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新丰江库区上地壳三维细结构层析成像

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Tomographic imaging of the upper crustal structure beneath the Xinfengjiang reservoir area

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摘要

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摘要

在新丰江库区布设一个范围约50 km×40 km、由50个地震临时台站组成的观测台阵,接收来自不同方位的人工震源产生的莫霍界面反射波;台阵中的20个台站和5个区域固定台还对2009年3月至2010年5月发生在库区的地方震进行了观测.本文联合利用人工地震莫霍面反射波走时和天然地震直达波走时,采用连续模型反演技术重建了库区上地壳P波、S波慢度扰动和 V_p/V_s 扰动分布图像.研究表明:新丰江库区东、西部地区上地壳结构存在明显的差异.库区东部地区构造复杂,多条断裂在该区呈交叉状分布.北西向的石角—新港—白田断裂带在库区段内具有复杂的岩性和构造特征,该断裂带在新港至双塘一线可能延伸至地下8 km左右;近北东向的断裂带切割地壳较深.峡谷区及大坝以东附近地区存在上、下贯通的波速比高值区,尤其是大坝以西的深水峡谷区,存在一条顺河走向的陡倾角断层裂隙带,为库水渗透提供了良好通道.库区西部地区为相对稳定构造区,完整坚硬的花岗岩体透水性能较差,受库水渗透影响很小.新丰江水库诱发地震的形成与深部构造环境密切相关.峡谷区及大坝以东附近地区上地壳介质的性质呈现明显的横向不均匀性,微震分布在介质物性结构的特定部位,"软"、"硬"交错的介质环境是倾滑正断层型微小震产生的可能原因.

关键词 新丰江库区, 人工地震和天然地震, 走时联合反演, 上地壳三维细结构, 水库诱发地震

Abstract:

A three-dimensional temporary seismic array with 50 stations was deployed in an approximately 50 km×40 km region around the Xinfengjiang reservoir to receive seismic waves generated by artificial sources from different azimuths. The local earthquakes occurred in the area from March 2009 to May 2010 were recorded by 20 stations of the seismic array and 5 permanent seismic stations. With the inversion method without model blocks, both reflection waves generated by the artificial sources from Moho at critical distances and direct waves from local earthquakes are used to reconstruct the 3-D images of P,S velocity and V_p/V_s perturbation of the upper crust under the seismic array. The results show that the upper crust structures below the Xinfengjiang reservoir area have significant differences between the eastern and the western region. The structure is complicated in the east of the reservoir where the faults intersect mutually. Under the reservoir, the NNW striking Shijiao-Xingang-Baitian fault zone has complex lithology and structural features, and from Xingang to Shuangtang, it probably extends down to 8 km depth. The fault zone of nearly NE direction cuts crust deep. There are through shallower and deeper high-velocity ratio zones in both the canyon and near the east of the Xinfengjiang dam, especially in the western deep water canyon region of Xinfengjiang dam, along the river there is a steep fault fracture zone. The high-velocity ratio zones provide a good channel for water infiltration. The west of reservoir is a relatively stable tectonic region, where intact and hard granite rock with low permeability has been affected little by reservoir water. The occurrence of Xinfengjiang reservoir-induced earthquakes is closely related to the deep structure environment. The upper crustal medium property in the canyon and near the east of the dam is obviously laterally heterogeneous. The micro earthquakes are located in the specific parts of medium physical property and structure. It is suggested that the "soft" and "hard" staggered media environment possibly leads to occurrence of

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dip-slip normal fault type micro earthquakes.

Keywords [Xinfengjiang reservoir area](#), [Artificial earthquake and natural earthquake](#), [Joint inversion of travel times](#), [3-D fine structure of the upper crust](#), [Reservoir-induced earthquakes](#)

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