GARP

GLOBAL ATMOSPHERIC RESEARCH PROGRAMME

GARP
SPECIAL
REPORT

No. 2

REPORT OF INTERIM PLANNING GROUP ON GARP TROPICAL EXPERIMENT IN THE ATLANTIC

LONDON, JULY 1970

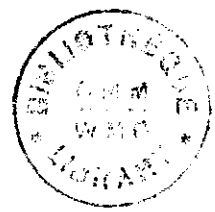
INTERNATIONAL COUNCIL
OF SCIENTIFIC UNIONS

WORLD METEOROLOGICAL
ORGANIZATION

GLOBAL ATMOSPHERIC RESEARCH PROGRAMME (GARP)

REPORT OF INTERIM PLANNING GROUP ON GARP TROPICAL EXPERIMENT IN THE ATLANTIC

London, July 1970



GARP SPECIAL REPORT No. 2

August 1970

NOTE

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the Secretariat of the World Meteorological Organization concerning the legal status of any country or territory or of its authorities, or concerning the delimitation of its frontiers.

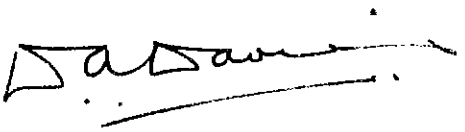
F O R E W O R D

This publication, the second in the series of GARP Special Reports, contains the report of the session of the Interim Planning Group on the GARP Tropical Experiment in the Atlantic. The session was convened in London from 22-24 July 1970 as a result of a recommendation of the Planning Conference on GARP (Brussels, March 1970). Invitations were sent out by the Secretary-General of WMO on behalf of WMO and the International Council of Scientific Unions.

Apart from a few minor editorial changes, the report contained herein is in the form approved by the Interim Planning Group. The recommendations it contains will be considered in due course by the Executive Committees of WMO and ICSU. Action has already been taken on certain of the more urgent interim measures proposed.

I wish to express my appreciation of the excellent spirit of co-operation and dedication shown by all participants at the session of the Interim Planning Group. As a result of this, many of the ideas expressed in the Planning Conference on GARP were translated into firmer plans of action which make it possible to embark on the detailed planning for the GARP Tropical Experiment in the Atlantic.

I particularly wish to thank Dr. B.J. Mason for the very capable manner in which he served as chairman of the session of the Interim Planning Group and for the excellent arrangements he made for the session to be held at the Royal Society. The participants at the session were unanimous in their appreciation of the inspiring premises and generous hospitality of the Royal Society, and I wish to record my thanks to the officers of the Society for their support.



(D.A. Davies)
Secretary-General
World Meteorological Organization

C O N T E N T S

REPORT OF THE SESSION

1. ORGANIZATION OF THE SESSION

1.1 Opening of the session

1.1.1 The session was opened at 10.00 a.m. on 22 July 1970 at the Royal Society, London, by Dr. A. Nyberg, President of WMO. Participants were welcomed on behalf of Her Majesty's Government by Dr. B.J. Mason, Director-General of the Meteorological Office. He considered that the GARP Tropical Atlantic Experiment was more complex than any previous international research project; this meant that the organizational structure would have to be very carefully planned. A major step in this direction should be taken during the present meeting.

1.1.2 The President of the Royal Society, Lord Blackett, welcomed participants on behalf of the Royal Society. He felt that the GARP Tropical Experiment had all the necessary ingredients for a successful international scientific enterprise, namely an essential international nature, some fascinating scientific problems to be solved and some expected practical benefits in the form of improved forecasts. He hoped that Governments would provide the necessary financial support.

1.1.3 The Secretary-General of WMO, Mr. D.A. Davies, thanked the British Government and the Royal Society for having made it possible for the meeting to be held in such excellent surroundings. GARP was a unique example of collaboration between a governmental organization (WMO) and a non-governmental organization (ICSU) and he was especially happy to be able to speak on behalf of both organizations.

