Surface wave tomographic images beneath the Pacific Ocean

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Several surface wave tomographic studies have already been carried out in past to understand and explain the evolution of the Pacific Ocean. Recently, a number of new broadband seismic stations are set up in the Pacific region. We attempted to investigate phase velocity variations using a new set of data in the Pacific Ocean to understand its implications to complex tectonics, mantle plumes, hotspots and spreading ridge of the region.

We estimated fundamental mode Rayleigh wave phase velocity distribution for about 4000 propagation paths across the Pacific Ocean at the different time periods of 70, 100, 150, 230 and 300 s. More than 100 earthquakes, which occurred in the Pacific Ocean and recorded at about 45 broadband digital seismic stations ascribed to IRIS, OHP, TERRAscope, Pacific 21 (formerly POSEIDON) and Pacific Northwest Region (UW) are used in this study. We used the surface tomographic method of Zhang and Tanimoto (1993).

The resulting phase velocity maps at varying time periods showed a good correlation with known geological and tectonic features of the region. The preliminary results demonstrate that the East Pacific Rise is associated with low velocity anomaly, where the lithospheric ages are youngest in the Pacific. The phase velocity gradually assumes higher values as we move away from the ridge in the northwest and southeast parts of the Pacific. This may be due to thickening of lithosphere in the cold environment besides their relatively old lithospheric ages in the Pacific Ocean.

The subduction zone and spreading regions are also demarcated by slower velocity anomaly in our results.