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High-resolution seismic reflection surveying with a land streamer

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In this study, newly designed seismic reflection data acquisition array (land streamer) is utilized to image the shallow subsurface. Our acquisition system consist of 24 geophones screwed on iron plates with 2 m spacing, moving on the surface of the earth which are connected with fire hose. Completely original, 4.5 Kg weight iron plates provides satisfactory coupling. This land-streamer system enables rapid and cost effective acquisition of seismic reflection data due to its operational facilities. First test studies were performed using various seismic sources such as a mini-vibro truck, buffalo-gun and hammer.

The final fieldwork was performed on a landslide area which was studied before. Data acquisition was carried out on the line that was previously measured by the seismic survey using 5 m geophone and shot spacing. This line was chosen in order to re-image known reflection patterns obtained from the previous field study. Taking penetration depth into consideration, a six-cartridge buffalo-gun was selected as a seismic source to achieve high vertical resolution. Each shot-point drilled 50 cm for gunshots to obtain high resolution source signature. In order to avoid surface waves, the offset distance between the source and the first channel was chosen to be 50 m and the shot spacing was 2 m. These acquisition parameters provided 12 folds at each CDP points. Spatial sampling interval was 1 m at the surface.

The processing steps included standard stages such as gain recovery, editing, frequency filtering, CDP sorting, NMO correction, static correction and stacking. Furthermore, surface consistent residual static corrections were applied recursively to improve image quality. 2D F-K filter application was performed to suppress air and surface waves at relatively deep part of the seismic section.

Results show that, this newly designed, high-resolution land seismic data acquisition equipment (land-streamer) can be successfully used to image subsurface. Likewise, results are and compatible with the results obtained from the previous study. This tool is extremely practical and very effective in imaging the shallow subsurface. Next step, an integrated GPS receiver will be added to recorder to obtain shot and receiver station position information during data acquisition. Also, some mechanical parts will be placed to further improve the stability and durability of the land streamer. In addition, nonlinear geophone layout will be added after completion of test.

We are planning to use this land streamer not only in landslide areas but also in archaeological sites, engineering applications such as detection of buried pipelines and faults. This equipment will make it possible to perform these studies both in urban and territory areas.