Latest Scientific and Technological Results From The Mexico Experiment

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Data from Mexico deployment: First results

Overview

•We have examined seismic data and wireless network characteristics from 100 broadband stations installed from Acapulco to Tampico in Mexico over a period of 2.5 years (2005-2007).

•The instruments were part of the MASE (Middle America Subduction Experiment). It has the objective to build a geodynamical model of the subduction process beneath the Middle America Trench.

•The stations had a 5-6 km spacing and were connected wirelessly with each other providing a unique high resolution data set.

•The data allows examination of various aspects in tomography, shear wave splitting, wave travel times as well as extensive analysis of the wireless network.

Seismic processing of waveforms

•Tomographic and SKS splitting studies in this area show the presence of a 50-80 km thick flat slab under the western part of the array, and a steeply dipping slab beneath its center to a depth of ~550km and ~375 km inland. Prior to the experiment, the slab location at depth was unknown because of a lack of deep earthquakes in the region.

Disruption Tolerant Shell (DTS) and wireless characterization

• A new remote management tool called Disruption Tolerant Shell (DTS) has been developed at UCLA and tested on the MASE network.

•Provides the ability to manage the system when there is poor link quality and frequent and unpredictable disconnections between nodes.

•DTS reaches 100\% of the nodes faster than end to end connections in the presence of poor link quality and frequent unpredictable disconnections between nodes.

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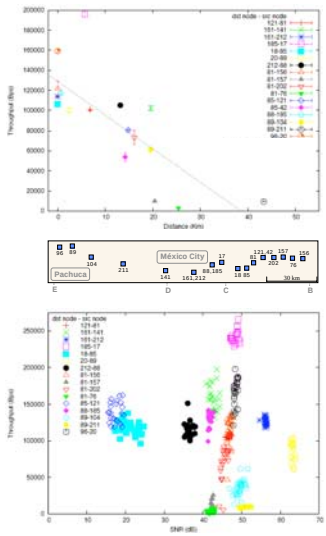
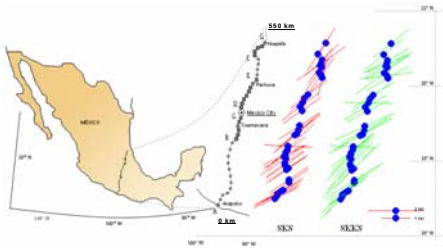
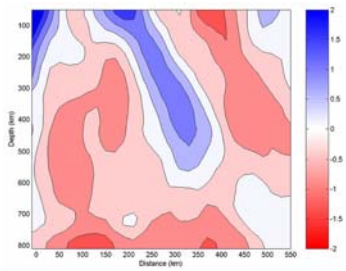
•Measurements of the wireless links show no correlation between SNR and throughput and a rough correlation between the distance and the throughput for the majority of the links.

•Various network tuning parameters were tested to further investigate the characteristics of the deployed network.



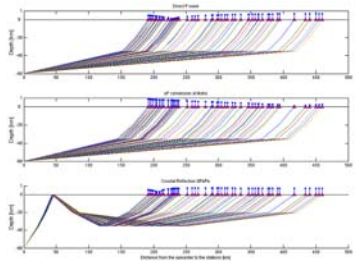


We observe large splitting delay times with, on average, a fast direction in the northeast-southwest direction, but with considerable variation along the network. Blue dots are the stations sorted by latitude. SKKS splitting is given for a comparison with SKS.



P-wave velocity tomography accounting for topography. Colors are percentage of P-velocity perturbation to the iasp91 background model. The horizontal distance is from Acapulco and runs inland.

The blue, fast velocity perturbation seen in the middle of the image is the Cocos slab.



Trajectories and amplitudes of the incident seismic waves. Red triangles show the relative position of the stations to the epicenter of the M6.0 Guerrero earthquake occurred on 08/11/06. Blue dots show the relative amplitude for the direct P waves, the converted sP waves and the crustal reflections at the bottom of the crust.

Future development: Preparation for installation of a network in Peru

Peru Network

•A chain of high mountains, the Andes, rises on the continental side of the collision boundary of two plates, a deep-sea trench lies just off the coast.

•Plans to install wireless Mollendo-Juliaca 50 station network (green dots) starting near sea level and ending in the high Andes at about 12000 feet with a separation of 5 km. Begin in January 2008.

•Expand the network with Caltech's stations in January 2009 (blue dots) and moving further to the Mollendo-Pisco line (pink dots).

An extra dimension to seismic experiment

The network has extra bandwidth that could sustain adding meteorological instrumentation to measure atmospheric parameters:

•Monitoring of the diurnal cycle.

•Monitoring of correlative evolutions of flow and convection.

•Boundary layer behavior over the Andean slopes.

•Measurements of a gravity wave generated by the diurnal variations in heating of the Andes.

iButton.

Instrumentation:

•Temperature and relative humidity sensors.
iButton – a computer chip enclosed in a 16mm thick stainless steel can.

•Portable all-in-one weather stations that measure wind, pressure, t and RH.
Vaisala Weather Transmitter WXT510 - a compact and lightweight multi-sensor instrument that measures the most essential weather parameters.

Vaisala WXT510