11. WWW and IGOSS

There was some discussion on the discontinuation of some Ocean Weather Ships in the western North Atlantic. The future of those in the eastern North Atlantic was under discussion.

The meeting was informed about the IGOSS pilot project for bathythermograph observations. It seemed likely that both WWW and IGOSS would wish to have sea-surface temperature charts on a synoptic basis.

12. Future activity of the Committee

It seemed clear that one major aim of the Committee, to foster research on air-sea interaction, was no longer needed: there was a lot of activity ranging from large international projects to individual researches.

The need now appeared to assist in selecting projects which would most illuminate the relevant physical processes and in ensuring that data were collected, processed and stored so as to allow their wide use not only by the group by whom they had been collected.

Dr Pond pointed to the need for a collection of case histories of thermocline development in relation to varying weather conditions. This was an example of data which were, in principle, available but which in practice were difficult to assemble because of differing data-banking procedures.

Dr Priestley reported that the WMO project on historical sea-surface temperatures was still in progress: this may be another data set which would be widely used if it were readily accessible.

13. Any other business

The Committee recorded its thanks to the University of Melbourne and to the Organizing Committee of the IAMAP/IAPSO Joint Assembly for making the meeting facilities available.

14. Date of next meeting

The next meeting would be held in association with the XVI General Assembly of IUGG at Grenoble in August/September 1975.

ANNEX VII

OCEAN CLIMATE PANEL OF WG. 34

Oceanographic Basis of Ocean Monitoring and Prediction Systems
Report of Meeting on 20 October 1973

The first meeting of the SCOR WG 34 Panel concerned with Monitoring Global Ocean Climate took plate on 20 October 1973 during the Ocean/Atmosphere Climate Workshop (Session 2) in Victoria, British Columbia. Four members of the Panel (Dickson (Chairman), Namias, Smed, Tabata) were present, while the fifth member (Hupfer) communicated his views by mail.

Our brief was to determine the oceanographic basis for the ocean monitoring and prediction systems of the future and specifically, to explore the feasibility of monitoring large-scale, long-period variations in ocean climate. Throughout our discussion we were conscious of the fact that if our recommendations were to be implemented, they must be concerned with specifics rather than with vague generalisations; similarly it was clear that the techniques involved should be practical and relatively inexpensive rather than over-sophisticated or futuristic. Thus although all members of the Panel were aware of what an "ideal" monitoring system would involve, we have concentrated on the one basic aim of providing time-series of a few essential hydrographic and meteorological parameters from fixed locations, globally distributed, in order to describe the long term climatological means of these parameters and their monthly deviations from "normal".

Reviewing the many possible approaches to this objective, the following were thought to be the most fruitful:

(1) The establishment of a "Phantom Weathership" network. Over the past 25 years the Ocean Weather Stations of the Atlantic and Pacific sectors have constituted the most complete data base for the study of ocean/atmosphere variation in open ocean areas. However the expense of maintaining these stations has now brought about a drastic reduction in the network and although data buoys have been suggested as replacements these will also be expensive to maintain, even in limited numbers. Certainly they do not offer a solution to the problem of data collection over the great expanse of tropical and southern oceans. Over the majority of the world ocean our knowledge of ocean climate variations is based largely on data collected by the commercial ship sampling programmes of WMO and others but from the point of view of our Panel this data-collection is currently too random in space and time to establish the fixed-point time-series which we require. It is the view of the Panel that without disrupting the current commercial ship sampling programme, a part of this sampling effort could be reshaped to provide a constant frequency of sampling at fixed locations, and at low cost. Our rationale is as follows: In world shipping there exist a number of major companies operating large fleets of bulk carriers (tankers, ore carriers) which operate between fixed points of supply and demand. Accordingly they occupy relatively fixed routes at a rather constant frequency, and for this reason this type of bulk carrier is ideally suited to the type of observational programme which we require. In essence we plan to identify each major fleet in this category, whether or not they are currently contributing ocean data, and for each fleet we will then seek to identify the precise routes and traffic frequencies worked by their vessels. Initial enquiries with three major fleets (Shell, B. P. and Exxon) have shown the existence of several routes worked by each company at a frequency of over 6 voyages per month; it is clear that if a sufficient number of these routes can be identified globally and if observations can be arranged at carefully chosen points along these routes and at a frequency of 6 observations or more per month we are approaching the type of fixed-point data collection networks which the weatherships used to provide, (but in this case on a global scale). The location of each site will be critical since no major carrier will agree to divert its vessels from their preferred route; thus while each station should be located in a hydrographically critical or representative site, the normal routing patterns of vessels (current routing, weather routing etc) must also be studied in detail if the system is to be practicable. In addition as we currently envisage the scheme, each major carrier will be responsible not for a chain of globally distributed stations (which would impose impossible restrictions on the navigation of their vessels) but for one or two stations only which they alone would occupy and located at the most favoured location along their most travelled route. Thus from 50-100 major

