Earthquake Measuring 4.0 on Richter Scale Shakes Delhi-National Capital Region (NCR)

Published On: 18-02-2025

Context:

A **magnitude 4.0 earthquake** struck the **Delhi-NCR** region, causing noticeable tremors.

Unlike typical Himalayan earthquakes, which are caused by plate tectonics, this one was classified as an **intra-plate event**, triggered by **"in situ material heterogeneity"** within the Earth's crust.

About:

- **Epicenter**: The earthquake's epicenter was located within **Delhi** itself, just 5 km deep, which is considered a **shallow earthquake**. Shallow earthquakes tend to cause more intense tremors and damage due to their proximity to the Earth's surface.
- **Cause of Tremors**: The tremors were more intense because the earthquake originated within Delhi, and the shallow depth amplified the seismic waves. It was caused by variations in the physical properties of the Earth's crust, like the **rock types** and the **presence of fluids in rock pores**, which contribute to stress buildup and increase the likelihood of earthquakes.

Seismic Zone and Fault Systems:

- Delhi is located in **Seismic Zone IV** of India, which is the second-highest seismic zone in the country, indicating that the region is prone to moderate earthquakes.
- **Fault Systems**:
- **Delhi-Haridwar Ridge**: This is an extension of the Indian Plate, contributing to intra-plate seismic activity.
- **Aravalli Fault System**: A deep-seated geological structure influencing seismic movements in the region.
- **Indo-Gangetic Plain**: Delhi-NCR sits on soft alluvial soil, which tends to **amplify seismic waves** during an earthquake, making the tremors feel more intense.

In-Situ Material Heterogeneity:

- This phenomenon refers to the inherent variations in the Earth's crust, including differences in **rock types**, **minerals**, and the presence of **fluids in rock pores**. Such heterogeneities cause stress concentrations, which can eventually lead to earthquakes, especially in fault zones.

Shallow Earthquakes:

- **Depth**: The earthquake occurred at a shallow depth of **5 km**, making it particularly impactful. Shallow earthquakes are known for causing more damage because they are closer to the Earth's surface.
- **Depth Classification**:
- **Shallow Earthquakes**: Occur between **0 to 70 km** depth.
- **Intermediate Earthquakes**: Occur between **70 to 300 km** depth.
- **Deep Earthquakes**: Occur between **300 to 700 km** depth.

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Given Delhi's proximity to the **Indian-Eurasian Plate collision zone** and the fact that the Indian Plate is moving northward at 5 cm/year, seismic activity in the region is expected to continue. The region's position on soft soil also contributes to the intensity of tremors.

This earthquake serves as a reminder of Delhi's vulnerability to seismic activity, and further research and preparedness are essential to minimize the impact of future events.