

**PROCEEDINGS OF THE MEETING ON ORGANIZATION  
AND IMPLEMENTATION OF REGIONAL CLIMATE  
CENTRES**

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## **1. INTRODUCTION**

The Commission for Climatology (CCI) Ad Hoc Expert Team on the Organization and Implementation of Regional Climate Centres (RCCs) met at the World Meteorological Organization Secretariat, in Geneva, Switzerland, from 27 to 28 November 2003. The Deputy Secretary-General (Secretary-General elect), Mr M. Jarraud, officially opened the meeting on behalf of the Secretary-General of WMO, Prof G.O.P. Obasi. In his remarks, he noted the benefits and support RCCs could provide to NMHSs in the production of regional climate services and products, and stressed that RCCs would take advantage of the strengths and capabilities within the Regions but not replace the role of NMHSs in the provision of services and warnings. He briefly reviewed the work of the Inter-Commission Task Team on Regional Climate Centres (the ICTT-RCC) and decisions of WMO Executive Council (EC) and Congress (Cg) with respect to RCCs, but pointed out that the Regional Associations still required guidance on ways to determine regional needs and requirements for RCC functions, possible structures to serve the regional needs, designation procedures and responsibilities of RCCs. In closing, Mr Jarraud stressed the importance of the task, given the role of effective seasonal to interannual forecasts and climate services in the alleviation of hunger and reduction of the impacts of natural hazards, especially for developing nations.

Mr Ken Davidson, Director of the World Climate Programme (WCP), welcomed the group to Geneva and reviewed the logistical details for the meeting. Mr Peer Hechler (Deutscher Wetterdienst), nominated as Chair for the meeting, noted that much valuable work had been done to refine the concepts of RCCs; that a number of RCC-related activities were underway (e.g. the establishment of the Tokyo Climate Centre; CIIFEN; etc.) and that Long-range Forecasting (LRF) had become a driving force for RCC development. The goals of the meeting were to produce Guidelines that would ensure the Regional Associations (RAs) had a clear understanding of procedures to establish RCCs and of the role of RCCs with respect to other institutions and the National Meteorological and Hydrological Services (NMHSs) within the Regions, and to facilitate RCC implementation. The members of the Group introduced themselves and briefly described the climate programmes and RCC-related activities in their regions. The list of participants is provided as **Annex 1**.

## **2. ORGANIZATION OF THE MEETING**

The Ad Hoc Team agreed on the working arrangements for the meeting (daily sessions from 9AM to noon and 1 to 5:30PM). Participants were invited to a WMO Reception at 5:30 PM on the 27th. The provisional agenda was reviewed, and approved with minor modifications (i.e. to address current producers of LRF (Global Production Centres, or GPCs); existing structures within the WMO system dealing with regional climate matters; the Future WMO Information System (FWIS) and WMO Technical Regulations for formal designation of operational centres). The final agenda is provided as **Annex 2**.

## **3. REVIEW OF THE WORK OF THE ICTT-RCCS AND OTHER RELEVANT BODIES**

### **3.1 Review of the Reports of the ICTT-RCCs**

Mr Boodhoo, President of the Commission for Climatology (CCI), reviewed the development of the concept of Regional Climate Centres. The impetus was the strong response to a CCI questionnaire on prediction products (Kimura, 1999). The

Inter-Commission Task Team on Regional Climate Centres (ICTT-RCC) was set up (Res. 2/EC-LII, 2000) with members from the Technical Commissions for Climatology (CCI), Agricultural Meteorology (CAgM) and Basic Systems (CBS) and several other members. The results of their efforts, documented in WCASP No. 52, May 2001, and WCASP No. 54, March 2002 and presented at WMO EC and Congress sessions, were outlined.

The CCI survey had pointed out the need to:

- Develop a climate Research and Development agenda;
- Facilitate regional availability of data for climate research;
- Study climate variability, predictability and impacts;
- Investigate, develop and validate regional models;
- Develop regional verification procedures for SI forecasts;
- Investigate and optimize methods of incorporating climate information in end-users decision-making processes; and to
- Produce climate predictions (seasonal or annual).

Mr Boodhoo noted the functions for RCCs proposed by the ICTT-RCC, including training, operational activities and liaison with end-users. Each region will have individual needs, but there are a number of functions that may be typical in many regions.

With respect to training, there is an urgent need for skill development for forecasting and product development, including interpretation, application and dissemination of long-range forecasts and other climate information. As well, there is a need to educate the end-users and intermediaries at NMHSs (those who apply the data and forecasts to serve sectors such as health, for example), and to train national trainers.

With respect to operational activities, RCCs should maintain exposure of regional and national needs at the international level; provide guidance on Human Resources and institutional needs at regional and national levels; and strengthen collaboration between NMHSs on implementation of observing and other networks. As well, they should produce and update regular regional and national seasonal climate outlooks and applications of related products; operate a climate watch system for extreme climate events (e.g. ENSO); and organize/facilitate real-time climate monitoring and data exchange.

With respect to liaison with end-users, RCCs should facilitate communication between suppliers of applications products and end-users; arrange workshops on users' needs for seasonal outlooks and for policymakers; and assist NMHSs to develop media strategies covering media liaison on long-range forecasts, public awareness and education objectives (the climate experts are not always experts on communication to the public).

Mr Boodhoo noted that the reports of several consultants (one presented to CBS and the other to the CCI) were reviewed by the ICTT-RCC, as discussed in WCASP No. 52 (2001).

### **3.2 Decisions of WMO EC and Congress on Matters Related to ICTT-RCCs**

The results of the deliberations of the various bodies that have dealt with the RCC issue were reviewed.

The real work on RCCs started at the Thirteenth Congress (May 1999) during which Members were urged to define the requirements for, and objectives and responsibilities of regional and global centres to support operational national climate services, to define the use of existing regional structures and institutions, and to involve regional associations and other partners in the development of the concept.

EC-LII (May 2000) welcomed the broadening range of activities to develop an effective framework for LRF; recognized the need for close collaboration between various WMO Programmes; recognized a number of options for structure and role of RCCs; and set up the Inter-Commission Task Team on Regional Climate Centres (ICTT-RCC) (Res. 2/EC-LII). The original ICTT-RCC had six members (two from CCI, two from CBS, one from research, and one from CAgM). One meeting was held (April-May 2001), and the ICTT-RCC reported to EC LIII.

EC-LIII (June 2001) recognized further work was needed, that RCC responsibilities should not duplicate or replace those of NMHSs; that user requirements and functions of RCCs needed to be defined; that establishment of RCCs should follow the steps set up for designation of RSMCs; and that the ICTT-RCC should continue, and expand to represent the WMO Regional Associations (Res. 7/EC-LIII).

The expanded ICTT-RCC met in March 2002, and delivered their report to EC-LIV in June 2002. EC-LIV accepted this report and recommended it to be submitted to Cg-XIV. However, Members felt that more work was still needed to define the leading roles of NMHSs and procedures that Regional Associations should use to designate the RCCs. As well, EC-LVI noted the need for flexibility in the role and functions of the RCCs, the need to use existing structures where available, and the need for a workshop of global LRF producers (subsequently held in March 2003).

Cg-XIV recommended that Regional Associations (RAs) and global producers of long-range forecasts consider the needs and requirements of RCCs; that appropriate Terms of Reference be established, under the guidance of CCI and CBS, prior to initiating the RCCs; and that the CCI should develop guidelines and procedures to assist the RAs in implementing the RCCs. See **Annex 4** for relevant WMO EC and Congress texts).

### **3.3 Results of Regional Activities Relevant to the ICTT-RCCs**

#### **3.3.1 RA I RCC-related Activities**

Three recent meetings/workshops have provided information regarding the capability within RA 1 to carry out RCC-related functions, e.g. the IRI Workshop (New York, 29 April - 2 May, 2002 on Advancing Regional Plans and Interregional Communication; the ACMAD Workshop on Evaluation of the PRESA AF process (Niamey, 9-16 November 2002); and the RA I meeting on Operational Numerical Weather Prediction (Pretoria, 1-8 October 2002).

ACMAD has a programme on seasonal forecasts, and initiatives such as the Elmasifa project relying on seasonal forecasts derived from the ARPEGE model developed by Météo-France are examples of efficient partnership. In partnership with WMO, ACMAD hosts Regional Climate Outlook Fora (RCOFs) for the sub-regions Afrique Centrale et le Golfe de Guinée (AC), Afrique Ouest (AO), Afrique Nord (NOR) and l'Océan Indien et à Madagascar (OIM). DMC-Nairobi and DMC-Harare currently issue seasonal climate products based on output from Global Production Centres and host regular RCOFs in partnership with WMO.

Six NMHSs in Africa use numerical weather models operationally, including South Africa, Morocco, Algeria, Egypt, Kenya, Tunisia and Réunion Island. The South African Weather Service (SAWS) has high computing power and operates a GCM for a range of applications including seasonal to interannual prediction. Morocco uses a regional model derived from the French limited-area model ALADIN for NWP, and the French ARPEGE Climat for their seasonal forecasts. Tunisia and Réunion Island work with Météo France: Tunisia locally adapts the ALADIN model, while La Réunion uses the so-called ARPEGE Tropics (a version of the model with maximum resolution over the area instead over France). Kenya, Egypt and Algeria have powerful workstations and work with the ETA/LAM NCEP model. Several other countries can receive model output, data and charts via GTS and Internet, and some receive charts by fax.

It was noted that Africa is a region heavily affected by climate variability and change, but operational programmes for climate observations, prediction and services are not consistently available in all countries to meet national and regional needs. Lack of computing and communications capacity needs to be addressed. However, there are a number of centres with the potential to take on the role of RCCs within RA I, and facilitate access to and dissemination of long range forecast products. Those services with capacity (adequate computing power and telecommunications) could apply downscaling from global models, and all Members should be encouraged to attain access to GPCs and, eventually, to other RCCs in neighbouring regions. It was felt, as regards structure of RCC functionality for Africa, that there should be no limitation on the number of centres established, and that designation should follow verification of commitment/reliability and capacity to deliver on the required tasks.

### **3.3.2 RA II RCC-related Activities**

The representatives from Japan, Korea and China reviewed climate activities in RA II. RA II has a Working Group on Climate Related Matters, but there have been no official RA II discussions on RCC development for that region to date. The WG is preparing to distribute a questionnaire survey in December 2003 on current climate information services mainly on monthly, seasonal and interannual time scales carried out by Members in RA II, but not yet on matters on RCCs in the Region. The results of this survey will be compiled in Spring 2004 and reported in the "Manual on Climate Information Services in the Region II", which the WG plans to develop, aimed at assisting Members to share the current situation on the services of Members in the Region. Previous surveys have indicated that many NMHSs in RA II are operationally issuing, or plan to issue seasonal forecasts. The WG has five rapporteurs. The rapporteur on Regional Climate Data Management, including data rescue, has completed her report, and notes that climate data management and data rescue are an important issue in the Region.

