Public Abstract
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The present doctoral dissertation thesis presents three studies in two regions within the Central Andes. One of the regions is known as the southern Puna plateau and is located between 24°S-29°S and 64°W-72°W. The second region covers most of the Peruvian Andes and parts of northern Chile and western Bolivia. I studied the velocity structure beneath the southern Puna plateau using a method called surface wave tomography. The results show a large region of low velocities in the crust (depths of 0-70 km) which are interpreted as partial crustal melting that is partly responsible for the high elevation of the region. The hot crust is also related to the eruption of the most recent ignimbrite complexes (around 2 Ma). A region of high velocity beneath the largest ignimbrite at depth of around 140-190 km is interpreted to be a cold-high density piece of lower crust and lithosphere that detached around 2 Ma during slab rollback. Low velocities around this block are interpreted to be upwelling of hot asthenosphere that melted the crust in its way up. The convective asthenosphere flow also reached parts of the slab which cause the slab gap seen in the results. The observed slab gap correlates very well with a gap of intermediate depth local seismicity. Secondly, I studied the seismic anisotropy in southern Puna plateau using shear wave splitting analysis and shear wave splitting tomography. I found that anisotropy in the subslab is controlled mostly by trench rollback and a small degree of coupling between the slab and the underlying mantle. The mantle wedge shows evidence for vertical flow related to asthenospheric upwelling. Finally, I have studied the attenuation of high frequency seismic waves in Southern Peru using the two-station and reverse two station methods. I have focused on the largest regional phase Lg, which is a wave that is entirely guided in the crust and travels mostly as an S-wave. Low attenuation, or high quality factor (Q), usually leads to high stronger ground shaking even at larger distances from the epicenter. Our attenuation model should determine whether the attenuation is intrinsic or cause by scattering. The western cordillera in northern Peru is characterized by high attenuation. I have also found that most regions with high attenuation in southern Peru correlated very well with location of volcanoes. However, I have also found regions with high attenuation where there is very little active volcanism. We believe the high level of attenuation is associated with scattering attenuation caused by a thick crustal root. The Altiplano plateau, where Lake Titicaca is located, shows intermediate values of attenuation. The city of Pisco shows the highest values of Q in Peru (~1500) associated with a high degree of site effect which makes this region potentially more susceptible to strong ground motion from regional earthquakes. Most of southern Peru tends to exhibit high intrinsic attenuation but scattering attenuation is also observed to dominate in regions where the topography changes drastically over small distances such as the northern edge of the Altiplano plateau.