Precise hypocenters determined by the "0.1 Manten" hyper dense seismic network: Implication of faulting structure linked to geological observation

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To deepen fundamental understanding of earthquake faulting, it is of crucial importance to image fine scale structure of fault zone. We have installed a thousand of seismic stations in the source area, which covers an entire aftershock zone of the 2000 Western-Tottori earthquake (Mw 6.7) from March 2017. The spatial interval of each seismic station ranges from 1 to 2 km. We initially detected ~3000 earthquakes from the continuous waveforms, using automatic arrival time picking technique. Applying a double-difference algorithm to the arrival data-set, we relocated more precise hypocenters in the studied region. The completeness magnitude of the catalog is around -1.0.

From the center to the southeast part, the relocated hypocenters are aligned along sharp fault planes, which are dipping almost vertically. In contrast, at the northwest area, the hypocenter distributions are complex, including several fault planes which are conjugate to the main NW-SE aftershock trend.

We focus on a tiny seismic cluster associated with Mj 1.7 event. Following this event, a total of ~150 micro-earthquakes were detected by matched filter technique. The relocated micro-earthquakes are sharply aligned along NNW-SSE fault strike. The length and dip-width of the fault dimension is about 200 m, respectively. Based on the distribution of earthquakes, the fault zone width is estimated to be at most 10 m. The ratio of the fault (process) zone width to the fault length is 0.005, which fairly matches with that geological observation of fault exposure. In addition, we find out that the tiny seismic cluster consists of several minor alignments which are oblique to the main trend, suggesting a development of Riedel shear (R) planes in the fault zone. This result indicates that this fault zone is likely at incipient stage of fault evolution.

