DEVELOPING AN EARTHQUAKE RESELIENT SOCIETY

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- GLOBAL EARTHQUAKES
- HIMALAYA
- UTTARAKHAND
- FORECAST
- EARLY EARTHQUAKE WARNING
- EARTHQUAKE SCENARIO
- M 9 EARTHQUAKE IN HIMALAYA

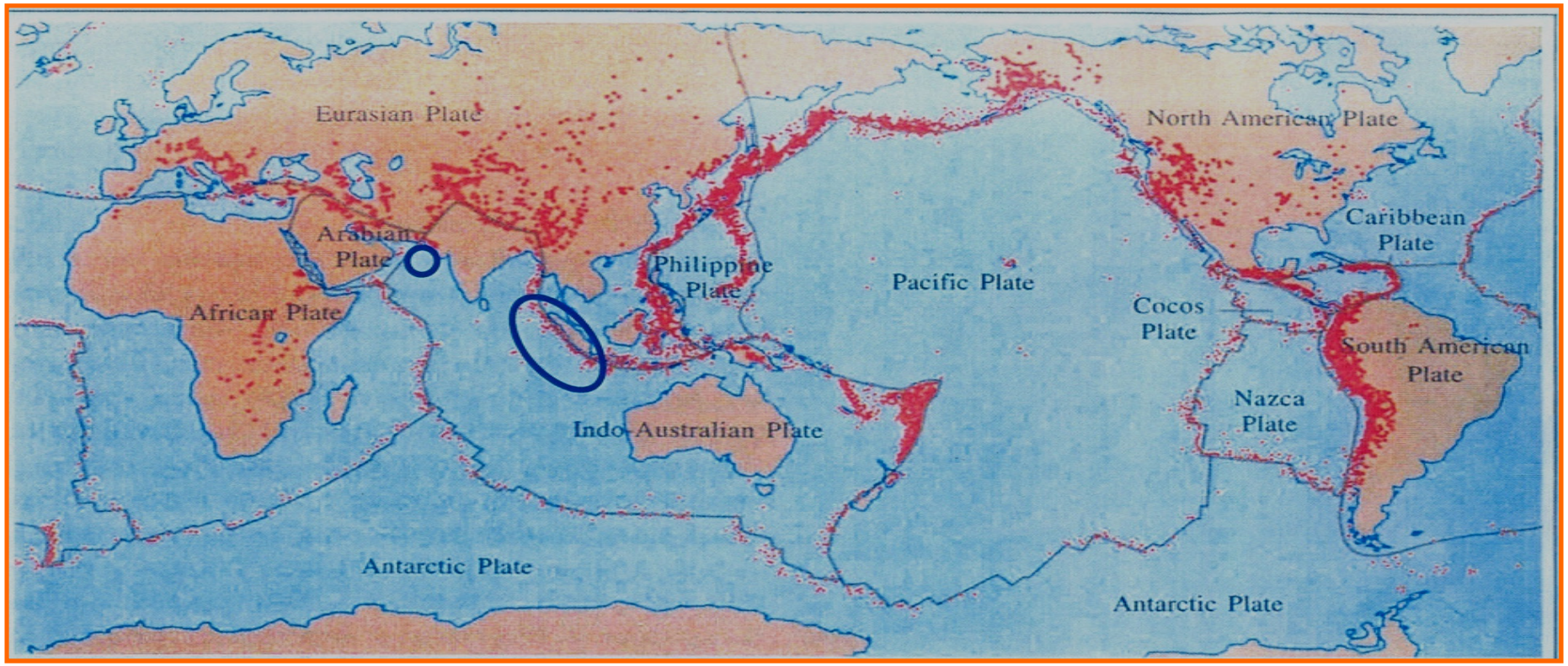


Diagram showing the distribution of earthquakes and major plate boundaries. It may be noted that globally, more than 75% of earthquake energy is released in the circum-Pacific belt, about 20% in the Alpine-Himalayan belt, and remaining 5% through the mid-oceanic ridges and other Stable Continental Region earthquakes. For a tsunami to hit Indian coast, it is necessary that a tsunamigenic earthquake occurs and its magnitude should be larger than M 7, and the possible locations of such events are enclosed in blue circle and ellipse.

Approximate annual frequency of earthquake occurrence in the world

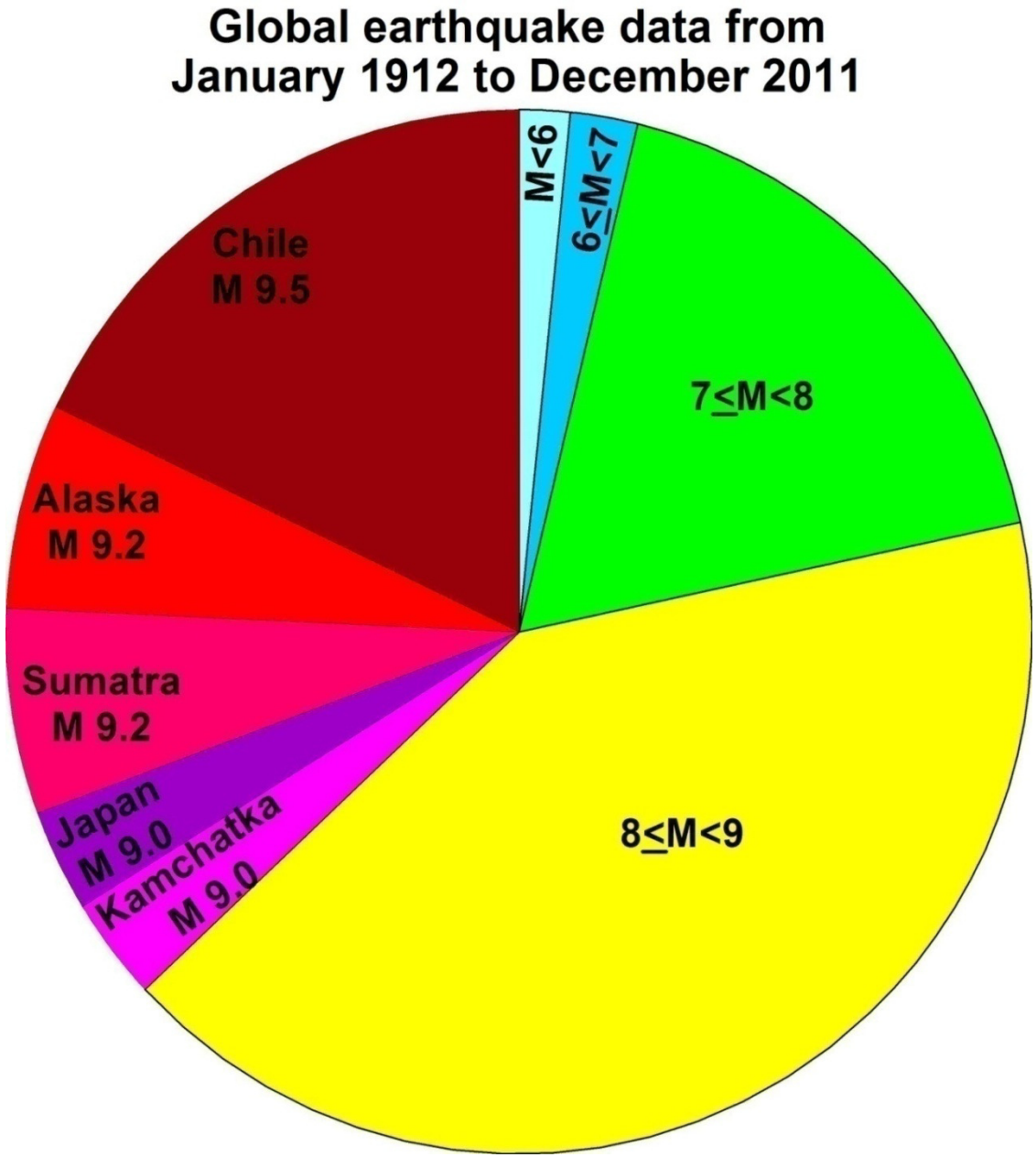
Descriptor	Magnitude	Annual Frequency in the World
Great	8 and higher	1
Major	7- 7.9	18
Strong	6-6.9	120
Moderate	5-5.9	800
Light	4-4.9	6200
Minor	3-3.9	49000
Very minor (micro)	2-2.9	About 1000 per day
	1-1.9	About 8000 per day

Source: *Dr. Harsh K. Gupta,* Nature of Earthquakes, 2005

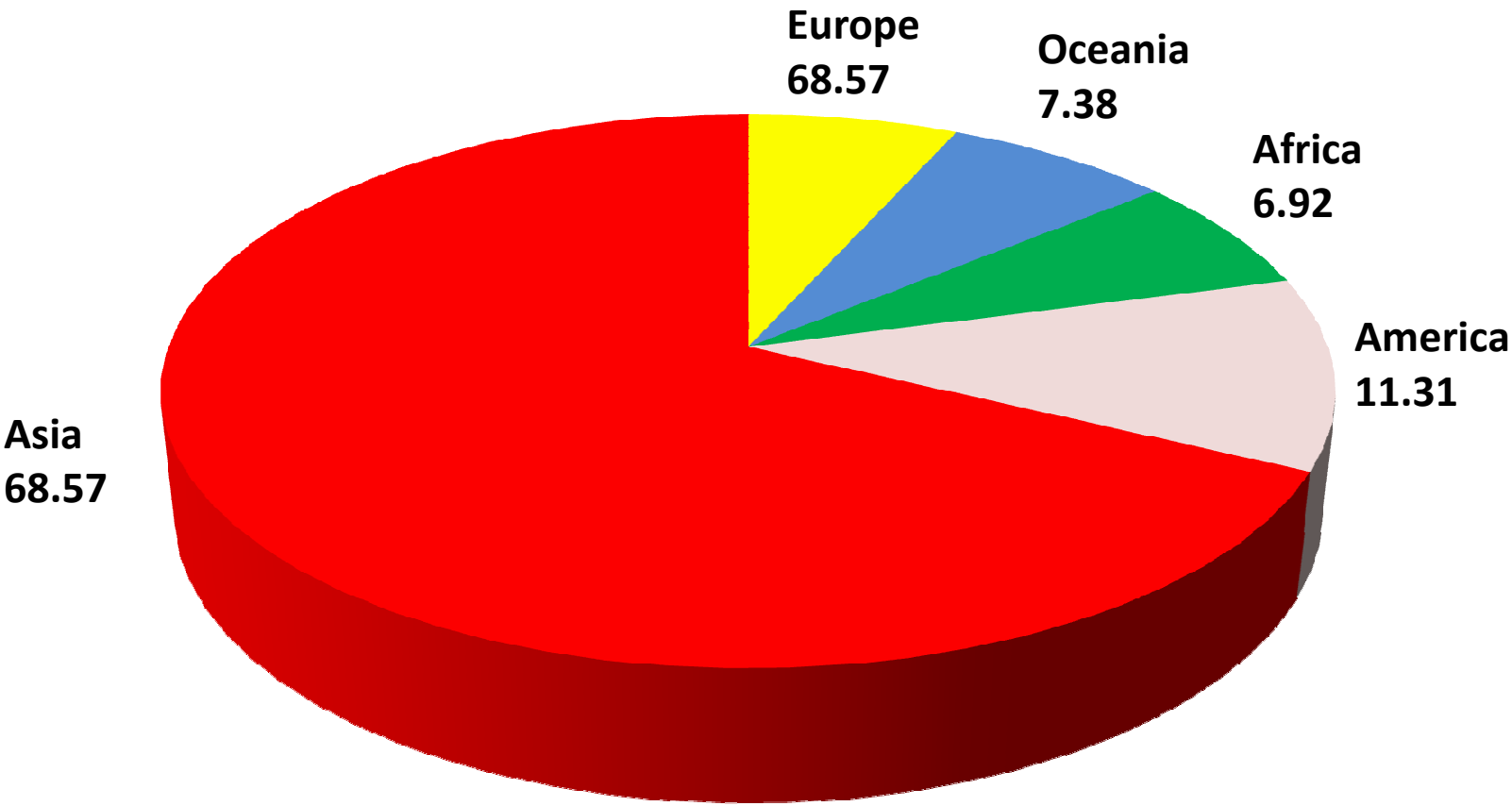
How does magnitude matter?

- With every increase in magnitude by 1.0, energy released increases by 31 times.
- Energy released by M 8.0 earthquake is 1000 times that by M 6.0 earthquake.
- Larger earthquake implies stronger shaking in larger area
- M 6 = 1 Hiroshima bomb
- M 9 = 40 000 Hiroshima bombs

ENERGY RELEASED BY EARTHQUAKES



Percentage of people killed by natural disaster by region



Globally Ten Largest Cities: 7 in Asia

Rank order	Country	Urban agglomeration	Population (millions)
1	Japan	**Tokyo**	**37.22**
2	India	**Delhi**	**22.65**
3	Mexico	**Mexico City**	**20.45**
4	USA	**New York-Newark**	**20.35**
5	China	**Shanghai**	**20.21**
6	Brazil	**Sao Paulo**	**19.92**
7	India	**Mumbai**	**19.74**
8	China	**Beijing**	**15.59**
9	Bangladesh	**Dhaka**	**15.39**
10	India	**Kolkata**	**14.40**

Urbanization of Asian Population

Sl. No.	Year	% of urban population
1	1950	**17**
2	2010	**43**
3	2012	**46**
4	2030	**55 (expected)**

What is important:

1. Mainstreaming DRR in urban developments projects aiming to make disaster risk reduction as a normal practice, fully and institutionally within the urban schemes.

