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MIRAI “Cruise Report”

MR16-E02

Array observation of ocean bottom pressure for studing phenomena in the ocean/solid Earth system

Far off east of Torishima Island

Jun.27,2016-Jul.02,2016

Japan Agency for Marine-Earth Science and Technology

(JAMSTEC)

1. Cruise Information

● Cruise ID: MR16-E02

● Name of vessel: MIRAI

● Title of the cruise: Array observation of ocean bottom pressure

● Title of proposal : Array observation of ocean bottom pressure for studying phenomena in the ocean/solid Earth system

● Cruise period: Jun 27, 2016 – Jul 02, 2016

● Ports of departure / call / arrival: Shimizu Port ~ Shimizu Port,

● Research area: Far off east of Torishima Is. (water depth: 4,500m～5,700m）
Area is defined by the following latitudinal and longitudinal ranges.

30°42’ N, 31°30’ N

141°12’ E , 142°18’ E

● Research Map

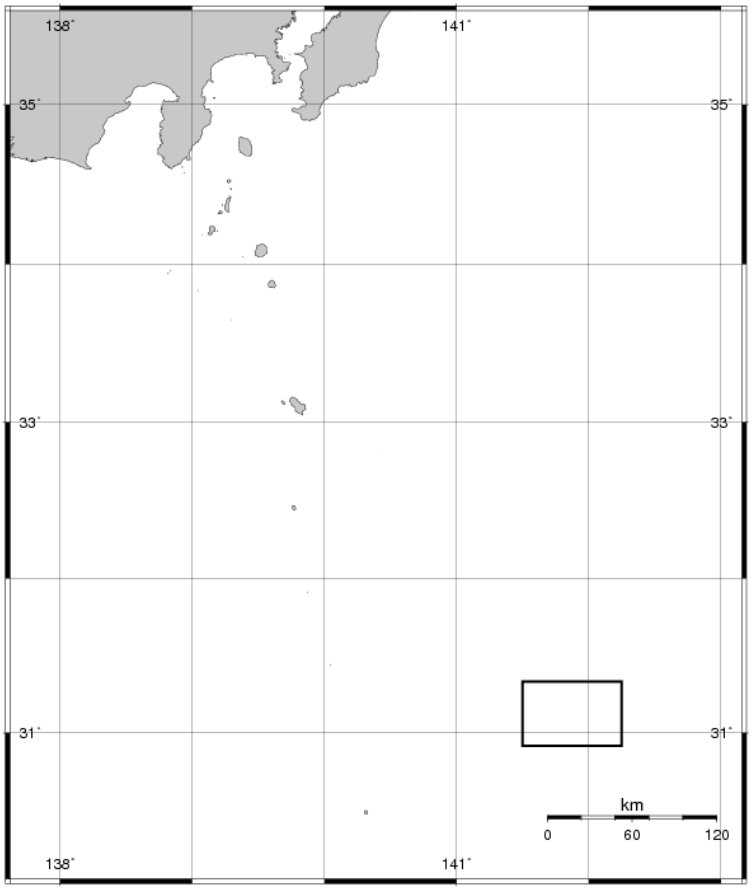


Figure 1. Far off east of Torishima Is. (water depth: 4,500m～5,700m）

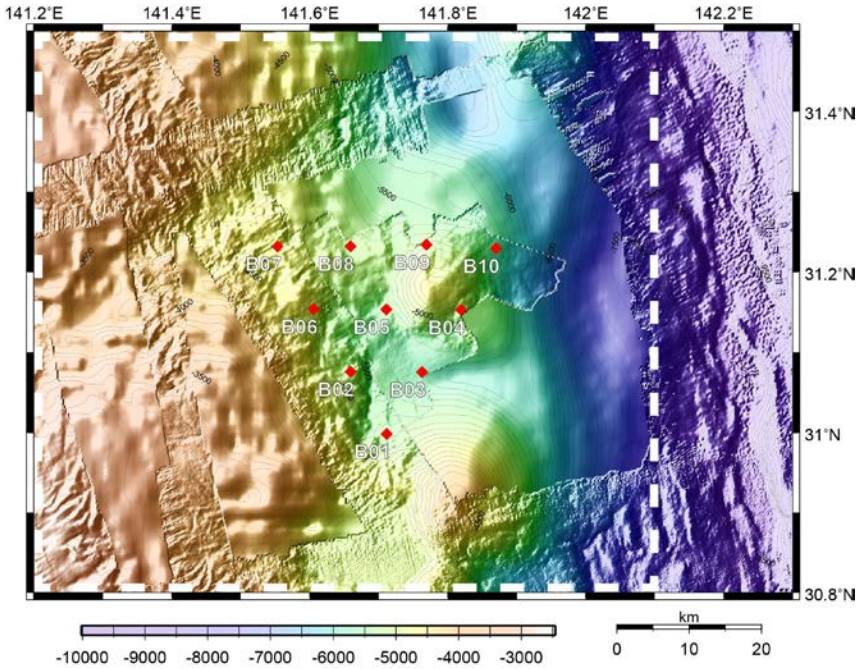


Figure 2. MR16-E02 Study area (Enlarged map)
Dots indicate the observational sites.