Twenty-five participants from eight Least Developed Countries (LDCs) in Asia attended a WMO Regional Workshop on Strengthening Capacity Building of the NMHSs of LDCs in Asia (Bangkok, Thailand 16 to 18 October 2002). The workshop recognised the need for assistance for LDCs for the provision of climate information services. While these countries already receive some assistance, meteorology and climate services are not the highest priorities for the use of the available funds. At the GCOS Regional Workshop for East and South-east Asia (Singapore, 16 to 18 September 2002), it was recognized that improvement of GSN and GUAN, and climate data management including data rescue, are the important issues of climate observation in the region that need action.

The Japan Meteorological Agency (JMA) has been operating a monitoring system of extreme weather and climate events and the global climate system for about 20 years. JMA has also been operating a dynamical prediction model for one-month forecasts since 1996 and an ENSO prediction model since 1999. In addition, JMA began operating a 3-month dynamical prediction model in 2003.

The JMA established the Tokyo Climate Centre (TCC) in April 2002 to provide climate products from the above systems to NMHSs in the region, as its contribution to the cooperative efforts of the Asia-Pacific region to enhance the regional capability of climate services. The objectives of the TCC are to assist NMHSs in the Asia-Pacific region mainly in issuing seasonal forecasts to their own nations with the aim of mitigating disasters and to contribute to the sustainable development in the region. The TCC provides NMHSs with climate monitoring products, one-month and three-month ensemble forecast products and other appropriate information for climate services (e.g.: monthly and weekly report on climate features such as extreme climate events, global temperature anomalies, global precipitation ratios, etc.; monthly reports on the global climate system, covering tropical circulation and convection, extratropical circulation, etc.; monthly reports on El Niño-Southern Oscillation including ENSO monitoring indices, and an El Niño outlook; and ensemble forecast products with maps of predictions of one-month and three-month forecast model and verification of predictions. The TCC assists in technical capacity building of climate services in the Asia-Pacific region, and also provides "News" on extreme climate events and other climate-related topics in the region.

Since October 2002, a number of products (including monthly and weekly reports on climate features and on ENSO) are posted on the JMA Internet site. A number of workshops have been held on Climate System Monitoring, Diagnosis and Prediction for the Asia-Pacific Region (2-6 December 2002 and 25-28 November 2003).

The Korea Meteorological Administration (KMA) has been operating the Asia-Pacific Economic Cooperation (APEC) Climate Network (APCN) to collect climate prediction data from several dynamic climate model-holders in the Asia-Pacific region including NMHSs and non-WMO climate institutions, and optimizes them to produce multi-model ensemble (MME) prediction information for real-time dissemination to Members and participating institutions in the Region.

The APCN was established in 1999 as a channel for the exchange of climate information in the Asia-Pacific region and is aimed at the reduction of human and economic losses by producing real-time operational climate prediction information based on a well-validated multi-model ensemble system, and enhancing capacity-building in the monitoring and prediction of unusual weather and climate in the Region.

The APCN activities build on the recommendations of the APCN Working Group and APCN Steering Committee, constituting the APCN infrastructure including the APCN Secretariat hosted by the KMA. The APCN Working Group, consisting of representatives of Members and participating institutions in the Region, discusses various issues relevant to the implementation of APCN. The APCN Steering Committee, providing overall administrative and scientific guidelines, consists of 13 leading scientists in the fields of climate modelling and prediction, and other areas of interest to the seasonal prediction. The KMA hosts the annual APCN Working Group and Steering Committee Meetings.

The APCN Secretariat is responsible for the processing of dynamic ensemble prediction data and making it available to NMHSs and participating institutions in the Region. It is also responsible for keeping APCN records and official papers, as well as providing administrative arrangements for meetings and other activities. The APCN Secretariat is operating a Visiting Scientist Program starting from 2004 to employ experts from all over the world in the areas of climate monitoring, prediction and application.

In order to derive suggestions for the future direction of research and development for better SI forecasts, underscoring the limitations of the current state-of-the-art of climate dynamic prediction systems, the APCN Symposium on the MME for Climate Prediction in the Republic of Korea, 7-10 October 2003. The Symposium, co-sponsored by the KMA, which hosts the APCN Secretariat, and the World Meteorological Organization (WMO), was jointly held with the Second APCN Steering Committee Meeting and the Third APCN Working Group Meeting. There were sixty participants from thirty-six NMHSs and institutes in fourteen APEC Member Economies (Australia; Canada; China; Hong Kong, China; Indonesia; Japan; Korea; Malaysia; New Zealand; Peru; Russia; Chinese Taipei; Thailand; and United States), two from non-APEC Members (United Kingdom and France), and representatives of World Meteorological Organization and European Centre for Medium-range Weather Forecasts. Key topics discussed were multi-model ensemble lessons learned; climate prediction and modelling; SST prediction and modelling; and applications.

There are three principle thrusts to meet the goal of developing the APCN as part of WMO-recognized activities: broadening the geo-political framework of the APCN; broadening the framework for research activities to include those led by the WCRP, and those covered under bi- and multi-lateral agreements within the APCN; and the establishment and application of standards and procedures for formal operational forecasting (many applications are in transition from research mode to fully operational functions, and require the guidance of the CBS and CCI, and the 4 Regional Associations that overlap with the APCN geographical area of interest). The APCN is developing a discussion paper on how best current and future APCN activities might contribute to existing applications activities being conducted under various sponsoring organizations such as WMO/CLIPS, ADPC, SPREP, SOPAC, PEAC, IRI and others.

At the Symposium, the APCN Steering Committee discussed the strategic approach on the linkage between APCN and WMO, and the future development of the APCN MME System. The Committee also made recommendations on data collection, verification and dissemination. These included: experiment frequency and time period of data exchange; variables; and data type and format. The APCN Working Group discussed various issues and provided the guidelines on the services, products and information of the APCN, including the certain provision of their feedback.

The vision of the APCN is primarily to develop a reliable seasonal prediction system by utilizing forecast products available from organizations currently generating dynamical forecasts and by optimally coordinating research and operational resources over the Asia-Pacific region, and ultimately to develop a next generation seasonal prediction system applicable to various sectors. The first vision can be achieved by coordinated activities, but the ultimate goal should be achieved by an institutional organization. Challenges to be faced include the prediction of boundary conditions; optimization of information; post-processing; forecast verification; development of downscaling and application of forecast products; and the building

of needed human and resource capacity. Amongst the APCN members, there are eight potential producers and eleven models. The KMA collects output from all of these.

The National Climate Centre for China (established in 1995) has undertaken an evaluation of differences between the output of the 10 best global climate models and observed climate, and have particularly studied the East Asian monsoon system from a forecast perspective. Monsoon climate is characterized by obvious dry and rainy seasons, droughts and floods and significant climate variability, and is typically very difficult to predict.

There is an urgent need in China and throughout Region II for climate services and forecasts. China, Japan, Korea and the Russian Federation have all developed high-level functionality and have offered to serve in the capacity of Regional Climate Centres in RA II. The Beijing Climate Centre (BCC) was established in China in April 2003; the KMA APCN MME was started in 2001, and the TCC in July 2002. Jointly these countries provide strong regional cooperation. Since 1998, in response to the urgent need for the cooperative efforts for the improvement of seasonal prediction of the East Asian Monsoon, China, Korea and Japan have been holding a Regional Climate Outlook Forum twice a year for the summer and winter monsoon predictions.

This existing cooperation has shown the importance of the determination of common interests and climate requirements of the countries in the region; data, information and knowledge sharing; capacity building; use of the Internet for dissemination of climate products; and strengthening public and governmental knowledge on climate, and what can be provided as information and services.

### **3.3.3 RA III RCC-related Activities**

In South America three sub-regions were established at the RA III Thirteenth Session (2001) for execution of CLIPS activities: the South-American South Cone; the Northeast of South America; and the Northwest of South America. Climate outlook forums held in these regions allow consensus to be developed on Seasonal to Interannual (SI) forecasts, and have established procedures and standardized methods for dissemination of results. Pilot projects are also undertaken. Research and CLIPS climate applications are still experimental in Region III (for example, objective verification procedures are not yet established), but the COFs have improved communications and exchange of information. Due to the high cost of holding these forums, alternatives such as virtual forums are being investigated.

The Centro Internacional de Investigación sobre el Fenómeno El Niño (CIIFEN) was established in partnership between the Government of Ecuador, WMO, and ISDR, in Guayaquil, Ecuador in 2003, to draw together information on ENSO and its impacts, and to collaborate with regional partners in climate data processing, applications and prediction (although it is not a prediction centre itself). Its goals include coordination with global prediction centres to facilitate interpretation and assessment of relevant products; fostering development of improved regional climate forecast models; serving as a coordination mechanism for the scientific and research community and strengthening the capacities of NMHSs in the region.

Development of RCCs in RA III has not officially been discussed to date, but there is interest in taking advantage of the Internet capacities of some RA III countries to host virtual forums and disseminate output and to use the already functional COF functionalities and centres such as CIIFEN to serve as a basis for RCC activities. It

was noted, however, that the CLIPS sub-regions are different from other existing regional divisions that exist in RA II, and that CIIFEN is research-focused, so any system of RCCs in RA III would be broader than the CLIPS regions and CIIFEN alone.

#### **3.3.4 RA IV RCC-related Activities**

RA IV has held an Ad Hoc Expert Advisory Group (AG) Meeting for Establishment of an RCC (Miami, USA, 22-25 July 2003) with the support of NOAA and the World Climate Programme. In 2002/03, preliminary discussions had been held with many RA IV Members and with agencies and centres such as NOAA/NWS, NOAA/NCPC and IRI. Subsequently the AG was established in April 2003 to advise on RCC Terms of Reference and structure, and to devise a work plan for implementation.

The AG noted that large countries such as the USA and Canada and Mexico did not need RCCs as the required climate activities are all being carried out within existing programmes. However, smaller NMHSs in the region do need the services of RCCs to generate SI prediction, monitoring products and related guidance. There is no centre within RA IV at present willing to host (and support) a single RCC for the region (the RCCs are expected to be funded by the Regions (WCASP-No 52, section 7.6)), so a combination of distributed and virtual systems is most feasible.

Two institutions generate seasonal outlooks for Central America and the Caribbean. The Caribbean Institute of Meteorology and Hydrology (CIMH) produces seasonal precipitation outlooks quarterly for the Caribbean. The Central American Regional Committee of Hydrological Resources (CRRH) coordinates a similar exercise among the countries of Central America.

The CIMH is a repository of meteorological and hydrological data for the Caribbean Meteorological Organization (CMO) members. It performs quality control on the data and generates climatological products. It is already a designated WMO Regional Meteorological Training Centre and in that capacity provides training in basic climatology for WMO Members throughout the Caribbean. In Central America the University of Costa Rica (UCR) is a designated WMO Regional Meteorological Training Centre, and is working with long-range numerical weather prediction models, exploring downscaling and statistical prediction techniques. However, it does not perform the data archiving functions that CIMH does for its members in the Caribbean. The Mona Campus of the University of the West Indies (UWI) in Jamaica is doing similar work.

