



Yokosuka+ “Cruise Report”

YK14-07

Ocean bottom pressure gauge array observation

Off east of Aogashima

May12, 2014-May15,2014

Japan Agency for Marine-Earth Science and Technology

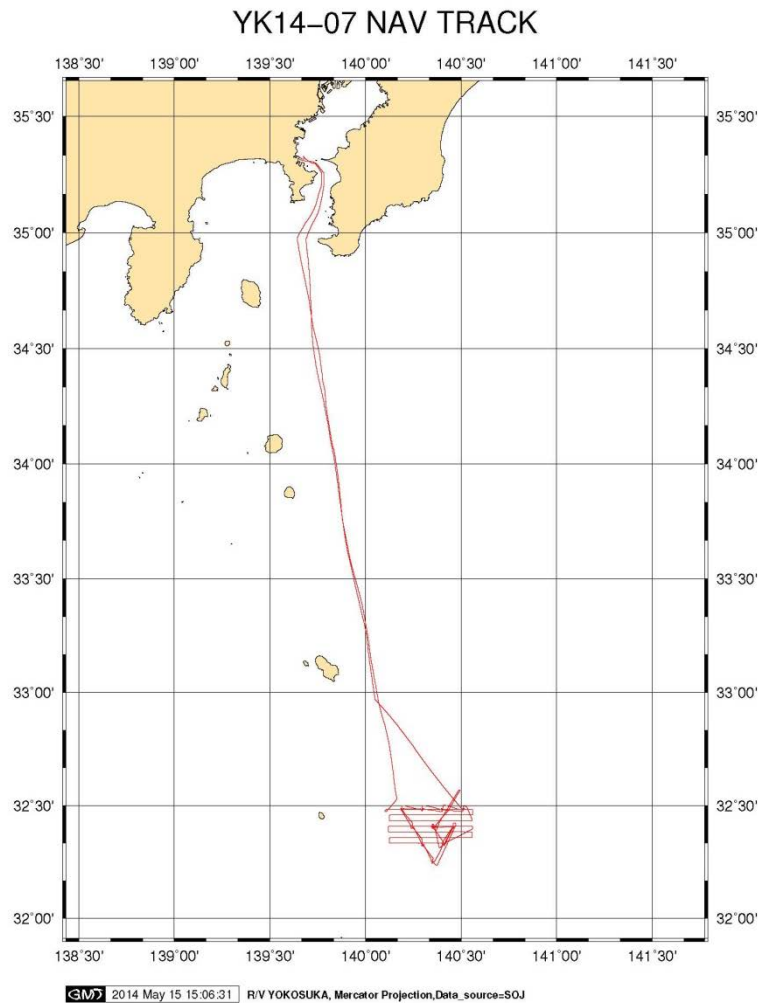
(JAMSTEC)

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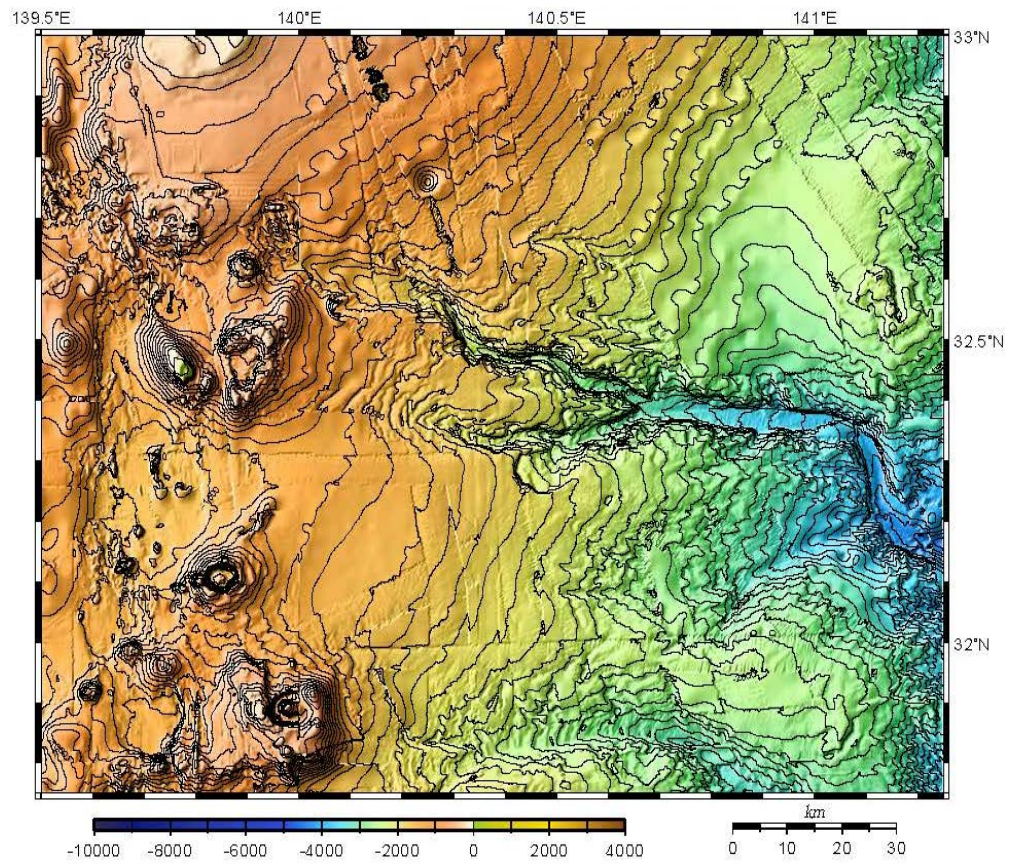
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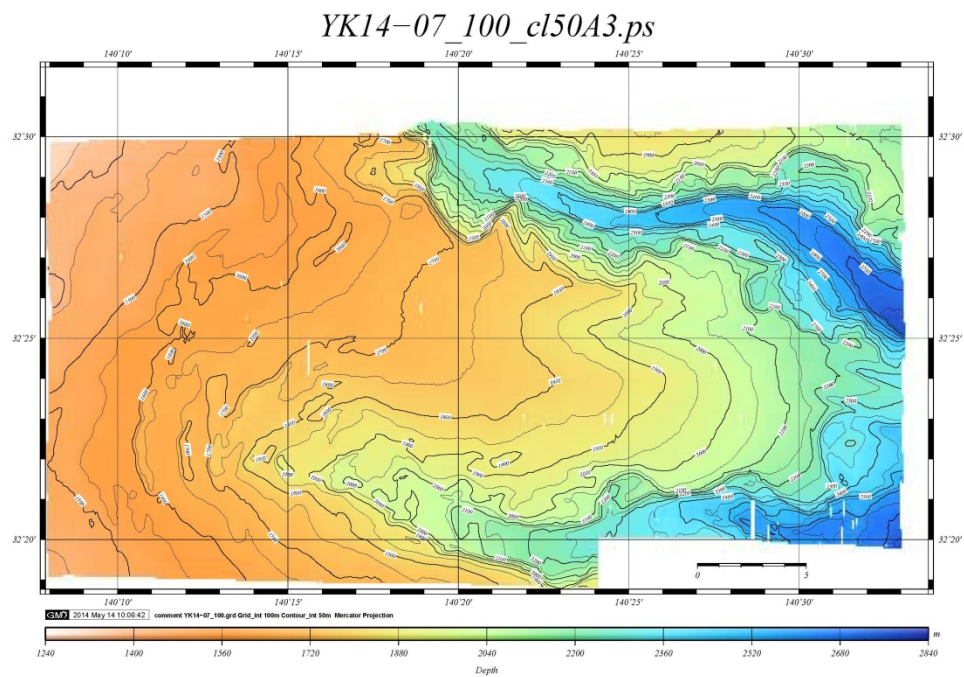
1. Cruise Information

