Geophysical Research Abstracts
Vol. 14, EGU2012-7535, 2012
EGU General Assembly 2012

Strong motion simulations using coupled numerical-empirical Green's functions: the 2009 L'Aquila-earthquake

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On April 6, 2009 a Mw 6.3 earthquake occurred near L'Aquila city, in central Italy. Strong motion data recorded in the near fault region exhibit large amplitudes, localized peaks and a strong space variability, this latter being also observed in pattern of the damage distribution. This earthquake hence represents an interesting case test to investigate near fault effects and to understand the role played by the source and the large scale wave propagation on the observed ground motion and ground motion variability. Moreover, beyond the main event, records of aftershocks and foreshocks form a database of Empirical Green's functions (EGFs) that can be used as the impulse response of the medium in the ground motion simulation. Specifically, records at the accelerometric network allow for calibration of source parameters by comparison with real observations, whilst records at the temporary network allow an estimation of the ground motion in sites where no data from the main event are available.
We use a kinematic approach to simulate broadband data. For the low-frequency part, we numerically describe the wave field accounting for the 3D structure of the target area (morphology of the basin and topography).The high-frequency part is completed by a selection of EGFs. Small events are selected as a function of the signal to noise ratio in frequency range of interest (0.4-10 Hz), when they are localized almost on the same plane as the one of the main event and share the same focal mechanism.
We show a comparison between synthetic estimations and real data and we discuss the variability of the ground motion for L'Aquila region. Tests were performed for different source models in order to verify the influence of the source parameters (slip, rupture velocity, etc.) on the ground motion.