OVERVIEW on CLIMATE & TRENDS in the PHILIPPINES

“Enhancing Communities Capacities to Confront Extreme Geo-Meteorological Events at the Core of Climate Change”

Bulwagang Juan Luna, UP, Baguio City
23 November 2009

RUSY G. ABASTILLAS
Climatology and Agrometeorology Division
DOST-PAGASA
The nation’s meteorological service and public weather service provider
58 Synoptic Stations
23 Agromet Stations
4 Radiosonde Stns.
5 Meteorological Satellite Receiving Facilities
10 Doppler radars (2 years from now)
The Philippine Climate

...Characterized by humid equatorial or tropical maritime

**Type 4 Climate:**
Rainfall more or less evenly distributed throughout the year.

Normal Temperature (Maximum, Minimum, Mean) of Baguio City (1971-2000)

Annual mean temperature of Baguio City (1971-2005)

\[ y = 0.0071x + 19.358 \]
Climatic controls that influence the climate in the Philippines

- **geography and topography** – large hilly terrain, and coastal plains

- **semi-permanent lows and highs** – produces airstreams/ocean currents

- **air streams**
  - *southwesterlies (SW monsoon)* – Apr-Sep
  - *northeasterlies (NE monsoon)* – Oct-Mar
  - *easterlies (North Pacific trades)* – transition period

- **ocean currents** = SST average 27.4°C Phil. Sea
  - influenced by complex interactions
  - rainfall variability
  - threatened by ECEs
  - various sectors affected

- **linear systems**
  - *ITCZ*
  - *cold front*
  - *easterly waves*

- **tropical cyclones**

- **ENSO phenomenon**
  - Devastating impacts could be mitigated through clear understanding of the complex mechanisms and dev’t of effective forecast tools.
Weather Causing Phenomena in the Philippines

- Southwest Monsoon (Habagat)
- Northeast Monsoon (Amihan)
- Intertropical Convergence Zone (ITCZ)
- Tropical Cyclone
ANIMATED SATELLITE PICTURES OF A COLD FRONT (TAIL-END) AFFECTING EXTREME NORTHERN LUZON) AND ITCZ AFFECTING SOUTHERN LUZON, VISAYAS AND MINDANAO
Seasonal Rainfall Distribution in the Philippines

First semester

AVERAGE RAINFALL
APRIL-SEPTEMBER
(1951-2000)

Legend:
- ≤ 450 (mm)
- 451 - 900
- 901 - 1800
- > 1800

Second semester

AVERAGE RAINFALL
OCTOBER-MARCH
(1951-2000)

Legend:
- ≤ 450 (mm)
- 451 - 900
- 901 - 1800
- > 1800

Cold air from Siberia
Frequency of Tropical Cyclones in the Philippines
Period: 1948-2005

Northern Luzon is most frequently hit by tropical cyclones followed by Catanduanes and Northern Samar and least in the Mindanao area.

The grid boxes indicate the total number of tropical cyclones passing through each 1°x1° lat/long grid over the period 1948-2005.

Data is obtained from the best track data of the Weather Branch of PAGASA

Climate Variability /ENSO
IMPACTS OF ENSO ON PHILIPPINE RAINFALL

Legend:
- **Red** colored years are EL NINO years.
- **Blue** colored years are LA NINA years.
- **Black** colored years are NON_ENSO years.

- Severe drought impacts
- Drought impacts with major losses
- Moderate drought impacts
- Near normal to above normal condition
- Way above normal condition
- Potential for flood damage
- Severe flood damage
TRENDS...

- Temperature
- Rainfall
- Tropical Cyclones
An increase of \(0.6104^\circ C\) from 1951-2006.
Observed Mean Annual Maximum Temperature Anomalies in the Philippines
Period: 1951-2006 (departures from the 1961-1990 normal values)

An increase of 0.3472°C from 1951-2006
Observed Mean Annual Minimum Temperature Anomalies in the Philippines
Period: 1951-2006 (departures from the 1961-1990 normal values)

An increase of 0.8904°C from 1951-2006, increase in minimum temperatures almost 3 times increase in maximum temperatures
Significant increase in the frequency of hot days

Significant increase in the frequency of warm nights

Trends in Extreme Daily Temperatures in the Philippines*

Legend:
- Decreasing trend (Not significant)
- Increasing trend (Not significant)
- Increasing trend (Significant)

Significant decrease in the number of cold days and cool nights.

