



## Science Talk • Earthquakes explained |B5

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ScienceTalk

# Earthquakes explained: Has their frequency been increasing?

Karen Lythgoe

With the spate of earthquakes hitting Mexico and Taiwan in the past couple of months, it may seem they are happening more often. But this is not the case, said Dr Karen Lythgoe, senior research fellow at the Earth Observatory of Singapore at Nanyang Technological University. Here, she answers some questions on earthquakes.

### ARE EARTHQUAKES HAPPENING MORE OFTEN?

On average, there are about 15 large earthquakes every year with magnitudes greater than 7.0. In the first 10 months of 2022, only seven such earthquakes were recorded, so the frequency of these disasters is within the normal range.

Based on the statistical expectation of 15 large earthquakes per year, a few more large earthquakes are expected to happen before the end of 2022.

The occurrence of large earthquakes around the world can be considered a random process. This means there can be clusters of quakes occurring within a few days and, at other times, at larger intervals of weeks or months.

While the probability of three large earthquakes occurring in the same country on the same date is very low, it is not impossible. In Mexico, for instance, three large earthquakes struck on Sept 19 – one in 1985, in 2017 and another in 2022, albeit at different locations in the country.

### WHAT CAUSES EARTHQUAKES?

The earth's crust comprises huge tectonic plates that are constantly moving very slowly, by centi-



Soldiers and civil defence personnel working to unblock access to three houses that collapsed after an earthquake in Colima, Mexico, in September. The disaster struck on Sept 19, the same date Mexico has experienced two other large earthquakes – in 1985 and in 2017, albeit at different locations in the country. PHOTO: AFP

metres per year. At some locations, the plates get stuck together. Stress builds up at these locations to a breaking point, when the faults, or cracks in the earth's crust, suddenly move.

This sudden movement causes energy to be released in the form of seismic waves, which spread and cause the shaking that we feel.

### IS CLIMATE CHANGE TO BLAME FOR EARTHQUAKES?

There is increasing awareness of

the impacts of climate change, but none of the recent earthquakes is likely to have been related to that. Think melting polar ice caps, extreme weather events like heat-waves, floods and droughts, which not only culminate in environmental destruction, but also pose risks to our health and food security.

Some scientific studies suggest that climate change might have a modest link to geological phenomena such as earthquakes, but these effects would be quite localised. Changes in terrestrial ice cover

are among the climatic factors that have been linked to earthquakes.

Glaciers and permanent ice sheets in the polar regions exert enormous pressure on the bedrock, causing it to warp downwards. As the ice melts and that weight is released from the earth's crust, the land responds with a rebound, like a slow, giant trampoline. This rebound can have consequences for geological faults, possibly resulting in earthquakes, although these will be confined to the icy regions.

However, the effects are secondary to the main cause of large earthquakes, which is the movement of tectonic plates.

### ARE WE GETTING BETTER AT PREDICTING 'THE NEXT BIG ONE'?

Despite many advances in the field, there is still no sure-fire method of predicting when an earthquake is going to happen.

What scientists can do is calculate the probability that a large earthquake will occur in a certain area at a certain time. For example, estimating a 70 per cent chance that there will be an earthquake larger than magnitude 6.0 within a certain area in the next five years. Palaeoseismology studies examine past earthquakes based on the evidence found at geological faults, and such studies can help scientists understand where big earthquakes might happen in future.

Such forecasts have large uncertainties, with timeframes spanning decades and the predicted epicentre, or origin point of the earthquake, being within a radius of hundreds of kilometres. But these forecasts are still a marked improvement from a century ago.

### DOES THE DEPTH OF THE EARTHQUAKE HAVE TO DO WITH ITS IMPACT?

Yes. The depth does matter. As shallow earthquakes are closer to the surface, they cause more shaking than deeper earthquakes of the same size.

Generally, an earthquake is deemed shallow if it is less than approximately 70km deep. The deepest earthquakes are around 600km beneath our feet, but these have only a small impact on the earth's surface.

### WILL SINGAPORE BE AT RISK OF EARTHQUAKES IN FUTURE?

Singapore is not located on a plate boundary, which is where two tectonic plates meet and the world's largest earthquakes occur.

This means the Republic is unlikely to experience large earthquakes of magnitudes that are greater than 9.0.

Big earthquakes can still happen away from plate boundaries, and there is still much to be discovered about seismic hazards in and around Singapore.

Scientists know, for example, that in 1922 there were two earthquakes of magnitude 5.0 that happened in South Malaysia near Singapore.

Therefore, there can be earthquakes of a similar severity, but it is not known how often they will happen or which geological fault causes them.

Seismicity, or the amount of seismic activity, decreases gradually away from the plate boundary. Singapore lies on the Sunda plate, along with Malaysia and Indonesia. The Malay Peninsula is still seismically active, although it experiences fewer earthquakes compared with Indonesia, which lies on the Sumatran subduction zone, the nearest plate boundary.

Tremors from earthquakes in Sumatra can occasionally be felt in Singapore. For example, a magnitude 6.2 earthquake in Sumatra in February 2022 was widely felt throughout the Republic.

More research is needed to assess the activity of geological faults and seismic hazard in Singapore and the neighbouring regions.

• Dr Karen Lythgoe's research uses seismology to address earth science problems, from seismic hazards to urban development applications.



Evolution of eye colour may be related to ambient light