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FOR LONG-RANGE FORECASTING

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PROCEDURES FOR EXCHANGE OF LRF FORECASTS INCLUDING DEFINING PRODUCTS

(Submitted by Mr M. Davey, United Kingdom)

Summary and purpose of document

Comments regarding procedures for exchange of LRF products.

Action proposed

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

Comments regarding procedures for exchange of LRF products

1. Background:

An initial planning meeting on the co-ordination of infrastructure needs for seasonal to interannual climate prediction was held in April 1999. Noted at that meeting (section 3.3 of the final report):

- infrastructure must be flexible, able to respond quickly to change
- infrastructure must address a wide range of products
 - climate monitoring and diagnostic products
 - SI (LRF) forecast and outlook products may be based on objective numerical prediction products (i.e. dynamical ocean and/or atmosphere models), statistical relationships and subjective weighting of various inputs (consensus opinions)
 - oceanography is an important element
 - need to cater for various geo-political settings
- infrastructure needs to accommodate NMHSs, academic research institutions, government institutions

among other relevant documents:

ICTT2001: Intercommission Task Team on Regional Climate Centres Geneva May 2001 (WCASP-No. 52). Note sections 5,6,7; annex 1 - review of user requirements; annex 2 - list of Regional Climate Centre functions

Pretoria99: meeting of CBS implementation co-ordination team on data processing and forecasting systems, Pretoria 1999. Section 6 is on LRF infrastructure

Kimura2000: a survey on the present status of climate forecasting

Reading1999: report by CBS ET on development of a verification system on long-range forecasts, including experimental exchange of scores

2. my perspective for input to the ET meeting

2.1 what is the purpose of LRF exchange?

some possible options:

A. To facilitate regional LRF products

As I understand it, the envisioned process for provision of regionally-specific LRF products is that Regional Climate Centres will have the function of distributing (and in some cases creating) products required for regional applications. This may take place via organisation of seasonal RCOFs and also forecast updates, using LRF input from regional NMSs, possibly the RCC itself, and relevant external LRF providers (some of which will be NMSs and organisations linked to WMO, and some of which will not be linked to WMO).

B. To compare LRF products

LRF products are also likely to be distributed independently of this regional process, as at present. In particular, those centres with the capacity to generate global LRF data also generate and disseminate generic products (e.g. above/below normal and tercile probability maps on the internet). Exchanges of LRF data (in greater detail than that made freely available) would provide the exchange participants with corroborative forecast and skill information that would allow better interpretation of their own forecasts. In the long term such exchanges could also facilitate the implementation of objective forecast combinations.

C. To distribute LRF data

In principle the distribution of LRF data could involve all NMSs, and institutes with LRF capacity (e.g. IRI, ECMWF, MPI). Rather than an exchange of basic LRF data only between producers, this would involve broader distribution to include NMSs that make use of basic LRF data.

2.2 who should be involved in the exchange?

from previous meetings:

Pretoria99 6.11: 3-level proposal by Allard

- level 1 - RSMCs with LRF specialisation global/regional
- level 2 - groups to develop consensus forecasts
- level 3 - NMHSs with responsibility for delivering LRF

ICTT2001 5.2

- level 2 needs further consideration: e.g. inclusion of all LRF organisations (WMO-linked and other) with demonstrated capabilities
- 'demonstrated' is interpreted as providing reliable products of satisfactory quality

For option A above, it seems sensible to set up regional LRF exchanges that involve all those organisations that provide LRF input with demonstrated capability, and the relevant (potential) RCC (i.e. levels 1 and 2). The information exchanged could then be specific to, the regional end-products and thus linked closely with end-user requirements.

For option B above, an exchange of similar products could be set up among the global LRF generators.

- e.g. ICTT 9.5 provides an initial list of centres capable of providing global outputs: NMSs for Australia, Brazil, Canada, France, Japan, South Africa, UK, USA; plus ECMWF, IRI: a subset of level 1.

For option C above, distribution would involve levels 1, 2, and 3.

2.3 present practice: provision of LRF products internationally

(see also Kimura2000)

- the (few) global LRF data providers mainly act independently, with LRF products mainly provided in the form of graphs and accompanying text, distributed via the internet (either openly or with some form of protection - e.g. password access or hidden site) or email.

- information includes (to varying degrees) current forecast, past forecasts, skill assessment, verification, description of forecast and/or forecast process.

- the global data is used (to varying degrees) alongside that provided by regional LRF producers. In particular, consensus forecasts have been produced in the RCOFs, which probably currently represent the most active level of practical LRF exchange.

- atmospheric information is mainly for surface temperature and rainfall anomalies, oceanic information is mainly for tropical Pacific SST.

- deriving in part from the practice established by the first RCOFs, atmospheric information is often provided in terce categories for seasonal rainfall and temperature anomalies. Tropical Pacific SST information is often provided as area-averaged monthly anomaly timelines. There is little uniformity of format or content however.

