CLIK hands-on (PART IV):

Multi Model Downscaling using CLIK

(http://clik.apcc21.org)

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APEC Climate Center
Downscaling procedure in CLIK

Station data

- Point (uploaded)

Global observation data

- Grid (built-in)
- Reanalysis: NCEP2; atmospheric variables
- Satellite: CAMS OPI; precipitation

Model data

- Grid (built-in)
- Hindcast by dynamical models
Downscaling procedure in CLIK

**STEP I**

- Station data (A)
- Global observation data (B)

Screening test 1

- No → Bad Stations
- Yes → Hopeful Stations

**STEP II**

- Hopeful Stations (B)
- Model data (C)

Screening test 2

- No
  - Remain as “Hopeful Station”
- Yes → Good Stations

**STEP III**

- Good Stations (C)
- Model data

Downscaled Forecast for the station (C)

Downscaling procedure in CLIK

**STEP 1**

Screening test 1:
- Do the station data and the global map from observation have a relationship based on “significance level”?
- Do the station data have relationship with the large-scale climate pattern?

Correlation map of global observation vs. station
Downscaling procedure in CLIK

**STEP II**

**Screening test 2:**
- Can the dynamical models reproduce the relationship between the global observation and hopeful stations?
- Screen based on the “minimum pattern correlation”.

Correlation maps show the relationship between global observations, model data, and station data for different variables and locations.
Downscaling procedure in CLIK

**Downscaled Forecast**
for the station

**Downscaling**

**Good Stations**

**Model data**

**Downscaling process:**
- Based on the linear regression model
- \( y = a + bx \)
Downscaling procedure in CLIK

Relationship between precipitation over Yangon & ...

- The station data has relationship with the global observational sst over some areas.
- Dynamical models can reproduce the relationship between observation and station data.
- We hope a successful downscaling by CLIK system...

[Images showing sst vs. prec over Yangon and sst (scm) vs. prec over Yangon maps for JJA]
Rainfall over Yangon for the next three month (JJA 2017)?
Produce a downscaled forecast

1. Select the dataset and station.
2. Shift + drag to select the area of interest.
3. View the station data and precipitation.
4. Check the common data period of selected stations.

<table>
<thead>
<tr>
<th>Station ID</th>
<th>Name</th>
<th>Precipitation</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pyinmana</td>
<td>1987/1 ~ 2010/12</td>
<td>NA</td>
</tr>
<tr>
<td>2</td>
<td>Khasaya</td>
<td>1987/1 ~ 2013/12</td>
<td>NA</td>
</tr>
<tr>
<td>3</td>
<td>Sagyang</td>
<td>1987/1 ~ 2010/11</td>
<td>NA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Month</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
</table>
Produce a downscaled forecast

A. Set options

Set-up Downscaling
Precipitation over Phetchaburi for JJA 2017
(up to you)
Produce a downscaled forecast

A. Set options

Prediction Season

2017 JJA
Produce a downscaled forecast

A. Set options

Variable

SST
Produce a downscaled forecast

Set-up Downscaling

- **Prediction Season**
  - Year: 2017
  - Season: JJA

- **Variable**
  - PREC, T850, 2500, SLP, U850, V850, U200, V200, SST

- **Models**
  - APOC, MSC, NASA, NCEP, PNU, POAMA

- **Predictand**
  - Precipitation, Temperature

- **Training Period**
  - From: 1987
  - To: 2010

- **Method**
  - Linear Regression

- **Advanced Options**
  - Significance Level: 5%
  - Minimum Pattern Score: 0.1

A. Set options

Models

ALL
Produce a downscaled forecast

A. Set options

Predictand
Precipitation
Produce a downscaled forecast

A. Set options

Training Period
Common period (default)
Produce a downscaled forecast

A. Set options

Method
Linear Regression
Produce a downscaled forecast

A. Set options

Advanced Options
Significance Level: 5%
Minimum Pattern Score: 0.1

Relationship between precipitation over Yangon and sst
Resemblance of model pattern (sst) and observation pattern (sst over the predictor area)
Produce a downscaled forecast

A. Set options

Downscaling Region
Latitude -10~15
Longitude 90~240
(predictor area)
Produce a downscaled forecast

