Seismotectonics of the northern Longitudinal Valley, Taiwan, inferred from aftershock sequences of 2018 Mw6.4 and 2019 Mw6.2 Hualien earthquakes

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In the Hualien area, two Mw6.4 and Mw6.2 earthquakes, 20 km apart, occurred in February 2018 and April 2019 respectively. The former to the northeast, located offshore to the Liwu river, triggered several earthquake clusters along the Milun fault and southward to the Longitudinal Valley, the suture of the Eurasian and the Philippine Sea plates; the latter to the southwest, located in the Central Range, also triggered several seismic swarms in the Central Range, along the Liwu river to the northeast and at Ji’an to the southeast. Except for the Milun fault, neither GPS nor InSAR observations detects significant surface deformation after the occurrence of these two main shocks, indicating that the earthquake ruptures mainly developed within the crust. Therefore, seismic observation becomes an efficient tool for revealing the seismotectonics of the two earthquake sequences. For monitoring the aftershock sequences, two days after the main shocks, we deployed two geophone arrays, 70 Z-component RefTek 125A TEXANs for two weeks in 2018 and 47 three-component Fairfield Nodal Z-Lands for one month in 2019, with 1-5 km station spacing around the Hualien City. These earthquake swarms were well recorded and analyzed through the dense seismic networks. The numbers of aftershock sequences manually identified are two-fold more than that issued by the Central Weather Bureau, Taiwan. The seismicity of the 2018 aftershock sequence, to depths of between 5-15 km, was significantly reduced within 10 days after the main shock. However, the seismicity of the 2019 aftershock sequence, to depths of between 2-50 km, was still above background seismicity rate 30 days after the main shock. The spatial distribution of the 2018 aftershock sequence could be related to a fault zone of the plate boundary, but that of the 2019 and the relocated 1986 aftershock sequences show a conjugate thrust fault pair beneath the eastern Central Range. Our results clearly depict several local tectonic structures that have not been observed at the northern tip of the Longitudinal Valley, not only a suture but also a transitional area from collision to subduction.
