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断层厚度的地震效应和非对称地震矩张量

刘超[1], 陈运泰[1,2]*

1. 中国地震局地球物理研究所, 北京 100081;
2. 北京大学地球与空间科学学院, 北京 100871

Seismic effect of fault thickness and asymmetric seismic moment tensor

LIU Chao[1], CHEN Yun-Tai[1,2]*

1. Institute of Geophysics, China Earthquake Administration, Beijing 100081, China;
2. School of Earth and Space Sciences, Peking University, Beijing 100871, China

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摘要 本文导出了具有厚度和滑动弱化区域的断层的非对称地震矩张量表示式，指出要求地震矩张量具有对称性不是一个绝对必要的限制.在非对称地震矩张量中，位错项对应于对称地震矩张量，拉力项对应于非对称地震矩张量.由于拉力项等效于单力偶，所以在非对称地震矩张量解的两个节面上，沿滑动矢量方向的力偶强度不再相同，与较大力偶相联系的节面为断层面，与较小力偶相联系的节面为辅助面.这一性质可用以从两个正交的节面中判断哪一个节面是断层面.如果忽略拉力项，会高估与位错对应的标量地震矩.只有满足相应的约束条件的非对称地震矩张量才能表示具有厚度和滑动弱化区域的断层模型，并从中分离出与位错和拉力对应的地震矩张量.

关键词 断层厚度, 非对称矩地震张量, 震源时间函数, 标量地震矩, 断层的不确定性

Abstract: Asymmetric seismic moment tensor representation of fault with finite thickness and slip-weakening zone was introduced. It is pointed out that the symmetry constraint on seismic moment tensor is not necessary. In asymmetric seismic moment tensor, the displacement dislocation term corresponds to a symmetric moment tensor, while the traction term corresponds to an asymmetric moment tensor. As their duration times are approximately equal, we can assume that they have the same normalized source time function. Due to the traction term is equivalent to a single-couple, the strengths of two single-couples are no longer the same (along the slip direction on two nodal planes). Fault ambiguity can be resolved by the fact that the real fault plane is with a larger couple, while the auxiliary plane is with a smaller couple. The scalar seismic moment corresponding to dislocation will be overestimated if the traction term is not taken into account. Appropriate constraints should be imposed when one use asymmetric moment tensors to represent the earthquake source of finite thickness and slip-weakening zone, and derive the moment tensor corresponding to the traction separately from that corresponding to the displacement.

Keywords Fault thickness, Asymmetric seismic moment tensor, Source-time function, Scalar seismic moment, Fault ambiguity

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About author: 刘超，男，1983年生，博士研究生，主要从事震源物理、地震矩张量反演等方面的工作.E-mail：liuchao@cea-igp.ac.cn

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