Lessons Learned from the 2011 Floods
(The Philippines Country Report)

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PAGASA-DOST
Outline of presentation

1. Background
2. Notable tropical cyclones and their impacts
3. Trends of flooding and response
4. Current initiatives
5. Lessons learned
The nature of flood hazard in the PH

According to any criteria, the Philippines is an extremely dangerous place to inhabit. One of the most comprehensive records on the occurrence of recent natural hazards even advised that the archipelago has experienced more disasters than any other country in the world since 1900. - Centre for Research on the Epidemiology of Disasters, Université Catholique de Louvain, Brussels (hereafter CRED) EM-DAT: The OFDA/CRED International Disaster Database.

Residents of southern Luzon were likely to face a major typhoon once every five to six years in the eighteenth century and once every four to five years in the 19th century. - Rantucci, Geological Disasters in the Philippines, 27;

Archive of the Manila Observatory, Manila (hereafter AMO):
The climate of the PH is influenced by the complex interactions of various factors such as:

- **Philippine Geography and Topography**
- **Ocean currents**
- **Semi-permanent cyclones and anti-cyclones**
- **Principal Air Streams**
- **Linear systems**
- **Tropical Cyclones**

**Average Annual Rainfall = 2,500 mm**

50% of the annual Rainfall – from Tropical Cyclones
19 - annual average
19 tropical cyclones (TCs) entered the Philippine Area of Responsibility (PAR) in 2011

- 6 Typhoons
- 8 Tropical Storms
- 5 Tropical Depression

7 TCs made landfall:
- 3 Typhoons
- 4 Tropical Storms
## Impacts of TCs in 2011

<table>
<thead>
<tr>
<th>Date</th>
<th>TC Name</th>
<th>Affected Regions</th>
<th>Casualties</th>
<th>Total Damage (PhP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 20-28</td>
<td>TY Chedeng <em>(Songda)</em></td>
<td>NCR, II, V, IX, X, XII &amp; ARMM</td>
<td>4</td>
<td>18,933,499</td>
</tr>
<tr>
<td>Jun 9-10</td>
<td>TS Dodong <em>(Sarika)</em></td>
<td>I, II, III, IV-A &amp; IV-B</td>
<td>3</td>
<td>6,192,000</td>
</tr>
<tr>
<td>Jun 14-20</td>
<td>TD Egay <em>(Haima)</em></td>
<td>III &amp; NCR</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Jun 21-25</td>
<td>TS Falcon <em>(Meari)</em></td>
<td>I, II, III, NCR</td>
<td>12</td>
<td>646,851,793</td>
</tr>
<tr>
<td>Jul 28-Aug 5</td>
<td>TS Kabayan <em>(Muifa)</em></td>
<td>I, III, IV-A, VI &amp; NCR</td>
<td>8</td>
<td>2,500,000</td>
</tr>
<tr>
<td>Aug 21-29</td>
<td>TY Mina <em>(Nanmadol)</em></td>
<td>I, II, V, VI, CAR and NCR</td>
<td>36</td>
<td>2,089,349,409</td>
</tr>
<tr>
<td>Sep 29-Oct 2</td>
<td>TY Quiel <em>(Nalgae)</em></td>
<td>I, II, III and CAR</td>
<td>17</td>
<td>115,075,527</td>
</tr>
<tr>
<td>Oct 10-14</td>
<td>TS Ramon <em>(Banyan)</em></td>
<td>IV-B, VI, VII, VIII, X, XII &amp; CARAGA</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Dec 15-18</td>
<td>TS Sendong <em>(Washi)</em></td>
<td>VI, VII, IX, X, XI, ARMM &amp; CARAGA</td>
<td>1268</td>
<td>1,455,825,723</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>15 regions</strong></td>
<td></td>
<td><strong>1557</strong></td>
<td><strong>26,582,346,395</strong></td>
</tr>
</tbody>
</table>

*Source: Office of Civil Defense (OCD)*

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20 February 2012, Bangkok, Thailand
## Impacts of TCs and other phenomena

<table>
<thead>
<tr>
<th></th>
<th>Damage to Properties (Billion PhP)</th>
<th>Damaged Houses</th>
<th>Total Population Served (Million)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Agri</td>
<td>Infra</td>
<td>Private Properties</td>
</tr>
<tr>
<td>Tropical Cyclones</td>
<td>18.368</td>
<td>8.203</td>
<td>0.011</td>
</tr>
<tr>
<td>Others*</td>
<td>1.303</td>
<td>2.142</td>
<td>0.001</td>
</tr>
<tr>
<td>Total</td>
<td>19.671</td>
<td>10.350</td>
<td>0.012</td>
</tr>
</tbody>
</table>

* Others: Southwest and Northeast monsoon rains, cold front, low pressure areas, Bulusan volcano, fish kills, food poisoning, etc.  
  *Source: Office of Civil Defense (OCD)*