- Cruise ID: YK14-07
 - Name of vessel: Yokosuka
 - Title of the cruise: Ocean bottom pressure gauge array observation
 - Title of proposal: Study of ocean-solid Earth system by ocean bottom pressure gauge array observation
 - Cruise period: May 12, 2014 – May 15, 2014
 - Ports of call: JAMSTEC Pier – Sumiju Port
 - Research area: Off east of Aogashima
 - Research Map
- Cruise track:

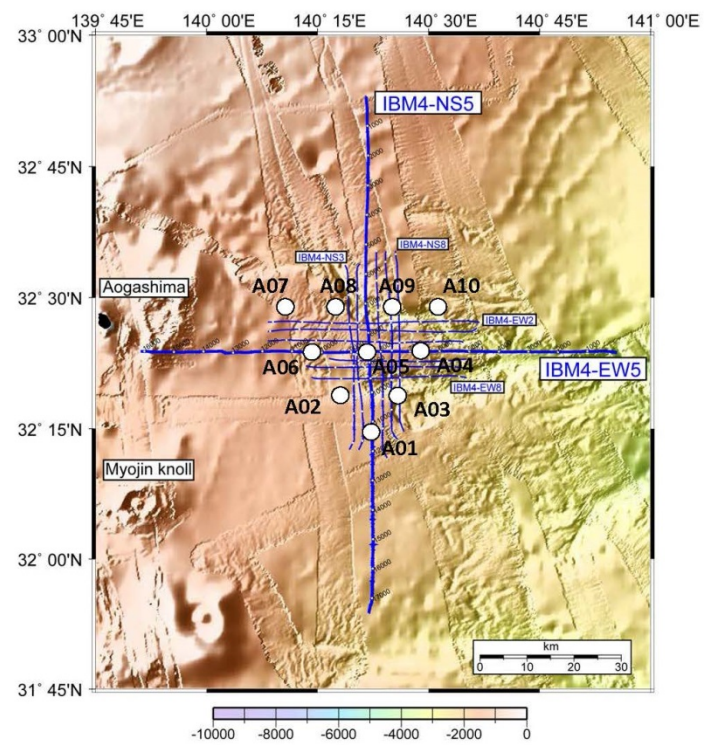


Survey Area





Observation points



設置点	時刻 (JST)	母船緯度	母船経度	水深 (m)	流向・流速
2014/5/13					
A10 OBP 投入	6:16:23	32-28.9644N	140-30.5870E	2228m	
A10 XCTD 投入	6:23:22	32-28.9307N	140-30.1760E	2258m	
A9 OBP 投入	7:07:21	32-28.9457N	140-24.1976E	1997m	
A9 XCTD 投入	7:12:05	32-28.9241N	140-23.9784E	2007m	投入/潮流→ 82.3, 0.6
A8 OBP 投入	7:56:09	32-28.9585N	140-17.8223E	1779m	投入/潮流→133.4, 0.7
A8 XCTD 投入	8:00:03	32-28.9206N	140-17.6902E	1767m	投入/潮流→155.8, 0.6
A7 OBP 投入	8:46:02	32-28.9449N	140-11.3897E	1468m	投入/潮流→175.6, 0.8
A7 XCTD 投入	8:49:04	32-28.7952N	140-11.4918E	1470m	投入/潮流→166.1, 0.7
A4 OBP 投入	9:33:02	32-24.2670N	140-14.5881E	1675m	投入/潮流→ 70.3, 1.0
A4 XCTD 投入	9:36:07	32-24.1777N	140-14.6868E	1687m	投入/潮流→ 78.8, 1.0
A2 OBP 投入	10:26:12	32-19.5637N	140-17.7971E	1771m	投入/潮流→104.1, 0.9
A2 XCTD 投入	10:29:19	32-19.4552N	140-17.9397E	1758m	投入/潮流→104.1, 1.1
A1 OBP 投入	11:17:08	32-14.9605N	140-21.0044E	1745m	投入/潮流→ 79.7, 0.9
A1 XCTD 投入	11:19:19	32-14.8726N	140-21.0995E	1747m	投入/潮流→ 87.2, 0.9
A6 OBP 投入	12:45:47	32-24.2717N	140-27.3954E	1973m	投入/潮流→113.0, 0.9
A6 XCTD 投入	12:48:17	32-24.1840N	140-27.3346E	1968m	投入/潮流→133.8, 0.8
A3 OBP 投入	13:37:22	32-19.5686N	140-24.2051E	2184m	投入/潮流→124.6, 0.6
A3 XCTD 投入	13:40:03	32-19.4856N	140-24.1583E	2155m	投入/潮流→157.5, 0.5
A5 OBP 投入	14:47:21	32-24.2612N	140-20.9697E	1759m	投入/潮流→156.9, 0.5
A5 BBOBS 投入	14:54:15	32-24.2787N	140-20.9741E	1754m	投入/潮流→150.1, 0.5
A5 XCTD 投入	14:58:04	32-24.2379N	140-21.0105E	1756m	投入/潮流→150.6, 0.6

