CLIK hands-on (PART IV):

Multi Model Downscaling using CLIK
(http://clik.apcc21.org)

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8 Jun 2017
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**
- **A**: Station data
- **B**: Global observation data
- **C**: Screening test 1

- **No**: Bad Stations
- **Yes**: Hopeful Stations

**STEP II**
- **B**: Screening test 2

- **No**: Remain as “Hopeful Station”
- **Yes**: Good Stations

**STEP III**
- **C**: Downscaled Forecast for the station
- **Downscaling**

- **Good Stations**: Model data
- **Model data**
Downscaling procedure in CLIK

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

**STEP 1**
**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**
- Correlation map of global observation vs. station
- Correlation map of model data vs. station
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 Phetchaburi & ...

- The station data has relationship with the global observational u850 over some areas.
- Dynamical models can reproduce the relationship between observation and station data.
- We hope a successful downscaling by CLIK system...
Rainfall over Phetchaburi in next three month (JJA 2017)?
Produce a downscaled forecast

1. Select Dataset / Station

<table>
<thead>
<tr>
<th>Dataset Name</th>
<th>Countries</th>
<th>Total Stations</th>
<th>Period(pres)</th>
<th>Period(temp)</th>
<th>Public</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thailand</td>
<td>Thailand</td>
<td>3</td>
<td>1982 ~ 2010</td>
<td>N/A</td>
<td>partly</td>
</tr>
<tr>
<td>GHCN</td>
<td>Ghana</td>
<td>2070</td>
<td>1980 ~ 2000</td>
<td>N/A</td>
<td>PUBLIC</td>
</tr>
<tr>
<td>Afghanistan, Bangladesh, Brunei</td>
<td>Afghanistan, Bangladesh, Brunei</td>
<td>4919</td>
<td>2004 ~ 2008</td>
<td>N/A</td>
<td>PUBLIC</td>
</tr>
<tr>
<td>Korea 80 Stations</td>
<td>Korea, Rep. of Korea</td>
<td>80</td>
<td>1983 ~ 2008</td>
<td>N/A</td>
<td>PUBLIC</td>
</tr>
</tbody>
</table>

2. Shift + drag

3. Check Station

<table>
<thead>
<tr>
<th>Station ID</th>
<th>Name</th>
<th>Precipitation</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>495201</td>
<td>Prachanburi</td>
<td>1982/1 ~ 2010/12</td>
<td>NA</td>
</tr>
<tr>
<td>832201</td>
<td>Ranong</td>
<td>1982/1 ~ 2010/12</td>
<td>NA</td>
</tr>
<tr>
<td>558501</td>
<td>Songkhla</td>
<td>1982/1 ~ 2010/12</td>
<td>NA</td>
</tr>
</tbody>
</table>

4. Common data period of selected stations

<table>
<thead>
<tr>
<th>Month</th>
<th>Precipitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2010</td>
</tr>
<tr>
<td>2</td>
<td>2010</td>
</tr>
<tr>
<td>3</td>
<td>2010</td>
</tr>
<tr>
<td>4</td>
<td>2010</td>
</tr>
<tr>
<td>5</td>
<td>2010</td>
</tr>
<tr>
<td>6</td>
<td>2010</td>
</tr>
<tr>
<td>7</td>
<td>2010</td>
</tr>
<tr>
<td>8</td>
<td>2010</td>
</tr>
<tr>
<td>9</td>
<td>2010</td>
</tr>
<tr>
<td>10</td>
<td>2010</td>
</tr>
<tr>
<td>11</td>
<td>2010</td>
</tr>
<tr>
<td>12</td>
<td>2010</td>
</tr>
</tbody>
</table>
Produce a downscaled forecast

A. Set options

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

A. Set options

Prediction Season

2017 JJA
Produce a downscaled forecast

A. Set options

Variable
U850
Produce a downscaled forecast

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)

