HIGH RESOLUTION IMAGES OF THE LG AND PG ATTENUATION AND VELOCITY STRUCTURES ACROSS THE NORTHERN MIDDLE-EAST

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We present an approach for understanding the origin and nature of seismic anomalies in the continental crust of the Northern Middle East. We have constructed detailed models of crustal attenuation and velocity structure for the Northern Middle East based on the analysis of waveforms of the regional seismic phases Lg and Pg from about 4200 regional earthquakes recorded at more than 590 stations in Turkish and Iranian Plateaus and the surrounding regions (Figure 1).

The attenuation and velocity models are assumed to serve as proxies for the bulk average effective crustal P-wave and S-wave attenuation ($Q_p$ and $Q_s$) and velocities ($V_p$ and $V_s$). More than 37000 reliable spectra were collected for both Lg and Pg phases and used to measure Lg and Pg $Q$ at 1 Hz ($Q_{Lg0}$ and $Q_{Pg0}$) and their frequency dependence factor ($\eta$) using the Two-Station Method (TSM) (Xie and Mitchell, 1990) and Reverse Two-station/event Method (RTM)(Chun et al., 1987; Bao et al., 2011). A detailed description of the methods used in this study is given by Kaviani et al (2015).

The $Q_{Lg0}$ and $Q_{Pg0}$ and $\eta$ values measured over the individual TSM and RTM paths are then used to perform an LSQR tomographic inversion for lateral variations in $Q_0$ and $\eta$. The results of our individual Lg and Pg $Q$ measurements and the tomographic maps are shown in Figure 2.
We observe a strong correlation between the effective Q and velocity models. Our models show lateral variations that coincide with the major tectonic boundaries in the region. The tomographic models as well as the individual TSM and RTM measurements show lower values of $Q_{Lg}$ and $Q_{Pg}$ over the Turkish-Anatolian Plateau ($Q_{Lg} < 150$ and $Q_{Pg} < 200$) than those observed over the Iranian Plateau ($150 < Q_{Lg} < 300$ and $150 < Q_{Pg} < 400$). Furthermore, we obtained the Lg and Pg group velocity models ($V_{Lg}$ and $V_{Pg}$) by inverting the time of the first arrival of the Lg and Pg envelopes. Our $Q_{Lg}$ and $Q_{Pg}$ models are strongly correlated with the $V_{Lg}$ and $V_{Pg}$ models suggesting that the source of many of the low Q and velocity anomalies is likely the same. Our Q models have implication for any hazard assessment in different regions of the northern Middle-East and can also be used for the magnitude determination of the local and regional seismic events.

REFERENCES


