



Climate Change in the Philippines and 2 Cases of Flooding (Oriental Mindoro & Metro Manila)

Genevieve Lorenzo*

Antonia Loyzaga*, Gemma Narisma PhD*,
Celine Vicente PhD*, James Simpas PhD* and,
Merlie Mendoza**

*Manila Observatory

**Caritas Manila

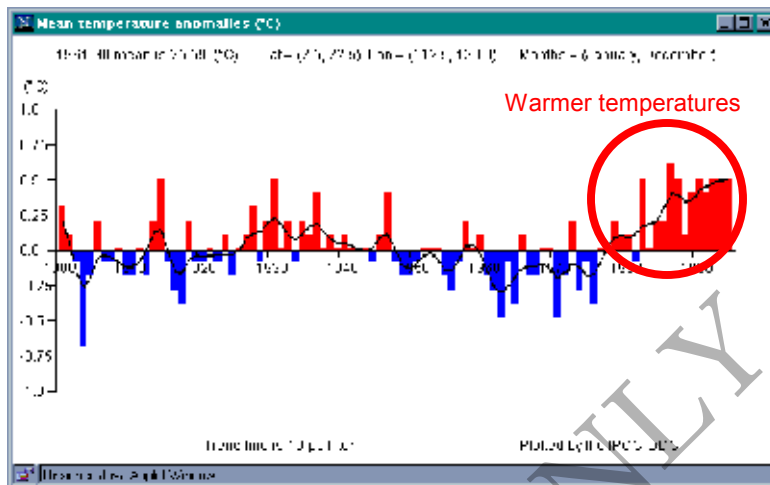
Outline

- Climate Change in the Philippines
- Case 1: Oriental Mindoro (Flooding & Early Warning Devices)
- Case 2: Metro Manila (Flooding & Post-Disaster Assessment of Ketsana/Ondoy)

- Climate Change in the Philippines



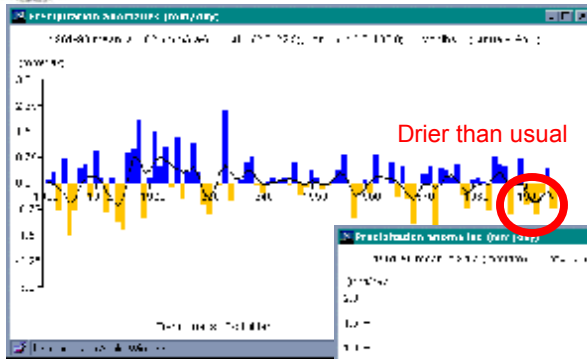
Average Annual Temperature, 1900-1995



Source: IPCC⁴ DDC

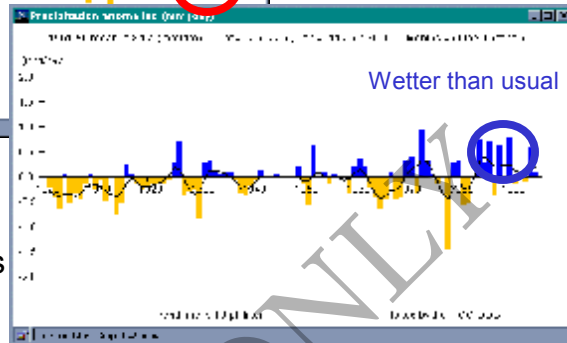


Rainfall



Dry months

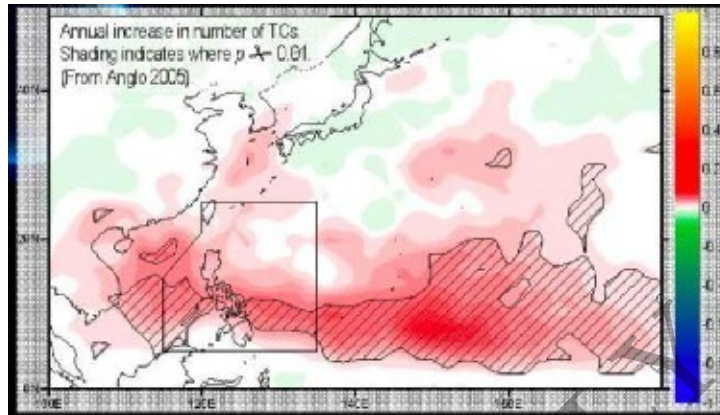
Wet months



Source: IPCC WDC



Geographic Trends in Tropical Cyclones (1945-2003)