2. Researchers

- Chief scientist: Yoshio Fukao (JAMSTEC)
- Representative of the science party: Yoshio Fukao (JAMSTEC)
- Science party (List) :

Yoshio Fukao (JAMSTEC), Planning, Observational support
Hiroko Sugioka (JAMSTEC), Preparation, Installation
Aki Ito (JAMSTEC), Preparation, Installation

3. Observation

- Overview of the observation

We have so far developed an array system of high resolution ocean bottom pressure gauges to observe phenomena occurring above and below the seafloor simultaneously. We deployed this system on the seafloor off coast of Aogashima Island to observe, among others, internal tides, ocean infragravity waves and low-frequency earthquakes for about a year period from May 13, 2013. This observation is expected to retrieve signals of low order internal tides and to obtain information about the sources of infragravity waves.

- Activities

- (1) Deployment of 10 high resolution pressure gauges and a BBOBS

We placed 10 high resolution pressure gauges in an equilateral triangle with a side 30 km that consists of 9 smallest equilateral triangles with a side 10 km long. At the central site of this array we also deployed a set of broadband ocean bottom seismometer and a high resolution differential pressure gauges. At each of 10 pressure gauge stations and a broadband seismic station we confirmed that the instrument started recording. We also conducted echo ranging to determine its precise position.

- (2) XCTD measurements

At each of the ten observational sites we conducted XCTD measurement to extract information about the 1D structure of the ocean.

- (3) Seafloor topographic survey

A seafloor topographic survey was done by multi-beam echo sounding. The amount of data was limited, however, because we had to shorten the schedule to escape from an approaching storm.

- (4) ADCP survey

During the navigation an ADCP survey was done to extract information about ocean current.

Detail

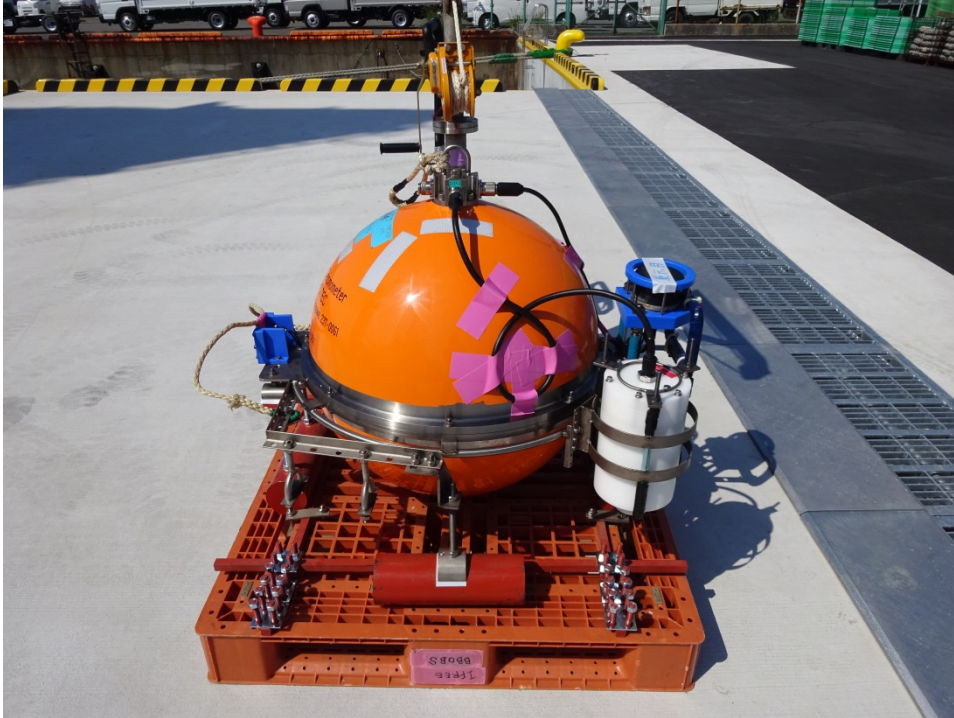
日付 Date	時間 Local Time	内容 Note	特記事項 Description	本船位置／気象／海象 Position/Weather/Wind/Sea condition
12-May-14		Sail out, proceeding to research area		5/12 12:00 (UTC+9h)
	08:00	boarded		34-43.4'N, 139-42.2'E
	09:00	Proceeding to research area		East off Oshima
	10:00-10:30	Briefing about ship's life and safety		c (Cloudy)
	16:30-17:00	Meeting (R/V YOKOSUKA Crew and Scientist).		SW-5 (Fresh breeze)
	23:00	Arrived at research area.		3 (Sea slight)
	23:01	Released XBT at <32-32.7062'N, 140-09.6134'E>		1 (Low swell short or average)
	23:48	Commenced MBES survey.		Visibly: 7'
13-May-14		Deploy OBP & BBOBS at site A01-A10		5/13 12:00 (UTC+9h)
	05:48	Finished MBES survey.		32-19.5'N, 140-25.4'E
	06:16	Deployed OBP at site A10 (32-28.9644'N, 140-30.5870'E)	depth: 2228.4m	East off Aogashima
	06:23	Released XCTD at site A10 (32-28.9307'N, 140-30.1760'E)	depth: 2258.2m	r (Rain)
	07:07	Deployed OBP at site A09 (32-28.9457'N, 140-24.1976'E)	depth: 1997.1m	S-7(Near gale)
	07:12	Released XCTD at site A09 (32-28.9241'N, 140-23.9784'E)	depth: 2007.4m	5 (Sea rough)
	07:56	Deployed OBP at site A08 (32-28.9585'N, 140-17.8223'E)	depth: 1779.2m	4 (Moderate average)
	08:00	Released XCTD at site A08 (32-28.9206'N, 140-17.6902'E)	depth: 1767.0m	Visibly: 2'
	08:46	Deployed OBP at site A07 (32-28.9449'N, 140-11.3897'E)	depth: 1467.7m	

