WORLD CLIMATE PROGRAMME

WORLD CLIMATE SERVICES PROGRAMME

MEETING OF THE
JOINT CCl/CBS EXPERT TEAM ON REGIONAL CLIMATE CENTRES

Offenbach, Germany, 12-14 October 2011

FINAL REPORT

WORLD METEOROLOGICAL ORGANIZATION
2011

The **World Climate Programme (WCP)** implemented by WMO in conjunction with other international organizations consists of the following major components:

- World Climate Research Programme (WCRP)
- Global Climate Observing System (GCOS)
- World Climate Services Programme (WCSP)

World Meteorological Organization
7bis, av. de la Paix
Case postale 2300
CH 1211 Geneva
Switzerland

Telephone : +41 (0) 22 730 81 11
Telefax : +41 (0) 22 730 81 81
Email: wmo@wmo.int

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Participants at the first meeting of CCl/CBS Expert Team on RCCs
From left to right: C. Coelho, R. Kolli, M. Coughlan, R. Yamada, J. Pahalad,
P. Hechler, W. Thiaw, S. Rösner and K. Takano

1. OPENING

The Meeting of the joint CCl/CBS Expert Team on Regional Climate Centres (ET-RCC) was opened at 10:00 hours on Wednesday, 12 October 2011, at Deutscher Wetterdienst (DWD) Headquarters in Offenbach, Germany. Mr. Stefan Rösner, Co-Chairperson of ET-RCC welcomed the participants on behalf of DWD. In his opening remarks, Dr. Mike Coughlan, Chairperson of the ET expressed his gratitude to the participants as well as the host for organising and preparing the Meeting and wished fruitful discussions. Dr Rupa Kumar Kolli addressed the Meeting on behalf of WMO Secretariat. He stressed the important role WMO RCCs are expected to play in the implementation of the Global Framework for Climate Services (GFCS) and highlighted the nature of the Expert Team as a joint CCl/CBS undertaking to ensure most efficient guidance for WMO RCC implementation. This was followed by a *tour de table* of self-introductions by the attending participants. The Team noted that Dr David Jones (Australia) could not attend due to other unavoidable engagements, and welcomed Ms. Janita Pahalad as his substitute nominated by the Permanent Representative of Australia with WMO. The list of Participants in the meeting is provided in Annex 1 to this report.

2. ORGANIZATION OF THE MEETING

2.1 Adoption of the agenda

The agenda was considered and adopted without any changes, as provided in Annex 2 to this report.

2.2 Working arrangements

The Meeting agreed on its hours of work and other practical arrangements.

3. INTRODUCTION

3.1 WMO RCCs: Background and current status

The Meeting was briefed on the background and current status of WMO Regional Climate Centres (RCCs) in terms of concept and implementation. Participants took note of the implications of the integration of WMO RCCs as operational centres into WMO's Global Data Processing and Forecasting System (GDPFS). The Meeting discussed the current status of RCC implementation worldwide and provided updates to the document 'Regional Climate Centres – Status by Region' (Annex 3). The Team furthermore highlighted the need to ensure an efficient uptake and use of RCC products at national level. It was felt that the report of the *CCl Expert Team on CLIPS Evolution* might help WMO RCCs and RCC candidates to get useful additional information on GFCS-related climate information needs and capabilities at national level.

Action 1
WMO Secretariat to distribute the final report of the *CCl Expert Team on CLIPS Evolution* to all WMO RCCs and RCC candidates.

3.2 Update on GFCS implementation

The Meeting was briefed on the background and latest developments of GFCS implementation. The Team noted the specific emphasis given by the High-Level Taskforce for the GFCS to the implementation of WMO RCCs as an approach to facilitate improvement of national climate services in a larger number of Member countries. The participants were presented with the schedules for (i) the consultation meetings on the five GFCS components as well as (ii) for the elaboration of the GFCS draft implementation plan being developed by the WMO Executive Council Task Team on the GFCS. The draft implementation plan will be tabled at the Extraordinary Session of the World Meteorological Congress scheduled to be held in October 2012. Based on this plan, Congress is expected to decide on the appropriate governance structure for the GFCS.

3.3 Terms of Reference of the Expert Team on RCCs

The Expert Team reviewed its Terms of Reference and proposed some modifications in order to allow for an efficient performance during the remaining part of the current intersessional period. The proposed modified Terms of Reference are attached as Annex 4 to this report.

Action 2
WMO Secretariat to forward the proposed modifications to the Terms of Reference of the CCl/CBS Expert Team on RCCs to the CCl Management Group for endorsement.

4. ESTABLISHMENT AND OPERATION OF WMO RCCs

4.1 Aspects of RCC operations

The experts noted the two main distribution mechanisms for RCC products, namely through WMO Information System (WIS) and through RCC web pages. Whilst WIS ensures an efficient access to RCC products for WMO Members, web pages offer a greater flexibility for the distribution of additional product and service information. The Team discussed the need to agree on an appropriate syntax to describe WMO RCC products within the Global Information System Centre (GISC) catalogue to allow for the efficient identification of RCC products within the WIS.

Recommendation 1
The Expert Team to develop, in close liaison with CCl OPACE 1 experts, a common syntax to uniquely identify WMO RCC products in the GISC catalogue.

Action 3
CCl Management Group to help identify a CCl expert for WIS to facilitate the development of an appropriate syntax for the description of RCC products in the GISC catalogue as well as to bring WIS-related RCC needs to the attention of the relevant WMO WIS bodies.

Action 4
Mr Rösner and Mr Yamada, jointly with a representative of RCC Beijing, to take the lead in developing a common syntax to describe WMO RCC products in the GISC catalogue for submission through the appropriate channels to CBS.

The Meeting furthermore discussed the advantages as well as disadvantages of having WMO RCCs with overlapping responsibilities. The Team agreed to address the relevant coordination needs, as covered by Action 7 (see below).

The Team also recognized the need for operational RCC products to constantly reflect the latest status of scientific knowledge.

Recommendation 2
In order to operate at effective scientific levels, all WMO RCCs to develop an internal research and development programme as well as liaison mechanisms with the wider research community, such as regional CLIVAR panels, universities, research institutions and programmes etc., and the Expert Team to include appropriate guidance in the RCC Guidance Document under development.

The Expert Team addressed RCC-related training aspects that would enable NMHSs to fully understand RCC products and convert them into national climate services. The Team was informed of the current training programme of RCC Tokyo and agreed that it could serve as a good example for RCC-related training activities. The Group noted the long-term dimension of successful training and capacity building, and stressed the importance of appropriate follow-up activities to any training event. Relevant requirements for training and capacity development are outlined in Annexes 5a and 5b.

Recommendation 3
The Expert Team to encourage WMO RCCs to establish appropriate training programmes and to liaise with WMO Education and Training (ETR) Programme to identify and develop suitable training activities and materials for RCC staff and users.

With respect to quality management aspects, the Team noted that longer RCC operational experiences are needed to efficiently identify and introduce specific measures, such as performance indicators etc. To this end the Expert Team agreed to liaise with the CCl Task Team on Quality Management Framework (QMF) for Climate Services, to familiarise itself with the issue.

The Meeting addressed data requirements for RCC operations. Taking into account the sensitivities attached to the exchange of meteorological data, the Team agreed on a stepwise approach whereby it will be demonstrated how the quality of RCC products and services can be improved by integrating more comprehensive input data into the production process. It is expected that such an approach will encourage all NMHSs to provide more national data to the respective WMO RCCs.

To raise the profile of the WMO RCC process the Team agreed that RCCs be encouraged to prominently display their status as WMO RCCs including the WMO logo on their letterheads for formal communication and, where feasible, on their products and related web pages.

4.2 Standards for RCC products and services

The Meeting was presented with current RCC product examples from RCC Tokyo and the RA VI Pilot RCC-Network as provided through their respective WebSites. The Meeting noted with appreciation that both Websites present a variety of products in accordance with the RCC

mandatory functions. The Team furthermore noted that the network character of the RA VI Pilot RCC-Network poses special challenges with respect to consistency in product access. The Team emphasized the need to clearly distinguish which products are RCC products and which products are generated under a different responsibility.

Recommendation 4

Clear labelling of all RCC products is strongly recommended, which preferably should be provided through dedicated RCC WebPages.

Action 5

WMO Secretariat to produce a global map showing the current and proposed areas of geographical coverage of WMO RCCs and RCC candidates to allow for an analysis of worldwide RCC service coverage in terms of gaps and overlaps.

Recommendation 5

WMO RCCs and RCC candidates are encouraged to adopt current WMO practices with respect to the use of Climatological Normals and reference periods in the development and display of anomaly products.

The Expert Team was pleased to note that the CCl had established a *Task Team on Climatological Normals* to clarify the various related issues, which needs to be consulted on RCC-relevant aspects.

The Meeting reiterated the importance for WMO RCCs to provide comprehensive documentation on the methodologies used to generate mandatory and highly-recommended products as well as guidance on their interpretation.

4.3 Co-ordination aspects with NMHSs, GPCs, regional organizations, RCOFs, GSCU etc.

The Meeting discussed co-ordination aspects of RCCs with relevant global, regional and national entities and mechanisms.

Recommendation 6

The principles for WMO RCCs liaising with other relevant CSIS entities and mechanisms should be included in the RCC Guidance Document. Such principles might include, *inter alia*, the establishment of formalised arrangements with individual GPCs to allow for the exchange of data, products and expertise beyond globally agreed minimum requirements in order to facilitate RCC downscaling efforts.

Recommendation 7

WMO RCCs are recommended to take principal responsibility for the generation of technical inputs to RCOFs, and in particular for the current status of the climate system in the region of interest and for the seasonal outlooks.

The Team noted with satisfaction that there is already a close ongoing involvement of WMO RCCs and RCC candidates in RCOFs in many regions.

Regarding the Global Seasonal Climate Update (GSCU), the Expert Team emphasised the user role of WMO RCCs with respect to this product. In addition, WMO RCCs might provide

regional perspectives as input for the GSCU as well as contribute to the GSCU pilot phase by providing dedicated feedback on the structure, content and timeliness of the GSCUs.

Action 6
Expert Team Chair to seek advice from the CCl Task Team on GSCU on specific input requirements from, and roles to be played by, WMO RCCs in the generation and uptake of the GSCU.

The Expert Team recognised the need for WMO RCCs to provide regional information to regional bodies within their respective domains of responsibility and noted the role that WMO Regional Association(s) could play in co-ordinating appropriate arrangements.

With respect to co-ordination aspects with NMHSs the Team referred to its related deliberations under agenda item 4.1.

Action 7
Mr. Rösner to provide a list of co-ordination aspects to be considered within a WMO RCC-Network and to share it with the Expert Team. This compilation would also facilitate co-ordination amongst multi-functional RCCs within a Regional Association and therefore should be incorporated into the RCC Guidance Document.

4.4 Project concepts in support of WMO RCC implementation in vulnerable regions

The Meeting noted a number of relevant project activities in RA I (e.g. KOICA, ClimDev Africa etc.) and in RA V (PI-CPP, proposed COSPPac etc) that are implementing some of the proposed RCC-relevant project activities as listed in the Cg-XVI endorsed "Compendium of Project Initiatives". The Expert Team agreed that progress on these activities should be regularly reported to WMO by the implementing Members. Such opportunities should be utilised as a basis for formally developing RCC capabilities in the respective regions as well as models and examples for other regions. It was agreed that WMO should strive to coordinate its own resource mobilisation efforts in these and other regions with such initiatives.

Action 8
Expert Team members to gather information on similar projects in their respective regions and share it with the Expert Team and the WMO Secretariat.

The Expert Team recognised the GFCS initiatives regarding the implementation of WMO RCCs, and agreed that the associated opportunities should be optimally exploited.

Recommendation 8
RCC candidates are encouraged to identify potential donors in their region and to use the 'Cg-XVI Compendium of Project Initiatives' as guidance when identifying and elaborating specific project proposals to be funded from voluntary contributions.

4.5 Review of the draft RCC Guidance Document

The Meeting was presented with the draft RCC Guidance Document on WMO RCCs (Annex 6) and agreed that finalising a first working draft was a high priority deliverable for the current intersessional period.

Action 9
WMO Secretariat to submit the current draft RCC Guidance Document to the upcoming CCl Management Group meeting for perusal and advice as appropriate.

5. POTENTIAL ROLES OF THE EXPERT TEAM IN RCC DESIGNATION AND OPERATION

The Meeting was briefed on the procedures to establish and run a WMO RCC as per WCASP-80 (WMO/TD 1534) 'How to establish and run a WMO Regional Climate Centre'. Within the designation process, the Expert Team considered its advisory role to the CCl President on the various formal steps required.

Recommendation 9
The Expert Team should fulfil its mandate according to its Terms of Reference, by extending its expertise to assist the President of CCl in facilitating his role in the designation process and specifically in steps 2, 3 and 5 (cf. WCASP-80). The Expert Team may further apprise the WMO Regional Associations of its potential support on RCC matters in cases where appropriate regional arrangements are not in place or not functioning properly.

Action 10
WMO Secretariat to draft a checklist for evaluating the technical appropriateness of RCC proposals, which would enable the Expert Team to efficiently carry out its role in assisting the President of CCl.

Recommendation 10
The Expert Team agreed on the need for formal mechanisms to monitor and evaluate the operations of WMO RCCs and requests that the CCl Management Group refers this issue for consideration in the next intersessional period.

6. PROMOTION AND OUTREACH OF WMO RCCs

The Meeting was informed of various RCC posters prepared for the International Conference on Climate Services (17-19 October 2011, New York/USA) and for the WCRP Open Science Conference 'Climate Research in Service for Society' (24-28 October 2011, Denver/USA). Existing RCC brochures as well as the Newsletter of RCC Tokyo were highly appreciated by the Team. Mr. Takano briefed the Team on his efforts to promote WMO RCCs on the occasion of regional activities especially on adaptation. The Team reiterated the two principal user domains of WMO RCCs, viz. NMHSs and regional/international groups including WMO's GFCS partners within the UN System and in particular the UNFCCC.

Action 11
Chair and Co-Chair of the Expert Team, supported by its members, to develop a WMO RCC booklet for the extraordinary World Meteorological Congress scheduled for October 2012.

