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"KAIYO" Cruise Report

KY14-16

Experiments of underwater acoustic technology,

Suruga-Bay and Sagami-Bay

19/Dec./2014 – 27/Dec./2014

Japan Agency for Marine-Earth Science and Technology

(JAMSTEC)

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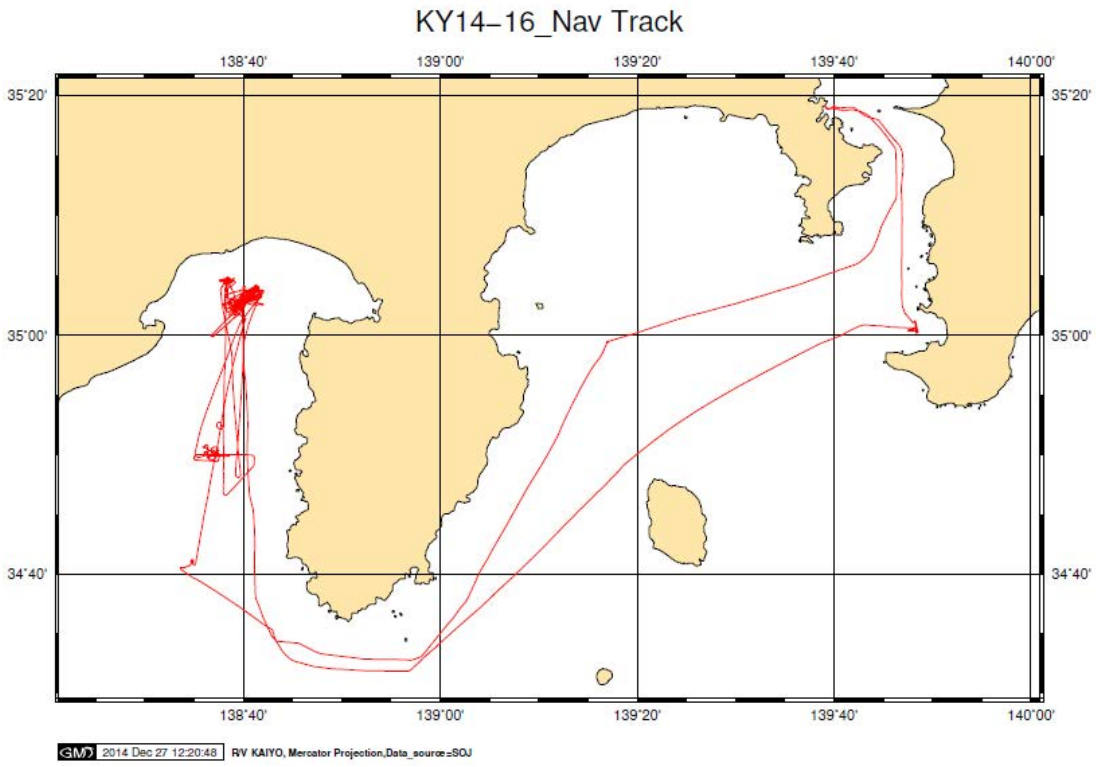
1. Cruise Information

- Cruise ID: KY14-16
- Name of vessel R/V KAIYO
- Title of the cruise Experiments of underwater acoustic technology
- Title of proposal Research for multi-user underwater acoustic communication, and research for deep sea seismic.
- Cruise period 19/Dec./2014 – 27/Dec./2014
- Ports of call Yokosuka
- Research area Suruga-Bay and Sagami-Bay
- Research Map



2. Researchers

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3. Purpose

Our group is researching and developing acoustic communication system for AUV-ASV communication and deep sea seismic. In this cruise, our purposes are

1. To obtain data of acoustic communication for vertical direction.
2. To obtain very first data of deep sea seismic using low frequency (500 Hz).

And to get XBT and sound speed profile data are also the purposes of this cruise.