1.1.4 The Secretary-General of ICSU, Professor K. Chandrasekharan, associated himself with Mr. Davies' remarks and referred to the happy marriage between WMO and ICSU. He mentioned some other major international scientific projects in which ICSU had been associated and some programmes now being developed which could also involve collaboration with governmental organizations, such as Unesco and the United Nations.

1.1.5 The list of participants is given in Annex I.

1.2 Election of chairman

At the proposal of Dr. R.M. White, supported by several other participants, Dr. B.J. Mason was elected chairman of the session by acclamation.

1.3 Approval of agenda

The approved agenda is given in Annex II.

1.4 Working arrangements

No working committees were established but an ad hoc group was convened under the chairmanship of Mr. J.S. Sawyer to draft the regulations for the Tropical Experiment Council and the Tropical Experiment Board (see paragraph 4.2.2 below).

2. REVIEW OF JOC PROPOSALS FOR TROPICAL EXPERIMENT

2.1 Background

The discussion on this item was based mainly on the proposals contained in GARP Publications Series No. 4 and on a supplement prepared by JOC in response to the request made at the Planning Conference on GARP. In introducing this supplementary material, the Chairman of JOC referred also to an informal meeting held in London on 21 July 1970 at which the outcome of a recent meeting in Miami had been reviewed. The following report is based on Professor Bolin's introductory statement and the subsequent exchange of views.

2.2 Objectives of the experiment

2.2.1 The Planning Conference on GARP had asked JOC to recommend whether the Tropical Experiment should be of type I (i.e., to examine the interactions between the large wave-scale (Scale A: 2-10,000 km) and the scale of cloud clusters (Scale B: 100-1000 km)) and/or type II (i.e., to examine the interactions between Scale B and the meso-convective scale (Scale C: 10-100 km) including the collective effect of the scale of convective cells (Scale D: 1-10 km)). JOC had replied that both types should be carried out concurrently but had expressed some reservations about the adequacy of the facilities offered for the type II experiment.

2.2.2 There was general agreement in the group about the need for a type I experiment. This could be designed largely on the basis of observations from an improved WWW operational network, supplemented by a suitably located geostationary satellite and the ships provisionally offered at the Planning Conference on GARP. There was also agreement on the importance of the transfers of energy which take place on Scale C and on the desirability that the experiment should be designed to provide data which could improve our understanding of these energy transfers. It was however realized that there is still a considerable divergence of views among scientists about how the type II experiment could best be designed. Some participants felt that, in view of the considerable overlap between Scales A, B and C, a rigid division into type I and type II might not be the most useful approach to the problem;

another approach would be to decide how to make the best use of the resources available in order to obtain the maximum amount of additional information abou the role of the tropics in the general circulation.

2.2.3 It was also reported that some scientists consider that, in addition to studies of the energy cycle in the tropics as it affects the general circulation, the Tropical Experiment should pay attention to investigations which would help more directly to improve weather forecasting in the tropics. Such an approach would probably help in obtaining the full support of tropical countries for the experiment.

2.2.4 The session concluded that these various objectives should be entirely compatible. It would however be a mistake to widen the scope of the experiment too much. It should be possible without compromising the overall objectives of GARP to make provision for other studies of interest to tropical countries. Clearly this would be a very important task for study by the Scientific and Management Group (see paragraph 4.3). They should be requested to design the experiment in such a way as to include a type I experiment, and as much as possible of type II; additional studies of special interest to tropical countries could be added provided that they would not hinder the achievement of the primary GARP objectives.

2.3 Area of experiment

2.3.1 Scale A

The JOC proposals regarding the area needed to define Scale A were accepted. This means that observations will be collected from an enhanced WWW network of surface and upper-air stations in the belt from approximately 20°N to 10°S stretching from Ethiopia westwards to the Pacific coasts of Latin America. The limits of the area should not be defined too rigidly at this stage; it may for example be necessary to extend somewhat north of 20°N in the western Atlantic.

