Natural Hazards in India - Earthquakes

- Earthquakes in India are less frequent in Peninsular India when compared to the Himalayan zone, where there is collision of plates leading to upheaval.
The Bhuj Earthquake, January 26, 2001

• The look of desperation and hope on the face of a child survivor.

• Will the help and support arrive?
What are the priorities?

• Protection of quake survivors.
• How?
• Who are the people responsible?
• Do they come at the right time?
• If not, who comes?
What next?

• It’s a matter of looking for whatever that can be obtained.

• Is it worthwhile?

• If at all it’s worthwhile, can the lives lost be gotten back?
Importance of Rescue Teams

More than the importance of the arrival of rescue teams, it is the response time that is VITAL in any natural disaster.
Rescuing people can be an arduous task

Searching for survivors can be testing, mentally and physically.
Hospital after Bhuj earthquake
Immediate medical aid

In any emergency, first aid assumes greatest importance.

It is imperative that participating communities are made aware of how to administer First Aid.
Much needed clothing
Importance of foreign assistance

In an emergency, and the trauma that follows, there is always SOLACE in a helping hand, whatever the nation may be.
The fate of orphaned children
Post-earthquake comforts?

When natural hazards strike at inopportune times, mankind is doubly affected.
Damage to buildings - Bhuj
Significance of demolition of prone buildings

It is imperative that inspections of buildings be made to assess whether they are EQ resistant, or otherwise. These have to be carried out on a regular basis.
Why should we panic?

Unless emergency measures such as evacuation of an area, for example, are made with proper planning, the net consequence can only be CHAOS.
Survivors fleeing in panic due to aftershocks
Taking undue advantage......
Past tsunamis in India

- 31 Dec. 1881 (Source: Prof. Roger Bilham) - 7.9 Richter scale earthquake beneath Car Nicobar - Entire east coast of India and Andaman & Nicobar Islands affected; 1 m tsunami recorded at Chennai.
- August 1883 (Source: Dr. Arun Bapat) - Explosion of the Krakatoa Volcano, Indonesia - East coast of India affected; 2 m tsunami recorded at Chennai.
- 26 June 1941 (Source: Dr. Arun Bapat) - 8.1 Richter scale earthquake in Andaman archipelago - East coast of India affected but no estimates of tsunami height available.
- 27 November 1945 (Source: Dr. Arun Bapat) - 8.5 Richter scale earthquake at a distance of about 100 km south of Karachi - West coast of India from north to Karwar affected; 12 m tsunami felt at Kandla.
Tide gauge network – Survey of India
Tide gauge records

Non-tidal oscillations continued at all the four locations well after the main event took place on the 26th December, 2004. Red arrow indicates the approximate time of occurrence of the earthquake off Sumatra and the blue arrow indicates the time of arrival of the disturbance at the tide gauge (Chennai at 09:05 a.m; Kochi at 11.10 a.m.;). The discontinuities in the sea level curves indicate data gaps.
Topography at the site of the main (m9.0) event. This has been generated using world digital topo data. According to this, the location of the event is about 1,300 m deep from surface of the water.
Coastal areas affected by 2004 tsunami
Destroyed houses at Kolachel
Destroyed house and car
Flooding and force
Officers clear debris in a village near Cuddalore's Silver Beach
Villagers from Car Nicobar island are flown to Port Blair
Survivors waiting for milk at a relief camp
Life goes on....
Rebuilding and Relief
Unraveling the past
Drifting ashore

The tsunami washed up a 9 inch-tall bronze Buddha on the coast off Kalpakkam in the state. It is believed to have been brought by the tsunami waves from Thailand!
Rehabilitation by the SIFFS
The smiles are back again
LANDSLIDES

• Vast expanse of areas in the country, particularly, in the Himalayan and other hilly terrains, being highly fragile, are perennially under repeated threats of landslides and mass movements.

• Building Materials and Technology Promotion Council (BMTPC), Ministry of Urban Development & Poverty Alleviation, New Delhi and Centre for Disaster Mitigation & Management (CDMM), Anna University, Chennai, have prepared the landslide Hazard Zonation Atlas of India.
Landslide hazard zonation

The Atlas presents the first ever Geographical Information System (GIS) based landslide inventory map and landslide hazard zonation maps of India at the scale of 1:6 million. A notable complimentary initiative in the Atlas is the inclusion of some of the worst landslides of India like Great Malpa Rock Avalanche of 1998, the Alaknanda Tragedy of 1970 and Amboori landslide of Kerala of 2001, which are still fresh in the minds of people as nightmares. These have resulted in creating wide public awareness on the subject, in the recent past, thereby justifying the need for this Atlas.
Incidences of landslides in India

- Himalayas – Very high to high.
- NE hills – High
- Western Ghats and Nilgiris – Moderate to high.