The Team members furthermore agreed to use any appropriate opportunity to promote WMO RCCs.

7. ACTIVITIES AND DELIVERABLES OF THE EXPERT TEAM IN THE CURRENT INTERSESSIONAL PERIOD

The Expert Team agreed that its activities and deliverables during the rest of the current inter-sessional period (2010-2014) are properly reflected in the Actions of this report. It agreed further that the WMO RCC Guidance Document will be amongst its most important deliverables.

Under this item, the experts considered again the current status of WMO RCC implementation in the six WMO Regional Associations and identified a number of upcoming activities and milestones (Annex 3).

8. ANY OTHER BUSINESS

No further items were raised by the participants.

9. CONCLUSIONS AND RECOMMENDATIONS

The Expert Team agreed that its conclusions and recommendations are adequately reflected within the actions/recommendations agreed under the respective agenda items, which are highlighted in the corresponding sections of this report.

10. CLOSING

In closing, the Chair thanked all the participants for their strong commitment and valuable inputs to the discussion and the WMO Secretariat staff for their support and advice. He also thanked the host, DWD in general and Mr Rösner in particular, for the efficient arrangements to facilitate the meeting and the warm hospitality. Mr. Kolli expressed his firm conviction that the Expert Team will provide a most valuable contribution to the establishment of WMO RCCs worldwide, and assured all possible support from the WMO Secretariat.

The meeting was closed on Friday, 14th of October 2011 at 2:41 p.m.

ANNEX 1

LIST OF PARTICIPANTS

Australia

Dr Michael COUGHLAN
2 Corsewall Close
HAWTHORN 3122

Tel: +613 9818 1062
Mobile: +614 1941 1225
E-mail: Coughlan@climate-insight.com

Ms Janita PAHALAD
Bureau of Meteorology
700 Collins Street, Docklands
MELBOURNE, VICTORIA

Tel: +613 9669 4781
Fax: +613 9669 4678
E-mail: j.pahalad@bom.gov.au

Brazil

Dr Caio Augusto SANTOS COELHO
Instituto Nacional de pesquisas Espaciais (INPE)
Centro de Previsão de Tempo e Estudes Cliáticos (CPTEC)
Rodovia Presidente Dutra, Km 40, SP-RJ
CACHOEIRA PAULISTA, SP 12630-00

Tel: +5512 3186 8670
E-mail: Caio.coelho@cptec.inpe.br

Germany

Dr Stefan RÖSNER
Deutscher Wetterdienst
Department of Climate Monitoring (KU23b)
P.O. Box 10 04 65
63004 OFFENBACH

Tel. +49 170 90 54658
+49 69 8062 4306
Fax: +49 69 8008 663115
Email: Stefan.roesner@dwd.de

Japan

Dr Kiyoharu TAKANO
Administration Division
Global Environment and Marine Department
Japan Meteorological Agency
1-3-4 Otemachi, Chiyoda-ku
TOKYO 100-8122

Tel: +81 3 3211 4966
Fax: +81 3 3211 2032
Email: k_takano@met.kishou.go.jp

Mr Ryuji YAMADA
Tokyo Climate Center
Climate Prediction Division
Global Environment and Marine Department
Japan Meteorological Agency
1-3-4 Otemachi, Chiyoda-ku
TOKYO 100-8122

Tel: +81 3 3211 4966
Fax: +81 3 3211 2032
Email: r_yamada@met.kishou.go.jp

United States of America

Dr Wassila THIAW
Climate Prediction Center - NOAA
5200 Auth Road
CAMP SPRINGS, MARYLAND (MD) 20746

Tel: +1 301 763 8000/+1 301 763 7566
Fax: +1 301 763 8125
E-mail: Wassila.thiaw@noaa.gov

WMO SECRETARIAT

World Meteorological Organization
7bis, Avenue de la Paix
CP 2300
CH-1211 GENEVA 2
Switzerland

Dr Rupa Kumar KOLLI
Chief
World Climate Applications and Services Division
Climate Prediction and Adaptation Branch
Climate and Water Department

Tel: +(41 22) 730 8377
Fax: +(41 22) 730 8042
Email: rkolli@wmo.int

Mr Peer HECHLER
Seconded Expert
World Climate Applications and Services Division
Climate Prediction and Adaptation Branch
Climate and Water Department

Tel: +(41 22) 730 8302
Fax: +(41 22) 730 8042
Email: phechler@wmo.int

ANNEX 2

AGENDA

1. OPENING

2. ORGANIZATION OF THE MEETING

2.1 Adoption of the agenda
2.2 Working arrangements

3. INTRODUCTION

3.1 WMO RCCs: Background and current status
3.2 Update on GFCS implementation
3.3 Terms of Reference of the Expert Team on RCCs

4. ESTABLISHMENT AND OPERATION OF WMO RCCs

4.1 Aspects of RCC operations
4.2 Standards for RCC products and services
4.3 Co-ordination aspects with NMHSs, GPCs, RCOFs, GSCU etc.
4.4 Project concepts in support of WMO RCC implementation in vulnerable regions
4.5 Review of the draft guidance document

5. POTENTIAL ROLES OF THE EXPERT TEAM IN RCC DESIGNATION AND OPERATION

6. PROMOTION AND OUTREACH OF WMO RCCs

7. ACTIVITIES AND DELIVERABLES OF THE EXPERT TEAM IN THE CURRENT INTERSESSIONAL PERIOD

8. ANY OTHER BUSINESS

9. CONCLUSIONS AND RECOMMENDATIONS

10. CLOSING

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ANNEX 3

WMO REGIONAL CLIMATE CENTRES

Implementation Status by Region

WMO RCCs Designated or close to be Designated

Two Regional Climate Centres (RCCs) have been officially designated by WMO under the current GDPFS procedures established jointly by CBS and CCl, viz., the RCC Beijing and the RCC Tokyo in RA II. Four RCC candidates officially started the designation process, viz., RA VI RCC-Network (RA VI), the North Eurasian Climate Centre (RA II), ACMAD and ICPAC (both RA I). There are several additional climate centres performing at least some of the functions specified under the GDPFS provisions and hence could conceivably move towards formal designation within the expanding WMO RCC coverage. The WMO website for more information on RCC implementation is: http://www.wmo.int/pages/prog/wcp/wcasp/RCCs.html#RCCLinks

Progress in RCC implementation including other Centres and Related Activities

Following is a summary of the most recent relevant Regional Association decisions/resolutions with respect to the establishment of RCCs, together with a status summary of the existing, pilot or proposed RCCs within each Region that are delivering regional climate services on a routine basis or will do so. Reference is also made to two climate centres that cooperate with WMO and its members but not formally as RCCs, viz. the International Research Institute for Climate and Society (IRI) and the APEC Climate Centre (APCC). Both centres carry out RCC-type functions and deliver a range of climate products and services openly through the Internet.

A number of the larger WMO member countries use the term RCC to apply to centres servicing a region wholly within their respective national borders, the USA and Australia for examples, with the latter using the term Regional Climate Service Centre (RCSC). An RCC in the WMO GDPFS context, however, is one that generates products and services for domains extending beyond a single country. It is being further proposed that an RCC may provide products and services for a domain that is outside or extends beyond the boundaries of a single WMO Region.

Allied to the RCC process are a number of Regional Climate Outlook Forums that seek to reach consensus among participants on current and expected seasonal conditions and deliver a range of regional climate monitoring and outlook products.

The Executive Council Panel of Experts on Polar Observations, Research and Services (EC-PORS, 18-20 Oct 2010, Hobart/Australia) is exploring the establishment of Regional Climate Centres/Networks for the Polar Regions. Cg-XVI confirmed the Panel's intention to take action on defining the scope of Arctic and Antarctic RCCs in support of GFCS.

Earthwatch has also adopted the term Regional Climate Centre for a network of centres that deal mostly with climatic impacts on ecosystems; a short summary on each is included.

WMO RA I – Africa

Extract from Resolution 4.2/2 (XV-RA I) – ESTABLISHMENT OF REGIONAL CLIMATE CENTRES November 2010

Decides:

(1) To keep under review the needs and gap analysis for the establishment of RCCs in RA I, through continued assessment of the Region's requirements and capabilities vis-à-vis the mandatory and highly recommended RCC functions and to mandate the RA I Working Group on Climate Services *[to be established]* under the guidance of the president of RA I to coordinate this process;

(2) To develop and implement RCCs in RA I, including a pilot phase, with the guidance and support provided from time to time by the presidents of RA I, CCl, CBS and the Secretary-General;

(3) To keep the RA I RCC operational activities flexible during the pilot phase, allowing them to evolve based on Members' requirements and in compliance with WMO regulations;

(4) That the implementation of RA I RCCs, as well as the pilot phase prior to formal designation, be coordinated by the RA I Working Group on Climate Services under the overall guidance of the president of RA I;

(5) To seek formal WMO designation of the RA I RCCs, through the process described in the Manual on the GDPFS and to mandate the president of RA I to initiate this process, following satisfactory evaluation of the Region's requirements as well as capability to fulfil the mandatory functions and demonstration of this capability to CCl and CBS;

(6) To promote the development of cross-regional RCCs to address the common needs of large areas spread across the domains of two or more regional associations (e.g., Mediterranean Region covered in both RA I and RA VI);

(7) To regularly review RA I Member's requirements for climate information, products and services, and to ensure a 'state-of-the-art' service provision to Members to meet their priority needs;

Status

There are as yet no RCCs designated under the GDPFS in RA I. At its fifteenth session, RA I expressed the need to establish one RCC in each of the Regional Economic Communities (RECs) and name these centres accordingly: the IGAD-RCC for Eastern Africa, the ECOWAS-RCC for Western Africa, the SADC-RCC for Southern Africa, the North African RCC-Network, and the CEMAC-RCC for Central Africa. Considering the pan-African nature of the ACMAD, the Association assigned it the coordinating role among all RCCs in RA I and called it the African-RCC. In January-February 2011, WMO organized a meeting of the RA I Task Team on RCCs, which elaborated the implementation of RCCs as per the decisions of XV-RA I. Based on the recommendations of the Task Team, the following RCC candidates formally started their demonstration phase:

African Center of Meteorological Applications for Development (ACMAD)
http://www.acmad.ne/en/homepage.htm
Location: Niamey, Niger
Domain of interest: All countries of RA I

IGAD Climate Prediction and Applications Centre (ICPAC)
http://www.icpac.net/
Location: Nairobi, Kenya
Domain of interest: IGAD Countries (Greater Horn of Africa)

The North African countries Algeria, Egypt, Libya, Morocco and Tunisia elaborated a project proposal for the North African RCC-Network, with a demonstration phase expected to start in

March 2012. For West Africa, AGRHYMET and ACMAD started consultations to form an ECOWAS RCC-Network. A road map towards a Central African RCC has been outlined with the aim to establish a specialised ECCAS agency. For Southern Africa efforts are underway to extend the mandate and product suite of the SADC-Climate Service Centre to also cover WMO RCC functions.

Regional Climate Outlook Forums in RA I

There is a well-established structure of Region Climate Outlook Forums (RCOFs) in RA I supported by the centres above, which would enhance their respective RCC functionality: Western Africa (PRESAO); Greater Horn of Africa (GHACOF); Central Africa (PRESAC) and Southern African region (SARCOF). Efforts are underway to start a new RCOF for Northern Africa (PRESANORD).

WMO RA II – Asia

Extract from Resolution 1 (XIV-RA II) ESTABLISHMENT OF A REGIONAL CLIMATE CENTRE NETWORK IN REGIONAL ASSOCIATION II (ASIA)
December 2008

Decides:

(1) To ensure that all RA II Members are aware of the latest guidance on "Establishment and Designation of WMO Regional Climate Centres (RCCs)";

(2) To ensure that all RCCs and RCC proponents comply with the definitions of RCCs and RCC Networks and the Commission for Climatology-Commission for Basic Systems recommended mandatory functions and criteria for designation adhere to the relevant WMO Technical Regulations;

(3) To continue the pilot phase as a means to demonstrate the capabilities of centres in the Region aspiring to be designated as WMO RCCs, under the guidance of the WGCAA-CAS, of which the terms of reference are described under Resolution 9 (XIV-RA II);

Status

RA II is served by a collection of RCCs having pan-Asian as well as sub-regional interests, which have established a joint portal (http://www.rccra2.org/) that provides links to the various RCC products and services in RA II. The portal also includes a link to the APEC Climate Center (APCC), another key institution providing regional climate monitoring and prediction products. The following are the basic details of the two formally designated WMO RCCs in RA II:

Beijing Climate Center (BCC)
http://bcc.cma.gov.cn/en/
Location: Beijing, China
Domains of interest: East Asian Monsoon and all Asia for monitoring extremes.

Tokyo Climate Center (TCC)
http://ds.data.jma.go.jp/tcc/tcc/index.html
Location: Tokyo, Japan
Domain of interest: All Asia and Western Pacific (40N-20S, 30E-180)

The North Eurasia Climate Centre (NEACC) coordinated by the Russian Federation under the auspices of the Commonwealth of Independent States (CIS), has commenced the demonstration

phase of its operations to seek formal designation as a WMO RCC, from December 2010:

North EurAsia Climate Centre
www.neacc.meteoinfo.ru (English)
www.seakc.meteoinfo.ru (Russian)
Location: Moscow, Russian Federation
Domain: CIS countries including the Russian Federation, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan.

Three more countries in RA II, namely India, Iran and Saudi Arabia have also expressed their interest in establishing RCCs, and are making concerted efforts to initiate the pilot phase of operations. India sent a formal letter of intent to be designated as an RCC to P/RA II in July 2011.

RCOFs in RA II

Forum on Regional Climate Monitoring, Assessment and Prediction for Regional Association II (FOCRAII) coordinated by China since 2005, and South Asian Climate Outlook Forum (SASCOF) coordinated by India since 2010. A new North Eurasian Climate Outlook Forum (NEACOF) was launched by NEACC in May 2011.

