Witness Testimony
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OVERSIGHT HEARING ON:
"Whole Lotta Shakin': An Examination of America's Earthquake Early Warning System Development and Implementation"

BEFORE THE U.S. HOUSE OF REPRESENTATIVES COMMITTEE ON NATURAL RESOURCES, SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES

June 10th, 2014

Good morning Chairman Lamborn, Ranking Member Holt, Congressman DeFazio, and Committee Members. I want to thank the Chairman and all members of the committee for the opportunity to submit testimony about a West Coast Earthquake Early Warning (EEW) system. I would also like to thank the Chairman and all members of the committee for their leadership in holding this hearing.

I am Douglas Toomey, a professor of geophysics at the University of Oregon. I lead the Cascadia Initiative, a four-year, $30 million project funded by the National Science Foundation that features the largest array of onshore-offshore earthquake-measuring instruments in U.S. history. This onshore/offshore seismic and geodetic experiment uses an amphibious array to study questions ranging from megathrust earthquakes to volcanic arc structure to the formation, deformation and hydration of the Juan De Fuca and Gorda plates. The University of Oregon also participates in the Pacific Northwest Seismic Network, a cooperative operated by the University of Washington and the University of Oregon; it monitors earthquake and volcanic activity in the Pacific Northwest.

Today I will emphasize the unique opportunities for an Earthquake Early Warning system in the Pacific Northwest. I will outline the hazards of the Cascadia Subduction Zone, explain how an Earthquake Early Warning system can benefit the Pacific Northwest, and develop a vision for the future when the Cascadia Subduction Zone — which lies almost entirely offshore — is monitored in real time by ocean bottom observatories.

Cascadia Subduction Zone

A magnitude 9 (M9) earthquake and tsunami comparable to those that occurred in Alaska in 1964, Sumatra in 2004, Chile in 2010, and Japan in 2011, has, and will again, hit the Pacific Northwest. The source of this devastating earthquake will be the Cascadia Subduction Zone, which lies beneath the coastal areas of Northern California, Oregon and Washington. It's been more than 300 years since the last great earthquake and tsunami along the subduction zone, and we're in the window for its recurrence; we know that enough energy has built up as deformation in the rocks around the fault to power a magnitude 9 quake.

The Pacific Northwest is unprepared for a catastrophe of this scale. FEMA estimates that the direct financial losses would be $60 billion, while the Insurance Bureau of Canada expects losses of approximately $75 billion in Canada. By comparison, the estimated losses from the Christchurch, New Zealand, magnitude 6 earthquake exceeds $18 billion, and in a January 2012 press release, the reinsurer Munich RE estimated Japanese losses at $210 billion.

Because the Cascadia fault zone lies offshore, we do not understand it as well as onshore faults, which can be monitored through easy and relatively inexpensive means. However, several ongoing initiatives and monitoring efforts – including the NSF-supported Cascadia and Ocean Observatories Initiatives and the USGS-supported Advanced National Seismic System – are laying a solid foundation for assessing and helping to mitigate the seismic and tsunamigenic hazards of the next great earthquake in the Pacific Northwest.

As laudable as these efforts are, however, they fall well short of providing society with real-time warnings to take emergency action. Only a West Coast Earthquake Early Warning system can provide advance warnings that will save lives, protect businesses, and facilitate a more rapid recovery for local communities, the federal government, and the economy as a whole.

An Earthquake Early Warning (EEW) System for the U.S. West Coast

An Earthquake Early Warning system is well suited for the impending magnitude 9 earthquake on the Pacific Northwest coast. This is because the most powerful earthquakes in the Pacific Northwest occur along a fault that lies primarily offshore, as opposed to directly beneath major metropolitan areas. Given the immense length of this fault, if it were to begin rupturing in the south — as research indicates — Portland could receive a warning as much as three minutes

– and Seattle, as much as five minutes – prior to the earthquake hitting. Even in Eugene, Oregon, where I live, our schools, businesses, and hospitals could be warned as much as two minutes before the shaking starts.

Two minutes is a long time. I asked a principal of a local elementary school, which was built in 1926, how long it would take to evacuate all 350 students. The answer: A minute and a half. This is just one of the 1,000 schools that a recent state of Oregon study concluded would collapse in an magnitude 9 event. Because many structures in Oregon were built prior to current standards for seismic stability, it is imperative that we operate an Earthquake Early Warning system so our schools and public buildings can be safely evacuated.

To drive home just how unprepared the Pacific Northwest is, consider the map in Figure 1. This map shows seismic stations operated by the Pacific Northwest Seismic Network. Observe the near absence of earthquake monitoring sites within the large red circle encompassing southwestern Oregon. If we presume that the next massive earthquake in the Cascadia Subduction Zone begins in Northern California and unzips to the north, then it is obvious that our current capacity to detect earthquakes in this crucial region is woefully inadequate for protecting society.

