Development of seafloor displacement monitoring system during methane hydrate productions

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In order to monitor the seafloor stability during methane hydrate productions, it is required to measure seafloor displacement continuously. In the case of onshore landslide site, ground displacement monitoring of the landslide movement is usually done by such instruments as the slide sensors. These instruments measure the relative displacements between a fixed point and measuring points in the landslide mass. However, those can not be used for displacement monitoring at the seafloor where it is difficult to set a fixed reference point.

In this study, we proposed a new method to monitor the seafloor displacement by using a 3-component servo-accelerometer system. The basic concept of the proposed method is to calculate displacements from the double integrals of acceleration waveform records. Theoretically, velocity waveform is obtained by single integral of acceleration waveform, and displacement is obtained by double integrals of acceleration waveform. One of the most important points for the data processing is to reduce noises, especially long period trends, which produce much error in the integral calculations.

In this paper, we will first describe the outline of the prototype monitoring system. Next, the test results of servo-accelerometers and gimbaled mechanism will be explained. Then, we will introduce how to obtain displacement signals from the servo-accelerometer data, including data acquisition system and data processing algorithm. Then, we will demonstrate some results of performance tests for the servo-accelerometer in the laboratory. In addition, we will show a result of a shearing test for a soil sample in the laboratory and a monitored data at an onshore landslide site. Finally, we conclude the results and discuss about applicability of the system and future works.

The authors acknowledge the Engineering Advancement Association of Japan (ENAA) for the support in the development of our initial model. ENAA is a member of the Research Group for Environment Impact. This paper is published with the permission of the Research Consortium for Methane Hydrate Resources in Japan (also known as the MH21 Research Consortium).