



## R/V Yokosuka Cruise Report

YK16-17

Marine Geological and Geophysical surveys

to investigate the nature

of subduction zone mega earthquakes and tsunamis

2. High resolution seismic surveys in the trench axis area

Japan Trench, Kuril Trench, Off Fukushima

Nov.28, 2016-Dec.15, 2016

Japan Agency for Marine-Earth Science and Technology

(JAMSTEC)

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### **Acknowledgement**

## 1. Cruise Information

- Cruise ID: YK16-17
- Name of vessel: Yokosuka
- Title of the cruise: Marine Geological and Geophysical surveys to investigate the nature of subduction zone mega earthquakes and tsunamis

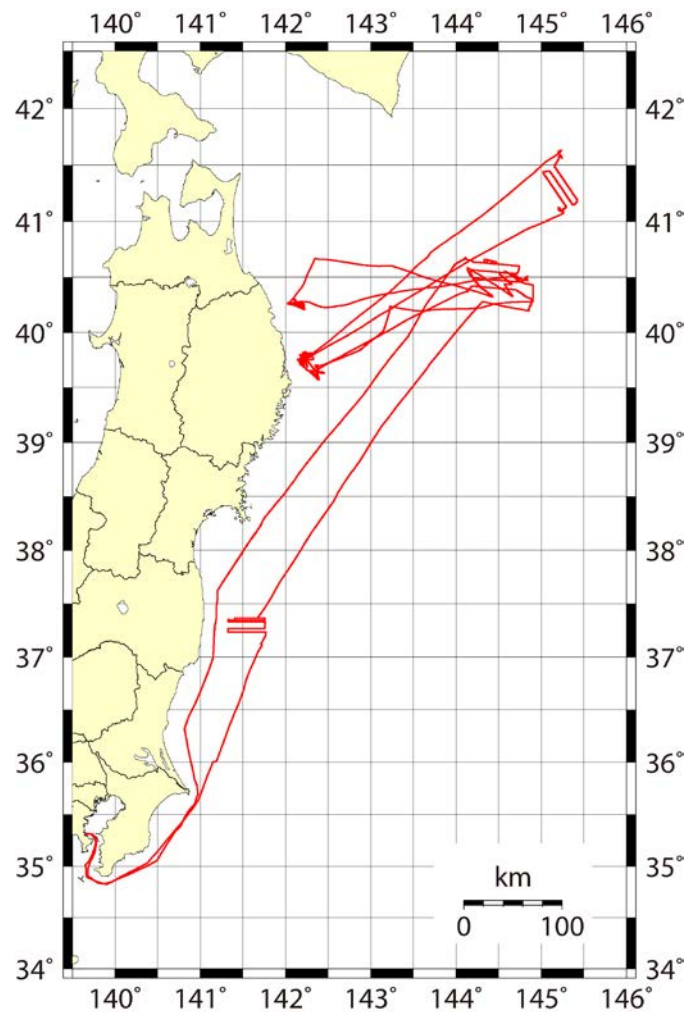
2. High resolution seismic surveys in the trench axis area

- Title of proposal: Marine Geological and Geophysical surveys to investigate the nature of subduction zone mega earthquakes and tsunamis

2. High resolution seismic surveys in the trench axis area

- Cruise period: 2016/11/28 – 2016/12/15
- Ports of departure / call / arrival: Yokosuka (JAMSTEC) – Yokosuka (JAMSTEC)
- Research area: Japan Trench, Kuril Trench, Off Fukushima
- Research Map

### Cruise Track



## 2. Researchers

- Chief scientist [Affiliation]: Yasuyuki Nakamura [JAMSTEC]
- Representative of the science party [Affiliation]: Shuichi Kodaira [JAMSTEC]
- Science party (List) [Affiliation]
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  - Seiichi MIURA [JAMSTEC]
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  - Mikiya YAMASHITA [JAMSTEC]
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  - Ayako NAKANISHI [JAMSTEC]
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  - Toshiya KANAMATSU [JAMSTEC]
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### **3. Observations**

#### **3.1 Background and objectives**

The 2011 Off the Pacific Coast of Tohoku Earthquake (Tohoku Earthquake: M9) was the largest earthquake in the Japanese history of earthquake observation. The plate boundary faults which was ruptured through the trench axis area were clearly imaged by the high-resolution seismic data. This observation and related studies exploded widely accepted conceptual model of the subduction zone earthquake, however the seismic survey area was limited within the vicinity of the epicenter of Tohoku Earthquake off central Miyagi. Thus further investigations in entire region of the Japan-Kuril Trench, off Hokkaido to the north, off Ibaraki to the south, are necessary to understand the mechanism of the great subduction zone earthquakes and Tsunami generation in the Japan Trench region. Several tsunamigenic great earthquakes have occurred in the Japan Trench area before the 2011 Tohoku Earthquake, therefore understanding of the possible seismogenic and tsunamigenic structure of this region is indispensable to prevent or mitigate the disasters caused by the future great earthquakes. The purposes of this cruise was to obtain detailed structural image in the northern part of the Japan Trench and western part of the Kuril Trench axis area off Aomori-Hokkaido region using high resolution (portable) multichannel reflection seismic system.

