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Probabilistic Fault Displacement Hazard Analysis: An Example from a Safety Evaluation Project of the Wushantou Reservoir

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The concern of safety of major facilities near faults has been taken seriously recently. When a fault is closed to the site of interest, not only the possible ground motions should be considered, but also, hazard analysis on fault displacement should also be included in the analysis to evaluate the potential risks, which are caused by dislocation on the site of interest. Probabilistic Fault Displacement Hazard Analysis(PFDHA), which analyzed exceedance probability of displacement under fault dislocation, was presented by Youngs et al. (2003) to study the structural safety of a site of interest during its duration of service. The method can be divided into earthquake approach and displacement approach.

In this study, the Liuchia Fault is analyzed with earthquake approach. The Liuchia Fault, which is located 240 meters away from the toe of the Wushantou dam, extends from south of Chuchi to west of the Wushantou dam, its total length is 18.1km. The fault has a dip of 30°E with a maximum estimated magnitude of Mw 6.7 and a long-term slip rate around 3.6∼12.7(mm/yr) according to related studies. Since the dam and reservoir is situated on the hanging wall of the fault, the influence of the fault should be carefully considered. Earthquake recurrence model is characteristic earthquake model. The method proposed by Moss and Ross (2011) are used for the determination of probability of surface rupture for principal fault and the selection of fault displacement prediction equation to calculate displacement hazard on the principal fault. Results indicated that it has a maximum displacement of 4.21 m and average displacement of 2.37 m for 1,000 year return period.

Since the fault does not intersect the dam and reservoir, the displacement along the fault line does no directly damage to the dam or reservoir. The method proposed by Petersen et al. (2011) is used for the probability of surface rupture and fault displacement prediction equation for distributed fault to calculate the hazard of distributed fault caused on the dam site and reservoir area. The possible displacement of 10000-year return period is smaller than 1cm.