2.3.2 Scale B

2.3.2.1 As regards the B-scale area, JOC had reported that the results of various investigations showed a higher frequency of cloud clusters in the eastern Atlantic than in the western Atlantic. Professor Bolin expressed the view however that it would be premature to take a final decision now about the B-scale area; further studies should be carried out and a specific recommendation should then be made by the Scientific and Management Group. In support of this view it was pointed out that we do not know to what extent the cloud clusters in the eastern Atlantic are typical of those elsewhere in the tropics; they may be greatly influenced by the effects of the adjacent African continent and may not be so active as cloud clusters further west. Further light on this problem would probably be shed by some studies of satellite cloud pictures now under way using enhancement techniques.

2.3.2.2 It was agreed to refer the selection of the B-scale area to the Scientific and Management Group. In making their recommendation the group should take into account the three considerations suggested by JOC (paragraph 5.2.1 of JOC-IV Report, Annex F) and also the desirability of observing cloud clusters which are not unduly influenced by land masses.

2.4 Oceanographic and air-sea interaction observations

2.4.1 The session recognized that many of the ships taking part in the Tropical Experiment would be oceanographic research vessels. Oceanographers would naturally wish to take advantage of the presence of these ships in the area to carry out additional oceanographic observations, and there was some discussion as to how best this could be done.

2.4.2 It was pointed out that the characteristic time and space scales of main interest to oceanographers are not the same as those of meteorological interest. An oceanographic experiment would therefore be designed differently from a meteorological experiment. In designing the Tropical Experiment, which should be clearly understood by everybody to be basically a meteorological experiment, it should however be possible to provide sufficient flexibility

to allow oceanographers to make additional observations of particular interest to them. For example small displacements of the A-scale ships, which might not be critical for the meteorological programme, might be very valuable for the oceanographers. Such flexibility would help to stimulate the interest of oceanographers in the experiment. Some oceanographic groups might then simply wish to make use of the capabilities of the ships dedicated to the meteorological experiment and located as required for this experiment. Such oceanic work should be welcomed provided that it was compatible with the meteorological programme.

2.4.3 It is also possible that oceanographers may wish to organize simultaneous oceanographic experiments, to take full advantage of the unusuall; detailed information available from the meteorological network. Such an initiative by the oceanographers should be welcomed, and advantage taken of th additional ships which might thus be in the area to obtain such meteorological information as is compatible with the oceanographic work.

2.4.4 Air-sea interaction studies constitute a separate GARP sub-programme However mesoscale and large-scale aspects of this programme have direct relevance to the Tropical Experiment. Measurements in the atmospheric boundar layer which will reveal the character of such mesoscale and large-scale phenomena will be needed. Hopefully the strictly microscale interactions can be deduced from measurements on larger scales by suitable parameterization It is therefore necessary to measure bulk parameters with sufficient accuracy to permit such parameterization.

2.4.5 The planning of major oceanographic experiments normally calls for a lead time of several years. Thus the oceanographers must know very soon the nature of those aspects of the meteorological experiment which will most influence their thinking in determining what kind of oceanographic observation they would like to carry out in conjunction with the Tropical Experiment. In particular the strategy and tactics of the deployment of ships should be established as soon as possible - preferably before September 1971. Oceanographers should also be told as soon as possible of any meteorological requirements which might provide constraints on the nature of oceanographic observations.

2.4.6 There was some discussion about the most appropriate international oceanographic body to be consulted about the additional oceanographic observations during the Tropical Experiment. Ultimately this must be left to the Tropical Experiment Board. In the meantime steps should be taken to interest national oceanographic groups in the possibilities offered by the Tropical Experiment. Also, advantage should be taken of existing SCOR and IOC working groups on time dependent oceanic motion and on air-sea interaction in order to effect liaison with the oceanographers. From time to time appropriate members of the oceanographic community should be invited to participate in the discussion of the Tropical Experiment Board and of the planning groups established by the Tropical Experiment Board.