A magnitude 7.4 earthquake occurred in 22<sup>nd</sup> November 2016 offshore Fukushima area and tsunami was observed at the coast of the Tohoku region. The bathymetric survey was also conducted to investigate the possible tsunami source around the epicenter of this earthquake.

#### **3.2 List of observations**

##### (1) High resolution seismic reflection survey

A cluster gun array with 380 inch<sup>3</sup> of total volume was towed at 5 m depth. The guns were fired every 37.5 or 50 m. Seismic data was recorded with a 192 channel, 1300-m-long streamer cable, which was towed at 6 m depth. Seven seismic lines were completed during the cruise.

##### (2) XCTD casts

The XCTD casts were conducted at 4 locations during the cruise to obtain accurate velocity profile in the water column.

##### (3) Bathymetry measurements

Bathymetry data were recorded during the cruise.

##### (4) Sub-bottom profiler

Sub-bottom profiler data were recorded during the cruise.

### 3.3 List of observation equipments

PMCS system (192 channel streamer cable, maximum offset ~1.3 km )

Cluster gun (40 inch<sup>3</sup> x2, 150 inch<sup>3</sup> x2)

EM 122

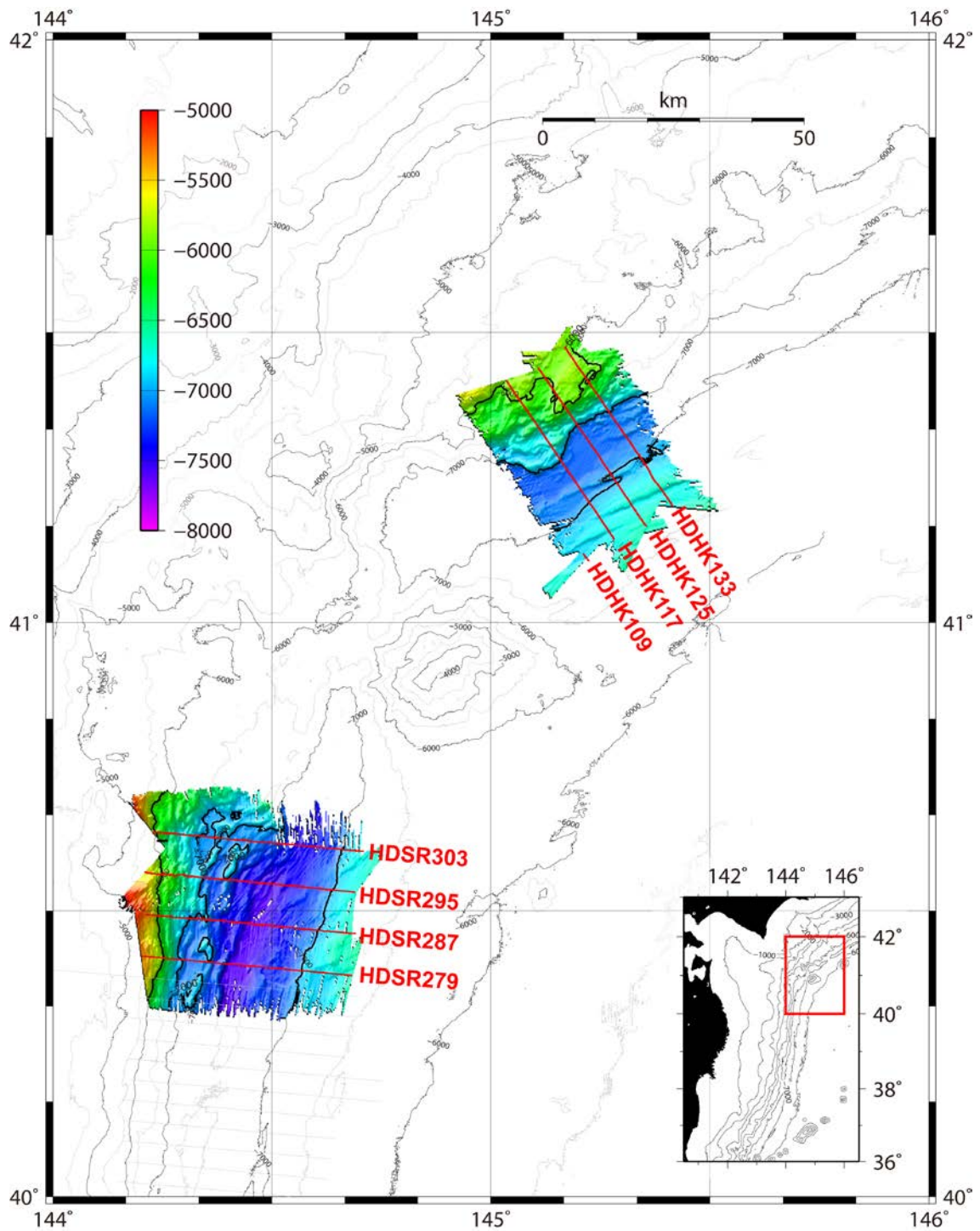
XCTD

### 3.4 Cruise log

Date	Log
11/28/2016	Departure from Yokosuka, Transit to survey area
11/29/2016	Bathymetric survey off Fukushima, transit to survey area
11/30/2016	Arrival at MCS survey area, HR MCS Line HDSR279, transit to off Miyako
12/01/2016	Stay off Miyako due to bad sea condition
12/02/2016	Stay off Miyako due to bad sea condition
12/03/2016	Stay off Miyako due to bad sea condition, transit to survey area
12/04/2016	HR MCS Lines HDHK133, HDHK125
12/05/2016	HR MCS Lines HDHK117, HDHK109, transit to off Miyako
12/06/2016	Stay off Miyako due to bad sea condition
12/07/2016	Stay off Miyako due to bad sea condition, transit to survey area
12/08/2016	HR MCS Lines HDSR287, HDSR295
12/09/2016	Transit to off Kuji
12/10/2016	Stay off Kuji due to bad sea condition
12/11/2016	Stay off Kuji due to bad sea condition, transit to survey area
