2017 Mw 8.1 Tehuantepec Earthquake: Deep Slip and Rupture Directivity Enhance Ground Shaking but Weaken the Tsunami

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The 8 September 2017 Mw 8.1 Tehuantepec normal-faulting earthquake caused unexpected widespread intensive shaking, strongly felt as far as Mexico City about 720 km northwest of the epicenter, and generated a 1.8 m tsunami at the coast. Just 11 days later, another devastating Mw 7.1 Puebla earth- quake occurred near Mexico City. In this contribution, we characterized this event by a joint inversion using static Global Positioning System (GPS) offsets, Interferometric Synthetic Aperture Radar (InSAR) measurements, high-rate GPS, and teleseismic displacement waveforms, then validated the preferred model by tsunami observations. We demonstrate that the Tehuantepec earthquake rupture propagates mainly unilaterally toward the northwest at a relatively high speed (~3:4km=s), with three asperities identified: the dominant one is centered between depths from ~40 to 60 km while the other two are located at shallower (~20 km) and deeper (~90 km) depths, respectively. Moreover, we find the peak ground acceleration (PGA) recorded along the rupture propagation direction is much larger than that recorded at stations in the opposite di- rection with nearly identical epicentral distances (~700 km). Dynamic displacements reaching 5 cm were also observed at a GPS station ~1450 km from the epicenter. Based on these ob- servations and ourmodel results,we suggest that the deep slip in the low-attenuation mantle and the rupture directivity likely enhance the nationwide ground shaking, whereas the shallow slip may contribute to the local tsunami heights.The derived slip distribution is valuable for future investigation on the explicit relationship between the Mw 8.1 Tehuantepec and Mw 7.1 Puebla events.