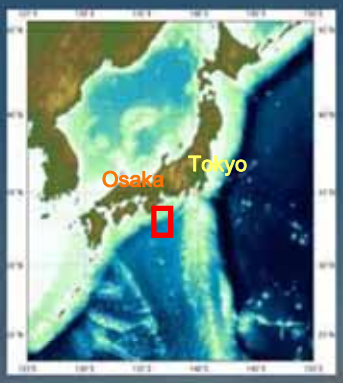
Dense Ocean floor Network system for Earthquakes and Tsunamis [DONET]

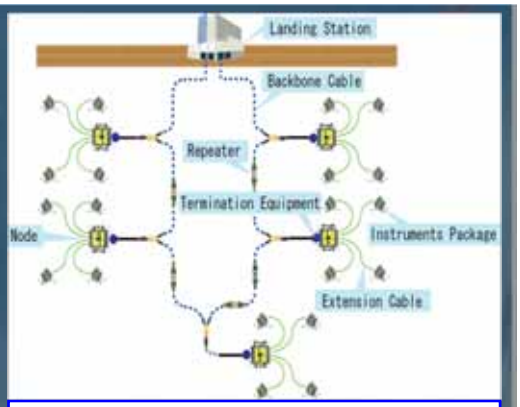


Redundancy:
Equipping redundant configuration on backbone cable and node

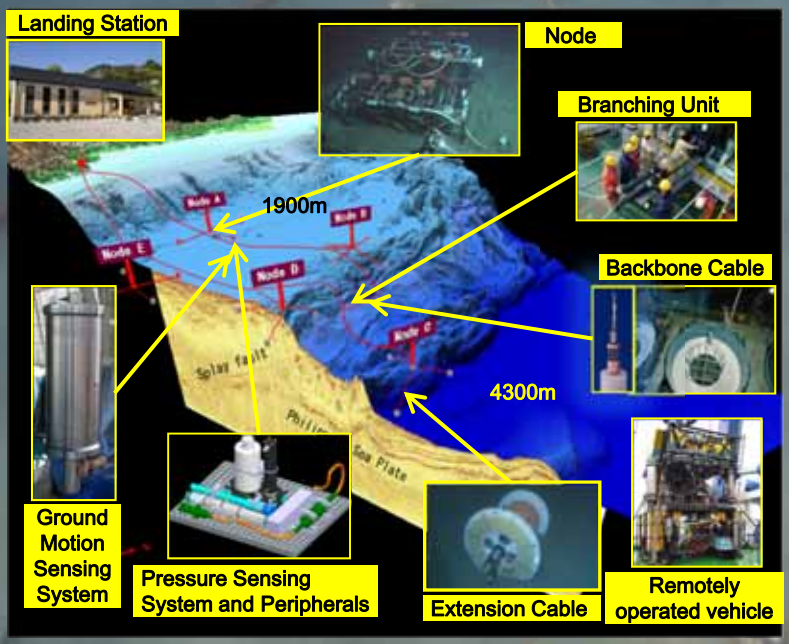
Expandability:
Branching unit enables wide-spread distribution of observation points.
Node plays the role of hub that connects underwater instruments to
the backbone cable system.

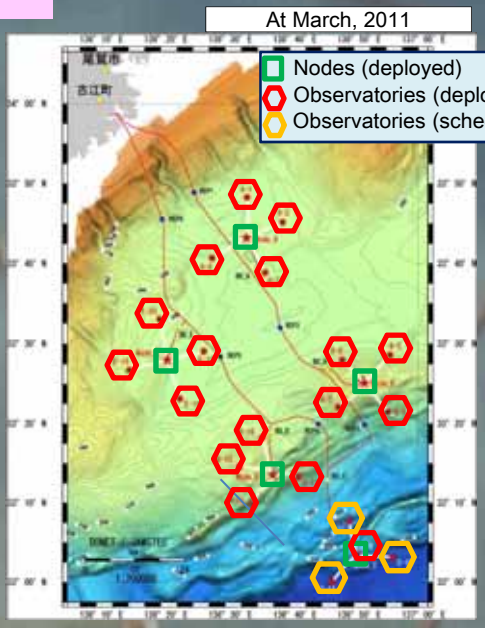
Replaceable function:
Replacing observation unit at the seafloor by using underwater
removable connector

Maintainability:
Operation on the seafloor by using Remotely Operated Vehicle (ROV)



Number of Science Node : 5 Nodes
Number of User Interface : 8 ports / Node
Power Distribution : 30 W / Port
Data Transmission : 50 Mbit / s / Port
Precise Timing Control : < 1μsec





Seventeen observatories are already working. More three observatories will be installed in this July to start full-scale operation.