2.5 Observational systems

2.5.1 Availability of satellites, ships and aircraft

The session reviewed the satellites, ships and aircraft which might be available for the Tropical Experiment, as listed in section 3.3 of the Report on the Planning Conference on GARP. Representatives of the countries concerned reported that there were no substantial changes in their possible contributions. The view was however expressed that some additional ships and aircraft might be contributed when the plans for the experiment had been developed in more detail and the need for such additional facilities had been clearly demonstrated on the basis of well-founded systems analysis. For example the number of aircraft needed should be assessed after considering such factors as flight paths and aircraft performance.

2.5.2 Observations from continental areas

The session considered that over the continental areas the observational data would be adequate to define the A-scale provided that the present WWW plan for radiosonde and radiowind stations were fully implemented by the time of the experiment. No plans have however been announced for implementing some of these stations and the group therefore recommended that the WMO Executive Committee should take all possible steps to remedy this situation. For example, priority in the allocation of VAP resources could

be given to implementing upper-air stations in the area of the experiment. Another possibility which should be explored is the temporary operation of such stations during the period of the experiment.

2.5.3 Supplementary sources of observations

It was recognized that observations from commercial vessels and aircraft could be of great importance for the realization of the Tropical Experiment. The Scientific and Management Group was asked to study carefully the best use of such facilities and in so doing to take due account of the experience gained in the GARP Basic Data Set Project. The group should maintain direct contact as required with those nations which might help in supplying such facilities for the Tropical Experiment. The session emphasized the importance of the islands within and near the area of the experiment. These islands should be used for basic observations, such as radiosonde and radiowind. The session also stressed the value of other supplementary means of observations, including radar for the observation and measurement of precipitation; such additional facilities should be installed on islands, on ships and on aircraft to the extent possible.

2.5.4 Comparability of radiosonde observations

The session also attached importance to ensuring the comparability of radiosonde observations from stations using different types of radiosondes. It was recommended that WMO should endeavour to improve the present situation in this respect.

2.6 Data transmission and processing

2.6.1 Data processing

2.6.1.1 JOC had called attention to the vital importance of having an adequate data-processing system for the experiment. The design of this system should be considered as an essential and integral part of the planning of the experiment. The session also realized that a real-time data-processing system would be needed for the monitoring of the experiment but that this raised many problems, including the provision of adequate communication facilities.

2.6.1.2 As a broad principle it was suggested that standard observations made at synoptic hours should be processed in real-time, that standard observations at non-synoptic hours should be processed with a fixed time lag, and that some non-standard observations may have to be transmitted and processed later. Even so, the object should be to have all the data processed as quickly as possible. This could be facilitated by having standard data formats also for the non-standard observations.

2.6.2 Data transmission

The session also recognized the importance of having adequate communication facilities, both for operational management and for data collection. It was decided that the Scientific and Management Group should conduct a detailed study of the whole question of data transmission and processing and should make proposals for a data management scheme as a matter of urgency. The Group should use as a basis for this study the proposals contained in section 9 of Annex F of the report of JOC-IV.

2.7 Numerical experimentation

The session emphasized the need for systematic numerical experimentation in connexion with the planning of the Tropical Experiment. In particular it was pointed out that numerical experiments simulating the interactions between cloud clusters and the large-scale motion ought to be carried out.

3. PLAN OF ACTION FOR TROPICAL EXPERIMENT

3.1 Calendar of events

The session endorsed the following calendar of events and decisions as proposed by the Planning Conference on GARP:

(a) The selection of the individuals who will do the detailed planning of the Tropical Experiment should be accomplished by September 1970;

(b) The detailed scientific design of this experiment should be completed by September 1971;

(c) On the basis of this design, a date for the experiment should be designated at this time (September 1971);

(d) Firm commitments by the nations should be received by January 1972.

3.2 Interim Planning Group

Some specific proposals regarding the steps which should be taken in order to meet these deadlines were made under other items of the agenda. As a further step in this direction it was decided that the Interim Planning Group should be maintained, with Dr. B.J. Mason as chairman, until the Tropical Experiment Board has been established.

