The Abdus Salam International Centre for Theoretical Physics

2053-13

Advanced Workshop on Evaluating, Monitoring and Communicating Volcanic and Seismic Hazards in East Africa

17 - 28 August 2009

Hazard Communication: Examples From Tanzania, Mozambique, and Cameroon

Gari Mayberry

U.S. Foreign Disaster Assistance
Washington
USA

Hazard Communication: Examples From Tanzania, Mozambique, and Cameroon




Gari Mayberry
USGS- USAID/OFDA Geoscience Advisor, Washington DC, USA

US Agency for International Development

The U.S. Agency for International Development (USAID) is the independent U.S. federal government agency that provides foreign assistance and humanitarian aid.

Office of U.S. Foreign Disaster Assistance

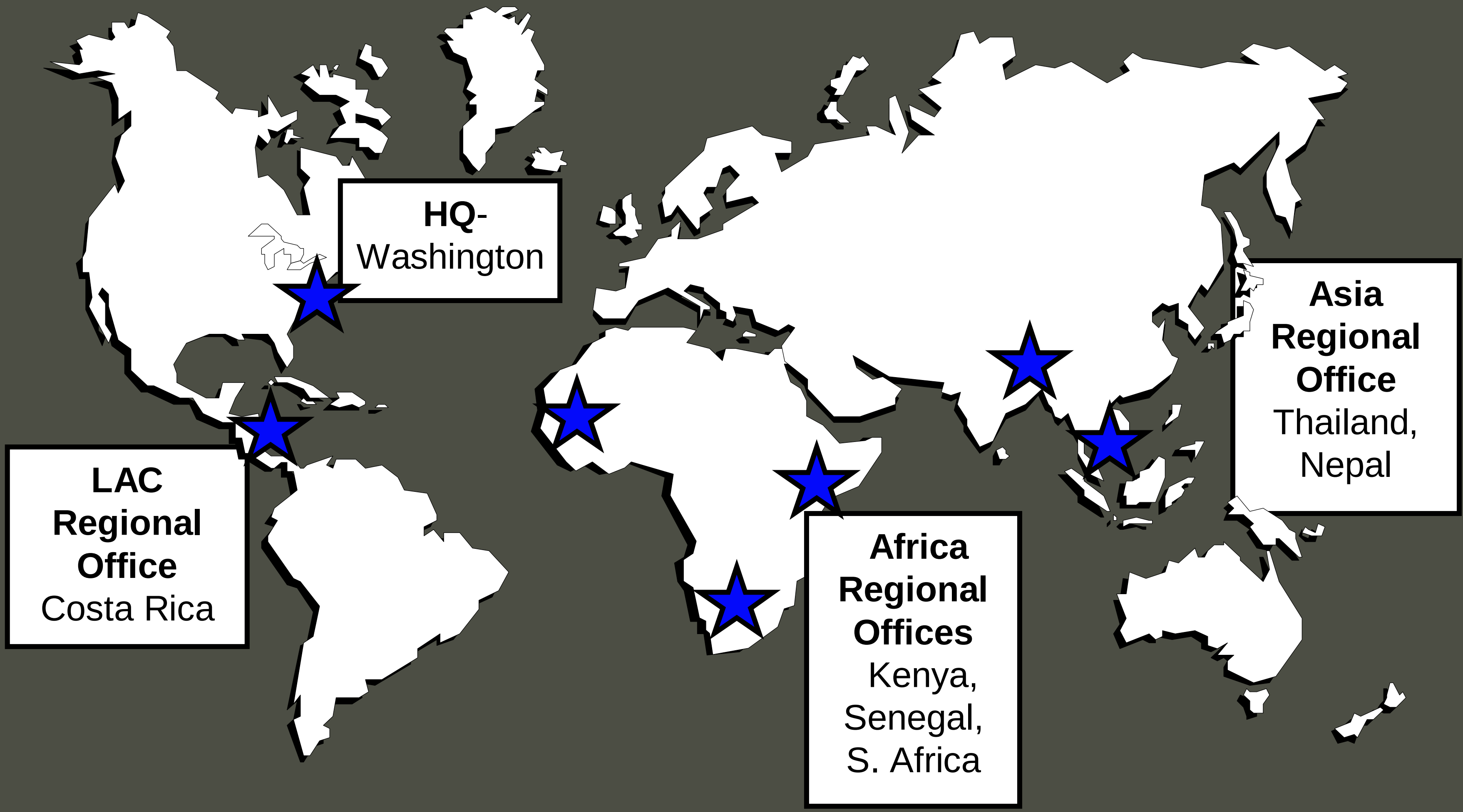
Within USAID, the Office of Foreign Disaster Assistance (OFDA) is responsible for coordinating humanitarian assistance from the US government in response to international crises and disasters