Data transfer system (DONET)

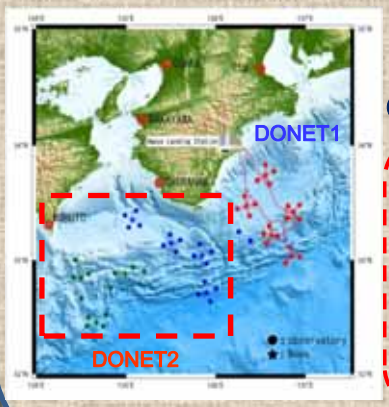
DONET data is open via the Earth LAN network which is a seismological data sharing network in Japan.

DONET Phase 2 (DONET2)

A similar seafloor network system is needed for region off Kii Peninsula and Shikoku to decrease disasters caused by the subduction zone earthquakes in the Nankai Trough. We apply a high voltage system for DONET2 so that the observational area is twice of that of the current DONET.

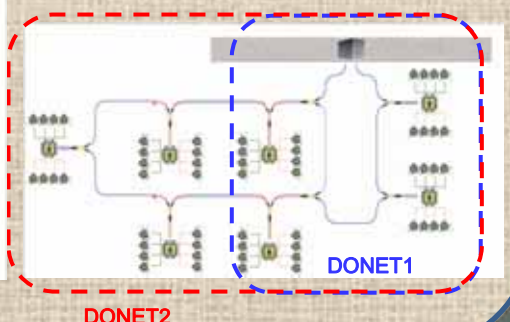
DONET1 — Middle-voltage system (3KV)

DONET2 — High-voltage system (10KV)

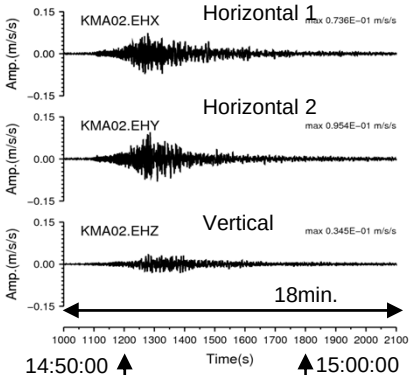


Cable length 300km
+
DONET type NODE 5
(40 ocean floor sites)

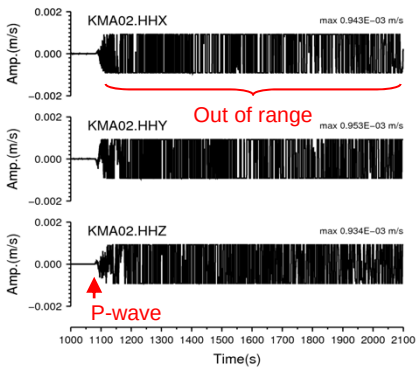
Cable length1000km
+
DONET type NODE over 10
(100 ocean floor sites)



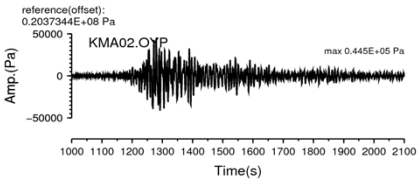
Records of the Tohoku eq. at DONET KMA02 station. [11th, March, 2011]