4. PLAN FOR ESTABLISHMENT OF TROPICAL EXPERIMENT BOARD

4.1 Background

The discussion of this item was based on a document submitted by the Secretary-General of WMO, Mr. D.A. Davies. Mr. Davies explained that his proposals followed very closely those made at the Planning Conference on GARP.

4.2 Tropical Experiment Council and Tropical Experiment Board

4.2.1 Mr. Davies' proposals were widely supported by the session. It was agreed in particular that all the countries in the area of the experiment should have the opportunity of being represented on some central body and that there would be a need for a smaller executive body. The functions of these two bodies would in fact be different. The former body would enable all the countries to contribute to the overall objectives of the experiment, with special attention to the use of enhanced WWW operational facilities. The latter body would be concerned mainly with the planning and operation of extra-territorial observing facilities, such as satellites, ships and aircraft, and with the processing and analysis of the data. The session decided to propose that the larger body should be called the Tropical Experiment Council (TEC) and the smaller body the Tropical Experiment Board (TEB). It was further agreed that both the TEC and TEB should report directly and independently to the Executive Committees of WMO and ICSU.

4.2.2 The session agreed on draft sets of regulations for the TEC and TEB; these are reproduced in Annexes III and IV. The Secretaries-General of WMO and ICSU were requested to take action for these texts to be submitted to the appropriate authorities of WMO and ICSU with a strong recommendation that they be promptly approved. To facilitate the formal setting up of the TEC and TEB, the Secretary-General of WMO was requested to carry out an urgent inquiry to ascertain which additional countries wished to participate in the Tropical Experiment and whether their contributions would include the provision of substantial extra-territorial observing facilities.

4.3 Scientific and Management Group

4.3.1 Staff

4.3.1.1 It was agreed that there would be a need for some full-time staff with various types of competence, including knowledge of tropical meteorology, atmospheric modelling, systems analysis, data processing, engineering design, and management. These various specialists would have to work in very close contact with each other and it was therefore agreed to propose to TEB that a single group should be established under central direction, to be known as the Scientific and Management Group. This group would be headed by a director and his deputy, who between them might carry out the functions of scientific leader and project manager. For the efficient conduct of their duties, both of these officials would need to be appointed by the Secretary-General of WMO with the status of international civil servants.

4.3.1.2 The other specialists and supporting technical staff for the Scientific and Management Group should be provided by participating countries, which should pay their salaries and allowances and their travel on taking up and completion of their appointments. The group would also need to have some clerical and secretarial support.

4.3.2 Location

As regards the location of the Scientific and Management Group, it was agreed that the best place would be within a major meteorological research institute where there would be a scientific atmosphere and adequate supporting facilities, including access to a powerful computer. The location should be readily accessible by international transport. Alternatively, it was pointed out that there would be some advantages in locating the group in Geneva, where there would be close contact both with the JPS and the WMO Secretariat.

4.3.3 Computer facilities

As regards the computer facilities required by the Scientific and Management Group, a distinction should be drawn between those needed during the planning stages and those needed as part of the experiment itself. The

session was reminded that, at the Planning Conference on GARP, some countries had already offered to provide computer time. The Scientific and Management Group should decide more precisely what facilities it will require and then determine how the best advantage could be taken of these and other offers.

4.3.4 Funding

4.3.4.1 The session recommended that international funds should be used to pay the recruitment expenses, salaries and allowances for the director of the Scientific and Management Group and his deputy, the corresponding expenses for the clerical and secretarial staff, and the expenses for all official travel carried out by any members of the staff of the group in the execution of official duties for the group. The Executive Committees of WMO and ICSU were requested to decide how the necessary funds (probably of the order of U.S. $100,000 to 200,000 per annum) could be provided.

4.3.4.2 The session considered that the GARP Implementation Fund should continue to be used for financing the activities of JOC and JPS, and that the Scientific and Management Group should therefore be financed from some other source.