An onshore Earthquake Early Warning system is entirely possible with the technology and scientific knowledge at hand. The only thing that is missing is the funding to develop this much-needed system. The opinion of the Pacific Northwest Seismic Network is that once funding is available, a high-performance Earthquake Early Warning system for the West Coast is, at most, five years away.

The Case for Ocean Bottom Observatories

Studies in the wake of recent magnitude 9 earthquakes in Japan and Chile show increasing evidence that subduction zones, like Cascadia, shimmy – sometimes for days or even weeks -- before they shake.

To investigate this, scientists are deploying ocean bottom seismometers directly above subduction zone faults. The NSF-supported Cascadia Initiative, for example, has deployed hundreds of seismometers along the coast of the Pacific Northwest. These seismometers form the potential backbone of an offshore Earthquake Early Warning system, but the current method of retrieving data — which is done by ship, once per year — is impractical for that purpose. If seafloor

cables attached the seismometers, they could provide real-time, near-field monitoring of the Cascadia Subduction Zone.

By altering the function of instruments that are already in place on the ocean floor, we can fundamentally transform our ability to monitor Cascadia. In the event of an magnitude 9 earthquake, cabled ocean bottom seismometers will increase the warning time and make earthquake and tsunami warnings more accurate. Cabled ocean bottom seismometers will also accelerate discovery, by allowing scientists to better monitor the creaks and groans that occur prior to catastrophic failure.

The technology necessary for cabled ocean observatories is proven. Japan is investing $1 billion to install seafloor observatories, in part motivated by the unusual events that were recorded by seafloor instruments prior to the 2011 magnitude 9 Tohoku earthquake. The NSF-funded Ocean Observatories Initiative is currently installing a modest-sized seafloor observatory in the Pacific Northwest. These efforts should be expanded to include an offshore Earthquake Early Warning system.

Summary

- Only a West Coast Earthquake Early Warning system can provide advance warnings that will save lives, protect businesses, and facilitate a more rapid recovery for local communities, the federal government, and the economy as a whole.
- An Earthquake Early Warning system is ideally suited to the Cascadia Subduction Zone in the Pacific Northwest.
- Extending Earthquake Early warning offshore will increase the warning time, the accuracy of warnings, and fundamentally transform our capacity to monitor activity that precedes the next magnitude 9 event.

Thank you Mister Chairman and the committee for your leadership on this vital issue.