	08:49	Released XCTD at site A07 (32-28.7952'N, 140-11.4918'E)	depth: 1469.9m	
	09:33	Deployed OBP at site A04 (32-24.2670'N, 140-14.5881'E)	depth: 1675.4m	
	09:36	Released XCTD at site A04 (32-24.1777'N, 140-14.6868'E)	depth: 1686.8m	
	10:26	Deployed OBP at site A02 (32-19.5637'N, 140-17.7971'E)	depth: 1771.0m	
	10:29	Released XCTD at site A02 (32-19.4552'N, 140-17.9397'E)	depth: 1757.9m	
	11:17	Deployed OBP at site A01 (32-14.9605'N, 140-21.0044'E)	depth: 1744.8m	
	11:19	Released XCTD at site A01 (32-14.8726'N, 140-21.0995'E)	depth: 1747.3m	
	12:45	Deployed OBP at site A06 (32-24.2717'N, 140-27.3954'E)	depth: 1973.0m	
	12:48	Released XCTD at site A06 (32-24.1840'N, 140-27.3346'E)	depth: 1968.2m	
	13:37	Deployed OBP at site A03 (32-19.5686'N, 140-24.2051'E)	depth: 2184.1m	
	13:40	Released XCTD at site A03 (32-19.4856'N, 140-24.1583'E)	depth: 2154.6m	
	14:47	Deployed OBP at site A05 (32-24.2612'N, 140-20.9697'E)	depth: 1759.1m	
	14:54	Deployed BBOBS at site A05 (32-24.2787'N, 140-20.9741'E)	depth: 1753.9m	
	14:58	Released XCTD at site A05 (32-24.2379'N, 140-21.0105'E)	depth: 1756.1m	
	21:02-22:22	Carried out confirmation of acoustic signal from OBP & BBOBS (A05).		
	22:33-23:09	Carried out confirmation of acoustic signal from OBP (A06).		
	23:53	Carried out confirmation of acoustic signal from OBP (A03).		
14-May-14		Calibrate OBP & BBOBS & Proceeded to SUMITOMOZYUKIKAI-Quay		5/14 12:00 (UTC+9h)
	00:10	Finished confirmation of acoustic signal from OBP (A03).		32-19.3'N, 140-23.9'E
	01:08	Commenced MBES survey.		East off Aogashima
	08:18	Finished MBES survey.		bc (Fine but cloudy)
	08:55-09:10	Carried out confirmation of acoustic signal from OBP & BBOBS (A05).		W-4 (Moderate breeze)

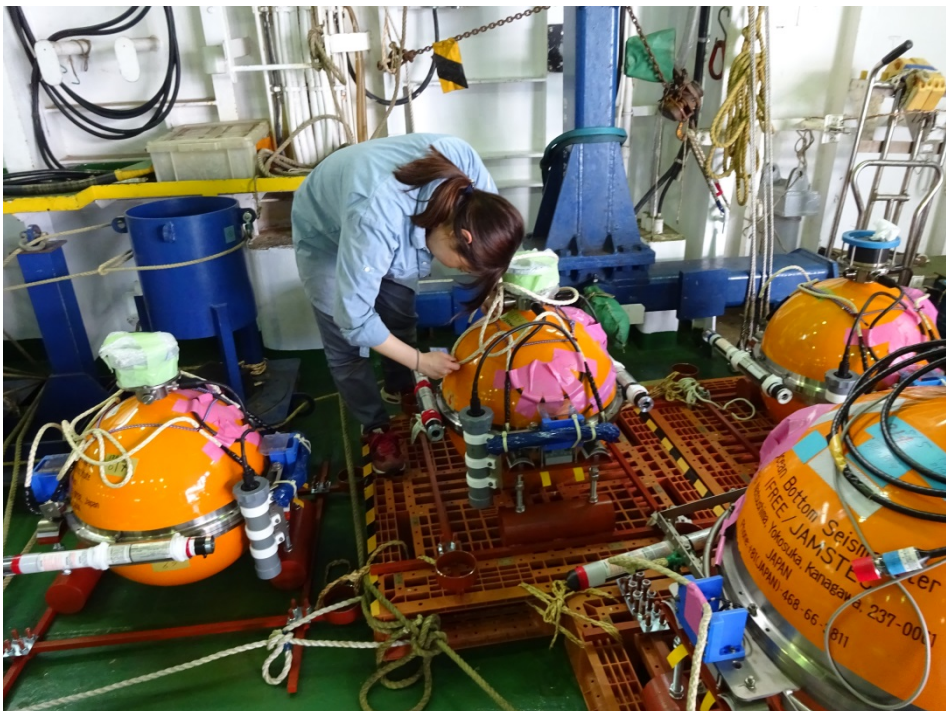
	09:15-10:02	Carried out calibration of OBP & BBOBS (A05).		3 (Sea slight)
	10:36-10:56	Carried out calibration of OBP (A06).		2 (Low swell long)
	11:32-12:10	Carried out calibration of OBP (A03).		Visibly: 7'
	12:46-13:23	Carried out calibration of OBP (A01).		
	13:57-14:34	Carried out calibration of OBP (A02).		
	15:09-15:47	Carried out calibration of OBP (A04).		
	16:20-16:53	Carried out calibration of OBP (A07).		
	17:29-18:04	Carried out calibration of OBP (A08).		
	18:46-19:21	Carried out calibration of OBP (A09).		
	20:00-20:30	Carried out calibration of OBP (A010).		
	20:45	Proceeding to YOKOSUKA-Ko.		
15-May-14		Arrived at off SUMITOMOZYUKIKAI-Quay		5/15 12:00 (UTC+10h)
	15:00	Disembarked at SUMITOMOZYUKIKAI-Quay.		35-19.7'N, 139-40.5'E
				YOKOSUKA-Ko No.4
		Finished YK14-07 cruise.		o (Overcast)
				NNE-4 (Moderate breeze)
				3 (Sea slight)
				1 (Low swell short or average)
				Visibly: 3'

