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芦山7.0级地震序列的震源位置与震源机制解特征

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Hypocentral location and source mechanism of the M_S 7.0 Lushan earthquake sequence

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摘要

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摘要

基于中国国家 and 四川区域数字地震台网记录, 采用HypoDD方法精确定位了四川芦山 $M_L \geq 2.0$ 级以上地震序列的震源位置, 采用CAP方法反演了36次 $M_L \geq 4.0$ 级以上地震的最佳双力偶震源机制解, 并利用小震分布和区域应力场拟合了可能存在的发震断层参数, 从而综合分析了芦山地震序列的震源深度、震源机制和震源破裂面特征, 探讨可能的发震构造. 结果显示, 7.0级主震的震源位置为 30.30° N 、 102.97° E , 初始破裂深度为15 km左右, 震源矩心深度为14 km左右, 最佳双力偶震源机制解的两组节面分别为走向 209° / 倾角 46° / 滑动角 94° 和走向 23° / 倾角 44° / 滑动角 86° , 可视为纯逆冲型地震破裂, 绝大多数 $M_L \geq 4.0$ 级以上余震的震源机制也表现出与主震类似的逆冲破裂特征. $M_L \geq 2.0$ 级以上余震序列发生在主震两侧, 集中分布的长轴为30 km左右, 震源深度主要集中在5~27 km, $M_L \geq 3.5$ 级以上较大余震则集中分布在9~25 km的深度上, 并揭示出发震断层倾向北西的特征. 利用小震分布和区域应力场拟合得到发震断层参数为走向 207° / 倾角 50° / 滑动角 92° , 绝大多数余震发生在断层面附近10 km左右的区域. 综合地震序列分布特征、主震震源深度和已有破裂过程研究结果, 可以推测主震破裂过程自初始点沿断层的两侧扩展破裂, 南侧破裂比北侧稍长, 滑动量主要集中在初始破裂点附近, 可能没有破裂到地表. 综合本文研究成果、地震烈度分布和现有的科学考察结果, 初步推测发震构造为龙门山山前断裂, 也不排除主震震中东侧还存在一条未知的基底断裂发震的可能性.

关键词 芦山地震, 震源位置, 震源机制解, 龙门山断裂带, 发震构造

Abstract:

Based on the digital waveforms of China National Seismic Network and Sichuan Seismic Network, The Lushan earthquake sequence ($M_L \geq 2.0$) was relocated precisely by HypoDD, 36 best double-couple focal mechanisms ($M_L \geq 4.0$) were determined by CAP method. The geometric fault parameters and slip direction were estimated by using distribution of the Lushan earthquake sequence and regional stress field. We analyzed the characteristics of focal depth, focal mechanisms and source rupture to determine the seismogenic structure. The main shock was relocated at 30.30° N , 102.97° E ; the depth of the initial rupture and centroid is about 15 km and 14 km, respectively; the nodal plane parameters of the best double-couple focal mechanism: strike 209° , dip 46° and slip 94° ; strike 23° , dip 44° and slip 86° , respectively. The focal mechanism of main shock is pure thrust type, and most of the focal mechanisms of the aftershocks show the same rupture property as the main shock. The aftershocks ($M_L \geq 2.0$) distributed in two sides of the main shock, the length of sequence is about 30 km, the focal depth is centrally distributed in 5~27 km; the focal depth of the aftershocks ($M_L \geq 3.5$) is centrally distributed in 9

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~25 km and show the focal fault dip toward northwest. We determined the focal fault parameter: strike 207° , dip 50° and slip 92° using distribution of sequences and regional stress field, most aftershocks distributed in the 10 km vicinity of the focal plane. Combine the distribution of earthquake sequence, the focal depth of the main shock with the result of rupture process, we infer that the main rupture extend along the two sides of the fault from the initial rupture point, the southern rupture is a little longer than the northern part, the slip focus on the vicinity of the initial rupture point and the rupture is not up to the surface. Based on the results of this paper, the distribution of seismic intensity and field investigation, we speculate preliminarily the focal fault is the front fault of Longmenshan, but we do not rule out the possibility that there is an unknown base fault nearby the east of main-shock.

Keywords [Lushan earthquake](#), [Hypocentral location](#), [Focal mechanism](#), [Longmenshan faults](#), [Seismogenic structure](#)