



R/V Kaiyo Cruise Report

KY15-11

Earthquake occurrence history research on the area from trench axis to the continental slope : Detailed bathymetry

Cruise Proposal

“The high accuracy acoustic survey around the trench axis off the Pacific Coast of Tohoku” and Sagami Bay

6 Aug 2015 (Yokosuka) – 11 Aug 2015 (Yokosuka)

Japan Agency for Marine- Earth Science and Technology (JAMSTEC)

Acknowledgements

We would like to thank Captain Mr. Ukekura and all ship crew of R/V KAIYO for their safe cruise. We are grateful to Marine Technician of Marine Work Japan for their support. We are pleased to MARITEC/JAMSTEC staff for their supports during our cruise.

This cruise report is a preliminary documentation as of the end of the cruise.

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KY15-11 Cruise report contents

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1. Objectives and Cruise summary of KY15-11 cruise

Cruise information

Cruise number	KY15-11
Name of the cruise	R/V KAIYO
Chief scientist	Takafumi Kasaya (CEAT, JAMSTEC)
Representative of the Science Party	Shuichi Kodaira (CEAT, JAMSTEC)
Title of the cruise	Earthquake occurrence history research on the area from trench axis to the continental slope : Detailed bathymetry
Cruise period	6 Aug 2015 – 11 Aug 2015
Ports of call	Yokosuka – Yokosuka
Research Area	Off Tohoku area and Sagami Bay (Fig.1)

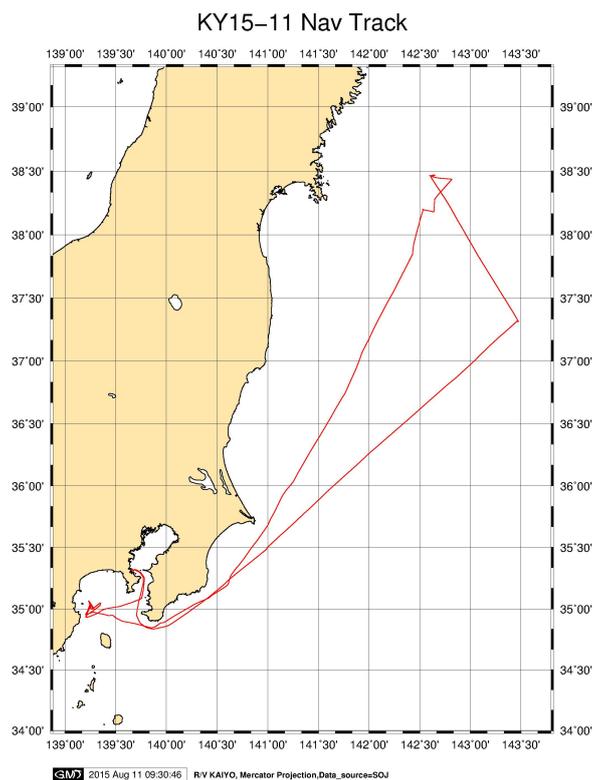


Fig.1 Ship track of this cruise.

Cruise summary

Cruise proposal

” Earthquake occurrence history research on the area from trench axis to the continental slope : Detailed bathymetry”

On 11 March 2011, Tohoku, northeast Japan, experienced a great earthquake (Mw 9.0, Mt 9.1) called the 2011 off the Pacific coast of Tohoku earthquake. Seismic and tsunami inversion analyses have shown that tsunami waves with a maximum run-up height of 38 m were generated after the main shock by topographic changes on the seafloor in the toe region of the Japan Trench slope off Sendai. These inversion analyses and bathymetric surveys (Fujiwara et al., 2011) indicate that the toe region slipped about 50 m along the thrust.

In this cruise, we planned to examine the deep-tow sonar system developed by JAMSTEC supported by the research program investigating many phenomena related with the earthquake and Tsunami of the MEXT, and obtain some acoustic data about the fault and detailed bathymetric data. However, we could only carry out a test towing in Sagami Bay because of the bad weather condition around off Tohoku area through this cruise.

Reference

T. Fujiwara, S. Kodaira, T. No, Y. Kaiho, N. Takahashi, Y. Kaneda, The 2011 Tohoku–Oki earthquake: Displacement reaching the trench axis. *Science* 334, 1240 (2011).

2. List of Science party

Chief scientist

Takafumi KASAYA JAMSTEC

Scientist

Miho Asada JAMSTEC

Takao SAWA JAMSTEC

Technician

Takuji OMURA Clovertech Inc.

3. Observation summary

3.1 Outline of the acoustic sonar deep-tow

New deep tow system with the high accuracy acoustic instrument was designed for the data acquisition of the detailed bathymetry, back scatter image and sub-bottom image in the deep sea. This system consists of a multi beam echo sounder, sidescan sonar and sub-bottom profiler (Fig.3.1), and the maximum operation depth is 6000 meters. The towed body is adjusted with neutral buoyancy using ten 17 inch glass sphere. Therefore, a depressor is needed for the towing operation. Figure 3.2 shows the depressor with 1 ton weight used in this cruise. The optical-electric convertor is also loaded on this depressor.



