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UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

SUBSIDIARY BODY FOR SCIENTIFIC AND TECHNOLOGICAL ADVICE
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Item 3 of the provisional agenda

COOPERATION WITH RELEVANT INTERNATIONAL ORGANIZATIONS

Conference on the World Climate Research Programme (Geneva, 26-28 August 1997)

Report on the Conference

Note by the secretariat

1. At its fifth session, the Subsidiary Body for Scientific and Technological Advice (SBSTA) welcomed the holding of the Conference on the World Climate Research Programme: Achievement, Benefits and Challenges, held at Geneva from 26 to 28 August 1997. It requested its co-sponsors, namely the World Meteorological Organization (WMO), the Intergovernmental Oceanographic Commission (IOC) and the International Council of Scientific Union (ICSU), to make a full report of the Conference available to the SBSTA (FCCC/SBSTA/1997/4, para. 26 (e)).

2. The Conference adopted a statement on the achievements and benefits of the programme, as well as on the programme's future priorities and challenges. It also adopted a message to the Conference of the Parties to the United Nations Framework Convention on Climate Change. These are given in the submission.

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3. The SBSTA may wish to:

(a) Note the statement of the international Conference on the World Climate Research Programme: Achievements, Benefits and Challenges included in Annex I;

(b) Make recommendations to the Conference of the Parties at its third session in relation to the message included in paper 2, in particular to put in place arrangements to ensure funding and support for the essential observation networks of the Global Climate Observing System (GCOS) and its oceanographic and terrestrial counterparts and for research involving data and interpretation and analysis, as well as for retrieval and preservation of historical data in electronic form.

4. In accordance with the procedure for miscellaneous documents, these papers are attached and are reproduced in the language in which they were received and without formal editing.

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PAPER NO. 1: WORLD METEOROLOGICAL ORGANIZATION (WMO)

STATEMENT OF THE INTERNATIONAL CONFERENCE ON THE WORLD CLIMATE RESEARCH PROGRAMME: ACHIEVEMENTS, BENEFITS AND CHALLENGES

Geneva, 28 August 1997

PREAMBLE

Much has been learned about the behaviour of the global climate system since the establishment of the World Climate Research Programme (WCRP) in 1979 as the research component of the international, interdisciplinary, interagency World Climate Programme. WCRP research has underpinned the Scientific Assessments of the Intergovernmental Panel on Climate Change (IPCC) and the negotiation of the United Nations Framework Convention on Climate Change (UNFCCC) and has provided the scientific basis for major advances in climate services around the world.

Notwithstanding, for nations to meet their fundamental obligations to ensure safety of their citizens and promote sustainable development, they must better understand, monitor, and manage the extremes of flood and drought and the threats of human-induced climate change. Support to and cooperative action in the framework of the WCRP offers an outstanding opportunity to improve understanding and prediction of climate. It is critically important that nations reinforce their commitment to a cooperative international research effort through the WCRP and its associated global observing, research and service programmes.

We, as representatives of the international climate research and policy communities, have taken stock of the achievements, benefits and limitations of WCRP during the past eighteen years and have considered the scientific challenges lying ahead. We commend our findings, summarized below, for the urgent consideration of the governing bodies of the World Meteorological Organization (WMO), the International Council of Scientific Unions (ICSU), the Intergovernmental Oceanographic Commission (IOC) of UNESCO, and through them, the governments of all nations, especially those who have committed themselves to the objectives of the UNFCCC, the United Nations Convention on Biological Diversity, and the United Nations Convention to Combat Desertification.

I. MAJOR ACHIEVEMENTS AND BENEFITS OF WCRP

WCRP has stimulated commitments of national support for research on critical climate issues and provided the international context for enhancing the value of national research efforts. Among achievements to date, the WCRP has contributed in significant measure to:

- the capability to observe, describe and predict climate anomalies several seasons in advance related to the El Niño - Southern Oscillation phenomenon. This capability is a direct result of the WCRP Tropical Oceans - Global Atmosphere (TOGA) project. The predictions so obtained are in increasing operational use and are providing major benefits in drought preparedness, water resource management, agriculture and public health in both developing and developed countries;

