

Natural Disasters and Management Issues in Nepal

— Emphasizing Transdisciplinary Approach —

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Presentation Content

- Background to Nepal's natural disaster situation
- National strategy for disaster management
- The 2015 Nepal Gorkha Earthquake
- Disaster response and lessons learned
- Current issues and problems
- Concluding remarks

Background Information

- Despite being one of the heavily disaster prone country, Nepal does NOT have an integrated national disaster mitigation plan.
- Even after the 2015 Earthquake Disaster, there have been no adequate and intensive discussions on government-centered national disaster mitigation plan.
- The new national disaster management act, which was drafted nearly a decade ago is still pending and has had no single occasion to be discussed at the parliament yet.
- General disaster risk reduction activities in the nation have significantly increased, but no concrete discussions on national disaster mitigation plan and on changing governance system have been made yet.
- The nation is adopting the federal system, but the position of disaster mitigation plan is still unclear and nothing has been discussed yet about what kind of disaster mitigation technology and disaster education system will be adopted in the new administrative system.
- Science and engineering issues are more or less clear, but their infusion in policy making is still largely lacking.
- All this leads to considering the national disaster mitigation plan through some new mechanism in government as well as society.

What We Need to Understand First

- The science of natural disasters (Mechanism)
- Scale and frequency of disasters
- Hazard and risk
- Vulnerability of the people/society
- Etc.



- Our needs and capacity
- Our social structure and our livelihood
- Level of poverty and peoples' disaster awareness level
- Level of peoples' understanding of science and technology
- Etc.

Risk and Safety

- **Safety:** Freedom from unacceptable **RISK**
- **Risk:** Combination of probability of occurrence of harm and severity of that harm

(ISO/IEC Guide 51: 1999)

Risk = Probability x Severity of consequence

Very low

Severe

Disaster

Extremely low

Extremely

Severe Catastrophe

Attitude to **Disaster**: Risk management

Attitude to **Catastrophe**: Risk management vs. Precautionary principle

Natural Hazards / Disasters in Nepal

- ❖ Landslides
- ❖ Flood
- ❖ Earthquake
- ❖ **GLOF** (Glacial Lake Outburst Flood)

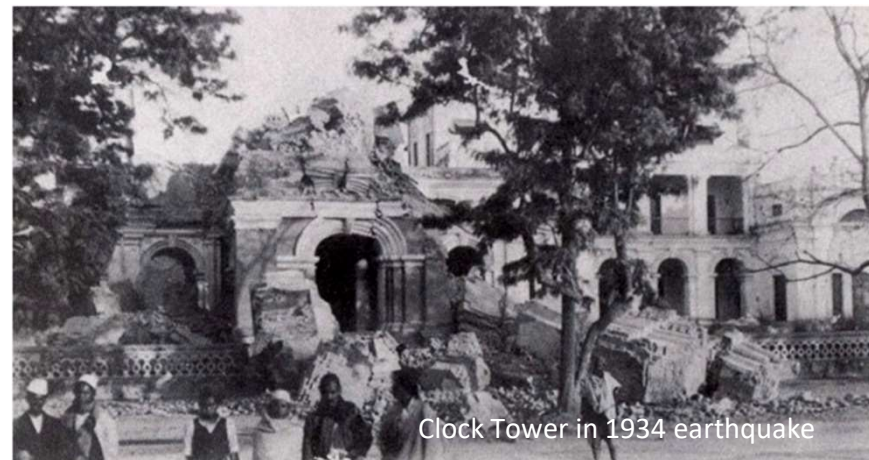


Krishnabhir Landslide (2003.11)

Flood-damaged bridge



Tso Rolpa Glacial Lake (Mool, 2000)



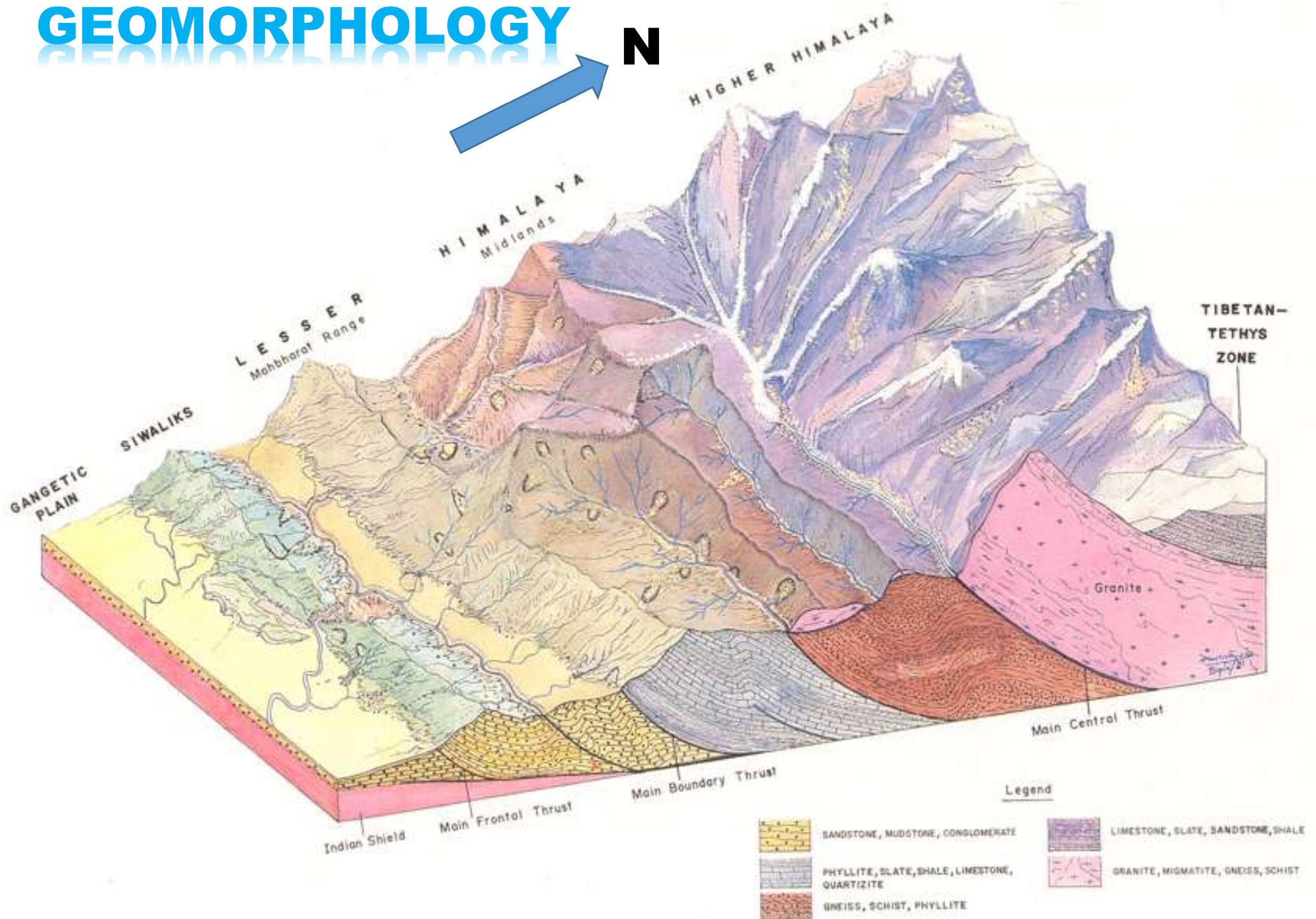
Clock Tower in 1934 earthquake

The Himalaya: Regional Setting



GEOMORPHOLOGY

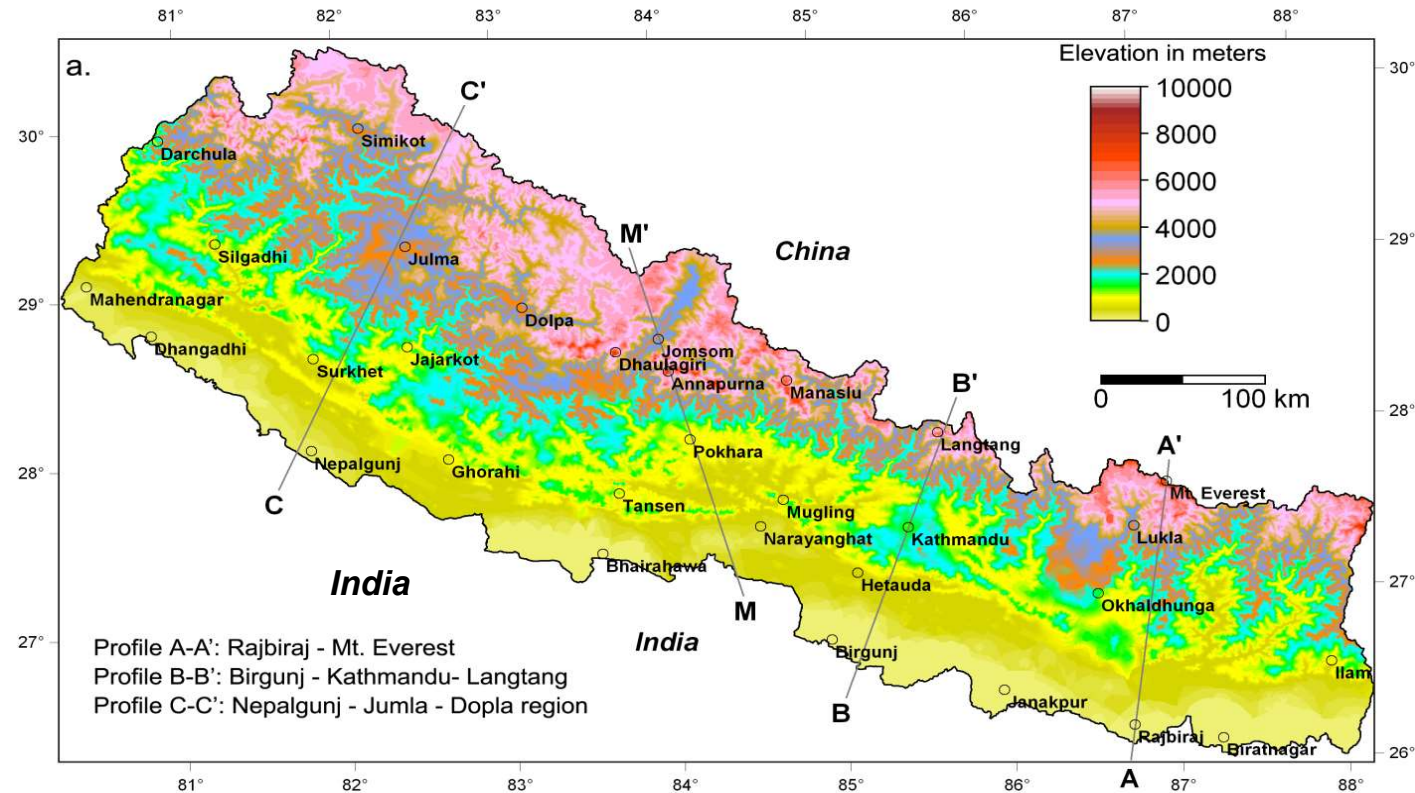
N



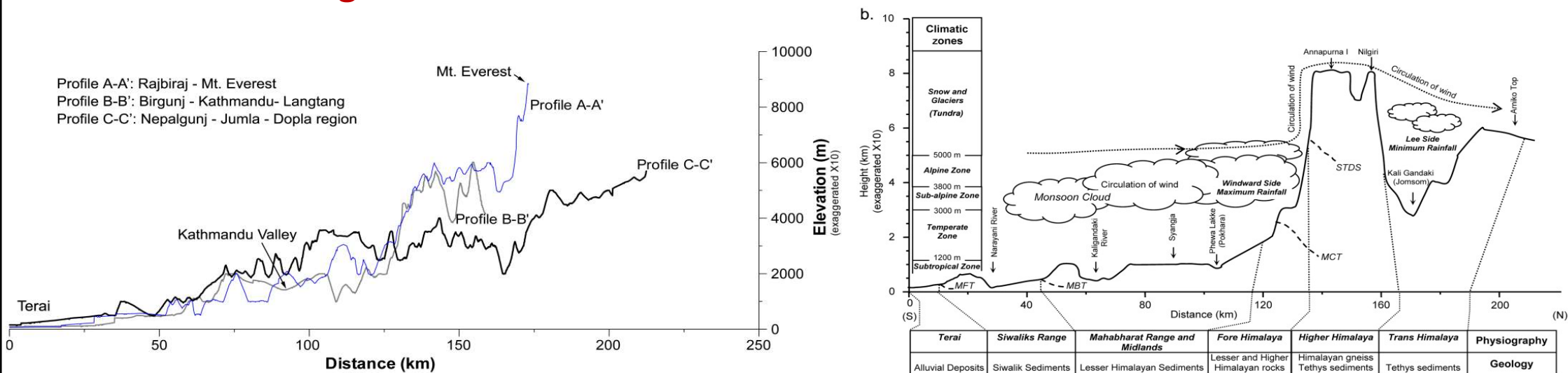
Topographic Variation

Huge difference of elevation in short distance

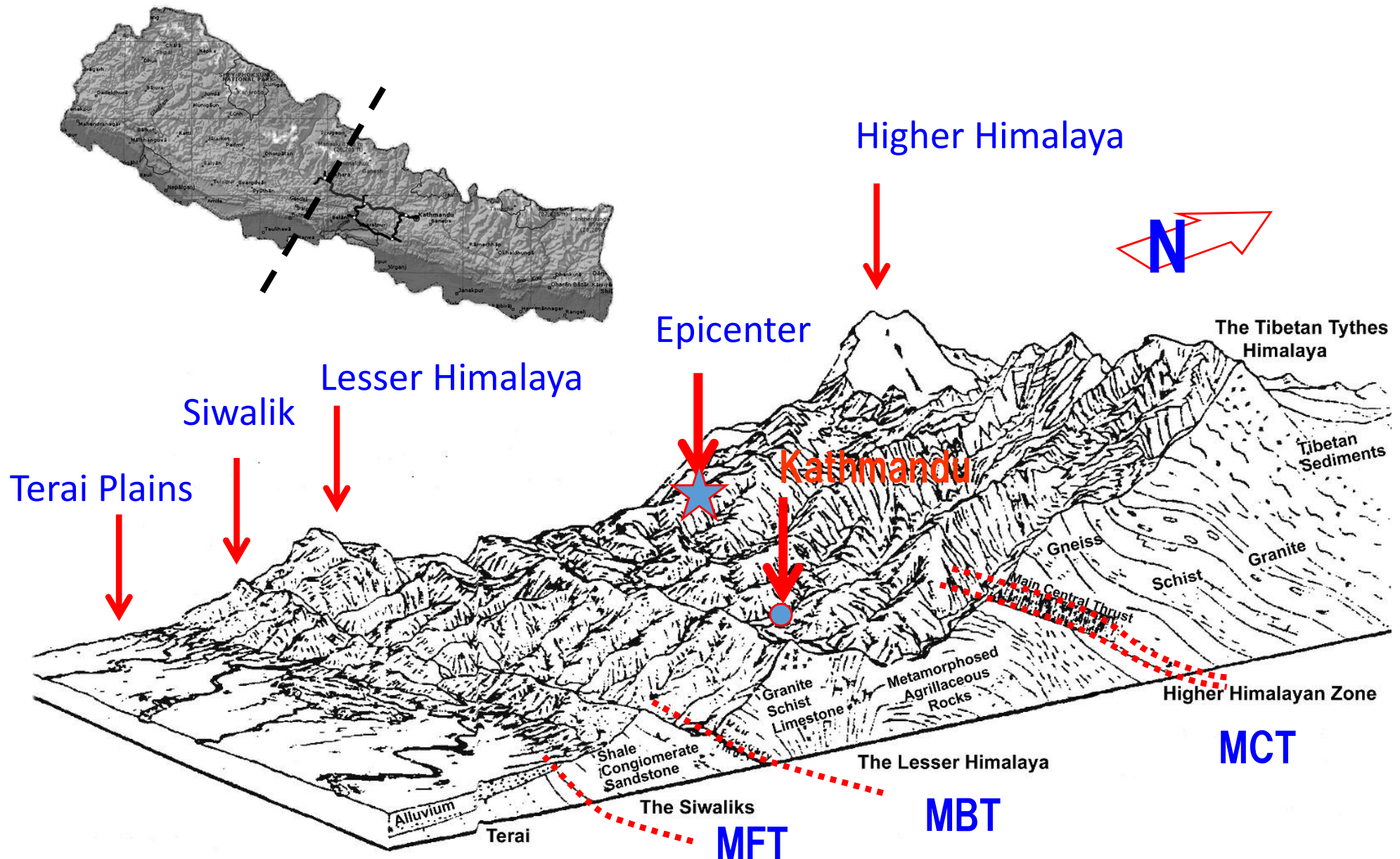
South is less elevated
North is highly elevated



