PBO Strainmeters on the Olympic Peninsula, Installation and Data Products.

Kathleen Hodgkinson, Greg Anderson, Mike Hasting, Bob Mueller

The first PBO strainmeter will be installed at Hoko Falls on the Olympic Peninsula in the Pacific Northwest in Mid March 2005. The borehole, one of eight that were drilled between November 2004 and January 2005, was cored in February 2005 by DOSECC and the site found to be suitable for strainmeter deployment. As of this writing 4 of the remaining 7 holes have been cored and 3 of them found to be suitable and one not very promising. Strainmeters and seismometers for suitable holes will be installed later this summer when instruments become available. These sites will comprise the first of 143 strainmeter sites that have been prioritized by the scientific community. The Olympic Peninsula was chosen as the first region of interest so as to capture deformation caused by the next silent earthquakes in Cascadia, which is anticipated in the fall of 2005.

PBO will install three component tensor strainmeters manufactured by GTSM Technologies. The strainmeter has four independent strain cells, one being redundant. The cells measures change in borehole diameter along one axis and are oriented at 120 degrees to each other. Areal and shear strain can be derived by combining these three gauge measurements. Additionally a 2 Hz three-component seismometer will be installed in each borehole, approximately 30 feet above the strainmeter. The seismic data will be sent to the Array Network Facility at Scripps where it will be processed and archived along with US Array data. When complete this will make the PBO seismic network the second largest borehole seismic network in the world.

The GTSM collects data at 20 samples per second. The data will be buffered on-site and downloaded in near real time via internet connections. The data are passed through Quality Control and then sent to the Borehole Strainmeter Analysis Center (BSAC) for processing. At the BSAC the data will be reduced to 300-second data by repeatedly filtering and decimating using a causal minimum delay FIR filter. The strainmeters will be calibrated in-situ by comparing the observed M2 and O1 tidal amplitudes with that measured by each gauge. The long-term trends observed in borehole strainmeter data are those created by borehole relaxation and the grout, in which the strainmeter is placed, curing. These trends can typically be described by two exponentials, one with a time constant of 10 to 40 days and the second on the order of a few 100 days. PBO will provide the parameters used to describe the borehole correction trends and the matrices required to combine the individual gauge measurements into tensor strain.

The raw data, the level 0 strainmeter data product, will be transferred to the strainmeter archives at IRIS DMC and NCEDC within minutes or arriving in the Strainmeter Analysis Center. The level 0 data will be available in the full 20 Hz sample rate in miniSEED and the data logger native format. The Level 1 data product, strain in natural units, are derived directly from the Level 0 product and therefore are available as rapidly as the Level 0 product. The cleaned 300-second real and shear strain data with borehole and tidal corrections will be available within 14 days of data collection in XML format.

The entire data set will be reprocessed every three months allowing for post processing and recalibration to produce the best possible modellable data set.