Geophysical Research Abstracts
Vol. 12, EGU2010-8537-1, 2010
EGU General Assembly 2010

A Methodology to Seperate and Analyze a Seismic Wide Angle Profile

Wolfgang Weinzierl and Heidrun Kopp
IFM-GEOMAR, Kiel, Germany

General solutions of inverse problems can often be obtained through the introduction of probability distributions to sample the model space. We present a simple approach of defining an a priori space in a tomographic study and retrieve the velocity-depth posterior distribution by a Monte Carlo method. Utilizing a fitting routine designed for very low statistics to setup and analyze the obtained tomography results, it is possible to statistically separate the velocity-depth model space derived from the inversion of seismic refraction data. An example of a profile acquired in the Lesser Antilles subduction zone reveals the effectiveness of this approach. The resolution analysis of the structural heterogeneity includes a divergence analysis which proves to be capable of dissecting long wide-angle profiles for deep crust and upper mantle studies. The complete information of any parameterised physical system is contained in the a posteriori distribution. Methods for analyzing and displaying key properties of the a posteriori distributions of highly nonlinear inverse problems are therefore essential in the scope of any interpretation. From this study we infer several conclusions concerning the interpretation of the tomographic approach. By calculating a global as well as singular misfits of velocities we are able to map different geological units along a profile. Comparing velocity distributions with the result of a tomographic inversion along the profile we can mimic the subsurface structures in their extent and composition. The possibility of gaining a priori information for seismic refraction analysis by a simple solution to an inverse problem and subsequent resolution of structural heterogeneities through a divergence analysis is a new and simple way of defining a priori space and estimating the a posteriori mean and covariance in singular and general form. The major advantage of a Monte Carlo based approach in our case study is the obtained knowledge of velocity depth distributions. Certainly the decision of where to extract velocity information on the profile for setting up a Monte Carlo ensemble is limiting the a priori space. However, the general conclusion of analyzing the velocity field according to distinct reference distributions gives us the possibility to define the covariance according to any geological unit if we have a priori information on the velocity depth distributions. Using the wide angle data recorded across the Lesser Antilles arc, we are able to resolve a shallow feature like the backstop by a robust and simple divergence analysis. We demonstrate the effectiveness of the new methodology to extract some key features and properties from the inversion results by including information concerning the confidence level of results.