Geophysical Research Abstracts
Vol. 12, EGU2010-2330-1, 2010
EGU General Assembly 2010

FM&TI (Forward Modeling & Tomographic Inversion) approach in passive and active seismic studies

Ivan Koulakov
Institute of Petroleum Geology and Geophysics, Novosibirsk, Russian Federation (koulakoviy@ipgg.nsc.ru)

Seismic tomography is like a photography taken by a camera with deformed and blurred lenses. Amplitudes and shapes of seismic patterns derived at tomographic images are often strongly biased with respect to real structures in the Earth. In particular, tomography usually provides continuous velocity distributions, while the major velocity changes in the Earth often occur on first order interfaces. While working with noisy data, one has to apply strong damping which makes impossible retrieving realistic amplitudes of anomalies. Uneven ray sampling may cause variable damping effect: within one model, one may obtain over- and underdamped solutions in different parts of the study area. Lack of some ray orientations may cause smearing of seismic patterns. Due to these and other reasons, quantitative values reported in most tomographic studies, although supported by pseudo-formal criteria (e.g. trade-off curves), do not often represent the reality.

We propose an approach which is used to construct a realistic structure of the Earth based on a combination of forward modeling and tomographic inversion. Based on available a-priori information we construct a synthetic model with realistic patterns. Then we compute synthetic times and invert them using the same tomographic code with the same parameters as in the case of observed data processing. The reconstruction result is compared with the tomographic image of observed data inversion. For the parts where discrepancy is observed, we correct the synthetic model and repeat the forward modeling and inversion again. After several trials we obtain similar results of synthetic and observed data inversion. In this case we claim that the derived synthetic model adequately represents the real structure of the Earth. In the talk, several examples of applying this approach at various scales for different data schemes are presented: (1) few real and synthetic examples of active source refraction travel time data; (2) local earthquake tomography scheme; (3) regional scheme which uses the global data of the ISC catalogue (with examples of regional upper mantle models in Asia);