4. Experiments

4.1. Overview

a. Experiment of acoustic communication for vertical direction.

In JAMSTEC, new acoustic communication system for vertical direction is been developing. In this cruise, basic acoustic data transmission test was carried out. The main purpose of this experiment is to record acoustic propagated signals containing multipath and Doppler shift.

b. Experiment of deep sea seismic.

The other experiment is for deep sea seismic (DSS). In JAMSTEC, there is a plan of developing equipment for observing sub-bottom, which target is between sub-bottom profiler and seismic reflection survey. This is a first experiment for DSS, and the main purpose is to obtain reflected acoustic waves, which are transmitted from low frequency source.

4.2. Experimental setup and results

a. Experiment of acoustic communication for vertical direction.

In this experiment, wideband transducer, whose bandwidth is from 16 to 24 kHz, was used. 2 types of set of a transmitter including a transducer were tested. One was suspended from “KAIYO”, the other was moored near the sea bottom. Receiver was set on “KAIYO”, and hydrophone array of acoustic navigation system, which was installed on the bottom of “KAIYO”, were used as receiving hydrophone.

Data obtained at case as below.

・Propagation between suspended transmitter and “KAIYO”: 3 times
・Propagation between moored transducer and “KAIYO”: 2 times

Figure 1 shows a transmitter, which is contained a transducer, batteries, a controller, a modulator, a D/A converter, a power amplifier and sensors. The size of transmitter is very large, but this is just test equipment. Experiments of propagation between moored transmitter and ship receiver were carried out 2 times at almost the same depth of 680 m. At Dec. 23rd, "KAIYO" were passing above moored transmitter, which speeds were 1, 2 and 3 knots, for obtaining data including Doppler shift (Fig. 2). At Dec. 25th, "KAIYO" kept the position at several points for obtaining data of angular characteristics. After that, experiment of obtaining data including Doppler shift was carried out again at same day. Obtained data are processing now.

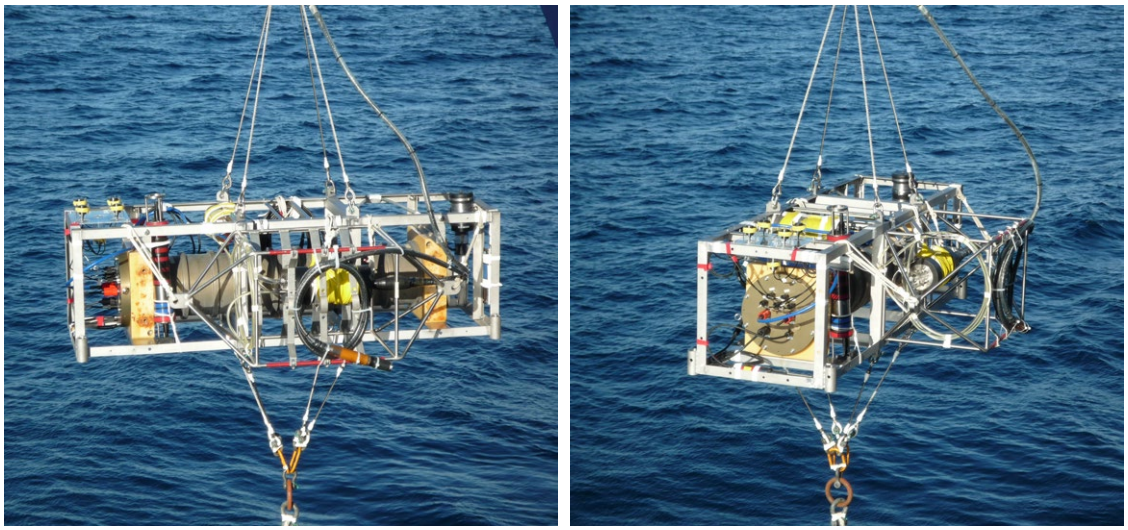

Fig.1 Transmitter of an acoustic communication test.

