Asian Regional Perspective for Pacific Predictability Experiment

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Typhoon Nesat

6/10 0Z
985 hPa

6/7 3Z
950 hPa

6/10 12Z

938 hPa
Typhoon Tokage (Oct.)
94 deaths in Japan

Typhoon Muifa (Nov), Nanmadol (Nov)
More than 1500 casualties in Philippines

Typhoon Rananim (Aug)
180 deaths in China

In Japan
● Damage in Public Infrastructure (Agriculture and Road) exceeds 10B$ in 2004
● 230 Deaths/Missing, Worse after 1983

Natural Disasters in Korea
10B$ in 2002 and 2003
From Dehui Chen in CMA

Research Foci in Asian THORPEX

Moisture transportation jets in summer monsoon season

- Drought
- Tropics-Extra tropics
- Indian Monsoon
- Hemispheric Interactions
- Flooding
- MJO
- Winter Monsoon
- Snow Storms
- Meiyu Front
- Tropical Cyclone

From Dehui Chen in CMA
SLP Analysis in Oct. 2004  Ma-On, Tokage

Ma-On Generated

Ma-On Landfall

Tokage Generated

Tokage Landfall
Typhoon Tokage near Okinawa

Landfall on 20th in Kohchi
New records in many stations of daily rainfall over 200 mm/day
94 casualties
## Ensemble Prediction System in JMA

<table>
<thead>
<tr>
<th>Prediction Frequency</th>
<th>Once a day, starting at 12UTC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Forecast Period</td>
<td>216 hours (9 days)</td>
</tr>
<tr>
<td>Numerical Forecast Model</td>
<td>JMA GSM (T106L40)</td>
</tr>
<tr>
<td>Grid Numbers ; Spatial Resolution</td>
<td>$320 \times 160$ ; 1.125 deg.</td>
</tr>
<tr>
<td>Vertical Layers ; Uppermost Layer</td>
<td>40 ; 0.4hPa</td>
</tr>
<tr>
<td>Ensemble Members</td>
<td>25</td>
</tr>
<tr>
<td>Perturbation Generation Method</td>
<td>Breeding of Growing Mode Method (12 mode pairs, 12 hour cycle)</td>
</tr>
<tr>
<td>Perturbation Area</td>
<td>North of 20 °S</td>
</tr>
</tbody>
</table>
Typhoon Track Ensemble Forecast

Tokage Case in 2004

10/12 12Z Initial
(8 day before landfall)

Splitting Northward
Or Westward

10/14 12Z Initial
(6 days)

Recurvature at Nansei Island

10/16 12Z Initial
(4 days)

Likely to land to Japan
Ensemble Forecast for Tokage

Initial: 2 day before landfall
Ensemble Forecast for Tokage

Initial: 8 day before landfall

Northward

Westward
Ensemble Forecast for Tokage

Initial: 6 day before landfall
Ensemble Forecast for Tokage  Initial: 4 day before landfall
Ensemble Spread (RSME of Ensemble Members)

Initial: 8 day before LF

Initial: 4 day before LF

Landfall on 19th
Example of Targeting Observation for Typhoon

**Ensemble Forecast t=-1**

- A
  - +5 day
  - +4 day
  - +3 day
  - +2 day
  - +1 day

- B
  - Initial Position

**Ensemble Forecast t=0**

- B
  - +4 day
  - +3 day
  - +2 day
  - +1 day

**Initial Position**

Track forecast differs due to the large variations of the position of mid-lat trough

Target Observation based on the ensemble forecast t=-1

Target Area

Targeting Observation improves the track forecast significantly
Improvement of Forecast System

Traditional Forecast System

Observing System → Data Assimilation → Analysis → Forecast Procedures including NWP model → Deterministic Forecast → User Applications

Interactive Forecast System

Observing System → Data Assimilation → Analysis → Forecast Procedures including NWP model → Probabilistic Forecast → User Applications

Demand for Targeting Observation with Evaluation of Observing System → Information on Forecast errors → User requests

(NOAA THORPEX Plan)
Interactive Forecast System

Targeting Observation for Typhoon

i) Global Ensemble Forecast

Verification Region

ii) Sensitivity Analysis

Sensitivity Analysis to identify the targeting region

iii) Targeting Observation

Targeting Observation to get the key information to improve forecast

Earth Observing Satellites

AQUA, GPM,

Smart Balloon

Driftsonde

Manned/Unmanned Aircraft
Downscaling Ensemble Forecast

v) Regional Ensemble Forecast
Detailed Forecast of Rain/Wind by Downscaling

iv) Global Ensemble Forecast
by additional key information
Dropsonde Observations for Typhoon Track Forecasts

Operational analysis at 500 hPa (12UTC 8 June 2004)

Broken circles: Areas with typhoon bogusing

Red: Dropsonde data by DOTSTAR (Wu et al. 2004 BAMS)
Dropsonde Observations for Typhoon Track Forecasts

Typhoon centers are plotted 6-hourly.

BST: Observation
RTN: Operational GSM with dropsonde data with typhoon bogusing
NDS: Experiment 1 w/o dropsonde data with typhoon bogusing
NTS: Experiment 2 w/o dropsonde data w/o typhoon bogusing
Asian THORPEX Regional Campaigns

To improve forecasts of **ANY** high-impact weather events over the region, such as
- tropical cyclones (high wind, tide and rain);
- heavy rainfalls (flood, land slide);
- winter severe snows/winds;
- dust and sand storms;
- heat waves
- MJO related phenomena (monsoon onset, TC genesis);
- Rossby wave breakdown for initiation of high-impact weather events;
- Beijing Olympic 2008 Demonstration Project;
- droughts;

and more.
Asian and National THORPEX Operation Centers (ATOCs & NTOCs)

ATOC
1. HQ during Obs. Ex. over the Globe and Asia
2. Data archive and distribution center
3. TIGGE Asian center
The THORPEX Vision

Pushing back the limits of predictability
Increasing the accuracy of high-impact weather forecasts