WORLD METEOROLOGICAL ORGANIZATION	CBS ET/ILRF/Doc. 6
COMMISSION FOR BASIC SYSTEMS	(I.XI.2001)
EXPERT TEAM MEETING ON INFRASTRUCTURE FOR LONG-RANGE FORECASTING	ITEM: 6
GENEVA, SWITZERLAND, 12-16 NOVEMBER 2001	ENGLISH ONLY

RECOMMENDATIONS FOR FUTURE CONSIDERATION

(Submitted by the Secretariat)

Summary and purpose of document

This document contains proposals on the infrastructure for the generation of long-range forecast products.

Action proposed

The Team is invited to make its recommendations taking into account the proposals submitted in this document.

INFRASTRUCTURE FOR THE GENERATION OF LONG-RANGE FORECAST PRODUCTS

1. Introduction

The meeting should take into account the deliberations of Cg-XIII, EC-LI and ECLIII on related matters as well as the conclusions the Inter Commission Task Team on Regional Climate Centres. It may then consider and propose to meet the confirmed identified needs for a WMO infrastructure for the generation of long-range forecast (LRF) products as elaborated below.

2. Emerging user requirements

Requirements for Long Range Forecast products have been known for a long time. End users have conveyed their requirements for LRF products in a general way to the meteorological community. The economical and societal impacts of such information are huge. Unfortunately, the scientific understanding of all processes involved is still quite limited and the skill associated with these Long Range Forecasts products is low. This provides for the development of unsatisfactory situation with end-users in the absence of a proper framework to deliver scientifically sound, properly formulated and useful information for decision-makers.

Many of the products are broad-scale if not global in coverage leading to overlapping in available predictions. As the skill in many regions is low the forecasts often vary considerably in their predictions. The products are often made available with no quality assessment or record of past performance of the technique, making it difficult for NMHSs and end-users to assign a level of confidence to the product. The end-result is confusion and uncertainty about the information being offered.

The general availability of long-range forecasting products has sometimes placed National Meteorological Services, who have the ultimate national responsibility for issuing forecasts, in an awkward position, and has led to the feeling that their national responsibility is being infringed. They have been caught unaware by comments in the media relating to their area of responsibility. They may not have the skills to comment on these predictions or to co-ordinate comment through the media.

Given the issues noted above, there is a need for co-ordination of the provision of long-range forecasts. However, the particular characteristics of long-range forecasting need to be recognized. In particular, there are many contributors outside the traditional NMHS framework. The valuable contribution of these organisations is recognised and needs to be included in any proposed co-ordination framework.

A. Any co-ordination framework needs at a minimum to:

- Provide a structure that will facilitate the preparation of authoritative and credible forecasts;
- Provide an opportunity for all organisations with a demonstrated capacity in the provision of long-range forecasting products to contribute their expertise;
- Recognise the particular peculiarities of long-range prediction products and their mode of delivery;
- Ensure and strengthen the role of NMHSs in the provision of long-range forecasts;
- Provide users with a credible forecast backed by appropriate performance statistics.

B. The strategy for action

It is recommended that a three level functional structure be used as a basis as follows:

- WWW/WMCs/RSMCs/NMCs and other institutions with demonstrated capability in long-range global forecasting, provide global and/or broad-scale regional products (Level 1);
- Establishing and designating RCCs and / or mechanisms to interpret global and /or broad scale regional products and develop and deliver a consensus forecast and related services to NMHSs and other users (Level 2);
- NMHSs having ultimate national responsibility for preparation and delivery of national forecasts and related services (Level 3);

It should be noted that some centres might functionally be co-located.

C. *Implementation Considerations at each Level*

<u>Level 1 implementation</u>

At Level 1, the three level structures should include proposals on the enhancement of current WWW/WMCs/RSMC/NMC functions for generation of long-range forecast. It should also include formal acceptance of the status of long range products of other institutions with demonstrated capability for generation of global and /or regional broad scale products.