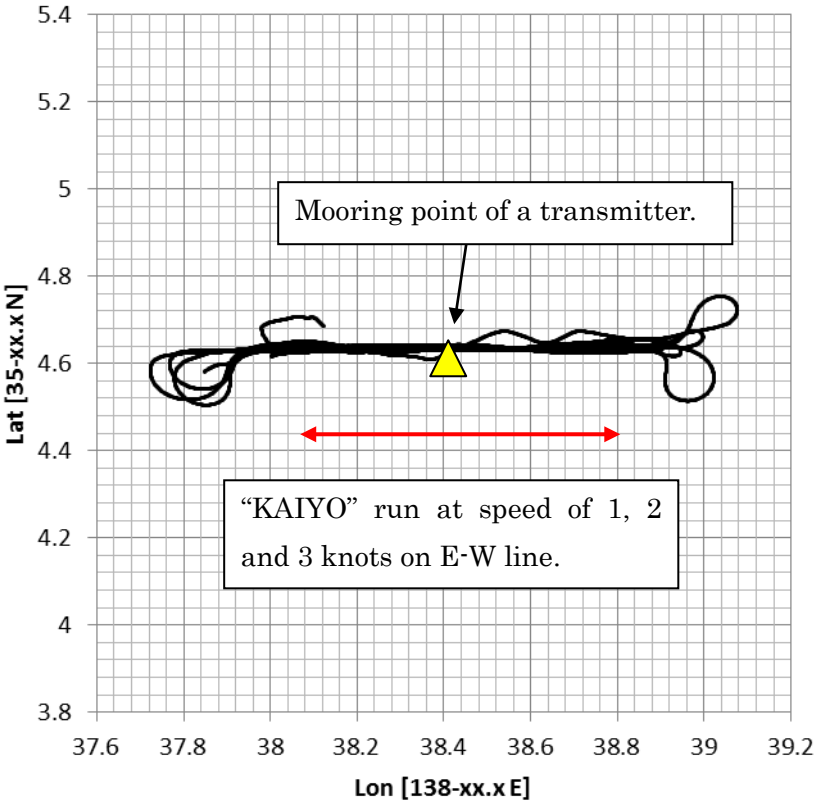

Fig.2 Ship track for acoustic communication test with Doppler shift at 2014/12/23.

