Geophysical Research Abstracts
Vol. 12, EGU2010-5553, 2010
EGU General Assembly 2010


# Three-Dimensional Joint Geophysical Imaging Using an Advanced Multivariate Inversion Technique: the Method and its Application to the Utah area, United States

Haijiang Zhang (1), Monica Maceira (2), Thomas Benson (1), and M. Nafi Toksoz (1)

(1) Department of Earth Atmospheric and Planetary Sciences, Massachusetts Institute of Technology, Cambridge, MA 02139, USA (hjzhang@mit.edu), (2) Los Alamos National Laboratory, EES-17, MS D443, Los Alamos, NM 87545, USA

We present an advanced multivariate inversion technique to generate a realistic, comprehensive, and high-resolution 3D model of the seismic structure of the crust and upper mantle. The model satisfies several independent geophysical datasets including seismic surface wave dispersion measurements, gravity, and seismic arrival time. The joint inversion method takes advantage of strengths of individual data sets and is able to better constrain the seismic velocity models from shallower to greater depths. To combine different geophysical datasets into a common system, we design an optimal weighting scheme that is based on relative uncertainties of individual observations, their sensitivities to model parameters, and the trade-off of different data fitting.

We apply this joint inversion method to determine the 3D Vp and Vs models of the Utah area. The seismic body wave arrival times are assembled from waveform data recorded by the University of Utah Seismograph Stations (UUSS) regional network and the EarthScope/USArray network. The surface wave dispersion measurements are obtained from the ambient noise tomography study by the University of Colorado group using EarthScope/USArray stations. The gravity data for the Utah area is extracted from the North American Gravity Database managed by the University of Texas at El Paso. The joint inversions using two individual data sets such as seismic arrival time and gravity data, as well as seismic surface wave and gravity data indicate strong low velocity anomalies in middle crust beneath some known geothermal sites in Utah. The joint inversion of all three data sets will be presented and is expected to produce a reasonably well-constrained velocity structure of the Utah area, which is helpful for characterizing and exploring existing and potential geothermal reservoirs.