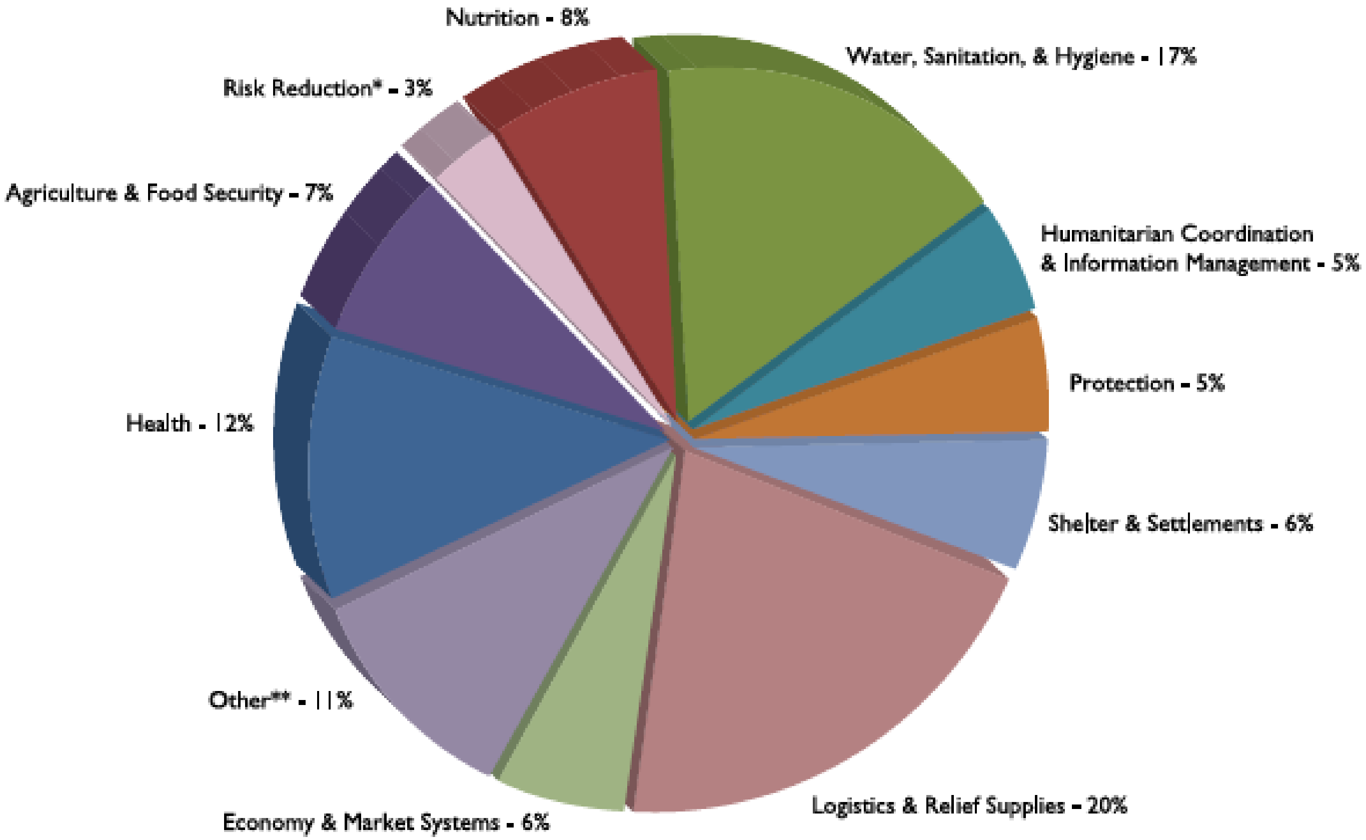
OFDA's Mandate

- **Save lives**
- **Alleviate human suffering**
- **Reduce the economic and social impact of disasters**

OFDA Regional Offices



OFDA FUNDING BY SECTOR



* Risk reduction includes geological and meteorological hazard mitigation activities and some disaster risk reduction activities. The sector does not include all disaster risk reduction activities, many of which are included in other sector totals.

** Other includes chemical, biological, radiological, and nuclear (CBRN) preparedness activities; urban search and rescue activities; and administrative support.

Hazard Communication Activities

- Examples from-
  - The 2007-08 explosive activity at Ol Doinyo Lengai in Tanzania
  - A M 7.0 earthquake in Mozambique
  - Deadly degassing events at lakes Monoun and Nyos in Cameroon

- Existing tools for hazard communication

Ol Doinyo Lengai

Overview of VDAP

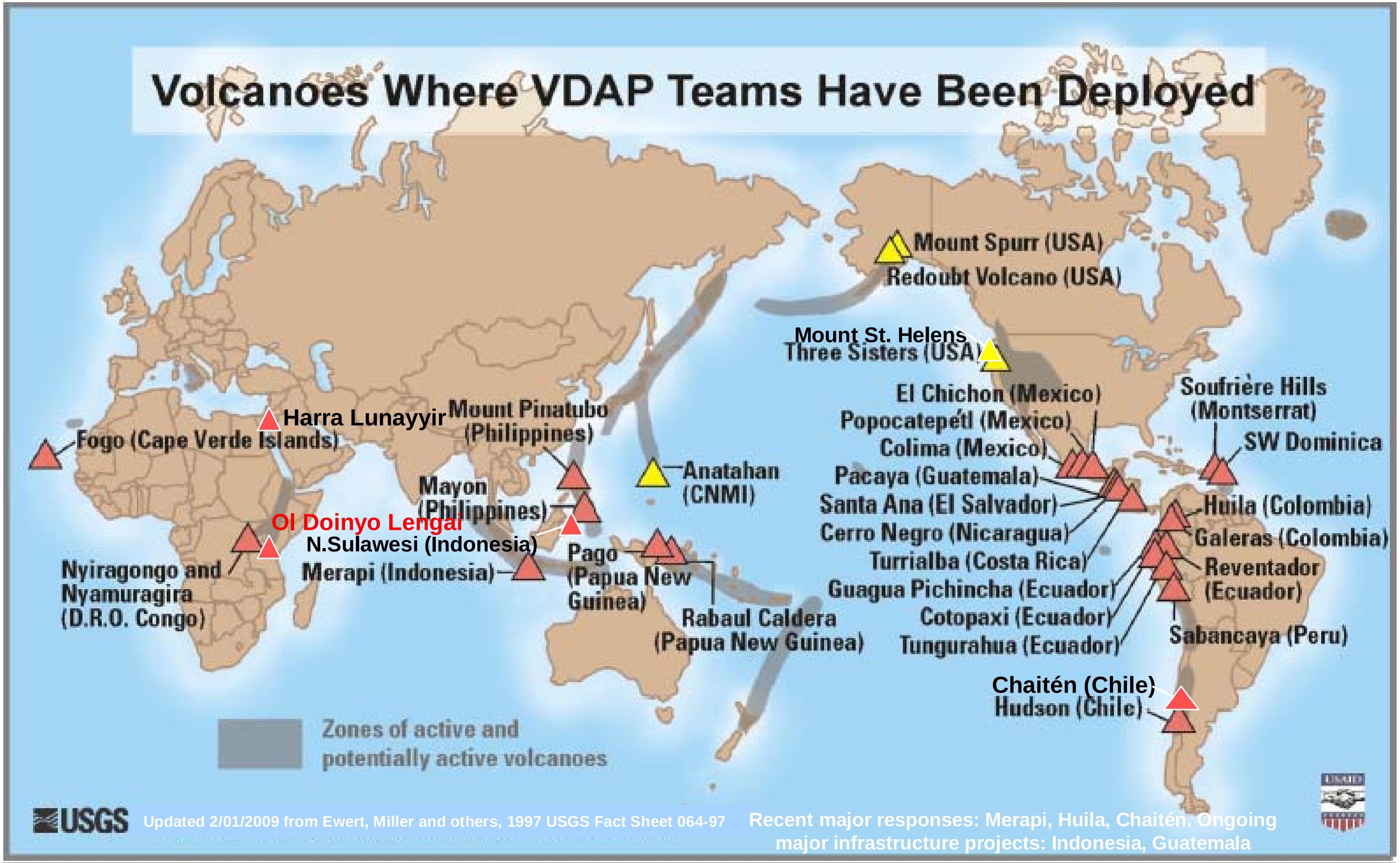
What: 23-year partnership between USAID/OFDA & USGS

