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中国大陆东南缘地震接收函数与地壳和上地幔结构

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Seismic receiver functions revealing crust and upper mantle structure beneath the continental margin of southeastern China

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摘要

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摘要

从2008—2011年,分别在中国大陆东南缘沿海和内陆两条NE向剖面上进行了宽频地震观测,利用记录到的远震波形资料提取得到1446个远震P波接收函数,用H-κ叠加扫描和CCP偏移叠加方法研究了中国大陆东南缘地壳及上地幔过渡带的结构及其变化特征.结合固定台网25个台站的H-κ结果,获得中国大陆东南缘(福建地区)地壳厚度从内陆到沿海逐渐减薄的图像:地壳从闽西北山区的33 km减薄到厦门沿海一带的29 km以下,平均地壳厚度为31.3 km,具有陆地到洋壳过渡的特征;地壳泊松比从内陆到沿海显示出分带特征,闽中西部内陆地区小于0.26,沿海地带高于0.26,且在断裂带的交汇区域表现为相对异常高值.地壳上地幔顶部(0~200 km)的CCP偏移叠加成像结果显示闽江断裂等NW向断裂深切Moho界面,在断裂两侧Moho面急剧抬升或下沉,产状改变,这些特征向内陆地区逐渐变得不明显.闽江等NW向断裂对研究区地壳厚度、地震等有明显控制作用.上地幔尺度(300~700 km)的CCP偏移叠加成像,未见410 km和660 km速度间断面突变和起伏异常,其绝对深度略大于IASP91模型的,上地幔转换带厚度正常(250±5 km),表明中国大陆东南缘上地幔转换带未受欧亚与菲律宾板块碰撞的明显影响,推断中国大陆东南缘及台湾海峡下方不存在俯冲板块,或俯冲前缘未扰动到410 km的深度.

关键词 中国大陆东南缘, 远震P波接收函数, Moho, 泊松比, 闽江断裂, 上地幔转换带, 菲律宾板块, 欧亚板块

Abstract:

1446 teleseismic P-wave receiver functions were selected from the seismographs of two NE-oriented profiles deployed along the coast and in the midland of Fujian Province, respectively. H-κ auto-searching stacking and CCP stacking methods were used to study the crust and upper mantle structure characteristics beneath the continental margin of southeastern China (SE China). With the data from 25 permanent stations of Fujian Seismic Network joined, we obtained an image of crustal thicknesses characterized by gradually thinning from inland to coast in the region of SE China margin (Fujian region). It is shown that the crust beneath Fujian region thins from about 33 km in the mountain area of northwestern Fujian to <29 km along the coast of southeastern Fujian around Xiamen, with an average of 31.3 km, which embodies the transition from continental crust to oceanic crust. Meanwhile, the Poisson's ratios of the coastal crust (>0.26) are higher than that of the inland crust (<0.26). The CCP migrated receiver function stacking images of crust and uppermost mantle (0~200 km) for the two profiles show that the NW trending faults like Minjiang Fault cut through the Moho, causing severe drop or uplift and different attitudes of the Moho across the faults, but such characteristics seem unobvious toward inland. NW trending faults like Minjiang affect the distributions of factors like crustal thicknesses and earthquakes in this region. There are no breaks and surge of 410 and 660 km discontinuities appearing on the image of CCP stacking results for the depths of upper mantle (300~700 km). The depths of 410 and 660 km discontinuities are slightly larger than that of IASP91 while the thicknesses of the mantle transition zone are normal (250±5 km), which indicates that the mantle transition zone beneath this area is less affected by the collisions between

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Eurasian and Philippine Sea plates. It is inferred that there are no any subducting plates existing beneath SE China margin and Taiwan Strait or the frontier of the subducting plates has not reached the depth of 410 km.

Keywords [Continental margin of SE China](#), [P-wave receiver functions](#), [Moho](#), [Poisson' s ratio](#), [Minjiang Fault](#), [Upper mantle transition zone](#), [Philippine Sea plate](#), [Eurasian plate](#)