S-wave velocity images of the Dead Sea Basin provided by ambient seismic noise

J. Badal[1], M. Chourak[2], Yun Chen[3], J. Stankiewicz[4]

(1) Physics of the Earth, Sciences B, University of Zaragoza, Pedro Cerbuna 12, 50009 Zaragoza, Spain
(2) Departement de BCG, Faculté Pluridisciplinaire, Université Mohammed Premier, Oujda, Morocco
(3) State Key Laboratory of Lithospheric Evolution, Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing 100029, P.R. China
(4) Deutsches GeoForschungsZentrum-GFZ, Telegrafenberg, 14473 Potsdam, Germany

Based on passive seismic interferometry applied to ambient seismic noise recordings between station pairs belonging to a small-scale array, we have obtained shear wave velocity images of the Dead Sea Basin. Empirical Green’s functions were extracted from cross-correlations of long-term recordings of continuous data, and inter-station Rayleigh wave group velocities were measured from the daily correlation functions for positive and negative correlation time lags in the secondary microseism bandwidth 0.1–0.5 Hz. A tomographic inversion of the travel times estimated for each frequency is performed, allowing the laterally varying 3-D surface wave velocity structure below the array to be retrieved. Subsequently, the velocity-frequency curves are inverted to obtain S-wave velocity images of the study area as horizontal depth sections and longitude- and latitude-depth sections. The results, which are consistent with other previous ones, provide clear images of the local seismic velocity structure of the basin. Low shear velocities are dominant at shallow depths above 3.5 km, but even so a spit of land with a depth that does not exceed 4 km is identified as a salt diapir separating the low velocities associated with sedimentary infill on both sides of the Lisan Peninsula. The lack of low speeds at the sampling depth of 11.5 km implies that there are no sediments and therefore that the basement is at a depth near 10−11 km, but gradually decreasing from south to north. The results also highlight the bowl-shaped basin with poorly consolidated sedimentary materials accumulated in the central part of the basin. The structure of the western margin of the basin evidences a certain asymmetry both whether it is compared to the eastern margin and it is observed in north-south direction. Infill materials down to a depth of ~8 km are observed in the basin hollow, unlike what happens in the north and south where they are spread beyond the western Dead Sea shore.