Who: World's most experienced volcano crisis-response team

Why: Prevent volcanic crises from becoming disasters

http://volcanoes.usgs.gov/vhp/vdap.php

How: By invitation only
Work in background with counterparts
Response and capacity building



- 24 major crises in 23 years
- Infrastructure built in 12 countries
- 10's of thousands of lives saved
- 100's of $ millions in property savings

(FY-03-08): 49 infrastructure missions, 11 crisis responses, 14 countries

Ol Doinyo Lengai, February 2008

Martinair crew photo

Ol Doinyo Lengai Volcano, Tanzania

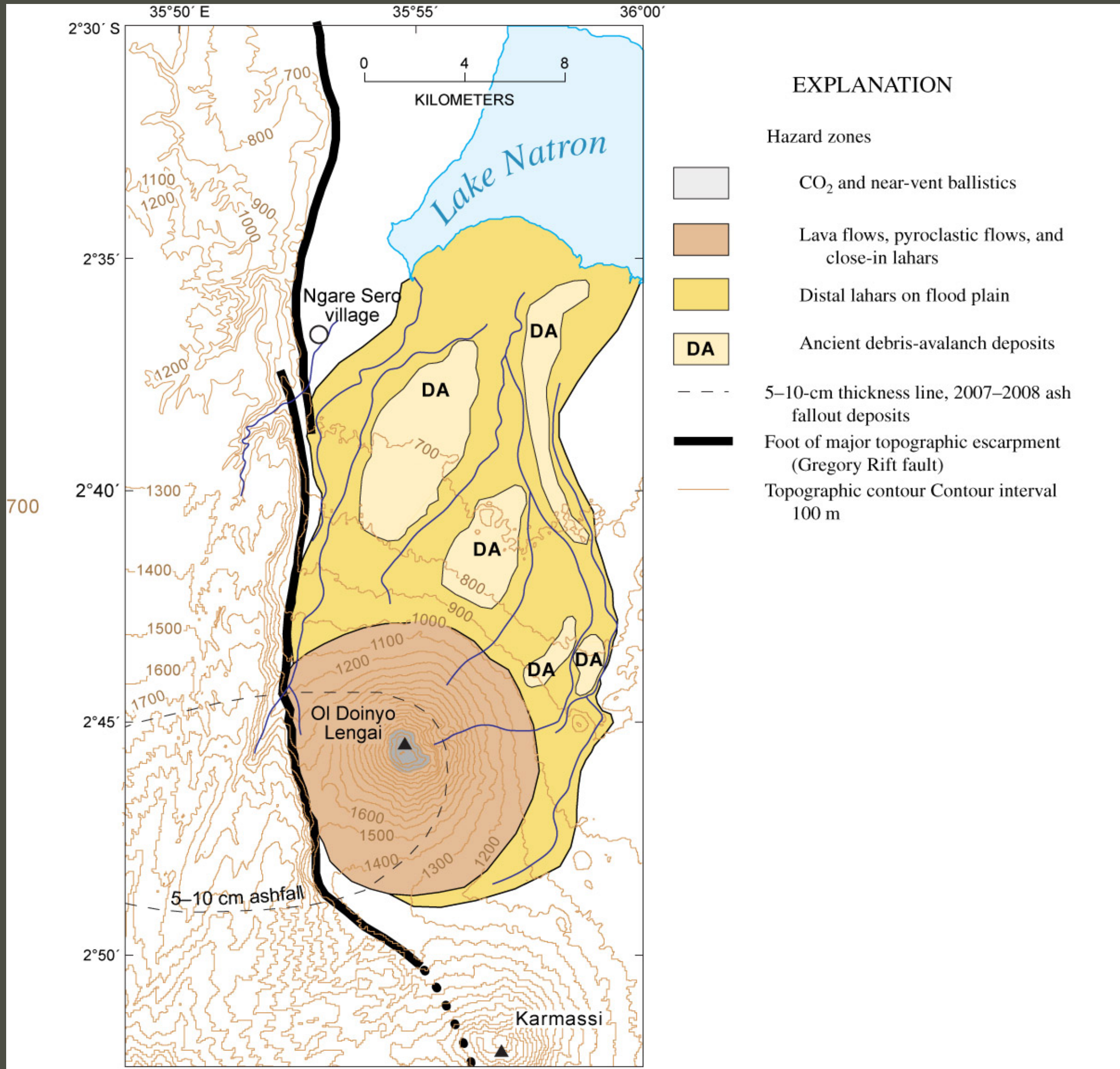
- Explosions September 2007 to April 2008
- Ash eruptions produce clouds 50,000+ ft.
- ~Volcano Explosivity Index (VEI max) 3
- Carbonatite magma is geologically unique
- Masaai culture adapted to eruptions over centuries
- Volcano attracts adventure tourists - up to several thousand persons per year

Field Studies

- Affects of the 2007-2008 eruption
  - People, Livestock, Infrastructure
- Geological deposits
  - Debris avalanches
  - Ash fall
  - Lava flows
- Assess possible early warning systems

Situation

- No volcano monitoring
- Population of about 10,000 people within kms of the volcano
- Very little infrastructure
- Little preparedness
- Informal notification network
- Very little funds available for DRR efforts


35°50′ E
35°55′
36°00′
2°30′ S
2°35′
2°40′
2°45′
2°50′
0
4
8
KILOMETERS
Lake Natron
Ngare Sero village
DA
Ol Doinyo Lengai
5–10 cm ashfall
Karmassi
EXPLANATION
Hazard zones
CO_2 and near-vent ballistics
Lava flows, pyroclastic flows, and close-in lahars
Distal lahars on flood plain
DA Ancient debris-avalanch deposits
5–10-cm thickness line, 2007–2008 ash fallout deposits
Foot of major topographic escarpment (Gregory Rift fault)
Topographic contour Contour interval 100 m

