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Sensitivity of Moment Tensor solutions to the shallow velocity structure: synthetics and data example from Etna Volcano, Italy

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Long Period (LP) signals with dominant periods in the range 0.2 – 2 Hz have received particular attention on volcanoes, as they are thought to be directly associated with moving fluids or resonating fluid-filled conduits. Consequently, in an effort to better understand fluid-driven processes, inverting seismic waveform for LP source mechanisms is becoming increasingly common. As the majority of LP events occur at shallow depths and have short path lengths and km-long wavelengths, the role of edifice heterogeneity is usually ignored. We use 3D full wavefield simulations in Mt Etna's heterogeneous media and topography to generate wavefield radiated from a synthetic LP source. Green's functions are calculated for the same topographic surface, and a homogeneous velocity distribution. Moment Tensor plus single force inversions of these synthetics demonstrate the extreme sensitivity of the solution for LP source forces to near-surface volcano structure. In particular, spurious forces and incorrect source geometries are obtained if the top 400 m is poorly constrained. Sensitivity kernels help to elucidate the details of the propagation effects which lead to poor source characterization and allow us to suggest an improved protocol for the inversion of real LP signals. We conclude that the effect of poorly resolved velocity structure can be minimized by using *a priori* information about the source geometry and inverting signals for as few free model parameters as possible. Source inversions for field data from Mt Etna, constrained by full wavefield simulations, will also be presented.