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New method for in situ testing of ocean-bottom observatory sensors

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Nowadays deep-water measurements are actively applied for early tsunami warning and monitoring earthquakes and long gravity waves in the ocean. Advanced ocean-bottom observatory (e.g. DONET) is usually equipped with an accelerometer (ocean bottom seismometer - OBS), and a tsunameter (pressure gauge - PG) situated at practically the same point. Sensors (PG, OBS) are normally exploited for many years. In order to make sure a sensor provide accurate measurements of a physical value it is useful to periodically calibrate sensor. Since the sensors are located at depth of a few thousand meters, their replacement is not only a rather complex technical problem but also a very expensive procedure. We suggest alternate method for in situ testing the calibration precision of PG and OBS sensors. The testing can be performed after each rather strong seismic event recorded by the couple of sensors: PG and OBS. The method is based on the relationship between pressure variations at the ocean bottom and the acceleration of its motion that was revealed and theoretically explained in our recent study [1]. It was shown that the relationship $p = a_z\overline{P}/g$ is valid within the frequency range $f_g < f < f_{ac}$, where $f_g = 0.366\sqrt{g/H}$ and $f_{ac} = c/4H$, g is the gravity acceleration and c is the speed of sound in water, H is the ocean depth, a_z is the vertical acceleration component of the ocean bottom's motion, p is pressure variations, $\overline{P}$ is the average value of the total pressure. The method consists in calculating of the ratio of power spectra of time-series of pressure variations p and vertical acceleration a_z. Within the frequency range $f_g < f < f_{ac}$ this ratio have to exhibit a constant value of $\overline{P}/g$. Otherwise the calibration of at least one of the sensors is incorrect. In our presentation, we shall demonstrate application of the method taking DONET-1 dataset recorded during the 2011 Tohoku-oki earthquake as example. Also the main restrictions of the method will be described.

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References

[1] Nosov, M., Karpov, V., Kolesov, S., Sementsov, K., Matsumoto, H., Kaneda, Y. (2018). Relationship between pressure variations at the ocean bottom and the acceleration of its motion during a submarine earthquake. Earth, Planets and Space, 70(1), 100