bulk carrier fleets we would plan a global network of perhaps 100 stations. So far the Panel has concentrated on identifying suitable fleets from Japan alone but already some 50 potentially suitable fleets have been identified, some running in sparsely sampled areas (Japan - South America or Japan - Australia for example). As regards cost the Panel sees no reason why the major fleets should not be persuaded to bear the relatively minor cost of instrumentation themselves. The oil industry is extremely sensitive to public opinion on environmental issues; put crudely if they are able to show that they are taking on the job of environmental monitoring at a time when the developed nations are running down their ocean station networks then the publicity trade-offs will far outweigh the cost of an XBT launcher and probes for each of their vessels. As regards the parameters to be sampled, the Panel is open to advice from potential users but perhaps the minimum program should involve XBT, surface temperature and salinity, the normal meteorological parameters and solar radiation measurements. At present the Panel sees its job as being to investigate the feasibility of setting up such a globally distributed network of fixed-point ocean data stations. If this proves feasible then it would recommend (through SCOR) that this programme be incorporated into the current WMO programme which already possesses the means to gather and distribute the data. It is perhaps relevant to add that in the opinion of the Panel, such a scheme must form the basis of any programme aimed at successfully monitoring the ocean climate on a global scale. For reasons of cost we must use commercial shipping to make the necessary observations. To establish an adequate data base we must obtain these observations at fixed locations. For these reasons the description of this one item of the Panel's work programme is given the greatest emphasis in this report.

(2) Extension of the tide gauge network. As Wyrtki has made plain in his recent studies, even a sparse network of tide gauges can provide useful and meaningful estimates of ocean current variations. Sus Tabata is currently compiling an inventory of tide-gauge data and this will be used to identify those locations where the network could usefully be expanded.

These two items will constitute the bulk of our initial work programme but during this phase of the Panel's work we will also give attention to the following problems which we think are of importance:

(3) The rescue of time-series in distress. Recognising that an existing time series of ocean data is a valuable asset we plan to be on the lookout for time series which are in danger of abandonment in the hope of urging their continuation. By this we do not merely mean the diminishing ocean weather station network; there exist many cases where hydographic effort has been carried out in a fixed location for a decade or so, only to be abandoned as research interest moves on to a different area. As one example we may cite Blindheims 10 year data series of hydrocasts in April in the Davis Strait, abandoned in 1969/70. In inacessible areas stations worked in a single month of successive years can be extraordinarily valuable, especially if (as in this case) they were sited in a critical area. As another example we may cite ultra-deep stations in critical areas where trends of change are slow and where an irregular history of past observations can be raised to the status of a time-series with little additional effort.

(4) The Climate Clinic concept. It was an early view of C.G. Rossby that the science of ocean/atmosphere interaction would benefit from the establishment of a centre where there would be access to data and computing facilities and where routine analyses of hydrographic and atmospheric data would be carried out and discussed with a view to isolating central research problems. Such a centre, perhaps attached to an established

institution, would have its own core staff of air/sea interaction scientists, but (perhaps more important) would permit visiting scientists to attend for period of some 3 months to 1 year. It is the opinion of the Panel that the interchange of ideas resulting from such a programme would advance our knowledge of ocean/atmosphere behaviour and should perhaps be a long term objective of our Working Group.

(5) Housekeeping. Since the Panel has recently met to discuss its initial work programme, no further meetings are planned for 1974 and no financial support will be required from SCOR.

(6) Additional Panel Members. The Panel has already received valuable support information from Dr Hayato Iida, T. M. A. Tokyo, would welcome his inclusion as a member, and seeks the approval of the SCOR Executive and of our own parent Working Group to this suggestion.

ANNEX VIII

THEORETICAL PANEL OF WG 34

Oceanographic Basis of Ocean Monitoring and Prediction Systems

Report of Meetings, Australia, January 1974

A. SESSIONS

I	Melbourne	23 January 1974	(afternoon)
*II	Melbourne	23	(evenings)
III	Melbourne	24	(afternoon)
*IV	Canberra	28	(afternoon)

* Indicates joint meeting with WG 38.

