NATURAL HAZARDS

By

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Natural Hazards

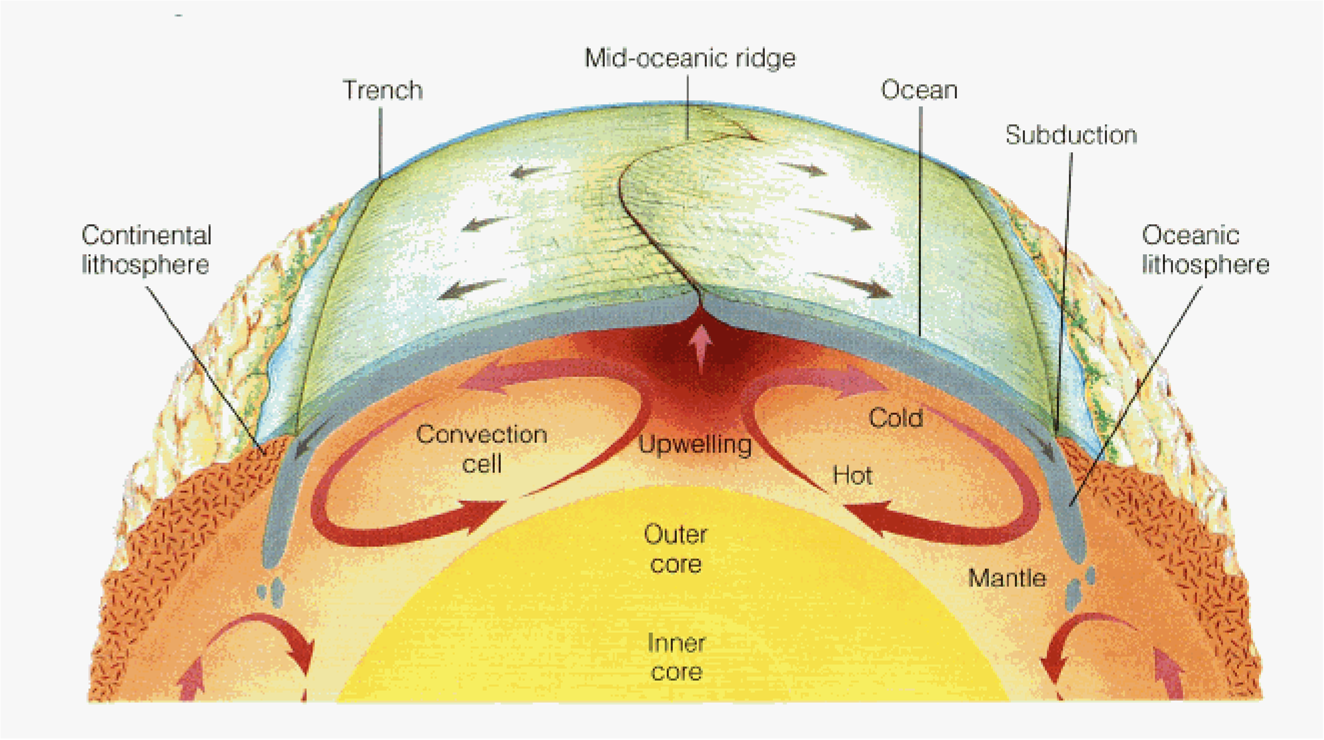
A. Geophysical:
1. Volcanoes,
2. Earthquakes
3. Tsunamis
4. Hill slopes failure and Landslides

B. Hydrological:
1.Snowy avalanches,
2.Floods,

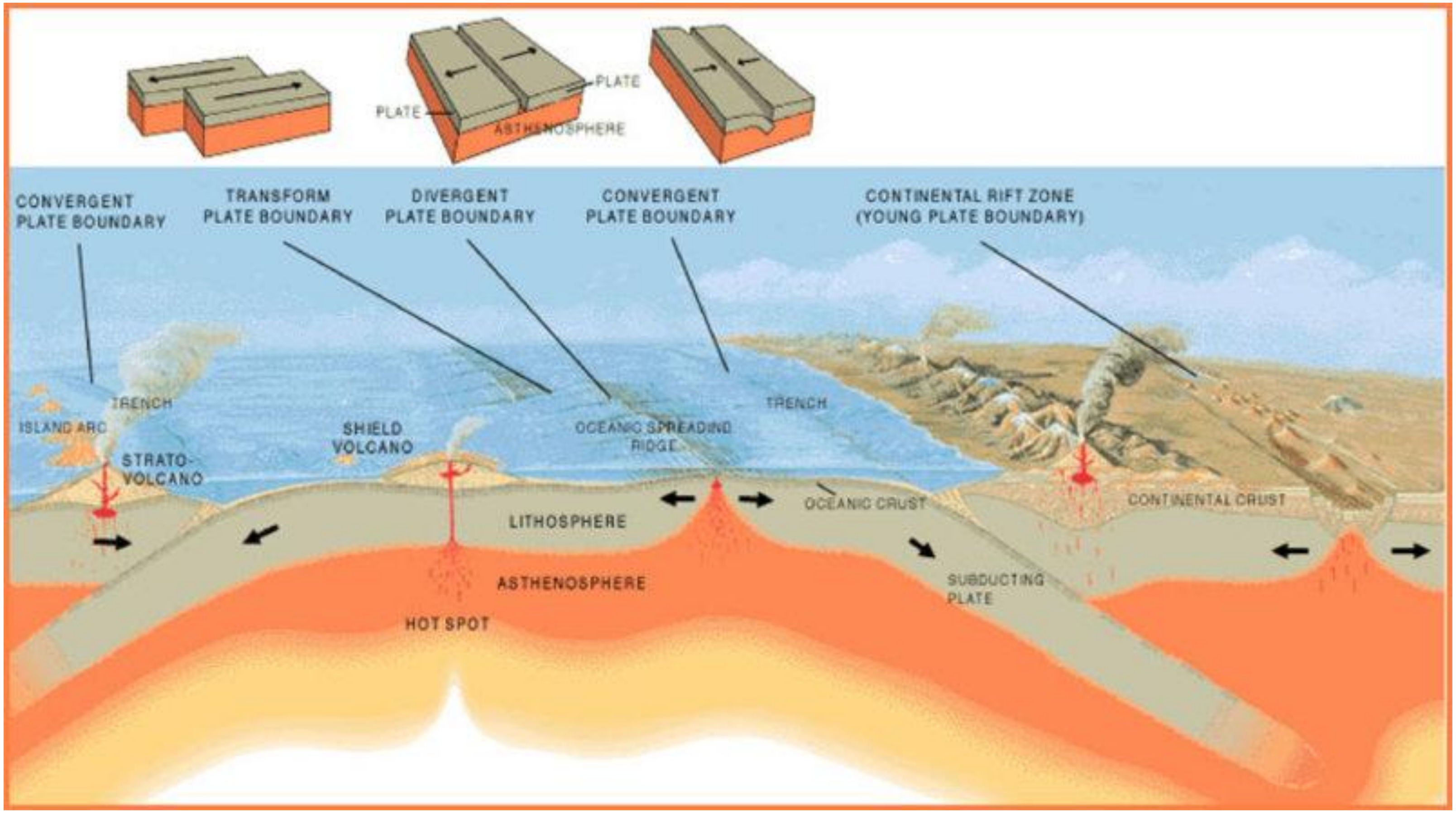
C: Meteorological
4. Cyclones,
5. Droughts

Causes of Geophysical hazards

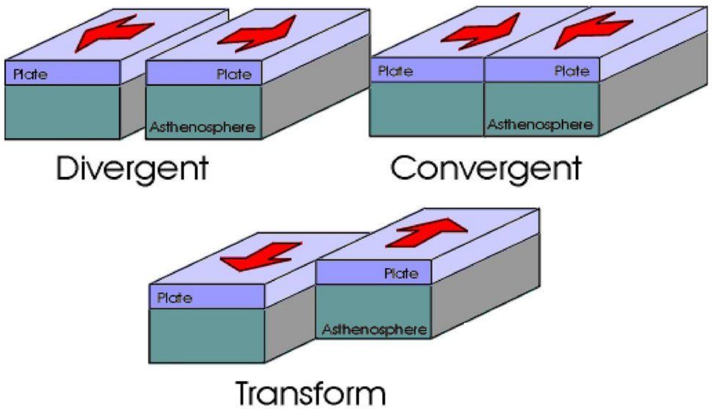
Convection currents are the result of differential heating. Lighter (less dense), warm material rises while heavier (more dense) cool material sinks. It is this movement that creates circulation patterns known as convection currents in the atmosphere, in water, and in the mantle of Earth.

