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.
SSN: local stations

J: Jalisco;   M: Michoacan;   G: Guerrero;   O: Oaxaca
TMVB: Trans-Mexican Volcanic Belt
LTVF: Los Tuxtlas Volcanic Field
VB: Veracruz Basin

Data and analysis

718 local 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

1000/Qp

1000/Qs

dVp%

dVs%

White line is ray density contour, an approximation for resolution.

Slab geometry variation along the trench

1000/Qp
1000/Qs
dVp%
dVs%

The Cocos slab is imaged as low attenuation and high velocity. The slab angle increases from north to south along the trench.

Comparison

Along line CC'

MT studies

(from Jödicke et al., 2006)

High attenuation, low velocity, low resistivity in the lower crust beneath the Trans-Mexican Volcanic Belt (TMVB) suggests the existence of partial melts or fluids.

Along line DD'

High attenuation and low velocity are observed beneath the Veracruz Basin.

Teleseismic studies along the VEOX line

Relative delay times for the first P-arrivals are used to invert for the deeper velocity structure.

The P-wave velocity tomography results are overlaid on top of the receiver functions results (Kim et al., 2011).

The high-V anomaly dipping from the Gulf of Mexico coincides with the discontinuities from the receiver functions, and is probably related to the collision between the Yucatan block and Mexico in the Miocene.