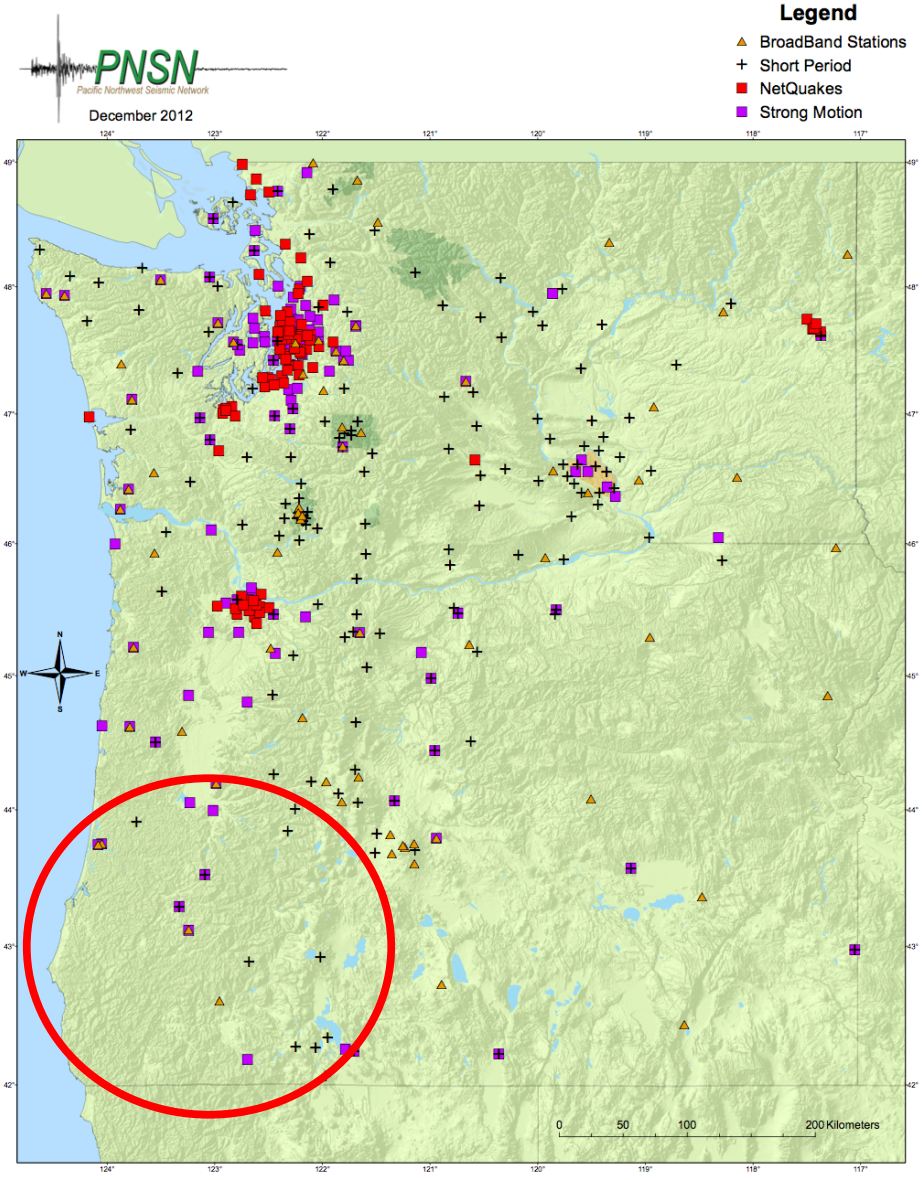
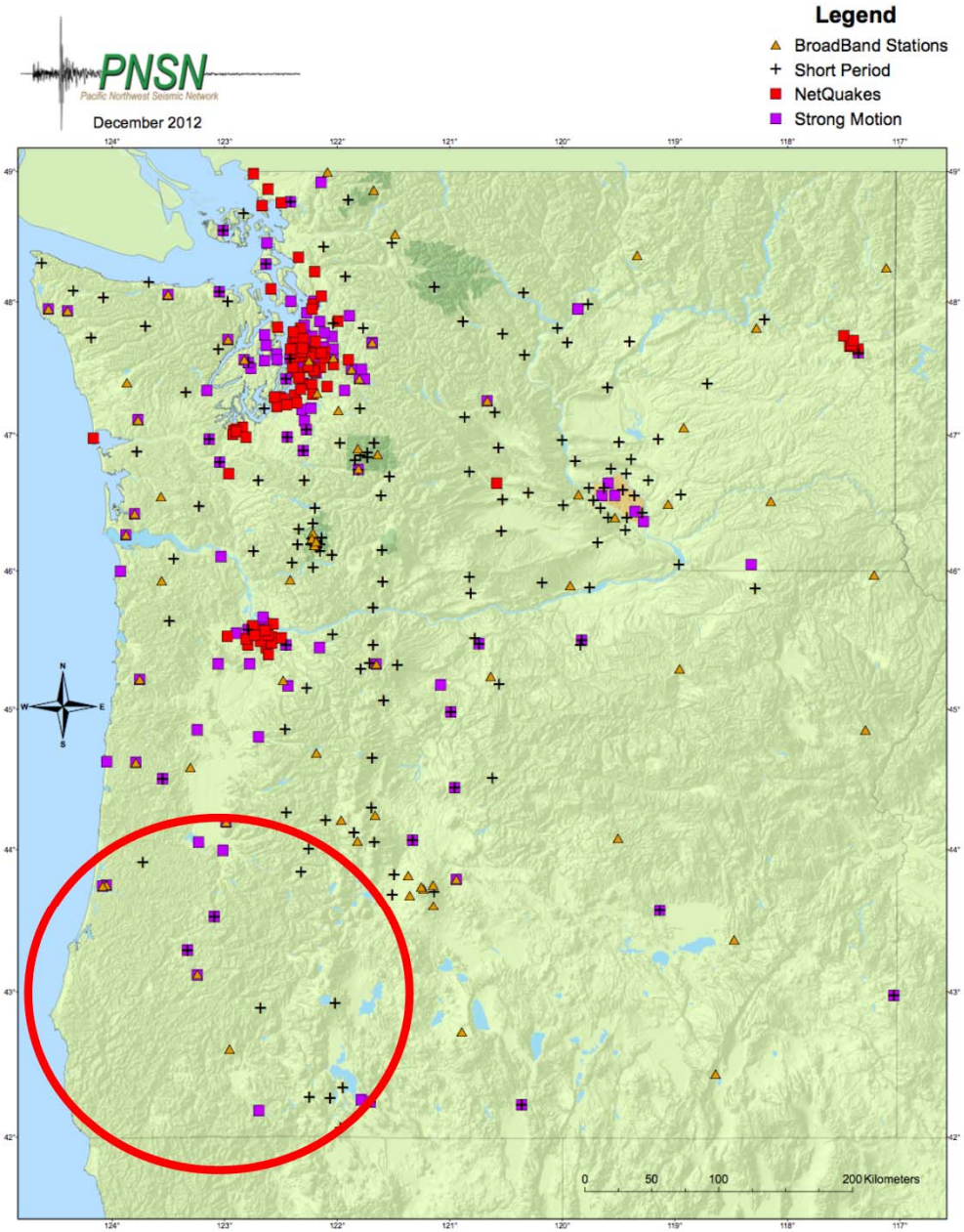


Figure 1. Map of seismic stations in the Pacific Northwest Seismic Network. Red oval indicates region of poor station coverage in southwestern Oregon.



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