FIELD LAND-STREAMER VS. CONVENTIONAL SEISMIC DATA: ADVANTAGES AND DISADVANTAGES

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High-resolution near-surface seismic imaging is required for many applications such as solving shallow geology, engineering, or environmental studies. It, also, has become important in calculating accurate static corrections for deep reflection processing. Near-surface seismic applications require the investigation of the subsurface velocity model for depths less than 300 m from the ground surface. In order to achieve the required high-resolution subsurface investigation, the seismic data must be recorded using high-fold and densely spaced receivers. The recording of high-fold and densely spaced receivers' seismic data with conventional acquisition techniques is highly time consuming and requires labor for receiver planting and cable moving, which is a major obstacle in shallow applications of the seismic method.

Contrary to the conventional acquisition, the land-streamer acquisition saves a lot of field-time since all receivers and cables are pre-connected and the time required for the field setup is almost 20% of the time required to setup the conventional survey. Time-saving factor is even more distinct in case of recording a very long profile where in conventional surveys, the profile must be divided into small sections and the receivers/cables must be collected and re-installed after recording each segment, which is very time consuming, however, in land-streamer these breaks are not required.

In this work we recorded one seismic profile using both conventional and land-streamer setups. The total profile length is 955 m. In case of conventional setup, we divided the profile into three segments, each one is 475 m with 50% overlap between each two segments. Here, we recorded 192 shot gathers, each one has 96 or 144 receivers, depending on the shot position. The shot and receiver intervals are 5m. It took 2 field days (10-working hours/day) to complete the conventional survey. Another 265 shot gathers were recorded on the same profile using a 48-receiver land-streamer with 1m receiver intervals. Shot gathers 1 to 75 has shot intervals equal to 5m, while shot gathers 75 to 265 has shot intervals of 2.5m. The land-streamer survey was completed in about four working hours.

The first arrival traveltimes of both profiles are manually picked and then inverted to generate the two corresponding traveltime tomograms. The conventional traveltime tomogram shows a depth of penetration of 150m from the ground surface, where four subsurface layers and a possible fault at offset 480m are shown on the subsurface tomogram. The land-streamer tomogram shows a maximum depth of penetration of 30m from the ground surface. It reveals more information about the lateral and vertical velocity variations and detailed shape of the shallow reflectors relative to the conventional tomogram. It also shows the subsurface fault, however, at shallower depth relative to the conventional tomogram.

To confirm the field result, one synthetic numerical test is conducted. The first arrival traveltimes are calculated using ray-tracing algorithm. In this synthetic test, we mimic both the conventional and the land-streamer field surveys. The synthetic tomograms show similar results to the field tomograms.

In summary, the land-streamer survey is much faster in the field and shows more details of the near-surface layers, however, the conventional survey can reach larger depths relative to the land-streamer.