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青海玉树M_S7.1级地震发震应力场与非稳定发震机理的模拟

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Stress field and modeling of instability mechanism of Yushu M_S7.1 earthquake

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摘要 分析了玉树地区的地应力场、速度场.在此基础上,对青海玉树2010.4.14 M_S7.1级地震发震机理进行了数值模拟.将围岩看成弹性体,断层看成具有应变软化特性的弹塑性体,断层和围岩组成统一的地质介质系统.在地应力、孔隙压力及边界位移的作用下,应力逐渐积累,当达到断层的摩擦破坏强度时,断层产生位移软化,断层突然滑动,能量突然释放,应力突然下降,形成地震.根据这一过程,对玉树地震进行了模拟.玉树7.1级地震是在印度板块向北推挤,青藏高原向东南侧向挤压,在玉树地区形成主压应力为北东东方向的水平应力场,使甘孜—玉树断裂带产生左旋走滑错动形成的.模拟结果给出了应力降、能量释放量、断层走滑和垂直错动量、地表变形,地震复发周期、应力积累速度等重要参数,模拟结果与野外调查资料具有较好的一致性.

关键词: 玉树地震 地震数值模拟 应变软化 地震非稳定过程

Abstract: The stress field and velocity field in Yushu region are analyzed. On this basis, the earthquake mechanism of magnitude M_S7.1 on April 14, 2010, in Qinghai Yushu is simulated by numerical method with strain softening model. Fault and surrounding rock is considered as a unified system of geological media, considering surrounding rock as elastic body, fault as the elastic-plastic strain softening body. Yushu M_S7.1 earthquake occurrs in stress field formed by northward compressing of Indian plat and southeast compressing of Qinghai-Tibet Plateau. Under the effect of stress and pore pressure and boundary displacement, stress is gradual accumulated. When stress reaches the strength of damage of fault, the fault displacement softening is produced, fault sliding suddenly, the energy releasing suddenly, a sudden drop in stress resulting, a earthquake occuring. According to this process, earthquake of Yushu earthquake of M_S7.1 is modeled. The stress drop, energy release amount, the magnitude of dislocation of fault, and earthquake recurrence intervals are given by modeling. Comparison of the modeling results with the results of geologic survey in the field shows that they are in good agreement.

Keywords: Yushu earthquake Earthquake modeling Strain-softening model Unsteady model of earthquake

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