



## R/V Kairei Cruise Report

KR10-11

Seismic study from off Shikoku to off Kii Peninsula,  
and Kii channel

Oct. 13, 2010 – Nov. 11, 2010

Japan Agency for Marine-Earth Science and Technology

(JAMSTEC)

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1 . Cruise Information :

(1) Cruise number, Ship name: KR10-11, R/V Kairei

(2) Title of the cruise:

2010FY “Seismic study and earthquake observation study off Shikoku”

(3) Title of proposal:

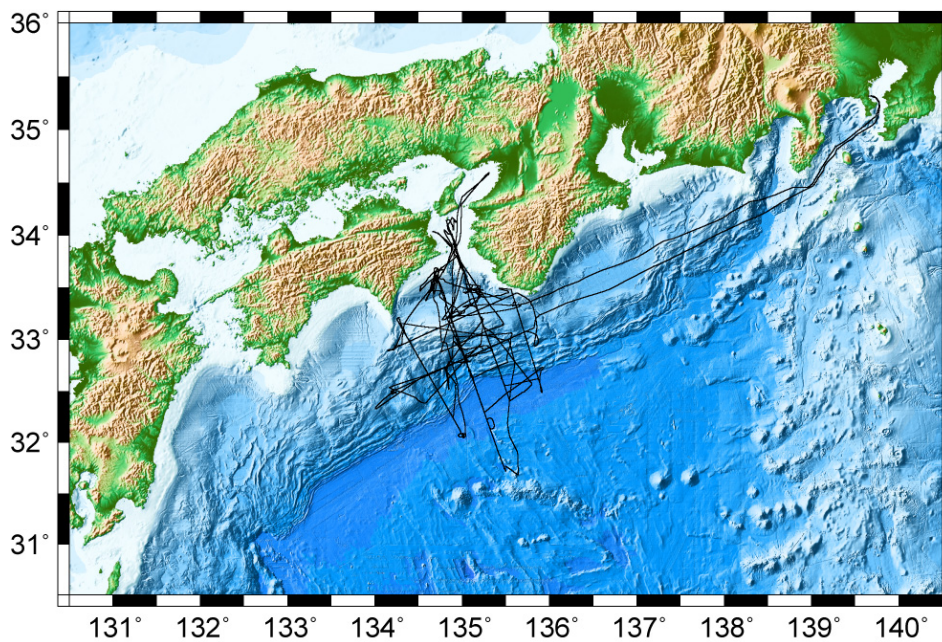
Seismic survey and observation study of evaluation for large earthquake synchronization in the Nankai Trough

(4) Cruise period, Port call:

2010/10/13-11/11, JAMSTEC (Yokosuka) to JAMSTEC (Yokosuka)

(5) Research Area: from off Shikoku to off Kii Peninsula, and Kii channel

(6) Research Map:



## 2. Researchers

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(2) Representative of Science Party [Affiliation]:

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### 3. Overview of Observation :

#### (1) Objectives :

This research cruise was conducted as a part of the study of “Research program concerning interaction between the Tokai, Tonankai, and Nankai Earthquakes” funded by the Ministry of Education, Culture, Sports, Science, and Technology of Japan.

In the Nankai Trough seismic subduction zone, a number of great earthquakes ( $M > 8$ ), such as 1944 Tonankai and 1946 Nankai earthquakes, have been repeatedly occurred. Notable features in this region are the segmentation of the rupture zones and synchronization of these segments. To understand the structure factors controlling the segmentation and the synchronization of rupture zones, it is necessary to reveal the detailed structure variations and seismic activities in this subduction zone. The objectives of this cruise are to reveal detailed seismic structure and seismic activity from off Shikoku to off Kii Peninsula in the Nankai Trough, and in the Kii channel.

#### (2) List of observation instruments :

##### 1) Deployment of ocean bottom seismometers (OBSs)

174 OBSs were deployed from off Shikoku to off Kii Peninsula and in the Kii channel because of the bad sea condition, although 200 OBSs was planned to deploy during this cruise.

##### 2) Seismic refraction/wide-angle reflection survey

A seismic refraction/reflection survey using a tuned air-gun array of 7,800 cubic inch and OBSs was conducted on 6 survey lines (TK01-06 lines) from off Shikoku to off Kii Peninsula and in the Kii channel, although this survey was planned to conduct on 7 lines (TK01-07 lines). This survey on TK07 line could not be conducted because of the bad sea condition. On TK03 line, this survey and MCS survey were conducted, simultaneously, using the 444 channel hydrophone streamer with a 12.5 m group interval. A volume of a tuned air-gun array is 5,850 cubic inch on a part of TK02 line, and is 7,600 or 7,350 cubic inch on a part of TK03 line because of an air-gun system trouble.