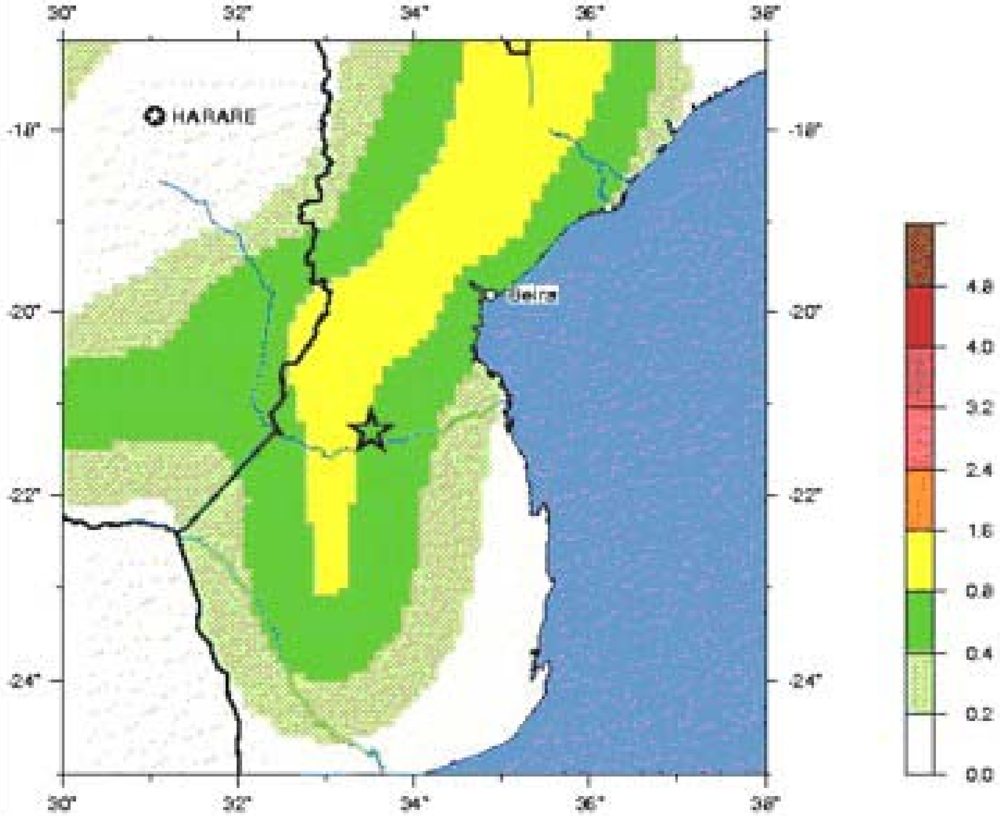
Recommendations

-Public education *("Living with Ash")*
-Emergency plan for villages at risk
-Revised hazard zonation
-Cooperation with Toulouse Volcanic Ash Advisory Center
-Hire a volcano-watcher for local village
-Post information on GST web site
-Install warning signs along climbing routes
-Participate in upcoming East Africa Hazard meeting
-Require research permits for international scientists

Hazard Communication Lessons

- Communicate hazard on 2 levels
  - Decision makers
  - At-risk communities
- Communication must be audience and capacity appropriate
- Research is necessary AND communicating the findings to the appropriate entities is necessary

M 7.0 Earthquake Macheze, Mozambique



The M 7 Macheze Earthquake

- Occurred on February 23, 2006 at 1219 AM local time
- Macheze, Mozambique 215 km (135 miles) SW of Beira
- 4 deaths, 36 injuries, 1,440 homeless
- Surface faulting, liquefaction, maximum slip surface of 2 m

Impact

- Few deaths and little damage
- Sparsely populated (18 people per square km)
- Most structures made of light-weight materials



mCel
RUBI

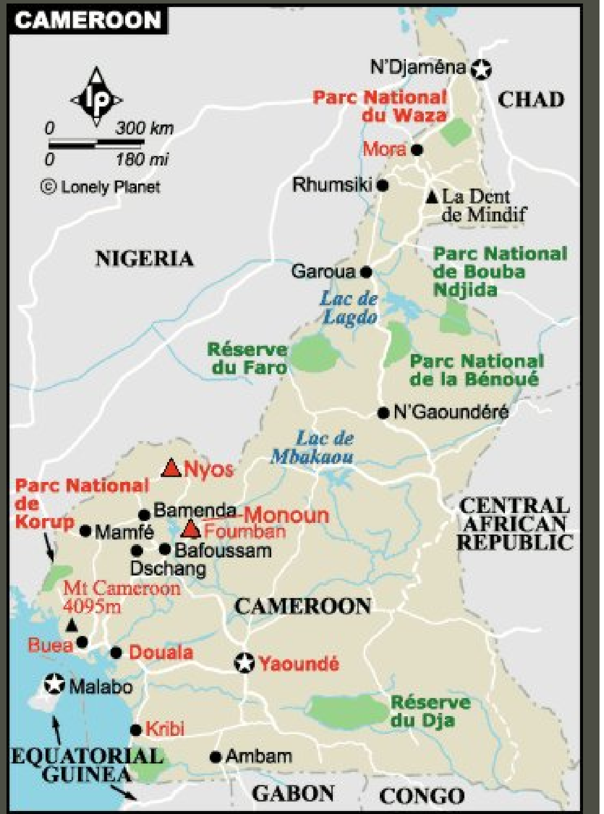
Cahora Bassa Dam

- Has impounded an enormous reservoir
- Generates 2.1 mega-Watts of electricity
- Provides power to Moz. and South Africa

Hazard Communication Lessons

- Widespread hazard communication is difficult when the hazard does not have a high recurrence rate
- USAID/OFDA takes a multi-hazard approach

