CLIK hands-on (PART I):

**introduction and structure**

(http://clik.apcc21.org)

Yun-Young Lee

7 June 2017
Climate/weather related disasters

5. Jan. 13 — Flooding in the capital

Indonesia landslide: 20 dead and dozens still missing

Monsoon rains cause flooding in Jakarta, and residents flee on mom

Rescuers, including local residents, are still hoping to find survivors

Flood

Landslide

Strong wind
Thailand is Suffering From The Worst Drought in Decades

Helen Regan
Jul 10, 2015

Thailand is experiencing the worst drought in decades, with seven out of 67 provinces affected and water rationing taking place in almost a third of the country.

Thailand’s Irrigation Department said that the amount of usable water in dams across the country, except in the West, have dwindled to below 10 percent and in the capital Bangkok tap water production

http://time.com/3960462/thailand-drought/
2015 Drought in Thailand during prolonged El Nino

Figure 1: Cumulated rainfall in Thailand between 2010 and 2015

Unit: millimeters

Source: EIC analysis based on data from Water Watch and Monitoring System, Royal Irrigation Department.

Rice: Change in production

Source: USDA World Agricultural Production
Southeast Asia: Temp. & Prec. (2016Apr)
Cambodia faces severe and prolonged drought

POSTED ON: March 23, 2016 | CAMBODIA - CURRENT AFFAIRS - FEATURED | By: Daniel Besant

Experts say that this year’s drought will be worse than in 2015, with soaring temperatures and a delayed monsoon season likely.

Cambodia is officially in a drought, and the conditions could last longer and be more severe than last year, when monsoon rains did not fall until July.

"Based on our monitoring, drought conditions in Cambodia will persist until at least May this year," said the Mekong River Commission Secretariat. "The current drought season was forecast to last until March 2016 could be at least as bad as last year, and likely be getting worse in coming months."

Schools face water shortages and government says entire nation is affected as rainy season is forecast to be delayed by months.

Last year, according to the MRC, draft plans were made to delay the harvesting season to late July due to the drought. This year, according to the MRC, the rice harvest is due in May, until as late as August or September in some places due to a delay in the rainy season.

7 photos: Children are among hardest hit by El Nino-related drought in Cambodia.
China and the Mekong Delta: Water Savior or Water Tyrant?

Don’t be fooled by reports about China discharging water to alleviate drought along the Mekong.

By Margaret Zhou
March 23, 2016

The Mekong Delta is facing its worst drought in recent history, causing food and water shortages for over half a million people. The Chinese government has been in the news headlines amidst the disaster for its actions on water from upstream dams within China. The Chinese government briefed that China “hopes it can bring about some benefits” to the region. The Mekong Delta is considered as the source of livelihood for millions of residents in the delta.

Government welcomes drought relief measures by China

17 Mar 2016, The Cambodia Daily

Government officials on Wednesday applauded China’s decision to take emergency measures to counter the impact of a regional drought by releasing water into the Mekong River from the Jinghong Hydropower Station in China’s southwestern Yunnan province. ...

Khy Sovuthy

Categories: Disasters and disaster management, Drought, Environmental & Natural Resources Management
Tag: Jinghong Hydropower Station
2011 Flood in Thailand: heavy monsoon rain

Worst Flooding in Decades Swamps Thailand
ALAN TAYLOR | OCT 12, 2011 | 37 PHOTOS | IN FOCUS

Heavy monsoon rains have been drenching Southeast Asia since mid-July, causing mudslides and widespread flooding along the Mekong River. Parts of Thailand are now experiencing the worst floods in half a century, as water inundates villages, historic temples, farms, and factories. At least 281 people have been killed in Thailand, and another 200 in neighboring Cambodia. Rescue workers are scrambling to prevent a humanitarian disaster, and Thailand’s prime minister is warning businesses not to use the flooding as an excuse to raise prices. About 8.2 million people in 60 of Thailand’s 77 provinces have been affected by the flooding, and economic losses are so far estimated to top $2 billion. Collected here are recent images of the crisis in Thailand as some 10 million residents in Bangkok keep a wary eye on the approaching surge of floodwater, due to reach the capital in a few days.

