Shear-Wave Velocity (Vs) Profiling by Surface Wave (MASW) Method

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The multichannel analysis of surface waves (MASW) method (Park et al., 1999) is a non-destructive (NDT) seismic method to evaluate shear-wave velocity (Vs) (or stiffness) of the ground. It analyzes dispersion properties of seismic surface waves propagating horizontally along the surface of measurement. It gives the Vs information in either 1-D (depth) or 2-D (depth and surface location) format in a cost-effective and time-efficient manner. The main advantage of the MASW method is its ability to take a full account of the complicated nature of seismic waves that always contain harmful noise waves such as higher modes of surface waves, body waves, scattered waves, traffic waves, etc (Figure 1). Since its first introduction to the related communities in mid 90s, there have been various types of applications with the MASW method at different parts in the world. Nowadays, the keyword MASW can be effectively used to search for related information on the Internet. Complete list of the MASW publications made at the Kansas Geological Survey (KGS) during the last one decade can be found at www.kgs.ku.edu and includes various types of case studies as well as theoretical ones.

Strong nature of surface waves makes the conventional spike coupling for geophones unnecessary. Therefore, a simple apparatus like a land streamer (Miller et al., 2003) can be used for field data acquisition in a convenient and fast mode. Key part of the MASW processing is the extraction of the fundamental-mode (M0) dispersion curve. The strong surface-wave nature also makes the processing much simpler than the body-wave processing because of the high signal-to-noise (S/N) ratio always ensured in the raw data. In addition, a 2-D wavefield transformation method (Park et al., 1998) is an objective scheme that can image dispersion trends of surface waves without operator's involvement, and the M0 curve can be effectively extracted from the image following a few judgmental steps that can be automated also. Figure 2 shows a comparison of processing results from a manual processing flow taken by an experienced operator and the fully-automated

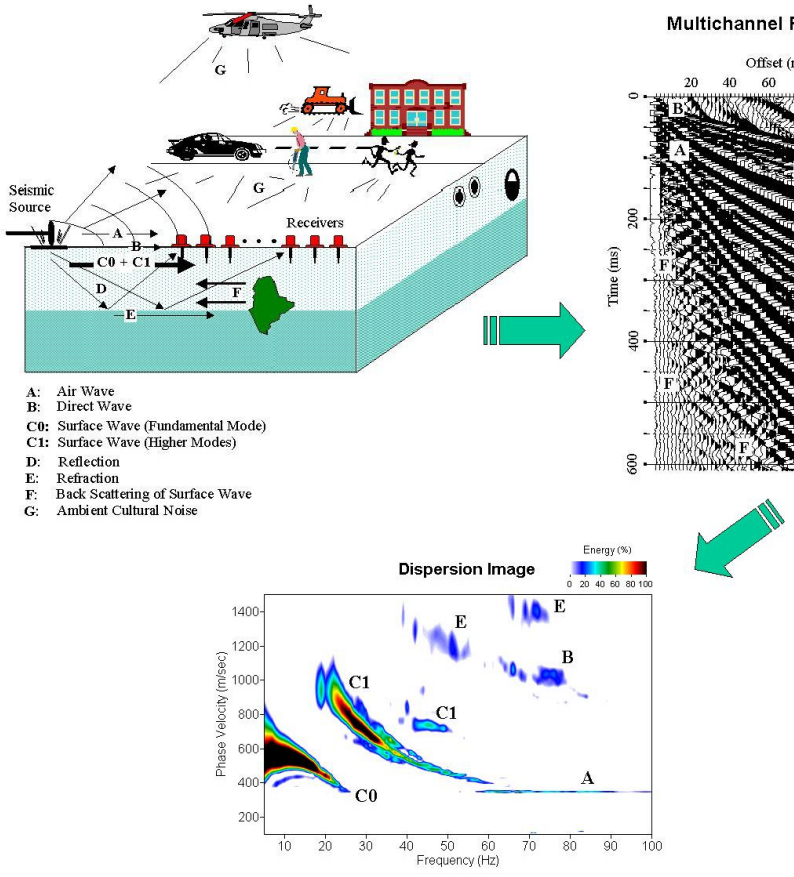

Figure 1. An illustration depicting the main advantage of the multichannel approach with the surface wave method.

processing flow. Although a slight difference can be noticeable between the two modes, it is expected the effectiveness of the automatic mode will be enhanced significantly in the near future as the algorithms will be continuously improved. These potentials for the automation of data acquisition and processing with the MASW method will make the survey mode depicted in Figure 3 routinely implemented in the field with the acquired data processed in a real-time mode.

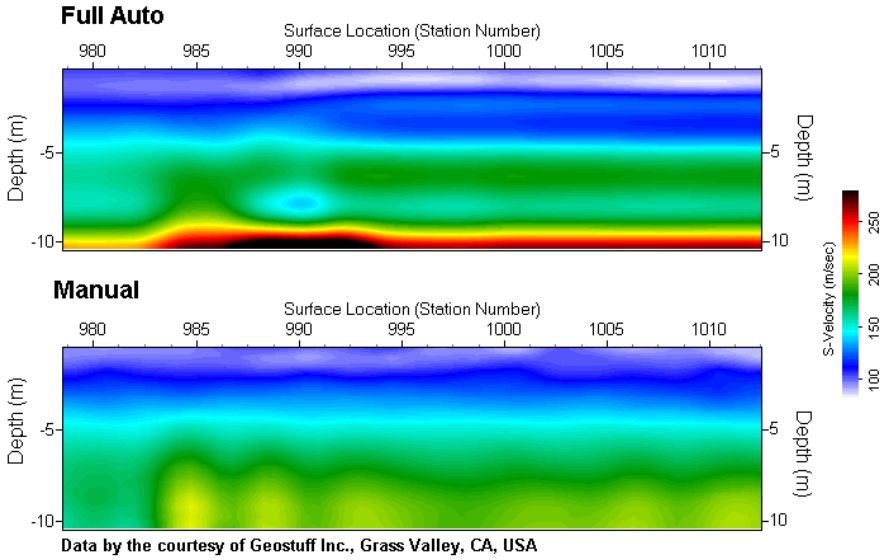

Figure 2. 2-D Vs maps processed from the same data set by following a fully-automated processing flow (upper) and by an experienced operator (lower).

References

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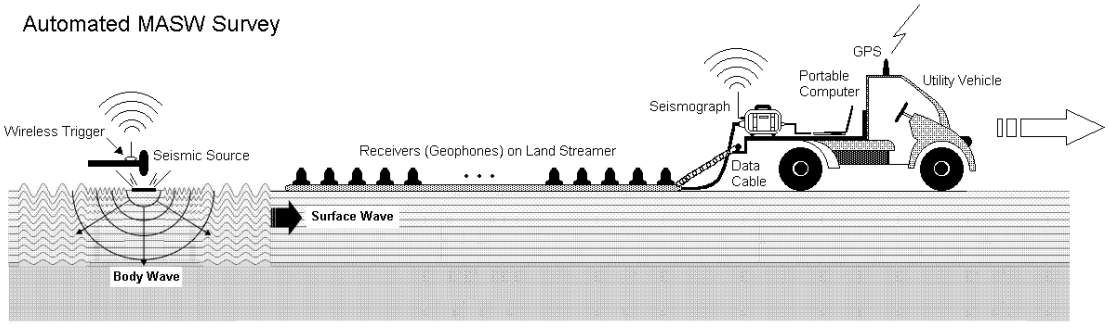

Figure 3. A schematic illustrating the fully-automated MASW survey with real-time processing.