Fig. 3.1 Developed acoustic deep tow system.

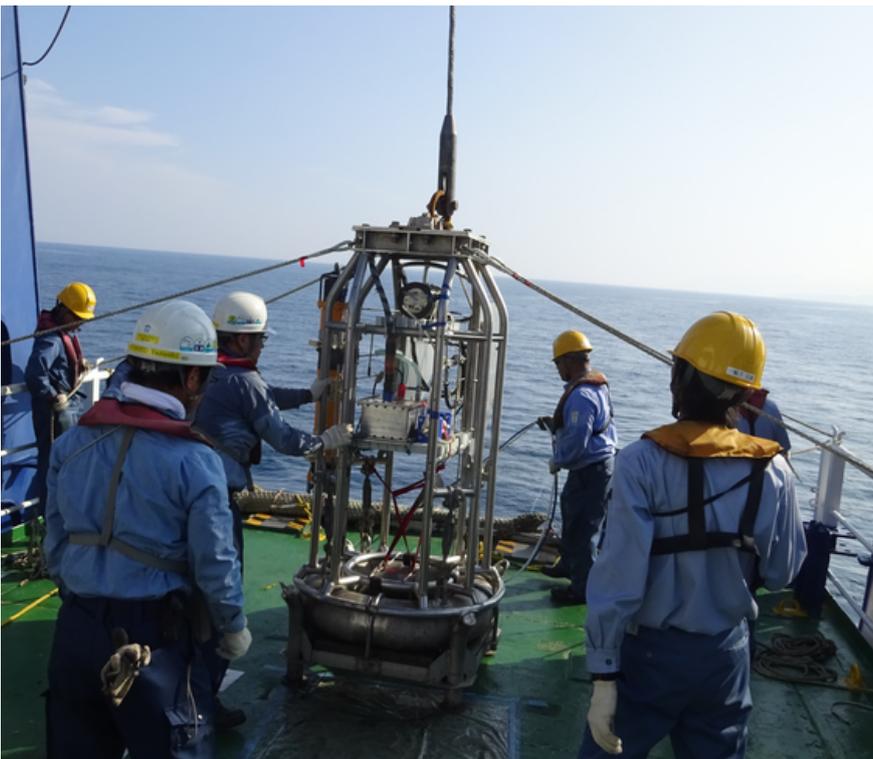


Fig. 3.2 Photo of the depressor with 1 ton weight.

The specifications of sonar system

Multibeam echo sunder

Operating frequency	200 kHz
number of Beams	256 beams @200 kHz
Average Resolution	2° (Along) x 1° (Across)@200 kHz

Sidescan sonar

Operating frequency	120/410 kHz
Signal modulation	Full spectrum chirp frequency modulated pulse
Resolution across track	8 cm @ 120 kHz, 2cm @ 410 kHz
Resolution along track	2.5m @ 120 kHz, 0,5m @ 410 kHz

Sub-bottom profiler

Frequency Output	1-6 KHz
Signal modulation	Full spectrum chirp frequency modulated pulse
Depth Resolution	15-25 cm

3.2 Deep tow dive

In this cruise, we planned to examine the deep-tow sonar system with high accuracy acoustic instruments around off Tohoku area. However, we could only carry out a test towing in Sagami Bay because of the bad weather condition around off Tohoku area through this cruise.

On August 10, we conducted the first dive of this sonar deep-tow 6 km off the Hatsushima Island. First, main sonar deep tow was deployed and the electric cable between deep tow and depressor was extended at a few knots of water. Then, a depressor was deployed using main winch cables (Fig. 3.4) Figure 3.5 shows the dive tracks of the depressor and main deep tow, and we were able to tow two lines at a depth of about 1000 meters. Unfortunately, sonar data could not be obtained because of a trouble of the main control unit.