**Total damage to Agriculture, Infrastructure and Private Properties:** **PhP30.033 Billion (USD690.4 Million)**  
**TCs:** **PhP26.582 Billion (USD611.1 Million)**  
**Casualties:** **1731** (1268 due to TS Washi)
Hazard Maps

Topographic map

Frequency of Tropical Cyclone Occurrence

Flood and landslide prone provinces areas

18 Major river basins

Flood & Storm prone areas

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Impacts of TY Pedring (Nesat) & STY Quiel (Nalgae)

<table>
<thead>
<tr>
<th>TC Name</th>
<th>Date</th>
<th>Casualties</th>
<th>Total Damage</th>
<th>Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>TY Nesat</td>
<td>Sep 24-28</td>
<td>85</td>
<td>Ph15.55 Billion USD357.5 M</td>
<td>Widespread flooding in Central Luzon</td>
</tr>
<tr>
<td>STY Nalgae</td>
<td>Sep 29 - Oct 2</td>
<td>17</td>
<td>Ph115.0 Million USD2.65 M</td>
<td>Widespread flooding in Central Luzon</td>
</tr>
</tbody>
</table>
Impacts of TY Pedring and STY Quiel

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**Issue:**

1. The LGUs blamed dam operators for releasing water from spillways of Angat Dam.
2. Duration of flooding lasted for 2 weeks due to constricted water ways in the downstream areas of the Pampanga and Angat rivers.

Duration of flooding: 4 days to 2 weeks (dark blue shaded areas.)
TS Washi – 19th TC and the most destructive – dumped extreme rainfall that triggered flash floods.

Casualties: 1268

Total Damage: 1,455,825,723
SATELLITE-BASED RAINFALL of TS WASHI

Dec 16, 2011 4 PM LST
Dec 16, 2011 5PM LST
Dec 16, 2011 6PM LST
Dec 16, 2011 7 PM LST
Dec 16, 2011 8 PM LST
Dec 16, 2011 9 PM LST

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SATELLITE-BASED RAINFALL of TS WASHI

Dec 16, 2011 10 PM LST
Dec 16, 2011 11 PM LST
Dec 16, 2011 12 MN LST
Dec 17, 2011 1 AM LST
Dec 17, 2011 2 AM LST
Dec 17, 2011 3 AM LST

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SATELLITE-BASED RAINFALL of TS WASHI

Dec 16, 2011 - 9 P.M. LST

Estimated RR in CDO river basin:
~ 15 – 20 mm/hr

- PAGASA Synoptic station

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Estimates of satellite-based rainfall for TS Washi on Dec 16, 2011 at 10 PM LST. Estimated rainfall rate in the CDO river basin is approximately 25 to 30 mm/hr. PAGASA Synoptic station.
SATELLITE-BASED RAINFALL of TS WASHI

Dec 16, 2011 - 11 P.M. LST

Observed max. hourly RR (Talakag station) = 60.6 mm (11PM-12MN)

Estimated RR in CDO river basin:
~ 20 – 25 mm/hr
FINDINGS:

1. PAGASA was able to forecast accurately the track of TS Washi, however rainfall forecasts from numerical weather prediction (NWP) models were underestimated.

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2. Heavy rainfall of short duration in the upstream of the Cagayan de Oro and neighbouring river basins

At Talakag station: Max 1-hr RR = 60.6 mm (11PM – 12MN)
Max 3-hr RR = 112.0 mm (10PM – 1AM)
Max 6-hr RR = 199.0 mm (7PM – 1AM)
3. Attendant landslides/flash floods/flooding

In CDO river basin, flash flood occurred at the Libona mini-hydro plant along the Bubunawan river.

In Iligan City, flash flood occurred due to the damming effect of logs and debris at Mandulog 1 bridge.

Logs and other debris were swept by flood waters that washed out Mandulog bridge in Iligan City.
4. Time of occurrence of tide at Macajalar port in CDO City

The time of occurrence of tide started at 12MN, Dec 16 and peaked at 2AM, Dec 17. The peak tide level was 1.24 m.
5. Encroachment in sandbars along river banks:

Communities live in 2 islets (sandbar): Isla de Oro and Isla Verde

In 2009, the local government applied for a permit to develop the areas into residential and commercial as part of the City’s industrialized area. The DENR declined the request and ordered the immediate relocation of all residents in the 2 islets.