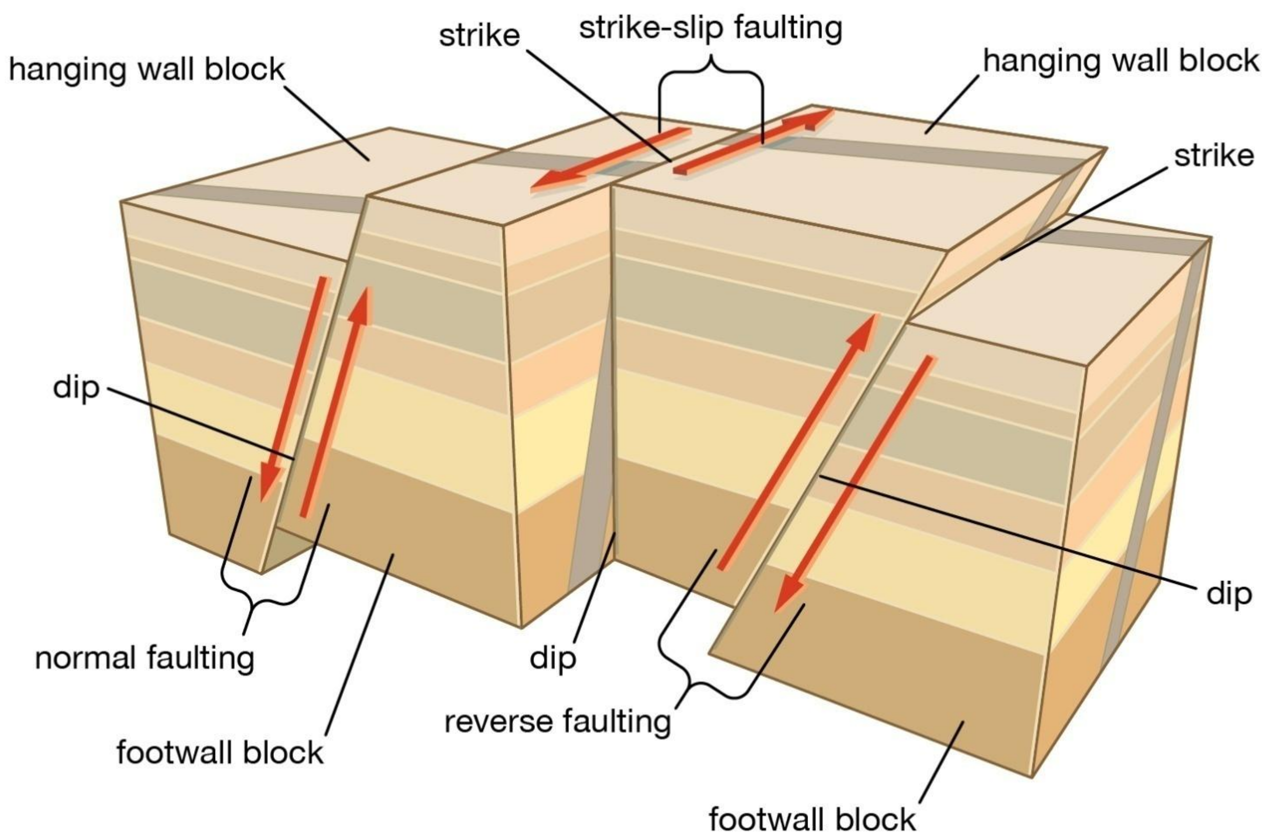


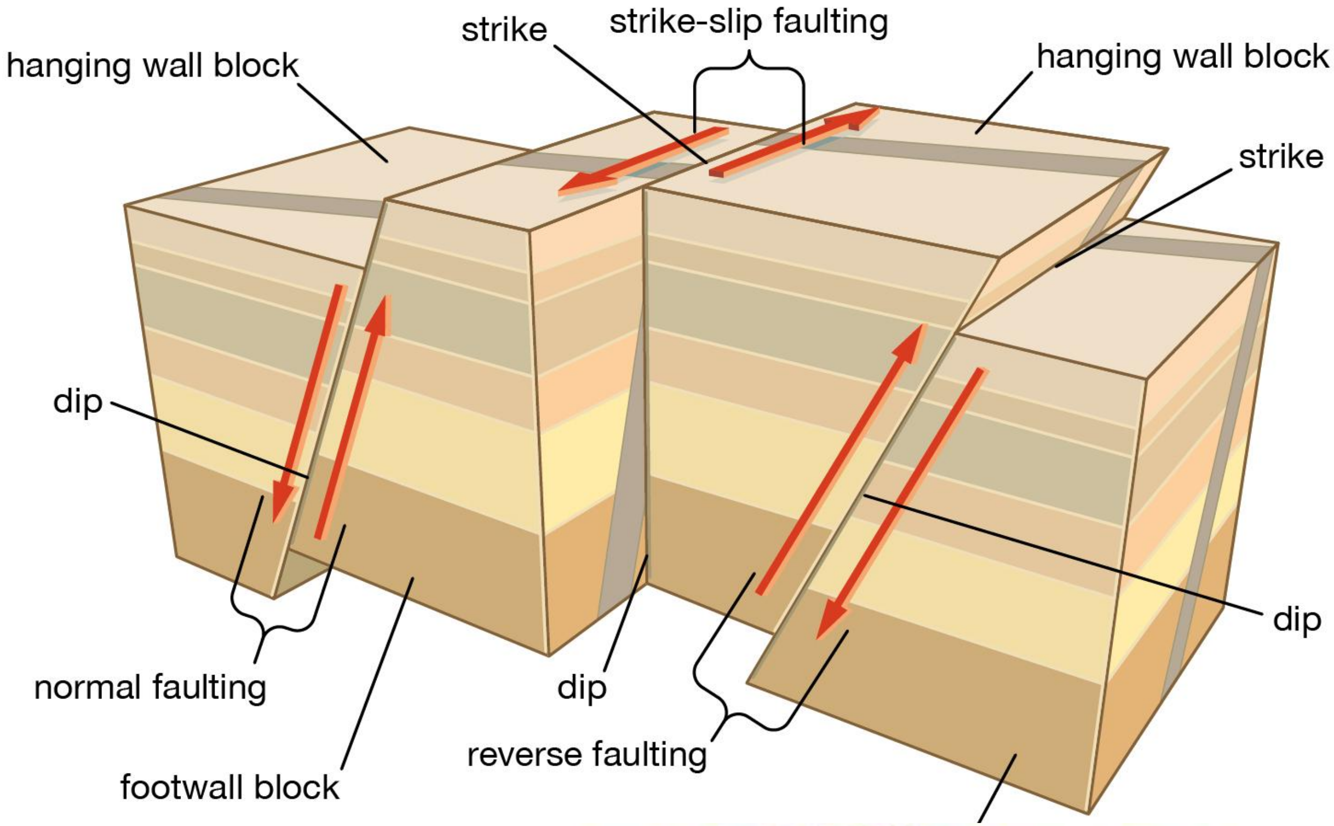
Causes of Geophysical hazards

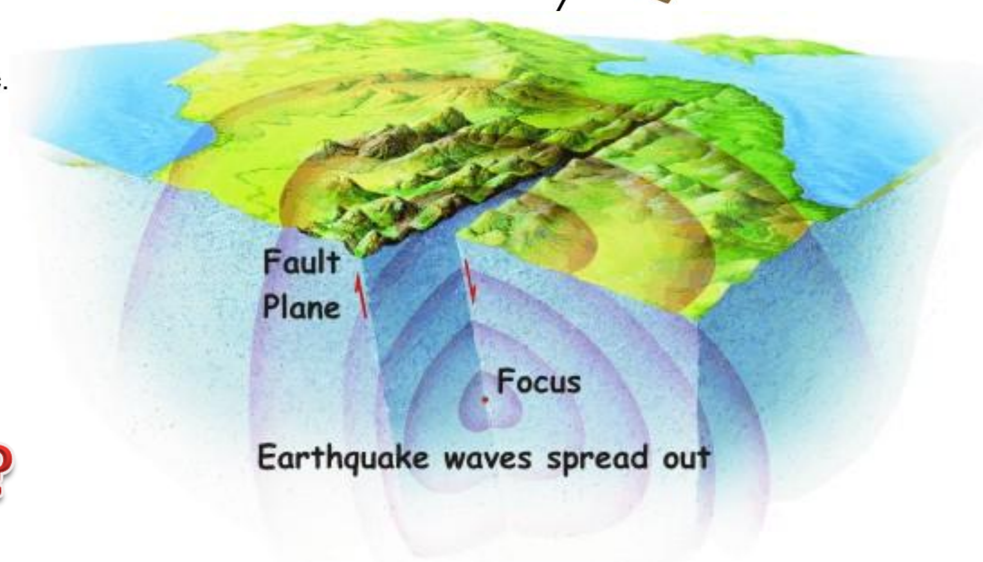


The 3 main types of plate boundaries/margins





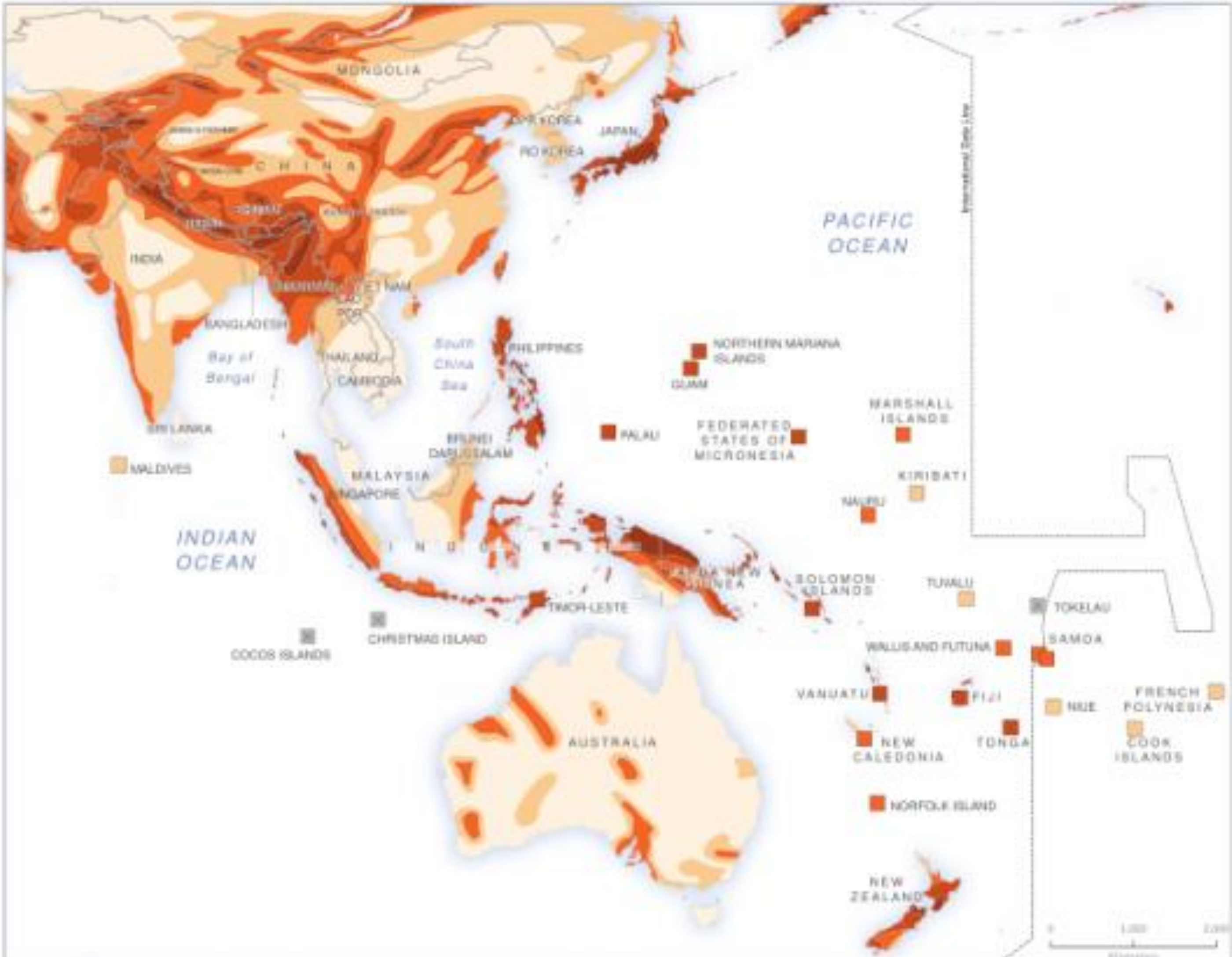




How a earthquake occurs ?

Asia-Pacific: Earthquake Risk - Modified Mercalli Scale

OCHA



Earthquake Intensity Risk Zones

This map shows earthquake intensity zones in accordance with the 1956 version of the Modified Mercalli Scale (MM), describing the effects of an earthquake on the surface of the earth and integrating numerous parameters such as ground acceleration, duration of an earthquake, and subsoil effects. It also includes historical earthquake reports.

The Zones indicate where there is a probability of 20 percent that degrees of intensity shown on the map will be exceeded in 50 years. This probability figure varies with time, i.e., it is lower for shorter periods and higher for longer periods.

Pacific islands and countries too small to be easily visible are represented by boxes giving an approximate level of equivalent risk based on data from Munich Reinsurance Company's NATHAN system.

I. Instrumental	VII. Very Strong
II. Feeble	VIII. Destructive
III. Slight	IX. Ruinous
IV. Moderate	X. Disastrous
V. Rather Strong	XI. Very Disastrous
VI. Strong	XII. Catastrophic

Earthquake Intensity (Modified Mercalli Scale)

- Degree I-V
- Degree VI
- Degree VII
- Degree VIII
- Degree IX-XII
- Insufficient data

The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations. **Feedback:** ocharoap@un.org **Creation date:** Dec 2014 **Map Doc Name:** OCHA_ROAP_Earthquakes_v1_2014

Sources: UN Cartographic Section, Pacific Disaster Center (PDC), Natural Hazard Assessment Network (NATHAN) by the Munich Reinsurance Company (Munich Re.), UNEP/GRID

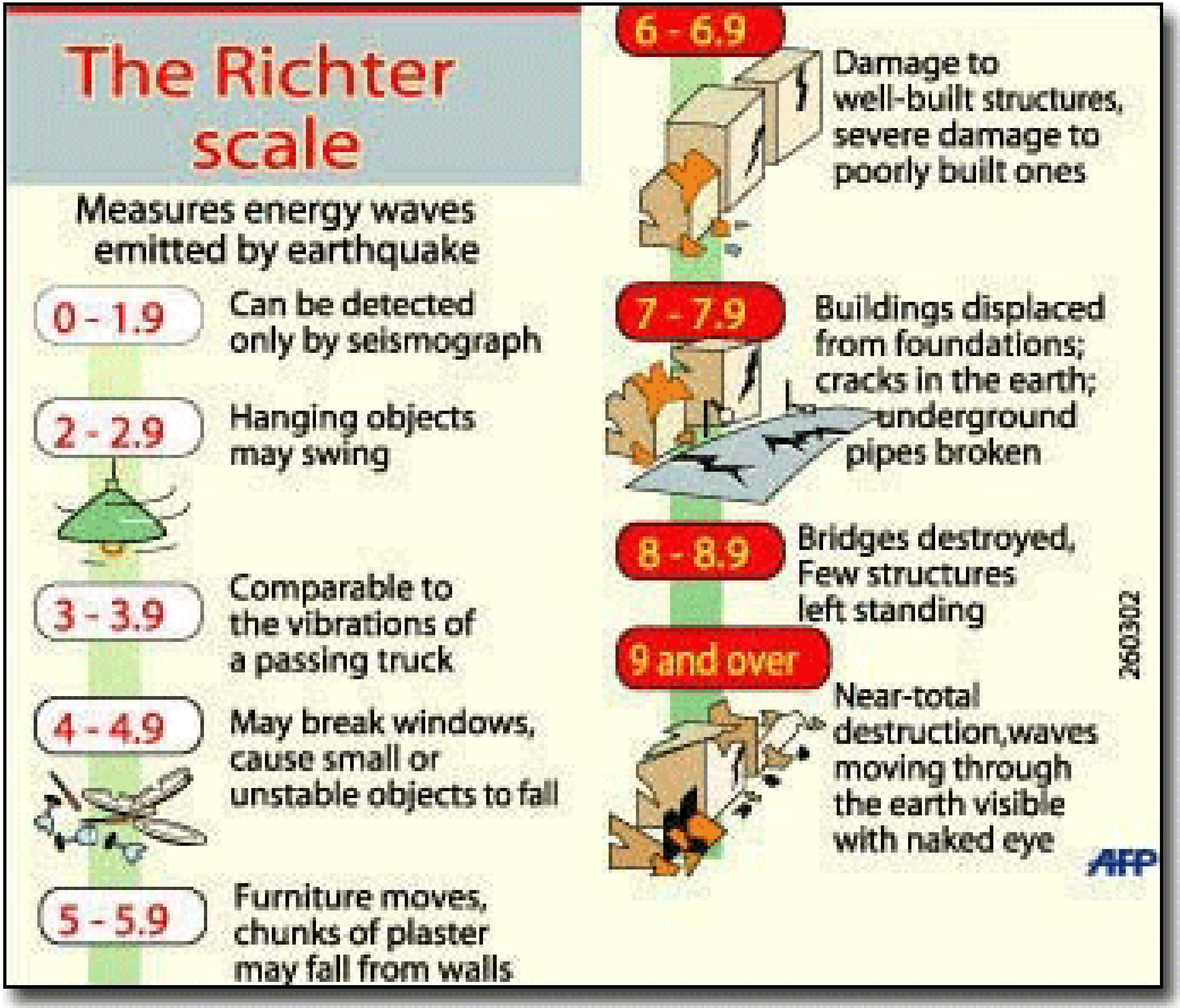
Understanding the Richter Scale:

Richter Magnitude	Feels like KG of TNT	Extra Information
0-1	0.6-20 kilograms of dynamite	We can not feel these
2	600 kilograms of dynamite	Smallest Quake people can normally feel
3	20,000 kilograms of dynamite	People near the epicenter feel this quake
4	60,000 kilograms of dynamite	This will cause damage around the epicenter. It is the same as a small fission bomb
5	20,000,000 kilograms of dynamite	Damage done to weak buildings in the area of the epicenter
6	60,000,000 kilograms of dynamite	Can cause great damage around the epicenter
7	20 bilion kilograms of dynamite	Creates enough energy to heat New York city for one year. Can be detected all over the world. Causes serious damage
8	60 bilion kilograms of dynamite	Causes death and major destruction. Destroyed San Francisco in 1906
9	20 trillion kilograms of dynamite	Rare, but would causes unbelievable damage!

Richter Scale of Earthquake Energy:

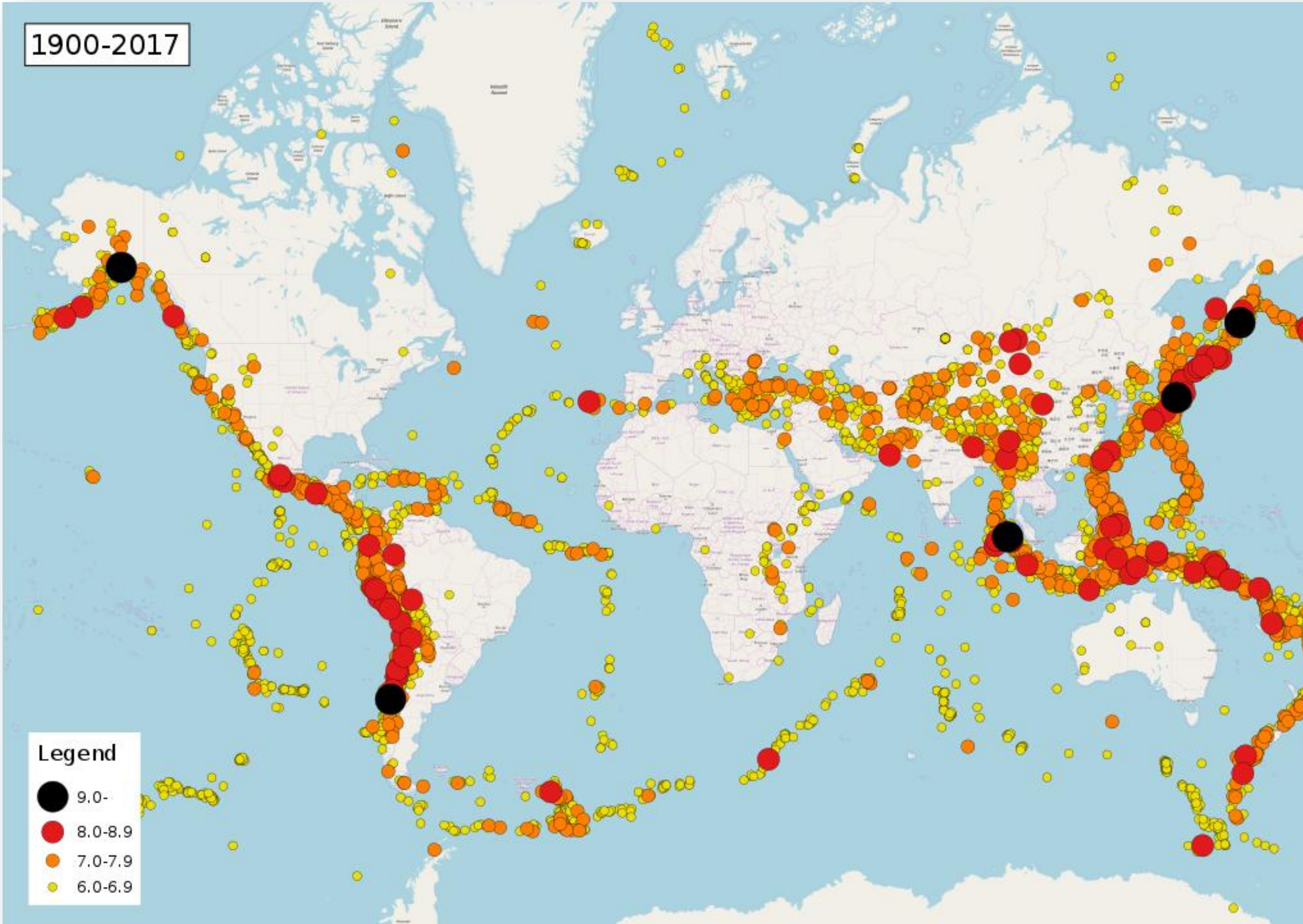
Each level is 10 time stronger than the previous level

	Description	Occurrence	In Population	Movement
1	Small	Daily	Every minute	Small
2	Small	Daily	Every hour	Small
3	Small	Daily	Every day	Small
4	Small	Daily	Every week	Moderate sudden
5	Moderate	Monthly	Every 10 years	Strong Sudden
6	Moderate	Monthly	Every 30 years	Strong Sudden
7	Major	Monthly	Every 50 years	Severe Sudden
8	Great	Yearly	Every 100 years	Very Severe
9	Great	Yearly	Every 300 years	Very Severe
10	Super	Rarely	Every 1.000 years	Extreme

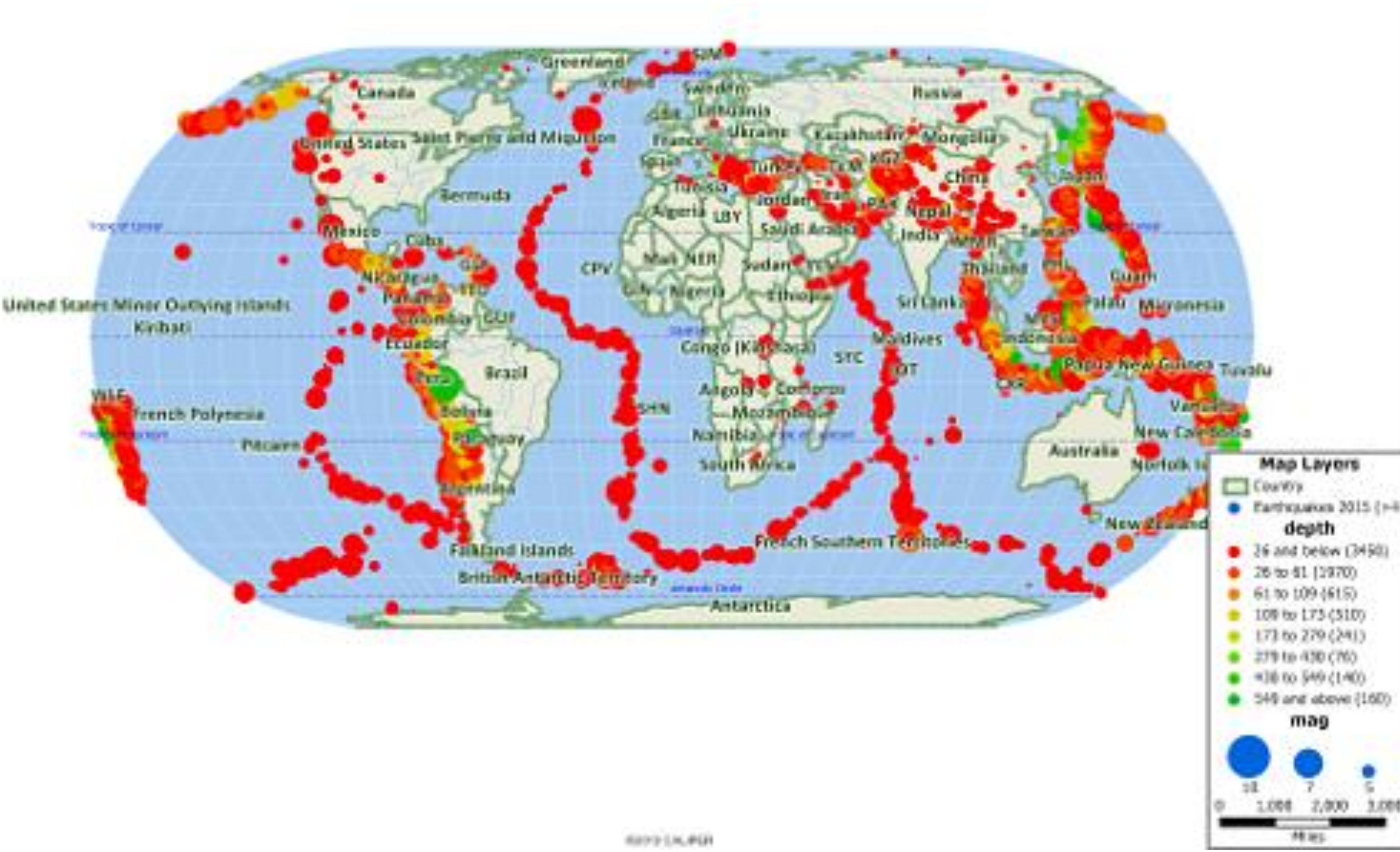

The Richter scale
Measures energy waves emitted by earthquake
0 - 1.9
Can be detected only by seismograph
2 - 2.9
Hanging objects may swing
3 - 3.9
Comparable to the vibrations of a passing truck
4 - 4.9
May break windows, cause small or unstable objects to fall
5 - 5.9
Furniture moves, chunks of plaster may fall from walls
6 - 6.9
Damage to well-built structures, severe damage to poorly built ones
7 - 7.9
Buildings displaced from foundations; cracks in the earth; underground pipes broken
8 - 8.9
Bridges destroyed, Few structures left standing
9 and over
Near-total destruction,waves moving through the earth visible with naked eye
260302
AFP

The Modified Mercalli Intensity Scale

Intensity	Shaking	Description/Damage
I	Not felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felto nly by a few persons at rest,especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.