Extreme relief - high risk for water-induced disasters

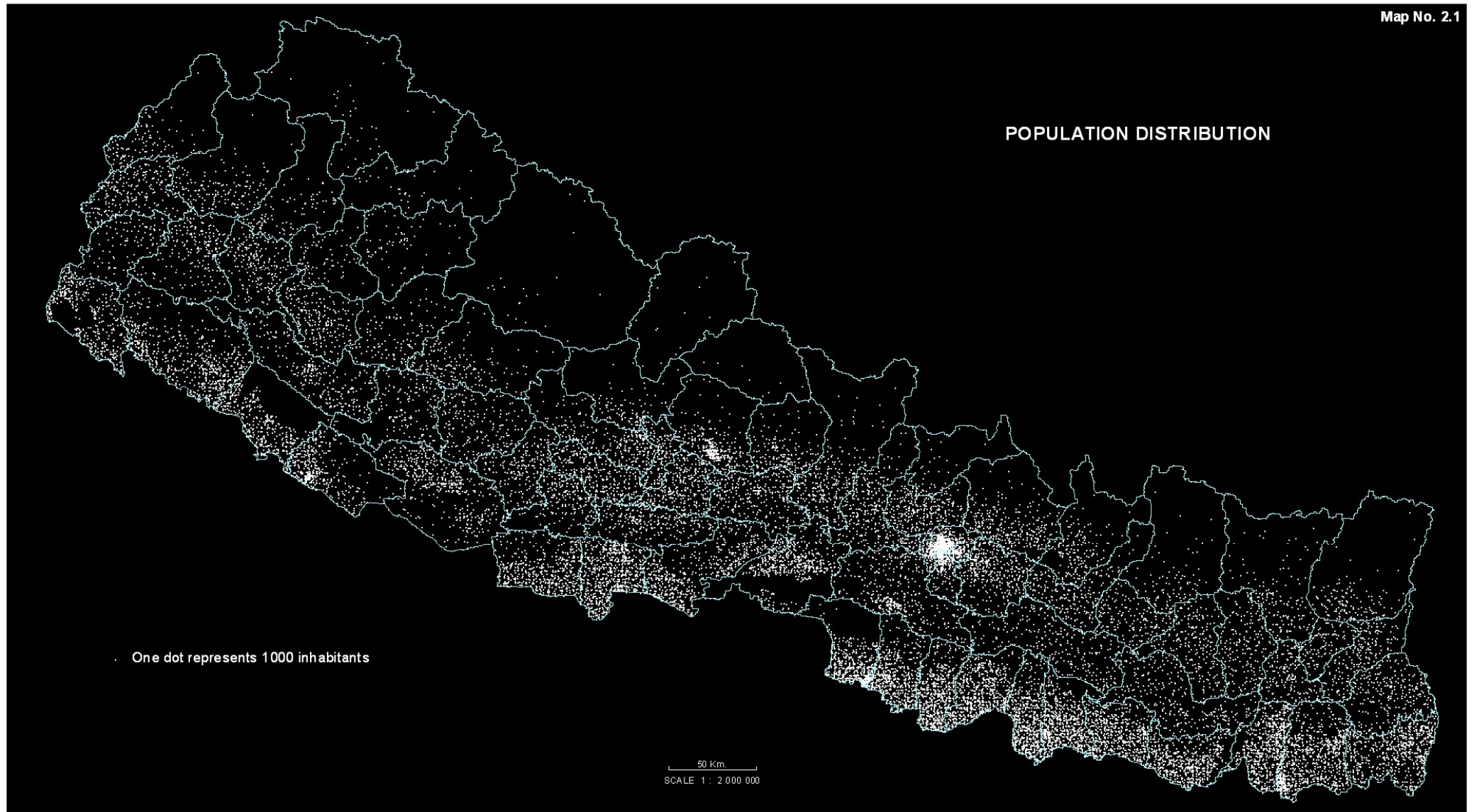


Geology and Geomorphology

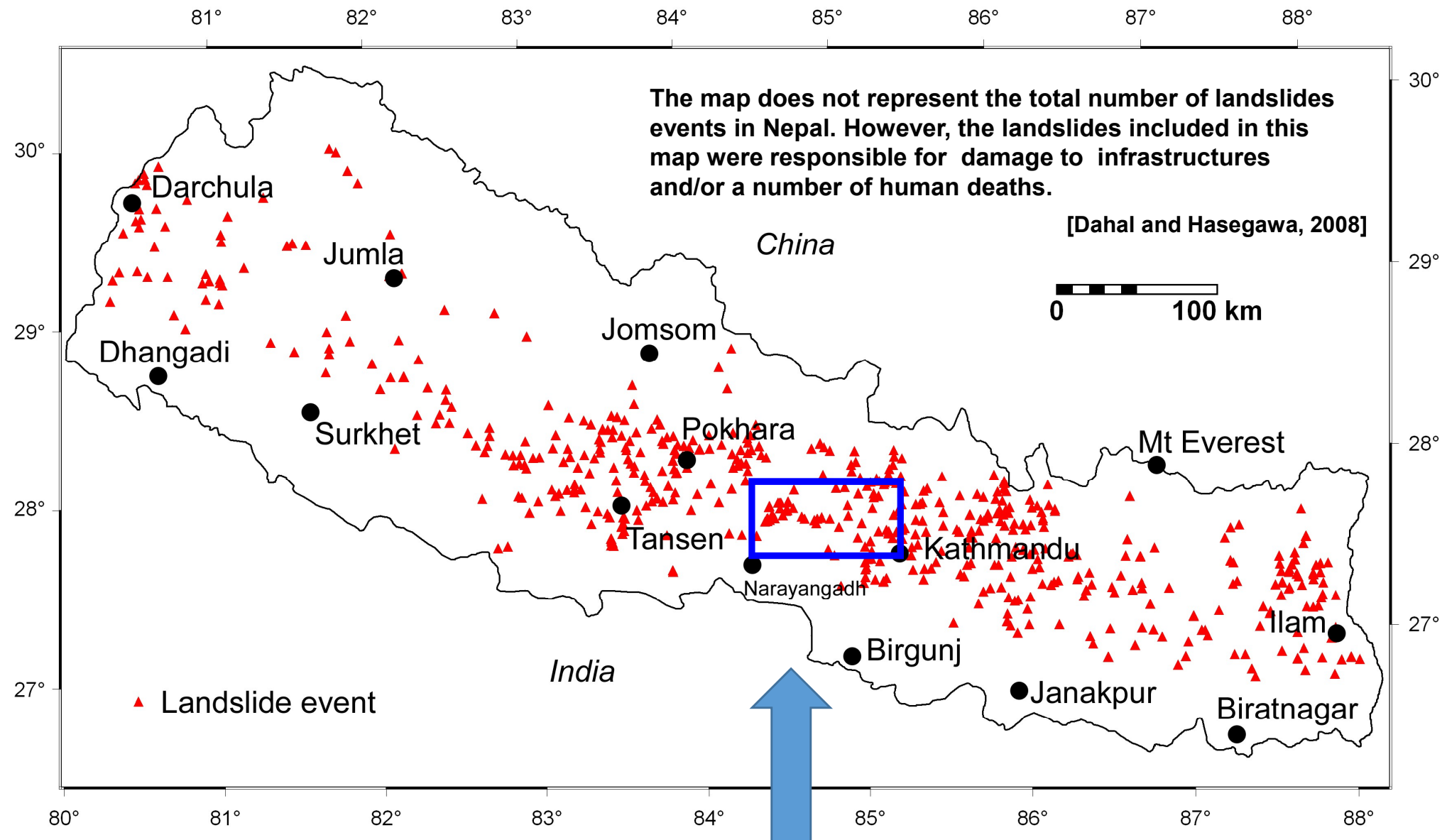


Settlements and Population Distribution

(Concentration in Lesser Himalayan Region)



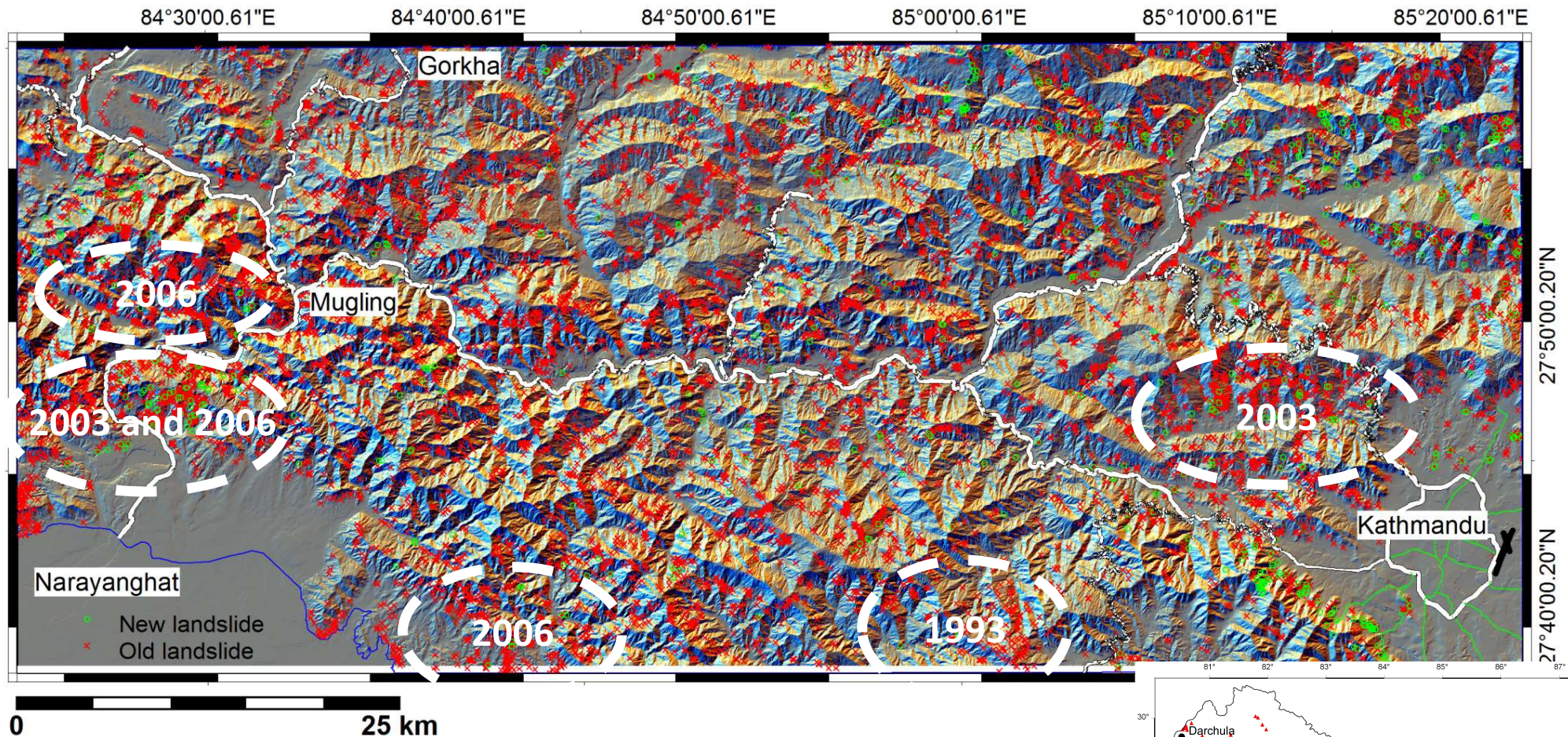
Distribution of Landslides in Nepal



Next page!

Landslide Inventory — In central Nepal

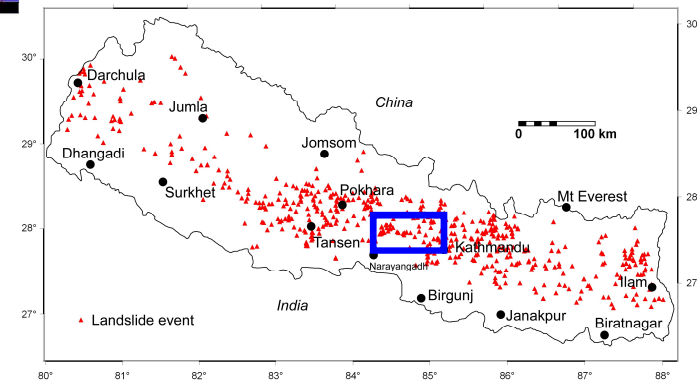
1993 to 2010 , in total 9884 events were identified



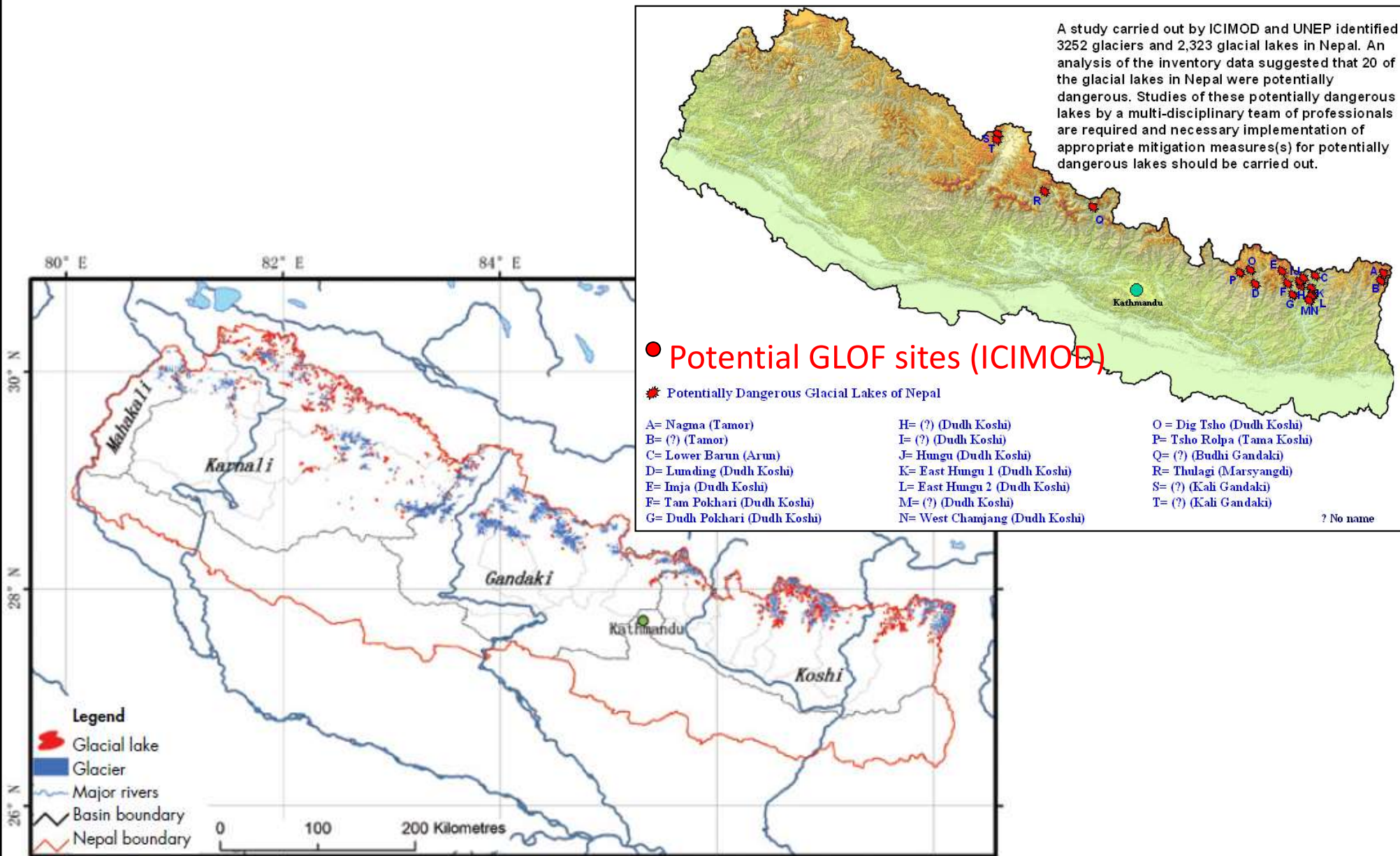
New landslides: 655

Old landslides: 9229

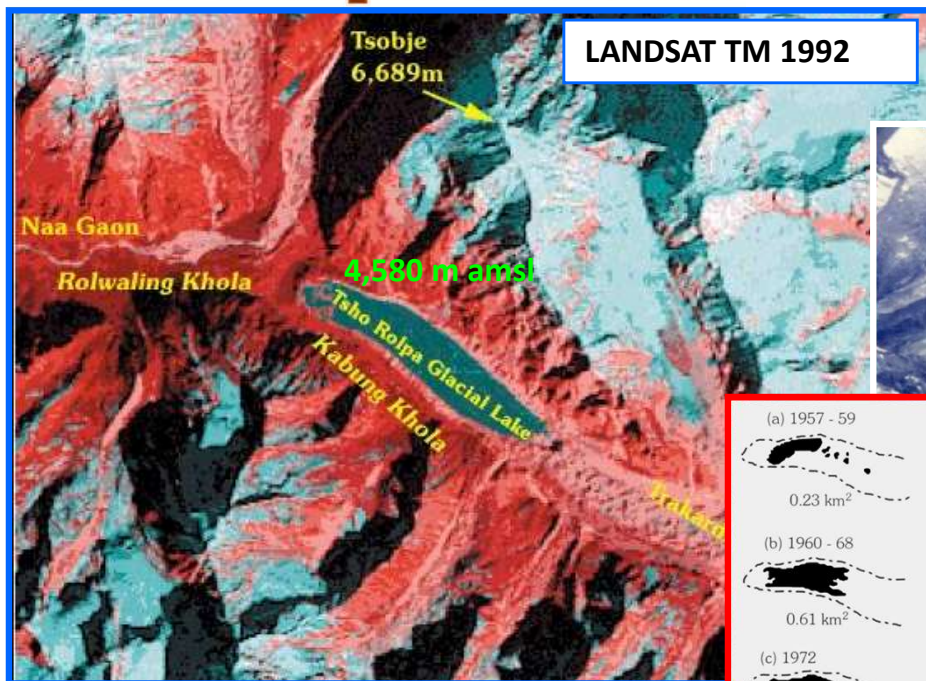
4043 sq. km. area of central Nepal



Glacial Lake Outburst Flood Hazard in Nepal



Tsho Rolpa Glacier



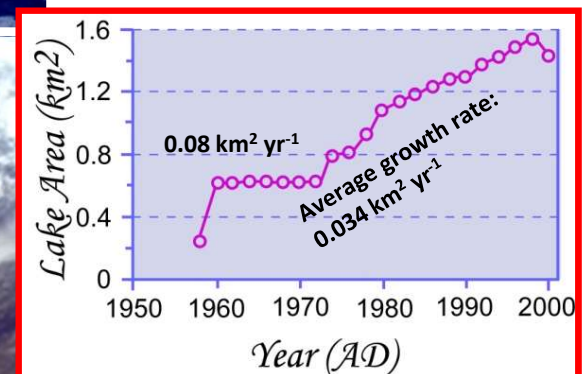
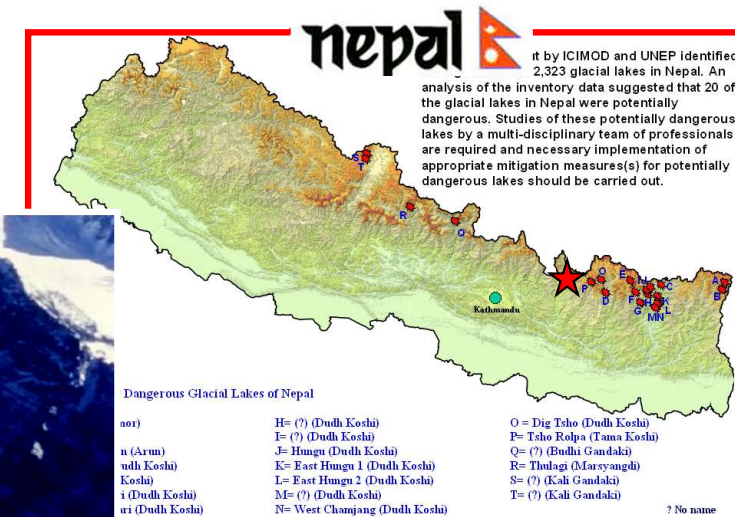
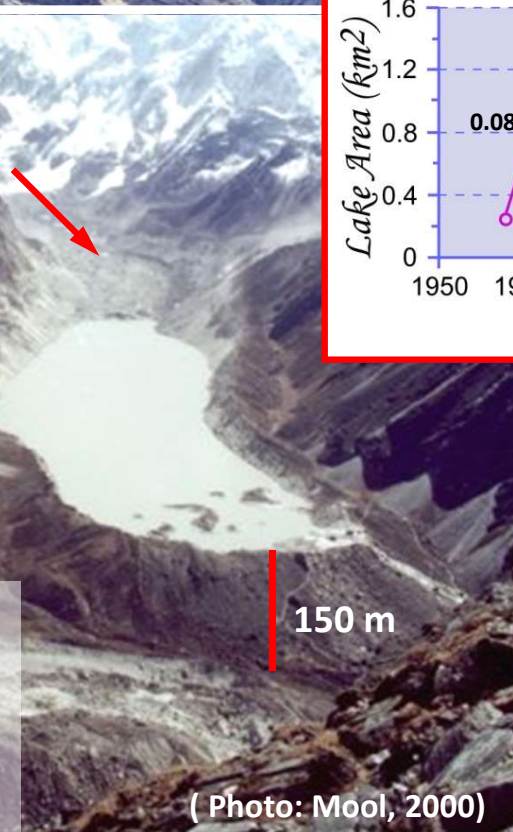
Max.

