# Abstract

Creeping crustal faults often generate streaks of microearthquakes, but less commonly, they may still produce large earthquakes that rupture the brittle crust. The 150-km-long Longitudinal Valley fault (LVF) in eastern Taiwan, characterized by ~ 1-3 cm/yr surface slip rate, is one of the best examples in the world that possesses earthquake potential in creeping segments. Built on the 2000-2011 earthquake catalog, we identified 405 M>2 repeating earthquake sequences (RES) along the LVF and studied the recurrence property of the repeating earthquakes. The population of repeating earthquake sequences (RES) and the inferred deep slip rate revealed that (1) the southern Chihshang area is locked in the southern half and creeping in the north with a deep slip rate of 1.4-1.5cm/yr at the depth of 10-25 km. The deep slip rate in southern half of the Chihshang fault was accelerated by the 2003 M6 ChengKung earthquake from inter-seismic rate of 1.92 cm/yr to 4.94 cm/yr; (2) the Yuli segment in the middle of the LVF is mainly locked but partially creeping in a narrow area with deep slip rate of 4.96 cm/yr at the depth of 10-20 km; (3) the Hualien segment reveals two fault strands, one beneath the coastline (likely the Milun fault) that is characterized by ~2 cm/yr deep slip rate (similar to surface slip rate), the other underneath the Central Range with ~80 km spatial extent in the mapview and deep slip rate of 4.96 cm/yr indicates a significant fast-slip fault motion that has been long neglected.