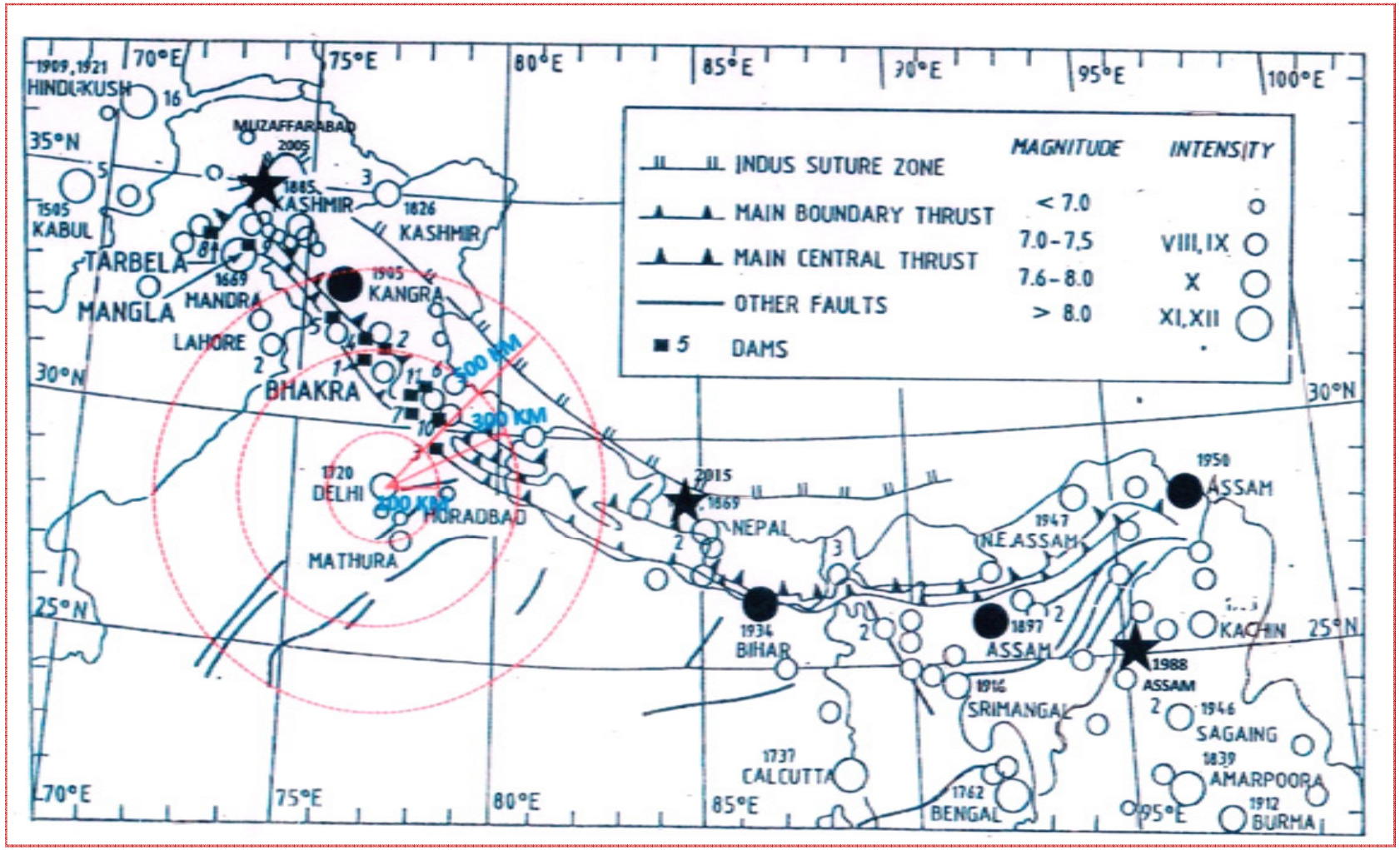
2. Target: To make development project insulated from disasters.

21st Century most devastating Earthquakes

Date	Earthquake	Magnitude	Human lives lost	Financial loss ~
Dec. 26, 2004	Northern Sumatra	9.2	About 3,00,000	$ 2.311 bn - $ 4.062 bn
Oct. 08, 2005	Muzaffarabad	7.6	About 80,000	About US $ 5.2 Billion
May 12, 2008	China	7.9	About 70, 000	About US $ 20 Billion
Jan. 12, 2010	Haiti	7.0	About 3,16,000	About 3.2778 bn (USD)
Feb. 27, 2010	Chile	8.8	About 523	$ 7.57 bn - $ 12.00 bn
March 11, 2012	Japan	9.0	About 15,848	$ 29.4 bn - $ 45 bn
April 25, 2015	Nepal	7.8	About 9,500	~ $ 2 bn

In-spite of scientific and technical developments, the impact of earthquakes keeps increasing. In the first 17 years of the 21st Century we have lost more human lives and the financial losses have been much more than the entire 20th century.

EARTHQUAKES IN HIMALAYA

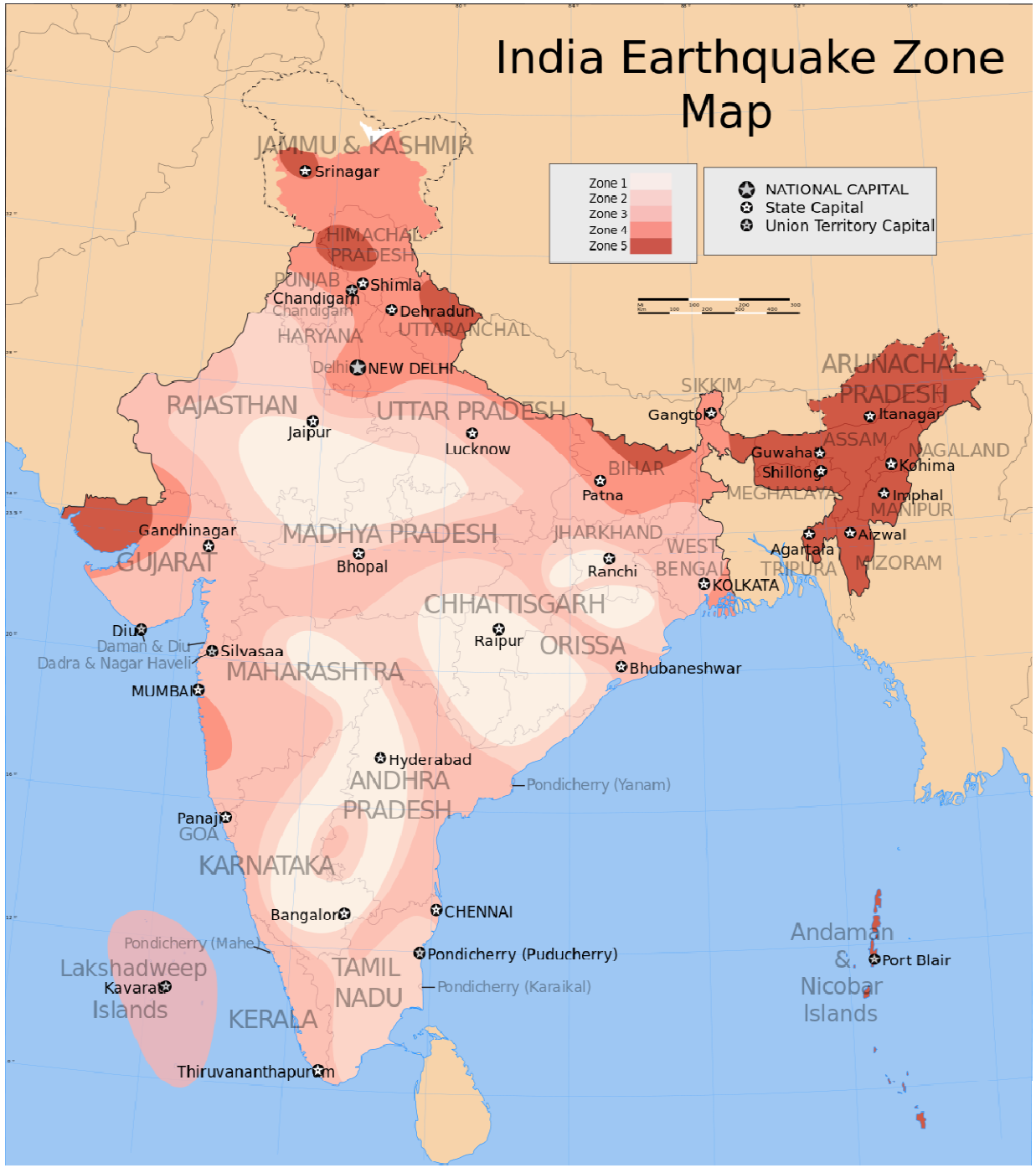


Earthquakes of M≥7.0, epicentral intensity ≥ VIII, and/or recent damaging earthquakes that caused fatalities in the Himalaya and the vicinity (25° - 37° N, 69° - 83° E; 20° - 30° N, 83° - 100° E). Four great earthquakes of M ≥8 are shown with filled circles. Stars: East is the August 8, 1988 M 7.3; west M 7.6 Muzaffarabad M 7.6 and Center: 25th April M 7.8 Nepal earthquake. Circles around Delhi indicate epicentral distances of 100, 300 and 500 km from Delhi. Updated from Chandra (1978)

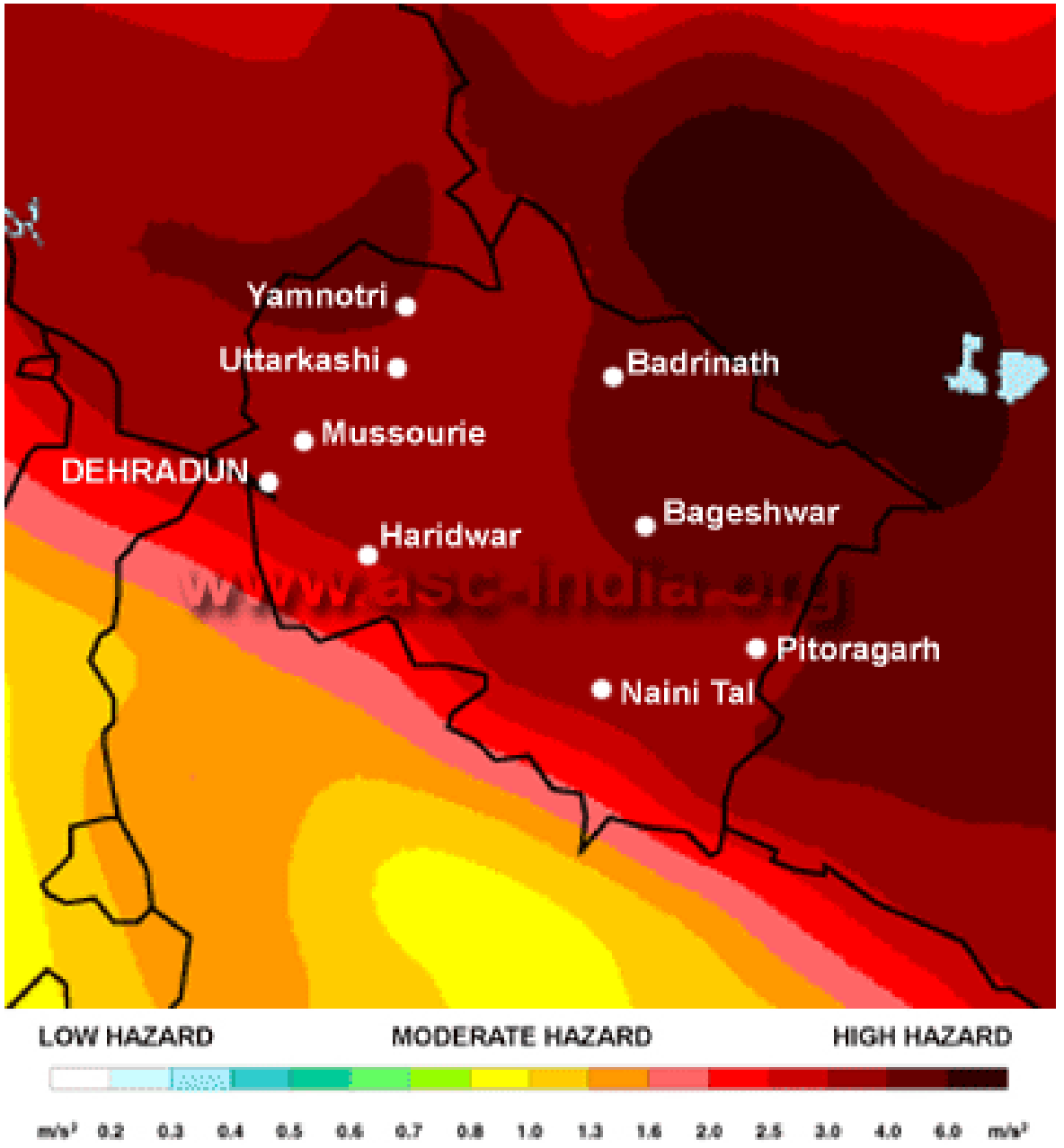
Magnitude distribution of earthquakes in the Himalayan region. Updated from Satyabala and Gupta (1996).

