

REPORT OF THE
SCIENTIFIC COMMITTEE ON OCEANIC RESEARCH
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This report covers the period from July 1986 to June 1987.

ORGANIZATION

The **Eighteenth General Meeting of SCOR** took place at the CSIRO Marine Laboratories in Hobart, Australia from November 26 to 28, 1986. It was preceded by a successful scientific symposium entitled "Interfaces in the Ocean; A Preliminary View" which was organized by the Australian Committee for SCOR. Reports were submitted to the General Meeting by the Chairmen of all SCOR subsidiary bodies and were critically reviewed in accordance with the SCOR Constitution. Several groups were disbanded, having discharged their terms of reference. Proposals for the establishment of seven new working groups were also considered by the General Meeting. This meeting was attended by a representative of ICSU, Dr. P. Scott.

PUBLICATIONS

The report of the XVIII General Meeting of SCOR has been published as Volume 22 of SCOR Proceedings. A new version of the SCOR Handbook is being published in June 1987. Information on more than thirty publications arising from recent SCOR activities is given in the latest issue of SCOR Proceedings.

SCIENTIFIC ACTIVITIES

There are currently twenty active SCOR Working Groups, Committees and Panels; six of these were established by the General Meeting. A complete list of all these SCOR subsidiary bodies is given at the end of this report. During the past year several subsidiary bodies have made significant contributions to the advancement of knowledge within their fields of expertise.

The final meeting of WG 73 (**Ecological Theory in relation to Biological Oceanography**) took place in December 1986. This has been a highly successful working group with several workshops and significant ecological publications to its credit. One of its last activities was to organize an international workshop on Flow Analysis which took place at the University of California, Santa Cruz just before the WG 73 meeting. The goal of this workshop was to submit various ecosystem models to testing using existing data sets in order to elucidate patterns and relationships common to various ecosystems and to compare the various measures and analytical techniques available with regard to their usefulness in improving our understanding of ecosystems. The Chairman of WG 73 reported to SCOR that "we may now be on the threshold of a comparative science of ecosystems".

WG 68 (**North Atlantic Circulation**) and WG 74 (**General Circulation of the Southern Ocean**) have both published their final reports. These are lengthy documents with many recommendations for future physical oceanographic research and modelling activities. They have both been used extensively by WOCE planners in developing WOCE Core Project 3 on Gyre Dynamics and Core Project 2 on the Southern Ocean and are expected to continue to have a major impact on future oceanographic research programmes.

The final report of WG 65 (**Coastal-Offshore Ecosystems Relationships**) has been published as No. 48 in the Unesco Technical Papers in Marine Science. Springer Verlag will publish the papers which were presented in a workshop organized by WG 65 in early 1986 which emphasized exchange processes between coastal and offshore systems.

This report has thus far highlighted the activities of a few SCOR subsidiary bodies. It is not all-inclusive and many other groups have significant programmes underway. One SCOR group which is so important that it warrants special attention in every report such as this is the **Joint SCOR/IOC Committee on Climatic Changes and the Ocean**. The CCCO's functions are to 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. The CCCO being the main international scientific body dealing with the oceans and climate, therefore cooperates with the JSC in planning the World Climate Research Programme (WCRP).

The Eighth Session of CCCO was held at the University of Kiel in May 1987. The primary task of CCCO-8 was to evaluate the development and implementation of the large-scale experiments within the WCRP; the Study of the Interannual Variability of the Tropical Ocean and Global Atmosphere (TOGA) and the World Ocean Circulation Experiment (WOCE). This session addressed a number of other topics including: CO₂ studies, IGBP, sea ice, satellite programmes and the opportunities for training, education and mutual assistance associated with the ocean components of the WCRP.

Tropical Ocean and Global Atmosphere Programme

The ten year observational period of TOGA began in January 1985 and CCCO undertook a major review of TOGA based on the first two years of experience, to determine whether the programme is meeting its established scientific objectives. CCCO-8 concluded that TOGA has been very successful to date and that rapid advances can be expected in our understanding of the influence of tropical oceans on global climatic patterns. Diagnostic and theoretical studies have more clearly revealed the global tropical linkages associated with the El Nino - Southern Oscillation phenomenon. These linkages are more far-reaching than previously thought and it is now clear that the Indian and Atlantic oceans are involved as well as the Pacific. TOGA is generating large amounts of data which are being used by modellers and theoreticians to test and modify their hypotheses. Those designing the observational programmes are doing so with these newly revised

hypotheses in mind. Moreover, CCCO noted that the degree to which current theories match the observations is unprecedented. In general, CCCO-8 gave its enthusiastic endorsement to the TOGA Programme.