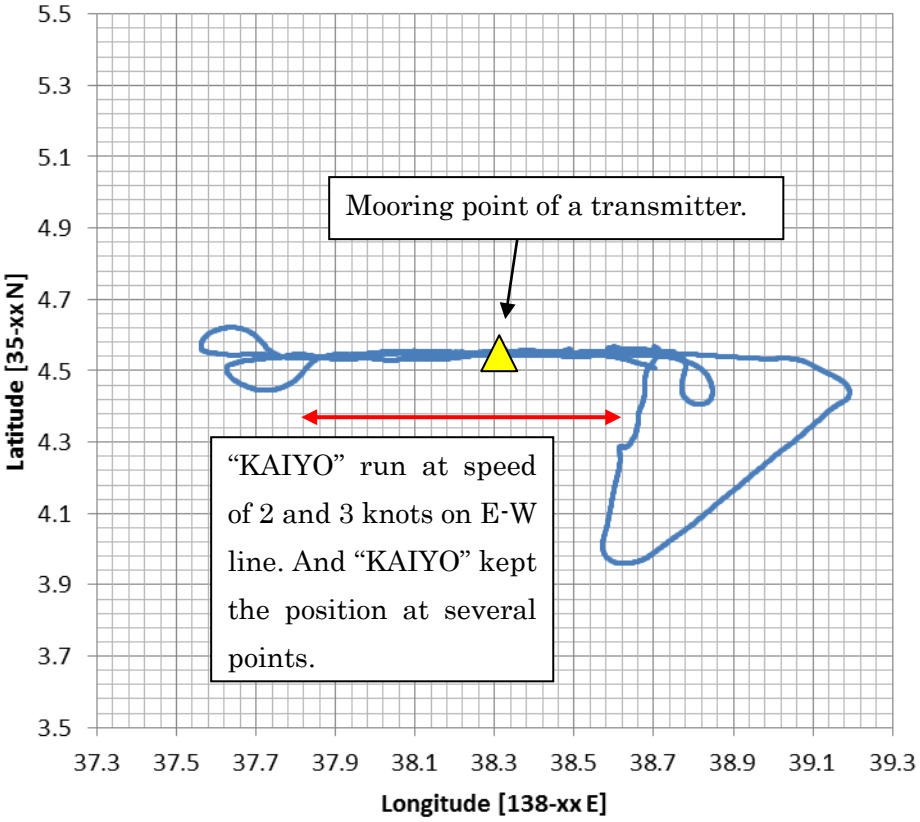

Fig.3 Ship track for acoustic communication test with multi-path and Doppler shift at 2014/12/25.

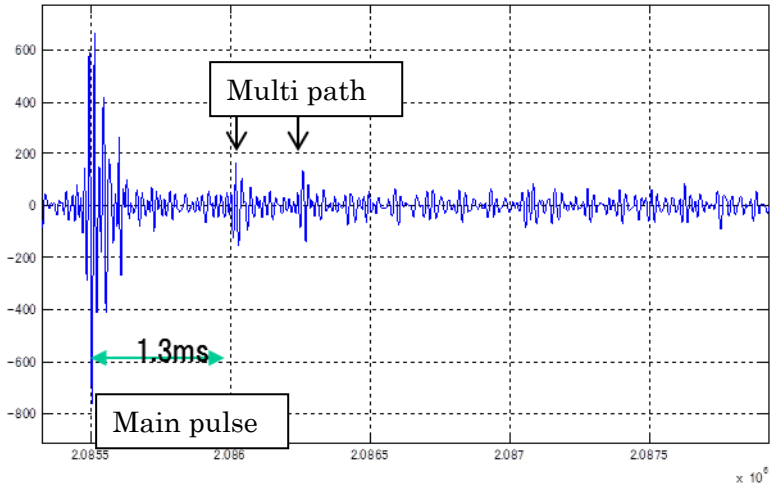

Fig.4 Example of received data. Impulse signal was transmitted.

b. Experiment of deep sea seismic.

A vertical hydrophone array was moored at near the sea bottom. That array has 20 elements hydrophones, which is spaced 1.5 m. Acoustic source of 500 Hz was suspended from “KAIYO”. Experiments were carried out twice at the different point. First point was north of Suruga-Bay at the depth of approximately 1,000 m at Dec. 21st (Fig.5). And second point was centre of Suruga-Bay at the depth of approximately 1,600 m at Dec. 24th (Fig.6). Fig.7 shows channel response of each hydrophone. Obtained data are processing now.