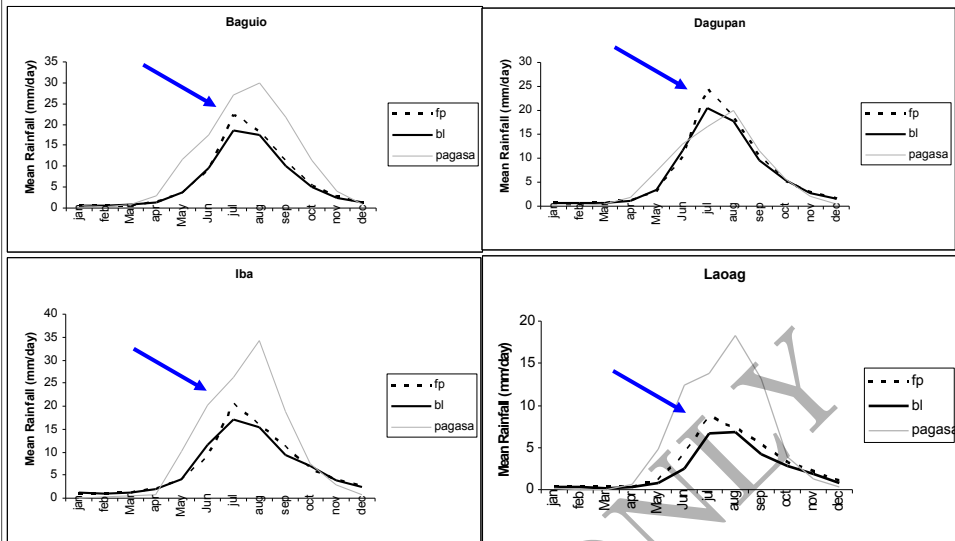


- The number has been increasing in the Western Pacific
- In RP, the rise is most significant over Visayas

Source: Anglo,⁶ 2005



Future Rainfall change Type I

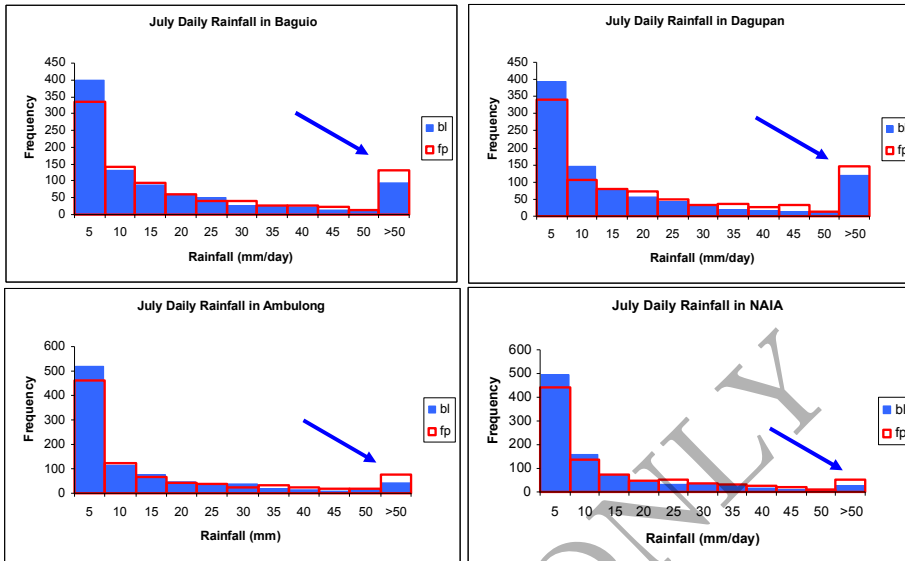


Source: Villafuerte (Manila Observatory), 2010⁷

Type 1 is centered on Benguet area for the regional climate model run ; type is western luzon (generally_ including metro manila



