Recent development at JMA

(Long-range NWP)

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Recent Developments in JMA's Climate Models

The following three models are used in CPD/JMA operationally.

1. One-month forecast / Early warning model
   - AGCM(TL159L60)
   - Ensemble: BGM M50
2. Three-month/Seasonal forecast model
   - AGCM(TL95L40)
   - Ensemble: SV M51
3. El-Nino prediction model
   - CGCM(TL95L40+1deg_L50)
   - Ensemble: LAF M12

Specification of current JMA's climate models

One-month	3-month/Seasonal	El Niño
• TL159: 1.125deg • L60: top=0.1hPa • Ensemble size: **50** • I. Perturbation: **BGM/LAF** • Frequency: **Once a week on Thursday/Friday** • Forecast period: **34 days** • Land: SiB • SST: **Persisted anomaly** **Early Warning** • Forecast period: **17 days** • Frequency: **Once a week on Sunday/Monday**	• TL95: 1.875deg • L40: top=0.4hPa • Ensemble size: **51** • I. Perturbation: **SV** • Frequency: **Once a month** • Forecast period: **120/210 days** • Land: SiB • **SST: Prescribed using persisted anomaly, climatology and ENSO prediction by CGCM**	Atmosphere • TL95: 1.875deg • L40: top=0.4hPa Ocean • 1º (lon) x 1º (lat), (1º (lon) x 0.3º (lat) near equator) 50 vertical levels • Ensemble size: **12** • I. Perturbation: **LAF (5 days interval)** • Frequency: **once a month** • Forecast period: **15 months** • Land: SiB

Developments in One-month forecast / Early warning model

- In March 2008, the one-month forecast model was upgraded (to GSM_V0803C).
- The followings changes were introduced in the model.

1. Enhancement in model vertical resolution

The number of vertical layer (model top) was changed from 40 (0.4hPa) to 60 (0.1hPa). Expression of the boundary layer is improved.

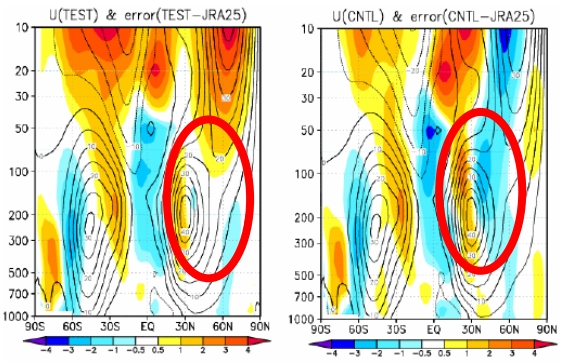
2. Improvement in land-surface initials for the hindcast

Land surface climatological data for the hindcast run were newly produced by JMA's land surface model (JMA-SiB) forced with atmospheric data. Observational snow data were also used as the input data.

3. Modification in gravity-wave drug scheme

Some coefficients which depend on model resolution were tuned properly for the one-month forecast model.

Comparison of the models' systematic errors in zonal mean winds for January

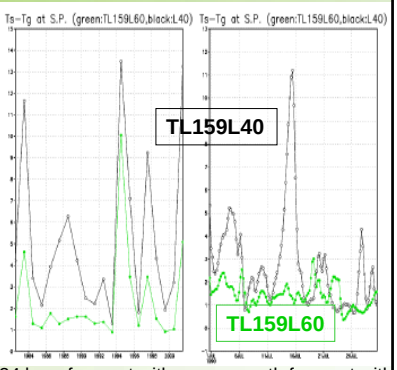


New model (V0803C) Previous model (V0703C)

Contours show model climatology (20-year average, 1982–2001) of five ensemble member hindcast data), and shading indicates model errors (differences from JRA-25 reanalysis). The unit is m/s.

Model errors in zonal mean winds for January are reduced mainly in the northern hemispheric troposphere due to changes in vertical resolution and tuning of gravity-wave drug.

T2m-Tg at the South pole in July.



24 hour forecast with initial of 12UT 30 June for 1982-2001.

one month forecast with initial of 12UT 30 June, 1990.

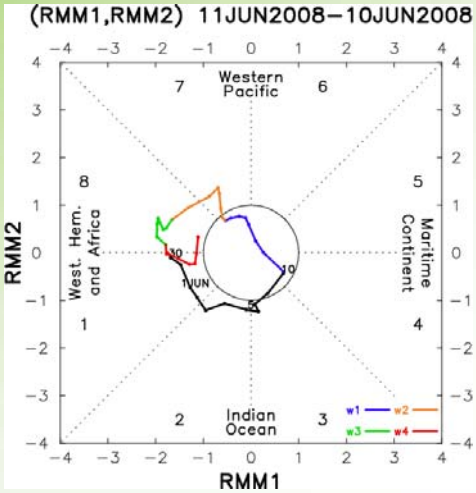
Unnatural large variations in forecasted temperature is reduced by enhancement in vertical resolution.

MJO monitoring with one-month forecast

MJO activity monitoring with one-month forecast was started in June 2008. In this monitor, U200, U850 and stream function at 200hPa are used. OLR isn't used in this monitor.

Data of one-month forecast for MJO monitoring is ready to be submitted to US-CLIVER MJO WG in response to the request at the last WGNE meeting.

(Data of medium-range ensemble forecast is also ready.)



Developments in three-month forecast model

- The seasonal forecast model was upgraded (to GSM_V0703) in September 2007 (This upgrade was already reported in the last year's presentation.)
- The followings changes were introduced in the model.

1. Enhancement in the ensemble member

   The number of ensemble member was increased from 31 to 51.