The AG concluded that the resources of these four institutions could be enhanced and coordinated to perform the functions of an RCC. CIMH and CRRH would perform the operational functions of the Centre, accessing the numerical weather prediction outputs, generating the regional analyses and seasonal and inter-annual prediction products, maintaining the regional database, and distributing the products to the NMHSs. CIMH would provide the products for the Island States of the Caribbean while CRRH would produce similar products for Central America and Mexico. UCR and UWI would be the lead institutes undertaking research in seasonal and long-range forecasting techniques, improving the numerical weather prediction model outputs and making them more meaningful for the region, developing dynamical and statistical downscaling, and providing training in the use and interpretation of the numerical weather prediction outputs. A method to coordinate the activities of the four nodes would have to be developed to ensure that there was no duplication of activities and to ensure that the entire region was provided with the full suite of products. The agencies of larger countries performing

similar functions, such as in the United States of America and Canada, would make significant contributions by actively collaborating with the Virtual RCC to provide global analysis and forecast products and to collaborate on research, development, training and capacity building (a detailed list of these contributions is provided in annex 7 of the final report of the meeting noted above).

The AG discussed the Terms of Reference for the RCC system in RA IV, and set up a Workplan for implementation. Participants agreed that designation should be sought through the procedure described in Appendix I-2 of the Manual on the Global Data Processing System (WMO No. 485), and that while waiting for that, a pilot project should be established to begin the RCC activities.

### **3.3.5 RA V RCC-related Activities**

Nominations for the RA V Task Team (TT) for Seasonal to Interannual Forecasts and Regional Climate Centres (8 core Members and other interested RA V Members) have only recently been received, with the RA V TT only being formally constituted in early 2004. However, a preliminary group (PG) including persons from Australia, New Zealand, USA, some Pacific Island countries and one of the RA V TT co-chairs met in August 2002 in Auckland, New Zealand to discuss a statement of requirements for RCC(s) for RA V; explore existing capabilities; discuss infrastructure and organizational settings to meet requirements; so as the RA V TT when it is formally constituted can use these ideas towards completing their terms of reference and preparing recommendations for review by the RA V WG on Climate-related Matters and approval of the RA V President. The RA V TT will liaise closely with the relevant OPAGs of CBS and CCI.

The PG noted that some of the required RCC functions were already being done and that a needs-analysis for Pacific Island Countries documents many of the RA V RCC requirements. Decisions included that RCCs should be inclusive and allow all regional Members to play a role; one or a few virtual centres would allow all Members to participate at their allowable levels; and that there is a need to determine how all RA V Members' NMHSs climate centres and agencies could contribute.

Four key requirements were identified by the Pacific Islands Needs Assessment: strengthening observing systems; strengthening telecommunications networks; climate data management, analysis and applications; and Institutional strengthening, including infrastructure support. In addition, the Association of South-East Asian Nations (ASEAN) members, comprising Brunei Darussalam, Cambodia, Indonesia, Lao P.D.R., Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam, have identified the need to strengthen the Seasonal-Interannual (S-I) prediction capability in the ASEAN region. Currently, the ASEAN Specialised Meteorological Centre (ASMC) is undertaking the development of the S-I prediction capability in ASEAN, with the effort in validating regional climate models and development of various climate applications.

The PG identified some key needs for RCC functions as operational activities; coordination; data services; training and capacity building; and research and development. The PG fully supported the concept of several or a few virtual RCCs; however, guidance and direction of responsibilities of these centres would be required. The concept of a few or several virtual RCCs for RA V was agreed to by the PG, emphasizing that coordination among Members of RA V is vital for this to work properly. The PG emphasized that coordination between BOM National Climate Center, NIWA, Pacific ENSO Application Center (PEAC), and the ASMC is

important. Subsequently, in March 2003, the co-chairs of the RA V TT suggested some key nodes for RA V might involve a Southeast Asian Climate Centre in collaboration with the ASMC, PEAC and SPREP groupings in the North and South Pacific, although this can only be determined once the full task team has been appointed and all NMHSs have been fully consulted.

The region has a number of existing climate information systems in place for seasonal and ENSO forecasts: the NOAA Pacific ENSO update, the BOM South Pacific Seasonal Outlook Reference Material, the NIWA Island Climate Update and the ASMC Climate Update for monitoring regional haze. The Island Climate Update has well-established procedures for regional consensus on climate outlooks derived from climate forecasts from the global production centres and statistical models for the South Pacific. These include a monthly teleconference involving climate forecasters in Australia, French Polynesia, Fiji, Hawaii, New Caledonia, New Zealand, and CPC and the IRI in USA. Given this functional basis, the region may evolve to three or four RCCs, managed virtually, to play a pivotal role in the collection, quality control, archiving and maintenance of databases across the region; capacity building; etc.

The Australian Bureau of Meteorology is a co-lead centre, with the Meteorological Service of Canada, for Long-range Forecast verification and is likely to be a WMO Global Producing Centre for forecasts from coupled models. It is also developing operational climate prediction systems for several Pacific Island countries in a three-year project funded by the Australia aid organisation AusAID. This project, intended to directly enhance the capabilities of South Pacific Island Countries to generate and utilise seasonal forecasts, is beginning its implementation phase.

### **3.3.6 RA VI RCC-related Activities**

During the RA VI XIII (2-10 May 2002, Geneva) the Association decided to proceed with the implementation of a systems approach to provide SI products for RA VI on an operational basis and to establish RCC functions as required by Members. Existing mandates include the rapporteur on coordination and implementation of RCC activities of the RA VI WG on climate-related matters (Res. 7, XIII-RA VI); and the RA VI Task Team on Provision of Seasonal to Interannual forecasts and Regional Climate Centre services (SIRCC) (Res. 9, XIII-RA VI) including, among others, the co-ordinator of the sub-group on regional aspects of the data-processing and forecasting systems of the RA VI WG on planning and implementation of WWW in Region VI (Res. 1, XIII-RA VI). The role for the CLIPS Focal Points (Res. 8, XIII-RA VI) in this respect has not yet been worked out, but may be central to providing RCC services.

To collect information on requirements and capabilities, RA VI employs input from a variety of sources: the ICTT on RCCs; the RA VI CLIPS Workshop (12-18 June 2003, Erfurt, Germany); a questionnaire (completed by the CLIPS Focal Points); the Task Team on SIRCC; EUMETNET/ECSN; IPCC, UNFCCC, CLIVAR, etc.

As to capabilities, many nations in the region wish to be part of an RCC structure, but it is not clear how to determine the capabilities in each centre to provide RCC functions. There are 4 global producing centres in RA VI: ECMWF, the UK Met Office; Météo France and Roshydromet (Russian Federation). There are also global centres such as the World Radiation Data Centre and the Global Precipitation Climatology Centre.

The Acting President of RA VI approved the proposals of the TT/SIRCC, and operational provision of LRF products (ocean analyses; Niño Indices; seasonal forecast maps) in graphical form on producer's websites were scheduled to begin in January 2004 at ECMWF and the Met Office (UK), and later in 2004 at Météo France and ROSHYDROMET (Russian Federation). The TT/SIRCC will review these activities after one year. Before deciding on the best structure for RCC activities in RA VI, both requirements and capabilities need further analysis. The general approach envisaged is to first, define the RA VI requirements and capabilities through the RA VI CLIPS Workshop and a questionnaire/survey; to then co-ordinate service provision by Members and identify those requirements that cannot be met by existing capabilities; to propose RCC functions and invite Members to apply for related responsibilities; and finally to have the RCC(s) designated through WMO Technical Regulations. The second stage includes provision of operational LRF products; development of ECA/D as an operational capability to provide RA VI Members with high-quality data sets and European climate Assessments; and implementation of GCMP as an operational capability to provide RA VI Members with climate monitoring products.

### **3.4 Producers of Seasonal Prediction/Long-range Forecasts**

The network of existing global producers of LRF was reviewed. A meeting of Global producers of SI forecasts was held in Geneva on 10-13 February 2003. The participants discussed the importance of Long-range Forecasting; forecasting extreme events; activities carried out under DEMETER, APCN, etc. from an operational production (not research) perspective. Their conclusions included that emphasis should be placed on ensemble prediction; multi-model approaches; further development of operational and research efforts; development of a feedback mechanism; automatic production of products whenever possible; and that it is important to follow the WMO verification scheme. Training and capacity building needs were also discussed.

### **3.5 Existing WMO Structures for RCC-related Activities**

The Manual on the Global Data-processing System (WMO No. 485, Appendix I-1) provides the locations of World Meteorological Centres (WMCs) and Regional Specialized Meteorological Centres (RSMCs) with Geographical Specialization and with Activity Specialization. There are three WMCs, located in Melbourne, Moscow and Washington. RSMCs with geographical specialization are located in Algiers, Beijing, Bracknell, Brasilia, Buenos Aires, Cairo, Dakar, Darwin, Jeddah, Khabarovsk, Melbourne, Miami, Montreal, Moscow, Nairobi, New Delhi, Novosibirsk, Offenbach, Pretoria, Rome, Tashkent, Tokyo, Tunis/Casablanca, Washington and Wellington. Six RSMCs focus on Tropical Cyclone Forecasting: Nadi, New Delhi, Miami, Tokyo, La Réunion and Honolulu. The European Centre for Medium Range Weather Forecasts (ECMWF) is the RSMC focused on global medium-range weather forecasting. Eight centres provide transport model products for environmental emergency response: Beijing, Bracknell, Melbourne, Montreal, Obninsk, Tokyo, Toulouse and Washington.

As well, there are a number of emerging specialized centres such as the African Centre for Meteorological Applications for Development (ACMAD) in Niamey, Niger; the Drought Monitoring Centres (DMCs) in Nairobi, Kenya and Harare, Zimbabwe; the ASEAN Specialized Meteorological Centre (ASMC) in Singapore; Instituto Nacional de Pesquisas Especiais (INPE) in Sao Paulo, Brazil; and the National Centre for Medium Range Weather Forecasting in New Delhi, India.

### **3.6 General Discussion on Agenda Item 3**

It was noted that some key components of the future RCC systems might not be NMHSs (i.e. universities, etc.) and that it is important to consider them when issuing and analysing the questionnaires. In addition, there is commercial competition on some LRF and climate products. Many of the present products are designed for the professional sector, and not for the public, so there is a question as to whether products tailored for a broader audience can be produced within existing budgets.

There are also distribution issues (Resolutions 25 and 40). Many countries place fewer restrictions on data for research than for the commercial sector. It was noted that WMO and the Regional Associations must ensure that the RCCs do nothing to upset the balance in which it is the countries themselves that control how they share their data. However, as data is essential to many RCC activities, countries must be urged to share their data in a timely manner. It is felt that products, especially regional products can be freely shared by the RCCs.

