Seismo-electric coupling: What we can learn from numerical simulations

Lanbo Liu
University of Connecticut

Abstract

In this talk I will first give a brief survey of the mechanisms of energy conversion through the mechanical-electric coupling. I then focus on two major aspects of the mechanical-electric coupling pertinent to geophysical research: 1) the seismo-electric (SE) coupling through electrokinetic phenomena and 2) the lithosphere-atmosphere-ionosphere (LAI) coupling through a few possible mechanisms. The most robust coupling mechanism is the one through the internal gravity waves in the lower atmosphere. I will show the field observation results from the Daqing Oilfield in China as the example for the SE coupling, and the perturbation in the GPS-derived total electron concentration (TEC) of the ionosphere associated with a couple of great earthquakes in Japan and the Sumatra 2004 tsunami as the examples of the LAI coupling.

Following the discussion of the SE and LAI coupling phenomena, I will discuss the general approaches to solve the physical-mathematical expressions of the couplings numerically through the finite difference time domain (FDTD) method. In this part, I will emphasize the challenges of using numerical simulation, rather than discussing the technical details. Finally, I will wrap up this talk by discussing a few points that I think are both interesting and challenging in terms of earthquake hazard mitigation and forecasting, if it is possible at all.