B. Check results

<table>
<thead>
<tr>
<th>JOB ID</th>
<th>TYPE</th>
<th>STATE</th>
<th>RESULT DATA</th>
<th>CREATED</th>
<th>UPDATED</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>5559</td>
<td>Downscale</td>
<td>success</td>
<td>download</td>
<td>2017-06-01 21:34:57</td>
<td>2017-06-01 21:35:34</td>
<td>running 850</td>
</tr>
<tr>
<td>5557</td>
<td>Downscale</td>
<td>success</td>
<td>download</td>
<td>2017-06-01 21:32:54</td>
<td>2017-06-01 21:33:35</td>
<td>phetchaburi</td>
</tr>
<tr>
<td>5553</td>
<td>Downscale</td>
<td>fail</td>
<td></td>
<td>2017-06-01 20:49:24</td>
<td>2017-06-01 20:49:29</td>
<td>-</td>
</tr>
<tr>
<td>5548</td>
<td>Downscale</td>
<td>fail</td>
<td></td>
<td>2017-06-01 20:01:57</td>
<td>2017-06-01 20:02:01</td>
<td>-</td>
</tr>
<tr>
<td>5547</td>
<td>Downscale</td>
<td>success</td>
<td>download</td>
<td>2017-06-01 19:36:02</td>
<td>2017-06-01 19:36:30</td>
<td>-</td>
</tr>
</tbody>
</table>

Showing 1 to 10 of 140 entries
B. Check results

<table>
<thead>
<tr>
<th>JOB ID</th>
<th>TYPE</th>
<th>STATE</th>
<th>RESULT DATA</th>
<th>CREATED</th>
<th>UPDATED</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>5553</td>
<td>Downscale</td>
<td>fail</td>
<td></td>
<td>2017-06-01 20:49:24</td>
<td>2017-06-01 20:49:29</td>
<td>-</td>
</tr>
<tr>
<td>5548</td>
<td>Downscale</td>
<td>fail</td>
<td></td>
<td>2017-06-01 20:01:57</td>
<td>2017-06-01 20:02:01</td>
<td>-</td>
</tr>
<tr>
<td>5547</td>
<td>Downscale</td>
<td>success</td>
<td>download</td>
<td>2017-06-01 19:36:02</td>
<td>2017-06-01 19:36:30</td>
<td>-</td>
</tr>
</tbody>
</table>

Showing 1 to 10 of 140 entries
### Produce a downscaled forecast

**B. Check results**

<table>
<thead>
<tr>
<th>Details</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>JOB ID</strong></td>
<td>5545</td>
</tr>
<tr>
<td><strong>DOWNSCALE_ID</strong></td>
<td>4748</td>
</tr>
<tr>
<td><strong>PREDICTAND</strong></td>
<td>PREDICTOR</td>
</tr>
<tr>
<td><strong>YEAR/SEASON</strong></td>
<td>2017 / 6</td>
</tr>
<tr>
<td><strong>PREDICTAND</strong></td>
<td>PREC</td>
</tr>
<tr>
<td><strong>DATASET</strong></td>
<td>Myanmar [ID: 8276]</td>
</tr>
<tr>
<td><strong>STATION</strong></td>
<td>3 Stations</td>
</tr>
<tr>
<td><strong>SIGNIFICANCE LEVEL</strong></td>
<td>5%</td>
</tr>
<tr>
<td><strong>MINIMUM PATTERN SCORE</strong></td>
<td>0.1</td>
</tr>
<tr>
<td><strong>CREATE At</strong></td>
<td>2017-06-01 09:31:36</td>
</tr>
<tr>
<td><strong>UPDATE At</strong></td>
<td>2017-06-01 09:34:05</td>
</tr>
<tr>
<td><strong>Training Period</strong></td>
<td>1987 / 2010</td>
</tr>
<tr>
<td><strong>VARIABLE</strong></td>
<td>SST</td>
</tr>
<tr>
<td><strong>MODELS</strong></td>
<td>APCC, MSC, NASA, NCEP, PNU, POAMA</td>
</tr>
<tr>
<td><strong>REGION</strong></td>
<td>Lat -10–15/ Lon 90–240</td>
</tr>
</tbody>
</table>