Lakes Nyos and Monoun

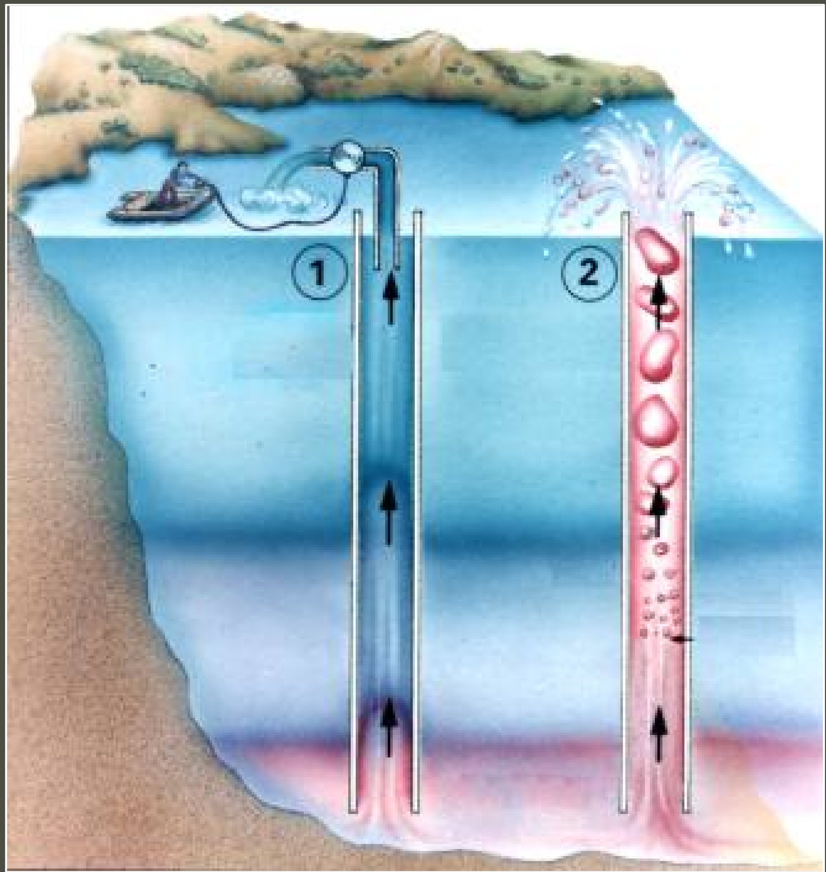


Photograph from: http://perso.wanadoo.fr/mhalb/nyos/

Chronology of Events

- August 1984 CO_2 release at Monoun- 36 people killed
- August 26, 1986 CO_2 release at Nyos- ~1800 people killed, 5,000-10,000 people displaced
- 1999-2004 OFDA funds Nyos and Monoun Degassing Project

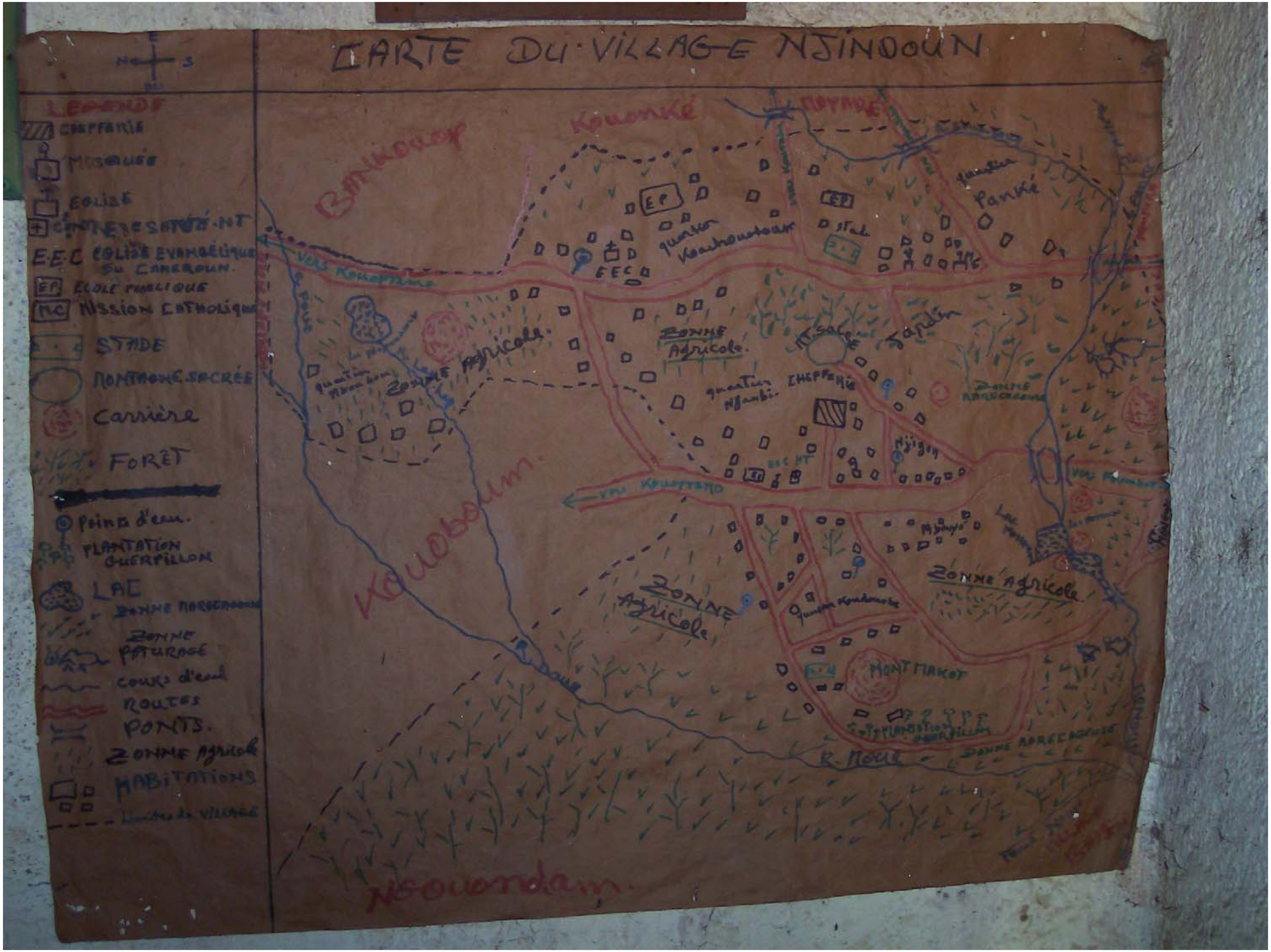
Pipe Installation



Figures from: http://perso.wanadoo.fr/mhalb/nyos/


PROGRAMME DE DEGAZAGE DES
"NMDP"
STATION DE
DE CO_2
Monoun et Nyos contiennent une importante quantité de


ATTENTION
ZONE A RISQUE D'EMANATION DE GAZ
SI VOUS ENTENDEZ UNE SIRENE OU
PERCEVEZ UNE
ROUGE
DANGER STOP
RENTREZ ALERTEZ LA
POPULATION INFORMEZ LES
AUTORITES


CARTE DU VILLAGE NJINDOUN
LEGENDE
CHEFFERIE
MOSQUÉE
EGLISE
E.E.C EGLISE EVANGÉLIQUE DU CAMEROUN.
EP ECOLE PUBLIQUE
MC MISSION CATHOLIQUE
STADE
MONTAGNE SACRÉE
Carrière
FORÊT
Point d'eau.
PLANTATION GUERPILLON
LAC
ZONNE PATURAGE
cours d'eau
ROUTES
PONTS.
ZONNE Agricole
HABITATIONS
Limites du VILLAGE
Kouonké
EEC
ZONNE Agricole
CHEFFERIE
MONT MAKOT
R. Noue

Hazard Communication Lessons

- Hazard communication directly to at-risk communities should accompany mitigation efforts
- Communication plans designed by at-risk communities can be very effective
- Hazard communication must be sustained

International Volcanic Health Hazard Network

Pamphlets available in:

- English
- Swahili
- French
- Japanese
- Spanish
- Italian
- Portuguese
- To download pdf: www.ivhhn.org