##### 3) Recovery of 5 OBSs with anchors and one OBS in the Kii channel

5 OBSs with their anchors and one OBS deployed the shallow area where the water depth is below 200 m in the Kii channel (Site 19-24) were recovered.

##### 4) Multi-channel seismic (MCS) reflection survey

On TK03 line, MCS survey using a tuned air-gun array of 7,800 cubic inch and a 444 channel hydrophone streamer with a 12.5 m group interval and the seismic refraction/wide-angle reflection survey were conducted, simultaneously. However, other lines on this survey could not be conducted during this cruise because of the bad sea condition.

##### 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-Bathy Thermograph (XBT) has been conducted to correct the sonic speed for the bathymetry survey.

## (3) Cruise log:

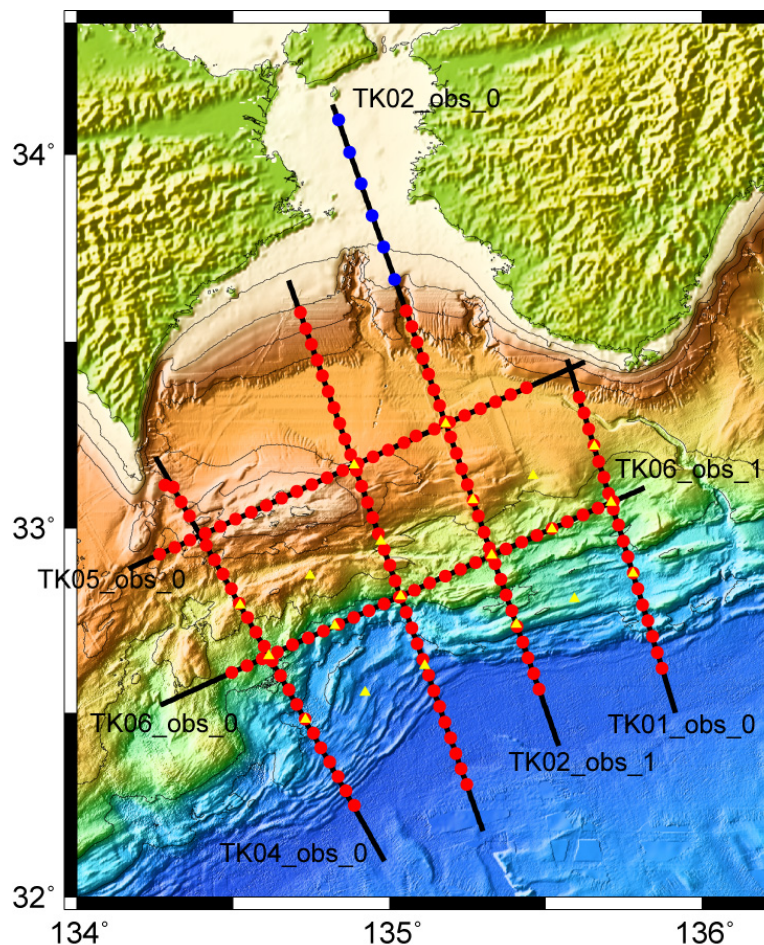
Date		Remarks
2010/10/13	Wed	Departure from JAMSTEC (Yokosuka), and transit to survey area
2010/10/14	Thu	Deployment of OBSs (Site 1-18, 41-49, L3, L9, L15, L17)
2010/10/15	Fri	Deployment of OBSs (Site 20-40, L1, L4-L5, L7, L11)
2010/10/16	Sat	Deployment of OBSs (Site 19) and air-gun shooting on TK02 line
2010/10/17	Sun	Air-gun shooting on TK02 line
2010/10/18	Mon	Recovery of OBSs (Site 19-24), and deployment of OBSs (Site 104-114)
2010/10/19	Tue	Deployment of OBSs (Site 50-58, 115-128, L2), and interruption of the observation due to the bad sea condition
2010/10/20	Wed	Transit to off Tokushima-Komatsushima-ko, and stay at there to escape the bad sea condition
2010/10/21	Thu	Stay at off Tokushima-Komatsushima-ko to escape the bad sea condition
2010/10/22	Fri	Stay at off Tokushima-Komatsushima-ko to escape the bad sea condition
2010/10/23	Sat	Transit to survey area, and holding of the observation due to the bad sea condition
2010/10/24	Sun	Holding of the observation due to the bad sea condition
2010/10/25	Mon	Air-gun shooting on TK01 line
2010/10/26	Tue	Air-gun shooting on TK01 line and deployment of OBSs (Site73-80), then interruption of the observation due to the bad sea condition
2010/10/27	Wed	Holding of the observation due to the bad sea condition
2010/10/28	Thu	Transit to Osaka Bay and stay at there to escape the typhoon
2010/10/29	Fri	Stay at Osaka Bay to escape the typhoon
2010/10/30	Sat	Stay at Osaka Bay to escape the typhoon
2010/10/31	Sun	Transit to survey area, deployment of OBSs (Site59-68, L6, L12), and holding of the observation due to the bad sea condition
2010/11/1	Mon	Deployment of OBSs (Site69-72, L18), and holding of the observation due to the bad sea condition
2010/11/2	Tue	Deployment of OBSs (Site81-103, L8, L10, L13-L14, L16, L19-L20)
2010/11/3	Wed	Air-gun shooting towed with the 444 ch. streamer on TK03 line
2010/11/4	Thu	Air-gun shooting towed with the 444 ch. streamer on TK03 line
2010/11/5	Fri	Air-gun shooting on TK04 line
2010/11/6	Sat	Air-gun shooting on TK04 and TK05 lines
2010/11/7	Sun	Air-gun shooting on TK05 line and Deployment of OBSs (Site 129-154)