MAGNITUDE	1897-1952	1953-2016
$M \geq 7.5$	14	3
$7.5 > M \geq 7$	11	10
$7 > M \geq 6.5$	19	31

SEISMIC ZONING


India Earthquake Zone Map
Zone 1
Zone 2
Zone 3
Zone 4
Zone 5
NATIONAL CAPITAL
State Capital
Union Territory Capital
JAMMU & KASHMIR
Srinagar
HIMACHAL PRADESH
Shimla
PUNJAB
Chandigarh
Dehradun
UTTARANCHAL
HARYANA
Delhi
NEW DELHI
RAJASTHAN
Jaipur
UTTAR PRADESH
Lucknow
SIKKIM
Gangtok
ARUNACHAL PRADESH
Itanagar
ASSAM
Guwahati
Shillong
NAGALAND
Kohima
BIHAR
Patna
MEGHALAYA
Imphal
MANIPUR
Aizwal
MIZORAM
Agartala
TRIPURA
WEST BENGAL
KOLKATA
Ranchi
JHARKHAND
Gandhinagar
GUJARAT
MADHYA PRADESH
Bhopal
CHHATTISGARH
Raipur
ORISSA
Bhubaneshwar
Diu
Daman & Diu
Dadra & Nagar Haveli
Silvasaa
MAHARASHTRA
MUMBAI
Hyderabad
ANDHRA PRADESH
Pondicherry (Yanam)
Panaji
GOA
KARNATAKA
Bangalore
CHENNAI
Pondicherry (Mahe)
Pondicherry (Puducherry)
Pondicherry (Karaikal)
TAMIL NADU
Lakshadweep Islands
Kavaratti
KERALA
Thiruvananthapuram
Andaman & Nicobar Islands
Port Blair

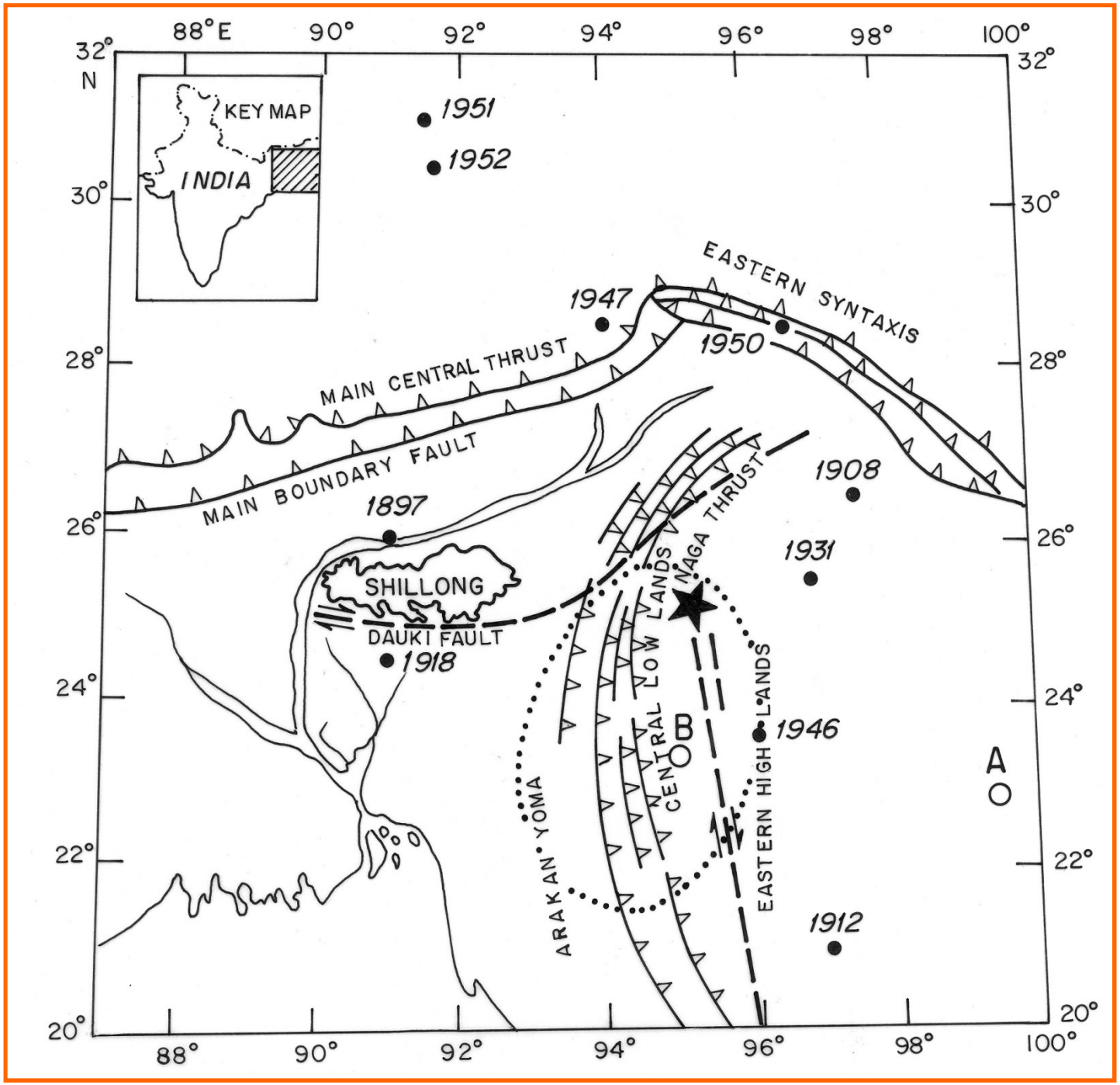
UTTARAKHAND EARTHQUAKE ZONATION


Yamnotri
Uttarkashi
Badrinath
Mussourie
DEHRADUN
Haridwar
Bageshwar
Pitoragarh
Naini Tal
LOW HAZARD
MODERATE HAZARD
HIGH HAZARD
m/s² 0.2 0.3 0.4 0.5 0.6 0.7 0.8 1.0 1.3 1.6 2.0 2.5 3.0 4.0 6.0 m/s²

Medium Term Earthquake Forecast in the North-East India Region

Forecast of August 6, 1988 earthquake.

Earthquake parameter	Forecast Gupta and Singh, 1986	Occurrence NEIS
Epicenter	21° N – 25 1/2° N 93° E-96° E	25.116° N 95.171° E
Magnitude (M)	8 ± 1/2	7.3
Depth	100 ± 40 km	115 km
Time	Feb. 1986 - Dec. 1990	August 6 1988 (00:36:26.9 G.C.T.)


88°E
90°
92°
94°
96°
98°
100°
32° N
30°
28°
26°
24°
22°
20°
KEY MAP
INDIA
1951
1952
1947
1950
EASTERN SYNTAXIS
MAIN CENTRAL THRUST
MAIN BOUNDARY FAULT
1897
SHILLONG
DAUKI FAULT
1918
1908
1931
NAGA THRUST
CENTRAL LOW LANDS
EASTERN HIGH LANDS
ARAKAN YOMA
1946
B
A
1912

News

Medium-Term Earthquake Prediction

PAGES 1620, 1630

There is a worldwide effort to study and identify spatial and temporal variation of seismicity and recognize patterns that precede earthquakes [*Mogi*, 1969, 1984; *Ohtake et al.*, 1977*a*, *b*; *Habermann*, 1981; *Wyss et al.*, 1983; *Liu Puxiong et al.*, 1984; *Ohnaka*, 1984–1985; and many others].

Gupta and Singh [1986] carried out a detailed study of earthquake swarms and quiescence which precede major earthquakes in the northeast India region and concluded:

1. Moderate magnitude to great earthquakes in the northeast India region are found to be preceded, generally, by well-defined earthquake swarms and quiescence periods.
2. On the basis of an earthquake swarm and quiescence period, an area bound by 21°N and 25½°N latitude and 93°E and 96°E longitude is identified to be the site of a possible future earthquake of M 8 +/- ½ with a focal depth of 100 +/- 40 km. This earthquake should occur any time from now onwards. Should it not occur till the end of 1990, this forecast could be considered as a false alarm.

These results were also reported in the symposium "Earthquake Hazard Assessment and Prediction" held during the XIX IUGG General Assembly at Vancouver, Canada, in August 1987 [*Gupta and Singh*, 1987]. The occurrence of August 6, 1988, earthquake with focal parameters as given in Table 1 (National Earthquake Information Service, preliminary determination, personal communication, Tim Hitchcock, USGS, Menlo Park, Calif.) has made this medium-term prediction come true.

The northeast India region and its vicinity is seismically one of the most active intracontinental regions of the world. Since 1897, ten earthquakes of M ≥ 7½ (excluding the recent one of August 6, 1988) have occurred in this region (Figure 1). These include the great earthquakes of June 12, 1897, and August 15, 1950, both of M 8.7. The last earthquake belonging to this category occurred on August 17, 1952. Following the work of *Evison* [1977, 1982], *Gupta and Singh* [1986] systematically examined the above-mentioned ten earthquakes for possible precursory swarms and quiescences. The earthquake data set had been critically examined for completeness, keeping in view the prevalent earthquake location capabilities [*Gupta and Singh*, 1986; *Gupta et al.*, 1986]. The main shock magnitude was found to depend upon the size of the largest events in the swarm and the time interval between the onset of the swarm and the time of the earthquake occurrence. The following regression equations relating the main shock magnitude (M_m), the average magnitude of the largest two events in the swarm (M_s), and the time interval in days (T_s) between the beginning of the swarm and the main shock were developed: $M_m = 1.37 M_s - 1.41$ and $M_m = 3 \log_{10} T_s - 3.27$.

Gupta and Singh [1986] pointed out that it is important to recognize the swarms and quiescences before the occurrence of the main shock, and reported that they have identified one such area in the vicinity of India-Burma border region, where four earthquakes of $m_b \geq 6.1$ occurred in a quick succession in 1964. To examine this swarm, an area bounded by

TABLE 1. Prediction of August 6, 1988, Earthquake

Earthquake Parameters	Prediction [*Gupta and Singh*, 1986]	Occurrence NEIS (Preliminary Determination)
Epicenter	21°N–25½°N 93°E–96°E	25.116°N 95.171°E
Magnitude (M)	8 ± ½	7½
Depth	100 ± 40 km	115 km
Time	February 1986–December 1990	August 6, 1988 (00:36:26.9 G.C.T.)

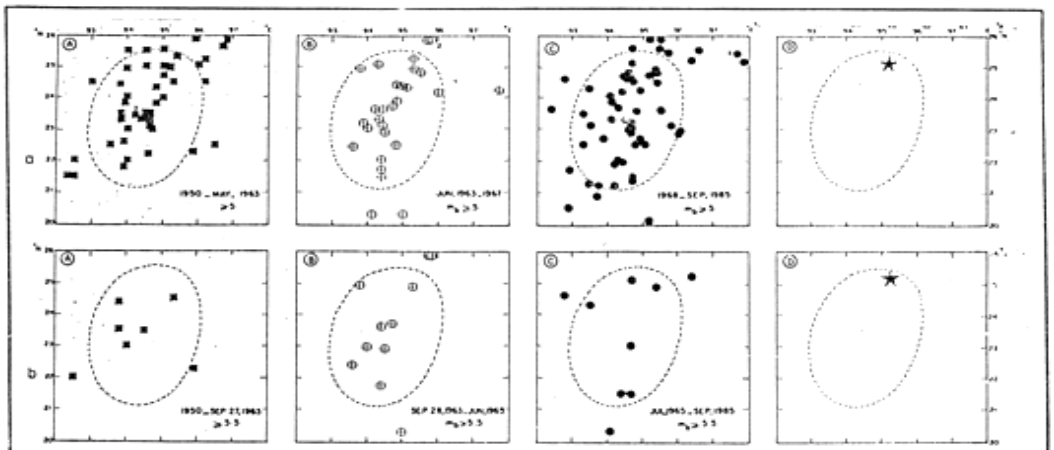


Fig. 1. Earthquakes in the vicinity of India-Burma border region. Earthquake data from 1950 through September 1985 are presented for (*a*) earthquakes of $m_b \geq 5.0$ and (*b*) earthquakes of $m_b \geq 5.5$. The epochs of background/normal seismicity (A, solid square), swarms (B, circle with cross), and quiescence (C, solid circle) are well identified. The August 6, 1988, earthquake (star) occurred in the elliptical zone of preparation for a future earthquake delimited by *Gupta and Singh* [1986].

This page may be freely copied.

