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Numerical earthquake models of the 2013 Nantou, Taiwan, earthquake series: Characteristics of source rupture processes, strong ground motions and their tectonic implication

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On 27 March and 2 June in 2013, two moderate large earthquakes with magnitude ML 6.2 and ML 6.5, named the Nantou earthquake series, struck the Central Taiwan. These two events located in middle-to-deep crust at about 15-20 km and their epicenter were very close to the historic Nantou earthquake series which cause destructive damages in 1916-1917. These events indicate that the deep crust of Central Taiwan is an active seismogenic area even there is no evidence show a subsurface structure directly related to any faults at surface. In order to know the origins of Nantou earthquake series and their influence of strong ground shakings, we investigated the rupture processes and seismic wave propagations by using inverse and forward numerical simulation techniques. First, joint source inversions were performed by using teleseismic body wave, GPS coseismic displacements and near field ground motion data. A 3D seismic wave propagation simulation was then carrying out based on the inverted source model. Source inversion results indicate that the rupture characteristics of these two events are different. One ruptures from deep to shallow crust in northwest direction, while the other ruptures to the southwest. Three dimensional wave propagation simulation results show that the thrust movement on eastern dipping fault planes of the two events result in distinct rupture directivity effects with different amplified shaking patterns in western Taiwan. From results of the numerical earthquake models, we deduce that the occurrence of Nantou earthquake series might be related to stress releasing from the easternmost edge of a preexistent strong basement under middle-to-deep crust in Central Taiwan.