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Study of the Upper Mantle Structure beneath China by Multimode Surface Wave Tomography

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China is an assembly of ancient continental fragments separated by fold belts accreted from late Proterozoic to Cenozoic. China being sitting on the triple junction of three major plates: Eurasian plate, Indian plate and Philippine sea plate resulted in the tectonic feature of todays like mountain ranges, fold belts, sedimentary basins and high plateaus. This has been the cause of many intraplate earthquakes also. In the Northern part this region is supposed to get some resistance from the Siberian shield. But the major tectonic feature in this region imprinted by two main tectonic events. First, the subduction of the of West Pacific plate and Philippine Sea plate to the west in the last 250 Ma. Second, the collision of Indian and Eurasian plate started about 50 Ma. It was this collision responsible for the uplift of Himalayan mountain and Tibetan Plateau. This event left there imprints on the upper mantle structure. It is generally agreed that the lithosphere is thick in west China while much of the lithospheric root was lost beneath some cratons in east China. Still it's an open debate whether the lithosphere beneath the Tibetan plateau has doubled its thickness as did the crust above or much of the thickened lithosphere was removed by mantle convection and delamination.

In our study we try to determine the three dimensional Sv wave speed and azimuthal anisotropy model by analyzing the vertical component multimode Rayleigh wave seismogram. The data which we used are from approx. 40 broadband station from Chinese Seismic network and seismograms recorded by some temporary broadband seismic experiment in China. We construct the three dimensional model in two step procedure. In the first step we use the automated version of the Cara and Leveque [1987] waveform inversion technique in terms of secondary observables for modeling each multimode Rayleigh waveform to determine the path-average mantle Sv wave speed structure. In the second stage we combine the 1-D velocity models in a tomographic inversion to obtain the three dimensional Sv wave speed structure and the azimuthal anisotropy as a function of depth. This gives a much clearer indication of the properties at depth than do group and phase velocity maps which represent a weighted average of the earth structure over a frequency-dependent depth interval.

We have taken a source region specific velocity structure from the three dimensional model 3SMAC to improve the source excitation computation. We analyzed the seismograms using a modified (smoothed) version of PREM for the upper mantle velocity structure both for the reference model used in extracting the modal information from the seismogram and for the starting inversion and a priori velocity models employed in determining the path-average mantle structure. However, each path has a path-specific crustal model determined by averaging the crustal part of 3SMAC along the path.