

# Monitoring the 2021 M8.2 Chignik, Alaska Earthquake by Ocean Networks Canada's NEPTUNE system

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## Abstract

Earthquakes cause ground shaking and the accompanying seafloor and sub-seafloor formation fluid pressure variations in offshore areas, but collocated observation of these signals has been limited. In this work, we report seismic and high-rate fluid pressure observations of the 2021 M 8.2 Chignik Earthquake by the Ocean Networks Canada (ONC) NEPTUNE observatory at an epicentral distance of  $\sim 2200$  km in the northeast Pacific Ocean. The observatory comprises multiple nodes in various tectonic settings (mid-ocean ridge, oceanic plate, and subduction accretionary prism), and each node includes seafloor and borehole pressure sensors close to buried broadband seismometers. The new observations help us better understand the mechanisms of seafloor and sub-seafloor pressure variations at seismic frequencies and the nature of the dynamic ocean-crust coupling. Seismic seafloor pressure variations ( $P_{sf}$ ) were dominated by Rayleigh waves of periods between 5-50 s, with peak amplitudes of 3-4 kPa at most sites. Waveform similarity and the linear scaling between  $P_{sf}$  and vertical ground acceleration ( $A_z$ ) indicate forced acceleration of the water column during long-period surface-wave arrivals. Analysis of formation pressure variations due to various types of ocean loading of different frequencies (e.g., tides, tsunami, and infra-gravity waves) shows stable 1-D loading efficiencies  $\gamma$  that depend on lithology at each borehole site. Because all data are available in real time, this

monitoring system can contribute to earthquake and tsunami early warning in the Pacific Northwest region.

**Figure caption:** Seafloor pressure signals of the 2021 M8.2 Alaska earthquake recorded at ONC NEPTUNE sites. (a) Raw records with tides. Pressure values at 0 o'clock (in kPa) are shown at the beginnings of each waveform trace, and instruments are shown at the ends. Dashed black box indicates zoom-in time span of panel b. (b) De-tided records showing seismic and tsunami signals. Dashed red lines mark the origin time of the earthquake.