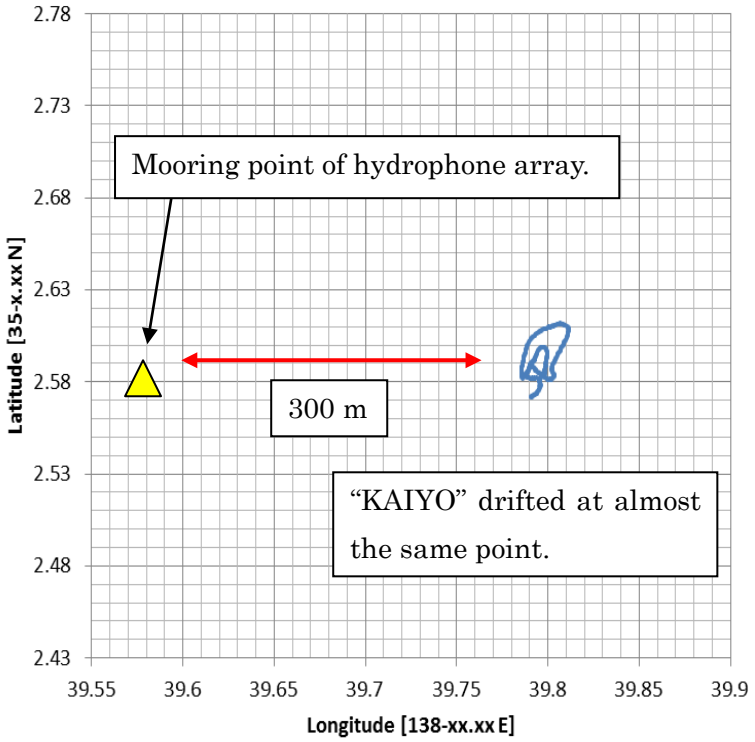

Fig.5 Ship track for DSS at 2014/12/21.

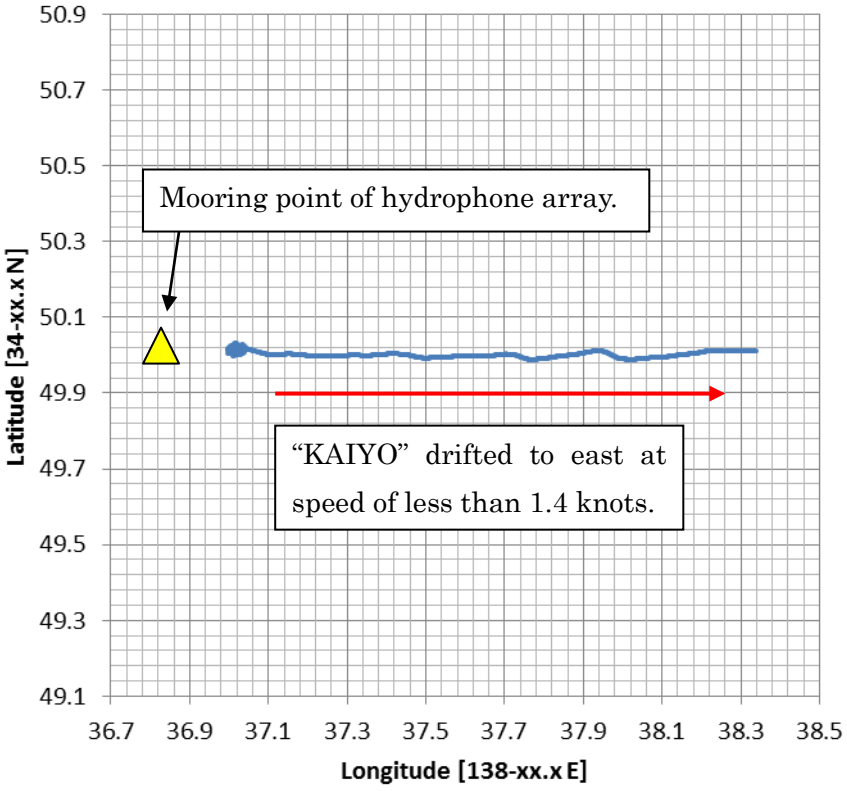

Fig.6 Ship track for DSS at 2014/12/24.

