NASA GPS software to calculate quake size

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GPS software developed by NASA could be the answer to determining the scale of an earthquake.

That's what a team of university scientists is saying, showing that data from NASA's GPS technology can be used to determine whether an earthquake is big enough to generate an ocean-wide tsunami, and in turn provide faster tsunami warnings.

The team, led by Geoffrey Blewitt of the Nevada Bureau of Mines and Geology and Seismological Laboratory at the University of Nevada, demonstrated that within 15 minutes an earthquake's size can be determined, much faster than current methods, according to the release.

"We'll always need seismology as the first level of alert for large earthquakes, and we'll need ocean buoys to actually sense the tsunami waves," Blewitt said. "The advantage of including GPS in warning systems is that it quickly tells how much the ocean floor moved, and that information can directly set tsunami models into motion."

Results of their study were published in the Geophysical Research Letters from the American Geophysical Union, in which the scientists tested a method called "GPS displacement" that they hope will aid in predicting large-scale earthquakes in the future.

The method entails "measuring the time radio signals from GPS satellites arrive at ground stations located within a few kilometers of an earthquake." And by calculating how far the stations moved because of

the earthquake, scientists could derive an earthquake model as well as its true size or "moment magnitude," which is connected to rather a quake would generate into a tsunami.

According to the team, the December 2004 Sumatra earthquake in Indonesia provided a good example to test their hypothesis. The team had noted that the earthquake moved the ground permanently more than 0.4 inches as far away as India or about 1,200 miles away.

"With signals like that, an earthquake this huge can't hide," Blewitt said. "We hypothesized that if GPS data could be analyzed rapidly and accurately, they would quickly indicate the earthquake's true size and tsunami potential."

The 2004 earthquake that killed thousands in its wake had a magnitude of 9.2 to 9.3 but was first estimated at 8.0 using seismological techniques designed for rapid analysis -- which the team says underestimates earthquakes larger than 8.5 by making estimates from the first recorded seismic waves. Additionally, it was noted that this initial estimate was "the primary reason warning centers in the Pacific significantly underestimated the earthquake's tsunami potential."

"Tsunami warning is a race against time," said co-author Seth Stein of the Department of Geological Sciences at the Northwestern University. "Tsunamis travel at jet speed, so warning centers must accurately decide, within minutes, whether to issue alerts. This has to be done fast enough for the warning to be distributed to authorities in impacted areas so they can implement response plans. Together with seismometer and ocean buoy data, GPS adds another tool that can improve future tsunami danger assessments."

So, taking advantage of NASA's satellite positioning data processing software, the scientists analyzed data within 15 minutes of the

earthquake. Looking at 38 GPS stations varying in distances from the Sumatra earthquake's epicenter, they tested the feasibility of their approach, the team said.

According to the release, the scientists' results indicated that most permanent ground displacements occurred within a few minutes of the arrival of the first seismic waves and that their analysis inferred an earthquake model and moment magnitude of 9.0 -- "very near the earthquake's final calculated size."

"Modeling earthquakes with GPS requires a robust, real-time ability to predict where GPS satellites are in space with exacting precision, which our software does," added Frank Webb, a NASA geologist at the agency's Jet Propulsion Laboratory in Pasadena, Calif. "This technique improves rapid estimates of the true size of great earthquakes and advances real-time tsunami modeling capabilities."