Intergovernmental Oceanographic Commission
Reports of Governing and Major Subsidiary Bodies

IOC Regional Committee for the Southern Ocean (Sixth Session) and the First Southern Ocean Forum

Alfred-Wegener Institute
for Polar and Marine Research
Bremerhaven, Germany
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UNESCO

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* For reasons of budgetary constraints, Annexes IV to VIII remain in English only.

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1. OPENING

The Sixth Session of the Intergovernmental Oceanographic Commission (IOC) Regional Committee for the Southern Ocean was opened by Dr. Albert Tolkatchev, IOC Assistant Secretary, who welcomed the participants on behalf of the Executive Secretary IOC and invited them to formulate recommendations to the IOC Executive Council on the future activities of IOC in this region on the basis of discussion and conclusions of the First Southern Ocean Forum, held prior to this session.

Dr. Max Tilzer, Director of the Alfred-Wegener Institute for Polar and Marine Research, welcomed the participants and informed them on the major activities of the Institute.

Dr. Tilzer was invited and accepted to chair the session.

2. ADOPTION OF THE AGENDA

The Agenda of the session was adopted as shown in Annex I.

The list of participants is given in Annex IV.

3. REVIEW OF THE CONCLUSIONS OF THE FIRST SOUTHERN OCEAN FORUM

The participants of the session reviewed the conclusions and proposals of the First Southern Ocean Forum.

The First Southern Ocean Forum was held at the Alfred-Wegener Institute for Polar and Marine Research (AWI), Bremerhaven, Germany, from 9 to 11 September 1996. The programme of the Forum is given in Annex V.

It was attended by experts of Argentina, Australia, Brazil, Chile, France, Germany, Russian Federation, South Africa, UK, USA, and representatives of IOC, WMO, IWC, CCAMLR, COMNAP, ICSU/SCOR, WCRP, GOOS. The Forum was chaired by Dr. Max Tilzer, Director of the AWI.

The list of participants of the Forum is given in Annex VI.

The Forum reviewed on-going research and ocean services programmes in the Southern Ocean. The presentations made by the participants focused on the achieved and expected results of ocean science and services programmes and activities in the Southern Ocean under the following topics:

(i) The role of the Southern Ocean in the climate system and in global change;
(ii) Southern Ocean and marine living resources research;
(iii) Marine pollution research and monitoring in the Southern Ocean;
(iv) The Southern Ocean Component of the Global Ocean Observing System (GOOS) including data/information management;
(v) Framework for International co-operation in the Southern Ocean: international treaties, conventions, declarations and organizations;
(vi) Overall synthesis of the state of scientific knowledge, gaps, and assessments of needs for further oceanographic research and related services to address major issues facing society in the Southern Ocean.

The abstracts and summaries of the papers presented at the Forum are given in Annex VII.

In addition to the presentations made at the Forum, a report on "Significance of the United Nations Convention on the Law of the Sea to International Co-operation in the Southern Ocean" was submitted to the Forum by the United Nations, Division for Ocean Affairs and the Law of the Sea.

4. RECOMMENDATIONS REGARDING THE FUTURE IOC ACTIVITIES AND CO-OPERATION IN THE SOUTHERN OCEAN

The following conclusions and recommendations were made by the Committee on the basis of the discussion and conclusions of the First Southern Ocean Forum.

The Southern Ocean is unique in its physical and biological characteristics. Its study is of great importance for the understanding of the world's climate system and climate change, as well as for the global cycling of carbon and other elements. Moreover, the Southern Ocean is a potential source of prominent marine living resources.

In order to promote international coordination of Southern Ocean scientific activities and observing systems, the Regional Committee formulated a number of recommendations. These are directed to the IOC Assembly and its subsidiary bodies, and to a range of other appropriate governmental and non-governmental bodies.

These recommendations are classified into the following broad themes:

(i) International co-operation in the Southern Ocean;
(ii) Climate and climate change;
(iii) Ecosystems and their living resources;
(iv) Pollution and monitoring;
(v) Global Ocean Observing System (GOOS) and data management.

They necessarily cover a wide range of topics, from the interactions between major programmes to new requirements for resources and technology. Southern Ocean studies include a broad spectrum of scientific disciplines, involving several international programmes and organizations. The Committee sees a clear need for greater liaison between programmes, and a major role for IOC in this. Several issues are identified in relation to data acquisition and management, especially the means of increasing spatial and temporal coverage for physical and biological measurements.

(i) International Co-operation

During the last decade, many important international developments of great relevance to the Southern Ocean have taken place. They include the approval of the Agenda 21, in particular its Chapter 17 of UNCED; the entering into force of UNCLOS, UN FCCC, UNCBD; development of the Protocol on Environmental Protection to the Antarctic Treaty; initiation and successful implementation of global programmes aimed at understanding and prediction of global environmental and climatic change, including in particular WCRP, IGBP, GOOS and GCOS. Many international programmes have been developed through joint efforts by several international organizations, and new projects related to climate, marine living resources, assessment and monitoring of marine pollution, data and information management have been initiated with Southern Ocean components.

The Committee felt that interagencies co-ordination is of great importance for the most efficient and rational use of available resources, and therefore **adopted** the recommendation IOCSOC-VI.1 on this matter.

(ii) Climate and Climate Change

The Southern Ocean is the primary conduit connecting the oceans. The largest ocean current on the planet, the Antarctic Circumpolar Current, transfers water, heat, carbon and other properties between the Indian, Pacific and Atlantic Oceans. Over 50 per cent of the World's water masses are formed in the Southern Ocean, which forms a key-element of the planetary climate system. The Southern Ocean is potentially a major sink of anthropogenic carbon dioxide. Recommendation IOCSOC-VI.2 was adopted on this matter.

(iii) Ecosystems and their Living Resources

With the growing concern over the conservation of Southern Ocean Ecosystems and their living resources, and with the world-wide awareness of potential climate change as a result of increased levels of CO_2 and the depletion of stratospheric ozone, Antarctica became the focal point of global conservation in the 1980s. The issues have stimulated the interest and activities of the scientific community who found in the unique physical, chemical and biological characteristics of the Southern Ocean major opportunities to improve our understanding of marine ecosystems, ocean productivity and pollution impacts. Nonetheless, these opportunities have not been fulfilled completely and, as a result,

serious gaps in our knowledge have been identified and underscored. Recommendation IOCSOC-VI.3 was adopted on this matter.

(iv) Pollution and Monitoring

The Southern Ocean has been little affected by pollution, except insofar as levels of contaminants reflect their global spread from remote sources. This very low level of contamination allows the use of the Southern Ocean as a baseline for the level of global pollution. At the same time, there is a compelling need to preserve the Southern Ocean environment and to have in place mechanisms for response to any future local incidents. Recommendation IOCSOC-VI.4 was adopted on this matter.

(v) Global Ocean Observing System (GOOS) and Data Management

The IOC-WMO-UNEP-ICSU Global Ocean Observing System (GOOS) is in its formative stage. It will provide a basic suite of operational oceanographic data for a wide variety of user groups. To support the broad requirements for research and operational activities in the Southern Ocean, GOOS must have a comprehensive Southern Ocean component. Recommendation IOCSOC-VI.5 was adopted on this matter.

Amongst priority areas are the study of the climate of the ocean interior and interaction with cryosphere and atmosphere and focus on the interaction between the ecosystem and physical forcing, in the context of both climate feedbacks and management of marine living resources. Baseline studies for pollution monitoring and the understanding of the effects of increasing flux of ultraviolet radiation are also emphasized.

5. TERMS OF REFERENCE OF THE REGIONAL COMMITTEE

In view of the many important developments of great relevance to the Southern Ocean that occurred since the establishment of the IOC Regional Committee for the Southern Ocean in 1967, the participants reviewed the Terms of the Reference of the Committee adopted by the IOC Assembly in 1967 and proposed revised Terms of Reference to better reflect the present role of the Committee in view of those developments.

Recommendation IOCSOC-VI.1 includes the proposed revised terms of reference of the Regional Committee addressed to the IOC Executive Council for approval.

The Committee also urged Member States to designate official national contact for SOC to provide better liaison between the Regional Committee's activities and Member States of IOC as well as other international organizations and programmes.

6. ELECTION OF THE CHAIRMAN AND VICE-CHAIRMAN OF THE COMMITTEE

The Committee unanimously elected Dr. Max Tilzer (Germany) as the Chairman of the Committee**. The Committee agreed** not to elect a Vice-Chairman but rather to create an advisory group to assist the Chairman.

The Committee decided to set up an intersessional advisory group to advise and assist the Chairman and the Secretariat in implementing recommendations of the session.

The composition of the advisory group, as agreed by the Committee, is: Mr. Carlos Daniel Carbone (Argentina), Dr. John Church (Australia), Dr. Alexander Klepikov (Russia), Dr. Eric Lindstrom (USA), Dr. Julian Priddle (UK). The group will work mainly by correspondence (via Internet).

7. ADOPTION OF THE REPORT AND RECOMMENDATIONS OF THE COMMITTEE

The Committee reviewed and adopted the Executive Summary of the Report and Recommendations (Annex III) for submission to the Twenty-Ninth session of the IOC Executive Council to be held in Paris from 24 September to 4 October 1996.

8. CLOSURE OF THE SESSION

Dr. Tilzer, Chairman of the Regional Committee, closed the session on 13 September 1996 and thanked the participants for their contribution to the success of the session of the Committee as well as the First Southern Ocean Forum.

The participants expressed their thanks and appreciation to Dr. Tilzer, the host of the meeting, and the staff of the Institute, particularly Dr. Gunter Giermann and Mrs. Doerte Burhop, for excellent arrangements regarding the 6th session of the Regional Committee and the First Southern Ocean Forum.

