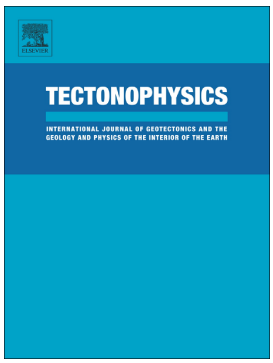

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S-Wave Velocities of the Lithosphere-Asthenosphere System in the Lesser Antilles from the Joint Inversion of Surface Wave Dispersion and Receiver Function Analysis

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Abstract

We present an overview of S-wave velocities (Vs) within the crust and upper mantle of the Lesser Antilles as determined with 19 seismic broadband stations. Receiver functions (RF) have been computed from teleseismic recordings of earthquakes, and Rayleigh wave group velocity dispersion relations have been taken from earlier surface wave tomographic studies in the Caribbean area. Local smoothness optimization (LSO) procedure has been applied, combined with an H-K stacking method, the spatial distribution of hypocenters of local earthquakes and of the energy they released, in order to identify an optimum 1D model of Vs below each station. Several features of the Caribbean plate and its interaction with the Atlantic subducting slab are visible in the resulting models: (a) relatively thick oceanic crust below these stations ranges from ~21 km to ~33 km, being slight thinner in the middle of the island arc; (b) crustal low velocity zones are present below stations SABA, SEUS, SKI, SMRT, CBE, DSD, GCMP and TDBA; (c) lithospheric thickness range from ~40 km to ~105 km but lithosphere-asthenosphere boundary was not straightforward to correlate between stations; (d) the aseismic mantle wedge between the Caribbean seismic lithosphere and the subducted slab varies in thickness as well as Vs values which are, in general, lower below the West of Martinique than below the West of Guadeloupe; (e) the depth of the subducted slab beneath the volcanic arc, appears to be greater to the North, and relatively shallower below some stations (e.g. DLPL, SAM, BIM and FDF) than was estimated in previous studies based on the depth-distribution of seismicity ; f) the WBZ is more than 10-15 km deeper than the top of the slab below the Central Lesser Antilles (Martinique and Dominica) where the presence of partial melt in the mantle wedge seems also to be more evident.

Key words: S-wave velocity models, Lesser Antilles, Caribbean region, surface waves, receiver function, non-linear inversion, seismicity.

Introduction