It was strongly noted that RCCs will provide a complementary range of services to those provided by NMHSs and will not usurp NMHS authority. Only national services will issue warnings, for example. Members in a region may decide on a range of products the RCC could, itself, release to the public. The primary 'users' of the RCCs will be the NMHSs.

#### **4. WAYS TO DETERMINE REGIONAL REQUIREMENTS AND EXISTING CAPABILITIES FOR RCC SERVICES**

The survey developed by the RA IV Ad Hoc Expert Advisory Group on Establishment of an RCC was discussed and found very useful. It was based on the RCC functions as described by the ICTT-RCC (WCASP No. 52, Annex 2 (May 2001)). In discussion, it was agreed that it could be improved with the inclusion of a column for priority rankings, which will help decision-making and effective use of available resources.

#### **5. ALTERNATIVE STRUCTURES THAT MIGHT MEET A REGION'S NEEDS**

The possible structures for Regional Climate Centres include: a single, multifunctional centre for all or some part of a region; several RCCs within the region, each providing a unique focus (a 'distributed' system); or services and products from several centres, linked and identified as one RCC (a 'virtual' system). The possibility was raised that some services and products may be provided through non-NMHS, non-WMO agencies such as Universities and other scientific organizations. Some Regional Associations may decide, based on their regional needs, priorities and the mandates of their Members, to provide some climate services and products under contract through their RCC and/or with commercial providers.

Discussion highlighted several important points. An RCC, or system of RCCs should be inclusive, allowing all Members to participate. Reliable communications for collection and dissemination of information, data and products will be vital to success of any RCC system. All components of an RCC must adhere to WMO data policies. Where a required capacity does not presently exist within a region, it may be feasible to have it provided through a service outside the region while the capacity is being developed. It will be important to establish the RCC where there will be continued availability of trained and skilled staff.

Virtual or distributed systems, or a combination of both, will likely best meet the needs for RCC functions within the large and diverse WMO regions, and would likely be the most inclusive and cost effective solution. A virtual system is, in fact, really a type of distributed system, managed virtually. The Internet site and the coordination would have to be provided (funded, operated, maintained), within the region itself if the capacity exists. Some tasks would be unique to specific centres within the system (e.g. seasonal outlooks for a specific sub-region), but other functions (e.g. training) might support the whole region. Training and research might naturally fall to University nodes, while data archiving will be performed by the NMHSs of the Members. In a distributed or virtual system of multiple centres, little duplication of results would take place. Some capacities/functions would be very similar, but applied to different geo-political sub-regions.

### **5.1 GPCs and RCCs: Roles, Responsibilities and Data**

Regions II, IV and VI have a number of GPCs each, but there are too few GPCs in Regions I, III, and V. It would be useful if all GPCs shared their output with all Regions through the Internet. Clear guidelines would be required for this, and to outline the roles and the responsibilities of GPCs with respect to RCCs. CBS should be consulted.

### **5.2 FWIS and RCC Structure and Functions**

The Future WMO Information System (FWIS) was discussed. Over time, multiple information systems have been established by various WMO Programmes, leading to duplication, overlap and errors. This is not cost effective or practical. A single, co-ordinated global infrastructure system is being designed, based on the most successful existing WMO system and industry standards.

The FWIS must serve the needs of all WMO Programmes and NMHSs. All data will be collected and stored by Members. Data and products will be provided to users through FWIS. Data Collection and Processing Centres (DCPCs) would collect data from national centres, provide the data to WDCs, create and distribute products and provide access to these data and products. FWIS would also ensure maintenance of WMO standards and collect and store metadata. At the highest level, global information centres will receive data and products and disseminate them as needed. Datasets will only be held for a limited time (observed data will not be archived). The global centres will maintain a catalogue of data exchanged, document the data sources and provide a back-up service. It will remain the responsibility of NMHSs to provide data and products to users. Resources for the development and transition are tight, but the benefits should outweigh the costs. It would be wise to develop the new RCCs in harmony with FWIS.

## **6. PROCEDURES AND CRITERIA FOR THE DESIGNATION OF AN RCC TO SERVE MEMBERS**

The official designation of new centres was discussed. The Manual on the Global Data Processing System (WMO No. 485) consists of 2 parts. Part I, Global Aspects, is part of the WMO Technical Regulations. It contains, *inter alia*, Organization and Functions of the Data-processing Systems, and includes the definition of the structure of the GDPS, which comprises WMC, RSMC and NMC. Part II, Regional Aspects, is not part of the Technical Regulations.

The regulations concerning RSMCs are contained in Part I. RSMCs are either centres with geographical specialization, or centres with activity specialization in

global medium-range weather forecasting; tropical cyclone forecasting; provision of transport model products for environmental emergency response; or (since 1997) activities related to the WCP, such as climate diagnostics, climate analysis and prediction products to assist in climate monitoring.

It was noted that the term 'regional' is normally used in the geographical connotation. The WMO Regional Associations are involved in developing and approving requirements (operations and products) if the RSMC is limited to one region and its functions are regional or sub-regional in nature (e.g. Tropical Cyclone Centres, Atmospheric Transport Model Centres, ACMAD, DMCs, etc.). Responsibility for such centres falls to the Regional Associations, not the CBS.

Appendix I-1 of the Manual on GDPS lists the WMCs and RSMCs currently designated under various recognised groups. Appendix I-2 of the Manual on the GDPS describes the procedures for designating new RSMCs (see **Annex 3**). The Manual also contains several other Annexes and Appendices which describe various RSMC responsibilities, functions, priorities in the production and transmission of forecast products, data representation forms to be used, quality monitoring of observations, NWP verification and online exchange of skill scores, etc.

If formal designation of RSMCs with activity specialization as RCCs is desired within the framework of the Global Data-processing and Forecasting Systems (GDPS) of the WWW, several sections of the Manual will have to be reviewed and amended to ensure that RCC functions are consistent across the manual. Terms such as 'virtual RCC' will have to be defined. As well, the Manual does not allow anything other than Member-run centres. It is not certain that virtual RCCs, or RCCs that include non-WMO nodes can be formally designated. There may be liability issues. Who would be responsible in case of any failure? There is considerable responsibility associated with a 'designated' centre, assigned to the host country, such as to maintain back-up systems, have contingency plans, etc. Some of these may not be requirements for climate activities, however. The key will be identification of the requirements for RCCs.

Once a request for designation is approved by CBS, the appropriate Technical Commissions (CBS and CCI) will require a demonstration that the requirements can be reliably met. Potential RSMCs have, in the past, failed to meet the requirements, as this is a rigorous process (for formats, data exchange, communications, etc.). If requirements are met, a formal recommendation will be made to WMO Congress who will approve the centre with its responsibilities and privileges.

## **7. COMPONENTS OF A WORKPLAN**

Once the Regional Association decided on the requirements (if any) for an RCC and selects the optimal structure for it, the next step will be to establish a work plan for implementation. Potential RCCs will need to set up action plans to lead towards operational performance of their assigned tasks (having previously committed to carrying out these tasks for an indefinite period). With the support of the RA, the centres will have to gain commitment from all supporting centres (e.g. the GPCs), set up a steering committee or oversight mechanism for coordination and problem solving, and implement the RCCs. If formal designation is required, the plan will include the necessary steps following the established procedures in the Manual on the GDPS. In many cases, a pilot phase will be useful.

## **8. GUIDELINES FOR THE ESTABLISHMENT OF REGIONAL CLIMATE CENTRES**

### **8.1 Overview**

On the second day of the meeting, the experts broke into groups to develop draft guidelines on the four key topics (requirements, structures, designation and workplan) discussed on the previous day, and taking into account the issues raised by the team, and decisions made. It was noted that the Guidelines would, once approved by the drafting team, be offered to the Regional Associations for comment and use, then they would be presented to EC-LVI (2004) as documentation.

The results of the breakout groups were discussed, and provided a strong consensus. A brief background and statement of the purpose of an RCC are given in section 8.2. The output and subsequent discussions and decisions on the key topics have been consolidated and are presented in sections 8.3 to 8.6. Additional background information used in development of these Guidelines is provided in several annexes to this report: the extracts on RCCs from EC-LII, EC-LIII, EC-LIV, Cg-XIII and Cg-XIV (**Annex 4**); and the list of RCC functions as described in WCASP No. 52 of May 2001 (**Annex 5**). A proposed questionnaire to determine the requirements for establishment of an RCC is presented in **Annex 6**.

### **8.2 Background and Statement of Purpose of the Regional Climate Centres**

The Commission for Climatology's Ad Hoc Expert Team on Organization and Implementation of Regional Climate Centres met in Geneva in November 2003. Team members reviewed the concept of the RCCs as described in the reports of the Inter-Commission Task Team on Regional Climate Centres (the ICTT-RCC) (WCASP No. 52, May 2001 and WCASP No. 54, March 2002), and in the decisions of WMO Executive Council and Congress (See **Annex 4**). Considerable progress had been made in setting out the tasks of RCCs for operational activities, coordination functions, data services, training and capacity building and for research and development, including regional and hydrological issues. However, the Expert Team noted that the following clarification of the concept of such centres was necessary to ensure a clear understanding of the RCCs with respect to other institutions and the National Meteorological and Hydrological Services (NMHSs) within the Regions:

The RCCs are to be complementary (non-duplicating) and supportive of the NMHSs. The services and products from the RCCs shall be provided to the NMHSs for further definition and dissemination and are not to be distributed to end users without the permission of the NMHSs within the region. These products and services should be regional in nature and should be those the NMHSs are not able to produce themselves. It was re-affirmed that the issuing of warnings and watches was a responsibility of the NMHSs and not an RCC responsibility. The Expert Team further recommended that all RCCs should always adhere to the principles of WMO Resolution 40 concerning the exchange of data and products.

In the event that a Region wishes to consider, and possibly establish an RCC, then issues such as regional requirements, operational capacities, possible structures, potential designation as specialized centres under the WMO Technical Regulations and a work plan must be addressed. The Ad Hoc Task Team developed Guidelines

on these issues to standardize the process across regions, and make it more straightforward to implement.

### **8.3 Determination of Requirements for a Regional Climate Centre**

The statements of requirements for implementation of RCCs are the responsibility of the Regional Associations. In order to start this process, the President of each Regional Association should first inform the Permanent Representatives (PRs) of that Region's Member countries of the results of the work of the ICTT-RCC, and the decisions and resolutions of WMO Executive Council and Congress concerning the establishment of RCCs (**Annex 4**). Following the recommendations of the ICTT-RCC, the requirements of the Region should then be determined.