- the centres that issue seasonal forecasts are variously experimental, semi-operational and operational in nature. They include centres that are not NMSs.

- current dynamical ensemble-type LRF prediction systems have a relatively small ensemble size (~10) that severely limits pdf resolution. The terce format is consistent with the ensemble size and skill of these current systems.

(see annex for list of current Met Office LRF products)

2.4 what LRF data should be exchanged?

Annex 1 to ICTT2001 provides an extensive list of likely requirements for LRF by centres that provide a service and products to end-users. This list goes beyond present capabilities, but provides a comprehensive starting point for further discussion. A much briefer list has been provide by the CBS ET on EPS.

A low level of exchange already exists, in that some centres distribute basic LRF information (at a relatively low level of content) to NMSs and publically, principally via the internet. This level of information provision is increasing. The benefits of this distribution can be increased by some form of agreement to use common formats and definitions.

some questions arising:

(i) types of products

- there are several different types of LRF products arising from the various (dynamical, statistical, atmospheric, oceanic, probabilistic, deterministic) LRF prediction schemes. Some are gridded fields, some are regional averages, some are indices. Which are most suitable for exchange? It seems easiest to exchange some gridded fields and indices.

(ii) level of detail in products

- expect there will not be exchange of raw data (e.g. individual ensemble members from ensemble prediction systems). But how much detail needs to be provided in order that ensuing products meet user requirements and have substantial practical value?

(iii) graphical vs numerical data fields?

- for the purposes of creating LRF products objectively, some data should be exchanged/distributed in numerical (rather than just graphical) form. The numerical form may also enable receivers to re-package the information in the locally-preferred format (e.g. regional maps)

(iv) level of skill in products?

- it is very difficult to set a minimum skill standard, as the accuracy requirements differ widely between applications

(v) information on past performance

- choice of skill measure? The recommended verification scores for exchange (ROC, RMSSS) are useful in providing an indication of the overall performance of a forecast system, but are they sufficiently specific to be of value when generating e.g. regional products for end-users?

- should representative track records (timeseries of indices) be provided?

- should numerical data be provided (e.g. from retrospective forecast datasets) such that the receiver can calculate own skill measure of specific interest?

(vi) uniformity of products: is a carefully-defined set of basic common LRF data required? If so, then some aspects to be agreed are:

- time-averaging period?

- spatial resolution? interpolated to common grid?

- geographical coverage?

- reference climatology?

- pdf resolution?

- e.g. terciles, defined over what period? category boundaries?

- indication of uncertainty?

- timing of issue of forecasts?

(vii) information about the prediction system and post-processing is required (including information about changes to the system).

2.5 How should the products be exchanged?

- the internet is currently the main dissemination route for LRF products, and would be a convenient basis to develop wider and more detailed exchanges. For some areas without suitable internet connections, email of small datasets is possible.

- not all centres will wish to distribute LRF information openly. Access can be restricted in various ways: e.g. password protection

- data format?

- need to seek input on the requirements of the likely data receivers. Although GRIB or NetCDF are likely to be acceptable by most NMSs for gridded data exchange, this may not suit all participants. For small datasets (e.g. timelines of indices, regionally-averaged forecasts) simple ASCII files (with how-to-read instructions) are generally easy to transmit and read. For regional LRF purposes it may be convenient to define regional subsets of global fields for exchange.

- interactive data access?

- LRF centres could provide internet access with the capability of creating user-specified products (e.g. provide pdf for a specified site/region/quantity along with associated skill information). This goes beyond the present scope for LRF exchange however.

2.6 what should be the terms and conditions for exchange?

- a workable starting point would be the free exchange of mutually-agreed sets of LRF data among (regional, global) groups of participants

- difficult Resolution 40 type issues may arise

ANNEX

Current Met Office LRF products made available to NMSs and/or publicly:

see <http://www.metoffice.com/research/seasonal/> for further details.

Products are available in the form of graphics, text and tables, but not as numerical data.

Further AGCM and CGCM products are planned.

- from AGCM ensemble system:

- T and Pr anomalies and above/below normal probabilities
- gridded maps for months 1-3, 2-4 ahead
 - global, and regional subsections
 - 2.5 x 3.75 lat-lon grid (the AGCM spatial resolution)
- with and without skill mask (based on ROC skill measure)
- updated weekly
- available to NMSs on the internet via a password-protected site

- from statistics and AGCM systems:

- regional Pr for Africa (west, east, south), north Brazil
 - for select rainy seasons
- deterministic and probabilistic (quint categories)
- regional-average and gridded
- subjectively combined best estimate summary
- distributed by email to regional NMSs and institutes

- from statistical systems:

- T and Pr tercile probabilities for Europe
 - July-August season only
 - gridded
 - freely and openly available on internet
 - NAO index
 - winter only
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