4.4 Interim arrangements

4.4.1 In view of the inevitable delay of several months in the establishment of TEB and in the setting up of the Scientific and Management Group, and bearing in mind the need for starting the detailed planning of the experiment as quickly as possible, the session considered what interim arrangements could be made. The session concluded that at least two full-time staff should start work as soon as possible. For the time being these full-time staff should be attached as consultants to the Secretary-General of WMO, who, in conjunction with the Director of the JPS, should conduct the necessary studies and report the results to the TEB.

4.4.2 The Secretary-General of WMO was requested to invite the Permanent Representatives with WMO of all the countries which had already indicated their intention to provide substantial support for the Tropical Experiment to indicate by 1 September 1970 what staff they would be prepared to provide for these interim arrangements. A more general invitation to all countries could be sent out at the time of distributing the report of the session. The final selection of these temporary staff should be made by the Secretary-General in consultation with the Chairman of JOC.

4.4.3 As the salaries, allowances and initial travel expenses of the interim staff would be paid by the contributing countries, the session considered that there would be little need for additional expenses for the interim staff in the immediate future. As they would be serving as consultants to the Secretary-General of WMO, any necessary expenses could be met from the WMO budget.

5. DATE AND PLACE OF FIRST SESSION OF THE BOARD

5.1 Tropical Experiment Board

The session hoped that the TEB would be established as soon as possible, but realized that this would not be until after the forthcoming sessions of the Executive Committees of WMO and ICSU. It was considered important that the TEB should meet soon after its establishment and the session accordingly proposed that the first session should be convened in Geneva in the first half of December 1970.

5.2 Tropical Experiment Council

It was agreed that the Executive Committees of WMO and ICSU should decide about the date and place of the first session of the TEC.

6. REPORT OF THE SESSION

6.1 Content and form

The session approved the text of the material to be included in the report of the session. The Secretary of the session was requested to edit the material for publication as a GARP Special Report.

6.2 Follow-up

The Secretary-General of WMO was requested to arrange for the report to be distributed to all concerned. The session expressed the hope that the Executive Committees of WMO and ICSU would consider the proposals contained in the report at their next sessions and that in the meantime the Secretary-General of WMO would take steps to initiate any urgent action.

6.3 Acknowledgements

The participants at the session unanimously expressed their appreciation to Dr. B.J. Mason for having arranged for the session to be held in London and for having acted in such an efficient manner as chairman. They also wished to place on record their gratitude to the Royal Society authorities for their hospitality and for the excellent facilities and services which had been made available.

6.4 Closing of the session

The session closed at 4.00 p.m. on 24 July 1970.

A N N E X I

LIST OF PARTICIPANTS

I. Delegations of Members of WMO

Name of Member	Name(s) of Participant(s)
Belgium	Mr. M. Quoilin
Federal Republic of Germany	Dr. K. Brocks Professor H. Hinzpeter
France	Mr. L. Facy Mr. A. Villevieille Mr. P. Vitureau
Portugal	Mr. A. Silva de Sousa
U.K.	Dr. B.J. Mason Professor H. Charnock Dr. G.E.R. Deacon Mr. J.S. Sawyer
U.S.A.	Dr. R.M. White Dr. R. Hallgren Professor V. Suomi Dr. J.W. Firor Mr. G.D. Cartwright
U.S.S.R.	Dr. M. Petrossiants

II. Presidents of Regional Associations

RA I	Dr. M. Seck

III.	Representatives of WMO	Dr. A. Nyberg (President) Mr. D.A. Davies (Secretary-General) Mr. B. Zavos
IV.	Representative of ICSU	Mr. F.W.G. Baker (Executive Secretary)
V.	Representatives of JOC	Professor B. Bolin (Chairman) Academician V. Bugaev Professor R. Stewart
VI.	Secretary	Mr. O.M. Ashford
	Joint Secretary	Professor B. Döös

