Typhoon Maemi and Hurricane Katrina: Impacts and Aftermath

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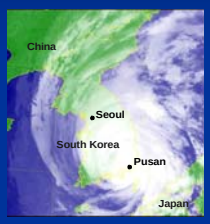
Typhoon Maemi: September 13, 2003



- Worst typhoon to hit South Korea
- Caused extensive damage
- 18,000 buildings damaged or destroyed by the strong winds
- Gupo Bridge failure
- More than 110 people killed

Typhoon Maemi Track and Characteristics

Korean Meteorological Administration, KMA

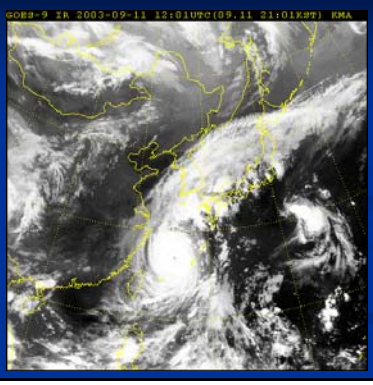
Sept. 12th 2003
Typhoon
South coast of Korea

Sept. 9th 2003
Typhoon

Sept. 8th 2003
Severe tropical storm

Sept. 6th 2003
Tropical depression
Near Guam

Visualization of Maemi's Track



Typhoon Maemi Landfall

- Lasted just 6 hours in South Korea
- Caused localized windstorms and torrential rainfall
- Extensive damage from wind and flooding
- Over 400 mm of rainfall with flashy hydrographs

Comparison with Other Typhoons

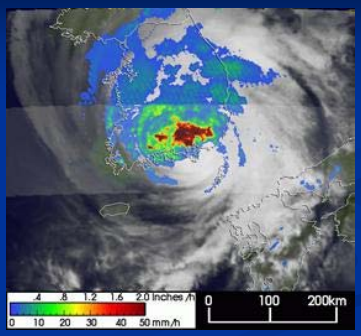
	Sarah 1959 (9/15/1929)	Thelma 1987 (7/15/1987)	Rusa 2002 (8/30/2002)	Maemi 2003 (9/12/2003)
Maximum Sustained Winds	117.9 mph (52.7 m/s)	90.1 mph (40.3 m/s)	88.8 mph (39.7 m/s)	134.2 mph (60 m/s)
Lowest Pressure	952 hPa	972 hPa	970 hPa	954 hPa

Korean Meteorological Administration, KMA

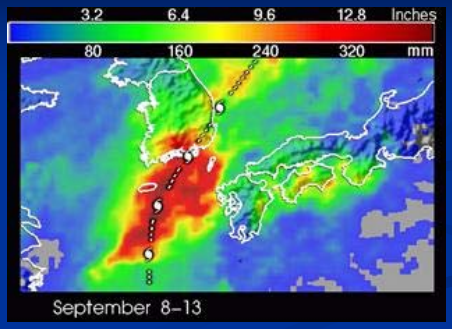
Saffir-Simpson Scale

Category	Central Pressure	Winds	Surge	Damage	
1	>28.94" (980 mb)	74-95 mph (119-153 km/hr)	4-5 ft (1.2-1.7 m)	Minimal	
2	28.91-28.50" (979-965 mb)	96-110 mph (154-177 km/hr)	6-8 ft (1.8-2.6 m)	Moderate	
3	28.47-27.91" (964-945 mb)	111-130 mph (178-209 km/hr)	9-12 ft (2.7-3.9 m)	Extensive	Sarah 1959
4	27.88-27.17" (944-920 mb)	131-155 mph (210-249 km/hr)	13-18 ft (4-5.5 m)	Extreme	Maemi 2003
Super Typhoon		>150 mph (241 km/hr)		Catastrophic	
5	<27.17" (920 mb)	>155 mph (249 km/hr)	>18 ft (5.5 m)	Catastrophic	Katrina 2005

Rainfall Distribution of Typhoon Maemi



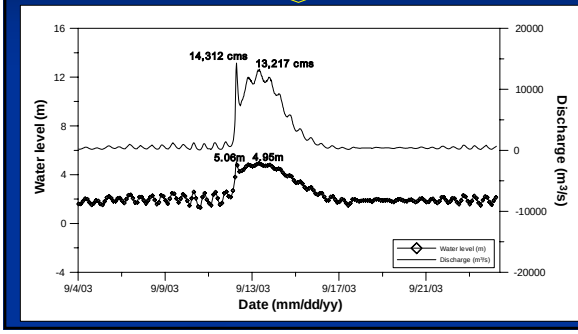
Total Rainfall of Typhoon Maemi



Typhoon Maemi Impacts

Basin area : 23,326 km²
Design flood : 18,300 m³/s
Estuary barrage located at the end of the river

Water stage and discharge graph at Gupo bridge
(Korea Water Resources Corporation, KOWACO)



Flood Damages

- **18,000 buildings damaged or destroyed by the strong winds**
- **Gupo Bridge failure**
- **More than 110 people killed**
- **Power outages for 1.5 million households**
- **Heavy-duty shipping cranes were damaged**

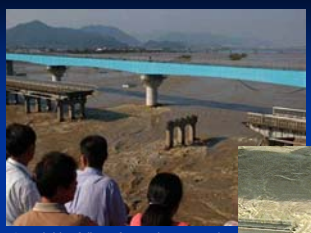
Flooded rice field, 9/12/2003, [AP]

Wah Yeon Beach on Geoje Island, 9/15/2004, photo by Paul J. Riely

Damages of ferry-hotel, 9/13/2003, AP

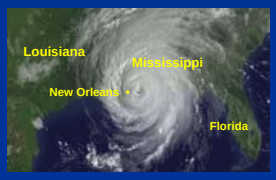
Gupo Bridge Failure

- 1.06 km-long Gupo bridge partially collapsed with the loss of 19th pier on 9/14/2003
- Bridge pier scour due to high velocities
- Nakdong River peak discharge: ~13,000 m^3/s