1900-2017
Legend
9.0-
8.0-8.9
7.0-7.9
6.0-6.9

Map of earthquakes for 2015. Size denotes magnitude (a modern scale that replaces ‘Richter Scale’) and the color denotes depth (in km). Click for larger view.



Seismic Zone Map of India: -2002

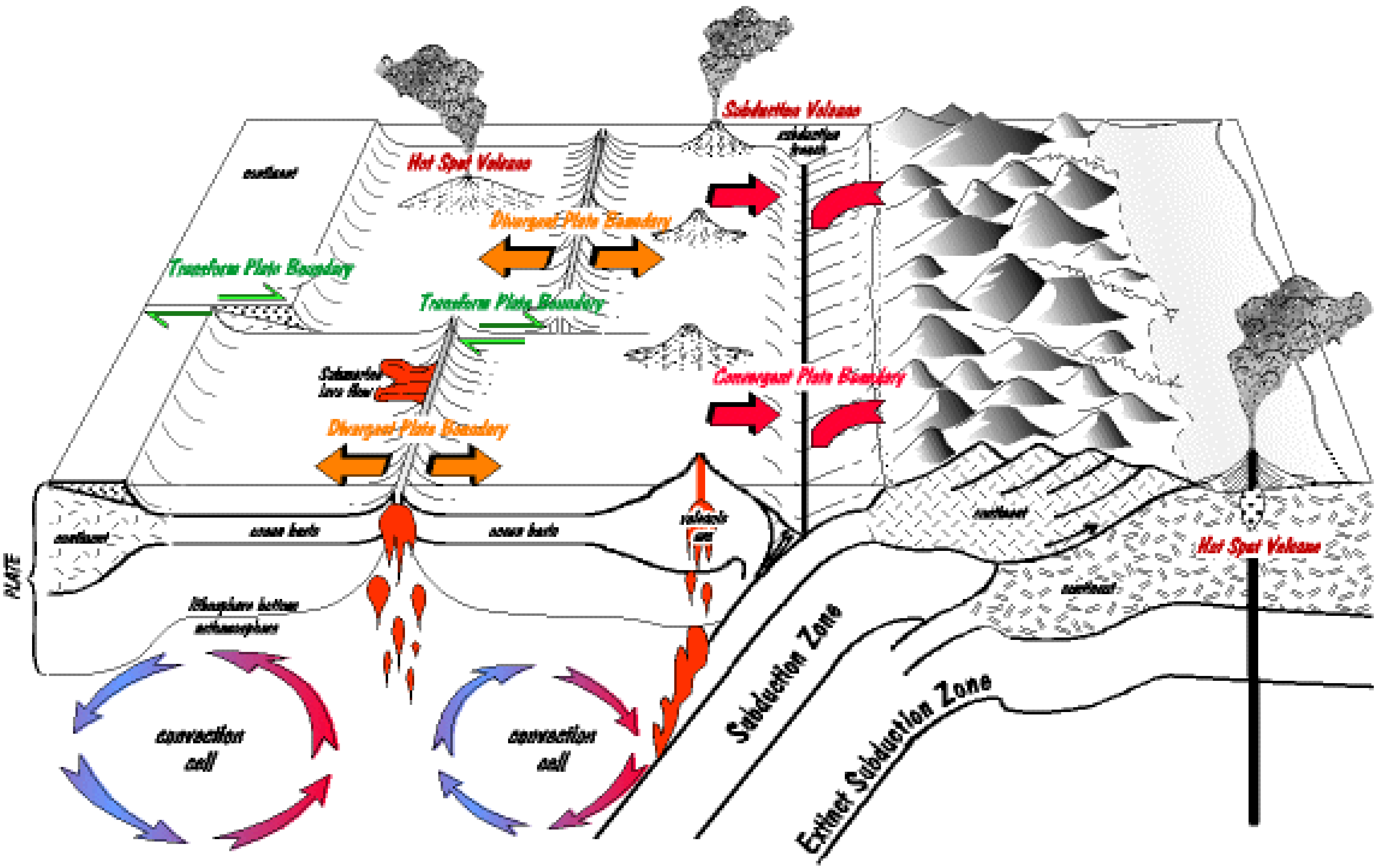
About <u>59 percent</u> of the land area of India is liable to seismic hazard damage

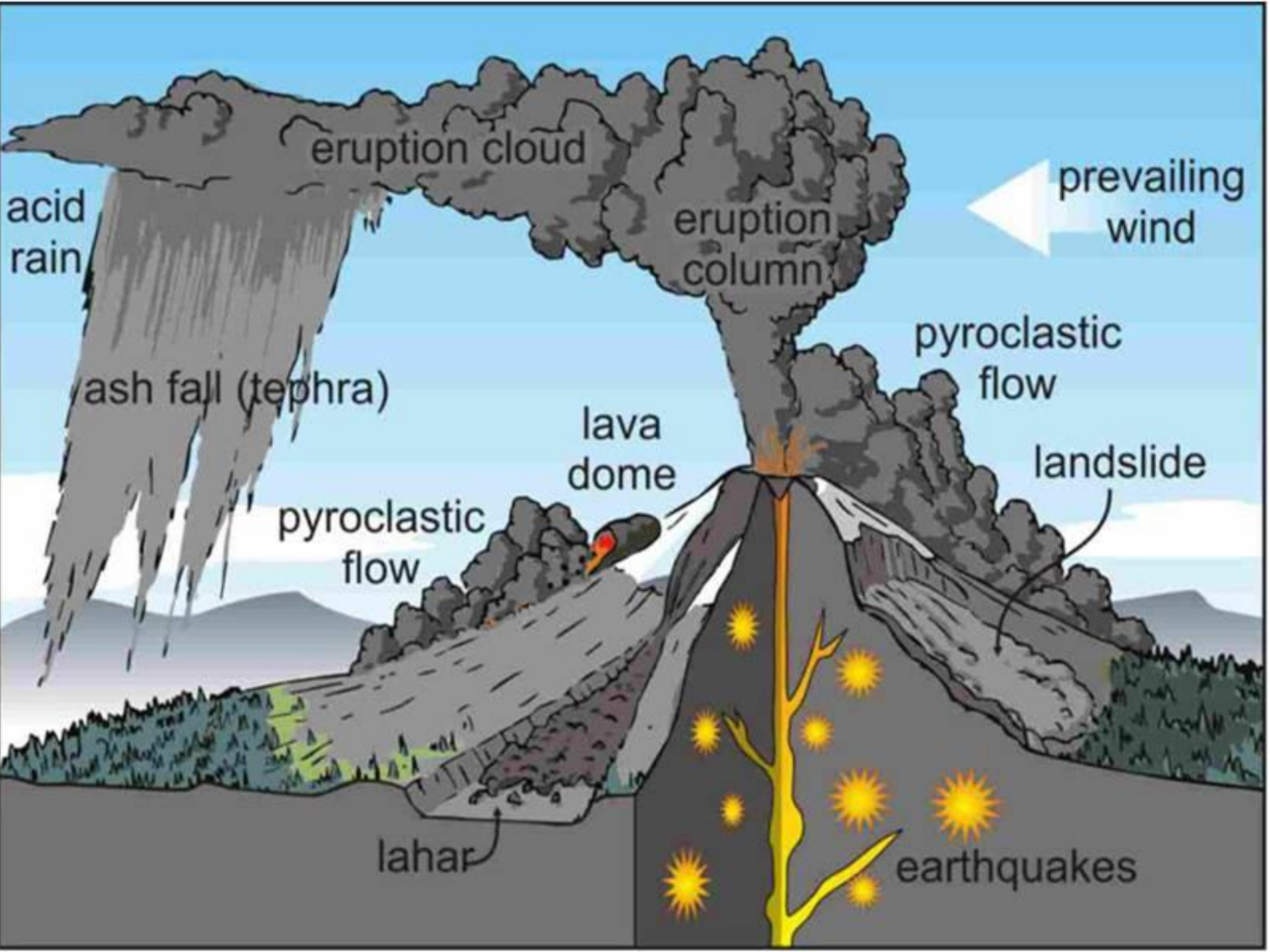
Zone	Intensity
Zone V	Very High Risk Zone Area liable to shaking Intensity IX (and above)
Zone IV	High Risk Zone Intensity VIII
Zone III	Moderate Risk Zone Intensity VII
Zone II	Low Risk Zone VI (and lower)

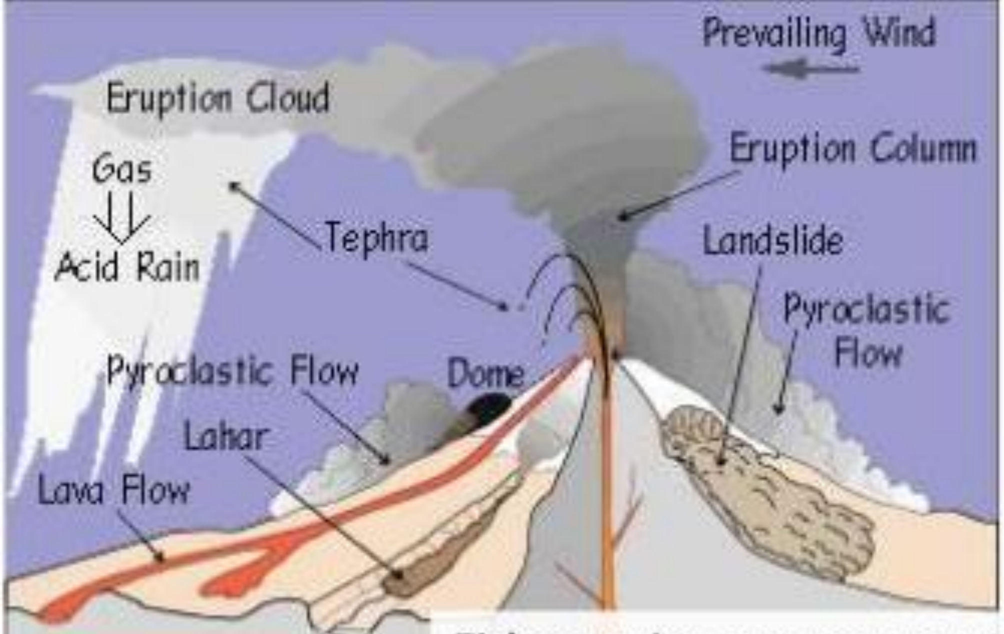
Seismic Zones in India


UTTARAKHAND EARTHQUAKE ZONATION
N
Uttarkashi
Rudraprayag
Chamoli
Dehradun
Tehri
Pithoragarh
Bageshwar
Haridwar
Pauri
Almora
Nainital
Champawat
Udham Singh Nagar
0 15 30 60 90 120
Kilometers
zone V
zone IV

How a volcano occurs ?




eruption cloud
acid rain
prevailing wind
eruption column
pyroclastic flow
ash fall (tephra)
lava dome
landslide
pyroclastic flow
lahar
earthquakes

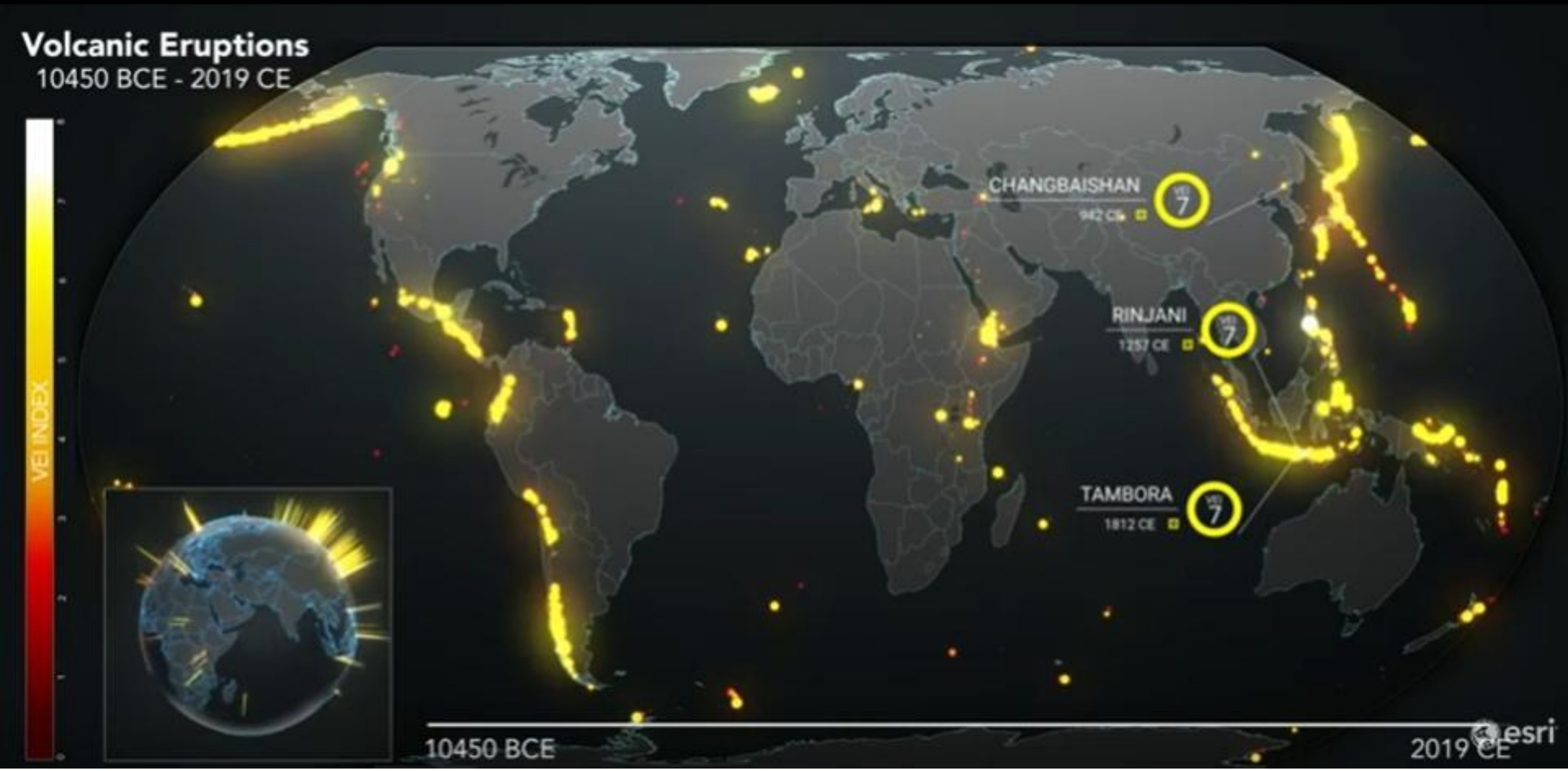


Task 2: Primary hazards of volcanoes

Pyroclastic flow
Tephra
Lava Flows
Volcanic gases

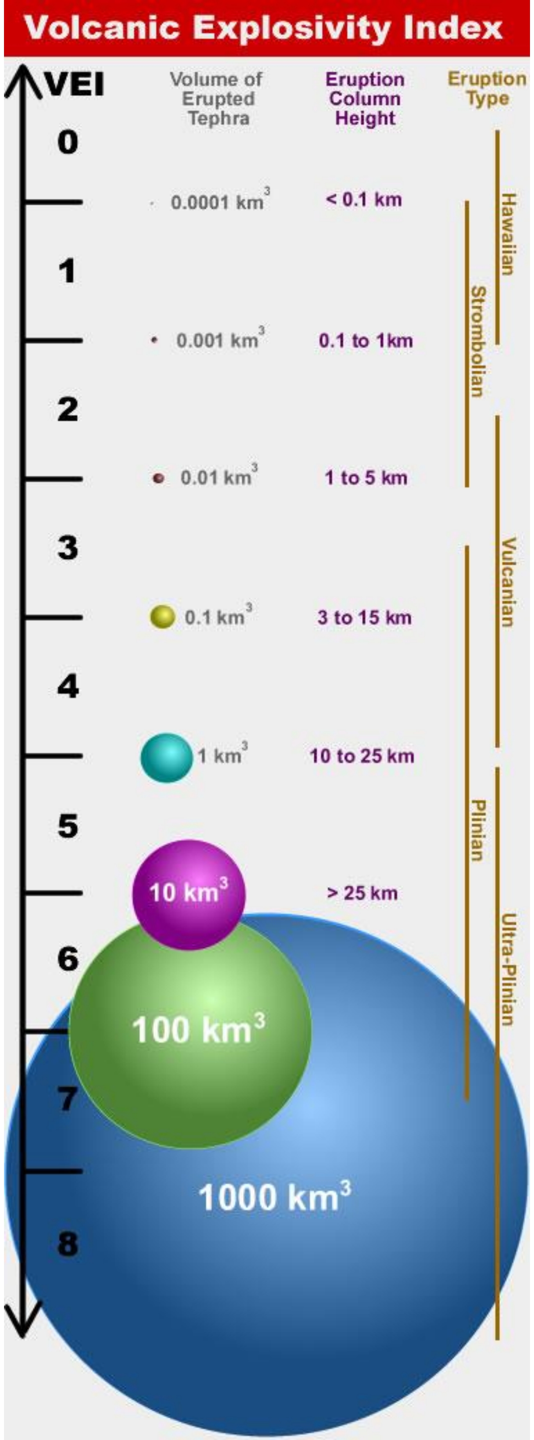
Either write out your own summaries of each or match these brief definitions with the correct term (use page 13 to help you):

