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根据GPS和InSAR数据反演2001年昆仑山口西地震同震破裂分布

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摘要 2001年昆仑山口西地震经历了一个相当复杂的破裂过程，迄今为止用不同资料、不同方法和模型得到的同震破裂发布具有很大差异.我们采用地震前后GPS和InSAR观测数据得到的同震位移反演该地震的同震破裂分布，检验各种可能的模型参数，得到在数据与平滑优化约束下尽可能详尽的结果.建模过程经历三个步骤：（1）采用直立断层模型反演，根据解的分辨率和拟合差的折中曲线得到最优平滑约束；（2）改变断层倾角，找到使得观测数据和正演计算拟合最好的断层倾角；（3）根据前面两步得到的最优平滑约束和断层倾角求得地震同震破裂分布.比起前人的研究结果，我们得到的地表走滑分量随断层分布与地质考察数据符合得更好.我们还发现形变沿断层两盘并不对称，断层南盘的位移比北盘大10%～20%.这种位移场的不对称性可以由倾角约为80°～81°的南倾断层所解释.我们首次用大地测量数据揭示了太阳湖断层东端和东昆仑主断层西端～50 km的左阶断层上吸收了0.1～0.2 m的正断层分量，昆仑山口断层段吸收了～0.8 m的逆冲分量.地震释放的总地震矩为9.3×10^{20} N·m, 对应于 M_w8.0的地震.

关键词 昆仑山口西地震 破裂分布 大地测量资料

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Coseismic slip distribution of the 2001 Kunlun mountain pass west earthquake constrained using GPS and InSAR data

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Abstract The rupture process of the 2001 M_S 8.1 Kunlun Mountain Pass west earthquake was quite complex. Studies on its coseismic rupture distribution using different datasets, methods, and models have so far produced rather different results. We use coseismic displacement data obtained from the Global Positioning System (GPS) and Interferometric Synthetic Aperture Radar (InSAR) measurements made before and after the earthquake to invert for its rupture distribution. We test multiple model parameters, and provide a more detailed result than previous studies under an optimized smoothing constraint. The modeling process consists of three steps: First, assuming a vertical fault plane we obtain an optimal smoothing constraint for the solution based on balancing a trade-off between the solution resolution and model misfit. Second, we vary dipping angles of fault segments to search for optimal dipping angles in data fitting. Finally, we adopt the fault smoothing constraint and dipping angles obtained from previous two steps and invert for the coseismic rupture distribution. Comparing with previous studies, our results agree better with the field survey results on horizontal surface offsets. We also find that the coseismic displacement amplitudes are asymmetric across the seismic fault, with the displacements south of the fault about 10%～20% larger in amplitude than that north of the fault. This observation can be explained by the fault dipping 80°～81° to the south. We also demonstrate the first time that a left step of about 50 km length located between the west end of the rupture on the East Kunlun fault and the east end of the Sun Lake fault absorbed 0.1～0.2 m of normal faulting, and the Kunlun Pass fault absorbed about 0.8 m thrust faulting. The seismic moment release is

estimated 9.3×10^{20} N • m, corresponding to a M_w 8.0 earthquake.

Key words The Kunlun mountain pass west earthquake; Slip distribution; Geodetic data

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