Geophysical Research Abstracts
Vol. 14, EGU2012-12291, 2012
EGU General Assembly 2012
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Tsunami Signals Recorded By Plate Boundary Observatory Borehole Strainmeters

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The Plate Boundary Observatory (PBO), the geodetic component of the US National Science Foundation funded Earthscope program, is designed to capture the continuous three-dimensional deformation field across the western United States plate boundary. Installed and maintained by UNAVCO, the observatory currently consists of over 1100 continuous GPS sites, 6 long-baseline laser strainmeters and 75 borehole strainmeters. PBO borehole strainmeters have recorded the arrival of tsunamis generated by the 2009 M8.0 Samoa, 2010 M8.8 Chile and 2011 M9.0 Tohoku earthquakes on the Pacific coast of North America. In our analysis of the strain data we find the following: the tsunami arrival times recorded by the strainmeters are consistent with those recorded by nearby tide-gauges, the data are of sufficient quality to compare the frequency content of the tidal signal in the days before and after the tsunami and, the strain measurements are comparable with those predicted by theory. In each case the strain measurements can be translated to water height estimates which are within centimeters of those recorded by tide gauges. It is possible that borehole strainmeters could play a role in providing a land-based, continuous, high-rate tsunami measurement system.