Potential RCC functions, as outlined in WCASP No. 52, Annex 2 (May 2001) (attached as **Annex 5**), could be used as the basis for a questionnaire for this purpose. An example of a questionnaire the Presidents of Regional Associations could use (developed by RA IV) is shown as **Annex 6**. Members should be asked to evaluate if the requirements, as listed, are adequate for their needs and, where necessary, to amend the list. For best results, the Expert Group suggests that CLIPS focal points and CCI members in each country could help the PRs complete this survey. It is also highly recommended that relevant regional institutions be included in this process from the beginning.

Once answers to the questionnaires are received and analysed, the President of the Regional Association will consolidate them into a regional statement of requirements for Regional Climate Centre(s), and then will seek confirmation by the PRs of the region. The easiest means of doing this may be through a regional circular letter from the President of the Regional Association, listing the requirements, and inviting volunteers to host related functionalities from that list. This letter should also explore issues such as the potential inclusion of relevant (non-NMHS) institutions, and data issues such as Resolution 40, and it is highly recommended that a deadline for response be given. Absence of responses from Members will indicate no interest in hosting RCCs related functionalities and acceptance of related requirements.

It is suggested that the president engage a relevant regional expert Working Group or Task Team (or establish an ad hoc group) to analyse the offered capabilities proposed by the responses from the PRs, to review the priority functions needed in the region and to evaluate any deficiency with respect to the requirements. The composition of this team should include experts familiar with RCC matters, preferably experts on climate matters, WWW activities (especially with respect to RSMCs) and/or relevant institutions. The Task Team should provide to the president a comprehensive report with recommendations including:

- the priority on establishment of the RCCs;
- remedial activities needed to solve any analysed deficiency;
- an appropriate structure to organise the region's RCC functionalities;
- necessary actions for the president to ensure the availability of products and services needed from GPCs (through WMO, to ensure provision of access); and
- an appropriate operational phase or pilot/demonstration project.

### **8.3.1 Gain Approval of the Requirements and Proposal to Establish an RCC**

The President of the Regional Association will inform all Members in the Region of the outcome of the Task Team and invite final comments and suggestions. The next task will be the adoption of the final proposal. Review and adoption by the Region may take place at the next session of the Regional Association, or by correspondence initiated by the President during the intersessional period. When regional consensus is reached, the requirements and indications of commitment to serve the stated needs (i.e. the centre(s) that will form the basis of the RCC System for that Region) should be sent to the various Regional Members, the WMO Secretariat (WCP) and the relevant Commission Presidents. Included should be the recommendation from the Region as to whether official designation is being sought for any centre(s).

### **8.3.2 Assessment of Projected RCC Operational Capabilities**

An assessment process that verifies the RCC's capability to produce the required products and services must be next established within the region. The outcome of this assessment process should be provided to CCI and CBS. These Technical Commissions will take the necessary actions (as requested or required) with other WMO bodies in consultation with the Regional Association.

Specifically, the assessment can be established either as pilot projects or as demonstrations, involving several NMHSs, for evaluation and/or verification that the RCC can produce the necessary products in a timely and accurate manner. (e.g. LRF verification within respective countries, evaluation of the quality of data rescue, training courses, etc.)

In some cases, the assessment can be based on existing capabilities. However, it should be recognized existing capabilities generally fulfil national requirements first. Mechanisms have to be established to verify that the needs of other NMHSs in the Region are also ensured. This can be made with an ad hoc questionnaire sent by the 'proposed' RCC to its 'users' (this approach is recommended within quality assurance techniques, in order to check the satisfaction of the "client"). Such questionnaires should be issued at regular intervals, and should allow identification of weaknesses as well as possible improvements. The RA itself should initiate this process prior to the designation of the RCC.

There are some activities for which the assessment is already well documented. This is the case, for example, of Long Range Forecasting where both the type of products, their quality and verification techniques were more or less already standardized by the CBS Expert Team on Infrastructure for Long Range Forecasting. In that case, the assessment will simply consist of checking that the RCC complies with those requirements.

The CLIPS focal points should play a key role in the assessment procedures, as national representatives in charge of collecting and summarizing all the relevant information of use for improving the RCC services. As well, the RCC itself should set up a mechanism and a structure in order to take into account requests for improvement. It should also document all of its production at the necessary level of detail, and provide a friendly access to it.

## **8.4 Structures**

Each Regional Association will determine how best to meet the requirements of its Members for RCC services, based on a number of factors such as sub-regional needs and capacities. It is important that the RCC systems be cost-effective and inclusive, allow for overlap and coordination between Regions as needed (such as between Regions II and V in the Asia-Pacific area), and include the role of the Global Producing Centres.

Options as described in WCASP No. 54 (March 2002), item 5.1 and in Annex 4 on Roles and responsibilities of Regional Associations, include the implementation of a single centre, a distributed function, or multiple or virtual centres. The six WMO Regions are large and diverse with a complexity of climatic, political and socio-economic issues to deal with, so the establishment of a single, multifunctional Regional Climate Centre to serve the needs of an entire Region was not seen by the Ad Hoc Expert Team as the most feasible option.

It is believed to be more feasible to have multiple climate centres in each WMO Region. These can be multifunctional or distributed functional centres or a combination of both. RCC functions such as training and capacity building; research and development; and data management might be potentially suitable for distributed functions. Such a system would be inclusive, allowing all Members in the Region to participate within their capacities. The Regional Association could distribute tasks to non-WMO climate institutions such as universities and specialized agencies, provided that they comply with WMO data policies. In a multiple-centre structure, it is unlikely that there would be much duplication of work. While some functions might be similar, they would apply to different sub-regional interests, with different results.

Coordination between the various centres on distributed functions and on consensus forecasting would be desirable, and can be done using physical or virtual systems. Virtual mechanisms such as Internet services and teleconferencing allow for wider participation for collection of information, building consensus guidance, production of tailored products and distribution, at minimal cost.

The Regional Association would need to identify Members with the capacity (commitment, interest and infrastructure) to maintain the virtual communications and coordination required. If necessary, a partnering country or agency outside the region could be called upon to fulfil this requirement, in collaboration with the Members of the region or sub-region.

## **8.5 Designation Procedure**

The WMO regulations and procedures for the establishment of operational centres are in the WMO Manual on the Global Data-Processing Systems (GDPS) (WMO No. 485). This manual consists of two parts:

Part I covers formal designation of a centre through the Technical Commission CBS and is part of the WMO Technical Regulations. It contains, inter alia, discussion on organization and functions of the Data-Processing Systems, and definition of the structure of the GDPS which comprises WMCs, RSMCs and NMCs. It refers (since 1997) to establishment of centres with activity specialization for climate diagnostics, climate analysis and prediction products to assist in climate monitoring, all pertinent to an RCC. It was noted that in order to designate RSMCs with activity specialization as RCCs within the framework of the Global Data-Processing and

Forecasting Systems (GDPFS) of the World Weather Watch (WWW), several sections of the Manual would need to be reviewed and adjusted to ensure that the RCC procedures are consistent throughout the Manual, and to ensure that all aspects related to RCCs are covered (for example, the concept of 'virtual' centres or coordination would need to be explicitly discussed). This process might need some time, and would require the joint efforts of the CCI and CBS. The key to setting the designation procedures for RCCs will be the statement(s) of requirements.

Part II of the manual covers Regional Aspects. Establishment of centres using Part II of the manual does not fall under the WMO Technical Regulations. A number of centres exist in this category, including the Drought Monitoring Centres and the African Centre of Meteorological Applications for Development (ACMAD) in Regional Association I (Africa). The Regional Associations have full responsibility for developing and approving the requirements for such centres.

The ICTT-RCC and WMO EC and Congress endorsed the official designation of Regional Climate Centres, but each Regional Association can decide whether or not it wishes – or needs -- to follow that process. If it does, it will need to proceed with the steps under Part I of the WMO Manual on the GDPS (WMO No. 485).

It is expected that WMO, once informed by a Regional Association on its desire to implement a Regional Climate Centre or Centres, will submit the proposal to CBS and CCI for recognition. Both Commissions should evaluate whether the proposal is in accordance with the Region's needs and the infrastructural framework (e.g. the Future WMO Information System (FWIS)), and might advise on the procedures necessary to incorporate the proposed RCC functionality into the GDPS. This can be done by incorporating the proposed functionality into Part II (Regional Aspects) of the Manual on the GDPS without any further designation procedure. However, if requested by the Region, and potentially feasible, the proposed centre(s) can be targeted for official designation as an "RSMC with activity specialisation in climatology", following the RSMC procedure as laid down in Part I of the Manual on GDPS. Although that would require revising the Manual, and would take considerable time, in the long-term, it is hoped this would eventually allow designation of RCCs to become more straightforward.

As part of the official designation procedure under Part I, the appropriate Technical Commission(s) require a demonstration that the proposed centre(s) can do the job. This is a rigorous process that not every proposed centre succeeds in meeting. If the requirements are met, however, a formal recommendation will be made to WMO Congress, who will approve the Centre along with its responsibilities and privileges. Pending final decisions by the appropriate WMO Constituent bodies, the Regional Association President may request the selected Members or candidates to start operating on a pilot basis under Part II of the manual.

The RA President should establish a procedure to periodically review the operational functions of the designated RCCs, so as to maintain standards and deal with evolving issues.

## **8.6 Workplan to Implement the Proposal to Establish an RCC**

A workplan should be developed that covers the process to establish a Regional Climate Centre (RCC). At this stage, a proposal has been made that incorporates analyzed requirements and capabilities, recommends a structure, and addresses

the issue of designation; and the Regional Members and President have approved it.

In the first step of this phase, the centres responsible for the RCC functions, and the other major centres with significant supporting roles, will complete Action Plans and make a formal commitment to their roles. The centres that are responsible for RCC functions should ensure that they have adequate commitments from any supporting centres or institutions (for example, global producing centres) that will provide the information needed in the preparation of the centre's RCC-related outputs or services.

The centres responsible for RCC functions might require a Steering Committee or other oversight mechanism to coordinate the process of making their formal commitments. Also, a Steering Committee (composed of representatives with high authority from each of the participating agencies) might be needed to coordinate the activities of the centres and to look after evolving needs once the proposal has been implemented.

The next step will consist of the consolidation of the centres' Action Plans and commitments into an overall Implementation Plan. The Implementation Plan will be reviewed by the President, any needed modifications will be coordinated with the centres, and the President will formally approve the adoption of the Implementation Plan. The Steering Committee (if one has been formed) will coordinate the implementation of activities under the plan.

If a formal designation is to be pursued through Part I of the Manual on the GDPS, the President will coordinate the completion of the steps described in the guidelines for that type of designation.

## **9. MEETING REPORT**

The Expert Team agreed that the draft report would be assembled by the Secretariat, circulated to the team for comment with a deadline of the end of January, and published by the end of March 2004.

## **10. CLOSURE OF THE MEETING**

The Chairman closed the meeting at 4PM on 28 November 2003. In his closing remarks, Mr Hechler commended the team on their efforts and the level of consensus achieved in the time available, and thanked all participants for their valuable contributions.