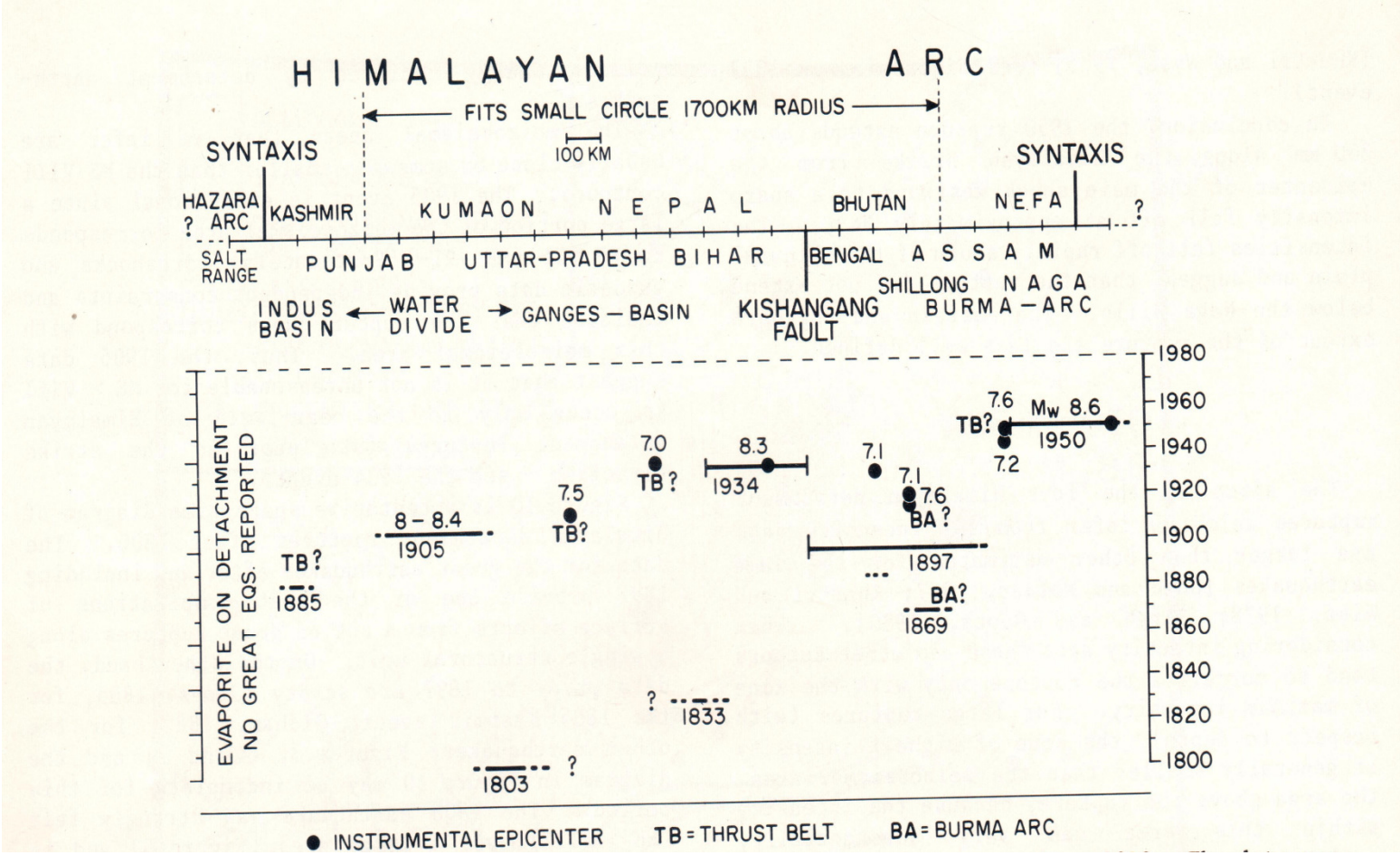
The probability of an earthquake of $M \geq 7.5$ occurring in the area and the time interval of prediction due to chance is 0.048 which is very small. Hence the occurrence of the predicted earthquake can be considered significant.

Return period

- Seeber and Armbruster (1981)

(Earthquake prediction : An international Review, AGU Monograph, Maurice-Ewing series 4)

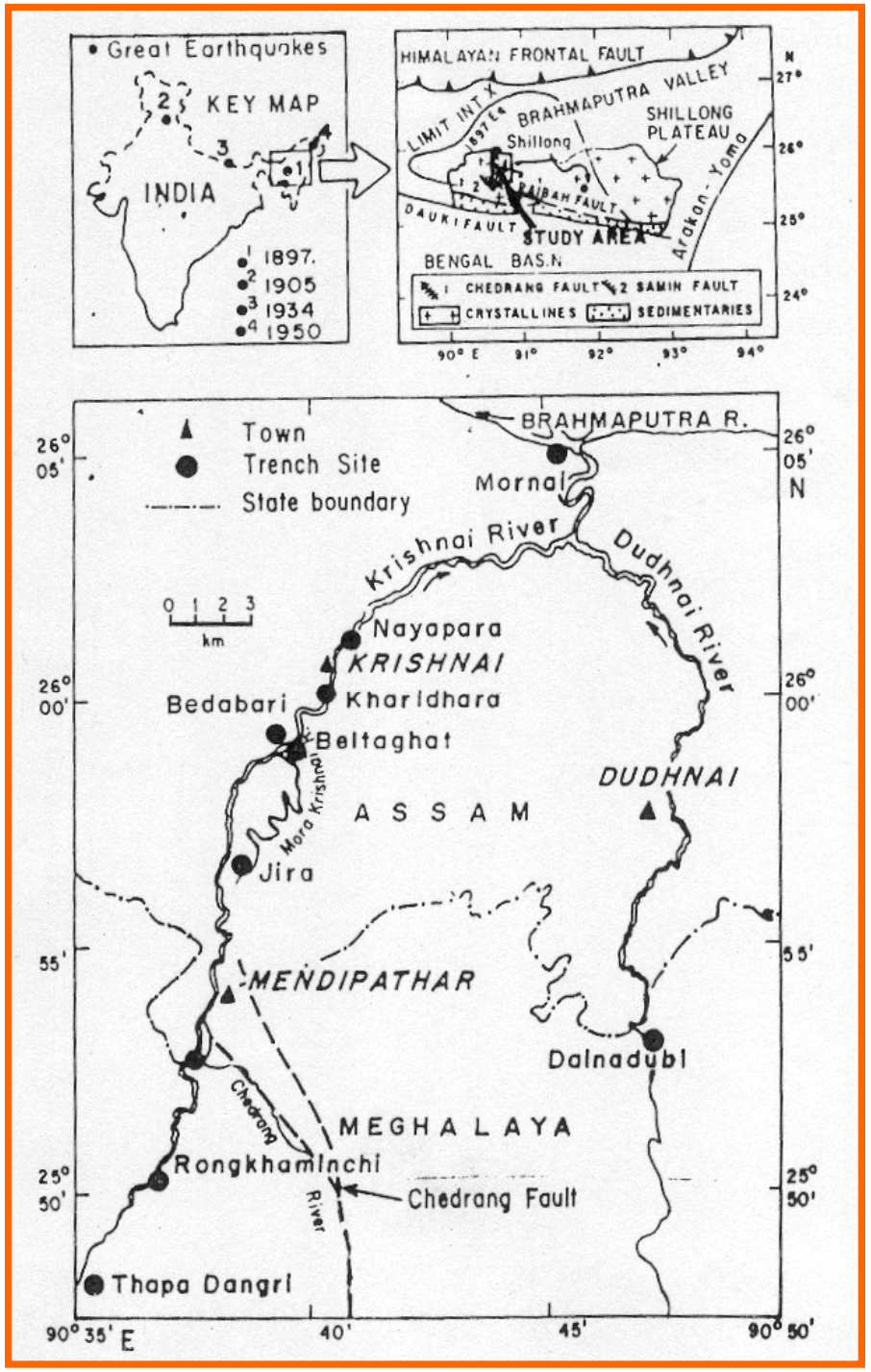
“….the entire Himalayan detachment would rupture in 180 to 240 years and the repeat time of a typical (300 Km) would be 200 – 270 years …”



Space –Time diagram of detachment ruptures along the Himalayan arc after 1800. The date are very scantly for the period before 1897 and may be incomplete. The most likely gaps unruptured since 1800 are in Kasmir and in Uttar Pradesh, between the 1883 and 1803 ruptures. The gap between the 1897 and 1950 ruptures was probably filled by the 1943 and 1947 earthquakes. If the 1833 and 1803 ruptures about, the entire Himalayan detachment, excluding Hazara and Kasmir where aseismic slip may play an important role, has probably ruptured since 1800.

Paleoliquefaction evidence and periodicity of large prehistoric earthquakes in shilong Plateau, India, EPSL

Sukhija et al (1999)



Location map of the study area in the Krishnai and Dudhnai river valleys close to the Chedrang Fault in the Shillong Plateau, northeast India. The top left inset map shows the location of four great Himalayan earthquakes, and the right inset includes the simplified geological map of the Shillong Plateau and the area of intensity X (MM) of the 1897 earthquake.

C ages of organic samples representing various seismic events in the Shillong Plateau

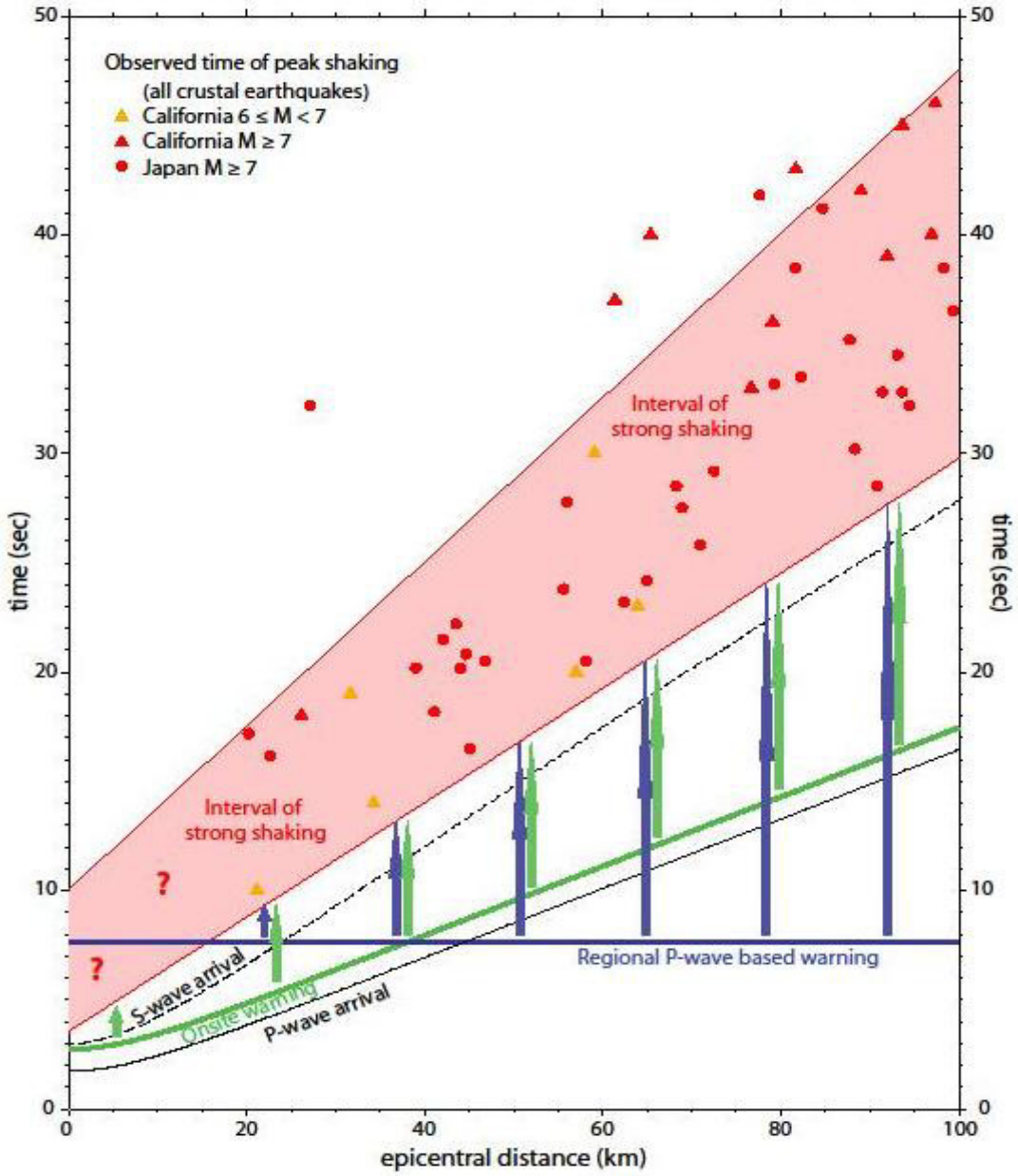
Event	Sample code	Minimum age	Coeval age	Maximum age	Age-range AD (MPAE)
I	AS-1: AS-3:	1430-1955 1425-1955	AS-33: Modern AS-34: Modern	AS-18: Modern AS-43: Modern	1897[a]
II	AS-39:	1050-1415	AS-13:1290-1950 AS-31:1240-1950 AS-32:1300-1955 AS-45:1450-1660	AS-19:1225-1660 AS-28:1290-1950 AS-30:1400-1630	1450-1650
III	AS-7: AS-7a; AS-10: AS-22: AS-23:	420-1010 440-1255 660-1280 540-890 400-1000	AS-11: 689-1290 RAS: 645-1017	AS-8: 530-1295 AS-24: 790-1300 AS-37: 550-1030 AS-41: 1020-1460	700-1050
IV	-		-	AS-16: 240-870	earlier than 600

MPAE = most probable age of the event. Modern = ^{14}C age ≤50 years. RAS = Rastogi et al.[34]

- Estimating the return times of great Himalayan earthquakes in eastern Nepal: Evidence from the Patu and Bardibas strands of the Main Frontal Trust, GR Bollinger et al (2014)