Future Rainfall change Type I

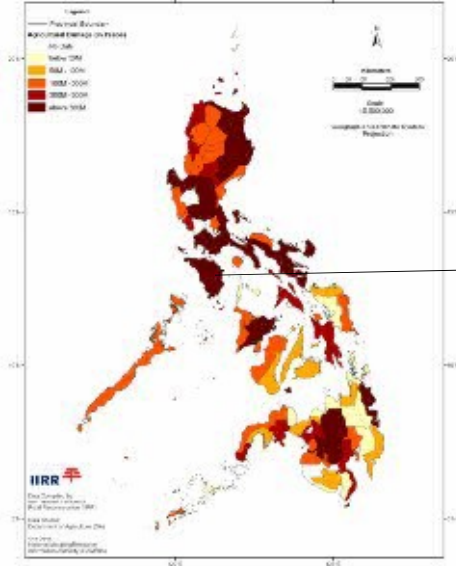


Source: Villafuerte (Manila Observatory), 2010

- Case 1: Oriental Mindoro (Flooding & Early Warning Devices)

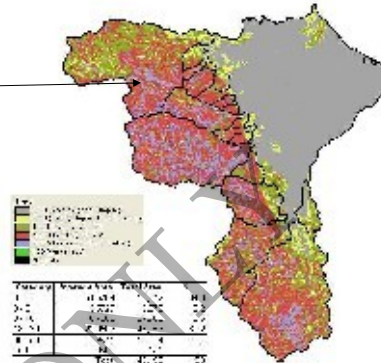


Total Agricultural Damage due to Drought, El Niño, Heavy Rains and Typhoons



Source : DA Data (1992-2006)