- Slope-Magnitude, length and Direction.
- Soil thickness.
- Relative relief.
- Land use.
- Drainage- pattern and density.
- Landslide affected population.
Darjeeling floods of 1968 destroyed vast areas of Sikkim and West Bengal by unleashing some 20,000 landslides, killing thousands of people. These landslides occurred over a three day period with precipitation ranging from 500 to 1000 mm in an event of a 100 year return period. The 60 km mountain highway to Darjeeling got cut off at 92 places resulting into total disruption of the communication system.
Other tragedies

• Alaknanda Tragedy of July 1970 that resulted from the massive floods in river Alaknanda, upon breach of a landslide dam at its confluence with river Patal Ganga.

• The Malpa rock avalanche instantly killed 220 people and wiped out the entire village of Malpa on the right bank of river Kali in the Kumaun Himalaya.

• Amboori landslide in the State of Kerala killed 23 people.
Landslides in the Nilgiris

The major landslides in the Nilgiri Hills are the Runnymede landslide, the Glenmore slide, the Conoor slide and the Karadipallam slide. In the recent times, casualties and damage due to landslides have increased in the Nilgiri hills.

Why???
Aftermath of a landslide in the village of Shajouba, Manipur, India, on Monday 19th September 2007. The disaster destroyed dozens of houses and led to the closure of the state highway which connects the Ukhrul District of Manipur and the Phek District of Nagaland.
DETAILED STUDIES OF VARUNAVAT PARVAT LANDSLIDE IN UTTARKASHI TOWN, UTTARANCHAL HIMALAYAS

• Uttarkashi town located at the toe of Varunavat Parvat on the right bank of Bhagirathi; covers 12 sq km area and inhabited by 16,000 people.

• Natural disasters faced by the town include floods in Bhagirathi in 1978, m=6.6 earthquake in 1991 and disastrous landslide in September-October in 2003.

• Massive landslide Varunavat Parvat started on September 24, 2003, following incessant rains in the area.

• The slide debris buried a number of buildings having houses, hotels, government offices etc located near the toe of hill slopes.

• This affected 3,000 people and damaged property worth rupees 500 million.

• During August 2003, the geologists of GSI observed movement in slopes and advised district administration for evacuation of population from the toe area of the hill slopes. Prompt action by the district administration saved human lives when disaster struck the area.
Landslide at Dhirenpara, Gauhati, Assam
Landslide at Dhirenpara, Gauhati, Assam
Landslide, Umshing, NH-40, Meghalaya
FLOODS

• India is divided into four flood regions according to the river systems. They are the Brahmaputra region, Ganga region, the Indus region and the central and Deccan regions comprising of the rivers Narmada, Tapti and all rivers flowing south eastwards.

• It is estimated that an average of 40 million hectares is subjected to floods annually.
River basin map
(Source: http://www.cwc.nic.in)

- Northern states worse hit than southern states.
- North Indian rivers are perennial.
- NE and Bihar are some of the worst affected regularly.
Bihar – Flood-affected blocks
Floods in 2002

- The mid-July monsoons of 2002, which lashed across the country, flooded 13 states and took a toll of 841 lives and 3,729 cattle. The floods washed over 11 districts, destroyed 485,048 houses and 17,176 villages. Assam and Bihar states were the worst hit and over 20 million people were affected. Water cascading down from the Himalaya mountains caused flooding and breaches in river embankments throughout northern India.
Floods in 2003

- Assam, Bihar, West Bengal, Orissa and Arunachal Pradesh worst affected.
- The worst-hit areas in India were the north-eastern states of Assam and Bihar.
- 20,000 people were stranded in a single district of Assam.
- thousands of bamboo and straw huts, as well as roads, bridges, railway tracks and power lines.
- Darjeeling's hilly interior region practically cut off, and road links with both Darjeeling and Sikkim blocked.
Flood in Assam – 2001
Flood in Bihar – 2002
Road damaged by flood
Flood in Assam – 2002
What is drought?

There are 3 types of drought:

• **Meteorological drought** - When the actual rainfall in an area is significantly less than the climatological mean of that area.

• **Hydrological drought** - Marked depletion of surface water causing very low stream flow and drying of lakes, rivers and reservoirs.

• **Agricultural drought** - Inadequate soil moisture resulting in acute crop stress and fall in agricultural productivity.
DROUGHTS IN INDIA

Droughts in India have resulted in tens of millions of deaths over the course of the 18th, 19th, 20th and 21st centuries. Indian agriculture is heavily dependent on the climate of India: a favorable southwest summer monsoon is critical in securing water for irrigating Indian crops. In some parts of India, the failure of the monsoons result in water shortages, resulting in below-average crop yields. This is particularly true of major drought-prone regions such as southern and eastern Maharashtra, northern Karnataka, Andhra Pradesh, Orissa, Gujarat, and Rajasthan.
In the past, droughts have periodically led to major Indian famines, including the Bengal famine of 1770, in which up to one third of the population in affected areas died; the 1876–1877 famine, in which over five million people died; the 1899 famine, in which over 4.5 million died; and the Bengal famine of 1943, in which over five million died from starvation and famine-related illnesses.
Major factors responsible

- Deficient rainfall
- Demographic pattern
- Poor water management strategy
- Indiscriminate exploitation of groundwater by industries
- Large-scale deforestation
Drought map of India
IMPACT OF DROUGHT

