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ScienceDirect
Earth and Planetary Science Letters 260 (2007) 549–563
EPSL
www.elsevier.com/locate/epsl

The crust and upper mantle structure beneath southeastern China

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Received 15 July 2006; received in revised form 29 May 2007; accepted 2 June 2007
Available online 12 June 2007
Editor: R.D. van der Hilst

Abstract

We analyzed teleseismic waveforms recorded by 44 stations in the Fujian and Taiwan provinces of China and obtained 5344 high quality receiver functions. The crustal thickness (H) and average crustal V_P/V_S ratio (k) beneath every station were estimated using the H–k stacking method. Crustal thicknesses near the Fujian Province range from 28.3 to 32.8 km with an average of 31.1 km, and the corresponding V_P/V_S ratios vary from 1.70 to 1.84 with a mean of 1.76. From inland to offshore of the Fujian Province, the crustal thicknesses decrease and Poisson's ratios increase. These may indicate decreasing SiO_2 and increasing calc-alkaline contents in the crust. The discontinuity structures such as the Moho, subducting slab, the 410- and 660-km discontinuities (hereafter we call them the 410 and the 660) are also studied using common converted point (CCP) stacking of receiver functions. Along two NW–SE lines of central and northern Taiwan, the CCP stacking results show a western dipping structure at depths above 50 km, suggesting that the Philippine Sea plate is probably subducting beneath the Eurasian continent plate near the central and northern Taiwan. The CCP stacking results show sharp and flat 410- and 660-km discontinuities, and the transition zone thickness (TZT) is the same as that of ambient mantle beneath Fujian and Taiwan Strait, but thickens in the east of Taiwan. These results suggest that (1) the subducting Eurasian continent plate is confined to the depths above 410 km beneath Fujian and Taiwan Strait; and (2) the South China Sea slab may reach the transition zone beneath the east of Taiwan.

Keywords: receiver functions; crustal thickness; Poisson's ratio; slab; the upper mantle discontinuity

1. Introduction

Located on the western Pacific margin, southeastern China is an ideal natural laboratory to study modern plate interaction and geodynamics. In this area, the Eurasian and Philippine Sea plates converge in the region of Taiwan. In northeastern Taiwan, the relative plate motion between the Philippine Sea plate and the Eurasian plate is in a NW direction with an estimated rate of 8.2 cm/yr (Yu et al., 1997), whereas in southern Taiwan, the plate motion between the South China plate and the Luzon arc of the Philippine Sea plate is eastward (Kim et al., 2004). As a consequence of plate collision, the Taiwan mountain belt, one of the youngest

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doi:10.1016/j.epsl.2007.06.009