L: 3.2 km

B: 0.6 km

D: 132 m

V: $76.6 \times 10^6 \text{ m}^3$



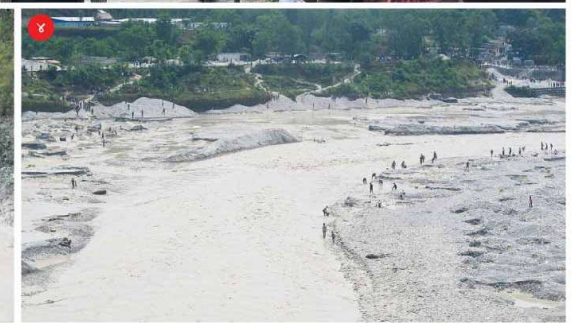
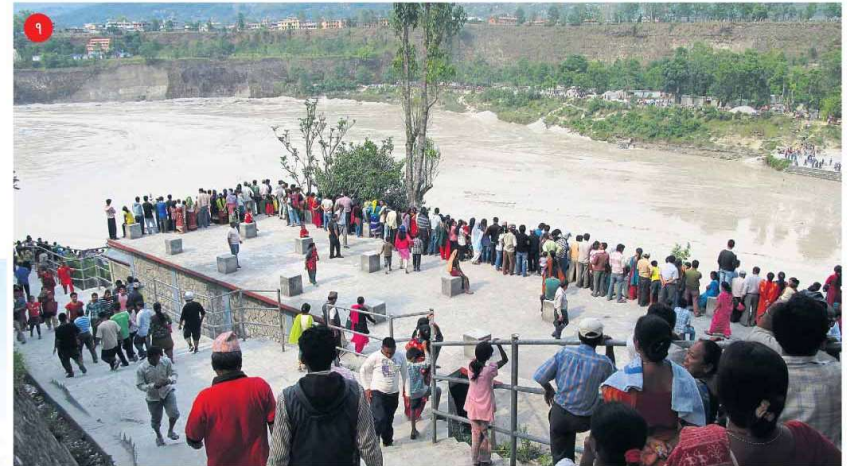
Debris-Flood Disaster in Seti River (Pokhara)

- **Date/Time: 5 May 2012, 9:00AM – 2:00PM**
- **Total 8 Flood Waves**
- **Dead: 31**
- **Missing: 40 (?)**
- **Bridges (suspended trail bridges): 2**
- **Buses and Trucks: 4**
- **Tractor: 1**
- **Property damage: 100 million rupees**
- **Clear weather (no rain!)**
- **No seismic effect**

सेतीमा बाढी

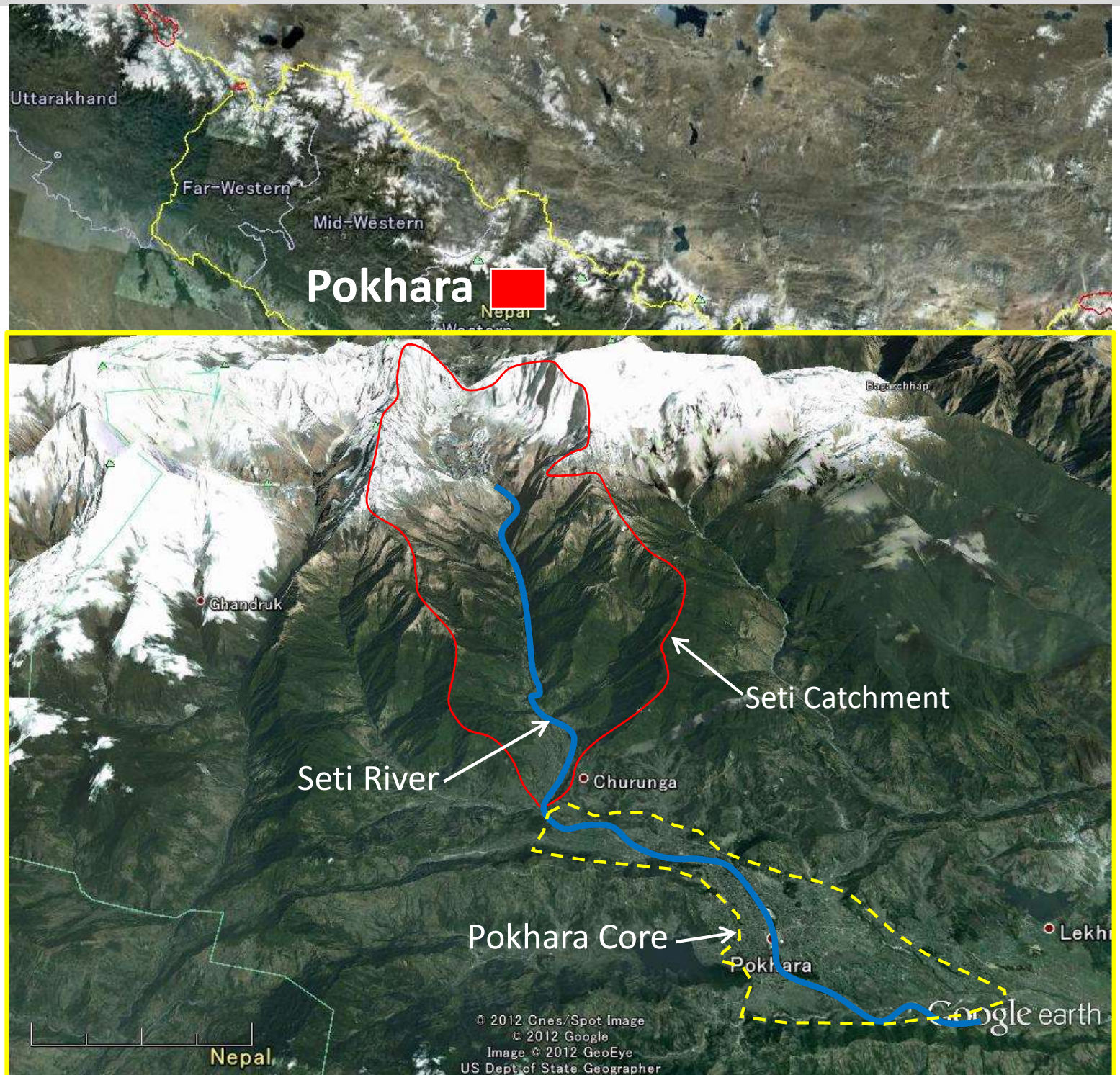
१. सेती नदी फुटेर आएको बाढी हेर्दै पोखरा रामघाटका स्थानीय, २. माछापुच्छ्रे र अन्नपूर्ण हिमशृङ्खला बीचबाट गएको पहिरो, ३. कास्कीको सर्दिखोलाबाट शव निकाल्दै सुरक्षाकर्मी, ४. पोखरा आइपुगेपछि देखिएको सेतीको बाढी, ५. हेलिकप्टरबाट हेर्दा बाढीले भरिएको सेती, ६. बाढीमा परी घाइते भएकालाई उद्धार गर्दै स्थानीय, ७. दमौलीनजिक उल्टि गरेको नदी हेर्दै स्थानीय, ८. पहिरोले बगरमा परिणत भएको कास्कीको सर्दिखोला-७ खारपानी क्षेत्र, ९. पोखरानजिकै सेतीबाबाट बाढीले बगाएर ल्याएको सामान खोज्दै स्थानीय, १०. सेती नदीमा बाढीले बगाएको ट्रक।

तस्विर: मनोज अधिकारी, सन्तोष पोखरेल, समुद्र पौडेल/नागरिक, एभिएन क्लब

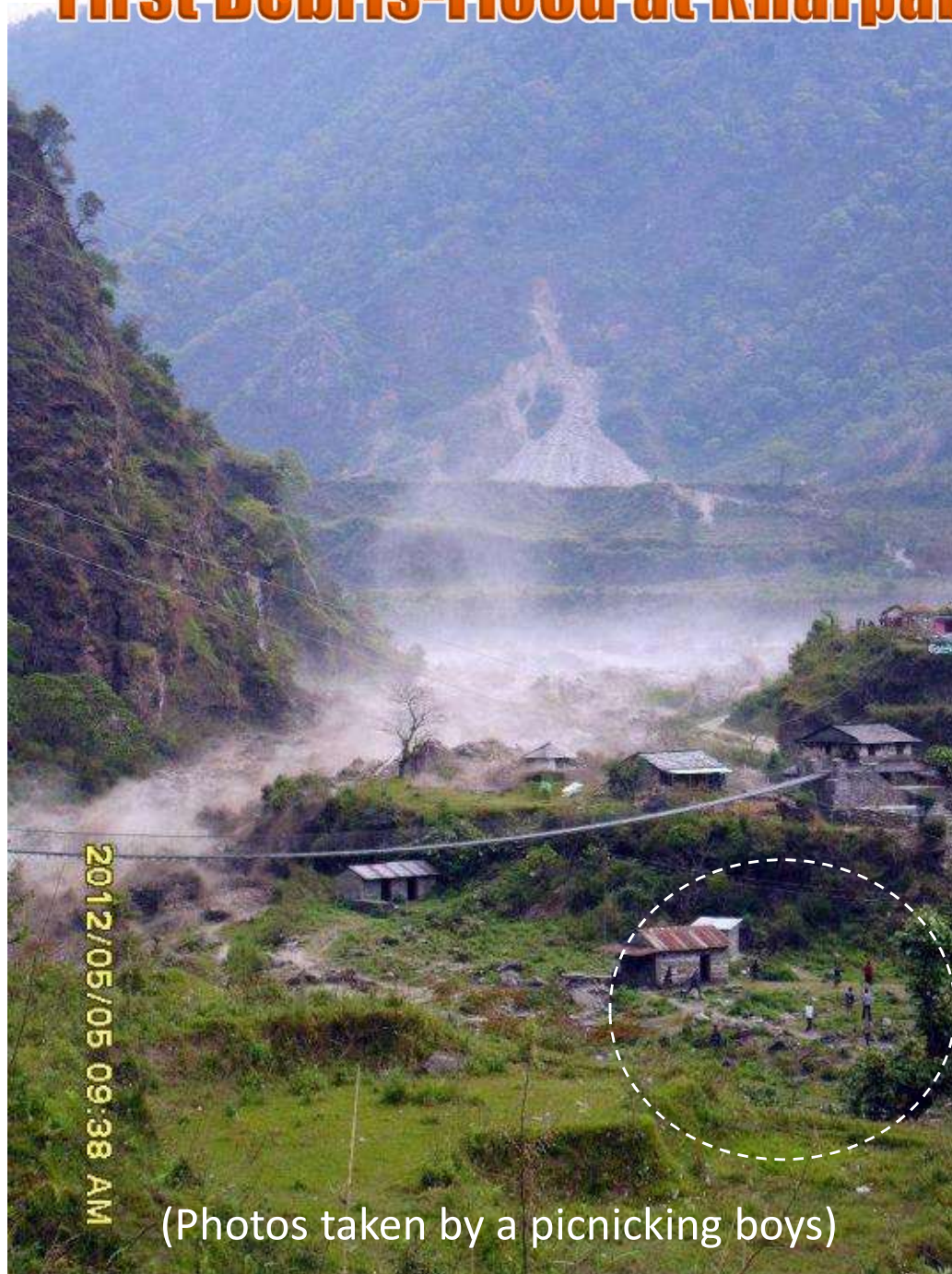


Location

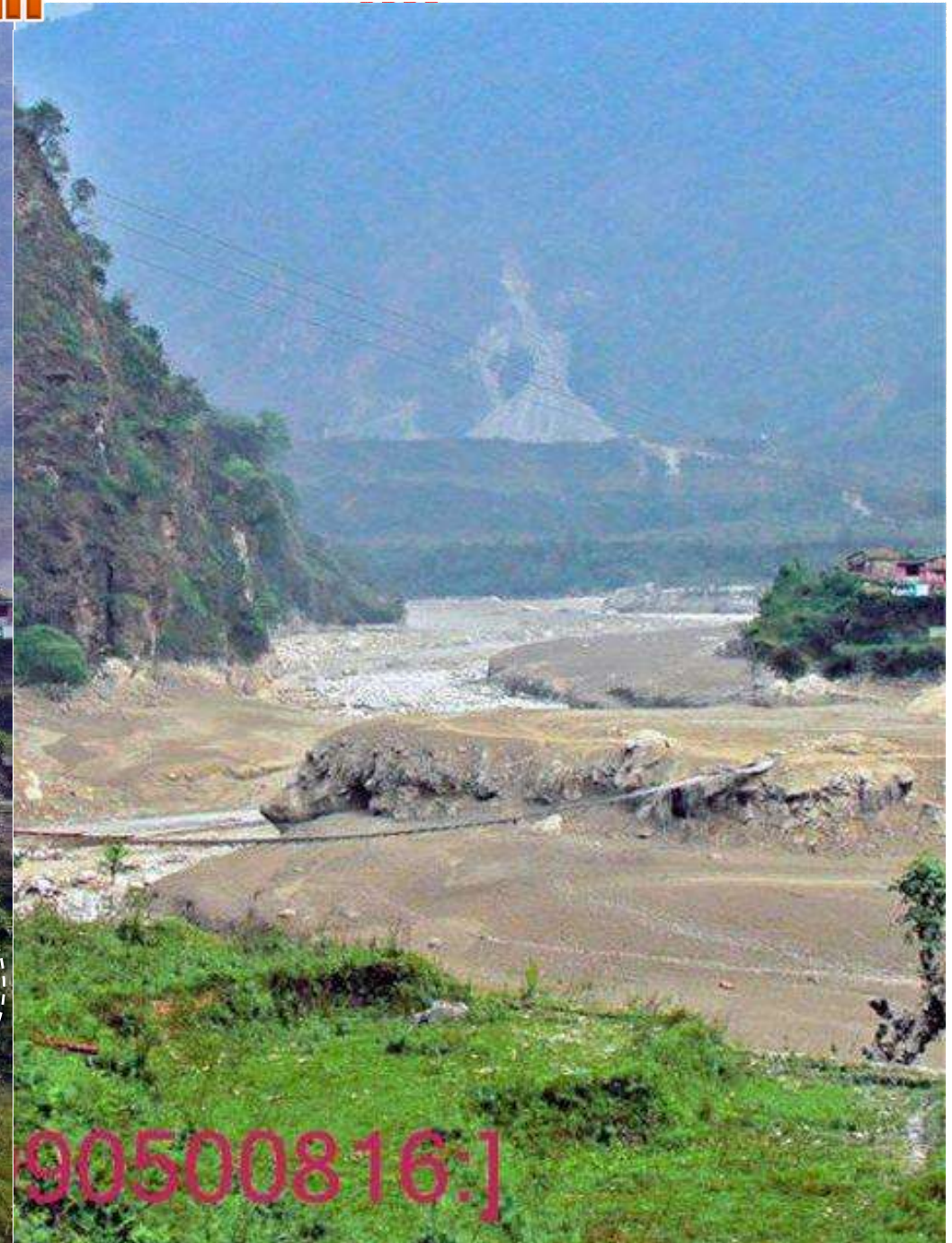
- Population: 0.5 mil.
- City altitude: 800m
- Seti Source Elevation: 3500 m