2010/11/8	Mon	Air-gun shooting on TK06 line
2010/11/9	Tue	Holding of the observation due to the bad sea condition
2010/11/10	Wed	Air-gun shooting on TK06 line
2010/11/11	Thu	Transit and arrive at JAMSTEC (Yokosuka)



(4) Seismic lines

1) Refraction/Reflection seismic survey



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

TK02_obs_0	Time (UTC)	Latitude (N)	Longitude (E)	Depth (m)	SP
First shot	2010/10/16 1:42	34° 07.97074'	134° 49.10165'	54	21001
First good shot	2010/10/16 1:42	34° 07.97074'	134° 49.10165'	54	21001
Last good shot	2010/10/16 14:45	33° 12.37376'	135° 12.67306'	1351	21546
Last shot	2010/10/16 14:45	33° 12.37376'	135° 12.67306'	1351	21546

TK02_obs_1	Time (UTC)	Latitude (N)	Longitude (E)	Depth (m)	SP
First shot	2010/10/16 15:29	33° 12.37631'	135° 12.68050'	1351	21546
First good shot	2010/10/16 15:29	33° 12.37631'	135° 12.68050'	1351	21546
Last good shot	2010/10/17 4:00	32° 24.66358'	135° 32.45781'	4741	22013
Last shot	2010/10/17 4:00	32° 24.66358'	135° 32.45781'	4741	22013

TK01_obs_0	Time (UTC)	Latitude (N)	Longitude (E)	Depth (m)	SP
First shot	2010/10/25 3:12	33° 27.17933'	135° 34.09014'	383	11023
First good shot	2010/10/25 3:12	33° 27.17933'	135° 34.09014'	383	11023
Last good shot	2010/10/25 16:48	32° 30.05651'	135° 54.87053'	4671	11575
Last shot	2010/10/25 16:48	32° 30.05651'	135° 54.87053'	4671	11575

TK03_obs_0	Time (UTC)	Latitude (N)	Longitude (E)	Depth (m)	SP
First shot	2010/11/3 8:58	32° 10.74734'	135° 17.92702'	4629	31924
First good shot	2010/11/3 8:58	32° 10.74734'	135° 17.92702'	4629	31924
Last good shot	2010/11/4 5:26	33° 39.85316'	134° 40.61666'	122	31051
Last shot	2010/11/4 5:26	33° 39.85316'	134° 40.61666'	122	31051

TK04_obs_0	Time (UTC)	Latitude (N)	Longitude (E)	Depth (m)	SP
First shot	2010/11/5 0:55	32° 05.88892'	134° 59.02163'	4699	41721
First good shot	2010/11/5 0:55	32° 05.88892'	134° 59.02163'	4699	41721
Last good shot	2010/11/5 17:12	33° 11.43644'	134° 15.11536'	815	41025
Last shot	2010/11/5 17:12	33° 11.43644'	134° 15.11536'	815	41025

