An Unexpected Discovery: PBO Tsunami Measurements
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The Plate Boundary Observatory (PBO) includes over 110 continuously operating GPS, 75 borehole strainmeter/seismic sites, 6 laser strainmeters and 28 tiltmeters. The purpose of the observatory is to characterize the three-dimensional deformation field across the western United States plate boundary over the broadest spatial and temporal range possible. An unexpected finding, , is that PBO strainmeters located within a few hundred meters of the coastline have repeatedly recorded tsunamis as they arrive along the west coast of North America. In this presentation we document the signal recorded by PBO strainmeters, tiltmeters and GPS as the devastating tsunami generated by the March 2011, M9 Tohoku earthquake reached the coast of North America.

Several PBO strainmeters, some as far as 13 km inland, recorded the arrival of Tohoku tsunami. Long term trends, teleseisms and the background ocean-load plus earth tide signals are removed from the strainmeter data by band pass filtering the time series at 5 to 180 minutes. The tsunami strain signals stand well above the noise in the filtered time-series and the arrival times are consistent with those recorded by tide gauges along the west coast. Areal strain recorded by strainmeter B928 on Vancouver Island, British Columbia, yields a predicted wave height to within 4 cm of that recorded by a nearby tide gauge. While the unfiltered time series from PBO GPS site NEAH, near the Washington coast seems to follow the tidal loading signal, the spectral evidence for the tsunami signal is slim. A small signal is evident in the PSD when the data are sidereally filtered to reduce multipath noise but it does not have enough power to be visually identifiable in the time series. Our initial investigation shows that although PBO tiltmeters do have the potential to record a tsunami signal the instruments, all in Alaska, are installed too far inland to record the signal.

Although the Plate Boundary Observatory was designed to study the interaction of faults and patterns of strain accumulation and release along the western United States plate boundary, it is possible that the strainmeter component of the observatory could complement existing tsunami warning systems by providing a land-based continuous, high-rate, tsunami measurement system.