Intergovernmental Oceanographic Commission
Reports of Governing and Major Subsidiary Bodies

IOC Programme Group on Ocean Processes and Climate

First Session

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Unesco

In this Series

Reports of Governing and Major Subsidiary Bodies, which was initiated at the beginning of 1984, the reports of the following meetings have already been issued:

- Eleventh Session of the Working Committee on International Oceanographic Data Exchange
- Seventeenth Session of the Executive Council
- Fourth Session of the Working Committee for Training, Education and Mutual Assistance
- Fifth Session of the Working Committee for the Global Investigation of Pollution in the Marine Environment
- First Session of the IOC Sub-Commission for the Caribbean and Adjacent Regions
- Third Session of the *ad hoc* Task Team to Study the Implications, for the Commission, of the UN Convention on the Law of the Sea and the New Ocean Regime
- Thirteenth Session of the Assembly

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1. OPENING

The Secretary of IOC, Dr. Mario Ruivo, opened the Session and welcomed the participants on behalf of IOC. 1

He noted that this Programme Group is taking place at a very active moment in the life of the Commission - just prior to the Thirteenth Session of the Assembly, during which IOC will be commemorating its 25th Anniversary. The fact that we are now discussing problems of ocean processes and climate is a very good indication of the enormous evolution and progress that have taken place in ocean affairs over the past quarter of a century, particularly in the Member States and their scientific communities, and, therefore in the Commission. 2

He expressed the view that the activities have been connected with the World Climate Research Programme, initiated and launched by WMO, and the close collaboration maintained with ICSU, have, in a certain way, provided an impetus for a concept that was already well established in the scientific community. The technical advances (notably the increase in data-handling through telecommunications and computers) have provided an opportunity for the application of the results of advanced science, to the mutual satisfaction of the Commission and its scientific community. The IOC assumed full responsibility for the overall co-ordination of the oceanographic component of the World Climate Research Programme (WCRP)* which is now acting as a dynamic element in the shaping of the Commission for the Year 2000 and beyond. The scale of the experiments that are envisaged (TOGA and WOCE), and the need to develop ocean observing systems and to interface with complementary activites being developed in WMO, are, in fact, some of the most important issues with which the Commission is confronted -- so important that, after a few years' work, the role of SCOR and the scientists involved, and more recently, the association of SCOR and IOC through the Joint Committee on Climatic Changes and the Ocean (CCCO), have created the basis for complementary action. The need to establish the basis for the intergovernmental co-ordination of oceanographic components arises from the enormous changes that have taken place in the United Nations system following the signature of the United Nations Convention on the Law of the Sea, which led to the establishment of economic zones and a new regime for scientific research whereby the consent of coastal states is required for the conduct of scientific research and certain type of observations in the maritime areas under national jurisdiction. 3

In this respect, governments are a decisive element in facilitating the deployment of research vessels, instrumentation, and in arranging for international exchange of data; this leads to the practical applications of the results of climate studies and thence to socio-economic benefits. (e.g., for the countries affected by El Nino and by the drought in Africa and Brazil). To achieve these benefits an improved dialogue between Member States and the scientific community is required. Considerable progress in this direction is to be seen in the adoption, by Unesco and ICSU, of a set of principles on the development of the oceanographic component of the WCRP (Annex VI), and the 4

* A list of Acronyms is given in Annex IX.

signature, by SCOR and IOC, of a Memorandum of Understanding on this matter (Annex VI). Certain aspects, particularly relations between IOC and the International Planning Offices for TOGA and WOCE, will require guidance from the Programme Group on the best arrangements to ensure effective co-operation with these Offices, in scientific and in administrative terms, and on their relationships with IMO and IOC.

The role of the Programme Group is to optimize the usefulness of the relevant ocean activities being carried out within various contexts such as IGOSS and IODE and ocean observing systems which have been developed by groups of scientists or, in some cases, by groups of governments through the joint action of WMO and IOC, notably the Joint Working Committee for IGOSS. 5

There is a need to ensure that developing countries (and TOGA will be carried out mainly in tropical areas which comprise mostly countries of the so-called "developing" or intermediate level) are associated with these challenges facing scientists and governments, and, through TEMA, to build up national capabilities. Progress in building up observing systems is directly related to the possibility of providing equipment, spare parts and, consequently, developing the capabilities to match those of developed countries. The IOC Voluntary Assistance Programme (VAP) is a vehicle that could be enhanced in the future. 6

The Fourth Vice-Chairman of IOC who was requested by the Executive Council at its Seventeenth Session to assist in the organization of the First Session of the Programme Group, Professor K. Voigt, then welcomed the participants.* 7

2. ADMINISTRATIVE ARRANGEMENTS

2.1 ADOPTION OF THE AGENDA

The Programme Group adopted the Agenda which is Annex I to this Report. 8

2.2 ELECTION OF CHAIRMAN AND VICE-CHAIRMAN

In accordance with the Guidelines for the Structure and Responsibilities of the Subsidiary Bodies of the Commission (IOC Manual, Part I, Section 5, para. 2.3), the Programme Group was invited to elect its own Chairman and Vice-Chairman. The Programme Group felt, however, that elections should be postponed till the end of the Session. Prof. K. Voigt was elected as the Chairman for the Session. 9

2.3 DESIGNATION OF A RAPPORTEUR

The Programme Group designated Dr. J. Merle (France) as Rapporteur for the Session, in accordance with IOC Rule of Procedure 25(3). 10

* The List of Participants is given in Annex III hereto.

2.4 CONDUCT OF THE SESSION

The IOC Technical Secretary, Dr. A. Tolkachev, reviewed the arrangements and documentation for the Session. The List of Documents is given in Annex IV, hereto. 11

3. THE WORLD CLIMATE RESEARCH PROGRAMME (WCRP) AND ITS OCEANOGRAPHIC COMPONENT

The Director of the Joint Planning Staff for the World Climate Research Programme (WCRP), Professor P. Morel, reported to the Programme Group on the development and implementation of the WCRP. He highlighted the following aspects: 12

The WCRP is the research component of the World Climate Programme established formally by the Eighth World Meteorological Congress in 1979. The WCRP was jointly undertaken by the World Meteorological Organization (WMO) and the International Council of Scientific Unions (ICSU), and is organized through the Joint WMO-ICSU Scientific Committee for WCRP. The overall objectives of the WCRP are to determine the extent to which climate can be predicted and the extent of the influence of man's activities on climate. 13

The WMO-ICSU Joint Scientific Committee for WCRP (JSC) further defined the goals of the programme in terms of three main scientific objectives or streams of climate research. 14

The first stream aims at establishing the physical basis for long-range weather forecasting on time-scales of several weeks to one or two months. It is generally agreed that predictability on these time-scales could be revealed by some considerable improvements of general atmospheric circulation models and initial values of atmospheric and surface variables. Thus, the first stream of WCRP requires better atmospheric data, especially for determining the upper-air wind in the tropics and surface pressure over the southern hemisphere oceans, since present deficiencies of meteorological analysis in the tropics can adversely affect mid- and high-latitude predictions within one week. The first stream also requires a much more precise formulation of important energetic processes in the atmosphere, such as precipitations which control the heating rate, and as the extended cloudiness which controls the transfer of radiation. Finally, the first stream requires a much improved representation of the sensible- and latent-heat sources in the sea-surface temperature (SST) over the oceans. Global observations of the SST field are obtained from voluntary observing ships as well as other vessels, and from satellite infrared radiance measurements. A global Sea-Surface Temperature Data Project is already under way to provide, for the WCRP, monthly mean temperature values for each 200 x 200-km squares of the oceans. 15

The second stream aims at predicting the variations of the global climate over periods of several months to several years; i.e., the atmospheric response to changes of surface conditions determined by the 16

dynamics of relatively rapidly changing components of the climate system, such as the tropical oceans and Arctic or Antarctic sea ice. A specific programme has been established to study the variability of the coupled system constituted by the Tropical Oceans and the Global Atmosphere (TOGA) which appears to be the cause of the largest climate signal observed on time-scales of months to years. TOGA addresses specifically the determination of air-sea interface fluxes of momentum (wind stress), sensible and latent heat (water vapour) and radiation, in addition to the improvement of atmospheric-circulation models already required by the first stream. TOGA also requires a major increase in the density of oceanographic observations (sea-level, temperature of the upper ocean layer, current velocity) over all tropical oceans. It will therefore call for very substantial oceanographic observation, data management and modelling activities as well as for a challenging programme of atmospheric observations and data analysis.

The physics of sea ice, as well as the particular constraints of polar research, led the JSC to establish a particular research programme on sea ice in the context of the WCRP. This programme, which is still in the conceptual definition phase, should aim at a fully interactive representation of the air-ocean-ice system in the Arctic and Antarctic basins, for ultimate coupling with global atmosphere-ocean climate models. 17

Finally, the third stream of WCRP addresses the problem of assessing and, ultimately, predicting the equilibrium or transient response of climate to man-made disturbances (such as the increase of atmospheric carbon dioxide) or changes of climate forcing factors resulting from natural causes. Such assessments or predictions can only be based on the development of comprehensive climate models and understanding of detailed processes which can be observed under the present climatic conditions and are not likely to change under different climate conditions. Climate predictions for time-scales of 10-100 years must be based on the full representation of the coupling between the atmosphere and the world ocean. For this reason, the scientific focus of the third stream of WCRP is the World Ocean Circulation Experiment (WOCE) which is expected to play, for the development of physical oceanography, the same role as that of the GARP Global Weather Experiment for the atmospheric sciences. Thus, global oceanography is the major achievement called for by the third stream of WCRP together with various systematic observation projects for monitoring solar radiation, the earth's surface vegetation and albedo, optically active gases in the atmosphere, etc. 18

As can be judged from this brief enumeration, the WCRP is truly a vast and ambitious multidisciplinary programme. Its success will rest, to a large extent, on the ability of oceanographers and atmospheric physicists to co-operate effectively. This objective has been achieved, through the conceptual planning stage, by the very successful collaboration of the Joint SCOR-IOC Committee on Climatic Changes and the Ocean (CCCO) and the JSC. 19

The WCRP sponsors, WMO and ICSU, expect that this excellent co-operation with the oceanographic community will be equally successful in the implementation phase of the programme. 20

The Chairman of the Joint SCOR-IOC CCCO, Prof. R. Stewart, stated that it was the same international need which led to the convening of the World Climate Conference in 1978 and to the formation of the SCOR Committee on Climatic Changes and the Ocean. SCOR invited IOC to co-sponsor this new Committee, and this invitation was accepted; subsequently, agreements were reached between ICSU and Unesco, and between SCOR and IOC concerning the responsibilities and operation of the CCCO, which is considered as "the main scientific body for the formulation of the overall scientific concepts and of the scientific programme needed to provide an understanding of the role of the oceans in climate variation and change". The SCOR-IOC CCCO works very closely with the ICSU-WMO Joint Scientific Committee for the World Climate Research Programme, which has overall responsibility for the entire WCRP, including the oceanic aspects. Joint JSC-CCCO bodies have been established as needed, and the CCCO has always had a Liaison (with JSC) Panel whose Chairman attends JSC meetings. Since its initial meeting in 1979, the CCCO has examined the most effective way to advance the oceanographic aspects of the WCRP. At present, the CCCO has three main thrusts: (i) Ocean Observing System Development Programme; (ii) TOGA; and (iii) WOCE. It should be recognized that, in time, new ideas will arise; it may well be that some of these ideas may not be easily incorporated into any of the above-mentioned thrusts, and new thrusts may be proposed in the future. 21

Prof. P. Morel drew the attention of the participants to the fact that the Executive Council of WMO, at its Thirty-sixth Session (June 1984) approved, in principle, the basic components and research projects foreseen in the updated Plan for the WCRP, and considered that consultations at the intergovernmental level should take place in the form of Informal Planning Meetings bringing together the representatives of all agencies prepared to participate in its implementation. The First Informal Planning Meeting on WCRP is now scheduled for March-April 1986 to consider the Implementation Plan for WCRP - Phase I. In preparation for the meeting, resources for the WCRP need will be identified by October 1985 and the First WCRP Implementation Plan will be circulated by the end of 1985. 22

Some Delegates, referring to the Unesco-ICSU Principles referred earlier, felt that a clearer definition of the "oceanographic component" of the WCRP is required, especially for the consideration of the implementation of programmes on the intergovernmental level within IOC and WMO. TOGA, for example includes meteorological and oceanographic components, whereas WOCE is considered largely as an oceanographic experiment, but also having important atmospheric components (such as air-sea interface, precipitation etc.). Therefore some Delegates felt that the division of responsibilities between oceanographic and meteorological components should not be made too exactly. 23

The Programme Group noted the progress made in the World Climate Research Programme, which includes TOGA and WOCE experiments. It stressed the necessity and vital importance of close co-operation of IOC and WMO, and ICSU in the planning and implementation of the WCRP and, in particular, in preparation of, and participation of IOC in, the First Informal Planning Meeting on WCRP. The Programme Group recommended that the IOC Assembly, at its Thirteenth Session, formally advise WMO and ICSU of IOC's wish to co-sponsor this meeting (Recommendation PG-OPC-I.1). 24

4. EXPERIMENTS FOR THE STUDY OF CLIMATIC CHANGES AND THE OCEANS

4.1 TROPICAL OCEANS AND GLOBAL ATMOSPHERE (TOGA)

On behalf of the TOGA Scientific Steering Group, Dr. Ferris Webster informed the Programme Group of the objectives, scope and state of the planning and implementation of TOGA, which is aimed principally at the study of the global atmospheric response to ocean surface temperature anomalies in the tropics. The TOGA Scientific Programme Plan is being finalized by the Joint CCCO-JSC Scientific Steering Group for TOGA. It will be published and circulated to Member States in June 1985. 25

Dr. Webster pointed out that the primary objective of TOGA is to understand interannual climate variability, with a view to developing the scientific basis for its prediction. The strongest example of interannual climate variability is the El Nino - Southern Oscillation phenomenon, a linked ocean-atmosphere event of global extent and impact. During the intense El Nino event of 1982-83, anomalous relatively high sea-surface temperatures extended along the equator in the eastern Pacific Ocean for about one third of the earth's circumference. The climate consequences were evident over extensive regions of the tropics and in many locations at higher latitudes. 26

The TOGA study calls for close collaboration between oceanographers and atmospheric scientists. The two fluids are so closely coupled that it is not possible successfully to carry out TOGA without full integration. The overall objectives of TOGA are: 27

(i) to describe the tropical oceans and the global atmosphere as a time-dependant system, in order to determine the extent to which this system is predictable of time-scales of months to years, and to understand the mechanisms and processes underlying its predictability;

(ii) to determine the feasibility of modelling the coupled ocean-atmosphere system for the purpose of predicting its variations on time-scales of months to years;

(iii) to provide the scientific background for designing an observing and data-transmission system for operational prediction, if this capability is demonstrated by coupled atmosphere-ocean models.

The TOGA study begins in 1985 and will run for ten years. The character of TOGA will change considerably around 1990 with the proposed launch of satellites to measure worldwide ocean surface currents and wind stress. A TOGA Scientific Conference was held in September 1984 at IOC Headquarters to provide a forum for international scientific discussions and to review the draft Plan for the TOGA Scientific Programme. 28

4.2 WORLD OCEAN CIRCULATION EXPERIMENT (WOCE)

On behalf of the WOCE Scientific Steering Group, Prof. J. Woods reported on the state of preparation of a WOCE Scientific Plan. The scientific goals of WOCE are: 29

(i) to develop models for predicting climate change and to collect data necessary to test them;

(ii) to determine the representativeness of the specific WOCE data sets for the long-term behaviour of the ocean, and to find methods for determining long-term changes in the ocean.

Prof. Woods drew attention to the fact that WOCE is the major activity in Stream 3 in WCRP, and is therefore concerned with the development of computer models for prediction of climate change over periods of 10-100 years, whether natural or as a result of man's activity (e.g., CO2 pollution). The development of computer power, presently increasing by a factor of 10 every five years, provides the technical background to advances in numerical prediction of climate. The factor of 1000 in the increase of computer power, expected between now and the end of the century, will open the way to including much more realistic representation of global circulation in decadal climate prediction models. Effective exploitation of that opportunity will involve hard work by ocean modellers, who will be faced by many options and the need to decide on priorities when it becomes clear that not all processes influencing ocean circulation can be represented in full detail, because computer power will still be limited. 30

In those circumstances, the modeller turns to the analysis of observations for guidance. The World Ocean Circulation Experiment is being planned to provide a new data set specified to meet these needs. It will help to overcome gaps in existing knowledge, and provide new kinds of data that will clarify the circulation, in particular from a global stand point. 31

The Experiment will benefit from new observing methods; for example, radars mounted on satellites (altimeters and scatterometers). These new techniques are central to the scientific design of WOCE. The Experiment will include an intensive programme of <u>in situ</u> measurements 32

phased to coincide with a new generation of oceanographic satellites scheduled for 1990-1995. Any delay in, or postponement of those satellite missions would have a serious impact on WOCE and could even lead to cancellation.

The JSC and CCCO have created the Scientific Steering Group to take responsibility for planning WOCE. Full details of the present state of WOCE planning are contained in the Reports of the first Six Sessions of SCOR-IOC CCCO and JSC for the WCRP. 33

4.3 PROMOTION OF TOGA AND WOCE DEVELOPMENT BY IOC

The Programme Group discussed the role of IOC in the planning and implementation of TOGA and WOCE and a work-plan for their development as presented in Document IOC/PG-OPC-I/10. 34

The Programme Group noted with satisfaction the progress made by the SCOR-IOC CCCO jointly with the JSC for the WCRP, in formulating and planning TOGA and WOCE. 35

The Programme stressed the following points regarding the role of IOC: 36

(i) Joint CCCO-JSC Scientific Steering Groups for TOGA and WOCE are key bodies for planning scientific aspects of this programme;

(ii) success in implementation of TOGA and WOCE depends on strong governmental actions and support of all countries and adequate co-ordination amongst international organizations involved;

(iii) IOC should play an active role in co-ordination of intergovernmental activities required for implementation of TOGA and WOCE through its Programme Group on Ocean Processes and Climate and other technical and regional subsidiary bodies;

(iv) the role of IOC as an intergovernmental body is of particular importance in harnessing, encouraging and promoting participation of developing countries in those experiments and providing access to the programmes and information on their planning and development.

