

S-wave velocity structure analysis down to the basement: towards estimation of strong ground motion

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1.Introduction

The S-wave velocity structure down to the basement is one of the key elements for the estimation of strong ground motion. Seismic reflection survey is one of the best techniques to image the precise underground structure and velocity. Unfortunately S-wave reflection surveys are so far used only for shallow targets, because of some limitations: high transmission loss and attenuation of the S-wave in the soft Alluvial and Diluvial sediments. For deeper structure survey, the reflection survey using P-S converted wave is supposed to be superior to the one using S-wave reflection, because the source can be stronger and the attenuation is smaller.

2.Data processing

We analyzed seismic reflection survey data using 3-component geophones to test the feasibility of making P-S converted wave sections, and to have precise S-wave velocity down to the basement. P-S converted processing needs different approaches in some processing techniques: CCP (common conversion point) gathering instead of the conventional CMP gathering, respective estimation of statics correction for shot and receiver sides, higher-order velocity analysis, V_p/V_s scanning, and so on.

3.Results

In our two processing examples, the sedimentary strata are almost flat, but the basement has some irregularity. In one example, the SH-wave section is better than the P-S converted wave section for shallower part, because the P-S converted wave section is contaminated by P-P reflections. But for the deeper reflection, the P-S converted wave section gives better results than the SH-wave section. In depth sections, the P-wave and P-S converted wave sections have good correlations in each example. Our deepest example, of which basement depth is about 1.2km, show a good P-S converted wave imaging from shallow to deep. This result suggests P-S converted wave can be used to extract deep S-wave velocity and structure.

4.Towards future research

To get a better image and velocity information for the deeper and geologically complex sedimentary basin, we have several things to do. For deeper structures, we can increase vertical stacks, or can use more powerful P-wave sources, which are partly available. For complex structure, we need more research for improving data processing. One thing is how to estimate stable statics correction, and another is how to improve the quality of mapping for the converted points. We will keep these things in mind and develop the technology for the estimation of the shear wave velocity structure.