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Structural characteristics of surface ruptures of the Central Range fault during the 2022 Mw7.0 Chihshang earthquake in eastern Taiwan

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In this study, we illustrate overall structural characteristics of the surface ruptures of the 2022 Guanshan/Chihshang earthquakes doublet (Mw=6.5 and Mw=6.9), based on field investigations before and after the earthquake. The M6.9 Chihshang earthquake, the second earthquake occurred 17 hours after the first one, appears to be the main responsible for the 50-60km-long surface ruptures. Field investigations showed abundant geological deformation features associated with the surface ruptures during the 2022 earthquakes, such as geomorphic scarps with fault or fold, tension cracks (often arranging in en-echelon arrays), pressure ridges, horizontal offsets (often in a left-lateral sense) and so on. We provide several examples of field sites in the different segments from north to south, in order not only to demonstrate a variety of surface deformation features, but also to use them to explain how we infer the Central Range fault, the causative fault of the 2022 earthquake doublet, superimposes with the Longitudinal Valley fault. We thus interpret the architecture of the two-fault system with two juxtaposing opposing thrusts around the middle part of the Longitudinal Valley. We discuss whether triggered slip on the Longitudinal Valley fault (the Chihshang fault segment) played a role on the co-seismic (or post-seismic) surface deformation. We also provide hypothetical interpretations that channelized seismic wave propagation as main mechanism for a widespread earthquake-related surface fractures around the surface trace of the Chihshang fault.

Keywords: 2022 Chihshang earthquake, Central Range fault , Longitudinal Valley fault