[ViewResult] [Edit]
Produce a downscaled forecast

B. Check results

- Historical time series of station data and hindcast data
- Correlation coefficient
- Deterministic forecast
- Tercile category of the forecast
Produce a downscaled forecast

B. Check results

- Location of the station

Details:

- Predictand: PREC
- Year/Season: 2017/18
- Training Period: 1987-2010
- Predictand: PREC
- Variable: SST
- Dataset: Myanmar
- Model: NASA, NCEP, FNL
- Region: 3 stations
- Region: Lat: 15° N, Lon: 90° - 140° E
- Significance Level: 5%
- Minimum Pattern Score: 0.1

Selected Stations:

<table>
<thead>
<tr>
<th>Station ID</th>
<th>Result</th>
<th>Name</th>
<th>Data period for PREC</th>
<th>Data period for TII</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bad</td>
<td>nguahrai</td>
<td>1951/1 - 2016/12</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Good</td>
<td>pondokkletung</td>
<td>1951/1 - 2016/12</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Bad</td>
<td>kemayorunn</td>
<td>1971/1 - 2016/8</td>
<td></td>
</tr>
</tbody>
</table>

Seasonal forecast of station:

- Correlation: 0.61
- PREC_forecasted = 3.04 mm/month

Observation prediction:

Satalon's Location:

Linear Regression of station on observed predictor:

Linear Regression of station on model predictor:
B. Check results

- Relationship pattern between the predictor (sst, observation) and the station data (precipitation) over the selected area
- Screening test 1
B. Check results

- Relationship pattern between the predictor (sst, model) and the station data (precipitation) over the selected area
- Screening test 2
B. Check results

**Stations & Prediction Result**

- **Seasonal Forecast of Station**
  - Correlation: 0.61
  - PREC_forecasted = 3.04 mm/month

- **Linear Regression of Station on Observed Predictor**

- **Linear Regression of Station on Model Predictor**

**Selected Stations**

<table>
<thead>
<tr>
<th>Station ID</th>
<th>Result</th>
<th>Name</th>
<th>Data period for PREC</th>
<th>Data period for TDB</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bad</td>
<td>ngozubai</td>
<td>1951/1 ~ 2016/12</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Good</td>
<td>pontokelung</td>
<td>1951/1 ~ 2016/12</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Bad</td>
<td>kemayoran</td>
<td>1971/1 ~ 2016/12</td>
<td></td>
</tr>
</tbody>
</table>

**Details**

- **Predictand**: PREC
- **Year/Season**: 2017/18
- **Predictor**: SST
- **Dataset**: Myanmar
- **Variable**: SST
- **Region**: 3 stations, Lat.: 15 ~ 15, Lon.: 90 ~ 140
- **Significance Level**: 0.1
- **Minimum Pattern Score**: 5%

http://clik.apcc21.org
Produce a downscaled forecast

- If the downscaling fails, be patient and try again!
  - Find the large scale climate system (predictor) that affects local climate.
  - Tropical area can be a good choice where dynamical models have good skill.
  - Check correlation maps that we give you.

http://clik.apcc21.org
Exercise 1

Precipitation over Yangon for JJA 2017

Q1

- Prediction Season (2017/JJA)
- Variables (U850)
- Models (ALL)
- Predictand (Precipitation)
- Training Period (default)
- Method (Linear Regression)
- Advanced Options (Sig lev 5%, Min pattern score 0.1)
- Downscaling Region (?)

CHECK CORRELATION MAPS!
Data for hands-on > cor map
Exercise 1

Precipitation over Yangon for JJA 2017

A1

Prediction Season (2017/JJA)
Variables (U850)
Models (ALL)
Predictand (Precipitation)
Training Period (default)
Method (Linear Regression)
Advanced Options (Sig lev 5%, Min pattern score 0.1)
Downscaling Region (lat 0~15, lon 85~190)
Exercise 1

Precipitation over Yangon for JJA 2017

A1

- CWB
- Hopeful
- Above normal
Exercise 1
Precipitation over Yangon for JJA 2017

A1

- POAMA
- Good
- Above normal
Exercise 2

Precipitation over YOUR CITY for JJA 2017

Q2

Prediction Season (2017/JJA)
Variables (?????)
Models (ALL)
Predictand (Precipitation)
Training Period (default)
Method (Linear Regression)
Advanced Options (Sig lev 5%, Min pattern score 0.1)
Downscaling Region (?????)