Horwell, 2008

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Earthquake Hazards Program

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  - World
  - EQ Notification Service
  - Feeds & Data
  - Animations
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  - Significant EQs
  - Earthquake Search
  - EQ Summary Posters
  - Scientific Data
- About EQ Maps
- Did You Feel It?
- Energy & Broadband Solutions
- Fast Moment Tensors
- Media Info
- PAGER
- Seismogram Displays
- ShakeMaps

Magnitude 6.3 - JAVA, INDONESIA

2006 May 26 22:53:58 UTC

Versíon en Español

Details | Summary | Maps | Scientific & Technica

Earthquake Details

Magnitude	**6.3** (Strong)
Date-Time	**Friday, May 26, 2006 at** = Coordinated Universal T **Saturday, May 27, 2006** = local time at epicenter Time of Earthquake in othe
Location	7.962°S, 110.458°E
Depth	10 km (6.2 miles) set by
Region	JAVA, INDONESIA
Distances	20 km (10 miles) SSE of 110 km (70 miles) S of **Se** 150 km (95 miles) SE of **P** 455 km (285 miles) ESE o
Location Uncertainty	horizontal +/- 7.5 km (4.7
Parameters	Nst=130, Nph=130, Dmin=220.2 km, Rmss=1.4 sec, Gp= 43°, M-type=teleseismic moment magnitude (Mw), Version=9
Source	USGS NEIC (WDCS-D)
Event ID	usneb6

This event has been reviewed by a seismologist.

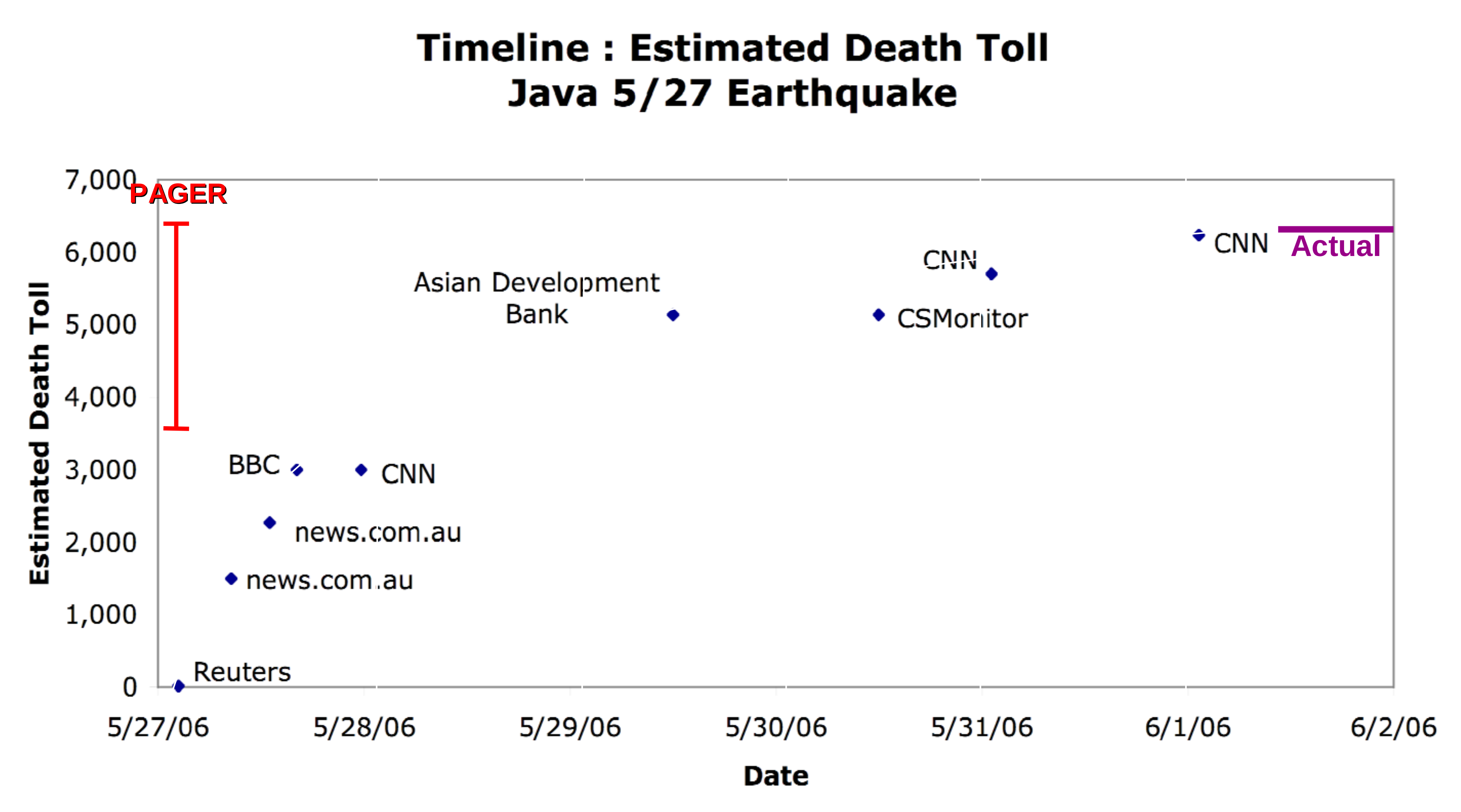
Did you feel it?
Report shaking and damage at your location. You can also view a map displaying accumulated data from your report and others.

