EVALUATION OF SURFACE-WAVE WAVEFORM MODELING FOR LITHOSPHERE VELOCITY STRUCTURE

Tao-Ming Chang, B.S., M. Prof. Geophys.

A Digest Presented to the Faculty of the Graduate School
of Saint Louis University in Partial Fulfillment of
the Requirements for the Degree of
Doctor of Philosophy

1997

DIGEST

Surface-waveform modeling methods will become standard tools for studying the lithosphere structures because they can place greater constraints on earth structure and because of interest in the three-dimensional earth. The purpose of this study is to begin to learn the applicabilities and limitations of these methods.

A surface-waveform inversion method is implemented using generalized seismological data functional theory. The method has been tested using synthetic and real seismic data and show that this method is well suited for teleseismic and regional seismograms. Like other linear inversion problems, this method also requires a good starting model.

To ease reliance on good starting models, a global search technique, the genetic algorithm, has been applied to surface waveform modeling. This method can rapidly find good models for explaning surface-wave waveform at regional distance. However, this implementation also reveals that criteria which are widely used in seismological studies are not good enough to indicate the goodness of waveform fit.

These two methods with the linear waveform inversion method, and traditional surface wave dispersion inversion method have been applied to a western Texas earthquake to test their abilities. The focal mechanism of the Texas event has been reestimated using a grid search for surface wave spectral amplitudes. A comparison of these four algorithms shows some interesting seismic evidences for lithosphere structure.