TK05_obs_0	Time (UTC)	Latitude (N)	Longitude (E)	Depth (m)	SP
First shot	2010/11/6 3:15	32° 53.31077'	134° 09.66374'	1084	50997
First good shot	2010/11/6 3:17	32° 53.40191'	134° 09.89649'	1060	50999
Last good shot	2010/11/6 21:35	33° 26.76491'	135° 37.47115'	265	51746
Last shot	2010/11/6 21:37	33° 26.78314'	135° 37.60279'	248	51747

TK06_obs_0	Time (UTC)	Latitude (N)	Longitude (E)	Depth (m)	SP
First shot	2010/11/8 0:31	32° 30.87103'	134° 14.62979'	2699	60971
First good shot	2010/11/8 0:47	32° 31.28452'	134° 16.09132'	2666	60983
Last good shot	2010/11/8 12:01	32° 53.31714'	135° 13.72126'	2293	61477
Last shot	2010/11/8 12:01	32° 53.31714'	135° 13.72126'	2293	61477

TK06_obs_1	Time (UTC)	Latitude (N)	Longitude (E)	Depth (m)	SP
First shot	2010/11/10 2:15	32° 52.70912'	135° 12.07604'	-	61463
First good shot	2010/11/10 2:21	32° 52.88199'	135° 12.54658'	2257	61467
Last good shot	2010/11/10 9:28	33° 06.48783'	135° 48.94467'	2508	61777
Last shot	2010/11/10 9:28	33° 06.48783'	135° 48.94467'	2508	61777

2) OBSs locations

## (1) OBS list

Site	OBS Calibration position					Remarks
	Latitude(N)	Longitude(E)	Depth(m)	x	y	
1	33_21.1022	135_36.3302	1468	-	-	1
2	33_18.5256	135_37.2887	1867	-	-	1
3	33_15.9214	135_38.2182	1640	-	-	1
4	33_13.3692	135_39.1723	1683	-	-	1
5	33_10.7210	135_40.1131	1868	-	-	1
6	33_08.1915	135_41.0567	2314	-	-	1
7	33_05.6010	135_41.9884	2685	-	-	1
8	33_03.0201	135_42.9154	2696	-	-	1
9	33_00.4615	135_43.8766	2752	-	-	1
10	32_57.8874	135_44.8118	3036	-	-	1
11	32_55.3077	135_45.7513	3533	-	-	1
12	32_52.7307	135_46.6790	3590	-	-	1
13	32_50.1475	135_47.6218	3747	-	-	1
14	32_47.5570	135_48.5730	3498	-	-	1
15	32_44.9707	135_49.4887	3941	-	-	1
16	32_42.3997	135_50.4336	4284	-	-	1
17	32_39.8219	135_51.3616	4675	-	-	1
18	32_37.2360	135_52.2904	4671	-	-	1
19	34_05.5093	134_50.1544	60.9	-8.7	4.0	
20	34_00.3835	134_52.2882	62.5	-82.7	-60.7	
21	33_55.3370	134_54.4890	76.3	-8.7	-15.3	
22	33_50.2574	134_56.6467	74.2	5.3	-30.0	
23	33_45.1797	134_58.7991	103.6	24.0	-46.0	
24	33_40.0473	135_00.9819	161.5	-57.3	-8.7	
25	33_35.0001	135_03.1398	1112	-	-	1
26	33_32.4475	135_04.2079	1245	-	-	1
27	33_29.8969	135_05.2879	1460	-	-	1
28	33_27.3479	135_06.3592	1484	-	-	1
29	33_24.8045	135_07.4389	1510	-	-	1
30	33_22.2646	135_08.5066	1516	-	-	1
31	33_19.7083	135_09.5848	1542	-	-	1
32	33_17.1553	135_10.6579	1432	-	-	1
33	33_14.6461	135_11.6977	1403	-	-	1
34	33_12.0555	135_12.8083	1329	-	-	1