ANNEX I

AGENDA

1. **OPENING**

2. **ADOPTION OF THE AGENDA**

3. **REVIEW OF THE CONCLUSIONS OF THE FIRST SOUTHERN OCEAN FORUM**

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ANNEX II

RECOMMENDATIONS

Recommendation IOCSOC-VI.1
INTERNATIONAL CO-OPERATION IN THE SOUTHERN OCEAN

The IOC Regional Committee for the Southern Ocean,

Noting the development of the national and international programmes and activities, related to the marine environment and the marine living resources of the Southern Ocean, since the establishment of the Regional Committee for the Southern Ocean in 1967,

Noting, in particular, (i) the UNCED Agenda 21, the entering into force the UNCLOS, UN FCCC, UNCBD; (ii) the development of global programmes aimed at understanding and predicting global environmental and climate changes, particularly WCRP, IGBP, GOOS and GCOS,

Noting also with satisfaction the close co-operation of IOC with WMO, UNEP and ICSU/SCOR in the implementation of the above global programmes and their projects as well as IOC interaction with ATCM,

Recognizing the need to strengthen co-operation with other organizations actively involved in the study of the Southern Ocean and its resources, and in view of the multidisciplinary and multi sectorial nature of the above programmes,

Recommends that the IOC Executive Council

(i) **invites** SCAR, SCOR, CCAMLR, COMNAP and IWC to consider ways and means to strengthen co-operation with IOC in the Southern Ocean particularly within the framework of GOOS, Data/Information Management and Southern Ocean ecology and Marine Living Resources;

(ii) **urges** other bodies of IOC to co-operate with the Regional Committee for SOC particularly in the field of training, education and mutual assistance (TEMA), oceanographic data and information management; and Global Ocean Observing System (GOOS) development;

(iii) **adopts** the revised Terms of Reference of the Regional Committee for SOC, as given in Annex to this Recommendation;

(iv) **invites** the Executive Secretary IOC to establish links with other international organizations through World Wide Web or other channels to exchange regularly information on-going and planned activites in the Southern Ocean.

Also recommends that IOC continues close collaboration with WMO, UNEP and ICSU/SCOR in developing the Southern Ocean components of the above global programmes;

Annex to Recommendation IOCSOC-VI.1

TERMS OF REFERENCE OF THE IOC REGIONAL COMMITTEE FOR THE SOUTHERN OCEAN (IOCSOC)

The IOC Regional Committee for the Southern Ocean (IOCSOC) shall:

(i) promote plans for a comprehensive study of the Southern Ocean, within the context of the global scientific issues and programmes;

(ii) promote the development and coordination of joint ocean research and systematic ocean observations in the Southern Ocean, in particular within the framework of WCRP and IGBP, the Global Ocean Observing System (GOOS) and the Global Climate Observing System (GCOS);

(iii) promote co-operation, training, education and mutual assistance among Member States and relevant international organizations in the study of the role of the Southern Ocean in global environmental and climate change; investigation of marine pollution, living marine resources and ocean ecosystem dynamics; particularly within the frameworks of WCRP, IGBP, GIPME, OSLR and TEMA;

(iv) closely co-operate and encourage exchange of relevant information with relevant international governmental and non-governmental organizations (e.g. ATCM, ICSU/ SCAR/ SCOR, CCAMLR, WMO, FAO, UNEP, IWC, IMO, IHO);

(v) encourage timely exchange and evaluation of various types of oceanographic data and information in this region among Member States and relevant international organizations.

Recommendation IOCSOC-VI.2
SOUTHERN OCEAN AND CLIMATE CHANGE

The IOC Regional Committee for the Southern Ocean,

Noting the success over the last decade of a number of WCRP and IGBP programs related to understanding of climate,

Noting that the JSC for WCRP has requested CLIVAR to work with Arctic Climate System Study (ACSYS) and Antarctic Sea Ice Processes, Ecosystems and Climate (SCAR-ASPECT) to develop a specific Southern Ocean sea-ice programme,

Recognizing the need to maintain a clear focus on critical climate issues through a small number of well-supported research efforts,

Expresses its strong support and affirmation of present efforts underway in WCRP and IGBP to advance our understanding of climate and climate change;

Recommends that the IOC Executive Council calls on member states to make long-term commitments to WCRP and IGBP and to strengthen their participation in these research programmes;

Noting the success of the TOPEX/POSEIDON satellite altimeter mission, the confirmation of a follow-on mission and that the utility of altimetric data will be greatly enhanced by the availability of a high resolution geoid,

Also noting that the Synthetic Aperture Radar (SAR) is the only means for obtaining data of sea-ice concentration, distribution, and movement at high spatial resolution,

Recommends that the IOC Executive Council encourages the satellite agencies to undertake a dedicated gravity mission;

Also recommends that the IOC Executive Council encourages the Member States of IOC to support research programs on sea-ice remote sensing, and that IOC invites the satellite operating agencies to enhance availability of SAR data on Southern Ocean ice;

Noting that the forthcoming requirements for operational use of high-resolution satellite data such as Synthetic Aperture Radar (SAR) and ocean colour will place a greatly increased load on ground receiving stations around the Southern Ocean,

Recommends that IOC collaborate with WCRP and WMO to conduct a review of both the distribution and capability of ground receiving stations covering the Southern Ocean;

Noting the paucity of long-time series observations in the Southern Ocean,

Recognizing the need for information on the time variability of a wide-range of ocean parameters,

Emphasizes the need for continued development of repeated observations for all Southern Ocean regions; and therefore

Recommends that the IOC Executive Council invites:

(i) the Joint Committee for IGOSS, in consultation with COMNAP and SCAR, to coordinate among member states development of a comprehensive Southern Ocean ship of opportunity program using polar supply and research ships;

(ii) the IOC Group of Experts on GLOSS to establish a protocol for datum control at selected Southern Ocean tide gauges;

(iii) DBCP and JSC for WCRP to develop a long-term program for Southern Ocean drifting buoys; and

(iv) Member States to establish further time-series stations and sections (hydrographic, water level, and biogeochemical, etc.);

Recognizing the progress in the understanding and prediction of climate variability on seasonal to interannual time-scales by inclusion of the upper ocean in research and observational networks and coupled modelling in the TOGA programme of WCRP,

Noting the enlarged time-scales (decades to centuries) in the Science Plan for the Climate Variability and Predictability (CLIVAR) Study of WCRP,

Noting the importance of ocean interior climate for the uptake and storage of anthropogenic CO_2 in the ocean's interior,

Noting the need for information on the interior ocean climate in the new IGBP core project GLOBEC and the SCAR-GLOCHANT project ASPECT,

Noting the possibility for a prediction of decadal natural variability through the slow reaction of major ocean gyres to ocean-atmosphere interaction variability,

Invites the IOC Executive Council to request the Joint Scientific Committee for WCRP to take into account the ocean interior climate in WCRP's studies.

Recommendation IOCSOC-VI.3
SOUTHERN OCEAN ECOSYSTEMS AND THEIR LIVING RESOURCES

The IOC Regional Committee for the Southern Ocean**,**

Recognizing that the unique physical, chemical and biological characteristics of the Antarctic seas provide major opportunities to expand fundamental knowledge of the region and help understanding of global issues such as climate change, ocean circulation, ocean productivity, and pollution,

Noting the continuing concern over the conservation of the Southern Ocean ecosystems and their living resources and the world-wide awareness over climate change as a result of increased levels of CO_2, and the depletion of stratospheric ozone, as witnessed by the initiation of several scientific programs to address these concerns,

Aware that the wealth of information on the physics, chemistry and biology of the Southern Ocean gained from several national and international programs has significantly advanced our understanding of the ecology of the Southern Ocean,

Noting, however, that these programmes have identified serious gaps in our knowledge which need to be addressed,

Recommends that IOC Executive Council urges Member States of IOC and relevant international organizations to undertake investigation of:

(i) The linkages between the physical and the chemical environments with the structure and dynamics of the marine ecosystem, including investigations on small and large-scale spatial distribution as well as seasonal and interannual variability (cf. SO-JGOFS, SO-GLOBEC, CCMLAR, IWC);

(ii) The role of sea-ice in affecting the productivity of the Southern Ocean, as well as the contribution of sea-ice communities to the overall production process of the Southern Ocean (cf. EASIZ, ASPECT);

(iii) The levels of UV-B and their effects on marine biota including impacts on biogeochemical cycles and productivity [c.f. ASPECT, SO-JGOFS, SPARC (Stratospheric Processes and their role in Climate)];

(iv) The spatial and seasonal distribution of trace elements (e.g. Fe), and their effects on the organisms (e.g. SO-JGOFS);

(v) A suite of ecosystem models for lower trophic levels (e.g. phytoplankton), as well as for krill life history stages, other zooplankton and top predators, which couple environmental and biological variability at appropriate scales (e.g. SO-JGOFS, SO-GLOBEC, CCAMLR).

Recommendation IOCSOC-VI.4
POLLUTION AND MONITORING IN THE SOUTHERN OCEAN

The IOC Regional Committee for the Southern Ocean,

Noting that although at present the Southern Ocean does not have a pressing pollution problem, it is important to identify early any pollution problem, when it is still practical to take measures to remedy such problem,

Taking into account that an adequate understanding of global and local pollution processes and forecast capabilities could only be developed if long-term observations and their data are available,

Recognizing the need to undertake coastal and oceanic monitoring to evaluate processes with the aim to achieve long-term datasets for the development of prediction capabilities and the need for references and/or calibration of instruments and laboratories in countries bordering the Southern Ocean,

Recommends that as a first step the Joint Scientific and Technical Committee for GOOS establish a pilot project for the GOOS Health of the Ocean Module in the Drake Passage area, including southern coastal regions of South America and the Antarctic Peninsula in close collaboration with Managers of National Antarctic Programmes;

Recommends that the Committee for GIPME work with Member States to establish baseline pollution monitoring sites in the Southern Ocean;

Recommends that the Committee for GIPME evaluate the use of biological samples as pollution indicators.