First Debris-Flood at Kharpani

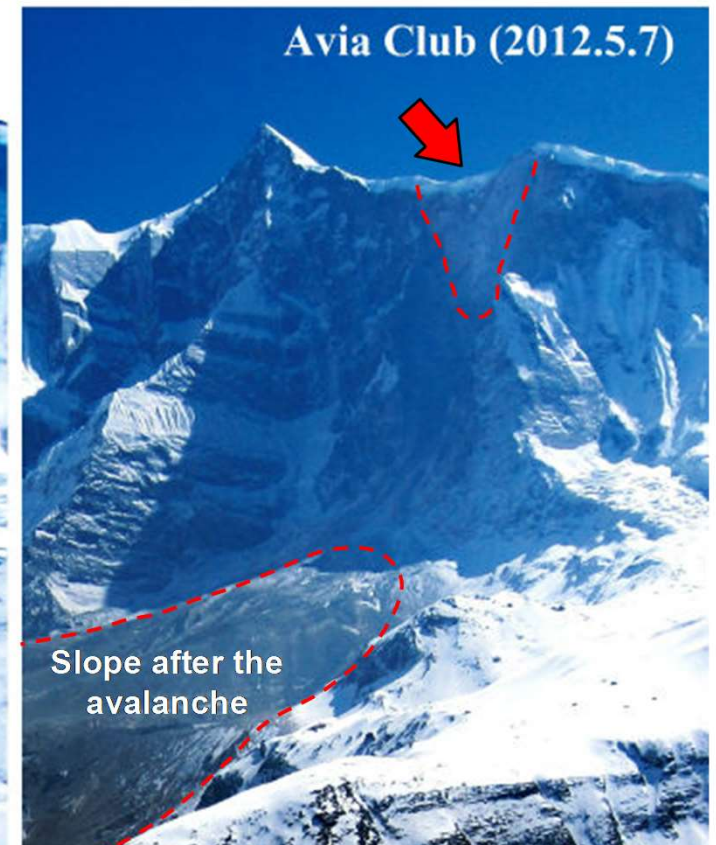
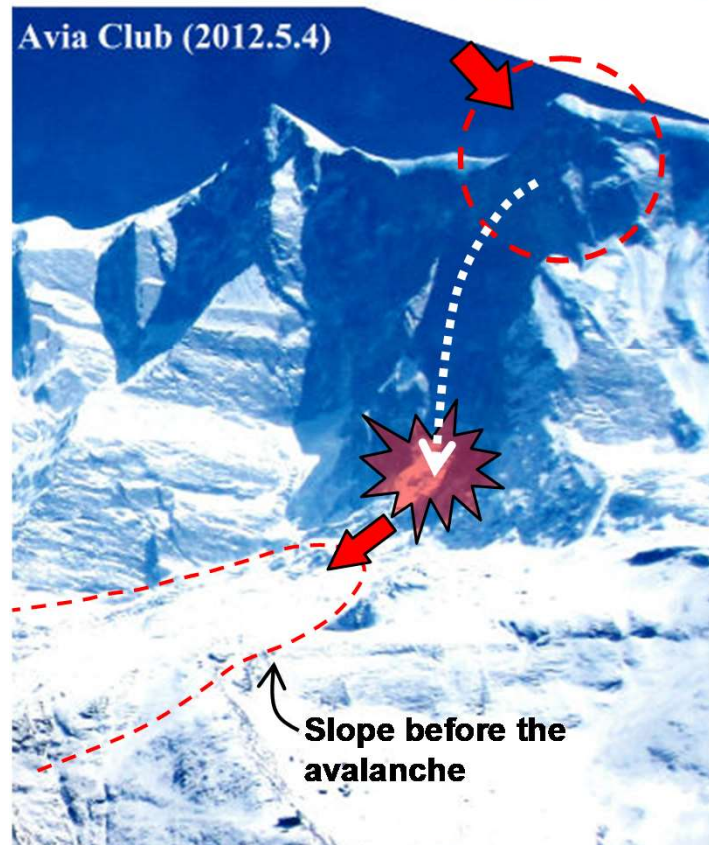
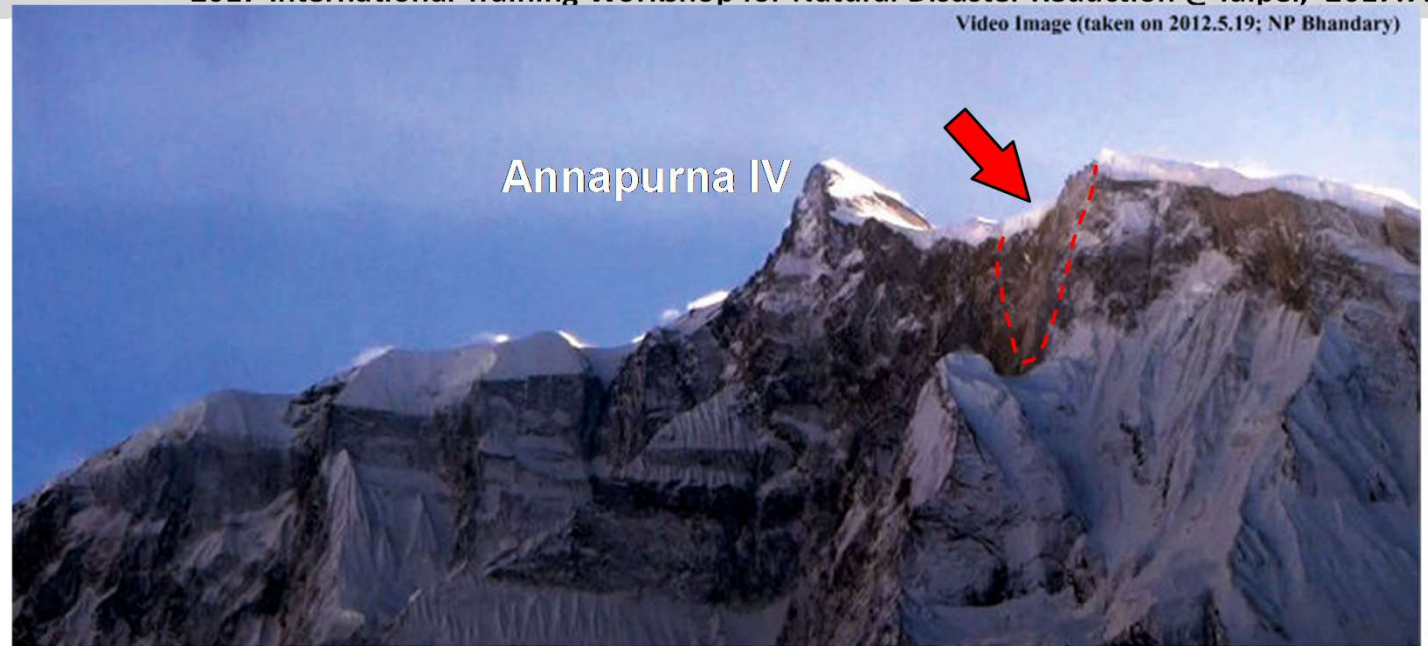


(Photos taken by a picnicking boys)

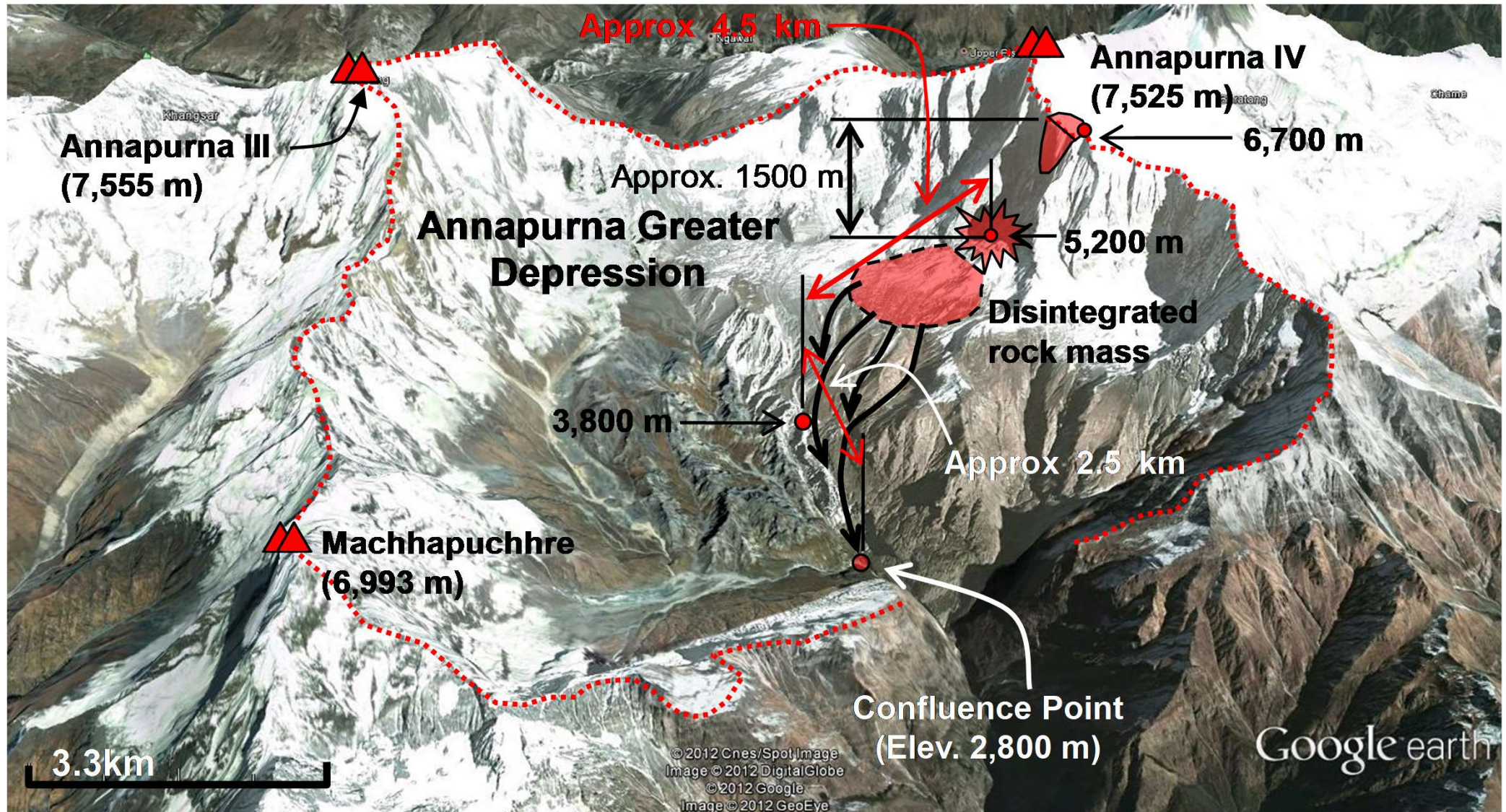


Evidence of High Altitude Rock Slope Failure

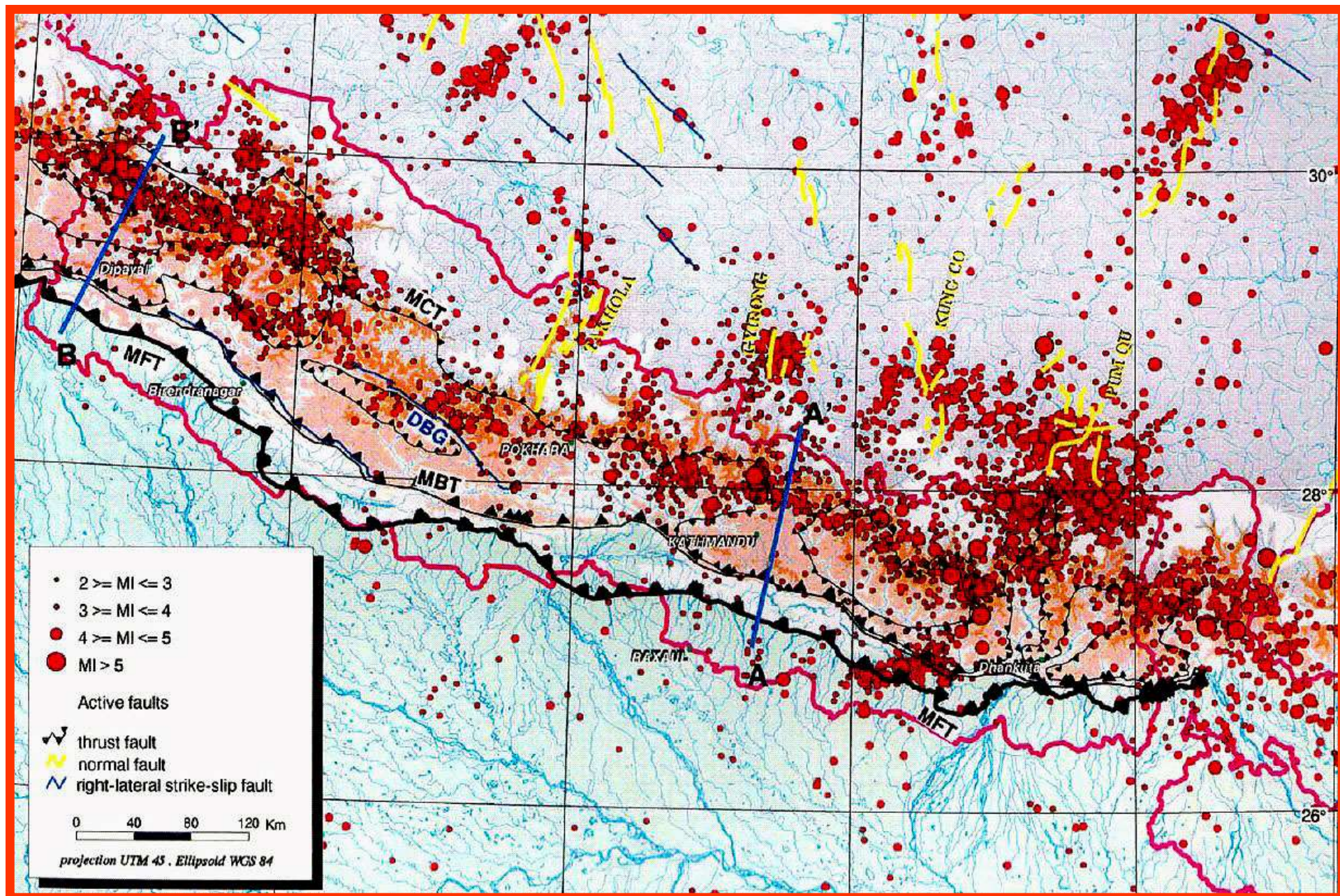
Video Image (taken on 2012.5.19; NP Bhandary)



Illustrated Possible Debris-Flood Mechanism



Earthquakes in and around Nepal

DMG, Nepal, DASE France
(1979-1999)

Recorded Historical Earthquake in Nepal Himalaya

Distribution of earthquake near Kathmandu

Source: JICA (2002)

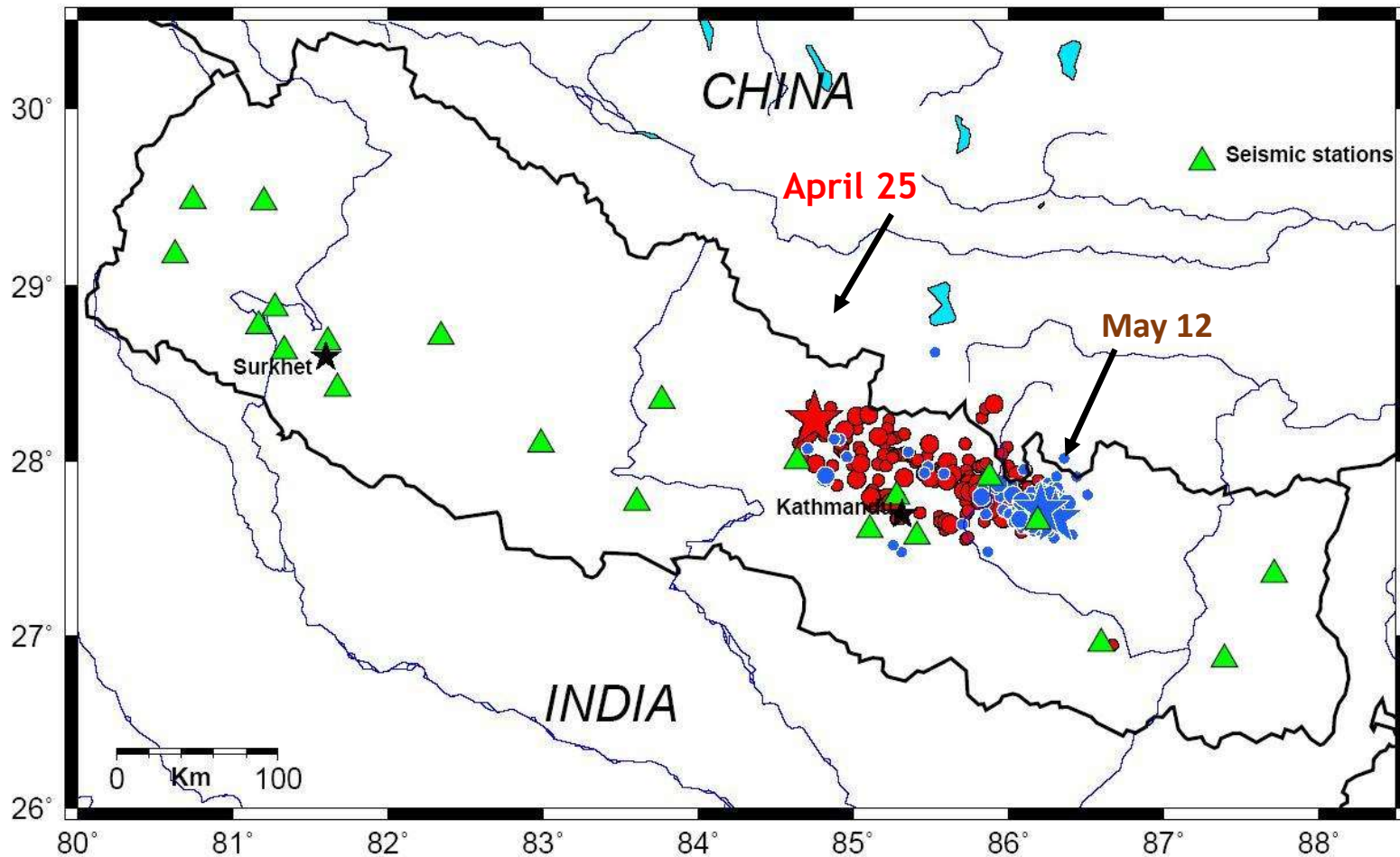
Date	Magnitude	Intensity	Latitude	Longitude	Epicenter dist. (Km)	Assumed PGA (gal)
1255/6/7	7.7(assumed)	X	NA	NA	Near KTM	NA
1408	NA	X	NA	NA	Near KTM	NA
1681	7 (assumed)	IX	NA	NA	Near KTM	NA
1810	NA	IX	NA	NA	NA	NA
1833	7		28	85	38	137
1833/8/26	7	X	27	85	84	75
1833/10/4	7	IX	27	85	151(Kalaiya)	47
1833/10/18	7	VIII	27	84	India	NA
1866/23/05	7	X	27.7	85.3	Kathmandu	NA
1869/7/7	7		28	85	45	121
1934/1/15	8.4	IX-X	27.55	87	177 (North of Chainpur)	188
1936/5/27	7	NA	28.50	83.5	199	38
1954/9/4	6.5	NA	28.30	83.8	163	34
1988/8/20	6.5		26.75	86.62	167 (Udayapur)	36

Note: NA here represents data not available

When ?? 25 April 2015??