12/12/2016	HR MCS Lines HDSR295, HDSR303
12/13/2016	HR MCS Line HDSR303, transit to Yokosuka
12/14/2016	Transit to Yokosuka
12/15/2016	Arrival at Yokosuka

### 3.5 Research Information

#### MCS Line Map with bathymetry data



MCS Line List

LINE NAME	DATE (UTC)	TIME (UTC)	F.S.P.	VESSEL POSITION	
			F.G.S.P.		
			L.G.S.P.	Lat.	Lon.
			L.S.P.		
HDHK109_0	05/12/2016	02:20:43	1991	41_06.23917'N	145_13.42350'E
	05/12/2016	02:46:39	1966	41_06.65900'N	145_13.04967'E
	05/12/2016	04:10:42	1933	41_07.21250'N	145_12.55417'E
	05/12/2016	04:23:44	1923	41_07.37800'N	145_12.39983'E
HDHK117_0	04/12/2016	19:03:44	969	41_25.22900'N	145_01.84417'E
	04/12/2016	19:12:09	993	41_24.69133'N	145_02.32533'E
	04/12/2016	22:52:09	1719	41_08.47417'N	145_16.94717'E
	04/12/2016	22:52:26	1720	41_08.45217'N	145_16.96767'E
HDHK125_0	04/12/2016	07:00:23	1990	41_09.78467'N	145_21.27950'E
	04/12/2016	07:16:53	1965	41_10.20283'N	145_20.90067'E
	04/12/2016	17:10:48	1000	41_26.38517'N	145_06.33717'E
	04/12/2016	17:10:48	1000	41_26.38517'N	145_06.33717'E
HDHK133_0	04/12/2016	00:12:31	969	41_28.59783'N	145_09.88217'E
	04/12/2016	00:19:38	994	41_28.18500'N	145_10.26550'E
	04/12/2016	04:30:36	1958	41_12.03100'N	145_24.82900'E
	04/12/2016	04:30:49	1959	41_12.01433'N	145_24.84433'E
HDSR279_0	30/11/2016	07:07:04	2103	40_23.23600'N	144_41.16033'E
	30/11/2016	07:13:55	2078	40_23.26600'N	144_40.49967'E
	30/11/2016	12:12:26	1000	40_25.20850'N	144_12.05817'E
	30/11/2016	12:12:26	1000	40_25.20850'N	144_12.05817'E
HDSR287_0	08/12/2016	02:08:44	2103	40_27.55950'N	144_41.68917'E
	08/12/2016	02:15:57	2079	40_27.57233'N	144_41.05183'E
	08/12/2016	08:16:10	1000	40_29.51617'N	144_12.55467'E
	08/12/2016	08:16:10	1000	40_29.51617'N	144_12.55467'E
HDSR295_0	08/12/2016	09:45:40	969	40_33.87700'N	144_12.35050'E
	08/12/2016	09:57:43	993	40_33.80767'N	144_12.98917'E
	08/12/2016	19:01:07	2072	40_31.88817'N	144_41.52217'E
	08/12/2016	19:01:07	2072	40_31.88817'N	144_41.52217'E
HDSR295_1	12/12/2016	08:55:26	1710	40_32.55467'N	144_31.96233'E
	12/12/2016	09:03:43	1734	40_32.51067'N	144_32.59417'E



