Upper crustal structure and earthquake mechanism in the Xinfengjiang water reservoir, Guangdong, China

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The Xinfengjiang Water Reservoir in Guangdong, China is one of reservoirs that have triggered earthquakes of magnitudes greater than M 6. Numerous earthquakes have occurred since the impoundment of the reservoir, making it one of the most active seismic zones in Guangdong. However, the detailed seismic structures within this area have not been resolved, thus hinder the understanding of the earthquake mechanism. In this study, we collected waveform data from both permanent and temporary stations from 2012 to 2015. We relocated 1528 earthquakes, and inverted both Vp and Vs structure from travel times of these earthquakes. Using waveform data, we also investigated focal mechanisms of earthquakes with magnitude greater than 1.5 in this region. Our results reveal fine crustal structure that has never been shown before, and show complicated crust structure with several low-velocity zones extending to 4-10 km depth under the major faults. On the other hand, we find that earthquakes mainly locate near the low-velocity or high Vp/Vs blocks, suggesting that the fractures nucleated from periphery of the main faults. Earthquake focal mechanism inversion results show more dip-slip faults than strike-slip faults. The principle stress direction is in northwest-southeast direction, consistent with the major local stress direction. Our results suggest that seismicity in the XWR area closely associated with the fracture structure (low velocity zones). The fractures may provide path for water to penetrate, increase the pore pressure, and thus cause the occurrence of swarms of earthquakes.
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