35	33_09.5392	135_13.8395	1206	-	-	1
36	33_06.9840	135_14.9133	1283	-	-	1
37	33_04.4452	135_15.9626	1361	-	-	1
38	33_01.8925	135_17.0417	1742	-	-	1
39	32_59.3424	135_18.1005	2027	-	-	1
40	32_56.8027	135_19.1443	2173	-	-	1
41	32_54.2415	135_20.2267	2643	-	-	1
42	32_51.7051	135_21.2708	2332	-	-	1
43	32_49.1564	135_22.3403	2998	-	-	1
44	32_46.6273	135_23.3805	3047	-	-	1
45	32_44.0578	135_24.4518	3215	-	-	1
46	32_41.5112	135_25.5054	4200	-	-	1
47	32_38.9654	135_26.5718	4458	-	-	1
48	32_36.4215	135_27.6112	4763	-	-	1
49	32_33.8750	135_28.6657	4762	-	-	1
50	33_34.6827	134_42.8284	261	-	-	1
51	33_32.1473	134_43.9012	467	-	-	1
52	33_29.6018	134_44.9809	745	-	-	1
53	33_27.0628	134_46.0583	1099	-	-	1
54	33_24.5314	134_47.1250	1385	-	-	1
55	33_21.9841	134_48.2062	1378	-	-	1
56	33_19.4370	134_49.2772	1369	-	-	1
57	33_16.8987	134_50.3927	1351	-	-	1
58	33_14.3502	134_51.4198	1272	-	-	1
59	33_11.7814	134_52.5115	1130	-	-	1
60	33_09.2428	134_53.5783	783	-	-	1
61	33_06.7035	134_54.6436	784	-	-	1
62	33_04.1591	134_55.7141	750	-	-	1
63	33_01.6357	134_56.7711	-	-	-	1, 2
64	32_59.0838	134_57.8507	1412	-	-	1
65	32_56.5395	134_58.9220	2072	-	-	1
66	32_53.9943	134_59.9892	1747	-	-	1
67	32_51.4206	135_01.0458	2209	-	-	1
68	32_48.8837	135_02.1153	2892	-	-	1
69	32_46.3536	135_03.1452	3842	-	-	1
70	32_43.7941	135_04.3008	3986	-	-	1
71	32_41.2608	135_05.3005	4300	-	-	1

72	32_38.7104	135_06.3692	4562	-	-	1
73	32_36.1587	135_07.4300	4600	-	-	1
74	32_33.6089	135_08.4751	4636	-	-	1
75	32_31.0621	135_09.5385	4800	-	-	1
76	32_28.5180	135_10.5906	4794	-	-	1
77	32_25.9727	135_11.6345	4804	-	-	1
78	32_23.4290	135_12.6960	4796	-	-	1
79	32_20.8830	135_13.7350	4779	-	-	1
80	32_18.3421	135_14.8014	4697	-	-	1
81	33_06.9086	134_16.8576	578	-	-	1
82	33_06.5759	134_18.4314	583	-	-	1
83	33_04.2209	134_20.0122	536	-	-	1
84	33_01.8954	134_21.5923	597	-	-	1
85	32_57.1984	134_24.8190	651	-	-	1
86	32_54.8556	134_26.3986	1269	-	-	1
87	32_52.5055	134_27.9863	1457	-	-	1
88	32_50.1601	134_29.5742	1816	-	-	1
89	32_47.8139	134_31.1722	1609	-	-	1
90	32_45.4714	134_32.7580	2042	-	-	1
91	32_43.1296	134_34.3317	2395	-	-	1
92	32_40.7932	134_35.9072	2689	-	-	1
93	32_38.4410	134_37.4737	2986	-	-	1
94	32_36.0925	134_39.0533	3015	-	-	1
95	32_33.7442	134_40.6333	3243	-	-	1
96	32_31.3986	134_42.2107	3805	-	-	1
97	32_29.0431	134_43.8049	4147	-	-	1
98	32_26.6990	134_45.3668	4074	-	-	1
99	32_24.3499	134_46.8216	4401	-	-	1
100	32_21.9980	134_48.5136	4403	-	-	1
101	32_19.6365	134_50.0775	4396	-	-	1
102	32_17.2977	134_51.6305	4627	-	-	1
103	32_14.9485	134_53.2114	4819	-	-	1
104	32_55.7545	134_15.8593	1016	-	-	1
105	32_56.8857	134_18.7713	1114	-	-	1
106	32_58.0316	134_21.6991	680	-	-	1
107	32_59.1700	134_24.6122	593	-	-	1
108	33_00.2698	134_27.5409	462	-	-	1

