Static-dynamic strain response to the 2016 M6.2 Hutubi earthquake (eastern Tien Shan, NW China) recorded in a borehole strainmeter network

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Strain caused by earthquakes give rise to many earthquake-related hydrological changes. Mechanisms responsible for them are different from place to place, depending on whether the trigger is the static strain or dynamic strain. Theoretic calculation indicates that the great difference in dependence on epicentral distance is robust enough to discriminate them, however, few studies based on direct strain measurements have tested this hypothesis. The 2016 M6.2 Hutubi Earthquake is a reverse event occurred in the northern Chinese Tien Shan, and the coseismic strain responses have been recorded by nine 4-component RZB borehole strainmeters at the distance from near field to far field. The nearest four stations have recorded resolvable static strain responses, and all stations have perfectly recorded the dynamic strain waves. Our result shows that the difference in the dependence on distance is truly reliable to differentiate static strains from dynamic strains, the static strain is of the same magnitude with the dynamic strain in the near field, and as the distance increase to intermediate and far field, the static strain are a few magnitude smaller. Yet the ratio between them is a complex index relating to the rupturing process itself, the tectonic background, and the seismic wave radiation pattern. Furthermore, the calibrated static strain were also used to relocate the fault plane through a grid-search method, and the result shows that the seismogenic fault is surprisingly a high-angle backthrust fault. The determined fault parameters are 279°/70°/87°, which are also consistent with the aftershock distribution. It indicates that the high-angle backthrust in the Chinese Tien Shan are capable of breaking individually. Considering the high vertical displacement, and their abundance inside the Tien Shan orogenic belt, the high-angle backthrust faults may had also played a significant role in building the modern ultra-high relief in Tien Shan.