2. Researchers

● Chief scientist [Affiliation]: Yoshio Fukao [JAMSTEC]

● Representative of the science party [Affiliation]: Yoshio Fukao [JAMSTEC]

● Science party (List) [Affiliation, assignment etc.]

Yoshio Fukao [JAMSTEC] Representative

Hiroko Sugioka [Kobe Univ.] Vice Representative

Aki Ito [JAMSTEC] Observation

Mikiya Yamashita [JAMSTEC] Observation

Takashi Tonegawa [JAMSTEC] Observation

Hajime Shiobara [Univ. Tokyo] Observation

3. Observation

Purpose:

We make an array observation of ocean bottom pressure towards establishing an observational approach of looking both upward and downward from the seafloor to understand coupling phenomena between the ocean and the solid Earth.

Background:

We developed an array system of high resolution ocean bottom pressure gauges to observe geophysical phenomena occurring above and below the seafloor simultaneously. We deployed this

system to observe, among others, internal tides, ocean infragravity waves and low-frequency earthquakes on the seafloor off east of Aogashima Island for about a year period from May 13, 2014, and far off east of Torishima Island for the next year from the end of May, 2015. The recovery of the instruments from the seafloor off east of Aogashima Is. and the re-installation of them far off east of Torishima Is. were carried out in one cruise. Our 2016 cruise was aimed at final recovery of all the instruments deployed for a year since the end of May, 2015.

Observations

The FY 2016 is the final fiscal year for the project of JSPS KAKENHI Grant Number 25247074 (Yoshio Fukao) based on which we have conducted our surveys.

(1) Recovery of the observational instruments

We recovered all the instruments from sites B07(OBP), B08(OBP), B09(OBP), B10(OBP), B04(OBP), B05(BBOBS+DPG), B06(OBP), B02(OBP), B03(OBP), B01(OBP), where OBP, DPG and BBOBS stand for Ocean Bottom Pressure gauge, Differential Pressure Gauge and BroadBand Ocean Bottom Seismometer, respectively. The data were safely retrieved from all the stations. The internal clock was calibrated against a GPS clock, which was confirmed to be within an error specified by the factory. The position (latitude and longitude) of each site was already measured accurately in the previous survey (YK15-08).

(2) XCTD survey

Right after the recovery of the instrument we made XCTD-casting at each site to obtain the temperature, salinity and conductivity profiles at that site.

(3) Multi narrow beam survey of seafloor topography

We made an extensive multi narrow beam survey of seafloor topography in the study area.

4. Results

(1) Instrumental Recovery

Date	Site	Instrument	Data retrieved	Clock
6/28	B07	OBP	OK	OK
6/28	B08	OBP	OK	OK
6/28	B09	OBP	OK	OK
6/29	B10	OBP	OK	OK
6/29	B04	OBP	OK*	OK
6/29	B05	BBOBS+DPG	OK	OK
6/29	B06	OBP	OK	OK
6/30	B02	OBP	OK	OK
6/30	B03	OBP	OK	OK
6/30	B01	OBP	OK	OK

OK*: OK but with some problem after 3/21, 2016.

Right after the deployment of the ocean bottom instruments (2015, May 30th, 11:23:02UT), a great deep shock (M7.8:USGS) occurred 190km to the northwest of Chichijima Island (27.831N,140.943E；USGS) at an anomalous deep depth of 678km, with an aftershock of M5.1(JMA) that happened 37minutes after the main shock.
http://earthquake.usgs.gov/earthquakes/eventpage/us20002ki3#general summary