With regard to TOGA, the Programme Group noted that it includes both atmospheric and oceanographic components and therefore closer formal liaison is required between IOC and WMO to ensure the most rational use of national resources and efforts. Particular efforts of IOC Member States within this programme will be required in expanding and improving the ocean observation system in tropical zones through IGOSS and through the timely exchange, collection and dissemination of sub-surface ocean data through IGOSS and IODE. 37

The Programme Group noted that the First Informal Intergovernmental Planning Meeting on the Implementation of WCRP, presently scheduled for March-April 1985, would discuss the First Implementation Plan for WCRP, which includes TOGA and WOCE. In order to ensure proper and timely preparation and contribution to this meeting by IOC Member States, the Programme Group recommended that the TOGA Scientific Programme Plan be widely circulated to Member States in 1985 well in advance of this meeting. 38

With regard to WOCE, the Programme Group noted that, within the next two years, the Joint CCCO-JSC Scientific Steering Group for WOCE would be preparing the WOCE Scientific Plan and, with the help of the International WOCE Planning Office, a draft WOCE Implementation Plan. 39

The Programme Group recommended that the IOC and SCOR jointly convene an International Conference on the WOCE in 1987-1988 to consider the WOCE Implementation Plan and that the WOCE Scientific and Implementation Plans be circulated to all Member States of IOC well in advance of the Conference. 40

Many Delegates expressed the interests of their countries in TOGA and WOCE. The Delegate of India stressed the importance of TOGA and WOCE for understanding the vagaries of the Indian Monsoon and the need for the immediate exchange of data collected in international waters for the success of the programmes. With regard to the data from exclusive economic zones required for these programmes, the IOC may approach individual governments. 41

The Delegate of Portugal pointed out that his country is interested in the development of TOGA as, for instance, ENSO type fluctuations are suspected to initiate the drought episodes that have occurred in Southern Portugal and Northern Africa during the last decades. Due to its subtropical geographical situation, Portugal can only have an indirect participation in the component of TOGA. - Portugal is interested in participating directly in WOCE and can do so by: 42

(i) maintaining, extending and improving the existing network of coastal sea-level, sea-surface-temperature and coastal meteorological observations, in continental Portugal and on the islands of the Azores and Madeira archipelago;

(ii) continuing the research already conducted by the University of Lisbon on the eastern Atlantic boundary-layer current system off Portugal, and expand it into a monitoring programme during the "field" phase of WOCE; recent current measurements with moored instrumentation on the Portuguese continental slope, in the framework of that research, show a fairly stable northward undercurrent reaching a 6-month vector mean as high as 10 cm s-1 at a depth of 750 m, and this may constitute a meaningful mechanism for the balance of heat in the North Atlantic.

The Delegate of Poland wished to stress that the concept and major objectives of WOCE are very attractive for oceanographers and it is an important scientific programme for the international oceanographic community. 43

The Delegate of the U.S.S.R. noted that the Soviet scientists are studying the proposal for WOCE with great interest, as it opens the way for future global oceanographic investigations. However, at this stage, it is difficult for U.S.S.R. scientists and institutions to make commitments, since they are concentrating on the implementation of the "Sections" programme, which involves substantial national resources with regard to the use of research vessels; 104 cruises have been implemented in five energetically active zones of the ocean since 1981. 44

Many Delegates felt that success in the implementation of TOGA and WOCE will depend on support by Member States, not only in the form of technical and human resources, but also in facilitating research in coastal areas under national jurisdiction which are of key importance, for example, for calculation of heat fluxes and studies of boundary currents, as well as facilitating the access of research vessels, working under WCRP programmes, to foreign sea ports. 45

The Programme Group adopted Recommendation PG-OPC-I.1.

5. OCEAN OBSERVING SYSTEMS AND RELATED DATA MANAGEMENT

5.1 OCEAN OBSERVING SYSTEM DEVELOPMENT PROGRAMME

The IOC Assembly, at its Twelfth Session, adopted Resolution XII-4, in which, inter alia, it recommended that: 46

"the Joint SCOR-IOC Committee on Climatic Changes and the Ocean prepare, in 1983 in consultation with the JSC, a comprehensive international programme for ocean monitoring for the purpose of the WCRP, giving priority to the co-ordination of existing or imminently scheduled programmes and projects, for consideration by the IOC Executive Council and the WMO Executive Committee early in 1984."

In response to the Resolution and a similar request by the WMO Executive Committee (XXXIII, June 1981), the Ocean Observing System Development Programme (OOSDP; IOC Technical Series No. 27) was prepared by the Joint SCOR-IOC CCCO and endorsed by the JSC for the WCRP. 47

The Secretary CCCO, Mr. B. Thompson, reported to the Programme Group on the preparation of this document and major items addressed to IOC. The Programme Plan (see IOC Technical Series No. 27) describes the principles that should govern the OOSDP for the purpose of the three streams of the WCRP and discusses issues requiring immediate action and other matters of a developmental, pilot or design nature. Four recommended major programmes cover sea-surface Temperatures, Mean Sea Level, Sub-surface Heat Storage, and Surface Drifters. Improvements are called for in the surface meteorological observation systems, mainly associated with the WMO Voluntary Observing Ship (VOS) Programme. The OOSDP plan indicates the lead agencies, (primarily IOC or WMO) responsibility for the implementation of each action item. 48

The two major programmes, Mean Sea Level and Sub-surface Heat Storage, to be undertaken by IOC, are discussed in Sections 5.2 and 5.3, below. 49

The Representative of WMO, Mr. P. Dexter, informed the Programme Group of actions taken by WMO(WWW) in response to the action items of OOSDP addressed to WMO. 50

(i) In January 1985, staff members of IOC, WMO(WWW, WCRP) and of the Joint SCOR-IOC CCCO discussed items identified in the OOSDP considered as being WMO actions. These items related primarily to observations made by WMO Voluntary Observing Ships; these are grouped in three categories: - meteorological observations (for streams 1, 2 and 3); - pilot project on operational-time VOS data transmission and assembly in the tropical Atlantic (stream 1); and - quality controlled subset of VOS surface data (streams 2 and 3).

(ii) WMO is able to contribute, where appropriate, to the OOSDP. Where actions required are relatively simple, and contribute to improvements in the WWW, they have been undertaken immediately within existing WMO programmes.

More difficult and complex actions will require approval and guidance from the WMO Executive Council and Congress. These are: 51

(iii) Ship Meteorological Observations - these observations included SST, surface wind and wet- and dry-bulb air temperatures. Actions are already being taken by the CMM Working Group on Marine Climatology with a view to recommending improved procedure for these VOS observations to WMO Members. In addition, a rapporteur study on the calibration of ships' anemometers is to be re-activated.

(iv) Pilot project on operational time VOS data
Actions required here are more complex. However, in order to determine the viability of the project, a preliminary study is to be made of the relative numbers of real-time and climate-mode observations now available on a global basis.

(v) Quality controlled subset of VOS data
This is also a complex project that has already been addressed in a preliminary way by the CMM Working Group on Marine Climatology. The action now under way is the initiation of a CMM rapporteur study to access the viability of the project and provide a detailed action plan and timetable. It is hoped that this study will be completed by the end of 1985.

The Representative of WMO pointed out that some of the proposed actions could be implemented immediately, whereas others would be submitted to the WMO Executive Council for approval. The JSC has agreed to incorporate appropriate OOSDP action items in the WCRP Implementation Plan. 52

The SCOR-IOC CCCO, at its Sixth Session, pointed out that the IOC has a basic responsibility for ocean monitoring for which immediate actions were required and, therefore, the IOC is obliged to ensure their efficient and timely implementation. The Mean Sea Level and Sub-surface Heat Storage projects are specific examples. The Joint SCOR-IOC Committee recommended that these projects be given top priority by the Commission and by the Programme Group in particular. 53

The Programme Group considered that the OOSDP represented a sound scientific basis for the co-ordination of implementation by IOC and WMO of the expansion and improvement of oceanic observations. The Programme Group recommended that the IOC focus its efforts on: (i) promotion and development of a Global Sea Level Observing System; (ii) promotion and development of a drifting-buoy programme (jointly with WMO); and (iii) promotion and development of ocean sub-surface thermal structure monitoring in the framework of IGOSS. 54

Document IOC-XIII/8 Annex 2 (a Proposal for the Establishement of an International Consortium for the Co-operative Implementation of Drifting Buoy Programmes) was prepared in pursuant to a decision of the Executive Council, at its Seventeenth Session, which instructed "the Secretary to explore with the WMO Secretariat future requirements for the international co-ordination of drifting buoy activities, in the light of expected scientific and technological developments". The proposed Consortium would provide a forum in which particular issues could be decided, including those, such as the preparation of plans and buoy deployment for global or large-scale regional meteorological and/or oceanographic programmes, the implementation of quality control procedures for the distribution of buoy data through the GTS and the Argos central processing centre or local user terminals. 55

The Joint WMO-IOC Preparatory Meeting for the Establishment of a Drifting Buoy Consortium (Geneva, 15-19 April 1985) will consider a co-ordinated drifting buoy implementation programme, and further develop the concept of the Consortium, including its terms of reference and modus operandi, and plan appropriate further action. 56

The Programme Group agreed that the proposed Consortium could provide an appropriate forum for the consideration of OOSDP action on drifting buoy programmes in support of WCRP, in particular TOGA and WOCE, and therefore supported in principle, the establishment of an International Consortium. 57

The Programme Group noted with satisfaction that the NODC of Canada had agreed to act as an RNODC for drifting buoy data and to collect these data, prepare data products and provide them to other countries. The Programme Group urged Member States to adopt common arrangements 58

for the distribution of these data in a timely manner and suggested that the question of data exchange via the GTS be addressed to the Preparatory Meeting on Drifting Buoy Consortium.

The Programme Group adopted Recommendation PG-OPC-I.3.

5.2 SEA LEVEL OBSERVING SYSTEM

59 The development of a Global Sea Level Observing System is an important action addressed to IOC within the OOSDP.

60 Dr. David Pugh presented a Proposal for the Development of a Global Network of Sea Level Stations (Doc. IOC-XIII/8 Annex I), prepared by Prof. Klaus Wyrtki and himself.

61 He pointed out that a Global Sea Level Observing System has to serve many purposes. Within the framework of the WCRP, a combination of mean density fields and measured fluctuations of sea-surface topography, and other remote-sensing techniques, such as acoustic tomography, may provide a workable system for monitoring ocean circulation. Sea level is also indirectly related to ocean heat storage through the expansion of sea water due to mean temperature changes.

62 There is also much geological and geophysical interest in the measurement of recent vertical crustal movements and their relationship to larger geological trends, as shown in IGCP Project 200. Sea level may also have many practical applications for operational and engineering-design activities, coastal flooding, harbour design etc.

63 According to the proposed plan, 250 sea-level gauges are required to provide valuable data for practical and scientific application (see Annex VIII). Many of the guages already operate, but may need upgrading in terms of levelling, accuracy, documentation, telemetry and the time taken before the data becomes available. About 100 new sites are proposed, many on ocean islands that are best placed for ocean monitoring. In a few cases, especially in polar regions, implementation will pose formidable problems for present technology.

64 The Programme Group was also informed of the implementation of the IGOSS Sea Level Pilot Project (ISLPP) in the Pacific Ocean launched in 1984. Twenty-two countries are now providing data to a Specialized Oceanographic Centre in Honolulu. The data are used for the preparation and wide distribution of monthly mean-sea level anomaly charts (Annex VIII).

65 The Programme Group expressed its satisfaction with the progress in the implementation of ISLPP. It also expressed its thanks to Dr. Pugh for the preparation of the Manual on Sea Level Observations, and requested the Secretary of IOC to arrange its prompt publication, translation and wide distribution.

66 The IOC Assistant Secretary, Dr. Albert Tolkachev, presented Document IOC/PG-OPC-I/7 (Proposal on the Development of a Sea Level Network in the Indian Ocean within the Framework of the Global Network of Sea Level Station). It provided background information on the development of a sea-level network in the Indian Ocean and proposals for its implementation. The Programme Group was informed of the actions taken by IOC, with the help of the CCCO Panel on Indian Ocean Climate Studies, to initiate the development of a sea-level network in the Indian Ocean, particularly in the IOCINCWIO area. A survey made by IOC in 1984 of the Member States of the IOCINCWIO area revealed that most countries of the region (namely, Kenya, Madagascar, Mauritius, Mozambique, Seychelles and Tanzania) need assistance in obtaining tide-gauges, the provision of spare parts, the installation of new tide-gauges, and training. Of 52 sea-level stations proposed for the Indian Ocean as part of the Global Network, about 30 will have to be installed. To implement the sea-level network in the Indian Ocean, substantial assistance to the Member States of the Indian Ocean will be required through IOC mechanisms such as the Trust Fund or the Voluntary Assistant Programme* (VAP) or through bilateral or multilateral arrangements (Annex VIII).

67 Dr. Selim Morcos, Representative of the Division of Marine Sciences of Unesco, informed the Programme Group of the assistance given by the Division in the implementation of a Network of Sea Level Gauges for the Red Sea and the Gulf of Aden.

68 The Delegate of Brazil informed the Programme Group of the tide guage programme in Brazil in support of the TOGA Programme. There are in operation 9 permanent tide-observing stations on the coast, 3 of which are on oceanic islands (Trinidad, Fernando de Noronha and the Sao Pedro and Sao Paulo Rocks, the latter as part of Brazil's collaboration in the FOCAL Programme). Brazil intends to put in operation 12 other stations by the end of 1985. All these stations are equipped with standard tide guages and, in the near future, at least 50% of the network will be operated with pressure tide guages.

69 The Delegate of the Philippines informed the Programme Group that the Philippines, Indonesia, Thailand, Malaysia and Singapore collaborate in the framework of the ASEAN Committee for Science and Technology in the development of a tide gauge programme. Recently, Australia has kindly agreed to assist this programme by sending experts and providing equipment to establish the necessary tide-gauges in these countries.

70 The Delegate of Malaysia informed the Programme Group of the installation of a wave- and tide-monitoring station in the Straits of Malacca, which would be an useful addition to the proposed network of sea level stations in the Indian Ocean. However, the monitoring equipment for this station does not work properly and Malaysia would seek IOC assistance to put the monitoring equipment back into operation, so that data derived from the station could be used to support TOGA or WOCE.

* Renamed Voluntary Co-operation Programme by the IOC Assembly at its Thirteenth Session.

The Delegate of Poland indicated the willingness of his country to contribute four sea-level stations to the Global Network - 2 in polar regions and 2 in the Baltic Sea. 71

The Delegate of Mexico emphasized the importance of developing the Global Sea Level Observing System on a regional basis. He noted, in particular, the plan to establish a sea-level network in the Caribbean area. Assistance will be required for this purpose and, therefore, the IOC VAP must be addressed to prove that it could be an useful and efficient mechanism to provide assistance to developing countries. 72

The Chairman of the Joint SCOR-IOC CCCO emphasized the need to ensure the training of specialists and the installation of tide-gauges in parallel, so the trained personnel could use their knowledge without delay. Another important matter to be solved at the national level is to ensure effective liaison between scientists using sea-level data and those organizations and experts who produce the data. 73

It was also noted that there are many oceanic areas where there is a need for new types of instruments, such as the inverted echosounders developed in the U.S.A. 74

The Delegates of Australia, China, France, Portugal and Spain expressed their countries' willingness to participate in the proposed Global Sea Level Observing System. The Delegates of Australia, Canada, China, France, India and Portugal indicated their possibilities to assist developing countries in establishing their tide gauges. 75

The Programme Group expressed its appreciation to the United Kingdom and China for organizing, with the support of IOC, training courses on sea-level measurements and analysis for specialists of developing countries in 1983-1984 and 1984, respectively. 76

The Delegate of Portugal offered to translate the Manual on Sea Level Observations so that it can be used in Portuguese-speaking countries. 77

The Programme Group emphasized that appropriate mechanisms should be developed and actions be undertaken by IOC and the Division of Marine Sciences of Unesco to provide the required assistance to the developing countries to enable them to participate actively in the Global Network of Sea Level Stations. 78

The Programme Group agreed that the development of the Global Network of Sea Level Stations should be given high priority by IOC. It adopted Recommendation PG-OPC-1.2 79

5.3 SUB-SURFACE THERMAL STRUCTURE MONITORING PROJECT

The Joint SCOR-IOC CCCO has stressed the need for significantly improved oceanic sub-surface thermal data, particularly to meet the requirements of TOGA and WOCE. The proposals for further development of the ocean sub-surface thermal structure observations were put forward in the Ocean Observing System Development Programme (OOSDP, IOC Technical Series No. 27), and further elaborated by the Joint SCOR-IOC Committee at the Sixth Session. The Joint Committee will address the specific thermal-structure data requirements for the WCRP over the next few months and these requirements would be submitted to the Joint IOC-WMO Working Committee for IGOSS for implementation. The SCOR-IOC CCCO agreed that the Joint IOC-WMO Working Committee for IGOSS was the appropriate body to address these requirements. 80

The Chairman of the IOC-WMO Working Committee for IGOSS, Mr. Geoff Holland, informed the Programme Group of the proposals to accelerate the IGOSS observation and data-product programmes and introduced Documents IOC/PG-OPC-I/8 (Requirements for an Accelerated Development of IGOSS in Support of the Ocean Climate Experiments within the World Climate Research Programme) and IOC-XIII/8 Annex 4 (Proposal for an Acceleration Phase for the Integrated Global Ocean Services System). He stressed the need of a governmental role in the implementation of the global climate experiments at many levels. Data management required intergovernmental agreements for data-quality control, formats, standards and the infrastructure for data exchange. Accessibility to data would be vastly improved if governments would agree to encourage the submission of all data acquired through national programmes, into the IGOSS system. The needs for climate studies for data may require the agreement of Member States to facilitate access of data, ships and instruments into areas of the world oceans under national jurisdiction. The role of governments in marshalling the necessary resources to meet the additional requirements of the climate programme would be very important. The accelerated programme of IGOSS will be addressing all the above-mentioned issues and recognizes the need for greater involvement of Member States in the IGOSS system. The Joint Working Committee for IGOSS can only provide the necessary infrastructure; it is up to the Member States themselves to provide input to the system. The Working Committee will be taking the data requirements from the SCOR-IOC CCCO and preparing an implementation programme which will include a ship-of-opportunity programme, the commitment of Member States of national programmes and resources, and the establishment of a number of Specialized Oceanographic Centres to produce standard data products. 81

The Delegate of India stated that his country intends to participate actively in the sub-surface thermal structure monitoring project and is willing to assist other countries in the region in the training of their scientists, he also considered the establishment of a TOGA regional data centre in the Indian Ocean region useful. 82

The Delegate of Portugal also indicated the willingness of his country to participate in the acceleration phase of IGOSS in the sub-tropical North Atlantic by extending XBT observations in the framework of the existing CLIVA programme. For this purpose, provision of XBT probes will be required. 83

The Programme Group discussed the relationship between the Joint Working Committee for IGOSS and the TOGA International Planning Office, particularly in connection with designation of TOGA data centres for sub-surface thermal structure. The Programme Group considered the guidelines for the sub-surface thermal structure component of TOGA prepared by the SCOR-IOC CCCO with the assistance of the Chairman of the Joint Working Committee for IGOSS, the Director of the WCRP and the Chairman of the Working Committee on IODE; these guidelines are included in the Summary Report of the Sixth Session of the SCOR-IOC CCCO (Doc. IOC-SCOR/CCCO-VI/3 pages 26-27). 84

Regarding the collection of data in special TOGA centres to satisfy the special interest of the scientific community, the Programme Group stressed the importance of exchanging all data between the TOGA centres and the WDCs (oceanography). 85

The Programme Group recognized that the establishment of TOGA data centres would need the formal agreement of Member States. 86

The Delegate of the U.S.A. indicated that one of the major issues that would have to be addressed is whether the IGOSS and IODE programmes would be able to make substantial contributions to the WCRP and, if so, what the extent and nature of these contributions should be. The size and complexity of data sets expected to result from WCRP programmes, such as TOGA and WOCE, are so great as to suggest that IGOSS and IODE may not be able to contribute significantly to the WCRP. He further noted that, since the most intensive field studies under the WCRP will not get underway for a few years, there is time to evaluate the performance of IGOSS and IODE in response to initial requirements of the WCRP. This time would also allow the WMO and IOC to encourage Member States to contribute data to, and thus increase the utility of IGOSS and IODE. Recent information indicated that most WMO and IOC Member States are contributing very little, if any, of the oceanographic data they collect to IGOSS. Therefore, it is essential for the WMO and IOC to focus on promoting increased contributions to, and the use of, IGOSS, and this matter should be given the highest priority by the Working Committee for IGOSS. 87

The Delegate of the U.S.A. strongly recommended that the position of the IGOSS Operations Officer in the IOC Secretariat be allocated full-time to working with Member States to promote increased submission of data to IGOSS, to identifying any problems that Member States encounter in this respect, and to addressing these problems. He further proposed that IGOSS: expand standardization of data products to assure their compatibility; increase distribution of IGOSS products to scientists concerned with the WCRP; and promote the use of automated systems and improved radio links for transmission of IGOSS data, especially XBT data. It was also suggested that the GTS could be improved to meet the special needs of the WCRP (e.g., to handle high-precision in situ sea-surface temperature data). 88

The Programme Group recognized that, without a greater involvement and commitment of Member States, the success of IGOSS in satisfying the ocean requirements of the climate experiments would be very limited. 89

The Programme Group agreed that IGOSS provides a suitable infrastructure for the timely exchange of data gathered by Member States. However, to meet the requirements of the WCRP, TOGA and WOCE in particular, it urged the Member States to intensify their efforts with a view to substantially increasing input of BATHY/TESAC data into the GTS system, to expand their BATHY/TESAC programmes in the data-deficient areas and participate in a ships-of-opportunity programme. 90

The Programme Group supported the actions (proposed in Doc. IOC/PG-OPC-I/8) on the accelerated development of IGOSS in support of the ocean climate experiments within the WCRP, which include: 91

(i) Submission of the plan for accelerating data collection and product dissemination under IGOSS to the Thirteenth Session of the IOC Assembly and the 37th Session of the WMO Executive Council for approval in March and June 1985, respectively.

