NOAA NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
UNITED STATES DEPARTMENT OF COMMERCE

Tsunamis May Telegraph Their Presence

Underwater Communication Network May Sense Tsunamis

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Tsunamis send electric signals through the ocean that appear to be sensed by the vast network of communication cables on the seabed, according to a new study led by Manoj Nair of the University of Colorado and NOAA.

Nair and his colleagues used computer models to estimate the size of an electric field created by the force of the 2004 Indian Ocean tsunami as it traveled over major submarine cables. Salty seawater, a good conductor of electricity, generates an electric field as it moves through Earth's geomagnetic field.

"We estimate that the 2004 tsunami induced voltages of about 500 millivolts (mV) in the cables. This is very small compared to a 9-volt battery, but still large enough to be distinguished from background noise on a magnetically quiet day," Nair said. "By monitoring voltages across this network of ocean cables, we may be able to enhance the current tsunami warning system."

But Nair cautioned that much research is still needed to effectively isolate the tsunami signals from other sources, such as Earth's upper atmosphere, or ionosphere, whose signals can reach 100 mV. One millivolt is equivalent to one-thousandth of a volt.

Tsunamis are created by a large displacement of water resulting from earthquakes, landslides, volcanic eruptions, and even meteors hitting the ocean. Vessels far out at sea may not notice the waves passing underneath at the speed of a jetliner, because the wave heights are very small in the deep ocean. This makes their detection and monitoring a challenge.

The current tsunami warning system relies on a global seismometer network to detect earthquakes that may indicate that a tsunami has formed. Deep-ocean pressure sensors and coastal tide gauges are the only tools available to detect and measure an actual tsunami. The electric current induced in submarine cables may provide an additional way to confirm and track a tsunami.

Since the 2004 tsunami, the international warning system has expanded to include 47 deep-ocean pressure sensors, most of them in the Pacific area. After an investment of more than $100 million and strong support of Congress, NOAA has made tsunami warnings and education a priority. Within the United States, real-time data from these deep ocean sensors are used to forecast the impact of the tsunami on U.S. shorelines.

Co-authors are Alexei Kuvshinov of the Swiss Federal Institute of Technology, Zürich, S. Neetu of the National Institute of Oceanography, India and T. Harinarayana of the National Geophysical Research Institute, Hyderabad, India. Nair is also associated with NOAA's Cooperative Institute for Research in Environmental Science at the University of Colorado.

The study will appear in the February edition of the journal *Earth, Planets and Space*.

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