- Instruments

BBOBS (Broadband ocean bottom seismograph) and DPG (Differential pressure gauge)



OBPs (Ocean bottom pressure gauges)



Installation of an OBP on the seafloor



BBOBS employed

Guralp CMG-3T: 100 Hz-sampling

<http://www.guralp.com/documents/DAS-030-0001.pdf#search='CMG3T'>

<https://www.passcal.nmt.edu/content/instrumentation/sensors/broadband-sensors/cm3g-3t-bb-sensor>

DPG employed

DPG_JAMSTEC: 100 Hz-sampling

http://www.godac.jamstec.go.jp/catalog/data/doc_catalog/media/JAM_RandDsp_17.pdf

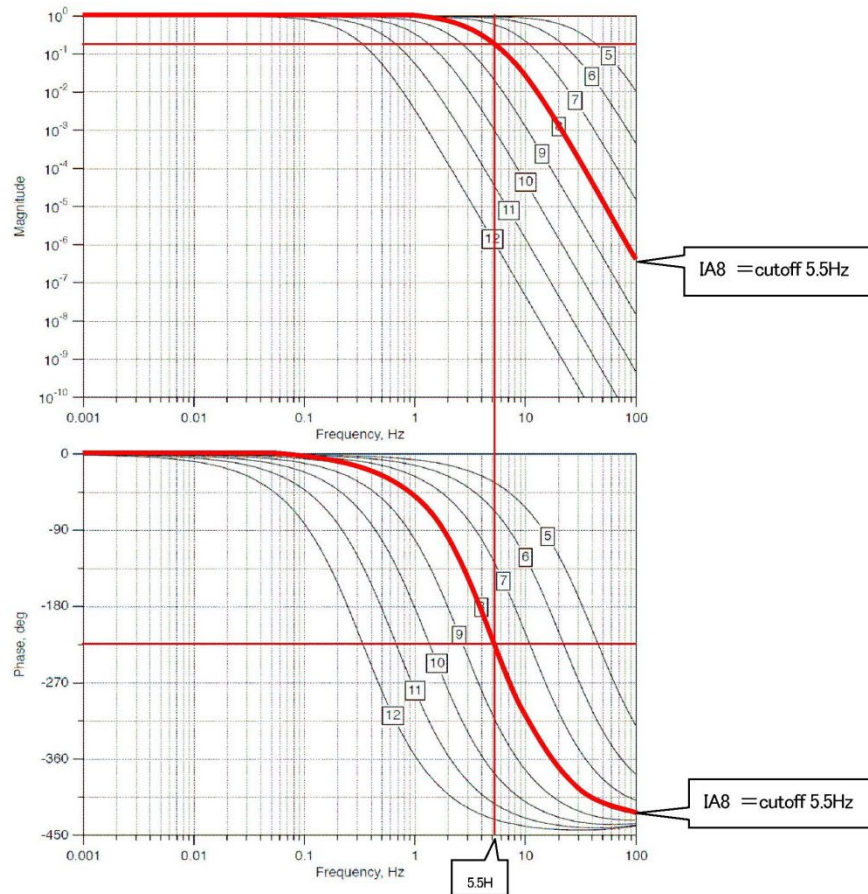
OBP employed

Paroscientific 8B7000-I-005: 4 Hz-sampling

Cutoff frequency: 1.4 Hz (IA=10)

