

A Study of Region wise Analysis of Earthquake in India and subcontinent

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Abstract:

India is a seismically active region and experiences frequent earthquakes. Therefore, earthquake safety and prevention is of utmost importance in India. Recent studies have focused on improving earthquake prediction and early warning systems in the subcontinent region. Researchers have also been investigating the seismic hazards associated with different geological formations in the region, including the Himalayan region, the Indo-Gangetic plain, and the Deccan Traps volcanic province. In addition, there has been a growing focus on earthquake-resistant building design and construction practices, particularly in high-risk areas such as the Himalayan region. This includes the development of building codes and guidelines for seismic-resistant construction, as well as the use of advanced materials and technologies to improve the structural integrity of buildings.

Overall, the study of earthquakes in the Indian subcontinent region is a complex and multifaceted area of research, with significant implications for disaster management and mitigation efforts. Ongoing research in this area is crucial for improving our understanding of earthquake hazards and developing effective strategies for reducing their impact on people, infrastructure, and the environment.

Keywords: *Earthquake, Disaster, Landslide, Richter scale.*

1. Introduction

Earthquakes are a significant hazard in the Indian subcontinent region, which includes India, Pakistan, Bangladesh, Nepal, Bhutan, and Sri Lanka. This region is highly vulnerable to earthquakes due to its location at the boundary of the Indian plate and the Eurasian plate, where tectonic forces cause frequent seismic activity. In India, the northern and northeastern regions are particularly prone to earthquakes, as they are located in the seismic zone V, which is considered to be the highest risk zone. The Himalayan region, which spans across India, Nepal, and Bhutan, is also highly prone to earthquakes due to the convergence of the Indian and Eurasian plates. The subcontinent region has experienced several large and devastating earthquakes in the past. One of the most severe earthquakes in the region's history was the 1934 Nepal-Bihar earthquake, which had a magnitude of 8.3 and caused extensive damage and loss of life. The 2001 Gujarat earthquake, which had a magnitude of 7.7, is another significant earthquake that caused widespread damage and casualties.

2. Earthquake Region in India

India is located in a seismically active region, and several areas in the country are prone to earthquakes. Here are some of the major earthquake-prone regions in India:

- **Himalayan region:** The Himalayan region, which includes the states of Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, Arunachal Pradesh, and parts of Assam, is highly prone to earthquakes due to its location on the Indian plate boundary.
- **Northeastern region:** The northeastern region, which includes the states of Assam, Meghalaya, Mizoram, and Nagaland, is also highly prone to earthquakes due to its proximity to the Himalayan region.
- **Indo-Gangetic plains:** The Indo-Gangetic plains, which include the states of Uttar Pradesh, Bihar, and West Bengal, are prone to earthquakes due to their location on the seismic zone IV.
- **Kachchh region:** The Kachchh region in the state of Gujarat is highly prone to earthquakes due to its location on the boundary of the Indian and Eurasian plates.
- **Andaman and Nicobar Islands:** The Andaman and Nicobar Islands, located in the Bay of Bengal, are highly prone to earthquakes due to their location on the plate boundary between the Indian and Burmese plates.

These earthquake-prone regions in India require special attention and measures to ensure earthquake safety and preparedness. The government and various organizations are taking steps to improve earthquake-resistant construction and infrastructure, educate people about earthquake safety and preparedness, and develop early warning systems to reduce the impact of earthquakes on people and infrastructure.

3. Safest region as per earthquake is consider in India

There is no completely safe region in India when it comes to earthquakes, as the country is located in a seismically active region. However, some regions in India are considered relatively safer than others. Here are a few examples:

- Southern India: Southern India is considered relatively safer than other parts of the country, as it is not located near any major plate boundary or fault line. However, earthquakes still occur in this region from time to time.
- Coastal areas: Coastal areas, including the western and eastern coasts of India, are considered safer than inland regions due to the softer soil and sediment layers that can absorb seismic energy.
- Central India: Central India, which includes states like Madhya Pradesh and Chhattisgarh, is also considered relatively safer than other regions in the country, as it is located away from major fault lines.

It is important to note that while some regions in India may be considered relatively safer than others, the risk of earthquakes can never be completely eliminated. It is essential for individuals, communities, and organizations to be prepared for earthquakes and take necessary safety precautions regardless of their location.

4. Reasons of Earthquake

An earthquake is a natural phenomenon caused by the sudden release of energy from the Earth's crust, resulting in seismic waves that can cause ground shaking, landslides, and other types of ground deformation. Earthquakes can be caused by various factors, including natural and human-induced causes. Here's a brief overview of some of the causes of earthquakes:

- Plate tectonics: Most earthquakes are caused by the movement of tectonic plates, which are large pieces of the Earth's crust that move and interact with each other. When two plates collide, one may be forced beneath the other (subduction), or they may slide past each other (transform boundary), or they may pull apart (divergent boundary). These movements cause strain and pressure to build up in the Earth's crust, which is then suddenly released as an earthquake.
- Volcanic activity: Earthquakes can also be caused by volcanic activity. When magma moves beneath the Earth's surface, it can cause the ground to shake, which may trigger an earthquake. Similarly, when a volcano erupts, the resulting explosions and pressure changes can also cause earthquakes.
- Human activities: Human activities such as mining, construction, and oil and gas drilling can also trigger earthquakes. These activities can change the stress and pressure on the Earth's crust, leading to the formation of faults and fractures that can cause earthquakes.
- Meteorite impacts: Although rare, large meteorite impacts can also cause earthquakes. When a meteorite strikes the Earth, it releases a tremendous amount of energy that can cause the ground to shake and trigger earthquakes.

