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海域観測への適用に向けた新たな水晶振動子加速度計の評価試験
Evaluations of a new resonant quartz-based accelerometer for oceanographic installations

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Earthquake and its related phenomenon have a broad range of frequencies and magnitudes. A lot of studies show that it is very useful to catch motions broadly with frequencies as much as possible, and it is essentially important for seismometer so as not to clip the record even when strong oscillation comes. One of the solutions is multi-sensor system. It requires, however, lots of resources such as electric power and special size. Considering the many limitations in marine environments, compact system is preferable. For the purpose of implementation of broad band seismic and geodetic observation easily in marine region, we have been evaluating a new type accelerometer, which is an application of resonant crystal transducers. The sensor has several features such as small size, low power, shock protection, and a suitable temperature range for oceanographic installations. The range of full scale is +/- 2g, so it is also relatively robust for strong motions. In addition to above, we have been evaluating several issues in a vault of Nokogiriyama Geophysical Observatory of Earthquake Research Institute, the University of Tokyo. In this presentation, we show the test environment and the results, and discuss the possibility of oceanographic installations. The records we have obtained look reasonable as compared with other seismometers in the vault. The frequency responses of the new sensor judged from power spectral density is better than that of conventional accelerometers used in marine regions both in high frequency (1 Hz - 10 Hz) and long period (10 s -). Long-period waves can clearly be seen during reasonable time after earthquakes, and the lowest self noise level near 10 s is about -140 dB. The curve between 10 s and 500 s on frequency versus acceleration spectrum density follows an 1/f slope. It means that the new sensor may work as not only a broadband seismometer which can record various events such as local earthquake, teleseismic events and slow slips but also a gravitometer, which can be used for the sensor of mass changes. The earth tide should be recorded in the sensor if we used it as a gravitometer. However, the earth tide could be seen from the record only after processing, and the periods what the tide can be seen are limited. We are considering two points, which are the clock system and the thermal condition, to improve the measurement system for obtaining more accurate long-period data. As of present, some improvements are required for gravitometric use, while we think it works well as a seismometer which could be mounted in various types such as cabled system, AUV and pop-up system.

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