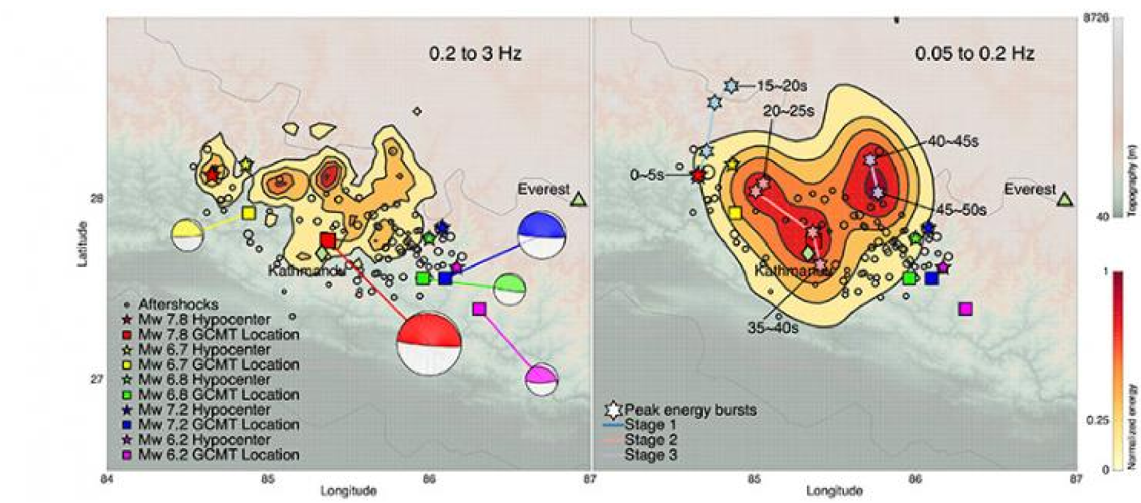
# Researchers map out trajectory of April 2015 earthquake in Nepal

July 23 2015




Images showing the back-projected power and path of the Nepal earthquake. Credit: Wenyuan Fan and Peter Shearer

Researchers from Scripps Institution of Oceanography at UC San Diego have accurately mapped out the movement of the devastating 7.8-magnitude Nepal earthquake that killed over 9,000 and injured over 23,000 people. Scientists have determined that the earthquake was a rupture consisting of three different stages. The study could help a rapidly growing region understand its future seismic risks.

The Himalayan region is particularly prone to earthquakes and this study will serve as an important benchmark for understanding where future earthquakes may occur, especially since the area has experienced high population growth over the past few decades.

The study assessed the presence of low frequency and high frequency waves over the three stages of the earthquake. High frequency waves cause more shaking, thereby posing the greatest risks for structural damages. Low frequency waves are less violent and less damaging to buildings and infrastructure.

"The Nepal earthquake is a warning sign that the region is of high seismic risk, and each earthquake behaves differently. Some earthquakes jump from one fault line to another, whereas the Nepal quake apparently occurred on the same fault line in three different stages, moving eastward," said Scripps geophysicist Peter Shearer, "Using this research, we can better understand and identify areas of high seismic hazard in the region."

This first peer-reviewed study on the April 2015 earthquake in Nepal, "Detailed rupture imaging of the 25 April 2015 Nepal earthquake using teleseismic P waves" was published online July 16 in the American Geophysical Union (AGU) journal *Geophysical Research Letters*.

Using the Global Seismic Network (GSN), Shearer and Scripps graduate student Wenyuan Fan were able to unravel the complex evolution of fault slips during this earthquake. The study concludes that the rupture traveled mostly eastward and occurred in three distinct stages; Stage 1 was weak and slow; Stage 2 was near Kathmandu and had the greatest slip but was relatively deficient in high-frequency radiation; and Stage 3 was relatively slow as well. Overall, this earthquake was more complicated, with multi-stage movements on multiple faults, than smooth models of continuous rupture on a single fault plane.

"Using the GSN instead of regional array data really enhanced the spatial resolution of the back-projection images and helped us see that frequency-dependent rupture was one of the main features of this earthquake," said Fan. "Stage 2 was high-frequency-deficient and occurred closest to Kathmandu, which was probably why ground shaking was less severer than expected for such a high-magnitude earthquake."

The Global Seismic Network provides high-quality broadband digital seismic data for monitoring earthquakes and learning about Earth structure. A precursor to this network was initiated by Scripps researchers in the 1960s and is still in use today. Scripps currently operates one-third of the 153 global seismometers of the GSN. Fan and Shearer used the GSN data because they are open-source (available to anyone), have good coverage of the Nepal region, and have a long history of reliable recordings.

"In general, understanding large earthquakes will inform our ability to forecast the nature of future earthquakes," said Shearer.

Shearer and Fan hope to use the same methodology to study other large, global earthquakes from the past decade to provide a broader picture of earthquake behavior and help in predicting ground shaking for future events.

Provided by University of California - San Diego