The EarthScope Plate Boundary Observatory and allied networks as a platform for seismo-geodetic integration to support Earthquake and Tsunami Early Warning Systems across the Americas

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The NSF-funded GAGE Facility, managed by UNAVCO, operates approximately ~1300 continuous GNSS stations distributed across North America, northern South America, and spanning the circum-Caribbean. Based on community input from several workshops and associated reports starting in 2011, UNAVCO has been exploring ways to increase the capability and utility of geodetic resources under its management to improve our understanding in diverse areas of geophysics including properties of seismic, volcanic, magmatic and tsunami deformation sources. Networks operated by UNAVCO for the NSF have the potential to profoundly transform our ability to rapidly characterize geophysical events, provide early warning, as well as improve hazard mitigation and response. Specific applications currently under development include earthquake early warning, tsunami early warning, and tropospheric modeling with university, commercial, non-profit and government partners on national and international scales. In the case of tsunami early warning, for example, an RT-GNSS network can provide multiple inputs in an operational system starting with rapid assessment of earthquake sources and associated deformation, which leads to the initial model of ocean forcing and tsunami generation. In addition, terrestrial GNSS can provide direct measurements of a tsunami through the associated traveling ionospheric disturbance from several hundreds of km away as they approach the shoreline, which can be used to refine tsunami inundation models. Any operational system like this has multiple communities that rely on a pan-Pacific real-time open data set. Other scientific and operational applications for high-rate GNSS include glacier and ice sheet motions, tropospheric modeling, and better constraints on the dynamics of space weather.

While progress has been made toward more open and free data access across national borders and toward more cooperation among cognizant government sanctioned “early warning” agencies, some impediments remain making a truly operational system a work in progress. Combining existing data sets and user communities, for example seismic and tide gauge observations with GNSS and meteorological data products, has proven complicated because of issues related to metadata, appropriate data formats, data quality assessment in real-time and other issues related to using these products operational forecasting.

UNAVCO has embarked on significant improvements to the original infrastructure and scope of our networks. We anticipate that the Plate Boundary Observatory (PBO) and related networks will form a backbone for these efforts with high quality, low latency raw and processed GNSS data as well as providing a platform for integration with other sensors, including broadband and strong motion seismometers. Low-cost MEMS accelerometers already have been deployed at 22 PBO stations in two clusters in California. Other additional and substantial upgrades are required across these networks, however, starting with upgrading the GNSS receiver, through robust data collection, archiving and open distribution mechanisms, to efficient data-processing strategies. UNAVCO is currently in a partnership with the stakeholders to define, develop, and deploy all segments of this improved geodetic network. We present the overarching goals together with current and planned future state of this international

resource.

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