Comparison of Ensemble Flood Forecasts from Two Regional EPS: Simple Downscaling of Global EPS and Regional Data Assimilation

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Regional ensemble prediction system (EPS)

- Simple Downscaling of Global EPS
- Regional Data Assimilation
Regional EPS

**Simple Downscaling**

- UK Met office
  - 33 km global → 2.2 km regional
- Météo France
  - 15 km global → 2.5 km regional

**Regional data assimilation**

- JMA
  - 20 km Global → 5 km regional (SV)
- ICHARM
  - 20 km Global → 3 km regional (LETKF)
Regional Data Assimilation by WRF-LETKF (Miyoshi and Kunii 2012)

• Assimilated data: PREPBUFR(U, V, T, Q, PS)+GPS PWV
• 27～33 ensemble members
## Analyzed cases

<table>
<thead>
<tr>
<th>Location</th>
<th>River</th>
<th>Time</th>
<th>Phenomenon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>Kinugawa River</td>
<td>Sep. 2015</td>
<td>Mesoscale rainband</td>
</tr>
<tr>
<td>Philippines</td>
<td>Pampanga River</td>
<td>Jun. 2011</td>
<td>Typhoon</td>
</tr>
</tbody>
</table>
Kinugawa River flood on 10 Sep. 2015

700 mm in 3 days

Unique Airflow by two typhoons

JMA Radar

00UTC10Sep.
Outer domain:
Boundary condition: JMA-GSM
Kain&Fritsch cumulus scheme

Inner domain:
No cumulus scheme

Δx=15km

Δx=3km

Δx=100m

Kinugawa river catchment area
1760 km²
Ensemble rainfall/Flood forecasts

Simple downscaling: 27 member

Regional data assimilation by WRF-LETKF: 27 member

12z08 \approx FT=18h

Simple downscaling:
27 member

Regional data assimilation by WRF-LETKF: 27 member

OBS

JMA MSM

Discharge

Discharge

OBS

OBS

Ensemble (25-75%)

Ensemble (25-75%) median

Discharge (m³/s)

Discharge (m³/s)
Ensemble streamflow forecasts

Simple downscaling: 27 member

Regional data assimilation by WRF-LETKF: 27 member

00z07 ~ FT=54h

12z07 ~ FT=42h

00z08 ~ FT=30h

Discharge (m³/s)

Discharge (m³/s)

JMA MSM

Ensemble (25-75%) median

OBS
WRF Model domain for Philippines

Outer domain:
Boundary condition: JMA-GSM
Grell3D cumulus scheme + shallow convection option

Inner domain:
No cumulus scheme

Pampanga river catchment 10434 km$^2$

$\Delta x = 15\text{km}$

$\Delta x = 3\text{km}$

$\Delta x = 450\text{m}$
Ensemble rainfall/flood forecasts

Simple downscaling: 16 member

Regional data assimilation by WRF-LETKF: 33 member

12z23 ~ FT=12h

Rainfall

Discharge

Ensemble (25-75%) median Raingauge
Ensemble streamflow forecasts

Simple downscaling: 16 member

Regional data assimilation by WRF-LETKF: 33 member

12z21 ~ FT=54h

12z22 ~ FT=36h

12z23 ~ FT=12h
## Discussions

<table>
<thead>
<tr>
<th>Country</th>
<th>Phenomenon</th>
<th>U spread</th>
<th>U RMSE</th>
<th>U bias</th>
<th>Assimilated OBS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>Mesoscale rainband</td>
<td>0.8 m/s</td>
<td>6 - 8 m/s</td>
<td>2 m/s</td>
<td>10000</td>
</tr>
<tr>
<td>Philippines</td>
<td>Typhoon</td>
<td>1.2 m/2</td>
<td>6 - 12 m/s</td>
<td>5 - 12 m/s</td>
<td>7000</td>
</tr>
</tbody>
</table>

![Map of Japan and Philippines](image)
Conclusion

• Regional data assimilation by WRF-LETKF was better in Japan.

• Simple downscaling was better in Philippines.

• We’d be careful to choose the better method of regional EPS.
Thank you for attention!