Oriental Mindoro



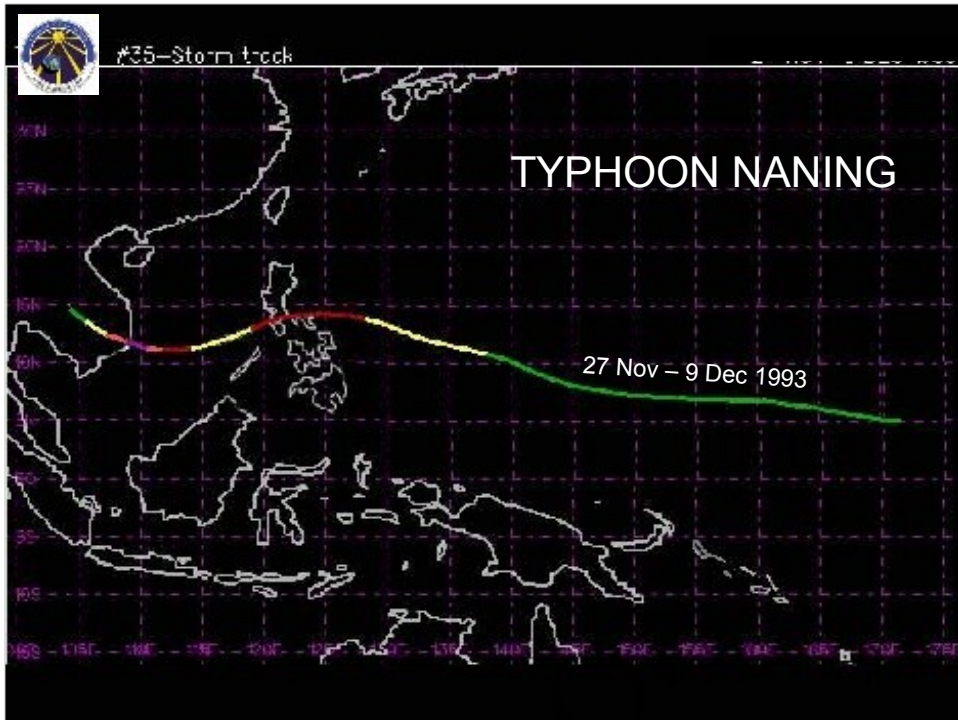
Source : Mangyan Mission



#35-Storm track

TYPHOON NANING

27 Nov – 9 Dec 1993

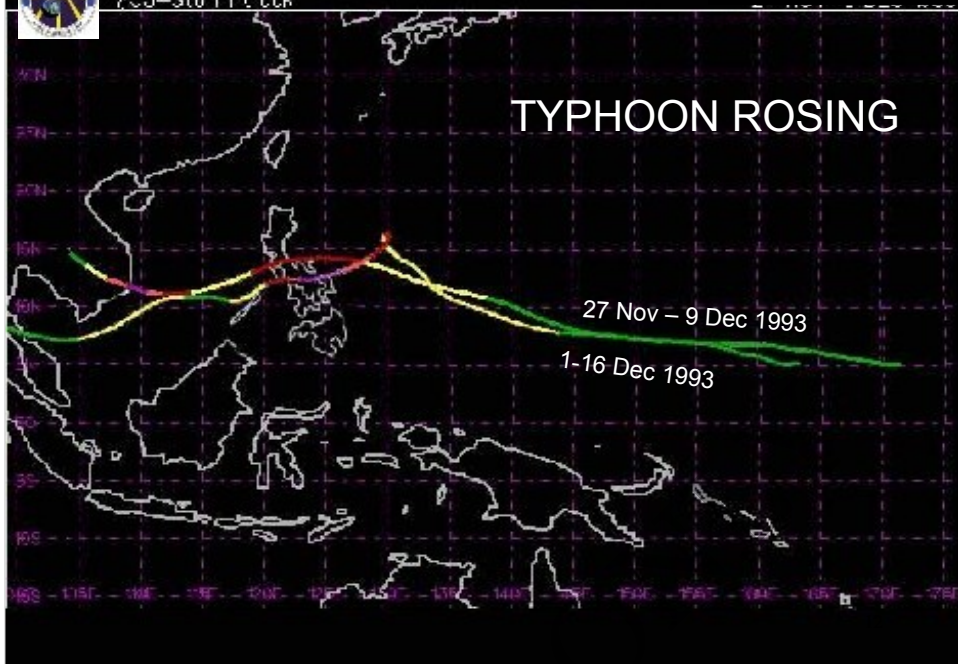


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#35-Storm track

TYPHOON ROSING

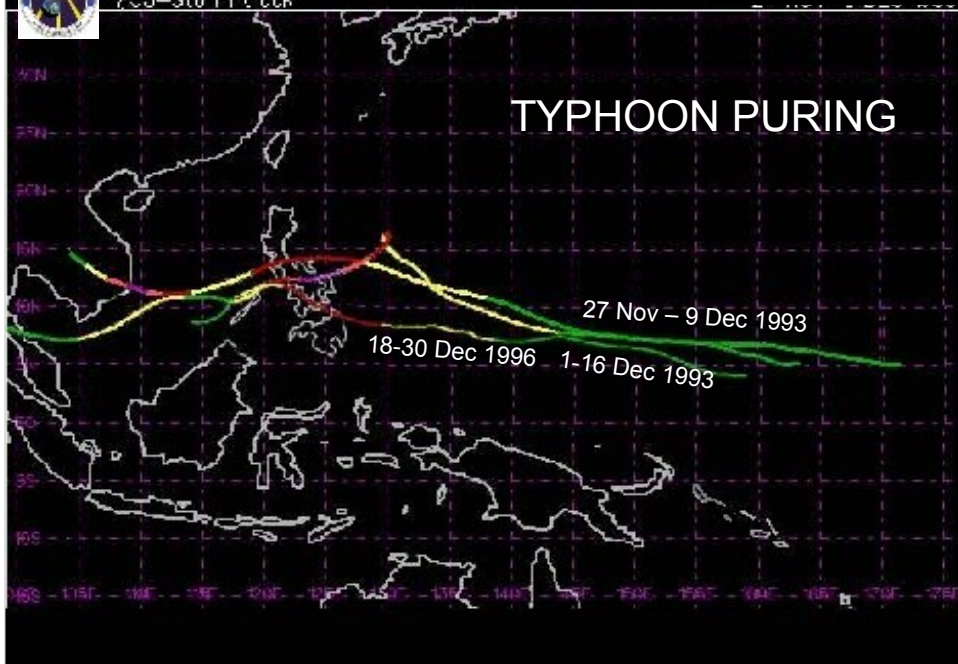


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#35-Storm track

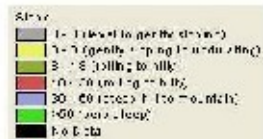
TYPHOON PURING



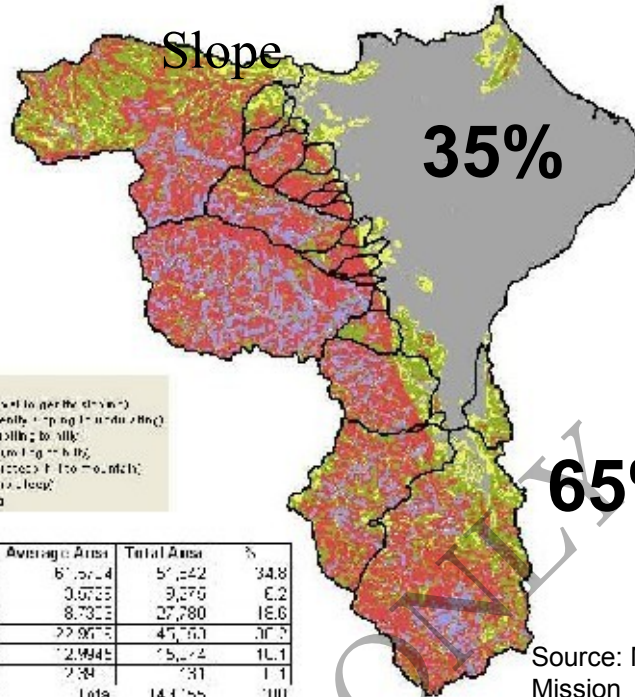
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Oriental Mindoro