The 2015 Nepal Earthquake

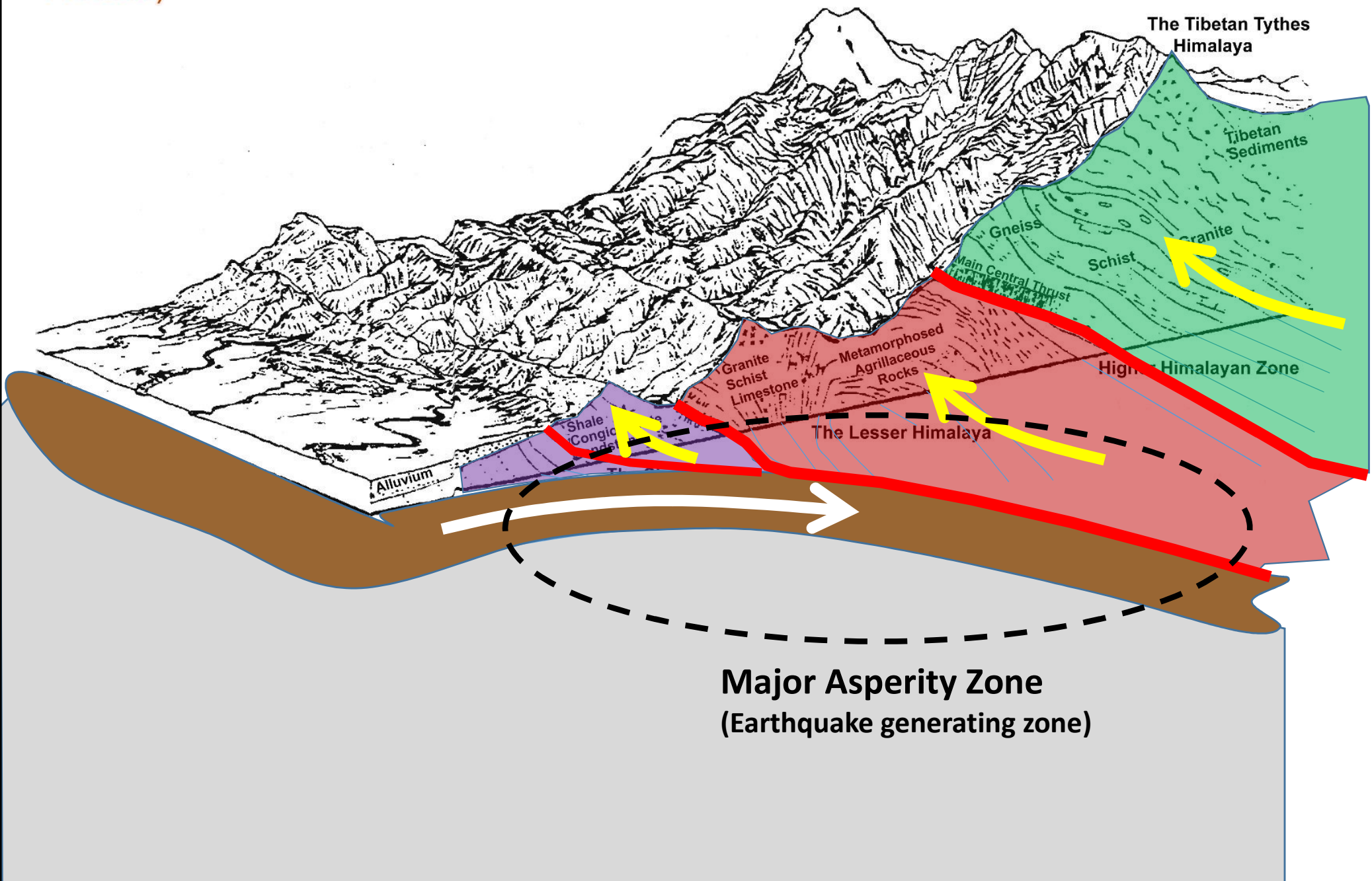
THE MAJOR SHOCK AND 407 AFTERSHOCKS WITH MAGNITUDE (ML) OVER 4 AS OF 4 NOVEMBER, 2015



COUNTRY	DEATH	INJURIES
NEPAL	>8857	>22304
INDIA	78	560
CHINA	25	383
BANGLADESH	4	200
FOREIGN NATIONALS FROM 17 COUNTRIES (in Nepal)	89	>500

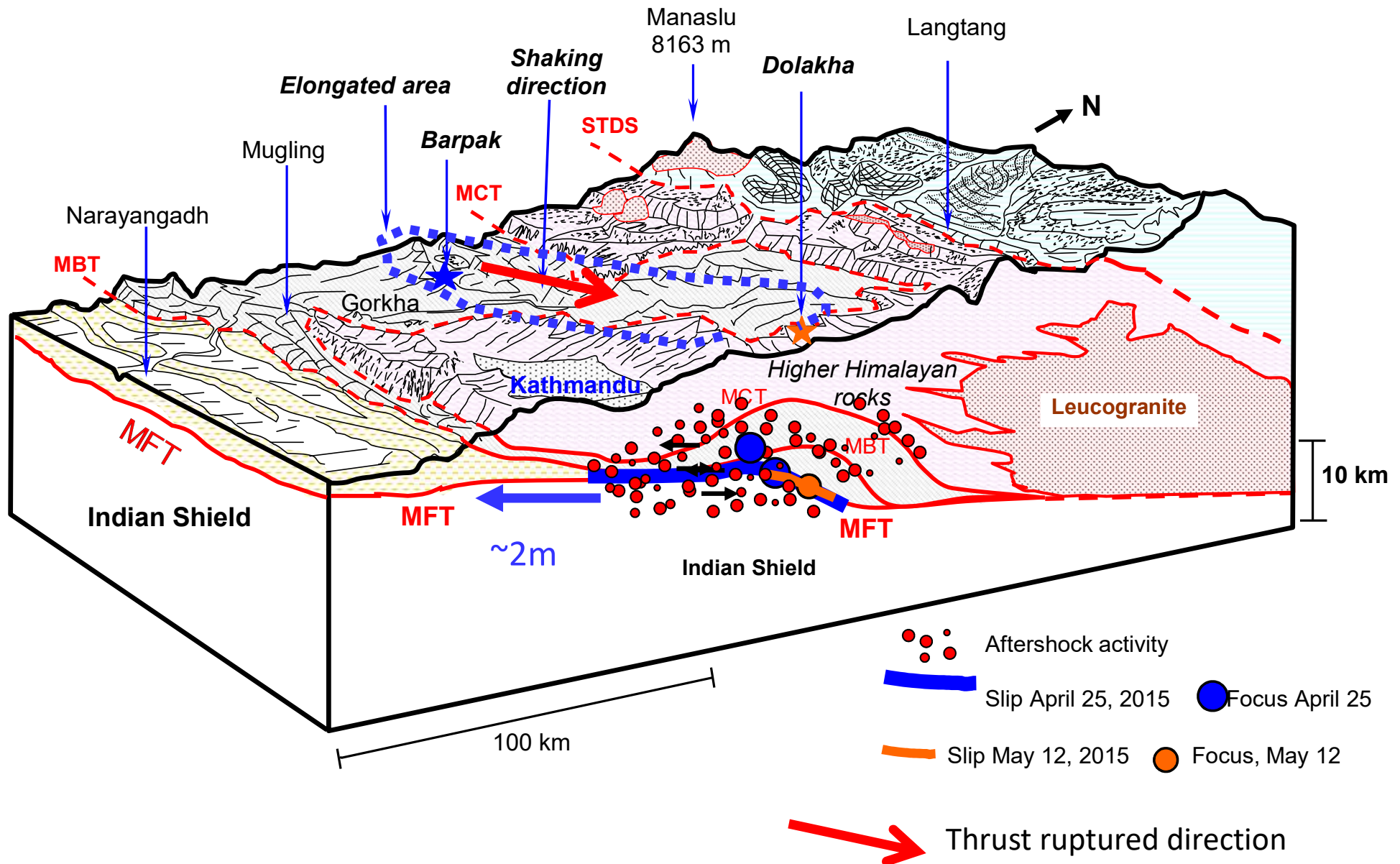
TOTAL LOSS :
> USD 650 billion (including cascading effects estimation and recent fuel crisis)

Geology and Geomorphology (Mountain Building Process)



The 2015 Gorkha Nepal Earthquake

Courtesy: RK Dahal (2016)



Typical Damage Scenes in Kathmandu



Typical Damage Scenes in Kathmandu



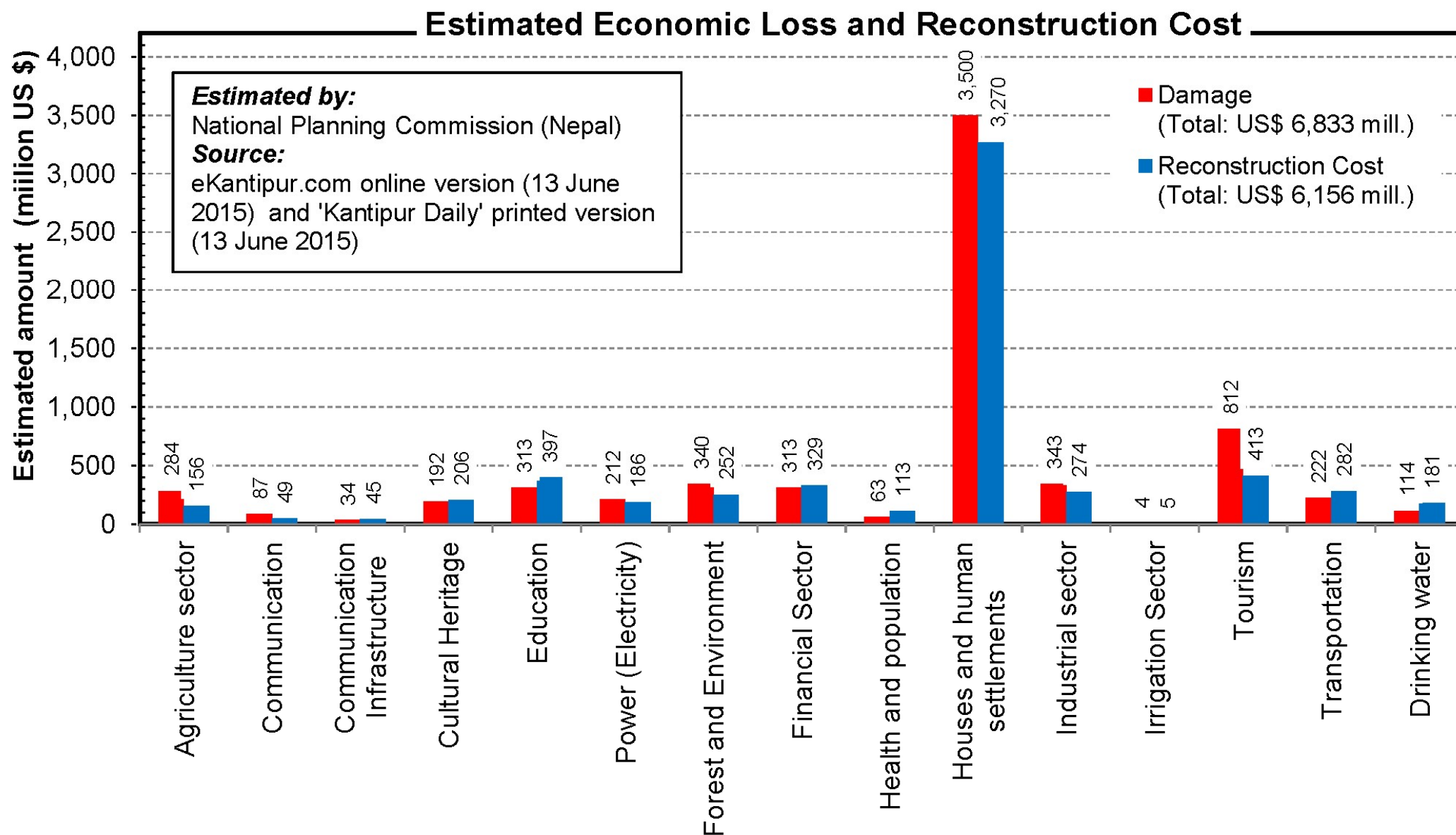
Typical Damage Scenes in Kathmandu and Lalitpur



Typical Damage Scenes in Kathmandu



Estimated Economic Damage and Reconstruction Cost



Old buildings/houses

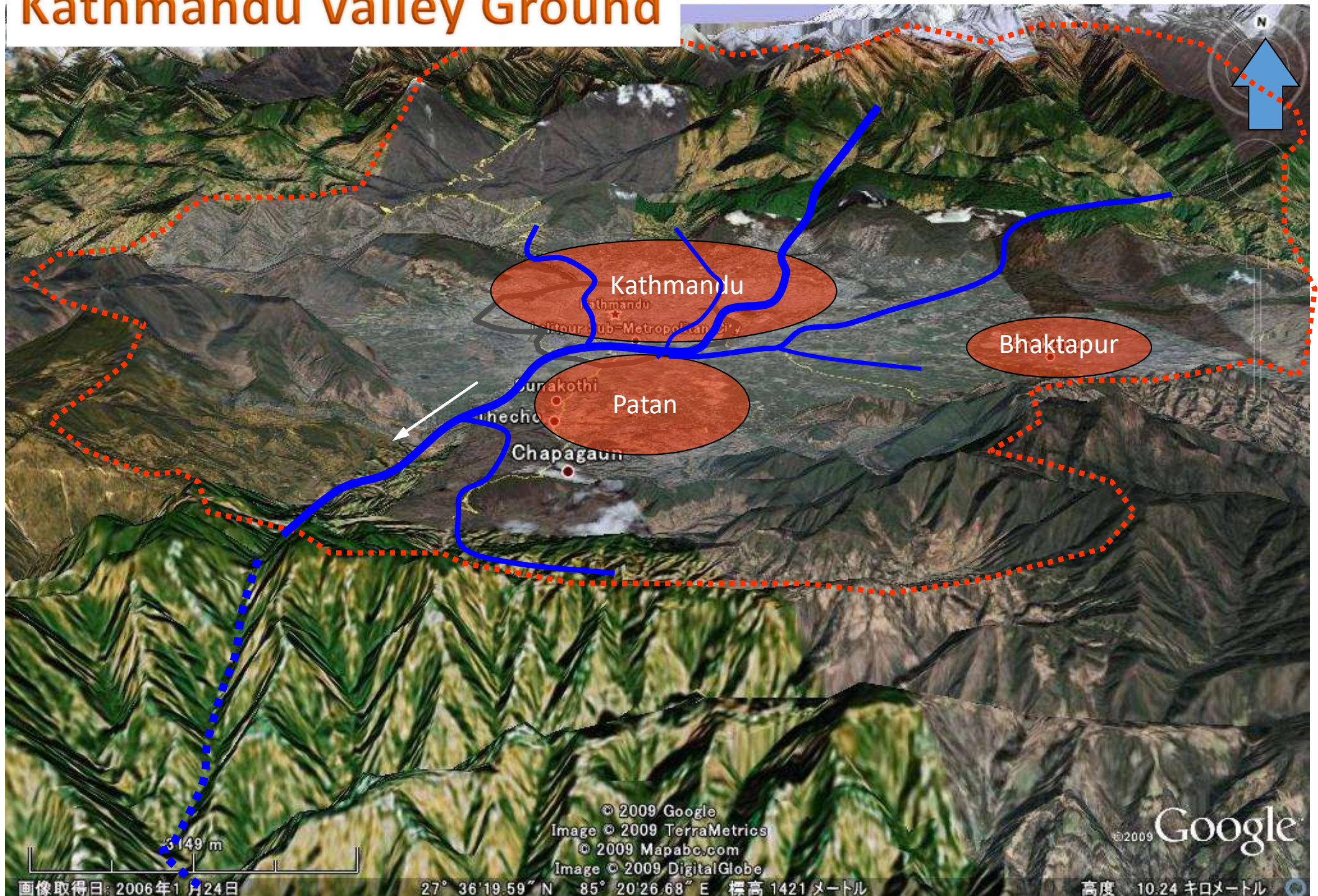


Deteriorated Brick Buildings



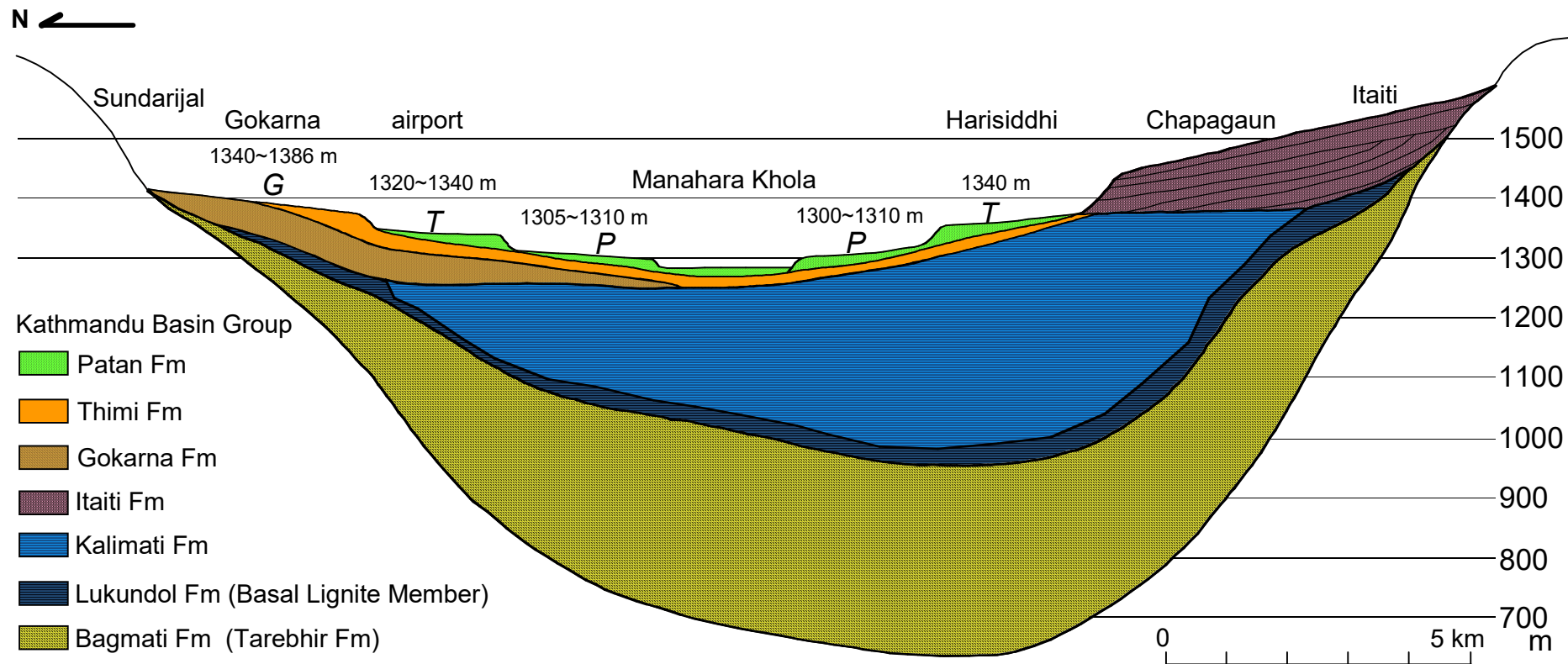
Slender buildings/houses
(Improper design??)

