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"ENHANCING PANGA (PACIFIC NORTHWEST GEODETIC ARRAY) FOR URBAN SEISMIC RISK ASSESSMENT: COLLABORATIVE RESEARCH WITH CENTRAL WASHINGTON UNIVERSITY, OREGON STATE UNIVERSITY, AND UNIVERSITY OF WASHINGTON" DATED 5/14/1999.

Final Technical Report

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Abstract

A five-year investment in concentrating Global Positioning System (GPS) geodetic resources in the Pacific Northwest has yielded remarkable results: Continuous and campaign measurements have established a budget for crustal faulting within the North America plate and constrained models of subduction zone locking [Dragert et al., 1994; Dragert and Hyndman, 1995; Khazaradze et al., 1999; Savage et al., 2000; Murray and Lisowski, 2000; Miller et al., 2001a; McCaffrey et al., 2000]. Continuous GPS (CGPS) recorded the February 28, 2001, Nisqually earthquake despite its great depth [Miller et al., 2001b; Nabelek, and McCaffrey 2001; Dreger et al., 2001]. Continuous GPS indicates at least one and possibly two slow earthquakes along the transition zone of the megathrust [Dragert et al., 2001]. These studies establish GPS as a critical tool in constraining surface deformation and revealing the processes that drive deformation, adding unique constraints on the budget of seismic vs. aseismic deformation.

In the Pacific Northwest, efforts to quantify the hazards associated with the Cascadia subduction zone have been hampered by the difficulty of geologic field work, and the lack of plate boundary seismicity. GPS however, now offers a methodology applicable to just this type of difficult tectonic problem. The Pacific Northwest Geodetic Array (PANGA) is a consortium of US. and Canadian institutions engaged in GPS geodetic investigation of the Cascadia plate boundary system. Currently, 30 permanent GPS sites have been installed and are now collecting continuous data in the Pacific Northwest. The primary focus of PANGA is to establish a velocity field for the Cascadia region that can be used directly to assess seismic hazards from the Cascadia plate interface, and also to understand the complex kinematics of the Pacific Northwest as a whole. Preliminary results thus far confirm that a strong locking signal from the Cascadia megathrust is present. This is strong independent evidence supporting the paleoseismic data from coastal marshes that indicate major episodic strain releases along the Cascadia margin. The magnitude and distribution of surface velocities in the Cascadia forearc is beginning to reveal details of how the plates are strongly coupled and where. The data thus far, though sparse and preliminary, also suggest both significant along-strike variability in this signal, and support a second signal associated with dextral shear and clockwise rotation that affects mostly northern California and southern Oregon.

This project was funded for two principal tasks: 1) PANGA investigator community meeting, and 2) maintenance of current permanent GPS sites in the PANGA array.