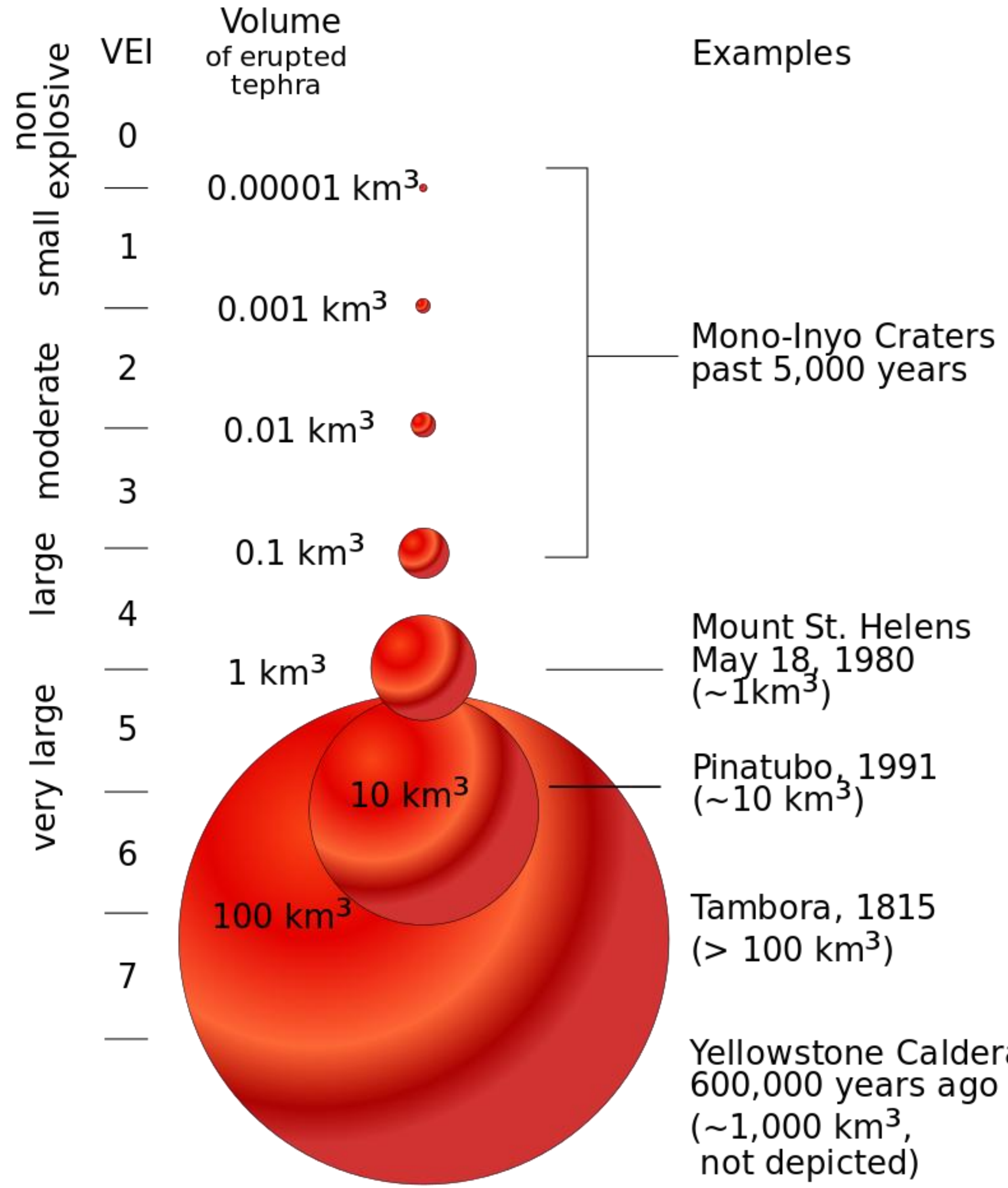
1. Gases released in violent eruptions, typically water vapour, sulphur dioxide, hydrogen and carbon monoxide (CO2 most dangerous as undetected)
2. Rock fragments ejected into the atmosphere, range from bombs (>32mm) to dust (<4mm)
3. A dense, destructive cloud of very hot ash, glass, pumice, crystals and gases
4. Lava (includes basaltic, andesitic and rhyolitic)- viscosity changes according to silicon content

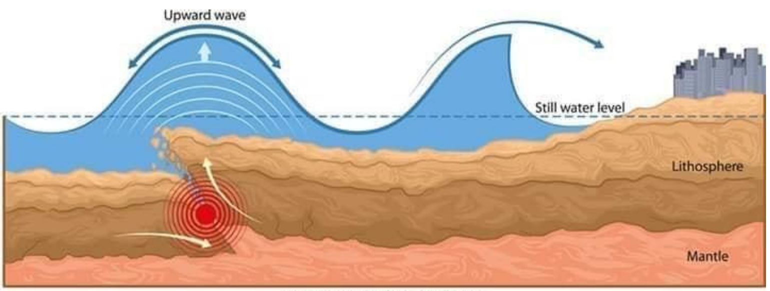


Digital map of known volcanic eruptions in the past 10,000 years by the company ESRI

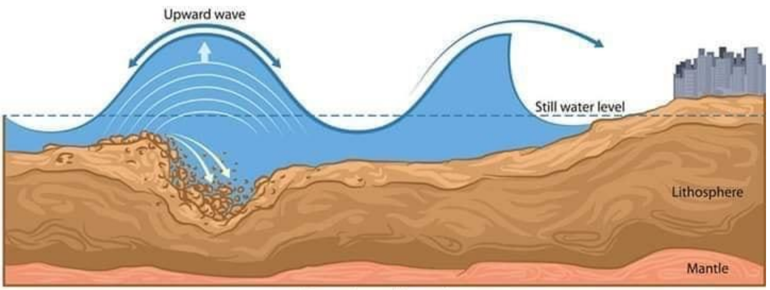
Volcanic Threats in India


Volcanic Explosivity Index
VEI
Volume of Erupted Tephra
Eruption Column Height
Eruption Type
0
1
2
3
4
5
6
7
8
0.0001 km3
< 0.1 km
0.001 km3
0.1 to 1km
0.01 km3
1 to 5 km
0.1 km3
3 to 15 km
1 km3
10 to 25 km
10 km3
> 25 km
100 km3
1000 km3
Hawaiian
Strombolian
Vulcanian
Plinian
Ultra-Plinian

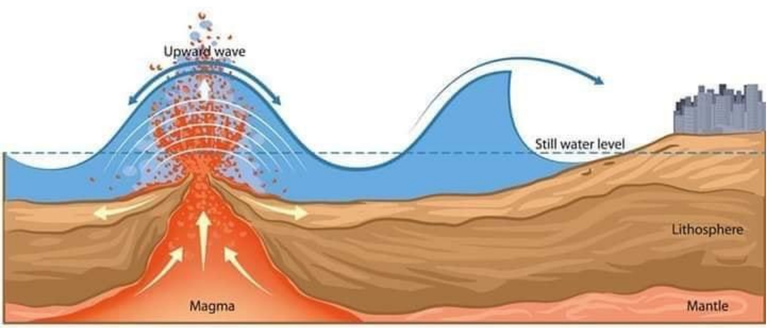

non explosive
small
moderate
large
very large
VEI
Volume
of erupted tephra
Examples
0
1
2
3
4
5
6
7
0.00001 km3
0.001 km3
0.01 km3
0.1 km3
1 km3
10 km3
100 km3
Mono-Inyo Craters past 5,000 years
Mount St. Helens May 18, 1980 (~1km3)
Pinatubo, 1991 (~10 km3)
Tambora, 1815 (> 100 km3)
Yellowstone Caldera 600,000 years ago (~1,000 km3, not depicted)



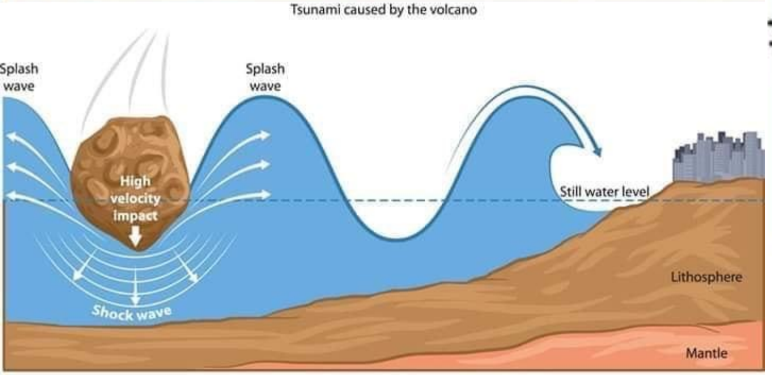
Tsunami caused by an earthquake



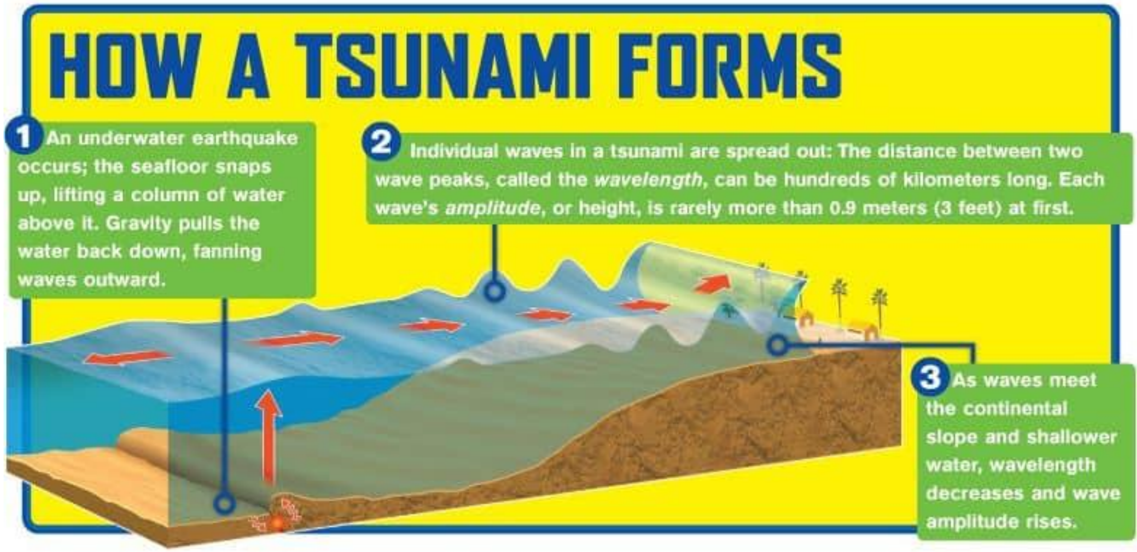
Tsunami caused by erosion

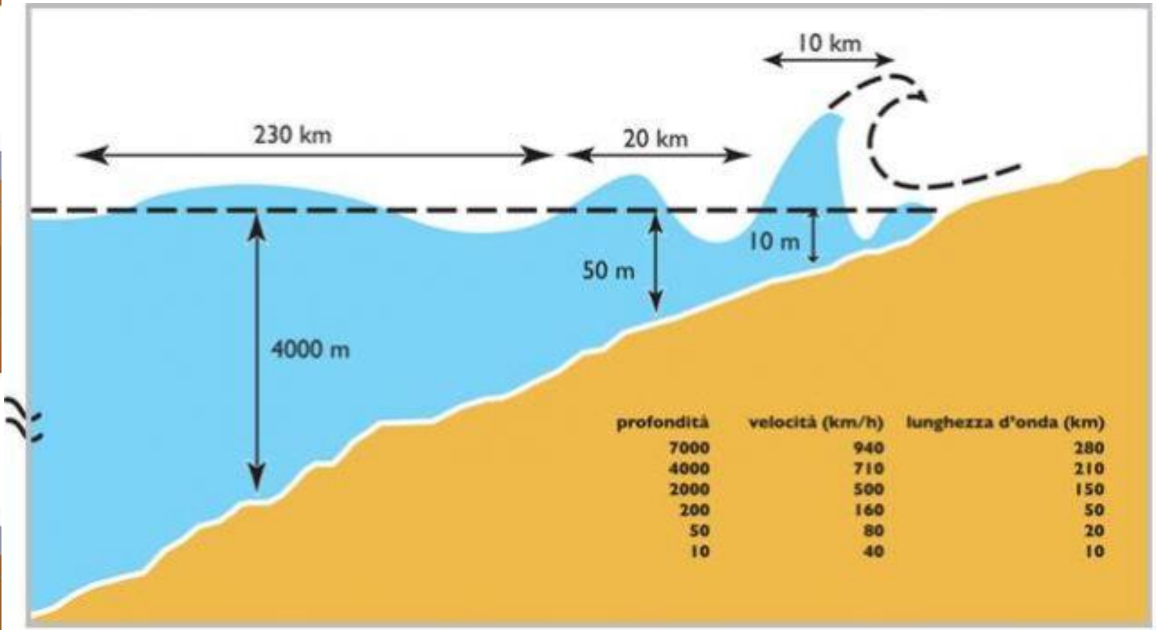


Tsunami caused by the volcano



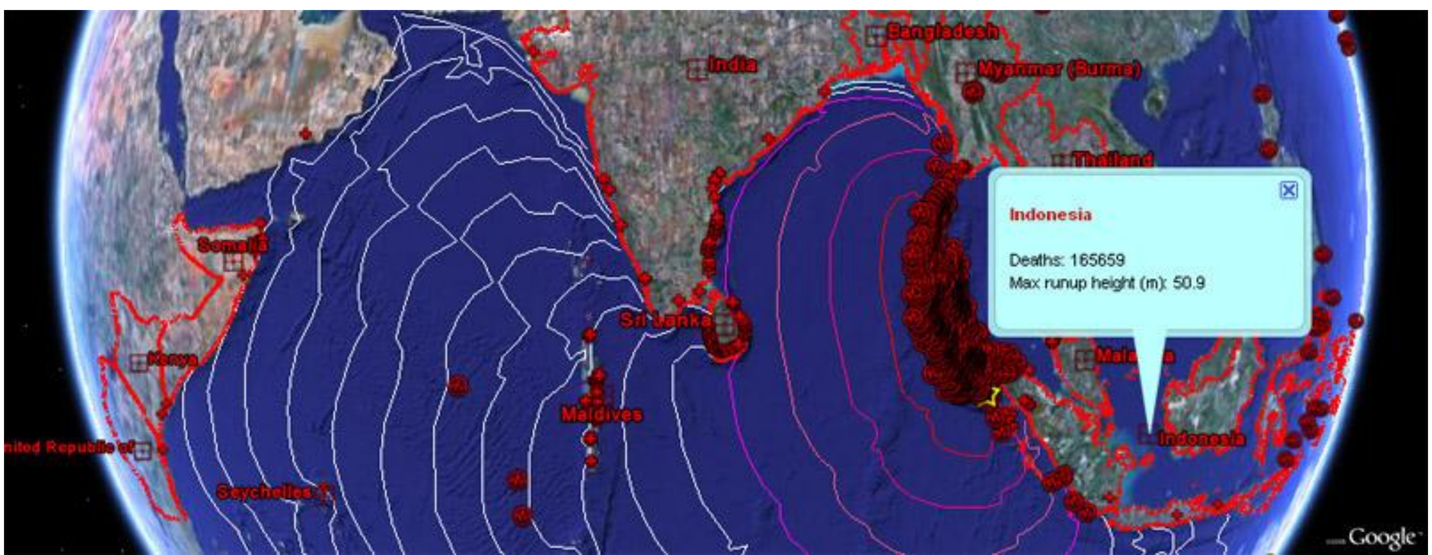
Tsunami (Mega tsunami) caused by falling meteoroid