Category	Average Area	Total Area	%
0-3	6,757.4	57,242	34.8
0-3	3,573.5	3,375	6.2
8-18	8,733.5	27,780	18.6
10-31	22,967.5	47,561	30.7
30-50	12,994.5	15,272	10.1
All	7,384	141,555	100



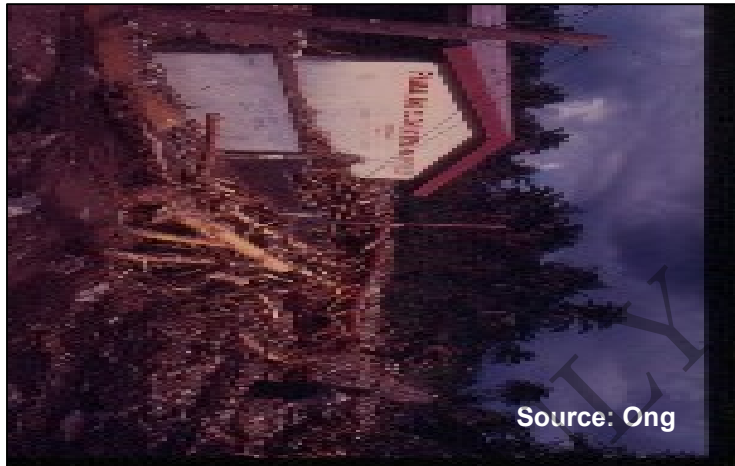
Source: Mangyan Mission



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Debris from the Mountain





Telemetric Rain Gauge (TRG) Principle



Sensors



Microprocessors



Telemetry modules ¹⁷

Source: Simpas, Ong,
Choy, Uy



Oriental Mindoro TRG network



Source:
Simpas, Ong,
Choy, Uy



TRG Installations





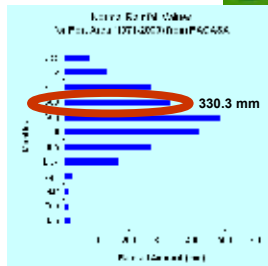
More installations...



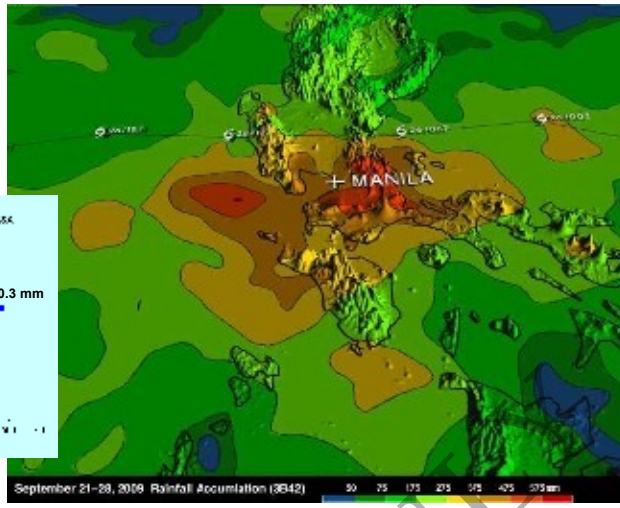
- Case 2: Metro Manila (Flooding & Post-Disaster Assessment of Ketsana/Ondoy)