(ii) Formulation of statements of requirements by the SCOR-IOC Committee on Climatic Changes and the Ocean by June 1985.

(iii) Analysis of the deficiencies of the present IGOSS programme and the requirements formulated by the SCOR-IOC CCCO, and preparation of an action plan on accelerated IGOSS development, by August 1985.

(iv) Co-ordination of requirements for, and contributions to, the implementation of a Ships-of-opportunity Plan at a meeting of Member States, in September 1985.

(v) Indentification of Specialized Oceanographic Centres for regional data products in support of the WCRP, and definition of appropriate data products.

(vi) Consideration and approval of the Plans for the Ships-of-opportunity Programme and IDPSS by the IOC-WMO Joint Working Committee for IGOSS at its Fourth Session in November 1985.

(vii) Submission of the Implementation Plan for the Ships-of-opportunity Programme and IDPSS to the Nineteenth Session of the IOC Executive Council (February/March 1986) for approval and circulation to Member States for the identification of contributors and acceptance by Member States.

(viii) Provision of technical assistance required by the participating developing countries, through the IOC Voluntary Assistance Programme and the WMO Voluntary Co-operation Programme.

5.4 OCEAN DATA MANAGEMENT REQUIRED FOR THE OCEANOGRAPHIC COMPONENT OF WCRP

92 Dr. F. Webster, on behalf of the CCCO-JSC TOGA Scientific Steering Group, reported on the CCCO-IGOSS-IODE ad hoc Meeting on WCRP Ocean Data Management, held in Paris, 8-12 October 1984 (Doc. IOC/INF-617). The task of the meeting was to review the suitability of IGOSS and IODE to meet the oceanographic data requirements of the WCRP, paying attention to existing data management, exchange, and processing systems. Prior to the meeting, CCCO has expressed its concern that the data management meet effective standards of timeliness, formats and exchange mechanisms, quality control, products and completeness.

93 The main conclusions of the above-mentioned Meeting were as follows:

(i) IGOSS could provide a mechanism for collecting and distributing near real-time sub-surface oceanographic data for WCRP purposes if certain improvements are made. The major IGOSS deficiencies are: (a) only a small portion of the sub-surface data obtained by research vessels enters IGOSS'; (b) only a few countries participate in the IGOSS BATHY/TESAC exchange; (c) data availability from many regions is poor, particularly the tropics for TOGA purposes.

(ii) IODE could function adequately as the archiving mechanism for surface and sub-surface data for WCRP purposes if certain conditions were met. The major deficiences are: (a) delays of up to several years in availability of data from the World Data Centres (oceanography); (b) sub-surface circulation data exchange and archiving methods are not being used effectively.

(iii) IGOSS and IODE do not provide a mechanism for data exchange after 30 days and prior to the data's availability from the World Data Centres. This is a major shortcoming of critical importance to TOGA.

(iv) Existing systems fail to capture significant quantities of existing oceanographic data. Institutions around the world should be canvassed to what data exist in those institutions that has not been exchanged, to learn why existing mechanisms have not been used (or if they were used, why they failed) and to encourage future data exchange.

(v) The present system for the collection of sub-surface temperature data appeared capable of meeting TOGA data needs in the tropical ocean if sufficient data were submitted by countries. However, in 1983, only 14 countries submitted data to IGOSS. Of those 14, only 5 submitted significant ammounts of data. In 1982-1983, the strongest El Nino ever observed took place, with intensive study of the phenomenon by many nations. The nature of the El Nino phenomenon requires near-real-time exchange of information for research purposes. In spite of this, not a single datum was submitted to IGOSS in 1982-1983 by any country in the El Nino region.

(vi) If the IGOSS is to be of value to TOGA and other experiments of the WCRP, it must be used by Member States. The CCCO must alert the IOC and WMO and, through them, the appropriate subsidiary bodies, that the submission of data to IGOSS by many Member States is inadequate for WCRP purposes.

94 The Chairman of the SCOR-IOC CCCO informed the Programme Group that the analysis made by the ad hoc Meeting, and its proposals, were discussed by the SCOR-IOC CCCO at its Sixth Session. The CCCO accepted the principles for guiding the development of the ocean-data management system to meet the requirements of the WCRP and endorsed the nomenclature of various types of data to be used in the WCRP. Particular emphasis was given to the development of the TOGA Data Management Scheme under which the establishment of several TOGA Data Centres was proposed (see Annex V). The CCCO also considered two solutions for the IGOSS system: automation of observations and their communication (via satellite) to collection centres; and the setting of data-submission requirements by funding agencies.

95 However, some Delegates expressed doubts that the present data exchange system will be able to cope with the big volume of data expected from new data-acquisition systems. In their opinion, careful analysis is required to understand why the present system does not operate successfully. For this purpose, direct contact with Member States is required to convince and encourage individuals and Member States to submit data for international exchange, and an IGOSS Operations Co-ordinator should be appointed to work full-time on this matter.

96 The Delegate of the Philippines proposed that a semi-popular brochure on El Nino and its effects be prepared for wide distribution, so that the Member States could see the importance of providing their data to the international community for use in the prediction of the event.

97 Prof. P. Morel informed the participants that such a brochure is being prepared by the TOGA International Planning Office.

98 The Programme Group agreed that the IGOSS and IODE, despite existing deficiencies, can contribute to WCRP and that the established international mechanism for data collection, exchange and analysis under IGOSS and IODE should be used for WOCE and TOGA. All data collected within WCRP should, ultimately, be archived in WDCs.

99 The Programme Group agreed that the commitment of Member States is the key factor in improving and developing future international data exchange scheme. The Programme Group recommended that the Working Committees for IGOSS and IODE draw particular attention to ways and means for ensuring timely submission and exchange of oceanographic data to meet the requirements of TOGA and WOCE with respect to data collection and analysis.

The Programme Group emphasized the need for close links between the SCOR-IOC CCCO and the Working Committees for IGOSS and IODE in developing data management arrangements for the WCRP with a view to using to the maximum extent possible, the IGOSS and IODE mechanisms and procedures for data collection, exchange and analysis. 100

The Programme Group adopted Recommendation PG-OPC-1.3

6. GUIDELINES FOR FUTURE JOINT IOC-WMO INTERGOVERNMENTAL PLANNING AND IMPLEMENTATION OF THE OCEANOGRAPHIC COMPONENT OF THE WCRP

6.1 RELATIONS WITH THE JOINT SCOR-IOC COMMITTEE ON CLIMATIC CHANGES AND THE OCEAN (CCCO) AND OTHER CONCERNED BODIES OF IOC AND WMO

The IOC Assistant Secretary introduced Document IOC/PG-OPC-I/6, which provides background information on existing mechanisms for international co-ordination and development of the oceanographic components of the WCRP, particularly on the SCOR-IOC CCCO and the IOC Programme Group on Ocean Processes and Climate, as well as other subsidiary bodies that are either involved or could assist with these activities. The following points were highlighted: 101

The World Climate Programme was established by WMO at the Eighth Congress of WMO (1979), Resolution 29 (cg-VIII). The World Climate Research Programme (WCRP) constitutes a research component of the WCP. The Joint WMO-ICSU Scientific Committee for WCRP is considered as the main scientific organ for the formulation of overall concepts and co-ordination of efforts at the international level for the WCRP. 102

In 1979 the IOC, at the Eleventh Session of its Assembly, through Resolution XI-3, decided to co-sponsor, jointly with SCOR, the Committee on Climatic Changes and the Ocean (CCCO) and requested the SCOR-IOC CCCO to take the lead in recommending and developing the programmes and arrangements for implementing the oceanographic components of climate programmes. 103

The SCOR-IOC CCCO, with the assistance of its subsidiary bodies and in co-operation with the JSC for WCRP, has formulated specific research experiments namely, TOGA, WOCE and the Ocean Observing System Development Programme (OOSDP) as the oceanographic components of the WCRP. It has also identified the need for effective support by OOSDP. 104

In 1984 Unesco and ICSU adopted "Principles Governing Co-operation between Unesco and ICSU on the Development of the Oceanographic Component of the WCRP, through the IOC and SCOR". (Annex VI). 105

The IOC Executive Council, at its Seventeenth Session, endorsed a "Memorandum of Understanding between IOC and SCOR", which includes Terms of Reference for, and the mode of operation of, the Joint SCOR-IOC CCCO. (Annex VI). 106

In the light of the above-mentioned Principles and Memorandum of Understanding, the IOC Executive Council at its Seventeenth Session, by Resolution EC-XVII.2 , established the Programme Group on Ocean Processes and Climate, as an IOC intergovernmental subsidiary body, in order to ensure co-ordination of intergovernmental activities of the oceanographic components of the WCRP. 107

In accordance with the above-mentioned documents and the decisions: The IOC will act as the body responsible for the overall intergovernmental co-ordination of the oceanographic component of the WCRP and related supporting ocean services (e.g., ocean monitoring, ocean-data exchange, training, education and mutual assistance); and other activities requiring international co-operation through the concerted action of the Member States. 108

The IOC Programme Group on Ocean Processes and Climate provides the overall co-ordination mentioned above; it will operate through existing or new subsidiary bodies (e.g., the IOC Sub-Commission for IOCARIBE, the IOC Programme Group for WESTPAC, etc.), as necessary, for the co-ordination of specific field projects or experiments, in consultation with WMO and other concerned agencies and organizations, and bearing in mind the recommendations of the CCCO. The Programme Group provides advice to the Commission on policy matters, budgetary and other forms of support, and guidance to the Commission on the progressive build-up of an adequate ocean-monitoring system. 109

The SCOR-IOC Committee on Climatic Changes and the Ocean is entrusted with the planning of the relevant field projects or experiments and advises SCOR and IOC on the most effective ways of implementing the oceanographic components of WCRP. In particular, the Joint SCOR-IOC Committee identifies ocean-climate research problems requiring increased international attention, stimulates research activities thereon, recommends to IOC and SCOR how these activities should be implemented, and formulates requirements for ocean observations needed to improve climatic forecasts. 110

At the Seventeenth Session of the IOC Executive Council, some Delegates stressed that the functions of the Programme Group should be clearly defined so as to avoid creating a situation in which the existing subsidiary bodies and the new Group would have conflicting Terms of Reference and authority. The IOC Executive Council also emphasized the need for co-operation and co-ordination with other relevant bodies, and stressed the importance of co-ordination with WMO, ICSU and SCOR and their relevant subsidiary bodies; it decided to seek closer co-operation.with them. 111

The diagrams in Annex VI hereto show which existing bodies of the IOC are already involved or could assist in the implementation of the major observational systems and in the planning mechanisms for co-ordination and development of the oceanographic component of the WCRP. 112

The Delegate of the Philippines stressed the fact that, through the IOC, the developing Member States could rally their support to the TOGA and WOCE. This should be so because these activities are not only mandated by the United Nations Assembly to the IOC as the UN's system's 113

intergovernmental body competent in oceanography, but also because, as is clearly stated in its Statute, it is the United Nations intergovernmental body that should be responsible for all aspects of oceanography requiring the concerted efforts of Member States. Likewise, this is clearly spelled out in the Memorandum of Understanding between the IOC and SCOR, which recognizes their desire to improve the collection of valuable data on a world-wide basis through the efforts of Member States, especially the developing ones, so that they can contribute to the fullest extent possible at the least cost. He reminded the participants that, although the Member States are concerned about, and will undertake the study of, certain aspects of oceanography in an endeavour to solve world-wide oceanographic problems, these subjects are still components of the science of oceanography. 114

The Delegate of Canada reminded the Programme Group that Governments are fully represented in IOC and WMO. The Delegates to the meetings of these organizations included representatives of the meteorological and oceanographic communities. No global programme can be carried out without the goodwill and support of Member States. However, Governments do not propose scientific plans, and for this reason the IOC and WMO have set up their scientific bodies, the SCOR-IOC CCCO and the ICSU-WMO JSC for the WCRP, respectively. When scientific plans are needed to be implemented, the intergovernmental mechanisms have to be involved, and it is at this level that the roles of the IOC and WMO and of their subsidiary bodies are clear. Member States must approve the implementation plans and provide the resources and the intergovernmental agreements necessary. Without this governmental involvement no programmes can be implemented. 115

The Delegate of Portugal emphasized the need for maintaining close co-ordination between SCOR and IOC, as appropriate representatives of the scientific community and of governments, respectively, in order to carry out jointly the oceanographic component of the WCRP in parallel with the meteorological component co-ordinated by WMO and ICSU. 116

The Delegate of Brazil recalled that, within the United Nations system, each organization has been assigned specific mandates so as to avoid duplication of effort and to reflect the natural structures and objectives. While recognizing that WMO is the competent organization to deal with atmospheric and meteorologiacl aspects, it should be also recognized that IOC was established 25 years ago as the competent body in the United Nations system to deal with the oceanographic research and services. The Delegate also reminded the Programme Group that the Assembly of IOC decided that the Commission should play a key role in the co-ordination of the oceanographic component of the WCRP and this Programme Group is the apropriate mechanism to facilitate such co-ordination at the intergovernmental level, in close co-operation with WMO as the appropriate organization for the overall co-ordination of the WCP. This basic point should be strictly respected if we wish to proceed with the implementation of WCRP and its oceanographic components on a constructive and positive basis. 117

The Chairman of the SCOR-IOC CCCO pointed out that more support is required from IOC for the activities of the Committee. He expressed his disappointment that, so far, no additional staff had been provided by Unesco for the work of CCCO. 118

Many Delegates felt that the structure outlines in the Document IOC/PG-OPC-I/9 (Organizational Structure and International Mechanism for Co-ordination and Development of Oceanographic Components of the World Climate Research Programme) offered a very reasonable and workable framework for the running of the TOGA and WOCE experiments (Annex VI). 119

The Programme Group having reviewed this document, noted that the WCRP and its oceanographic components (e.g., TOGA, WOCE and OOSDP) require substantial input from the world oceanographic and meteorological scientific communities so that a sound scientific basis could be developed for those programmes. This has been successfully achieved through the joint activities of the SCOR-IOC CCCO and the ICSU-WMO JSC for the WCRP. It also noted that success in the implementation of TOGA and WOCE will depend on governmental support from many Member States, particularly with regard to the development of global ocean-observing systems and data-management schemes needed for those experiments. Therefore, proper intergovernmental co-ordination is required on the part of the intergovernmental organizations - namely IOC and WMO - and the existing international mechanism developed by these two organizations should be used with the maximum possible extent. 120

The Programme Group stressed that besides the Working Committee for IGOSS, the Working Committee on IODE and the Working Committee for TEMA, all IOC regional subsidiary bodies should be involved in the planning and implementation of proposed regional activities relevant to the oceanographic components of the WCRP, particularly with regard to the implementation of ocean-observing systems and data exchange. 121

The Programme Group also pointed out that more effective information flow and interaction of the SCOR-IOC CCCO with the Programme Group will be required to ensure proper co-ordination of the required intergovernmental actions, and the IOC governing bodies should be regularly and fully informed of the progress in planning and of proposals for implementation of the oceanographic components of the WCRP with a view to endorsing them, as appropriate. 122

The Programme Group emphasized that arrangements should be made between IOC and WMO for improved co-ordination, and procedures to handle intergovernmental aspects, of the implementation of TOGA and WOCE experiments. 123

Discussion on this subject was continued under the Agenda item 6.2 124

6.2 INTERNATIONAL STATUS AND FUNCTIONS OF THE TOGA AND WOCE OFFICES AND THEIR RELATIONSHIP WITH IOC

125 The Programme Group was informed that the IOC Executive Council, at its Seventeenth Session, had been informed of the establishment of the International TOGA Planning Office in the United States by agreement between the U.S.A. and WMO, and that arrangements were being made for an international WOCE Planning Office in the United Kingdom by the CCCO-JSC WOCE Scientific Steering Group (SSG).

126 Document IOC/PG-OPC-I/9 (Functions and Structure of the International Planning Offices for TOGA and WOCE) describe the present arrangements and functions of the International TOGA Planning Office, the International WOCE Planning Office and their relationships with WMO and IOC (see Annex VII, hereto).

127 The International TOGA Planning Office was established by agreement between WMO and the U.S.A. The International WOCE Planning Ofice is being established through an exchange of letters between the Director of the Institute of Oceanographic Sciences, U.K., Chairman of the WOCE SSG, Chairman of the IOC-SCOR CCCO, and the Natural Environmental Research Council of the U.K.

128 The Delegate of the United Kingdom explained the U.K.'s decision to assist what was, in his view, the single most important unifying programme so far contemplated, by hosting a planning office to assist the WOCE Scientific Steering Group. The progress in large-scale oceanographic studies achieved through the efforts of single countries and international programmes such as IIOE, POLYGON and MODE made it possible to start to look jointly with meteorologists at the exchange across the air-sea interface. These complex experiments, in which meteorologists and oceanographers are co-participants, may need a variety of mechanisms for co-ordination. The United Kingdom has good experience in planning, implementation and analysis phases of the International Air-Sea Interaction Experiment (in which 7 countries participated), as well as in other international programmes that provided an infrastructure for the support of the international WOCE Planning Office. This Office has been established within the Institute of Oceanographic Sciences (Wormley), and the Government of Canada has kindly agreed to second a distinguished scientist, Dr. G. Needler, as Director of the Office. It is hoped that other countries will support the activities of the Office by, for example, seconding their scientists. Facilities will be provided for visiting scientists to work with the WOCE Office.

