A deep dive into shallow quakes

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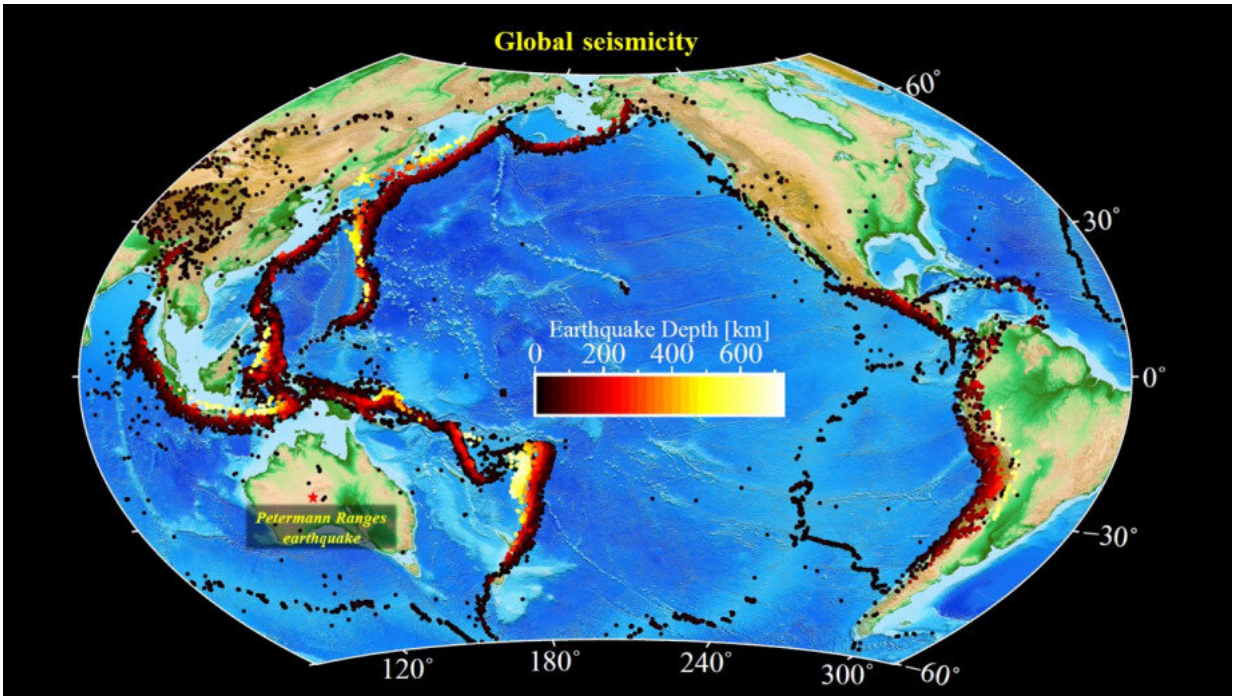

Credit: Australian National University

New research from the Australian National University (ANU) has shown that Australia is prone to shallow and potentially destructive earthquakes.

The research is at the international forefront of seismic source estimation and will help scientists calculate the time, location and characteristics of an earthquake.

By using higher frequency seismic waves and detailed 3-D earth models, researchers were able to more accurately simulate shallow earthquakes.

Lead researcher, Dr. Babak Hejrani says that routine seismological techniques are not suitable to simulate very shallow earthquakes.

"We have shown how the simulation of high frequency seismic waves can improve these outcomes."

Shallow earthquakes occur when seismic activity takes place within the top 30 kilometers of the earth's crust and according to Dr. Hejrani, they account for majority of the Earth's seismic activity.

"These earthquakes are also among the most destructive natural disasters," Dr. Hejrani said.

The research compared the traditional and new methods of simulation by replicating the 2016 Petermann ranges earthquake in Australia.

There have been four earthquakes in this region over the last 30 years that registered at a magnitude five or higher.

"The 2016 Petermann ranges earthquake occurred at a depth of one kilometer and ruptured 20 kilometers along the earth's surface," Dr. Hejrani said.

"Our simulations showed that at shallow depths of one to 10 kilometers, using higher frequencies and 3-D earth models is necessary. We hope that our research explains the steps that need to be taken to correctly estimate the sources of shallow earthquakes in Australia."

Dr. Hejrani also hopes that agencies responsible for simulating earthquakes will adapt their methods in the future.

"It is important that the authorities who report earthquakes eventually use simulations of high frequencies in high resolution 3-D earth models. It is a more computationally expensive method, but the accuracy with which it simulates these earthquakes means it is the only way forward," said Dr. Hejrani.

Dr. Hejrani notes that Australians should not be concerned about earthquakes to the same extent that people in places with frequent seismic activity such as Japan and California are.

"This is simply a reminder that the Earth is a dynamic planet and no place on Earth is totally free of natural disasters like shallow, destructive earthquakes," Dr. Hejrani said.

More information: Babak Hejrani et al. Resolvability of the Centroid-Moment-Tensors for Shallow Seismic Sources and Improvements From Modeling High-Frequency Waveforms, *Journal of Geophysical Research: Solid Earth* (2020). DOI: 10.1029/2020JB019643

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