# Dispersion characteristics of surface wave around the Korean Peninsula

전정수[1) · 전명순[1) · 민경덕[2) · 제일영[1) · 박윤경[1)

## 1. Introduction

As a part of research on tectonic environment between southwestern Japan and Korean peninsula, this study is performed to explain crustal velocity structure of the region using surface wave dispersion. Dispersion characteristic of group velocity of surface wave reflects average velocity structure of the medium between the seismic source and recording station. In this study, multiple filtering method using a single record is adopted to measure the group velocity of surface waves. Particle motion was analyzed to identify Love and Rayleigh wave from the expected arrival time.

For the interpretation of the data, 2-D average shear wave velocity models were inverted for the 5 regions. Averaged Rayleigh wave dispersion curves for each region were inverted using stochastic inversion process.

## 2. Data and Methodology

This study uses 35 earthquakes mostly occurred at or near subduction zones between June 2, 1996 and October 6, 2000. Earthquakes having magnitude larger than 4 mb and focal depth less than 55 km were selected to guarantee good quality surface waves. For this study we have mainly used the records of long-period stations at KSRS at Wonju, Korea and TKA, FUK and YTY from southwestern Japan were also used. Since accurate determination of earthquake epicenters and origin times is of importance, earthquake parameters in CEB(Calibration Event Bulletin) of IDC(International Data Centre), FARM(the Fast Archive Recovery Method) product of IRIS(the Incorporated Research Institutions for Seismology) and USGS(U. S. Geological Survey) earthquake parameters were used. The single-station method, multiple filtering method, which is the most general technique used to measure dispersion of group velocity is applied in this study. The multiple filtering analysis technique, first developed by Dziewonski, et al. (1969), and implemented using a set of computer programs written by Herrmann (1984), provides a fast, efficient method of analyzing signals that consist of multiple dispersed signals. In preparation of input data for multiple filtering method, particle motion analysis was performed to identify Love and Rayleigh wave component in the wave traces. Segmented records are tapered with proper window on both sides, then radial and tangential components of records were separated.

For the interpretation, 2-D velocity structural models were inverted from dispersion data. In this study, stochastic least-squares technique was adopted (Herrmann, 1984), where error estimates play a role in controlling the convergence of the inversion process.

## 3. Data processing and results

The propagation paths for this study were divided into 5 groups as shown in Fig. 1. We believe dispersion curves reflecting average velocity structure between seismic source and receiver. For the Love waves dispersion curves, average curve of group A ranged with 2.8-4.0 km/s is found to be 6 to 11 per cent faster than the other 3 groups. Like the Love wave, group velocity of the Rayleigh waves for group A is also higher than the others. In addition, average Rayleigh wave curve of group B is somewhat higher than those of groups C and D. On the other hand, there is no notable difference between group C and D in both Love and Rayleigh wave. Paths of group A traveled most of its path through the East Sea and paths of group B are also sampling the East Sea by some part of their paths. In contrast, group C and D passing the East China Sea, south of the Korea peninsula, show lower group velocity of Love and Rayleigh wave than paths passing the East Sea. In summary, we have been able to roughly divide the study area as the East Sea region and the East China Sea region by means of average group velocity dispersion and relative arrival of Love and Rayleigh wave particle motions. For the East Sea region, northern part of the East Sea, belong to group A with latitude higher than 38°, has higher group velocity than southern part of the East Sea. These differences of group velocities and dispersion characteristics of surface wave are mainly referred to the different shear velocity structure in the area.

Stochastic inverse process was applied to investigate 2-D velocity structures between sources and receiver. Anisotropy in the crust and upper mantle leads to very few simultaneous inversions of Love and Rayleigh waves that converge to similar velocity structures; therefore only Rayleigh waves were used to determine the structure of the studied areas. Averaged Rayleigh wave dispersion curves of each group are used as input data. Initial starting model consists of 24 layers with the P-wave, shear velocity, density are assigned in each 5km layers. For the inversion, a damping factor was chosen to keep the inversion result stable. Under the consideration of the trade-off between resolution and damping value, deduced models are reached with maximum convergence under 5 iteration.

The deduced velocity models for the region A and B show quite similar trend down to 30 km. On the other hand, Region C, D and E show similar trend down to 70 km depth. For the region A, velocity model below 30 Km matches quite well with the initial model and maximum velocity appears between 50 to 60 km. Considering our the longest period (40sec) corresponds to wavelength of approximately 140 km. The crust obtained from the inversion shows three layers with a low velocity layer with shear velocity about 2.8 km/sec, a middle layer of approximately 15 km with a mean shear wave velocity of 3.8 km/sec and lower layer with average velocity of 4.3 km/sec. For the region B, a low velocity zone appears between 30 and 40 km depth and velocity increase steadily and reach the maximum depth about 70 km. For region C, a middle layer about 15 km thick with mean velocity of 3.6 km/sec and a low velocity layer appears about 20 km thick and increases the velocity down to 90 km. For region D, a middle layer about 15 km thick with mean velocity of 3.6 km/sec and increases the velocity downward and reaches the maximum at depth about 60 km. For region E, a middle layer about 15 km thick with mean velocity a low velocity layer appears about 20 km thick and increase the velocity down to 90 km.

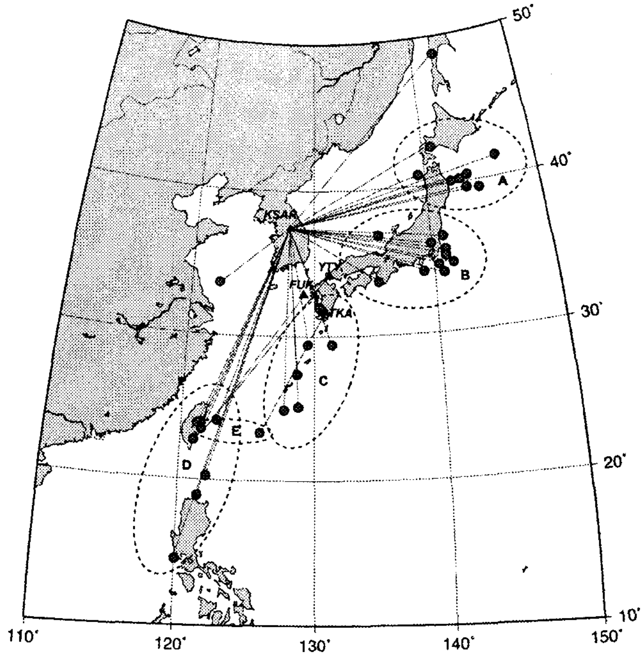


Fig. 1. Geographic distribution of earthquakes and stations.

## 4. References

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**주요어 : surface wave, dispersion curve, inversion**

1) 한국지질자원연구원 탐사개발연구부 지진연구센터

2) 연세대학교 지구시스템과학과