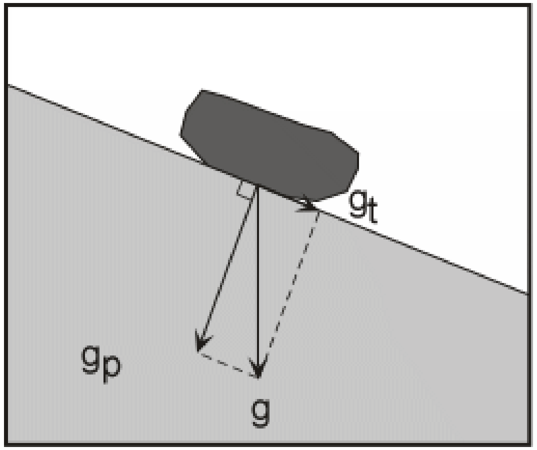


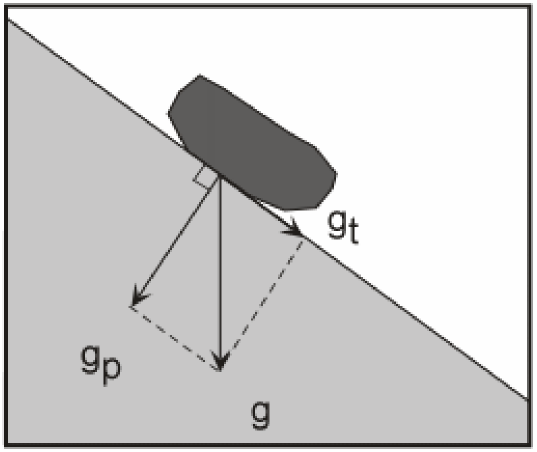
profondità	velocità (km/h)	lunghezza d'onda (km)
7000	940	280
4000	710	210
2000	500	150
200	160	50
50	80	20
10	40	10

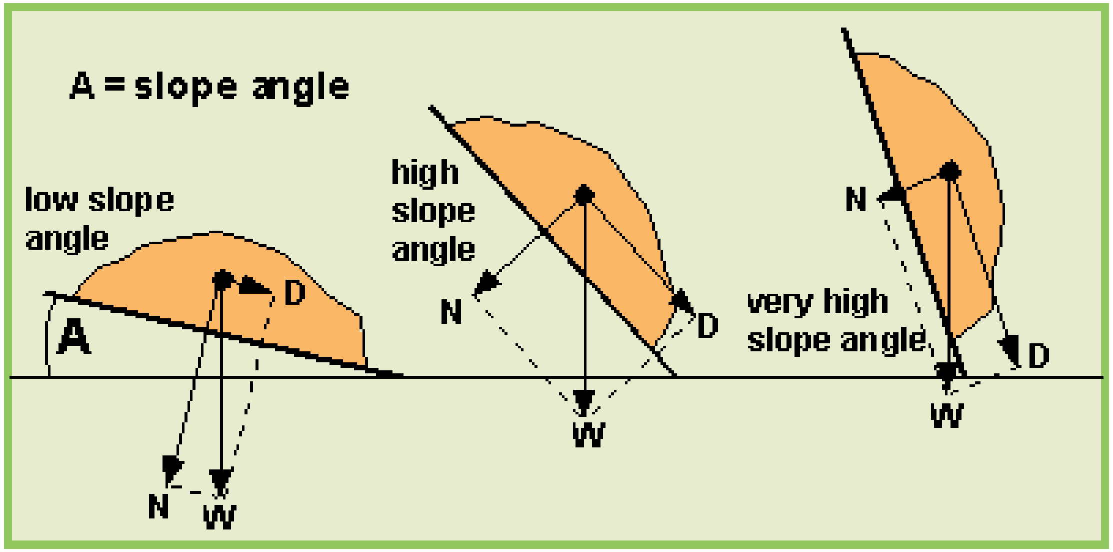

INDEX
Tsunami Risk
High Risk
Medium Risk
Low Risk
Very Low Risk
Pacific Ring of Fire
Seaquake Prone Areas
USA
Canada
Mexico
Colombia
Ecuador
Peru
Chile
PACIFIC OCEAN
ATLANTIC OCEAN
Portugal
Morocco
Greece
Turkey
Pakistan
India
B'desh
Myanmar
Thailand
China
Russia
S Korea
Japan
Philippines
Indonesia
Papua New Guinea
INDIAN OCEAN
PACIFIC OCEAN
TSUNAMI THREAT ZONES
IBN Live


Bangladesh
India
Myanmar (Burma)
Thailand
Somalia
Kenya
Sri Lanka
Maldives
Seychelles
Indonesia
Indonesia
Deaths: 165659
Max runup height (m): 50.9
Google

▪Hill slopes failure: Landslides

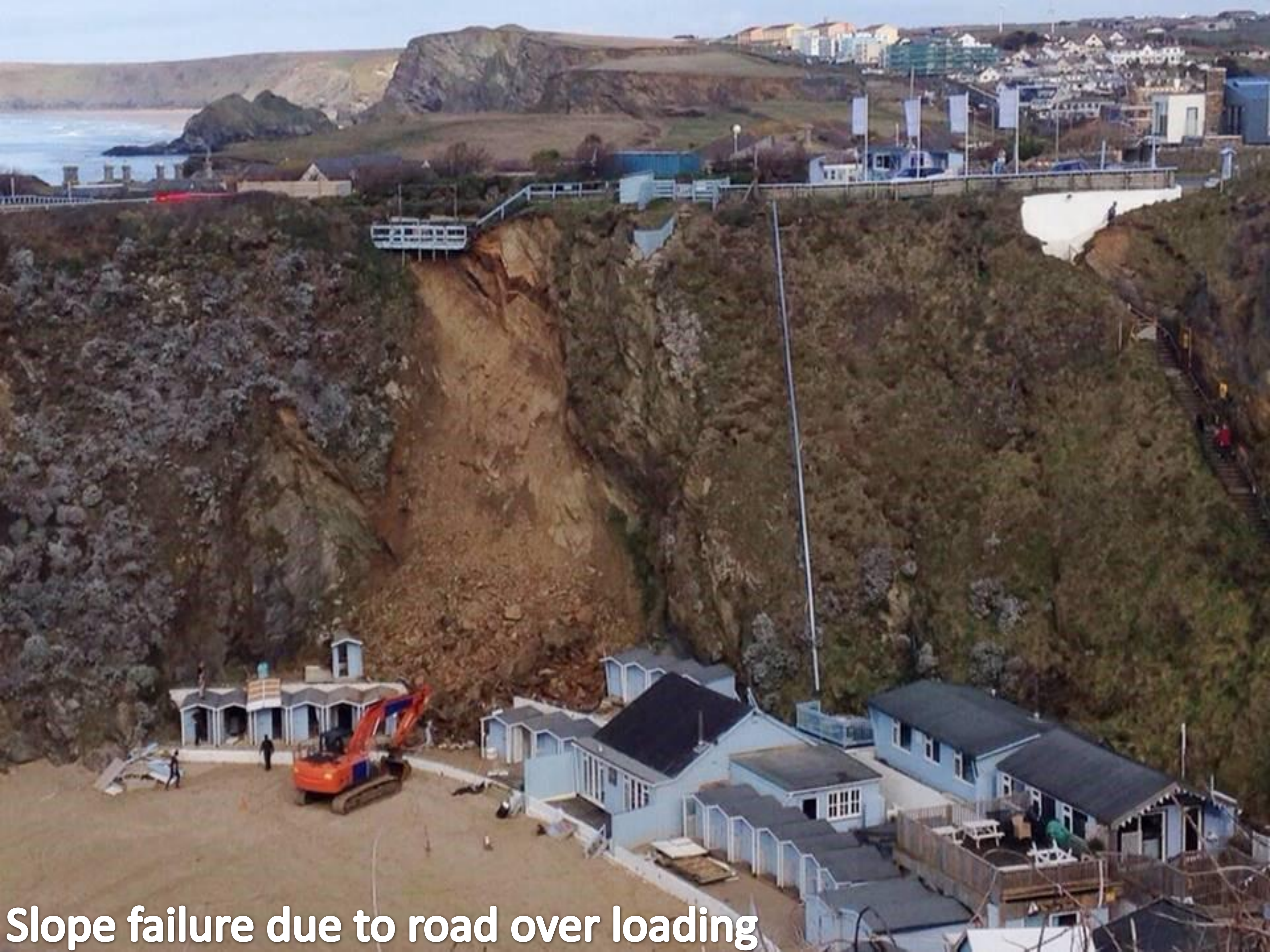






Slope failure due to road cutting

Slope failure due to seepage



Slope failure due to road over loading

Slope failure due to toe cutting

रुद्रप्रयाग–केदारनाथ मार्ग पर तिलवाड़ा के पास तबाही: सारी सड़कें इसी तरह बह गयी।

फोटो: सिद्धार्थ पांडे

Slope failure due to toe cu

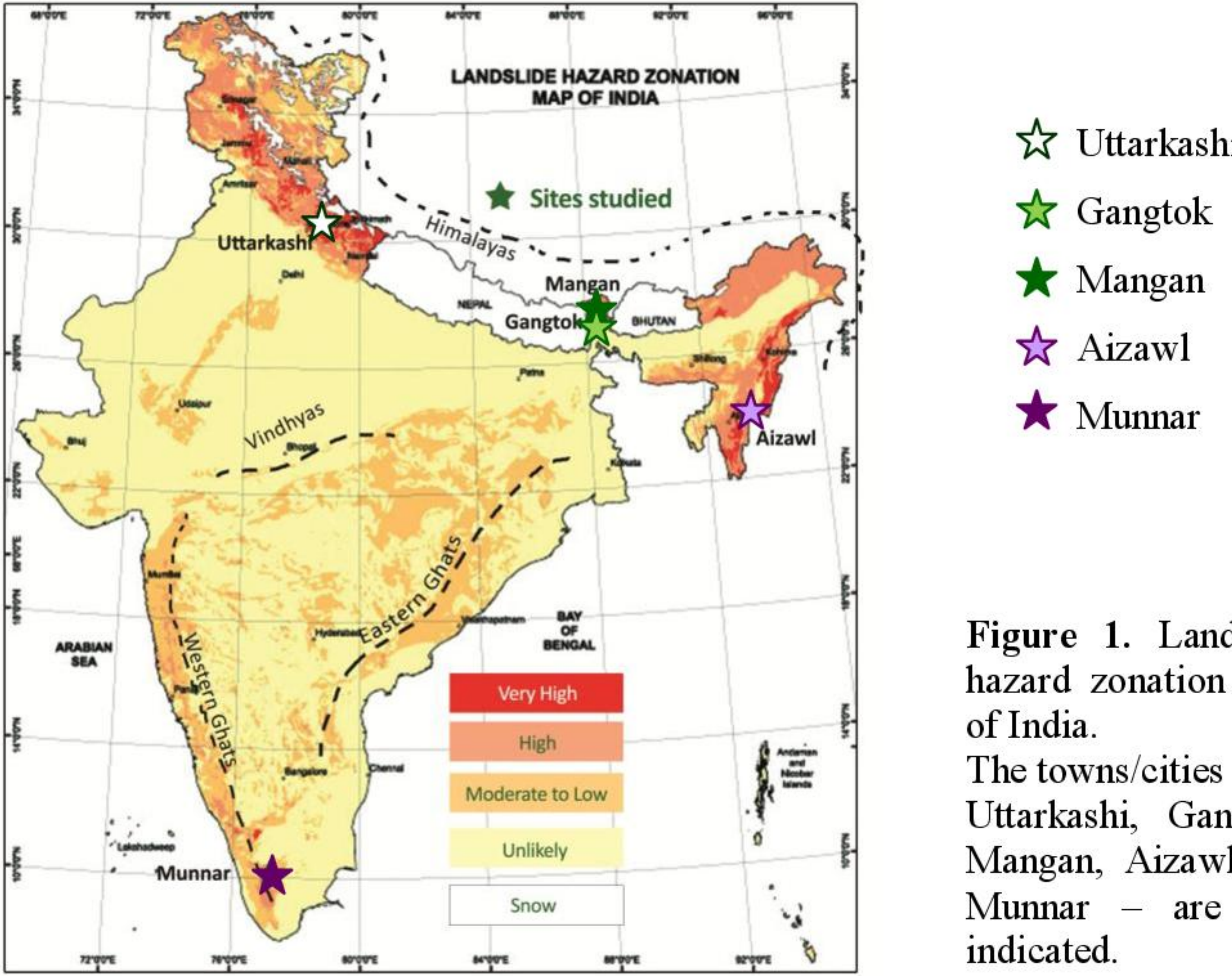
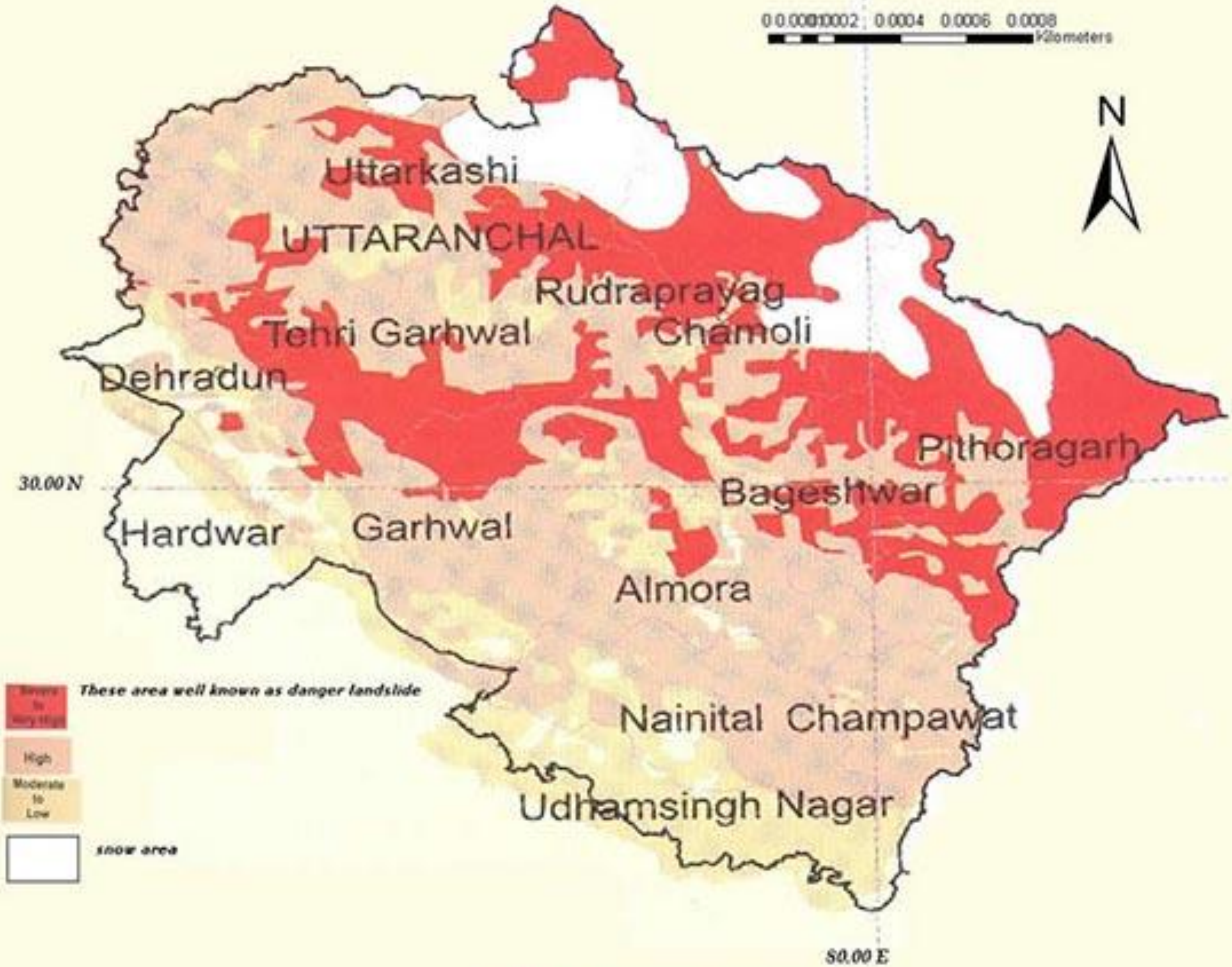


Figure 1. Landslide hazard zonation map of India.
The towns/cities – Uttarkashi, Gangtok, Mangan, Aizawl and Munnar – are also indicated.



Click to View Large

Effects of Geophysical hazards

Hazards	Urban infrastructure & Built Environment	Human Health & Safety	Vulnerable Communities
Earthquakes	• Damage & collapse of buildings, bridges & lifelines	• Death & injuries	• Displacement of seismic-prone communities
Landslides	• Damage of infrastructures near cliffs & slopes	• Death & injuries	• Displacement of landslide-prone communities
Tsunamis	• Losses to coastal infrastructures, ports and piers	• Flood, debris and drowning deaths	• Displacement of coastal communities
Volcanic eruptions	• Damage to infrastructures near volcanoes	• Death & injuries • Air quality: skin & respiratory illnesses	• Displacement of communities near volcanoes

Natural Hazards-Disaster Management Phases

HYDROLOGICAL HAZARDS:

- Snowy Mountains: Avalanches
- Floods

Snowy Mountains: Avalanche

An avalanche (also called a snowslide) is an event that occurs when a cohesive slab of snow lying upon a weaker layer of snow fractures and slides down a steep slope.

