Earthquake Decay and Self-Generation in the Area of Sanxia Reservoir

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Sanxia reservoir is a long and narrow valley-type reservoir in the last section of upriver of the Yangtse River. The length and width of the reservoir is about 660km and about 1.0~1.5km respectively, total water area is about l048km^2. The top altitude of the dam is 185m, the maximum water level is 175m, relevant maximum water capacity is 393×10^9m^3. Sanxia reservoir reached the water level of 135m in 2003, after that the water level fluctuated between 135~138m and the changing amplitude is small. From this time, the small earthquakes occurred densely. Since 2006 to 2009, the variety of the water level experience the circular processes with four quick increment stages (quick load phase, about 1 month) and three slow fall stages (slow unload phase, about 10 months), the load of reservoir water could be seen as an quasi-periodic load–unload process.

In this paper, five parameters of ETAS model (Ogata, 1988) in different phases have been calculated by genetic algorithm firstly, and then the results of GA have been taken as initial import for MLE algorithm to calculate the parameters more accurately. The fitness of the model with the observing data will be taken as the criterion for judgment of the optimized model. Calculating the averages of ETAS model parameters in all quick load phase and slow unload phase. The results show that the μ, α is relatively large and p is relatively small during the quick load phase. It is opposite for slow unload phase. No matter what quick load phase or slow unload phase, R_b, the ratio of fluid-induced earthquakes to total earthquakes (Hainzl, 2005), are about the same. This means that the direct external inducing action of fluid on earthquake activity is relatively strong during the quick load phase and the self-generating ability of earthquake enhances obviously, sequence decay becomes slow. During the slow unload phase, the direct external inducing action of fluid on earthquake activity and the self-generating ability of earthquake are relatively weak, and the sequence decay is quick relatively. Study the variation of the μ value with different lowest magnitude, M_c. The average μ decreases with the M_c both for quick load phase and slow unload phase. For fixed load or unload phase, the changing tendency of the μ for different M_c are about the same, but the μ value is small for large M_c and large for small M_c. Since the size of μ value expressing the direct external forcing strength by water percolation and load-unload process, it means that the water external forcing strength is stronger for small earthquake activity.

References

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