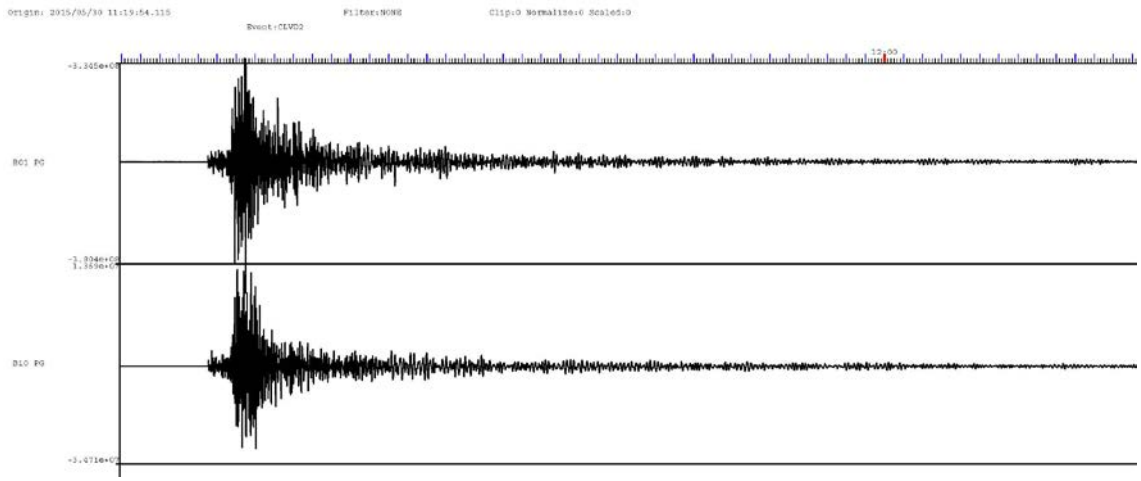


Figure 3. Example OBP records of the super-deep earthquake (B01 and B10)

On the same day (2015, May 30th,18:49:07UT）, an outer-rise earthquake with normal fault mechanism (M6.2, USGS) occurred to the east of the Bonin Trench (30.744N,142.974E,8.7km; USGS).
http://earthquake.usgs.gov/earthquakes/eventpage/us20002kpm#general

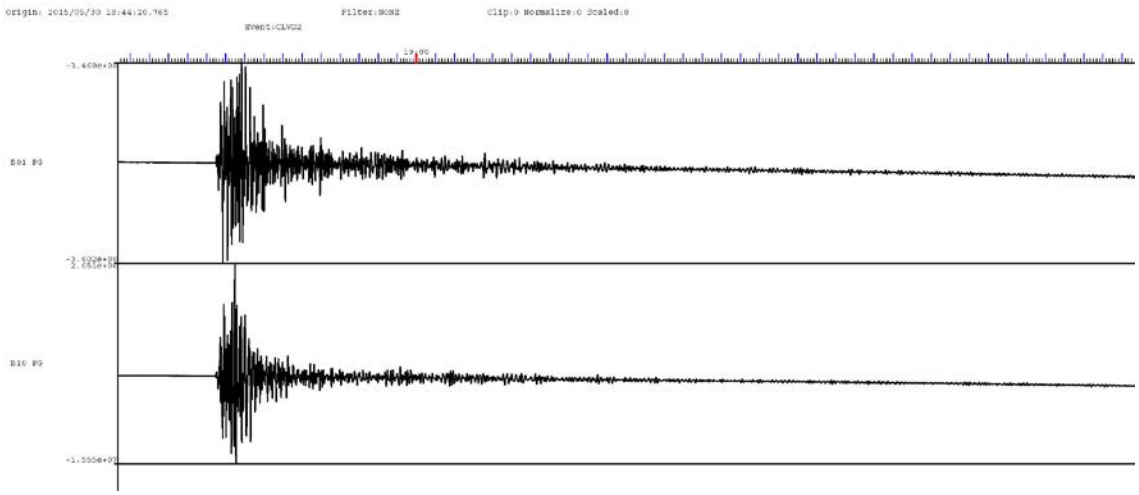
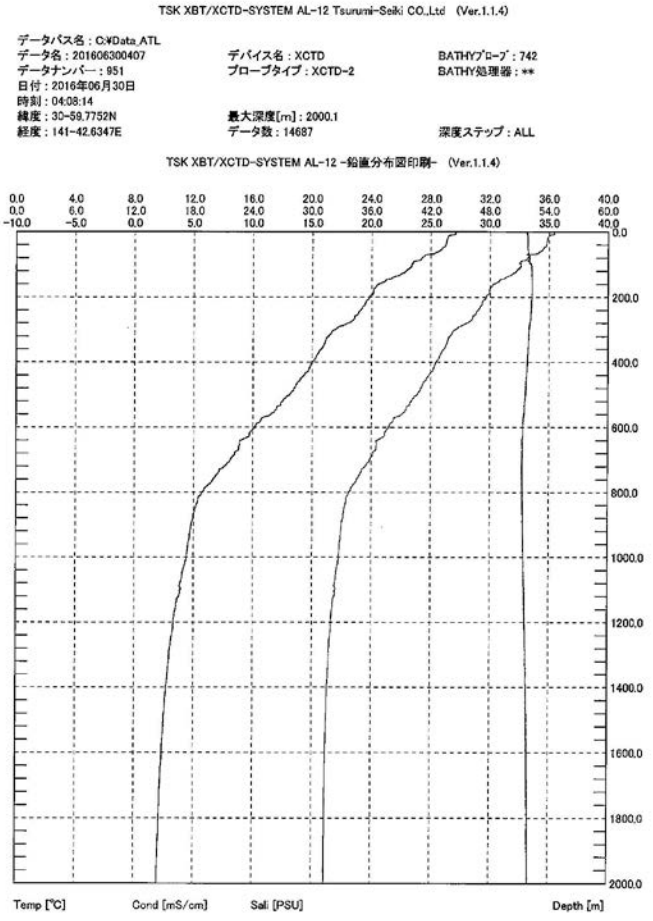