- improved modelling of the coupled physical climate system (comprising atmosphere, oceans, land surface and cryosphere) through systematic model diagnosis and intercomparisons, thereby providing more accurate predictions of natural climate variations and giving increased confidence in models and projections of anthropogenic climate change. These results are central to the Scientific Assessments of the IPCC and furnish essential basic information for the discussions on the implementation of the UNFCCC;

- data analyses and model simulations that have underpinned the assessment of natural climate variability, and hence the first suggestion of a discernible anthropogenic climate change signal, as discussed in the IPCC Second Assessment Report in 1995. Evidence presented at the Conference supported further the key conclusions of the IPCC Assessment;

- studies of atmospheric, hydrological and oceanic processes upon which the above developments were based, and which have led to better understanding, description and parameterization of important processes in the climate system;

- systematic observations of the ocean's three-dimensional structure, combined with satellite altimetry providing a vastly increased knowledge of the ocean circulation and behaviour, and permitting the development and testing of ocean models. This is enabling improved assessments of water and energy transports, ocean currents, and spatial patterns of change in sea level, essential for understanding climate change and variability and in the management of ocean and coastal resources;

- assembly of critical data sets, on global and regional scales, of radiative fluxes, clouds, the oceans, water vapour and the hydrological cycle as a basis for improved understanding and modelling of climate and of water resources;

- raising the level of scientific, governmental and public appreciation of the importance of climate issues, increasing the collaboration with the International Geosphere-Biosphere Programme (IGBP) in capacity building in developing countries, and fostering much greater cooperation between hitherto distinct scientific disciplines in understanding the whole climate system.

II. FUTURE PRIORITIES AND CHALLENGES

The objectives of the WCRP are to determine to what extent climate can be predicted and the extent of human influence on climate, aiming at the general goal of a greatly improved understanding of the role of climate in the total Earth system. The Conference agreed that the overall research priorities for the next decade should be:

- assessing the nature and predictability of seasonal to interdecadal variations of the climate system at global and regional scales, and providing the scientific basis for operational predictions of these variations for use in climate services in support of sustainable development.

- detecting climate change and attributing causes, and projecting the magnitude and rate of human-induced climate change, regional variations, and related sea level rise (as needed for input to the IPCC, UNFCCC and other Conventions).

The research required to reach these two targets is closely interconnected. The Conference considered that the present WCRP project structure (the Global Energy and Water Cycle Experiment (GEWEX), Stratospheric Processes and their Role in Climate (SPARC), the World Ocean Circulation Experiment (WOCE), the Climate Variability and Predictability study (CLIVAR), the Arctic Climate System Study (ACSYS), and the cross-cutting Climate Modelling activities) provides an efficient and flexible framework to tackle the priority scientific issues raised by the Conference and to respond to the questions identified in IPCC Scientific Assessments. The Joint Scientific Committee (JSC) for the WCRP needs to examine appropriate modifications to or extension of the scope of some of the projects (in particular ACSYS) to take into account the specific proposals made below. Particular efforts should be made to develop co-operation with the International Geosphere Biosphere Programme (IGBP) in the quest to develop the understanding and ability to predict the evolution of the fully coupled climate system (including the physical components already being studied by WCRP, as well as chemical and biospheric aspects) and to investigate the modes of behaviour of this system. Attention also needs to be given to encouraging the exploitation of WCRP results in climate impact studies.

These steps must be complemented by the systematic, sustained and reinforced observations of all key climate variables, by capacity building involving all nations in climate research activities, and by improving interactions with other climate-related programmes within the framework of the international Climate Agenda.

The Conference urged that the WCRP maintain an awareness and sensitivity to evolving user requirements. In particular the ultimate target of achieving an operational system for climate prediction with adequate regional detail on interannual and longer timescales, and the groundwork required for a future operational ocean observing and prediction system must be borne in mind. However, the Conference emphasized strongly that the main motivation of the WCRP must continue to be fundamental research into understanding the basic behaviour of the physical climate system.

1. RESEARCH ACTIVITIES

The main future priorities and challenges are:

(*i*) *Variability:*

- identifying modes of variability of the coupled ocean-atmosphere system, understanding their underlying mechnisms and investigation of their predictability;
- studying effects of anthropogenic forcing on the frequency or intensity= of natural modes.

(*ii*) *Understanding the hydrological cycle:*

- reducing uncertainties associated with the hydrological cycle, its main components and its interaction with changes in radiative forcing;
- improved understanding of land surface processes and linkages with the atmosphere;
- refining techniques for prediction of regional precipitation and run-off anomalies on time scales from seasons to decades.

