3D attenuation and velocity structure of the Cocos subduction zone in Mexico

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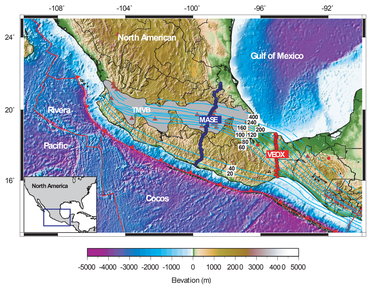
Background

MASE line: 01/2005 - 07/2007, consists of 100 broadband sensors.
VEOX line: 07/2007 - 03/2009, consists of 47 broadband sensors.



The slab contours are determined based on the combination of seismicity, velocity tomography and receiver functions.

Volcanos are shown as brown triangles. TMVB stands for Trans-Mexican Volcanic Belt.

Data and analysis

718 locall events (3.1 < M < 6.6) with depths larger than 50 km, recorded by MASE, VEOX and SSN stations.

Attenuation

We use spectral decay method [*Eberhart-Phillips and Chadwick*, 2002] to determine the attenuation parameter $t^* = t/Q$, assuming a Brune-type source.

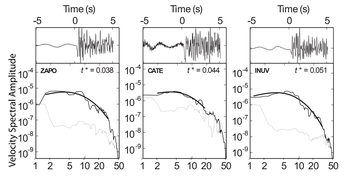
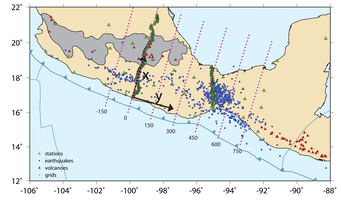


fig. Examples of signals, noises, and fittings for some seismograms.

Velocity

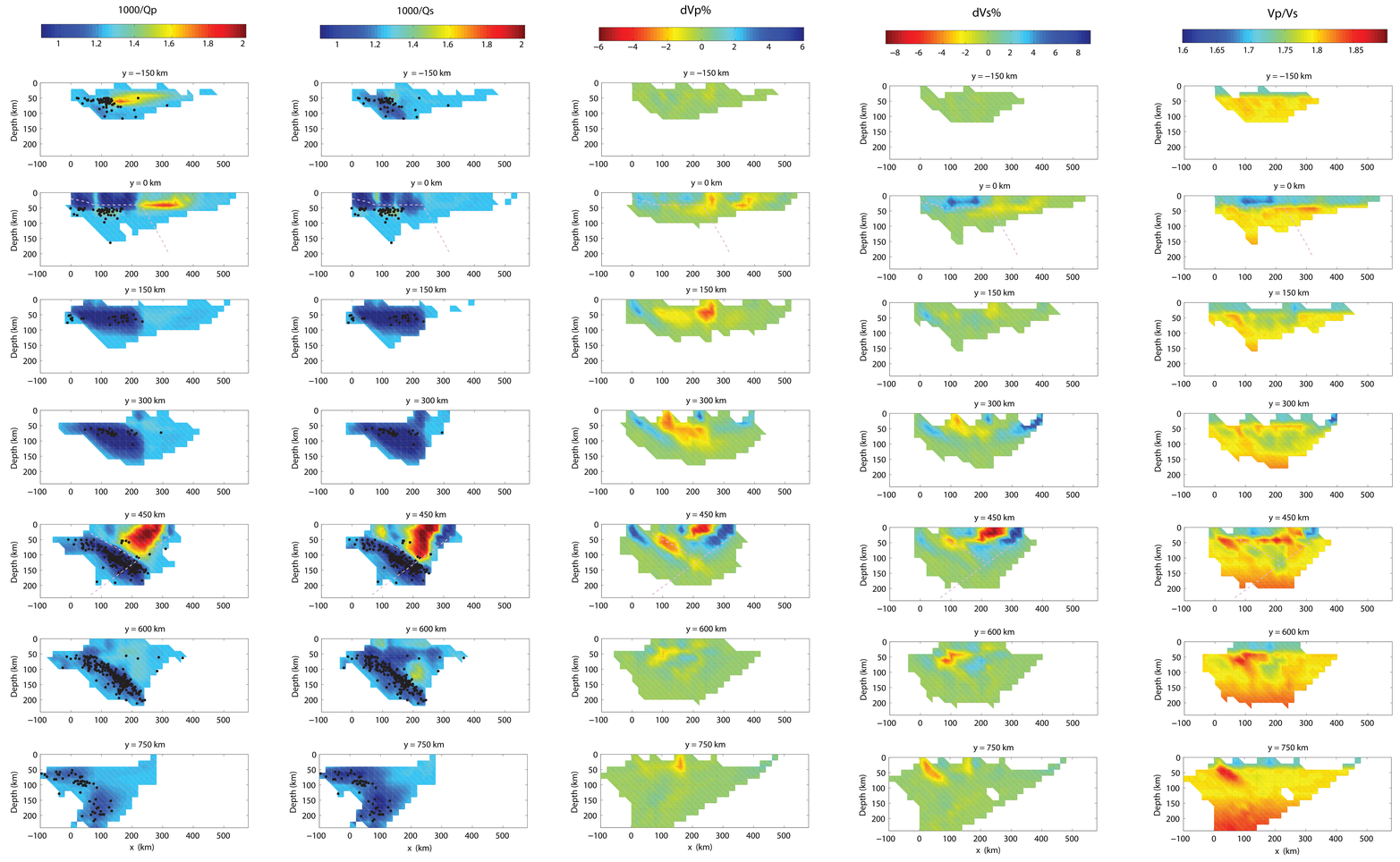
Direct P wave arrival picked on HHZ (BHZ) component
Direct S wave arrival picked on HHT (BHT) component

