

Seismological monitoring on the 2003 Tokachi-oki earthquake derived from Off-Kushiro cabled OBSs and land observations

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Japan Marine Science and Technology Center installed a cabled geophysical observatory system off Kushiro, Hokkaido Island in July 1999. This observatory system comprises three ocean bottom seismographs (OBSs), two tsunami gauges, and a geophysical/geochemical monitoring system. Four years and two months after the installation, a megathrust earthquake (the 2003 Tokachi-oki earthquake, Mjma 8.0) occurred just beneath the system. The system recorded clear unsaturated seismograms just at 28.6 km from the epicenter. This paper demonstrates the advantage brought by the cabled observatory to record the megathrust earthquake showing how earthquake detectability is improved dramatically combining permanent OBS and land-based observations around the interesting region, and importance of the in situ monitoring on the seismogenic zone. In the present study, processing OBSs and land-based network together, and comparing magnitudes of common observed earthquakes with national authorized network, event detection level improved down to M 1.5, which is much lower than the previously designed as down to magnitude around 2. Comparing detection level before and after installing OBSs, we found dramatic improvement of the earthquake detection level in the interesting region. Real-time continuous observations of microearthquakes since 1999 have brought us tremendous findings. First, a seismic quiescence started about ten days before the 2003 Tokachi-oki earthquake. Second, aftershock distribution is not uniform over the focal area and can be divided into several sub-regions, which might indicate an existence of several asperities. One of the asperities seems related to the existence of the subducting seamounts after combining the other geophysical facts on the focal area into discussions. We think that the geophysical observations helped to understand the initiation process of the rupture of the 2003 Tokachi-oki earthquake and that observations including seismological, geodynamic, hydrogeological, and the other multidisciplinary observations would provide a clue to future understanding of seismogenic processes at subduction zones.