Avalanches are typically triggered in a starting zone from a mechanical failure in the snowpack (**slab avalanche**) when the forces of the snow exceed its strength but sometimes only with gradual widening (**loose snow avalanche**).

TYPES OF AVALANCHES

1 Slab avalanches

2 Powder snow avalanches

3 Wet snow avalanches

4 Ice avalanche

5 Avalanche pathway

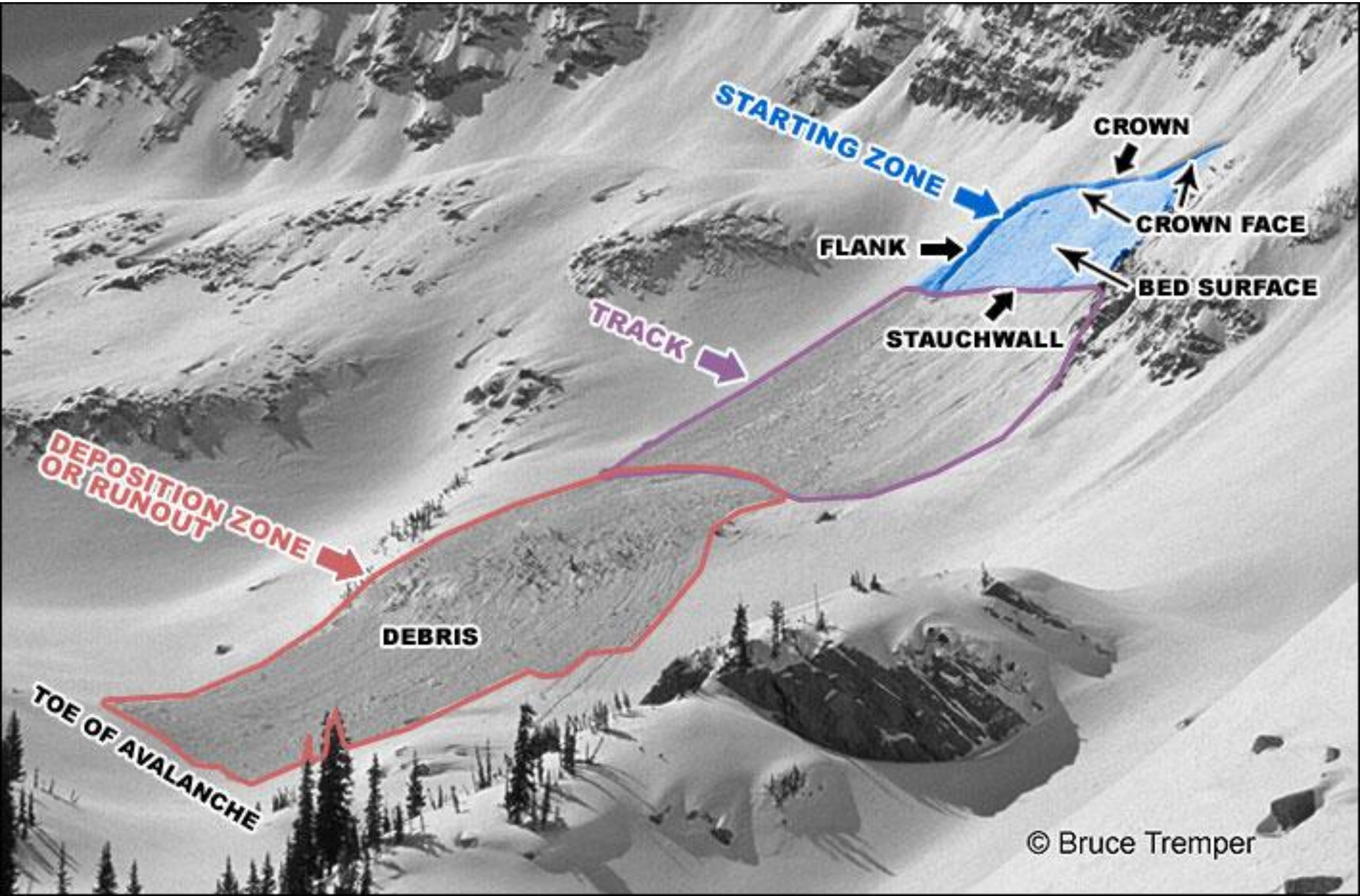
Slab avalanches

Powder snow avalanches

Wet snow avalanches

Ice avalanche

Avalanche pathway



How can Avalanches be managed?

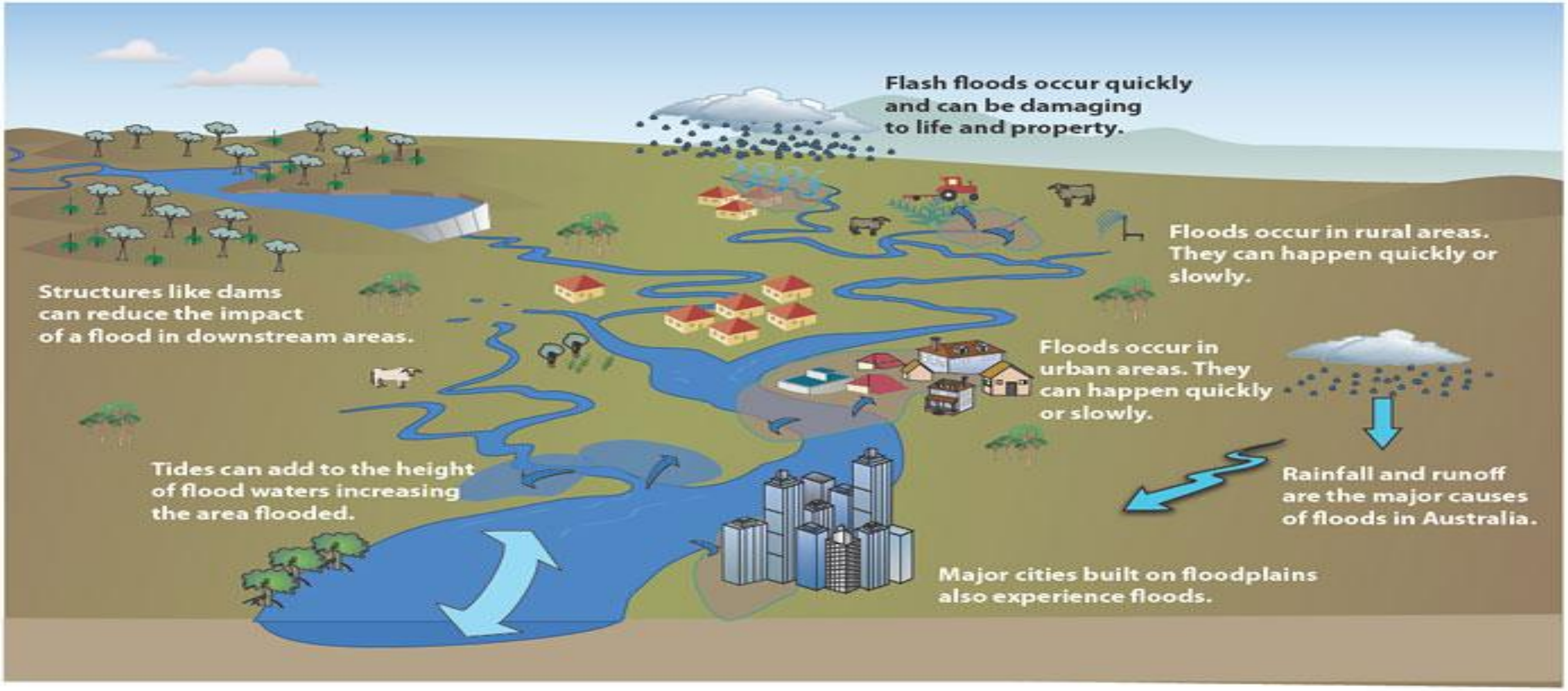
So, ski patrols and other organizations usually take steps to prevent major **avalanches**. One technique is to deliberately trigger small, **controlled avalanches** when no one is on the slope. ... Other techniques involve preventing the conditions that lead to **avalanches** or interrupting the flow of snow.

▪What is a Flood ?

Floods are the most frequent type of natural disaster and occur when an overflow of water submerges land that is usually dry. **Floods** are often caused by heavy rainfall, rapid snowmelt or a storm surge from a tropical cyclone or tsunami in coastal areas.

How do floods happen?

How **floods** form. A **flood** occurs when water inundates land that's normally dry, which can **happen** in a multitude of ways. Excessive rain, a ruptured dam or levee, rapid melting of snow or ice, or even an unfortunately placed beaver dam can overwhelm a river, spreading over the adjacent land, called a **flood**plain.



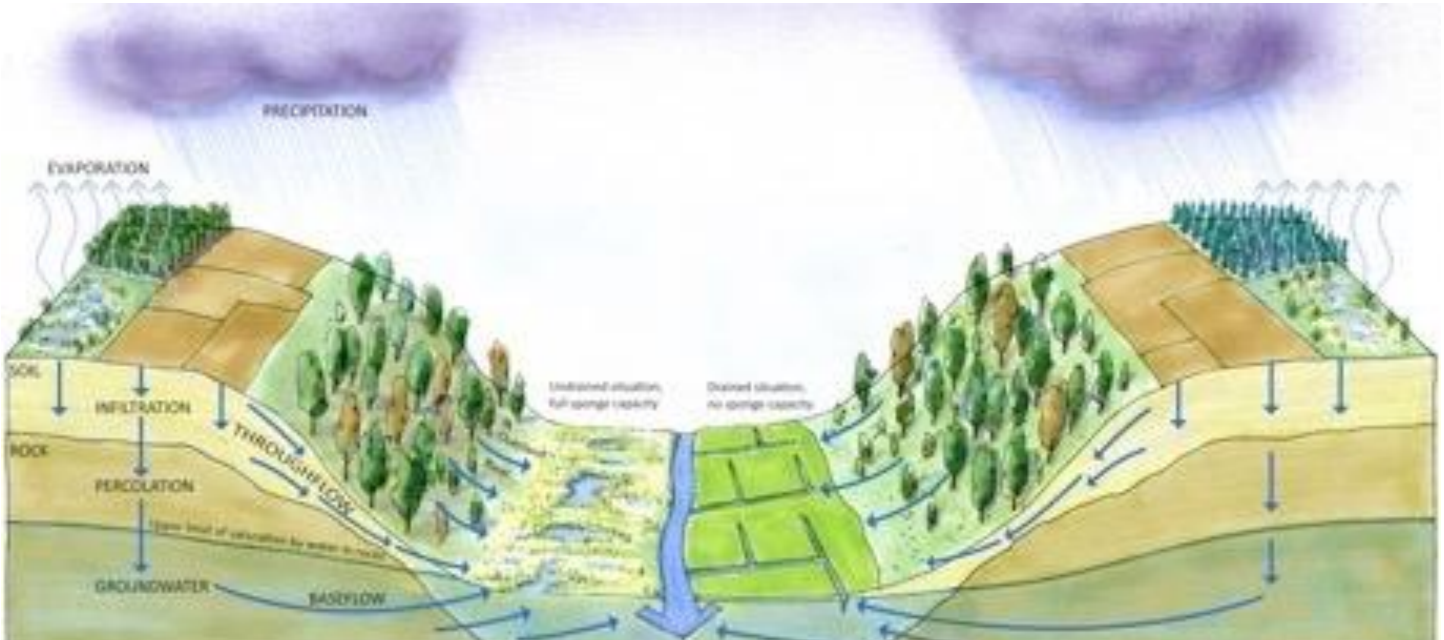
What are effects of flood?

The primary **effects of flooding** include loss of life and damage to buildings and other structures, including bridges, sewerage systems, roadways, and canals. **Floods** also frequently damage power transmission and sometimes power generation, which then has knock-on **effects** caused by the loss of power.


India Flood Zone Map
Flood Zone

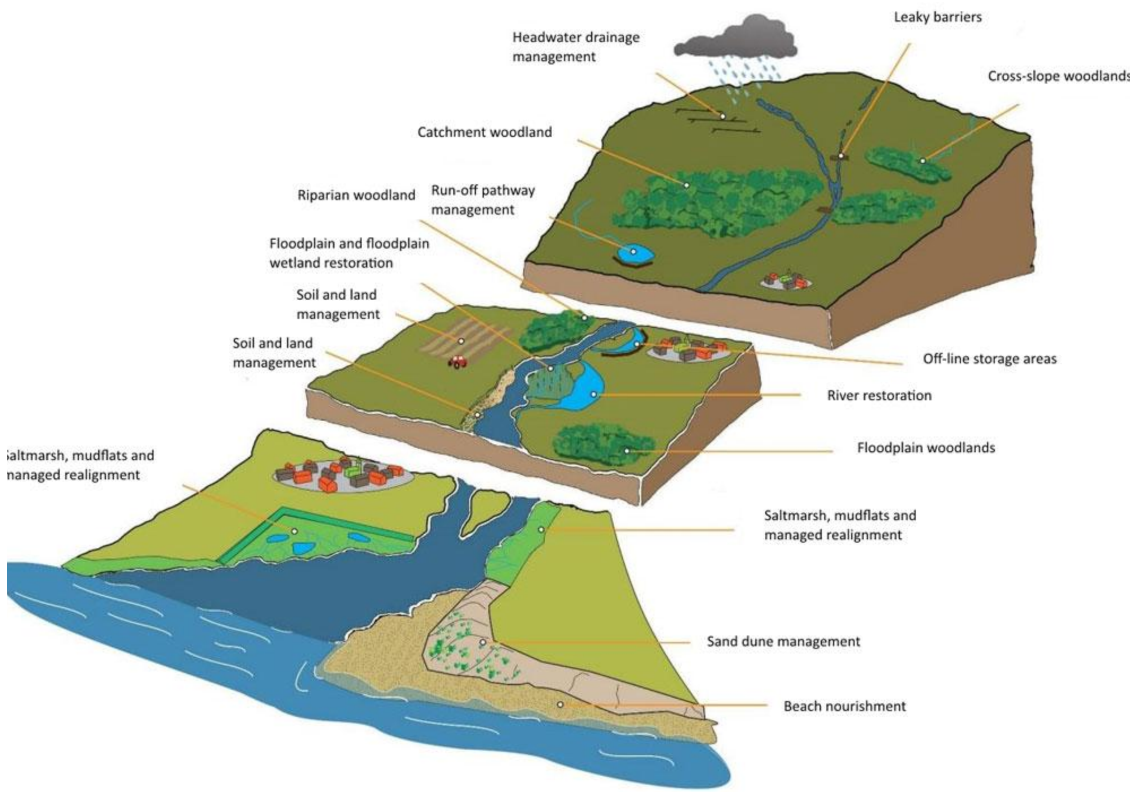
What is the solution of flood?

Some methods of flood control have been practiced since ancient times. These methods include planting vegetation to retain extra **water**, terracing hillsides to slow flow downhill, and the construction of floodways (man-made channels to divert floodwater).



Ways to **Prevent flood**

Warning systems must be set up so people get sufficient time to save themselves. In addition, areas that are more likely to have **floods** must have tall buildings above the **flood** level. Further, there should be an efficient system for storing excessive water due to rain.



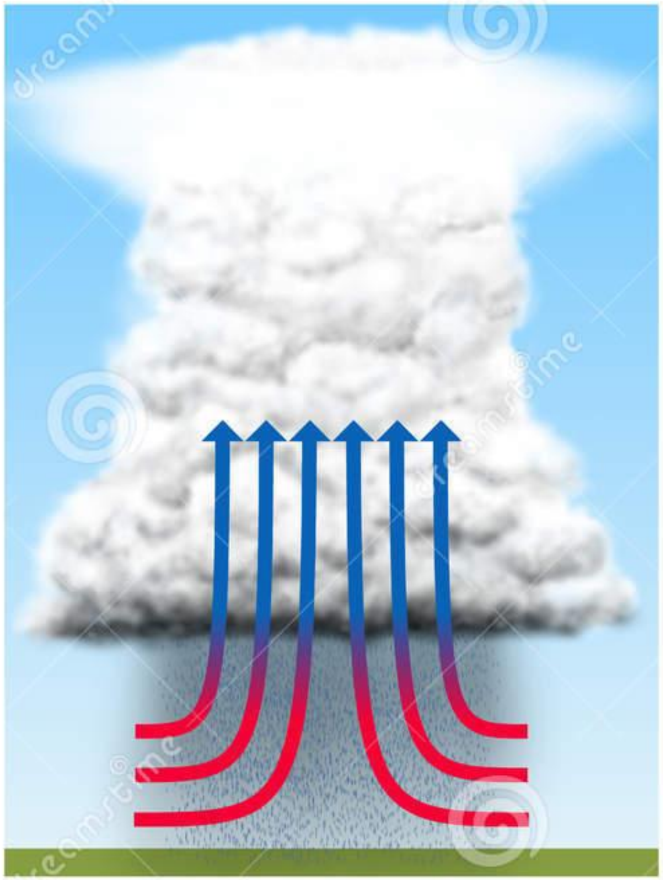
What are Cyclones and anticyclones

Cyclones and anticyclones **are both wind systems indicating distinctive weather patterns, but they have opposite characteristics.**

A cyclone is a storm or system of winds that rotates around a center of low atmospheric pressure.

