

New research on Japanese quake ominous for Pacific Northwest

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Scientists are still unraveling last year's giant Tohoku earthquake and tsunami in Japan, and some of what they're finding doesn't bode well for the Pacific Northwest.

Detailed analyses of the way the Earth warped along the Japanese coast suggest that shaking from a Cascadia megaquake could be stronger than expected along the coasts of Washington, Oregon and British Columbia, researchers reported Sunday at the annual meeting of the [American Association for the Advancement of Science](#).

"The Cascadia subduction zone can be seen as a [mirror image](#) of the Tohoku area," said John Anderson, of the University of Nevada.

Anderson compiled ground-motion data from the Japan quake and overlaid it on a map of the [Pacific Northwest](#), which has a similar fault - called a subduction zone - lying offshore.

In Japan, the biggest jolts occurred underwater. The seafloor was displaced by 150 feet or more in some places, triggering the massive tsunami. But in the Northwest, it's the land that will be rocked hardest - because the Pacific coast here lies so close to the subduction zone.

"The [ground motions](#) that we have from [Tohoku](#) may actually be an indication that there could be much stronger shaking in the coastal areas of British Columbia, Washington and Oregon," Anderson said.

Cities like Seattle, Portland and Vancouver, B.C., are far enough from the coast that they might dodge the most violent hammering. But all of the urban areas sit on geologic basins that can amplify ground motion like waves in a bathtub.

"Basins shake more than hard rock," Anderson said. "Local site conditions can have an enormous effect on the nature of strong ground motions."

The U.S. Geological Survey (USGS) is already at work on a new analysis of how hard the ground is likely to shake and how close the rupture zone might come to urban areas the next time the [Cascadia subduction zone](#) really lets loose. The last time was in 1700, and the resulting quake was a magnitude-9 - just like the monster that struck Japan on March 11, 2010.

Japan's extensive network of seismometers, satellites, strain meters and GPS sensors logged a wealth of data that scientists continue to mine for insights.

"It's the best-recorded megaquake ever, and it's very relevant for the hazard in Cascadia," Anderson said.

Japanese scientists are struggling to answer several haunting questions: Why was the quake so big? How did the tsunami swell to such giant proportions? And why was it such a surprise to the world's most earthquake-savvy nation?

"It was very disheartening for people doing [earthquake](#) research and hazard mitigation in Japan," said Jim Mori, of Kyoto University's Disaster Prevention Research Institute.

Seismologists were fooled by a series of small quakes that rocked the

area every 35 years or so, said Kenji Satake, of the University of Tokyo.

They believed each small quake relieved the pressure on the subduction zone - the boundary where two geologic plates slip past each other as the ocean floor shoves under the continent.

Now they realize strain continues to build until the series of small quakes is punctuated by a giant one about every 700 years. Similar quakes and tsunamis struck in the years 869 and 1896, but Japanese scientists failed to look far enough into their own history, Satake said. "We needed longer time records."

The longest record for a subduction zone is from Cascadia, where scientists have linked buried marshes and submarine landslides with a series of about 22 megaquake quakes going back 10,000 years. The time between quakes ranges from 200 to 1,000 years, with an average of about 500 years.

There's no obvious "supercycle" of supergiant quakes, as Satake suggests, in Japan. But it is clear that quakes on Cascadia have varied in size, said USGS scientist Brian Atwater. Some geologists argue the magnitude-9 quake 300 years ago was simply average and that the Northwest has been slammed by quakes twice as big in the distant past.

Most earthquake scenarios for the Northwest coast project tsunamis of about 30 feet, and scientists still don't know how much that needs to be ratcheted up post-Tohoku. Walls of water up to 120 feet high washed away entire communities on the Japanese coast.

"Does Cascadia also have a 40-meter tsunami coming onshore?" Mori asked.

Several of the yardsticks used to gauge the risk on subduction zones

were proved questionable in Japan, he added.

Foremost among them is the measurement of strain buildup, as reflected by bulging and sinking land masses. Scientists had hoped they could identify fault segments that are about to snap - but the tension on the Japan [subduction zone](#) was not remarkable, Mori said.

Scientists are rethinking which subduction zones are most dangerous, said Kelin Wang, of the Geological Survey of Canada.

One emerging theory suggests seafloor topography might be key. Oceanic plates dotted with mountains seem to hang up and slip more frequently as they scrape under continental plates, he explained.

The result is a series of smaller quakes that occur when segments of the fault break. Giant quakes seem to occur most frequently where the seafloor is smooth and featureless - as off the Northwest coast, Wang said. With no surface bumps and hills to interfere, the two plates can stick together over vast distances, he said. When they slip, the whole fault breaks at once.

The nuclear-power industry around the world is still dealing with fallout from the meltdowns at Japan's Fukushima nuclear complex, said Stuart Nishenko, of Pacific Gas and Electric, which operates the Diablo Canyon nuclear plant on the California coast.

Seven nations, including Switzerland, Germany and Mexico, opted to either phase out nuclear power or halt construction of new plants. The U.S. Nuclear Regulatory Commission is preparing to issue orders to all of the nation's 104 nuclear reactors, requiring new seismic safety analyses, Nishenko said.

Operators also will be required to walk through their plants with

inspectors, looking for any parts or systems vulnerable to earthquakes or floods, and to upgrade plans for coping with a complete loss of power, as happened when the Japanese tsunami knocked out electrical lines and flooded backup generators.

The Northwest's only nuclear power plant is the Columbia Generating Station, located on the Hanford Nuclear Reservation. In recent years, geologists have discovered several new faults running through the area, capable of generating earthquakes as big as magnitude 7.5. Plant operators recently applied for a license extension to operate the 28-year-old reactor through 2023.

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