Geophysical Research Abstracts
Vol. 16, EGU2014-5969, 2014
EGU General Assembly 2014

Numerical Modeling of seismic wave propagation on Etna Volcano (Italy): Construction of 3D realistic velocity structures

Claudio Trovato (1,2), Hideo Aochi (1,2), and Florent De Martin (1)

(1) BRGM, Bureau de Recherches Géologiques et Minières, ORLEANS, France , (2) ISTO, Institut des Sciences de la Terre d'Orléans, University of Earth Sciences of Orléans, ORLEANS, France

Understanding the source mechanism of long-period (LP) seismic signals on volcanoes is an important key point in volcanology and for the hazard forecasting. In the last decades, moment tensor inversions have led to various descriptions of the kinematic source mechanism. These inversions suppose a relatively simple structure of the medium. However, the seismic wave propagation in a realistic 3-D volcano model should be taken into account for understanding the complicated physical processes of magma and gas behaviors at depth. We are studying Etna volcano, Italy, to understand the volcanic processes during different stages of activity. We adopt a spectral element method (SEM), a code EFISPEC3D (De Martin, BSSA, 2011), which shows a good accuracy and numerical stability in the simulations of seismic wave propagation. First we construct the geometrical model. We use a digital elevation model (DEM) to generate finite element meshes with a spacing of 50 m on the ground surface. We aim to calculate the ground motions until 3 Hz for the shallowest layer with Vs = $\sim$500 m/s. The minimal size of the hexahedral elements is required to be around 100 m, with a total number of elements n = $\sim$2 10ˆ6 for the whole model. We compare different velocity structure configurations. We start with a homogeneous medium and add complexities taking in account the shallow low velocity structure. We also introduce a velocity gradient towards depth. Simulations performed in the homogeneous medium turn in approximately 20 hours for calculations parallelized on 16 CPUs. Complex velocity models should take approximately the same time of computation. We then try to simulate the ground motion from the LP sources (0.1-1.5 Hz) obtained by the inversion for the Etna volcano in 2008 (De Barros, GRL, 2009 and De Barros, JGR, 2011). Some vertical and horizontal structures can be added to reproduce injected dikes or sills respectively.