Title: Use of web-base database to reduce uncertainty associated with geophysical investigations

Abstract:

Most geophysical analyses are essentially non-unique, and it is very difficult to obtain unique and reliable solutions without uncertainty from an individual geophysical method. For example, it is well known that a seismic refraction analysis based on first arrival traveltimes is essentially non-unique. In most cases, it is difficult to obtain a true velocity model from first arrival traveltimes observed only on the ground surface. This non-uniqueness is a problem not only for the seismic refraction method but also for most geophysical methods in which underground structures are estimated from geophysical data observed from the ground surface. All geophysical practitioners and algorithm developers have to admit this inherent limitation and try to develop alternative approaches. There are many mathematical approaches to reduce the non-uniqueness. Using a priori information is one of the most promising approaches. It is well-known that the result of a non-linear least-squares inversion depends highly on the initial model. Constraints during an inversion are also very important. For example, a constraint that velocity is increasing with depth is generally very effective during the inversion of the surface seismic refraction method. The real question is how to obtain a priori information and constraints on analyses. One of the practical ways to prepare a priori information and constraints is the use of database. The database of existed geophysical, geological and geotechnical investigation results can provide a priori information and constraints for geophysical processing. Most investigations, however, are carried out by individual organizations and the investigation results are rarely accumulated in the unified and organized database. To study and discuss appropriate database and digital standard format for the non-invasive site investigations, we developed a prototype of web-based database to accumulate observed data and processing results of active and passive surface wave investigations that we have performed at more than 600 sites in U.S. and Japan. The database was constructed on a web server using MySQL and PHP so that users can access to the database through the internet from anywhere with any devices. All data are registered in the database with location and users can search geophysical data through Google Map. The database stores dispersion curves, horizontal to vertical spectral ratios and S-wave velocity profiles at each site. All data were saved in XML files as digital data so that users can review and reuse the data. The database also stores a published 3D deep basin and crustal structures and users can use them during surface wave data processing.

Biography:

Koichi Hayashi has worked in the development and research of geophysical methods over 27 years. He is currently a Senior Technical Manager of Geometrics/OYO Corporation, San Jose, CA. He earned a bachelor's degree in Earth Sciences from Chiba University, a master's in Earth Sciences from the Massachusetts Institute of Technology, and a PhD in Earth Resources Engineering from Kyoto University. His main research areas are seismic refraction, active and passive surface waves, finite-difference seismic modeling, and traveltime inversion. He is the main developer of the widely used SeisImager program and has incorporated many of his theoretical developments into the software, making SeisImager a premier surface-wave, refraction, and downhole processing package available today. He was in charge of SEG's 2014 Near Surface Honorary Lecturer. The title of his talk was “Integrated Geophysical Methods Applied to Geotechnical and Geohazard Engineering: From Qualitative to Quantitative Analysis and Interpretation”
and he gave 22 lectures in eight countries between September and December of 2014. He regularly presents papers at SEG meetings and has published over 30 papers in journals and proceedings of SEG, EEGS, and SEGJ. In 2006, he received an award from SEGJ for the development of surface-wave methods.