129 The Director of the JPS for the WCRP drew the attention of the participants to Document IOC/PG-OPC-I/9 which describes the functions and mode of operation of the International TOGA Planning Office established in the U.S.A. under agreement with WMO to support the CCCO and the Director of the WCRP in the planning of TOGA. Dr. R. Fleming has been seconded by the U.S.A. as Director of the Office. India, Canada and France have also seconded their scientists to the TOGA Office. He stressed that its major function is to assist in planning the TOGA Programme, and the TOGA Office is considered as an extension

of the Joint Planning Staff for the WCRP, which is a joint body of ICSU and WMO. It is, therefore his duty as Director of JPS to report on TOGA activities to WMO and ICSU governing bodies. On all intergovernmental aspects of the implementation of the TOGA, actions are taken through the Secretary General of WMO and the WMO Executive Council and Congress.

Many Delegates expressed their appreciation to the United Kingdom and the United States of America for these important contributions to the IOC and WMO through the WOCE and TOGA Offices.

The main discussions on this item concentrated on the relationship between the TOGA and WOCE Offices and the IOC, their functions, staffing and reporting procedures, as well as arrangements to be made by IOC jointly with the host countries and WMO to ensure the truely international status of the TOGA and WOCE Offices.

The Delegate of Mexico emphasized that the programme on ocean processes and climate, being of great importance to mankind, should be carried out exclusively within a multilateral intergovernmental framework. With this in mind, Mexico had earlier supported the establishement of the Programme Group in order to ensure a wide participation of the international scientific community in the programmes and to obtain the information available from these programmes. In his opinion, the relationship between IOC and WMO, which has hitero been excellent, could perhaps be improved by making more use of the ICSPRO Agreement by which the IOC is the joint specialized mechanism of the United Nations System in the programmes relating to oceanography. The oceanographic component of the WCRP is evidently of great importance to IOC. The present agreements between Unesco and ICSU, and IOC and SCOR, on the oceanographic component of WCRP (Annex VI) provide a well defined institutional framework and reflect the need to have a real international projection of the oceanographic component of the WCRP with the active participation of developing countries. Under the Unesco-ICSU agreement, the IOC will act as the intergovernmental body responsible for the overall co-ordination of the oceanographic component of the World Climate Research Programme.

The Delegate of Mexico expressed the concern of his country with regard to the present trend to minimize IOC's involvement in the central areas of oceanographic components of the WCRP. He stressed that the TOGA and WOCE Offices should operate in close association with the IOC and WMO in respect of intergovernmental aspects and should report formally to the Secretary of IOC. He also emphasized the need to strengthen IGOSS and IODE activities in order to make them more effective in responding to WCRP needs and to contribute to the development of a permanent ocean observing system. The trend to create several specific data centres for the WCRP is dangerous, since there is a risk that they would not become part of a permanent system, so that, in the long term, the international character of the experiment may be lost.

The Delegates of Brazil, the Federal Republic of Germany, and the U.S.S.R. shared the views expressed by the Delegate of Mexico on the need to strengthen the role of IOC as the intergovernmenatl body for the oceanographic activities within the WCRP and, with this in mind, the IOC's relationship with the TOGA and WOCE Offices should be considered. 134

The Delegate of the U.S.S.R. expressed his appreciation of the scientists for their efforts in designing and planning such global experiments as TOGA and WOCE, the concept of which is supported by Soviet scientists. However, in considering an international mechanism for the planning and co-ordination of these experiments, it is necessary to provide equal opportunity to all countries to participate in the programmes, even in the planning stages. In his opinion, the creation of the TOGA and WOCE Offices had been undertaken too fast without appropriate formel arrangements and approval by the major intergovernmental bodies concerned, namely IOC and WMO. The TOGA Office was created on the basis of an exchange of letters between the Permanent Representative of the U.S.A. to WMO and the former Secretary General of WMO in December 1983 on the eve of his retirement. With regard to the WOCE Office, the decision to create it was taken by the CCCO and the JSC in consultation with the IOS and the NERC of the U.K. He stressed the view that the usual internationally accepted procedures should be used when considering the establishment of a new international structure, which require, in the case of the TOGA and WOCE Offices, approval of the IOC and WMO governing bodies. The role of IOC in co-ordinating oceanographic activities under WCRP should be strengthened. 135

The Delegate of the U.S.A. pointed out that the examination of the actual function of the International TOGA and WOCE Planning Offices, in practical terms, establishes clearly the appropriate reporting scheme for them to function effectively. The JSC, the CCCO, and the Joint Scientific Steering Groups for TOGA and WOCE have brought these programmes to the point where their further planning and implementation require extensive intersessional activity on behalf of the Scientific Steering Groups. In seeking ways to acomplish its intersessional work, while ensuring proper scientific direction, the Scientific Steering Groups have created Project or Planning Offices as instruments for carrying out their functions and responsibilities. Under these circumstances, the primary reporting route of the Planning Offices must be to the Scientific Steering Groups themselves. Additional linkages may be necessary for co-ordination and information purposes, but these should not be allowed to interfere with the role of the Planning Offices in support of the Scientific Steering Groups. 136

Having reviewed the Document IOC/PG-OPC-I/9 (Function and Structure of the International Planning Offices for TOGA and WOCE)(Annex VII hereto) and after considerable discussion, during which different viewpoints were expressed regarding the desirability of formalizing the relations between the International TOGA and WOCE Planning Offices and IOC, the Programme Group agreed that: 137

(i) the primary functions of the International TOGA and WOCE Planning Offices will be to assist the Scientific Steering Groups in formulating detailed plans for TOGA and WOCE;

(ii) on all activities requiring intergovernmental co-ordination of the TOGA and WOCE experiments, IOC governing bodies, the Programme Group on Ocean Processes and Climate, and the Secretary of IOC should be kept informed and properly consulted;

(iii) in view of the responsibilities of the Commission in the overall co-ordination of the oceanographic component of the WCRP, a clear definiton of the tasks assigned to each of the participating organizations and bodies, as well as of procedures, would greatly facilitate implementation and the full mobilization of the capabilities and competence of each body;

(iv) some formal arrangements will be required with the WMO for co-ordination of intergovernmental aspects of the implementation of TOGA and WOCE experiments and with the International WOCE Planning Office.

The Programme Group adopted Recommendation PG-OPC-1.4.

7. OTHER NATIONAL, REGIONAL AND MULTINATIONAL PROJECTS AND PROGRAMMES RELEVANT TO WCRP-OCEANOGRAPHY

Various Delegates made brief presentations on their oceanographic research or monitoring programmes relevant to WCRP and expressed their views on participation and co-ordination with the proposed experiments and programmes. 138

The Delegate of Brazil informed the Programme Group that, in order to facilitate research at national and international levels, a national committee for TOGA was established in Brazil under the supervision of the Marine Research Commission, the highest body in Brazil for marine affairs. This TOGA committee is composed of representatives of the research and academic institutions from different regions, in Brazil, in order to assure a wide national participation. Within the TOGA experiment, several projects are being developed, some in co-operation with other countries. These projects are related to the objectives of TOGA which deal with the tropical oceans and global atmosphere as in an integrated system. The draft of the Brazillian National Programme for TOGA was presented at the International Conference on TOGA that took place in Paris in September 1984. The final version is scheduled to be prepared next April. Along the Brazillian coast, there are already several meteorological stations that will be adapted to the mode and and rate of the collection of data on meteorological parameters as set out by TOGA. 139

Brazillian oceanographic vessels have started to collect oceanographic data across the Brazil Current, using the following equipment: Pegasus, CTD and XBT, in the framework of collaboration between Rhode Island University and Sao Paulo University. The Delegate informed the Programme Group that his country is looking forward to participation in the WOCE programme, to receive data from oceanographic satellites for which it is setting up land stations for reception and data processing. 140

The Delegate of Bulgaria informed the Programme Group of the efforts made by Bulgaria to ensure more active participation of Bulgarian scientists in oceanographic components of the WCRP. In particular, he drew the attention of the participants of the following activities of his country: 141

(i) starting in 1983, within the framework of the IODE, the data collected by research vessels in the Black Sea are submitted for international exchanges;

(ii) A National Oceanographic Data Centre has been established in Sofia which has direct links with the Telecommunications Centre, responsible within the WMO for Southeastern Europe;

(iii) The Academy of Sciences of Bulgaria has received a research vessel of middle tonnage - the R.V. AKADEMIC - which would participate in future in certain oceanographic activities under WCRP;

(iv) the People's Republic of Bulgaria declared to the IOC its willingness to provide, in 1985-1986, two fellowships each of 9 months' duration for the training of specialists in the University of Sofia in the fields of oceanography and meteorology.

He also indicated the possiblity of the wider use of merchant ships for the collection of meteorological and oceanographic data in certain oceanic areas. In this connection, provision of modern oceanographic instruments is required. 142

The Representative of the International Atomic Energy Agency informed the Programme Group that, - since 1961, the International Atomic Energy Agency has been collecting and publishing data on isotopic composition of water (stable isotopes of hydrogen, oxygen and tritium), of precipitation, on a global scale (approximately 200 stations of the WMO network) on a mean monthly basis. Seven volumes of the data are available for the construction of a general global picture of the circulation of the atmosphere and the surface water of the oceans. 143

The Delegate of Portugal informed the Programme Group of the implementation of the research programme "Climate and Variability of the North Atlantic" (CLIVA) , which the Oceanography Group of the University of Lisbon is conducting with the collaboration of the NOAA/National Ocean Service (U.S.A.). The first phase of the Programme is for 1983-1986. The objectives of the programme are: 144

(i) establishment of XBT and surface-salinity monitoring with VOS along a zonal transect at mid-latitudes in the North Atlantic;

(ii) study of heat content and fluxes on seasonal to interannual time scales with mesoscale resolution (approximately 100 km);

(iii) estimation of (zonal) de-correlation length and time-scales;

(iv) analysis of available MBT and XBT data for the subtropical North Atlantic in order to establish background mean fields and fluctuations; and

(v) contribution to operational meteorological and oceanographic analyses and forecasts, particularly by transmitting XBT data via GTS as a contribution to IGOSS.

145 The Delegate of China informed the Programme Group that, since 1978, China had conducted several surveys by research vessels in the equatorial Pacific, in which the surface and sub-surface ocean parameters have been measured. In addition, during the Global Atmospheric Research Programme (GARP), upper-air wind measurements and sea-surface meteorological observations were made. In the future, China will gradually conduct essential surveys in this area. Some observations have been made along the major navigation routes in the Pacific and Indian Oceans. China is interested in the world sea level programme and willing to make contributions in this field. China organized and hosted in 1984 a training course on tidal observation and data processing with the collaboration of IOC. China is also improving its tidal-gauges and is willing to provide data from some of her tidal stations for international exchange.

146 The Delegate of the Netherlands informed the Programme Group that apart from the general interest of the Netherlands in the WCRP and its oceanic component, and the importance of the international developments in the organization of national activities, the Humidity Exchange Over the Sea (HEXOS) experiments should be mentioned. Institutions from the Netherlands, U.S.A., Canada, U.K., Ireland and Greece take part in these experiments which aim at better defining the latent heat and water exchange, especially at high wind speeds. It is believed that this will result in the improved data on the atmosphere-ocean coupling.

147 The Delegate of Japan introduced briefly a plan proposed by Japanese Oceanographers: the Ocean Mixed Layer Experiment (OMLET). Japan is located close to the western boundary current of the North Pacific Ocean, and the objective of the plan is the mixed layer study in this region. The problems particular to this region are:

(i) that the horizontal re-distribution of heat from the Kuroshio, and the Kuroshio extension, to the adjacent sea areas is very important in the heat balance as well as the one-dimensional air-sea heat exchange; and

(ii) that the winter deep convection, plus some other processes which have not been elucidated yet, cause the formation of sub-tropical mode water, the variation of which would have a significant role in the climatic variation.

The main objectives of this experiment are:

(i) to create a data base by intensive monitoring of seasonal cycles, including the deep convection; and

(ii) to investigate the processes that control the heat balance and the variation of the mixed layer in this particular sea area.

Attaining these objectives will help in the construction of a model 148
that could describe the variability of the mixed layer and the heat flow of this sea area, possibly in relation to the variability of the Kuroshio.

OMLET is thus a study of the gyre region of the North Pacific, and 149
is therefore a Pacific precursor of the World Ocean Circulation Experiment (WOCE). At the same time, it will contribute to Stream I of the WCRP, since it will contribute directly to the understanding of the life cycle and the predictability of the sea-surface temperature anomaly, in this particular region.

Most of the universities that have a physical oceanography 150
laboratory will be involved in OMLET, and scientists of the Japan Meteorological Agency and the Hydrographic Department of the Maritime Safety Agency are expected to participate in this Programme.

The Delegate of the Soviet Union informed the Programme Group of 151
the implementation of a multinational programme "Sections" (Energetically active zones of the ocean (EAZO) and climate variability) carried out by the Soviet Union, German Democratic Republic, Bulgaria and Poland. Since the beginning of the programme in 1981, 104 cruises have been carried out in five EAZO's in the North and Tropical Atlantic and the North-Western Pacific. The preliminary evaluation of scientific results of the "Sections" were made at a National Conference in May 1984 and an International Conference in October 1984, in Sofia, Bulgaria. At those conferences, the following major topics were discussed: development of oceanographic and coupled ocean-atmosphere models and results of numerical experiments; oceanographic data analysis and assimilation; observational programmes and data management, and the study of variability of oceanographic characteristics in EAZO. The scientific papers presented at the Conference are in press and they will be published in the VINITI series "Itogi nauki i Techiki" "Atmosphere, ocean, space - "Sections" programme", (editor-in-chief-Academician G.I. Marchuk), under which 4 volumes have already been issued on various aspects of the "Sections" programme.

The Representative of CPPS indicated the interest of his 152
organization in participating in oceanographic and meteorological aspects of the WCRP. The adequate infrastructure and co-ordination mechanisms had been developed particularly for implementation of the regional study of the El Nino phenomenon (ERFEN), which includes national institutions and bodies such as the Scientific Committee for ERFEN and the Joint IOC-WMO-CPPS Working Group on the Investigations of El Nino.

He also stated that efforts and support are required to improve national capabilites in the field of ocean observations and data management in order to increase the efficiency and quality required for ERFEN studies and active participation in the WCRP. He identified the following important tasks in this connection: 153

(i) provision of advice and support in scientific planning of regional programmes and their implementation; and

(ii) evaluation and improvement of the quality of the results of observations.

8. TRAINING, EDUCATION AND MUTUAL ASSISTANCE IN THE MARINE SCIENCES: (TEMA) REQUIREMENTS

The Assistant Secretary drew the attention of the Programme Group to the decision and the proposals made by the IOC Executive Council, at its Seventeenth Session, which recognized that the global nature of the WCRP demands that all countries be involved and that developing countries were still not involved to a great enough extent. The Executive Council urged the Member States, through the Working Committee for TEMA, to define a TEMA component of the oceanographic components of the WCRP, including the identification of needs and offers through the IOC Volunatry Assistant Programme (VAP). It recognized that the WCRP could serve as the catalyst for changing VAP into an effective TEMA component, as the Global Atmospheric Research Programme (GARP) had been for the WMO Voluntary Co-operation Programme (VCP). Member States were urged to pursue this line of development of international co-operation actively, and the Secretary was instructed to develop an appropriate training programme. 154

The SCOR-IOC Committee on Climatic Changes and the Ocean, at its Sixth Session, expressed concern about the participation of developing-country scientists in the planning and implementation of the WCRP and the interpretation of data sets for regional applications. There was a general feeling that these scientists are not well informed about the WCRP and, more than likely, most have not focussed their education and research on global oceanographic and atmospheric dynamics and the connection between remote events and local impacts. While, for example, some training opportunities for sea level technicians have been offered through IOC, there is no effort to train graduate students for WCRP purposes. This can be accomplished through university training or the direct assignment to a major climate analysis and prediction centre. The CCCO felt that TEMA activities such as the IOC Voluntary Programme should be used for expanding the observational networks. Three experts, (Drs. Voigt, Barberan and Varadachari) were requested to prepare, with the collaboration of members of the Scientific Steering Groups for TOGA and WOCE, a WCRP-TEMA proposal for consideration by CCCO, at its Seventh Session in 1985. The difficulty in making data and products available to scientists in developing countries so that they can participate in the WCRP (TOGA, for example) was discussed. The IOC was invited to look into this problem. It was 155

also suggested that the WMO be requested to assist since it is in contact and co-operates with many National Weather Services which can distribute data and products available on the GTS. Most airports have weather offices which could be encouraged to support scientific as well as operational needs. If data were made available, scientists would be encouraged to participate in the WCRP.

156 The Chairman of IGOSS informed the Programme Group of the activities of the IGOSS Working Committee related to the ocean climate experiments and of the need of the involvement of developing countries. In particular, he mentioned an implementation meeting to be held in September 1985 to initiate a ships-of-opportunity programme for sub-surface thermal data, and an IGOSS training session proposed to be held immediately prior to the Fourth Session of the Joint Working Committee of IGOSS.

157 The Secretary of IOC provided information on the role and activities of the IOC and its Working Committee on Training, Education and Mutual Assistance (TEMA) and the Unesco/IOC Comprehensive Plan for a Major Assistance Programme to Enhance the Marine Science Capabilities of the Developing Countries, adopted by IOC in 1982, which provides strategies by which TEMA could respond to the emerging needs of developing countries. During the last few years, within TEMA, the training of many specialists from developing countries to enhance participation in IOC Programmes has been supported. In addition, shipboard training and study grants were provided to enable scientists from developing countries to participate in international symposia, and several workshops were organized. Particular reference was made to the Workshop on Improved Uses of Research Vessels, organized in co-operation with FAO and with the support of NORAD (Lisbon, 28 May - 2 June 1984) which emphasized that mutual assistance among countries in the acquisition, chartering, operation and maintenance of research vessels and sea-going equipment could resolve some of the problems confronting the developing countries and advocated the promotion of co-operative use of research vessels.

158 The Secretary of IOC stressed the beneficial role of regional participation in programmes - TOGA and WOCE - and the need to use the IOC Voluntary Assistance Programme to provide assistance to the developing countries within the oceanographic components of the WCRP.

159 The Programme Group agreed that substantial efforts under TEMA will be required by IOC Member States themselves, and by the IOC and the Division of Marine Sciences of Unesco to enable developing countries to participate in the WOCE and TOGA and related ocean-observing programmes. Particular efforts in the very near future should be concentrated on provision of the assistance to the developing countries within the framework of the Global Network of Sea Level Stations and the accelerated development phase of IGOSS. This will require in particular:

(i) provision of the instruments and equipment (XBTs, tide-gauges) needed for implementation of those projects;

(ii) assistance in their installation and maintenance;

(iii) organizaton of training courses on sea level and sub-surface thermal structure measurements and analysis; and

(iv) organization of the workshops on interpretation of WCRP data sets for regional and national applications.

