



Array analysis and source location of deep tremor

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Three small aperture seismic arrays (diameter $\sim 600\text{m}$) were operated in Northern Washington during spring and summer, 2004 to monitor an expected episode of Deep Tremor which occurred in July. Besides recording two weeks of strong deep tremor, many earthquakes with a range of magnitudes, distances and azimuths were also recorded. Earthquake signals have been used to test the resolving ability of the arrays for subsequent analysis of the deep tremor signals. Array techniques have been applied both in time domain ("Zero Lag Cross-Correlation" and classical "Beam Forming") and frequency domain ("Beam Forming" and "High Resolution"). Calculated backazimuth and slowness values of P and S direct phases were compared with those calculated basing on the hypocenters determined by the regional network and the regional velocity structure to give an estimate of the error associated with array techniques. The resolving capability associated with the Zero Lag Cross-Correlation method is between 0.01 and 0.02 s/km for slowness and 10-15 degrees for backazimuth, depending mostly on the signal to noise ratio.

Deep tremor has been analyzed with array techniques in order to characterize the propagation properties of the wavefield. Slowness vectors estimated at the three array sites for the strongest tremor bursts have been used to compute a probabilistic source location on a 3D grid. The source location has also been estimated using the waveform envelope computed at the PNSN stations. Results from both location methods are in good agreement and indicate a wide range of depth for the source of deep tremor. Polarization analysis results confirm that the wavefield of deep tremor is composed mostly by shear waves, but evidences also the presence of P waves.