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

Ayoub KAVIANI
Institute of Geosciences, Goethe University, Frankfurt, Germany
Kaviani@geophysik.uni-frankfurt.de

Eric SANDVOL
Department of Geological Sciences, University of Missouri-Columbia, USA
sandvole@missouri.edu

Georg RÜMPKER
Institute of Geosciences, Goethe University, Frankfurt, Germany
rumpker@geophysik.uni-frankfurt.de

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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).

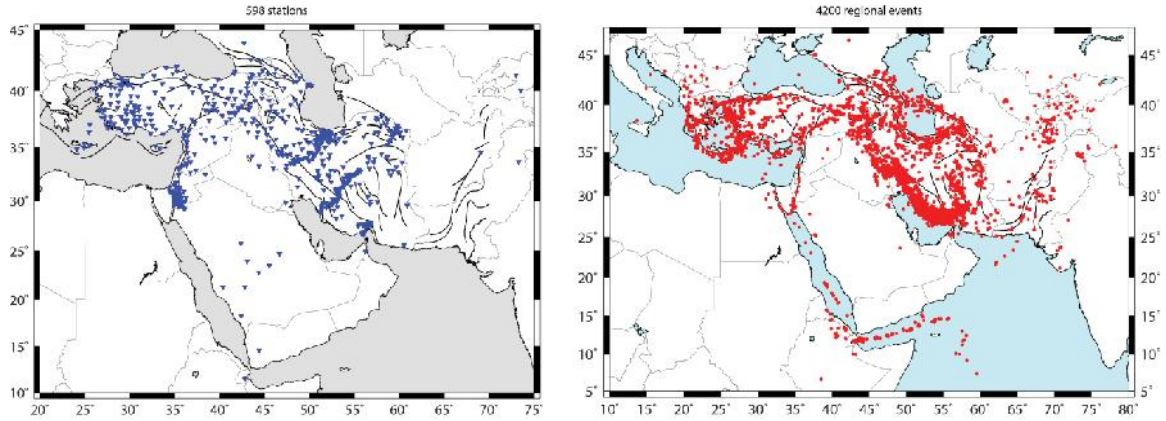

Figure 1. Location of stations (left) and earthquakes (right) used in this study

The attenuation and velocity models are assumed to serve as proxies for the bulk average effective crustal P-wave and S-wave attenuation (Q_α and Q_β) 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 (η) 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 η 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 η. The results of our individual Lg and Pg Q measurements and the tomographic maps are shown in Figure 2.

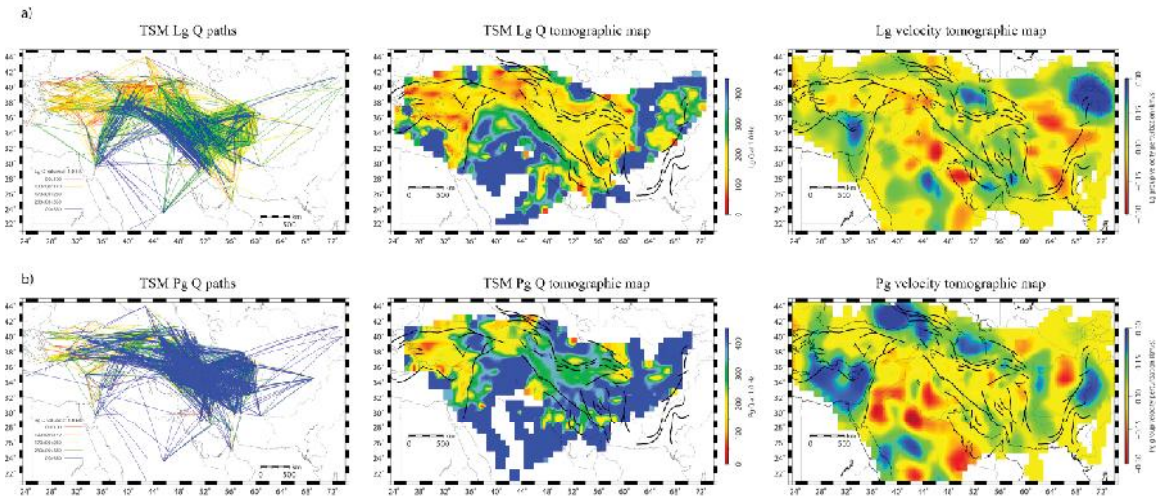

Figure 2. a) left: Individual Lg ray paths color-coded according to the measured Lg Q values along each path. Middle: Tomographic map of the Lg Q at 1 Hz. Right: Tomographic map of the Lg group velocity. b)Same as a) for the Pg waves

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_{Lg0} and Q_{Pg0} over the Turkish-Anatolian Plateau (Q_{Lg0}<150 and Q_{Pg0}<200) than those observed over the Iranian Plateau (150< Q_{Lg0}<300 and 150< Q_{Pg0}<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_{Lg0} and Q_{Pg0}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.

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