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基于InSAR同震形变场反演汶川M_w7.9地震断层滑动分布

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摘要 通过综合分析2008年5月12日汶川地震野外地震地质考察的地表破裂带空间分布及分段资料，结合InSAR干涉形变场资料，构建了五段断层几何结构模型，该模型与野外地震地质考察结果在多数分段上基本一致；基于此五段断层模型，运用敏感性迭代拟合算法反演了汶川地震InSAR同震形变场，获得了断层滑动分布及部分震源参数.结果表明,基于余震精定位获得的地震断层倾角模型模拟的同震形变场与InSAR形变场吻合较好，且残差较小；反演的滑动分布主要集中于地下0～20 km，最大滑动量分别位于北川及青川等地区，最大可达到10 m；沿SW-NE走向，断层面的滑动方向主要以右旋兼逆冲形式为主，在汶川及都江堰地区以强烈的逆冲为主兼有一定右旋走滑分量，在北川及映秀地区以逆冲兼右旋运动为主，在平武及青川等地区则逐渐过渡为以右旋运动为主兼有一定的逆冲分量，其中汶川地区的平均滑动角为97°，北川地区的平均滑动角为119°，青川地区平均滑动角为138°.反演矩张量为7.7×10^{20} N·m，矩震级达M_w7.9.

关键词 汶川地震 InSAR同震形变场 敏感性迭代拟合算法 滑动分布反演 震源参数

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Slip distribution and source parameters inverted from co-seismic deformation derived by InSAR technology of Wenchuan M_w7.9 earthquake

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Abstract We have established a five-segment fault model based on field investigation and the linear noncoherent characteristics of InSAR wrapped deformation. The five-segment fault model is consistent with the surface rupture trace of field investigation at most of the segments. Then we use this fault model as constraints to simulate the co-seismic deformation of Wenchuan earthquake derived from InSAR technology. Our favored fault model contains five segments with varied dips, based on the seismogenic structure of precise aftershock relocation. The simulated deformation by forward modeling matches very well the InSAR data with a RMS of 0.3~0.35 m. The inverted slip distribution is concentrated in the depth of 0～20 km and the maximum slip is 10m. Among the largest-slip areas Beichuan area has relatively more concentrated slip at shallower depth than other areas. This may be the deep cause why Beichuan area is the most severely destroyed area in this earthquake. The inverted rake distribution shows that there is a transition along the direction of SW-NE. It is mainly reverse and some right-lateral slip at Wenchuan and Beichuan areas, but it is dominantly right-lateral with some thrusting in Qingchuan area, with the mean rake of 97° and 138° respectively. The inverted seismic moment M_0 is 7.7×10^{20} N·m, and the moment magnitude M_w is 7.9.

Key words Wenchuan earthquake; Co-seismic deformation derived from InSAR; Sensitive-based iterative fitting method; Inversion of slip distribution; Earthquake source parameters

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