

frequent earthquakes in Himalayas than the Alps, where the plates converge slowly, and hence, there is less seismic activity.

Reason behind prediction of a largescale earthquake in northern India

The frontal thrust in the central Himalayas (covering parts of India and eastern Nepal) has remained seismically quiet for 600 to 700 years. This implies an enormous build-up of strain in the region. This stacking up of strain in the region may cause at least one earthquake of magnitude 8.5 or more in one of the overlapping segments of the central Himalayas anytime in the future.

Forecasting can play an important role in earthquake disaster mitigation. Some of them are as under:

- **Observation based:** Unusual animal behavior such as restlessness and movement have been observed. However, their correlation with earthquakes is not yet established.
- **Hydrochemical precursors:** Dissolved concentration of minerals has been observed to change during days preceding earthquake. Release of radon gas is also observed.
- **Seismic gap:** Scientists predict earthquake based on expected build-up of strain in regions where earthquakes are expected but have not happened in sometime.
- **Statistical models:** A combination of classical earthquake statistics and numerical models such as seismo-thermo-mechanical (STM) modelling that simulates the way the tectonic plates move and collide.
- **Physics based models:** Recently a research, conducted by Columbia University, simulated nearly 500,000 years of California earthquakes on a supercomputer, which was able to match hazard estimates based on statistical models.
- **Uniform California Earthquake Rupture Forecast (UCERF3):** It provides authoritative estimates of the likelihood and severity of potentially damaging earthquake ruptures in the long- and near-term.
- **Technological interventions:** Local geology and structural maps published by GSI, Google Earth imagery from ISROs, Carto-sat 1 contributes to research and development
- **Palaeoseismology:** Geological Investigations of active faults.
- Other methods of **traditional prediction** include unusual animal behaviour, change in underground water, Radon gas levels in soils etc.

14. Highlighting India's vulnerability to droughts, discuss the major guidelines of National Disaster Management Authority (NDMA) for management of droughts.

Approach:

- Briefly discuss the key facts regarding India's vulnerability to droughts.
- Discuss the impacts of drought on Indian economy.
- Discuss the NDMA guidelines and challenges attached to the management of drought.
- Discuss government initiative and innovative measures to overcome the challenges posed by Drought.

Answer:

Rainfall data over the past century indicates that there has been a severe drought every eight to nine years. The government's drought mitigation programmes cover 225 drought-prone districts. Most of India's poor inhabit the drought-prone areas.

The inability of ecosystems to tolerate water-limited conditions poses a serious challenge in terms of crop production, food security and carbon sequestration. The traditional approach to drought as a phenomenon of arid and semi-arid areas is changing in India as even regions with high rainfall often face severe water scarcities.

Indian economy's vulnerability to drought stems from a combination of factors like a relatively high share of agriculture in overall employment and weak rural infrastructure. Inefficient food distribution