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A COARSE Receiver Function Survey of the Southern Arizona Lithosphere

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Project COARSE (COnsortium for Arizona Reconnaissance Seismic Experiment) operates a temporary network of broadband seismic stations in southern Arizona. The goal of the project is to investigate the crustal and deep structure across the transition from the Southern Basin and Range to the southern Colorado Plateau. Southern Arizona is a region of notable undersampling in tomographic and receiver function studies of the lithospheric-scale structure of the western United States. In addition, these data will provide unique first-order constraints on crust and upper mantle structure beneath the region in preparation for more focused efforts as EarthScope and USarray pass through the region. We are currently operating eight broadband seismographs recording continuously at 25 samples/sec in an approximate SW-NE swath across southeastern Arizona. When combined with the two permanent broadband stations in the state (TUC and WUAZ), the array will provide the requisite data to delineate the first-order structure of the lithosphere and sublithospheric mantle, as well as improve imaging capabilities for deep Earth structure in adjacent regions. One key question we are addressing is the nature of extension in the Southern Basin and Range, and how this extension is accommodated at greater depths. The current study therefore focuses on data collected at stations located at astronomical observatories on mountain summits associated with metamorphic core complexes. From SW to NE the seismic stations are located at 1) Kitt Peak (KITT), 2) Mt. Lemmon (LEMN) and the nearby GSN station TUC, and 3) Mt. Graham (SQRL). Analyses of receiver functions from teleseismic events at each station indicate a gradual SW to NE increase in crustal thickness from 29 km at KITT, to 30 km at LEMN, and 32 km at SQRL. This crustal thickness increase correlates with the increase in summit elevations from 2100m at KITT, to 2800m at LEMN, and 3050m at SQRL. Among these stations, only the TUC station has a clear Moho multiple from which we can estimate the bulk crustal Vp/Vs value of 1.74. The receiver functions from stations KITT and SQRL have prominent arrivals from the top of a crustal low-velocity zone at depths of 17 km and 14 km, respectively. Inter-crustal arrivals in this region possibly mark shallowly dipping shear zones that have played a role in accommodating extension during core complex formation. We hope to characterize how crustal thickness, anisotropy, extension, and shear within the crust are related in southern Arizona.