(iii) The role of the oceans:

- formulating a dynamically consistent view of the ocean circulation with the goal of producing improved models of the global ocean circulation and its variability, essential to longer-term climate prediction and estimation of sea-level rise;
- focussed exploration of modes of natural variability in the oceans on all time scales and their effects on ocean resources and climate.
- designing, in the light of new scientific results and technology developments, a global observational system for the oceans and supporting its implementation.

(iv) Extremes:

- assessment of past fluctuations and trends in extreme events such as severe storms, heavy rains and droughts, and estimation of future evolution;

- improving the capability of providing longer term warnings of floods and other extreme events.

(*v*) *External forcing:*

- assessing the impact of natural and human-produced aerosols on the climate system as needed to understand present and past climates and to make projections of the future climate, supported by improved knowledge of the global distribution of aerosols of different types and their optical properties;

- refining evaluation of climate forcing due to trace (greenhouse) gases, including improved determination of oceanic and terrestrial sources and sinks, and measurements of global distribution;

- examination of effects of natural external forcing (in particular solar variability) on decadal to centennial timescales.

(*vi*) *Detection and attribution of climate change*:

- exploitation of all available data (including ocean and palaeo-climatic data sets) and model results in discerning climate change, and its attribution to specific causes.

(*vii*) *Feedbacks and response to climate change:*

- reducing uncertainties associated with water vapour, cloud/radiation and atmosphere/ocean interactions, and snow/ice albedo feedback mechanisms;

- investigating (as a joint initiative with IGBP) the responses of terrestrial and marine ecosystems to climate variability and change, including positive and negative feedbacks.

(*viii*) *Regional climate simulation and predictions:*

- intensive efforts to develop regional and smaller-scale coupled models able to draw on the results from coarser-scale global climate models to give more realistic simulations of regional climate, local climate variations and change.

(ix) Sensitive regions

- special attention to be given to sensitive key regions such as arid or desert areas, mountainous zones, polar regions, and small island countries;

- improved understanding of climate processes having an important role in such sensitive regions, in particular those involved in droughts and desertification in order to broaden the scientific basis for implementation of the United Nations Convention to Combat Desertification;

- Promotion of appropriate regional projects, involving local concerned nations and drawing on local expertise.

(x) The role of the cryosphere:

- investigation of the role in climate of the global cryosphere (sea ice, snow cover, ice sheets and shelves, glaciers, lake and river ice, frozen ground and permafrost), requiring expanded WCRP activity in the field of cryospheric research;

- examination of factors determining the extent and variability of the cryosphere, feedbacks to the global climate system, and role in global climate variability and change and in
sea-level rise.

(xi) Stratospheric interactions:

- improving the understanding of the physical and chemical characteristics of upper tropospheric/lower stratospheric interactions (as a joint initiative of WCRP/SPARC and the IGBP International Global Atmospheric Chemistry Project), including particularly stratosphere/troposphere exchanges of energy, water vapour and chemicals;

- quantifying and clarifying the impact of the major depletions of ozone in the lower stratosphere resulting from human activities, and of the observed increase of stratospheric water vapour on global climate;

- investigation of the potential effects of the rapidly increasing= emissions from the growing fleet of civilian aircraft.

(xii) Palaeo-climate:

- extending palaeo-climatic data sets, improving temporal and spatial resolution, and identifying spatial patterns of past climate variations, especially over the past few thousand years;

- improving knowledge of transfer functions for the optimum translation of proxy data into climate information.

(xiii) Research data sets:

- continued generation of specialised high quality global atmospheric, oceanographic, land-surface and cryospheric climatological data sets as needed to improve understanding of the physical climate system and transports of heat, momentum and water and other constituents in the different components of the climate system. These are required to validate climate models and for detection and attribution of climate change.

(xiv) Model development:

- constructing a hierarchy of comprehensive models of the coupled climate system able to simulate realistically past and present climate and predict climate variations, through use of results of research on climate system processes, analyses of model errors, and model intercomparisons;

- maintaining the close connection between models as developed for climate studies and operational numerical weather and ocean prediction, particularly as a means of verifying and refining models.