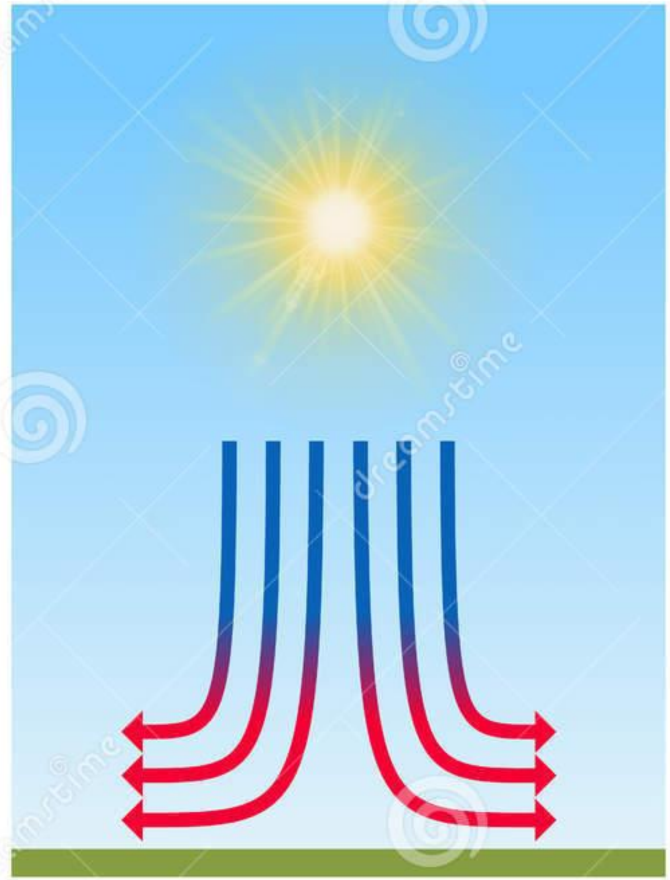
An anticyclone is a system of winds that rotates around a center of high atmospheric pressure

CYCLONE



Low pressure
Rising warm, moist air
Cloudy weather

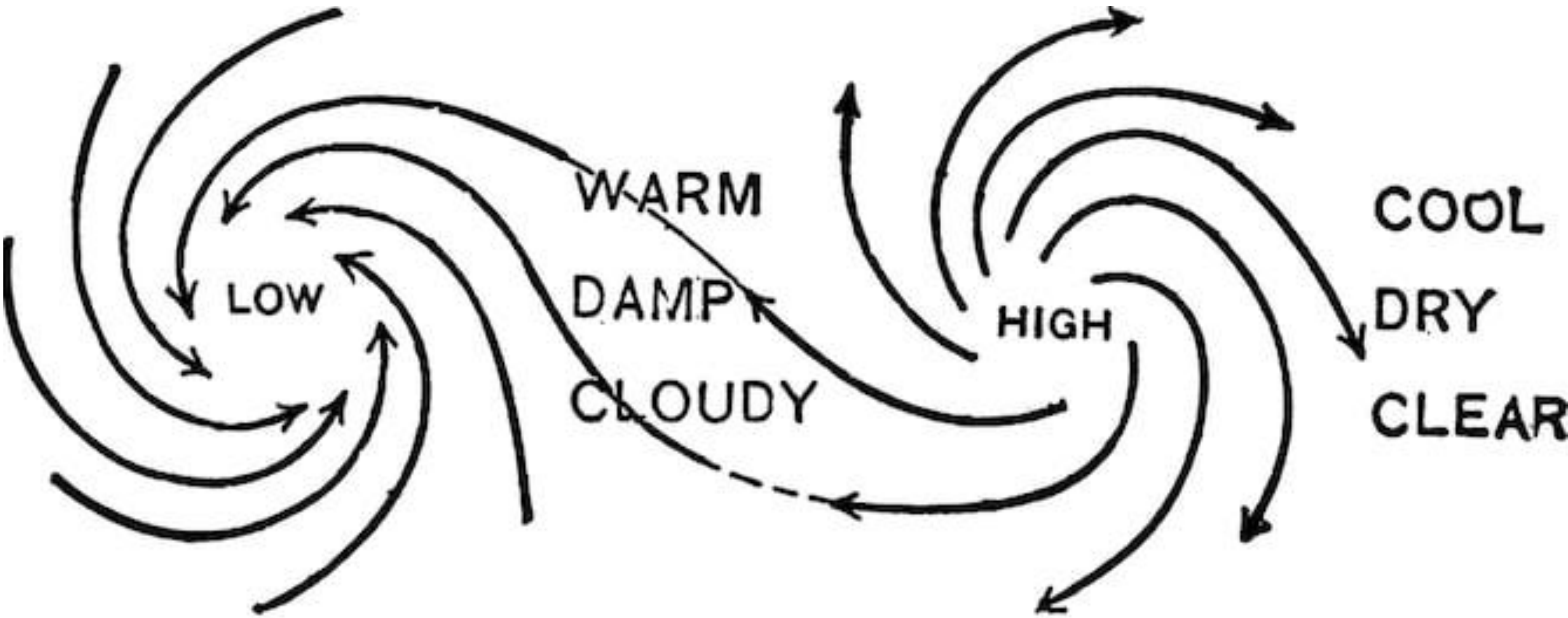
ANTICYCLONE



High pressure
Descending cool, dry air
Clear weather

How cyclones and anticyclones are formed?

The development of **anticyclones** aloft occurs in warm core **cyclones** such as tropical **cyclones** when latent heat caused by the **formation** of clouds is released aloft increasing the air temperature; the resultant thickness of the atmospheric layer increases high pressure aloft which evacuates their outflow.


LOW
WARM
DAMP
CLOUDY
HIGH
COOL
DRY
CLEAR

Why are cyclones followed by anticyclones?

This is because the Coriolis effect directs winds away from their original path due to the rotation of the Earth and deflects winds to the right in the Northern Hemisphere and to the left in the Southern Hemisphere.

Anticyclones are spinning storms around high-pressure systems

What are types of cyclones?

There are two types of cyclones: middle latitude (mid-latitude) cyclones and **tropical cyclones**.

Mid-latitude cyclones are the main cause of winter storms in the middle latitudes.

Tropical cyclones are also known as **hurricanes**.

What weather do cyclones and anticyclones bring?

Areas of high pressure are called **anticyclones**, whilst low pressure areas are known as **cyclones** or depressions. Each **brings** with it different **weather** patterns.

Anticyclones typically result in stable, fine weather, with clear skies whilst depressions are associated with cloudier, wetter, windier conditions

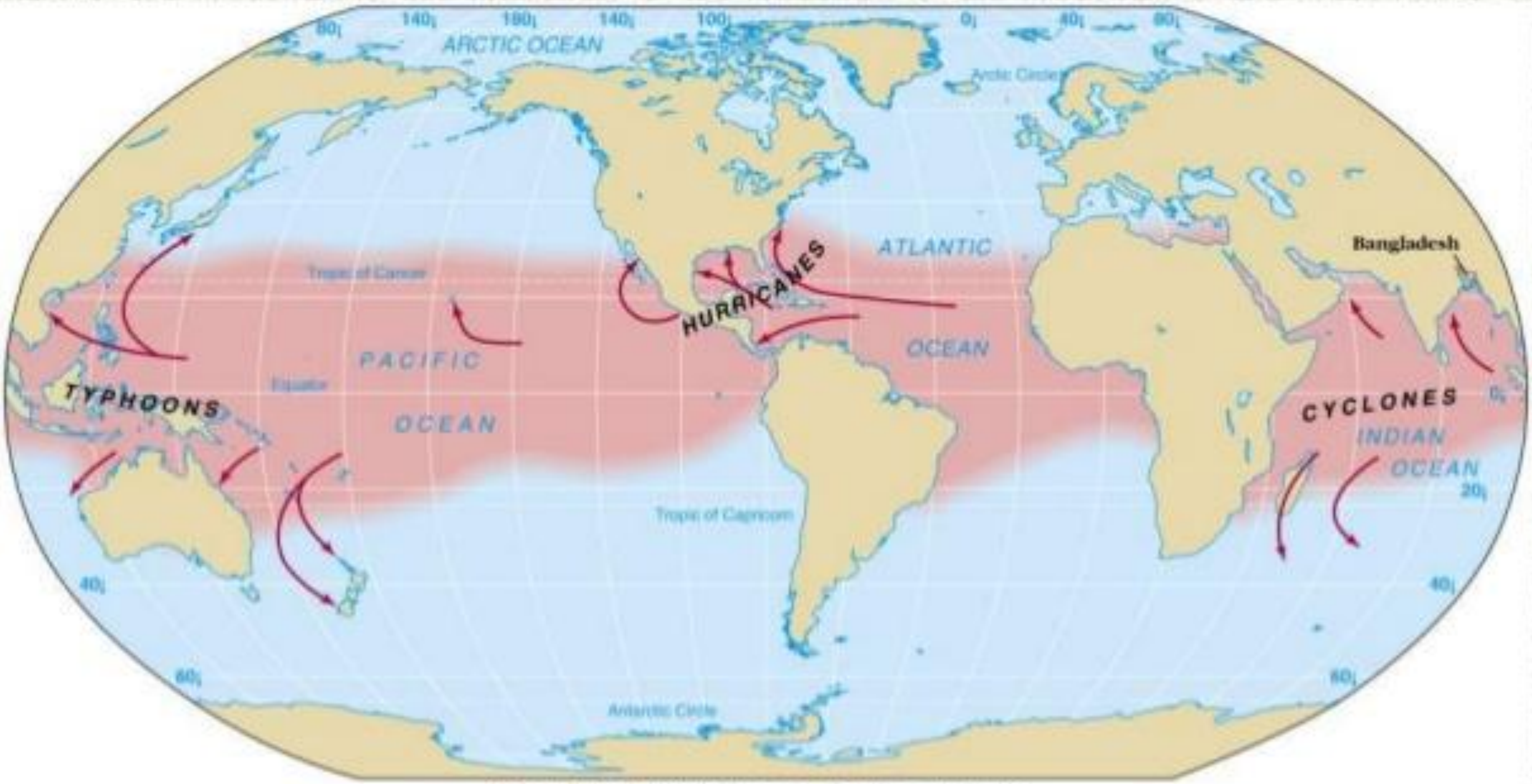
What are the 3 types of cyclones?

1. They are called hurricanes in the North Atlantic and eastern Pacific oceans,

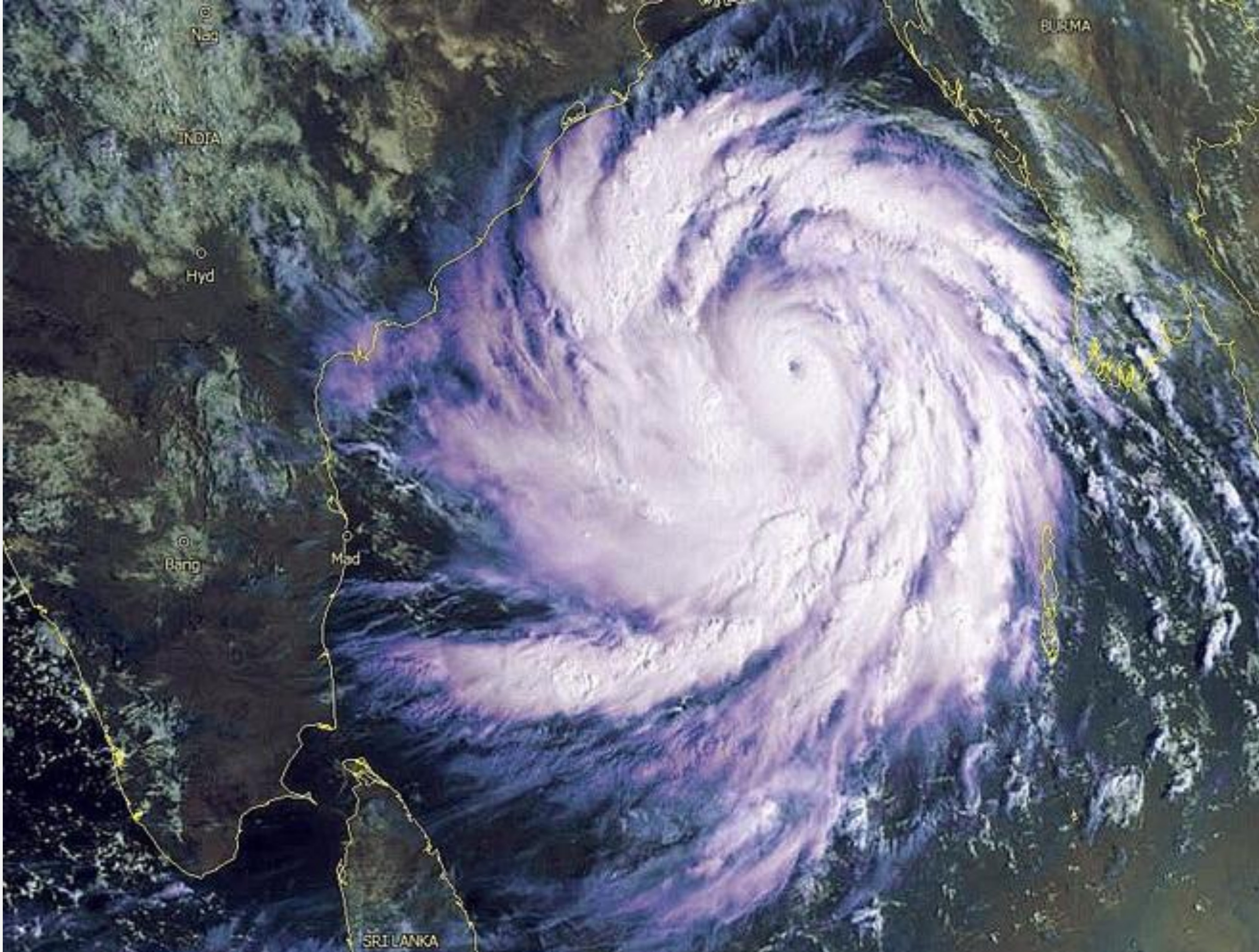
2. typhoons in the western Pacific Ocean,

3. tropical **cyclones** in the Indian Ocean,

Types of Cyclones



Cyclones have regional names, such as hurricane and typhoon, conforming to local traditions.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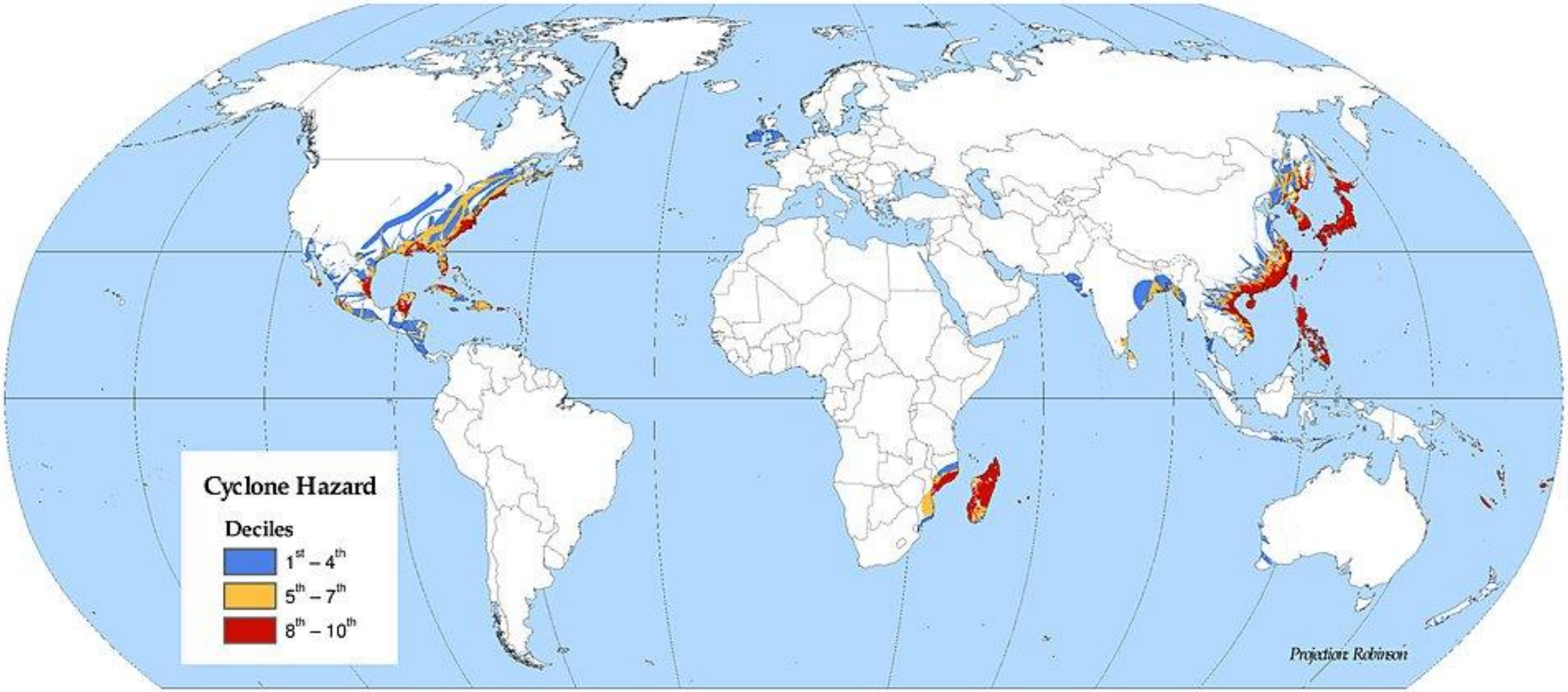
What are the effects /Hazard of cyclone?

