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Anomalous high deformation rate in mudstone of fold-and-thrust belt in southwestern Taiwan: mud diapirism or mud-core anticline?

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The southwestern Taiwan is located in the transition zone of an active accretionary wedge and the northern end of the Manila trench, where the thrust sheets demonstrate a distinctive deformation pattern. To characterize the deformation pattern, we use the PSInSAR technique with constrains by precise leveling and GPS measurements to derive the line of sight (LOS) velocities of the study area. From different periods of SAR images of various wavelengths and different periods (e.g. ERS, Envisat and ALOS satellites), we noticed that the boundary between the subsidence and the uplift area roughly aligns with the deformation front. The main subsidence area is in the Chianan coastal plain with a LOS velocity of $\sim$ 30 mm/yr relative to a continuous GPS station LIKN as a local reference point. The maximum LOS velocities of $\sim$ 20 - 30 mm/yr is recorded on an active fault-related folding in Tainan tableland and the footwall of Longchuan reverse fault in Gutingkang mudstone formation. From PSInSAR and GPS measurements, the northern segment of the Longchuan fault shows a high LOS velocity gradient of $\sim$ 10 - 15 mm/yr with a right-lateral component of 4 mm/yr across the fault. However, it demonstrates a reverse fault with a left-lateral component of about 10 mm/yr at the middle segment, while it turns back to a reverse fault with a right-lateral component at the southern segment. Based on precise leveling data, the footwall of Longchuan reverse fault demonstrates a very high uplift rate of $\sim$ 20 - 30 mm/yr, which is unusual for a reverse fault. The anomalous deformation rate might part be related with a ramp duplex located in the footwall and the triggered slip of moderate earthquake in nearby area.

In addition, high uplift rate of footwall can be also observed in the surrounding area (Chishan fault), and it might be due to the mechanical heterogeneity of mudstone in the Gutingkang formation. Consequently, we use DynearthSol3D, an efficient unstructured finite element code, to simulate the deformation. We will discuss how the contrast of viscosity in mudstone and sandstone contributed in deformation pattern and upward mobility. We will also test the hypothesis of mud diapirism of a recent study and incorporate a new mud-cored anticline model to explain the mechanics of anomalous deformation in the study area.