Rain Accumulated in Southern and Central Luzon (21-28 Sep 2009)



http://www.nscb.gov.ph/headlines/StatsSpeak/2009/030909_rav_climatechange.asp

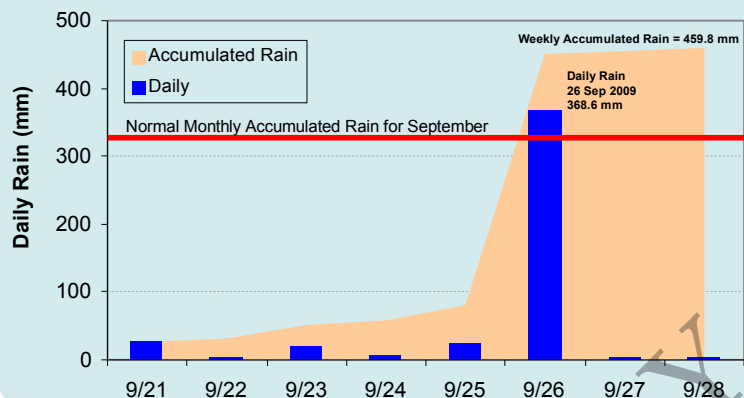


http://trmm.gsfc.nasa.gov/trmm_rain/Events/manila_rainfall_perspective_21-28sep09.jpg

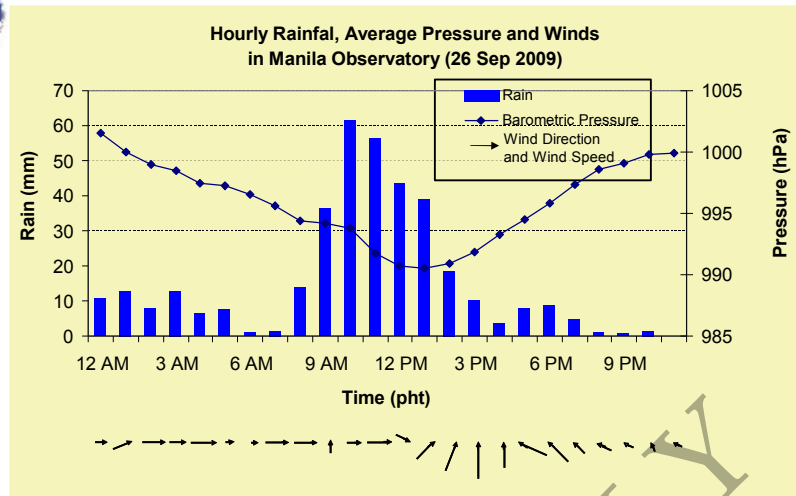
Accumulated rainfall over a week measured by TRMM was over 500 mm in Metro Manila. This value is higher than the monthly normal.



Accumulated Rainfall in Manila Observatory (21-28 Sep 2009)



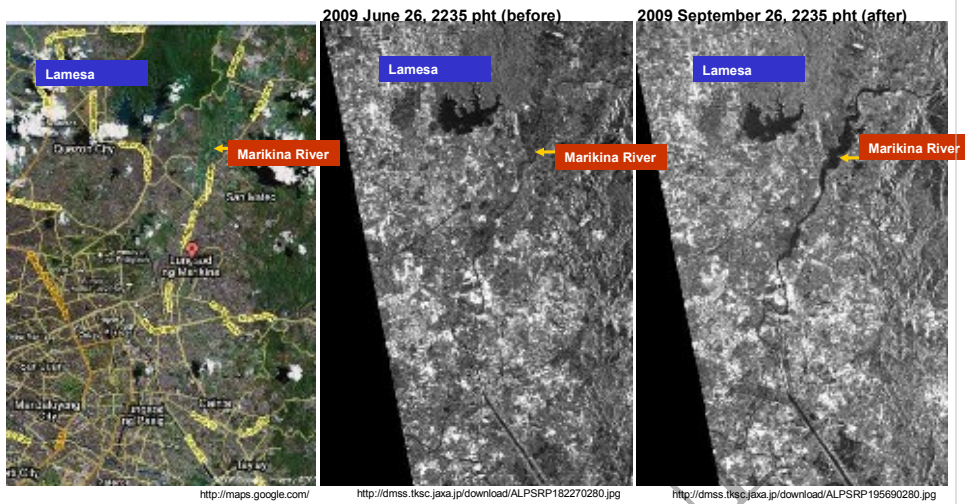
- “Ondoy” brought a total of 368.8 mm of rain over Manila Observatory on September 26, 2009.
- This daily rain measured in Manila Observatory is higher than the monthly normal in the Port Area.



- The highest rainfall was measured in Manila Observatory between 9 AM and 1 PM.
- Highest rainfall of 61.4 mm/hr was measured at 10 AM.



