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论文

1999年台湾集集地震震源破裂过程

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摘要: 使用GPS同震位移资料和远场P波记录, 研究了1999年台湾集集地震震源破裂过程. 根据地质构造和余震分布引入了一个由弯曲断层面构造的三段“铲状”断层模型. 在使用静态GPS位移资料反演集集地震的断层破裂滑动分布时, 由于集集地震断层北部近地表破裂的复杂性, 在位错模型中考虑拉张分量对地表同震位移的贡献, 可更好地同时拟合GPS观测资料的水平和垂向分量. 而纯剪切位错弹性半空间模型和分层地壳模型都无法同时拟合水平和垂向GPS观测资料. 在此基础上, 同时使用静力学同震位移资料和远场地震波形记录, 反演集集地震的震源破裂过程. 结果表明, 一种垂直于断层面的“挤压性”(负)拉张分量几乎集中分布于地震断层的浅部和北部转折处, 而这一带地表破裂远较没有(负)拉张分量出现的南部断层复杂. “冒起构造”的数字模拟表明, 这种在集集地震破裂转折处及北部断裂带广为出现的典型破裂造成的地表位移可以用具有负拉张分量(挤压)的逆冲断层更好地模拟. 而这种负拉张分量(挤压)的分布正是地震破裂性质和几何复杂性的综合反映, 震源破裂过程也显示北部转折处破裂在空间和时间上的复杂性. 高滑区域与余震分布表现为负相关.

关键词: 集集地震 同震位移 破裂过程 模拟退火

Rupture process of the Chi-Chi (Taiwan) earthquake in 1999

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扩展功能

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Abstract: The rupture process of the 1999 Chi-Chi, Taiwan earthquake is investigated by using co-seismic surface displacement GPS observations and far field P-wave records. In according to the tectonic analysis and distributions of aftershocks, we introduce a three-segment bending fault plane into our model. Both elastic half-space models and layered-earth models are employed to invert the distribution of co-seismic slip along the Chi-Chi earthquake rupture. The results indicate that the shear slip model can not fit horizontal and vertical coseismic displacements simultaneously, unless we add the fault-normal motion (tensile component) to inversion. And then, the Chi-Chi earthquake rupture process is obtained by inversion using the seismograms and GPS observations. Antidilatational fault normal motions determined by inversion, concentrating on the shallow northern bending fault where the surface earthquake ruptures, reveal more complexity and the developed flexural slip folding structures than the other portions of the rupture zone. For understanding the perturbation of surface displacements caused by near-surface complex structures, we have taken a numerical test to synthesize and inverse the surface displacements for a pop-up structure that is composed of a main thrust