160 The Programme Group, referring to the discussion under Item 5.2, noted with satisfaction that training courses on sea-level measurements and analysis had already been organized by the U.K. and China in 1983 and 1984 with the participation of 17 specialists from 16 countries, and that several countries (Australia, Canada, China, France and Portugal) had indicated their willingness to assist some developing countries in developing their sea-level stations. The Programme Group also noted the Manual on Sea Level Measurements and Interpretation, to be prepared soon; - it also noted that the Manual was a form of assistance for specialists of the developing countries, within this project.

161 The Programme Group noted with concern, however, the lack of responses from the IOC Member States to the requests for assistance received from Member States of the CINCWIO region related to tide gauge network development (as indicated in Doc. IOC/PG-OPC-I/7 Proposal on the Development of a Sea Level Network in the Indian Ocean within the Framework of the IOC Global Network of Sea Level Stations.)

162 The Representative of CPPS emphasized the need that the IOC and WMO intensify their efforts to assist scientists and regional programmes to enable them to participate actively in WCRP programmes through existing mechanisms, such as TEMA, VAP etc. and through direct participation of scientists from developed countries in joint investigations with the scientists of the CPPS region.

163 The Programme Group recommended that strong TEMA components be developed by IOC with the support of Member States and the Division of Marine Sciences of Unesco, so that developing countries could participate actively in the oceanographic activities within the WCRP, particularly with regard to consultant services, provision of instruments and training of technicians and specialists through, inter alia, the IOC Voluntary Assistance Programme and/or bilateral and multilateral assistance mechanisms.

164 Proposals on this matter are included in Recommendations PG-OPC-1.2 and 1.3.

9. GUIDANCE ON PROGRAMME OF WORK AND BUDGET FOR 1986-87 AND OTHER FORMS OF SUPPORT

165 The Programme Group, in the light of the discussion under previous Agenda Items, considered and commented on the proposed schedule for the development and co-ordination of oceanographic components of WCRP and the schedule of related meetings for 1985-1987.

No comments were made regarding the schedule for meetings related to oceanographic activities within the WCRP for 1985-1986. However, the Programme Group recognized that the implementation of the proposed activities would require increased financial support from IOC and other sources. 166

The Secretary of IOC, informed the participants on the preparation of the IOC Draft Programme and Budget for 1986-1987, as a part of the Unesco Programme and Budget for 1986-1987, to be discussed at the Thirteenth Session of the IOC Assembly, although a final decision on the total Unesco budget will be made at the 23rd Session of the Unesco General Conference in November 1985. 167

10. TIMING OF THE SECOND SESSION

The Programme Group agreed that its Second Session should, if possible, be held in 1987 prior to the Fourteenth Session of the IOC Assembly. 168

ELECTION OF CHAIRMAN AND VICE-CHAIRMAN

Prof. Dr. Sc. K. Voigt (German Democratic Republic) was unanimously elected Chairman of the Programme Group, following his nomination by the Delegate of the United Kingdom, seconded by the Delegates of France and Poland. 169

Capt. L.C. Ferreira da Silva (Brazil) was unanimously elected Vice-Chairman of the Programme Group, following his nomination of the Delegate of Spain, seconded by the Delegates of Mexico and Peru. 170

11. ADOPTION OF THE SUMMARY REPORT

The Programme Group adopted four Recommendations (Annex III, hereto) and agreed to submit these recommendations, together with an Executives Summary of the Session, to the Thirteenth Session of the IOC Assembly. 171

The Programme Group did not have enough time to review, in detail, the Draft Summary Report; it agreed that the participants provide their comments to the Secretariat in written form so that the final version of the Summary Report could be prepared by the Secretariat with the collaboration of the Chairman, Vice-Chairman and Rapporteur of the Programme Group. 172

12. CLOSURE

The Chairman of the Programme Group closed the Session on 8 March 1985. 173

AGENDA

1. OPENING

2. ADMINISTRATIVE ARRANGEMENTS

   2.1 ADOPTION OF THE AGENDA

   2.2 ELECTION OF CHAIRMAN AND VICE-CHAIRMAN

   2.3 DESIGNATION OF A RAPPORTEUR

   2.4 CONDUCT OF THE SESSION

3. THE WORLD CLIMATE RESEARCH PROGRAMME (WCRP) AND ITS OCEANOGRAPHIC COMPONENT (WCRP-O)

4. EXPERIMENTS FOR THE STUDY OF CLIMATIC CHANGES AND THE OCEANS

   4.1 TROPICAL OCEANS AND GLOBAL ATMOSPHERE (TOGA)

      4.1.1 Review of state of planning and implementation

      4.1.2 Promotion of TOGA implementation by IOC

   4.2 WORLD OCEAN CIRCULATION EXPERIMENT (WOCE)

      4.2.1 Review of state of planning

      4.2.2 Promotion of WOCE development by IOC

5. OCEAN OBSERVING SYSTEMS AND RELATED DATA MANAGEMENT

   5.1 OCEAN OBSERVING SYSTEM DEVELOPMENT PROGRAMME

   5.2 SEA-LEVEL OBSERVING SYSTEM DEVELOPMENT

   5.3 SUB-SURFACE THERMAL STRUCTURE MONITORING PROJECT

   5.4 OCEAN DATA MANAGEMENT REQUIRED FOR WCRP-OCEANOGRAPHY

6. GUIDELINES FOR FUTURE JOINT IOC-WMO INTERGOVERNMENTAL PLANNING AND IMPLEMENTATION OF WCRP-O

6.1 RELATIONS WITH THE JOINT SCOR-IOC COMMITTEE ON CLIMATIC CHANGES AND THE OCEAN (CCCO) AND OTHER CONCERNED BODIES OF IOC AND WMO

6.2 INTERNATIONAL STATUS AND FUNCTIONS OF THE TOGA AND WOCE OFFICES AND THEIR RELATIONSHIP WITH IOC

7. OTHER NATIONAL, REGIONAL AND MULTINATIONAL PROJECTS AND PROGRAMMES RELEVANT TO WCRP-OCEANOGRAPHY

8. TRAINING, EDUCATION AND MUTUAL ASSISTANCE IN THE MARINE SCIENCES: (TEMA) REQUIREMENTS

9. GUIDANCE ON PROGRAMME OF WORK AND BUDGET FOR 1986-87 AND OTHER FORMS OF SUPPORT

10. TIMING OF SECOND SESSION

11. ADOPTION OF THE REPORT

12. CLOSURE

RECOMMENDATIONS

Recommendation PG-OPC-I.1

OCEANOGRAPHIC RESEARCH ACTIVITIES WITHIN THE WORLD CLIMATE RESEARCH PROGRAMME

The IOC Programme Group on Ocean Processes and Climate,

A

Recalling Resolutions XI-3 (IOC's Role in the Study of Climatic Changes and the Ocean), XII-4 (Ocean Dynamics and Climate), and EC-XVII.2 (Establishment of the Programme Group on Ocean Processes and Climate),

Recognizing that many countries have initiated studies of the role of the ocean in climatic changes and variability, and related aspects,

Expresses its satisfaction with the progress made by the Joint SCOR-IOC Committee on Climatic Changes and the Ocean (CCCO), in collaboration with the Joint WMO-ICSU Scientific Committee (JSC) for the World Climate Research Programme (WCRP) in formulating and planning the oceanographic activities in the WCRP and notably the major experiments known as the Study of the Tropical Oceans and Global Atmosphere (TOGA), and the World Ocean Circulation Experiment (WOCE);

B

Recognizing that implementation of the proposed experiments requires the active participation of IOC Member States and the involvement of most of the major IOC technical and regional subsidiary bodies,

Recommends that the IOC, at the Thirteenth Session of its Assembly,

(i) endorse the work plan contained in the Annex to this Recommendation for the development and co-ordination of TOGA and WOCE,

(ii) formally advise WMO and ICSU of IOC's wish to co-sponsor the Informal Intergovernmental Planning Meeting on the Implementation of the WCRP, and

(iii) offer to co-sponsor, in co-operation with SCOR and WMO, the International Conference on the WOCE.

Annex to Recommendation PG-OPC-I.1

Subject	Bodies	Timing
- Distribution of the TOGA Scientific Programme Plan to Member States	IOC-WMO	June 1985
- Consideration of a Draft Implementation Plan for the WCRP (including TOGA and WOCE)	JSC-CCCO	October 1985

- Distribution of the First Implementation Plan for the WCRP to IOC Member States for identification of participation	IOC	end 1985
- Informal Intergovernmental Planning Meeting on the Implementation of the WCRP	WMO, IOC and ICSU	March-April 1986
- Consideration of the First Implementation Plan for the WCRP (including TOGA and WOCE) by IOC	IOC (PG/OPC)	1987
- Distribution of the WOCE Plan to the Member States of IOC and WMO for identification of participation	IOC-WMO	beginning 1987
- International Conference on the WOCE, to consider the WOCE Implementation Plan	IOC, WMO and ICSU	1987-1988

Recommendation PG-OPC-I.2

GLOBAL SEA-LEVEL OBSERVING SYSTEM

The IOC Programme Group on Ocean Processes and Climate,

Noting the request addressed to the Commission by the Joint SCOR-IOC Committee on Climatic Changes and the Ocean to assist in the development of a Global Sea-Level Observing System in support of the World Climate Research Programme,

Having carefully evaluated the Proposal for the Global Network of Sea-Level Stations (Document IOC-XIII/8 Annex 1),

Recognizing the value of sea-level observations for many other scientific and practical applications including coastal-zone management, the provision of sea-truth data, and calibration of satellite altimetry for studies of the long-term trends and their relationship to ocean warming and glacial melting, and their significance for tectonic processes,

Further recognizing the success of the IGOSS Sea-Level Pilot Project (ISLPP) in the operational collection of sea-level data and dissemination of sea-level data products for the Pacific basin,

Recommends that the IOC Assembly, at its Thirteenth Session, approve the above-mentioned Proposal as the basis for a Global Sea-Level Observing System;

Recommends also that the IOC Assembly authorize the Secretary to call upon a guiding group of experts to assist with the development of the Global Sea-Level Observing System and to draft appropriate terms of reference;

Requests the major regional subsidiary bodies of the Commission to give the required priority to the implementation of sea-level observing networks within their respective oceanic regions;

Requests the Joint SCOR-IOC Committee on Climatic Changes and the Ocean to continue its work on formulating scientific requirements for sea-level data and analyses for various oceanic areas, especially for the tropical oceans, the South Pacific and the South Atlantic;

Requests the Joint IOC-WMO Working Committee for IGOSS to continue its activities in the operational exchange of sea-level data and in the dissemination of operational sea-level products;

Requests the Secretary of IOC, and the Division of Marine Sciences of Unesco, with the support of Member States and organizations concerned, to develop and promote the required TEMA components in support of the Global Sea-Level Observing System and of its regional networks;

Urges the Member States to participate in the implementation of the Global Sea-Level Observing System by:

(i) maintaining existing, and establishing new, sea-level stations as indicated in the Proposal;

(ii) providing assistance and support to developing countries through, inter alia, the IOC Voluntary Co-operation Programme and/or bilateral and multilateral assistance mechanisms, by providing tide gauges and spare parts, by assisting in the installation and maintenance of such gauges, and by providing training for specialists and technicians in the installation, operation, and maintenance of such gauges, and in the analysis of data derived therefrom;

(iii) submitting mean sea-level data to the PSMSL.

Recommendation PG-OPC-I.3

OCEAN OBSERVING SYSTEM DEVELOPMENT PROGRAMME IN SUPPORT OF THE WORLD CLIMATE RESEARCH PROGRAMME

The IOC Programme Group on Ocean Processes and Climate,

Recalling Resolution XII.4 (Ocean Dynamics and Climate) on the preparation of a comprehensive international programme for ocean monitoring for the purpose of the WCRP,

Having reviewed the proposals of the Joint SCOR-IOC Committee on Climatic Changes and the Ocean, addressed to the Commission, on the Ocean Observing System Development Programme (IOC Technical Series No. 27), as well as proposals for accelerated development of IGOSS (Documents IOC-XIII/8 Annex 4 and IOC/PG-OPC-I/8), and a proposal for the establishment of an international consortium for the co-operative implementation of drifting-buoy programmes (Document IOC-XIII/8 Annex 2),

Recommends that, in developing ocean-observing systems in support of the World Climate Research Programme, IOC's main effort in the immediate future be focused on the following activities:

(i) promotion and development of a Global Sea-Level Observing System,

(ii) promotion and development of a drifting-buoy programme (jointly with WMO) for oceanographic and meteorological purposes;

(iii) promotion and development of ocean sub-surface thermal structure monitoring in the framework of IGOSS;

Recommends that the IOC, at the Thirteenth Session of its Assembly,

(i) approve the concept of an Acceleration Phase for IGOSS (Document IOC-XIII/8 Annex 4) and the Accelerated IGOSS Action Plan (Document IOC/PG-OPC-I/8),

(ii) request the Joint IOC-WMO Working Committee for IGOSS to prepare and submit an Implementation Plan on the IGOSS Observing System (IOS) and on the accelerated development of the IGOSS Data Processing and Services System (IDPSS) to the next session of the IOC Executive Council for consideration with a view to its approval,

(iii) support, in principle, the establishment of an international consortium for the co-operative implementation of meteorological and oceanographic drifting-buoy programmes;

(iv) urge Member States

- to take measures with a view to substantially increasing input of BATHY/TESAC data into the GTS system,

- to expand their BATHY/TESAC programmes in the data-deficient areas (tropical zones and southern hemisphere),

- to provide assistance to developing countries to enable them to participate actively in an IGOSS ship-of-opportunity programme,

- to facilitate implementation, in coastal waters under national jurisdiction, of research and monitoring programmes formally approved by the Commission, and

- to participate actively in the Joint WMO-IOC Preparatory Meeting on the Establishment of a Drifting-Buoy Consortium,

(v) call on the Working Committee on International Oceanographic Data Exchange to consider ways and means for ensuring timely submission and exchange of oceanographic data through the IODE system to meet the requirements of TOGA and WOCE for data collection and analysis,

(vi) instruct the Secretary of IOC to promote the required TEMA support, taking into account the advice of the appropriate technical and regional subsidiary bodies of the IOC, and

(vii) invite the Unesco Division of Marine Sciences to provide support for the TEMA components of the ocean-observing activities.

Recommendation PG-OPC-I.4

INTERNATIONAL MECHANISM FOR CO-ORDINATION AND DEVELOPMENT OF OCEANOGRAPHIC COMPONENTS OF THE WORLD CLIMATE RESEARCH PROGRAMME

The IOC Programme Group on Ocean Processes and Climate,

Recalling the definition of the ICSU-WMO World Climate Research Programme which calls for joint actions of the oceanographic and meteorological communities to meet the overall objectives and priorities of the Programme,

Recalling Resolution XII-4 concerning preparation of a detailed study of the international mechanism required for implementation of the proposed large-scale oceanographic experiments, and Resolution EC-XVII.2 on the establishment of the IOC Programme Group on Ocean Processes and Climate,

Noting the "Principles governing co-operation between Unesco and ICSU on the development of the oceanographic component of the WCRP through the IOC and SCOR" and the "Memorandum of Understanding between the IOC (of Unesco) and the SCOR (of ICSU)" on the modus operandi of the Joint SCOR-IOC Committee on Climatic Changes and the Ocean,

Having reviewed the organizational structure and international mechanisms for co-ordination and development of oceanographic components of the World Climate Research Programme, and functions and structure of the international planning offices for TOGA and WOCE,

Taking into account the arrangements between the WMO and the United States regarding the International TOGA Office and between the SCOR-IOC CCCO and the JSC for the WCRP and the United Kingdom regarding the International WOCE Office,

Recommends that

(i) the Assembly instruct the Secretary of IOC to make the necessary arrangements with WMO to define specific contact points in both organizations and procedures for co-ordination of intergovernmental aspects of the implementation of TOGA and WOCE experiments,

(ii) the Assembly instruct the Secretary of IOC to arrange for IOC Governing Bodies to be regularly and fully informed of progress in planning and proposals for implementation of the oceanographic components of the WCRP with a view to endorsing them as appropriate,

(iii) the Assembly urge the Member States of the Commission to organize, through their oceanographic and meteorological communities, their participation in the World Climate Research Programme, and mobilize their oceanographic and meteorological communities to this effect;

Further recommends that IOC note the arrangements for the establishment of an International WOCE Planning Office, and

Urges that appropriate arrangements and liaison be established for dealing with matters requiring intergovernmental action through IOC.

LIST OF PARTICIPANTS

I. PARTICIPANTS FROM MEMBER STATES

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Permanent Service for Mean Sea Level (PSMSL)	Dr. D. Pugh Director PSMSL Bidston Observatory Birkenhead Merseyside L43 74A United Kingdom (Also representing the United Kingdom)

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Comisión Permanente del Pacífico Sur (CPPS)	Mr. Luis Arriaga Secretario General CPPS Paez 370, 60 Piso, y Robles Quito Ecuador

III. IOC SUBSIDIARY BODIES

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Joint CCCO/JSC Scientific Steering Group for the Tropical Oceans and Global Atmosphere (TOGA)	Dr. F. Webster College of Marine Studies University of Delaware Lewes, DE 19958 USA
Joint CCCO/JSC Scientific Steering Group for the World Ocean Circulation Experiment (WOCE)	Prof. J. Woods Institut für Meereskunde an der Universität Kiel Dusternbrooker Weg 20 D - 2300 Kiel 1 Federal Republic of Germany
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Programme Group for the Wester Pacific (WESTPAC)	Dr. J. Bunt Chairman WESTPAC Director Australian Institute of Marine Science P.M.B. 3 Townsville M.S.O. QLD 4810 Australia (Also representing Australia)

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Past Chairman	Dr. A. Ayala-Castañares Director Instituto de Ciencias del Mar y Limnología Universidad Nacional Autónoma de México Apartado Postal 70-157 México 20 DF México

V. SECRETARIAT

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Technical Secretary	Dr. A. Tolkachev
Assistant Secretaries	Mr. R.C. Griffiths Dr. Y. Oliounine Mr. B. Thompson (Secretary, Joint SCOR-IOC CCCO) Dr. F. Robles Dr. K. Kitazawa Mr. Y. Tréglos Mr. J. Lyons (IGOSS Operations Co-ordinator)
Consultant	Mr. A. Alexiou

DATA REQUIREMENTS AND DATA MANAGEMENT FOR WCRP

A. TOGA DATA REQUIREMENTS (1)

	Parameter	Horizontal (Vertical) Resolution	Time Resolution	Accuracy
1.	Upper Air Winds	500 km (two levels 900 and 200 mb)	1 day	3 m/sec
2.	Tropical Wind Profiles	2500 km (100 mb)	1 day	3 m/sec
3.	Surface Pressure	1200 km	1 day	1 mb
4.	Total Column Precipitable Water	500 km	1 day	0.5 g/cm^2
5.	Area Averaged Total Precipitation	2°lat x 10°long	5 days	1 cm/5 days
6.	Global SST	5° x 5°	30 days	0.5 K
7.	Tropical SST (§)	2°lat x 2°long	15 days	0.3 K-0.5 K
8.	Tropical Surface Wind	2°lat x 10°long	5 days	2 m/sec
9.	Tropical Surface Wind Stress	2°lat x 10°long	5 days	0.04 Pa (§§§§)
10.	Surface Short-Wave Radiation	2°lat x 10°long	30 days	10 Watts/m^2
11.	Surface Humidity	2°lat x 10°long	30 days	0.5 g/kg
12.	Tropical Sea Level	(§§)	1 day	2 cm
13.	Tropical Ocean Sub-Surface Temperature	2°lat x 10°long (five levels 0-500 m)	30 days	0.25 K
14.	Tropical Ocean Surface Salinity (§§§)	2°lat x 10°long	30 days	3 x 10^{-5}
15.	Tropical Ocean Surface Circulation	2°lat x 10°long	30 days	0.1 m/s
16.	Sub-Surface Equatorial Currents	40°long (5 levels)	as recorded	0.1 m/s

(§) The combined space/time resolution and accuracy specification is not feasible at present. Priority is then given to the space/time sampling requirement. The higher accuracy requirement only applies to the regions of warmest water (over 25°C).