Magnitude & Epicenter

< 20 min

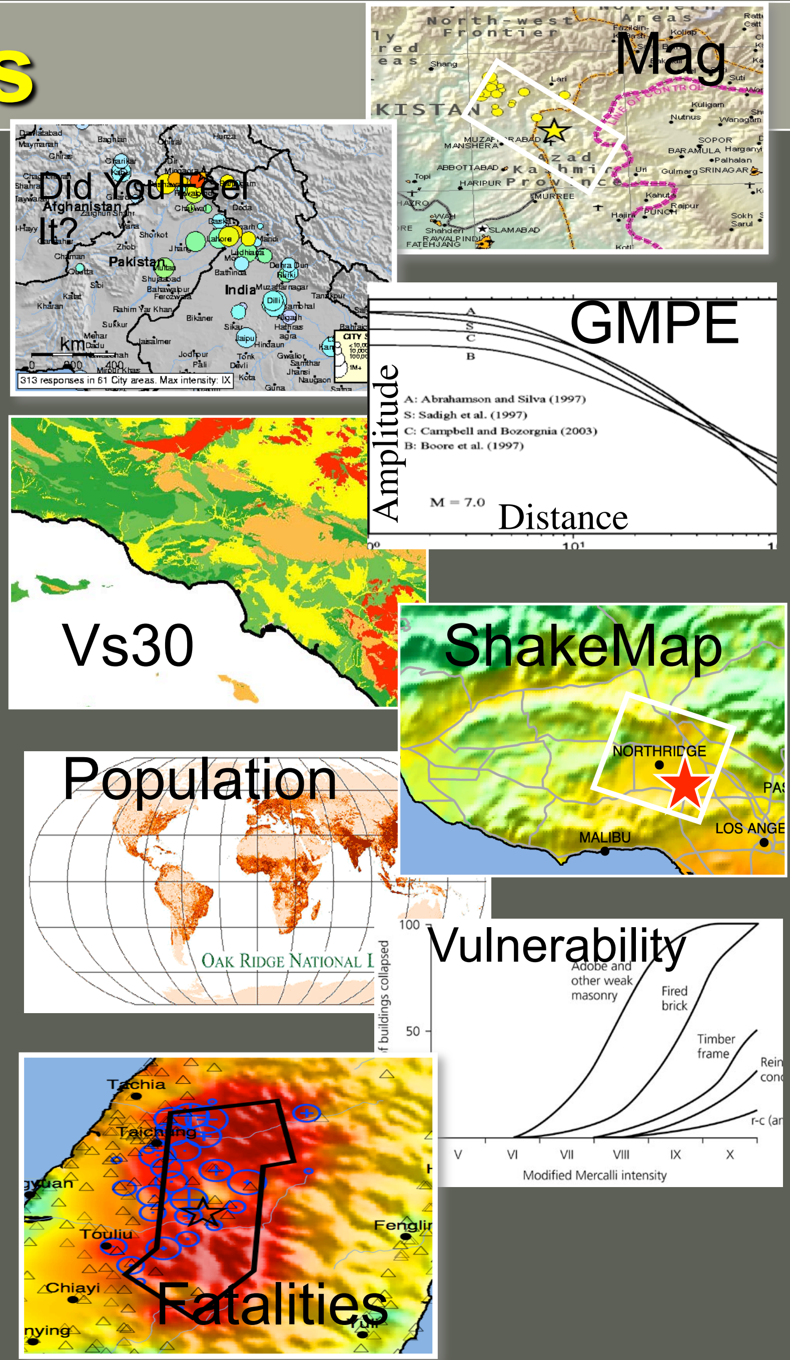
News Accounts

~ hours to days


Timeline : Estimated Death Toll
Java 5/27 Earthquake
Estimated Death Toll
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
PAGER
Reuters
news.com.au
news.com.au
BBC
CNN
Asian Development
Bank
CSMonitor
CNN
CNN
Actual
5/27/06
5/28/06
5/29/06
5/30/06
5/31/06
6/1/06
6/2/06
Date

PAGER Ingredients

- Earthquake Information (location, magnitude, & rupture dimensions)
- Shaking Observations & Intensities
- Ground Motion Prediction Equations
- Site Conditions (Site Amplification)
- ShakeMap Shaking Estimates
- Population database
- Region-specific vulnerabilities
- Past earthquake database for calibration



USGS
science for a changing world

GSN USAID FROM THE AMERICAN PEOPLE

M 7.9, EASTERN SICHUAN, CHINA

PAGER
Version 11

Origin Time: Mon 2008-05-12 06:28:01 UTC
Location: 30.99°N 103.36°E Depth: 19 km

Created: 6 days, 22 hrs after earthquake

Estimated Population Exposed to Earthquake Shaking

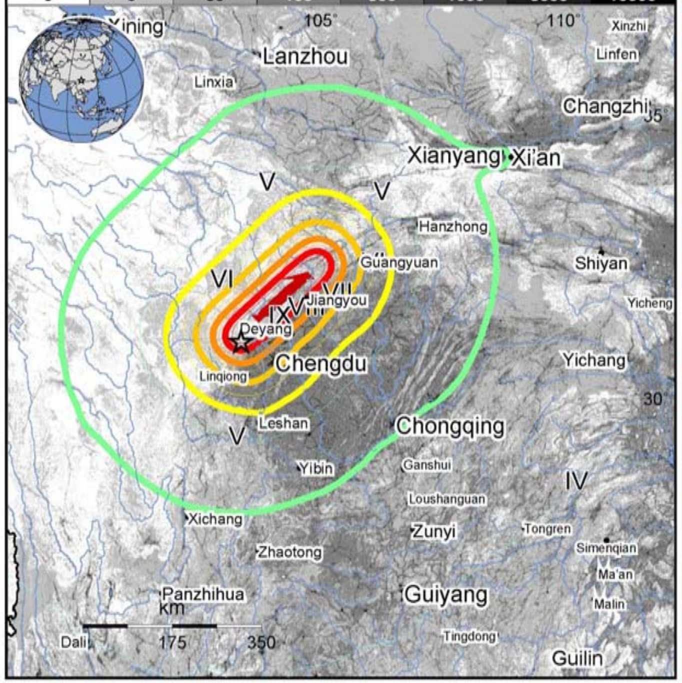
ESTIMATED POPULATION EXPOSURE (k = x1000)		- -*	- -*	192,012k*	89,480k	15,484k	12,396k	4,301k	692k	603k
ESTIMATED MODIFIED MERCALLI INTENSITY		I	II-III	IV	V	VI	VII	VIII	IX	X+
PERCEIVED SHAKING		Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	Resistant Structures	none	none	none	V. Light	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy
	Vulnerable Structures	none	none	none	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy	V. Heavy

*Estimated exposure only includes population within the map area.

Population Exposure

population per ~1 sq. km from Landscan 2006

0	5	50	100	500	1000	5000	10000



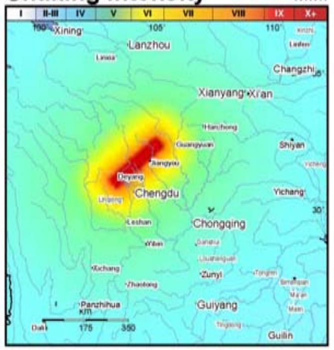
Selected City Exposure

MMI	City	Population
VIII	**Jiangyou**	**127k**
VIII	Tianpeng	60k
VIII	Mianyang	264k
VII	**Deyang**	**152k**
VII	**Linqiong**	**55k**
VII	**Chengdu**	**3,950k**
VII	**Guangyuan**	**213k**
V	**Xi'an**	**3,225k**
V	Nanchong	7,150k
V	**Chongqing**	**3,967k**
IV	Shiyan	3,460k

bold cities appear on map (k = x1000)

Shaking Intensity

MMI



Overall, structures in this region are vulnerable to earthquake shaking, though some resistant structures exist. A magnitude 6.4 earthquake struck the Sichuan, China region on August 23, 1976 (UTC), with estimated population exposures of 1,500 at intensity IX or greater and 5,700 at intensity VIII, resulting in 41 deaths. Additionally, a magnitude 7.3 struck this region in 1933 killing 6,800 people. Recent earthquakes in this area have also triggered landslide hazards that have contributed to losses. Users should consider the preliminary nature of this information and check for updates as additional data becomes available.

