

Lithospheric seismic structure of the eastern region of the Arabian Peninsula

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Abstract

The lithospheric structure of the eastern region of the Arabian Peninsula has been derived using the spectral analysis of intermediate period P-wave amplitude ratios. Sixteen earthquakes recorded at the intermediate 3-components DHR station during the period from 1986 to 1995 were selected for analysis based on the following criteria : focal depths with a range between 15 and 300 km, body-wave magnitudes greater than 5.0, epicentral distances with a range from 13° to 82° .

By comparing the spectral peak positions of the observed and theoretical values, the thickness and velocity can be resolved within 3 km and 0.3 km/s, respectively of the observed values. Earthquakes from the Eurasian plate, Japan and China show high cross-correlation ratios (> 85 %) and events from the Arabian plate, Gulf of Aqabah, Red and Mediterranean Seas indicate cross-correlation ratios between 60-84 %.

The derived crustal model is not unique due to the theoretical assumptions (horizontal layering, constant densities and velocities in each layer), quality of the data and complexities of the crustal structure. The model suggests that the crust consists of five distinct layers with a strong velocity gradient of about 0.05 km/s/km in the upper crust and 0.03 km/s/km in the lower crust. The average results for several observations give a crustal thickness of 51 km and , a mean P velocity of 6.2 km/s. Depth to the crystalline basement is approximately 8 km which is in good agreement with values obtained by some oil wells in the eastern region. The Mohorovicic discontinuity indicates a velocity of 8.3 km/s of the upper mantle and 51 km depth.