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Contribution of DONET to early tsunami forecasting: Brief review and status report

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DONET, i.e., Dense Ocean-floor Network System for Earthquakes and Tsunamis has started in partly operation since 2010. DONET has been developed for the purpose of not only geophysical scientific use but also mega-thrust earthquake-related disaster mitigation. An observatory of DONET consists of various sensors, such as broadband seismometer, seismic accelerometer, tsunami meter, differential pressure gauge, hydrophone, and thermometer. In the current presentation, we focus on tsunami meters, of which a quartz crystal broadband pressure sensor with thermal compensating is employed. We need to evaluate long term sensor drift and carry out tide assimilation in order to extract tsunami component from the original observation with high accuracy. Before deployment of tsunami meter under the ocean-bottom, we carried out the laboratory experiment, which demonstrated both the constant loading pressure of 20 MPa, i.e., equivalent 2,000 meters deep and the constant temperature of 2 degree C environment for duration of one month. Initial sensor drift could be observed to be 5 to 20 centimetres at the end of the laboratory experiment. After the deployment under the ocean-bottom, we compute tide component based on the series of pressure observation by using harmonic coefficient technique. Thus predicted tide component is subtracted from the pressure observation in real-time. Although a few centimetres low frequency residuals remains, we could observe several tsunamis from the recent far-field earthquakes by DONET tsunami meters. About 20 min earlier tsunami detection prior to the coastal tide gauges could be achieved. Thus DONET now can contribute to effective tsunami observation in SW Japan.

Keywords: tsunami, DONET, quartz pressure gauge, Nankai Trough