2. DATA REQUIRED FOR RESEARCH AND SERVICES

Progress in climate science, applications and services depends upon the timely availability of global and special observations of the whole climate system. Issues requiring particular attention by governments, national and international agencies include the following:

- Operational weather observation systems, integrated in the WMO World Weather Watch (WWW), are under serious threat in several regions of the world. The maintenance of these networks, enhancement where necessary to meet the requirements for observing climate, and data archival in electronic form for climate analysis and modelling purposes, are of critical importance;

- Other operational and quasi-operational climate-related observational systems, including subsets of the WWW (e.g. the Global Climate Observing system (GCOS) upper air and surface networks) and specialized hydrological, oceanographic and terrestrial networks, particularly as needed to support seasonal and longer-range predictions, are, or may become, threatened by lack of appropriate funding. This is a concern that should be recognized and addressed by governments;

- GCOS, the climate-related aspects of the WMO Global Atmosphere Watch (GAW), and the climate components of the Global Ocean Observing System (GOOS) and Global Terrestrial Observing System (GTOS) integrate the observational requirements for monitoring climate, and provide essential advice on and predictions of climate variability and impacts. Greater financial support and continuing sustained commitment to these are needed from all countries, as required under Articles 4.1 g, h and 5 of the UNFCCC;

- An operational ocean observing system must be developed for seasonal and longer-term predictions, for the estimation of climate variability and for detection of climate change and its attribution. Existing research-specific observational networks should be continued, expanded and transformed into components of routine global climate observations;

- Global satellite observations are crucial for climate prediction and research but require continuous calibration and validation. Satellite-operating countries are urged to give high priority to climate-related missions and to support the calibration and validation activities necessary to ensure the utility of satellite data for climate applications;

- Long-term, stable support for data management, information systems, analysis and reanalysis, quality control, archiving and distribution is essential for advancing climate science and services on a global basis. At present, support for these data activities is inadequate. Governments should provide the necessary long-term support for the full range of data services required for climate research and applications;

- Free and unrestricted access to all climate-related data for research purposes is vital to meet agreed international obligations of the UNFCCC (Article 4.1h) and to protect safety of life and property. Appropriate mechanisms, based on the example of Resolution 40 of WMO (Cg-XII), must be adopted to ensure such access;

- Monitoring changes and variations in climate requires increased support for seamless transitions between new and established observing and data management systems;

- Long-term historical data sets, which presently exist in non-electronic form should be rescued before they are permanently lost;

- The continuation of existing monitoring stations for which long-term data records have been collected is of extreme importance. These stations should be identified and treasured;

- Particular attention needs to be paid to filling the gaps in data-sparse areas of the globe, for example equatorial regions and much of the southern hemisphere. The lack of capacity in many countries is a major continuing concern and an obstacle to progress.

3. INSTITUTIONAL FRAMEWORK AND CAPACITY BUILDING

To meet the challenges outlined in previous sections and to deliver research results relevant to the entire global community, the WCRP must interact with many partners and must promote the involvement of scientists from developing countries.

The main WCRP partners and relationships are identified in Figure 1. On the "Research Axis", WCRP is a key component together with the IGBP and the International Human Dimensions Programme on Global Environmental Change (IHDP) in what has been termed Earth System Science or, in some cases, Global Change Research.

The WCRP is also a key component of the Climate Agenda, which provides an overall integrated framework for climate-related programmes, and which is supported by many agencies and organizations. The WCRP is a major foundation of the research thrust "New Frontiers in Climate Science and Prediction" and also contributes to the other (closely-related) thrusts "Dedicated Observations of the Climate System", "Climate Services for Sustainable Development", and "Assessment of Impacts of Climate Variability and Change and Response Strategies to Reduce Vulnerability". Furthermore, the WCRP provides the essential scientific research which forms the basis of the assessments of anthropogenic climate change by the IPCC.

In order to involve scientists from developing countries more intensively in the planning and conduct of WCRP activities, scientific capacity in developing countries must be built up in a sustained and expanding manner. WCRP cooperates with IGBP and IHDP in the Global Change System for analysis, Research and Training (START), the Inter-American Institute for Global Change Research (IAI) and other related inter-governmental groupings in capacity building efforts. Through START, WCRP contributes to a multi-disciplinary capacity building programme on agriculture and climate variability, aimed at improving agricultural output at local and national levels. The Conference regarded the following specific actions as particularly important:

- building up a critical mass of research activities and a critical number of research scientists;
- building to the extent possible upon existing institutions;
- strengthening cooperation between developing countries in a particular region;
- seeking the funding required for sustained capacity building activities;
- encouraging developing countries to indicate their own priorities within the international research framework.

