



R/V Kairei Cruise Report

KR12-20

Seismic study in the Japan Trench region

Dec. 10, 2012 – Jan. 8, 2013

Japan Agency for Marine-Earth Science and Technology

(JAMSTEC)

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1 . Cruise Information :

(1) Cruise number, Ship name: KR12-20, R/V Kairei

(2) Title of the cruise:

2012FY “Tsunami prediction system and comprehensive research in the Japan Trench”

(3) Title of proposal:

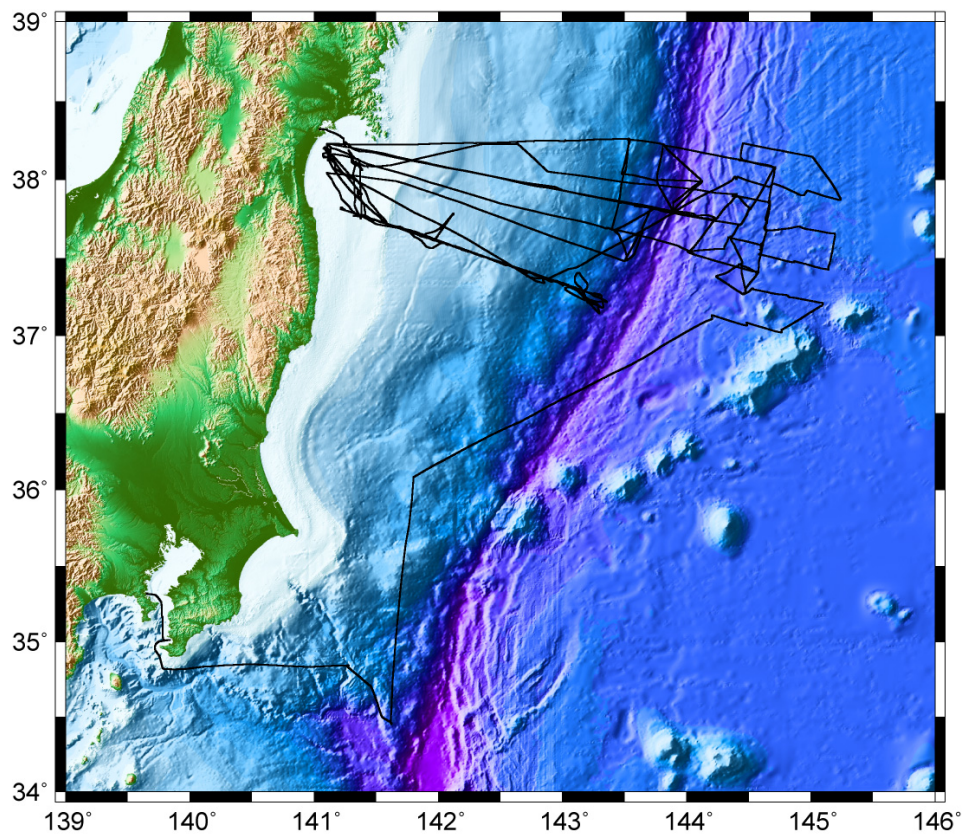
Tsunami prediction system and comprehensive research in the Japan Trench (Part 1.Seismic survey and earthquake observation)

(4) Cruise period, Port call:

2012/12/10-2013/1/8, JAMSTEC (Yokosuka) to Sendai-Shiogama-ko Port

(5) Research Area: off Sanriku, Japan Trench region

(6) Research Map:



2. Researchers

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3. Overview of Observation :

(1) Objectives :