Recommendation IOCSOC-VI.5
GLOBAL OCEAN OBSERVING SYSTEM (GOOS) AND DATA MANAGEMENT

The IOC Regional Committee for the Southern Ocean,

Recognizing that the emergent Global Ocean Observing System will provide a basic suite of operational oceanographic data for a wide variety of user groups,

Recognizing the need for a broad spectrum of input to GOOS planning and particularly specialized advice on Southern Ocean requirements to realize a program responsive to the user community,

Recognizing the need for broader interaction and collaboration between and among research and operational oceanography communities,

Noting that the Global Ocean Observing System will serve as a useful framework to promote specific Southern Ocean observations for all disciplines and that some Southern Ocean programs serve as fine examples upon which to build GOOS plans,

Noting in particular that CCAMLR Ecosystem Monitoring is especially commended as a model for planning and implementation of the developing LMR module of GOOS,

Recommends that IOC should promote wherever possible continued communication between and among GOOS and existing Southern Ocean research and operational programmes during the intersessional period of the IOC Regional Committee for SOC;

Further recommends IOC should maintain a World Wide Web site for the Regional Committee on the Southern Ocean. The site should maintain a comprehensive set of Southern Ocean links as edited by the Chairman and the Secretariat of the IOC Regional Committee for SOC. To complement this effort, participating member states are encouraged to maintain Web sites with specific information such as cruise plans and national Southern Ocean planning activities;

Noting also the need for improved coordination and access to a wide variety of Southern Ocean data sets,

Recommends that the RNODC for the Southern Ocean expand its responsibilities to provide access to a wider range of parameters and beyond just cruise profile data. Furthermore it should coordinate its activities with those of the SCAR/COMNAP Antarctic Data Management System and with the major independent data management systems of WOCE, JGOFS and CLIVAR and to promote knowledge of and access to key historical data sets (e.g. DISCOVERY Investigation, BIOMASS, ISOS, POLEX-South and Data Set for "Hydrographic Atlas of the Southern Ocean);

Requests the IODE Committee in consultation with RNODC-SOC-IOC to consider the extension of northern boundary of the area of responsibility of RNODC;

Recommends to IOC that the complete set of recommendations from IOCSOC-VI should be summarized and annotated by the IOCSOC Chairman and Secretariat to constitute a "Southern Ocean Agenda for the late1990's". This Agenda would be made available widely and especially to all J-GOOS scientific planning teams, CLIVAR SSG, SCAR and SCOR for due consideration.

ANNEX III

Twenty-ninth Session of the IOC Executive Council
24 September - 4 October 1996

RESOLUTION EC-XXIX.6
SOUTHERN OCEAN FORUM AND REGIONAL COMMITTEE FOR THE SOUTHERN OCEAN

The Executive Council,

Having considered the Executive Summary of the First Southern Ocean Forum and the Sixth Session of the IOC Regional Committee for the Southern Ocean (Document IOC/SOC-VI/3S), held in Bremerhaven, Germany, 9-13 September 1996,

Noting with satisfaction that the Forum has reviewed the present knowledge, gaps and needs for future ocean research and related services in the Southern Ocean, as well as the international framework for co-operation,

Having reviewed the recommendations of the Sixth Session of the Regional Committee (Document IOC/SOC-VI/3S) prepared on the basis of the Forum's conclusions and proposals, covering the following broad themes: International cooperation in the Southern Ocean; Climate Change; Southern Ocean Ecosystems and their living resources; Pollution and monitoring; GOOS and data management,

Noting also that many important events have taken place since the establishment of the IOC Regional Committee for the Southern Ocean in 1967, in particular, UNCED and its Agenda 21, the entering into force of UNCLOS, UN Framework Convention on Climate Change (FCCC), UN Convention on Biological Diversity (CBD), the initiatives of the Antarctic Treaty Consultative Meeting (ATCM), the Protocol on Environmental Protection to the Antarctic Treaty, the development of global research and observational programmes such as WCRP, IGBP, GOOS and GCOS as joint efforts of intergovernmental and non-governmental international organizations,

Emphasizing that the Southern Ocean is unique in its physical and biological characteristics; that its study is of great importance for the understanding of the world's climate and climate change, as well as for the global cycling of carbon and other elements; and that it is a potential source of marine living resources,

Recognizing that the study of the Southern Ocean and its resources, as well as the development of observing systems, require close co-operation with other international governmental and non-governmental organizations, particularly WMO, UNEP, FAO, IHO, CCAMLR, IWC, COMNAP, ATCM, ICSU/SCAR/SCOR,

Expressing its strong intention to continue close collaboration with WMO, UNEP and ICSU in the planning and implementation of the Southern Ocean components of WCRP, particularly CLIVAR, IGBP and its projects JGOFS and GLOBEC, GOOS and GCOS,

Approves the recommendations of the Sixth Session of the IOC Regional Committee for the Southern Ocean (Document IOCSOC-VI/3S);

Decides to revise the terms of reference of the IOC Regional Committee for the Southern Ocean as shown in the Annex to this Resolution;

Invites SCAR, SCOR, CCAMLR, COMNAP and IWC to consider adequate ways and means to strengthen co-operation with the IOC Regional Committee for the Southern Ocean, particularly within the framework of GOOS, as well as the exchange of environmental data and information on Southern Ocean ecology and marine living resources;

Invites the JSC for WCRP, SC for IGBP, I-GOOS, DBCP, GE/GLOSS to bear in mind the recommendations of the Regional Committee with a view to establishing close interaction with its activities;

Urges Member States of IOC to participate in the activities of the Regional Committee and designate official national contacts for SOC;

Instructs the Executive Secretary to establish and maintain the information network on the Southern Ocean national and international activities through World Wide Web and to arrange for publication of the proceedings of the First Southern Ocean Forum.

Annex to Resolution EC-XXIX.6

TERMS OF REFERENCE OF THE IOC REGIONAL COMMITTEE FOR THE SOUTHERN OCEAN (IOCSOC)

The IOC Regional Committee for the Southern Ocean (IOCSOC) shall:

(i) promote plans for a comprehensive study of the Southern Ocean, within the context of global scientific issues and programmes;

(ii) promote the development and coordination of joint ocean research and systematic ocean observations in the Southern Ocean, the latter in particular within the framework of WCRP and IGBP, GOOS and the GCOS;

(iii) promote co-operation, training, education and mutual assistance among Member States and relevant international organizations in the study of the role of the Southern Ocean in global environmental and climate change; and in the investigation of marine pollution, living marine resources and ocean ecosystem dynamics; particularly within the frameworks of WCRP, IGBP, GIPME, OSLR and TEMA;

(iv) closely co-operate and encourage exchange of relevant information with relevant international governmental and non-governmental organizations (e.g. ATCM, CCAMLR, WMO, FAO, UNEP, IWC, ICSU, SCAR, SCOR);

(v) encourage timely exchange and evaluation of various types of oceanographic data and information in this region among Member States and relevant international organizations;

(vi) in performing its activities, the Committee will take into account the need to not affect the respective sovereignities and jurisdictions of the coastal states of the region, nor to affect the rights and obligations emanating from the Antarctic Treaty and related instruments.

ANNEX IV

SIXTH SESSION OF THE IOC REGIONAL COMMITTEE FOR SOC
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ANNEX V

FIRST SOUTHERN OCEAN FORUM

PROGRAMME

Session I:	**The role of the Southern Ocean in the climate system and in global change**
Keynote speaker:	*John Church (Australia)* "The role of the Southern Ocean in the climate system and in global change"
Presentations:	*Alexander Klepikov (Russia)* "Oceanography of the Antarctic Zone of the Southern Ocean" "Antarctic Sea Ice and Icebergs within the World Climate System".
	Hartmut Grassl (WCRP) "World Climate Research Programme (WCRP) activities in the Southern Ocean".
Session II:	**Southern Ocean and marine living resources research**
Keynote speakers:	*Max Tilzer (Germany)* "The Southern Ocean paradox revisited! Alternative explanations for its low productivity despite ample nutrient supply"
	Sayed El-Sayed (USA) "Antarctic Marine Ecosystems Research in Post-BIOMASS Years"
Session III:	**Marine pollution research and monitoring in the Southern Ocean**
Keynote speaker:	*Carlos Daniel Carbone (Argentina*) "Marine pollution research and monitoring in the Southern Ocean"
Session IV:	**The Southern Ocean component of the Global Ocean Observing system (GOOS) includin g data/information management**
Keynote speaker:	*Eric Lindstrom (USA)* "The Southern Ocean component of the Global Ocean Observing System"
Presentations:	*Nora Prieto (Argentina)* "Responsible National Oceanographic Data Center for the Southern Ocean"

Session V: **Framework for international co-operation in the Southern Ocean: international treaties , conventions, declarations and organizations**

Keynote speaker: *Francisco Orrego Vicuña (Chile)*
"Framework for international co-operation in the Southern Ocean"

Presentations: *Eduard I. Sarukhanian (WMO)*
"World Meteorological Organization (WMO) Antarctic Activities"

Ray Gambell (IWC)
"Activities of the International Whaling Commission (IWC) in the Southern Ocean"

Jarl Stromberg (SCOR/ICSU)
"Activities of the Scientific Committee on Oceanic Research (SCOR/ICSU) related to the Southern Ocean Study"

