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PROCEDURES FOR EXCHANGE OF LRF FORECASTS INCLUDING DEFINING PRODUCTS

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Summary and purpose of document

This document contains proposals for the output of a dynamical model and information on the LRF operational model of the Japan Meteorological Agency (JMA).

Action proposed

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

Appendix:

(1) Atmospheric model for long-range forecasts at the Japan Meteorological Agency (JMA).

Several Proposals for the Output of a Dynamical Model

1. Signal out of the model output

Since a skill of a forecast of the field such as 500hPa height and 850 hPa temperature by a dynamical model is not always high enough for the seasonal forecast, a technique to derive a signal from model output is necessary.

The coefficients of Rotated Empirical Orthogonal Function (REOF) mode might contain useful signal. Kusunoki et al. (2001) shows that the coefficients of a couple of modes are predicted well in the SMIP experiment with observed SST. Since several modes of REOF are similar to the well-known tele-connection patterns such as PNA(Pacific/North American), WP(Western Pacific) and NAO(North Atlantic Oscillation), forecasters could squeeze some signal out of the model output. SST over the El Nino region also has a skill in our coupled ocean-atmosphere model. Since a useful index is different from one region to another, standardization is not necessary. Note that the guidance for a particular NHMS can be calculated either at each NHMS or the center that operates an ensemble prediction system.

2. Elements to be exchanged

Although verification is to be exchanged with forecast, a few other elements might be necessary to be exchanged:

1. *Threshold value for the above/near/below normal (Canada has already shown it on the geographical map at its Web site);*

2. *SST used as a lower boundary condition for the atmospheric model;*

3. *Value used to calibrate the model output.*

References:

Kusunoki, S., M. Sugi, A. Kitoh, C. Kobayashi and K. Takano, 2001: Atmospheric Seasonal Predictability Experiments by the JMA GCM, J. Meteorol. Soc., Japan, 79, in press.

Appendix

Atmospheric model for long range forecast at Japan Meteorological Agency

Operational one-month dynamical ensemble forecast

A dynamical ensemble forecast for one-month forecast has been operationally conducted since March 1996 at JMA. The concept of probabilistic forecast was introduced to the long-range forecast at the same time. The numerical prediction model used for the ensemble prediction is a T106 version of the Global Spectral Model (GSM0103, T213) used for a short range forecast. The specifications of the model are shown in Table 1. For the lower boundary condition to the model, SST anomalies are fixed during the 34-day time integration. Soil moisture and snow depth are predicted by the model, although their initial states are taken from climatological values.

Table 1: The specification of GSM for one-month forecast

Horizontal Resolution	*T106 (about 1.125-degree Gaussian grid)*
Vertical levels	*40 levels (0.4 hPa model top)*
Cumulus Parameterization	*Prognostic Arakawa-Schubert scheme*
Land surface process	*Simple Biosphere Model*
Time integration range	*34 days*
Executing frequency	*Twice per week*
Ensemble size	*26 members (13 members x 2 days)*
perturbation method	*Hybrid of Breeding of Growing Mode (BGM) method and Lagged Average Forecast (LAF) method*

An ensemble consists of 26 one-month forecast members. The 26 members are prepared with a combination of a breeding of growing mode (BGM) and lagged average forecast (LAF) method. That is, 13 forecasts are computed from 1200 UTC initial fields on Wednesday and the remaining 13 from 1200 UTC on Thursday.

A model systematic bias was estimated as an average forecast error which was calculated from hindcast experiments for years of 1984 to 1993. The bias is removed from forecast fields, and then grid point values are processed to produce several forecast materials (ensemble mean map, spread map, time sequences figures etc.). Objective guidance products of forecast elements are also derived from the ensemble forecast by the Perfect Prognosis Method (PPM).

Semi-operational seasonal dynamical ensemble forecast

Now JMA is testing the prototype of seasonal prediction system, which consists of an atmospheric model for ensemble runs and a coupled ocean-atmosphere model which provides the atmospheric ensemble forecast with SST prediction. At present the SST anomalies used as the lower boundary

condition of the atmospheric model are provided by the coupled model in the equatorial region and by persistence or climatology in the middle or high latitude regions.

The real time ensemble seasonal prediction (up to 4 - 8 months ahead) is performed every month in semi-operational mode. Dynamical seasonal forecast is planned to be used for operation in March 2002. The specifications of the model as shown in table 2.

Table 2: The specification of GSM for seasonal forecast (4 - 8 month forecast) model

Horizontal resolution	*T63 (about 1.875-degree Gaussian grid)*
Vertical levels	*40 levels (0.4 hPa model top)*
Time integration range	*4 months or 8 months*
Executing frequency	*Once a month (4-month prediction)* *Twice a year (8-month prediction)*
Ensemble size	*30 members*
Perturbation method	*Singular Vector method*

- Physical processes are the same as those of one-month forecast model

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