Kathmandu Valley Ground

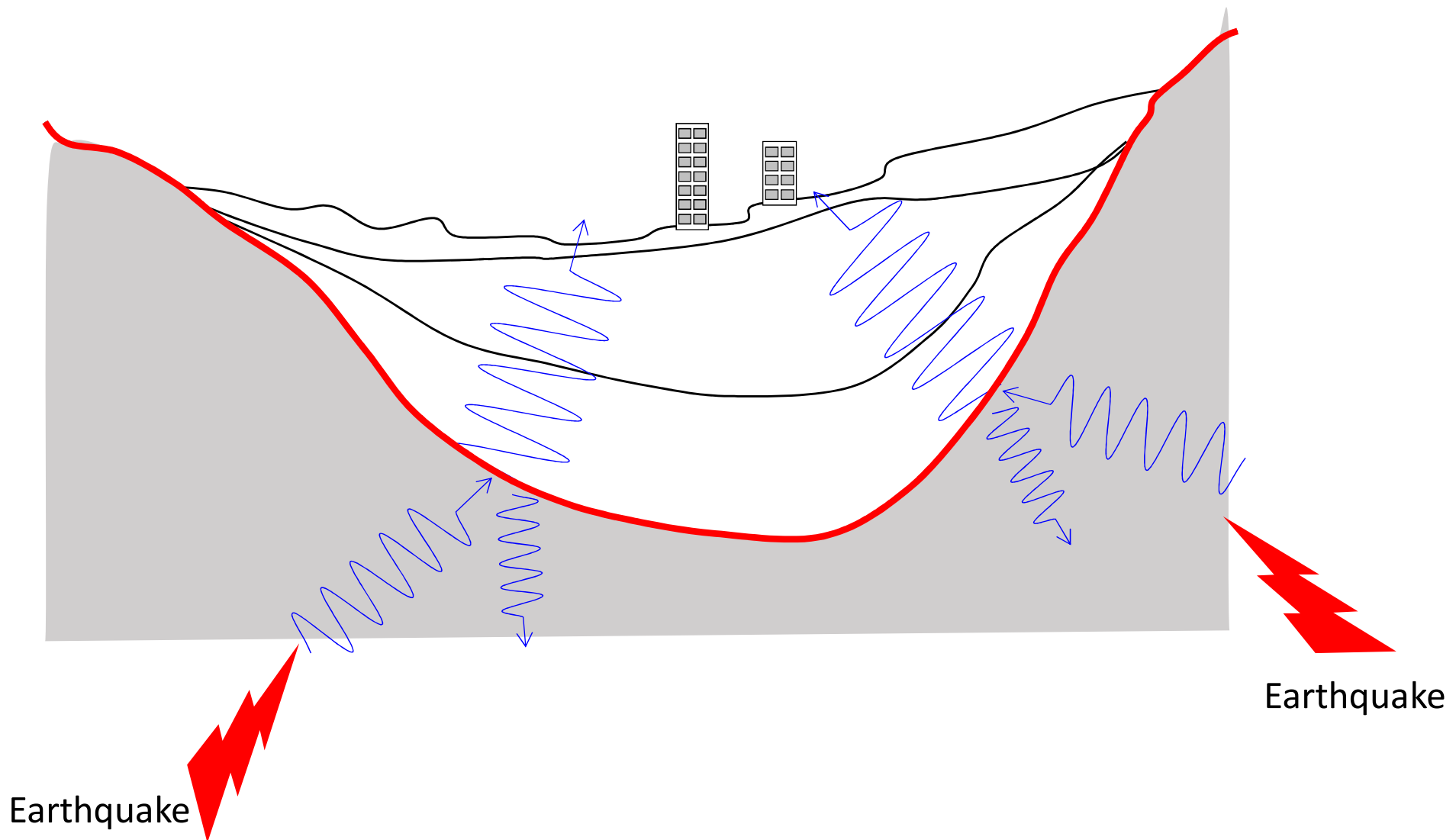


Estimated Sediment Deposit in Kathmandu Valley

Sakai et al. (2001)



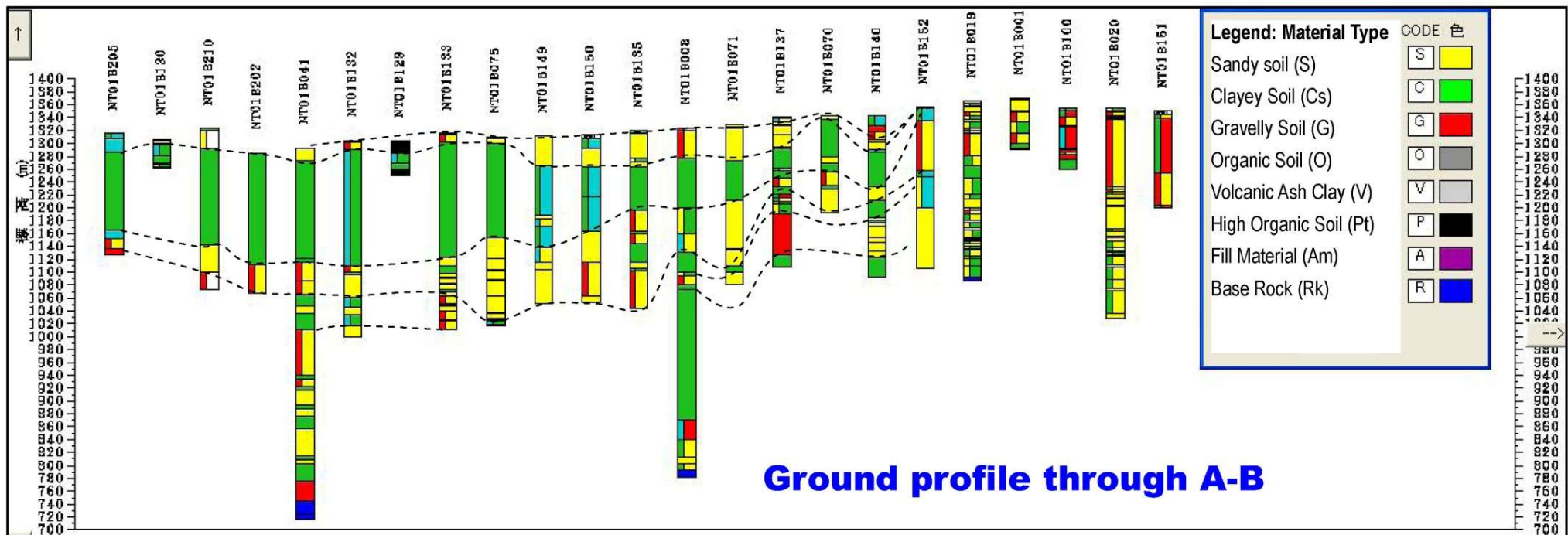
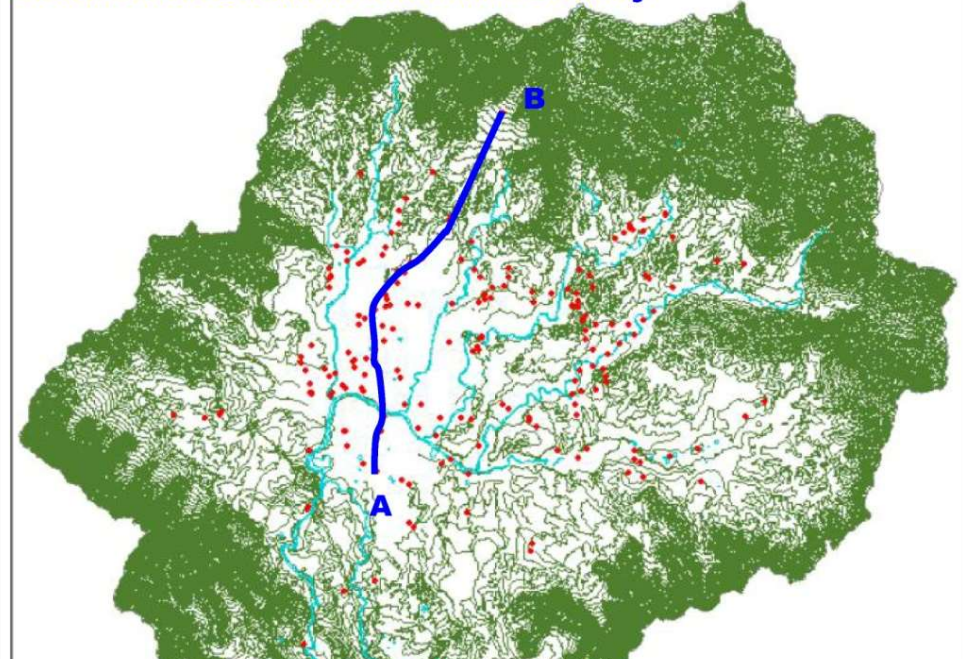
Typical feature of Kathmandu deposit



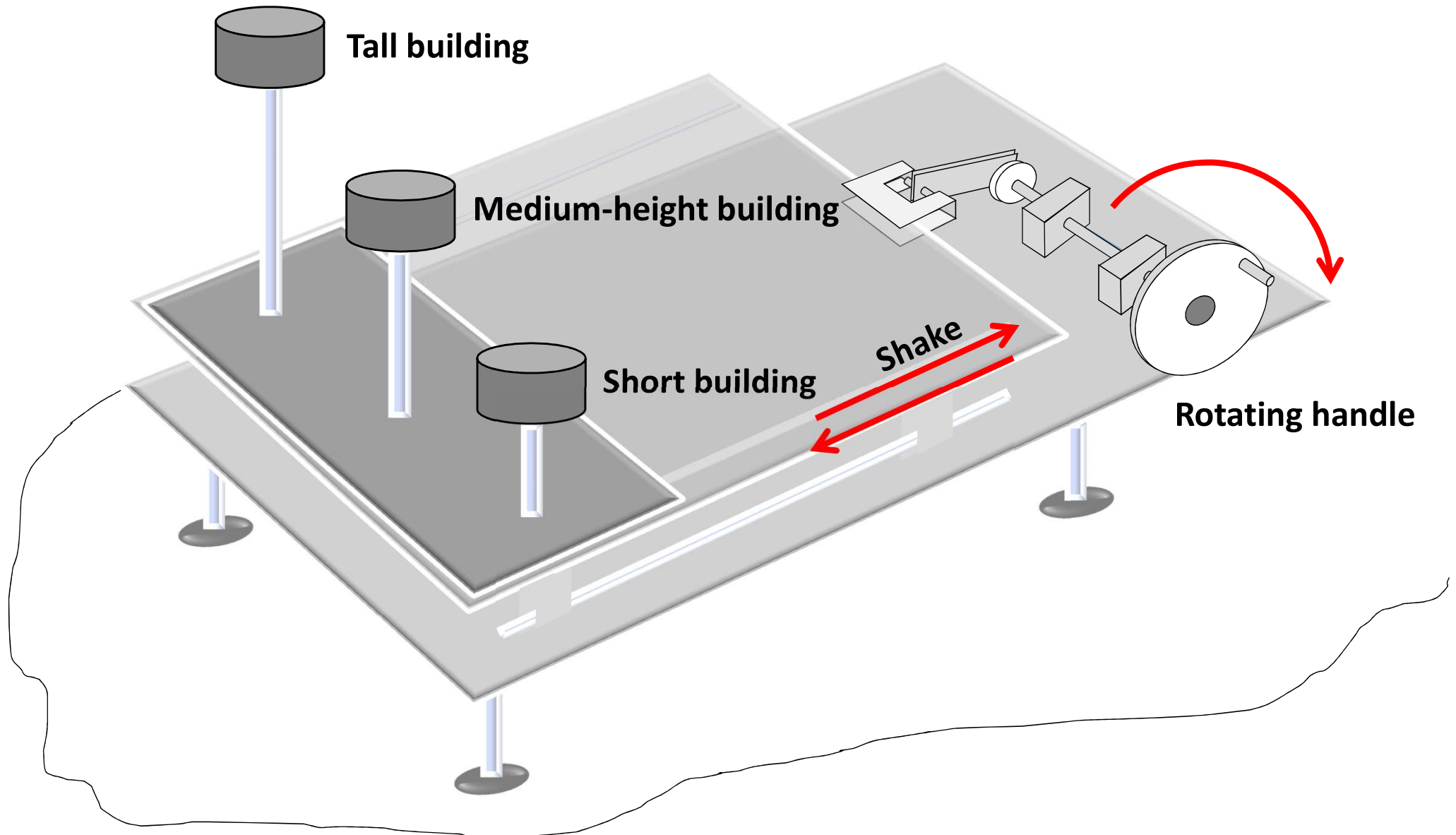
Geo-info Database Preparation (Preliminary)

Borehole Information :
Multi-purpose boring

Borehole locations in Kathmandu Valley



Small-scale Shake Table Demo (Resonance Effect)



Small-scale Shake Table Demo (Resonance Effect)

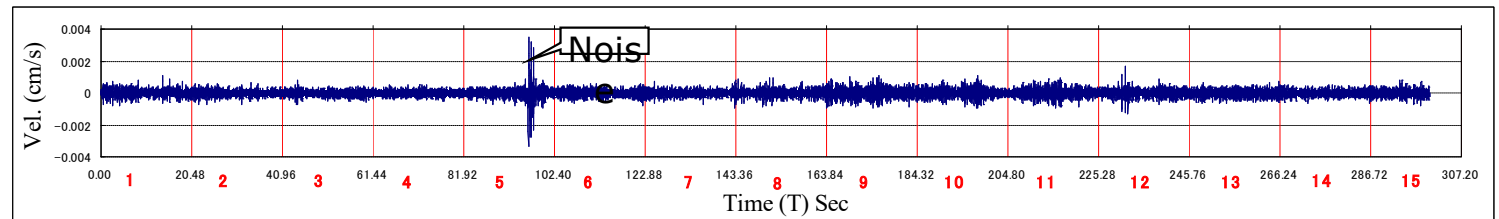


Instrument used in MT Survey

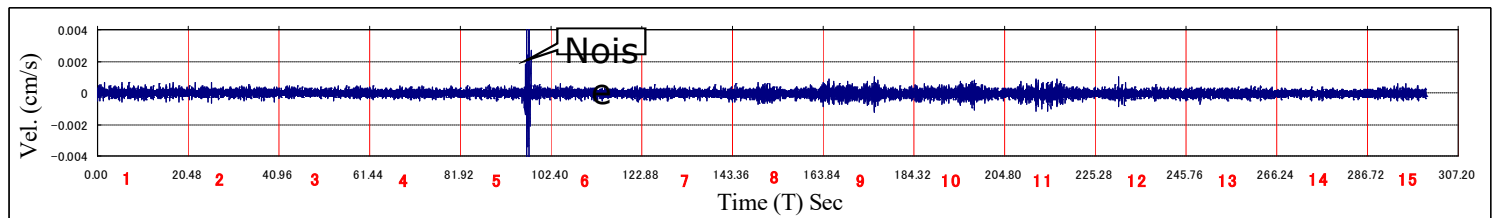
Three components (EW, NS and UP) of ground motion (velocity) measured at single station