Weather
Volume 68, Issue 9, pages 233-237, 27 AUG 2013 DOI: 10.1002/wea.2133

Landslide
Importance of “Accurate” prediction

ACCURATE climate prediction optimized to your region (village) will make early warning possible and reduce economic and human losses in Southeast Asia.
High-end climate information service center

: operating MME climate prediction system utilizing state-of-the-art GCMs
The mission of APCC is 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 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 when participating in the model developing process

> Target users are, but are **not limited to NMHS staffs** of developing countries having basic understanding of climate and meteorology.
CLIK (CLimate Information ToolKit)  
: online prediction tool

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

MME Prediction with different model combination

Downscaling:
- Simulated large scale pattern to station matching
- To provide statistical downscaling capability using multi model prediction

For those who wants to play with model data,
CLIK (CLimate Information ToolKit): online prediction tool

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

- To provide statistical downscaling capability using multi model prediction

→ Facilitate the cooperation in the exchange of information and services so that users are able to cope with climate related disasters
The CLimate Information ToolKit (CLIK) version 1.0 was developed.
- Deterministic Multi-Model Ensemble (DMME) prediction

CLIK version 2.0
- Probabilistic Multi-Model Ensemble (PMME)
- Statistical Downscaling

Clustering Computation
Enhancing Internal Algorithm

CLIK v3.0 with New Web Framework (New CLIK)
- Enhancement of User Interface & Performance
- Database optimization, Lightweight Map, etc.
CLIK 3.0: Internals

• The Customized Climate Information Service

• Be able to produce and utilize the climate information data by CLIK with only a computer and an internet connection.

• Based on Java and HTML with NCAR Command Language (NCL)

• Existing NCL, Fortran Code can be reused with Java Container

• Standard Web technology (HTML/JSP)

• CLIK 3.0 leverages on the robust functionality of previous product releases but at around 10 times the performance

http://clik.apcc21.org
https://www.youtube.com/watch?v=5CNPoX1fIXY
CLIK: process diagram

APCC Climate Application System

ADSS Client

AFS

DFT

Climate Information tool Kit (CLIK)

• Web Based
• Customized
• Remote/Local calculations

Data Sets

Data Base

Data Manager

Computation Backends

User Interface

AFS: Automated Forecast System
DFT: Downscaling Forecast Tool

http://clik.apcc21.org
APCC: data collection

- Collection of Dynamic ensemble seasonal prediction data from NMHS and research institutes (16 operations/institutions from 10 countries)

http://clik.apcc21.org
## List of available models

### DATA SOURCES

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<tr>
<th>Nation</th>
<th>Organization</th>
<th>Acronym</th>
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For those who wants to play with model data,

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**MME Prediction with different model combination**

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

- To provide statistical downscaling capability using multi model prediction
Uncertainty in climate prediction

Why MME?

- Climate predictions have huge **uncertainty**!

  NO perfect GCM

  NOT the same with NATURE

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

- Multi-model ensemble (MME) approach yields **superior forecasts** compared to any single model.
PREDICTION_methodology

**Deterministic**

**Multi-Model Ensemble (MME)**

**Probabilistic**

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

$$P = \frac{1}{M} \sum_{i} F_i'$$

**SCM**

**GAUS**

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.
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.
PREDICTION_product

DMME (SCM)

PMME (GAUS)
2015 MJJ Drought

OLR Anomaly

May 1 2015 - Jul 12 2015

Unit: W/m^2

Data Source: NOAA OLR
Climatology: 1981-2003
PREDICTION_verification_score

Success Rate
the fraction or percentage of success among a number of attempts.
CLIK provides a simple success rate as DMME verification score.

CLIK provides a simple success rate as DMME verification score.

\[
\frac{7}{34} \approx 0.20
\]

\(~0.33: \text{Poor skill region}\)
\(0.33\sim0.66: \text{Reasonable skill region}\)
\(0.66\sim: \text{High skill region}\)

Heidke Skill Score (HSS)
For the verification of categorical probabilistic forecast
Measuring the fractional improvement of the forecast over the standard forecast

\[
HSS = \frac{(score - score \ by \ chance)}{(perfect \ score - score \ by \ chance)}
\]

\[
\frac{(h+c)/n - [(h+f)(h+m)+(f+c)(m+c)]/n^2}{1 - [(h+f)(h+m) +(f+c)(m+c)]/n^2}
\]

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<td>False Alarm (F)</td>
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<tr>
<td>No</td>
<td>Miss (M)</td>
<td>Correct Rejection (C)</td>
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http://clik.apcc21.org
**PREDICTION_product**

**DMME (SCM)**

**PMME (GAUS)**
PREDICTION_product

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 \((X, \text{predictor})\), CLIK estimates seasonal mean precipitation/temperature \((Y, \text{predictand})\) at specific station.

