

Experimental Study on Fundamental Characteristics of Long-Period Microtremors

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Abstract

Microtremors in a period range from 1 to 5 sec, the so-called long-period microtremors, have been studied for elucidating characteristics of the vibration, propagation and source as well, in order to open the appropriate way for the application to the earthquake-related fields. The observational studies have been carried out in Hachinohe, Aomori and Miyako cities in the Tohoku district, Japan, since 1973.

Long-continued observations at several selected sites with different geological soil conditions from the outcrop of basemental rock to deep soil deposit had been conducted by use of a newly developed instrument system, and through the spectral analysis the general characteristics of the long-period microtremors was examined in relation with the site geological condition. It is ascertained that the observed predominant periods of the microtremors under consideration reflect well the deep soil conditions underneath the observation site is very stable regardless of times and seems to have a proper value.

The strong motion records in Hachinohe and Aomori cities at the Tokachi-oki earthquake of 1968 have large accelerations in the period range from 2 to 3 sec. The long-period microtremors, observed at accelerograph sites in Hachinohe and Aomori where the bedrock is located as deep as several hundreds of meters, show a predominancy in the same long period range. This suggests that the microtremors observation take a role of a good alternative for estimating the strong motion characteristic, and provides an application to the earthquake engineering.

Propagation characters as well as wave type was intensively investigated by means of the temporary array observations. The results from these observations are: (i) The long-period microtremors are interpreted as an ensemble of dispersive Rayleigh and Love waves; (ii) The propagation direction of the long-period microtremors is, though slightly time variant, decisive and mainly from an open sea. The calculated periods at which surface waves dominate in relation with a given structural model agree well with the observed predominant periods of the microtremors.

From the simultaneous observation of the long-period microtremors and sea waves it is conformed that the periods of the microtremors are nearly equal to one-half of those of sea waves. This is nothing but an experimental evidence of Longuet-Higgins' theoretical result obtained by assuming that the microtremors are produced by an energy transformation from sea waves.

1. Introduction

Microtremors and microseisms with period from 1 to 20 sec have been observed since the nineteenth century. The character of these waves is different from that of seismic waves caused by natural and artificial earthquakes. In general, these waves with periods shorter

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