(§§) As permitted by the existence of suitable sites.

(§§§) Systematic monitoring of the changes of sub-surface salinity on some meridional transects across the tropical zone (5 levels in the upper 200 m) will be valuable when appropriate instruments become available.

(§§§§) These numbers are estimates. The requirement is that the 30-day average have an accuracy of 0.5 m/sec (wind) and 0.01 Pa (stress).

(1) As formulated by the SSG for TOGA at its 3rd session (April 1984).

B. PROPOSED TOGA DATA MANAGEMENT CENTRES (§)

1) Tropical Upper Wind Data Centre - to provide data on large-scale, low-frequency variations of the tropical atmospheric wind field.

2) Precipitation Data Centre - to provide large-scale precipitation statistics for the 20°N - 20°S latitude band.

3) Air-Sea Interface Data Centre - to provide gridded fields of surface fluxes at the air-sea interface, for the 20°N - 20°S latitude band.

4) Surface Wind Data Centre - to provide wind stress fields over the ocean surface, for the 20°N - 20°S latitude band.

5) Tropical Sea-Level Data Centre - to provide maps of monthly sea-level anomalies over the three tropical ocean basins.

6) Global Sea Surface Temperature Data Centre - to provide global fields of mean sea-surface temperature.

7) Ocean Subsurface Data Centres - to provide for the centralized collection of quality-controlled Level II-b data (one centre for each of the three oceans).

(§) pages 2, 3 of this Annex are extracts from Document IOC/INF-617 "Report of the CCCO-IGOSS-IODE and the Meeting on WCRP Ocean Data Management (Paris, 8 - 12 October 1984).

C. SATELLITE DATA EXPECTED DURING THE 1984-1995 PERIOD

SST

NIMBUS SMMR (still going)
NROSS LFMR late 1989
NOAA series 5 channel vis & IR
ATSR/M on ERS-1 1990 (ESA)

Altimeter

Geosat Alt late 1985 (Navy) & late 1987
NROSS Alt 5 cm
TOPEX/POSEIDON Alt 1991 3 cm
ERS-1 Seasat class
MOS-2 Alt Japan mid 1990's

Winds

Speed from altimeters to 2 m/sec
Speed from SMMR to 2 m/sec
Speed & direction from NSCATT. NROSS
Winds aloft from WINDSAT
Speed & direction from scatterometer on MOS-2

Wave Information

Height from altimeter to 50 cm or 10%, whichever greater
From Seasat SAR (wavelength & direction)
Probably SAR on ERS-1

H_2O Vapour, rain rate, ice

SMMR on Nimbus (still going)
SSM/I on DMSP 1986
on TOPEX/POSEIDON 1990
on NROSS

Colour

NIMBUS CZCS (still going)
OCI (colour imager) launch 1990
8 channels, 2.5 mbit/sec

"Organizational Structure and International Mechanisms for Co-ordination and Development of Oceanographic Components of the World Climate Research Programme"

A. PRINCIPLES GOVERNING CO-OPERATION BETWEEN UNESCO AND THE INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS (ICSU) ON THE DEVELOPMENT OF THE OCEANOGRAPHIC COMPONENT OF THE WORLD CLIMATE RESEARCH PROGRAMME, THROUGH THE IOC AND SCOR

PREAMBLE

In the tradition of their close association, ICSU and Unesco have agreed to co-operate in the development of the oceanographic component of the WCRP through the Scientific Committee on Oceanic Research (SCOR) and the Intergovernmental Oceanographic Commission (IOC). To that effect, these bodies have established the Joint Committee on Climatic Changes and the Ocean (CCCO). The oceanographic component of the WCRP will be composed, as appropriate, of non-governmental and intergovernmental activities. Those activities requiring intergovernmental co-ordination, such as ocean monitoring and other ocean services, will be the responsibility of the IOC. In order to facilitate the preparation of the ICSU/Unesco Agreement and the SCOR/IOC Memorandum of Understanding on the Joint Committee, the following principles have been agreed.

PRINCIPLES

1. The development of the oceanic component of the World Climate Research Programme (WCRP) comprises field projects or experiments, each of them divided into two phases - a planning phase and an implementation phase.

2. The Joint Committee is entrusted with the planning of the field projects or experiments part of the Scientific Programme and would also advise on organizational requirements for implementation.

3. Within the programme of work and budget approved by SCOR and IOC, the Joint Committee has authority and freedom of action to develop the planning phase of the field projects and experiments of the scientific programmes, including convening of meetings, selections of experts, preparation of recommendations and reports, and other activities compatible with this objective such as facilitating co-operation in field projects or experiments not requiring intergovernmental co-ordination.

4. The Secretary of IOC and the Secretary of SCOR may, at their discretion, review the operation of the Joint Committee (normally at the time of meetings of the executive/governing bodies of SCOR

and IOC). Results of the reviews undertaken at other times will be communicated to the Chairman of IOC and the President of SCOR with a copy to the Chairman of the Joint Committee. The Chairman of the Joint Committee would then address and resolve any problems identified. In the unlikely event that a problem cannot be solved, it would be referred to the appropriate authorities of IOC and SCOR for resolution.

5. The IOC will act as the intergovernmental body responsible for the overall co-ordination of the oceanographic component of the World Climate Research Programme (WCRP) and related supporting ocean services (e.g., ocean data exchange; training, education and mutual assistance; ocean monitoring) and other activities requiring international co-operation through the concerted action of Member States.

6. Some projects or experiments need intergovernmental co-ordination, especially to facilitate field activities through the concerted action of Member States, to establish the required logistic support and to mobilize adequate funding. The IOC will establish an intergovernmental subsidiary body for the overall co-ordination as indicated above, and will operate through existing or new subsidiary bodies (e.g., IOCARIBE, WESTPAC), as necessary, for the co-ordination of specific field projects or experiments. The Joint Committee will advise these bodies on these projects and will monitor their scientific progress.

7. The Secretary of the Joint Committee shall be appointed by the Director-General of Unesco taking into account the views expressed by IOC, SCOR and the Joint Committees or their appropriate representatives. The Secretary of the Joint Committee shall be a member of the IOC Secretariat and shall be under the authority of the Director-General of Unesco whose prerogatives as the Executive Head of the Organization shall be maintained. For scientific purposes he will be directed by the Chairman of the Joint Committee. On matters concerning the implementation phase which require intergovernmental co-ordination arranged by the IOC, or interaction between the work of the Joint Committee and other work of the Commission (e.g., IODE and TEMA), and on matters having institutional, operational or policy implications or of an administrative and procedural nature, he will be under the supervision of, and report to, the Secretary of IOC.

8. To facilitate the work and the required close interaction between the IOC and the Joint Committee, the Secretary thereof shall keep the Secretary of IOC adequately and currently informed In all administrative matters he shall follow Unesco/IOC procedures.

B. MEMORANDUN OF UNDERSTANDING BETWEEN THE INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (OF UNESCO) AND THE SCIENTIFIC COMMITTEE ON OCEANIC RESEARCH (OF ICSU)

The Intergovernmental Oceanographic Commission and the Scientific Committee on Oceanic Research,

Mindful of the scientific and societal importance of achieving a better understanding of variations and changes in climate and, in particular, the role of ocean-atmosphere interaction in these variations and changes,

Having established a Joint Committee on Climatic Changes and the Ocean (CCCO) hereafter referred to as the Joint Committee, as the main scientific body for the formulation of the overall scientific concepts and of the scientific programme needed to provide an understanding of the role of the oceans in the climate variation and change,

Agree to formalize the Joint Committee's terms of reference and mode of operation, as follows:

1. TERMS OF REFERENCE

The Joint Committee shall:

(i) identify ocean-climate research problems requiring increased international attention, stimulate research activities thereon and recommend to IOC and SCOR how these activities should be implemented;

(ii) establish requirements for ocean observations that are needed to improve climatic forecasts over seasonal, interannual, and decadal time scales and to gain a greater understanding of oceanic aspects of the carbon dioxide problem;

(iii) collaborate, as appropriate, with the Joint ICSU/WMO Scientific Committee (JSC) for the World Climate Research Programme (WCRP) and with other relevant scientific bodies;

(iv) review relevant activities of SCOR and IOC and suggest ways whereby these activities could be made more effective in meeting the requirements of the WCRP, particularly the oceanographic component;

(v) prepare budgetary project proposals, with justification, for each Unesco biennial period, for approval by the governing/executive bodies of SCOR and IOC;

(vi) report regularly to the governing/executing bodies of IOC and SCOR on the Joint Committee's activities and the state of implementation of agreed decisions and recommendations, for approval and action deemed appropriate;

(vii) undertake other appropriate tasks assigned jointly by the sponsoring bodies.

2. RULES OF PROCEDURE

2.1 Membership

(i) The Joint Committee shall consist of not more than 15 scientists selected by the Chairman of IOC and the President of SCOR, by mutual agreement, and appointed jointly by them. The members of the Joint Committee shall be selected for their scientific knowledge, capability and global vision, keeping in mind the desirability of ensuring an adequate participation of experts from the major oceanic regions.

(ii) Members will normally serve one term of four years, but may be invited to serve up to two additional two-year terms. Membership will be arranged so that approximately 25% of the members complete their terms in a given year.

2.2 Officers

The Officers of the Joint Committee shall be:

(i) the Chairman, elected from amongst its members by the Joint Committee itself, for one period of two years, and who may be re-elected for one further two-year term;

(ii) the immediate Past-Chairman;

(iii) two Vice-Chairman, elected from amongst its members by the Joint Committee itself, for one period of two years, and who may be re-elected for one further two-year term.

2.2.1 The duties of the Chairman shall be:

(i) to preside over the sessions of the Joint Committee;

(ii) to guide and co-ordinate the work of the Joint Committee and the subsidiary groups of experts between sessions of the Joint Committee;

(iii) to carry out such specific duties as are prescribed by the governing/executive bodies of SCOR and IOC, acting in unision;

(iv) to submit reports to the governing/executive bodies of SCOR and IOC at their regular sessions on the activities of the Joint Committee;

(v) to act, on behalf of the Joint Committee, on matters requiring urgent decisions;

(vi) to provide technical guidance to the Secretary of the Joint Committee.

2.2.2 The duties of the Vice-Chairman of the Joint Committee shall be:

(i) to assist the Chairman in the discharge of his responsibilities;

(ii) to take over from him in the event of his absence.

2.3 Sessions of the Joint Committee

(i) the Joint Committee shall normally meet every two years at the Headquarters of IOC or ICSU, alternately;

(ii) the date and place of the sessions of the Joint Committee shall be decided by its Chairman, in consultation with the Secretary of the IOC and the Secretary of SCOR, taking into account invitations received and costs, particularly when meetings are proposed outside Paris;

(iii) the members of the Joint Committee and other invited participants shall be notified of the arrangements for each session at least 90 days in advance of the session;

(iv) the Joint Committee shall approve the draft report of each session before the end of the session;

(v) the reports of the sessions of the Joint Committee shall be submitted for appropriate action to the governing/executive bodies of IOC and SCOR;

(vi) the reports of the subsidiary bodies of the Joint Committee may be submitted to the governing/executive bodies of IOC and SCOR at the discretion of the Chairman of IOC and the President of SCOR;

(vii) representatives and observers from relevant international scientific and intergovernmental organizations, and individual experts, may be invited to attend sessions of the Joint Committee and of its subsidiary bodies, in accordance with the procedures of SCOR and IOC.

2.4 Subsidiary Bodies

(i) the Joint Committee shall be authorized to create appropriate subsidiary bodies formed by experts acting in their personal capacities (expert panels, study groups, etc.) within the mandate of the Joint Committee and the Programme of Work and budgetary allocations approved by SCOR and IOC, taking into account existing and relevant technical and scientific groups, of which it shall make maximum possible use whenever appropriate;

(ii) the date and place of a session of a subsidiary body shall be approved by the Chairman of the Joint Committee after consultation with the Secretary of the IOC and the Secretary of SCOR, so as to avoid scheduling conflicts;

(iii) in the case of urgency, keeping in mind the principles established in paragraph 2.4 (i), and subject to the concurrence of the Secretary of IOC and the Secretary of SCOR, the Chairman of the Joint Committee may, between sessions, establish any special subsidiary body that may be deemed by him to be essential, and to nominate its Chairman;

(iv) for urgent recommendations made, either in a session or by correspondance by a subsidiary body between sessions of the Joint Committee, the Chairman of the Joint Committee may approve the recommendation, after consultation with the Officers and submit it to the Chairman of IOC and the President of SCOR for approval.

2.5 Secretary of the Joint Committee

2.5.1 The specific duties of the Secretary of the Joint Committee shall be:

(a) to assist in the formulation of detailed plans for the oceanographic component of the World Climate Research Programme (WCRP) and in the organization of related workshops, conferences, symposia and other meetings;

(b) assist with the formulation of requirements for ocean monitoring in support of projects and activities related to climatic changes and the ocean;

(c) to arrange for meetings of the Joint Committee and its subsidiary bodies, in consultation with the Chairman of the Joint Committee and others as appropriate;

(d) to maintain liaison, in respect of the Joint Committee's activities, with the Joint Planning Staff of the WCRP;

(e) to ensure dissemination of relevant information on the activities of the Joint Committee to interested institutions and marine scientists;

(f) to keep IOC subsidiary bodies, SCOR Working Groups and other scientific bodies concerned informed of the activities of the Joint Committee, and request, through appropriate channels, their assistance in carrying out the work of the Joint Committee;

(g) to undertake technical studies at the request of the Joint Committee;

(h) to maintain liaison with the Officers and Members of the Joint Committee and its subsidiary bodies.

2.5.2 Principle No. 7 of the principles adopted by Unesco and the International Council of Scientific Unions as a basis of an Agreement on their co-operation shall apply to the Secretary of the Joint Committee.

3. FINANCIAL ARRANGEMENTS

The Joint Committee shall prepare budget estimates for its work. These shall be submitted through the Secretary of IOC and the Secretary of SCOR for approval by the governing/executive bodies of IOC and SCOR sufficiently in advance of their respective meetings. A report on the expenditures incurred in the previous year will be submitted at the time of presentation of the budgetary estimates for the following year.

4. IMPLEMENTATION

All the major decisions concerning the requirements for the implementation of the Joint Committee's recommendations shall be taken jointly by the two organizations. The implementation may be on a joint basis or one or the other organization may, by mutual consent, accept the sole responsibility, in accordance with its respective mandate. In the case of joint projects, the procedures and methods adopted shall conform to the constitutions of both organizations.

All proposals from the Joint Committee should clearly indicate the requirements for the implementation of the recommemdations, using as far as possible appropriate existing mechanisms.

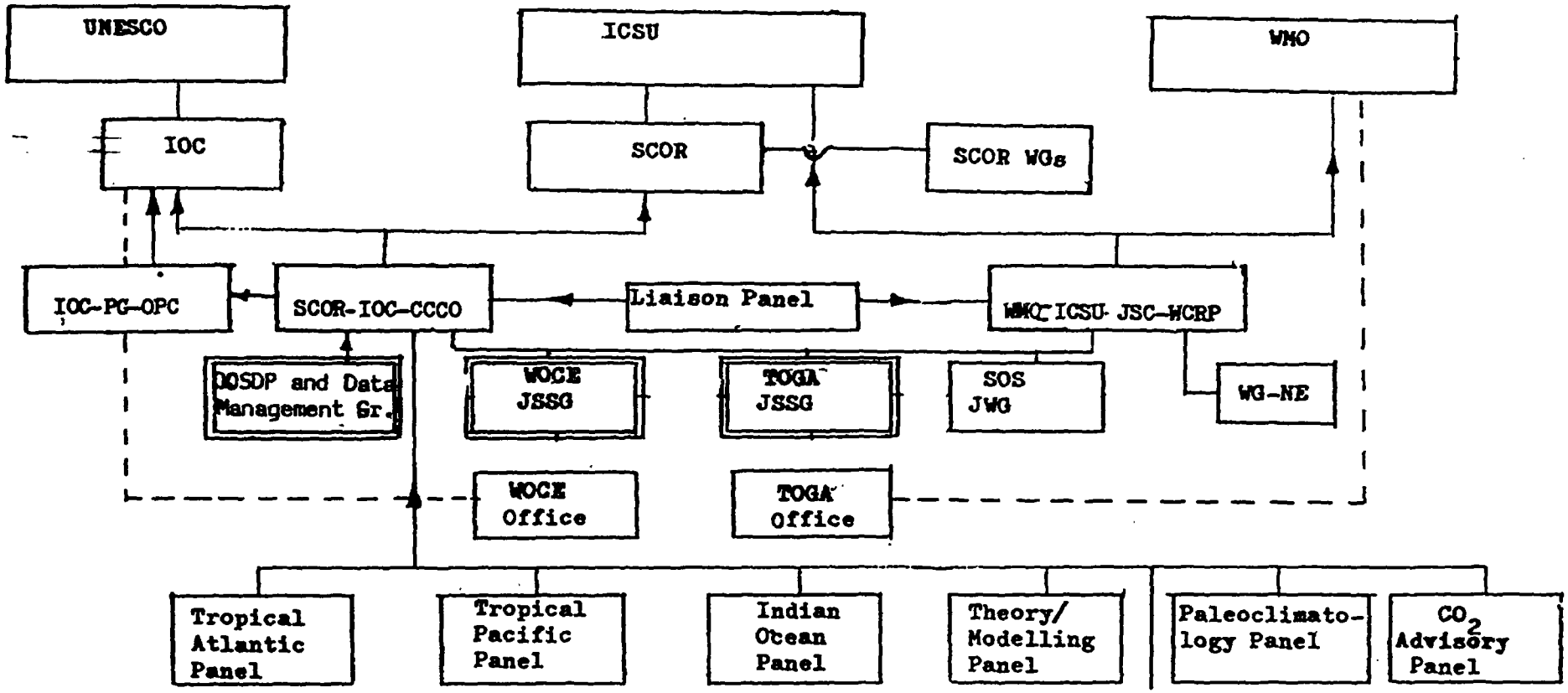
This Memorandum of Understanding shall come into force on 1 February 1984; it shall be reviewed every four years by IOC and SCOR; it may be terminated by either organization with two years' notice.