Inversion



The package simul2000 [*Thurber and Eberhart-Phillips*, 1999] is used for the inversion.

Attenuation and velocity tomography results



The highest attenuation for both P and S wave is observed in the crust and mantle wedge in the backarc close to the VEOX line. This high-attenuation region in the crust correlates with low Vp, low Vs, and high Vp/Vs, also lies close to low resistivity region, suggesting possible existence of melts.

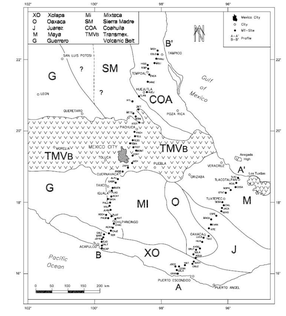
The other prominent P-wave high-attenuation region lies in the lower crust beneath Trans-Mexican Volcanic Belt along the MASE line. This P-wave high-attenuation region correlates with low Vp, low Vs, high Vp/Vs, and low resistivity; it might be related to dehydration and melting process.

The Cocos slab is imaged as low attenuation and high velocity. The top of the oceanic crust along MASE and VEOX line based on receiver functions (Kim and Clayton) are shown as magenta dashed lines for reference.

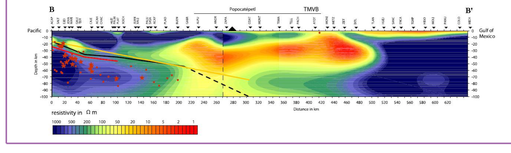
IASP91 is used as reference model for velocity tomography. Vp/Vs for this reference model increases with depth.

Comparison with resistivity

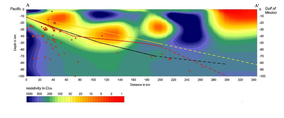
(from Jödicke et al., 2006)



compare with y = 0 km

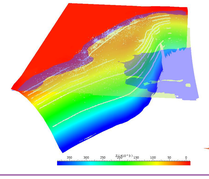


compare with y = 300, 450 km

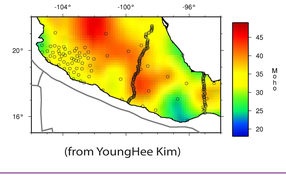


Toward building 3D model for Mexico

A 3D model for Mexico can be built combing different study results, including slab geometry from seismicity, receiver functions, and velocity tomography; moho depth from receiver functions; velocity structure from local, teleseismic body wave, surface wave and noise tomography; attenuation structure from local tomography, etc.

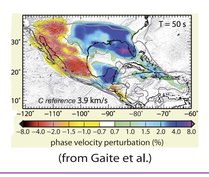


receiver functions



(from YoungHee Kim)

noise tomography



(from Gaite et al.)

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