Albert Tolkatchev (IOC)
"Activities of the Intergovernmental Oceanographic Commission (IOC) in the Southern Ocean"

Pentti Mälkki (COMNAP)
"The Council of Managers of National Antarctic Programmes (COMNAP) and its role in Antarctic Research"

Karl-Hermann Kock (CCAMLR)
"Activities of the Commission for the Conservation of Antarctic Marine Resources (CCAMLR) in the Southern Ocean"

Session VI: **Overall synthesis of the state of scientific knowledge, gap s, and assessments of needs for further oceanographic research and related services to address major issues facing society in th e Southern Ocean**

Keynote speaker: *Julian Priddle (U.K.)*

"Overall synthesis of the state of scientific knowledge, gaps, and assessments of needs for future oceanographic research and related services to address major issues facing society in the Southern Ocean"

ANNEX VI

FIRST SOUTHERN OCEAN FORUM

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ANNEX VII

ABSTRACTS

Page

THE ROLE OF THE SOUTHERN OCEAN IN THE CLIMATE SYSTEM AND IN GLOBAL CHANGE

Dr. John Church, Leader, Climate and Ocean Programme
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The ocean with their huge heat capacity and the ability to absorb heat at one location, transport it thousands of kilometres, and then release it to the atmosphere are a central component of the climate system. The Southern Ocean has a central and unique role in this system. It is the only circumpolar ocean and it allows large transports of mass, heat and other properties between the ocean bases. It thus transforms what would otherwise be a basin scale issue into a global issue. The circumpolar nature of the Southern Ocean also allows unique dynamics to occur which are present in no other ocean basis.

The Southern Ocean is also a window to much of the deep oceans of the world. Over half of the world's water masses are formed in the Southern Ocean -Antarctic Immediate Water and Antarctic Bottom Water can be traced well into the northern hemisphere.

The oceans are also the largest store of carbon in the world and absorb an estimated 2GtC/yr of carbon released by the burning of fossil fuels. Determining the factors that control the size of this sink and low it may vary in future is important to determining future atmospheric concentrations of carbon dioxide.

A comprehensive summary of our understanding of the Antarctic Circumpolar Current (ACC) in the mid-1980s is given by Nowlin and Klinck (1986). Estimates of the transport of the ACC (about 130 Sverdrups) were confined mostly to the Drake Passage and there were few estimates of meridional transport of properties across the ACC. Observations being conducted as part of the World Ocean Circulation Experiment (WOCE) are significantly improving our knowledge of the properties and circulation of the Southern Ocean. Satellite altimetry (Geosat, ERS1 and most importantly TOPEX/Poseidon) has allowed a far more comprehensive description of the variability of the Southern Ocean and an assessment of the importance of this variability for the dynamical balance of the ACC. Greatly expanded computing power has allowed the development of eddy resolving models of the Southern Ocean (eg the Fine Resolution Antarctic MODEL° AND ALLOWED FUNDAMENTAL QUESTIONS ABOUT THE MOMENTUM BALANCE OF THE ACC to be addressed. Both satellite and in situ studies have increased our understanding of sea ice-ocean-atmosphere interactions. Studies of the Southern Ocean's role in the carbon cycle conducted as part of the Joint Global Ocean Flux Study (and with the support of the WOCE programme) are beginning to reveal the magnitude and seasonal variability, as well as the processes that control the air-sea flux of carbon dioxide. Coupled ocean-atmosphere-sea ice models with improved parameterization of subgrid scale processes are being developed. These models are improving our estimates of global climate change and our estimates of ocean thermal expansion and thus of sea-level rise. Highlights of recent progress in all of these areas will be presented.

Although the first tentative descriptions of the seasonal, interannual and decadal variability of the Southern Ocean are becoming available (White and Peterson, 1996) many gaps in our description and understanding of the Southern Ocean's role in the climate system and global change remain. The presentation will conclude with possible directions for the future.

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ANTARCTIC SEA-ICE AND ICEBERGS WITHIN THE WORLD CLIMATE SYSTEM

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Global climate is the result of the interplay between the components of the Earth's climate system: global atmosphere, world ocean, sea ice and ice of land origin, land surface hydrology, driven by solar radiation.

Within the global climate system sea ice cover is a vivid indicator of the environmental climate variability and at the same time, the global climate-forming factor. Insufficient or inaccurate regard for the Antarctic sea ice cover due to its greater variability if compared with that for the Arctic region is the basic cause for the fact, that up to now developed numerical and statistical climatic or forecast models of the sea ice with various degree of complexity depict the ice cover with the least adequacy for the Antarctic. Therefore, the solution of the described problem is impossible without the development and analysis of the high-quality data base on the Antarctic sea ice, on the basis of which further development of concepts and advanced models depicting evolution of the environmental processes in the Antarctic is possible.

At present there are two most extensive sources of the sea ice data for the Southern Ocean. Russian data are prepared at the Arctic and Antarctic Research Institute and involve the period from the end of 50s. Data accumulate the expert knowledge and technique gained in the Arctic and are based on the shipborne, coastal, satellite measurements and partly on aircraft surveys.

Presently available USA data start from 1973 and has been prepared at the National Ice Center. Data charts are compiled on the basis of the multi-channel passive microwave satellite information and to greater extent than Russian indicate theoretical knowledge than expert interpretation of the material.

Gathered material is characterized by statistically significant period of intersection -1973 - 1990 years. That fact allows to carry out statistical and expert comparison of data on a number of such parameters as position and oscillation of sea ice boundary, areas of propagation of compact and open ice, area and location of stationary and non-stationary polynyas. At the same time, on the basis of the joint processing of the prepared data it is possible, firstly, to produce more accurate estimates of the sea ice and icebergs extent and volume for the 1970-1990 period and, secondly, to carry out expert investigation on a number of the scientific conclusions on the Antarctic ice cover evolution currently available (Romanov, 1985, Wadhams, 1994, Johannessen, 1995 and others).

Hypothesis on the existence of the auto-oscillations inside the system cryosphere-sea ice-ocean-atmosphere comprises the basics of the concept of the investigation of the climate variability of the Antarctic natural processes delivered in the report. Hypothesis is proved by the actual data on the Antarctic ice-coast dynamics, quantity and volume of icebergs and sea ice and variability of other concerned hydrometeorological factors. Principal factor causing auto-oscillation is the inner-, per- and interannual variability of the fresh-water balance of the Southern Ocean which is formed by sea ice and icebergs melting. Estimates equal to 23.000 and 1.500 km^3 of fresh water per year are proposed for two components of the balance which exceed those for the northern polar region and define the leading role of the ocean heat in the processes of the ice melting and destruction. Thus, it is evident that the Southern ocean ice exerts significant influence on the seasonal variability of the World ocean phenomena connected with ice cover.

OCEANOGRAPHY OF THE ANTARCTIC ZONE OF THE SOUTHERN OCEAN

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The physical oceanography of the Antarctic Zone of the Southern is observed. The Antarctic Zone is the area located to the south of the Antarctic Circumpolar Current (ACC). This is the source region of the coldest and densest bottom waters. The Antarctic Bottom Water formed near the Antarctic Continent spreads throughout all the world's oceans and generates slow abyssal circulation beneath the bowls of wind-driven gyres. On the other hand, due to wind induced upwelling the layer of relatively warm/salty Circumpolar Deep Water (CDW) lies very close to the surface within the Antarctic Zone. It provides substantional upward heat flux to the upper layer and through the sea ice to the atmosphere. This heat flux is sufficient to maintain the anomalously low ice concentration in particular regions of the ice-covered Antarctic Zone. Presumably, a very delicate balance exists between the strength of the ACC, the amount of CDW transport to the Antarctic Zone, the intensity of large-scale/meso-scale up welling and CDW entrainment to the upper layer and, finally, the intensity of heat flux from the ocean to the atmosphere.

All of these processes are very important for understanding the climate variability on time scales from 10 to 1000 years.

The circulation in the Antarctic Zone consists of the set of cyclonic gyres. The circulation, thermohaline stratification and climate related processes in some regions of the Weddell gyre have been investigated using historical data analysis, recent field works and numerical modeling. In the North-East part of the gyre the dynamics are governed by the meso-scale warm-core and cold-core eddies. Eddy field forms meridional transports of heat and salt between the ACC and the Antarctic Zone and within the Antarctic Zone. In the South-East limit of the gyre the dynamics are determined by the topographic eddies downstream of the Maud Rise. The warm and salty core of isolated warm deep water pool west of the Maud Rise has parameters of CDW from the southern edge of the ACC.

The mixed layer over the core of the pool is shallower, warmer and lower in salinity and dissolved oxygen due to intensive cross-pycnocline exchange between the core and upper layer. The reduced ice concentration and thickness as well as direct measurements of heat fluxes above the ice floe confirms the existence of enhanced heat flux from the ocean to the atmosphere in this area. The water mass distribution and circulation in the unexplored western part of the gyre observed during the US-Russia project "*Ice Camp Weddell-1*" are discussed.

Water mass distribution and currents in the Indian Ocean sector of the Antarctic Zone are described. Three large-scale cyclonic gyres are found in this region. The Cosmonaut Sea gyre lies between 35° and 55° E, the Davis Sea gyre lies in the region 85-100° E and the Commonwealth Sea gyre lies between first two gyres. The interiors of the gyres are characterized by a dome-shaped up welling of isopycnal layers. High values of temperature and salinity of the Antarctic Winter Water layer in the interiors indicates enhanced vertical exchange of this layer with underlying warm deep water. An analysis of the data set of large-scale surveys of the Cosmonaut Sea shows that an anomalous development of the vertical exchange processes in the interior can create the conditions favourable for the formation of open ocean polynya. The structure of Antarctic Slope Front and the Coastal Antarctic Current are described. The differences between the processes at the continental margins of Indian Ocean sector and the other Antarctic Seas are established.