On 11 March 2011, the great earthquake (the 2011 Off the Pacific Coast of Tohoku Earthquake: Mw 9.0) occurred in the forearc area of the Japan Trench region. This earthquake caused devastating damages in the Tohoku and the Kanto regions. Especially, the huge tsunami struck to the Pacific coast in these regions and caused considerable damage. This research cruise was conducted as a part of the study of “Research program concerning tsunamigenic and seismogenic study off the Pacific coast of Tohoku” funded by the Ministry of Education, Culture, Sports, Science, and Technology of Japan. To understand the mechanism of this great earthquake and tsunami and tectonics around the source area of this earthquake, and to collect the information about the mitigating of the disaster such as this earthquake, it is very important to clarify the detailed crustal structure in the Japan Trench region. The objectives of this cruise are the revealing the detailed structure around the rupture zone of this great earthquake and transition of the structure in the oceanic plate from the outer rise region, the trench to landward and continental plate from the inner slope to landward

And, the earthquake of $M_{JMA} = 7.4$ occurred on December 7, 2012 off the east of Ojica Peninsula in the Japan Trench area. To understand the mechanism of the earthquake generation and the tsunami generation of this earthquake, and the deformation of the crustal structure around this hypocenter, it is important to clarify the location and geometry of the fault plane of the main shock. The objectives are also to reveal the precise aftershock distribution of this earthquake because this distribution is essential to determine the fault geometry.

(2) List of observation instruments :

1) Deployment of ocean bottom seismometers (OBSs)

31 OBSs were deployed on A6 line, and 46 OBSs were deployed in the outer rise region and in aftershocks area of the earthquake occurred off the east of Ojica Peninsula in the Japan Trench region, respectively. Moreover, 3 OBSs were deployed off Boso Peninsula.

2) Seismic refraction/wide-angle reflection survey

A seismic refraction/reflection survey and OBSs was conducted on 2 survey lines (A6_obs and A6_50m lines) off Soma, Fukushima in the Japan Trench, although this survey was planned to conduct on 3 lines (A6_obs, A6n, and A6_50m lines) using a tuned air-gun array of 7,800 cubic inch. A volume of a tuned air-gun array is 5,850 cubic inch on a part of A6_obs line because of an air-gun system trouble. And the volume of this array is 3,900 cubic inch on the other part of A6 and A6_50m lines in the area less than 200m of water depth.

3) Multi-channel seismic (MCS) reflection survey

The MCS survey using a tuned air-gun array of 5,950 cubic inch and a 444 channel hydrophone streamer with a 12.5 m group interval were conducted on A6_mcs line, although the array of 7,800 cubic inch would be used. A6n line on this survey could not be conducted during this cruise because of the bad sea condition.

4) Recovery of OBSs

31 and 24 OBSs deployed on A6 line and in aftershocks area of the earthquake occurred off the east of Ojica Peninsula in the Japan Trench region were recovered.

5) Bathymetry, Gravity and Geomagnetic observation

During this cruise, bathymetry, gravity and geomagnetic data have been recorded continuously by SEABEAM2112, gravity meter (KSS-31) and three-component magnetometer (SFG1214), respectively.

6) Temperature and Conductivity observation for the correction of sonic speed

Expendable Conductivity-Temperature-Depth (XCTD) and expendable-Bathy Thermograph (XBT) have been conducted to correct the sonic speed for the bathymetry survey.

