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Neotectonic characteristics of Liuchia fault, southwestern Taiwan, from the analysis of fluvial channel morphology

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The Liuchia fault in southwestern Taiwan has been considered as one of major active faults in the active Taiwan orogen. It is identified by its clear geomorphic features, and forms a major geologic boundary of Taiwan's Western Foothills. In the twentieth century, several large earthquakes occurred in southwestern Taiwan and caused significant damages. However, there is no unanimous historical evidence for the activity on the Liuchia fault. Therefore, the Liuchia fault poses large hazard potentials for this populous area. Several previous studies have shown that fluvial channel morphology, such as channel slope and width, is strongly influenced by tectonic activities. As river channels reach steady state, the rock uplift would be balanced by the incision of river channels. Base on these hypotheses, it has been shown previously that the analysis of river channel morphology can successfully estimate the activity of potentially active faults in central Taiwan. As a result, we attempted to obtain information of recent activity of the Liuchia fault by analyzing the channel morphology of the Erchung River, which flows across the fault. We also attempted to calculate the actual river incision rates from the age of river terraces along the river. Such information would enable us to construct the subsurface geometry of this important active structure.
We have obtained a detailed river long profile of the Erchung River from surveys using RTK-GPS, and the channel width profile from actual field measurements using a Laser Rangefinder. The fluvial channel morphology of the Erchung River appears to have been affected by active folding in the hanging-wall block of the Liuchia fault. Such active deformation pattern is also evident from river incision rate patterns, calculated from the ages and elevations of river terraces along the channel. We have also measured bedrock attitudes across the Liuchia fault and into its hanging-wall block. Combing these different datasets, we are able to construct a realistic model of the subsurface geometry of the Liuchia fault in southwestern Taiwan.