Attempt of early tsunami detection using tsunami induced magnetic field

--- For tsunami disaster prevention of coastal facilities ---

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Observations have already proved that tsunamis generate magnetic fields. This phenomenon is theoretically explained by the fact that an induced current flows in seawater due to the Faraday effect between the tsunami and the earth's magnetic field, and a secondary induced magnetic field is generated. In addition, examples of observations from land have been reported. We are working on research on early detection of tsunami using geomagnetic field measurement for that contributes to tsunami disaster prevention and mitigation at Hamaoka Nuclear Power Station of Chubu Electric Power Co., Ltd. located in Shizuoka Prefecture, and installed a magnetometer on the premises in 2020. Test observations were carried out for about one year. The advantages of this observation method are (1) that the tsunami can be detected about 10 minutes earlier than the arrival time of the tsunami at the coast, and (2) that it can be sufficiently observed with one inexpensive and compact magnetic force observation device. Therefore, this method may be cost-effective. Prior to the test observation, in order to estimate the scale of the tsunami-induced magnetic field that can be observed, a numerical simulation of the tsunami-induced magnetic field due to the tsunami caused by the 2011 off the Pacific coast of Tohoku Earthquake and the Nankai megathrust earthquake tsunami were performed. The results of the simulation showed that a tsunami-induced magnetic field of about 8 nT may be observed at Hamaoka power station about 10 minutes before the arrival of the tsunami. During the test observation period from December 2019 to December 2020, no tsunami-induced magnetic field could be observed because there was no tsunami in the vicinity. However, the magnetic noise from the Tokaido Line (of the DC train), which is a serious noise source near the observation point, was measured and evaluated. From the results of the survey and examination, it was considered that tsunami detection at the observation point is possible by using some simple noise reduction. In this presentation, we will introduce the simulation results, the obtained magnetic field observation results, and the arrangement of observation points aimed at practical use.
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