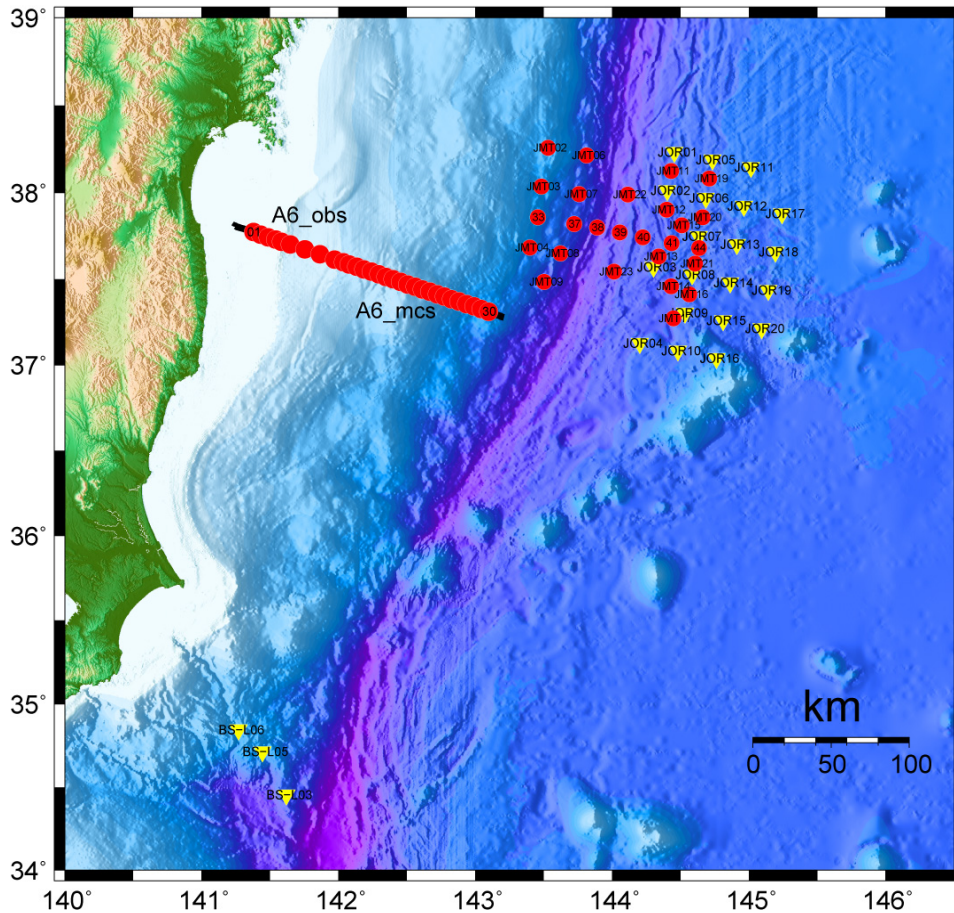
(3) Cruise log:

Date		Remarks
2012/12/10	Mon	Departure from JAMSTEC (Yokosuka), and transit to Tateyama Bay to escape the bad sea condition
2012/12/11	Tue	Transit to survey area (off Boso Peninsula) and deployment of 3 OBSs (BS-L03, 05, 06)
2012/12/12	Wed	Transit to survey area (Japan Trench region) and deployment of 8 OBSs (JOR 04, 09, 10, 15, 16, 20, JMT14, 17)
2012/12/13	Thu	Deployment of OBSs (JOR03, 07, 08, 13, 14, 19, JMT13, 16, 20, 21, 23, Site44)
2012/12/14	Fri	Deployment of OBSs (JMT02, 03, 06, 07, 11, 12, 22, Site38-40)
2012/12/15	Sat	Deployment of OBSs (JMT04, 08, 09, 15, 19, Site33, 37, 41), and transit to Sendai Bay to escape the bad sea condition
2012/12/16	Sun	Transit to survey area and deployment of 13 OBSs (Site 01-13)
2012/12/17	Mon	Deployment of OBSs (Site 14-30, 25-2) and air-gun shooting on A6_obs_0 line
2012/12/18	Tue	Air-gun shooting test and transit to off Sendai-Shiogama-ko to escape the bad sea condition
2012/12/19	Wed	Transit to survey area and air-gun shooting on A6_obs_1 and A6_50m lines
2012/12/20	Thu	Air-gun shooting on A6_obs_1 line
2012/12/21	Fri	MCS survey on A6_mcs_0 line
2012/12/22	Sat	MCS survey on A6_mcs_0 line and recovery of OBSs (Site05-09), and then the interruption of the survey due to the bad sea condition
2012/12/23	Sun	Interruption of the survey due to the bad sea condition, and then recovery of OBSs (Site01-04, 10-21)
2012/12/24	Mon	Transit to off Sendai-Shiogama-ko and stay at there to escape the bad sea condition
2012/12/25	Tue	Stay at off Sendai-Shiogama-ko to escape the bad sea condition
2012/12/26	Wed	Stay at off Sendai-Shiogama-ko to escape the bad sea condition and transit to survey area
2012/12/27	Thu	Transit to survey area, recovery of OBSs (Site25, 27-30, 25-2), and then interruption of the survey due to the bad sea condition
2012/12/28	Fri	Interruption of the survey due to the bad sea condition, recovery of OBSs (Site 22-24, 26) and then deployment of OBSs (JOR01, 02, 05, 06, 11, 12, 17)
2012/12/29	Sat	Recovery of OBSs (Site44, JMT11, 13, 14, 16, 17, 20, 21)
2012/12/30	Sun	Recovery of OBSs (Site41, JMT12, 15) and transit to Sendai Bay to