Figure 4. Example OBP records of the outer-rise earthquake (B01 and B10)

(2) XCTD casting

Date	Site	Instrument	Data retrieved
6/28	B07	XCTD	OK
6/28	B08	XCTD	OK
6/28	B09	XCTD	OK
6/29	B10	XCTD	OK
6/29	B04	XCTD	OK (at the 3rd casting)
6/29	B05	XCTD	OK
6/29	B06	XCTD	OK
6/30	B02	XCTD	OK
6/30	B03	XCTD	OK
6/30	B01	XCTD	OK



B01

Figure 5. Example XCTD profile (B01)

(4) Multi narrow beam topographic survey

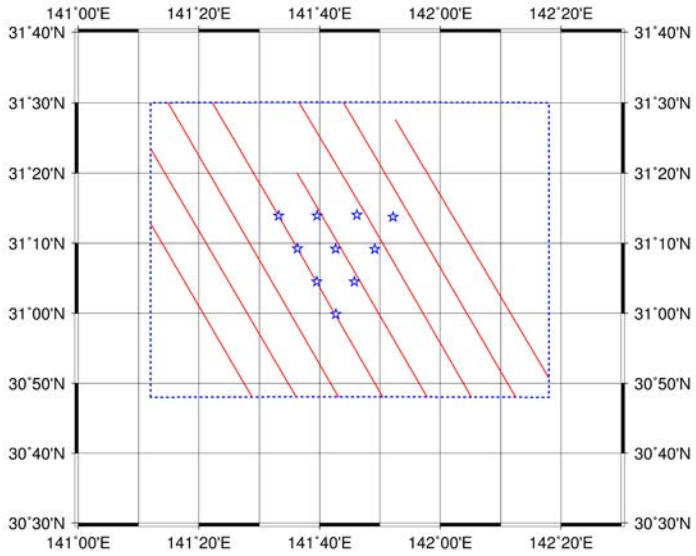


Figure 6. Multi narrow beam survey routes

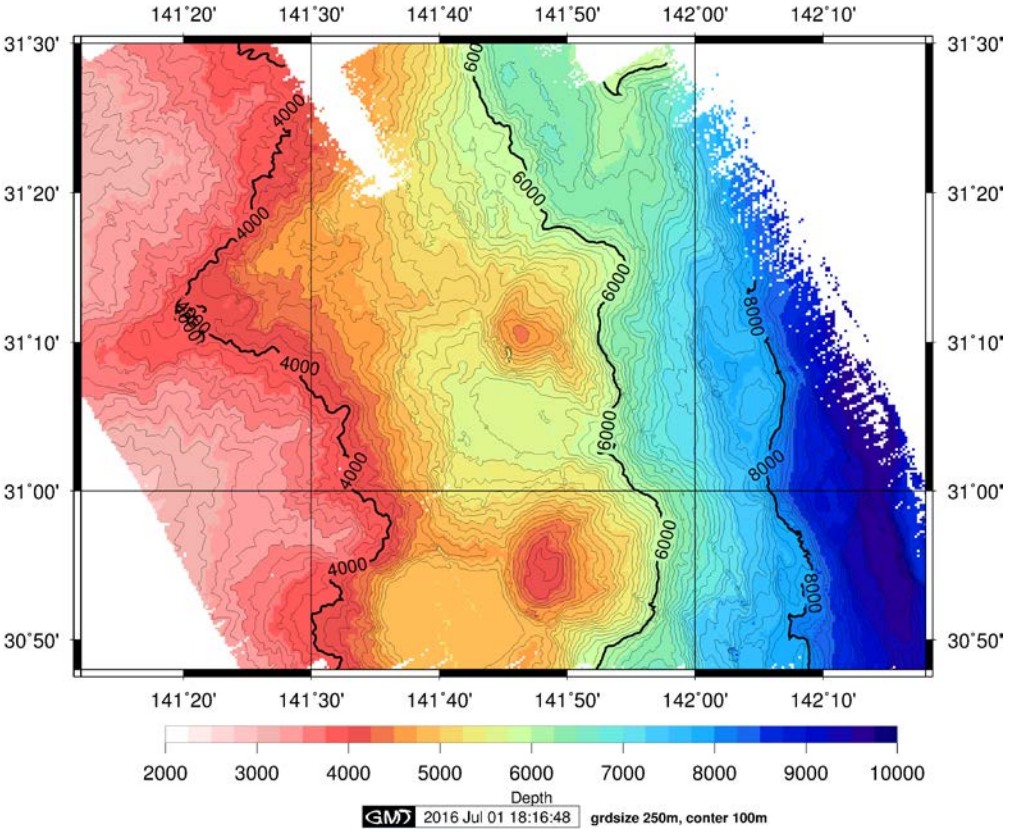


Figure 7. Seafloor topography obtained by multi narrow beam survey

5. Activities: Recovery of emerging instrument by a boat sent from MIRAI

Figure 8a: MIRAI viewed from the boat

Figure 8b: Boat heading to the floating BBOBS

Figure 8c: Ting the floating BBOBS with a rope

Figure 8d: Recovery of the BBOBS by the rope

6. Instruments

Ocean Bottom Pressure gauges (OBP)

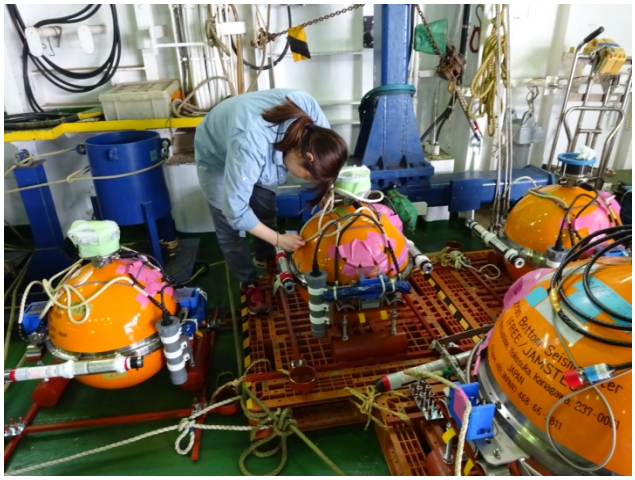


Figure 9. Ocean Bottom Pressure gauges (OBP)

