

Monitoring of underground sound and vibration concurrent with seismic motions

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It was reported that many people heard sounds from the ground just before the Kobe earthquake of January 1995. Further, it was known among seismologists as well as people living there that a sound from the ground is sometimes audible concurrent with earthquakes in Tsukuba area where our Institute is located. With this background, we initiated an observation of the sound and seismic motion using a monitoring system developed to detect possible signals from an imminent earthquake in collaboration with the geo-current monitoring group in the Institute for earthquake prediction.

Introduced here is a system for monitoring the signals in groundwater by a hydrophone set 50 m beneath the ground as well as seismic motions. Through observations of these sounds and vibration, the hydrophone system was found to be able to detect very small signals of possible earthquakes that occurred near the observatory or very distant medium-class earthquakes even in an area where background vibrations are not small. This feature of the hydrophone records might be attributed to low permeability of the soil and incompressibility of the water for arriving tremors particularly longitudinal waves. This perhaps enabled the hydrophone to capture medium-scale earthquakes that occurred far away or very small earthquakes near the observatory of which the seismometer cannot easily capture where background vibration levels are not small. Spectrogram analyses of the hydrophone signal revealed that the frequency components up to and possibly above 100 Hz were included for earthquakes that occurred nearly below the observatory.