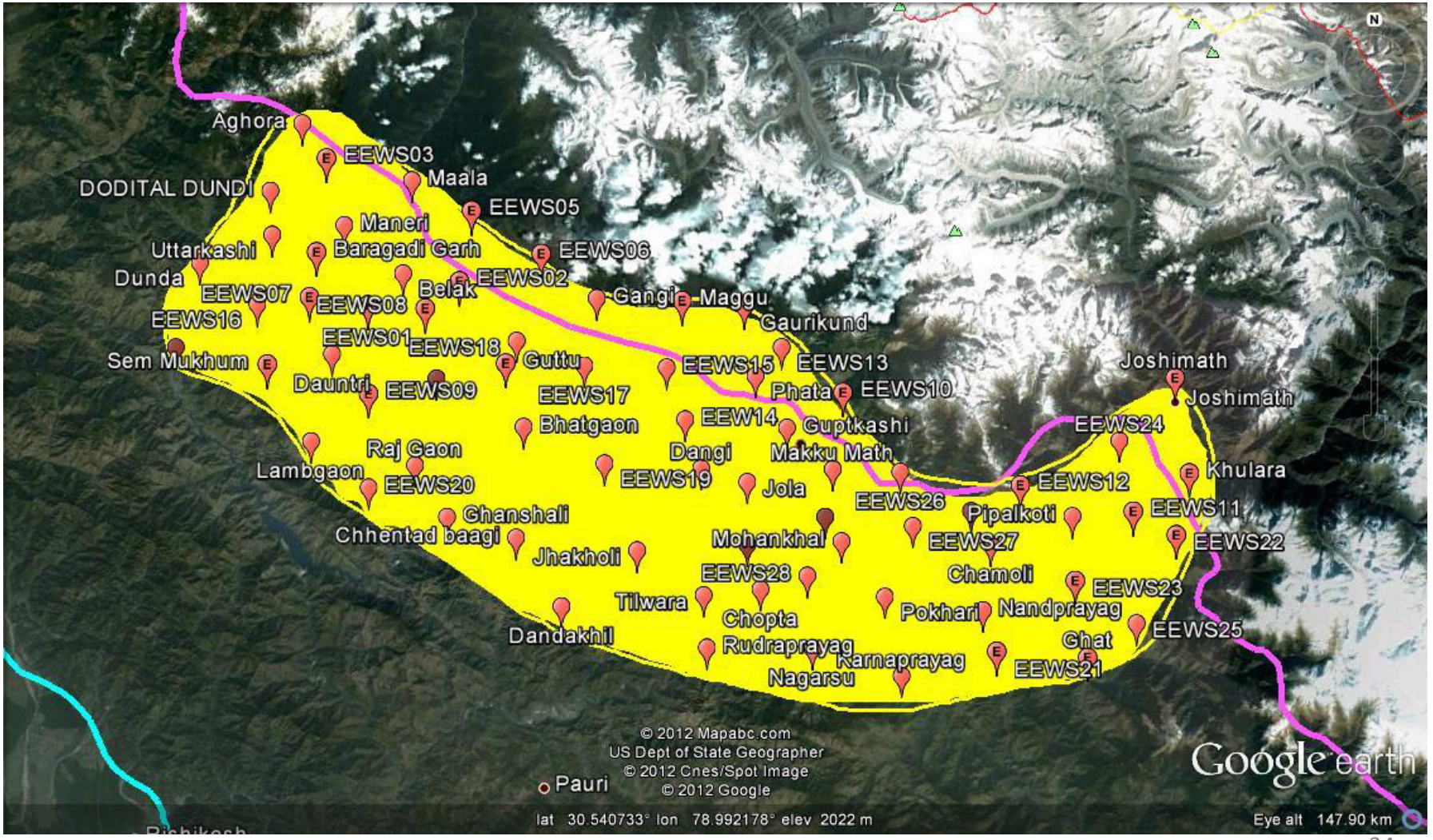
"……The coeval rupture of both strands during great Himalayan earthquakes implies that in eastern Nepal, the late Holocene return times of such earthquakes probably ranged between 750 +/ -140 and 870 +/ -350 years …"

EARTHQUAKE EARLY WARNING



From:- 'Encyclopedia of Solid Earth Geophysics

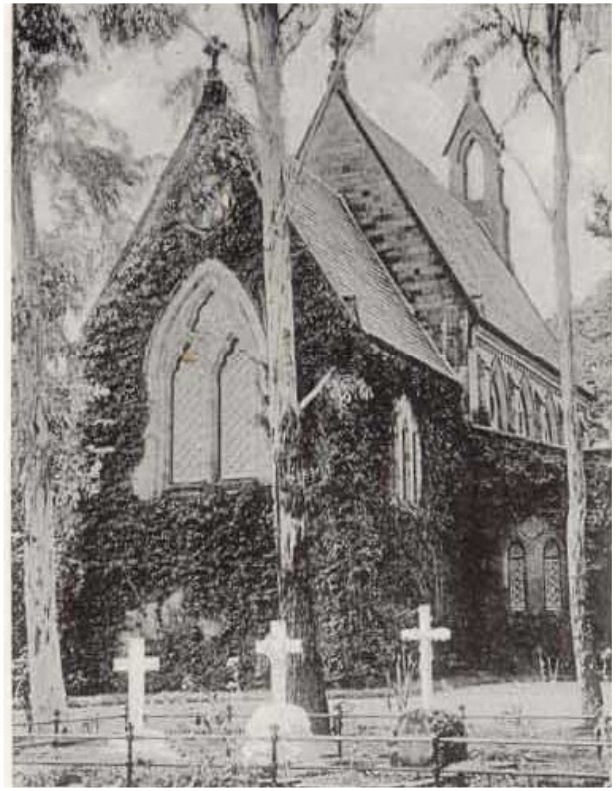
Proposed Location of Sensors



EARTHQUAKE SCENARIO

1905 Kangra Earthquake

- Magnitude M_w 7.8



Before

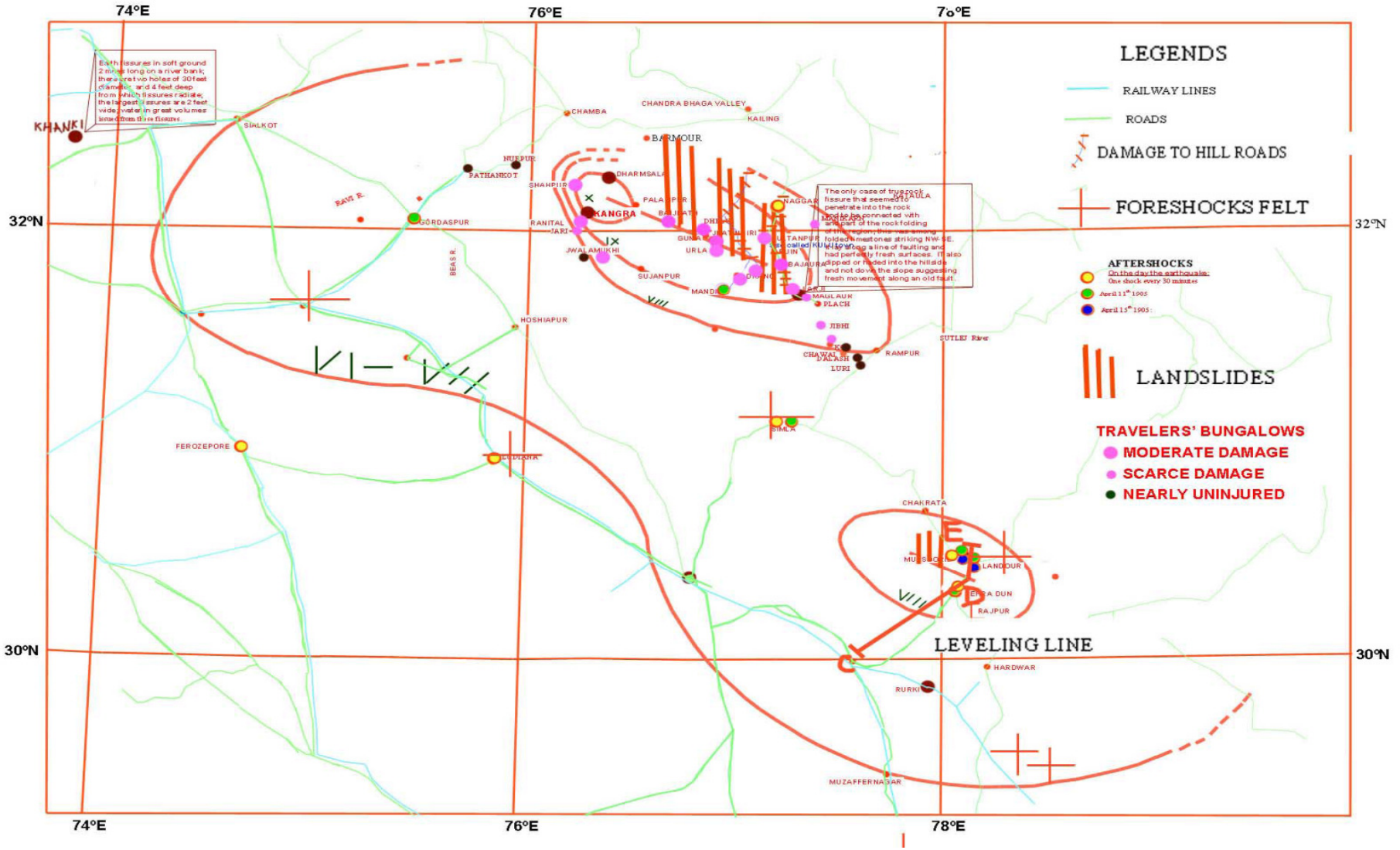
After

Palampur Church

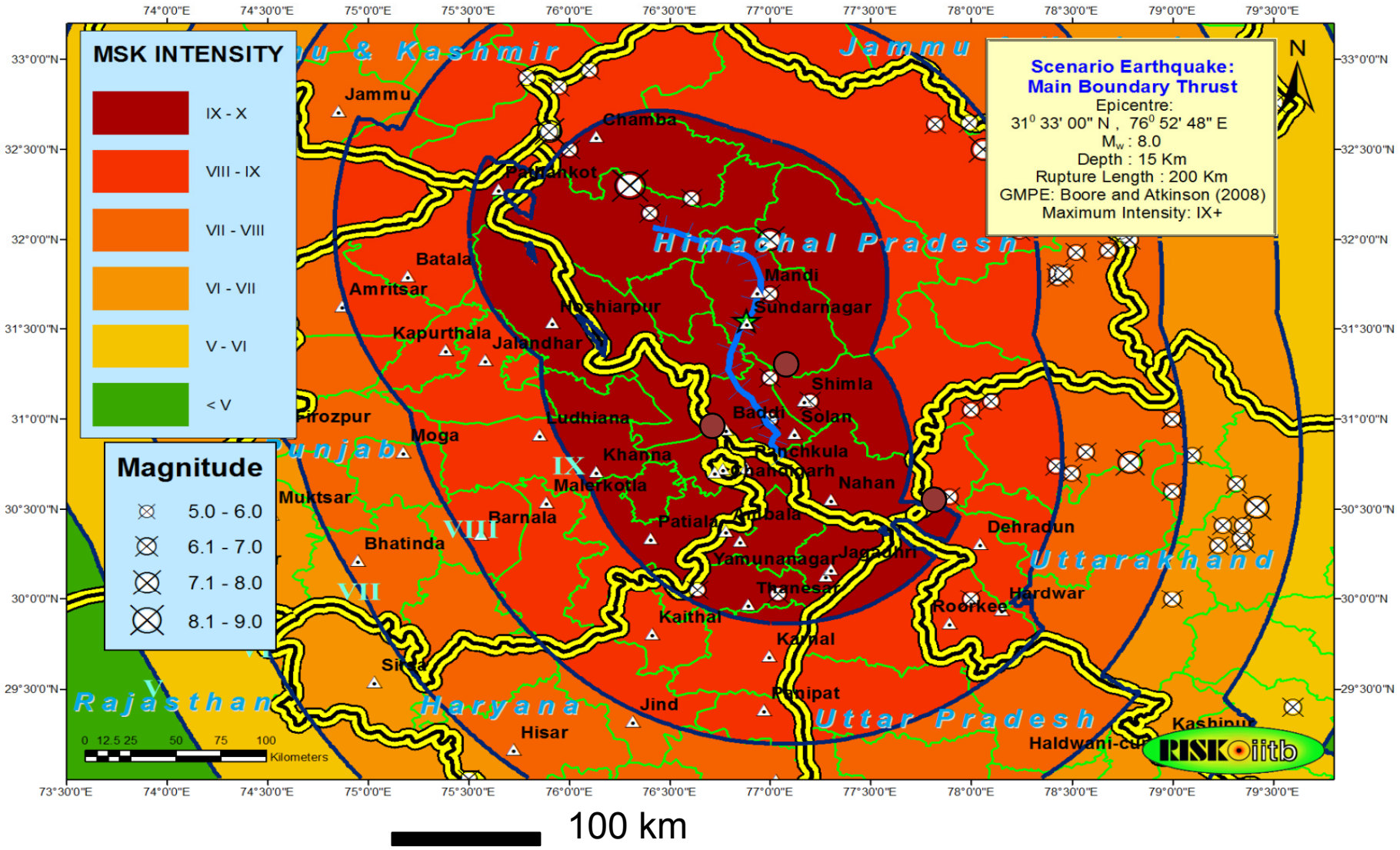
CLAIMED ~ 20,000 HUMAN LIVES

1905 Kangra Earthquake

- Isoseismals (Rossi-Forel Scale)



