NEWS RELEASE

Singapore, 12 May 2021

NTU Singapore study of ancient corals in Indonesia reveals slowest earthquake ever recorded

- Study highlights missing factors or mismodelling in global risk assessments

A 'slow-motion' earthquake lasting 32 years – the slowest ever recorded - eventually led to the catastrophic 1861 Sumatra earthquake, researchers at the **Nanyang Technological University, Singapore (NTU Singapore)** have found.

The NTU research team says their study highlights potential missing factors or mismodelling in global earthquake risk assessments today.

'Slow motion' earthquakes or 'slow slip events' refer to a type of long, drawn-out stress release phenomenon in which the Earth's tectonic plates slide against one another without causing major ground shaking or destruction. They typically involve movements of between a few cm/year to cm/day.

The NTU team made the surprise discovery while studying historic sea-levels using ancient corals called 'microatolls' at Simeulue Island, located off the coast of Sumatra. Growing both sideways and upwards, the disc-shaped coral microatolls are natural recorders of changes in sea level and land elevation, through their visible growth patterns.

Using data from the microatolls and combining them with simulations of the motion of the Earth's tectonic plates, the NTU team found that from 1829 until the Sumatra earthquake in 1861, south-eastern Simeulue Island was sinking faster than expected into the sea.

This slow slip event was a gradual process that relieved stress on the shallow part of where two tectonic plates met, said the NTU team. However, this stress was transferred to a neighbouring deeper segment, culminating in the massive 8.5 magnitude earthquake and tsunami in 1861 which led to enormous damage and loss of life.

The discovery marks the longest slow slip event ever recorded and will change global perspectives on the timespan and mechanisms of the phenomenon, says the NTU team. Scientists previously believed that slow slip events take place only over hours or months, but the NTU research shows that they could, in fact, go on for decades without triggering the disastrous shaking and tsunamis seen in historical records.

Lead author of the study, **Rishav Mallick, a PhD student at the NTU Asian School of Environment**, said, “It is interesting just how much we were able to discover from just a handful of ideally located coral sites. Thanks to the long timespans of the ancient corals, we were able to probe and find answers to secrets of the past. The method that we adopted in this paper will also be useful for future studies of other subduction zones - places that are prone to earthquakes, tsunamis, and volcanic eruptions. Our study can therefore contribute to better risk assessments in future.”

Co-author **Assistant Professor Aron Meltzner** from the **Earth Observatory of Singapore at NTU** said, “When we first found these corals more than a decade ago, we knew from their growth patterns that something strange must have been going on while they grew. Now we finally have a viable explanation.”

The findings, published in the peer-reviewed scientific journal *Nature Geoscience* in May, led the authors to suggest that current earthquake risk assessments may be overlooking ongoing slow slip events in the observations, and hence not properly considering the potential for slow slip events to trigger future earthquakes and tsunamis.

Possible ‘slow motion’ earthquake ongoing at Enggano Island

Located far from land below kilometres of water, the shallower part of the subduction zone is typically ‘quieter’ and does not produce as many earthquakes. Its distant location also makes it difficult for land-based scientific instruments to detect activities and for scientists to understand what is going on.

Many scientists have therefore tended to interpret the ‘quietness’ of the shallow part of the subduction zone to mean that the tectonic plates lying underneath to be sliding along steadily and harmlessly.

Though this might be correct in some cases, the NTU study found that this sliding is not as steady as assumed and can occur in slow slip events.

Elaborating on their findings, Rishav said, “Because such slow slip events are so slow, we might have been missing them as current instrumental records are generally only up to ten years long.”

He added, “If similar behaviour is observed leading up to earthquakes elsewhere, this process might eventually be recognised as an earthquake precursor.”

Tapping on their methodology in the research, the NTU team also highlighted a potential ongoing drawn-out slow slip event at Enggano Island, Indonesia, located at about 100 km (60 miles) southwest of Sumatra.

Asst Prof Meltzner said, “If our findings are correct, this would mean that the communities living nearby this Indonesian island are potentially facing higher risk of tsunami and earthquake than what was previously thought. This suggests that models of risk and mitigation strategies need updating.”

***

Note to Editors:

Paper titled *“Long-lived Shallow Slow-slip Events on the Sunda Megathrust”,* published online in Nature Geoscience, 3 May 2021.

Image 1: Assistant Professor Aron Meltzner collecting samples from a microatoll at the Latiung village site on southeastern Simeulue Island. *Photo by Imam Suprihanto.*

Image 2: Microatoll from the Labuhan Bajau village site on southeastern Simeulue Island. The radial slab that was extracted from the microatoll was 2.6 m long and was used to reconstruct changes in relative sea level and land level. *Photos by Aron Meltzner*

END

Media contact:

Ms Junn Loh
Manager, Media Relations
Corporate Communications Office
Nanyang Technological University, Singapore
Email: junn@ntu.edu.sg

About Nanyang Technological University, Singapore

A research-intensive public university, Nanyang Technological University, Singapore (NTU Singapore) has 33,000 undergraduate and postgraduate students in the Engineering, Business, Science, Humanities, Arts, & Social Sciences, and Graduate colleges. It also has a medical school, the Lee Kong Chian School of Medicine, set up jointly with Imperial College London.

NTU is also home to world-class autonomous institutes – the National Institute of Education, S Rajaratnam School of International Studies, Earth Observatory of Singapore, and Singapore Centre for Environmental Life Sciences Engineering – and various leading research centres such as the Nanyang Environment & Water Research Institute (NEWRI) and Energy Research Institute @ NTU (ERI@N).

Ranked amongst the world's top universities by QS, NTU has also been named the world's top young university for the past seven years. The University's main campus is frequently listed among the Top 15 most beautiful university campuses in the world and it has 57 Green Mark-certified (equivalent to LEED-certified) building projects, of

which 95% are certified Green Mark Platinum. Apart from its main campus, NTU also has a campus in Singapore's healthcare district.

Under the NTU Smart Campus vision, the University harnesses the power of digital technology and tech-enabled solutions to support better learning and living experiences, the discovery of new knowledge, and the sustainability of resources.

For more information, visit www.ntu.edu.sg

About the Earth Observatory of Singapore

The Earth Observatory of Singapore (EOS) conducts fundamental research on earthquakes, volcanic eruptions, tsunamis and climate change in and around Southeast Asia, toward safer and more sustainable societies.

Established in 2009 as a Research Centre of Excellence at Nanyang Technological University, EOS has never been more important for Singapore and Southeast Asia. Disasters connected with natural hazards affect increasingly large populations, and in many cases are compounded by the threat of climate change and rising sea levels. EOS generates scientific breakthroughs that meet our societal needs and improve the lives of those that live in the region.

For more information, visit www.earthobservatory.sg