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Crustal Thickness of the Central American Arc

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Magmatism resulting from subduction is a source of continental crustal growth, for which crustal thickness is often used as a proxy. Central American subduction is of particular interest due to the extreme variations in geochemical indicators of the depth and degree of melting along the arc. The upper limit of both of these indicators is crustal thickness. Crustal velocities reflect bulk composition. This study focuses primarily on crustal thickness and Vp/Vs for these reasons. Teleseisms recorded on broadband seismometers during the eighteen month PASSCAL deployment of the TUCAN network have been used to determine crustal thickness, Vp/Vs and to develop receiver function images. For each event, a single incident wavefield is deconvolved from each of the 59 P and PP teleseismic arrivals, to generate 1742 receiver functions. The inclusion of PP arrivals is necessary to provide adequate azimuthal coverage.
Applying a moveout correction using velocities derived from tomography converts time to depth for the direct P-to-S conversion as well as the first two surface reflected phases. The resulting depth-corrected receiver functions are stacked for a best fit of crustal thickness and Vp/Vs for each station. Along the back arc, crustal thickness is fairly constant ranging from 29-34 km. Crossing the arc in Costa Rica, crustal thickness ranges from 32-39 km dipping from the forearc to the backarc, with the thickest crust just past the volcanic arc. The Nicaraguan transect has more variation in crustal thickness ranging from 25-41, km thinning from the coast to the arc and thickening to the back arc. The thinning below the arc is opposite to what is expected, as magmatism should thicken the crust. It is possible that the image is not the Moho, however it shows continuity. The arc in this location follows the Nicaragua graben, so crust may be stretched and thinned. This may result in a focusing of arc magmas to a region of thin crust. Along the forearc crustal thickness ranges from 25 km in Nicaragua to almost 50 km at the far end of the forearc transect in Nicaragua. Vp/Vs ranges from 1.66 to 1.88 with uncertainty. The most notable variation in Vp/Vs is along the back arc where a clear transition between a low and high Vp/Vs delineates the transition from continental crust to accreted arc terranes. Images are created of the crust and upper mantle through stacking of receiver functions for each section and smoothing along a given transect. All cross sections reveal layered structure in the upper crust. The most striking feature is a dipping structure between the subducting slab and the Moho beneath

Nicaragua present in the first three converted phases. If interpreted as a discontinuous feature this may be the base of a magma chamber or a region of varying composition. If interpreted as a continuous feature, this may be a portion of slab from a previous subduction event.