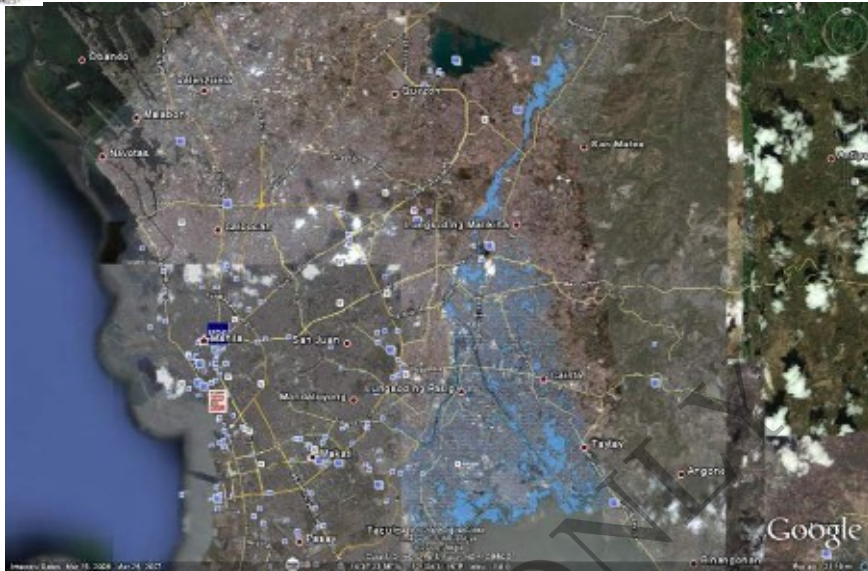
ALOS/PALSAR Images Before and After “Ondoy”



- Apparent increase in the Marikina River width after “Ondoy”.



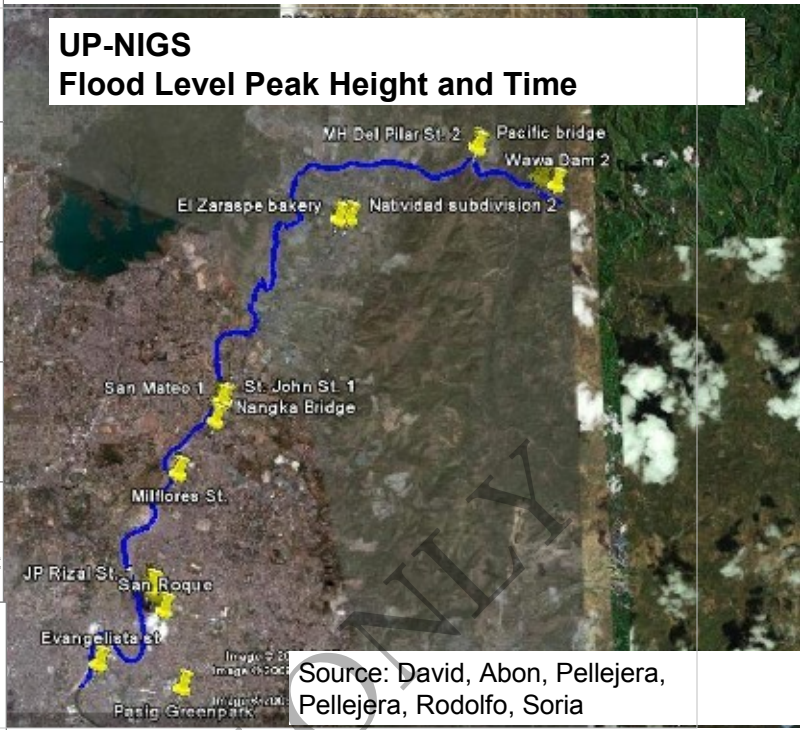
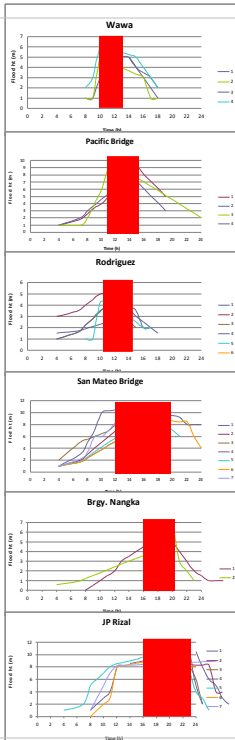
Flood Map of Eastern Metro Manila and Rizal Attributed to Ondoy