## AGENDA

1. OPENING OF THE MEETING
  2. ORGANIZATION OF THE MEETING
    - 2.1 Approval of the Agenda
    - 2.2 Other organizational matters
  3. REVIEW OF THE WORK OF THE ICTT-RCCs AND OTHER RELEVANT BODIES
    - 3.1 Review of the reports of the ICTT-RCCs
    - 3.2 Decisions of EC and Congress matters related to ICTT-RCCs
    - 3.3 Results of Regional Activities relevant to the ICTT-RCCs
    - 3.4 Producers of Seasonal Prediction/Long Range Forecasts
    - 3.5 Existing WMO Structures for RCC related activities
  4. WAYS TO DETERMINE REGIONAL REQUIREMENTS AND EXISTING CAPABILITIES FOR RCC SERVICES
  5. ALTERNATIVE STRUCTURES THAT MIGHT MEET A REGION'S NEEDS
    - 5.1 GPCs and RCCs: roles, responsibilities and data
    - 5.2 FWIS and RCC structure and functions
  6. PROCEDURES AND CRITERIA FOR THE DESIGNATION OF AN RCC TO SERVE MEMBERS
  7. COMPONENTS OF A WORKPLAN
  8. DEVELOPMENT OF THE GUIDELINES
  9. REPORT
  10. CLOSURE OF THE MEETING
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**Extract from the Manual on the Global Data Processing System  
(WMO No. 485, 1992 edition, Suppl. No. 4 (VII, 1997))**

**Appendix I-2**

**Procedures for broadening the functions of existing RSMCs and for  
designation of new RSMCs**

The procedures are as follows:

1. Establishment of a statement of requirements for WWW products and services initiated and endorsed by the WMO constituent body and bodies concerned.
2. Identification of capabilities of relevant existing RSMCs and/or candidate RSMCs, to meet the requirements.
3. Determination in principle whether there is a requirement to:
  - (a) Broaden the functions of an existing RSMC; and/or
  - (b) Establish a new RSMC
4. Formal commitment by a Member or a group of cooperating Members to fulfill the required function(s) of a centre:
  - The prospective RSMC should:
    - (a) Establish a closely defined relationship between the RSMC and the WWW Meteorological Centres as users of RSMC products;
    - (b) Commit itself to make available a set of products and services designed to meet the given requirements, where appropriate, in terms of specific forecast parameters and formats, the frequency of their issue and targets for timeliness, overall reliability and quality;
    - (c) Propose method(s) and procedures by which such products and services will be delivered;
    - (d) Propose method(s) and procedures by which ongoing performance will be assessed (e.g. by verification);
    - (e) Propose method(s) by which particular WWW Meteorological Centres' changing requirements could be made known and improvements in operational performance introduced by the RSMC;
    - (f) Address the question of contingency and back-up arrangements to cover situations where RSMC may not be able to provide the required services.
5. Demonstration of the capabilities to CBS and the constituent body or bodies referred to under (1):
  - The prospective RSMC should expect to demonstrate its general capabilities of relevance to the service to be offered (such as access to relevant data and processing capability), its ability to meet the above commitment and the suitability of its other proposals.
6. Recommendation by CBS to include in the *Manual on the GDPS*:
  - (a) The new function(s) of the existing centre; or
  - (b) The identification and function(s) of the new centre.
7. Acceptance of the CBS recommendation by Congress or the Executive Council.

**EXTRACT OF PARAGRAPHS ON REGIONAL CLIMATE CENTRES  
FROM THE ABRIDGED FINAL SUMMARIES OF CG-XIII,  
EC-LII, EC-LIII, EC-LIV AND CG-XIV**

**CG-XIII, Geneva, 4-26 May 1999**

**3.2.0.14** Noting the gradual development of a regional approach in providing support to the implementation of the CLICOM and CLIPS projects, Congress welcomed the intention of CCI to consider how the regional organization of work in the climate area should be expanded. In that regard, Congress strongly urged CCI to work in consultation with Members to clearly define the requirements, objectives and responsibilities of regional and global centres envisioned in an operational framework to support national climate services. Congress further emphasized the need to make full use of existing regional structures and institutions and to involve the regional associations and the existing external partners in the development of that concept. Congress emphasized that warning services should continue to be the purview of NMSs and that the role of regional centres or entities other than NMSs should be clearly identified.

**3.2.5.3** Congress noted that, in continuing to strengthen its capacity building activities, the CLIPS project would need to work towards assisting Members through the establishment of a framework that would enable them to exploit the growing level of skill in seasonal time-scale predictions. Such a framework must address observational and archival needs, the role of the advanced analysis and prediction centres, the formats of prediction products and procedures for validating them, the definition of responsibilities of regional climate centres, their establishment and the assurance that information and products would be made available to the benefit of all Members. The introduction of new operational methodologies for seasonal prediction based on products from global models was recognized as being a new requirement for capacity building and infrastructure development over the coming years.

**3.2.5.4** Congress noted and endorsed the steps being taken by CCI to define clearly the concept of regional climate centres, recognizing the important role of regional cooperation for capacity building and infrastructure development, particularly as they underpinned predictions on seasonal time-scales. Congress noted that the CLIPS activities related to infrastructure requirements for seasonal prediction including regional centres would require close cooperation and coordination between several WMO Programmes, and therefore requested the Secretary-General to take appropriate steps to ensure progress and to eliminate duplication in that area as a matter of some urgency.

**3.2.5.9** Congress noted the activities of the WMO Secretariat in coordinating the provision of up-to-date summary information on the 1997–1998 El Niño/La Niña event, including the preparation of a series of El Niño updates over a period of months, and briefings given to the press, to other United Nations agencies and to Diplomatic missions in the Geneva area. Congress agreed that the respective roles of different climate centres within its Member countries in responding to climatically induced crises were major points for discussion. It therefore requested that the presidents of CCI and CBS ensure that that issue was addressed in conjunction with the respective roles of major analysis and prediction centres, specialized regional meteorological centres, emerging regional climate centres and those national centres with climate responsibilities.

## **EC-LII, Geneva, 16-26 May 2000**

**4.1.28** The Council welcomed the broadening range of activities to develop an effective framework for seasonal to interannual prediction and recognized that those activities required close collaboration between various WMO Programmes. The Council also recognized that there were several options for the development of institutional structures. The Council further recognized that, among those options, a concept of regional climate centres had been proposed. The Council considered that in developing a framework for seasonal to interannual prediction, that concept should be further explored through a suitable arrangement involving CCI, CBS, CAS and CAgM. The Council therefore decided to establish an Intercommission Task Team to define the concept and the need for, and the requirements of, RCCs. It adopted **Resolution 2 (EC-LII)**.

### **RESOLUTION 2 (EC-LII) INTERCOMMISSION TASK TEAM ON REGIONAL CLIMATE CENTRES**

THE EXECUTIVE COUNCIL,  
**NOTING:**

- (1) Resolution 2 (Cg-XIII) — World Weather Watch Programme for 2000-2003,
- (2) Resolution 8 (Cg-XIII) — Climate Information and Prediction Services Project,
- (3) Report of the Meeting of the Presidents of Technical Commissions, 1999,
- (4) General Regulations 37 and 38,

#### **RECOGNIZING:**

- (1) The need for the development of an effective infrastructure for seasonal to interannual climate predictions that consolidates, within an operational framework, the progress made by climate monitoring and research programmes sponsored by WMO in this area,
- (2) The suitability of a regional mechanism for the interpretation and interface to users of seasonal to interannual predictions which may be achieved through the development of a system of Regional Climate Centres (RCCs),
- (3) That there is a need to define more clearly the role and potential functions of RCCs, especially with respect to those of national centres,
- (4) That definition of the role of RCCs would be facilitated through the development of a detailed user requirement for seasonal to interannual predictions that covers the infrastructure required to produce them and to transmit them for effective use by end users,
- (5) The important role of regional cooperation for capacity building and infrastructure development,
- (6) That activities related to the development of infrastructure requirements for seasonal to interannual prediction, and within that context to RCCs, would require close cooperation and coordination between several WMO Programmes,

#### **DECIDES:**

- (1) To establish an Intercommission Task Team on Regional Climate Centres comprising six experts from the Commissions for Climatology (two experts), Basic Systems (two experts), Atmospheric Sciences (one expert) and Agricultural Meteorology (one expert) to define the needs for, and the roles of, the RCCs;
- (2) To define the terms of reference of the Intercommission Task Team on RCCs as follows:

- (i) To develop the concept of RCCs taking account of existing WMO regional centres and, as appropriate, to recommend the procedure for their designation;
  - (ii) To take into consideration during the review process the Statement of User Requirements being prepared by the president of the Commission for Climatology (CCI), once available;
  - (iii) To review the existing methodologies for the production and verification of seasonal to interannual forecasts;
  - (iv) To propose an infrastructure for the dissemination of seasonal to interannual forecasts to the Members, both globally and regionally, that satisfies user requirements;
  - (v) To evaluate the existing facilities in terms of the proposed infrastructure for seasonal to interannual prediction defined through 2(iv);
  - (vi) To advise mechanisms and options for future cross-programme cooperation between the technical commissions concerned;
  - (vii) To report on its deliberations to the presidents of CCI and of those other commissions involved prior to the fifty-third session of the Executive Council;
- (3) To designate in accordance with General Regulation 38, CCI as the constituent body to which the Intercommission Task Team shall report;

**REQUESTS** the presidents of the four commissions mentioned in **DECIDES**: (1) above to designate, taking into account regional balance, experts to participate in the work of the Intercommission Task Team;

**REQUESTS** the president of CCI:

- (1) To arrange in accordance with General Regulation 38 the election of a chairperson of the Intercommission Task Team from among its members;
- (2) To report on the work of the Intercommission Task Team to the fifty-third session of the Executive Council;

**REQUESTS** the Secretary-General to provide the necessary assistance and Secretariat support for the Intercommission Task Team on RCCs, within the available budgetary resources.

#### **EC-LIII, Geneva, 5-15 June 2001**

**4.1.31** The Council was pleased to receive the report from the Intercommission Task Team on Regional Climate Centres. The Council expressed its sincere appreciation for the quality of the work undertaken by the Intercommission Task Team and, while recognizing that an important foundation had been laid, commented that more detailed preparation still needed to be made. Future work was needed to secure the leading role of NMHSs in the delivery of services in order to ensure that the development of climate services within NMHSs of developing countries was not held back, and that there was close collaboration between relevant WMO commissions and between WMO and all other bodies involved. The Council noted that the report included the Statement of User Requirements for Seasonal to Interannual Operational Prediction and Forecast Products, prepared by CCI, and a proposed list of RCC functions. The Council requested that CCI keep the Statement of User Requirements under review.

