

地球物理学报 » 2011, Vol. 54 » Issue (6) : 1501-1510

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引用本文:

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JIANG Chang-Sheng, WU Zhong-Liang. Intermediate-term medium-range Accelerating Moment Release (AMR) priori to the 2010 Yushu M_S 7.1 earthquake. Chinese J. Geophys. (in Chinese), 2011, V54(6): 1501-1510, DOI: 10.3969/j.issn.0001-5733.2011.06.009

2010年玉树 M_S 7.1地震前的中长期加速矩释放(AMR)问题

蒋长胜, 吴忠良*

中国地震局地球物理研究所, 北京 100081

Intermediate-term medium-range Accelerating Moment Release (AMR) priori to the 2010 Yushu M_S 7.1 earthquake

JIANG Chang-Sheng, WU Zhong-Liang*

Institute of Geophysics, China Earthquake Administration, Beijing 100081, China

摘要

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摘要 2010年4月14日青海玉树 M_S 7.1地震前的加速矩释放(AMR)现象的研究,对理解这次地震的孕震过程、对于时间相依的地震危险性分析(或中长期地震预测)具有重要意义. 鉴于以往AMR研究中的争论,本文不刻意选取AMR分析的时空尺度,而是在已知发震时刻和震中位置情况下,对 T - R - M_c 三维空间中矩释放指数 m 值的分布进行分析,结果表明玉树 M_S 7.1地震前在时间尺度 $T=10\sim 20y$ 和空间尺度 $R=50\sim 120$ km范围内,存在较稳定的AMR,但AMR的时、空尺度与以往研究中得到的AMR定标率不吻合. 在多时间尺度下,无法在空间上惟一地识别玉树 M_S 7.1地震震中附近的AMR“热点”,但如借鉴“迁移图像”的做法考察AMR“热点”的演化,则可见震前似存在AMR逐渐向震中附近“迁移”的现象.

关键词: 时间相依的地震危险性分析 中长期地震预测 AMR现象 迁移图像 玉树地震

Abstract: Investigation of the accelerating moment release (AMR) phenomena plays an important role in understanding the preparation process of the April 14, 2010, Yushu M_S 7.1 earthquake, with implications to time-dependent seismic hazard assessment or intermediate-term medium-range earthquake forecast. Considering the debates related to AMR study, we avoid the special selection of the spatio-temporal ranges for the AMR analysis. Alternatively, we investigate the distribution of m value, the exponent in the power-law-like 'time-to-failure' function describing the moment release, in the $(T-R-M_c)$ space, where T and R are the scales of temporal and spatial window, respectively, and M_c is the cutoff magnitude of earthquake catalogue in use. The failure time and center of the spatial range were fixed at the origin time and the epicenter of the mainshock. Stable pre-shock AMR can be observed at the time scale $T=10\sim 20y$ and spatial range $R=50\sim 120$ km. But such T and R are not consistent with those deduced from the scaling relation obtained by previous studies. With varying time scale T , it is difficult to find a self-similar pattern of AMR 'hot spots' around the epicenter of the Yushu M_S 7.1 earthquake. Using the 'migration pattern' method, it can be found that the AMR pattern migrated to the epicenter before the earthquake.

Keywords: Time-dependent seismic hazard Intermediate-term medium-range earthquake forecast Accelerating moment release (AMR) Migration pattern Yushu earthquake

Received 2010-09-25;

Fund:

国家科技支撑计划项目(2008BAC44B02-0102)和国家自然科学基金青年基金项目(40804010)联合资助.

About author: 蒋长胜,男,1979年生,博士、副研究员,主要从事数字地震学和地震预测研究.E-mail:jiangcs@cea-igp.ac.cn

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