Intensity Distribution Scenario



100 km

Projected Scenario Earthquake

- Exposed Area under the Scenario

Intensity	Area (km^2)
X to IX	56,167
IX to VIII	87,015
VIII to VII	86,424

Mandi Earthquake Scenario

Estimated Injuries and Loss of Life (mid-night estimates)

State/UT	Injuries (% Popul-ation)	Injuries	Deaths (% Popul-ation)	Deaths	Financial Loss
Himachal Pradesh	16.18	11,09,500	2.35	1,61,000	?
Haryana	7.66	15,96,100	1.36	3,45,800	
Punjab	8.96	20,14,700	1.67	4,62,500	
UT Chandigarh	12.00	1,02,400	2.33	24,200	
Total		48,22,700		9,93,500	

Earthquake Concern & Risk

- **Concerns**
  - A large earthquake close to a city, like Shimla, can have devastating effects
    - Extent of damage influenced by local soil properties

- **Earthquake Risk**
  - Considers impact of the event
    - Potential damage and loss
  - Risk management is effective, only if it is understood before attempting to manage it

Objectives of the Project

- **Main**
  - Provide a common understanding of consequences of a large earthquake scenario in the Himalaya
  - Facilitate mainstreaming earthquake risk management in state governments
  - Undertake **awareness campaign** and **mock-drill**

Earthquake Risk

- **HP State Agencies to assess**
  - Impact on their functionality and financial resources
  - Their expected responsibilities
  - Effectiveness of coordination systems
    - Other organizations
    - Within organizations

Role of HP Government

- **1. Departments**
  - Suggested
    - Disaster Management / SDMA / DDMA
    - Revenue
    - Home
    - Police
    - Civil Defense
    - Home Guards
    - Urban Department
    - Fire Department
    - Health

Role of HP Government

- 3.
  Coordinate compilation of lifeline structures inventory
  - Assess seismic vulnerability of select buildings and lifelines

- 4.
  Facilitate tabletop exercises as per project requirements

Benefits to HP

- Realistic understanding of consequences of a large earthquake
- Upgraded/strengthened state and district DMPs
- Improved implementation of tabletop exercises

Fig. 5: NDMA team meeting CM Punjab, Administrator UT Chandigarh and CM Himachal Pradesh

Photographs

SCHOOL SENSITIZATION PROGRAMMES IN EARTHQUAKE VULNERABLE STATES

- **Children are the most valuable asset and are amongst the most vulnerable segments of society.**
- **Recent Casualties to School Children:**
  - Sichuan China Earthquake (May,2008): **20,000** children killed
  - Muzzafarabad, Pakistan Earthquake (October,2005): **16000** children killed
  - Bhuj, Gujarat Earthquake (Jan, 2001): **971** School children died

Collapse of School Building, Bhuj Earthquake, 2001

On the other hand, school children can become message carriers to their parental families and citizens of future generation of society on Earthquake Safety

SAFETY OF LIFELINE BUILDINGS FROM EARTHQUAKES

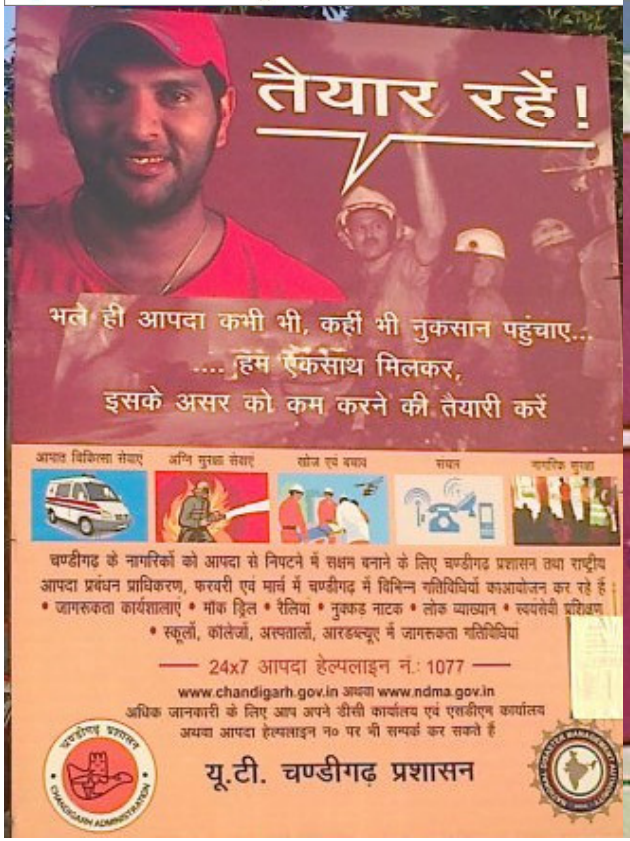
- Seismically deficient lifeline buildings (hospital, fire stations, electric substations etc.) : **Pose significant threats to life safety.**
- Rapid Visual Screening (RVS): **A simple and fast procedure in assessing/grading the safety of lifeline buildings.**
- **Doesn't require any structural calculation**
- Inspection, data collection and decision-making process occurs **at the site of the structure**
- Takes **couple of hours** for a building

The Jubilee Hospital, shattered by the earthquake of 2001, Photo: John Pritchard

Be Smart
Be Prepared
Sh. M. Shashidhar Reddy
Vice Chairman, NDMA
Sh. Tejendra Khanna
Lt. Governor, Delhi
Dr. Manmohan Singh
Prime Minister
Smt. Sheila Dikshit
Chief Minister, Delhi
Sh. Arvinder Singh
Minister of Revenue, Delhi
Presenting DEMEx - Delhi Emergency Management Exercise
• The Delhi Emergency Management Exercise (DEMEx) shall help prepare a comprehensive medical emergency response plan.
• DEMEx shall lead medical teams, rescue teams, initiate people's participation, organize mock drills and also create general awareness about disaster management among the citizens of Delhi.
Participate and help.
Be a life saver.
Virender Sehwag (Goodwill Ambassador)
Emergency Support Functions (ESFs)
Communication
Evacuation
Search and Rescue
Medical Health
Equipment Supply
Helpline, Warning
Drinking Water
Electricity
Relief (Food/Shelter)
Debris & Road Clearance
Law and Order
Transport
For more information contact your Area DC, ADM or SDM.
http://ddma.delhi.gov.in
DELHI DISASTER MANAGEMENT AUTHORITY
REVENUE DEPARTMENT
GOVERNMENT OF NCT OF DELHI
DDMA - BUILDING A CITIZEN - GOVERNMENT PARTNERSHIP OF SAFETY
www.ndma.gov.in
NATIONAL DISASTER MANAGEMENT AUTHORITY
GOVERNMENT OF INDIA
NDMA - ALWAYS ENSURING YOUR SAFETY
Bhagidari
24X7 Disaster Helpline No. : 1077

Dr. Manmohan Singh
Prime Minister and
Chairman, NDMA
Sh. Tejendra Khanna
Lt. Governor, Delhi
BE PREPARED!
EVEN THOUGH CALAMITY BRINGS TERROR & TRAUMA...
...TOGETHER WE CAN PREPARE TO RESTORE ORDER & CALM
DDMA is organising a MEGA MOCK DRILL on Disaster Preparedness on 15th February, 2012 at 11.30 am
Delhi, be there, defeat fear!
To prepare citizens of Delhi to tackle disasters, DDMA and NDMA are organising various activities in all districts of Delhi in December, January & February : • Orientation Workshops • Mock Drills • Rallies • Nukkad Nataks • Public Lectures • Volunteers Training • Awareness Activities in Schools, Colleges, Hospitals, RWAs, Slums, Villages
Emergency Medical Services
Fire Safety Services
Search & Rescue
Communication
Civil Defence

तैयार रहें !
की तैयारी करें
संचार
नागरिक सुरक्षा
http://ddma.delhi.gov.in
दिल्ली आपदा प्रबंधन प्राधिकरण
गृहकार विभाग
राष्ट्रीय राजधानी क्षेत्र, दिल्ली सरकार
www.ndma.gov.in
राष्ट्रीय आपदा प्रबंधन प्राधिकरण
भारत सरकार
एनडीएमए – भारत सिर में तत्पर
भागीदारी
24x7 आपदा हेल्पलाइन नं.: 1077
दिल्ली आपदा प्रबंधन प्राधिकरण- सुरक्षा के लिए नागरिक-सरकार साझेदारी की दिशा में तत्पर


तैयार रहें !
भले ही आपदा कभी भी, कहीं भी नुकसान पहुंचाए..
.... हम एकसाथ मिलकर,
इसके असर को कम करने की तैयारी करें
आपात चिकित्सा सेवाए
अग्नि सुरक्षा सेवाए
खोज एवं बचाव
संचार
नागरिक सुरक्षा
चण्डीगढ़ के नागरिकों को आपदा से निपटने में सक्षम बनाने के लिए चण्डीगढ़ प्रशासन तथा राष्ट्रीय आपदा प्रबंधन प्राधिकरण, फरवरी एवं मार्च में चण्डीगढ़ में विभिन्न गतिविधियों का आयोजन कर रहे हैं।
• जागरूकता कार्यशालाएं • मॉक ड्रिल • रैलियां • नुक्कड़ नाटक • लोक व्याख्यान • स्वयंसेवी प्रशिक्षण
• स्कूलों, कॉलेजों, अस्पतालों, आरडब्ल्यूए में जागरूकता गतिविधियां
24x7 आपदा हेल्पलाइन नं.: 1077
www.chandigarh.gov.in अथवा www.ndma.gov.in
अधिक जानकारी के लिए आप अपने डीसी कार्यालय एवं एसडीएम कार्यालय अथवा आपदा हेल्पलाइन नं० पर भी सम्पर्क कर सकते हैं
यू.टी. चण्डीगढ़ प्रशासन

भूकम्प आने की स्थिति में
क्या करें
मजबूत कुर्सी या मेज के नीचे छुप जाएं। उसे अच्छी से पकड़े रखें तथा भूकम्प रुकने तक वहीं पर रुकें
भूस्खलन और गिरती चट्टानों से दूर हो जाएं
केवल सीढ़ियों का ही प्रयोग करें
बाहर जाने के लिए दौड़ें नहीं शांति व सुरक्षा से बाहर आएं
क्या न करें
बिजली के तारों, खम्भों, फटता शीशियों, पत्थरों जैसी वस्तुएं जो गिर सकती हैं, के नजदीक खड़े न हों या पास न जाएं
हड़बड़ाएं या धक्कामुक्की नहीं
कांच की खिड़कियों वाली इमारतों के नजदीक खड़े न हों या पास न जाएं
कमजोर इमारतों के नजदीक न रहें
राजस्व एवं आपदा प्रबंधन विभाग

Shimla

Mohali

Mohali

HOTWASH 13th Feb ’13

- After the Exercise
- At Unified Command and all EOCs
- Unified Command: Hon’ble Members (JKS) and M(HKG)
- State EOCs: Revenue Secretary
- District EOCs: DC

De-brief on 14th Feb. ’13

- Overview
- Brief report by District Authorities
- Observations by NDRF
- Initial feedback by Army Observers

'भूकंप' से थर्राई राजधानी, बचाव मुहिम में खामियां

पंचकूला- मोहाली में भी 'झटके'; तीन माह की तैयारियों के बावजूद संभाल नहीं पाए आयोजक

चंडीगढ़, 13 फरवरी (जनसत्ता)। मौकों पर एंबुलेंस आदि आपात्कालीन सेवाओं में देरी और संचार व्यवस्थाओं में बाधाओं का नतीजा यह रहा कि भूकंप से बचाव की तैयारियों के तहत आज पूरे जोर-शोर से कराया गया अभ्यास विलंब से शुरू हुआ। ये अभ्यास चंडीगढ़ के अलावा पंचकूला और मोहाली समेत पूरे ट्राईसिटी के अलावा हिप्र की राजधानी शिमला में भी कराया गया। हालांकि, इसकी तैयारियां बीते तीन महीनों से चल रही थीं पर इसके बावजूद अभ्यास में कुछ खामियां उजागर हुईं।

यह अभ्यास यहां कुल 15 जगह पर कराया गया। अभ्यास स्थलों का चयन राष्ट्रीय आपदा प्रबंधन प्राधिकरण (एनडीएमए) ने स्थानीय प्रशासन के सहयोग से किया था। रिहायशी और कारोबारी इलाकों के अलावा अस्पतालों, बस अड्डों, रेलवे स्टेशन और हवाई अड्डे तक को इसका हिस्सा बनाया गया। समूचे अभ्यास कार्य का तानाबाना रिक्टर पैमाने पर 8 दर्जे वाले 'भूकंप' के इर्दगिर्द बुना गया था, जिसका केंद्र हिमाचल प्रदेश के मंडी जिले में सुंदरनगर में माना गया।

दरअसल, पंजाब-हरियाणा के अलावा हिप्र और यूटी चंडीगढ़ भूकंप संभावित चतुर्थ एवं पंचम क्षेत्र में आते हैं जहां इस कुदरती आपदा के आने का डर सबसे ज्यादा है।

