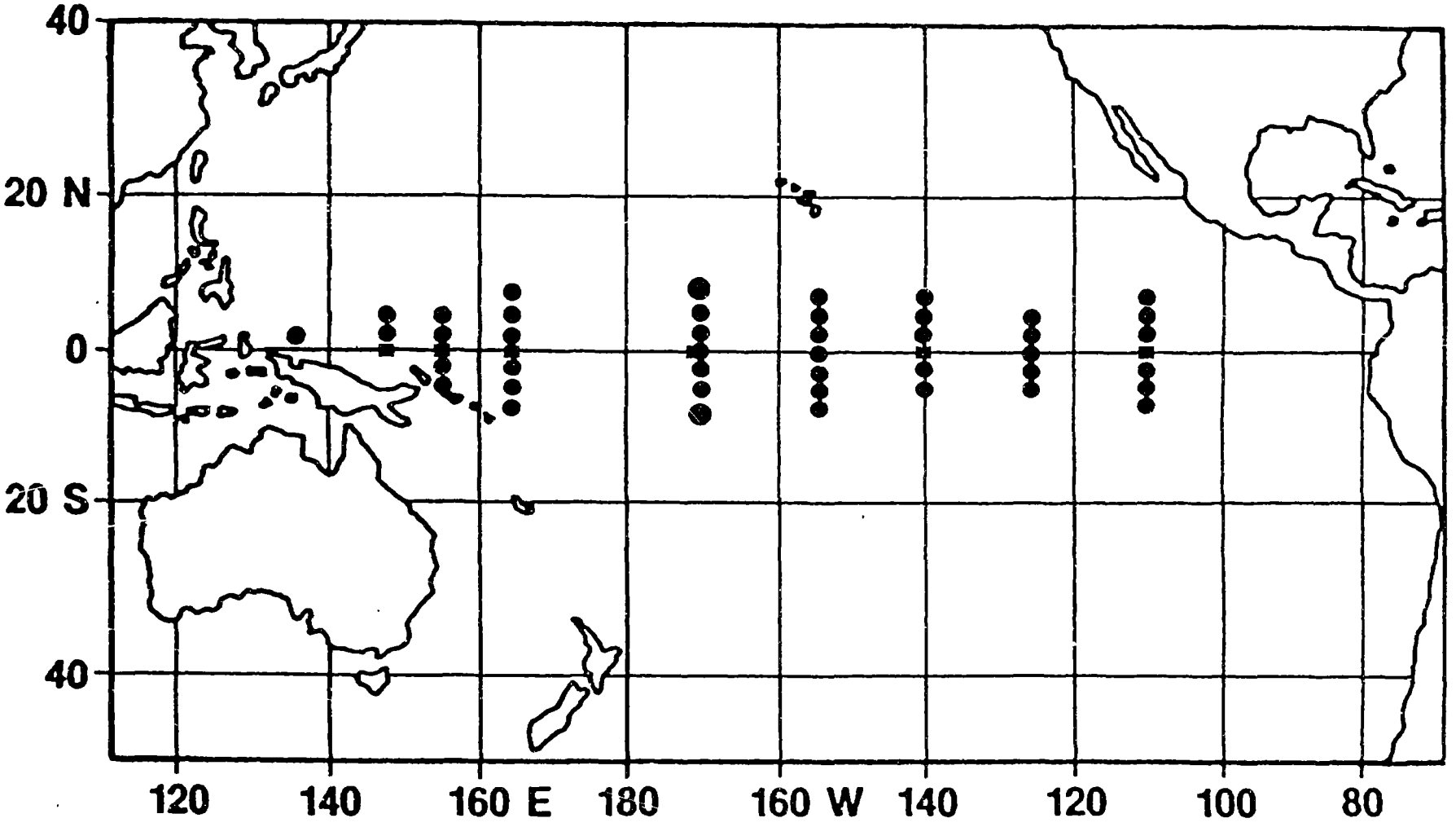


Figure 13. Number of buoys and number of DRIFTER messages archived at the RNODC/DB per month for the period January 1992 to October 1992 (sources RNODC/DB-MEDS).





