

Assessing seismic activity near site of planned city NEOM

October 25 2021



Two separate studies conducted by KAUST researchers reveal that northeastern Saudi Arabia, where the gigaproject NEOM is under construction, is at low risk of significant seismic activity. Credit: KAUST

The potential for major earthquakes around the southern end of the Gulf of Aqaba may be lower than geophysicists feared. Separate studies by two students, using quite different approaches but arriving at similar findings, give hope that there will be low risks for emerging cities on the nearby shores of the Red Sea.

The Dead Sea Transform fault spans roughly 1200 kilometers from the Red Sea north to Turkey, and written records show it has produced many devastating earthquakes over the last 2,000 years. However, there has been little study of seismicity in the sparsely populated region around the southern part of the fault, where the Gulf of Aqaba meets the Red Sea.

"This area is now of great interest to Saudi Arabia because they are building the future megacity of NEOM very close to the Gulf of Aqaba," says geophysicist Sigurjón Jónsson from KAUST. "They also want to build the King Salman road crossing across the Gulf to Sharm El Sheikh." In 1995, a 7.2 magnitude quake struck the northern Gulf. The impact of an earthquake of such magnitude beneath the proposed crossing would be disastrous, so it is essential that engineers understand the seismic hazard in the region.

Xing Li and Nicolás Castro-Perdomo, Jónsson's research students, led separate studies of plate motion around the Gulf of Aqaba. Both students used satellite geodesy, a universal framework for measuring the precise location of points on Earth. By observing how reference points on the surface move over time, geophysicists can study the deformation of tectonic plates and observe how rapidly stress and strain is building around fault lines. "Estimating how fast elastic energy builds up gives us crucial information on how frequently, and how large, earthquakes might be," says Perdomo.

Perdomo used a network of more than 40 global positioning system (GPS) stations on the ground around the Gulf and modeled the tectonic deformation from their positions in 2015, 2017 and 2019.

Conversely, Xing Li used Interferometric Synthetic Aperture Radar (InSAR) imagery, produced by satellites bouncing radar signals off the Earth's surface, to measure plate motion. However, InSAR imagery from polar-orbiting satellites does not capture north-south motion. "By

focusing on areas where the [satellite images](#) overlap, where common signals cancel out, we could retrieve the north-south displacement," explains Li. She used more than 300 satellite images collected between 2014 and 2020 to create multiple 160-kilometer-long profiles of plate motion around the Gulf.

Both studies found the Arabian side of the fault has been moving steadily northwards at around five millimeters per year. However, they noted a greater near-fault velocity to the south of the Gulf, which they attribute to the Earth's crust thinning, thereby creating less friction towards the Red Sea. Perdomo used existing models of crustal deformation to interpret their observations. "The rapid near-fault velocity gradient implies that the southernmost fault could be steadily sliding along without producing [major earthquakes](#)," he says.

Both methods have proven reliable, yet GPS surveys remain labor intensive and expensive. "We've found an efficient and low-cost way to gather vast quantities of data that enable us to calculate even very slow horizontal displacement along a north-south fault, without doing any fieldwork," says Li.

"There is uncertainty within each method, and lots of assumptions had to be made," says Jónsson. "But the fact that both studies independently concluded that earthquake hazard decreases towards the southern end of the Gulf strengthens the results tremendously." And a recent analysis of sedimentary cores collected from the bottom of the Gulf also suggests that large quakes have historically been less frequent at its southern end. "While this is good news, NEOM is not off the hook," says Jónsson, "More investigations into local site conditions, as well as [earthquake](#) simulations, are needed to guide the construction of a resilient city."

More information: Nicolás Castro-Perdomo et al, Interseismic deformation in the Gulf of Aqaba from GPS measurements, *Geophysical*

Journal International (2021). [DOI: 10.1093/gji/ggab353](https://doi.org/10.1093/gji/ggab353)

Provided by King Abdullah University of Science and Technology

Citation: Assessing seismic activity near site of planned city NEOM (2021, October 25) retrieved 10 April 2024 from <https://phys.org/news/2021-10-seismic-site-city-neom.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.