Mobile pressure calibrator for ocean bottom pressure gauge of the DONET, Part1: Development of the pressure measurement unit

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We have developed a mobile calibration device for an ocean bottom pressure gauge. Since vertical seafloor displacements result in changes in water pressure, precise pressure measurement on the seafloor has been a key to understand geophysical phenomena such as occurrence of large interplate earthquakes. A simulation of earthquake cycles in the Tonankai distinct, Japan, showed long-term uplift at a rate of about 1 hPa/year (i.e., = 1cm seawater height/year) as a result of pre-seismic slip immediately above the rupture area at depth ~2000 m. However a pressure sensor has inherent instrumental drift at a maximum rate of 10 hPa/year. Therefore we need to calibrate each pressure sensor absolutely on the seafloor to detect crustal deformations. The mobile pressure calibrator is composed of a pressure measurement unit and a level adjusting unit. The pressure measurement unit has quartz pressure sensors (Paroscientific Inc. 410K). We laboratory evaluated dependencies of temperature and pressure condition of quartz pressure gauge assuming a transport condition between laboratory and seafloor. Based on the results, we have developed the pressure measurement unit with high accuracy on the seafloor condition. In order to adjust a level with the ocean bottom pressure gauge, the pressure measurement unit is combined with the level adjusting unit whose adjustment accuracy is 1 mm. The system enables us to calibrate the ocean bottom pressure gauge at accuracy of less than 1 hPa. We have plan to calibrate the DONET pressure sensors over 5 years. In March, 2018, a first calibration of the DONET pressure sensor is performed. In the presentation, we show initial results of the calibrations, and discuss about the possibility to detect crustal deformation in the Nankai trough seismogenic zone.

Keywords: Mobile pressure calibrator, crustal deformation, pressure sensor, seismogenic zone, Nankai trough