		escape the bad sea condition
2012/12/31	Mon	Transit to off Sendai-Shiogama-ko and stay at there to escape the bad sea condition
2013/1/1	Tue	Transit to survey area and recovery of OBSs (JMT02, 03, Site33)
2013/1/2	Wed	Transit to off Sendai-Shiogama-ko and stay at there to escape the bad sea condition
2013/1/3	Thu	Stay at off Sendai-Shiogama-ko to escape the bad sea condition
2013/1/4	Fri	Stay at off Sendai-Shiogama-ko to escape the bad sea condition, and transit to survey area
2013/1/5	Sat	Transit to survey area and recovery of OBSs (JMT23, Site39, 40)
2013/1/6	Sun	Recovery of OBSs (JMT04, 06-09, 22, Site38)
2013/1/7	Mon	Re-try to recovery of OBS, bathymetry observation on A6n line and then transit to Sendai-Shiogama-ko Port
2013/1/8	Tue	Transit and arrive at Sendai-Shiogama-ko Port

(4) Seismic lines

1) Refraction/Reflection seismic survey and observation of aftershocks



Red circles and yellow triangles show locations of deployed and recovered OBSs in this cruise and deployed them for long-term observation, respectively. Black line is seismic refraction/reflection survey line conducted in this cruise using a tuned air-gun array and OBSs.

A6_obs_0	Time (UTC)	Latitude (N)	Longitude (E)	Depth (m)	SP
First shot	2012/12/17 7:59	37° 16.80195'	143° 12.16361'	4688	4889
First good shot	2012/12/17 8:02	37° 16.87443'	143° 11.90862'	4687	4881
Last good shot	2012/12/17 9:47	37° 19.60417'	143° 02.06281'	4415	4573
Last shot	2012/12/17 10:17	37° 20.40313'	142° 59.37215'	4326	4485

A6_50m	Time (UTC)	Latitude (N)	Longitude (E)	Depth (m)	SP
First shot	2012/12/19 2:09	37° 46.65283'	141° 21.59811'	100	1451
First good shot	2012/12/19 2:13	37° 46.67350'	141° 21.53490'	100	1449
Last good shot	2012/12/19 2:54	37° 49.28317'	141° 13.61139'	61	1198
Last shot	2012/12/19 2:54	37° 49.28317'	141° 13.61139'	61	1198

A6_obs_1	Time (UTC)	Latitude (N)	Longitude (E)	Depth (m)	SP
First shot	2012/12/19 7:47	37° 48.41241'	141° 14.67803'	61	1229
First good shot	2012/12/19 7:50	37° 48.34463'	141° 14.93688'	57	1237
Last good shot	2012/12/20 10:01	37° 16.72810'	143° 12.40999'	4706	4889
Last shot	2012/12/20 10:01	37° 16.72810'	143° 12.40999'	4706	4889