Summary of specific recommended actions

To the Joint Scientific Committee (JSC), Joint Planning Staff (JPS) and the Project Offices of the WCRP:

- Develop further collaboration with IGBP (particularly on aerosols, trace gases, hydrological cycle and modelling of the physical-chemical-biological climate system) and with IHDP;
- Maintain and strengthen further links with IPCC, and in particular consider the needs of the Third Assessment Report in determining shorter-term research priorities;
- Determine research needs and provide results as required to the United Nations Conventions to Combat Desertificationand on Biological Diversity, and to the UNFCCC, the latter primarily through the IPCC;

- Foster capacity building in the framework of START, and intergovernmental groupings such as IAI in implementing the WCRP research agenda, making full use of existing regional centres, such as the African Centre for Meteorological Applications for Development and Regional Meteorological Training Centres;

- Develop an effective communication strategy directed towards national governments, funding agencies, non-governmental organizations and the general public, to promote WCRP achievements and benefits and to highlight the challenges being faced;

- Play an active role in coordination of activities in the Climate Agenda, particularly in support of Climate Information and Prediction Services (CLIPS) and ensuring appropriate involvement of national meteorological, hydrological and oceanographic agencies.

To National Governments and Funding Agencies:

- Support national programmes of research and observations aligned with and underpinning the WCRP and take advantage of WCRP achievements in applications of climate prediction and information to social and economic activities;

- Establish or strengthen national committees or focal points for climate research, or for earth system science (including IGBP and IHDP);
- (Developed countries) Support capacity building in research and applications of climate information through national, regional and international funding channels (e.g., the Global Environmental Facility (GEF));

- (Developing countries) Ensure that climate research and observations are placed on the agenda for discussion with potential donors;

- Support action through the UNFCCC to make operational the commitments under Articles 4.1 (g) and 5, by making use of WCRP, GCOS and linked programmes, particularly START;

To Organizations sponsoring WCRP (WMO, ICSU, IOC of UNESCO):

- Promote and expand coordination in the Climate Agenda between WCRP, other components of the World Climate Programme, GCOS, IGBP and IHDP, and relevant regional bodies with the aim of advancing climate research and related observations, data management and use of information on climate variability and change;

- Encourage respective counterpart national agencies to adopt coordinated approaches in their countries in the planning and implementation of WCRP and related monitoring and services;

- Improve the capability of providing longer-term warnings of floods, droughts and other extreme climatic events and the wide dissemination and use of warnings in all nations;

- Keep under review the need for further international and regional conferences on climate issues;

- Seek greater support from the private sector for WCRP activities.

PAPER NO. 2: WORLD METEOROLOGICAL ORGANIZATION (WMO)

Message to the Conference of the Parties to the United Nations Framework Convention on Climate Change

Well over 300 members of the climate research and policy communities present at the Conference on the World Climate Research Programme (WCRP) (Geneva, Switzerland, 26-28 August 1997) agreed that comprehensive bservations of the climate system are critical and noted with concern the decline in conventional observation networks in some regions. This is a serious threat to continuing progress in climate research, and to detection of climate change and attribution of its causes. Without action to reverse this decline and develop the Global Climate Observation System, the ability to characterize climate change and variations over the next 25 years will be even less than during the past quarter century. In some regions, for example, drought-prone parts of Africa, climate change detection, prediction of seasonal and long term variations and reliable assessment of climate impacts could become impossible.

Recognizing the obligations of the Parties to the United Nations Framework Convention on Climate Change under Article 4.1 (g) and (h) (Commitments) and Article 5 (Research and Systematic Observations), we strongly urge that, at the coming sessions of the Conference of the Parties, arrangements be put in place to ensure funding and support for the essential observation networks of the Global Climate Observing System (GCOS) and its oceanographic and terrestrial counterparts, and for research involving data interpretation and analysis, as well as for retrieval and preservation of historical data in electronic form.

Without such support, future assessment reports of the Intergovernmental Panel on Climate Change (IPCC) which draw heavily on WCRP research and on the observational data sets, will be significantly compromised.

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