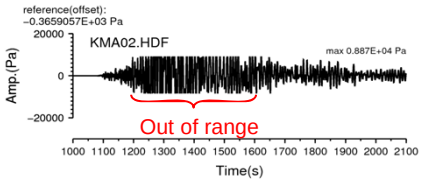
Strong-motion Seismograph



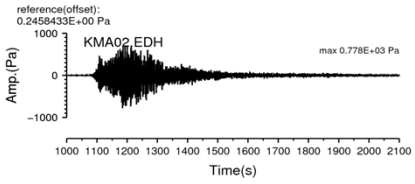
Broad Band Seismograph



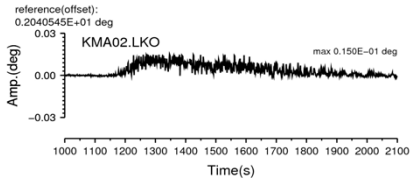
Quartz pressure gauge



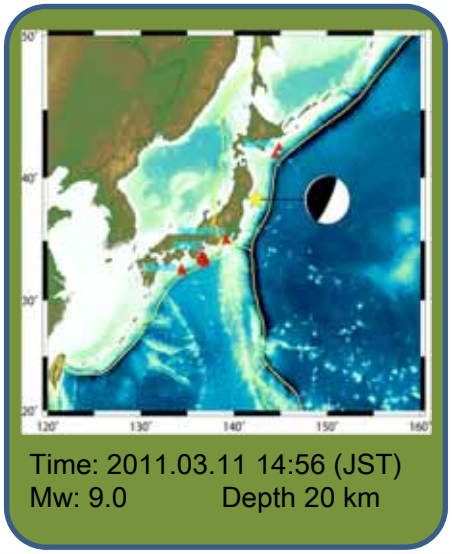
Differential pressure gauge

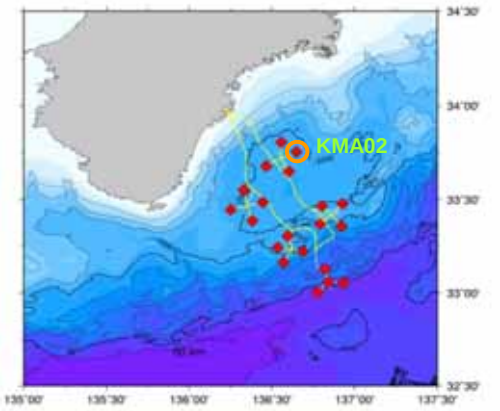


Hydrophone

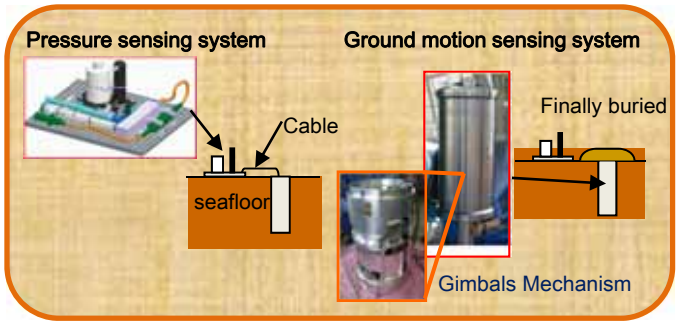


Precision thermometer





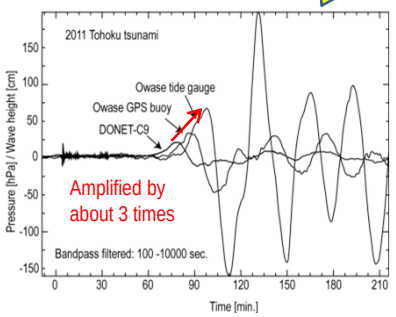
	Sensor	Type	specification
Ground motion sensing system	broadband seismometer	CMG-3T,RH (Guralp Systems)	•standard velocity output band: 120s ~ 50Hz •mass position output band: DC ~ 120s •output sensitivity: 2×750V/m/s •horizontal linearity: 107dB •vertical linearity: 111dB
	strong motion accelerometer	TSA-100S (Metrozet)	•full scale range: ±4g peak to peak •dynamic range: 160dB, at1Hz, in 1Hz bandwidth •offset: < 0.05g •non linearity: < 0.015% total non linearity •hysteresis: < 0.005% FS
	gimbals	E124-1000	•phase-control angle: ±10°
Pressure sensing system	hydrophone	HTI-99-DY (HIGH TECH, INC.)	•expected gain: 30dB •response high: 30kHz •response low: 2Hz •source capacitor: 1.467nF
	pressure gauge	8B7000-2-005 (Paroscientific, Inc.)	•pressure range: 0 ~ 68.95MPa •repeatability: < 0.005%FS •hysteresis: < 0.005%FS
	differencial pressure gauge	MA567000 (Nichiyu co. ltd) : NPH-8-007GH (GE NOVA Sensor)	•pressure range: 7kPa@1psi •linearity: 0.1%FSO @2.5kPa, 0.05%FSO @7kPa •hysteresis & repeatability : 0.05%FSO @2.5kPa, 0.05%FSO @7kPa
	thermometer	MA565-2** (Nichiyu co. ltd)	•temperature rang: -1.0 ~ +10.0°C •resolution: < 1/1000°C •accuracy: < 5/1000°C