This information was automatically generated and has not been reviewed by a seismologist.

http://earthquake.usgs.gov/pager

Event ID: us2008ryan

OpenSHA Home Page - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://www.opensha.org/

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Search Add Buttons

OpenSHA

Open Seismic Hazard Analysis

SCEC

a joint venture

USGS

- Mission Statement
- Brief Overview
- Accomplishments
- Near-Term Goals
- Applications
- Publications
- Documentation

WARNING - this application is in Beta mode (mostly working, but still undergoing tests)

This application can be used to compute and plot Scenario ShakeMaps for chosen *IMR* , *Earthquake Rupture*, and *Geographic Region*.

Download (click the following):

- **Stand-Alone Application (Jar file, Version 0.0.14, ~ 9.0 MB)**
- **Stand-Alone Application that uses Distributed Objects (Jar file, Version 0.0.14, ~4.0 MB)** **(Recommeded)**

Windows Users: When downloading the stand-alone applications, make sure they are saved with a ".jar" extension rather than ".zip" or ".WinZip" (the latter two are apparently the default for some users). You can achieve this either by using the "save as" option in your browser, or you may be able to simply change the extension to ".jar" after downloading.

User Manual:

Not yet available, although the applications should be intuitive enough if you know something about SHA.

Tutorials:

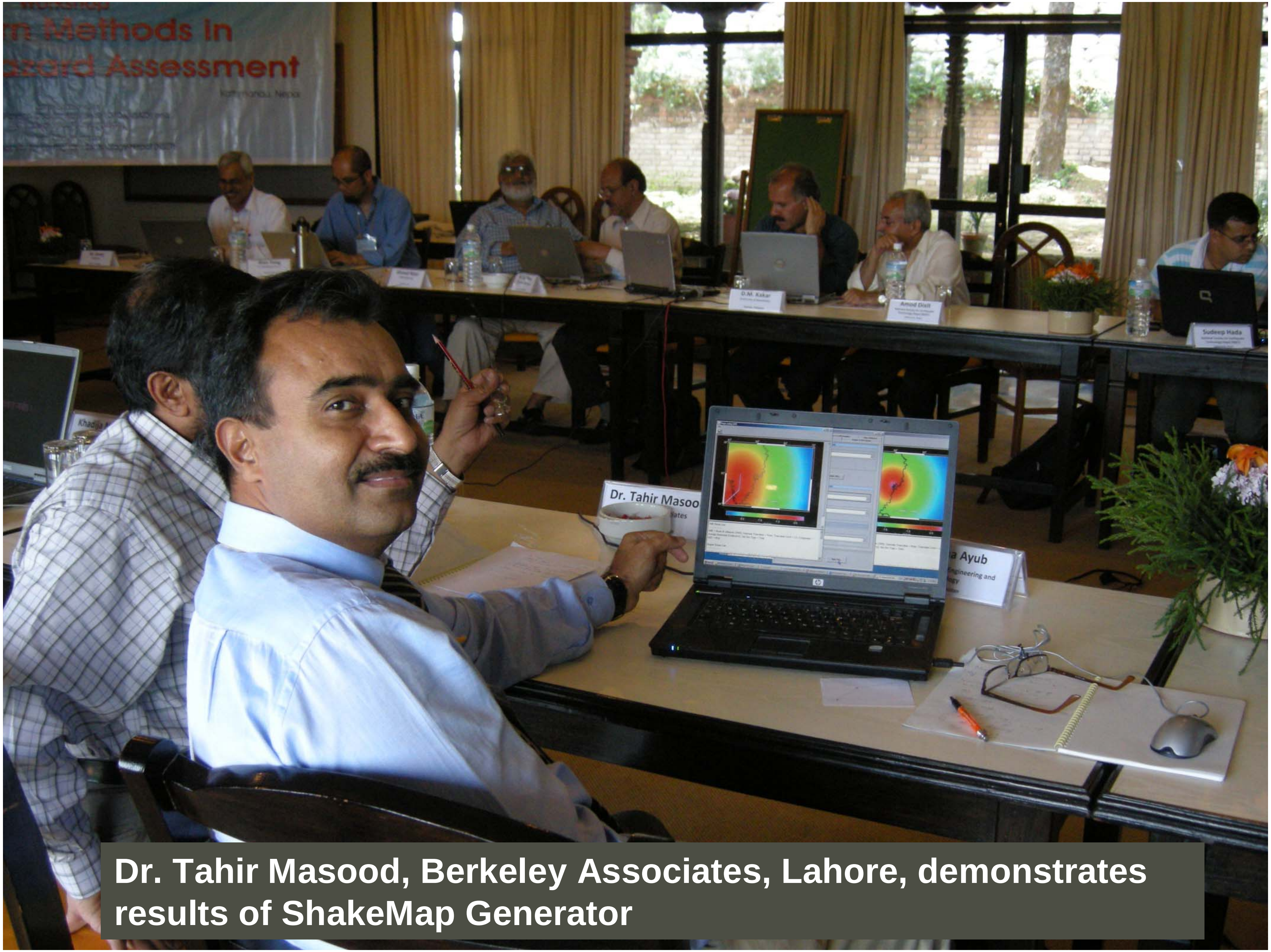
Click here for instructions on how to use this application to reproduce figures in one of our publications.

Code Verification:

Done

OpenSHA

- Primary goal is to improve Seismic Hazard Analysis by providing a platform that can accommodate both past and future models
- Object-oriented, web- & GUI-enabled, open-source, and freely available
- The goal is to provide a framework where any arbitrarily complex (e.g., physics based) Earthquake Rupture Forecast, ground-motion model, or engineering-response model can “plug in” for analysis without having to change what’s being plugged into



Dr. Tahir Masood, Berkeley Associates, Lahore, demonstrates results of ShakeMap Generator

Summary

1. Hazard communication plans vary according to the situation
   - Communication to decision makers
   - Communication to at-risk communities
   - Multi-hazard projects may be utilized

2. At-risk communities may create effective hazard communication plans

1. Communication tools exist that may be useful for new hazard communication projects (ash pamphlets, PAGER, and OpenSHA)