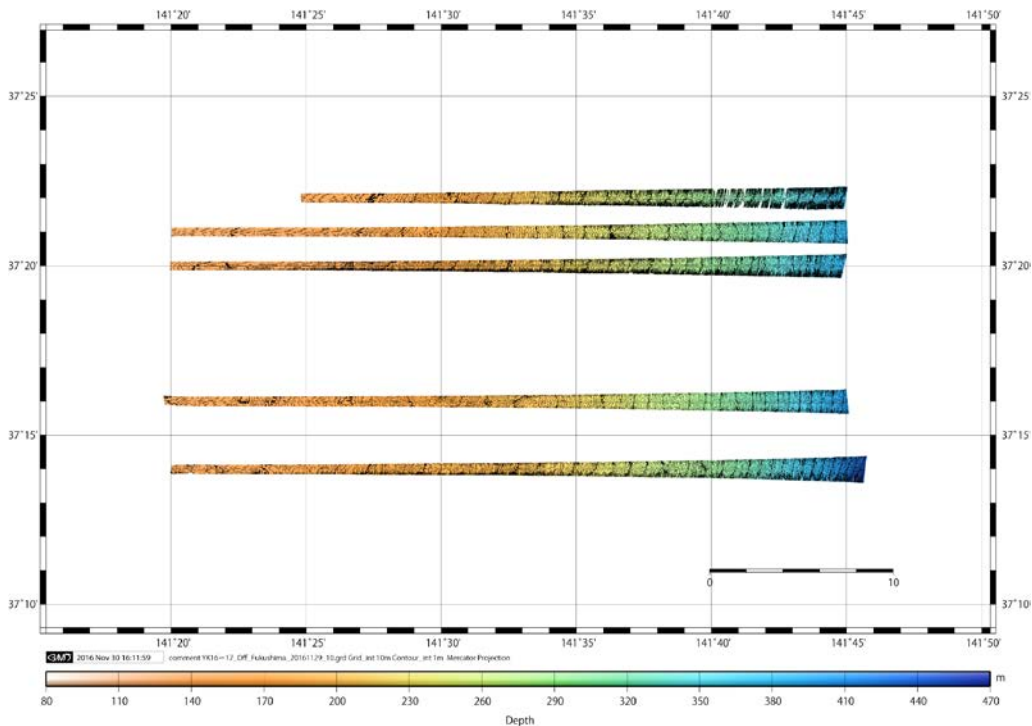
	12/12/2016	11:05:02	2072	40_31.87967'N	144_41.52817'E
	12/12/2016	11:05:02	2072	40_31.87967'N	144_41.52817'E
HDSR303_0	12/12/2016	12:40:21	2103	40_36.12983'N	144_42.74067'E
	12/12/2016	12:49:59	2078	40_36.16583'N	144_42.07767'E
	12/12/2016	17:30:34	1336	40_37.53683'N	144_22.44583'E
	12/12/2016	17:30:34	1336	40_37.53683'N	144_22.44583'E
HDSR303_1	12/12/2016	19:54:35	1535	40_37.16967'N	144_27.71667'E
	12/12/2016	20:04:18	1510	40_37.20200'N	144_27.05317'E
	12/12/2016	20:56:34	1356	40_37.48383'N	144_22.97450'E
	12/12/2016	21:01:23	1340	40_37.50160'N	144_22.63880'E
HDSR303_2	12/12/2016	23:50:56	1410	40_37.39133'N	144_24.41033'E
	13/12/2016	00:00:22	1384	40_37.42817'N	144_23.72017'E
	13/12/2016	02:33:52	1000	40_38.09150'N	144_13.55783'E
	13/12/2016	02:33:52	1000	40_38.09150'N	144_13.55783'E

\*F.S.P.: First Shot Point, F.G.S.P: First Good Shot Point

L.G.S.P.: Last Good Shot Point, L.S.P.: Last Shot Point

Note: Line HDHK109 was terminated soon after starting the line due to the system trouble. This line was not completed and the seismic profile was not created for this line.

#### Bathymetry map off Fukushima area



#### **4. 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.

#### **Acknowledgement**

We would like to thank the captain Shin'ya Ryono and his crew of the R/V Yokosuka, and Yuki Ohwatari and the marine technician team (Nippon Marine Enterprises, Ltd.) for their safe operation and great support during the cruise. We are grateful to member of CEAT (R&D Center for Earthquake and Tsunami), and MARITEC (Marine Technology Center) at JAMSTEC for their help on this cruise. Figures are produced with "The Generic Mapping Tools" (Wessel and Smith, 1991).