1-TO 5-SEC MICROTREMORS AND THEIR APPLICATION FOR ELUCIDATING NATURES OF STRONG GROUND MOTIONS

by

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An investigation of long-period ground motions by means of 1-5 sec microtremors is reported. At the Tokachi-oki earthquake of 1968 (M=7.9), in Hachinohe and Aomori of which epicentral distances are about 200 km, very large amplitudes in 2-3 sec period range appeared on the strong motion records of SMAC type accelerographs. In Miyako, though almost the same distance, there were no significant amplitudes in long-periods. To understand whether these differences are from source or site effects is very important for estimating input earthquake motions to high-rise buildings and large-scale structures. A long-period microtremors observation was introduced as a new technique to pursue this difficult problem.

Observations of the long-period microtremors were carried out in Hachinohe, Aomori and Miyako cities. A specially designed instrument was employed so that microtremors with periods ranging from 0.5 to 6 sec can be observed. In each city an observation line (5 to 10 km) was chosen so as to traverse the SMAC site, along which a comparative observation was made at several points while paying attention to extract the natures of microtremors to subsoil conditions. In Hachinohe it was found that there is a very systematic change of spectrum peaks along the line. The shortest period was 0.7 sec at the closest point to the outcrop of the bedrock and the longest one was 3.5 sec at the point with deep soil deposits, which were explained by the well-known law of quarter wave length of S-wave. The depth to the bedrock at the SMAC site is about 400 m and the expected predominant period, 2.5 sec, agreed with that of microtremors. This suggests with much possibility that the 2.5 sec conspicuous peak in the strong motion spectrum is essentially caused by the subsoils at the site. In Aomori the similar observation was carried out. This disclosed that the periods change clearly from point to point along the line, like in Hachinohe, and the predominant period at the SMAC site was 3 sec. The concordance of the predominant periods between the strong motion and microtremors was again recognized. In Miyako a simultaneous observation was done at the SMAC site and several points on the outcrop. The obtained spectra were very alike regardless of points. This means that in long periods there was no much site effect on the strong motion record in Miyako. Later it was estimated the thickness of soil is at most 10 m.

By the observation of long-period microtremors in the mentioned SMAC sites it was derived that the long-period microtremors and strong earthquake motions show good correspondences both in presence of predominancy and in predominant period. Thus we conclude that the systematic observation of long-period microtremors brings us much knowledge about deeper soil conditions through which the amplification characteristics of long-period strong motions in future earthquakes can be estimated.

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