Climate Change-Related Meteorological Events in the Southern Philippines

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A Note on the Philippines

- South of Hong Kong & Taipei, north of Indonesia, east of peninsular Southeast Asia
- 11.3333°N, 123.0167°E
- Three regions: Luzon, Visayas and Mindanao
- We’ll focus on **Southern Mindanao**
  - north of equator
  - 7.0644°N, 125.6078°E

![Map of the Philippines](https://upload.wikimedia.org/wikipedia/commons/thumb/c/ce/Mindanao_Red.png/656px-Mindanao_Red.png)
Extreme Events (Pablo & Matina Pangi)
Unusual Weather Patterns
Adaptation Activities
Extreme Events: Typhoon Pablo

- **International name:** Bopha
- **Landfall:** December 2011, southeastern end of Mindanao
- **The category 5 storm in numbers (AGU, 2012)**
  - ~1500 fatalities
  - ~150,000 damaged houses
  - ~61,000 “total loss” houses
  - ~USD 350 million in economic losses
  - ~5.5 million people affected
Why Mindanaoans Were Unprepared for Pablo
Pablo’s Effects: Agriculture - Banana Industry
Pablo’s Effects: Agriculture – Coconut/Palm Industry
Pablo’s Effects: Agriculture – Coconut/Palm Industry
## Flood Monitoring Report

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Level/Current</th>
<th>Monitoring</th>
<th>Water Level</th>
<th>Evacuated</th>
<th>Evacuation Area</th>
<th>No. Of Families</th>
<th>Time</th>
<th>Subsided</th>
<th>Remarks</th>
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</thead>
<tbody>
<tr>
<td>28-Jun</td>
<td>9:31 PM</td>
<td>Level 3</td>
<td>9:31 PM</td>
<td>Teachers Village</td>
<td>Jesus is Lord Chapel</td>
<td>28</td>
<td>4:15 of June 29</td>
<td>8:05 PM heavy rain started</td>
<td>11:17 PM Balusong Bridge over flow</td>
<td></td>
</tr>
<tr>
<td>28-Jun</td>
<td>9:55 PM</td>
<td>Level 6.5</td>
<td>9:55 PM</td>
<td>Golden Valley</td>
<td>Higher ground area</td>
<td>35</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>28-Jun</td>
<td>10:30 PM</td>
<td>Level 8</td>
<td>9:55 PM</td>
<td>Conception</td>
<td>Barangay Hall 74-A</td>
<td>15</td>
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<td></td>
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<tr>
<td>28-Jun</td>
<td>11:03 PM</td>
<td>Level 13</td>
<td>9:55 PM</td>
<td>Lastima Compound</td>
<td>Km. 6 San Isidro Chapel</td>
<td>26</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28-Jun</td>
<td>11:17 PM</td>
<td>OVERFLOW</td>
<td>9:55 PM</td>
<td>Guadalupe</td>
<td>Santiago</td>
<td>23</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Brgy. Disaster Risk Reduction Management Committee  
*Disaster Operation Center 74-A*

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**Source:** Manila Observatory  
**BDRRMC Matina Crossing 74-A**  
**Extreme Events: Matina Pangi River**
Extreme Events: Matina Pangi River

August 24, 2011

Flood reached this level

January 20, 2012

[Image: Flood reached this level]
Extreme Events: Matina Pangi River - Water Level Gauge at Matina Bridge

Accumulated Rainfall during June 28, 2011: 127 mm
Unusual Rain Patterns

• **Usual Weather in Mindanao region**
  - warm sunny days
  - light rain at sundown that stops by nightfall
  - no storms or extreme events
  - *great* weather for agriculture

• **With climate change, first generation to not know a steady weather pattern**
Possible scenario: city temperature (General Santos City) expected to be the same as agricultural area (Polomolok, South Cotabato) over time
Unusual Rain Patterns

- **Polomolok weather stations: increasing rainfall → increasing floods**

- **Issues: density and frequency**
  - Can have high rainfall at only one time in a month
  - Unusual events: Ondoy, Pablo

(Tubigon, 2012)
Unusual Rain Patterns

- Regular flooding pattern in Polomolok: June – August
- Recent Polomolok flooding: two periods
  - January – March
  - June – August
- Flooding has increased in past ten years
- Different sectors affected

(Tubigon, 2012)
Sea Level Rise: 1950 - 1990

(Yanagi & Akaki, 1994)
Sea Level Rise

Adaptation Activities

- Local weather stations to increase local rainfall data for pattern prediction
  - Locally produced weather stations
  - ADDU TROPICS and DOST, with local state and national universities

- Atmospheric vapor research
  - SCINDA
  - GPS
  - World Wide Lightning Location Network (University of Washington, Seattle)
Adaptation Activities

• Masters in Tropical Risk Management due to Climate Change
  • 2013: 2nd graduating class of government planning officials
  • Student project data collected into centralized databank for Mindanaoan science
  • Conducted in South Cotabato province
  • province is susceptible to climate change
  • Province is also known for tourism and agriculture (pineapple plantations)
Mindanao (Davao) Station
Current Observatory Space Weather Studies
Manila Observatory – Davao Station

- **Established:** 1965
- **Location:** 7° 4’ N; 125° 36’ E; 133 m elevation
- **Branch of the Manila Observatory (MO)**
  - MO was established in 1865 in downtown Manila
  - MO functioned as the official Philippine weather bureau until 1948
Manila Observatory – Davao Station

- Current MO Davao Station studies and connections
- IRIS (early tsunami warning system for the Pacific)
- MAGDAS (Kyushu University with Prof. Yumoto)
- World Wide Lightning Location Network
- Weather station
- SCINDA station
Manila Observatory Current Space Weather Studies

- **MAGDAS**
  - Kyushu University with Prof. Yumoto
  - Part of the nationwide network includes a Philippine government station
- **Weather station**
- **SCINDA station**
- **Upper Atmosphere/Space Weather (Boston College)**
- **GPS station (JPL)**
Manila Observatory Current Space Weather Studies (UAD program)

- in cooperation with Kyushu University
- looks at scintillation phenomenon, especially plasma bubbles
- makes use of ionosonde radar
The Vertical Total Electron Content (VTEC) is obtained from GPS satellite measurements.

VTEC peaks at around 2 pm local time and goes to zero at around dawn (6 am local time).
Manila Observatory Current Space Weather Studies
Manila Observatory Current Space Weather Studies
Discussion Session
Further Questions

• Could our weather phenomena be related to space weather? What connections are there between the ionosphere and troposphere?

• Given our station, developing country status and location, what other research could we undertake?

• Are we in the zone immediately affected by El Niño?

• Can the satellite data monitoring SST include temperatures as far east as Mindanao (125°E)?

• Should we be looking for upper atmosphere vapor currents, like the ones recently reported in Europe? (EOS, August 2013)
References


Thank you!

Questions?