Scientific objectives and requirements for future field works and modeling are proposed.

THE SOUTHERN OCEAN PARADOX REVISITED! ALTERNATIVE EXPLANATIONS FOR ITS LOW PRODUCTIVITY DESPITE AMPLE NUTRIENT SUPPLY

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The Southern Ocean between the Antarctic divergence in the South and the Polar front in the North is high in nutrients (nitrate, phosphate, silicate) which are never exhausted by the phytoplankton whose biomass, with rare exceptions is consistently low. Three alternative hypotheses have been put forward for this paradox:

(i) Energy limitations: The low availability of radiant energy (deep mixing, low sun angles, short growing season) in conjunction with low ambient temperatures, does not allow the build-up of biomass to the point of nutrient exhaustion.

(ii) Micronutrient limitation: Extremely low concentrations of trace elements, kin particular iron, slow down the production process and prevent the accumulation of larger biomass.

(iii) Heavy grazing by meso-zooplankton (mainly copepoda and slaps) leads to continuous removal of biomass and to the regeneration of nutrient salts.

The production of biomass is dependent on supply both, energy and nutrients. As a general rule, energy supply control the rate of production, whereas nutrient supply is the major determinant for the yield of production. However, under extreme energy shortage, also biomass yield can be restricted by energy supply. Whereas Liebig's Law of the Minimum states that at any given time only one factor controls production yield, more than one factor leading to losses of biomass can be effective in restricting biomass accumulation. This implies that at least the "limitation hypotheses" and the "grazing hypothesis" are not mutually exclusive.

It has long been known that high stocks of grazers frequently are coincident with low phytoplankton biomass in the Southern Ocean, thus giving support to the "grazing hypothesis". Recent observations, moreover, demonstrate that consistently enhanced phytoplankton biomass is found in frontal regions. Here mixing depths are restricted thus increasing energy supply. In addition, Fe-concentrations are enhanced within frontal regions giving support to the "micronutrient hypothesis".

In conclusion, energy supply is always short in the Southern Ocean and can be considered the major determinant for low phytoplankton productivity. In addition the production process can be regionally stimulated by enhanced micronutrient supply. On the other hand, excessive grazing can diminish the build-up of biomass wherever her bivorous zooplankton populations attain high densities.

ANTARCTIC MARINE ECOSYSTEMS RESEARCH IN POST-BIOMASS YEARS

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With the growing concern over the conservation of the Southern Ocean ecosystems and their living resources and with the worldwide awareness over climate change as a result of increased levels of carbon dioxide, and the depletion of stratospheric ozone over Antarctica, Antarctica became the focal point of global conservation in the 1980's.

As a result we have witnessed the initiation of several scientific programmes to address these concerns. Foremost among these programmes (in the early 1980's) was the BIOMASS Programme (Biological Investigations of Marine Antarctic Systems and Stocks). Within its relatively short life span, BIOMASS provided several important insights into the functioning of the Southern Ocean ecosystems, and has rekindled great international interest in Antarctic affairs reminiscent of the International Geophysical Year. In so doing, it helped in creating a climate in which research programmes addressing elements of the general and specific objectives of BIOMASS were able to flourish. This has led to an explosion of marine research programmes to study phenomena and processes of global significance in which Antarctica and the surrounding seas play a key role. A few of the programmes that have a focus on the Antarctic marine ecosystems and their living resources, e.g. CCAMLR Ecosystem Monitoring Programme, Southern Ocean-Joint Global Ocean Flux Study (SO-JGOFS), Southern Ocean Global Ocean Ecosystem Dynamics (SO-GLOBEC), Coastal and Shelf Ecology of the Antarctic Sea-Ice Zone (CS-EASIZ), are discussed and their contributions to a better understanding of the Antarctic marine ecosystems evaluated.

MARINE POLLUTION RESEARCH AND MONITORING IN THE SOUTHERN OCEAN

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When we talk about the Southern Oceans we are generalizing a gigantic cask of the earth. The interests of a few countries and bodies related among themselves by a common factor, the sea, are inter-linked therein. A so common element that some people take it as a unique Southern Ocean.

In this so huge sea there are less explored spaces, the most extreme meteorological conditions, the less populated Areas and the most clean areas. How to protect them? How to achieve that the overwhelming passage of mankind do not turn the Southern Oceans in another part of a waste collection?

In this brief statement sen from the point of view of an inhabitant from that region, I will try to:

(i) Region characterization. Relevant aspects connected with marine pollution at regional and global scale. Background, national and international countries and agencies in the area;

(ii) Coastal and oceanic matters, their differences and special features in the area. Specially, oceanid field;

(iii) Main challenges for the development of research and monitoring programmes in the region. Methodologies, standards and reference material;

(iv) Description of the main current programmes. An analysis on their connections with research, oceanic services, training, education and mutual assistance (TEMA);

(v) Keys for assessing the possible IOC efforts to contribute to a better knowledge on marine pollution in the Southern Oceans.

THE SOUTHERN OCEAN COMPONENT OF THE GLOBAL OCEAN OBSERVING SYSTEM (GOOS) INCLUDING DATA/INFORMATION MANAGEMENT

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The Southern Ocean presents a challenge to many aspects of a Global Ocean Observing System (GOOS). Succinctly, GOOS is intended to provide a global framework for the gathering, coordination, quality control, distribution, and the generation of derived products, of all kinds of marine and oceanographic data of common utility, as defined by the requirements of a full spectrum of user groups. The gathering of data in the Southern Ocean, as an operational activity to generate products, is made difficult by climatological and logistical challenges. Historically this has resulted in a relatively sparse in situ data set for the Southern Ocean. Also, for a GOOS (and unlike our meteorological brethren), coordination of observing systems in polar regions involve a different suite of agencies and more specialized oceanographic observing platforms than those involved in subpolar and tropical oceanography.

Such considerations have not yet been addressed in GOOS planning. This paper serves as a call to action.

Because, in principle, GOOS will be built to the extent possible on existing observational and data management systems and because new resources for the growth of new observational systems (or expansion of existing systems) are extremely limited, a plan for a Southern Ocean component to GOOS must be very pragmatic. To this end, an attempt to answer four questions constitutes the basis of this paper.

Those questions are:

(i) What are the primary repositories of systematic, routine, long-term Southern Ocean data?
(ii) What are the existing sources of Southern Ocean data for operational oceanographic purposes?
(iii) With co-ordination and modest investment of resources, what can be envisioned for a GOOS in the Southern Ocean?
(iv) How might data management systems adapt and evolve to support GOOS?

GOOS planning to date involves mainly the scientific design of "modules" related to Climate, Health of the Ocean, Living Marine Resources, the Coastal Environment, and Marine Services. Implementation will occur slowly through evolution of existing systems into GOOS and development of new products.

Because of this, data management plays a leading role in the initial stages of GOOS development.

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The IOC Technical Committee on International Oceanographic Data and Information Exchange (IODE), at its twelfth Session (10-17 December 1986, Moscow), having reviewed Argentina's offer to become an RNODC for the Southern Oceans, recommended that the RNODC for the Southern Oceans be established in Argentina. This Recommendation was approved by the IOC Assembly at its fourteenth Session (17 March-1 April 1987, Paris).

The established RNODC/SOC operate with the following responsibilities:

(i) Acquire the physical and chemical data obtained by the international scientific community from cruises and research programmes carried out in the Southern Oceans, control their quality and store them in standard format, as well as distribute -upon request- the information stored in its files;

(ii) Co-operate closely with the World Data Centres in Oceanography by sending regular shipments (at least once a year), free of charge, of complete set of physical and chemical data stored, as well as inventories, data summaries and other products related with physical and chemical data from Southern Oceans;

(iii) The RNODC/SOC was created and developed its activity within the scope of the Argentina Oceanographic Data Centre (CEADO which depends of the Navy Hydrographic Service (SHN) and the National Scientific and Technical Research Council (CONICET) of the Argentina Republic.

During the last ten years, the RNODC/SOC has stored over than 13,000 oceanographic stations, corresponding to 348 research cruises, carried out by 19 different countries. The data and the corresponding meta data information are available, for the international scientific community, upon request or via Internet.

FRAMEWORK FOR INTERNATIONAL CO-OPERATION IN THE SOUTHERN OCEAN: INTERNATIONAL TREATIES, CONVENTIONS, DECLARATIONS AND ORGANIZATIONS

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Four main stages can be identified in the development of international co-operation in the Antarctic: (i) the heroic stage of discovery and exploration; (ii) the prevalence of science under the Antarctic Treaty; (iii) the concern for identification and access to resources; and (iv) the concern for the environment. While in all these stages science has had a prominent role political interests have also been closely associated to its development and orientation. Legitimate as this relationship might be, it has been anyhow the source of antagonism and rivalry. The main challenge for international co-operation in the years ahead shall be to ensure that science be conducted with independence from political events.

International co-operation in the Southern Ocean has been the outcome of the three last stages mentioned. Both the Antarctic Treaty and the work of the Consultative Meetings set the basic legal arrangements under which that co-operation evolved and allowed for the first expressions of a maritime dimension of the System. The Convention on the Conservation of Antarctic Marine Living Resources and the earlier Seals Convention signaled the introduction of scientific research and resource management in the context of specific concerns associated to the exploitation of the Southern Ocean. Until science was able to assert its independence, serious political conflicts arose in the management of CCAMLR and led to the paralysis of its institutions.