• Famines
• Malnutrition
• Epidemics
• Forced migration
• Economic destabilization
• Loss of life
• Social conflicts
### EFFECTS

**PRIMARY**

- Loss of water for drinking and hygienic use
- Loss of crops, livestock and other animals
- Loss of employment in agricultural and farm sectors

**SECONDARY**

- Migration of people in search of water
- Large-scale deaths due to famine
- Spreading of epidemics
- Permanent changes in settlement patterns and living and social styles
Frightening figures - 2002

- Chhattisgarh: 10,252 villages in 12 of 16 districts, 9,400,000 people affected.
- Gujarat: 12,240 villages in 22 of 25 districts, 29,100,000 people, 107,00,000 cattle.
- Madhya Pradesh: 22,490 villages in 32 of 45 districts, 12,700,000 people, 8,570,000 cattle.
- Orissa: 15,000 villages in 28 of 30 districts, 11900,000 people, 39900,000 cattle.
- Rajasthan: 31,000 villages in 31 of 32 districts, 33,000,000 people, 39,900,000 cattle.
- Himachal Pradesh: All 12 districts affected, 4600,000 people, 88,000 hectare of crop area.
- Maharashtra: 20,000 villages in 26 of 35 districts, 45,500,000 people, 258,000 cattle.
- Uttarakhand: One district affected.
Women in Gujarat trek miles to fetch water delivered by tankers
People in a queue for drinking water
Women from the drought-affected Kutch district in Gujarat draw water from a pump.
A lady takes water to her house on a donkey
Women collect water from a well in Kurla, Orissa.
Farmers use a dead tree and a pulley try to retrieve water from an almost dry well.
A tired young girl, Sambhi Bhen, prepares for the long wait for water.
With temperatures hitting 45C two men take respite from the immense heat.
Carcasses being readied for transport in drought-hit Rajasthan
Desertification and Overexploitation of groundwater
Severe depletion of water table levels in Andhra Pradesh
Children collecting water during drought
People gather to get water from a huge well in the village of Natwargadh in Gujarat on June 1, 2003. Natwargadh was in the midst of the worst drought in over a decade.
Cyclones

- Deep Depression - 28 – 33 knots (52 – 61 kmph)
- Cyclonic Storm - 34 – 47 knots (62 – 87 kmph)
- Severe Cyclonic Storm - 48 – 63 knots (88 – 117 kmph)
- Very Severe Cyclonic Storm - 64 – 90 knots (118 – 167 kmph)
- Very Severe Cyclonic Storm - 91 – 119 knots (168 – 221 kmph)
- Super Cyclonic Storm - 120 knots and above (222 kmph and above)
Cyclone map of India
Cyclone 03B

- **Cyclone 03B** (IMD designation: *Deep Depression BOB 03/2007*) was a deadly tropical cyclone that made landfalls on India and Pakistan. The Pakistan Meteorological Department referred to Tropical Cyclone 03B as "Tropical Cyclone Yemyin". However, the official WMO body responsible for tropical cyclones in the Arabian Sea, the India Meteorological Department, did not name the storm. Thus, the storm officially has no name and the name "Yemyin" remained unused after the storm.
Cyclone 03B - Facts

• **Formed** - June 21, 2007
• **Dissipated** - June 26, 2007
• **Highest winds** - 55 km/h (35 mph) (3-minute sustained) 95 km/h (60 mph) (1-minute sustained)
• **Lowest pressure** - \( \leq 990 \) hPa (mbar)
• **Fatalities** - at least 950 direct
• **Damage** - Unknown
• **Areas affected** - India, Pakistan, Afghanistan
• **Part of the** 2007 North Indian Ocean cyclone season
Cyclone track

TRACK PREDICTION BY IMD MODEL
based on 00 UTC of 03-06-2007
1999 Orissa cyclone

**Formed** - October 25, 1999

**Dissipated** - November 3, 1999

**Highest winds** - 260 km/h (160 mph)

**Lowest pressure** - < 912 hPa (mbar)

**Fatalities** - 10,000+ direct

**Damage** - $4.5 billion (1999 USD)
$5.4 billion (2006 USD)

**Areas affected** - India, Myanmar

**Part of the** 1999 North Indian cyclone season
Track of 1999 Orissa cyclone
A view of 1999 Orissa cyclone
A scene of appalling devastation following the cyclone
Washed-out roads slowed the relief effort in Orissa
Villagers wait for army boats to transport them across a washed out road in Soro.
Many roads were washed away
In Ersama, members of the Catholic Mission head off to remove the bodies of the victims.
In flooded paddy fields destroyed by the cyclone, the Catholic Mission retrieve a floating body
A member of a voluntary organization ensures the cremation process is complete.
Attention is now focused on providing relief to survivors
At a medical centre in Ersama, 350km south of Calcutta, villagers await their turn as a doctor examines a child suffering from diarrhoea.
Children in Raghunathpur village wait in a long queue to collect kerosene.
A farmer begins his morning with a shave from the village barber, in front of his cyclone-damaged house in Balikuda.