Signed:

Chairman
Intergovernmental
Oceanographic Commission

Signed:

President
Scientific Committee on
Oceanic Research



PLANNING STRUCTURE FOR THE OCEAN ASPECTS OF THE WORLD CLIMATE RESEARCH PROGRAMME (WCRP)

OCEAN OBSERVATIONAL AND DATA MANAGEMENT ACTIVITIES WITHIN WCRP
REQUIRING PARTICIPATION OF IOC AND ITS SUBSIDIARY BODIES

Activities	IOC Subsidiary Bodies											
					Atlantic Ocean		Indien Ocean		Pacific Ocean			Southern Ocean
	WC - IGOSS	WC - IODE	WC - TEMA	WC - CIPME	IOCARIBE	IOCEA	IOCINCWIO	IOCINDIO	WESTPAC	EL NIÑO	TSU	IOC-SOC
Sea-surface temperature	+				+	+	+	+	+	+		
Sub-surface thermal structure monitoring	⊛	+	+		+	+	+	+	+	+		+
Mean Sea-level monitoring	+	+	+		+	+	+	+	+	+	+	+
Drifting buoy programme (meteorogical and oceano-graphic)	+											
Satellite measurments of the ocean	+	+	+									
Sub-surface floats												
Special air-sea and deep sea measurements aboard research vessels (air-sea flux; tracers)				+								
Oceanic CO_2 measure-ments				+								
Oceano-grapic data management	+	⊛	+	+	+	+	+	+	+	+	+	+

⊛ - main responsibility

LIST OF SCOR-IOC CCCO AND JOINT CCCO-JSC SUBSIDIARY GROUPS INVOLVED IN THE DEVELOPMENT OF THE OCEANOGRAPHIC COMPONENT OF THE WCRP AND LIST OF IOC, SCOR AND WMO SUBSIDIARY BODIES WHICH ARE EITHER ALREADY INVOLVED OR MAY BE INVOLVED IN THESE ACTIVITIES

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1. Joint IOC-SCOR Committee on Climatic Changes and the Ocean (CCCO)

   - Tropical Atlantic Ocean Climate Studies Panel
   - Tropical Pacific Ocean Climate Studies Panel
   - Indian Ocean Climate Studies Panel
   - Modelling and Theory Panel
   - Paleoclimatology Panel
   - CO2 Advisory Panel
   - WCRP Ocean Data Management Group
   - Ad hoc Group on Ocean Observing System Development Programme

2. Joint JSC-CCCO

   - TOGA Scientific Steering Group
   - WOCE Scientific Steering Group
   - Working Group on Satellite Observing Systems for Climate Research

3. JSC - Joint ICSU-WMO Scientific Committee on the World Climate Research Programme

   - JSC Working Group on Numerical Experimentation

4. IOC - Intergovernmental Oceanographic Commission (of Unesco)

   - IOC Programme Group on Ocean Processes and Climate
   IODE - IOC Working Committee on International Oceanographic Data Exchange
   TEMA - IOC Working Committee for Training, Education and Mutual Assistance in the Marine Sciences
   GIPME - IOC Working Committee for the Global Investigation of Pollution in the Marine Environment
   IOCARIBE - IOC Sub-Commission for the Caribbean and Adjacent Regions
   IOCSOC - IOC Programme Group for the Southern Oceans
   WESTPAC - IOC Programme Group for the Western Pacific
   IOCINCWIO - IOC Programme Group for the North and Central Western Indian Ocean
   IOCINDIO - IOC Programme Group for the Central Indian Ocean
   IOCEA - IOC Programme Group for the Central Eastern Atlantic
   ITSU - IOC International Co-ordinated Group for the Tsunami Warning System in the Pacific.

5. Joint IOC-WMO - Joint IOC-WMO Working Committee for the Integrated Global Ocean Services System

6. Joint IOC-WMO-CPPS - Joint IOC-WMO-CPPS Working Group on the Investigation of El Nino

7. WMO - World Meteorological Organization

CAS - WMO Commission for Atmospheric Sciences
CBS - WMO Commission for Basic Systems
CMM - WMO Commission for Marine Meteorology
CCI - WMO Commission for Climatology

8. SCOR - Scientific Committee on Oceanic Research (of ICSU)

WG 66 - Oceanographic Applications of Drifting Buoys
WG 68 - North Atlantic Circulation
WG 69 - Small Scale Oceanic Turbulence
WG 74 - General Circulation of the Southern Ocean
WG 75 - Methodologies for Oceanic CO2 Measurements
WG 79 - Geological Variations in CO2 and the Carbon Cycle
WG 81 - Deep-water Paleo-oceanography
WG 82 - Polar Deep-Sea Paleoenvironments (Proposed)
- Data Assimilation (Proposed)
AOSB - Arctic Ocean Sciences Board

FUNCTIONS AND STRUCTURE OF THE INTERNATIONAL PLANNING OFFICES FOR TOGA(2) AND WOCE(3)

Introduction

The SCOR-IOC Committee on Climatic Changes and the Ocean (CCCO) and the WMO-ICSU Joint Scientific Committee (JSC) for the WCRP were requested by their Scientific Steering Groups (SSG) for TOGA and WOCE to establish international offices to assist in the detailed planning of these two large-scale experiments. The establishment of two offices was subsequently announced: a TOGA office in Boulder Co., USA, hosted by the National Oceanic and Atmospheric Administration; and a WOCE office in Wormley, UK, hosted by the Institute of Oceanographic Sciences. This document provides background information on the negotiations and describes the present organization and functions of these offices and liaison arrangements with CCCO, JSC and their parent bodies.

1. International TOGA Planning Office

The Permanent Representative of the USA to WMO, by his letter of 23 November 1983 "offered to establish an International TOGA Office in the USA located in the National Oceanic and Atmospheric Administration (NOAA) to support the CCCO Secretariat and the Director WCRP in the planning of TOGA". The offer included staff, facilities and secretarial support and was conditional upon the secondment of two additional professionals from other countries. The Secretary General of WMO accepted the USA offer in December 1983, soon after CCCO recommended, at its Fifth Session, that the establishment of the office should proceed. The Seventeenth Session of the IOC Executive Council was informed of these negotiations. The International TOGA Planning Office was established in November 1984, with the charge to assist the Joint CCCO-JSC TOGA Scientific Steering Group in the planning of TOGA through the following specific activities:

- preparing detailed implementation and operations plans for the various components of TOGA
- preparing detailed plans for data management and processing and the production of reference data sets for TOGA, and
- assisting with the documentation and other organizational duties relevant to the planning of TOGA

The specific activities of the International TOGA Planning Office are approved by the Director, WCRP.

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(1) This Annex is reproduced from document IOC/PG-OPC-1/9 "Functions and Structure of the International Planning Offices for TOGA and WOCE"

(2) TOGA - Study of the Interannual Variability of the Tropical Oceans and Global Atmosphere

(3) WOCE - World Ocean Circulation Experiment

The international staff of the TOGA Office is under the direction of Dr. R. Fleming, seconded by the USA. Dr. Fleming was proposed as director by the USA Permanent Representative to the WMO in his original offer accepted by WMO. The second full-time USA staff member assigned to the Office is Mr. T. Osborn, a NOAA employee. At the invitation of WMO, the Government of India has seconded Dr. D. Sikka to the Office. In accordance with the agreement between WMO and the USA, international travel undertaken by staff members of the Office and subsistence allowance for Dr. Sikka are supported by the WMO-ICSU Joint Climate Research Fund. Short-term secondments have also been arranged through the efforts of the Chairman of CCCO. They are Dr. N. Boston - Canada (Feb-May 1985) and Dr. Y. Tourre - France (Feb-March 1985). France has indicated it will evaluate a long-term assignment following Dr. Tourre's initial stay at the Office. Financial support (travel and per diem) is being provided by IOC to Dr. Tourre. Other countries may wish to second scientists to the TOGA office. If so, they may submit their offer through WMO, IOC, SCOR or ICSU.

Scientific direction to the International TOGA Planning Office is given by the Chairman of the TOGA SSG assisted, as necessary, by other designated members of the Group. CCCO has emphasized the need for the Office to carry out its tasks in accordance with the approved Scientific Plans. The Office is charged with the responsibility for keeping the Chairmen of TOGA, JSC and CCCO fully informed of all matters of substance. The Chairman of the TOGA SSG has authority to act intersessionally, with the TOGA SSG being formally responsible to its parent bodies, namely the JSC and CCCO. The present Chairman of the TOGA SSG is Dr. A. Gill (UK). The agreement between WMO and the USA provides for annual reviews to ensure that the Office is operating to the mutual satisfaction of the host agency and the WCRP programme.

2. International WOCE Planning Office

At the invitation of the WOCE Scientific Steering Group, the Institute of Oceanographic Sciences (IOS), Wormley, UK, offered, at the Second Session of the WOCE SSG, January 1984 (WCP-81), to host the International WOCE Planning Office. This offer was endorsed by CCCO and JSC each at their Fifth Session (December 1983 and March 1984, respectively) and the CCCO Officers were instructed to prepare Terms of Reference for the Office in consultation with IOS. These negotiations were reported to the Seventeenth Session of the IOC Executive Council in February 1984.

The offer of the IOS/UK was formalized in January 1985 through an exchange of letters between the Director of IOS (14 January 1985), the Co-chairman of the WOCE SSG, the Chairman of CCCO, and the Natural Environment Research Council of the UK. These letters specified the details of the IOS offer (scientific, technical and secretarial support equivalent to at least two man-years per year, and facilities) and defined the Terms of Reference of the Office. They are, to :

- provide support for the scientific planning of WOCE as it develops within the Scientific Steering Group (SSG) and its associated groups to achieve WOCE goals;

- collaborate and liaise closely with the CCCO secretariat as required by the SSG in forging links with other WCRP components and in the development of appropriate intergovernmental initiatives through WMO and IOC;

- provide facilities for visiting scientists to work with the WOCE Office;

- take part in and develop data management plans as they are needed;

- inform oceanographic colleagues of progress of, and encourage participation in, WOCE;

- arrange Working Groups as required by SSG.

The Director of the International WOCE Planning Office has been designated by the Chairmen of CCCO and JSC, having received an offer from Canada to second Dr. G. Needler (Bedford Institute) to the Office for four years starting in the Spring of 1985. The IOS contribution of two man-years/year will be provided mainly through Mr. J. Crease and Members of the Marine Physics Group and Marine Advisory Service. One or two additional Office staff members will be needed as the programme develops. Member States and organizations are, therefore, invited to consider secondments which, as for TOGA, can be arranged through WMO, IOC, SCOR or ICSU. International travel undertaken by members of the WOCE Office during 1985 will be supported by SCOR.

The WOCE SSG is responsible for providing scientific guidance to the WOCE Office and the Scientific Director reports to the Chairman of the WOCE SSG. The WOCE Office has been advised by the SCOR-IOC CCCO to work through the Secretary of CCCO on intergovernmental aspects of WOCE. The WOCE SSG will report annually on the activities of the WOCE Office, at which time the agreement will be reviewed to ensure that the Office is operating to the mutual satisfaction of IOS, CCCO and JSC.

3. Association of the TOGA and WOCE Offices with WMO and IOC

Although the TOGA and WOCE Offices are presently concentrating on scientific planning, they will eventually need to address organizational matters of an intergovernmental nature. The IOC and WMO have the responsibility for organizing international co-ordination of those aspects of TOGA and WOCE which require the concerted action of Member States. The TOGA Office is placed under the responsibility of the Director of the WCRP who is a WMO staff member. As regards the

implementation of WCRP activities, WMO considered that consultations at the intergovernmental level should take place in the form of Informal Planning Meetings. It is now foreseen that WMO will convene the first Informal Planning Meeting on the WCRP early in 1986.

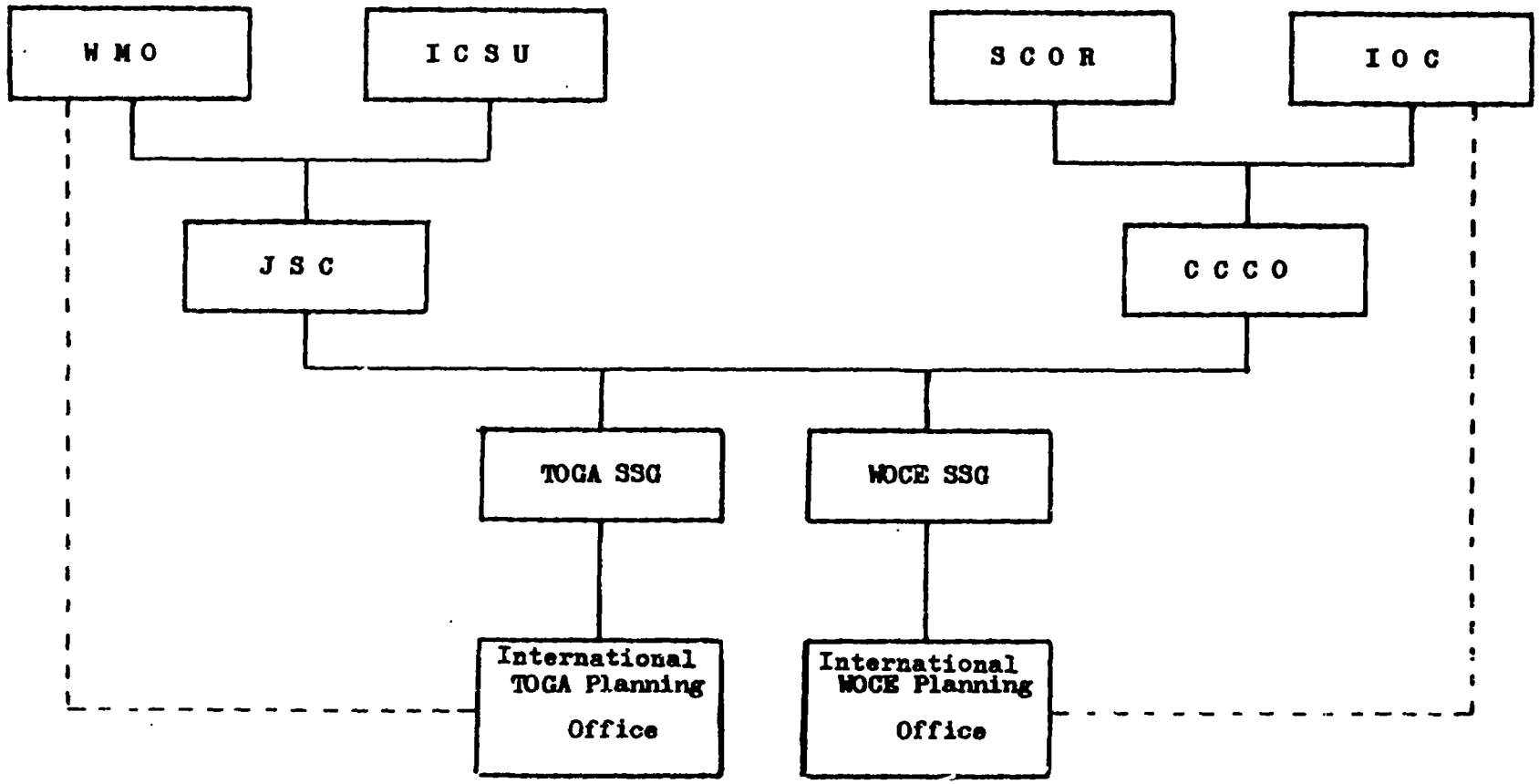
The CCCO has proposed that a similar organizational link between the WOCE Office and the IOC be arranged through the Secretary of CCCO, who is an IOC staff member. The IOC Assembly has established its intergovernmental mechanism - the Programme Group on Ocean Processes and Climate - to address the intergovernmental aspects of the oceanographic components of the WCRP. The Programme Group's primary responsibility is to :

> "promote, on behalf of the Commission, the necessary support and co-ordination at the intergovernmental level to ensure the effective implementation of the oceanographic component of the World Climate Research Programme, having regard to the recommendations of the Joint SCOR-IOC Committee on Climatic Changes and the Ocean, and in consultation with WMO and other agencies and organizations as appropriate."

Therefore, on all activities requiring intergovernmental co-ordination of the TOGA and WOCE experiments, reports on the activities of the TOGA and WOCE Offices should be provided on a regular basis to the IOC Programme Group on Ocean Processes and Climate and the Secretary of the IOC should be kept informed and consulted on relevant matters.

The single-line association for the TOGA and WOCE Offices with WMO and IOC, proposed by CCCO and JSC and described above, has been utilized to facilitate management and day-to-day operations of the Offices. Each Office reports to one body for scientific direction, the appropriate Scientific Steering Group, and is associated with one intergovernmental body as shown in the attached schema. Administrative co-ordination concerning organizational matters at the intergovernmental level is carried out by Liaison between the two relevant intergovernmental bodies, IOC and WMO. The CCCO proposed that reports on the activities of the TOGA and WOCE offices be provided to the governing bodies of IOC, WMO and SCOR through the Secretary of CCCO and the Director of the WCRP, to facilitate the co-ordination of WOCE and TOGA.