WMO RA III – South America

Extract from Resolution. 4.2/1 (XV-RA III) – ESTABLISHMENT OF REGIONAL CLIMATE CENTRES September 2010

Decides:

(1) To conduct a needs and gap analysis for the establishment of RCCs in RA III, through assessment of the region's requirements and capabilities vis-à-vis the mandatory and highly recommended RCC functions and to mandate the RA III Working Group on Climate Services [to be established] under the guidance of the president of RA III to initiate this process;

(2) To develop and implement RCCs in RA III on a pilot basis with the guidance and support provided from time to time by the presidents of RA III, CCl, CBS and the Secretary-General;

(3) To keep the RA III RCC operational activities flexible during the pilot phase, allowing them to evolve based on Members' requirements and in compliance with WMO regulations;

(4) That the implementation of RA III RCCs, as well as the pilot phase prior to formal designation, be coordinated by the RA III Working Group on Climate Services under the overall guidance of the president of RA III;

(5) To seek formal WMO designation of the RA III RCCs, through the process described in the Manual on the GDPFS and to mandate the president of RA III to initiate this process, following satisfactory evaluation of the Region's requirements as well as capability to fulfil the mandatory functions and demonstration of this capability to CCl and CBS;

(6) To regularly review RA III Member's requirements for climate information, products and services, and to ensure a 'state-of-the-art' service provision to Members to meet their priority needs;

Status

There are as yet no RCCs designated under the GDPFS in RA III. At the fifteenth session of RA III (September 2010), discussions were held on the establishment of three RCC/RCC-Network structures to cater the needs of the northern, southern and western sub-regions of South America. The Association welcomed the initiatives undertaken by CIIFEN for its designation as an RCC for the sub-region of Western South America, and encouraged Members to support CIIFEN´s efforts. The Association also welcomed the offers of Brazil, in collaboration with French Guyana, and Argentina in collaboration with Brazil, to establish RCCs to serve sub-regions of Northern and Southern South America, respectively. CIIFEN works closely with WMO and has been providing regional climate information products:

Centro Internacional para la Investigación del Fenómeno de El Niño (CIIFEN)
http://www.ciifen-int.org/index.php
Location: Guayaquil, Ecuador
Domain: Eastern and Southern South America

In April 2011, WMO organized a Consultation Meeting on Implementation of RCCs in South America (27-29 April 2011, Brasilia, Brazil) with representatives of potential RCC candidates as identified by XV-RA III. The Meeting agreed on the way forward to establish three RCCs in RA III: CIIFEN to serve as an RCC for Western South America; Brazil and French Guyana to set up an RCC-Network for Northern South America; and Argentina and Brazil to set up an RCC-Network for Southern South America. The meeting further decided to first establish appropriate governance structures involving the stakeholder countries, to guide the implementation process. Implementation plans for the demonstration phases of the RCC/RCC-networks in RA III are expected to be developed by January 2012.

RCOFs in RA-III

Two RCOFs, namely Western Coast of South America Climate Outlook Forum (WCSACOF) and Southeast of South America Climate Outlook Forum (SSACOF), have sustained their operations for more than a decade in RA III.

WMO RA IV – North America, Central America and the Caribbean

Extract from the General Summary of Fifteenth Session of RA IV)
May 2009

4.2.5 Regional Climate Centres (RCCs)

4.2.5.1 The Association noted the significant progress made by WMO, through the joint efforts of the Commission for Climatology (CCl) and the Commission for Basic Systems (CBS) towards development of a formal designation process for Establishment and Implementation of Regional Climate Centres. Recalling the early efforts taken within RA IV (2003) to establish a regional Advisory Group on RCCs (AG-RCCs), and noting with appreciation the launch of the RA IV RCC Pilot Project sponsored by the United States of America and implemented by the Central American Regional Committee of Hydrological Resources (2005) and of a project in 2007 to initiate RCC activities for Central America (supported by the Inter-American Development Bank and the European Union), the Association urged Members to take into account the latest WMO Guidance on Establishment and Implementation of RCCs, and to ensure that all mandatory requirements for formal designation as 'WMO RCCs' are fulfilled by the potential centres in the Region interested in seeking such designation.

4.2.5.2 The Association, noting the urgent need for improved climate information reaffirmed its intent to establish an RCC network to assist RA IV Members in meeting these needs. The Association urged the president of RA IV to assess the needs and capabilities in the Region for climate services (by organizing an appropriate survey, if required), and to encourage Members to participate in RCCs and to develop an implementation plan for the establishment of an RCC network in the Region. The Association urged potential RCC hosts to build, under the guidance of the president) CCI, CBS and the WMO Secretariat, demonstrable and sustainable capacity for all the mandatory RCC functions defined in the proposed amendments to GDPFS Manual and, where possible, the highly recommended functions.

4.2.5.3 The Association urged GPCs to continue and to reinforce their inputs to RCCs. The Association urged Members to extend their active support to the implementation of an RCC network in RA IV and requested the potential RCC hosts to adequately address the needs of the Members in the Region while planning their operational activities.

Status

There are as yet no RCCs identified or designated under the GDPFS in RA IV. There has been a strong interest in the establishment of WMO RCCs, but there are no concrete actions at the moment towards an RCC. Countries in North America: Canada, Mexico, and the United States are moving forward with the establishment of the North America Climate Services Partnership (NACSP). The Partnership provides a mechanism for sharing data, information, concepts, and knowledge on climate services between Canada, Mexico, and the United States. The NACSP can be framed as an initiative that addresses issues unique to North America and that could contribute to and complement, rather than supersede, other existing regional and global efforts (e.g., WMO RCCs, GFCS). Also, the Caribbean Institute for Meteorology and Hydrology informally expressed its intent to serve as a WMO RCC, with the domain of interest being the English-speaking countries of the Caribbean.

RCOFs in RA-IV

The Foro Regional del Clima de América Central (FCCA), the Climate Outlook Forum for Central America has been in operation for more than a decade. There is also a recent proposal to establish a Caribbean Climate Outlook Forum (CARICOF) in 2012, expected to be coordinated by CIMH with support from NOAA, WMO, IRI and other partners.

WMO RA V – Southwest Pacific

Resolution 2 (XV-RA V) – ESTABLISHMENT OF REGIONAL CLIMATE CENTRES – May 2010
Decides:

(1) To work towards the establishment of RCCs in RA V, through assessment of current RCC related functions being performed in the region *vis à vis* the mandatory and highly recommended RCC functions and subsequent gap analysis, with the guidance and support provided from time to time by the presidents of RA V, CCl, CBS and the Secretary-General;

(2) To implement a RCC Network in RA V on a pilot basis;

(3) To keep the RA V RCC operational activities flexible during the pilot phase, allowing them to evolve based on Members' requirements and within WMO regulations;

(4) To seek formal WMO designation of the RA V RCCs, through the CCl-CBS process described in the Manual on the GDPFS (2009 version) and to mandate the president of RA V to initiate this process, following satisfactory evaluation of capability to fulfil the mandatory functions and demonstration of this capability to CCl and CBS;

(5) That the implementation of RA V RCCs, as well as the pilot phase prior to formal designation, be coordinated by a task team *(or any other structure with this responsibility to be set up by the Association)* as a subsidiary body of RA V under the overall guidance of the president of RA V;

(6) To regularly review RA V Member's requirements for climate information, products and services, and to ensure a 'state-of-the-art' service provision to Members to meet their priority needs;

Status

There are so far no RCCs designated under the GDPFS in RA V. There are, however, activities and services being delivered throughout the Pacific areas of RA V that could form a sound basis on which to develop a RCC network that would meet the GDPFS requirements. Notable entities include: the Pacific ENSO Applications Centre (PEAC; http://www.prh.noaa.gov/peac/), which provides climate services and support to the US-affiliated Pacific Island Countries; the Pacific Island Climate Prediction Project (PI-CPP; http://www.bom.gov.au/climate/pi-cpp/), which has been working to build basic climate services within several island countries of the SW Pacific including Papua/New Guinea; and the Island Climate Update (ICU; http://www.niwa.co.nz/our-science/climate/publications/all/icu), which provides a monthly consensus summery of climate variability and seasonal outlooks for the Pacific. In addition, the entities and networks listed under RA II in effect also service South East Asian parts of RA V and the North West Pacific. Given the vastness of RA V, it may be appropriate for some regional climate services to be delivered from RCC entities or networks in adjacent Regions.

RCOFs in RA V

The Internet and teleconferencing between NMHSs and other climate centres are being used very effectively (virtual forums) to link and coordinate the delivery of NMHS based climate services throughout the region, e.g. Pacific Island Climate Outlook Forum (PICCOF).

WMO RA VI – Europe

Extract from Resolution 1 (XV-RA VI) ESTABLISHMENT OF A REGIONAL CLIMATE CENTRE NETWORK IN REGIONAL ASSOCIATION VI (EUROPE)
September 2009

Decides:

(1) To implement the pilot RA VI RCC-Network until the end of 2010 with the following initial structure (noting the consortia of National Meteorological and Hydrological Services in each node, and lead centres):
   (a) RA VI RCC node on climate data (De Bilt):
      – Royal Netherlands Meteorological Institute (KNMI)/The Netherlands (lead);
      – Météo-France/France;
      – Meteorological Service (OMSZ)/Hungary;
      – Norwegian Meteorological Institute/Norway;
      – Republic Hydrometeorological Service of Serbia (RHMS)/Serbia;
      – Swedish Meteorological and Hydrological Institute (SMHI)/Sweden;
      – Turkish State Meteorological Service (TSMS)/Turkey;
   (b) RA VI RCC node on climate monitoring (Offenbach):
      – Deutscher Wetterdienst (DWD)/Germany (lead);
      – Armstatehydromet/Armenia;
      – Météo-France/France;
      – KNMI/The Netherlands;
      – RHMS/Serbia;
      – TSMS/Turkey;
   (c) RA VI RCC node on Long-Range Forecasting (Toulouse/Moscow):
      – Météo-France/France and ROSHYDROMET/Russian Federation (joint lead);
      – Norwegian Meteorological Institute/Norway;
      – RHMS/Serbia;
      – TSMS/Turkey;

(2) That training in the use of operational RCC products and services, a mandatory function for the designation of Regional Climate Centres, shall be integrated into the activities of all the above three nodes;

(3) To keep the RA VI RCC-Network structure flexible throughout the pilot phase and beyond, allowing it to evolve based on Members' requirements;

(4) To ensure that the RA VI RCC-Network meets the criteria for formal designation in all the mandatory functions by the end of the pilot phase, and that the corresponding institutions make available their catalogue of services;

(5) To appoint an RA VI RCC-Network Focal Point to act as the official and formal contact for the entire RA VI RCC-Network, to coordinate the activities of the network and to implement a Website as a single entry point into the network, noting that the Focal Point would be one of the constituent leads of the RA VI RCC-Network nodes;

(6) To regularly review Members' requirements for climate information, products and services, and to ensure a state-of-the-art service provision to Members to meet their priority needs;

(7) To seek formal WMO designation of the RA VI RCC-Network in 2011, through the Commission for Climatology-Commission for Basic Systems process described in the Manual on the Global Data-Processing and Forecasting System (2009 version) and to mandate the president of RA VI to initiate this process, following satisfactory evaluation of capability to fulfil the mandatory functions and demonstration of this capability to the Commission for Climatology and the Commission for Basic Systems;

(8) That the implementation of the RA VI RCC-Network, as well as the pilot phase prior to formal designation, is coordinated by the RA VI Working Group on Climate and Hydrology, under the guidance of the president of RA VI and the RA VI Management Group;

Status

As decided by XV-RA VI, the implementation of an RCC-Network has been taken up, comprising of centres which provide regional level services according to their individual strengths, while making use of as many national level data and products as possible. Currently 3 nodes have been established under the demonstration phase of RA VI RCC-Network that commenced in June 2009:

RCC Node on Data Services (Lead: The Netherlands)
RCC Node on Climate Monitoring (Lead: Germany)
RCC Node on Long-range Forecasting (Lead: Russia and France)

Each of these nodes is supported by a consortium of NMHSs of RA VI Member countries as per the above Resolution of XV-RA VI. RA VI RCC-Network is currently being coordinated by Germany. The network approach has been chosen to ensure incorporation of as much competence and know-how as possible of the 50 RA VI Members.

The RA VI RCC-Network has successfully completed its demonstration phase and the process has been initiated for its formal designation by the relevant WMO bodies.

WMO RA VI Pilot Regional Climate Centres Network
http://www.wmo.int/pages/prog/dra/eur/RAVI_RCC_Network.php
http://www.rccra6.org/
Domain: All countries of RA VI
Awaiting designation as a WMO RCC-Network

Other Climate Centres with Regionally Focused Interests

The following is a non-exhaustive list of institutions providing operational climate information on the regional scale, complementing the efforts of WMO RCCs:

International Research Institute for Climate and Society (IRI)
http://portal.iri.columbia.edu/portal/server.pt
The mission of the IRI is to enhance society's capability to understand, anticipate and manage the impacts of climate in order to improve human welfare and the environment, especially in developing countries. The IRI conducts this mission through strategic and applied research, education, capacity building, and by providing forecasts and information products with an emphasis on practical and verifiable utility and partnership.
Location: New York State, USA
Domain of Interest: Global with targeted regional and national activities.

APEC Climate Center (APCC)
http://www.apcc21.org/en/
APCC aims to enhance the socio-economic well-being of countries in the Asia-Pacific region by utilizing up-to-date scientific knowledge and applying innovative climate prediction techniques. The Center specializes in multi-model ensemble techniques and developing related climate information products. APCC also provides training and support on seasonal climate prediction and downscaling, particularly targeted to developing countries in the region.
Location: Busan, Korea
Domain of interest: Countries that are members of Asia-Pacific Economic Cooperation

Earthwatch
Earthwatch is concerned with monitoring the integrity of life on earth to meet the needs of current and future generations. It works with a wide range of partners, from individuals who work as conservation volunteers on research teams through to corporate partners, governments and institutions. It has established a number of Regional Climate Centres (not to be confused with WMO RCCs) focussing on particular ecosystem types and related problems
See: http://www.earthwatch.org/europe/our_work/corporate/hcp/climate_centres/

- *North America Regional Climate Centre*
  - http://www.earthwatch.org/europe/rcc_northamerica
  - In Chesapeake Bay, Maryland, USA, scientists are studying the impact of human activities on forest ecosystems, and how they are likely to be affected by climate change.
- *Europe Regional Climate Centre*
  - http://www.earthwatch.org/europe/rcc_europe
  - In Wytham Woods, Oxfordshire, UK, research into the effects of climate change on this temperate forest will inform management plans and policy decisions in similar habitats worldwide.
- *China Regional Climate Centre*
  - http://www.earthwatch.org/europe/rcc_china
  - In recent years reforestation efforts have increased dramatically. Scientists working at Gutianshan National Nature Reserve are comparing biodiversity and carbon storage in both new and old forests.
- *India Regional Climate Centre*
  - http://www.earthwatch.org/europe/rcc_india
  - India's Western Ghats mountain range is a highly biodiverse environment. Scientists here are studying the forest ecosystems that provide food, fuel, shelter and medicines for local communities.
- *Latin America Regional Climate Centre*
  - http://www.earthwatch.org/europe/rcc_latinamerica
  - The Rio Cachoeira reserve is part of Brazil's threatened Atlantic Forest - one of the most species-rich environments on Earth. Research here is focussed on the responses of trees and animals to climate change in fragmented tropical forests.