Downscale

CHECK
CORRELATION
MAPS!
Data for hands-on > cor map
Thank you.
Exercise 2

Precipitation over Simtokha for JJA 2017

Q2

Prediction Season (**2017/JJA**)
Variables (**SST**)  
Models (**ALL**)  
Predictand (**Precipitation**)  
Training Period (default)  
Method (Linear Regression)  
Advanced Options (**Sig lev 5%, Min pattern score 0.1**)  
Downscaling Region (**lat -60~40, lon 40~150**)

![Map of sst (scm) vs. prec over Semtokha](image1)
![Map of sst vs. prec over Semtokha](image2)
Exercise 2
Precipitation over Simtokha for JJA 2017

A2

<table>
<thead>
<tr>
<th>Details</th>
<th>PREDICTAND</th>
<th>PREDICTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>YEAR/SEASON</td>
<td>2017/0</td>
<td>Training Period</td>
</tr>
<tr>
<td>PREDICTAND</td>
<td>PREC</td>
<td>90T</td>
</tr>
<tr>
<td>DATASET</td>
<td>Bhutan</td>
<td>MODELS</td>
</tr>
<tr>
<td>REGION</td>
<td>1 Stations</td>
<td>REGION</td>
</tr>
<tr>
<td>SIGNIFICANCE LEVEL</td>
<td>5%</td>
<td>MINIMUM PATTERN SCORE 0.1</td>
</tr>
</tbody>
</table>

**Selected Stations**

<table>
<thead>
<tr>
<th>Station ID</th>
<th>Name</th>
<th>Data period for PREC</th>
<th>Data period for TEMP</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>12700045</td>
<td>Good</td>
<td>1995/01 - 2015/12</td>
<td></td>
<td>0.338176</td>
</tr>
</tbody>
</table>

- MSC
- Good
- Below normal
Exercise 2

Precipitation over Simtokha for JJA 2017

A2

✓ NASA
✓ Hopeful
✓ Above normal
Exercise 2
Precipitation over Pyinmana for JJA 2017

Q2
Prediction Season (2017/JJA)
Variables (SLP)
Models (ALL)
Predictand (Precipitation)
Training Period (default)
Method (Linear Regression)
Advanced Options (Sig lev 5%, Min pattern score 0.1)
Downscaling Region (lat -5~10, lon 155~215)

http://clik.apcc21.org
### Exercise 2

**Precipitation over Pyinmana for JJA 2017**

#### A2

<table>
<thead>
<tr>
<th>Details</th>
<th>PREDICTAND</th>
<th>PREDICTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRAINING</td>
<td>2017/0</td>
<td>Training Period 1997 / 2015</td>
</tr>
<tr>
<td>PREDICTAND</td>
<td>PREC</td>
<td>VARIABLE SLP</td>
</tr>
<tr>
<td>DATASET</td>
<td>WYNNR</td>
<td>MODELS</td>
</tr>
<tr>
<td>REGION</td>
<td>3 stations</td>
<td>REGION</td>
</tr>
<tr>
<td>SIGNIFICANCE</td>
<td>LEVEL</td>
<td>0%</td>
</tr>
<tr>
<td>MINIMUM PATTERN</td>
<td>SCORE</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Mandatory stations & good result only.

#### Stations & Prediction Result

- **Correlation**: 0.32, **PREC_forecast** = 70.08 mm/month

#### Selected Stations

<table>
<thead>
<tr>
<th>Station ID</th>
<th>Model</th>
<th>Name</th>
<th>Date period for PREC</th>
<th>Date period for TEMP</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>APCC</td>
<td>nqutara</td>
<td>1951/1 - 2016/12</td>
<td>0.323762</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Good</td>
<td>paisandololung</td>
<td>1961/1 - 2016/1</td>
<td>0.531862</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Bad</td>
<td>lemeyanan</td>
<td>1971/1 - 2015/9</td>
<td>0.990</td>
<td></td>
</tr>
</tbody>
</table>

- ✓ APCC
- ✓ Good
- ✓ Above normal
Exercise 2

Precipitation over Pyinmana for JJA 2017

A2

- NASA
- Hopeful
- Near normal