Alaskan earthquake in 2002 set off tremors on Vancouver Island

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Perhaps it was just a matter of sympathy, but tremors rippled the landscape of Vancouver Island, the westernmost part of British Columbia, in 2002 during a major Alaskan earthquake. Geoscientists at the University of Washington have found clear evidence that the two events were related.

Tremor episodes have long been observed near volcanoes and more recently around subduction zones, regions where the Earth's tectonic plates are shifting so that one slides beneath another. Tremors in subduction zones are associated with slow-slip events in which energy equivalent to a moderate-sized earthquake is released in days or weeks, rather than seconds.

Now researchers studying seismograph records have pinpointed five tremor bursts on Vancouver Island on Nov. 3, 2002, the result of a magnitude 7.8 earthquake on the Denali fault in the heart of Alaska.

As surface waves, called Love waves, shook Vancouver Island they triggered tremors underneath the island in the subduction zone where the Explorer tectonic plate slides beneath the North American plate. The tremors were measured by seismometers along roughly the northern two-thirds of the island.

"What we found is that when the waves pushed the North American plate to the southwest, the tremor episode turned on and when the motion reversed it turned off," said Justin Rubinstein, a UW

postdoctoral researcher in Earth and space sciences and lead author of a paper describing the work published in the Aug. 2 edition of *Nature*.

Though the Denali quake was mostly felt in Alaska, its effects were apparent thousands of miles away. It sloshed lakes from Seattle to Louisiana, muddied wells as far east as Pennsylvania and triggered small earthquakes in seismic zones across the Western United States.

Still, finding evidence of tremors on Vancouver Island was unusual.

"A few people have seen tremor episodes triggered by earthquakes, but not as clearly as we have. This is by far the clearest and easiest to interpret," said co-author John Vidale, a UW professor of Earth and space sciences and director of the Pacific Northwest Seismic Network.

"This shows us it's just like a regular fault – you add stress and it slips," Vidale said. "It's like regular faulting but on a different time scale."

Other authors are Joan Gomberg of the U.S. Geological Survey in Seattle and UW researchers Paul Bodin, Kenneth Creager and Stephen Malone.

An earthquake typically will appear suddenly on a seismograph, while the much more subtle ground motion from a tremor burst gradually emerges from the background noise and then fades again, Rubinstein said.

By comparison, tremors typically produce the strongest seismic signals in a slow-slip event, in which seismic energy is released very gradually during periods as long as three weeks.

In this case, the authors suggest that the force of the Love waves induced slow slip on the interface between the North American and Explorer

tectonic plates near Vancouver Island and triggered the tremor bursts, each lasting about 15 seconds.

"That made it easier for us to observe because there were these five distinct bursts," Rubinstein said. "Normally you are not going to feel these tremors. The shaking in the tremors we observed was 1,000 times smaller than the surface waves from the earthquake."

Being able to spot the tremors was largely a matter of distance and timing, Vidale said.

"We were able to separate the tremor signal from that of the distant earthquake because the surface waves had traveled more than 1,200 miles, losing the high-frequency vibrations that would have masked the high-frequency tremor vibrations," Vidale said.

While the tremors were recorded a great distance from the rupture that triggered the Denali earthquake, the scientists suggest the same process could occur closer to the fault and might actually be important in the rupture process.

Source: University of Washington