TOGA and WOCE Planning Mechanism



SSG: Joint JSC-CCCO Scientific Steering Group

JSC: WMO/ICSU Joint Scientific Committee for the WCRP

--- Intergovernmental Aspects and Support

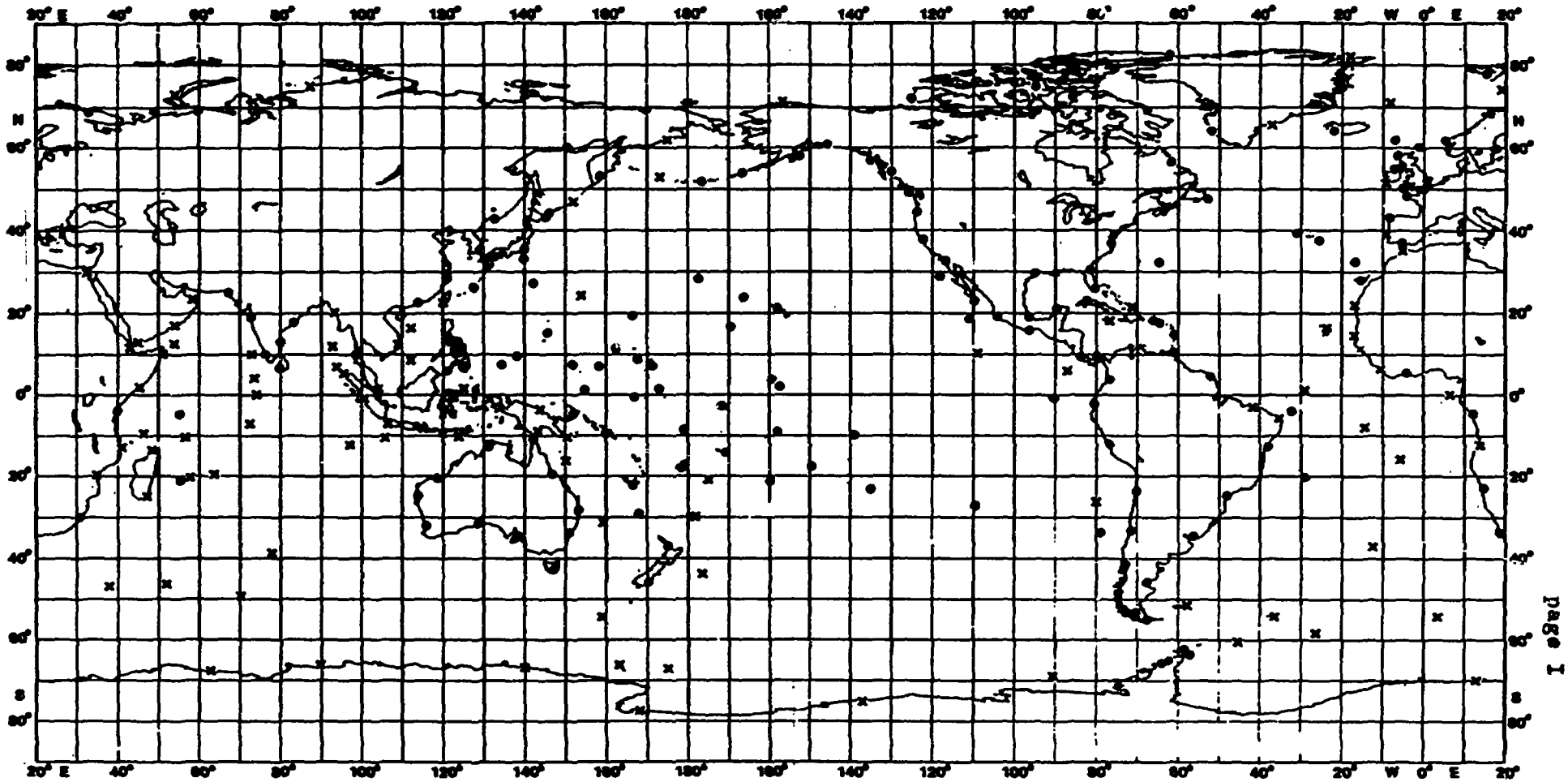
GLOBAL SEA-LEVEL OBSERVING SYSTEM AND ITS REGIONAL COMPONENTS(§)

(§) This annex contains extracts from the following documents :

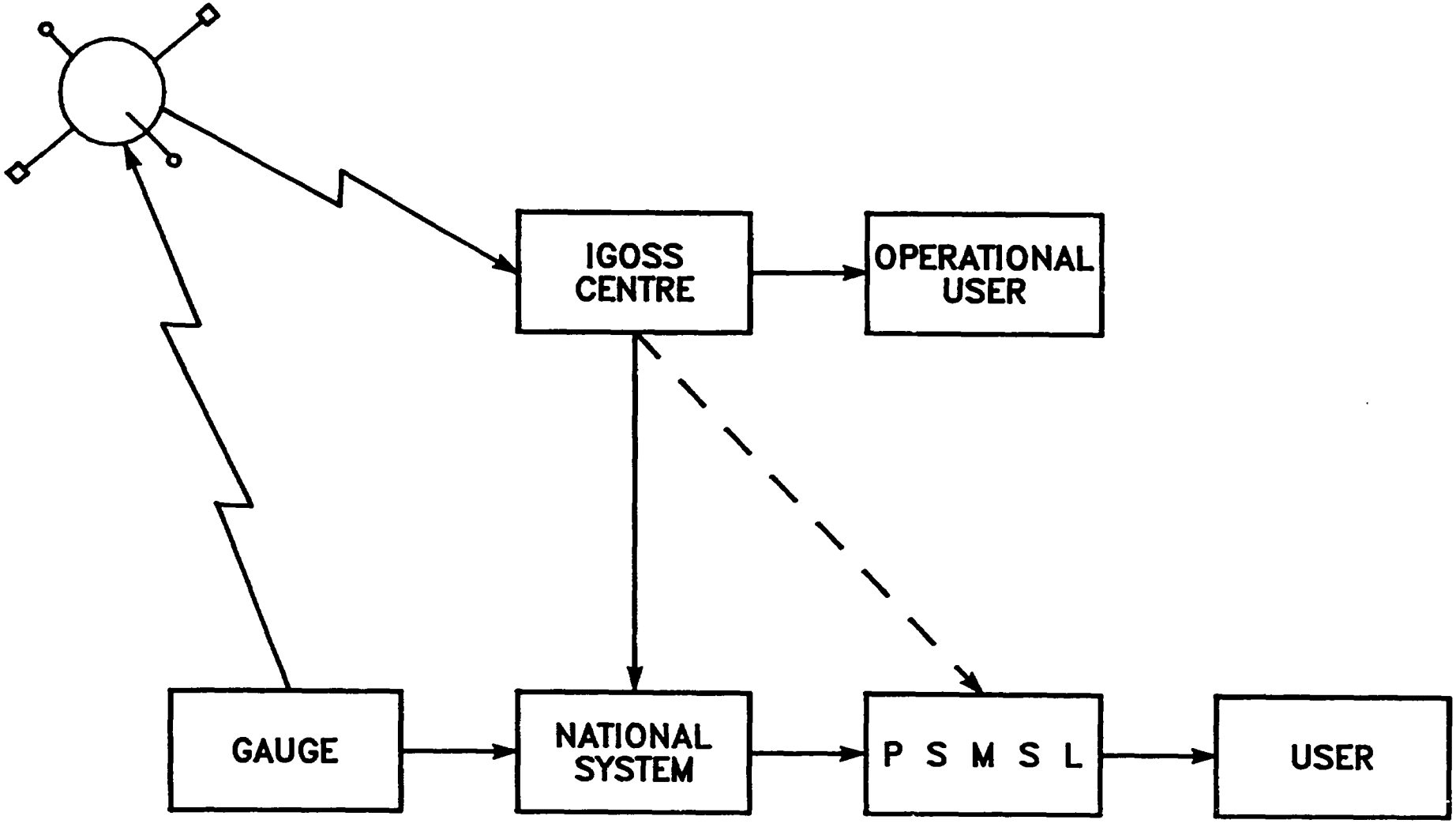
1. IOC-XIII/8 Annex 1 "Proposal for the development of an IOC Global Network of Sea-Level Stations".

2. IOC/PG-OPC-1/7 "Proposal on the development of a sea-level network in the Indian Ocean within the framework of the IOC Global Network of Sea-Level Stations. "

GLOBAL SEA LEVEL OBSERVING SYSTEM (GLOSS)



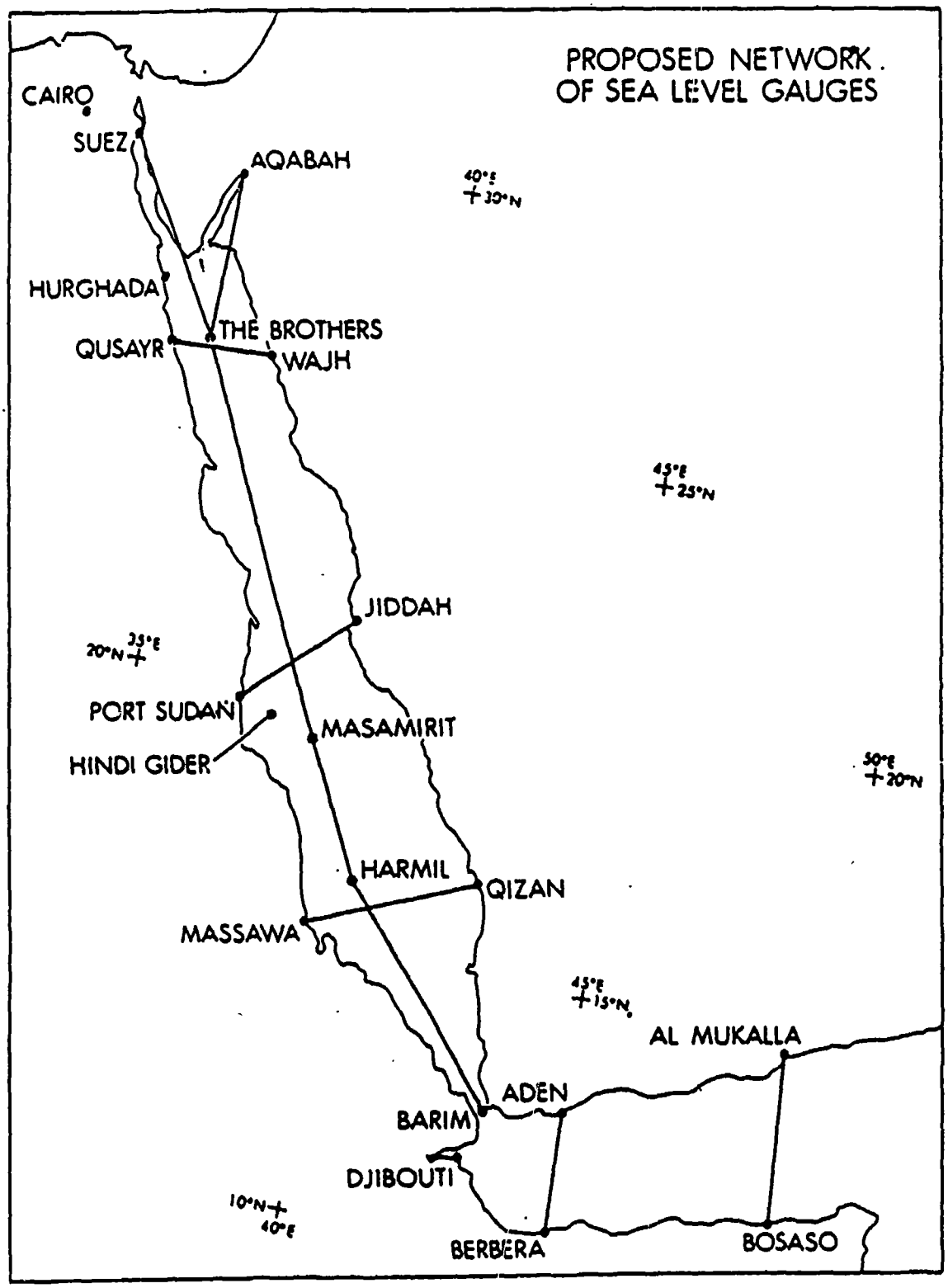
SEA LEVEL DATA FLOW WITHIN THE GLOBAL SEA LEVEL OBSERVING SYSTEM



REQUIREMENTS FOR ASSISTANCE IN SEA-LEVEL NETWORK DEVELOPMENT BY MEMBER STATES OF CINCWIO REGION

(based on the replies to IOC Circular Letter No. 960 of 20 February 1984)

	Order of priorities
Mozambique (4 gauges in operation)	
Assistance needed in supply of tide gauges	1
Assistance in providing spare parts	2
Training	3
Assistance in the installation of new tide gauges	5
Assistance in improved levelling	-
Consultant to visit the country	7
Kenya (no gauges)	
Assistance in providing spare parts	1
Assistance in supply of tide gauges	2
Assistance in the installation of new tide gauges	3
Consultant to visit the country	4
Training	5
Mauritius (no gauges)	
Assistance in supply of tide gauges	1
Assistance in providing spare parts	2
Consultant to visit the country	8
Training	3
Assistance in the installation of new tide gauges	6
Assistance in levelling	7
Seychelles (1 gauge)	
Assistance in supply of tide gauges	1
Spare parts	2
Training	3
Installation of new tide gauges	6
Consultant	7
Improved levelling	8
Madagascar (no gauges)	
Supply of tide gauges	1
Installation of new tide gauges	6
Spare parts	3
Improved levelling	8
Consultant	5
Training	2
Tanzania (no gauges)	
Supply of tide gauges	1
Installation of tide gauges	5
Training	3
Consultant	6



Proposed network of sea level gauges for the Red Sea and the Gulf of Aden. ++

++ Extract from the Plan for a Network of Sea-level Gauges for the Red Sea nd the Gulf of Aden, (prepared by Klaus Wyrtki, University of Hawaii, 11 September, 1981

Integrated Global Ocean Services System (IGOSS)
IGOSS Sea Level Pilot Project (ISLPP)
Specialized Oceanographic Center (SOC) for Mean Sea Level in the Pacific

Sea Level, February 1985

The negative sea level anomaly along the south coast of Japan and around the Ryukyu Islands has decreased in size and intensity; the lowest value is -19 cm at Kushimoto. Negative anomalies exist along the entire coast of the U.S.A., Canada, Alaska and the Aleutian Islands with a low value of -20 cm at Seldovia. The positive anomaly existing in January along the Aleutian Islands has disappeared.

Positive anomalies have formed in the western Pacific both north and south of the equator. The anomaly to the north of the equator is centered near Ponape (+12 cm), the other stretches from Australia to Tahiti with a maximum of +13 cm at Funafuti. Sea level in the eastern tropical Pacific near the equator is 4 cm below normal, indicating a slightly increased east-west slope along the equator. At Buenaventura in the Gulf of Panama sea level is 14 cm below normal. Sea level along the coast of Chile and New Zealand is near normal.

Data to this map were contributed by:

Australia, Canada, Chile, Colombia, Cook Islands, Belau, Ecuador, Federated States of Micronesia, French Polynesia, Hong Kong, Japan, Kiribati, Korea, Marshall Islands, Nauru, New Caledonia, New Zealand, North Mariana Islands, Papua New Guinea, Solomon Islands, Tuvalu, and the United States of America.

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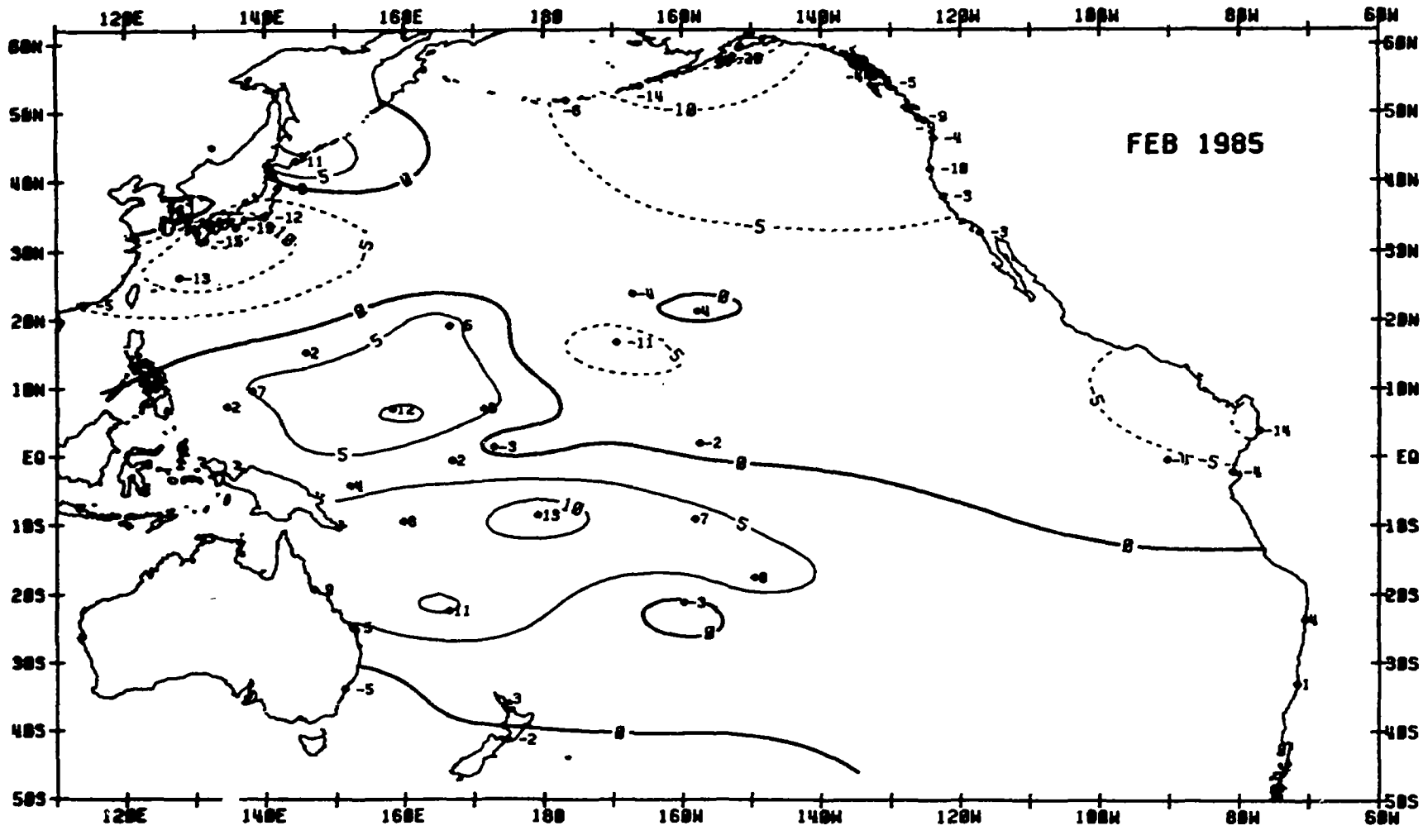

DEVIATION OF SEA LEVEL IN FEBRUARY 1985 FROM THE 1975 TO 1981 MEAN SEA LEVEL IN CENTIMETER.

LIST OF ACRONYMS

CCCO	Committee on Climatic Changes and the Ocean (of SCOR and IOC)
CLIVA	Climate and Variability of the North Atlantic
CTD	Conductivity-temperature-depth instrument to obtain salinity and temperature profiles
EAZO	Energetically Active Zones of the Ocean
ENSO	El Niño - Southern Oscillation
ERFEN	Estudio Regional del Fenómeno El Niño
FGGE	First GARP Global Experiment
FOCAL	Français Océan et Climat de l'Atlantique Equatorial, France
HEXOS	Humidity Exchange Over the Sea
ISLPP	IGOSS Sea Level Pilot Project
ICES	International Council for the Exploration of the Sea
ICSU	International Council of Scientific Unions
IAEA	International Atomic Energy Agency
IGOSS	Integrated Global Ocean Services System
IOC	Intergovernmental Oceanographic Commission
IMO	International Maritime Organization
IODE	Working Committee on International Oceanographic Data Exchange
JSC	Joint Scientific Committee (ICSU and WMO) for the WCRP
MSL	Mean Sea Level
OMLET	Ocean Mixed Layer Experiment, a Japanese programme in the Western Pacific/Kuroshio region
PEQUOD	Pacific Equatorial Ocean Dynamics, USA
SCOR	Scientific Committee on Oceanic Research
SEQUAL	Seasonal, Equatorial, Atlantic Experiment, USA
SSG	Scientific Steering Group
SST	Sea Surface Temperature
SECTIONS	Multinational Programme on the study of Energetically active zones of the Ocean and Climate Variability

TOGA	Interannual Variability of the Tropical Oceans and Global Atmosphere
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNEP	United Nations Environmental Programme
WCRP	World Climate Research Programme
WMO	World Meteorological Organization
WOCE	World Ocean Circulation Experiment
WWW	World Weather Watch
XBT	Expendable bathythermograph
XCTD	Expendable conductivity-temperature-depth probe