Centro de Previsão de Tempo e Estudos Climáticos (CPTEC)
http://www.cptec.inpe.br/
São Paulo, Brazil
Domain: Central, Eastern and Southern South America

El Observatorio Andino
An Environmental Watch System for the Andean Countries
http://ole2.org/
For more details, see the article at:
http://arxiv.org/PS_cache/arxiv/pdf/1006/1006.0926v1.pdf

ANNEX 4

Proposed modified

Terms of Reference of a Joint CCl-CBS Expert Team on RCCs

as considered by the CCl/CBS ET on RCCs on 12 Oct. 2011

Develop and provide to the CCl and CBS Management Groups for further consideration, technical guidance as well as the oversight approaches for the establishment and operation of Regional Climate Centres (RCCs) and RCC-Networks, and to closely liaise with the concerned experts of CBS, Regional Associations and RCCs/RCC-Networks on this matter, with the following specific activities;

1. Guide the implementation, designation and effective operation of RCCs;

2. Identify, and support the adoption of, common standards for mandatory RCC products and services and their delivery as well as verification of forecasts and reporting of results;

3. Promote the use of GPC and RCC products at regional and national levels and development of consensus-based forecasts, especially through mechanisms such as RCOFs;

4. Liaise with other relevant CCl OPACEs, regional associations, WCRP/CLIVAR regional panels, CBS/DPFS, and CAS and other relevant entities;

5. Provide guidance on the development of project concepts for resource mobilization and advise on RCC implementation;

6. Submit reports in accordance with timetables established by the OPACE 3 co-chairs.

Members:

1. Michael Coughlan, Australia (Lead)
2. Stefan Roesner, Germany (Co-Lead)
3. Wassila Thiaw, USA
4. Ryuji Yamada, Japan
5. Epiphane Ahlonsou, Benin
6. David Jones, Australia
7. Caio Coelho, Brazil

ANNEX 5a

Basic Climate Training Needs for NMHSs and RCCs

By Wassila Thiaw and Ryuji Yamada

I Notes on training strategy

Capacity building is a long term process. It takes time to master tools for operational climate monitoring and predictions. Training programs must be carefully designed and tailored to the needs of NMHSs and RCCs. Emphasis should be on tools and interpretation of results accompanied by lectures to refresh students on the basic state of the climate and its variability. It must be hands-on. Ideal Approach for training: Residency Training Programs, where the student is sitting in an office. Classroom training must be accompanied by frequent follow up training courses. Web – training modules should be considered as supplement only – can't replace hands-on training programs. NMHSs and RCCs leaderships must be fully engaged in the training process to ensure that the knowledge gained feeds into the operations of the NMHSs and the RCCs.

II Specific training topics:

Basic Understanding of the climate base state and its variability

- The general circulation of the atmosphere and what drives global and regional climate systems
- The annual cycle
- Interannual variability
- Intraseasonal variability

Modes of variability – What they are and Impacts

- ENSO, MJO, Kelvin Waves, AO/NAO, AAO, PDO, etc

Derivation of Monsoon and Drought Indices

- Onset of the rains
- Dry/Wet spell frequencies
- Number of rainy days/dry days

Diagnostics Studies

- Data Analysis Tools
- Downloading and processing large data sets
- Example: UNIX/LINUX scripting, GrADS, and other tools
- Advanced statistical tools beyond EXCEL: Example: CCA, PC Regression, etc.
- Understanding of diagnostics results: Attribution. Example: Understanding sources of variability

Operational prediction systems

- Understanding of biases in global model outputs
- Mastering of downscaling techniques for operational seasonal forecasting
- Understanding of probabilistic forecasts
- Forecast interpretation and verifications
- Communication of the forecasts to the users

ANNEX 5b

Capacity Development and Experiences in WMO RA V

By Janita Pahalad

- Programs that operate across many countries need to find a balance between working with common regional issues and working with individual country plans and priorities, recognising that each country has its own Government and set of cultural, economic, social and relationship factors that influence the capacity of organisations to deal with climate data
- Increasing ownership in strategic decision-making and centralising country priorities in designing aid programs is a key factor in achievement of development outcomes and sustainable benefits
- Donor harmonisation is critical for countries to achieve sustainable development outcomes, especially in low-population countries that do not have the personnel resources to cater to multiple donors in particular sectors
- Multi-country and regional programs require a high degree of flexibility to suit each country's existing capacity strengths, priorities, systems, structures, personnel, procedures etc.
- Introducing change is frequently a long-term and integrated process; the integration of climate information into economic and social planning processes from community (bottom-up) to national (top-down) levels is the highest priority. A long-term, programmatic, whole-of-government approach is required to strengthen the enabling environment at national level across multiple sectors. Strong leadership and coordination from an influential central ministry will support a climate change coordinating agency that should be mandated to influence key ministries. Public awareness raising, targeted information and capacity development are critical.
- Alignment to national policies and processes is essential. Development partners must structure their international and regional aid effectiveness commitments[1] to engender national and regional ownership and support existing processes and policies - particularly national priority setting through national planning processes.
- Donor project application, management and reporting procedures should not be cumbersome and overly-demanding on national and regional capacities.
- Coordination is needed between climate change and disaster risk reduction as these two areas are closely linked. Local efforts and external support have both often been implemented in isolation.
- Equal partnership means equal commitment from all partners. Success in each country is dependent on commitment and responsiveness of each partner agency. This includes provision of dedicated personnel resources and required data.

The following approaches were prioritised by participants in a April 2011 design workshop to inform future programs in RA V:

- Opportunities and priorities in individual countries need to be reflected in the overall program

[1] Refer to commitments under Paris, Accra, Pacific and Cairns aid effectiveness principles.

- Understanding of and respect for existing capacity strengths (of which there are many) should be the basis for all future programs
- Capacity development processes need to be carefully planned and implemented to support both technical and broader institutional strengthening priorities in each country, with particular emphasis on:
    - in-country decision-making processes
    - increasing young people's professional development in the sector through scholarships, work placements, and ambassador programs
- Priority given to strengthening existing communications and outreach activities within and beyond program teams, NMSs and PICs to inform and engage other countries, other sectors, civil society and communities
- Demand for increased use of and strengthening of existing trust-based and supportive regional networks to support program implementation.
- Managing NMHSs expectations. RCC unable to meet all or most demands due to limited resources, data and technology.
- Sense of ownership should be created through equal partnership and responsibilities.
- Benefits should be demonstrated.
- Multi-faceted training: science, applications, media, etc
- Facilitation and funding of exchanges and placements for NMHS staff
- Follow-ups.

NMHS should have some understanding on how the products are derived including their strengths and limitations; know how to derive relevant information from RCC products; know how to interpret the products/information in simple non-technical language; and be able to package the information for various stakeholders.

ANNEX 6

WORLD METEOROLOGICAL ORGANIZATION

WORLD CLIMATE PROGRAMME
WORLD CLIMATE SERVICES PROGRAMME

Guidelines on Establishment and Operation of WMO Regional Climate Centres

WCSP-No. xx
WMO-TD-No. yy

DRAFT VERSION 1.2
21 October 2011

CONTENTS

Note: It is planned to either extend this document by, or to develop a complementary document on, WMO RCC product specifications. Such a document would also specify training requirements, which are considered an essential function of WMO RCCs.

Annexes

FOREWORD

Following the release of the IPCC 4th Assessment report in 2007, there has arisen an unprecedented commitment amongst people, societies, agencies and governments to take appropriate steps to cope with climate variability, and to be ready to adapt as necessary to climate change. As such, there is an increasing demand for climate information of all kinds for policy makers, decision-support systems and climate risk management in all socio-economic sectors. The third World Climate Conference (WCC-3) in 2009 decided to establish a Global Framework for Climate Services (GFCS) to respond to these challenges.

The World Meteorological Organization (WMO), consisting of its 189 Members (as of 2011) represented by their National Meteorological and Hydrological Services (NMHSs), works in close collaboration with research communities, universities, the private sector, other government agencies and various space agencies as well, to systematically observe the climate system. Much of the data collected by NMHSs in real-time serves the important task of delivering weather related services that require the rapid generation of a wide range of monitoring and forecast products, especially for services that track and forewarn of potentially life threatening and property damaging severe weather. These data form the backbone of the much larger set of earth system data required for monitoring and predicting climate variability and for projecting climate change into the future based on range of forcing scenarios. The climate-relevant information collected by NMHSs and other institutions of WMO's Members is archived and managed in climate databases. These data, critical to our knowledge and understanding of the climate system, feed dynamical and statistical computer models to predict and project future climatic states, and to develop useful information, products and services for decision-makers in all walks of life.

All countries need to know which activities are sensitive to climate and understand how they are affected in order to develop an appropriate range of products and services to meet user needs. This knowledge and understanding requires climate observations, management and transmission of data, various data services, climate system monitoring, practical applications and services for different user groups, forecasts on monthly, seasonal and interannual time scales, climate projections; through to policy-relevant assessments of climate variability and change, and the research that makes all of this possible. Many countries, especially developing and least developed countries (LDCs) do not have sufficient capacity to meet the requirements from their own resources. The situation is exacerbated in these countries when they are severely affected by climate extremes and climate change, since societal and economic vulnerability is usually at the highest levels. WMO Members have long recognized the needs of these countries, and WMO technical experts in climatology, regional cooperation, service delivery and product development and transmission are working with the Secretariat to establish mechanisms to improve institutional capacity for delivering climate services around the world. The development of appropriate products and services will require close collaboration between providers and users of climate information, and where necessary the establishment of institutional mechanisms to facilitate the exchange.

In response to these challenges, WMO's basic infrastructure has been extended to strengthen NMHS capabilities in generating and delivering up-to-date climate services, especially with respect to risk management and adaptation to climate variability and change. Accordingly, several Global Producing Centres (GPCs) have been established to provide global long-range forecasting products. Furthermore, Regional Climate Centres (RCCs) are now being established to generate and deliver more regionally focused high-resolution data and products as well as to carry out a

range of training and capacity building activities. Both entities are integral components of WMO's Global Data Processing and Forecasting System (GDPFS), and, at the same time have become the basic building blocks of the Climate Services Information System (CSIS) being implemented under the Global Framework for Climate Services (GFCS).

The purpose of this document is to inform any organization that might consider establishing or becoming a WMO Regional Climate Centre, or alternatively a node in a WMO RCC-Network. It contains information on the RCC concept, definitions and terms, on the recommended steps to be followed for a candidate centre to be designated as a WMO RCC or for a group of centres to be designated as a WMO RCC-Network, and for WMO RCC operations. It also provides the framework for the range of activities that might be undertaken within a stand-alone RCC or the node of an RCC-Network.

1. INTRODUCTION

1.1 WMO Regional Climate Centres at a glance

Why WMO Regional Climate Centres?

Climate relevant processes have strong inter-scale linkages going beyond borders of individual countries. To meet the needs of its Members, a worldwide, three-level infrastructure is therefore being implemented: Global Producing Centres for Long-range Forecasts (GPCs), Regional Climate Centres and Networks of Centres (RCCs & RCC-Networks) and National Meteorological or Hydrometeorological Services (NMSs/NMHSs)[2].

Climate variability and climate change pose enormous challenges to societies, and there is an urgent need for WMO Members to have access to the best possible climate services in support of climate risk management and adaptation. Global-scale information provided by GPCs is generally coarse in terms of resolution and lacks some specificity in terms of the reflected features that are important for national-scale services. Consequently, the concept of WMO Regional Climate Centres was developed to bridge any gaps between information provided at global and national scales. Moreover, up-to-date climate services require adequate computer power, modelling capacities and other forms of specialist expertise, to which not all WMO Members currently have adequate access. In this respect, WMO RCCs offer excellent opportunities for networking and pooling the capacities of NMSs in a region to ensure that each NMS can provide the full suite of climate services required to meet national needs.

What are WMO RCCs?

WMO RCCs are Centres of Excellence that create regionally oriented products including long-range forecasts that support both regional and national climate activities, and thereby strengthen the capacity of WMO Members in the delivery of better climate services to national users. The notion of RCC-Networks is also proposed whereby a region may be served by several sub-centres or nodes that collaborate to provide the broad range of services required to meet the needs of individual nations subscribing to the RCC-Network. For simplicity and unless otherwise specified the term RCC also encompasses the term RCC-Network. Establishment of the RCC-Networks will inevitably be a more complex process, especially for any network whose interests or component sub-centres extend beyond a single WMO Region[3].

Serving as a backbone for the development and maintenance of NMSs' climate services, WMO RCCs also contribute to capacity building of NMSs and more broadly to sustainable development within countries. WMO RCCs support NMSs by: regionalizing global climate products; introducing innovative regionally focussed products; facilitating access to and application of tools such as software and models for regional and national analyses and applications; offering infrastructural support such as archiving services; stimulating the development of a regional research and development agenda; conducting training activities; and promoting resource mobilization.

RCCs also look to establish working relationships with other regional organizations that represent interests that have sensitivities to climate variability and change, e.g. agriculture, health and disaster preparedness.

Who are the users of WMO RCCs?

A WMO RCC serves primarily the NMSs whose areas of responsibility lie fully or partly within the RCC's region of interest.

