Delineation of Climate Zone in Cambodia

Dr. Jothiganesh S., Team Leader – Climate Application, RIMES

July 9, 2020

Acknowledgement – Mr. Oum Ryna, Ms. Peou Phalla - DoM; Dr. Muhibuddin Usamah - UNDP; Dr. Itesh Dash, Dr. Yuvaraj Eswaran, Ms. Karthika - RIMES

Strengthening Climate information and Early Warning System in Cambodia
Fallacies in dealing with spatial Scale (Statistical)

- **Individualistic fallacy**: Interpolating information from smaller/local scale (location) to larger scale (province)
- **Ecological fallacy**: Interpreting larger scale (e.g. province) to smaller/local scale (location)
Spatial Scale and Errors in Longer Lead Forecast

Errors in Longer Lead Forecast are generally low in larger spatial extent and especially over meaningful climatological zones.
“Climate has its own boundary”

- We need to adjust our human lens to look at it
Data used

   • Rainfall and Mean temperature from 19 observatories

   • Rainfall - NASA’s Global Precipitation Measurement (GPM) at 10 X 10km
   • Temperature – MODIS Land Surface temperature at 5 X 5 km

   • Winds, Mean Sea Level Pressure from ERA5
Methodology

1. **Data acquisition, processing, and quality checks**: Rainfall and Temperature data from surface observatories.


3. **Spatial Analysis**: Annual accumulated rainfall and averaged temperature spatial plots for the observatory locations.

4. **Data acquisition and processing**: Satellite based gridded rainfall and temperature estimates.

   - Annual accumulated rainfall and averaged temperature spatial plots.

6. Identifying homogeneous climatological zones:
   - Identify homogeneous zone based on annual accumulated rainfall from observatories and gridded data.
   - Assess the temperature and elevation characteristics over climate zones.
   - Assess the climate drivers over climate zones.

7. Delineate homogenous climate zones based on rainfall map using GIS and provide inferences.

- **Data, acquisition, processing, and quality checks** (Surface Observatory + Satellite based estimates)
- **Spatial analysis and Monthly climatological analysis using surface observatory data**
- **Comparing with Satellite based estimates**
- **Identifying homogeneous climatological zones and understanding its climate drivers**
- **Climate Zone Delineation**
Spatial variability of annual rainfall and temperature
1. Very Heavy rainfall and July peak – Koh Kong, Preah Sihanouk, Kampot (South West)
2. Heavy rainfall and Sep peak – Stung Treng (North East)
3. Heavy rainfall and Oct peak – Svay Rieng (South East)
4. Progression of monsoon season – West-East
# Climate Zone of Cambodia

## Climate Zones

<table>
<thead>
<tr>
<th>Zone</th>
<th>Stations</th>
<th>Rainfall characteristics</th>
<th>Annual Rainfall (mm)</th>
<th>Name of the zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 1</td>
<td>Koh Kong, Preah Sihanouk, Kampot</td>
<td>Very Heavy</td>
<td>1931 to 4201</td>
<td>South-west/Coastal</td>
</tr>
<tr>
<td>Zone 2</td>
<td>Pailin, Battambang, Banteay Mean Chey</td>
<td>Low</td>
<td>1079 to 1294</td>
<td>North-west/Continental</td>
</tr>
<tr>
<td>Zone 3*</td>
<td>Siem Reap</td>
<td>Heavy</td>
<td>1520</td>
<td>North central/Continental</td>
</tr>
<tr>
<td>Zone 4</td>
<td>Pursat, Kampong Thom, Kampong Chhang, Kampong Cham, Kratie</td>
<td>Moderate</td>
<td>1135 - 1468</td>
<td>Central Plains/Continental</td>
</tr>
<tr>
<td>Zone 5</td>
<td>Kampong Speu, Pochentong/Phnom Penh, Kandal, Prey Veng, Takeo</td>
<td>Low</td>
<td>1261</td>
<td>South-central/Continental</td>
</tr>
<tr>
<td>Zone 6</td>
<td>Svay Rieng</td>
<td>Heavy</td>
<td>1689</td>
<td>South-east/Continental</td>
</tr>
<tr>
<td>Zone 7</td>
<td>Stung Treng</td>
<td>Heavy</td>
<td>1891</td>
<td>North-east/Continental</td>
</tr>
</tbody>
</table>
Climate Zones

<table>
<thead>
<tr>
<th>Zone</th>
<th>Stations</th>
<th>Rainfall characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 1</td>
<td>Koh Kong, Preah Sihanouk, Kampot</td>
<td>Very Heavy</td>
</tr>
<tr>
<td>Zone 2</td>
<td>Pailin, Battambang, Banteay Mean Chey</td>
<td>Low</td>
</tr>
<tr>
<td>Zone 3*</td>
<td>Siem Reap</td>
<td>Heavy</td>
</tr>
<tr>
<td>Zone 4</td>
<td>Pursat, Kampong Thom, Kampong Chiang, Kampong Cham, Kratie</td>
<td>Moderate</td>
</tr>
<tr>
<td>Zone 5</td>
<td>Kampong Speu, Pochentong/Phnom Penh, Kandal, Prey Veng, Takeo</td>
<td>Low</td>
</tr>
<tr>
<td>Zone 6</td>
<td>Svay Rieng</td>
<td>Heavy</td>
</tr>
<tr>
<td>Zone 7</td>
<td>Stung Treng</td>
<td>Heavy</td>
</tr>
</tbody>
</table>
Climate Zone of Cambodia

Inference from Satellite based estimates – Annual rainfall
Satellite based estimates – Wet Season Rainfall

Wet Season Rainfall (May-October)

Rainfall in mm:
- < 1300
- 1500
- 1800
- 2100
- 2400
- > 2700

- Major waterbodies
- Province boundary
- Country boundary
Satellite based estimates – Dry Season Rainfall

Dry Season Rainfall (November-April)

Rainfall in mm
- 200
- 300
- 400
- 500
- 600
- 800

Country boundary
Province boundary
Major waterbodies
Satellite based estimates – Monthly variation in rainfall and temperature in Cambodia

Rainfall in mm
- 10
- 50
- 100
- 200
- 300
- 400
- 500
- 600
- 700
- 800

Temperature in °C
- 17
- 20
- 23
- 26
- 29
- 32
- 35
Climate Zone of Cambodia

Climate Zone delineation

- Characterization of climate using Surface observatory provides basis
- Satellite based estimates provides confirmation and the spatial extent of climate zones
- GIS used to digitize the zone boundaries
Climate drivers – Winds @ 1.5km above sea level

May to October

November to April
Climate Zone of Cambodia

Climate drivers - Topography

- Elevated terrain
- Hills
- Plain

Elevation in meters:
- 0-50
- 50-100
- 100-150
- 150-200
- 200-250
- 250-500
- 500-750
- 750-1000
- 1000-2000
Climate Zone of Cambodia

Climate drivers - Land Cover
Climate Zone of Cambodia

Climate drivers

Large Scale Drivers – Monsoon winds (southwesterly), Inter Tropical Convergence Zone movement

Topography – Hilly terrains over the South West influences rainfall over windward and leeward side of areas

Forest cover/Dense vegetation – Enhanced evapotranspiration could increase the moisture over atmosphere
Strengthening Climate Information and Early Warning System in Cambodia

Climate Zone of Cambodia

Application – Generating Seasonal Forecast by Climate Zones (FOCUS)