Receiver functions are traditionally used in a 1-D sense in that events from all backazimuths are stacked and delay times are converted to depth assuming a velocity model. The result is an image of shear velocity contrasts, e.g. the Moho, as a function of depth. We present two alternatives to this approach that allow separating seismogenic from aseismic lithospheric layers in the Himalaya and Zagros, as well as targeting crustal thermal structure in the Tibetan Plateau via anisotropy contrasts across the alpha-beta quartz transition.

Ps receiver functions measure the amplitude of P-to-S converted signal as a function of the time delay between the initial P and the converted S phase. To obtain depth of a converter, the delay time is scaled by P and S velocities above the converter. In some applications, the absolute depth is not the feature of interest. Instead, research questions center on where in the lithospheric column seismicity occurs. In the Himalayan collision zone, seismicity deep in the underthrusting Indian plate may be above or below the Moho, with implications for the rheology of the plate. In the Zagros, convergence results in seismicity that occurs within a thick sedimentary package or in the basement under it, affecting shortening estimates for the basement. In both cases, migrating receiver function structure and seismicity to depth before comparison has led to unclear pictures due to bias introduced during the depth migration. Direct comparison of S minus P delay times between local events and receiver functions avoids introducing bias and scatter. Deep seismicity in southern Tibet is clearly limited to the mantle (Fig. 1). In the Zagros, seismicity occurs preferentially in the sedimentary package, but extends into the basement.

The thermal structure of the continental crust is difficult to constrain. A temperature- and pressure- dependent transition from one quartz polymorph to another (cooler alpha quartz to hotter beta quartz) has been proposed as a seismic observable to constrain crustal temperature in areas of hot or thick crust. The phase transition does not only change the bulk isotropic characteristics, but also introduces a significant contrast in seismic anisotropy (Fig. 2). Synthetics show that analyzing azimuth-dependent arrivals in the radial and transverse components of receiver functions are capable of picking up such a contrast in deforming crust such as the Tibetan Plateau, and we investigate candidate signals in available data from Tibet.

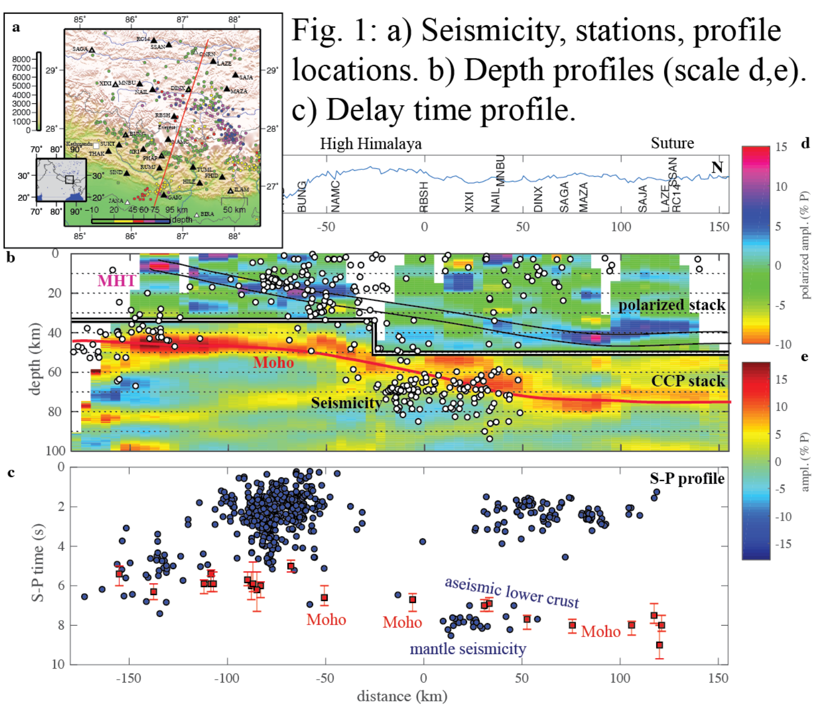

Fig. 1: a) Seismicity, stations, profile locations. b) Depth profiles (scale d,e). c) Delay time profile.

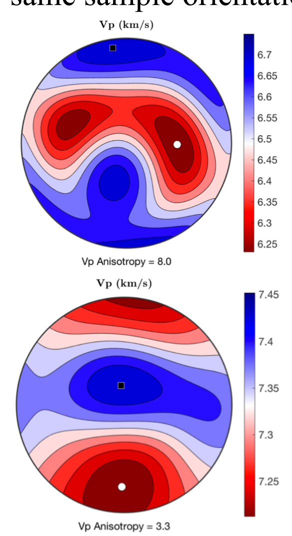

Fig. 2: Vp hemispheres for quartzite shear zone sample. (top) α, (bottom) β quartz, same sample orientation.