Mt. Pinatubo Lahars 1991

Contributing Factors of the Pinatubo Lahars

- Volcanic deposits
- Steep Valleys and Channels
- Heavy Rainfall

Social Aspects

- Our records indicate that the villages around Pinatubo were not aware it was a volcano prior to 1991 eruption
- 30,000 people lived on the volcano flanks, and 500,000 on the sloping alluvial fans
- Agricultural people reside
- Spiritual connection to the mountain

Precursors/Preparation

- March 15, 1991 earthquakes
- April 2 Series of small explosions
- April 5 PHIVOLCS came and installed portable seismographs
- 30-180 high-frequency earthquakes a day
- USGS joined PHIVOLCS and installed more seismographs
- Residents 10 km around summit evacuated
Background Assessment

- Began Geological interpretation of area
  - Voluminous material 20 km circumference
  - Evidence of repeated lahars
  - Lahars inundated large parts of low-gradient alluvial fans
  - Last eruptions dated 500, 3,000, and 5500 years ago

- Hazard map created
- Acquainted civil defense and military about possible eruption/hazards
- Educated using Krafft videos

Precursors Continue

- Deformation of Pinatubo
- Dome formed and grew until June 11
- Vertical eruptions June 12-14
- Pyroclastic flow deposit Maraunot Valley
- Extended evacuation again to 30 km 120,000 ppl
- June 10 14,500 evacuated Clark Air Base

- June 15 Violent eruption
- Also Typhoon Yunya is approaching just north of Pinatubo
- 5-6 km³ volcanic material deposited extending 12-16 km from the summit
- Pre-existing valleys have ash deposits as high as 200 m

And it Begins

- 1.5 m blocks common
- Discharge peak 1000 m/s
- Pasig-Potro, Maraunot, O’Donnell, Sacabia, Gumain, Sta. Tomas, Bucao
- Inundated several villages

Prediction vs. Actual
• Pinatubo eruption was a plinian eruption, occurs once every 100 years
• Because of the continual lahar activity pinatubo lahars are considered the worst in human history

Lahars Alert System
• PHIVOLCS formulated a 3 level alert system
• Level 1- Rain is falling in Pinatubo area
• Level 2- intense rain has fallen for 30 minutes
• Level 3 – mudflows have been observed
• Official Civil Defense send warnings to hierarchy of officials who used radios, loud speakers, sirens, church bells or gunshots
• At first people doubted warnings

Education
• Educational warnings were dispersed to public
  – Brochures
  – Videos
  – Maps of threatened areas
  – Seminars and posters used to describe what to do after warnings issued
  – People Encouraged to build permanent hummocks

Resettlements
• Resettlements established for homeless
• Had inadequate water supply and waste manangement
• Aetas 30,000 ppl isolated tribe lived on flanks of volcano
• Proved inadequate for Aetas
• 349 died within 12 weeks
• Total 537 dead by December 1991

Damage 1991
• Infrastructure loss; $374 million
• Refugee camps; $69 million
• Mudflow control; $150 million
• 8,000 homes, 700 schools
• 42 % of croplands
• 100 people dead

Difficult Recovery
• Oct. 1993 159 evacuation centers accommodating 55,000 people
• Rebuilt public buildings and roads before building homes in relocated villages
Long term affects

- Agriculture has shifted to early season crops
- Making of permanent flat-top hummocks
- Draining of the crater lake

Evaluation

- Considering only 3 months to prepare they did pretty good
- Improve alert system
- Improve resettlement conditions

Questions?