地球物理学报 » 2012, Vol. 55 » Issue (7) :2353-2361 doi:10.6038/j.issn.0001-5733.2012.07.020
地球动力学·地震学·地热学

引用本文(Citation):
孙玉军, 张怀, 董树文, 郑亮, 张贝, 程惠红, 石耀霖.利用三维孔隙弹性模型探讨紫坪铺水库对汶川地震的影响. 地球物理学报, 2012,55(7): 2353-2361,doi: 10.6038/j.issn.0001-5733.2012.07.020

SUN Yu-Jun, ZHANG Huai, DONG Shu-Wen, ZHENG Liang, ZHANG Bei, CHENG Hui-Hong, SHI Yao-Lin.Study on effect of the Zipingpu reservoir on the occurrence of the 2008 Wenchuan earthquake based on a 3D-poroelastic model.Chinese J.Geophys. (in Chinese),2012,55(7): 2353-2361,doi: 10.6038/j.issn.0001-5733.2012.07.020

利用三维孔隙弹性模型探讨紫坪铺水库对汶川地震的影响

孙玉军[1,2], 张怀[2], 董树文[3], 郑亮[2], 张贝[2], 程惠红[2], 石耀霖[2]*

1. 中国地质科学院地质力学研究所, 北京 100081;
2. 中国科学院计算地球动力学重点实验室, 北京 100049;
3. 中国地质科学院, 北京 100037

Study on effect of the Zipingpu reservoir on the occurrence of the 2008 Wenchuan earthquake based on a 3D-poroelastic model

SUN Yu-Jun[1,2], ZHANG Huai[2], DONG Shu-Wen[3], ZHENG Liang[2], ZHANG Bei[2], CHENG Hui-Hong[2], SHI Yao-Lin[2]*

1. Institute of Geomechanics, Chinese Academy of Geological Sciences, Beijing 100081, China;
2. Key Laboratory of Computational Geodynamics, Chinese Academy of Sciences, Beijng 100049, China;
3. Chinese Academy of Geological Sciences, Beijing 100037, China

摘要 | 参考文献 | 相关文章

Download: PDF (3911KB) HTML KB Export: BibTeX or EndNote (RIS) Supporting Info

摘要 本文基于三维孔隙弹性理论,建立了紫坪铺水库及周边地区的有限元模型.根据紫坪铺水库开始蓄水到汶川地震发震时刻的水位变化情况,计算了整个区域的孔隙压力和库仑应力.详细讨论了断层及周围地层的弹性模量和扩散系数对计算结果的影响.计算结果表明:从弹性角度看,断层的弹性模量对汶川地震震源处的库仑应力影响很小;震源处的库仑应力随着断层和周围地层的扩散系数增大而增大.当给定弹性模量和扩散系数代表性值的时候,计算结果表明在汶川地震发震时刻,震源处的库仑应力变化量为+1 kPa左右,这表明紫坪铺水库使得汶川地震发震断层更加危险.是否这个量级的库仑应力就能够触发汶川地震还需要进一步探讨.通过分析库区周边小震的分布,发现小震分布区域均是库仑应力增加的地区,因此紫坪铺水库周边的小震应该与紫坪铺水库蓄水有直接关系.

关键词 孔隙弹性模型, 紫坪铺水库, 汶川地震, 库仑应力

Abstract: Some large reservoirs are known to induce earthquakes. After occurrence of the Wenchuan earthquake, some studies suggest that it was induced by the Zipingpu reservoir which is not far from the Longmenshan fault. In this paper, based on the poroelastic theory, a 3D finite element model of the Zipingpu area is constructed. According to the water level of the Zipingpu reservoir from the beginning of the impoundment to the occurrence of the 2008 Wenchuan earthquake, we calculate the pore pressure and the change of Coulomb stress with the model. Furthermore, we discuss the effects of elastic modulus and diffusivity of faults and around medium on the results. The results show that the elastic modulus of faults and around medium has little effect on the Coulomb stress in the hypocenter of the Wenchuan earthquake. With the increase of diffusivity of the fault or around medium, the Coulomb stress in the hypocenter increases. If we give the representative values of elastic modulus and diffusivity, the change of Coulomb stress in the hypocenter reaches 1 kPa when the Wenchuan earthquake occurred. The Zipingpu reservoir enhanced the seismic activity of the Longmenshan fault. But it needs further investigation whether increasing 1 kPa of Coulomb stress can trigger the occurrence of the Wenchuan earthquake. The analysis of the distribution of small earthquakes in the Zipingpu area before the Wenchuan earthquake reveals that most of the small earthquakes are located in the increasing region of Coulomb stress. So it indicates that the small earthquakes in the Zipingpu area should have a direct relationship with the impoundment of the Zipingpu reservoir.

Keywords Poroelastic model, Zipingpu reservoir, Wenchuan earthquake, Coulomb stress

Received 2011-09-13;

Fund:中央级公益性科研院所基本科研业务费项目(DZLXJK201205);深部探测技术与实验研究专项(SinoProbe-07,SinoProbe-08-01);地震动力学国家重点实验室开放基金(LED2010B01);国家自然科学基金(90814014)联合资助.

Corresponding Authors: 石耀霖,男,教授.E-mail:shiyl@gucas.ac.cn Email: shiyl@gucas.ac.cn

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
孙玉军
张怀
董树文
郑亮
张贝
程惠红
石耀霖

链接本文:

http://118.145.16.227/geophy/CN/10.6038/j.issn.0001-5733.2012.07.020 或 http://118.145.16.227/geophy/CN/Y2012/V55/I7/2353

查看全文 下载PDF阅读器

Copyright 2010 by 地球物理学报