UPPER-CRUSTAL STRUCTURE IN SE ARIZONA FROM P AND RG PHASES GENERATED BY EXPLOSIONS

Tae Sung Kim, Brian W. Stump • Southern Methodist University

The goal of this study is to constrain upper crust P and S velocity structure around a mine in SE Arizona in order to separate the propagation path effects from explosion signals. This separation will provide the opportunity to quantify the explosion source mechanism of Rg and the relationship between Rg and S phases at near-source and regional distances. As indicated in the map below, a mixed deployment of PASSCAL supplied Texans and broadband CMG-40Ts were located along profiles moving away from the mine. This instrumentation documented the P and S phases from single-fired explosions detonated at the mine.

The locations of the Texan (green), CMG-40T (red) and source (blue) are mapped to the far left. The Texan record section documents the body waves in the upper panel (0.7-20 Hz) and Rg in the lower panel (0.5-3 Hz). The arrival times of the body waves are used as a first estimate of the velocity model along the path. The dispersion of the Rg is then used to refine the model.

The dispersion curves of Rg phase recorded on the broadband and Texan data are extracted using the MFA (Multiple Filter Analysis; Dziewonski et al., 1969) and refined by PMF (Phase Match Filter Analysis; Herrin and Goforth, 1977). Texan and CMG-40T group velocity dispersion curves in the 0.5-3 Hz band produced similar results after correcting the Texan data for the nominal instrument response. The dispersion curves for the broadband data are displayed to the right. Group velocities along the south section of the array are higher than those along the north section. These results imply a strong lateral variation in shallow crustal velocity structure.

The observed dispersion curves were inverted to constrain the shear wave velocity structure between pairs of stations along the path using the differential inversion method (Jin and Herrin, 1980; Bonner and Herrin, 1999). The shear wave velocity at each mid point pair is used to produce a 2-D shear wave velocity structure (right). The mapped variation in shear wave velocity is coincident with granite intrusions around the mine as reflected in high velocities over the first 5-10 km and unconsolidated Tertiary and Quarternary pyroclastic and sedimentary rocks from 15 to 35 km. These results will be used to assess the relationship between Rg generated by explosions and the regional Lg phase.

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