B. PARTICIPATION

Members

L. Fomin	USSR	I	II	III	-
A. Gill	UK	I	II	III	IV
K. Hasselman	FRG	I	II	III	-
A. Robinson (Chmn)	USA	I	II	III	IV

Invitees

L. Brekhovskikh	USSR	I	-	III	-
H. Charnock	UK	I	-	III	IV
W. Holland	USA	I	-	III	-
G. Needler	Can	I	II	III	-
W. Schmitz	USA	I	II	III	IV

For WG 38					
D. J. Baker	USA	-	II	-	IV
B. Ekov	USSR	-	II	-	-
Sir G. Deacon (Chmn)	UK	-	II	-	IV
V. Neal	USA	-	II	-	IV
Additional					
F. Anderson	S. Af.	-	-	-	IV
K. Bowden	UK	-	-	-	IV
T. Gaskell	UK	-	-	-	IV
R. Pollard	UK	I	-	III	-
D. Rochford	Aus.	-	-	-	IV
G. Siedler	FRG	-	-	III	-
R. Stewart	Can.	I	-	-	-

C. DISCUSSION TOPICS

1. Dynamics of Mod-Ocean Eddies: (Sessions I, & III) In accordance with the initial specific charge to WG 34 "....., to consider the desirability and possible design of a mid-ocean dynamics experiment....." this topic, which was the subject of a Recommendation adopted at our 1971 Moscow meeting (SCOR Proc. Vol. 8 No. 1) and also discussed at our 1972 Boulder, Colorado meeting, was discussed and a general Recommendation (see below) was adopted at the end of Session III.

As requested by the SCOR Executive on an ad hoc basis, two additional topics were considered.

2. Dynamics of the Antarctic Region: (Sessions II, & IV) A Recommendation (see below) was adopted at the end of Session IV.

3. An Oceanographic Programme for FGGE (The First GARP Global Experiment)· (Sessions II, & III) The following Recommendation to the SCOR Executive was adopted at the end of Session II.

(1) The timely, fundamental, and practically important problem of the Dynamics of Climate (The 2nd GARP Objective - "improving our understanding of the physical basis of climate") necessarily involves special oceanographic as well as meteorological studies, and particularly requires the development of coupled ocean-atmosphere models and coordinated joint air-sea experimental studies.

(2) Because of the commonality of many specific scientific objectives and the large effort and investment required in their pursuance, a strong interaction between the oceanographic community, including its burgeoning activity in large experiments (e. g. NORPAX), and GARP is desirable; in particular.

(3) It is recommended that a special SCOR Working Group be established to develop plans for a comprehensive oceanographic programme for FGGE, and note:

(a) the immediacy required in order that the requisite joint oceanographic-meteorological input may enter FGGE planning at an early stage.

(b) that the Global Coverage of meteorological parameters, especially the improvement during FGGE in the southern hemisphere, suggests that the following major possibilities for oceanographic experimentation be considered.

i) Dynamics and Response of the Southern Ocean
ii) In light of the relatively short oceanic equatorial time scales, the Dynamics of Equatorial Currents and Waves (Indian, Atlantic, Pacific).
iii) Large Scale Upper Layer Dynamics.
iv) The Monitoring of appropriately identified Indices of Variability (e.g. Current Transports).

(c) that the desirability and feasibility of exploiting or modifying for oceanographic purposes the large number of proposed surface free drifting buoys should be considered.

4. Dynamical Considerations within SCOR: A discussion of the organization within SCOR WG's required for the effective consideration of dynamical problems naturally arose and recommendations (a WG for Internal Dynamics of the Sea, for Coupled Air-Sea Dynamics, and a mutual Sub-Group on Numerical Modelling both WG's to concern themselves necessarily with aspects of the Antarctic dynamics) were reported to the SCOR Executive verbally in detail in Canberra on 29 January.

C. RECOMMENDATIONS

It is hoped that the following may be published and publicized so as to encourage international participation in these important programmes.

I. Mid-Ocean Dynamics Experiments: POLYMODE

1. The critical Importance of the low frequency Eddy-scale (mesoscale or oceanic synoptic scale) for the dynamics of the general circulation of the open ocean has been established by the results of recent investigations including, (i) the low frequency analysis of the POLYGON Experiment, (ii) the results of MODE-O and the preliminary analysis of MODE-I data, (iii) evidence from initial researches into historical data which indicate the widespread geographical distribution of the phenomena.