Trends in extreme daily temperatures and 24-hr rainfall in the Phil. CAB Technical Report, PAGASA.

- Decreases in the top northern part of Luzon and Southern Luzon.
- Increases in the Bicol Region (except Daet), Visayas and Mindanao.
- Findings not statistically significant.

Annual Number of Tropical Cyclones and five-year running mean

y = -0.0104x + 19.755

<table>
<thead>
<tr>
<th>Year</th>
<th>Frequency of Tropical Cyclones</th>
</tr>
</thead>
<tbody>
<tr>
<td>1948</td>
<td>19</td>
</tr>
<tr>
<td>1953</td>
<td>20</td>
</tr>
<tr>
<td>1958</td>
<td>21</td>
</tr>
<tr>
<td>1963</td>
<td>22</td>
</tr>
<tr>
<td>1968</td>
<td>23</td>
</tr>
<tr>
<td>1973</td>
<td>24</td>
</tr>
<tr>
<td>1978</td>
<td>25</td>
</tr>
<tr>
<td>1983</td>
<td>26</td>
</tr>
<tr>
<td>1988</td>
<td>27</td>
</tr>
<tr>
<td>1993</td>
<td>28</td>
</tr>
<tr>
<td>1998</td>
<td>29</td>
</tr>
<tr>
<td>2003</td>
<td>30</td>
</tr>
</tbody>
</table>

Number of Tropical Cyclones
5 per. Mov. Avg. (Number of Tropical Cyclones)
Linear (Number of Tropical Cyclones)
Mean Number of Tropical Cyclones during Normal, El Niño and La Niña Years

<table>
<thead>
<tr>
<th>Year</th>
<th>Normal Years</th>
<th>La Niña Years</th>
<th>El Niño Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>JFM (QTR1)</td>
<td>1.21</td>
<td>1.24</td>
<td>0.38</td>
</tr>
<tr>
<td>AMJ (QTR 2)</td>
<td>3.29</td>
<td>2.87</td>
<td>2.38</td>
</tr>
<tr>
<td>JAS (QTR3)</td>
<td>9.91</td>
<td>8.86</td>
<td>8.85</td>
</tr>
<tr>
<td>OND (QTR4)</td>
<td>6.55</td>
<td>6.79</td>
<td>4.56</td>
</tr>
<tr>
<td>Total</td>
<td>20.96</td>
<td>19.76</td>
<td>16.17</td>
</tr>
</tbody>
</table>
Percentage of Annual Rainfall associated with the passage of Tropical Cyclones (1951-2005)
HIGHLIGHTS:

- The Philippines is highly vulnerable to the impacts of tropical cyclones: flooding, high winds, storm surges and landslides.
- Increasing trend in annual mean temperature
- No trend in rainfall pattern
- No trend in the total number of annual tropical cyclones
RECENT DEVASTATING TROPICAL CYCLONES

1. Ondoy (Ketsana)
2. Pepeng (Parma)
On September 26, shortly before noon in (around 0400 UTC), Ketsana made its landfall at the border of Aurora and Quezon provinces, packed with maximum winds of 85 km/h near the center and gustiness of up to 100 km/h.
TS Ondoy brought the worst rainfall to Metro Manila among recorded typhoons since the start of rainfall record keeping, producing only moderate winds but hours of extremely heavy rains. Metro Manila experienced the highest rainfall in history that brought heavy flooding.

PAGASA documented a record-high amount of rainfall in 24 hours at 455 mm (17.9 in) recorded during September 26. And also, the amount of rainfall recorded for six hours, which was 341.3 mm (13.44 in), was comparable to the 24 hour rainfall in 1967.

SCIENCE GARDEN Greatest Daily RR = 334.5 mm (June 7, 1967).
24-Hr Rainfall during the Passage of TS “Ondoy” (Sept. 24-27, 2009)