**4.1.32** Noting that the concept of RCCs was widely supported within the contributing commissions, the Council confirmed that establishment of such Centres was desirable, where appropriate, to assist NMHSs to interpret and apply seasonal to interannual

forecasts. The Council further confirmed that the list of RCC functions developed by the Task Team was comprehensive and that, depending on regional requirements, individual Centres might not necessarily be required to handle all functions. Furthermore, the Council recognized that the needs for establishing those Centres and the structure of such Centres, might vary between and across regions. Individual regions might require more than a single Centre. The option of virtual centres created by networking existing organizations was also recommended for consideration. Accordingly, the Council strongly endorsed the involvement of regional associations in further activities directed at the establishment of RCCs. The Council was pleased to note the offers made by China and the Islamic Republic of Iran to host RCCs. The Council also noted that there were already existing relevant activities for operational delivery of global forecast products for climate by many national and regional Meteorological Services as identified by the Intercommission Task Team.

**4.1.33** The Council confirmed that the creation of RCCs should follow the established procedures for the designation of RSMCs and that that process should involve all relevant commissions in order to discriminate clearly the additional activities of the Centres from those of existing GDPS RSMCs. The demonstration of capabilities of proposed Centres fell into the remits of both CBS and CCI.

**4.1.34** The Council noted that commitments to providing operational seasonal to interannual forecasts would need to be sought from producing centres. In a first developmental stage, the Council agreed that a limited number of forecast producers with global capabilities should be approached, including both numerical and empirical producers. The Council noted that the Intercommission Task Team proposed that the following centres be approached in the first instance: the Bureau of Meteorology (Australia), the Centre for Weather Prediction and Climate Studies (Brazil), the Meteorological Service of Canada, *Météo-France*, the Japan Meteorological Agency, the South African Weather Bureau, the Meteorological Office (United Kingdom), the Climate Prediction Center (United States), ECMWF and the International Research Institute for Climate Prediction (United States). The Council was pleased to note that the Max Planck Institute for Meteorology in Germany had agreed to serve as a producing centre. Recognizing that seasonal to interannual forecast capabilities existed in a substantial and growing number of centres, the Council strongly recommended that neither the initial limited list of producers, nor any subsequent expanded list, be exclusive of any organization that wished to participate provided that they could fulfill the stated requirements.

**4.1.35** Considering the extent of further cross-programme coordination necessary to establish RCCs, the Council agreed that the work of the Intercommission Task Team on Regional Climate Centres would be extended until its forty-fourth session. Accordingly, the Council adopted **Resolution 7 (EC-LIII)**.

## **RESOLUTION 7 (EC-LIII)** **INTERCOMMISSION TASK TEAM ON REGIONAL CLIMATE CENTRES**

THE EXECUTIVE COUNCIL,  
**NOTING:**

- (1) Resolution 2 (Cg-XIII) — World Weather Watch Programme for 2000-2003,
- (2) Resolution 8 (Cg-XIII) — Climate Information and Prediction Services Project,
- (3) Resolution 2 (EC-LII) — Intercommission Task Team on Regional Climate Centres,
- (4) Report of the 1999 Meeting of the Presidents of Technical Commissions,

- (5) Report of the Intercommission Task Team on Regional Climate Centres, 2001,
- (6) General Regulations 37 and 38,

**RECOGNIZING:**

- (1) The need for the development of an effective infrastructure for seasonal to interannual climate predictions that consolidates, within an operational framework, the progress made by climate monitoring and research programmes sponsored by WMO in this area,
- (2) That the Intercommission Task Team on Regional Climate Centres (RCCs) has confirmed that RCCs would provide an effective regional mechanism for the interpretation and interface to National Meteorology and Hydrological Services and users of seasonal to interannual forecasts,
- (3) That the Intercommission Task Team has agreed on an initial list of functions that might be undertaken by RCCs based on a user requirement for seasonal to interannual forecasts prepared by the Commission for Climatology (CCI) that covers the infrastructure required to produce the forecasts and to transmit them for effective use by end-users,
- (4) That the RCCs would play an important role in regional cooperation for capacity building and infrastructure development,
- (5) That the development of RCCs will require close cooperation and coordination between several WMO Programmes and the regional associations,

**DECIDES:**

- (1) To extend the term of the Intercommission Task Team on RCCs with the present membership designated by the presidents of the Commissions for Climatology, for Basic Systems, for Atmospheric Sciences and for Agricultural Meteorology, and to invite additional experts to be nominated by the presidents of the regional associations and the president of the Commission for Hydrology;
- (2) To define the terms of reference of the Intercommission Task Team on RCCs as follows:
  - (i) To initiate follow-up actions leading to the creation of RCCs;
  - (ii) To establish mechanisms for cooperation between global forecast production centres, RCC, the National Meteorological and Hydrological Services and any other participating institutes;
  - (iii) To advise on the requirements for workshops, including implementation/coordination meetings;
  - (iv) To consider and recommend future developments necessary within the infrastructure to enhance the delivery of climate services;
  - (v) To assist in developing cooperation between programme groups and to advise mechanisms and options for future cross-programme cooperation between the technical commissions and regional associations concerned;
  - (vi) To report on its deliberations to the presidents of CCI and of those other commissions and associations involved prior to the fifty-fourth session of the Executive Council;
- (3) To designate in accordance with General Regulation 38, CCI as the constituent body to which the Intercommission Task Team shall report;

**REQUESTS** the presidents of the six regional associations and the president of the Commission for Hydrology (CHy) to designate the additional experts to participate in the work of the Intercommission Task Team;

**REQUESTS** the president of CCI to report on the work of the Intercommission Task Team on RCCs to the fifty-fourth session of the Executive Council;

**REQUESTS** the Secretary-General to provide the necessary assistance and Secretariat support for the Intercommission Task Team on RCCs, within the available budgetary resources.

#### **EC-LIV, Geneva, 11-21 June 2002**

**4.1.2.9** The Council was pleased to receive the report from the Intercommission Task Team on RCCs. The Council expressed its sincere appreciation for the quality of the work undertaken by the Task Team and, while recognizing that an important foundation had been laid, commented that more detailed preparation still needed to be made as a preparation for the establishment of RCCs. Future work was needed to secure the leading role of NMHSs in the delivery of services, to ensure that the development of climate services within the NMHSs of developing countries was not held back and that there was close collaboration between relevant WMO commissions and between WMO and all other bodies involved.

**4.1.2.10** Noting that the concept of RCCs was widely supported within the contributing commissions, the Council reiterated its support for the establishment of such Centres without undermining the role of NMHSs in their provision of seasonal to interannual forecasts.

**4.1.2.11** The Council stressed the importance of ensuring that the RCC concept was further developed within an integrated framework of global, regional and national meteorological and related service provision so that it did not lead to any artificial division in the continuum of weather and climate services. In re-emphasizing that climate service provision was an integral part of the meteorological service role of NMSs and that the WMO system of Regional/Specialized Meteorological Centres for supporting the work of NMSs was well established, the Council further stressed that the definition of the functions, operating procedures and terminology for the issue of climate products should be carried out in close coordination with CBS, in respect of both its basic systems and public weather service responsibilities. The Council confirmed that the designation of RCCs should follow established procedures for the designation of RSMCs in order to take full account of the climate-related functions being carried out by existing GDPS RSMCs. The Council encouraged CCI, CBS and the regional associations to coordinate carefully the designation and implementation of the RCCs as soon as possible.

**4.1.2.12** The Council noted the report of the second meeting (25–28 March 2002) of the Intercommission Task Team on RCCs, recognized that sufficient requirements had been proposed as functions for RCCs and acknowledged that it was now time to proceed to the establishment of the network of RCCs. The Council further noted that, based on the work of the Task Team, the regional associations should consider the issue of designating those Centres.

**4.1.2.13** The Council noted and concurred with the recommendations of the Task Team. Specifically, the Council concurred that as the regional associations proposed RCCs and their functions, they should be flexible in determining the functions based on individual regional needs. However, the Council reminded the regional associations that they should consider the entire suite of climate services necessary as they determined which services were necessary within the Region. The Council noted the importance of the various functions that needed to be performed, including the continuation and expansion of the Climate Outlook Forums, climate predictions and general capacity building within the Regions.

**4.1.2.14** The Council considered that in some Regions, a virtual RCC might meet the needs of the regional associations, while in others; an RCC more focused on a single institution might be required. That would be determined on a Region-by-Region basis.

**4.1.2.15** The Council noted that JMA had established the Tokyo Climate Centre to provide services for Japan. However, it further noted that some of the functions of that Centre might support the NMHSs within the Asia/Pacific area on climate information services, in particular the services on seasonal and interannual forecasts. In that connection, the Meeting of National Meteorological and Hydrological Service Directors on Advanced Climate Services in the Asia/Pacific Region was scheduled to be held in Tokyo in July 2002.

**4.1.2.16** The Council concurred with the Task Team and strongly supported the need for a workshop of global producers of seasonal to interannual forecasts, including GDPS centres and institutions outside of WMO that were committed to make those products available on an operational basis. The meeting, to be coordinated by CBS, would give the state of commitments of those Centres in determining which products they were willing to make available. It would also provide an opportunity to agree on standards, formats and arrangements to make the products available on an operational basis, as well as the establishment of the operational schedule necessary for supporting the RCCs.

**4.1.2.17** The Council commended the members of the Task Team for the excellent work accomplished and, especially, to the chairperson, Mr S. Mildner, and the president of CCI, Mr Y. Boodhoo.

**4.1.2.18** The Council concurred with the Task Team that the work associated with the terms of reference was completed. The Council further recognized that should the need arise for further consideration of the matter, adequate structures existed within CCI and CBS for appropriate follow-up actions. The Council further concurred that through the presidents of the regional associations and the technical commissions concerned, the programme implementation of regional associations should now consider the specific RCC functionalities within each Region and begin the establishment of the RCC network.

#### **CG-XIV, Geneva, 5-24 May 2003**

**3.2.0.10** Noting the requests of Thirteenth Congress as well as the fifty-second and fifty-third sessions of the Executive Council, Congress expressed its appreciation to the CCI for the excellent work completed by the Intercommission Task Team on Regional Climate Centres. Congress concurred with the recommendations of that Task Team and encouraged the regional associations, in collaboration with the Long-Range Forecast (LRF) Global Producing Centres (GPCs), to carefully and efficiently consider the needs and requirements of RCCs, and to develop the appropriate terms of reference prior to initiating the process needed to establish RCCs, with the guidance of CCI and CBS. Congress took note of the offers made by Members to host RCCs. Congress urged CCI to develop guidelines and procedures to assist the regional associations in the implementation of the RCC's.

**3.2.5.16** Congress noted that the Intercommission Task Team on Regional Climate Centres, established by the fifty-second session of the Executive Council, had proposed that Regional Climate Centres might undertake some of the responsibilities of organizing Regional Climate Outlook Forums. Congress emphasized the need that

any development in the Forum process itself take due consideration of progress towards establishing the role and functions of Regional Climate Centres.

