Geophysical Research Abstracts, Vol. 8, 04471, 2006
SRef-ID: 1607-7962/gra/EGU06-A-04471

Shallow velocity-depth model using first arrival traveltime inversion at the CO_2SINK site, Ketzin, Germany

S. Yordkayhun (1), C. Juhlin (1), R. Giese (2), and C. Cosma (3)

(1) Department of Earth Sciences, Uppsala University, Sweden, (2) GFZ, Potsdam, Germany, (3) Vibrometric, Finland

(sawasdee.yordkayun@geo.uu.se / Phone: +46-18-471 7161)

2D and 3D seismic reflection data have been acquired as a part of the CO_2SINK project in the Ketzin area, Northern Germany, in the autumn 2004 and 2005, respectively. The project is a pilot study for in-situ monitoring of geological storage of CO2 in a saline aquifer. Large-scale geological storage of CO2 has the potential to reduce greenhouse gas emissions significantly. For long term monitoring, a variety of geophysical surveys, geochemical techniques, numerical models and risk assessment strategies will be performed. Although the target depth of the project is about 700 m, the main objectives of the present study are to image near surface structures and to enhance the seismic reflection processing and interpretation. Generally, the quality of stacked seismic sections are distorted by shots associated with noise, surface waves and direct arrivals that obscure the reflected energy from shallow subsurface heterogeneities. By using first arrivals in reflection surveys, refraction data analysis can more accurately image near-surface structures. We have used generalized linear inversion techniques to model the near-surface velocity field from two 2D seismic reflection profiles acquired within the CO_2SINK project. Similar to tomography methods, the generalized linear inversion method is based on ray tracing though an initial guess model and solving the problem in a least-squares sense. Near-surface velocity models obtained from the inversion were correlated with CDP stacked sections. Time sections from the reflection processing were depth converted using the inverted velocity fields from the first arrival picks and stacking velocities from the reflection processing. The former depth converted sections show better correlation with inverted velocity fields.

Joint interpretation of our models, reflection data and borehole data show that the upper 400 m of the subsurface are represented by three groups of sediments. Quaternary sandstone deposits with velocities of 1,600 -1,700 m/s and 70-110 m thick comprise the uppermost part. This unit is underlain by Tertiary deposits of mudstone with velocities of about 2,050 m/s and 80-200 m thick. The Jurassic sedimentary sequences are represented by an alternating sequence of sandstone, mudstone and siltstone reaching depths of about 250-400 m and with velocities in the range of 2,300-2,600 m/s.