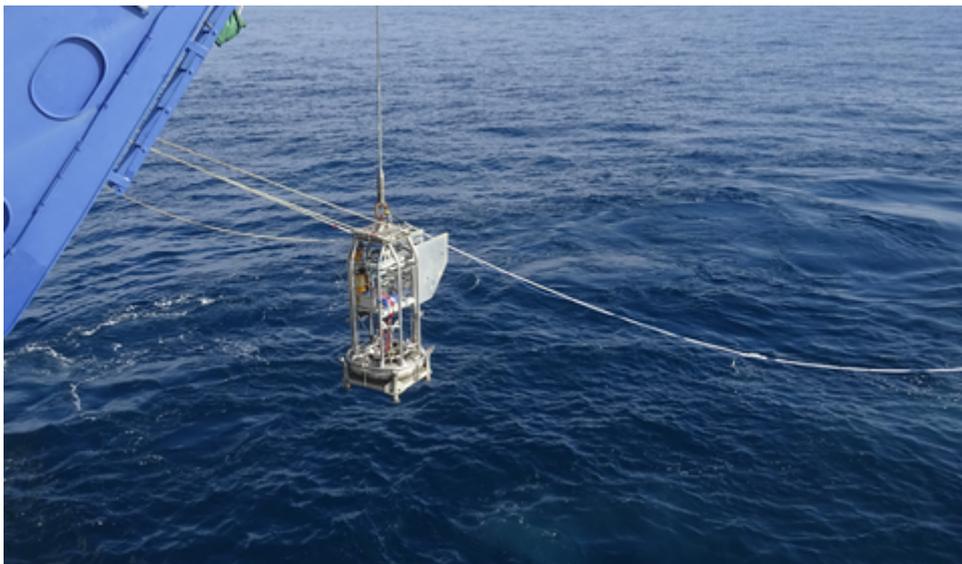
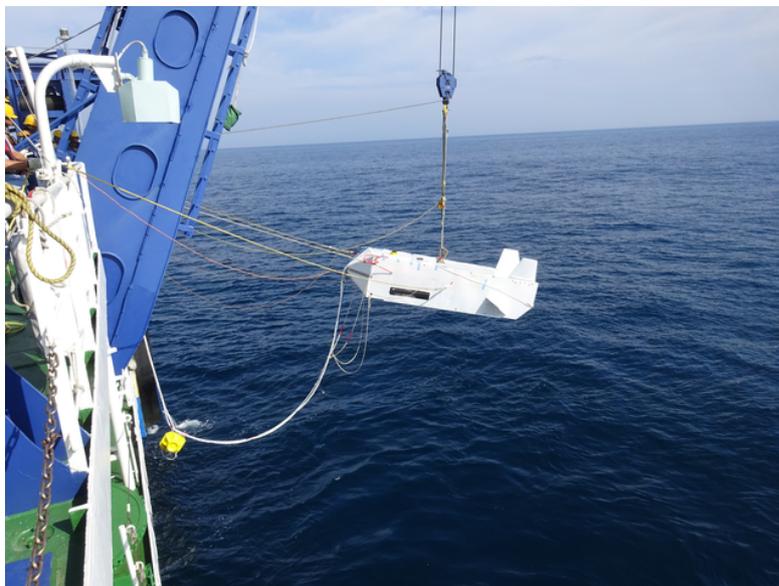


Figure 3.3 Photos of the deploy operation.

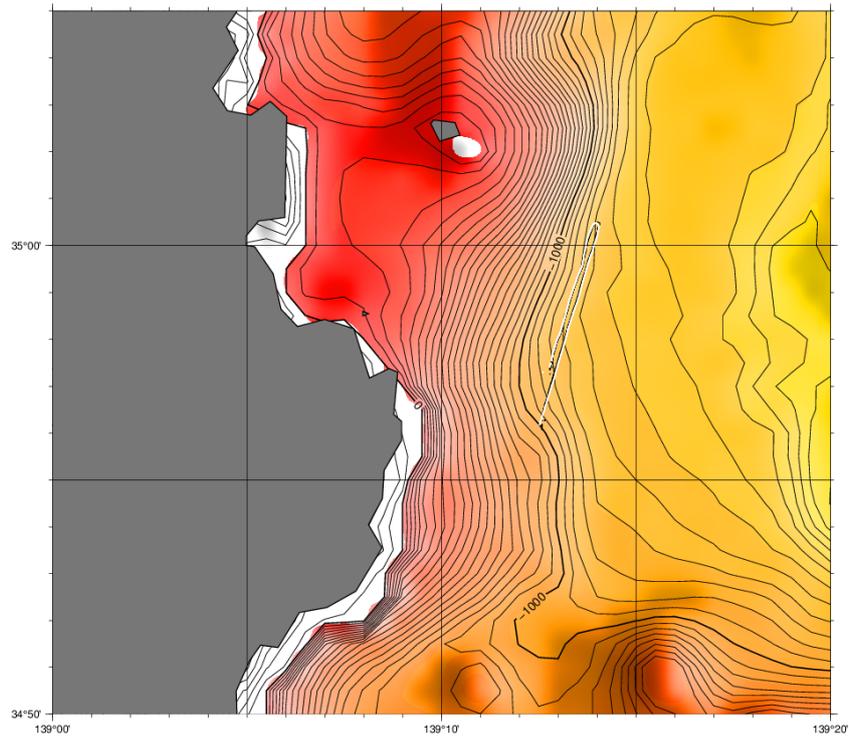


Fig. 3.4 Towing line off Hatsushima Island. White and black lines show the position of depressor and deep tow, respectively.