A6_mcs_0	Time (UTC)	Latitude (N)	Longitude (E)	Depth (m)	SP
First shot	2012/12/21 8:50	37° 18.35016'	143° 06.60484'	4450	4715
First good shot	2012/12/21 8:59	37° 18.58005'	143° 05.77349'	4397	4689
Last good shot	2012/12/21 21:30	37° 37.02117'	141° 58.05312'	458	2579
Last shot	2012/12/21 21:30	37° 37.02.117'	141° 58.05312'	458	2579

2) OBSs locations

(1) OBS list

Site	OBS Calibration position					Remarks
	Latitude(N)	Longitude(E)	Depth(m)	x	y	
01	37_46.3514	141_22.7321	116.3	-16.7	-3.3	
02	37_45.4758	141_25.9277	121.9	0.0	10.0	
03	37_44.6310	141_29.2017	130.8	6.7	10.0	
04	37_43.8098	141_32.4340	137.3	6.7	-6.7	
05	37_43.0938	141_35.0104	174.6	0.0	-16.7	
06	37_42.0720	141_38.9284	238.1	-6.7	-6.7	
07	37_40.3421	141_45.3396	323.4	10.0	-13.3	
08	37_38.6466	141_51.8444	383.0	-3.3	-3.3	
09	37_36.9086	141_58.2763	467.8	-3.3	6.7	
10	37_35.8903	142_02.1531	498.1	-79.3	-144.7	
11	37_35.1988	142_04.7168	540.5	-40.0	-170.0	
12	37_34.3225	142_07.9057	607.6	-86.7	-180.0	
13	37_33.4792	142_11.1501	644.9	-46.7	-173.3	
14	37_32.6206	142_14.4166	706.6	-13.3	-106.7	
15	37_31.7682	142_17.6162	828.8	16.7	-143.3	
16	37_30.8942	142_20.7804	919.9	10.0	-200.0	
17	37_30.0024	142_23.9985	954.7	-13.3	-183.3	
18	37_29.1539	142_27.2097	1093.1	-3.3	-210.0	
19	37_28.2453	142_30.4030	1193.8	-53.3	-230.0	
20	37_27.3382	142_33.5697	1263.0	-80.0	-296.7	
21	37_26.4639	142_36.7874	1455.5	-86.7	-273.3	
22	37_25.6344	142_40.0269	1728.4	-50.0	-253.3	

23	37_24.7629	142_43.3481	2089.4	-130.0	-93.3	
24	37_23.9426	142_46.3989	2552.9	76.7	-310.0	
25	37_23.1081	142_49.5967	3022.4	296.7	-420.0	
25-2	37_23.0504	142_49.6442	3007.6	190.0	-350.0	
26	37_22.2760	142_52.9043	2725.9	320.0	-216.7	
27	37_21.3523	142_56.1602	3865.4	253.3	-153.3	
28	37_20.5726	142_59.4163	2419.2	446.7	-93.3	
29	37_19.7075	143_02.6388	2655.9	510.0	-13.3	
30	37_18.7868	143_05.8922	4459.9	450.0	60.0	
33	37_51.5667	143_27.5128	4334.1	-173.3	346.7	
37	(37_49.2577)	(143_43.3285)	(5979)	-	-	2
38	37_48.0299	143_53.3942	7319.6	406.7	826.7	
39	37_46.2113	144_03.4561	6739.0	-90.0	840.0	
40	37_44.6207	144_13.4202	6320.4	-146.7	720.0	
41	37_42.6229	144_26.0634	5988.0	-206.7	633.3	
44	37_40.8459	144_38.0859	5946.0	110.0	23.3	

