

引用本文(Citation):

蒋海昆, 宋金, 吴琼, 李金, 曲均浩. 基于ETAS模型对三峡库区流体触发微震活动的定量检测. 地球物理学报, 2012, 55(7): 2341-2352, doi: 10.6038/j.issn.0001-5733.2012.07.019

JIANG Hai-Kun, SONG Jin, WU Qiong, LI Jin, QU Jun-Hao. Quantitative investigation of fluid triggering on seismicity in the Three Gorge Reservoir based on ETAS model. Chinese J. Geophys. (In Chinese), 2012, 55(7): 2341-2352, doi: 10.6038/j.issn.0001-5733.2012.07.019

基于ETAS模型对三峡库区流体触发微震活动的定量检测

蒋海昆¹, 宋金¹, 吴琼¹, 李金², 曲均浩^{3*}

1. 中国地震台网中心, 北京 100045;
2. 中国地震局地震预测研究所, 北京 100036;
3. 中国地震局地质研究所, 北京 100029

Quantitative investigation of fluid triggering on seismicity in the Three Gorge Reservoir area based on ETAS model

JIANG Hai-Kun¹, SONG Jin¹, WU Qiong¹, LI Jin², QU Jun-Hao^{3*}

1. China Earthquake Networks Center, Beijing 100045, China;
2. Institute of Earthquake Science, China Earthquake Administration, Beijing 100036, China;
3. Institute of Geology, China Earthquake Administration, Beijing 100029, China

摘要

参考文献

相关文章

Download: PDF (2785KB) HTML KB Export: BibTeX or EndNote (RIS) Supporting Info

摘要 针对ETAS模型参数估计方法(MLE)中的初值敏感性问题,提出GA+MLE算法,以GA结果作为MLE算法的初始输入,对结果进行精细计算.通过ETAS模型研究三峡库区微震活动在快速加载及缓慢卸载两种状态下的流体触发、地震自激发及微震活动衰减特征,讨论库水渗透及加卸载过程的可能影响.结果显示:(1)库水快速加载阶段ETAS模型参数 μ 、 a 、 p 及流体触发地震所占比例 R_b 均显示由小变大、又由大变小的变化过程,但 p 值的统计差异不显著;在库水缓慢卸载阶段, μ 与 R_b 持续减小;(2)平均来看,库水快速加载阶段流体对微震活动显示较强的外因触发作用,同一条件下序列地震自激发明显增强、衰减相对较慢;水位缓慢卸载阶段,流体对地震活动的触发影响相对较弱,地震自激发不强、衰减相对较快;(3)分阶段来看,蓄水初期库水作用对微震活动的外因触发影响较弱,随库水位的升高及作用时间的增长,流体渗透逐渐发挥作用,孔隙压逐渐增大,流体外因触发作用明显增强,大多数微震活动缘于流体的直接触发($R_b \geq 95\%$);足够长的时间之后,由于地下数公里范围在新的载荷及渗透条件下趋于新的平衡,流体渗透影响趋于稳定,孔隙压趋于常数,孔隙压变化趋于0,流体对微震活动的触发作用逐渐减弱.

关键词 三峡水库, 微震活动, ETAS模型, 流体触发, 渗透, 加卸载

Abstract: To solve the sensitivity problem of the initial value in the MLE algorithm for ETAS model parameter estimation, the GA+MLE method has been proposed in this paper. We take the results of GA (genetic algorithm) as the initial input of MLE, and then estimate the ETAS model parameters more accurately. Under two conditions of quick load and slow unload, the features of fluid triggering, self-generation of earthquakes and sequence decay in the Three Gorge Reservoir area has been studied by the ETAS model. The potential influence of fluid intrusion and load-unload process on seismicity has been discussed roughly. The results show that for quick load phase, the ETAS model parameters, μ , a and p , as well as the R_b , the ratio of fluid-induced earthquakes to total earthquakes, have a positive correlation, all of which showing a similar changing tendency: from small to large, and then to small. But the statistic difference of p value is not very obvious. For slow unload phase, μ and R_b values decrease unceasingly. Averagely, the fluid triggering on seismicity is something strong during the quick load phase. Meanwhile, the self-generation of earthquakes enhances obviously and decay tends to slow down. During the slow unload stage, the fluid triggering on microearthquake activity is relatively weak. In this situation the self-generation is weak and the decay is somewhat quick. For different phases, the influence of fluid triggering on seismicity is weak during the initial phase of water storage. With the time going and with the increase of water level, the pore pressure increases gradually due to the fluid intrusion, and the fluid triggering on seismicity increases obviously. Most of microearthquakes during this phase are caused by the direct fluid triggering ($R_b \geq 95\%$). After the time long enough, the medium several kilometers below the reservoir becomes saturated under the new condition and the influence of fluid intrusion tends to be stable. In this case, the pore pressure approaches constant and the variation of pore pressure approaches zero, therefore the fluid triggering on microearthquakes decreases gradually.

Service

- 把本文推荐给朋友
- 加入我的书架
- 加入引用管理器
- Email Alert
- RSS

作者相关文章

- 蒋海昆
- 宋金
- 吴琼
- 李金
- 曲均浩