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Network for tracking earthquakes exposes glacier activity

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Alaska's seismic network records thousands of quakes produced by glaciers, capturing valuable data that scientists could use to better understand their behavior, but instead their seismic signals are set aside as oddities. The current earthquake monitoring system could be "tweaked" to target the dynamic movement of the state's glaciers, suggests State Seismologist Michael West, who will present his research today at the annual meeting of the Seismological Society of America (SSA).

"In Alaska, these glacial events have been largely treated as a curiosity, a by-product of earthquake monitoring," said West, director of the Alaska Earthquake Center, which is responsible for detecting and reporting seismic activity across Alaska.

The Alaska seismic network was upgraded in 2007-08, improving its ability to record and track glacial events. "As we look across Alaska's glacial landscape and comb through the seismic record, there are thousands of these glacial events. We see patterns in the recorded data that raise some interesting questions about the glaciers," said West.

As a glacier loses large pieces of ice on its leading edge, a process called calving, the Alaska Earthquake Center's monitoring system automatically records the event as an earthquake. Analysts filter out these signals in order to have a clear record of earthquake activity for the region. In the discarded data, West sees opportunity.

"We have amassed a large record of glacial events by accident," said West. "The seismic network can act as an objective tool for monitoring glaciers, operating 24/7 and creating a data flow that can alert us to dynamic changes in the glaciers as they are happening." It's when a glacier is perturbed or changing in some way, says West, that the scientific community can learn the most.

Since 2007, the Alaska Earthquake Center has recorded more than 2800 glacial events along 600 km of Alaska's coastal mountains. The equivalent earthquake sizes for these events range from about 1 to 3 on the local magnitude scale. While calving accounts for a significant number of the recorded quakes, each glacier's terminus – the end of any glacier where the ice meets the ocean – behaves differently. Seasonal variations in weather cause glaciers to move faster or slower, creating an expected seasonal cycle in seismic activity. But West and his colleagues have found surprises, too.

In mid-August 2010, the Columbia Glacier's seismic activity changed radically from being relatively quiet to noisy, producing some 400 quakes to date. These types of signals from the Columbia Glacier have been documented every single month since August 2010, about the time when the Columbia terminus became grounded on sill, stalling its multi-year retreat.

That experience highlighted for West the value of the accidental data trove collected by the Alaska Earthquake Center. "The seismic network is blind to the cause of the seismic events, cataloguing observations that can then be validated," said West, who suggests the data may add value to ongoing field studies in Alaska.

Many studies of Alaska's glaciers have focused on single glacier analyses with dedicated field campaigns over short periods of time and have not tracked the entire glacier complex over the course of years. West suggests leveraging the data stream may help the scientific community observe the entire glacier complex in action or highlight in real time where scientists could look to catch changes in a glacier.

"This is low-hanging fruit," said West of the scientific advances waiting to be gleaned from the data.

More information: West will present their findings today at the SSA 2014 Annual Meeting in Anchorage, Alaska. The searchable database of presentations is available here: www.seismosoc.org/meetings/2014/program.php

Provided by Seismological Society of America