

Surface Wave Velocities Across Arabia

T. A. Mokhtar,¹ C. J. Ammon, R. B. Herrmann² and H. A. A. Ghalib³

Abstract — The group-velocity distribution beneath the Arabian Plate is investigated using Love and Rayleigh waves. We obtained a balanced path coverage using seismograms generated by earthquakes located along the plate boundaries. We measured Love- and Rayleigh-wave group-velocity dispersion using multiple filter analysis and then performed a tomographic inversion using these observations to estimate lateral group velocity variations in the period range of 5–60 s. The Love- and Rayleigh-wave results are consistent and show that the average group velocity across Arabia increases with increasing period. The tomographic results also delineate first-order regional structure heterogeneity as well as the sharp transition between the Arabian shield and the Arabian platform. Systematic differences are observed in the distribution of the short-period group velocities across the two provinces, which are consistent with surface geology. The slower velocities in the platform reveal the imprint of its thick sedimentary section, while faster velocities correlate well with the exposed volcanic flows in the shield. Shear-wave velocity models for the two regions, obtained from the inversion of the group velocities, confirm results from previous studies of higher *S*-wave velocity in the upper crust beneath the shield. This may be due to the present remnants of the oceanic crust (ophiolite belts) associated with the island arcs evolutionary model of the Arabian shield.

The mapping of the surface-wave group velocity using a large data can be used in constraining the regional structure at existing and planned broadband stations deployed in this tectonically complex region as part of the seismic monitoring under CTBT.

Key words: Arabia, crust, surface waves, seismic tomography.

Introduction

The deployment of broadband seismic stations within the Arabian shield (VERNON and BERGER, 1998) provided an excellent opportunity to study the seismic structure of the Arabian plate using high quality seismic signals previously unavailable for this part of the world. A number of recent studies have made use of the recorded broadband data (e.g., SANDVOL *et al.*, 1998; MCNAMARA *et al.*,

¹ Department of Geophysics, Faculty of Earth Sciences, King Abdulaziz University, P.O. Box 80206, Jeddah, 21589, Saudi Arabia.

² Department of Earth & Atmos. Sci., Saint Louis Univ., 3507 Laclede Ave., St. Louis, MO, 63103, USA. E-mail: rbh@eas.slu.edu, E-mail: ammon@mantle.slu.edu

³ Multimax Inc., 1090 N. Highway A1A, Suite D, Indialantic, Florida 32903, USA. E-mail: hghalib@multimax.com