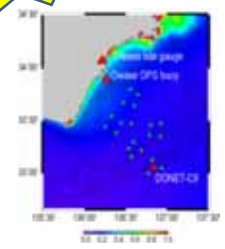
Tsunami site amplification：Comparison of offshore and near-shore tsunami waveforms from the Tohoku earthquake

Near-shore tsunami height
＝ Tsunami amplification factor
✕Offshore height (DONET data)

For improvement of real-time tsunami prediction

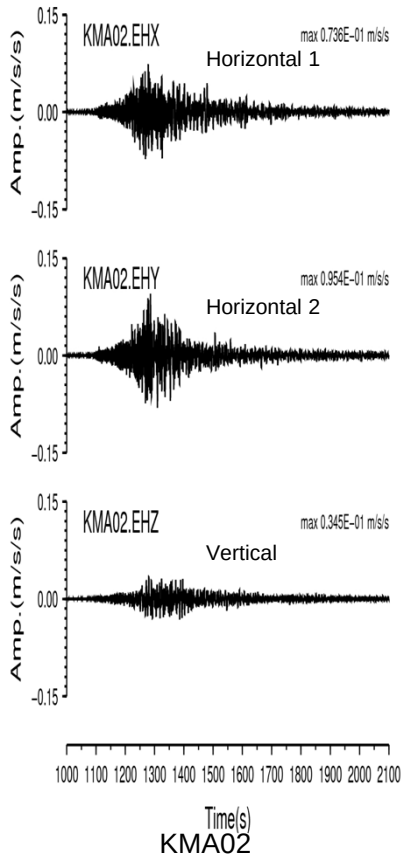


Comparison of tsunami waveforms recorded by DONET-C9, Owase GPS tsunami meter, and Owase tide gauge from the 2011 Tohoku earthquake

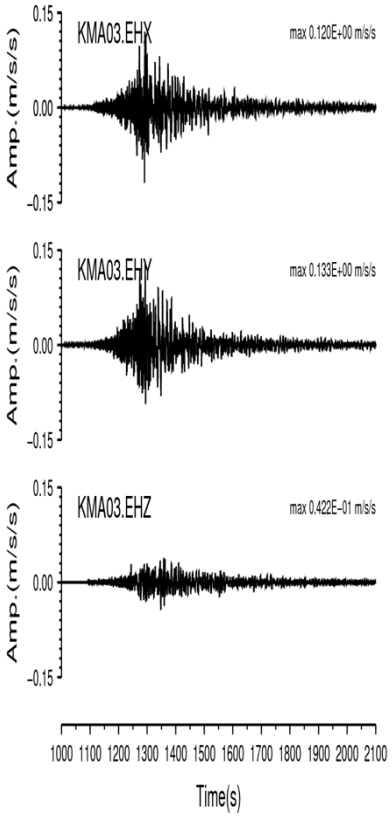


DONET-C09 detected the first tsunami wave of about 20 cm, about 20 minutes earlier than the costal tide gauge at Owase which recorded about 70cm tsunami height during the first wave.