अभ्यास सुबह 10.30 बजे भोंपू बजने के साथ शुरू हुआ। दिक्कत तब हुई जब रेलवे स्टेशन और पेक परिसर समेत कुछ अभ्यास स्थलों पर भोंपू के कारण परेशानी आई। आपात्कालीन वाहनों के मौकों पर पहुंचने के साथ ही दमकल और पुलिस की गाड़ियों का पहुंचना भी शुरू हो गया था। कुछ स्थलों पर एंबुलेंस पहुंचने में भी विलंब हुआ।

संबंधित बचाव दलों के करीब 30 दस्ते बनाए गए थे जिनमें से सात-सात पंचकूला और मोहाली में तैनात किए गए थे, जबकि चंडीगढ़ और शिमला में आठ-आठ दस्तों को तैनात किया गया था। करीब 900 नागरिक सुरक्षा कर्मियों और सेना से 270 पर्यवेक्षकों ने भी अभ्यास में हिस्सा लिया। ये सब पुलिस, स्वास्थ्य, दमकल, बिजली और लोक निर्माण विभाग- लोनिवि आदि के कर्मचारियों के अलावा थे। इसके लिए आपात्काल संचालन केंद्र और जिला केंद्र भी स्थापित किए गए थे।

सेक्टर-17 स्थित नीलम सिनेमा के नजदीक वाहन खड़ा करने के स्थल पर एक भी वाहन खड़ा करने नहीं दिया गया। स्थल में प्रवेश ही बंद था। सेक्टर-10 स्थित होटल माउंटव्यू के सामने वाली सड़क पर भी आवाजाही रोक दी गई। डीटी मॉल पर भी हालत कुछ ऐसी ही थी। यूटी के उपायुक्त मोहम्मद शाईन ने बताया कि हादसों से बचाव या बाशिंदों को परेशानी से बचाने के लिए सुरक्षात्मक उपाय सुनिश्चित किए गए थे।

उधर, मोहाली में कुछ वाकये ऐसे भी हुए जहां दमकल कर्मी बचाए गए लोगों को ऊंची इमारतों से नीचे नहीं उतार पाए। एक संबंधित अधिकारी ने बताया कि प्रदेश में आपदाओं से बचाव के लिए बेहतर संचार व्यवस्था जरूरी है। जनसहभागिता को भी बेहतर बनाया जा सकता है और बेहतर सेवा केंद्र सुनिश्चित कराना भी आवश्यक है।

मौके पर मौजूद बचाव दल के एक अन्य आला अधिकारी ने कहा कि बेहतर संचार व्यवस्था आवश्यक है। अधिकारी जेके सिन्हा ने बताया, 'संचार में रुकावट एक गंभीर मसला है। इसके लिए प्रदेश में बेहतर व्यवस्था जरूरी है। इस अभ्यास कार्य का मकसद विभिन्न सेवाओं की क्षमता जांचने और लगने वाले समय को जांचना रहा। कोई भी आपदा घटित हो जाने के बाद एक घंटे का समय सबसे अहम होता है। अब सभी पर्यवेक्षकों की राय ली जाएगी और आला अधिकारियों से विचार-विमर्श भी होगा।'

राष्ट्रीय आपदा बचाव बल के महानिदेशक पीएम नायर ने कहा कि स्थानीय स्तर पर इस अभ्यास को दोहराए जाने और युवावर्ग को प्रशिक्षित किए जाने की सख्त जरूरत है। राष्ट्रीय आपदा प्रबंधन प्राधिकरण के आला अधिकारियों ने भी कहा कि इस अभ्यास में तो बाहरी संस्थाओं का भी सहयोग रहा पर यूटी और प्रदेश सरकारों को चाहिए कि वे अपने संसाधनों में भी बेहतरी लाएं।

ये रहीं मेगा मॉक ड्रिल की खामियां

चंडीगढ़ प्रशासन को इंफ्रास्ट्रक्चर अपग्रेड करने का सुझाव

रेलवे स्टेशन | एंबुलेंस पहुंची ही नहीं। मॉक ड्रिल में घायलों को फायर टेंडर में अस्पताल ले जाया गया। फोटो अजय जलंधरी

भास्कर न्यूज़ | चंडीगढ़

कोई भूकंप नहीं आया था। लेकिन भूकंप की न तो भविष्यवाणी की जा सकती है, न ही इसे रोका जा सकता है। ट्राईसिटी सीस्मिक जोन 4 में आता है, जो भूकंप के लिहाज से बेहद संवेदनशील भी है।

ऐसे में वास्तव में भूकंप आए तो जान-माल का कम से कम नुकसान हो इसी लिहाज से नेशनल डिजास्टर मैनेजमेंट अथॉरिटी (एनडीएमए) की देखरेख में यह मेगा मॉक ड्रिल की गई। इसकी तैयारी पिछले तीन महीने से चल रही थी, फिर भी कई खामियां सामने आई हैं।

बुधवार सुबह 10.30 बजे ट्राईसिटी में एक साथ शुरू हुई इस मॉक ड्रिल के दौरान कहीं वक्त पर एंबुलेंस नहीं पहुंची, तो कहीं पीसीआर जिप्सी को धक्के लगाकर स्टार्ट करना पड़ा। नेशनल डिजास्टर मैनेजमेंट अथॉरिटी ने प्रशासन को अपना इंफ्रास्ट्रक्चर अपग्रेड करने का सुझाव दिया है। कम्युनिकेशन सिस्टम की खामियों को प्रशासन के सामने खास तौर पर रखा गया है।

इन खामियों को दूर करना होगा

क्विक एक्शन में देरी
40 मिनट देर से फायर ब्रिगेड की गाड़ी पहुंची यूटी सेक्रेटेरिएट

फर्स्ट एड पहुंचाने में देरी
23 मिनट देर से एम्बुलेंस पहुंची यूटी सेक्रेटेरिएट

एजेंसियों में तालमेल की कमी
सेक्टर-17 की पार्किंग बंद कर दी गई थी। एनडीएमए से जुड़े सीआरपीएफ के पूर्व डीजी एवं मॉक ड्रिल एक्सपर्ट जेके सिन्हा ने डीसी को बताया कि ऐसा नहीं करना चाहिए था।

कम्युनिकेशन सिस्टम में खामी
भूकंप जैसी स्थिति में टावर गिरने पर मोबाइल और लैंडलाइन बंद हो सकते हैं। मौजूदा वायरलेस सिस्टम उस वक्त का कम्युनिकेशन सिस्टम नहीं झेल पाएगा।

पर्याप्त इंफ्रास्ट्रक्चर नहीं
एनडीआरएफ को बठिंडा, गाजियाबाद और गांधीनगर से लाने पड़े जरूरी इक्विपमेंट्स।

इमरजेंसी ऑपरेशन सेंटर चाहिए
- ट्रॉमा से निपटने के लिए ट्राईसिटी में फिलहाल ऐसा एक भी सेंटर नहीं है।
- छोटे फायर टेंडर्स की जरूरत।

आईआईटी मुंबई और चेन्नई के अर्थक्वेक इंजीनियरिंग एक्सपर्ट्स ने इस सारे सीन की परिकल्पना की थी कि सुंदरनगर में 8 तीव्रता का भूकंप आए तो क्या-क्या नुकसान होगा।

(जख्मी होने की एक्टिंग करनी है, हंसना मत... पैकेज पेज 2 पर)

भूकंप का केंद्र
हिमाचल प्रदेश के मंडी जिले का सुंदरनगर

भूकंप की तीव्रता
रिक्टर स्केल पर 8 तीव्रता का भूकंप

	मृतक	घायल
चंडीगढ़	24,200	1,02,400
मोहाली	21,000	88,600
पंचकूला	11,400	51,900

ट्राईसिटी में 45 स्थानों पर मॉक ड्रिल
चंडीगढ़ में ही 15 स्थानों पर मॉक ड्रिल की गई। इनमें हॉस्पिटल से लेकर रेलवे स्टेशन, एयरपोर्ट, बस स्टैंड, कॉलेज, शॉपिंग मॉल तथा इंडस्ट्री तक में भूकंप से निपटने की तैयारियों को परखा गया।

30 टीमें नेशनल डिजास्टर रिस्पॉन्स फोर्स (एनडीआरएफ) की मॉक ड्रिल में शामिल थीं

900 जवान थे इन टीमों में

900 कर्मचारी सिविल डिफेंस के

270 आब्जर्वर सेना के मौजूद रहे

मकसद

लोगों को जागरूक करना था उद्देश्य
एनडीएमए से जुड़े सीआरपीएफ के पूर्व डीजी एवं मॉक ड्रिल एक्सपर्ट जेके सिन्हा ने बताया कि हमारा उद्देश्य लोगों को जागरूक करना था। इसमें हम काफी हद तक सफल भी रहे हैं। इस मॉक ड्रिल से हमें यह भी पता चला है कि कहां-कहां गैप हैं। वीरवार तक मॉक ड्रिल की पूरी रिपोर्ट तैयार हो जाएगी। जो भी खामियां होंगी उन्हें पूरा करने का प्रयास किया जाएगा।

पहली बार मल्टी स्टेट एक्सरसाइज
जाने-माने सीस्मोलॉजिस्ट पद्मश्री प्रोफेसर हर्ष के. गुप्ता के अनुसार देश में पहली बार भूकंप को लेकर ऐसी मल्टी स्टेट एक्सरसाइज की गई है। यह पहले चरण की एक्सरसाइज है, जिसका उद्देश्य राज्यों को अपने स्टेट डिजास्टर रिस्पॉन्स फोर्स सिस्टम को मजबूत बनाने के लिए प्रेरित करना था। यह एक शुरुआत थी। 6 या 8 माह बाद एक बार फिर एक्सरसाइज की जाएगी।

"There were four injured persons whom we referred to GMSH-16 and discharged them in a mock drill."
DR HARPANT SINGH, *Surgeon, GMSH, Sector 16*

Mega Mock Drill exposes chinks in disaster management plan

DP **CORRESPONDENT**
Chandigarh

The Mega Mock Drill on earthquake preparedness, conducted in tri-cities of Chandigarh, Mohali and Panchkula on Wednesday, have brought out many loopholes in the preparation of the various departments of the Administration. The exercise was held at 15 different places of the city.

In sector 17 the ambulances reached late to its schedule time and on another incident people got confused while coming out from the buildings in the absence of the exit or entry signs. There was no public address system to inform the public at sector 17. The move to vacate the parking was also wrong as the exercise should have done in the natural environment.

The lack of the women force in the civil defence

Mega Mock Drill at Sector-17 plaza in Chandigarh on Wednesday. UPENDRA SEN GUPTA

of the coordination was also noticed in the UT secretariat as the team of the NDRF was unable to locate the incident commander. The lack of the public awareness was also felt as instead of participating in the exercise many went for the market for the shopping.

The lack of establishment Disaster Management Plans

oberved. The exercise was conducted with collaboration and guidance of National Disaster Management Authority (NDMA).

The officers of the NDMA said that the key lessons learnt are : Need for state-of-the art emergency operation centres at the state and district levels with redundancy; Setting-up and use

system for the stakeholders to more effectively deal with an earthquake disaster scenario; Recognise capacity of having better road accessibility in case of disaster; Identification of requirements of state-of-the-art equipment and systematic inventory of resources, both with government and private sector; Need for adequate number of ambulances and greater public awareness and sensitisation of people for enhanced preparedness.

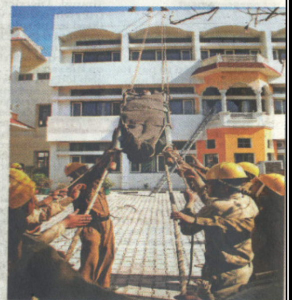
The need to make younger generation aware of the earthquake hazards and coping mechanism is also felt. About 900 personnel from NDRF organised in 30 teams, 900 civil defence personnel and 270 independent observers from Army participated in the exercise. The emergency support functionaries like police, health, fire, ambulance, civil defence, power and PWD etc

Exercise held across Panchkula

DP **CORRESPONDENT**
Panchkula

District Administration in active collaboration with NDRF conducted a mega Mock Drill at 15 various sites in Panchkula on Wednesday. Around 1500 officers and personnel of various departments participated in the drill which was monitored and supervised by Harsh Gupta, member NDMA, P Raghvendra Rao, IAS, Principal Secretary Urban Local Bodies, Haryana, Ashima Brar, Deputy Commissioner, and some of the Army and Air Force observers.