A N N E X II

AGENDA

1. ORGANIZATION OF THE SESSION

   1.1 Opening of the session
   1.2 Election of chairman
   1.3 Approval of the agenda
   1.4 Working arrangements

2. REVIEW OF JOC PROPOSALS FOR TROPICAL EXPERIMENT

3. PLAN OF ACTION FOR TROPICAL EXPERIMENT

4. PLAN FOR ESTABLISHMENT OF TROPICAL EXPERIMENT BOARD

5. DATE AND PLACE OF THE FIRST SESSION OF THE BOARD

6. REPORT OF THE SESSION

A N N E X III

REGULATIONS APPLICABLE TO THE TROPICAL EXPERIMENT COUNCIL

1. Applicability

These regulations, which apply within the framework of the Agreement between WMO and ICSU on GARP, relate to the Tropical Experiment Council (TEC) for the GARP Tropical Experiment in the Atlantic.

2. Approving authorities

The regulations are approved jointly by the World Meteorological Organization (WMO) and the International Council of Scientific Unions (ICSU) and may only be amended by decision of both organizations.

3. Composition

3.1 The TEC shall be composed of members who shall be the officially designated representatives of:

(a) Member governments whose territories or territorial waters extend into the region of the GARP Tropical Experiment in the Atlantic.

(b) Other Member governments wishing to participate in the experiment.

3.2 Each such Member government shall be invited by WMO to designate a representative to serve on the TEC.

4. Functions

4.1 The functions of the TEC shall be:

(a) To review progress in the planning of the experiment;

(b) To pay special attention to the ways in which the WWW operational facilities may be enhanced so as to provide the maximum contribution to the experiment;

(c) To consider how the results of the experiment can be best utilized for the development of meteorological research and the improvement of meteorological applications in the area of the experiment.

4.2 At the opening of each session the TEC will elect from its members a chairman who will continue to serve in that capacity during the session and thereafter until the next session. He may be re-elected without limit.

5. Secretariat support

To the extent that secretariat support is necessary from outside, this will be provided by the Secretaries-General of WMO and ICSU. In particular the Secretary-General of WMO will be the channel of communication between TEC and participating governments. The Secretary-General of ICSU will be kept fully informed of any action taken by the Secretary-General of WMO in this capacity.

6. Sessions

6.1 The TEC shall hold sessions at dates and places which it shall decide in consultation with the Secretary-General of WMO.

6.2 Invitations as appropriate to attend or be represented at sessions shall be sent to the following:

(a) All members of the TEC, each of whom may also designate an alternate and as many advisers as he considers necessary;

(b) WMO and ICSU;

(c) JOC.

6.3 The conduct of business at sessions shall mutatis mutandis follow those prescribed in the WMO Regulations.

6.4 The sessions shall as far as possible be arranged without financial cost to WMO and ICSU. In particular WMO and ICSU will not meet travel or per diem costs of participants to the sessions (other than such costs for participants specifically nominated as WMO and ICSU representatives). WMO will, however, provide the conference secretariat for sessions as well as limited linguistic support during sessions. It will also reproduce and distribute pre-conference documentation and the report of each session in English, French, Russian and Spanish, as necessary.

6.5 The conference facilities of the WMO Building and the services of the WMO Secretariat will be made available for sessions of the TEC.

7. Reporting

The TEC will submit a report on each session to the Executive Committees of WMO and ICSU. Copies will also be sent to all members of the JOC.

A N N E X IV

REGULATIONS APPLICABLE TO THE TROPICAL EXPERIMENT BOARD

1. Applicability

These regulations, which apply within the framework of the Agreement between WMO and ICSU on GARP, relate to the Tropical Experiment Board (TEB) for the GARP Tropical Experiment in the Atlantic.

2. Approving authorities

The regulations are approved jointly by the World Meteorological Organization (WMO) and the International Council of Scientific Unions (ICSU) and may only be amended by decision of both organizations.

3. Composition

3.1 The TEB shall be composed of members who shall be the officially designated representatives of the Member governments which have signified their intention of providing substantial extra-territorial observing facilities (such as satellites, ships and aircraft) for the GARP Tropical Experiment in the Atlantic.

3.2 Each such Member government shall be invited by WMO to designate a representative to serve on TEB, preferably on a permanent basis.