In addition, other WMO RCCs and NMSs from areas outside a RCC's region of interest may subscribe to its services. WMO RCC products and services are regional in nature and provide support to NMSs to extend or

[2] Use of the acronym NMS also implies NMHS unless otherwise specified.
[3] The capitalized term Region refers to one of the six WMO Regional Associations.

improve their user-oriented services. Regional and international organizations might also be served by WMO RCCs.

How do WMO RCCs interact?

WMO RCCs are regional institutions mandated to deliver high-quality regional-scale products, for example, by drawing on data and products from GPCs and other global centres and by scaling and tailoring the information down to the regional-scale. In doing so, WMO RCCs will also draw on the national data, products, know-how and feedback they receive from the NMSs.

WMO RCCs provide online access to their products to NMSs and other regional users, including the Regional Climate Outlook Forums. At the same time, they provide regional data, products and feedback to GPCs and associated lead centres for respective verification and product optimization of the global-scale information.

1.2 The Climate Services Information System

World Climate Conference-3 (WCC-3, 31 August – 4 September 2009, Geneva/Switzerland) decided to establish a Global Framework for Climate Services (GFCS) to strengthen the production, availability, delivery and application of science-based climate prediction and services. The GFCS consists of five pillars mainly following the cycle of climate service generation and delivery: (i) Observation and Monitoring component, (ii) Research, Modelling and Prediction component, (iii) Climate Services Information System component, (iv) Climate User Interface Platform component and – as a cross-cutting component- (v) capacity building.

The Climate Services Information System (CSIS) is the component of the framework that is designed to routinely generate climate information that users need for the decisions they have to make. The current elements of infrastructure that could form the basis of the CSIS include: (i) WMO's Global Data Processing and Forecasting System (GDPFS) with its WMO Global Producing Centres for Long-range Forecasts (WMO GPCs) and associated Lead Centres for Long-range Forecast Multi-Model Ensembles (LC-LRFMME) and for Standard Verification System for Long-range Forecasts (LC-SVSLRF) as well as WMO Regional Climate Centres (WMO RCCs); (ii) regional institutions, such as Drought Management Centres, etc.; (iii) provision of standards and best practices, e.g. through its Technical Commissions for Basic Systems (CBS) and for Climatology (CCl); and (iv) coordinated mechanisms, such as Regional Climate Outlook Forums (RCOFs), Global Seasonal Climate Updates (GSCUs), Climate Watch systems etc.

The following paragraphs provide a brief overview of some of the elements mentioned above.

The function of WMO Global Producing Centres for Long-range Forecasts (WMO GPCs) is to provide global-scale, long-range (mostly seasonal) prediction information for WMO RCCs, RCOFs and NMHSs. Their services are provided according to defined WMO standards and criteria. WMO GPC minimum products comprise probabilities for tercile categories of 2m temperatures, precipitation and sea surface temperatures (all global coverage) for forecast ranges of at least 4 months, issued at least quarterly. Associated Lead Centres for Long-range Forecast Multi-Model Ensembles and for Standard Verification System for Long-range Forecasts provide WMO GPC-related ensemble products and verification information respectively.

WMO Regional Climate Centres (WMO RCCs) are Centres of Excellence that perform operational regional-scale climate functions in the domains of Long-range Forecasting, climate monitoring, climate data and training (all mandatory functions). Highly recommended functions comprise domains of climate projections, co-ordination of regional activities including capacity building and Research & Development. RCCs are complementary to and supportive of NMSs, which will normally deliver all warnings and national-scale products. Mandatory WMO RCC products comprise assessments of WMO GPC products as they apply

to the RCC's area of interest, regional and sub-regional seasonal outlooks, consensus outlook statements, verification datasets, climate diagnostic bulletins, reference climatologies, and regional climate data sets.

Regional Climate Outlook Forums (RCOFs) bring together national, regional and international climate experts on a regular basis to produce regional climate outlooks based on input from global and regional producers of climate information (such as WMO GPCs and WMO RCCs) as well as from NMSs from the region concerned. The RCOF mechanism typically: (i) covers regions of common climate characteristics; (ii) ensures consistency in access to and interpretation of climate information; (iii) facilitates close user interaction to jointly assess the likely implications of the outlooks; and (iv) provides training on Long-range Forecasting, communication of climate information etc. Currently, more than a dozen RCOFs with a range of different characteristics are active around the world.

Global Seasonal Climate Updates (GSCU) are publications on the observed status and potential evolution during an ensuing quarter of the global climate in terms of 2m temperatures, precipitation, Sea Surface Temperatures and significant events.

Regional WMO Climate Watch systems are designed to detect, monitor and predict climate anomalies and related extremes with the potential for social, economic and environmental damage. Fed by global and regional guidance products such as from WMO GPCs, WMO RCCs, RCOFs, WMO Climate Watch Systems enable NMHSs to issue related national climate advisories to users as a co-ordinated climate service.

1.3 Definitions and functions of WMO Regional Climate Centres

A multifunctional centre that fulfils all the required functions of an RCC for the entire Region, or for a sub-region defined by the Regional Association may be designated by WMO as a 'WMO Regional Climate Centre' (WMO RCC)[4]. A group of centres performing climate-related activities that collectively and in cooperation fulfil all the required functions of an RCC may be designated by WMO as a 'WMO Regional Climate Centre Network' (WMO RCC-Network). Each centre in a designated WMO RCC-Network will be referred to as a 'Node'. A Node will perform, for the region or sub-region defined by the Regional Association, one or several of the mandatory RCC activities (e.g. long-range forecasting (LRF), climate monitoring, climate data services, training). Only centres or groups of centres designated by WMO will carry the title 'WMO RCC' or 'WMO RCC-Network' respectively. Recipients of RCC products and services will be NMSs, other RCCs and international institutions recognized by the Regional Association, and will be referred to as 'RCC Users'. WMO RCCs and RCC-Networks shall follow Guidance published by the Commission for Climatology on technical, climate-related matters.

WMO RCCs or WMO RCC-Networks might be established, by request of the Members of the Regional Associations concerned, for climate-sensitive areas whose boundaries extend beyond or are outside those of a single Regional Association (e.g. Polar Regions).

In order for a centre or a group of centres in a cooperative effort to be officially recognized as a WMO RCC (Regional Climate Centre), or a WMO RCC-Network, it shall perform the following minimum set of functions:

- Operational Activities for LRF**:
    - Interpret and assess relevant LRF products from Global Producing Centres (GPCs) (some of which can be obtained through the Lead Centres for Long-range Forecast Multi-Model

[4] The geographical area of interest of any WMO-RCC will of its nature extend beyond the jurisdictional borders of one WMO Member country.

Ensembles), make use of Lead Centre for Standard Verification System on LRF, distribute relevant information to RCC Users; and provide feedback to GPCs;
- Generate regional and sub-regional tailored products, relevant to RCC User needs, including seasonal outlooks etc.;
- Perform verification of RCC quantitative LRF products, including the exchange of basic forecasts and hindcast data;
- Generate 'consensus' statements on regional or sub-regional forecasts;
- Provide on-line access to RCC products/services to RCC Users;
- Assess use of RCC products and services through feedback from RCC Users.

Note: ***Both dynamical and statistical, within the range of 1 month to 2 year timescale, based on regional needs.*

- Operational Activities for Climate Monitoring:
  - Perform climate diagnostics including analysis of climate variability and extremes, at regional and sub-regional scales;
  - Establish an historical reference climatology for the region and/or sub-regions;
  - Implement a regional Climate Watch.
- Operational Data Services, to support operational LRF and climate monitoring:
  - Develop regional climate datasets, gridded where applicable;
  - Provide climate database and archiving services, at the request of NMHSs.
- Training in the use of operational RCC products and services:
  - Provide information on methodologies and product specifications for mandatory RCC products, and provide guidance on their use;
  - Coordinate training for RCC Users in interpretation and use of mandatory RCC products.

Notes:
- *Additional requirements for RCC functions may vary in detail from Region to Region. A list of 'highly recommended', but not mandatory, functions is given below*
- *An RCC or RCC node is not necessarily an NMHS, but any non-NMHS entity must be nominated by the Permanent Representative of the concerned country.*

Detailed criteria for WMO RCC mandatory functions

Functions	Activities	Criteria
Operational Activities for LRF (both dynamical and statistical, within the range	Interpret and assess relevant LRF products from Global Producing Centres (GPCs), distribute relevant information to RCC Users; and provide feedback to GPCs	***Product:*** assessment of the reliability and outcomes of GPCs or Lead Centre (LC)-LRFMME products including the reasoning (making use of LC SVSLRF), for the region of interest, in the form of texts, tables, figures, etc. ***Element:*** 2-m mean temperature, total precipitation ***Update frequency:*** monthly or at least quarterly

of 1 month to 2 year timescale, based on regional needs)	Generate regional and sub-regional tailored products, relevant to RCC User needs, including seasonal outlooks etc.	***Product:*** probabilities for tercile (or appropriate quantile) categories for the region or sub-region ***Element:*** 2-m mean temperature, total precipitation ***Output type:*** rendered images (maps, charts), text, tables, digital data ***Forecast period*:** one month up to 6 months ***Update frequency:*** 10 days to one month
	Generate consensus* statement on regional or sub-regional forecasts. **NB: A collaborative process to generate consensus would typically involve scheduled discussion amongst experts in the region (e.g. through Regional Climate Outlook Forums (RCOFs), teleconferencing, etc.).* *Consensus is both the agreed process, and its joint conclusion, which could be that there is limited skill in the LRF/seasonal prediction for a region or sub-region for the forecast period.*	***Product:*** consensus statement on regional or sub-regional forecast ***Element:*** 2-m mean temperature, total precipitation ***Output type:*** report *F**orecast period*:** a climatologically significant period (from one month to one year) ***Update frequency:*** at least once per year (to be defined by the region)
	Perform verification of RCC quantitative LRF products, including the exchange of basic forecasts and hindcast data.	***Products:*** verification datasets (e.g. SVS LRF scores, Brier Skill Score; ROC; Hit Rate Skill Score) ***Element:*** 2-m mean temperature, total precipitation
	Provide on-line access to RCC products/services to RCC Users.	***Product:*** an on-line data/information portal
	Assess use of RCC products and services through feedback from RCC Users.	***Product:*** analysis of feedback (which is made available using a template) ***Update frequency:*** annually, as part of a regular reporting of RCCs to WMO RAs
Operational Activities for Climate Monitoring	Perform climate diagnostics including analysis of climate variability and extremes, at regional and sub-regional scales	***Products:*** climate diagnostics bulletin including tables, maps and related products ***Element:*** Mean, Max and Min temperatures, Total precipitation; other elements (esp. GCOS essential climate variables) to be determined by the region, ***Update frequency:*** monthly
	Establish an historical reference climatology for the region and/or sub-regions	***Product:*** database of climatological means for various reference periods (e.g. 1931-60; 1951-80; 1961-90; 1971-2000; etc) ***Spatial resolution:*** by station or grid ***Temporal resolution:*** monthly at a minimum ***Elements:*** Mean, Max and Min temperatures, Total precipitation; other elements (esp. GCOS essential climate variables) to be determined by the region, ***Update frequency:*** at least 30 years, preferably 10 years

	Implement a Regional Climate Watch	***Products:*** climate advisories and information for RCC Users ***Update:*** whenever required, based on the forecast of significant regional climate anomalies.
Operational Data Services, to support operational LRF and climate monitoring	Develop quality controlled regional climate datasets, gridded where applicable	***Products:*** regional, quality controlled climate datasets, gridded where applicable, following CCl guidance on QA/QC procedures ***Elements:*** Mean, Max and Min Temperature, and Precipitation, at a minimum ***Temporal resolution:*** *daily* ***Update:*** monthly
	Provide climate database and archiving services, at the request of NMHSs	***Products:*** national databases with metadata, accessible to the NMHS in question (backup service, development site, etc). ***Elements:*** as determined by the NMHS ***Update:*** at the request of the NMHS
Training in the use of operational RCC products and services	Provide information on methodologies and product specifications for mandatory RCC products, and provide guidance on their use	***Products:*** Manuals, guidance documents and information notes. ***Update frequency:*** when methods/products are revised or introduced or discontinued
	Coordinate training for RCC Users in interpretation and use of mandatory RCC products	***Products:*** survey and analysis of regional training needs, and proposals for training activities.

Note: *An RCC is expected to perform certain functions (e.g. for homogeneity testing; database management; metadata management, statistical evaluation of climate data, etc.) using procedures proposed in the WMO Guide to Climatological Practices and in other official Commission for Climatology Guidance documents.*

<u>Highly-recommended functions for WMO RCCs</u>

- Climate Prediction and Climate Projection (beyond 2 years timeframe)
    - Assist RCC Users in the access and use of WCRP-CMIP climate model simulations
    - Perform downscaling of climate change scenarios
    - Provide information to RCC Users for use in development of climate adaptation strategies
    - Generate, along with warnings of caution on accuracy, seasonal forecasts for specific parameters where relevant, such as:
        - onset, intensity and cessation of rainy season;
        - tropical cyclone frequency and intensity
    - Perform verification on consensus statements for forecasts;
    - Perform assessment of other GPC products such as SSTs, winds, etc.
- Non-operational data services
    - Keep abreast of activities and documentation related to WMO WIS, and work towards WIS compliance and DCPC designation;
    - Assist NMHSs in the rescue of climate data from outmoded storage media;
    - Assist NMHSs to develop and maintain historical climate datasets;

- Assist RCC Users in the development and maintenance of software modules for standard applications;
- Advise RCC Users on data quality management;
- Conduct data homogenization, and advise RCC Users on homogeneity assessment and development and use of homogeneous data sets;
- Develop and manage databases, and generate indices, of climate extremes;
- Perform Quality Assurance/Quality Control on national datasets, on request of an NMHS;
- Provide expertise on interpolation techniques;
- Facilitate data/metadata exchange amongst NMHSs, including on-line access, through an agreed regional mechanism;
- Perform Quality Assurance/Quality Control on regional datasets.

- Coordination Functions

  - Strengthen collaboration between NMHSs on related observing, communication and computing networks including data collection and exchange;
  - Develop systems to facilitate harmonisation and assistance in the use of LRF products and other climate services;
  - Assist NMHSs in user liaison, including the organisation of climate and of multidisciplinary workshops and other forums on user needs;
  - Assist NMHSs in the development of a media and public awareness strategy on climate services.