BroadBand Ocean Bottom Seismometer (BBOBS) and Differential Pressure gauge

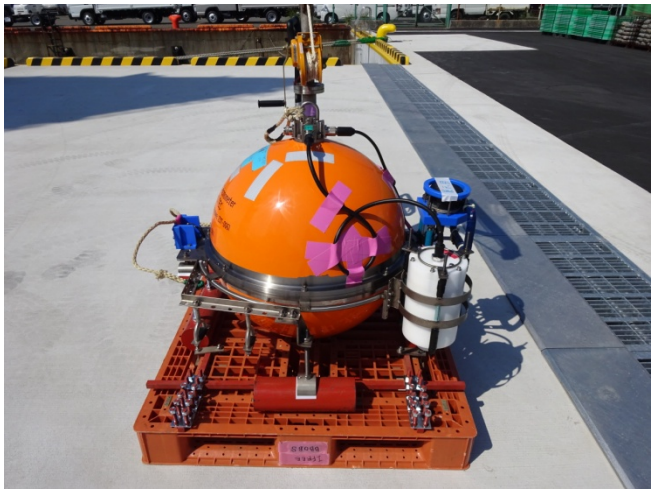


Figure 10. BroadBand Ocean Bottom Seismometer (BBOBS) and Differential Pressure gauge

7. Commemorative photo (June 30th)

Figure11. Commemorative photo (June 30th)

8. Notice on Using

Notice on using: Insert the following notice to users regarding the data and samples obtained.

This cruise report is a preliminary documentation as of the end of the cruise.
This report may not be corrected even if changes on contents (i.e. taxonomic classifications) may be found after its publication. This report may also be changed without notice. Data on this cruise report may be raw or unprocessed. If you are going to use or refer to the data written on this report, please ask the Chief Scientist for latest information.
Users of data or results on this cruise report are requested to submit their results to the Data Management Group of JAMSTEC.