TOGA TAO, end of December 1992

Key: ● ATLAS

■ Current meter Moorings

Figure 14. Status of Implementation TOGA-TAO Array (December 1992)

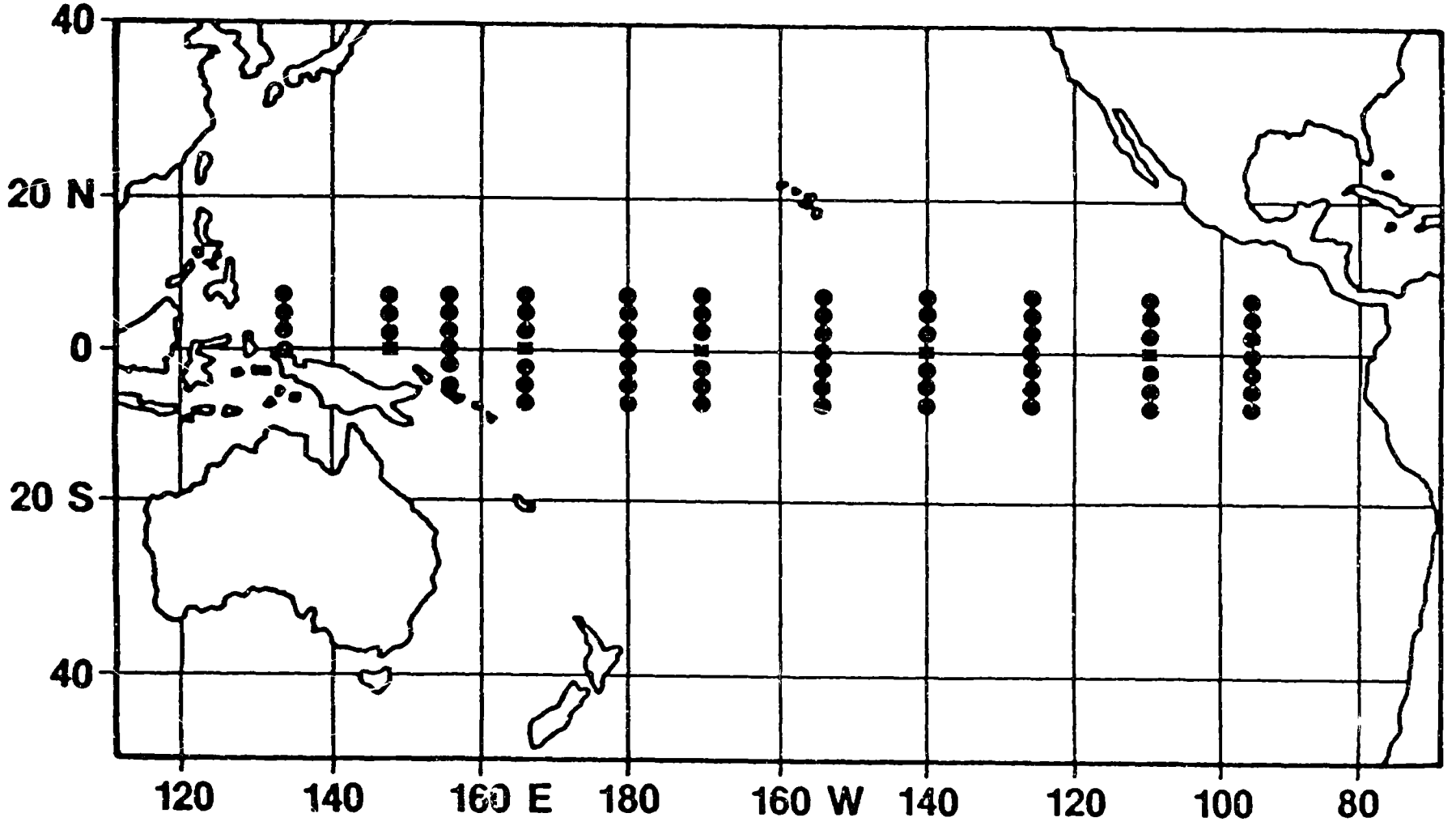


Figure 15. Planned Implementation of TOGA-TAO Array (end of 1993)