<http://www.paroscientific.com/depthsensors.htm>

<http://www.mercan.co.jp/series8000-jp.pdf#search='paroscientific'>



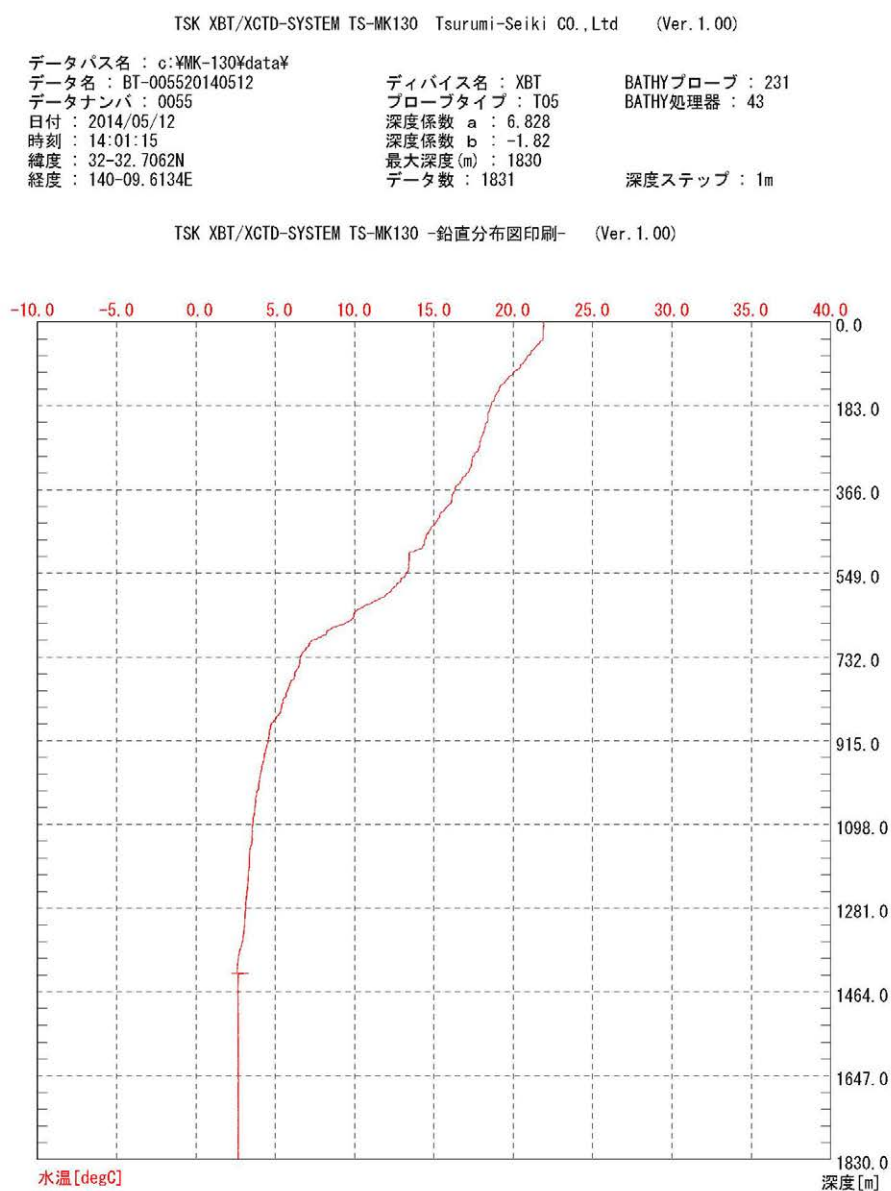
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sampling frequency : fs = 1 / 28.7e-6 / 4
integer ia
real pi, f, omega, fs, delta, alpha, mag, phase, xfr, xfi
complex z, xf, xfl
alpha = 1 / (2 ^ ia)
omega = 2 * pi * f
fs = 1 / 28.7e-6 / 4
delta = 1 / fs
z = complex(cos(omega*delta), sin(omega*delta))
xfl = 1 / (1/alpha - (1-alpha)/alpha/z)
xf = xfl * xfl * xfl * xfl * xfl
xfr = real(xf)
xfi = imag(xf)
mag = sqrt(xfr * xfr + xfi * xfi)
phase = atan(xfi / xfr)

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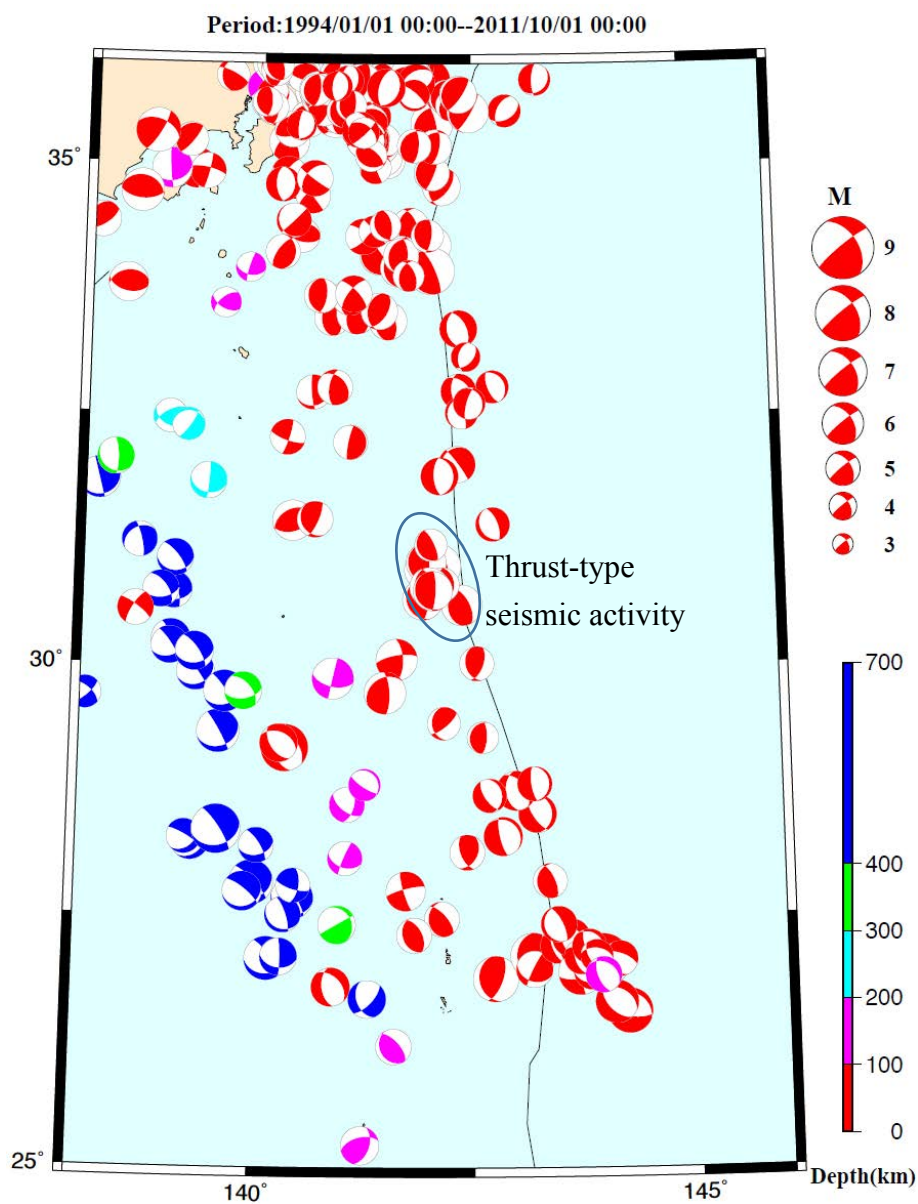
● Research results

The ocean bottom array observations have just started. We have to await a year period to recover the array system and to retrieve the records from it. Following is an example of the result of the XCTD cast that was simultaneously with the OBP installation at each observational site.