Barangay Macasandig, CDO City before (left) and after (right) the disaster.
FINDINGS:

6. Logging activities

Logs & uprooted trees at the river mouth in Iligan City

7. Rampant development

Orchids Subdivision at the estuary of Mandulog river, Iligan City
FINDINGS:

8. Complacency of the local government units (LGUs) and community

TCs that affected Mindanao

- 38 TC from 1948-2011 (64 years)
- 7 TC from 1996-2011 (16 years)

Tropical Cyclone Occurrence in the Philippines: 1948-2010

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<table>
<thead>
<tr>
<th>Facts</th>
<th>03 Jan 2009</th>
<th>16 Dec 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rainfall:</strong> Max 1-day</td>
<td>Sil-icorn, Bungon: 150 mm</td>
<td>Capehan, Bukidnon (Del Monte): <strong>475 mm</strong> (highest in 20 years)</td>
</tr>
<tr>
<td></td>
<td>PAGASA Lumbia, CDO: 11.8</td>
<td><strong>Lumbia: 181 mm</strong></td>
</tr>
<tr>
<td></td>
<td>PAGASA Malaybalay: 0.6</td>
<td>Malaybalay: 83.9 mm</td>
</tr>
<tr>
<td></td>
<td>Antecedent rianfall – light -heavy in Lumbia &amp; Malaybalay</td>
<td>Butuan: 83.2 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Hinatuan: 180.4 mm</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dipolog: 87.5 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Talakag: 230.5 mm</strong> (<strong>Mo. Normal: 113 mm (Lumbia)</strong></td>
</tr>
<tr>
<td><strong>Estimated Flood</strong></td>
<td><strong>50-year</strong> return period (DENR-MGB)</td>
<td><strong>75-year</strong> return period (DPWH-FCSEC)</td>
</tr>
<tr>
<td><strong>Maximum Flood height</strong></td>
<td>2 meters in Isla de Oro WL at Mini-hydro (along Bubunawan river) – 2.6 m</td>
<td>7-9 meters (downstream) Mini-hydro (along Bubunawan river) – 2 to 3 m</td>
</tr>
<tr>
<td><strong>High tide</strong> (Iligan City and CDO City)</td>
<td>1:56 AM, 1.15 m</td>
<td>12 MN Dec 16 and peaked at 2:00AM, Dec 17, 1.24 m</td>
</tr>
</tbody>
</table>
## Summary of Findings & Recommendations – TS Washi

<table>
<thead>
<tr>
<th>Findings</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainfall/ flood forecasts &amp; warnings</td>
<td>Establishment of early warning systems for flood and rainfall-induced landslides</td>
</tr>
<tr>
<td>Land use issue</td>
<td>Update hazard maps using recent flood data, relocate informal settlers, easement of river banks, review issuance of land use permits</td>
</tr>
<tr>
<td>Sediment control</td>
<td>Construction of sabo dams</td>
</tr>
<tr>
<td>Complacency of LGUs and residents</td>
<td>Conduct/organize disaster preparedness training, IEC on hydromet hazards and their impacts, conduct flood drills</td>
</tr>
<tr>
<td>Constricted waterways</td>
<td>Re-design flood control structures, dredging</td>
</tr>
<tr>
<td>Deforestation</td>
<td>Strict implementation of forest management laws; Investigation and filing of charges to illegal loggers and mining operation</td>
</tr>
</tbody>
</table>

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1. **There is no one description for ‘floods’**. Rather there are different situations such as flash floods, monsoon flooding and wind storms such as tropical cyclones. The scale of floods in the Philippines is increasing, as is the number of floods.
2. Overall, fewer people are being killed as a direct result of floods, thanks to improvements in warning systems and better preparedness.

- In May 2009, the province of Zambales was devastated by flooding due to passage of a storm but no casualties were recorded. This was mainly attributed to the community based flood early warning system (CBFEWS) in place.

- On 16 Dec 2011, Surigao del Sur recorded 2 casualties compared to Cagayan de Oro and Iligan City (more than 1000) due to the passage of TS Washi. In 2005, CBFEWS was established under the UNDP Ready project. People in the area still remember the lessons during the flood drills conducted. LGUs immediately convened the local DRRMC in anticipation of storm Washi.
3. While floods resulted in fewer fatalities overall, the number of people whose lives and livelihoods were affected by the flood waters has increased.
4. The economic and social impact of floods is significant: the annual cost of the damage caused by disasters can constitute a significant percentage of developing country GDP.

Metro Manila’s regional GDP in 2008 was 468 billion PHP (National Statistical Coordination Board). Damage costs range from 3% of GDP (SQ-EX-10) to 24% (A1FI-EX-100).

Climate change costs represent 1% (1-in-10 flood), 6% (1-in-30 flood) & 10% (1-in-100 flood) of GDP.