Level 3 implementation

At Level 3, it is clear that the organisational structure should rely on NMHSs to play a central role in the flow of information and in the dissemination of monitoring and prediction products, and to provide the technical and scientific support to their user communities. Capacity building in this area should strengthen the role of the NMHSs in the area of delivery of forecasts and related services

Level 2 implementation

At Level 2, the more specific requirements at the sub-regional level still need clarification. Furthermore it is quite clear that at Level 2 more flexibility is needed to allow adjustment to regional circumstances. For instance, there may not be a need for Level 2 in some sub-regions while in others a Level 2 structure may only be a short lived interim measure, or may in fact become a structure that needs to be institutionalised. The need for this intermediate level will depend on factors such as:

- The presence of several countries within broadly homogeneous climate areas
- National capabilities for interpretation and co-ordination of the broad-scale guidance
- The state of the science and the level of skill in LRF.

A wide range of mechanisms or entities could fulfil this role. The RAs with the support of WCP/CLIPS should take a strong role in defining the Level 2 structure. The designation of Regional Climate Centres (RCCs) and other related mechanisms will fulfil this role. In some regions similar entities and/or mechanisms already exist.

Co-ordination mechanism between the WWW/generation centres other institutions and designated RCCs and user NMHSs will be essential. Co-ordination within CBS/WWW focus on large-scale products generation and verification on the basis of stated requirements and ability to meet the requirements and confidence in the verifiable forecast skill of the product generating systems and should be continued as such. On the other hand the functions of designated RCCs under CCl/WCP in providing statements of requirements for large scale long-range forecast products, interpretations and delivery of consensus forecast to NMHS and other users equally needs a co-ordination mechanism. The RCC and the WCP/CLIPS programme provide such co-ordination mechanisms. There is still a need for overall co-ordination as currently provided by the ICTT.

D. Additional Overall Considerations

The organisational structure should allow particular attention to be paid to the end users, particularly at Level 2 and 3 with feedback provided to Level 1.

The organisational structure should facilitate the acquisition and exchange of data and products required by all involved interested parties.

The organisational structure should be flexible enough to accommodate a foreseen rapid scientific evolution of the long-range forecast field.

The organisational structure should build on current overall WMO Constituent Bodies and Programs and allow other co-operating agencies (e.g. ICSU, FAO, WHO, UNEP, UNDP, etc.) to contribute to and/or benefit from its operations and development.

In fact, many of the major Centres (for example, Washington/NCEP, Montréal/CMC, Reading/ECMWF, JMA etc.) are already producing operationally Long Range Forecast products. Others have not yet operationalised their Long Range Forecasting activities and are still performing them in a more quasi-operational or research mode. In some countries, organisations other than the NMHS might have even been given the mandate to produce Long Range Forecasts. For the benefit of most WMO Members, an organisational functional structure using capabilities of the WWW Systems and other institutions as generating centres and designation of RCCs supporting NMHSs who have ultimate natal responsibility for delivery of national forecasts and related services will represent an improvement over the current operational WMO framework for LRF activities.

E. The Proposal

The team should take into account the conclusions of the EC-LIII quoted below for ease of reference. These effectively require assuring freedom of participation in providing operational seasonal to interannual forecasts by any WWW Centre or other institutions with capability to fulfil the stated requirements. Consequently it should recommend that there was no requirement for specific designation of specific activity specialization centres for provision of long-range forecasts including seasonal to interannual forecasts.

> **"The Executive Council noted that commitments to providing operational Seasonal to Interannual Forecasts would need to be sought from producing centres**. In a first developmental stage the Council agreed that a limited number of forecast producers with global capabilities be approached, including both numerical and empirical producers. The Council noted that the ICTT proposed the following centres be approached in the first instance: BoM, Australia; CPTEC, Brazil; MSC, Canada; MF, France; JMA, Japan; SAWB, South Africa; MO, UK; CPC, USA; ECMWF; IRI, USA. The Council was pleased to note that the Max Planck Institute for Meteorology in Germany has agreed to serve as a producing centre. **Recognizing that Seasonal to Interannual Forecast capabilities exist in a substantial and growing number of centres, the Council strongly recommended that neither the initial limited list of producers, nor any subsequent expanded list, be exclusive of any organizations that wished to participate provided that they could fulfil the stated requirements**."

The team should solicit and obtain indication of the views of experts of participating centres listed above as to their current commitments to providing operational seasonal to Interannual forecasts and advise on a formal process of obtaining such commitment. It should be noted that for the WWW centres such a commitment is already explicit in the relevant parts of the Manual on the GDPS.

