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Extraction of Crustal Deformation from Seafloor Hydraulic Pressure Gauges: A trial collaboration study

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It has been well known that megathrust earthquakes such as the 2004 Sumatra-Andaman Earthquake (Mw 9.1) and the 2011 the Pacific Coast of Tohoku Earthquake (Mw 9.0) had devastated the coastal areas in the western of Indonesia and in the north-eastern of Japan, respectively. Some researchers have pointed out that the 2011 Tohoku earthquake may correspond to the recurrence of the 869 Jogan earthquake. In addition, the 887 Nin'na earthquake followed it and ruptured the source regions for both the 1946 Mw 8.1 Nankai and 1944 Mw 7.9 Tonankai earthquakes with probably greater magnitude than the sum of the two earthquakes. These may indicate that megathrust earthquakes like the Nin'na earthquake might occur along the Nankai Trough in the near future.
To mitigate the disaster of those forthcoming megathrust earthquakes, the Japanese government has established seafloor networks of cable-linked observatories around Japan: DONET (Dense Oceanfloor Network system for Earthquakes and Tsunamis along the Nankai Trough) and S-net (Seafloor Observation Network for Earthquakes and Tsunamis along the Japan Trench). The advantage of the cable-linked network is to monitor the propagation process of tsunami and seismic waves as well as seismic activity in real time.
Before the occurrence of such megathrust earthquakes, monitoring of seismically plate coupling is important to evaluate the disaster risk in advance. Recently, owing to the inland networks of highly sensitive seismic broadband seismogram stations, very low-frequency interplate earthquakes (VLFEs) have been observed near the trench. Since VLFE is thought to be located in the shallower and deeper edge of seismogenic segments occurring megathrust earthquakes and be sensitive to small stress change such as Earth tidal modulation due to low stress drop, monitoring the spatiotemporal change of VLFE activity has been expected to detect the strongly plate coupling regions in advance of megathrust earthquake occurrence.
In this study, we propose a new interpretation of seismic plate coupling around the Tonankai region along the Nankai Trough, and discuss how to detect it by using the DONET data effectively. In the future, we have to extract the crustal deformation component by separating other components such as instrumental drift and oceanic changes as an integral study collaborated by seismology, geodesy, physical oceanography, and mechanical engineering.