Set-up Downscaling

Downscale Description: Precipitation over Phetchaburi in JJA 2017

Prediction Season
Year: 2017
Season: JJA

Variable
- PREC
- SLP
- U850
- V850
- U200
- V200
- SST

Models
- APCC
- NASA
- NCEP
- PNU
- POAMA

Predictand
- Precipitation
- Temperature

Training Period
From: 1983
To: 2005

Method
Linear Regression

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

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

A. Set options

Downscaling Region
Latitude 0~20
Longitude 90~150
(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 21:35:24</td>
<td>ranong1850</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>
<tr>
<td>5546</td>
<td>Downscale</td>
<td>success</td>
<td>download</td>
<td>2017-06-01 09:50:28</td>
<td>2017-06-01 09:51:29</td>
<td>-</td>
</tr>
<tr>
<td>5545</td>
<td>Downscale</td>
<td>success</td>
<td>download</td>
<td>2017-06-01 09:31:36</td>
<td>2017-06-01 09:34:05</td>
<td>-</td>
</tr>
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<td>5544</td>
<td>Downscale</td>
<td>fail</td>
<td></td>
<td>2017-06-01 09:26:16</td>
<td>2017-06-01 09:26:17</td>
<td>-</td>
</tr>
<tr>
<td>5543</td>
<td>Downscale</td>
<td>success</td>
<td>download</td>
<td>2017-06-01 09:22:59</td>
<td>2017-06-01 09:25:29</td>
<td>-</td>
</tr>
</tbody>
</table>

Showing 1 to 10 of 136 entries
B. Check results

Produce a downscaled forecast

My Page

Jobs

<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>
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<td>success</td>
<td>download</td>
<td>2017-06-01 21:34:57</td>
<td>2017-06-01 21:35:24</td>
<td>ranong 1850</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>download</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>download</td>
<td>2017-06-01 20:01:57</td>
<td>2017-06-01 20:02:01</td>
<td>-</td>
</tr>
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<td>2017-06-01 19:36:02</td>
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<td>-</td>
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<td>2017-06-01 09:51:29</td>
<td>-</td>
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<td>-</td>
</tr>
</tbody>
</table>

Showing 1 to 10 of 136 entries

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

#### B. Check results

<table>
<thead>
<tr>
<th>Details</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Job ID</td>
<td>5509</td>
</tr>
<tr>
<td>Downscale ID</td>
<td>4712</td>
</tr>
<tr>
<td>Predictand</td>
<td>PREDICTOR</td>
</tr>
<tr>
<td>Year/Season</td>
<td>2017 / 6</td>
</tr>
<tr>
<td>Predictand</td>
<td>PREC</td>
</tr>
<tr>
<td>Dataset</td>
<td>Thailand [ID 8272]</td>
</tr>
<tr>
<td>Station</td>
<td>3 Stations</td>
</tr>
<tr>
<td>Significance level</td>
<td>5%</td>
</tr>
<tr>
<td>Minimum pattern score</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Training Period: 1983 / 2005
VARIABLE: U850
MODELS: APCC, CWB, MSC, NASA, PNU, POAMA
REGION: Lat 0–20/Lon 90–150

[View Result](http://clik.apcc21.org)
B. Check results

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

Stations & Prediction Result

- Seasonal forecast of station
- Observation prediction
- Correlation = 0.48, PREC_forecasted = -60.98 mm/month

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

- Location of the station

http://clik.apcc21.org
B. Check results

- Relationship pattern between the predictor (u850, observation) and the station data (precipitation) over the selected area
- Screening test 1
B. Check results

- Relationship pattern between the predictor (u850, model) and the station data (precipitation) over the selected area
- Screening test 2
Produce a downscaled forecast

B. Check results

Stations & Prediction Result

Seasonal forecast of station

- Observation prediction

Correlation = 0.48, PREC_forecasted = -60.98 mm/month

Linear Regression of station on observed predictor

Linear Regression of station on model predictor

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.
Exercise 1
Precipitation over Phetchaburi in JJA 2017

