Seafloor Geodesy at the Cascadia Subduction Zone: A step towards an Offshore Plate Boundary Observatory

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In 2014, we will start seafloor geodetic measurements of plate motion in the Cascadia Subduction Zone. The project is for a three-year effort to measure plate motion at three sites along an East-West profile at latitude 44.6 N, offshore Newport Oregon. One site will be located on the incoming plate to measure the present day convergence between the Juan de Fuca and North American plates and two additional sites will be located on the continental slope of NA to measure the elastic deformation due to stick-slip behavior on the mega-thrust fault. These new seafloor data will constrain existing models of slip behavior that presently are poorly constrained by land geodetic data 100 km from the deformation front.

We will implement for the first time a new autonomous approach to collecting GPS-Acoustic data that will greatly reduce the cost of data collection by no longer relying upon research ships. Similarly, for the first time, permanent seafloor benchmarks for horizontal positioning will be implemented ensuring the time series of positions can be continued into the future, past the end of this project and the GeoPRISMS program. Also for the first time, the seafloor transponders will be re-used once their original battery capacity is depleted. No longer will seafloor transponders be considered disposable. Instead the 12 transponders proposed in this study will become part of an instrument pool. These three changes in methodology are transformative for GPS-Acoustic seafloor geodesy.

An offshore component of the Plate Boundary Observatory is now practical.

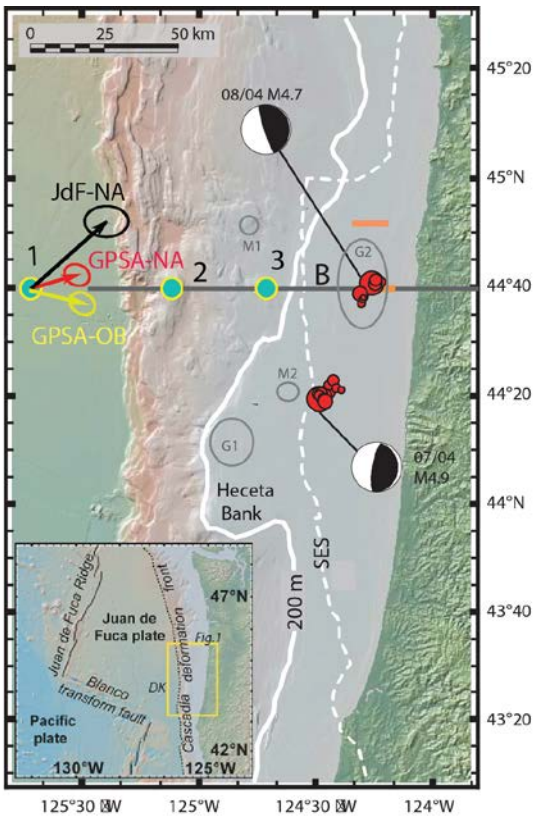

FIGURE: Map adapted from *Trehu et al.* [2012] showing general location of the sites (green filled yellow circle). Site 1 exists and will be restarted. Sites 2 and 3 are new. At site 1, the geologic average convergence JdF-NA (black), measured GPSA-NA and GPS-Oregon Block (OB) are shown [*Chadwell*, 2007]. Red dots are relocated earthquakes dates, magnitudes, and mechanisms are shown for the two largest events. Orange segments in indicate strong plate boundary reflectivity. Magnetic anomalies M1 and M2 and gravity anomalies G1 and G2 are also shown. See *Trehu et al.* [2012] for details.