### Dynamical fcst
- Simulated LSMF from Individual models

### Statistical fcst
- Station to LSMF regression relationship

- Hypothesis: The station to LSMF relationship is well replicated in individual models
- Predictor: LSMF
- Predictand: Prec. at specific station

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

A way to localize existing coarse climate information

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Empirical relationship: LSMP ~ local station rainfall

LSMP (model) → Local station rainfall

sst vs. prec over Phetchaburi  
JJA  
sst (scm) vs. prec over Phetchaburi  
JJA
CLIK downscaling

A way to localize existing coarse climate information

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

\[ \text{LSMF (model)} \sim \text{local station rainfall} \]

Local station rainfall
CLIK downscaling: results

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

Correlation coefficient skill
**Deterministic forecast value (anomalies)** with **tercile range** from historical observation

No integration (no merging) of models

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

http://clik.apcc21.org
CLIK - main page

Background

The CLimate Information Toolkit version 1.0 (CLK1.0) was developed in line with APCC's mission of empowering users to maximize the use of climate information and forecasts. The CLIK system provides customized multi-model ensemble (MME) prediction with verification. It also has a statistical downscaling tool which conducts predictor variable pre-screening, basic diagnostic testing, and graphing of climate data from January 2008 onwards. More than 1,200 registered users enjoy the service and about 7,500 predictions have been generated based on the users' request since 2008. Building on the success of CLIK 1.0, new features such as inclusion of other MME methods, improving the downscaling function, enhancing performance, and supporting multiplatform use have been added in the updated version CLIK 2.0 based on user feedback. The product is continuously being improved as APCC responds to the climate information needs of APEC member economies and users worldwide.

Product Description

CLIK aids users in retrieving and using climate prediction data and information available from APCC data servers in a user-friendly manner. Climate forecasters, disaster managers, water resource managers, researchers, and other users anywhere in the world can use this service to generate customized climate predictions on seasonal to inter-annual time scales for their region of interest. The tool has an immense potential to contribute to early warning and management of climate-related disasters and resource management, particularly in developing countries.

The data processing engines powering CLIK at the back end are built on the NCAR Command Language (NCL), a powerful suite of libraries for climate data manipulation and visualization. The web interface of CLIK 1.0 and CLIK 2.0 was built on the web framework Ruby on Rails (RoR). RoR provided simplicity and productivity to the developers but resulted in heavy use of computing resources and raised software incompatibility problems. To resolve these performance and incompatibility issues, we have designed and developed a faster, lighter CLIK 3.0 based on Java and pure HTML with NCL. The main motivation for the new developments is to make the product more useful to developing countries.

CLIK 3.0 leverages on the robust features of RoR, and the robust data processing engine to produce faster, lighter, more scalable, and more secure system.

User Manual

PDF

Contact Information

If you have any questions or feedback regarding APCC CLIK, please contact the Climate Informatics and Application Team (clik@apcc21.org)

Data Sources

Please refer to [DATA SOURCES]

Terms of Use

Please refer to [TERMS OF DATA USE]

✔ User can see the information about the CLIK background, product description, user manual and so forth.
User can produce the **customized MME climate forecast**, then view the result figure map and download corresponding data.
CLIK - “Downscale”

✓ User can upload their own regional station data and make a downscaled forecast
Users can find the list of jobs requested, identify the status of jobs, and download result data of successful jobs.
CLIK

http://clik.apcc21.org
CLIK - Getting Started

- Creating your account

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The CLik Climate Information Toolkit version 1.0 (CLIK1.0) was developed in line with APCC's mission of empowering users to maximize the use of climate information and forecasts. The CLIK system provides customized multi-model ensemble (MME) prediction with verification. It also has a statistical downscaling tool which conducts predictor variable pre-screening, basic diagnostic testing, and graphing of climate data from January 2008 onwards. More than 1,200 registered users enjoy the service and about 7,500 predictions have been generated based on the users' requests since 2008. Building on the success of CLIK 1.0, new features such as inclusion of other MME methods, improving the downscaling function, enhancing performance, and supporting multiplatform use have been added in the updated version CLIK 2.0 based on user feedback. The product is continuously being improved as APCC responds to the climate information needs of APEC member economies and users worldwide.

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CLIK - Getting Started

- Creating your account

1. I read the contents and agree

2. I read the contents and agree

3. Check your name and E-mail for uniqueness property

   - First Name
   - Last Name
   - E-mail

4. Apply
CLIK - Getting Started

- Creating your account

http://clik.apcc21.org
CLIK - Getting Started

• Creating your account

✓ Please fill in the blanks!
CLIK - Getting Started

• Creating your account

http://clik.apcc21.org
Please **activate your account** by clicking the LINK in the e-mail sent you.
CLIK - Getting Started

• Creating your account

✓ Please **log in** with your ID and password.
✓ Finally, you guys are **READY** to play with the CLIK system!
Thank you.