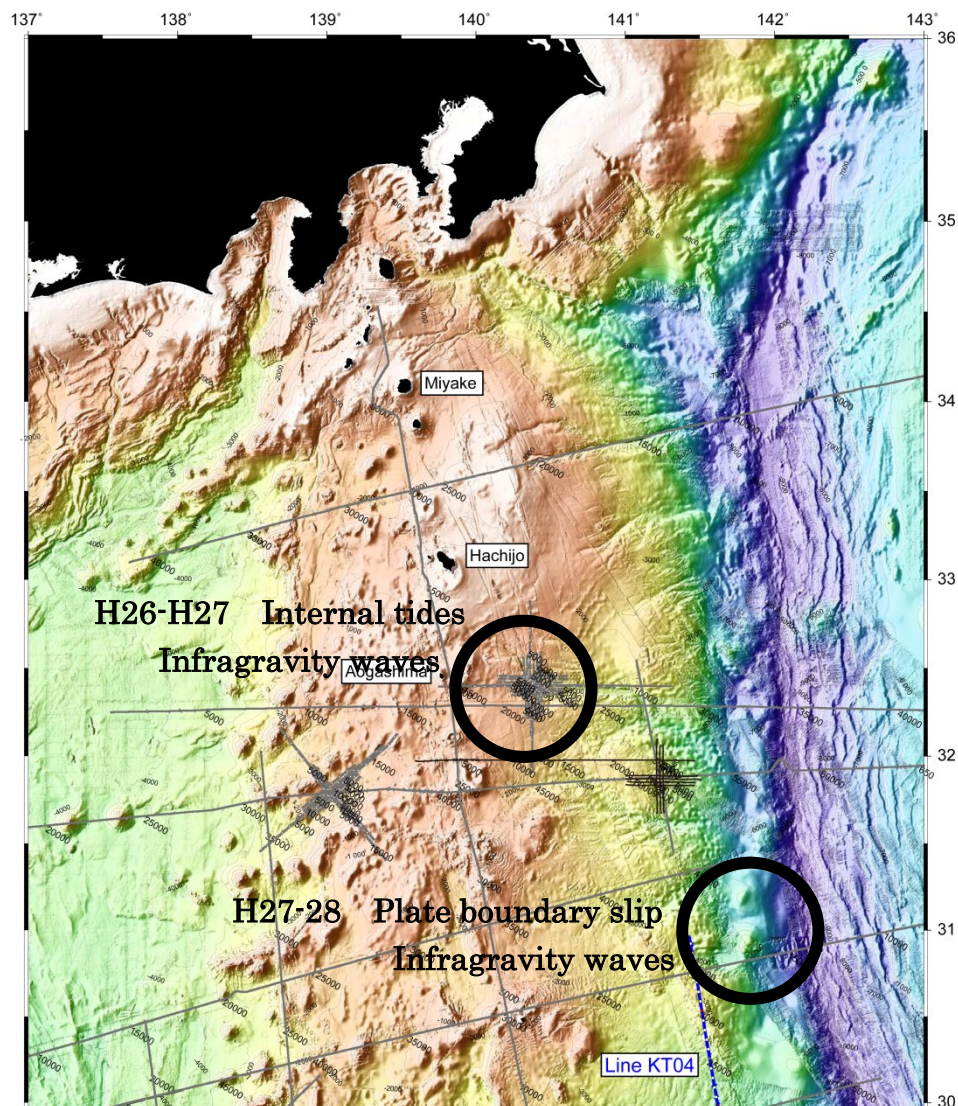


- Future plans

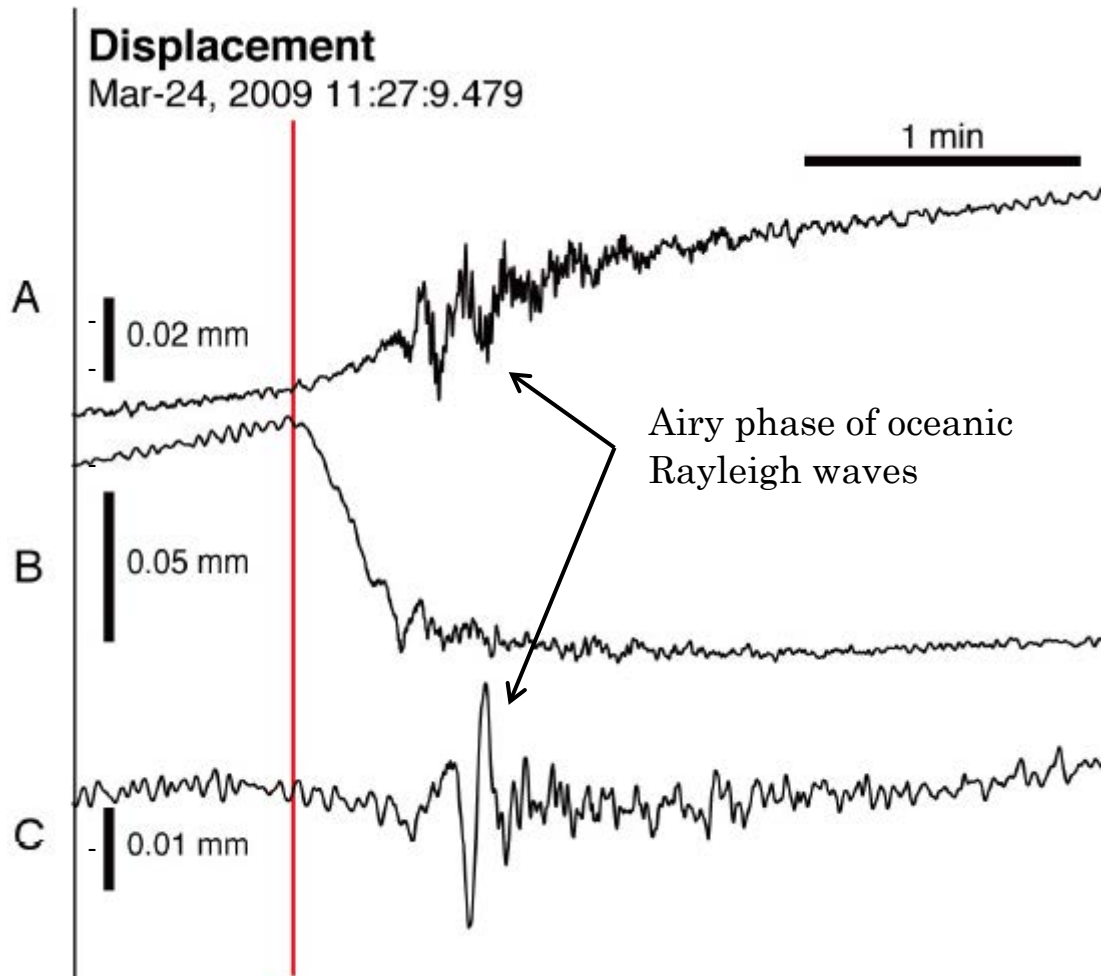
The survey this time is emphasized on one-year observation of processes occurring mainly in the ocean, including internal tides and infragravity waves, using the array of 10 high-resolution pressure gauges placed at the sea bottom off east of Aogashima. The next survey is planned to target on one-year observation of processes occurring mainly inside the Earth using the same observational system. The target area is marked by ellipse in the following map, where the thrust-type seismic activity is unusually high in this particular area of the Izu-Bonin subduction zone.