3.3 On the recommendation of TEB, WMO should invite additional Member governments, whose participation on the TEB is considered to be important for the success of the experiment (for example, Members providing major operational bases for the experiment), to designate a representative to serve on TEB.

4. Functions

4.1 The functions of the TEB shall be to act as the central international body for the planning and implementation of the experiment. In exercising these functions, the following principles shall apply:

(a) Due regard shall be paid to the views expressed by the TEC and to the overall arrangements for GARP approved by WMO and ICSU and in particular the responsibilities of the JOC, which in brief are to act in a review and advisory capacity to the TEB*;

(b) Within these overall arrangements for GARP, the TEB shall have full authority to formulate plans for implementing the experiment and to organize the implementation. To this end it may establish subsidiary bodies and designate or create operational or other centres related to the experiment;

(c) It is recognized that the major elements of the experiment will comprise national facilities, services and personnel and the TEB will be responsible for ensuring that these individual contributions are combined into a co-ordinated programme, having in mind at all times the scientific aims of the experiment;

(d) In general the activities of the TEB will be supported and financed by the respective Member governments concerned. If other resources are necessary the TEB is authorized to request assistance from WMO and ICSU.

4.2 At the opening of each session the TEB will elect from its members a chairman who will continue to serve in that capacity during the session and thereafter until the next session. He may be re-elected without limit.

5. Secretariat support

To the extent that secretariat support is necessary from outside, this will be provided by the Secretaries-General of WMO and ICSU. In particular the Secretary-General of WMO will be the channel of communication between TEB and participating governments. The Secretary-General of ICSU will be kept fully informed of any action taken by the Secretary-General of WMO in this capacity.

* Full details of the agreed JOC responsibilities are given in GARP Publications Series No. 1, Appendix II.

6. Sessions

6.1 The TEB shall hold sessions at dates and places which it shall decide in consultation with the Secretary-General of WMO.

6.2 Invitations as appropriate to attend or be represented at sessions shall be sent to the following:

(a) All members of the TEB;

(b) WMO and ICSU;

(c) JOC

(d) Additional experts invited on a personal basis, all such invitations being decided upon by the TEB itself.

6.3 The conduct of business at sessions shall mutatis mutandis follow those prescribed in the WMO Regulations.

6.4 The sessions shall as far as possible be arranged without financial cost to WMO and ICSU. In particular WMO and ICSU will not meet travel or per diem costs of participants to the sessions (other than such costs for participants specifically nominated as WMO and ICSU representatives). WMO will, however, provide the conference secretariat for sessions as well as limited linguistic support during sessions. It will also reproduce and distribute pre-conference documentation and the report of each session in English, French, Russian and Spanish, as necessary.

6.5 The conference facilities of the WMO Building and the services of the WMO Secretariat will be made available for sessions of the TEB or its subsidiary bodies.

7. Financial arrangements

The TEB shall fulfil its functions in the most economical manner. It shall have no independent budget and as far as possible its affairs will be conducted within limits of national contributions and existing Secretariat facilities.

8. Personnel

Subsidiary bodies of TEB may be headed by a director and deputy appointed as international staff. Otherwise, the activities of TEB and its subsidiary bodies will, as far as possible, be conducted by utilizing staff provided and paid for by the participating Member governments. Any international staff will on the other hand receive appropriate contracts from WMO. Such international staff will in general be appointed at the request and on the nomination of TEB. In nominating such staff for scientific duties, the TEB will give due consideration to the views and proposals of the JOC.

9. Reporting

9.1 The TEB will submit a report on each session and an annual report to the Executive Committees of WMO and ICSU. Copies will also be sent to all members of the Tropical Experiment Council and of the JOC.

9.2 Each session report will contain the decisions taken by the TEB both as regards those taken on subjects within its own jurisdiction and those which require the approval of WMO and ICSU (i.e. resolutions and recommendations in WMO nomenclature). The annual report shall contain a review of all activities of the TEB in the preceding year.