Source: Loyzaga, Vicente, De Mesa²⁶

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UP-NIGS Flood Level Peak Height and Time



Source: David, Abon, Pellejera,
Pellejera, Rodolfo, Soria



Source: Benjie,
Caritas-Antipolo

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Source: Benjie,
Caritas-Antipolo

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Source: Benjie,
Caritas-Antipolo

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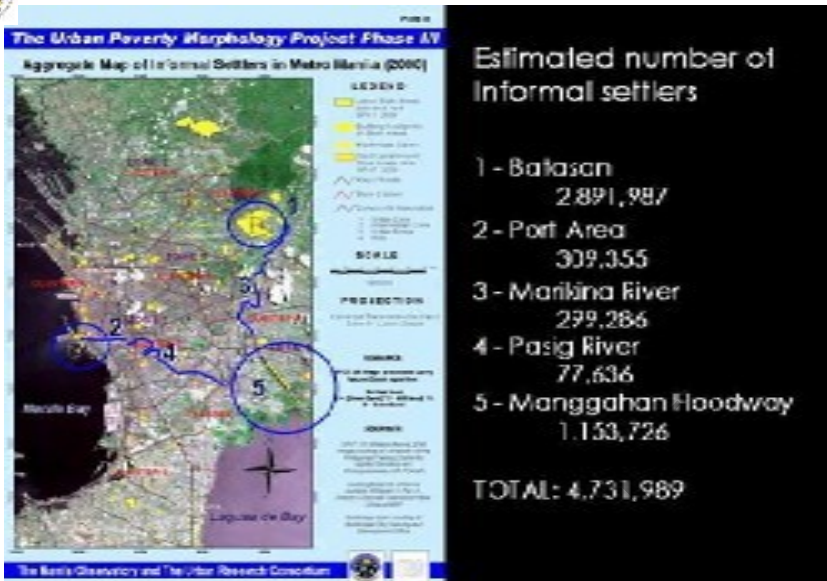
Source: Benjie,
Caritas-Antipolo

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Source: Benjie,
Caritas-Antipolo

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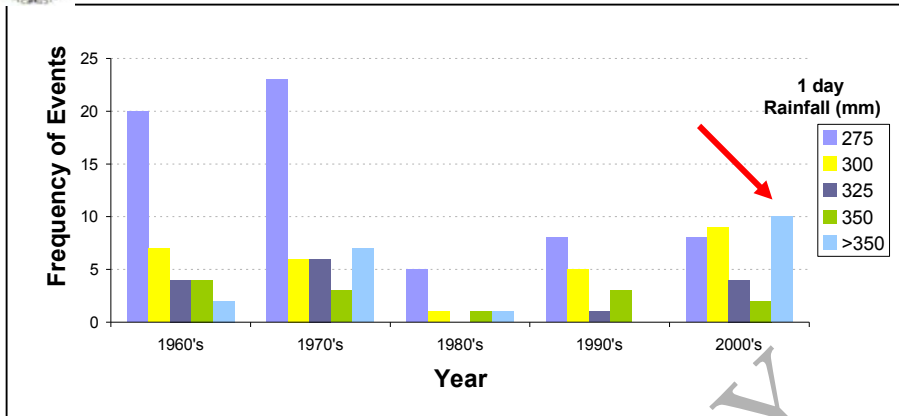


Source: Loyzaga, Vicente, De Mesa³⁴

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Frequency of Heavy Rainfall Events 1961-2004 in Luzon



Increase in occurrence of very high rainfall amounts
in 2000-2004

Based on RIHN, MRI/JMA Aprodite data

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Investigated incidents of heavy rainfall in Luzon in particular. This is only indicative and not yet conclusive. To be conclusive we need longer records

$$\text{RISK} = \text{HAZARD} \times \text{EXPOSURE} \times \text{VULNERABILITY}$$

RISK

Likelihood of harm, loss, disaster

Risk Lexicon

HAZARD

Physical impact of disturbance

EXPOSURE

Elements affected by hazard

VULNERABILITY

Susceptibility & capacity to prepare, absorb, & recover from hazard



(UNDP and UNDRO, 1979)

Hazard is the threat of a changing climate to the energy sector

Acknowledgements

- Regional Climate Systems (Manila Observatory)
- Geomatics for Environment and Development (Manila Observatory)
- Instrumentation and Technology Development (Manila Observatory)
- Caritas Manila