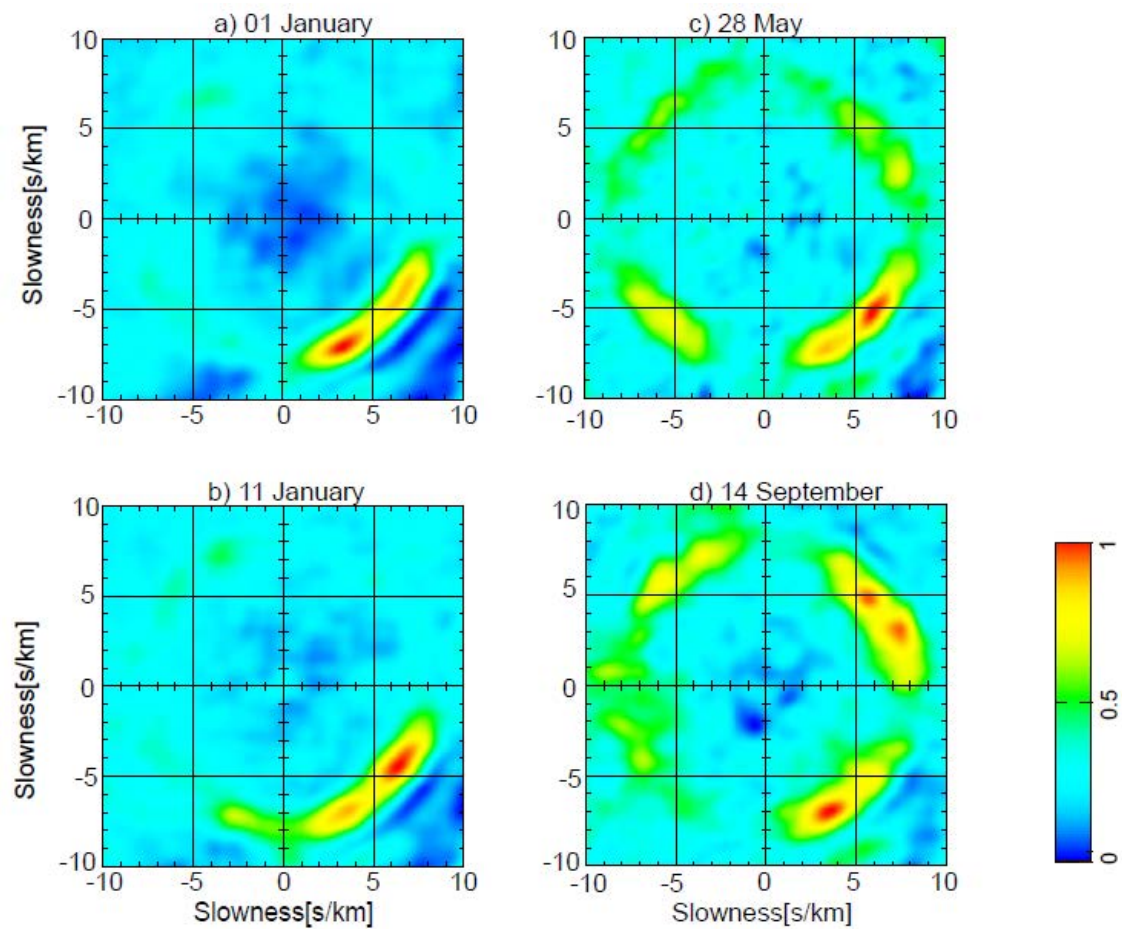
We for this reason plan to apply the form for the use of a JAMSTEC research vessel in the FY2015 to recover the observational system now deployed off east of Aogashima, to retrieve the data, check the instruments and prepare for the next installation on board and to deploy the observation system on the seafloor in the next target area, about 200 km to the southeast of the currently observing area. The new target area is slightly inward of the Bonin trench, as shown in the next map, where the plate subduction is considered to occur mostly in aseismic mode.



The main observational target is the event-like plate boundary slip, which may be detected by observing the oceanic Rayleigh waves in Airy phase with dominant periods of about 10 s, as shown in the next figure. The array of high resolution pressure gauges could detect even slower plate boundary slip that excites seismic waves poorly/



We will also try to locate the excitation sources of infragravity waves using this pressure gage array and that of the DONET of JAMSTEC simultaneously. We have so far determined the direction of the excitation sources of infragravity waves using the pressure gage array of the DONET, as demonstrated below (Tono et al. EPS, 2014 under review). Joint use of the two arrays will make it possible to locate the excitation sources.



4. Notice on Using

Notice on using: Insert the following notice to users regarding the data and samples obtained.

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.