Geophysical Research Abstracts
Vol. 18, EGU2016-6791, 2016
EGU General Assembly 2016

Automated inter-station phase velocity measurements across the eastern Mediterranean and Middle East

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The structure of the lithosphere in northeastern Africa, eastern Mediterranean and the Middle East is highly variable. It ranges from young oceanic lithosphere in the Red Sea to what is considered the oldest oceanic lithosphere on Earth in the Mediterranean Sea north of Libya, and from highly deformed continental lithosphere at the east-Mediterranean margins to more stable continental lithosphere of Phanerozoic origin and to cratonic lithosphere beneath the Arabian Peninsula. Details of the lithospheric structure are, however, poorly known. Surface waves are ideally suited for studies of the lithosphere and the sublithospheric mantle. Our goal is to better define the 3D lithospheric shear-wave velocity structure within this region by surface wave tomography. Using regional to teleseismic Rayleigh and Love waves that traverse the area we can obtain information about its seismic structure by examining phase velocities as a function of frequency. A newly developed algorithm for automated inter-station phase velocity measurements (Soomro et al. 2016) is applied here to obtain both Rayleigh and Love fundamental mode phase velocities. We utilize a database consisting of more than 3800 regional and teleseismic earthquakes recorded by more than 1850 broadband seismic stations within the area, provided by the European Integrated Data Archive (WebDc/EIDA) and IRIS. Moreover, for the first time, data from the Egyptian National Seismological Network (ENSN), recorded by up to 25 broad band seismic stations, is also included in the analysis. For each station pair approximately located on the same great circle path, the recorded waveforms are cross correlated and the dispersion curves of fundamental modes are calculated from the phase of the weighted cross correlation functions. Path average dispersion curves are obtained by averaging the smooth parts of single-event dispersion curves. Parameters tests and preliminary results of automatically measured phase velocities are presented here. For selected inter-station paths, inversions for the 1D path-average S-wave velocity structure are shown. Our broadband surface wave measurements, utilizing the dense sampling of the area with newly available data, can offer important new insights into the structure and evolution of the lithosphere beneath the entire region.

Key words: Surface waves, Fundamental modes, Dispersion Curves, Inversion, 1D Models.

Reference:
Soomro, R.A., C. Weidle, L. Cristiano, S. Lebedev, T. Meier. Phase velocities of Rayleigh and Love waves in central and northern Europe from automated, broadband, inter-station measurements, Geophys. J. Int., 204, 517–534, 2016.