2. The scope of the Eddy phenomenon and its characteristic scales in space and time are such that a large and necessarily International Effort is required for its investigation. The next major field experiment POLYMODE is scheduled for the western North Atlantic in 1976; fully international cooperation in its planning and execution is strongly encouraged.

a) Accomplishment of the Scientific Objectives of POLYMODE should provide a significant advancement in understanding of the dynamics of the phenomenon and should include feasible aspects of Energy transformations in the deep sea involving the Eddy-scale motions, Eddy production mechanisms, Eddy-Eddy Eddy-Mean Field Interactions, and

b) International Cooperation in the investigation of the geography of the phenomenon is essential. A number of small individual efforts (e.g. isolated

moorings and small arrays, closely spaced along XBT tracks) are required to map the distribution of eddy energy and scales over the vast reaches of the worlds oceans.

3. The increased knowledge of the eddy phenomenon afforded by both the increased data base and the results of modelling efforts provides a basis for improved and more extensive numerical modelling. Such models should play a critical role in the design and interpretation of POLYMODE and of future Mid-Ocean Dynamics Experiments.

a) Communication between the modelling groups concerned with eddy processes and those concerned with other isolatable special dynamical processes and specific oceanic regions should be effectively maintained in order to allow for as rapid as possible a construction of a dynamically correct comprehensive general ocean circulation model.

II. Antarctic Dynamics

1. The Importance of physical oceanographic studies in the Antarctic Ocean is recognized because:

a) of the many regional phenomena which are dynamically interesting and complex. Included are the Antarctic Circumpolar Current which links the Southern oceans, deep convection which is the origin of more than half the world oceans' deep water, and exchange processes involving air, sea and ice which influence the energy balance of the polar heat sink. Many aspects of the physical processes involved in these phenomena may typically occur elsewhere in the worlds oceans.

b) of the role of the Antarctic circulation in the General Circulation of the worlds ocean and its probable influence on the atmospheric global circulation.

c) of the practical benefits associated with increased knowledge such as the prediction of local weather, sea and ice conditions, exploitation of the regions high biological productivity, and climatic modelling.

2. On account of the importance of the region, the present lack of understanding of process, and the availability of modern observational techniques it is recommended that an International Cooperative Programme of Exploratory Experimentation be carried out now in the Antarctic Ocean. This experimentation, such as that planned by ISOS (International Southern Ocean Studies), should:

a) be addressed to the definition of

i) the scales of variability in space and time

ii) specific physical processes, associated with the phenomena.

b) be associated with a related programme of theoretical/numerical modelling of the region and of processes.

c) serve as the basis for the identification and design of major Antarctic Experiments where and when feasible and necessary.

SCOR WORKING GROUP 35 — ANNEX IX

Methods in Quantitative Ecology of Coral Reefs

Report by Chairman

SCOR WG35 held a field meeting at the Heron Island Research Station, Great Barrier Reef, immediately following the Second International Symposium on Coral Reefs held on board m.v. Marco Polo in June-July 1973. Some members of the field meeting left the Marco Polo at its final stop, at Heron Island, on 30 June. Others travelled to Heron Island from Brisbane on 2 July. Most members left Heron Island on 9 or 10 July, some a little later.

All members of WG35 were present for the meeting: these comprised

Dr D. R. Stoddart (Cambridge, England), Chairman
Dr R. E. Johannes (Georgia, USA)
Professor K. Jonishi (Kanazawa, Japan)
Dr Y. Loya (Tel-Aviv, Israel)
Dr M. Pichon (Marseille, France)
Dr G. Scheer (Darmstadt, Germany)
Dr F. H. Talbot (Sydney, Australia)

In addition the Group was joined by thirteen other scientists, at their own expense, specifically for the purpose of this meeting. This greatly broadened the scope of the fieldwork and discussion. The additional participants were:

Dr Nurit Gundermann, South Pacific Commission, New Caledonia
Dr P. Hutchings, Australian Museum, Sydney
Dr D. W. Kinsey, Mauri Bros. and Thompson, Sydney
Dr D. Kühlmann, Humboldt Universität, German Democratic Repulic
Dr E. Lovell, University of Queensland, Brisbane
Dr J. Marsh, Marine Laboratory, University of Guam
Dr J. Porter, University of Michigan, USA
Mrs K. Porter, University of Michigan, USA
Dr B. Russel, Australian Museum, Sydney
Dr H. Schuhmacher, Ruhr Universität, Bochum, Germany
Dr B. Thomassin, Station marine d'Endoume, France
Mrs C. C. Wallace, Queensland Museum, Brisbane
Dr M. Wijsman-Best, Rijksmuseum, Leiden, Netherlands

The Group conducted fieldwork on the reefs of Heron Island and on other nearby reefs during the day, and held seminars and discussion meetings during the evenings. The fieldwork consisted of studying reef areas using alternative methodologies. In addition, several members were able to visit the field laboratory maintained by The Australian Museum on One Tree Island, and observe its reef, by invitation of the Director, Dr Talbot.