The present stage of environmental concern has introduced a two-fold dimension to the international co-operation in the Southern Ocean. First it has meant the updating of the orientation of the legal and institutional framework so as to make it responsive to the new scientific approaches. Ecosystem management and the implementation of the precautionary approach are two examples of this trend. A second dimension has been the development of an active linkage between the co-operation in the Southern Ocean and the initiatives for Global co-operation in major environmental areas of concern. UNCED Agenda 21 and the Conventions on Climate Change and Biological Diversity are examples of this new interactions of the Southern Ocean as a key element of the global environment.

The Law of the Sea Convention and the 1995 Agreement on the Conservation and Management of straddling fish stocks and highly migratory fish stocks offer a clear example of the relationships between the Southern Ocean and global issues in a broader number of areas, including fisheries management, protection of the marine environment, the conduct of marine scientific research and the problems associated to the continental shelf.

The Protocol on Environment Protection to the Antarctic Treaty has also reflected underlying tensions, not only between different political interests but also between science and the role of environmental organizations. In spite of having CCAMLR been exempted from the operational ambit of the Protocol, it is quite likely that situations of overlapping responsibility will emerge in the near future.

ACTIVITIES OF THE INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (IOC) IN THE SOUTHERN OCEAN

Albert Tolkatchev
IOC/UNESCO, Paris, France

The Intergovernmental Oceanographic Commission (IOC) is a functionally autonomous body within UNESCO and now includes 125 Member States. The Commission serves the Members of the UN family in their implementation of joint programmes relating to ocean research and observation.

The Commission implements programmes within three subject areas: marine sciences; ocean services; and training, education and mutual assistance/capacity building.

In 1967, the Commission established the Regional Committee for the Southern Ocean (IOCSOC) in order to promote and co-ordinate scientific research and related ocean services in the Southern Ocean. In 1993, a comprehensive report called "The Southern Ocean: A Review of Activities in Relation to IOC Programme" was issued. As decided by the 13th IOC Assembly (1993), several Member States have designated their official national contacts for SOC in order to better co-ordinate national activities with IOC research programmes and ocean observing and data management systems in the Southern Ocean.

Since 1987, the activities of the Commission in the Southern Ocean have been carried out mainly within the framework of other research programmes, in particular:

(i) World Climate Research Programme, sponsored by WMO, IOC, ICSU, particularly WOCE Southern Ocean;
(ii) IOC-UNEP-IMO-IAEA Programme on Global Investigation of Pollution in the Marine Environment (GIPME);
(iii) by co-operating with SCOR in the IGBP Joint Global Ocean Flux Study (JGOFS), particularly JGOFS Southern Ocean Study, as well as making overview evaluations;
(iv) Global Ocean Ecosystem Dynamics (GLOBEC) programme jointly sponsored by SCOR and IOC, particularly GLOBEC Southern Ocean component;
(v) General Bathymetric Chart of the Oceans (GEBCO) jointly with IHO and regional bathymetric/geological/geophysical charts; and

on-going ocean services activities such as:

(i) Joint IOC-WMO Integrated Global Ocean Services System (IGOSS);
(ii) IOC Global Sea-Level Observing System (GLOSS) including Southern Ocean Sea-Level Project;
(iii) WMO-IOC Data Buoy Programme (DBCP), including South Atlantic Buoy Programme and Antarctic Buoy Programme;
(iv) IOC International Oceanographic Data and Information Exchange (IODE) System, including activities of the Responsible National Oceanographic Center for the Southern Ocean (Argentina).

Development of the Global Ocean Observing System (GOOS) in co-operation with WMO, UNEP and ICSU in response to the appeal of Second World Climate Conference (1990) and United Nations Conference on Environment and Development (1992). GOOS will also provide the oceanographic data needed by the Global Climate Observing System (GCOS) sponsored jointly by WMO, IOC, UNEP and ICSU.

WORLD METEOROLOGICAL ORGANIZATION (WMO) ANTARCTIC ACTIVITIES

Dr E.I. Sarukhanian, Chief, Observing Systems Division
World Meteorological Organization, Geneva, Switzerland

Antarctica and its surrounding Southern Ocean is one of the two large regional sinks of heat and is an area of intensive interaction between the atmosphere and the ocean. As such, it plays a significant role in the formation of global weather and climate. WMO activities in the Antarctic concentrate on the promotion and co-ordination of the operation of the basic components of the World Weather Watch (WWW) system to meet the requirements for both meteorological services and research in the Antarctic including the monitoring of climate change and the environment.

The Antarctic Basic Synoptic Network (ABSN) is an important element of the WWW Global Observing System. The operation and maintenance of this network and the timely transmission of the observational data by means of the Global Telecommunication System (GTS) are essential to provide meteorological data for global weather analysis and prediction and for climate research. The preparation and distribution of meteorological analyses and prognoses for the Antarctic as well as warnings of dangerous conditions are important tasks of the Global Data Processing System. The current basic synoptic network in the Antarctic comprises 35 manned stations, including 14 upper-air stations, and more than 60 Automatic Weather Stations (AS). The inclusion of AS in the ABN has led to a substantial increase in the availability of synoptic data from the Antarctic. There are also 12 stations which carry out environmental monitoring of carbon dioxide, ozone and other trace constituents to determine their effect on global change. As regards meteorological observations over the Southern Ocean, the launch of an International Programme for Antarctic Buoys (IPAB), under the auspices of the World Climate Research Programme, has provided a network of drifting buoys within the Antarctic sea-ice zone which supplies observational data for research and operational purposes. Meteorological data over the ocean is also obtained from voluntary observing ships, the number of which may be extended with assistance of the International Association of Antarctic Tour Operators. Large streams of meteorological and oceanographic data are provided by environmental observation satellites. There are 11 APT and one HRPT ground receiving stations in the Antarctic which collect satellite information.

In view of the importance of climate research in the Antarctic, a Catalogue of Antarctic Climate Data was recently produced by the WMO Executive Council on Antarctic Meteorology on the basis of contributions provided by Australia, China, France, Italy, Japan, New Zealand, Poland and the Russian Federation.

In carrying out its Antarctic activities, WMO collaborates with other International Organizations, in particular with the Antarctic Treaty Consultative Meeting, Scientific Committee for Antarctic Research, Council of Managers of National Antarctic Programmes and the Intergovernmental Oceanographic Commission. This co-operation will be continued to ensure a co-ordinated and cost effective implementation of the scientific and technical programmes in the Antarctic.

WORLD CLIMATE RESEARCH PROGRAMME (WCRP) ACTIVITIES IN THE SOUTHERN OCEAN

Hartmut Grassl, Director, World Climate Research Programme
Geneva, Switzerland

The ocean are surrounding the Antarctic has rather unique climate relevance, for example through the connection it supplies for all three major oceans, the strong seasonal sea-ice cycle and the bottom water formation along some shelf areas of the Antarctic. Two projects of WCRP have collected and still are collecting data in this area, namely WOCE (World Ocean Circulation Experiment) and ACSYS (Arctic Climate System Study). While the former has its core project 2 totally devoted to the Southern Ocean (here counted as being the ocean area south of 30°S), the latter encompasses also the Antarctic Sea-ice Thickness Project (ASITP) and the International Programme for Antarctic Buoys (IPAB). ACSYS also includes sea-ice modeling around the Antarctic in its sea-ice modeling panel.

The Joint Scientific Committee (JSC) for WCRP has given the charge to CLIVAR (Climate Variability and Predictability Study) and ACSYS to discuss, within the next two years, the need for internationally co-ordinated research of coupled glaciological (including sea ice), oceanic and atmospheric components of the Antarctic climate system, thereby involving representatives of SCAR-GLOCHANT and iAnZone. The background is the extension of time-scales to decades and centuries in CLIVAR, making it essential to include the detailed representation of the Southern Oceans into coupled modeling studies.

Some results will be given for the ASITP and IPAB, showing that, despite the hostile environment, unique data sets on sea-ice draft and sea-ice drift have been obtained.

ACTIVITIES OF THE COMMISSION FOR THE CONSERVATION OF ANTARCTIC MARINE RESOURCES (CCAMLR) IN THE SOUTHERN OCEAN

Karl-Hermann Kock, Chairman, CCAMLR Scientific Committee
Hamburg, Germany

CCAMLR continues to be very active in the fields of Antarctic ecosystem research and resource management. This reflects the continued emphasis that the Commission places on rational, ecosystem-sensitive management of the exploitation of fisheries resources in the Antarctic.

There are currently three major fisheries in the CCAMLR Convention Area, for krill (between 70 000 and 100 000 tonnes taken annually mainly from the South Atlantic), toothfish (about 8 000 tonnes taken annually from around South Georgia and Kerguelen Islands) and icefish (about 4 000 tonnes taken from Kerguelen in 1995). The fishery for toothfish currently takes its allowable catch, but the krill fisheries take less than 10% of their allowable catch.

All fisheries are subject to management measures (CCAMLR Conservation Measures) such as catch limitations, and provision is made for the controlled development of new fisheries alongside the acquisition of data with which they can be assessed. Developments in assessment methodology over the last few years have seen the introduction of precautionary mechanisms for dealing with uncertainty and ecosystem interactions. This means that, under conditions of increased uncertainly and/or greater risk of adverse impact on the ecosystem (for instance, reduced food supply to dependent predators), the assessment models will generally calculate a reduced allowable catch.

CCAMLR has had an Ecosystem Monitoring Programme in place since 1987 which monitors reproductive parameters of selected predators and complements CCAMLR's more traditional assessment approaches. The aim of this programme is to detect changes in the Antarctic ecosystem and identify those which are due to fishing and those which are due to natural environmental causes. The programme has generated an extensive dataset, with time series of over 15 years for some parameters , which is now yielding highly valuable information on interactions within the Antarctic ecosystem, and which will act as the basis for advice on the management of the harvested components of the ecosystem.