World Ocean Circulation Experiment

The planning for WOCE passed a milestone with the finalization of the Scientific Plan (issued in Sept. 1986). The WOCE Scientific Steering Group is now concentrating on the development of a detailed experimental design which will be incorporated into an implementation plan to be completed by mid 1987 and submitted to an International WOCE Conference, cosponsored by SCOR, in 1988.

There are three "Core Projects" within WOCE; the Global Description, the Southern Ocean Experiment and the Gyre Dynamics Experiment. Each of these was the topic of a planning workshop in 1986. Major programmatic components envisaged for Core Projects 1 and 2 are surface fluxes, marginal seas exchanges, basin-scale circulation and variability (i.e. mass flux), heat flux, equatorial exchanges and boundary currents. Core Project 3 will focus on processes in the surface layer, ocean interior and the deep ocean in order to improve our understanding of large-scale forcing.

A WOCE Hydrographic Programme is being developed - this will have important links to the JGOFS programme (see below) since CO₂ and tracer measurements will be conducted in conjunction with the Hydrographic Programme. The use of tracers to study circulation has been identified as an important component of WOCE. A WOCE Hydrographic Programme Planning Committee will be established to define needs and allocate ship-time, equipment, scientific teams, etc. based on guidance from the WOCE Scientific Steering Group and the working groups responsible for the Core Projects.

A data information center is being established in the UK which will be responsible for the coordination and dissemination of information on various WOCE data sets. It has been agreed that within WOCE a major effort must be focussed on the calibration and validation of satellite data.

CO₂ Biogeochemical Activities

CCCO-8 considered a CO₂ research proposal which deals with the measurements needed to determine and understand the changes in oceanic carbon resulting from human activities, principally fossil fuel combustion and deforestation. The Committee accepted the need for its involvement in a CO₂ programme aimed at determining how, and by how much, ocean processes influence the CO₂ content of the atmosphere over the long term. Present global data sets are inadequate to even establish a baseline for CO₂ in the ocean and the information required for an understanding of the changing CO₂ content of the ocean presents a much more complex problem. The CO₂ Panel of CCCO proposed a ten year international observational programme that would define the fundamental controls on the ocean CO₂ system and its temporal variability. This will involve the cooperation of WOCE planners in

incorporating CO₂ measurements into the WOCE Hydrographic Programme and close links to JGOFS (see below) in recognition of the fact that a combination of aspects of WOCE and JGOFS can form the major elements of a global CO₂ programme. Ultimately, three-dimensional models will be an essential part of understanding the global carbon cycle.

Ocean Observing System Development Programme

Steady progress is evident toward developing the various components of the ocean observing system. The TOPEX-POSEIDON satellite programme, critical to the success of the WCRP, has passed crucial budget tests in the U.S. and France. Other satellites required for the success of WOCE in particular, are either flying or in the advanced planning stages for launches in the next three years (ERS-1, N-ROSS). The eventual operational implementation of the key remote sensing systems, then, seems to be well in hand.

Important advances were noted in the development of in situ observing systems for TOGA with expanded XBT and sea level networks and more drifting buoys in many regions. Sufficient amounts of high quality data are now becoming available to permit the production of operational products for model verification for these regions. Further efforts are required to expand observational networks in the Indian Ocean and in certain other areas. CCCO has been concerned about the delays in the timely submission of data to the national and international data centres and has sought SCOR's assistance in considering ways in which individual scientists can be actively encouraged to submit their data for use by the wider oceanographic community in these important international efforts.

Modelling Activities

CCCO has reorganized its modelling activities under two Numerical Experimentation Groups, one each for TOGA and WOCE. One of the goals of CCCO has been to promote the development of general circulation models and a primitive equation GCM is now being run on a monthly basis. The results are being used to diagnose the climatic state of the tropical Pacific and have proved invaluable in the description of oceanic changes associated with the 1986/87 El Nino. Comparisons of model simulations with in situ data are showing general agreement for several important oceanographic parameters. CCCO-8 identified other parameters (sea surface temperature for example) for which there remains much room for improvement in the current models. Work continues on coupled ocean-atmosphere models with encouraging results for the prediction El Nino events.

INTERNATIONAL SCIENTIFIC PLANNING AND COORDINATION OF GLOBAL OCEAN FLUX STUDIES

A major recent initiative of SCOR relates to ocean flux studies. During the last two years, on a number of occasions, concern has been expressed at meetings of SCOR, and other international marine science groups, about the growing number of large-scale, international oceanographic programmes and about the potential for overlap and duplication of effort between them. While the oceanographic

components of the WCRP are planned and implemented through an organizational framework which includes the CCCO, its secretariat, scientific subsidiary bodies and two international project offices, no similar mechanism exists for the international coordination and planning of studies of ocean fluxes which have been emerging in several countries. In late 1986 a proposal was received from CCCO, the Chairman of the Committee for the US Global Ocean Flux Study and the Chairman of the IOC Working Committee for GIPME, which suggested that a meeting should be convened by SCOR for the purpose of bringing together experts in the study of biogeochemical cycles in the ocean. It suggested that they should be asked to decide whether a coordinated international programme of ocean flux studies is desirable and, if so, to consider an appropriate framework for its scientific development and coordination. This meeting took place at ICSU headquarters in February 1987.

