O8-5 REGIONAL SURFACE WAVE INVERSION AND THE EFFECT OF INITIAL SOURCE PHASE SHIFT

OZCAN CAKIR and **MURAT ERDURAN**
Karadeniz Teknik Univ. Jeofizik Muh. Bolumu 61080 Trabzon, Turkey

Surface wave recordings of regional earthquakes are efficient tools to explore the crustal structure around a seismic station capable of recording three component signals. In case of single station method initial earthquake phase shift is an important factor which has to be taken into account, when particularly considering the local and regional surface wave recordings for structural estimation (Dziewonski and Hales,1972). Initial source phase for a given azimuth is a function of the fracture mechanism, source time function and elastic parameters around the source. In case that source phase is constant or slowly varying with the frequency, observed group velocities, which are proportional to the derivative of the total propagation phase, are not much affected by the omission of the initial phase shift.

In order to show the effect of this phase on the observed group velocities we performed some numerical calculations assuming 4 different fault mechanisms of 4 different source time functions. Fault mechanisms are assumed as strike slip, dip slip and normal and reversed oblique faulting. The source moment rate functions are assumed as combinations of some simple triangular pulses. Synthetic seismograms, based on reflectivity method by Muller (1985), at epicentral distances of 350 and 700 km are calculated for each source combination given above with shallow focal depth. After applying the multiple filter technique (Hermann, 1973) to the seismograms, we obtained group velocities. At the end, linearized least-square inversion technique is applied to group velocities to estimate the elastic parameters for the propagation path. The inversion technique is performed differentially and is computer coded based on work by Chen (1993). Inversion is damped gradually less with increasing iteration.

In general we saw that group velocities below 20 sec. period suffered from phase advance and above it phase delay happened. At 350 km epicentral distance, inverted velocities follow the average of what really earth structure until 30 km depth is. Below this depth, because of phase delay at greater periods, inverted velocities drop well beyond the actual ground velocities. This case is also caused by shallow penetration or by poor sampling of surface waves at greater depths, when observed at particularly close epicentral distance. We also observed that group velocity coherence at greater periods diminished gradually. Synthetic seismograms calculated at 700 km showed surface waves penetrating to deeper parts of the earth and observed group velocities at higher periods were obtained more clearly. Since the effect of initial source phase decreases with epicentral distance, ground velocities after inversion of group velocities are obtained more accurately and deeper parts of the earth is better resolved. We saw that the fracture mechanism of the earthquake is the primary cause of initial phase flactuation, and the source time function and elastic parameters is secondary to this.

References

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