CCAMLR has a Scheme of International Scientific Observation and a System of Inspection which monitor its fisheries. The Scheme of Observation establishes a mechanism for the placing of observers on vessels to collect scientific data from fisheries, and is currently mandatory for all vessels in the South Atlantic toothfish fishery. The System of Inspection provides a mechanism for international inspection of compliance of vessels with CCCAMLR Conservation Measures.

Both systems have been in successful operation for a number of years. Data obtained by observers has been particularly useful in addressing the incidental seabird mortality problem, which occurs in long line fisheries where birds are accidentally caught on sinking hooks and drown. Observations in 1995 demonstrated that the measures put in place by CCAMLR for reducing seabird mortality, particularly the requirement for night time setting, appear to be reducing the number of albatross killed, but not petrels. CCAMLR is currently producing an information booklet entitled "Fish the Sea not the Sky" to further inform fishermen worldwide about its mitigation measures.

ACTIVITIES OF THE INTERNATIONAL WHALING COMMISSION (IWC) IN THE SOUTHERN OCEAN

R. Gambell
International Whaling Commission, Cambridge, United Kingdom

Minke whale sightings programme

As a result of a request from the Scientific Committee of the IWC a properly organised and scientifically supervised census of minke whales, based primarily on sightings, was initiated in the 1978/79 southern summer. The Japanese Government made two scouting vessels available and a team of international scientists accompanied each vessel.

These cruises have continued up to the 1995/96 season and have provided nearly three complete circum-polar surveys of the waters south of 60°S in the 18 years in which they have been conducted. Initially whale marking was also carried out using marks recoverable from the carcasses processed by the commercial whaling operations, but since the cessation of commercial whaling this programme has ended.

Non-lethal biopsy sampling is now being undertaken as an adjunct to the sightings programme. Together with associated developments in line-transect theory, these cruises have provided statistically rigorous estimates of the Southern Hemisphere minke whale population abundance (762,000 95% confidence interval 514,000 - 1, 138,000), and because of their largely overlapping distribution in the summer months, of the numbers of true blue whales as well (460 95% CI 210 - 1,000).

Blue whale research programme

A new programme is being designed and implemented to refine estimates of abundance of blue whales in their feeding areas, to determine the distribution of breeding areas, and to distinguish between true and pygmy blue whales at sea. An important element of this work is investigation of the potential of low frequency acoustic methods, using a combination of passive and towed arrays; and in combination with sightings surveys to determine areas of blue whale concentrations and assess their abundance. The first research cruise was successfully carried out in the 1995/96 season south of Australia, and plans are in hand for a second cruise using two Japanese vessels and a team of international scientists in the 1996/97 season.

Southern Ocean Sanctuary

The IWC designated a Southern Ocean Sanctuary (a region where commercial whaling, whether by pelagic operations of from land stations, is prohibited) in 1994. This provision is due to be reviewed in 2004. It is hoped that this designation may stimulate research activity into the large whales and encourage the development of studies along the lines of those already in operation as described above.

Much research in this area has been carried out over the past 20 years under the umbrella of the two International Decade of Cetacean Research (IDCR) programmes of the IWC. This has now been replaced by the new IWC Southern Ocean Whale and Ecosystem Research (SOWER) programme from 1996, including emphasis on environmental research and cetaceans.

Environmental Change and Cetaceans

There is now greater awareness in the IWC that whales should not be considered apart from the marine environment which they inhabit, and that detrimental changes may threaten whale stocks. This issue has therefore been examined at two levels. First, in the context of the Revised Management Procedure developed for commercial whaling on baleen whales, the Scientific Committee has concluded from its computer testing trials that the RMP adequately addresses such concerns. However, it went on to state that the species most vulnerable to such threats might well be those reduced to levels at which the RMP, even if applied, would result in zero catches. Secondly, the Scientific Committee has held two workshops, one on the effects of chemical pollutants in March 1995 in Bergen, Norway, and another on the effects of climate change (global warming and ozone depletion) in March 1996 in Hawaii, USA.

The IWC has now endorsed proposals from its Scientific Committee for increased collaboration and co-operation with existing Southern Ocean programmes such as those of CCAMLR, SCAR, GLOBEC, IPCC and IOC.

OVERALL SYNTHESIS OF THE STATE OF SCIENTIFIC KNOWLEDGE, GAPS AND ASSESSMENTS OF NEEDS FOR FUTURE OCEANOGRAPHIC RESEARCH AND RELATED SERVICES TO ADDRESS MAJOR ISSUES FACING SOCIETY IN THE SOUTHERN OCEAN

Julian Priddle, British Antarctic Survey
Cambridge, UK

This final overview presentation will attempt to synthesise the recent advances in our understanding of the Southern Ocean, which will have been covered in greater detail by previous speakers. However, and more importantly, it will provide an opportunity to identify those key areas where specific scientific activities will be required to meet major challenges and gaps in our knowledge.

The role of the Southern Ocean in the climate system and in global change: It appears that an important scientific goal for Southern Ocean research is to develop an understanding of the teleconnections between Southern Ocean physical processes and those in adjacent oceans and the atmosphere. In particular recent work has revealed what appears to be an intrinsic periodicity in ocean, ice and atmospheric properties, but the mechanism for this is unclear. The interactions of this sub-decadal variability with that of adjacent oceans deserves further study.

Biological interactions with climate remain unclear. Despite two decades of research, including work under the JGOFS programme, we do not appear able to solve the Antarctic Paradox. Is there a single variable or reduced suite of variables which describe adequately the control of Southern Ocean primary production. If any limitation appears to derive from factors amenable to human intervention, under what circumstances could we contemplate undertaking 'ecological engineering' on a grand scale?

Sea ice poses a unique series of problems for studies in polar oceans. Additional efforts are needed to improve the representation of sea-ice physics in regional and global models of the ocean-atmosphere system. We also need to develop coupled biological-physical models which include the interaction between the ice, water column and biota, and which contain the major ways in which sea ice acts as an environmental control in the ecosystem.

Southern Ocean and marine living resources research: Research into Southern Ocean marine resources, especially Antarctic krill, has led to significant advances in our understanding of the pelagic ecosystem. However, the aspiration to conserve the entire marine ecosystem, rather than to base measures around the sustainable exploitation of individual stocks, places an enormous load on the conservation system, and makes major demands of the scientific information base. One could question how this system would perform under pressure. Do we have sufficient information on stocks and recruitment, and interactions within the ecosystem and with environmental variability if, say, the krill fishery expanded suddenly towards the TAC?

The effects of interannual variability, noted above, need to be taken into account in the assessment and management of Southern Ocean marine resources.

Marine pollution research and monitoring in the Southern Ocean: We have to accept that the Southern Ocean is not pristine, but nevertheless does offer something close to a baseline for the assessment of global pollution. However, the few studies of 'global' pollutants, such as hydrocarbons, pesticides and heavy metals, in the region indicate that the present data are insufficient to provide such a baseline in most cases - local variability and the difficulty in distinguishing between local and global sources offer the main complicating factors. More monitoring sites designed to determine typical pollutant concentrations in the environment and in representative biota are required. In parallel with this, we need to compile local information, in order to assess the scale and impact of any local contamination.

Ozone depletion and the consequent increase in ultraviolet flux is a form of global pollution which will have effects on the Southern Ocean marine system. Indeed, it is probably the most 'certain' of the anthropogenic changes to the high latitude oceans. Can we predict the effects adequately? The longer term prognosis must include possible changes to the community composition, in addition to changes in growth rates and other short-term ecosystem properties - at what point will we identify unequivocal uv-associated ecosystem effects?

The Southern Ocean component of the Global Ocean Observing System, including data/information management: The collection of global-scale data on the oceans is an exciting development in oceanography. For the Southern Ocean, this presents some special challenges both in scientific and logistic aspects. As pointed out already, this must be approached pragmatically, capitalizing on resources already in place. The paucity of long-term datasets places a special emphasis on the needs for effective data management. One operational use of Southern Ocean data would be the detection of long-term change - arising from climatic change, fisheries, pollution etc - can we capitalize on the very few long-term datasets which we have?

What do we ask of remote sensing and other new technologies? In most cases, the applications are the same as other areas of the ocean, but there is often weakness in the local supporting validation observations. Obtaining a remotely-sensed product for sea ice which is at the same spatial scale as forthcoming biogeochemical observations such as ocean colour must be seen as a special priority.

Framework for international co-operation in the Southern Ocean: international treaties, conventions, declarations and organizations: Because of the unique status of Antarctica, priorities for Southern Ocean research may develop to a different agenda from that in other parts of the world. Experience with Antarctic and Southern Ocean regional programmes of the major global research projects, including global change programmes within WCRP and IGBP, indicates that the coordination of multinational research programmes demands a hierarchy of approaches. Some components of the research effort are so clearly specific to the region that these are managed most effectively at a local level. At the other end of the spectrum, full participation in activities such as GOOS should be an area where Southern Ocean research is integrated completely with other regional studies. Only by taking this flexible approach can the potential contribution of Southern Ocean studies to global issues be realised.

The effects of interannual variability, noted above, need to be taken into account in the assessment and management of Southern Ocean marine resources.

SOUTHERN OCEAN SEA LEVEL CENTRE
NATIONAL TIDAL FACILITY

Ms Marion Tait
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National Tidal Facility - The Flinders University of South Australia

Since the first tentative steps were made to investigate the feasibility of setting up a data centre that would concentrate on sea level in the Southern Ocean, the Southern Ocean Sea Level Centre (SOSLC) has had a significant response of support and enthusiasm from the wider scientific community. Establishment of the Centre and accrual of sea level data has been, and continues to be, an ongoing pursuit. It is also promising that there is a steady increase in the requests for data for use in varied scientific fields-geodetic, biological, glaciological as well as oceanographic.

