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## 玉树地震震源区速度结构与余震分布的关系

王长在, 吴建平, 房立华, 王未来\*

中国地震局地球物理研究所, 北京 100081

The relationship between wave velocity structure around Yushu earthquake source region and the distribution of aftershocks

WANG Chang-Zai, WU Jian-Ping, FANG Li-Hua, WANG Wei-Lai\*

Institute of Geophysics, China Earthquake Administration, Beijing 100081, China

摘要

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摘要 利用玉树震区21个应急流动地震台站和青海省地震台网固定地震台站的观测数据, 采用双差分成像方法, 对2010年4月14日至6月15期间发生的地震进行了重定位, 并反演得到了玉树地震震源区的三维速度结构. 重定位结果揭示余震主要沿NW向成窄带状分布在断层的两侧, 表明脆性破裂应力释放主要集中于一个狭窄的区域内. 在西北端, 余震偏离玉树—甘孜断裂分布, 在SW向也有分布, 推测可能与南西向次级断裂有关. 双差分成像得到的速度结构在浅部与地表地质构造相一致, 中上地壳的速度结构显示巴颜喀拉地块为高速异常, 羌塘地块为低速异常. 玉树地震余震分布与特定的速度结构存在相关性: 主震发生在高低速过渡带偏高速体的一侧, 余震主要分布在高速体外围, 高速体内部几乎没有余震分布. 一般说来, 中上地壳的高速体通常具有较高的强度, 可以积累较强的孕震能量. 主震发生后, 高速体内积累的弹性能量向周边释放, 可能是导致高速体周边余震发生的主要原因.

关键词 玉树地震, 双差分成像, 地震重定位, 玉树—甘孜断裂

Abstract: Using travel time data from 21 temporary seismic stations and the permanent stations of Qinghai Seismological Network, we obtained precise relocation of earthquake sequence and 3D seismic velocity structure around Yushu focal area by double-difference tomography. To ensure the accuracy of the phases, the seismic events downloaded from the Data Management Center of China National Seismic Network were re-processed. The result of aftershock relocation shows that the earthquake sequence has a banding distribution along NW in both sides of the fault, which reveals horizontal lineations of hypocenters that define the narrow regions on the fault where stress is released by brittle failure. At the northwest end the aftershocks are distributed not only along the Yushu-Garzê fault, but also along the direction vertical to the fault. It reveals an intersecting fault. The result of 3D seismic velocity structure showed that shallow velocity structure has good correlation with surface geology. The velocity structure of middle crust shows that Bayan Har block is characterized by high velocity, Qiangtang block is imaged as a low velocity region. The result of earthquake location and seismic velocity structure shows that the high-low velocity anomaly has certain control action to the aftershock distribution. The mainshock occurred in the transition zone between low and high velocity bodies. Most aftershocks appear to be distributed on the periphery of the high-velocity body. There are rarely earthquakes in the high-velocity body. The high-velocity body reflects the more brittle and competent parts of the crust, which are capable of sustaining greater seismogenic energy. The seismogenic energy in the high-velocity body was released into the surroundings after the mainshock, which leads to many aftershocks in the surrounding areas.

Keywords Yushu earthquake, Double-difference tomography, Earthquake relocation, Yushu-Garzê, fault

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About author: 王长在, 1982年生, 助理研究员, 主要从事地震精定位、近震层析成像及地震监测研究. E-mail: wangchangzai@cea-igp.ac.cn

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