This meeting agreed that there should be an internationally coordinated study entitled the Joint Global Ocean Flux Study (JGOFS) and that planning for this study should proceed as soon as possible, building on various existing and developing national programmes. This international planning is to be done under the auspices of a Scientific Planning Committee for JGOFS which the meeting proposed should be established by SCOR. This proposal will be considered by SCOR at its Executive Committee meeting in October 1987. The participants in the meeting held at ICSU agreed on the main goal of JGOFS and on its major elements. A high priority was given to carbon dioxide studies by the meeting. JGOFS will clearly have substantial links to IGBP and reference is made to these links in several places in the report. For example:

"In terms of links with other ongoing planning, the meeting recognized the recent establishment of an ICSU Special Committee for the Geosphere-Biosphere, which has in its terms of reference mention of ocean interests encompassing those of JGOFS. The meeting recommended that informal communication be established with the SCGB, and that a representative from that Committee be invited to JGOFS Planning Meetings. As planning for JGOFS develops, and as the SCGB develops its priorities, the possibility of more formal links, including cosponsorship, may be considered. The meeting noted that it is expected that the SCGB will also look to SCOR and CCCO for advice and guidance on ocean programmes related to studies of global change."

JOINT OCEANOGRAPHIC ASSEMBLY

SCOR is also in the process of planning for the next Joint Oceanographic Assembly which will take place in Mexico, from August 23 to 31, 1988. This two week assembly is held every six years and is a major international forum for oceanographers, providing a unique opportunity for interdisciplinary discussions which are not possible at most of the smaller, more specialized meetings in the field of marine science. In July 1986, SCOR formally accepted the invitation from the Director of the Consejo Nacional de Ciencia y Tecnologia (the parent organization of the Mexican Committee for SCOR) to hold the JOA

in Acapulco in August 1988. A Mexican Organizing Committee has been established and SCOR has appointed an international Scientific Programme Committee. The programme can be expected to direct attention to current international research activities of broad general interest, especially those in which SCOR has played an important role such as climate studies, living resources and non-living resources.

OTHER ACTIVITIES

SCOR continues to act as the official scientific advisory body to the Division of Marine Sciences of Unesco and the Intergovernmental Oceanographic Commission. SCOR has responded, as appropriate, to the requests of several other international organizations for cosponsorship of scientific meetings. For example, SCOR cosponsored the Antarctic Variability Seminar in cooperation with IOC, CCAMLR and SCAR. Through a grant from the National Science Foundation, SCOR provides funds for travel by oceanographers from developing countries to international scientific meetings which are organized or cosponsored by SCOR. Between fifteen and twenty such travel awards are made annually.

Further information on these and other SCOR activities may be found in SCOR Proceedings, or by contacting E. Tidmarsh, Executive Secretary, SCOR, Department of Oceanography, Dalhousie University, Halifax, Nova Scotia, Canada, B3H 4J1.

SCOR SUBSIDIARY BODIES AS AT JUNE 1, 1987

WG 69	Small-scale Turbulence and Mixing in the Ocean
WG 71	Particulate Biogeochemical Processes
WG 72	The Ocean as a Source and Sink for Atmospheric Constituents
WG 75	Methodology for Oceanic CO ₂ Measurements
WG 76	Ecology of the Deep Sea Floor
WG 77	Laboratory Tests Related to Basic Physical Measurements at Sea
WG 78	Determination of Photosynthetic Pigments in Seawater
WG 79	Geological Variations in Carbon Dioxide and the Carbon Cycle
WG 80	Role of Phase Transfer Processes in the Cycling of Trace Metals in Estuaries
WG 81	Deep Water Palaeoceanography
WG 82	Polar Deep Sea Palaeoenvironments
WG 83	Wave Modelling
WG 84	Hydrothermal Emanations at Plate Boundaries
WG 85	Experimental Ecosystems
WG 86	Ecology of Sea Ice
WG 87	Fine-scale Distribution of Gelatinous Planktonic Animals
WG 88	Intercalibration of Drifting Buoys

Joint SCOR/IOC Committee on Climatic Changes and the Ocean
SCOR/UNESCO/ICES/IAPSO Joint Panel on Oceanographic Tables and Standards
Editorial Group for the Ocean Modelling Newsletter