The Centre is based on a collaborative agreement between the Australian Antarctic Division of the Department of the Environment, Sport and Territories, the Australian Surveying and Land Information Group of the Department of the Arts and Administrative Services and the NTF. Recognizing the significance of the Southern Ocean in World scale circulation and its links with issues of climate change, the SOSLC aims to secure high quality, geodetically controlled sea level data from the Southern Ocean in order to:

- support oceanographic, geodetic and geographic research requirements for national and international programmes;

- enable a focus upon sea-level measurements as indicators of ocean dynamics in the context of climate change;
- assist in datum control for mapping and charting;
- supply tidal predictions for shipping and operational needs including safety of ships, personnel and equipment.

The Centre is responsible for the collection, quality-control, archiving and distribution of this data to the wider scientific community on a national and international scale. We are actively participating in data-archaeology to extend the long-term time series of sea levels in the Southern Ocean and facilitate the availability of historical data.

As of July 1996, one year after the Centre was established, data has been received from four oceanographic data institutions for almost 50 sites in the Southern Ocean. Some of these sea level time series extend back into the late 1800's and with regard to monitoring long term sea level variability these have proved invaluable.

In terms of monitoring sea level, the field of satellite altimetry also needs to be addressed and the SOSLC is including and utilizing such data. Currently, Sea Level Anomaly maps of the Southern Ocean from Topex/Poseidon satellite data are available on the WWW site for the SOSLC (URL http://www.ntf.flinders.edu.au) and it is hoped that these prove useful tools in the study of variations in sea level of the Southern Ocean.

THE COUNCIL OF MANAGERS OF NATIONAL ANTARCTIC PROGRAMMES (COMNAP) AND ITS ROLE IN ANTARCTIC RESEARCH

Pentti Mälkki, COMNAP
Helsinki, Finland

1. General information

The Council of Managers of National Programmes was established in 1988 in order to respond to needs of coordinating operations in the Antarctic Treaty region. The activities of the Council consist of:

(i) Cooperation in logistics among others by spreading information on new technologies available, by organizing regularly symposia on logistics, sharing and coordinating contingency plans in case of emergency, coordinating aviation plans and aviation safety during towards harmonizing medical screening of scientific staffs. The Council also has ongoing dialogue with tourist operators in order to solve the problems of increasing tourism in the region.

(ii) COMNAP acts as an expert body for ATCM in matters dealing with logistics and operations in the Antarctic Treaty region. The Council reports regularly to ATCM on progress of the activities and presents statements on issues relevant to the operations.

(iii) COMNAP cooperates closely with SCAR through having common working groups on various items, having simultaneous meetings with SCAR and during the intervening years having simultaneous meetings with the SCAR executive.

(iv) COMNAP has annual meetings of its own, shared with subsidiary bodies. It has a Standing Committee for Logistics (SCALOP) to deal with operational questions, it has established internal information network (Antarctic Manager's Electronic Network, AMEN) and a home page in the Internet (http://WWW.agu.org/amen). For the needs of cooperation in monitoring and other environmental issues, COMNAP has an Environmental officers network. Correspondingly, according to the recommendation of joint SCAR/COMNAP working group on Antarctic Data, a Network of data centers has been established.

(v) Secretariat of the organization is located since 1988 in AGU, cosponsored by United States. Effective September 1997 the Secretariat will be moved to Hobart, Tasmania.

2. Relation of COMNAP activities to Antarctic marine Science

By definition, the Managers of National Programmes are responsible for organizing expeditions, including marine expeditions in the Treaty region. The scientific content of these expeditions depends on national interests as well as cooperation needs discussed either during SCAR or COMNAP meetings.

Of particular interest for marine research, one may mention the following:

(i) COMNAP cooperates with IHO on improving the available bathymetric information of the Southern Ocean;

(ii) COMNAP, through a Working Group of SCALOP, has studied measures to prevent oil spills in the Antarctic and has acted on development and coordination of contingency plans for response to oil spills;

(iii) The establishment of Network of National Data Centers is used for collection of national data in a coordinated fashion, and information on existing data files in national centers will be obtainable through the new Antarctic Master Directory, to be further developed by SCAR/COMN on AP Joint Committee for Antarctic Data Management;

(iv) Information about the membership of COMNAP, its organization and procedures and also a description of each of the National Antarctic Programmes are all available on the COMNAP homepage.

ACTIVITIES OF SCIENTIFIC COMMITTEE ON OCEANIC RESEARCH (SCOR of ICSU) RELATED TO THE SOUTHERN OCEAN STUDY

Jarl-Ove Stromberg
SCOR/ICSU, Fiskebäckskil, Sweden

Since atmospheric climate related projects and monitoring programmes had already been touched upon, Professor Stromberg gave a short account of the three organizations within ICSU, that are or interest in relation to the Southern Ocean. Those are IGBP with three core projects (JGOFS, GLOBEC and LOICZ), SCAR with groups of experts and standing committees, and SCOR with short-term working groups (e.g. WG 86: Ecology of Sea Ice) and more long-lived Scientific Committees (e.g. for JGOFS and GLOBEC). He then concentrated on GLOBEC.

GLOBEC (Global Ocean Ecosystem Dynamics) as a global project is now co-sponsored by IGBP, SCOR and IOC. It has presently four major components: Carrying Capacity and Climate Change in the North Pacific (co-sponsored by PICES), Cod and Climate Change of the North Atlantic (co-sponsored by ICES), Small Pelagic fish and Climate Change, and Southern Ocean GLOBEC.

An Implementation Plan for Southern Ocean GLOBEC has been published as GLOBEC Report No. 7. This outlines the three proposed study areas, time series surveys, process studies and modeling efforts needed. Data management, timing and implementation management are also outlined.

Thanks to Prof. V. Smetacek of AWI, preliminary results from a time series survey from the latest German JGOFS/GLOBEC cruise to the Antarctic could be presented as an example of the feasibility of the proposed research.

Prof. Stromberg made an appeal for national support for the Southern Ocean GLOBEC programme, and also for the possibility of joint funding of expensive instruments, e.g. a towed video-recorder for identification of particular zooplankton species.

ANNEX VIII

LIST OF ACRONYMS

ASPECT	Antarctic Sea Ice Processes, Ecosystems and Climate (SCAR-GLOCHANT)
ACSYS	Arctic Climate System Study (WCRP)
ANITP	Antarctic Ice Thickness Project (WCRP/ACSYS)
ATCM	Antarctic Treaty Consultative Meeting
ADM	Antarctic Data Management (SCAR/COMNAP)
CCAMLR	Commission for Conservation of Antarctic Marine Living Resources
CEOS	Committee on Earth Observations Satellites
CLIVAR	Climate Variability and Predictability Programme (WCRP)
COMNAP	Council of Managers of National Antarctic Programmes
CS-EASIZ	Coast and Shelf Ecology of the Antarctic Sea-Ice Zone (SCAR)
DBCP	Data Buoy Cooperation Panel (WMO/IOC)
FAO	Food and Agriculture Organization of the UN
GAPA	Geological/Geophysical Atlases of the Pacific and Atlantic (IOC)
GCOS	Global Climate Observing System (WMO/IOC/UNEP/ICSU)
GEBCO	General Bathymetric Chart of the Oceans (IOC/IHO)
GESAMP	Group of Experts on Scientific Aspects of Marine Protection (FAO/IAEA/IOC/WMO/UN/UNEP/UNESCO/WHO/WMO)
GIPME	Global Investigation of Pollution in the Marine Environment (IOC/UNEP/IAEA/IMO)
GLOBEC	Global Ocean Ecosystem Dynamics (IGBP) (SCOR/IOC)
GLOCHANT	Global Change and the Antarctic (SCAR)
GLOSS	Global Sea Level Observing System (IOC)
GOOS	Global Ocean Observing System (IOC/WMO/UNEP/ICSU)
IAEA	International Atomic Energy Agency
ICES	International Council for the Exploration of the Sea
ICSU	International Council of Scientific Unions
IGBP	International Geosphere-Biosphere Programme (ICSU)
IGOSS	Integrated Global Ocean Services System (IOC/WMO)
IHO	International Hydrographic Organization
IMO	International Maritime Organization
IOC	Intergovernmental Oceanographic Commission
IODE	International Oceanographic Data & Information Exchange (IOC)
IPAB	International Programme for Antarctic Buoys (WCRP/DBCP)
IWC	International Whaling Commission
JGOFS	Joint Global Ocean Flux Study (IGBP) (SCOR/IOC)
LOICZ	Land-Ocean Interactions in the Coastal Zone (IGBP)
OSLR	Ocean Science in Relation to Living Resources (IOC)
PICES	North Pacific Marine Sciences Organization
RNODC	Responsible National Oceanographic Data Centre (IOC/IODE)
SCAR	Scientific Committee on Antarctic Research (ICSU)
SCOR	Scientific Committee on Oceanic Research (ICSU)
SCOPE	Scientific Committee on Problems of the Environment (ICSU)
SOE	Southern Ocean Ecology (SCAR)
SOWER	Southern Ocean Whale and Ecosystem Research (IWC)
SPARC	Stratospheric Processes and their Role in Climate (WCRP)
UN	United Nations
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
WCRP	World Climate Research Programme (WMO/IOC/ICSU)
WHO	World Health Organization
WMO	World Meteorological Organization
WOCE	World Ocean Circulation Experiment (WCRP)

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