Crust and upper mantle structures of the Makran subduction zone in south-east Iran by seismic ambient noise tomography

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Seismic ambient noise surface wave tomography was applied to estimate Rayleigh wave empirical Green's functions to study crust and uppermost mantle structure beneath the Makran region in south-east Iran. 12 months of continuous data from January 2009 through January 2010, recorded at broadband seismic stations were analysed. Group velocity of the fundamental mode Rayleigh-wave dispersion curves were obtained from the empirical Green's functions. Multiple-filter analysis was used to measure group velocity maps at periods from 10 s to 50 s. Using group velocity dispersion curves, 1-D Vs velocity models were calculated between several station-pairs. The final results demonstrate significant agreement with known geological and tectonic features. Our tomography maps display low-velocity anomaly with south-western north-eastern trend, comparable with volcanic arc settings of the Makran region, which may be attributable to the geometry of Arabian Plate subducting overriding lithosphere of the Lut block. At short periods (<20s) there is a pattern of low to high velocity anomaly in northern Makran near the Sistan Suture Zone. These results are evidence that surface wave tomography based on cross correlations of long time-series of ambient noise yields higher resolution group velocity maps compare to surface wave tomography based on traditional earthquake-based measurements. Group velocity maps provide a significant improvement especially in those areas with low level of seismicity or those regions with few documented large or moderate earthquake.