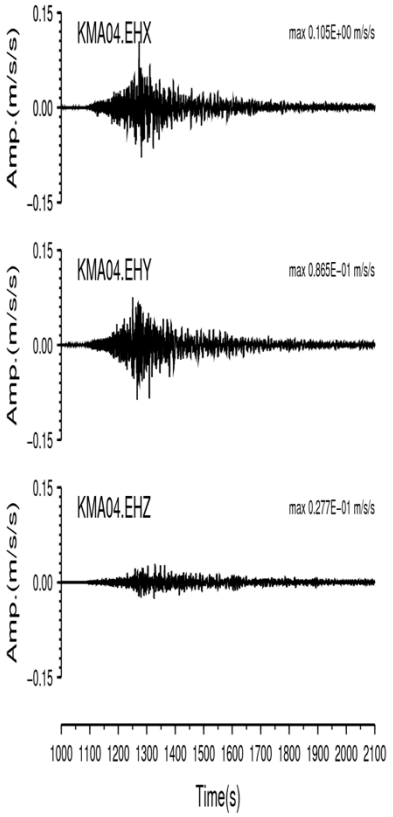
Strong-motion Seismograph records of the Tohoku eq. at DONET stations. [11th, March, 2011]



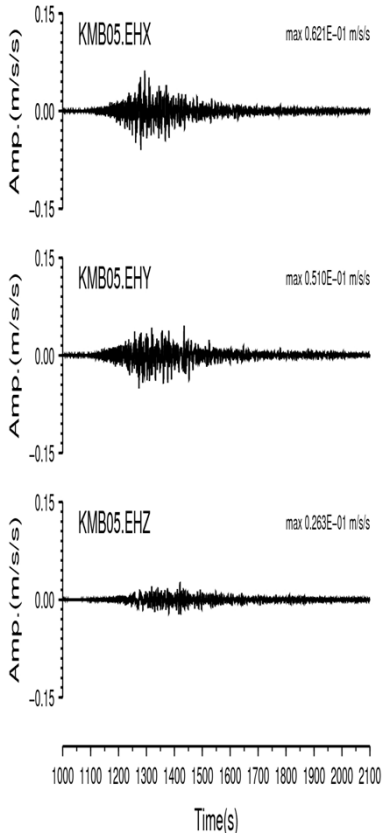
KMA02



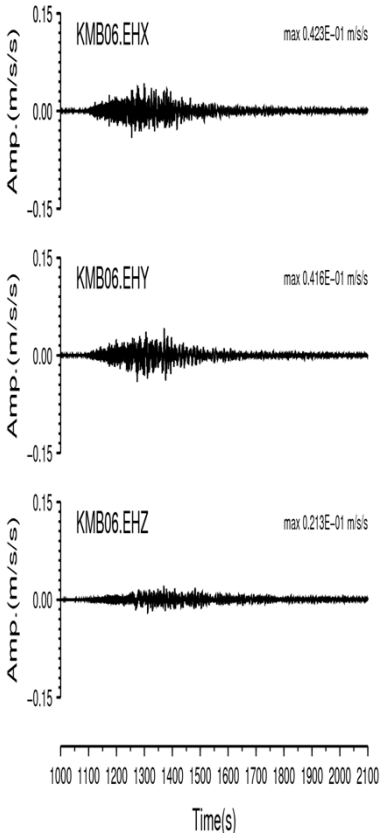
KMA03



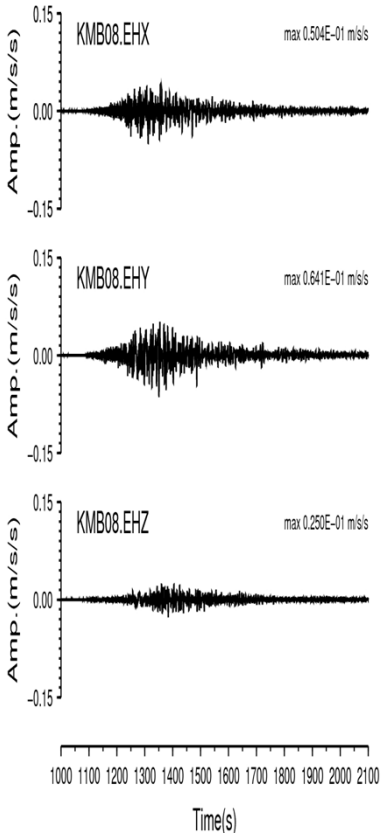
