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Initial results from the Array of Arrays in Cascadia

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We are capturing the intimate details of tremor activity in Cascadia with 8 small-aperture seismic arrays in northwestern Washington. The Array of Arrays (AoA) focuses on the tremor-active megathrust, including the area we previously imaged with a solo seismic array in 2008 [*Ghosh et al.*, GRL, 2009, 2010]. Each array consists of 10 to 20 three-component sensors recording in continuous mode. Since it became operational in June 2009, the AoA has recorded several minor tremor episodes, and the recent episodic tremor and slip (ETS) event in August 2010. During the ETS event, each array was augmented by 10 additional single-channel, vertical-component sensors.

We have already started to analyze seismic data for tremor episodes in July 2009, and March 2010. At each array, we apply a beamforming technique to stack the seismic energy at every 0.2 Hz from 2 to 15 Hz. During tremor episodes, the arrays show stable slowness, and azimuth over the tremor frequency band. While *P* waves energy stack coherently up to 10 Hz and higher, *S* waves extend up to 6 Hz or so, with slowness consistent with the *P* and *S* waves respectively. Compared to a conventional envelope cross-correlation (ECC) method, our array analysis reveals significantly longer duration of tremor activity, including the episodes that remain completely undetected by ECC. Exploratory perusal of array stacks indicates a complex pattern of tremor activity. Oftentimes, multiple lively tremor sources appear to be active simultaneously.

The ETS started early second week of August about 60 km south of our arrays, and in a week or so, migrated along-strike to the north passing directly underneath the arrays. Strong tremor is still active about 60 km north of the arrays as we write this abstract. Currently, we are developing an algorithm to focus as many arrays as possible to locate the tremor sources.

With fine tremor detection capability and good azimuthal coverage, our AoA will better resolve the various confounding features of tremor spatiotemporal distribution (e.g., tremor patches, bands, streaks, rapid tremor reversals, low frequency earthquakes) that have been recently discovered in Cascadia. The AoA is poised to provide a high-resolution probe of seismic activity during both ETS, and inter-ETS time period, and take us to the next step toward nailing the underlying mechanism of tremor.