<table>
<thead>
<tr>
<th>STATION NAME</th>
<th>24</th>
<th>25</th>
<th>26</th>
<th>27</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBA</td>
<td>15.0</td>
<td>8.2</td>
<td>103.8</td>
<td>40.0</td>
</tr>
<tr>
<td>PORT AREA</td>
<td>10.4</td>
<td>41.3</td>
<td>258.5</td>
<td>7.0</td>
</tr>
<tr>
<td>SUBIC BAY</td>
<td>6.0</td>
<td>50.4</td>
<td>127.7</td>
<td>55.0</td>
</tr>
<tr>
<td>SANGLEY POINT</td>
<td>6.0</td>
<td>61.4</td>
<td>163.0</td>
<td>7.0</td>
</tr>
<tr>
<td>SCIENCE GARDEN</td>
<td>1.1</td>
<td>94.0</td>
<td>455.0</td>
<td>6.0</td>
</tr>
<tr>
<td>AMBULONG T</td>
<td>T</td>
<td>49.5</td>
<td>234.5</td>
<td>8.0</td>
</tr>
<tr>
<td>TANAY</td>
<td>0.0</td>
<td>141.4</td>
<td>331.8</td>
<td>13.0</td>
</tr>
</tbody>
</table>

24-hr RR vs Normal RR for Sept. 26, 2009 at Selected Stations affected by TS "Ondoy"
Ondoy’s Fury
“Ondoy’s Fury”
TY PEPENG (Parma) Sept.30-Oct.10
Rainfall Associated w/ TC Passage (Pepeng)
Cumulative RR (Oct. 1-10, 2009) vs. October Normal RR

### Extreme Rainfall (24-hr)

<table>
<thead>
<tr>
<th>STATIONS</th>
<th>TOT_OCT1-10</th>
<th>NOR_OCT</th>
<th>Extreme Rainfall (24-hr)</th>
<th>Highest</th>
<th>Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITBAYAT</td>
<td>303.6</td>
<td>478.7</td>
<td>678.2</td>
<td>106.1</td>
<td>6-Oct-09</td>
</tr>
<tr>
<td>BASCO</td>
<td>281.3</td>
<td>429.2</td>
<td>616.4</td>
<td>95.0</td>
<td>7-Oct-09</td>
</tr>
<tr>
<td>VIGAN</td>
<td>1005.3</td>
<td>154.3</td>
<td>594.1</td>
<td>417.3</td>
<td>4-Oct-09</td>
</tr>
<tr>
<td>LAOAG</td>
<td>843.4</td>
<td>143.6</td>
<td>564.2</td>
<td>402.6</td>
<td>4-Oct-09</td>
</tr>
<tr>
<td>APARRI</td>
<td>338.6</td>
<td>359.5</td>
<td>453.1</td>
<td>154.5</td>
<td>3-Oct-09</td>
</tr>
<tr>
<td>TUGUEGARAO</td>
<td>508.5</td>
<td>324.4</td>
<td>349.7</td>
<td>188.7</td>
<td>3-Oct-09</td>
</tr>
<tr>
<td>ECHAGUE</td>
<td>238.2</td>
<td>239.6</td>
<td></td>
<td>111.9</td>
<td>8-Oct-09</td>
</tr>
<tr>
<td>IBA</td>
<td>236.7</td>
<td>273.7</td>
<td>623.7</td>
<td>99.8</td>
<td>3-Oct-09</td>
</tr>
<tr>
<td>DAGUPAN</td>
<td>759.7</td>
<td>200.6</td>
<td>722.6</td>
<td>443.5</td>
<td>8-Oct-09</td>
</tr>
<tr>
<td>BSU</td>
<td>2169.2</td>
<td>290.2</td>
<td></td>
<td>761.8</td>
<td>8-Oct-09</td>
</tr>
<tr>
<td>BAGUIO</td>
<td>1876.5</td>
<td>461.8</td>
<td>1085.8</td>
<td>685.0</td>
<td>8-Oct-09</td>
</tr>
<tr>
<td>MUÑOZ</td>
<td>302.1</td>
<td>201.7</td>
<td></td>
<td>208.0</td>
<td>8-Oct-09</td>
</tr>
<tr>
<td>CABANATUAN</td>
<td>267.5</td>
<td>207.3</td>
<td>406.1</td>
<td>96.2</td>
<td>8-Oct-09</td>
</tr>
</tbody>
</table>
### Daily RR at Selected Stations in Luzon (Oct. 1-10, 2009)