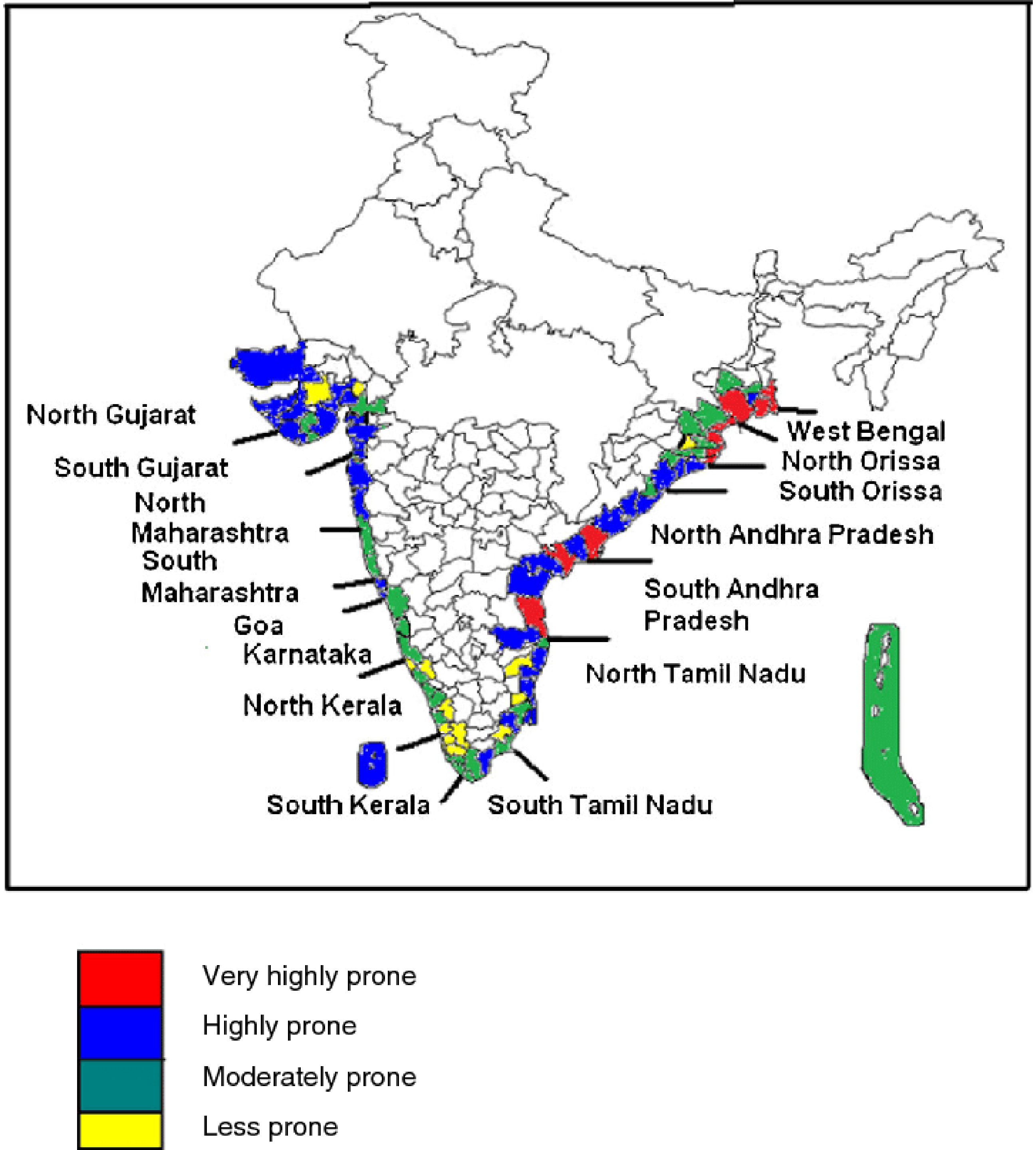
Tropical cyclones are among the most destructive natural phenomena. The impact from cyclones extends over a wide area, with strong winds and heavy rains. However, the greatest damage to life and property is not from the wind, but from secondary events such as storm surges, flooding, landslides and tornadoes

Global Cyclone Hazard Distribution

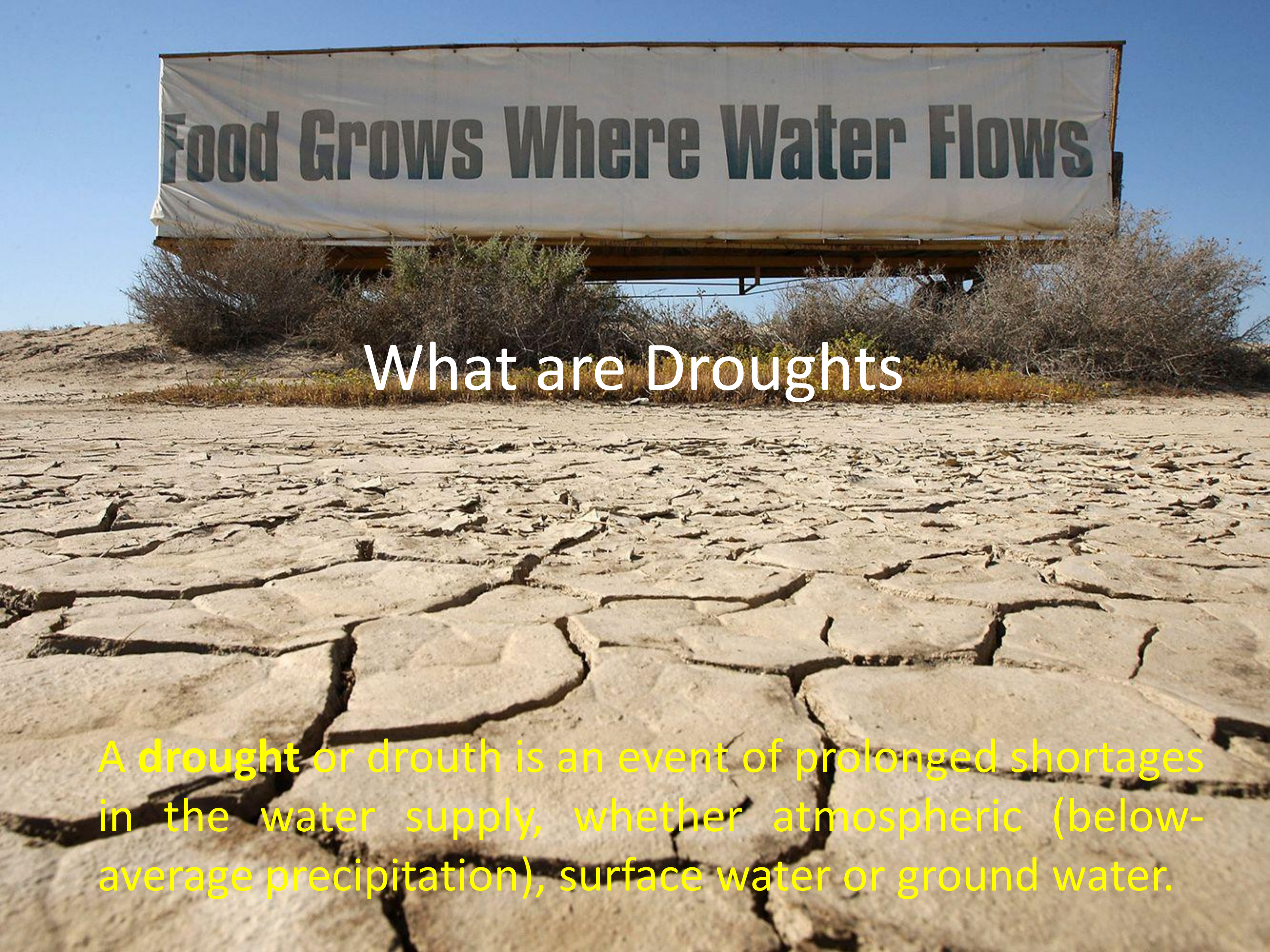


The cyclone data set is comprised of data collected from more than 1,600 storm tracks during the 21-year period from 1980 – 2000 for the Atlantic, Pacific, and Indian Oceans. At least 6.7% of the world's land area was subject to at least one instance of tropical storm or hurricane-type conditions.

Source:
Dilley, Maxx, Robert S. Chen, Uwe Deichmann, Arthur L. Lerner-Lam, and Margaret Arnold. 2005. *Natural Disaster Hotspots: A Global Risk Analysis*. Washington, D.C.: World Bank.



Cyclone hazard prone districts of India based on frequency of total cyclones, total severe cyclones, actual/ estimated maximum wind strength with ratings of 2, 4, 7 and 10; PMSS associated with the cyclones and PMP for all districts.

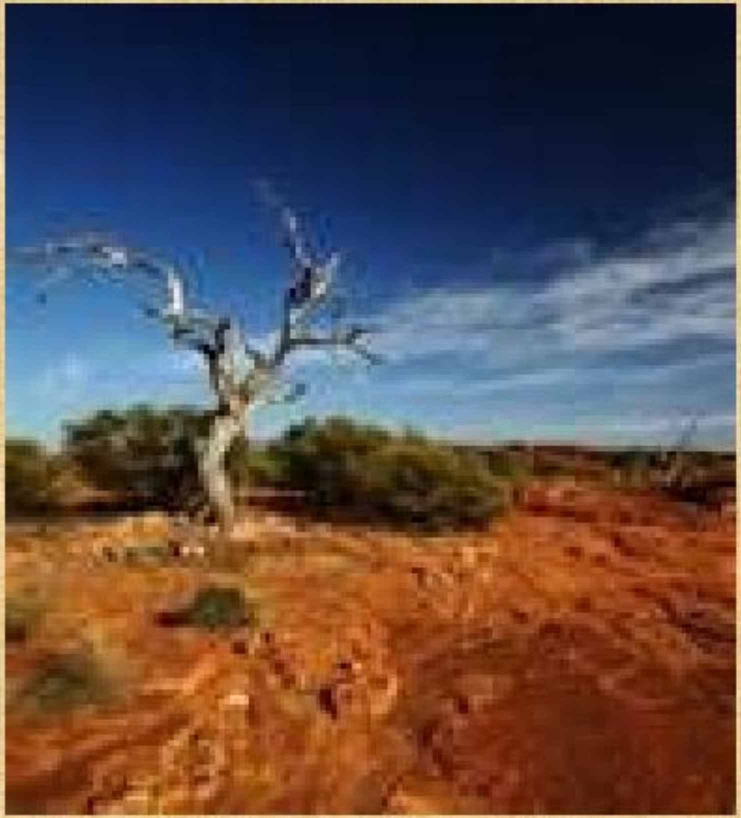


What are Droughts

A **drought** or drouth is an event of prolonged shortages in the water supply, whether atmospheric (below-average precipitation), surface water or ground water.

What are Droughts?

A drought is a period of time when there is a lack of water on land. Plants and crops do not grow properly, plants and animals die and streams and river shrivel up. Because farm crops and animals die due to lack of water, there is less food for people to eat, and the price of food goes up. If a drought lasts a long time, people may also die of starvation and the land might turn into a desert.



A **drought** is **caused** by drier than normal conditions that can eventually lead to water supply problems. Really hot temperatures can make a **drought** worse by evaporating moisture from the soil. ... A **drought** is a prolonged period with less-than-average amounts of rain or snow in a particular region.

CONSEQUENCES OF DROUGHT

- Effects of droughts can be divided into three groups:
- Environmental
- Economic
- Social consequences
- **In environmental effects:** lower surface , lower flow levels, increased pollution of surface water, the drying out of wetlands, more and larger fires, losing biodiversity, worse health of trees and the appearance of pests.

TYPES OF DROUGHT

- There are 3 types of drought. They are as follows:

Meteorological Drought

Hydrological Drought

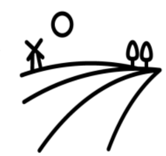
Agricultural Drought

FIVE TYPES OF DROUGHT

1 **METEOROLOGICAL** drought refers to an extended period of dry weather patterns.

2 **HYDROLOGICAL** drought refers to low water supply in our rivers, lakes, aquifers, and other reservoirs that often follows meteorological drought.

3 **AGRICULTURAL** drought occurs when a water shortage significantly damages or destroys agricultural crops.



4 **ECOLOGICAL** drought is the most recently defined type of drought and refers to ecological damage caused by the lack of soil moisture.

5 **SOCIOECONOMIC** drought refers to when a water shortage affects the supply and demand of drought commodities, such as water, food grains, and fish.

How to Fight Drought, Make Every Drop of Water Count, and Keep Your Plants Alive—and Thriving

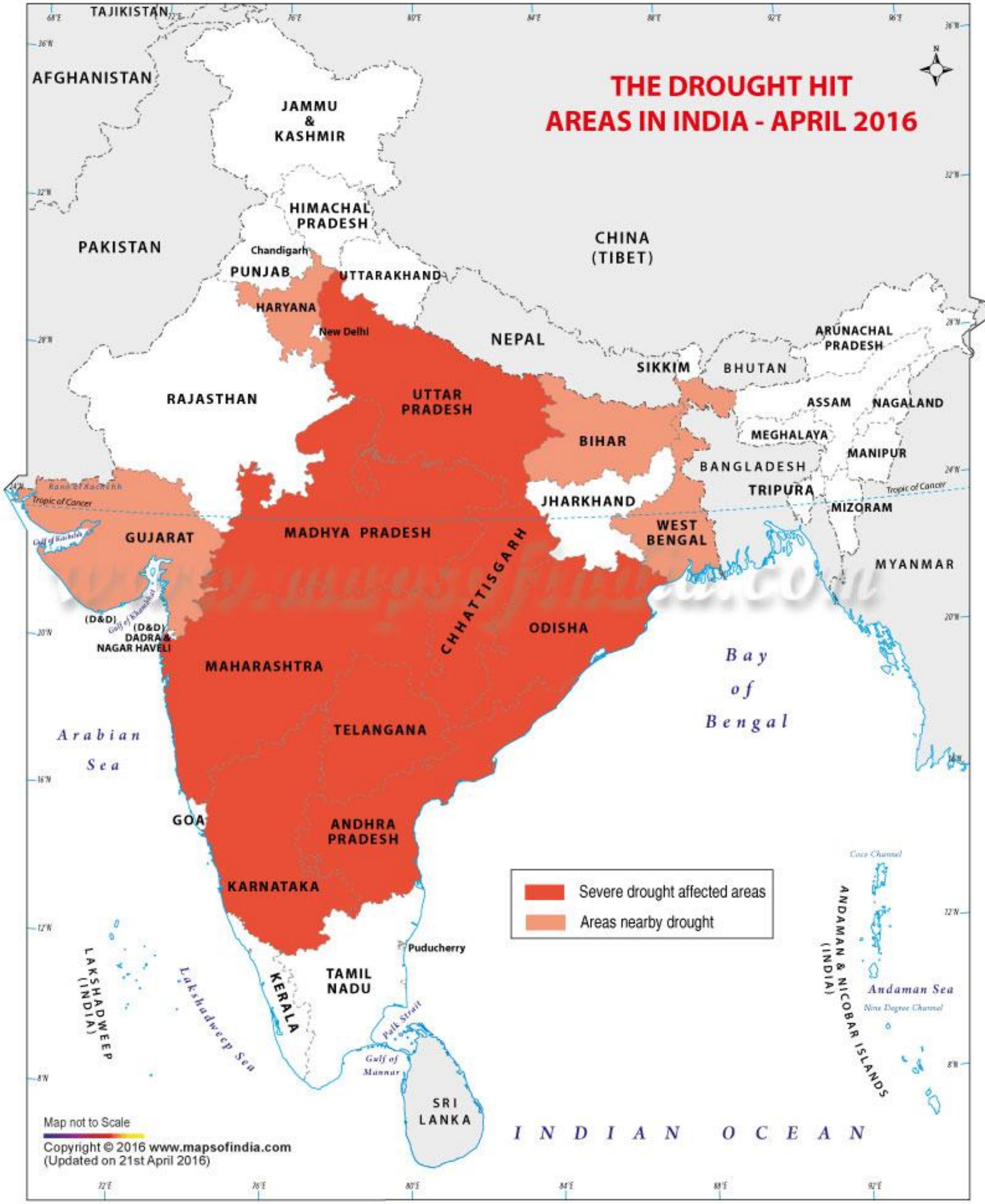
- Assess your priorities. ...
- Identify root zones. ...
- Try a root irrigator. ...
- Check soil moisture. ...
- Irrigate slowly. ...
- Build watering basins. ...
- Use soaker hoses. ...
- Apply mulch.

Avoiding Overuse

Being mindful of the amount of water you use each day **can** be a powerful **way to prevent droughts**. Turning off the faucet while you brush your teeth, watering your garden early in the morning so less water evaporates, and installing low-flow plumbing fixtures all are good **ways to prevent** wasted water

Precautions to be taken during droughts are:

- Never pour down used water in drain. Use it to water the plants.
- Replace dripping faucets by replacing washers.
- Check all plumbing for leakages and get the faulty repaired by plumber.
- Take a bath by bucket rather than by shower.
- Use mulch to retain water in the soil.



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THANKS

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