Geophysical Research Abstracts
Vol. 12, EGU2010-8452-1, 2010
EGU General Assembly 2010
© Author(s) 2010

Modeling the impact of topography on seismic amplification at regional scale

Muhammad Shafique (1,2), Dita Anggraeni (1), Wim Bakker (1), and Mark van der Meijde (1)

(1) International Institute for Geo-information science and Earth Observation, (ITC), (2) National Center of Excellence in Geology, University of Peshawar, Pakistan

The intensity of earthquake triggered ground shaking is influenced by the characteristics of earthquake source, medium and site effects. These site effects are often not included in the regional ground shaking models, especially the local topography. It is being experimentally proved and noticed during many previous earthquakes, that topography has significant impact on variation of ground shaking and subsequent building damages. Majority of the previous studies investigating the topographic impact on seismic response are limited to synthetic environments or isolated hills. This study deals with exploring the impact of topography on variation of ground shaking caused by the 2005 Kashmir earthquake, at a regional scale.

With the proliferation of remote sensing technologies, digital elevation models (DEMs) are freely and readily available at medium resolution, and with global cover. DEMs derived from Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER), with 30m resolution, and Shuttle Radar Topography Mission (SRTM), with 90m resolution, can therefore be utilized to model and predict the impact of topography on seismic response, also quickly after a seismic event. The topography of the 2005 Kashmir earthquake affected area is derived from ASTER and SRTM DEMs and analyzed using a 3D spectral finite element code (SPECFEM3D). SPECFEM3D takes into account the seismic source parameters, medium and topography to generate shake maps and earthquake simulations.

The ground shaking simulations and peak ground acceleration maps were generated initially assuming the homogenous ground surface and later by including the topography to assess the role of topography in seismic amplification. Topography derived from ASTER and SRTM DEMs were simulated separately to predict the impact of DEM resolution on computed ground shaking simulations and maps. The preliminary result from the model simulations shows that seismic waves were dispersed at topographic discontinuities, leading to intensification of seismic response at hill ridges. Comparing the simulations with and without topography confirmed that the ground shaking was intensified at the hill ridges and steep slopes upto 5 times. Therefore, this study shows the considerable impact of topography on variation of ground shaking and how seismic response modeling can benefit from the readily available global DEMs and SPECFEM3D in modeling earthquake impact more realistic and as early warning technique.