Earthquakes shed light on British Columbia’s early warning system

Submitted by Katie Shoemaker Tue, 2017-09-12 14:04

In September 2017, Ocean Networks Canada’s (ONC) seismic sensors collected real-time information on two recent and very different earthquakes: one distant quake off Mexico’s west coast and a much smaller regional event near Ucluelet, British Columbia. Both seismic events provide insight into British Columbia’s earthquake early warning system, currently in development.

Early warning for Mexico’s magnitude 8.1 earthquake

On 7 September, a magnitude 8.1 earthquake struck off Mexico’s southwest coast near the Guatemalan border. ONC’s sensors detected the seismic waves over 4,700 kilometres away (Figure 1).
Earthquake Data Dashboard

The interactive dashboard below lets you explore recent earthquakes around Vancouver Island and around the world (see below for additional information and instructions).

![ONC's interactive earthquake data dashboard displays data from the magnitude 8.1 quake, detected by ONC's sensitive underwater sensors 4,700 kilometers away.](image)

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<td>SOUTH SANDY ISLANDS REGION</td>
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<td>6.3</td>
<td>2017-08-31 17:06:55</td>
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**Figure 1.** ONC’s interactive earthquake data dashboard displays data from the magnitude 8.1 quake, detected by ONC’s sensitive underwater sensors 4,700 kilometers away.

The epicenter was located about 515 kilometres from Mexico City, which is home to the world’s first earthquake early warning system. SASMEX was developed within six years of the deadly earthquake that devastated the country in 1985. During last week’s quake, this investment likely saved lives when Mexico City residents received more than 86 seconds of warning before the quake’s major shaking began at approximately 11:49 local time (*Figure 2*).
Figure 2. This Mexico City TV news clip shows Mexico’s earthquake early warning system SASMEX in action on 7 September 2017. The early warning siren starts to sound more than 86 seconds before major shaking begins.

On 7 September 2017, SASMEX was likely responsible for saving lives and preventing injuries as people were able to take protective actions before the shaking started, comments ONC’s Innovation Centre Business Analyst, Teron Moore. The successful performance of the Mexican earthquake early warning system is a clear opportunity for British Columbia to ramp up efforts to complete our own system before the ‘big one’ hits.

British Columbia’s earthquake early warning system

In February 2016, the Government of British Columbia invested $5 million for ONC to develop and install an earthquake early warning system.
will be installed, tested, and delivered to Emergency Management BC by March 2019. Once completed, the system will be capable of providing British Columbians with advance warning of a large mega-thrust earthquake occurring on the Cascadia subduction zone.

Unlike Mexico’s land-based sensors, British Columbia’s earthquake early warning system has the advantage of underwater sensors deployed on or near the Cascadia subduction zone. The closer a sensor is to the earthquake’s epicentre, the more advance warning can be provided (Figure 3).

Figure 3. How does earthquake early warning work? Seismic instruments can rapidly detect an earthquake as its energy travels through the earth and communicate a warning before shaking arrives. Upon a non-destructive primary P-wave detection, accelerometers send notifications before the damaging secondary S-waves arrive.

To date, ONC has deployed three strong-motion accelerometers from Canadian company Nanometrics. These instruments are designed to detect the primary non-destructive P-waves of large nearby seismic events. Engineered to withstand and record strong local events, these sensitive underwater sensors were nevertheless able to record the seismic waves that radiated from the Mexican quake’s hypocentre 4,700 kilometers away (Figure 4).
Figure 4. ONC’s sensitive strong-motion accelerometers picked up the Mexican earthquake 4,700 kilometres away.

In addition to strong-motion accelerometers, ONC’s broadband seismometers—also installed underwater in the eastern Pacific—advance our scientific understanding of tectonics and seismogenic (earthquake generating) processes. Despite being more sensitive than the accelerometers, broadband seismometers lack the rapid P-wave detection and reporting capabilities of the strong-motion accelerometers.
Ucluelet’s M3.8 earthquake

Meanwhile closer to home, on 5 September ONC’s strong-motion accelerometers detected the primary P-waves that initiated the magnitude 3.8 earthquake near Ucluelet on the west coast of Vancouver Island. There were no reports of damage but shaking was felt in nearby Tofino, Port Alberni, and Nanaimo (Figure 6).
ONC’s seismic sensors detected primary P-waves prior to a M3.8 earthquake near Ucluelet. Detection time depends on the distance between the earthquake’s epicentre and the seismic sensor.

ONC operates real-time sensor networks under water and on land using the advanced data management system Oceans 2.0. ONC’s ability to deploy sensors close to the fault at the Cascadia subduction zone adds valuable warning time to decision makers and for those in harm’s way.

**Great British Columbia ShakeOut drill happens 19 October**

On 19 October at 10:19 a.m., millions of people worldwide will practice how to ?Drop, Cover and Hold On? during the Great ShakeOut Earthquake Drill. British Columbians are invited to join in by registering for the 2017 Great British Columbia ShakeOut (Figure 7).
Figure 7. Participating in the Great British Columbia ShakeOut is a great way for your family or organization to be prepared to survive and recover quickly from big earthquakes.

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