Prototype of deep-sea ocean bottom pressure recorder with self-calibration capability using “A-0-A” approach for detection of long-term crustal deformation

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Ocean bottom pressure gauge (OBP) can continuously observe the vertical crustal deformation in the seafloor. However, a nature of long-term drift of pressure sensors causes a serious problem in detection of the long-term crustal deformation. A possible approach to remove the sensor drift on the sea-floor is to use a dead-weight tester as the pressure standard to make in-situ calibration on the seafloor by periodically switching between the ambient pressure and the reference pressure (Sasagawa et al. 2016). Recently, an alternative approach, an “A-0-A” method, using the internal pressure of the instrument housing as the reference pressure was proposed (e.g. Wilcock et al., 2018). We investigated the long-term drift behavior and ability of “A-0-A” method by a laboratory experiment using dead-weight tester as a pressure standard (e.g. Nishimagi et al. AGU fall meeting, 2018). We regard the reading at high applied pressure as ambient pressure point (“A”) and that at atmospheric pressure as zero-point (“0”). Although the residual time series between the “A” and “0”, however, showed small discrepancy, we found drift characteristics of “A” and “0” are basically similar to each other.

Based on these laboratory experiment results, we have started to develop a proto-type of ocean bottom pressure recorder with self-calibration capability using “A-0-A” approach for deep-water (up to 7,000 m) deployment. We install all the equipments including a pressure sensor in a 17-in glass sphere. To measure both of the internal and external (water) pressure by a single sensor, we adopt 3-way a ball valve controlled by an electric actuator in front of the sensor, as in the previous self-calibrating system using a dead-weight tester. The actuator is operated by the microcomputer to switch by arbitrary interval. We also install alternative barometer to compare the internal pressure value recorded by the pressure sensor. The development is still under way, and we will show more detail characteristic of the prototype system and its potential abilites.