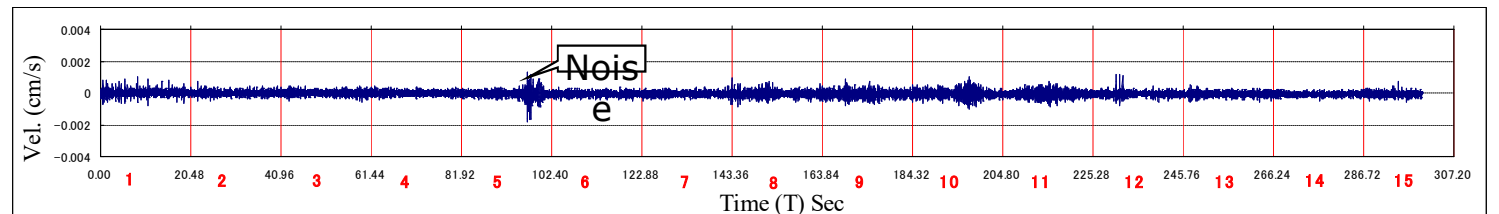
North- South (NS)
component data



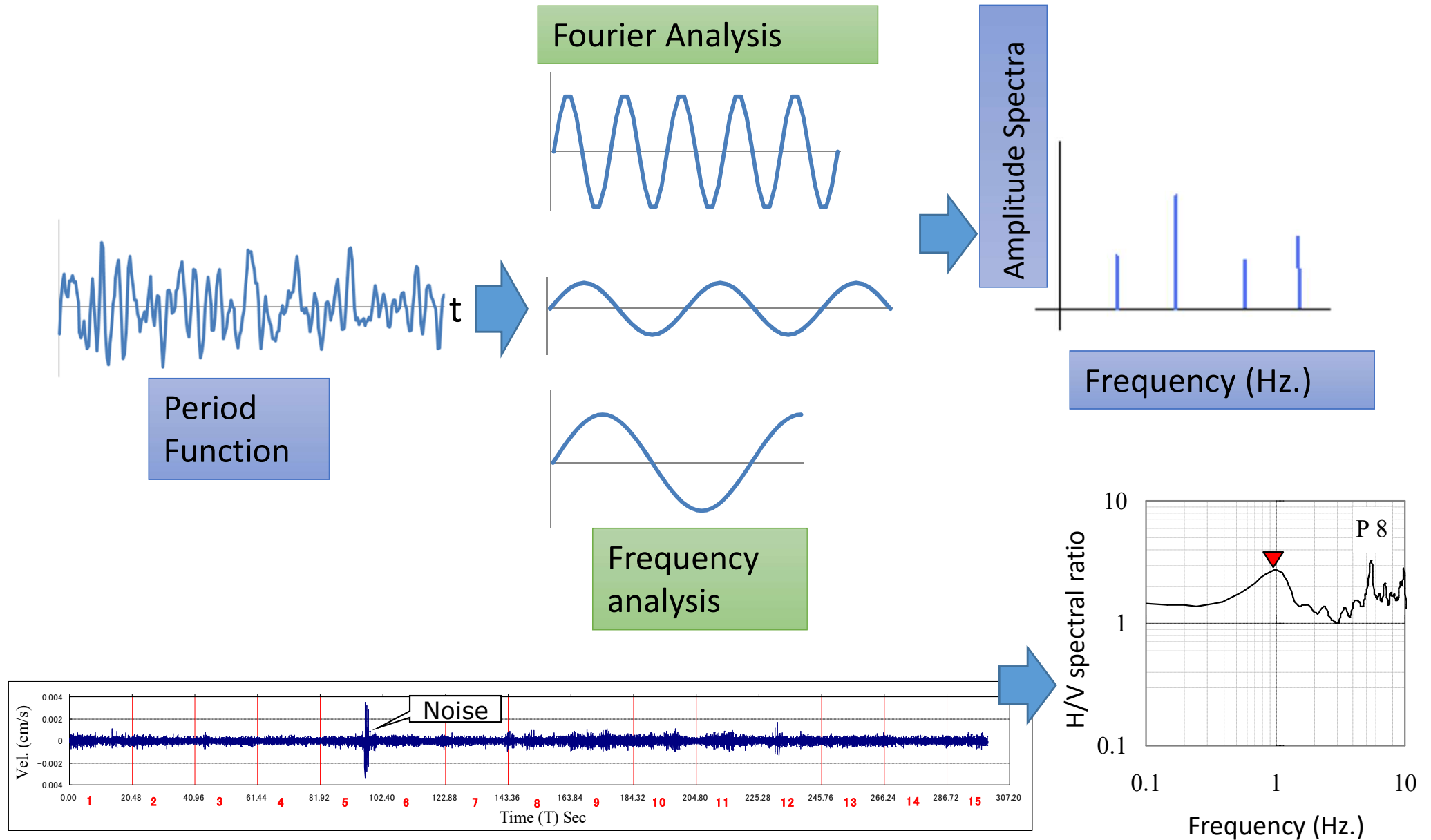
East- West (EW)
component data



Vertical (UP)
component data

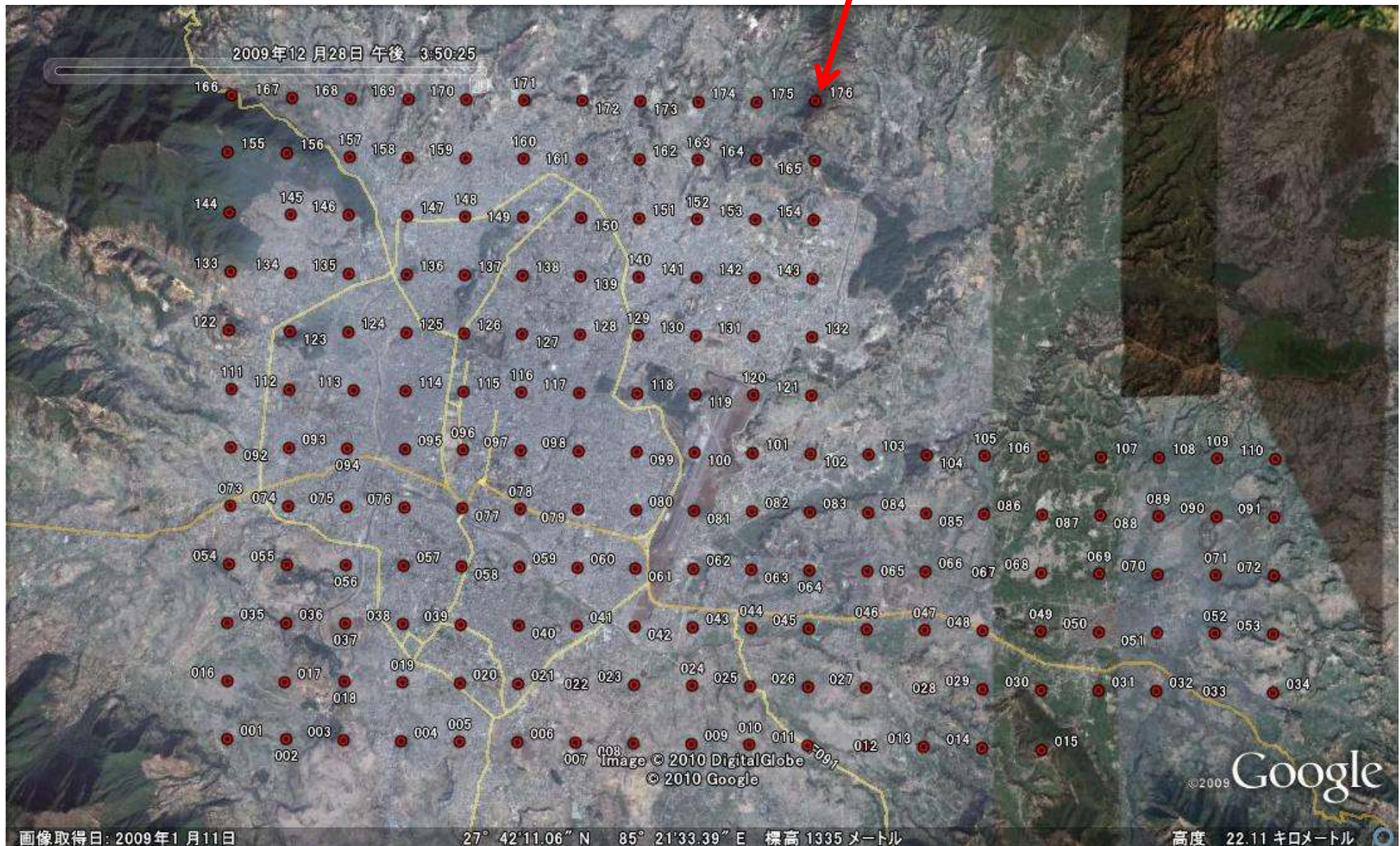


Fourier Analysis

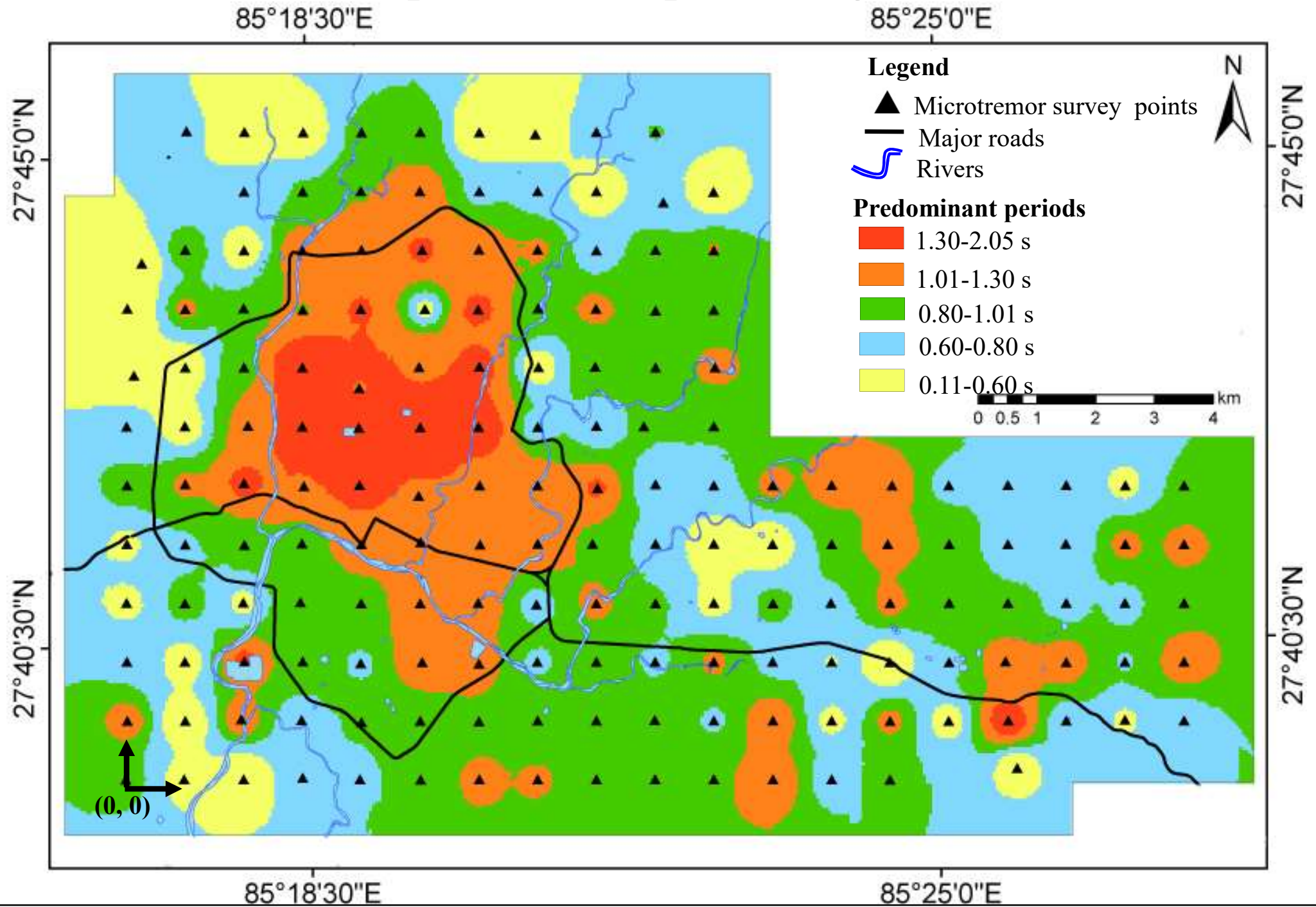


Microtremor Measurement (Paudyal et al. 2012)

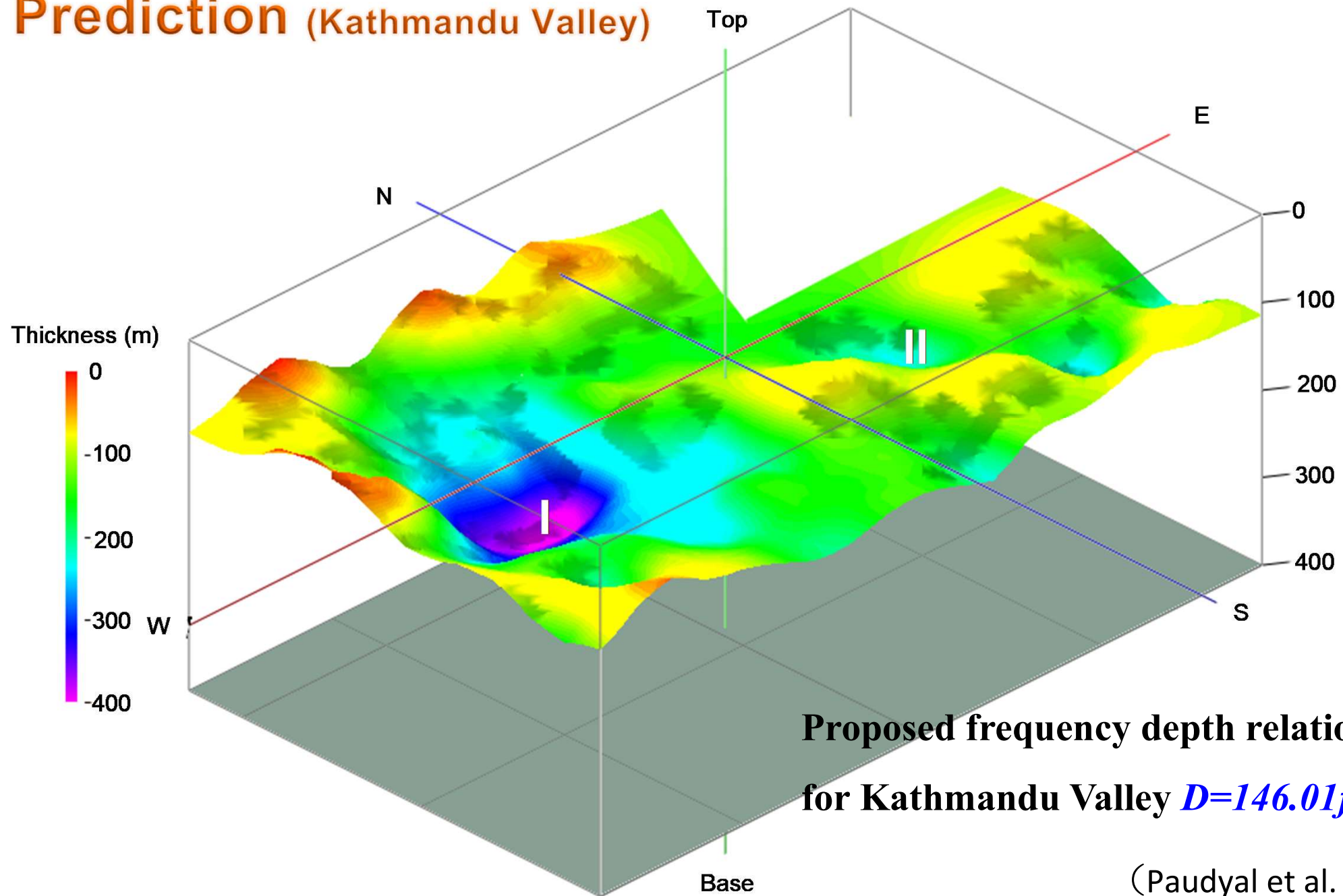
Total: 176 points



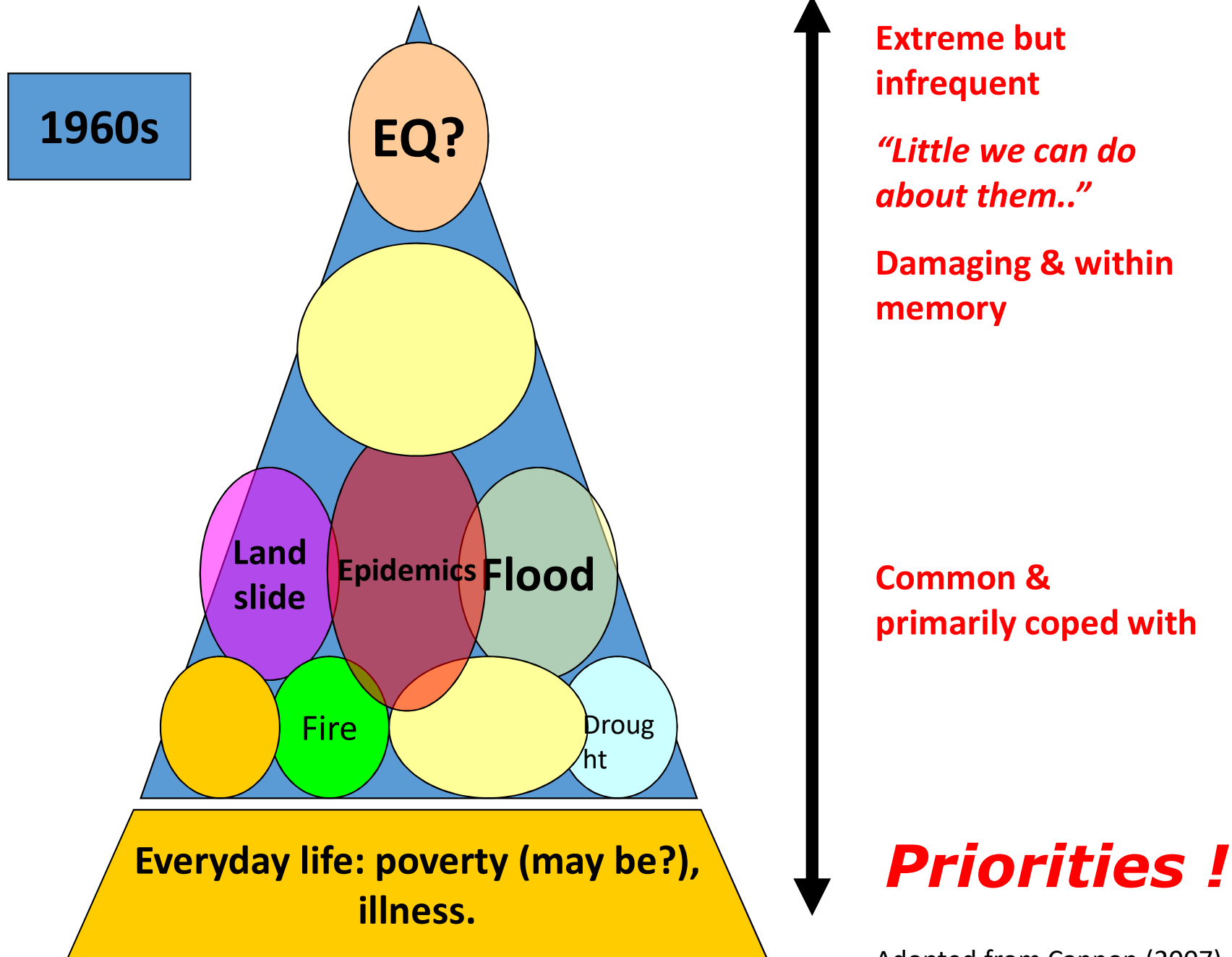
Profiles based on the predominant period of ground



Ambient Vibration-based Basement Topography Prediction (Kathmandu Valley)

