TOMOGRAPHIC IMAGING OF THE PERU SUBDUCTION ZONE BENEATH THE ALTIPLANO AND IMPLICATIONS FOR ANDEAN TECTONICS

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This work describes preliminary results from a multiple station broadband seismic network installed mid-2008 from the coast to the high Andes in Peru. UCLA's Center for Embedded Network Sensing (CENS) and Caltech's Tectonic Observatory are collaborating with the IRD (French L'Institut de Recherche pour le Developpement) and the Institute of Geophysics, in Lima Peru in a broadband seismic experiment that will study the transition from steep to shallow slab subduction. The currently installed 3 lines have stations located above the steep subduction zone and crossing the transition from steep to shallow subduction at a variable spacing starting at 6 km.

The network consists of a mix of wirelessly linked and stand-alone sites. We have examined shear wave splitting in teleseismic shear waves from nearly all broadband stations (See Figure 1). We observe large splitting delay times with, on average, a fast direction in the east-west direction, but with considerable variation along the network. It mostly coincides with the South-America continent westward absolute plate motion. We also compare the splitting results with the three dimensional structure inferred from the geochemistry and seismic analyses.

In addition, teleseismic and local earthquake travel time residuals are being combined in the tomographic inversions. The crust under the Andes is found to be 70-80 km thick decreasing to 30 km near the coast. The morphology of the Moho is consistent with the receiver function images and gravity. Ray tracing through the heterogeneous structure is used to locate earthquakes. However the rapid spatial variation in crustal thickness, possibly some of the most rapid in the world, generates shadow zones when using conventional ray tracing for the tomography. We use asymptotic ray theory and finite difference solutions to the eikonal equation that approximates effects from finite frequency kernels to model diffracted waves in these regions. The observation of thickened crust suggests that models that attribute the recent acceleration of the Altiplano uplift to crustal delamination are less likely than those that attribute it to crustal compression.

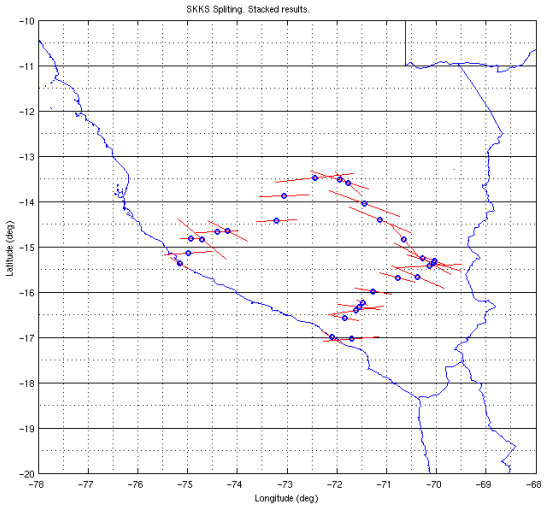
SKKS Splitting. Stacked results.
Latitude (deg)
Longitude (deg)
−10
−11
−12
−13
−14
−15
−16
−17
−18
−19
−20
−78
−77
−76
−75
−74
−73
−72
−71
−70
−69
−68

Figure 1