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京津唐地区地壳三维P波速度结构与地震活动性分析

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Three-dimensional crustal P-wave velocity structure and seismicity analysis in Beijing-Tianjin Region

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摘要

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摘要 本文利用华北遥测地震台网和首都圈数字地震台网112个台站记录到的1993~2004年发生在首都圈地区3983次地震到时资料和相对到时资料,采用双差地震层析成像方法联合反演了京津唐地区地壳三维P波速度结构和震源参数.京津唐地区P波速度结构图像在浅层上很好地反映了地表地质、地形的特征.在平原和凹陷的盆地处呈现P波低速速度异常,而在隆起的山区则显示为P波高速速度异常.在研究区域内震级 $M \geq 6.0$ 历史地震和经过重新定位后的震级 $M_L \geq 3.0$ 的地震的震源位置在10 km深度处的P波相对速度扰动图上的投影都显示出相似的特点,即:绝大部分的地震的震源位置在P波相对速度扰动图上的投低、高速异常的交界地带,且偏高速体一侧,只有极少数的地震分布在P波速度异常体内部.

关键词: 双差地震层析成像 速度结构 地震活动性 横向不均匀性

Abstract: In this paper, we present a joint inversion investigation of both three-dimensional crustal P-wave velocity structures and hypocenter parameters using double-difference seismic tomography method in Beijing-Tianjin Tangshan (BTT) region. The double-difference seismic tomography method was adopted to refine the absolute and relative event locations and P-wave velocity structures simultaneously with the direct use of both arrival times and the more accurate differential travel times. These data came from the earthquake catalog records of totally 3983 events recorded by 112 stations from the Northern China Telemetry Seismic Network (NCTSN) and Capital Digital Seismic Network (CDSN) in BTT region during the years of 1993 to 2004. The results indicated that this method produced a more pronounced and detailed velocity model of the BTT region which was more consistent with the features of the local geological setting. It revealed the low P-wave velocity anomaly in the plains and basins. In the uplifts of mountain and exposed rock areas, it appeared as high velocity anomalies. In the BTT region, after being projected to the horizontal P-wave relative velocity perturbation maps in 10 km and 15 km depths, the relocated hypocenters of magnitude $M_L \geq 3.0$ earthquakes showed identical features with those of the historic earthquakes with magnitude $M \geq 6.0$. The majority of hypocenters were located in the conjunctural areas of low and high P-wave velocity anomalies. And the slightly closer to the high P-wave velocity abnormal areas. Only few earthquakes have ever occurred within high P-wave velocity anomalies.

Keywords: Double-difference seismic tomography Velocity structure Seismicity Lateral heterogeneity

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