- Training and Capacity building

  - Assist NMHSs in the training of users on the application and on implications of LRF products on users;
  - Assist in the introduction of appropriate decision models for end-users, especially as related to probability forecasts;
  - Promote technical capacity building on NMHS level (e.g. acquisition of hardware, software, etc.), as required for implementation of climate services.
  - Assist in professional capacity building (training) of climate experts for generating user-targeted products.

- Research and Development

  - Develop a climate Research and Development agenda and coordinate it with other relevant RCCs;
  - Promote studies of regional climate variability and change, predictability and impact in the Region;
  - Develop consensus practices to handle divergent climate information for the Region;
  - Develop and validate regional models, methods of downscaling and interpretation of global output products;
  - Promote the use of proxy climate data in long-term analyses of climate variability and change;
  - Promote application research, and assist in the specification and development of sector specific products;
  - Promote studies of the economic value of climate information.

2. ESTABLISHMENT OF WMO REGIONAL CLIMATE CENTRES

2.1 Practical issues

2.1.1 Organisational Models

WMO RCCs can be structured in one of two ways: RCC functions for a region may be undertaken within a single multifunctional centre, or may be distributed amongst various centres or nodes in a WMO RCC-Network. WMO Regional Associations define the region for which respective RCC functions are carried out. It is essential that the RA endorses a proposed RCC structure prior to any implementation phase.

2.1.2 Issues to be considered by a potential RCC candidate

In order to conduct RCC functions to the standards set out in the Manual on the GDPFS, a centre or group of centres will need the following:

> i) Clear internal mandates, and clear mandates from the WMO Permanent Representative of the host country or countries and the relevant WMO Regional Association to undertake and to sustain high-quality, consistent, climate activities for the benefit of a region or sub-region;
>
> ii) Appropriate resources to set up and run the centre, including physical infrastructure (computers, offices, hardware, operating supplies, etc.); communications systems (Internet, phones, faxes, satellite feeds, etc.); the necessary basics (power, water, lighting, heating, cooling, etc.); and human resources including, inter alia, administration staff, technical support staff, climate data specialists, analysts, forecasters and service specialists (NB: the amount of resources required to set up and run an RCC will depend on a number of factors, including the extent of the programme to be undertaken and the extent of the region to be served).

WMO designation of a non-NMHS centre as an RCC or as a node in a RCC-Network is entirely possible, but will require the endorsement of the Permanent Representative of the WMO Member country in which this centre is based. This endorsement is essential for a number of reasons including for reporting to WMO constituent bodies, communication of relevant WMO decisions and requirements including those related to data exchange and constraints, to ensure that the centre is compliant with WMO regulations and that it will respect WMO policies for data, etc.

In all cases, it is highly recommended that RCC candidates take part in a pilot phase during which they build their capacity to perform the mandatory RCC functions, undertake any other functions of high priority in the region, and prepare to demonstrate that they meet the requirements laid out on the Manual on the GDPFS. Pilot programmes will be organized through the Regional Associations, at the discretion of the regional Members. The duration of a pilot phase will be determined on a case-by-case basis. The title of RCC, however, is only granted following the complete WMO designation process.

2.1.3 WIS compliance

RCC operations must be consistent with WIS standards. WMO RCCs may also become WMO WIS DCPCs.

2.1.4 Data policy, aspects of data exchange and product accessibility

WMO RCCs shall always adhere to the WMO principles on the exchange of data and products.

The full suite of WMO RCC data, products and services:
- *shall* be made accessible to all NMSs within the RCC's area of mandate,
- *should* be made accessible to neighbouring WMO RCCs, and
- *might* be made accessible to international organisations subject to the approval of the Regional Association(s) which host the respective RCC.

Appropriate password protection and management should be considered.

All NMSs within the area of mandate of a WMO RCC are strongly encouraged to ensure a lively exchange of data with the WMO RCC in order to allow for the generation of high-resolution regional services by the WMO RCC for the benefit of the NMSs.

2.1.5 Co-ordination aspects

Any WMO RCC service development should be closely co-ordinated with the NMSs within the WMO RCC area of mandate. WMO RCCs within a Regional Association should be closely co-ordinated by an appropriate RA-internal mechanism to ensure an appropriate level of service consistency.

2.2 Recommended steps for designation of a WMO RCC or WMO RCC-Network

When a climate-centred entity wishes to be designated by WMO as a WMO RCC, or if a group of entities wishes to be designated as WMO RCC-Network, the following steps are recommended:

Step 0 Regional Associations (RAs) are strongly encouraged to conduct a survey of Members on regional needs for and capacity to deliver RCC services, to underpin decisions related to candidate entities seeking WMO RCC status. A draft survey template*[5], based on the mandatory functions required for RCC designation as well as the associated highly recommended functions, is available through the WMO Secretariat, and can be modified based on regional requirements.
Note: Ideally, the RA adopts a resolution formally committing itself to the establishment of RCCs, including the operation of a pilot phase, during one of its regular sessions. This resolution should be based on a related survey on regional needs for and capacity to deliver RCC services and should mandate a Working Group, Task Team or an appropriate body reporting to the President of the concerned RA (P/RA) to elaborate a WMO RCC implementation plan based on mutual consensus among the relevant stakeholders.

Step 1 The RCC candidate(s) will contact*[6] P/RA through, and with the endorsement of, the Permanent Representative of the country in which it is situated, expressing its intent to be designated as a WMO RCC, and to begin a demonstration phase.
Notes:
(1) It is highly recommended that RCC candidates take part in a demonstration phase during which they (i) build their capacity to perform the mandatory RCC functions, (ii) undertake any other functions of high priority in the region, and (iii) prepare to demonstrate that they meet the requirements laid down in the Manual on the GDPFS. Demonstration programmes will be organized through the RAs, at the discretion of the RA Members. The duration of a demonstration phase will be determined as needed on a case-by case basis. The official title of WMO RCC, however, is only granted following the complete WMO designation process.
(2) If a group of centres would like to collectively fulfil all the required functions of a WMO RCC (termed as WMO RCC-Network), P/RA might mandate any relevant coordination group of the RA dealing with climate related matters to provide the required coordinating assistance throughout the entire designation process.

Step 2 P/RA will inform*[7] P/CCl, with copy to P/CBS and the SG, of the intent expressed by the candidate(s). In consultation with the CCl, the appropriate coordination group of the RA dealing with climate related matters and WMO Secretariat, P/RA will consider the criteria for designation (as per the Manual on the GDPFS, Vol 1, Global Aspects), respective regional requirements and any existing pilot or existing WMO RCC(s) in the region. If needed, P/RA will provide information on regional needs and fulfilment of WMO designation criteria.

[5] Cf. Annex B
[6] Cf. Section 2.2.2 and corresponding Annex C
[7] Cf. Section 2.2.3

Step 3 The candidate(s) will work in contact with the relevant coordination group of the RA dealing with climate related matters, the CCl, other experts nominated by the P/RA, other existing WMO RCCs in the region if any, WMO Secretariat and possibly the existing WMO GPCs during its preparations for designation.

Step 4 Upon successful conduct of the demonstration phase and based on the respective positive assessment of the mandated (climate) coordination group of the RA, P/RA will contact the SG with a request for formal designation of the candidate(s) as WMO RCC, providing information/documentation on the process followed, and an assessment of the capability to meet requirements of the designation criteria.

Step 5 WMO SG will arrange for appropriate consultations with P/CCl and will take up any concerns with P/RA.

Step 6 When advised by P/CCl on satisfactory compliance with the designation criteria, SG will forward the request for formal designation to P/CBS for further action with copy to P/CCl and P/RA for information.

Step 7 CBS, through its relevant bodies, will review the submission and will discuss any concern with the RA and CCl through WMO Secretariat. The proposal may need to be resubmitted with all required clarifications addressed.

Step 8 When appropriate, the candidate(s) will be invited by CBS to present the proposal (in the form of an amendment to the Manual on the GDPFS) at one of its sessions for decision. The presentation of the proposal shall be complemented by the respective demonstration of capabilities, through documentation as well as oral presentation. WMO Secretariat will assist in the development of the proposed amendment to the Manual on the GDPFS.

Step 9 With the approval of the Members of CBS, the amendment to the Manual will be put up to WMO Congress or to WMO Executive Council for approval.

Step 10 With this final WMO approval, the Manual on the GDPFS will be revised and the RA and the candidate(s) will be advised in writing on the designation of the respective WMO RCC or WMO RCC-Network.

The following modifications apply in case of WMO RCCs or WMO RCC-Networks whose boundaries of interest extend beyond or outside those of a single Regional Association:

Specific modification regarding designation steps 0 and 1:

Proposals for the implementation of cross-regional RCCs will be facilitated by the Secretariat in close collaboration with the Presidents of the Regional Associations concerned. It is suggested, that Regional Associations concerned establish an appropriate *co-ordination mechanism* to deal with the designation procedure including the elaboration of RCC-related requirement and capability statements, the development of a RCC implementation plan as well as the conduct of a RCC demonstration phase.
The designation process for any specific cross-regional RCC could be initiated formally by EC.

Specific modification regarding designation step 2:

Once the Regional Associations concerned are satisfied with the level of preparations, P/CCl, with copy to P/CBS and SG are informed by written communication, signed by the Presidents of the RAs concerned, of the intent of the candidate(s) to establish a WMO RCC (-Network).

Specific modification regarding designation steps 3-10:

The *co-ordination mechanism* should remain in force until the designation procedure is finished.

2.2.1 Elaboration of a Statement on Requirements

It is highly recommended that each Regional Association conduct a survey on regional needs for, and capacity to, deliver RCC services (see Annex B for a draft survey, based on the functions required for RCC designation and on proposed highly recommended functions). The results of the survey will efficiently support and underpin decisions related to applications from candidates for RCC status.

2.2.2 Elaboration of a WMO RCC proposal

An agency or organization that wishes to be considered for WMO designation as an RCC will make this known to the President of the respective WMO Regional Association in writing through, and with the endorsement of, the Permanent Representative with WMO of the country in which the candidate is situated.
Note: A Non-NMHS candidate is encouraged to engage prior consultations with the Permanent Representative of the respective country to facilitate his/her endorsement as required.

The written communication should comprise a ***letter of intent*** with **2** ***annexes*** providing the following information (applies also to individual members of a group of centres, which will collectively fulfil the RCC functions):

a) Letter of intent

The letter of intent should clearly state the candidate's willingness and capability to provide RCC services. It is highly recommended, that the letter of intent refers to a RCC requirements survey in the region. Furthermore, the letter shall clearly define the geographical region for which the RCC services are offered and it shall clearly imply, whether the candidate proposes acting as a single multifunctional RCC or as a node in a RCC network.

b) Annex 1: Institutional portrait

1. Name of the centre and full address

2. Affiliation (host, sponsors, stakeholders, partnering agencies, etc) at global, regional and national levels

3. Mandate (mission, vision) of the centre for climate activities

4. Websites relevant to the centres climate activities

5. Current operational climate products relevant to the RCC application including respective Web Links or product examples
   Note: The product list should be structured along the mandatory RCC functions on (i) Long-range forecasting, (ii) climate monitoring, (iii) climate data services and (iv) training. Furthermore, any product relevant to RCC highly recommended functions should be listed.

6. Staff deployment relevant to RCC-related activities (scientific, technical and administrative categories)

7. Description of current facilities relevant to RCC-related products and services including computing and communications profiles, modelling capacity, statistical capacity, data, data management, archiving profile, etc., and the nature of financial resources used to allow for sustained funding of the respective RCC services

Supplementary information on the following topics is welcomed:

A. Current linkages with WMO Global Producing Centres (GPCs) or other producers of global or regional climate information
B. Participation in Regional Climate Outlook Forums (RCOFs)
C. Current provision of climate services beyond national borders

c) Annex 2: Proposed RCC portrait

Note: The RCC portrait including its attachments is intended to be the guiding document through the pilot/demonstration phase. Its updated version may serve as the basic document for the formal WMO RCC designation.

1 Introduction
[Optional]

2 Background
[Short history of RCC evolution in the region concerned]

3 Proposed RCC portrait
[(i) Geographical area to be covered by the RCC's services including list of Member countries concerned;
(ii) Language(s) in which the RCC services will be offered;
(iii) Full address and contact details of the RCC Focal Point or -in case of a RCC-Network- of the RCC-Network coordinating Focal Point;
(iv) URL of the RCC/RCC-Network WebSite;
(v) Additional information requested for RCC-Networks: List of responsible and participating entities.]

4 Open issues to be tackled in the RCC demonstration phase
[List of open issues to be tackled during the RCC demonstration phase in order to entirely fulfil RCC designation criteria]

5 Strategy to extend the RCC service suite (highly-recommended functions and beyond)
[Summary of related plans]

6 Further schedule
[List of milestones relevant to sections 4 and 5 above including start and expected end date of pilot/demonstration phase]

7 Concluding remarks
[Optional]

Attachment 1: Detailed RCC Service Overview
Attachment 2 (for RCC-Networks only!): RCC-Network Nodes and Focal Points

Templates for attachments 1 and 2 are provided in Annex C to this guidance document.

2.2.3 Conduct of a RCC demonstration phase

The aim of the demonstration phase is to enable RCC applicants to successfully apply for formal WMO designation by demonstrating full implementation of, at least, WMO RCC mandatory functions. It has to be noted, that the products identified and specified in the list of detailed criteria for WMO RCC mandatory

functions form the ultimate minimum basis for implementing WMO RCC functions and for evaluating its implementation throughout the entire WMO RCC designation process!

The scope of the demonstration phase is: (i) to fully implement and consolidate routine RCC-related services with a special focus on WMO RCC mandatory functions for the region/subregion agreed upon by the Regional Association(s) concerned, and (ii) to fully implement an organisational structure of the RCC/RCC-Network including a WebPage for access to all RCC services as well as a point of contact.

In order to start a demonstration phase, RCC applicants shall: (i) be able to generate, in principle, all products defined in the list of WMO RCC mandatory functions and (ii) have provided an agreed upon WMO RCC proposal.

