

ABSTRACT

Aegean is one of the most tectonically complex areas worldwide. Because of its position in the back arc area of the active subduction of the African plate beneath the Eurasian plate as well as occurrence of two successive stages of extension within Aegean since Oligocene times, it belongs to the most interesting areas and has been the focus of many studies. In this thesis a joint P and S receiver function analysis is used to estimate the crustal and upper mantle structure in the whole Aegean Sea, mainland Greece and the island of Crete. To reach this goal, combined P and S receiver functions of teleseismic events are computed, which are recorded by a total number of 65 temporary and permanent stations including GEOFON, National Observatory of Athens, Cyclades-network, Mediterranean network and the Seisfaultgreece experiment. These combined data show a more dense coverage in the southern and central Aegean Sea where no information from P receiver functions can be obtained without OBS stations. The receiver function images reliably demonstrate the subducting oceanic African lithosphere up to northern Greece, where the slab is not marked by earthquakes. The results lead also to an average depth of 40 km for the subducted oceanic Moho beneath southern Crete, western Peloponnesus and southeast of Rhodes, which significantly increases down to the volcanic arc to a depth of 160 km. The oceanic Moho can be reliably followed further north to depth of 220 km beneath northern Greece. The new information on the oceanic and continental lithosphere deduced from the new technique of S receiver function clearly reveals the lithosphere-asthenosphere boundary beneath each part of the area. This boundary is estimated about 150 km beneath mainland Greece, which presents the continental Aegean lithosphere (Eurasian lithosphere) and shows a thickening from 100 km beneath southern Crete to about 225 km under volcanic arc of the subduction zone.

This thickening of the LAB towards the Aegean Sea is associated with the subduction of the oceanic African lithosphere beneath the Aegean plate. Moreover, detailed informations about the crustal thickness variation are inferred from this study. In Crete, the Aegean Moho varies from 25 km in the east to 33 km in the west. In the Cretan Sea a thin crust of approximately 20 km is observed, which thickens up to 30 km at the volcanic arc. A thicker crust of about 35 km beneath two volcanic islands in the Aegean (SANT, MILO) are also observed. In the northern Aegean Sea the crustal thickness is ranging between 25-28 km, whereas beneath western Greece a significantly crustal thickening resulted in a Moho depth of 32-38 km. The estimations in the Peloponnesus show a crustal thickness of 25-28 km.