The teams demonstrated host of activities like creating suspension bridges with ropes and harnesses and taking out uninjured victims by helping them slither. They also showed how a less injured could be brought down from the affected building by loading stretchers on these bridges. For those who remained trapped in little space under the debris, the Jawans showed how the victim's hands and feet could simply be fastened around the body to bring down the victim. On the occasion, Deputy Commissioner informed that district administration had made extensive arrangements for the successful demonstration and completion of such mock drills. She told that basic scenario of such mock drill was earthquake and



Team of civil defence bringing the injured who was trapped on a building on mock drill conducted by district administration in Panchkula. DP PHOTO

20 fire fighting systems, 19 Ambulance, 15 JCB machine and various water tankers along with staff was utilised for the successful completion

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regional

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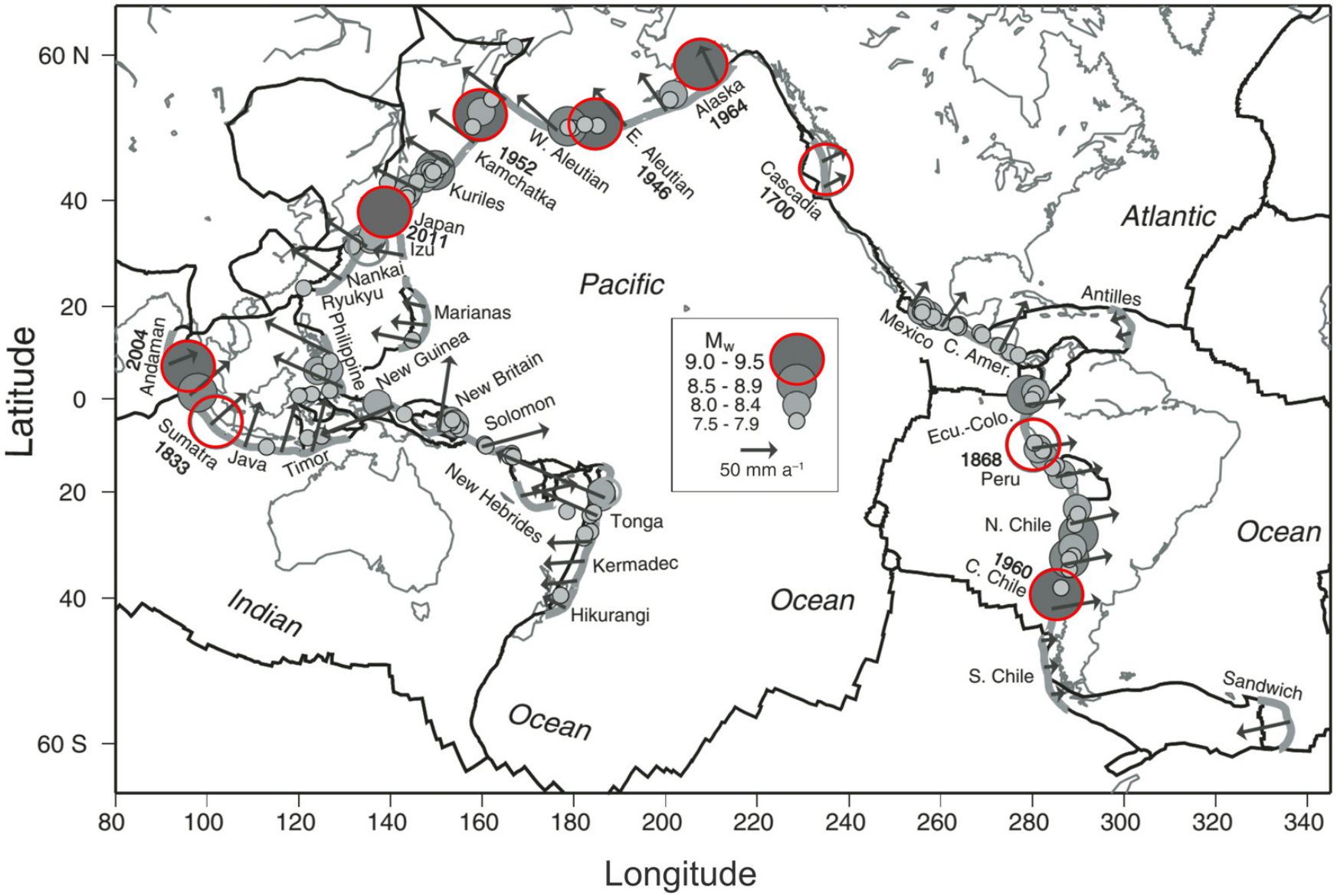
Team of civil defence bringing the injured who was trapped on a building on mock drill conducted by district administration in Panchkula. DP PHOTO

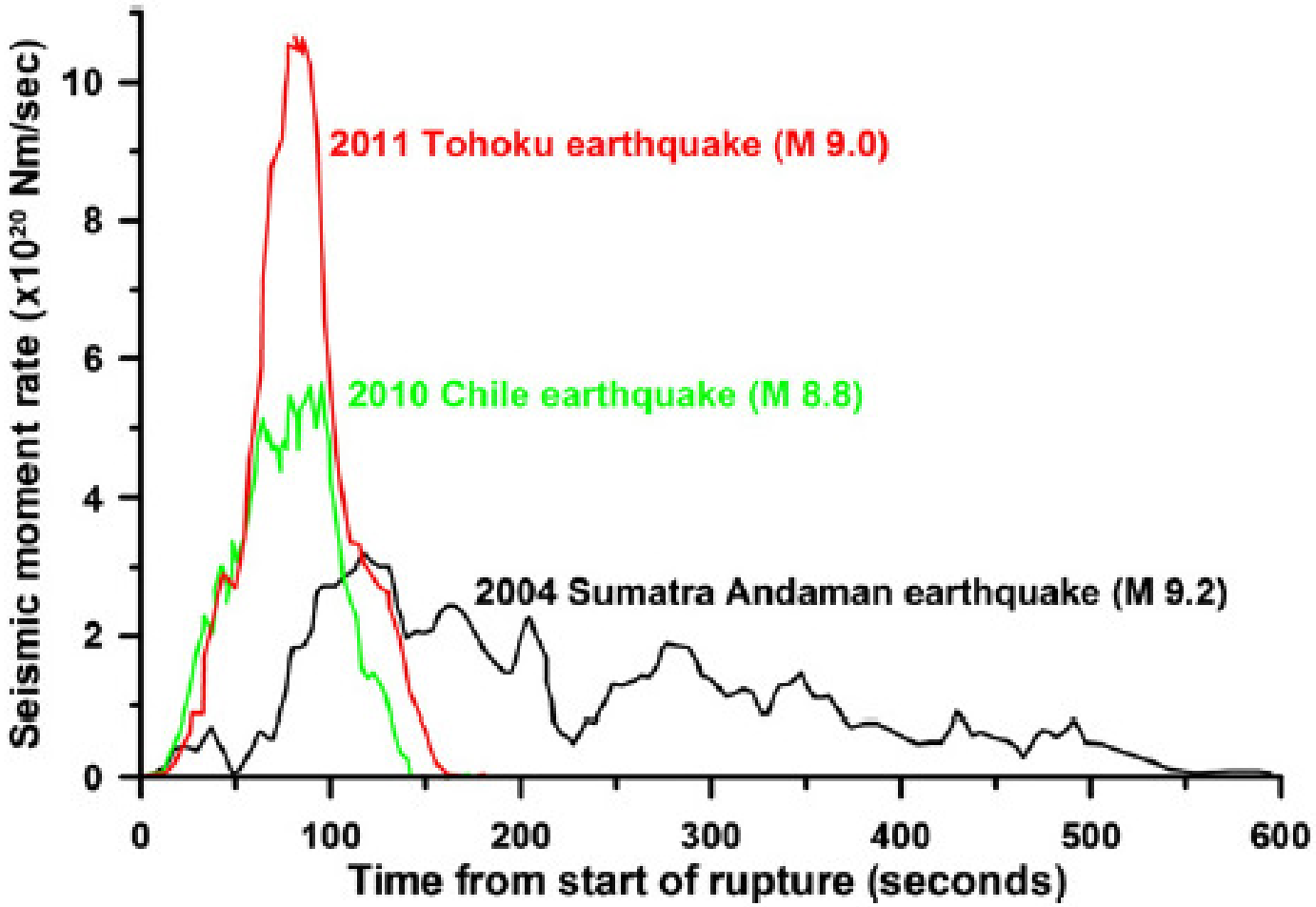
Positive Outcomes

- Sensitization of State Administration
- Hands-on experience
- Awareness generation
- Gaps identification

Mw 9 EARTHQUAKE IN HIMALAYA?

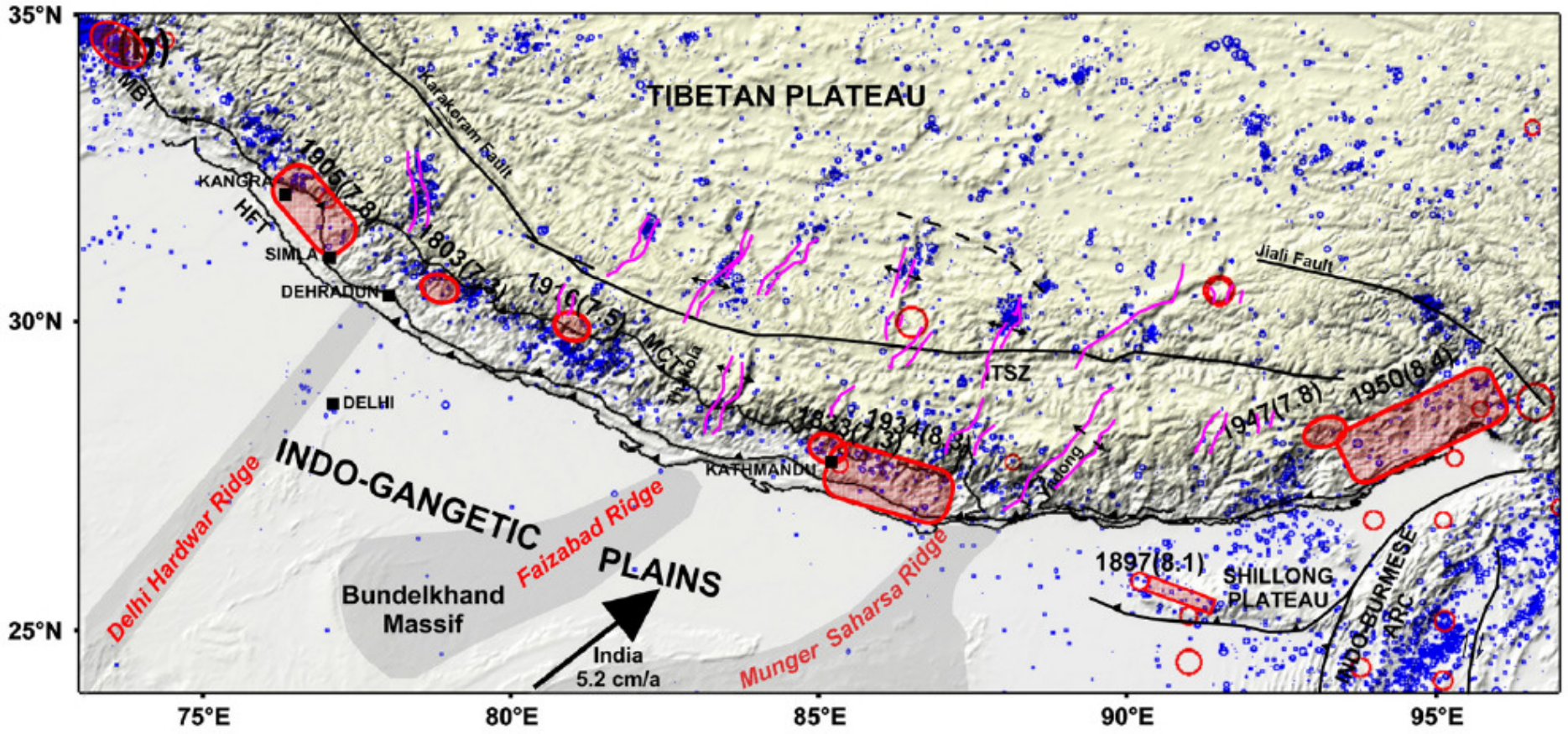
Global distribution of M ≥ 9 earthquakes (updated from McCaffrey 2008) since AD 1700. Open circles are the largest known earthquakes from AD 1700 to 1900.





Comparison of the seismic moment rate release of 2004 Sumatra Andaman earthquakewith the 2010 Chile and 2010 Tohoku earthquakes (Lay and Kanamori, 2011). Note the quick and high seismicmoment release during the 2011 Tohoku earthquake in which a high slip (~50 m) occurred on a rupture of ~500 km long.

Major tectonic features and seismicity of the Himalayan arc. Earthquakes are from the ISC catalogue. The ruptures of earthquakes of M>7.2 of past 200 years in the Himalayan arc are shown by red rounded rectangles and ellipses. Earthquakes of M>7.2 are also shown by red circles.



THANK YOU

DESCRIPTOR	MAGNITUDE	ANNUAL FREQUENCY
Great	8 and higher	1
Major	7 to 7.9	18
Strong	6 to 6.9	120
Moderate	5 to 5.9	800
Light	4 to 4.9	6,200
Minor	3 to 3.9	49,000

21st Century most devastating Earthquakes

Date	Earthquake	Magnitude	Human lives lost	Financial loss ~
Dec. 26, 2004	Northern Sumatra	9.1	About 3,00,000	$ 2.311 bn - $ 4.062 bn
Oct. 08, 2005	Muzaffarabad	7.6	About 80,000	About US $ 5.2 Billion
May 12, 2008	China	7.9	About 70, 000	About US $ 20 Billion
Jan. 12, 2010	Haiti	7.0	About 3,16,000	About 3.2778 bn (USD)
Feb. 27, 2010	Chile	8.8	About 530	$ 7.57 bn - $ 12.00 bn
March 11, 2012	Japan	9.0	About 15,800	$ 29.4 bn - $ 45 bn

A future M 7.5 earthquake in the vicinity of Tokyo could cost US$ 1.2 trillion