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The analysis of GPS crustal deformation, seismicity, and strain rate in October 2013 Ruisui, Taiwan Earthquake

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The Ruisui earthquake occurred on 31 October 2013 on the Longitudinal Valley (LV) in eastern Taiwan, close to the town of Ruisui. The event was the third Mw $\geq$ 6 event occurring in Taiwan, during 2013, following the 27 March and 2 June Nantou sequence. The LV, which is considered as an active collision boundary between the Eurasian plate (EU) and the Philippine Sea plate (PSP), is accounting for more than one third of the 82 mm/yr of oblique plate convergence. The LVF is separating two different geological regions: the Coastal Range to the east and the Central Range to the west. The deformation along the LV is mostly accommodated by two large structures: the Longitudinal Valley fault (LVF) and the Central Range fault (CRF). According to the previous research results of geology, GPS, and other geophysical data, the 60° east-dipping LVF, which represents the main active structure of the LV, is characterized by high rates of oblique slip on its southern segment and by primary left-lateral strike-slip on its northern segment. The CRF, dipping 50°–60° westward underneath the eastern flank of the Central Range, is associated with the fast uplift of the Central Range.

The Ruisui earthquake is believed to rupture a 30–35-km-long segment of this northeast-southwest trending CRF with a primary thrust mechanism, in agreement with the tectonic stress regime in this region. However, the existence of the CRF has long been debated since its introduction. The earthquake report of the Central Weather Bureau (CWB) of Taiwan indicated an epicenter located at a depth of about 15 km at the position (121.348° E, 23.566° N). Source parameters inferred from GPS data inversion and seismic waveform inversion were reported soon after its occurrence. Both indicate a thrust-fault mechanism with a strike, dip, and rake angles varying from about 200° to 209°, 45° to 59°, and 42° to 50°, respectively, and with a moment magnitude of about 6.2.

This shock occurred near a dense Continuous GPS network, a groundwater station specially designed for observation of seismic precursor signals. Most of all, the shock is located in the area with very active seismicity and fast crustal deformation. Furthermore, the quality of Central Weather Bureau Seismic Network (CWBSN) seismic data has been significantly improved and reached micro-earthquake level. Therefore, we have plenty data to do the case research for this earthquake event. To try to understand the possible seismogenic mechanism and tectonic structure. We also try to search for any pre-seismic signal and assess the capability of very short-term prediction in the area during the earthquake.