2. Improvements in the model

   - Improvements in cloud-radiation scheme, ozone and aerosol climatology and short-wave absorption by water-vapor
   - Introduction of DCAPE trigger function in cumulus parameterization and raindrop re-evaporation

3. Improvement in predicted SST fields

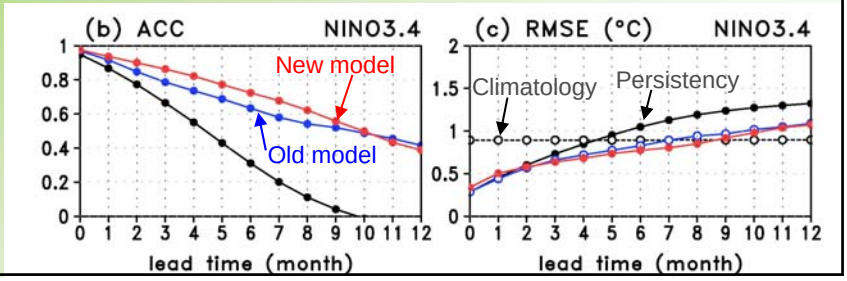
   In the two-tier system, predicted SST needs to be provided as the boundary data. The uncertainty in the SST field is taken into consideration in the ensemble prediction system.

   Probabilistic forecast score is improved due to this change.

Developments in El-Nino prediction model

- The El-Nino prediction model was upgraded in March 2008.
- Major changes are as follows.

1. New ocean model, MRI.COM, which was developed in MRI, is introduced. It is enhanced in resolution from 2.5x2.0 L20 to 1.0x1.0 L50.
2. AGCM is also upgraded to the JMA unified GCM (T42L40 -> TL95L40).
3. The new CCGM system shows very improved performance in SST prediction over the western Pacific as well as NINO3.4 and NONI3.4.



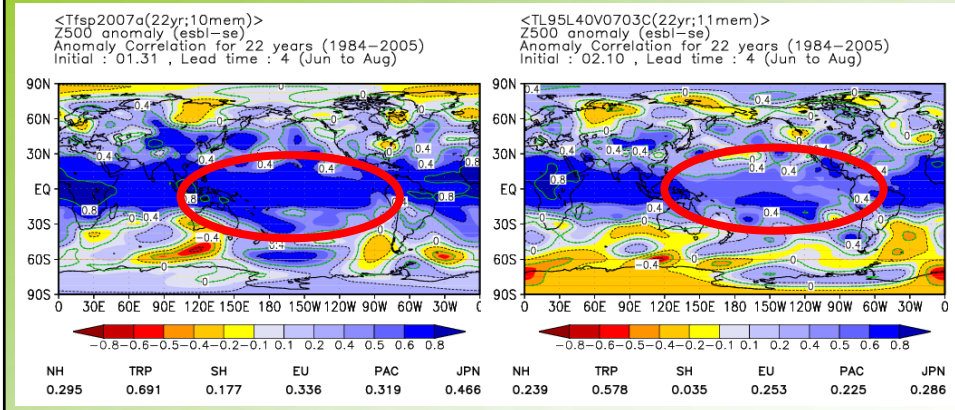
Development of a new Seasonal/El-Nino forecast model

- In February 2010, a new version of CGCM will be introduced for the both purposes of the El-Nino outlook and seasonal forecasts.
- Now, development of the system based on the current CGCM (El-Nino) model is almost completed by replacing AGCM with the new one.
- The WCRP/TFSP experiment data with the current El-Nino model show improvements of forecast performance in many aspects.

Specification of current El-Niño forecast model	
AGCM	**JMA/MRI Unified AGCM (TL95L40)**
OGCM	**MRI.COM** Ishikawa *et al.* (2005) • 75S-75N, 0-360E • horizontal resolution: lon 1.0°, lat 0.3-1.0° • vertical resolution : 50 levels (23 levels in the upper 200m)
Coupler	• coupling interval : 1 hour • flux adjustment for heat and momentum flux

Expected improvement in seasonal forecast with CGCM

Z500 Anomaly Correlation **Jun-Aug** **Lead time:4month**

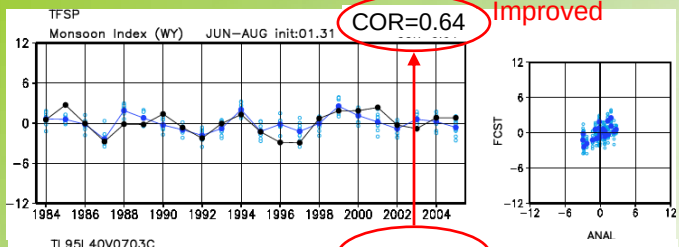


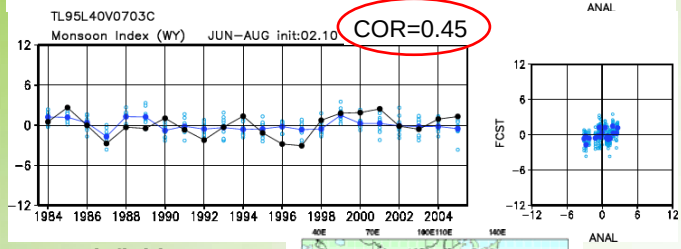
CGCM **2-tier**

Anomaly correlation of Z500 over the tropics is very improved.

This is considered to be due to better performance in tropical SST prediction.

Webster-Yang Index **Jun-Aug** **Lead time: 4 month**





WYI : definition
0-20N, 40-110E
U(850hPa)-U(200hPa)