Q1

- Prediction Season: 2017/JJA
- Variables: SST
- Models: APCC, POAMA
- Predictand: Precipitation
- Training Period: default
- Method: Linear Regression
- Advanced Options: Sig lev 5%, Min pattern score 0.1
- Downscaling Region: ?????
Exercise 1
Precipitation over Phetchaburi in JJA 2017

A1

- Prediction Season (2017/JJA)
- Variables (SST)
- Models (APCC, POAMA)
- Predictand (Precipitation)
- Training Period (default)
- Method (Linear Regression)
- Advanced Options (Sig lev 5%, Min pattern score 0.1)
- Downscaling Region (lat -10~10, lon 120~240)
Exercise 1

Precipitation over Phetchaburi in JJA 2017

A1

- APCC
- Good
- Below normal
Exercise 1
Precipitation over Phetchaburi in JJA 2017

A1

- POAMA
- Good
- Below normal
Exercise 2

Precipitation over Pochentong in 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
Exercise 2
Precipitation over Pochentong in JJA 2017

A2

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 80~130)

http://clik.apcc21.org
Exercise 2

Precipitation over Pochentong in JJA 2017

A2

- APCC
- Hopeful
- Below normal
Exercise 2

Precipitation over Pochentong in JJA 2017

A2

- PNU
- Good
- Below normal
Thank you.
Precipitation over Ranong in 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
Exercise 2
Precipitation over Ranong in JJA 2017

Prediction Season (2017/JJA)
Variables (t850)
Models (ALL)
Predictand (Precipitation)
Training Period (default)
Method (Linear Regression)
Advanced Options (Sig lev 5%, Min pattern score 0.1)
Downscaling Region (lat -20~, lon 90~150)

Downscale
Exercise 2
Precipitation over Ranong in JJA 2017

A2-1

- NASA
- Good
- Below normal

Details:
- PRECIP MISO
- YEAR / SEASON: 2017 / JJA
- PRECIP MISO: PREC
- VARIABLE: T850
- DATASET: Thailand
- MODELS: A21C, RCP 8.5, NASA, POAMA
- REGION: Thailand
- Let: -50° - 50°, Lat: 80° - 150°
- 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 TEMP</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>4G52201</td>
<td>Good</td>
<td>Phetchaburi</td>
<td>1992/1 – 2016/11</td>
<td>0.591625</td>
<td></td>
</tr>
<tr>
<td>5325981</td>
<td>Good</td>
<td>Ranong</td>
<td>1992/1 – 2016/12</td>
<td>0.40745</td>
<td></td>
</tr>
</tbody>
</table>

Stations & Prediction Result:
- Correlation = 0.41, PREC_forecasted: -118.29 mm/month

Linear Regression of station on observed predictor:

New Downscale
Exercise 2
Precipitation over Ranong in JJA 2017

A2-1

- PNU
- Good
- Below normal
Exercise 1

Precipitation over Ranong in JJA 2017

A2-2

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 0~20, lon 65~120)

Downscale
**Exercise 2**

**Precipitation over Ranong in JJA 2017**

### A2-2

- APCC
- Good
- Above normal

---

**Tables and Maps**

<table>
<thead>
<tr>
<th>Station ID</th>
<th>Result</th>
<th>Name</th>
<th>Data period for PREC</th>
<th>Data period for TEMP</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>465201</td>
<td>Good</td>
<td>Phetchaburi</td>
<td>1982/1 - 2015/11</td>
<td></td>
<td>0.368555</td>
</tr>
<tr>
<td>532201</td>
<td>Good</td>
<td>Ranong</td>
<td>1992/1 - 2015/12</td>
<td></td>
<td>0.272546</td>
</tr>
</tbody>
</table>

**Stations & Prediction Result**

- **Correlation**: 0.27, **PREC_forecast** = 218.62 mm/month

---

**Maps**

- Linear Regression of station on observed predictor
- Linear Regression of station on model predictor
Exercise 2

Precipitation over Ranong in JJA 2017

A2-2

- CWB
- Hopeful
- Near normal