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Observations and Modeling of Strong Ground Motions for the 23 October 2011 Mw 7.1 Van, Turkey, Earthquake

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The October 23 2011 Van earthquake occurred at 13:41 p.m. local time in the eastern Turkey with an epicenter at 42.43oN, 38.69oE, about 16 km kilometers north-northeast of the city Van. The hypocenter is located to the north of the Bitlis structure zone, a convergence zone between the Arabian and Eurasian plates in the Eastern Anatolia. According to the Kandilli Observatory and Earthquake Research Institute, KOERI, the earthquake nucleated at a shallow depth of 5 km, and had a local magnitude Ml 6.6. A moment magnitude Mw 7.1 was computed with a 16 km hypocentral depth using regional broadband waveforms by United States Geological Survey, USGS. The size of the rupture has been estimated by USGS as 60 km x 20 km, consistent with the observed distribution of aftershocks, on a WSW-ENE orientated fault plane with a dip of about 35°.
There have been eight aftershocks greater than magnitude 5.0; six occurred within 5 days after the mainshock.Two weeks after the mainshock, another earthquake with magnitude Mw 5.7 and a depth of 9.4km was reported near Van on November 9 at 21:23 local time. it caused 40 deaths and hundreds of injured. Its different focal mechanism and its location centered 16 km south of Van provocating a debate if the earthquake of November 9 was an aftershock of the October 23 earthquake. The stress changes in the region due to this earthquake may interact with other faults in the area, and may lead to a heightened chance of further large earthquakes in the months and years ahead. Therefore we partly consentrate on how applicable the static Coulomb stress trigering mechanism to the 2011 Van Lake afterschock.
Furthermore substantial effort has been directed toward undestanding the high frequency ground motion characteristics associated with the seismic sequence. In this perspective we aim to reproduce the high frequency portion of the strong ground motion recordings obtained during the earthquake. The earthquake's complex nature and the absence of the observed data near field distances motivated us simulating variability of the near-source ground motion and to account for the extended source properties, such as earthquake rupture propagation and asperities distribution on the fault plane.