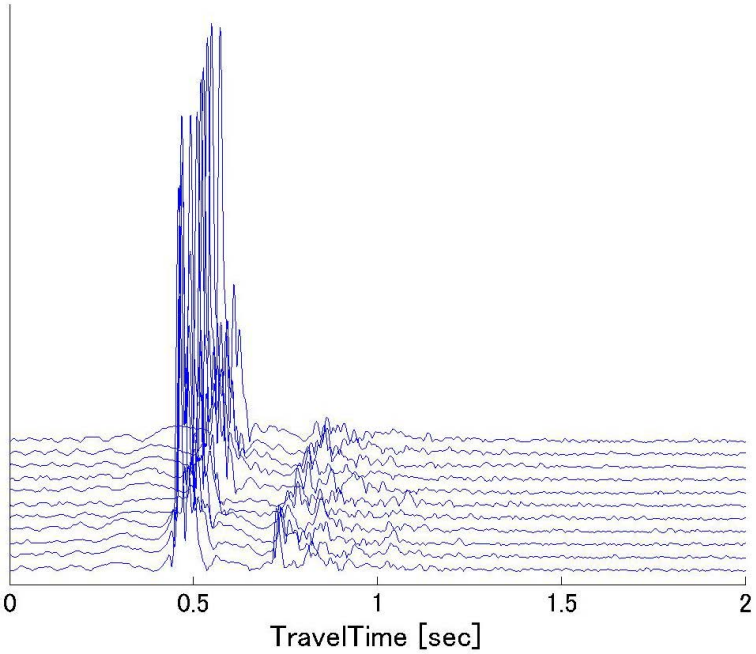

Fig.7 Example of analysis channel response of all channel.

4.3. Cruise log (Date-time: JST)

2014/Dec./19	09:00	Departure from Yokosuka
	12:50	XBT
	14:12-14:40	Suspend a transmitter unit from “KAIYO”
	14:41-16:40	Operation test
	16:40-17:02	Recover a transmitter unit
2014/Dec./20	06:55	XBT
	08:41-08:58	Suspend a transmitter unit from “KAIYO”
	08:58-14:05	Measurement of acoustic signal for communication with Doppler shift
	14:05-14:19	Recover a transmitter unit
2014/Dec./21	-08:30	Waiting for calm sea
	08:39-09:36	Deploy of hydrophone array unit
	11:30-12:30	Suspend a transmitter unit from “KAIYO”
	12:30-14:00	Measurement of acoustic signal for DSS
		Experiment was terminated by becoming gale
	14:30-14:43	Recover a transmitter unit

2014/Dec./22	-08:00	Waiting for calm sea.
	08:24-09:58	Recover a hydrophone array unit
	10:50	XBT
		Refuge from gale
2014/Dec./23	07:13-07:46	Deploy of a transmitter unit
	09:09-14:06	Measurement acoustic signal for communication with Doppler shift
	14:12-15:00	Recover a transmitter unit
		Move to next experiment point
	16:32-18:24	MBES
	18:29	XBT
2014/Dec./24	07:19-08:18	Deploy of a receiver array unit
	09:45-10:35	Suspend a transmitter unit from “KAIYO”
	11:00-13:00	Measurement of acoustic signal for DSS
	13:00-13:35	Recover a transmitter unit
	14:17-15:49	Recover a hydrophone array unit
2014/Dec./25	07:11-08:37	Deploy of a transmitter unit
	09:17-10:02	Suspend a receiver unit
	10:02-12:14	Measurement of acoustic signals for communication I
	12:24-12:37	Recover a receiver unit
	13:06-14:39	Measurement of acoustic signals for communication II
	15:01-15:55	Recover a transmitter unit
2014/Dec./26	07:01	XBT
	07:35-08:23	Suspend a transmitter unit
	08:26-11:09	Measurement of acoustic signals for communication
	11:11-11:40	Recover a transmitter unit
		Departure from Suruga-Bay
2014/Dec./27	09:00	Arrive at Yokosuka

4.4. Research Information

- Deployment and recovery information

Moored number	Moored date	Moored point		Depth	Recovery date
		Latitude	Longitude		
#01	2014/12/21	35-02.5788N	138-39.5781E	1,089m	2014/12/22
#02	2014/12/23	35-04.6350N	138-38.4238E	682m	2014/12/23
#03	2014/12/24	34-49.9992N	138-36.8296E	1,610m	2014/12/24
#04	2014/12/25	35-04.5504N	138-38.3201E	680m	2014/12/25