KMA04



KMB05

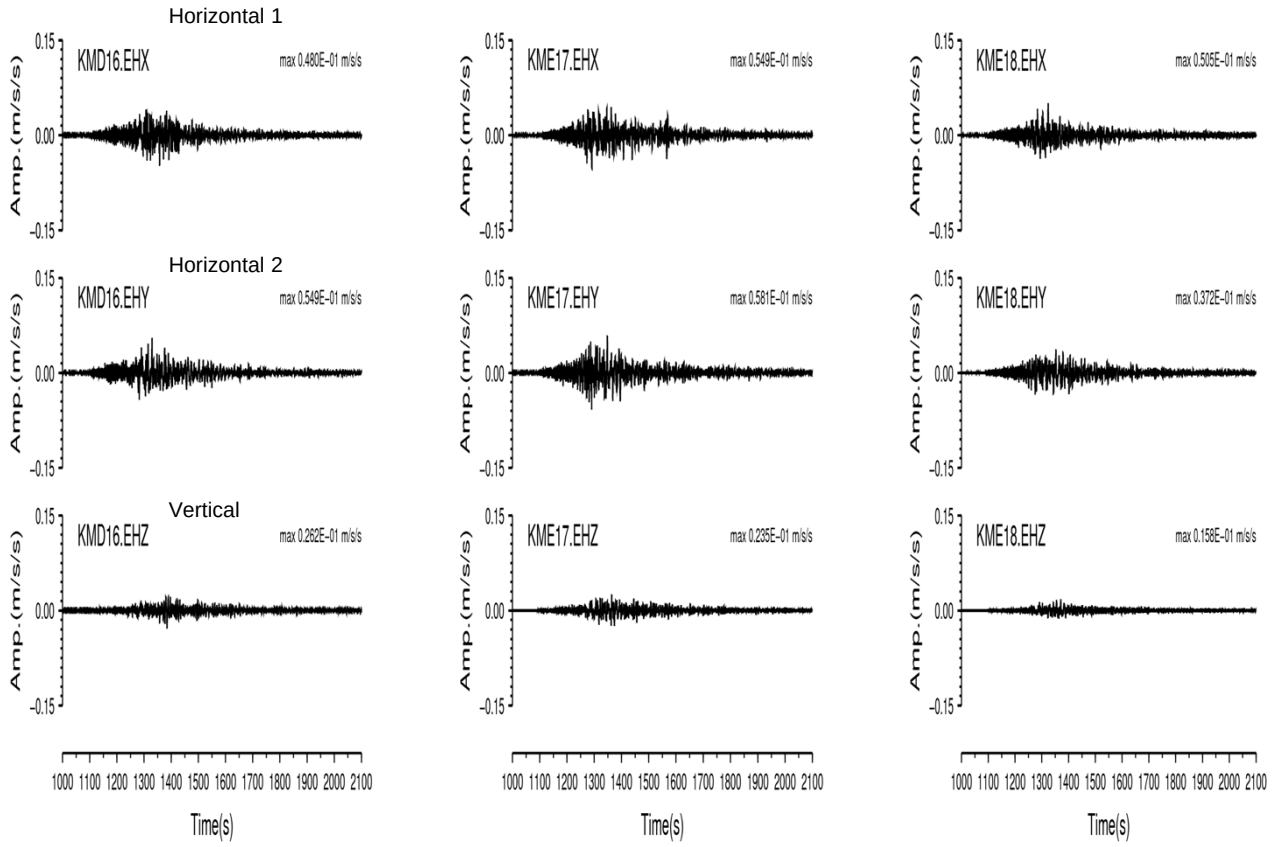


KMB06



KMB08

Strong-motion Seismograph records of the Tohoku eq. at DONET stations. [11th, March, 2011]



KMD16 KME17 KME18

Quartz pressure gauge records of the Tohoku eq. at DONET stations. [11th, March, 2011]