**LIST OF REGIONAL CLIMATE CENTRE FUNCTIONS**

From WCASP No. 52, May 2001

The requirements of NMHSs for RCC functions will vary from Region to Region, and may comprise only a subset of the following list. The required activities may be undertaken within a single centre or distributed amongst NMHSs.

*Operational Activities:*

- Interpretation and assessment of relevant output products from global prediction centres;
- Generation of tailored products to meet NMHS needs including seasonal outlooks etc.;
- Product verification, including the necessary exchange of basic data;
- Product distribution.

*Coordination Functions:*

- Strengthen collaboration between NMHS on related observing, communication and computing networks including data collection and exchange;
- Development of systems to facilitate harmonisation and assistance in the use of SI Forecast products;
- Assist in coordination with end users, including the organisation of workshops and other forums on users' needs;
- Assist NMHSs in the development of a media and public awareness strategy relating to SI Forecasts;
- To represent the needs of associated NMHSs.

*Data Services:*

- Rescue of climate data sets;
- Provision of climate data base and archiving services;
- Assist in the development and maintenance of software modules for standard applications;
- Advising on data quality management.

*Training and Capacity building:*

- Training of NMHS staff in SI Forecasting methods and characteristics to assist NMHSs to strengthen their services;

- Assist in the training of end-users on the application and impact of SI Forecast products;
- Assist in the introduction of appropriate decision models for end-users, especially as related to probability forecasts;
- Assist in technical capacity building on NMHS level.

*Research and Development:*

- Develop a climate Research and Development agenda and coordinate it with other RCCs in the Region;
- To arrange for studies of climate variability, predictability and impact in the Region;
- To develop consensus practices to handle conflicting information for the Region;
- Develop validation procedures relating to SI Forecast products in coordination with other centres;
- Develop and validate regional models, methods of downscaling and interpretation of global output products;
- Undertake application research, and assist in the specification and development of sector specific products;
- Arrange for studies of the economic value of climate information.

NOTE: The second meeting of the ICTT (May 2002), with an expanded membership, noted that the list of RCC functions developed by the first ICTT (shown above as published in WCASP No. 52) could be expanded to include regional climate monitoring and climate data services including data from satellites and ocean observing systems; and hydrological activities, and that these items would merit the full attention of the relevant implementation groups on the regional level (item 3.1.1, WCASP No. 54, March 2002).

**QUESTIONNAIRE TO DETERMINE REQUIREMENTS  
FOR THE ESTABLISHMENT OF A REGIONAL CLIMATE CENTRE**

	<i>Is your NMHS able to perform this activity to fulfil national needs? (Y/N)*</i>	<i>Is your NMHS able to perform this activity on behalf of the Region? (Y/N)*</i>	<i>Do you require this activity to be performed by a regional climate centre? (Y/N)</i>	<i>Prioritize the different functions or activities as HIGH, MEDIUM or LOW</i>
<b>Operational Activities:</b>				
Provide interpretation and assessment of relevant output products from global prediction centres				
Generate and distribute tailored products to meet NMHS needs including seasonal outlooks etc.				
Undertake product verification, including hind cast verification of the tools, and the necessary exchange of basic data				
Provide climate analysis, monitoring				
Provide climate advisories in coordination with NMHS				
Climate Database Management (free access to data partners is key)				
<b>Co-ordination Functions:</b>				
Strengthen collaboration between NMHS on related observing, communication and computing networks including data collection and exchange (level of data to be discussed)				
Develop systems to facilitate harmonization and assistance in the use of Seasonal and Interannual (SI) Forecast products				
Assist in coordination with end users, including organization of workshops and other forums on users' needs				
Assist NMHSs in the development of a media and public awareness strategy relating to SI Forecasts				
Assist in coordination of research concerning the best means of communicating climate products and other information				
Foster the sharing and use of data and information from climate and other scientific disciplines				
Assist the introduction of climate information and predictions into early warning and disaster prevention systems				
Represent the needs of associated NMHSs in climate related matters				
Facilitate links to external climate community				
Internally coordinate all parts of the RCC collective				
Coordinate relevant training of RCC staff				

**NOTE:** Reflect true capacity to deliver the function, in consideration of the required human resources, computing and telecommunications capacities including equipment, power, hardware, software, etc., and other infrastructure requirements.

	<i>Is your NMHS able to perform this activity to fulfil national needs? (Y/N)*</i>	<i>Is your NMHS able to perform this activity on behalf of the Region? (Y/N)*</i>	<i>Do you require this activity to be performed by a regional climate centre? (Y/N)</i>	<i>Prioritize the different functions or activities as HIGH, MEDIUM or LOW</i>
<b>Data Services:</b>				
Assist in the rescue of climate data sets				
Provide climate database and archiving services				
Assist in the development and maintenance of software modules for standard applications				
Advise in data quality management				
<b>Training and Capacity building:</b>				
Train NMHS staff in SI Forecasting methods and characteristics to assist NMHSs to strengthen their services				
Assist in the training of end-users on the application and impact of SI Forecast products				
Assist in the introduction of appropriate decision models for end-users, especially as related to probability forecasts				
Assist in technical capacity building on NMHS level				
<b>Research and Development:</b> Develop a climate Research and Development agenda to promote and undertake studies the following:				
Study climate variability, predictability and impact in the Region				
Develop tools for objective climate analysis and prediction				
Promote research, development, and application of methodologies to harmonize and unify information from varied sources for regional and sub-regional products				
Develop verification procedures relating to SI Forecast products in coordination with other centres and WMO guidelines				
Develop and/or validate regional models and methods of downscaling of global output products				
Undertake application research, and assist in the specification and development of sector specific products				
Promote studies of the economic value of climate information				

**NOTE:** Reflect true capacity to deliver the function, in consideration of the required human resources, computing and telecommunications capacities including equipment, power, hardware, software, etc., and other infrastructure requirements.

## ACRONYM LIST

<b>ACMAD</b>	African Centre of Meteorological Applications for Development
<b>AG</b>	Advisory Group
<b>APCN</b>	APEC Climate Network
<b>APEC</b>	Asia-Pacific Economic Corporation
<b>ASEAN</b>	Association of South-East Asian Nations
<b>ASMC</b>	ASEAN Specialized Meteorological Centre
<b>BCC</b>	Beijing Climate Centre
<b>CAGM</b>	Commission for Agricultural Meteorology
<b>CBS</b>	Commission for Basic Systems
<b>CCI</b>	Commission for Climatology
<b>Cg</b>	WMO Congress
<b>Chy</b>	Commission for Hydrology
<b>CIIFEN</b>	Centro Internacional de Investigación sobre el Fenómeno El Niño (Ecuador)
<b>CIMH</b>	Caribbean Institute of Meteorology and Hydrology
<b>CLIPS</b>	Climate Information and Prediction Services (WCASP/WCP/WMO)
<b>CLIVAR</b>	International Research Programme on Climate Variability and Predictability (WCRP)
<b>CMO</b>	Caribbean Meteorological Organization
<b>CRRH</b>	Central American Regional Committee of Hydrological Resources
<b>DEMETER</b>	Development of a European Multimodel Ensemble system for seasonal to interannual prediction (EU)
<b>DMC</b>	Drought Monitoring Centre (Kenya; Zimbabwe)
<b>DPCP</b>	Data Collection and Processing Centre
<b>EC</b>	WMO Executive Council
<b>ECA/D</b>	European Climate Assessment and Data Set (EUMETNET/ECSN project)
<b>ECMWF</b>	European Centre for Medium Range Weather Forecasts (UK)
<b>ECSN</b>	European Climate Support Network (EUMETNET)
<b>ENSO</b>	El Niño-Southern Oscillation
<b>EUMETNET</b>	The Network of European Meteorological Services
<b>FWIS</b>	Future WMO Information System
<b>GCM</b>	General Circulation Model
<b>GCMP</b>	Generate Climate Monitoring Products (EUMETNET/ECSN project)
<b>GCOS</b>	Global Climate Observing System (WMO/IOC/ICSU/UNEP)
<b>GPC</b>	Global Production Centres
<b>GSN</b>	GCOS Surface Network
<b>GUAN</b>	GCOS Upper Air Network
<b>ICTT-RCC</b>	Inter-Commission Task Team on Regional Climate Centres
<b>INPE</b>	Instituto Nacional de Pesquisas Especiais (Brazil)
<b>IPCC</b>	Intergovernmental Panel on Climate Change
<b>IRI</b>	International Research Institute for Climate Prediction (USA)
<b>ISDR</b>	International Strategy for Disaster Reduction
<b>JMA</b>	Japan Meteorological Agency
<b>KMA</b>	Korea Meteorological Administration
<b>LDC</b>	Least Developed Country
<b>LRF</b>	Long-range Forecasting
<b>MME</b>	Multi-Model Ensemble
<b>NCPC</b>	National Climate Prediction Centre (NOAA)
<b>NIWA</b>	National Institute of Water and Atmospheric Research (New Zealand)
<b>NMHS</b>	National Meteorological and Hydrological Service
<b>NOAA</b>	National Oceanic and Atmospheric Administration (USA)
<b>NWP</b>	Numerical Weather Prediction
<b>NWS</b>	National Weather Service (NOAA)
<b>OPAG</b>	Open Programme Area Group

<b>PEAC</b>	Pacific ENSO Application Center (U. Hawaii, USA)
<b>PRESA-AC</b>	Prévision Saisonnière et ses Application en Afrique Centrale et le Golfe de Guinée
<b>PRESA-AF</b>	Prévision Saisonnière et ses Application en Afrique
<b>PRESA-AO</b>	Prévision Saisonnière et ses Application en Afrique Ouest
<b>PRESA-NOR</b>	Prévision Saisonnière et ses Application en Afrique Nord
<b>PRESA-OIM</b>	Prévision Saisonnière et ses Application dans l'Océan Indien et à Madagascar
<b>RA</b>	Regional Association
<b>RCC</b>	Regional Climate Centre
<b>RCOF</b>	Regional Climate Outlook Forum
<b>RSMC</b>	Regional Specialized Meteorological Centre
<b>SAWS</b>	South African Weather Service
<b>SI</b>	Seasonal to Interannual
<b>SIRCC</b>	RA VI TT on Provision of Seasonal to Interannual forecasts and RCC Services
<b>SPREP</b>	South Pacific Regional Environment Programme
<b>TCC</b>	Tokyo Climate Centre (Japan)
<b>TT</b>	Task Team
<b>UCR</b>	University of Costa Rica
<b>UNFCCC</b>	United Nations Framework Convention on Climate Change
<b>UWI</b>	University of the West Indies
<b>WCASP</b>	World Climate Applications and Services Programme
<b>WCP</b>	World Climate Programme
<b>WCP</b>	World Climate Research Programme
<b>WG</b>	Working Group
<b>WMC</b>	World Meteorological Centre
<b>WMO</b>	World Meteorological Organization
<b>WWW</b>	World Weather Watch