Once agreed by P/RA and communicated formally to P/CCl with a copy to P/CBS and SG/WMO (cf. section 2.2, step2), the Secretariat informs all NMSs concerned of the started RCC demonstration phase and encourages appropriate liaison and feedback.

During the demonstration phase, RCC applicants work along the milestones as laid down in the proposed RCC portrait. It is strongly recommended that the RCC applicants implement a dedicated pilot RCC Web page to make their RCC-relevant services available to the NMSs concerned and provide appropriate information to the RA President and the mandated coordination group of the Regional Association(s), indicating the status of work vis-à-vis the milestones defined in the proposed RCC portrait.

Once all milestones defined in the proposed RCC portrait are fulfilled, and therewith at least all WMO RCC mandatory functions implemented for the area to be covered by the RCC services, the applicant(s) contact the President(s) and the relevant co-ordination group of the Regional Association(s) concerned in order to apply for formal WMO designation as described above. It is strongly recommended to provide an update of the proposed RCC portrait in form of a status report as a technical reference document for the following evaluation of capabilities and the formal designation process.

Accordingly, the following procedure is recommended:

The RCC candidate provides the status report to the appropriate co-ordination group in the Region mandated to advise P/RA on RCC matters.

The coordination group formally reviews the following aspects:

- Does the applicant meet the Regional RCC requirements as stated in the RCC Statement of Requirements
- Does the applicant meet the mandatory RCC requirements
- Are appropriate collaboration arrangements with Regional key players in place
- Are all RCC data, products and services available and adequate including technical documentation and methodology descriptions.

Based on the positive result of this review, the co-ordination group provides a short report to P/RA stating the successful review of the above mentioned aspects, confirming the successful conduct o the demonstration phase and recommending formal designation of the RCC.

The president of the regional association, once satisfied that the candidate can -and can continue to- perform the RCC mandatory functions, will nominate that centre to the Secretary-General of WMO. In this communication, the president of the regional association will include:

1. A description of the process followed to demonstrate capability to fulfil the stated requirements

2. An assessment of the results and outcomes of the demonstration phase, developed by the co-ordination group or other expert advisor(s)
3. A description of any remedial actions already taken to ensure capacity, and identification of any challenges related to sustainability that may recur
4. A list of activities performed during the demonstration phase, and an evaluation of these (also from user perspective)
5. All appropriate endorsements and stakeholder commitments.

The demonstration phase ends when either the applicant(s) is/are designated as WMO RCC/WMO RCC-Network or if the President of the Regional Association(s) concerned formally declare the demonstration phase ended by written communication to the Secretary-General.

3. OPERATIONS OF WMO REGIONAL CLIMATE CENTRES

Note: This chapter will be regularly updated considering upcoming experiences with operations of WMO RCCs.

3.1 Operational aspects

3.1.1 WMO RCC Web Pages

WMO RCC products and services should be provided preferably through the Internet. Within the product and service suite of a RCC hosting institution, RCC products and services should be clearly identifiable. It is recommended to implement RCC-dedicated WebPages, which should, as a minimum, provide the following information/functionalities:

- Logos of RCC host(s) and WMO
- Area of mandate
- Contact point including host institution's postal address, phone and fax numbers and Email address
- Product list incl. sample products
- Access to all RCC products and services incl. methodology information
- User feedback possibilities
- Operational service messages

It is highly recommended to provide the following additional information on the RCC Web page:

Access to reference documents and technical documentation
Event calendar
Provision of a short history of RCC evolution in the region
Links to RCC-relevant entities, such as WMO GPCs, NMSs in the area of mandate, neighbouring WMO RCCs etc.

3.1.2 User feedback mechanisms

Appropriate user feedback mechanisms are key for an efficient uptake and use of RCC products and services. WMO RCCs are strongly encouraged to implement related mechanisms, such as feedback Email boxes, Web-based user feedback forms, meetings, questionnaires, etc.

3.1.3 Technical documentation including service messages

A WMO RCC shall make available to its users an appropriate set of technical documentation providing information of methodologies used, product characteristics and means of accessibility for all RCC products

and services offered. If needed, service messages should be release to inform users of relevant changes in, including updates of, the RCC services and product suite.

3.1.4 Reporting

WMO RCCs shall provide annual operations reports using –in principle- the following format:

1. Introduction
[optional]
    1.1 Reporting period
    [period for which the report is valid]
    1.2 Reference documents
    [list of reference documents]
    1.3 Major achievements
    [short summary of important developments and activities]
2. Availability and completeness of RCC services and products
[committed range and schedule of services and products versus effectively provided services and products]
3. Main operations anomalies and response measures
[service disruptions incl. causes and response measures]
4. Interaction with users, user feedback
[means of user interaction, analysis of user feedback and response measures]
5. Training activities
[List of training activities]
6. Future updates and plans
[short sketch of planned activities]

The annual RCC reports shall cover one calendar year and shall be provided by the end of February of the following year to P/RA with copy to P/CCl, P/CBS and SG/WMO.

3.2 Communication aspects

WMO RCCs should maintain a lively flow of information with all NMSs within their area of mandate as well as with other WMO RCCs within a Regional Association.

3.3 Requirements reviews

It is strongly recommended that WMO RCCs perform a requirements survey amongst the NMSs within their area of mandate every 5 years. These surveys should not be restricted to mandatory functions only, but should also address highly-recommended functions as well as climate-related services beyond currently defined RCC functions. The outcome of the surveys will help WMO RCCs to gradually expand their service suite to continuously meet NMSs requirements in a fast developing environment.

3.4 Dysfunction of WMO RCC services and derecognition of WMO RCC status

In case a WMO RCC can not fulfil its mandatory functions for a short period (service interruption less than 6 months), it shall report to P/RA with a clear indication on the process and timing to re-establish its full service suite. In case a WMO RCC can not fulfil its mandatory functions for a period longer than 6 months, P/RA in consultation with P/CCl, P/CBS and SG/WMO might propose its derecognition as WMO RCC. Such a step would require related resolutions of the RA(s) concerned as well as CBS and a final decision by EC/Cg.

List of abbreviations

CBS	WMOs Technical Commission for Basic Systems
CCl	WMOs Technical Commission for Climatology
CLPA	WMO Secretariat's Climate Prediction and Applications Branch
CLW	WMO Secretariat's Department on Climate Water
CSIS	Climate services Information System of the GFCS
DCPC	Data Collection and Production Centres (WIS component)
DPFS	WMO's Data Processing and Forecasting System Division
GCOS	Global Climate Observing System
GDPFS	WMO's Global Data Processing and Forecasting System
GFCS	Global Framework for Climate Services
GPC	Global Producing Centres for Long-range Forecasts
GSCU	Global Seasonal Climate Update
GTS	WMO's Global Telecommunication System (predecessor of WIS)
LC-LRFMME	WMO Lead Centre for Long-range Forecast Multi-Model Ensembles
LC-SVSLRF	WMO Lead Centre for Standard Verification System for Long-range Forecasts
LRF	Long-range Forecasts (1 month up to two years)
NMHS	National Meteorological and Hydrological Services
NMS	National Meteorological Service
P	President (of a WMO Regional Association/ a WMO Technical Commission)
QA/QC	Quality Assurance/Quality Control
RA	WMO's Regional Associations
RCC	Regional Climate Centres
RCOF	Regional Climate Outlook Forum
ROC	Receiver Operating Characteristic (analysis tool)
RSMC	WMO's Regional Specialised Meteorological Centres
SG	(WMO) Secretary-General
SST	Sea Surface Temperature
SVS LRF	Standard Verification Scheme of Long-range Forecasts
WCAS	World Climate Applications and Services Programme including CLIPS project
WCC-3	World Climate Conference-3
WCRP-CMIP	World Climate Research Programme – Coupled Model Intercomparison Project
WDS	WMO's Weather and Disaster Risk Reduction Services Department
WIS	WMO Information System (successor of GTS)

References

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- Report of the Meeting of the CBS Expert Team on Extended and Long-range Forecasting (Infrastructure and Verification) (April 2008)
- Report of the RA VI Working Group on Climate-related Matters (Bucharest, Romania, November 2008)
- Abridged Final Report with Resolutions of the Fourteenth Session of the WMO Commission for Basic Systems, (Dubrovnik, Croatia, March/April 2009)
- Abridged Final Report with Resolutions of the Sixty-first Meeting of the WMO Executive Council (in print), (Geneva, June 2009)
- Abridged Final Report with Resolutions of the Fifteenth Session of the WMO Commission for Climatology, (Antalya, Turkey, February 2010)
- Abridged Final Report with Resolutions of the Sixteenth World Meteorological Congress (May 2011)
- How to establish and run a WMO Regional Climate Centre (RCC), WCASP-80, WMO/TD-1534

ANNEXES

Annexes

A Background on development of the concept of, and mechanisms to, designate WMO RCCs
B Survey of Members on NMHSs' regional needs for and capacity to deliver RCC services
C Attachments 1 & 2 to the 'Proposed RCC Portrait' (cf. section 2.2.2)

Background on development of the concept of, and mechanisms to, designate WMO RCCs

The Intercommission Task Team on Regional Climate Centres

WMO has formally sought to define and establish RCCs since the thirteenth World Meteorological Congress (Cg-XIII, May 1999). During Cg-XIII, 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 of Regional Climate Centres (RCCs). An 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 (CCl), Agricultural Meteorology (CAgM) and Basic Systems (CBS) and several other members including regional representatives. The second iteration of the ICTT included representatives as well from the Commission for Atmospheric Sciences (CAS) and the Commission for Hydrology (CHy). The results of their efforts were documented in WCASP No. 52, May 2001, and WCASP No. 54, March 2002 and presented at WMO EC sessions and at the Fourteenth World Meteorological Congress in May 2003. These sessions noted that RCC responsibilities should not duplicate or replace those of NMHSs; that establishment of RCCs should follow the steps set up for designation of Regional Specialized Meteorological Centres (RSMCs); and that the procedures for designation of RCCs needed to be defined. The range of Regional Climate Centre Functions developed by the ICTT-RCC was published in WCASP No. 52.

2003 Guidelines

A meeting on the organization and implementation of RCCs (Geneva, 27-28 November 2003), developed Guidelines for the Establishment of RCCs. These Guidelines (published in WCASP No.62) covered, amongst other things, determination of requirements for an RCC; possible structures, the designation procedure as per the CBS Manual on the Global Data Processing and Forecasting System (Vol. I, Global Aspects), and establishment of centres by regional associations without formal WMO designation. The Guidance recognized that the requirements of NMHSs for RCC functions may vary from region to region, and that RCC functions for a region may be undertaken within a single centre, or may be distributed amongst various centres, or nodes, in a Regional Climate Centre Network.

Advent of Global Producing Centres of Long-range Forecasts

In May 2007, the fifteenth World Meteorological Congress (Cg-XV) approved the establishment of nine Global Producing Centres (GPCs) along with the definitions of GPCs, description of their roles and a minimum set of products, for amendment to the Manual on the Global Data Processing and Forecasting System (GDPFS) (Vol. I). Cg-XV requested that the global LRF products be made available to as many RCCs and NMCs as possible for purpose of enabling them to perform their tasks, and further requested that CBS and CCl collaborate to develop the minimum set of functions and services required of RCCs, in order to support their official designation and inclusion in the Manual on the GDPFS (Vol. I). Cg-XV noted that ongoing coordination would be required to ensure that operational products from the GPCs meet the requirements for seasonal forecasting services provided by RCCs and NMHSs, and that RCCs would need assistance for training users, and requested that GPCs identify and provide suitable experts for interpretation and use of GPC LRF products, verification techniques (e.g. local verification of RCC-generated products) and applications.

Given the anticipated improvements in skill of LRF by using a multi-model ensembles (MME) approach, Congress XV agreed that some GPCs of LRF could serve as collectors of global LRF data to build MMEs, and requested standards for MME products be developed. Congress noted that ECMWF was already disseminating MME products based on Met Office, Météo-France and ECMWF LRF model output (EURO

SIP) and that GPC Seoul and GPC Washington have agreed to explore the use of MME for LRF with a view to implement a joint Lead Centre for LRF MME.

Commission for Climatology Implementation Coordination Team

The Commission for Climatology Implementation Coordination Team (CCl ICT) met 9-11 October 2007 in Geneva, Switzerland, with representation from the six regional Working Groups on climate-related matters and of the WMO World Weather Watch and the CBS. This group agreed on definitions of RCCs and RCC-Networks, and also agreed that the terms RCC and RCC-network would be exclusively used for centres designated by WMO under the Manual on the Global Data Processing and Forecasting System (Vol. I, Global Aspects) (the 'GDPFS Manual'). Roles and responsibilities of RCCs and RCC-Networks were identified in two categories: mandatory functions that would be common to all designated RCCs or RCC-Networks, and highly desirable functions. It was decided that RCCs and RCC-Networks will be considered, in the GDPFS Manual, as a type of Regional Specialized Meteorological Centre (RSMC), and will be 'centres in a cooperative effort', a concept already defined in the GDPFS Manual. These decisions underpin the concept that RCCs and RCC-Networks will be centres of excellence, with uniformity of service around the globe in their mandatory functions. The CCl ICT established a technical expert group, with CCl and CBS representation, to address and resolve remaining issues, and to develop the amendments required for the GDPFS Manual to support formal WMO designation of RCCs or RCC-Networks, and established a workplan for this activity.

In discussion it was noted that user requirements are prone to frequent changes, so these should not be specified in the Manual on the GDPFS. It was also noted that a standardized verification system (SVS) for long-range forecast (LRF) was already part of the GDPFS Manual (December 2007 version, attachment II.8, including the role of the SVSLRF Lead Centre). It was agreed that performance should be monitored and evaluated accordingly, and that regular assessments of the users of the products should be made. This will be conducted as part of performance measurement and evaluation of the diverse aspects of the overall WMO Operating Plan. Because tools and methods for socio-economic evaluation of products and services are in development stage, it was agreed that reference to socio-economic value of RCCs would be made only under Research and Development, in 'Highly recommended' RCC functions.

