Strong motion pulse and building collapse during the 2016 Tainan earthquake

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Ground motions during the 2016 Tainan earthquake have been observed by many stations of P-alert, which is an earthquake early warning system in Taiwan. Looking at the velocity seismograms at stations in Tainan City, a large long-period pulse is found mainly in the EW component to be as large as 100 cm/s at maximum. The Fourier spectrum of the seismogram at the station W21B indicates that the predominant period of this pulse was 1 to 4 s. The collapsed building causing more than 100 fatalities had 16 stories so that its natural period should be 0.8 to 1.3 s according to the relationship of natural period T and number of story N: T = (0.049 ~ 0.082)×N (Architectural Institute of Japan, 2000). Since the natural period can be longer due to construction defect, this pulse would have had a significant impact on the building.A source inversion of teleseismic body waves revealed that the source fault dipping to the north was located in the east of the city center of Tainan and a rupture consisting of strike-slip and reverse faulting propagated along the strike of the source fault. The westward rupture propagation towards the city center of Tainan went through parts of larger strike slip in the source fault. For a strike-slip fault, it is well known that the rupture directivity effect generates a long-period strong motion pulse in the direction perpendicular to the fault strike. However, the pulse of the Tainan earthquake was dominant in the EW direction, which was parallel to the fault strike. Therefore, a second source fault should be introduced around the area of aftershocks, or the geometry of the original source fault should be revised.

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