Figure 16. The global coverage of marine meteorological reports from the VOS during the month of September 1992

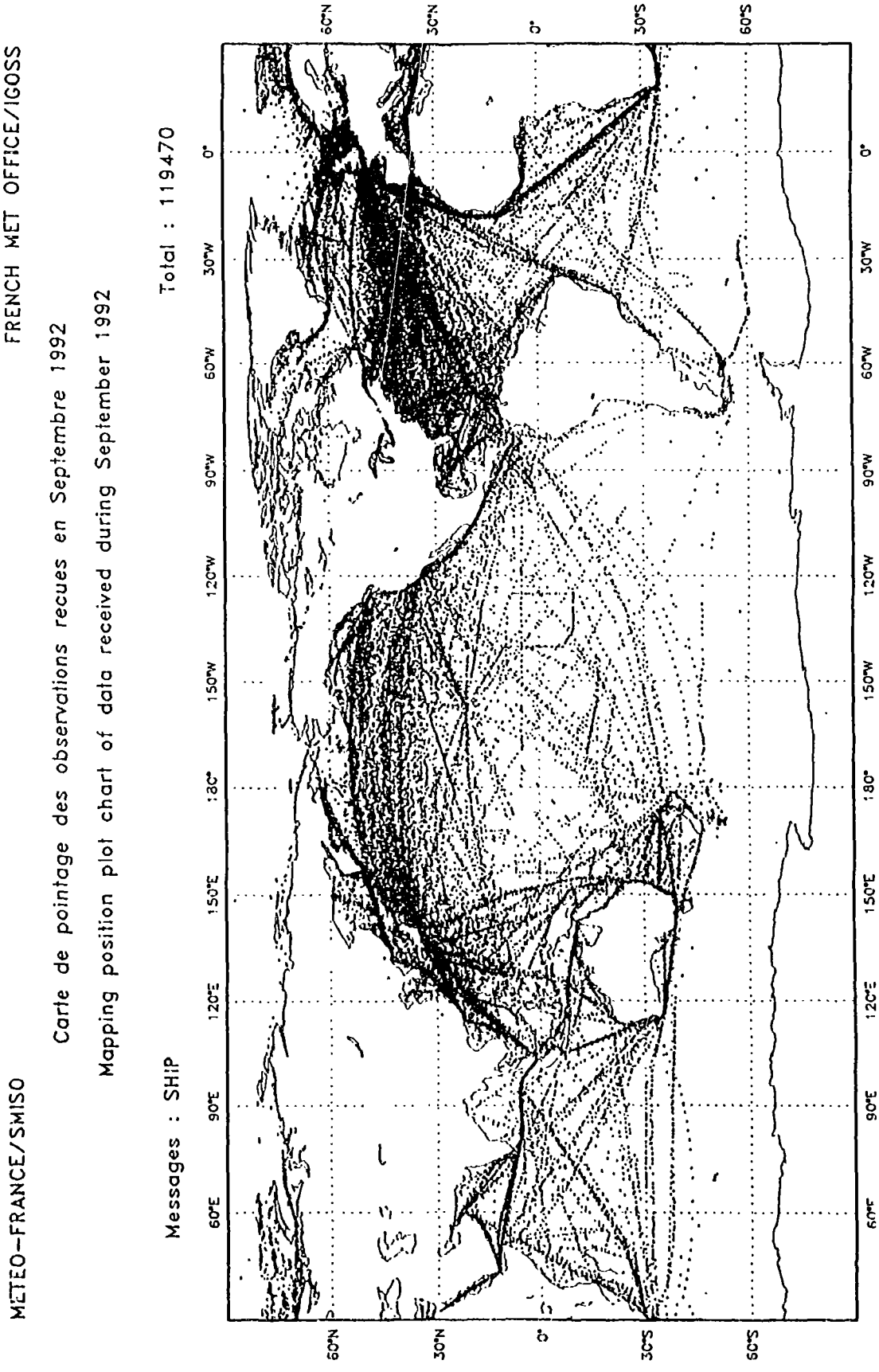


Figure 17. WDC-A and WDC-B Marine Data Center Holdings.