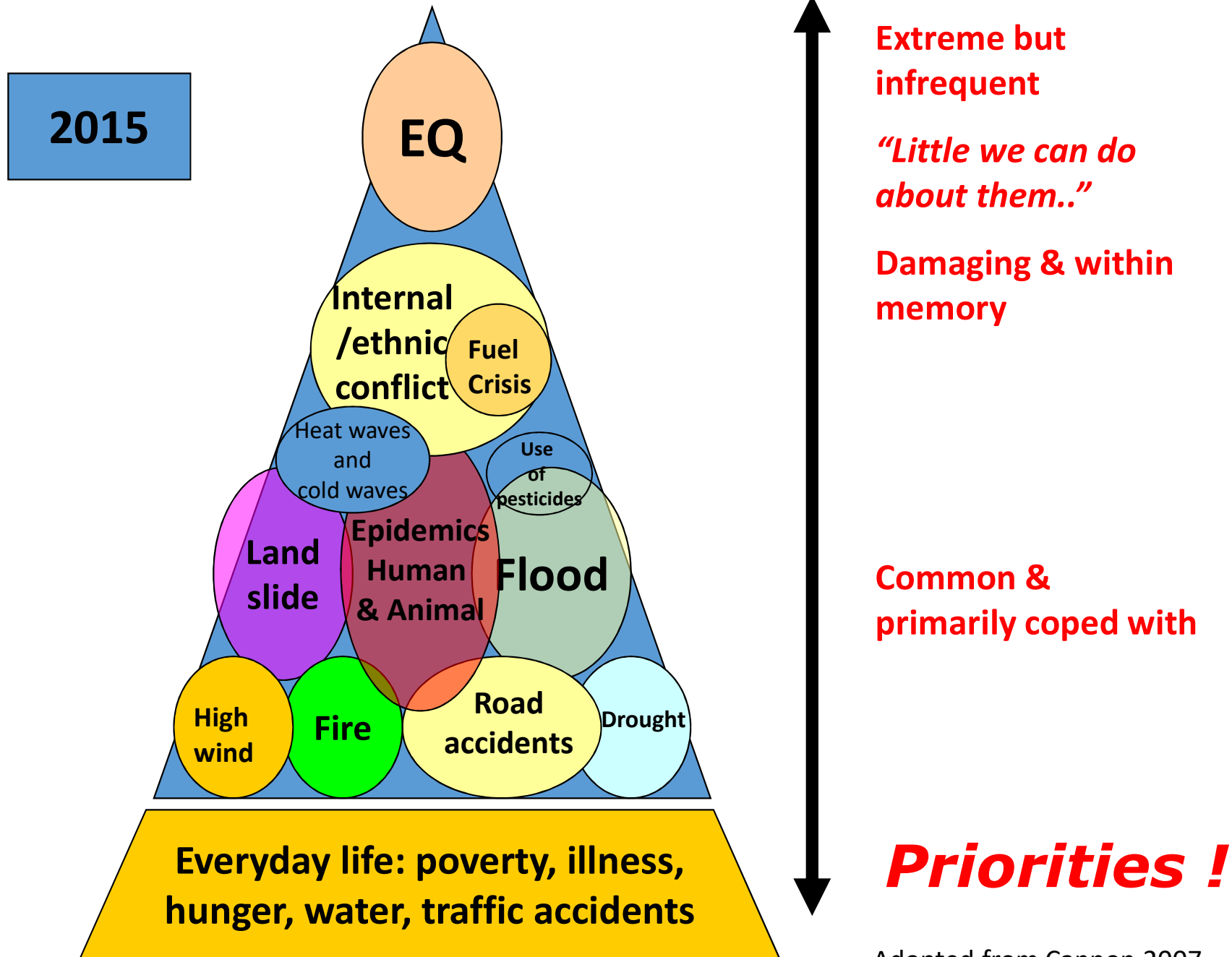


Disaster Risk Hierarchy in Nepal



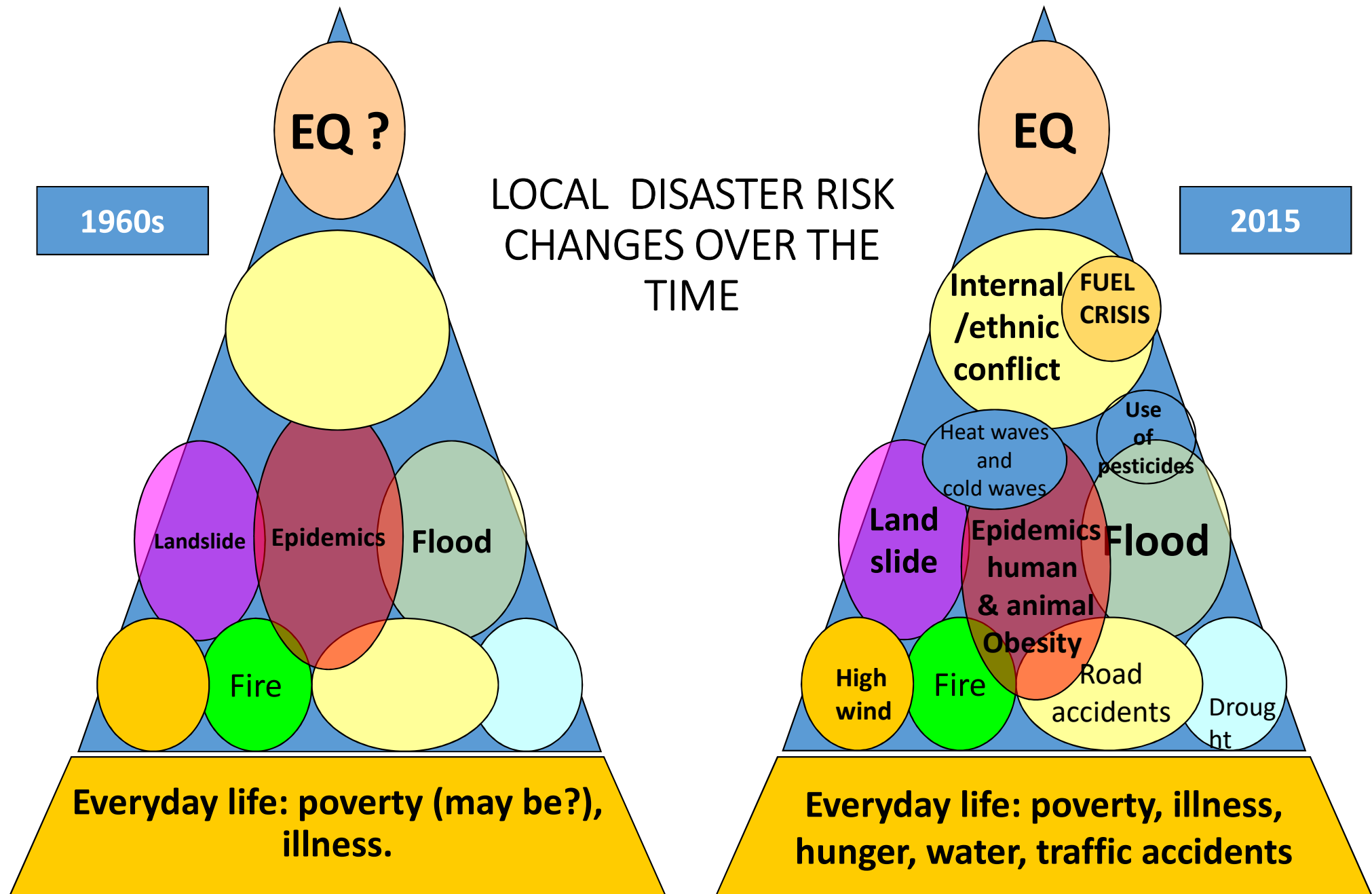
Adopted from Cannon (2007)

Disaster Risk Hierarchy in Nepal

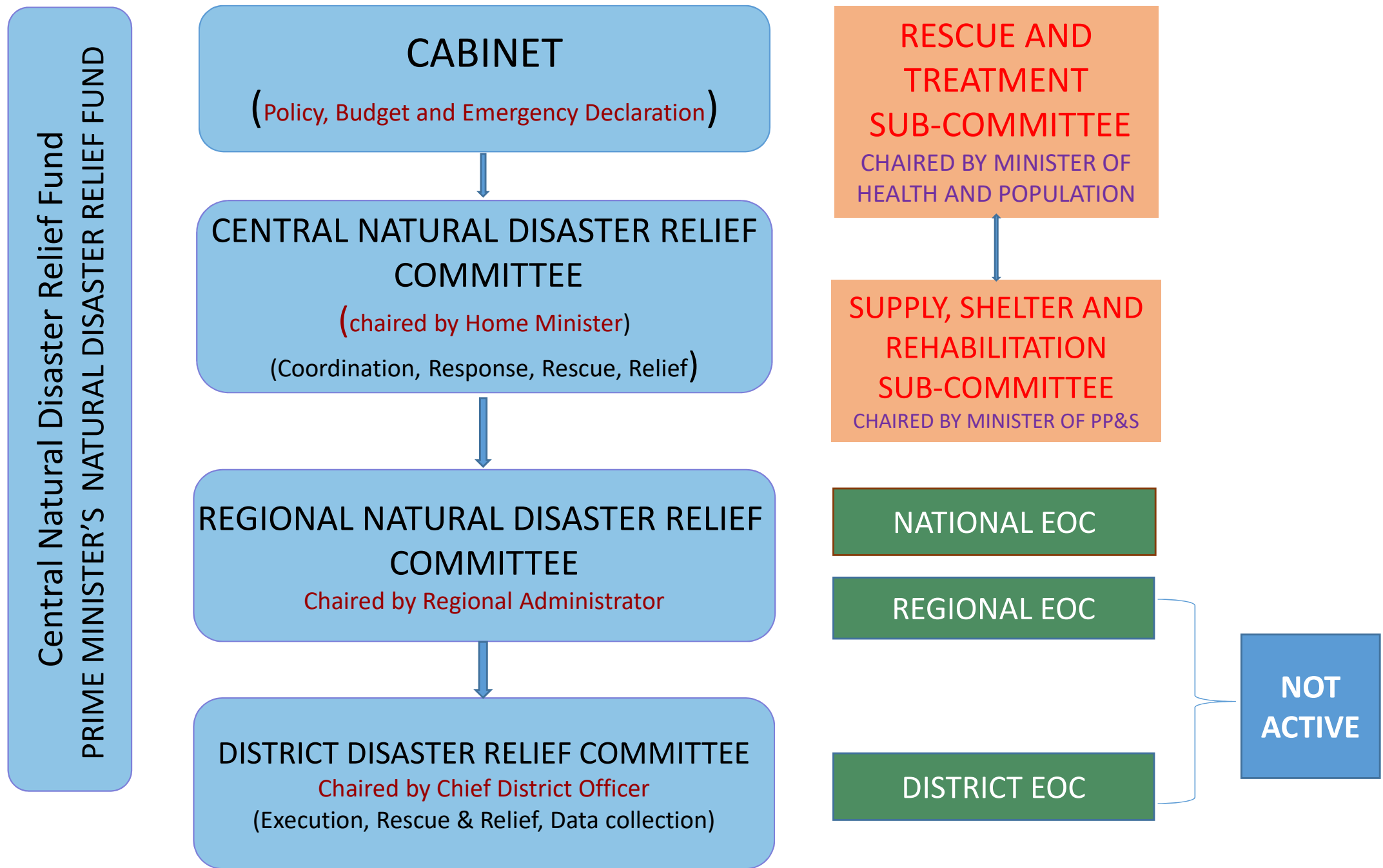


Adopted from Cannon 2007

Disaster Risk Hierarchy in Nepal



Institutional Framework (Disaster Response)



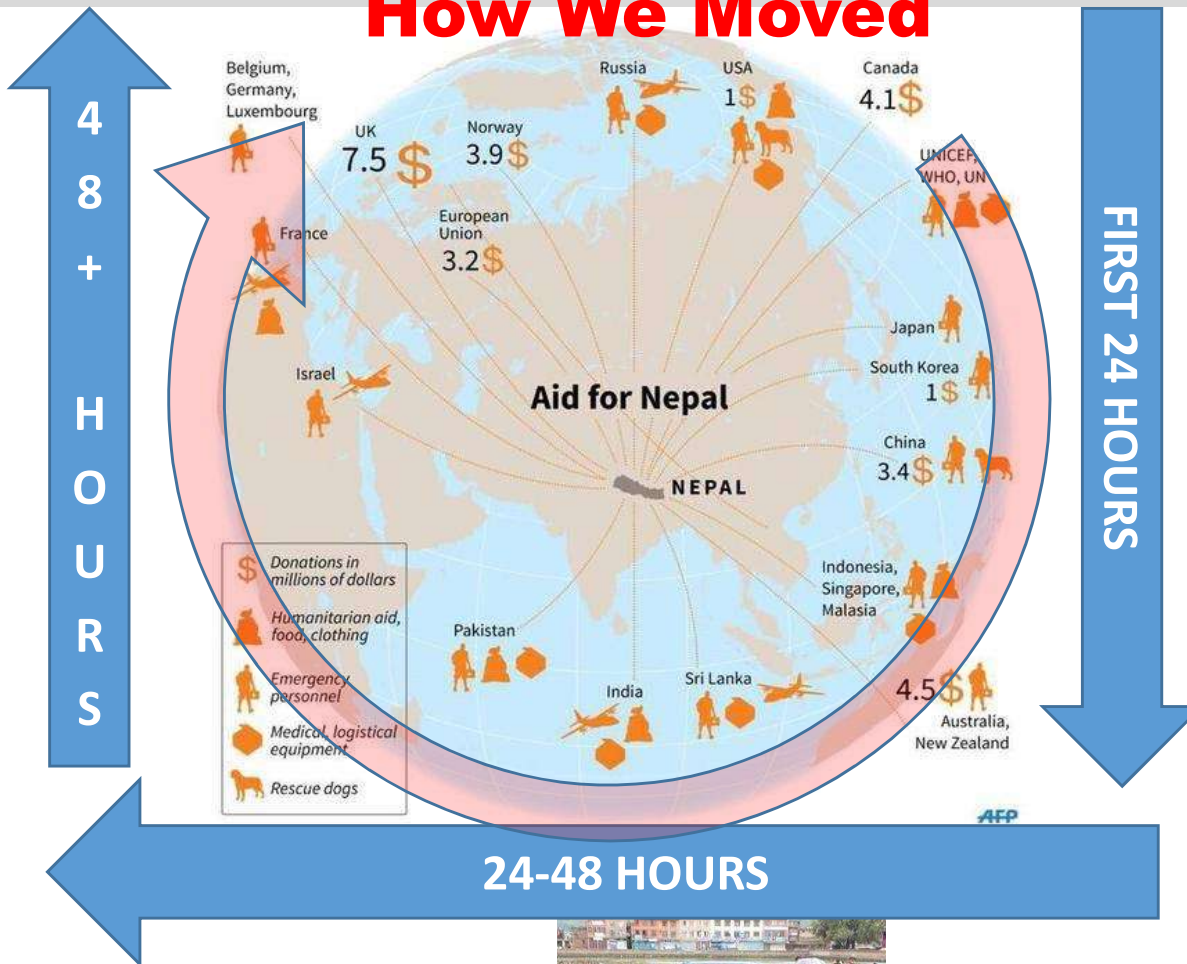
Legal Framework

Timeline of the Legal Framework for Disaster Management before the M7.8 Gorkha Earthquake



Basically for the sake of preparing for and reporting to international meetings (e.g.: UN)

2017 International Training Workshop for Natural Disasters How We Moved



What are the issues?

- We have been working a lot but the **achievement** is very less!
- We were/are **not at all prepared** to deal with disasters, not only earthquakes but also landslides and flood or any small-scale disasters
- The **New DMA Bill** is still pending
- We are **only focused** on reconstruction!
- Our state mechanism for disaster management and disaster preparedness is **very weak**
- Many more!

What may be the immediate action?

- Table the **new DMA bill** as soon as possible and revise it at the parliament
- Strengthen the **academic institutions** and do more **disaster-related research** on local issues
- Establish **national research institutes** (in government mechanism)
- Introduce **school and community-based** disaster education programs
- Strengthen **community** disaster groups
- Train and strengthen **local government** bodies

Present Status

2017 International Training Workshop for Natural Disaster Reduction @Taipei, 2017.7.17-18

○: Fully involved | △: Partly involved | ×: Not involved

	Pre-disaster responsibilities, preparedness and research	Emergency response, revival and restoration	Post-disaster responsibilities and reconstruction
■ Government Agencies:			
Ministry of Home Affairs	×	○	×
Ministry of Physical Infrastructure and Transportation	×	×	△
Ministry of Urban Development	×	×	△
Ministry of Irrigation (DWIDP)	△	△	△
Ministry of Federal Affairs and Local Development	×	×	×
Ministry of Forests and Soil Conservation	△	×	×
Ministry of Land Reform and Management	×	×	×
Ministry of Industry (DMG)	△	×	×
Department of Archeology	×	×	×
Reconstruction Authority (2015)	—	—	○
■ Non-Government Organizations (NGOs)	△	△	△
Local Community, Schools, Private Firms	△	△	△

Future Plan

2017 International Training Workshop for Natural Disaster Reduction @Taipei, 2017.7.17-18

○ : Fully involved | △ : Partly involved | × : Not involved

	Pre-disaster responsibilities, preparedness and research	Emergency response, revival and restoration	Post-disaster responsibilities and reconstruction
■ Government Agencies:			
Ministry of Home Affairs	△	○	○
Ministry of Physical Infrastructure and Transportation	○	△	○
Ministry of Urban Development	○	△	○
Ministry of Irrigation (DWIDP)	○	△	○
Ministry of Federal Affairs and Local Development	○	△	○
Ministry of Forests and Soil Conservation	○	△	○
Ministry of Land Reform and Management	○	△	○
Ministry of Industry (DMG)	○	○	△
Department of Archeology	○	○	○
Reconstruction Authority (2015)	—	—	—
■ Non-Government Organizations (NGOs)	○	△	△
Local Community, Schools, Private Firms	○	○	△

Linking Science/Engineering with Policy

- Networking with academic institutions and professional societies
- Networking with government institutions
- Regular scientific meetings (symposiums and seminars)
- Public forums (workshops)
- Local disaster leaders (**local politicians**) training (workshops)
- Exposure visit to Japan of young disaster workers, **media people, parliamentarians** to learn about disaster risk reduction
- School disaster risk reduction education
- **Networking with law makers** (Parliamentarians)
- **Reporting to government officials and seeking their support**

Pre-Disaster Plan

1

Immediate tabling/enacting of new NDMA and its implementation

- Land use law enforcement
- Enforcement and compliance to building code
- Road slope prevention and enforcement
- Road and river protection law enforcement
- Enforcement of line ministry collaboration
- Clarity in line ministries' responsibilities
- First step to disaster resilient nation building

2

President's National Disaster Education Program

Government Schools

NGOs

Local Governments

Local DRR Communities

Inclusion in government's policy and plans within this fiscal year

MP's Electoral Zone Development Fund

| Academic Institutions |
Program manual preparation

Various funding projects of JICA

| Academic Institutions |
Manual preparation, Disaster leaders' program, Disaster experts program, Licensing system

3

Disaster Research

Academic Research Institutes

1. TU: scientific research on earthquake, landslide and GLOF, etc.
2. PU (Pokhara): scientific research on landslides and flash floods
3. PU (Biratnagar): scientific research on flood and erosion in Siwalik area
4. Research-based degree programs

National Research Institutes

1. National Building and Material Research Institute (DUDBC)
2. National Seismology and Earthquake Engineering Research Institute (DMG)
3. National Water-induced Disaster Research Institute (DWIDP)
4. National Meteorology and Climatology Research Institute (DHM)

International Support

- Collaborative Research
- Fund/Budget
- Human resource training
- Research Capacity Building
- Partnership research development
- etc.

Self-sustainability after 10 years of international support

Why all this?

- National disaster policy addresses only 10% of the total need.
- We need to be prepared for bigger earthquakes and greater disasters in future.
- Present government mechanism will always fail to address the national need of disaster management capacity.
- Academic institutions have never planned/thought of prioritizing research and they will never.
- Government mechanism needs to be strengthened/changed for a long-term disaster management and infrastructure development plan.
- Millions of dollars have been spent annually in disaster risk reduction activities through various government agencies and NGOs in last two-three decades, but there is no change in government disaster capacity.
- Besides emergency response and post-disaster revival and reconstruction capacity, we need to develop our pre-disaster capacity such as disaster research and disaster education.
- In this scenario, all important government agencies that are somehow associated with disaster risk reduction activities and research need to be strengthened and repositioned inside the government mechanism with increased capacity.

Thank you!

Contact: netra@ehime-u.ac.jp