Shallow intraslab normal faulting: Rupture process of the Mw 8.1 2017 Chiapas Mexico earthquake

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On 8 September 2017, a large earthquake occurred beneath the gulf of Tehuantepec, along the coast of Chiapas, Southern Mexico. Promptly published centroid moment tensor (CMT) solutions (GCMT, USGS NEIC, GEOFON, JMA) had a general agreement for steeply dipping (~75˚) normal faulting that strikes (~315˚) nearly parallel to the Middle American Trench, and the centroid depths were obtained in a range of 40–70 km, which suggested the 2017 Chiapas earthquake was the intraslab, normal-faulting event. However, the CMT solution based on a single point-source assumption showed nearly equal variance minima for the centroid depths at ~20 km and ~60 km, which may have resulted from the trade-off between the focal depth and the source time function and have made it difficult to interpret the physical mechanism of the event in a context of stress regime in slab. We constructed a finite fault model for the Mw 8.1 2017 Chiapas earthquake by kinematic waveform inversion using globally observed teleseismic waveforms to discuss the detailed source rupture process including rupture nucleation and termination. The model suggests that the earthquake was a normal faulting on a steeply dipping plane, with the major slip focused on a relatively shallow 28 km depth. The modeled rupture evolution showed unilateral, down-dip propagation toward northwest from the hypocenter, and the down-dip width of the main rupture was restricted to less than 30 km below the slab interface, suggesting that the down-dip extensional stress due to slab bending were the primary cause of the earthquake. Waveform fitting that prefers the rupture nucleation near the slab interface supports the idea of slab bending that induces tensile stress at upper-most slab. The rupture front abruptly decelerated at the northwestern end of the main rupture where it intersected the subducting Tehuantepec Fracture Zone, suggesting that the fracture zone may have inhibited further rupture propagation. The possibility of steeply dipping normal faulting in the shallow slab, but landward of the trench, due to slab bending is a fresh view of the subduction zone process in southern Mexico.

キーワード：スラブ内地震、正断層地震、震源過程、波形インバージョン、スラブ屈曲、2017年 Mw 8.1 チアパス・メキシコ地震
Keywords: intraslab earthquake, normal faulting, source rupture process, kinematic waveform inversion, slab bending, Mw 8.1 2017 Chiapas Mexico earthquake