3. IMPLEMENTATION

3.1 It is recommended:

3.1.1 That initially, the following centres with demonstrated capability for generation of global long-range forecasts:

Australia (RSMC Melbourne),
Brazil (INPE/CPTEC),
Canada (RSMC Montreal),
France (RSMC Toulouse),
Japan (RSMC Tokyo),
South Africa (SAWB) (RSMC Pretoria)
UK (RSMC Bracknell),
USA (NCEP/CPC),
ECMWF,
IRI for Climate Prediction,
and
Max Planck Institute,
Other centres with similar capability.

Are invited to consider making the commitment to produce on a regular basis, verify, exchange with other above mentioned centres, and make available to RCCs and related mechanisms and NMCs the LRF products as specified in ANNEX I.

They would help better define sets of products, proper standards and procedures for generation of long-range Forecasts and their dissemination (see Annex I for procedure for dissemination).

3.1.2 Regional Associations be invited to review the needs for RCCs or mechanisms in their area of responsibility and, if appropriate, to recommend designation of RCCs, determining their functions and deciding who and/or which organisation(s) should be involved in RCC activities in various sub-areas.

3.2 Implementing the ILRF will require the following actions from the CCl, CBS and CAS:

3.2.1 CCl/CLIPS will support RAs in determining the evolving requirements for a Level 2 structure and, if appropriate, in designating RCCs and / or related mechanisms. CCl/CLIPS will facilitate and co-ordinate regional capacity building activities needed for the operation of the RCCs and related mechanism at sub regional and Level 3 national levels. CBS and /or CCl will use the CBS designation procedure for the designation of the RCCs.

3.2.2 CBS/GDPS will facilitate and co-ordinate activities needed for the proper operation of the generation of LRF. CBS/GDPS will maintain in its regulatory manual the description and mode of operation of the ILRF

3.2.3 CCl/CAS(WGNE) will contribute to ensure the scientific integrity of the global regional and national information produced.

ANNEX I

LRF Products Specifications, proposed by the ET on EPS to be made available from global generating centres in support of RCCs and related mechanisms and NMCs in RLF Activities

UPDATE TO THE MANUAL ON GDPS APPENDIX II-6
4. FORECASTS

Extended range forecasts (levels and parameters as appropriate five, 10, 15 or 30 day) and applicable mean values

Long-range forecasts (monthly, three-month or 90-day, seasonal to multi-seasonal outlook

Ensemble prediction system products for extended-range and long-range:

Ensemble Means anomalies/Spread:

One week averages for first month, monthly means thereafter (all anomalies with respect to model climate) for:

- Tropical SST
- Standard ENSO Indices
- Precipitation, Z500, Z1000, T850 and surface temperature

Probabilities:

Terciles: above, below, normal (with respect to model climate) of:

- Precipitation
- Z500
- Z1000
- T850 and surface temperature

Model fields:

- Full set or subset of EPS members variables and levels for requesting WMO Members for specific applications.
- Relevant post processed fields from sequence of daily output (e.g., indices of monsoon onset, droughts, tropical storm activity, extratropical storm track activity)

PROCEDURES FOR MAKING AVAILABLE AND EXCHANGE OF LONG RANGE PRODUCTS

Since most of the products will be EPS based there were also three types of products:

(i) Text and graphical products on Internet;
(ii) Gridded derived products such as probabilities of exceeding various thresholds, ensemble mean and spread;
(iii) Full or sub set of model fields of ensemble members.

In the producer Web site, a catalogue of long range EPS fields and products should be available. Documentation on the long range generation methods and EPS system should be provided: time of availability of products, version number of EPS system, last modifications, perturbation method, etc. Verification scores should also be provided.

For making available full or subset of model fields the Team may consider and agree that GRIB 2 be used for products posted on web sites or disseminated on the GTS as has already been agreed by the ET on EPS that the FM-92 GRIB Edition 2 format shall be used for the official exchange of EPS fields and GPV products. GRIB 2 software should be available for distribution during 2002. The EPS data producer should add an EPS version number with the products (e.g. octets 13,14 in GRIB 2)

WMO should maintain a WEB page with URLs for sources of EPS and long-range information. WMO Secretariat should be informed by product generating centres of web site URLs and any changes in order to maintain the list.

_____