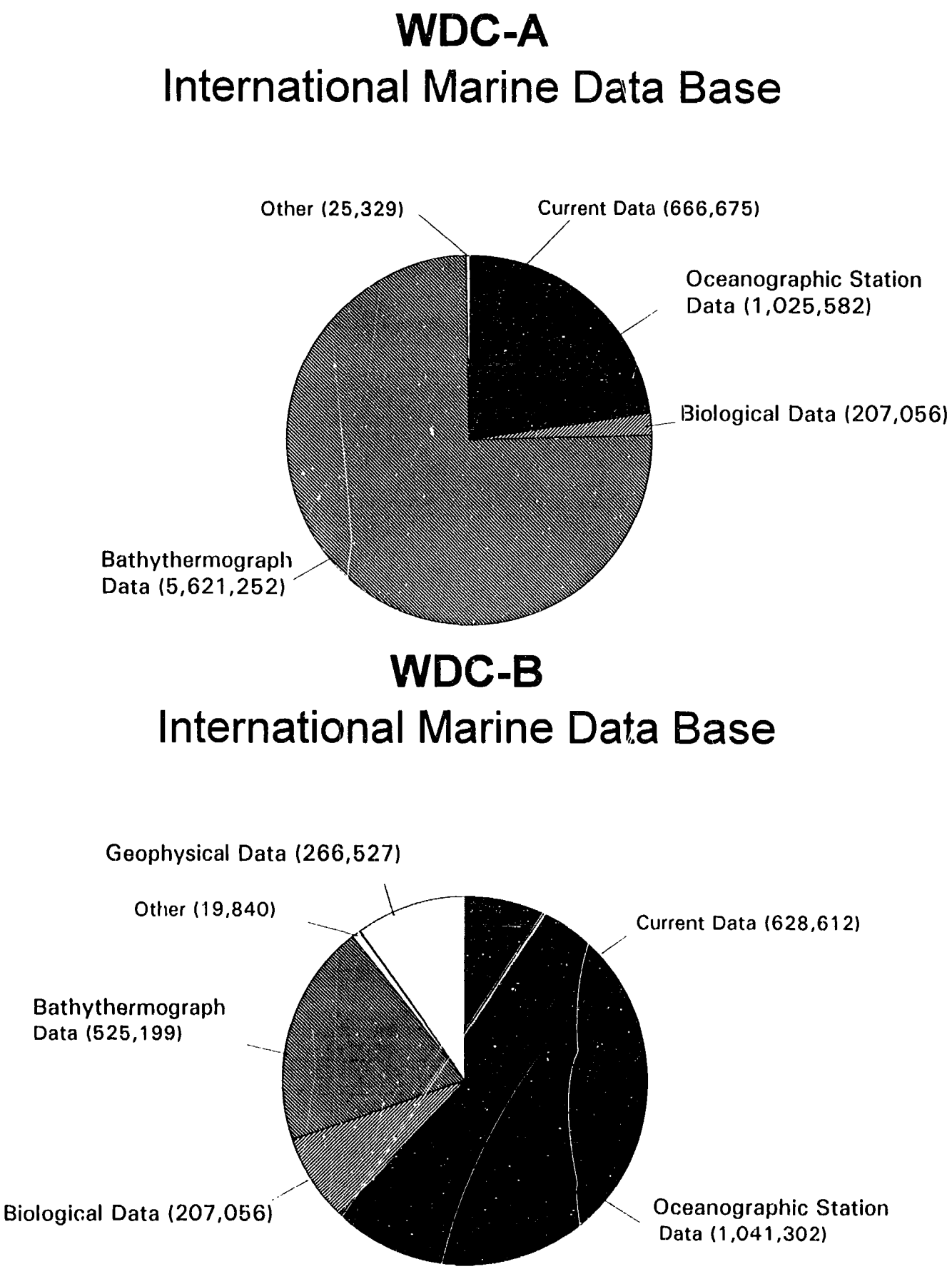


Figure 18. International Mussel Watch Initial Implementation Phase