地球物理学报 » 2009, Vol. 52 » Issue (4) :1025-1032 doi:10.3969/j.issn.0001-5733.2009.04.019
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引用本文(Citation):
张永庆;谢富仁;Susanna J. Gross.利用1996年丽江地震序列反演震区应力状态. 地球物理学报, 2009,52(4): 1025-1032,doi: 10.3969/j.issn.0001-5733.2009.04.019

ZHANG Yong-Qing;XIE Fu-Ren;Susanna J. Gross.Background stress state estimated from 1996 Lijiang earthquake sequence .Chinese J.Geophys. (in Chinese),2009,52(4): 1025-1032,doi: 10.3969/j.issn.0001-5733.2009.04.019

利用1996年丽江地震序列反演震区应力状态

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Background stress state estimated from 1996 Lijiang earthquake sequence

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摘要 本文以1996年丽江M_S7.0地震为例，以地震目录和强震震源模型为输入参数，将力学计算与统计分析相结合，反演计算了1986～1996年间丽江震区2.5°×3.0°空间范围内的地壳应力状态.结果表明，丽江地区应力场最大主应力为近南北向，方位角为355°，最小主应力方位角为241°，二者倾角为近水平，应力形因子为0.398，最大主应力大小约为53 MPa，远小于完整岩石的强度.该方法可获得地壳深部绝对应力大小、有效摩擦系数，反演获得的震区地壳深部应力状态的方向性特征与震源机制解结果基本一致；该研究表明地震活动的空间分布可以为我们提供有关强震孕震的地壳深部应力状态信息.这些结果对了解震区应力场具有理论上和实践上的意义.

关键词 丽江地震，地震序列，反演，震区，构造应力状态

Abstract: Estimates of the tectonic stress state including direction and magnitude of principal stress are derived from the regional seismicity before and after 1996, M_S7.0 Lijiang earthquake. This technique was originally applied to the Landers aftershock sequence (Gross and Kisslinger, 1997). Two kinds of input include a combined catalogue of events before and after the Lijiang earthquake, and a source model derived from the inversion of body wave. The stress field in source region was calculated using a 3-D dislocation model, and the best stress state is statistically determined by evaluating the relativity between stress change and seismicity change. The result shows that the azimuth of maximum principal stress in 10 km depth is 355 degree, and the magnitude of maximum principal stress is 53MPa, which is much smaller than the value estimated from the intact rock at that depth. Inversions for the best fitting background stress state are consistent with focal mechanism solution (with a 12 degree difference). This study shows that the spatial distribution of seismicity can present stress state information of source area. Although the estimations of the magnitude of background stress, gradient of stress with depth and effective coefficient of friction are quite uncertain, and need further research to confirm, the result provides the dynamic information of stress loading on the faults, which is useful for the further research on stress environment of seismogenic area.

Keywords Lijiang earthquake, Earthquake sequence, Inversion, Source area, Tectonic stress state

Received 2008-05-20;

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