Caltech Research with the Seal Beach Seismic Data

R. Clayton, 2017/06/13

Caltech will use the data from the Seal Beach survey to develop a model of the shallow structure in the area. In particular, we anticipate that we will be able to determine the shear-wave speed (Vs) in the top 500m, which will help determine which areas of the NWSSB are vulnerable to enhanced shaking. We have done a similar study for Long Beach using the same type of data that is proposed for Seal Beach. We will also use the Seal Beach survey to locate microseismicity in the area. These are typically very small earthquakes that help illuminate the locations of subsurface faults. The results of our analysis will be published in a scientific journal and can be presented to the staff of NWSSB.

The studies we will do will be similar to ones done in Long Beach, Ca with data from the node array shown in Figure 1. In the shallow structure study, the data were correlated to generate virtual sources, which in turned allowed the measurement of the shear velocity. These were then used to produce a map of the shear-wave velocity variations such as those shown in Figures 2 and 3. The shear-wave speed is an important factor that contributes to the amplification of ground motion (slower speeds indicate softer soil/rock, which serve to enhance the motion).

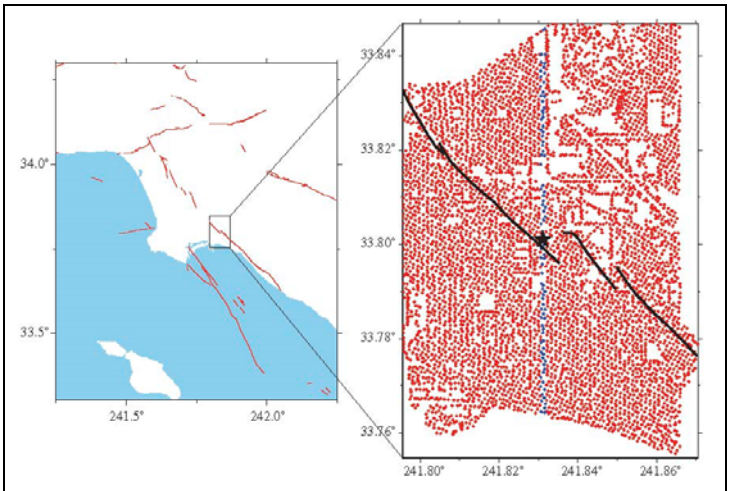

Figure 1. The layout of the Long Beach nodal array. There are over 5000 nodes in the array.

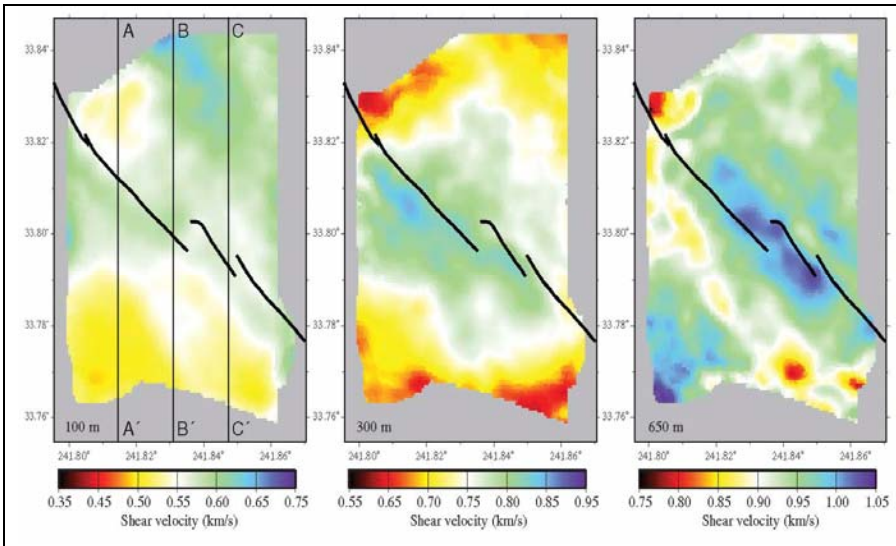

Figure 2. Shear wave results for layers at depths of 100m, 300m, and 650m are shown. The dark blue region highlights the Newport-Inglewood Fault structure, and the red zones show zones of low shear velocity near the coast, which are prone to liquefaction during earthquake shaking.

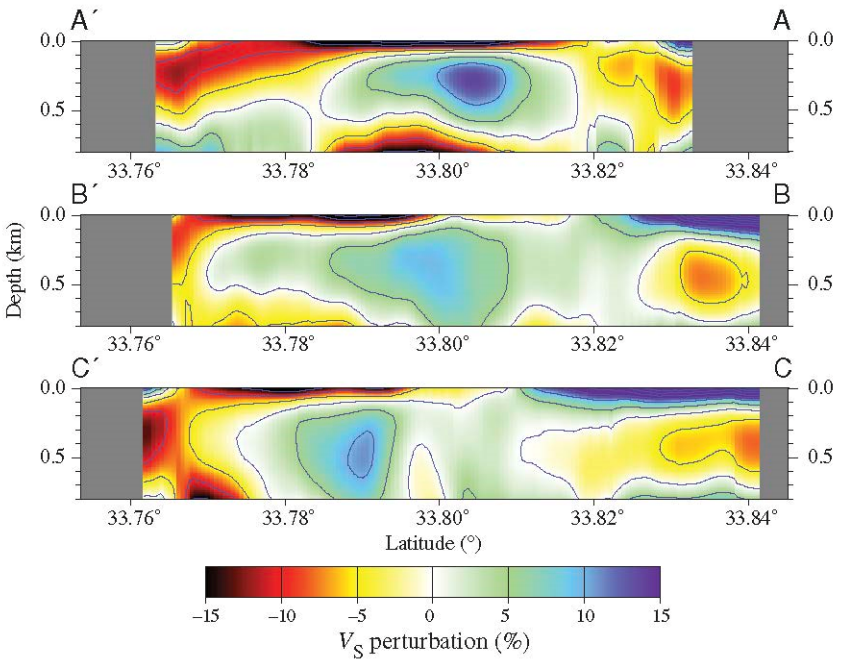

Figure 3. Cross-sections of the shear-velocity model are shown. The blue region shows the Newport-Inglewood Fault structure, while the red zone near the surface shows areas prone to liquefaction. The location of the cross-sections is shown in Fig. 2.

Published Work Using the Long Beach Survey

Lin, Fan-Chi, D. Li, R. Clayton, D. Hollis, 2013, High-resolution shallow crustal structure in Long Beach, California: application of ambient noise tomography on a dense seismic array, Geophysics, 78(4), Q45-Q56, doi:10.1190/geo2012-0453.1.

Inbal, A., R. Clayton, and J-P Ampuero, (2015), Mapping Active Faults in Long Beach, California Using a Dense Seismic Array, Geophys. Rec. Lett., 42, 6314-6323, doi:10.1002/2015GL064942.

Inbal, A., J-P Ampuero, and R. Clayton, (2016) Localized Seismic Deformation in the Upper Mantle Revealed by Dense Arrays, Science, 354, pp88-92, doi:10.1126/science.aaf1370.

.