Site	OBS Calibration position					Remarks
	Latitude(N)	Longitude(E)	Depth(m)	x	y	
JOR01	38_13.9763	144_27.2581	5883	-	-	1
JOR02	38_00.7185	144_24.1823	5981	-	-	1
JOR03	37_34.1707	144_18.1306	5915	-	-	1
JOR04	37_07.6427	144_12.0983	5928	-	-	1
JOR05	38_11.3403	144_44.0599	5573	-	-	1
JOR06	37_58.1010	144_41.0224	5631	-	-	1
JOR07	37_44.8068	144_37.9107	5890	-	-	1
JOR08	37_31.5485	144_34.9459	5936	-	-	1
JOR09	37_18.2731	144_31.8911	5773	-	-	1
JOR10	37_05.0061	144_28.9073	5692	-	-	1
JOR11	38_08.6878	145_00.8163	5315	-	-	1
JOR12	37_55.4175	144_57.8194	5505	-	-	1
JOR13	37_42.1474	144_54.7184	5607	-	-	1
JOR14	37_28.8647	144_51.6756	5656	-	-	1
JOR15	37_15.5978	144_48.6703	5640	-	-	1
JOR16	37_02.3366	144_45.6910	5056	-	-	1
JOR17	37_05.7095	145_14.5025	5493	-	-	1

JOR18	37_39.4563	145_11.4644	5463	-	-	1
JOR19	37_26.1571	145_08.4359	5648	-	-	1
JOR20	37_12.8696	145_05.4417	5778	-	-	1

Site	OBS Calibration position					Remarks
	Latitude(N)	Longitude(E)	Depth(m)	x	y	
JMT02	38_15.4161	143_31.9883	3325.3	-180.0	170.0	
JMT03	38_02.0972	143_28.9710	4139.7	-256.7	283.3	
JMT04	37_40.9587	143_23.9553	4730.7	56.7	30.0	
JMT06	38_12.8866	143_48.8557	5725.8	-146.7	156.7	
JMT07	37_59.5125	143_45.4568	6040.7	-463.3	276.7	
JMT08	37_39.0168	143_37.2818	6097.8	40.0	370.0	
JMT09	37_29.0886	143_30.2030	6021.9	476.7	330.0	
JMT11	38_07.5414	144_25.9078	5898.8	410.0	220.0	
JMT12	37_54.1482	144_23.9504	5958.8	0.0	-33.3	
JMT13	37_37.9602	144_20.5329	5965.1	110.0	83.3	
JMT14	37_27.6211	144_25.8151	5875.3	46.7	86.7	
JMT15	37_48.6875	144_30.5353	6023.9	-230.0	540.0	
JMT16	37_24.8061	144_33.8675	5907.6	-76.7	-53.3	
JMT17	37_16.4257	144_26.8868	5877.1	30.0	523.3	
JMT19	(38_04.8412)	(144_42.6937)	(5629.7)	(243.3)	(186.7)	2
JMT20	37_51.5678	144_39.7764	5721.1	20.0	-56.7	
JMT21	37_35.4011	144_36.3489	5946.9	-53.3	-100.0	
JMT22	37_59.3124	144_06.8451	6725.2	60.0	446.7	
JMT23	37_32.6393	144_00.8727	6833.4	-223.3	666.7	

Site	OBS Calibration position					Remarks
	Latitude(N)	Longitude(E)	Depth(m)	x	y	
BS-L03	34_27.2408	141_37.0558	5907.1	223.3	146.7	
BS-L05	34_42.9035	141_26.6445	4547.7	339.3	190.0	
BS-L06	34_50.6493	141_16.1401	3673.6	350.0	823.3	

Remarks:

1: OBS deployment location because of no OBS calibration.

2: OBS could not be recovered in this cruise.

4. Notice on using:

This cruise report is a preliminary documentation as of the end of the cruise. It may not

be corrected even if changes on content (i.e. taxonomic classifications) are found after publication. It may also be changed without notice. Data on the cruise report may be raw or not processed. Please ask the PI(s) for the latest information before using. Users of data or results of this cruise are requested to submit their results to Data Integration and Analysis Group (DIAG), JAMSTEC.