## Major Disasters and GoP’s Response

<table>
<thead>
<tr>
<th>Event</th>
<th>Government Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Great Flood in Central Luzon in <strong>July 1972</strong></td>
<td>Pilot FFWS in the Pampanga river basin (Grant from GoJ-JICA)</td>
</tr>
<tr>
<td>Flood in <strong>Oct 1979</strong> due to unprecedented release of water from Angat dam</td>
<td>Flood Forecasting and Warning System for Dam Operation (FFWSDO)</td>
</tr>
<tr>
<td>Flash flood in <strong>Nov 2004</strong> in Aurora and Quezon provinces</td>
<td>The Four Point Action Plan on Disaster Risk Reduction was issued in Jan 2005.</td>
</tr>
</tbody>
</table>
| Flood/Flashflood due to Tropical Storm Ketsana in **Sep 2009** in Metro Manila & flooding in Pangasinan due to release of water from San Roque dam | Public-Private Partnership  
Re-assessment of flood control structures  
Review of Existing Dam Protocols  
Signing of the Climate Change Act of 2009 (R.A. 9729)  
Signing of the Philippine Disaster Risk Reduction and Management Act of 2010 (R.A. 10121) |
| **Floods in 2011**                                                   | Designation of a Water Czar and creation of the National Water Resources Management Council |
Current initiatives & future directions on DRR in the PH

• **Enhancement of early warning systems:** additional monitoring stations (National Flood Forecasting, Monitoring & Mitigation Program by the GoP, remote sensing data application in DRR - ADB/JAXA and ADB/CHARM Projects

• **Hazard, vulnerability and risk mapping:** use of Lidar technology, update of hazard maps (hydromet & geological)

• **Improved awareness of natural hazards and their impacts at the local levels, localization of forecasts**

• **Mainstreaming DRR and climate change adaptation**

• **Creation of an integrated super body on water resources management:** National Water Resources management Council (NWRMC)

• **Sustained public-private partnerships**
Recent Laws governing DRR in the Philippines


“AN ACT MAINSTREAMING CLIMATE CHANGE INTO GOVERNMENT POLICY FORMULATIONS, ESTABLISHING THE FRAMEWORK STRATEGY AND PROGRAM ON CLIMATE CHANGE, CREATING FOR THIS PURPOSE THE CLIMATE CHANGE COMMISSION, AND FOR OTHER PURPOSES”

Philippine Disaster Risk Reduction and Management Act of 2010 (R.A. 10121) – signed in May 2010

“AN ACT STRENGTHENING THE PHILIPPINE DISASTER RISK REDUCTION AND MANAGEMENT SYSTEM, PROVIDING FOR THE NATIONAL DISASTER RISK REDUCTION AND MANAGEMENT FRAMEWORK AND INSTITUTIONALIZING THE NATIONAL DISASTER RISK REDUCTION AND MANAGEMENT PLAN, APPROPRIATING FUNDS THEREFOR AND FOR OTHER PURPOSES”
National Water Resources Management Council (NWRMC)

Restructuring of the water resources sector thru the creation of the National Water Resources Management Council (NWRMC)

Guiding Principles:
- Good water governance for water security
- IWRM
- River basin approach
- Updated and accurate data collection & analysis
- Use of scientific DSS for water resource management including flood modeling & warning system
- Development of water resources including mitigation of water-related hazards

Governing Board: Policy-making, direction-setting, high level integration

President as Chairman
Council Members: DPWH, DA, DENR, DOE, NEDA, DILG, DOST

Inter-governmental Panel
Multi-stakeholder Water Advisory Panel
(including NGOs, Private sector, Academe, LGU)

Executive Management Body:
Day-to-day operations of the various functions of the Council
Headed by Executive Director

Economic Regulation
- Independent tariff regulation for WSS
- Independent tariff regulation for energy

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Activities in the establishment of CBFEWS

1. Consultation meeting with Local Government Units (LGUs)

2. Site survey and ocular inspection

3. Installation of monitoring facilities, flood signages & hydrographic surveys

4. On-site training of observers & volunteers

5. Seminar on data observation/retraining

6. Special IEC and flood drill/dry run

7. Turn over of CBFEWS to LGUs

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Infrastructure on Early Warning System in the PH

- 58 Synoptic stations
- 23 Agromet stations
- 120 Automatic Weather Stations
- 6 Upper air stations
- 3 Doppler radars (5 under construction)
- 2 Marine bouys
- 5 telemetered major river basins
- 5 telemetered major dams
- 3 Satellite receivers

Integrated High Power Computing (IHPC) Facility

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Lessons learned:

The key to better planning and reconstruction efforts is to recognize that flooding has become conditional. It depends on land use conditions, urbanization and climate variability (extreme events).

Remote sensing technology provides sufficient lead time in forecasting and analysis of catastrophic events.

Essentially, the involvement of the local government units and the communities at risk is critical in any flood risk mitigating measure.

In any disaster of given magnitude, the first line of defense is still awareness and preparedness of the communities at risk.

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The source of man's unhappiness is his ignorance of Nature.

- Paul Henry Thiry d'Holbach