CCl/CBS Intercommission Technical Meeting on Designation of Regional Climate Centres (January 2008)

The CCl-CBS Intercommission Technical Meeting on Designation of Regional Climate Centres (RCCs) was held in Geneva, Switzerland, at WMO headquarters, on 21-22 January 2008. The WMO Information System (WIS), including information on designation of Data Collection or Production Centres **(**DCPCs), was discussed and it was noted that in the WIS concept, RCCs would act as data centres for climate activities within each WMO region, and that RCCs would therefore be considered as DCPCs under WIS. It was noted that WIS is being designed to respect WMO's data policies, and that users will know what information is available, but WIS will not give access to that information. The custodians of the data will retain full command over access, and their data security. It was further noted that, while it is not yet possible to identify exactly what an RCC or RCC-Network node will have to do to become recognized as a WIS DCPC (this is a work in progress), all candidate RCCs and RCC-networks must be aware that WIS compliance will eventually be required. It was agreed that working towards WIS compliance and DCPC designation would be listed as a 'highly recommended' function for RCCs and RCC-Networks in the category of 'non-operational data services'.

The participants reviewed and revised the first draft set of amendments developed by the ICT on October 2003, and endorsed the work plan and its deadlines, recognising the importance of adherence to the timeframe identified in order to support the wishes of the Members to have the first RCCs designated at EC-LXI in 2009. In addition, the expert group reviewed the recommended steps for establishment of an RCC in the earlier (2003) Guidelines, and revised the recommendations, to be consistent with the current

concepts developed for the Manual on the GDPFS. The recommended steps are presented in section 4 of this Guidance document.

Meeting of the CBS Expert Team on Extended and Long-range Forecasting (Infrastructure and Verification) (April 2008)

In accordance with the work plan developed by the CCl ICT (October 2007), the CBS Expert Team on Extended and Long-range Forecasting met in Beijing, China, from 7-10 April, 2008. The ET reviewed the proposed amendment to the Manual on the GDPFS, and proposed one change, to include the possibility that RCCs will obtain some of the global LRF products from Lead Centres for LRFMME (in development), in addition to GPCs. With that suggestion made, the ET approved the content of the amendment.

The ET, in addition, was informed of current status and planned activities of several centres considering recognition as future RCCs, namely the Beijing Climate Centre, the Tokyo Climate Centre, the North Eurasia Regional Climate Centre, and the India National Climate Centre, Pune.

CBS XIV and EC LXI (March/April and June 2009)

CBS, and subsequently EC, confirmed the proposed amendment to the Manual on the GDPFS and designated Beijing Climate Centre and Tokyo Climate Centre as WMO RCCs.

CCl-XV (February 2010)

CCl adopted a resolution on the 'Establishment and Operation of Regional Climate Centres Worldwide'

CBS-Ext. (10) and 16th Cg (November 2010 and May/June 2011)

CBS, and subsequently Cg approved the amendment to the manual on the GDPFS on cross-regional RCCs (e.g. for Polar Regions).

SURVEY OF MEMBERS
ON NMHSs' REGIONAL NEEDS FOR AND CAPACITY TO DELIVER RCC SERVICES

-> Note: Questionnaire can be adapted to better reflect regional characteristics! <-

PART A: Functions that will be **mandatory** for WMO designation as RCC or RCC-Network

	Is your NMHS able to perform this activity to fulfil national needs? (Yes/No)	***Is your NMHS able to perform this activity on behalf of the Region? (Yes/No)***	***Do you require this activity to be performed by n RCC? (Yes/No)***	***Is your NMHS using regional or global climate information from international institutions (Yes/No)***
Operational Activities for LRF:				
Interpret and assess relevant LRF products from Global Producing Centres (GPCs), distribute relevant information to RCC Users; and provide feedback to GPCs				
Generate regional and sub-regional tailored products, relevant to RCC User needs, including seasonal outlooks etc.				
Generate consensus* statement on regional or sub-regional forecasts				
Perform verification of RCC quantitative LRF products, including the exchange of basic forecasts and hindcast data				
Provide on-line access to RCC products/services to RCC Users				
Assess use of RCC products and services through feedback from RCC Users				
Operational Activities for Climate Monitoring				
Perform climate diagnostics including analysis of climate variability and extremes, at regional and sub-regional scales				
Establish an historical reference climatology for the region and/or sub-regions				
Implement a Regional Climate Watch				
Operational Data Services, to support operational LRF and climate monitoring				
Develop quality controlled regional climate datasets, gridded where applicable				
Provide climate database and archiving services, at the request of NMHSs				
Training in the use of operational RCC products and services				
Provide information on methodologies and product specifications for mandatory RCC products, and provide guidance on their use				
Coordinate training for RCC Users in interpretation and use of mandatory RCC products				

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, and also mandate of the organization.**

PART B: **Highly recommended** functions of RCCs and RCC-Networks

	Is your NMHS able to perform this activity to fulfil national needs? (Yes/No)	***Is your NMHS able to perform this activity on behalf of the Region? (Yes/No)***	***Do you require this activity to be performed by an RCC? (Yes/No)***	***Prioritize the activity as HIGH, MEDIUM or LOW***
Climate Prediction and Climate Projection				
Assist RCC Users in the access and use of WCRP-CMIP climate model simulations				
Perform downscaling of climate change scenarios				
Provide information to RCC Users for use in development of climate adaptation strategies				
Generate, along with warnings of caution on accuracy, seasonal forecasts for specific parameters where relevant, such as: onset, intensity and cessation of rainy season; tropical cyclone frequency and intensity				
Perform verification on consensus statements for forecasts;				
Perform assessment of other GPC products such as SSTs, winds, etc				
Non-operational data services				
Keep abreast of activities and documentation related to WMO WIS, and work towards WIS compliance and DCPC designation;				
Assist NMHSs in the rescue of climate data from outmoded storage media;				
Assist NMHSs to develop and maintain historical climate datasets;				
Assist RCC Users in the development and maintenance of software modules for standard applications;				
Advise RCC Users on data quality management;				
Conduct data homogenization, and advise RCC Users on homogeneity assessment and development and use of homogeneous data sets;				
Develop and manage databases, and generate indices, of climate extremes;				
Perform Quality Assurance/Quality Control on national datasets, on request of an NMHS;				
Provide expertise on interpolation techniques;				
Facilitate data/metadata exchange amongst NMHSs, including on-line access, through an agreed regional mechanism;				
Perform Quality Assurance, Quality Control on regional datasets				
Coordination Functions				
Strengthen collaboration between NMHSs on related observing, communication and computing networks including data collection and exchange;				
Develop systems to facilitate harmonisation and assistance in the use of LRF products and other climate services;				

Assist NMHSs in user liaison, including the organisation of climate and of multidisciplinary workshops and other forums on user needs;				
Assist NMHSs in the development of a media and public awareness strategy on climate service				
Training and Capacity building				
Assist NMHSs in the training of users on the application and on implications of LRF products on users;				
Assist in the introduction of appropriate decision models for end-users, especially as related to probability forecasts;				
Promote technical capacity building on NMHS level (e.g. acquisition of hardware, software, etc.), as required for implementation of climate services.				
Assist in professional capacity building (training) of climate experts for generating user-targeted products				
Research and Development				
Develop a climate Research and Development agenda and coordinate it with other relevant RCCs;				
Promote studies of regional climate variability and change, predictability and impact in the Region;				
Develop consensus practices to handle divergent climate information for the Region				
Develop and validate regional models, methods of downscaling and interpretation of global output products;				
Promote the use of proxy climate data in long-term analyses of climate variability and change;				
Promote 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, and also mandate of the organization.**

Attachment 1

1. Mandatory functions: Detailed product overview

Note: The first column of the tables below summarise the specific mandatory products as defined in the Manual on the GDPFS (full specification see http://www.wmo.int/pages/prog/wcp/wcasp/documents/RCC_Mandatory_Functions_Criteria.pdf).

1.1 Operational products for long-range forecasting

Product required	**Specific RCC product/service offered**	**Elements addressed (e.g. Temperature, Precipitation, etc.)**	**Area covered and Update frequency**	**Accessibility (e.g. URL)**	**Remark**
Assessment of reliability and outcomes of GPC or LC-LRFMME products incl. its reasoning for the area of interest (temperature and total precipitation)					
Regional long-range forecasts: Probabilities for tercile (or appropriate quantile) categories (temperature and total precipitation)					
Consensus statements on regional forecasts (temperature and total precipitation)					
Verification datasets (temperature and total precipitation)					
Online data/information portal					
Analysis of user feedback					

1.2 Operational products for climate monitoring

Product required	Specific RCC product/service offered	Elements addressed (e.g. Temperature, Precipitation, etc.)	Area covered and Update frequency	Accessibility (e.g. URL)	Remark
Climate diagnostics bulletin (Mean, Max and Min temperatures, total precipitation, other elements) Database of climatological means for various reference periods Climate Watch advisories					

1.3 Operational data services, to support operational LRF and climate monitoring

Product required	Specific RCC product/service offered	Elements addressed (e.g. Temperature, Precipitation, etc.)	Area covered and Update frequency	Accessibility (e.g. URL)	Remark
Regional quality-controlled climate data sets (daily values; Mean, Max and Min temperatures, total precipitation at least) National databases with metadata at NMHS request					

1.4 Training in the use of operational RCC products and services

Product required	Specific RCC product/service offered	Elements addressed (e.g. Temperature, Precipitation, etc.)	Area covered and Update frequency	Accessibility (e.g. URL)	Remark
Manuals, guidance documents, information notes on methodologies, product specifications and application of RCC products Co-ordination of training: Survey and analyses of training needs and proposal for training activities					

2. Highly-recommended functions: General product overview

[Please list relevant services and provide a product example/the respective URL for product access]

Domain: Climate Prediction and Climate Projection (beyond 2 years timeframe)	Specific RCC product/service offered
Assist RCC Users in the access and use of WCRP-CMIP climate model simulations	
Perform downscaling of climate change scenarios	
Provide information to RCC Users for use in development of climate adaptation strategies	
Generate, along with warnings of caution on accuracy, seasonal forecasts for specific parameters where relevant, such as: onset, intensity and cessation of rainy season; tropical cyclone frequency and intensity	
Perform verification on consensus statements for forecasts	
Perform assessment of other GPC products such as SSTs, winds, etc.	

Domain: Non-operational data services	Specific RCC product/service offered
Keep abreast of activities and documentation related to WMO WIS, and work towards WIS compliance and DCPC designation	
Assist NMHSs in the rescue of climate data from outmoded storage media	
Assist NMHSs to develop and maintain historical climate datasets	
Assist RCC Users in the development and maintenance of software modules for standard applications	
Advise RCC Users on data quality management	
Conduct data homogenization, and advise RCC users on homogeneity assessment and development and use of homogeneous data sets	
Develop and manage databases, and generate indices, of climate extremes	
Perform Quality Assurance/Quality Control on national datasets, on request of an NMHS	
Provide expertise on interpolation techniques	
Facilitate data/metadata exchange amongst NMHSs, including on-line access, through an agreed regional mechanism	
Perform Quality Assurance/Quality Control on regional datasets	

Domain: Coordination Functions	Specific RCC product/service offered
Strengthen collaboration between NMHSs on related observing, communication and computing networks including data collection and exchange Develop systems to facilitate harmonisation and assistance in the use of LRF products and other climate services Assist NMHSs in user liaison, including the organisation of climate and of multidisciplinary workshops and other forums on user needs Assist NMHSs in the development of a media and public awareness strategy on climate services.	

Domain: Training and Capacity building	Specific RCC product/service offered
Assist NMHSs in the training of users on the application and on implications of LRF products on users Assist in the introduction of appropriate decision models for end-users, especially as related to probability forecasts Promote technical capacity building on NMHS level (e.g. acquisition of hardware, software, etc.), as required for implementation of climate services Assist in professional capacity building (training) of climate experts for generating user-targeted products.	

Domain: Research and Development	Specific RCC product/service offered
Develop a climate Research and Development agenda and coordinate it with other relevant RCCs Promote studies of regional climate variability and change, predictability and impact in the Region Develop consensus practices to handle divergent climate information for the Region Develop and validate regional models, methods of downscaling and interpretation of global output products Promote the use of proxy climate data in long-term analyses of climate variability and change Promote application research, and assist in the specification and development of sector specific products Promote studies of the economic value of climate information	

3. Short product/service description

Note: Please indicate for each mandatory product/service –as offered in 1.1 to 1.4 above- the methodology used, spatial and temporal product resolutions, information on quality indicators and validation as well as references

3.1 Operational products for long-range forecasting

RCC product/service offered	Product specification
…	**Methodology:** **Spatial resolution:** **Temporal resolution:** **Quality indicators/validation:** **References:**
…	…

3.2 Operational products for climate monitoring

RCC product/service offered	Product specification
…	**Methodology:** **Spatial resolution:** **Temporal resolution:** **Quality indicators/validation:** **References:**
…	…

3.3 Operational data services, to support operational LRF and climate monitoring

RCC product/service offered	Product specification
…	**Methodology:** **Spatial resolution:** **Temporal resolution:** **Quality indicators/validation:** **References:**
…	…

3.4 Training in the use of operational RCC products and services

RCC product/service offered	Product specification
…	**Methodology:** **Spatial resolution:** **Temporal resolution:** **Quality indicators/validation:** **References:**
…	…

Attachment 2

RCC-Network Nodes and Focal Points

Note: If appropriate, a RCC-Network organisation chart is welcomed!

1. RCC-Network Node …

Institution	Domain of activity	Focal Point
[full address]	*[activity domain (mandatory functions: LRF, climate monitoring, data, training; highly-recommended functions: climate prediction and projection, non-operational data services, coordination functions, training and capacity building, Research and Development)]*	*[full contact details]*

2. RCC-Network Node …

Institution	Domain of activity	Focal Point
[full address]	*[activity domain (mandatory functions: LRF, climate monitoring, data, training; highly-recommended functions: climate prediction and projection, non-operational data services, coordination functions, training and capacity building, Research and Development)]*	*[full contact details]*

3. RCC-Network Node …

…

Short description of interfaces amongst RCC Nodes including communication and overall network coordination

[Please indicate operational Node interactions (to ensure consistent RCC services of the entire RCC-Network) and provide information on related communication measures including for the overall RCC-Network co-ordination. In addition, please indicate any existing written agreement amongst the anticipated Nodes of the RCC-network, such as Memorandum of Understanding etc.]