109	33_01.3907	134_30.4523	346	-	-	1
110	33_02.5181	134_33.3900	352	-	-	1
111	33_03.6540	134_36.3120	440	-	-	1
112	33_04.7698	134_39.2467	241	-	-	1
113	33_05.8879	134_42.1609	289	-	-	1
114	33_07.0128	134_45.1170	320	-	-	1
115	33_08.1263	134_48.0148	483	-	-	1
116	33_09.2454	134_50.9557	688	-	-	1
117	33_10.3892	134_53.9028	936	-	-	1
118	33_11.4924	134_56.8623	1001	-	-	1
119	33_12.5964	134_59.7605	1035	-	-	1
120	33_13.7143	135_02.7033	1176	-	-	1
121	33_14.8398	135_05.0477	1351	-	-	1
122	33_15.9597	135_08.5754	1416	-	-	1
123	33_17.0514	135_11.5130	1443	-	-	1
124	33_18.1550	135_14.4367	1493	-	-	1
125	33_19.2666	135_17.3844	1516	-	-	1
126	33_20.3666	135_20.3252	1553	-	-	1
127	33_21.4800	135_23.2702	1584	-	-	1
128	33_22.5804	135_26.2208	1645	-	-	1
129	32_36.5568	134_29.7300	2576	-	-	1
130	32_37.6831	134_32.6453	2527	-	-	1
131	32_38.8089	134_35.5740	2904	-	-	1
132	32_39.9264	134_38.4865	2842	-	-	1
133	32_41.0485	134_41.4125	2594	-	-	1
134	32_42.1625	134_44.3287	3079	-	-	1
135	32_43.2877	134_47.2541	3083	-	-	1
136	32_44.3908	134_50.1488	3018	-	-	1
137	32_45.5121	134_53.0672	3551	-	-	1
138	32_46.6276	134_56.0068	3307	-	-	1
139	32_47.7276	134_58.9192	3059	-	-	1
140	32_48.8361	135_01.8430	2941	-	-	1
141	32_49.9415	135_04.7716	2388	-	-	1
142	32_51.0510	135_07.6999	2395	-	-	1
143	32_52.1560	135_10.6293	2319	-	-	1
144	32_53.2523	135_13.5509	2281	-	-	1
145	32_54.3590	135_16.4844	2454	-	-	1

146	32_55.4685	135_19.4286	2361	-	-	1
147	32_56.5745	135_22.3611	2533	-	-	1
148	32_57.6587	135_25.2904	2617	-	-	1
149	32_58.7718	135_28.2390	2461	-	-	1
150	32_59.8713	135_31.1728	2450	-	-	1
151	33_00.9645	135_34.1198	2505	-	-	1
152	33_02.0644	135_37.0546	2375	-	-	1
153	33_03.1618	135_39.9938	2577	-	-	1
154	33_04.2574	135_42.9365	2713	-	-	1

Site	OBS Calibration position					Remarks
	Latitude(N)	Longitude(E)	Depth(m)	x	y	
L1	33_16.7777	135_10.7969	1427	-	-	1
L2	33_10.1328	134_53.2213	913	-	-	1
L3	33_13.1271	135_39.2550	1705	-	-	1
L4	33_08.3977	135_27.5848	1731	-	-	
L5	33_04.5142	135_15.9810	1361	-	-	1
L6	32_57.8331	134_58.3697	1862	-	-	1
L7	32_52.2748	134_44.8201	1273	-	-	
L8	32_47.5219	134_31.3556	1608	-	-	1
L9	33_04.1066	135_42.5367	2700	-	-	1
L10	32_59.8397	135_31.1218	2447	-	-	1
L11	32_55.5731	135_19.6626	2363	-	-	1
L12	32_48.9337	135_02.0951	2875	-	-	1
L13	32_44.1330	134_49.5133	3212	-	-	1
L14	32_39.3137	134_36.8881	2888	-	-	1
L15	32_52.6313	135_46.7210	3592	-	-	1
L16	32_48.5560	135_35.5190	3304	-	-	1
L17	32_44.3542	135_24.3489	3100	-	-	1
L18	32_37.7150	135_06.7763	4580	-	-	1
L19	32_33.3642	134_55.3194	4445	-	-	1
L20	32_28.9610	134_43.8437	4138	-	-	1

Remarks:

1: OBS deployment location because of no OBS calibration.

2: No depth data because of the SEABEAM system trouble

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.