Introduction

The Cascadia Subduction Zone (CSZ) presently hosts episodic tremor and slip (ETS), small intraplate and few small interplate earthquakes.

No great earthquakes instrumentally or historically recorded, but geologic evidence for past great earthquakes (~18 in the last 1800 years), with the most recent occurring in 1700 and estimated to have been ~Mw 8.7-9.2.

The seismogenic zone of the CSZ is located primarily offshore, the extent of which is estimated by thermal modeling. Geodetic analysis indicates that the seismogenic zone is presently kicked.

Subspace Detection

A portion of the data corresponding to a sliding window is projected onto a subspace spanned by the basis vectors of the set of templates, U, with coefficients α[n].

For a given data file containing unknown signals, we end up with a distribution of correlation coefficients and z-statistics. Those above a chosen threshold likely correspond to events.

Figure 3. Modified from Harris (2006) and Harris and Paik (2006). The subspace detector uses multiple template events to compare with the data containing unknown signals. An unknown signal, s, is the data can be represented by a linear combination of the basis vectors of the set of templates, U, with coefficients α[n].

Event Detection

Implementation

We use land-seismometer based catalogs (NEIC, ANF, PNSN, and Canadian NEDB) to identify clusters and individual interplate earthquakes to use as templates.

We find these events on OBSs and few additional coastal land stations (Earthscope, Global Seismic Network, US National Seismic Network, U. Washington/Pacific NW Regional Seismic Network, and Canadian Seismic Network) to create templates.

The new presence of seismometers directly over the seismogenic zone enable us to better detect interplate earthquakes occurring within the seismogenic zone.

We detect and locate repeating seismogenic earthquakes, which likely represent megathrust asperities.

Subspace Detection

Event Detection

During the first year of CI deployment, 263 events were detected with the target cluster abandoning 6 events with only 3 readings.

136 events were located.

Horizontal errors: 1 to 72.5 km, with the lowest errors being in the targeted cluster (due to station coverage), and vertical errors range 1.4 to 99 km. Depths range -4.4 km to 30.0 km (negative values due to shifting station elevations to all positive values).

Conclusions / Future Work

During the first year of CI deployment, 263 events were detected with the target cluster templates on stations M08A, J25A, and J02D. We have preliminary locations for the 103 events that appear on multiple stations.

The majority of the new events are located within the target cluster, where previous repeaters have been observed (e.g. Trehu et al., 1994, 2000, 2012, 2015) and Williams et al., 2011)

We will continue running detection codes using templates along the margin for all four years of deployment and locate all detected events along the CSZ, as well as compute source parameters of detected events.

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