- TD

Moored or Cast number	Date [JST]	Time [JST]	Point		Max Depth [m]
			Latitude	Longitude	
034	2014/12/19	12:49	34-59.6195N	139-17.6337E	1,575
035	2014/12/20	06:56	35-02.1955N	138-39.4886E	1,337
037	2014/12/22	10:50	35-04.6333N	138-38.3850E	778
038	2014/12/23	18:49	34-49.4626N	138-37.0853E	1,829
039	2014/12/26	07:02	34-40.8581N	138-34.9065E	1,833

- XBT

Cast number	Cast date [JST]	Cast time [JST]	Cast point		Max Depth [m]
			Latitude	Longitude	
034	2014/12/19	12:49	34-59.6195N	139-17.6337E	1,575
035	2014/12/20	06:56	35-02.1955N	138-39.4886E	1,337
037	2014/12/22	10:50	35-04.6333N	138-38.3850E	778
038	2014/12/23	18:49	34-49.4626N	138-37.0853E	1,829
039	2014/12/26	07:02	34-40.8581N	138-34.9065E	1,833

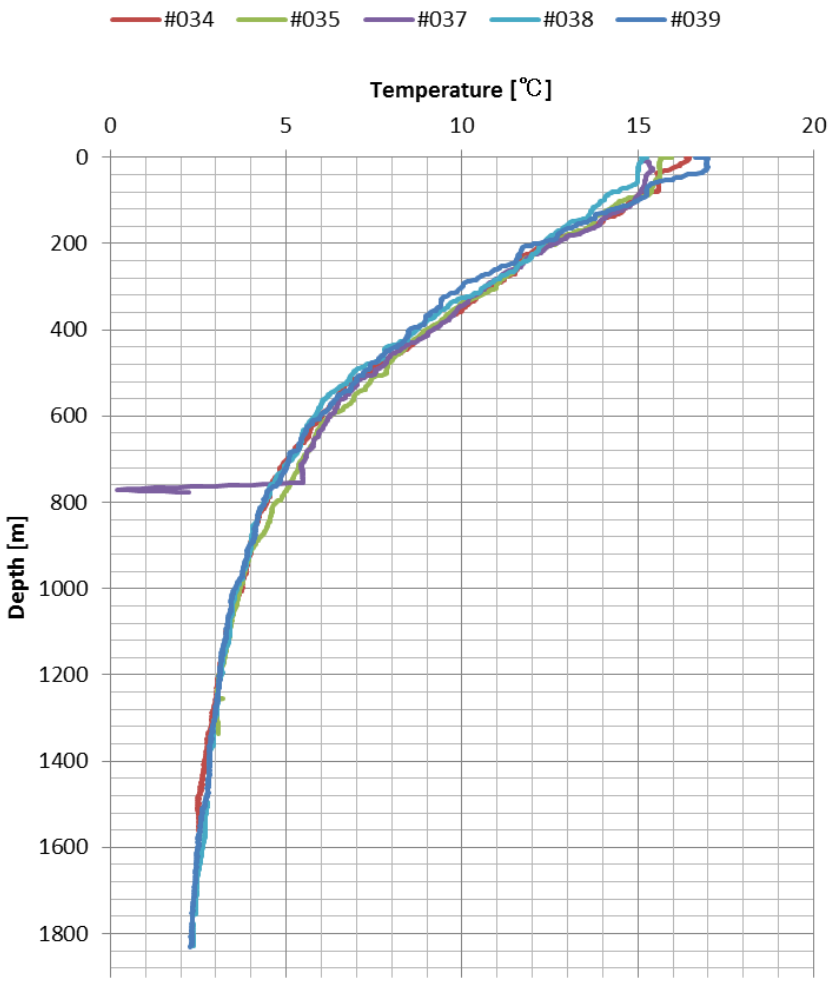

Fig.8 XBT profile.

5. Notice on Using

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.