EGU2020-2788
https://doi.org/10.5194/egusphere-egu2020-2788
EGU General Assembly 2020
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New insights into the complex surface faulting of the 1927 M8.0 Gulang earthquake, NE Tibetan Plateau

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The rupture patterns of large earthquakes in transpressional systems can provide important information for understanding oblique motion and strain partitioning between tectonic blocks. The 1927 M8.0 Gulang earthquake occurred on the transpressional boundary between the Tibetan and Gobi-Alashan blocks. Combined with the results of previous studies, we find that the Lenglongling fault (LLLF) and Southern Wuwei Basin fault (SWBF) might have both ruptured during the Gulang earthquake, but they exhibited different motions. A ~120-km-long surface rupture zone formed along the LLLF, with a left-lateral strike-slip motion and a coseismic offset of ~2.4-7.5 m. Bending, bifurcation, and change of the slip sense occurs at both ends of the fault. The ~42-km-long rupture zone on the SWBF, with a coseismic vertical offset of ~0.6-2.8 m, can be divided into two segments. The eastern segment shows thrust motion, while the western shows thrust motion with a left-lateral strike-slip component. Thus, the Gulang earthquake may be a multifault rupture event where strike-slip and thrust faults ruptured simultaneously. Analysis of deep and shallow structures and three-dimensional finite-element modeling reveal that the north-dipping LLLF and the SWBF may converge downward to a low-angle decollement. This pattern of deformation partitioning is similar to some other earthquakes where oblique block convergence is partitioned into strike-slip motion on steeply dipping faults and vertical motion on gently dipping faults.