CLIK (CLimate Information ToolKit)
http://clik.apcc21.org

7 Dec 2016
Yun-Young Lee
Mission of APCC

to enhance the socio-economic well-being of member economies by utilizing up-to-date scientific knowledge and applying innovative climate prediction techniques through

**Climate Prediction**
APCC produces value-added, reliable, and real-time climate prediction information and provides the APEC region with it.

**Interdisciplinary Research**
APCC leads in the development of interdisciplinary research and application techniques at the climate-environment-society nexus.

**Climate Information Services**
APCC strives to be a key climate database center to distribute climate data, information products, and related tools.

**International Cooperation**
APCC guides developing countries from the APEC region toward building their own capacity to produce reliable climate prediction information.
CLIK
CLimate Information ToolKit
http://clik.apcc21.org
CLIK (CLimate Information ToolKit) : online prediction tool

For those who wants to play with model data,

- To allow user manipulation of multi-model ensemble prediction in producing his/her own forecast
- MME Prediction with different model combination
- Downscaling: Simulated large scale pattern to station matching
  - To provide statistical downscaling capability using multi model prediction

Output: 3-months mean (seasonal) forecast & verification score
For those **who wants to play with model data,**

- To allow **user manipulation** of multi-model ensemble prediction in producing his/her own forecast

**CLIK**

**Downscaling:** Simulated large scale pattern to station matching

- To provide **statistical downscaling** capability using multi model prediction

**MME Prediction** with different model combination
Why MME?

• Climate predictions have **uncertainty** coming from two major sources,
  – Initial conditions uncertainty (errors in obs. system or estimates)
  – Model formulation uncertainty (errors due to discrete representation of temporally and spatially continuous real world)

  ➔ multi-institutional multi-model ensemble approach to **minimize the uncertainty**

  ➔ multi-model ensemble (MME) approach yields **superior forecasts** compared to any single model.
Collection of Dynamic ensemble seasonal prediction data from NMHS and research institutes (16 operations/institutions from 10 countries)
# List of available models

## Data Sources

<table>
<thead>
<tr>
<th>Nation</th>
<th>Organization</th>
<th>Acronym</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>Bureau of Meteorology</td>
<td>BoM</td>
</tr>
<tr>
<td>Canada</td>
<td>Meteorological Service of Canada</td>
<td>MSC</td>
</tr>
<tr>
<td>China</td>
<td>National Climate Center, CMA</td>
<td>NCC</td>
</tr>
<tr>
<td></td>
<td>Institute of Atmospheric Physics</td>
<td>IAP</td>
</tr>
<tr>
<td>Chinese Taipei</td>
<td>Central Weather Bureau</td>
<td>CWB</td>
</tr>
<tr>
<td>Italy</td>
<td>Centro Euro-Mediterraneo sui Cambiamenti Climatici</td>
<td>CMCC</td>
</tr>
<tr>
<td>Japan</td>
<td>Japan Meteorological Agency</td>
<td>JMA</td>
</tr>
<tr>
<td></td>
<td>Korea Meteorological Administration</td>
<td>KMA</td>
</tr>
<tr>
<td>Korea</td>
<td>Pusan National University</td>
<td>PNU</td>
</tr>
<tr>
<td></td>
<td>National Institute of Meteorological Research</td>
<td>NIMR</td>
</tr>
<tr>
<td>Peru</td>
<td>Servicio Nacional de Meteorologia e Hidrologia</td>
<td>SENAMHI</td>
</tr>
<tr>
<td>Russia</td>
<td>Hydrometeorological Research Centre of Russian Federation</td>
<td>HMC</td>
</tr>
<tr>
<td></td>
<td>Voeikov Main Geophysical Observatory</td>
<td>MGO</td>
</tr>
<tr>
<td>UK</td>
<td>Met Office</td>
<td>Met Office</td>
</tr>
<tr>
<td></td>
<td>International Research Institute for Climate &amp; Society</td>
<td>IRI</td>
</tr>
<tr>
<td></td>
<td>Center for Ocean-Land-Atmosphere Studies</td>
<td>COLA</td>
</tr>
<tr>
<td>USA</td>
<td>National Centers for Environmental Prediction, NOAA</td>
<td>NCEP</td>
</tr>
<tr>
<td></td>
<td>National Aeronautics and Space Administration</td>
<td>NASA</td>
</tr>
</tbody>
</table>
PREDICTION_methodology

**Deterministic**

**Multi-Model Ensemble (MME)**

**Probabilistic**

**SCM**

**GAUS**

**Simple Composite Method:**
Average of individual forecast with equal weighting

\[ P = \frac{1}{M} \sum_{i} F_i \]

**A parametric Gaussian fitting method** for the estimation of tercile-based categorical probabilities; forecast probability of each category is estimated as a portion of the forecast PDF (Probability Density Function) with respect to the historical one.
MME PREDICTION: product

DMME (SCM)

PMME (GAUS)

http://clik.apcc21.org
MME PREDICTION: skill score

<table>
<thead>
<tr>
<th>Lead Month</th>
<th>When</th>
<th>Variables</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>3Month</td>
<td>Year 2016, Season JFM</td>
<td>PREC, T850</td>
<td>APCC, CMCC, COLA, CWB, HMC, IRIF, IRI_CA, MIO, MSC, NASA, NCEP, PNU, POAMA</td>
</tr>
</tbody>
</table>

**DMME (SCM) ➔ Success rate**

**PMME (GAUS) ➔ HSS**
For those **who wants to play with model data,**

- To allow **user manipulation** of multi-model ensemble prediction in producing his/her own forecast

**CLIK**

**Downscaling:** Simulated large scale pattern to station matching

- To provide **statistical downscaling** capability using multi model prediction

**MME Prediction**
with different model combination
CLIK downscaling

A way to localize existing coarse climate information

CLIK downscaling is mainly based on station to Large Scale Meteorological Field (LSMF) relationship. (Y = a*X + b) By utilizing the simulated LSMF (X, predictor), CLIK estimates seasonal mean precipitation/temperature (Y, predictand) at specific station.

A kind of hybrid system for point-wise seasonal forecast
CLIK downscaling

A way to localize existing coarse climate information

CLIK downscaling is mainly based on station to Large Scale Meteorological Field (LSMF) relationship.

\( Y = a \times X + b \)

By utilizing the simulated LSMF (\( X \), predictor), CLIK estimates seasonal mean precipitation/temperature (\( Y \), predictand) at specific station.

Empirical relationship:

\( \text{LSMP} \sim \text{local station rainfall} \)

![CLIK Interface](http://clik.apcc21.org)
CLIK downscaling: results

Historical station time series & Historical downscaled time series (hindcast) for individual models

Correlation coefficient skill
**Deterministic forecast** with tercile range from historical observation

No integration (no merging) of models

http://clik.apcc21.org
Target Users

→ Target users are, but are **not limited to** NMHS staffs of developing countries having basic understanding of climate and meteorology.

CLIK was developed and updated based on the analysis of potential users: their status and needs.

1. Limitation of manpower and computing resources
2. Desire for utilizing **dynamical** forecast data
3. Direct benefit on regional community
4. Thirsty for Capacity building: Interests in learning science and technology and high satisfaction from participating in the model developing process
Thank you.
감사합니다.