<table>
<thead>
<tr>
<th>Stations</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>Decadal</th>
<th>Highest 24-hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITBAYAT</td>
<td>0.2</td>
<td>8.0</td>
<td>67.9</td>
<td>25.2</td>
<td>16.1</td>
<td>106.1</td>
<td>12.0</td>
<td>48.0</td>
<td>19.3</td>
<td>0.8</td>
<td>303.6</td>
<td>106.1</td>
</tr>
<tr>
<td>BASCO</td>
<td>0.0</td>
<td>14.2</td>
<td>31.6</td>
<td>0.8</td>
<td>8.7</td>
<td>69.6</td>
<td>95.0</td>
<td>50.2</td>
<td>11.0</td>
<td>0.2</td>
<td>281.3</td>
<td>95.0</td>
</tr>
<tr>
<td>VIGAN</td>
<td>0.0</td>
<td>31.7</td>
<td>168.9</td>
<td>417.3</td>
<td>126.2</td>
<td>75.4</td>
<td>68.6</td>
<td>111.8</td>
<td>5.4</td>
<td>0.0</td>
<td>1005.3</td>
<td>417.3</td>
</tr>
<tr>
<td>LAOAG CITY</td>
<td>0.0</td>
<td>10.7</td>
<td>90.6</td>
<td>402.6</td>
<td>197.3</td>
<td>47.5</td>
<td>60.0</td>
<td>33.0</td>
<td>1.7</td>
<td>0.0</td>
<td>843.4</td>
<td>402.6</td>
</tr>
<tr>
<td>APARRI</td>
<td>0.0</td>
<td>34.0</td>
<td>154.5</td>
<td>0.0</td>
<td>8.0</td>
<td>35.1</td>
<td>82.0</td>
<td>25.0</td>
<td>0.0</td>
<td>0.0</td>
<td>338.6</td>
<td>154.5</td>
</tr>
<tr>
<td>TUGUEGARAO</td>
<td>0.0</td>
<td>90.3</td>
<td>188.7</td>
<td>0.0</td>
<td>4.8</td>
<td>23.5</td>
<td>129.7</td>
<td>71.5</td>
<td>0.0</td>
<td>0.0</td>
<td>508.5</td>
<td>188.7</td>
</tr>
<tr>
<td>ECHAGUE</td>
<td>0.0</td>
<td>29.6</td>
<td>0.0</td>
<td>0.1</td>
<td>2.6</td>
<td>94.0</td>
<td>111.9</td>
<td>0.0</td>
<td>0.0</td>
<td>238.2</td>
<td>111.9</td>
<td></td>
</tr>
<tr>
<td>IBA</td>
<td>T</td>
<td>52.6</td>
<td>99.8</td>
<td>0.0</td>
<td>0.2</td>
<td>3.4</td>
<td>19.7</td>
<td>47.4</td>
<td>13.6</td>
<td>0.0</td>
<td>236.7</td>
<td>99.8</td>
</tr>
<tr>
<td>DUGUPAN CITY</td>
<td>T</td>
<td>25.5</td>
<td>159.5</td>
<td>8.0</td>
<td>T</td>
<td>36.2</td>
<td>52.0</td>
<td>443.5</td>
<td>35.0</td>
<td>0.0</td>
<td>759.7</td>
<td>443.5</td>
</tr>
<tr>
<td>BSU</td>
<td>2.1</td>
<td>23.7</td>
<td>410.7</td>
<td>72.9</td>
<td>2.2</td>
<td>471.8</td>
<td>346.9</td>
<td>761.8</td>
<td>77.1</td>
<td>0.0</td>
<td>2169.2</td>
<td>761.8</td>
</tr>
<tr>
<td>BAGUIO CITY</td>
<td>0.4</td>
<td>20.0</td>
<td>531.0</td>
<td>38.2</td>
<td>4.6</td>
<td>260.0</td>
<td>276.0</td>
<td>685.0</td>
<td>61.3</td>
<td>0.0</td>
<td>1876.5</td>
<td>685.0</td>
</tr>
<tr>
<td>MUNOZ</td>
<td>0.2</td>
<td>18.5</td>
<td>0.0</td>
<td>0.5</td>
<td>10.7</td>
<td>63.8</td>
<td>208.0</td>
<td>0.4</td>
<td>0.0</td>
<td>0.0</td>
<td>302.1</td>
<td>208.0</td>
</tr>
<tr>
<td>CABANATUAN CITY</td>
<td>20.0</td>
<td>24.8</td>
<td>65.4</td>
<td>0.0</td>
<td>2.3</td>
<td>2.0</td>
<td>54.8</td>
<td>96.2</td>
<td>2.0</td>
<td>0.0</td>
<td>267.5</td>
<td>96.2</td>
</tr>
</tbody>
</table>
“Pepeng’s Fury”
Thank You!!!