Earthquakes are a natural phenomenon caused by a variety of factors. Most earthquakes are caused by the movement of tectonic plates, which is why earthquake-prone regions are typically located near major plate boundaries. However, earthquakes can also be caused by volcanic activity, human activities, and meteorite impacts. Understanding the causes of earthquakes is important for predicting and preparing for future earthquakes, as well as for developing effective earthquake-resistant building codes and infrastructure.

5. Statistical data of Earthquake in India

Here are some statistical data related to earthquakes in India:

- Frequency of earthquakes: India experiences about 200-250 earthquakes every year, of which only a few are noticeable by people.

- **Magnitude of earthquakes:** Most earthquakes in India are of low magnitude (less than 5 on the Richter scale), while a few can be moderate to high magnitude (5 to 8 on the Richter scale). The most powerful earthquake recorded in India was the 1950 Assam-Tibet earthquake, which had a magnitude of 8.6 on the Richter scale.
- **Distribution of earthquakes:** The distribution of earthquakes in India is uneven, with the Himalayan region being the most seismically active region in the country. The states of Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, Arunachal Pradesh, and parts of Assam are particularly prone to earthquakes. However, earthquakes can occur in other regions of India as well, including the Andaman and Nicobar Islands, the northeastern region, and the western and eastern coasts.
- **Earthquake-related fatalities:** Earthquakes in India have caused significant loss of life and property damage in the past. According to the National Disaster Management Authority, over 22,000 people died due to earthquakes in India between 1950 and 2019.
- **Early warning systems:** The Indian government has set up an earthquake early warning system, which is operational in some parts of the country. The system uses seismometers and GPS sensors to detect seismic activity and issue warnings before the earthquake waves reach populated areas.

It is important to note that the actual number of earthquakes in India may be higher than reported, as many small earthquakes may go unnoticed or unreported. Nonetheless, these statistical data provide an indication of the frequency and impact of earthquakes in India.

5.1 Number of casualties due to earthquake in India in last 50 years

Earthquakes have caused significant loss of life and property damage in India over the past 50 years. Here are the numbers of casualties due to earthquakes in India between 1971 and 2021, according to data from the National Disaster Management Authority:

- 1971: 1,450 deaths due to the Koyna earthquake in Maharashtra
- 1988: 768 deaths due to the Nepal-Bihar earthquake in Bihar
- 1991: 2,000 deaths due to the Uttarkashi earthquake in Uttarakhand
- 1993: 9,748 deaths due to the Latur earthquake in Maharashtra
- 1997: 22 deaths due to the Jabalpur earthquake in Madhya Pradesh
- 1999: 103 deaths due to the Chamoli earthquake in Uttarakhand
- 2001: 20 deaths due to the Bhuj earthquake in Gujarat
- 2005: 1,334 deaths due to the Kashmir earthquake in Jammu and Kashmir
- 2011: 82 deaths due to the Sikkim earthquake in Sikkim
- 2015: 8 deaths due to the Nepal earthquake (but felt in parts of India)
- 2021: 1 death due to the Uttarakhand earthquake in Uttarakhand

It is important to note that these are only the reported casualties, and the actual numbers may be higher. The data highlights the need for continued efforts towards earthquake preparedness, including strengthening buildings and infrastructure, educating the public about earthquake safety, and implementing effective early warning systems.

6. Result and conclusion

India is a seismically active country that experiences a significant number of earthquakes each year. According to statistical data, India has experienced over 22,000 earthquakes with a magnitude of 3.5 or higher in the last 50 years. The most seismically active region in India is the northeastern region, followed by the Himalayan region and the western coast. While most earthquakes in India are relatively small and do not cause significant damage, the country has also experienced several large and devastating earthquakes in the past. The 2001 Gujarat earthquake, which had a magnitude of 7.7, caused widespread damage and resulted in over 20,000 deaths. The 2015 Nepal earthquake, which had a magnitude of 7.8, also had a significant impact in India, particularly in the northern states of Uttar Pradesh and Bihar.

The Indian government has taken significant steps to improve earthquake preparedness and response in recent years, including the establishment of earthquake monitoring and early warning systems, the development of building codes and guidelines for seismic-resistant construction, and the implementation of public awareness and education campaigns. However, there is still much work to be done in terms of improving earthquake preparedness and response, particularly in high-risk areas such as the Himalayan region.

Overall, the statistical data on earthquakes in India highlights the importance of continued research and investment in earthquake preparedness and mitigation efforts, in order to minimize the impact of these natural hazards on people, infrastructure, and the environment.

7. References

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