Gupo bridge failure after Typhoon Maemi (Yonhap)

Hurricane Katrina: August 29, 2005



- Damages: $10B - $120B
- Deaths (09/07/2005):
  - 1,014 direct
  - 577 indirect
  - Estimates up to 10,000
- Affected 233,000 km² (90 ,000 mi²) of US: United K ingdom
- Five million people with out power

Hurricane Katrina Track and Characteristics

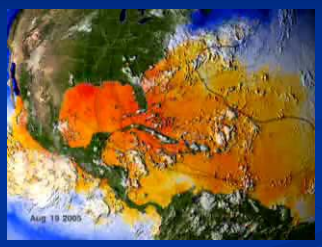
Aug. 29th 2005
Hurricane (Category 4)

Aug. 28th 2003
Hurricane (Category 5)

Aug. 24th 2005
Tropical storm

Aug. 20th 2005
Tropical depression

Visualization of Katrina's Track



Hurricane Katrina Characteristics

- Maximum sustained winds peaking at 175 mph (280 km/h)
- 918 mb of lowest minimum pressure at landfall: third strongest hurricane on record to make landfall on the United States
- 4.5 to 9 m (15 to 30 foot) storm surge

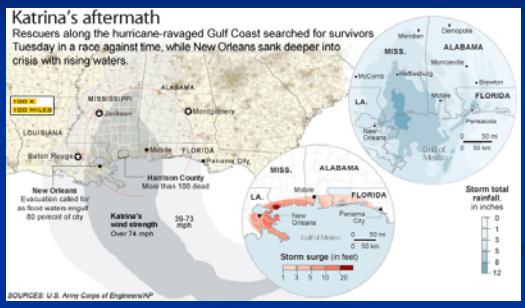
Comparison with Other Hurricanes

North Atlantic				Landfall U.S.			
Ran	Hurrican	Year	Pressur	Ran	Hurrican	Year	Pressur
1	Gilbert	1988	888 mbar	1	Labor Day	1935	892 mbar
2	Labor Day	1935	892 mbar	2	Camille	1969	909 mbar
3	Allen	1980	899 mbar	3	**Katrina**	**2005**	918 mbar
4	**Katrina**	**2005**	902 mbar	4	Andrew	1992	922 mbar

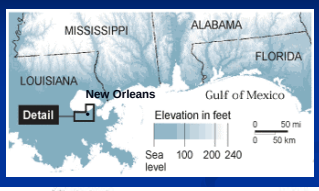
NOAA Technical Memorandum NWS TPC-1

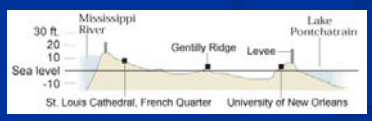
During the Storm

Total Rainfall and Storm Surge of Hurricane Katrina



New Orleans and Sea Level





80% of the city is below sea level

New Orleans levees

Heavy flooding forced the total evacuation of over a million people

Flood Damage: New Orleans, LA

Before: March 9, 2005

After: August 31, 2005

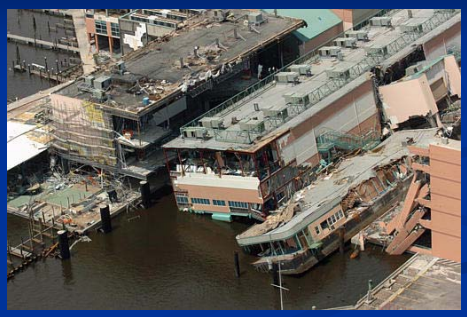
Flood Damage: New Orleans, LA

Flood Damage: Biloxi, MS

Before: April 12, 2005

After: August 31, 2005

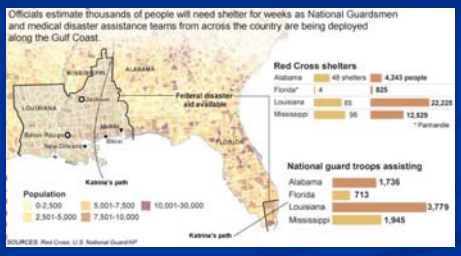
Flood Damage: Biloxi, MS



Aftermath

Aftermath

Response



Risk to survivors

Typhoon Maemi
September 13, 2003

- Max. sustained wind speed: 134 mph
- Lowest pressure: 954 hPa
- Category 4
- 18,000 buildings damaged or destroyed by the strong winds
- Gupo Bridge failure
- More than 110 people killed
- Power outages for 1.5 million households
- Heavy-duty shipping cranes were damaged

Hurricane Katrina
August 29, 2005

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- Lowest pressure: 902 hPa
- Category 5
- Damages: $10B - $120B
- Affected 233,000 km² (90,000 mi²) of US: United Kingdom
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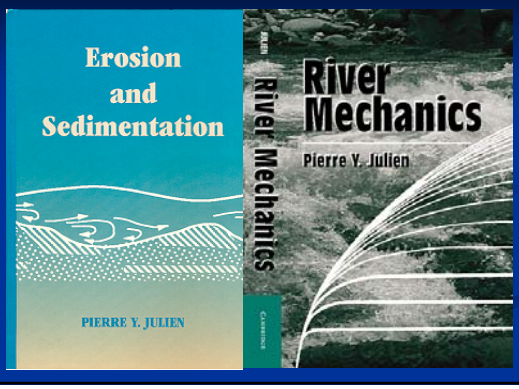
Erosion and River Mechanics Textbooks



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