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Cruise Report

MR12-E02

Off Sanriku, north-eastern Japan

Marine Ecosystems Investigation, Impact by the mega-earthquake (the 2011 Earthquake of the Pacific coast of Tōhoku) and Tsunami: For Recovery and Rebuilding of Sanriku Fisheries Activities

R. V. Mirai

Leg 2: March 15, 2012- March 22, 2012

of

March 6, 2012- March 30, 2012

Project: TEAMS (Tohoku Ecosystem-Associated Marine Sciences)

JAMSTEC

Cruise Report ERRATA of the Nutrients part

page	Error	Correction
13	potassium nitrate CAS No. 7757-91-1	potassium nitrate CAS No. 7757-79-1

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1-4. Title of proposal: Marine Ecosystems Investigation, Impact by the mega-earthquake (the 2011 Earthquake of the Pacific coast of Tōhoku) and Tsunami: For Recovery and Rebuilding of Sanriku Fisheries Activities

1-5. Cruise period: March 15-22, 2012

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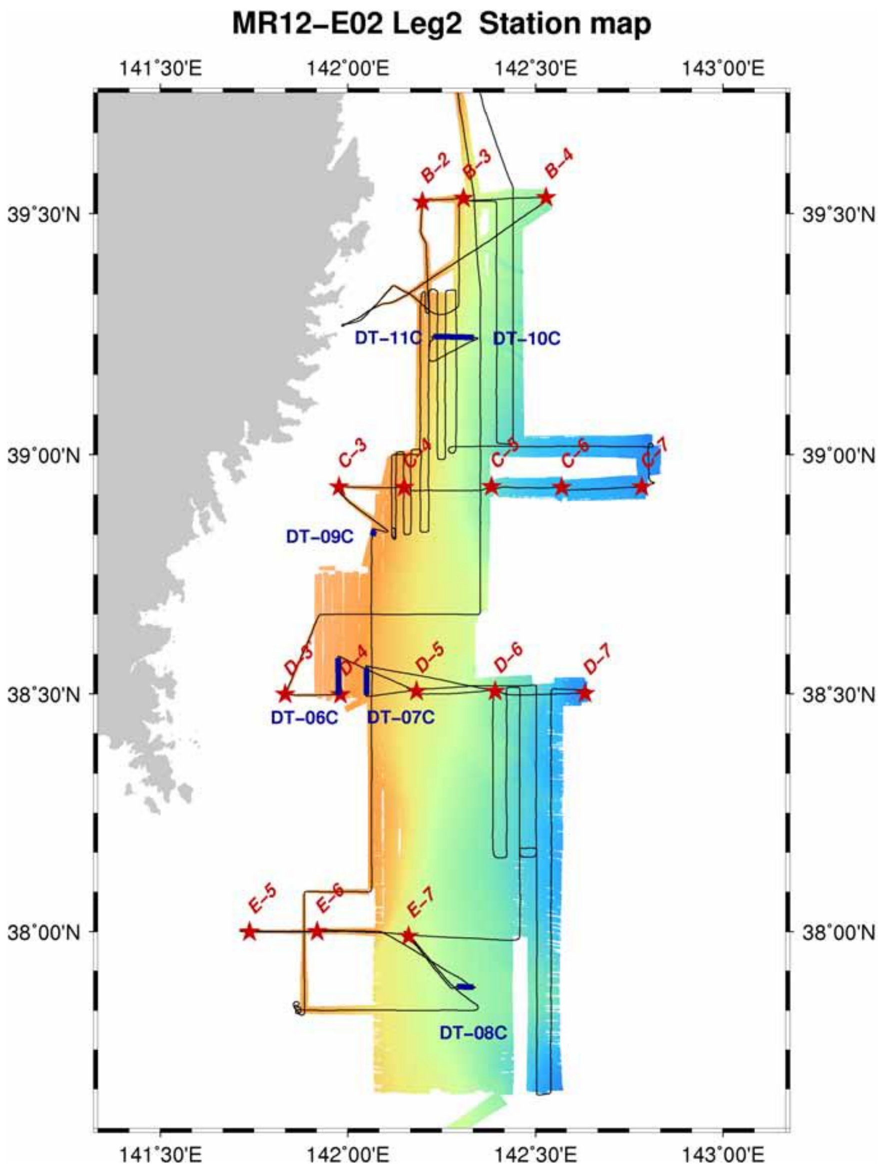
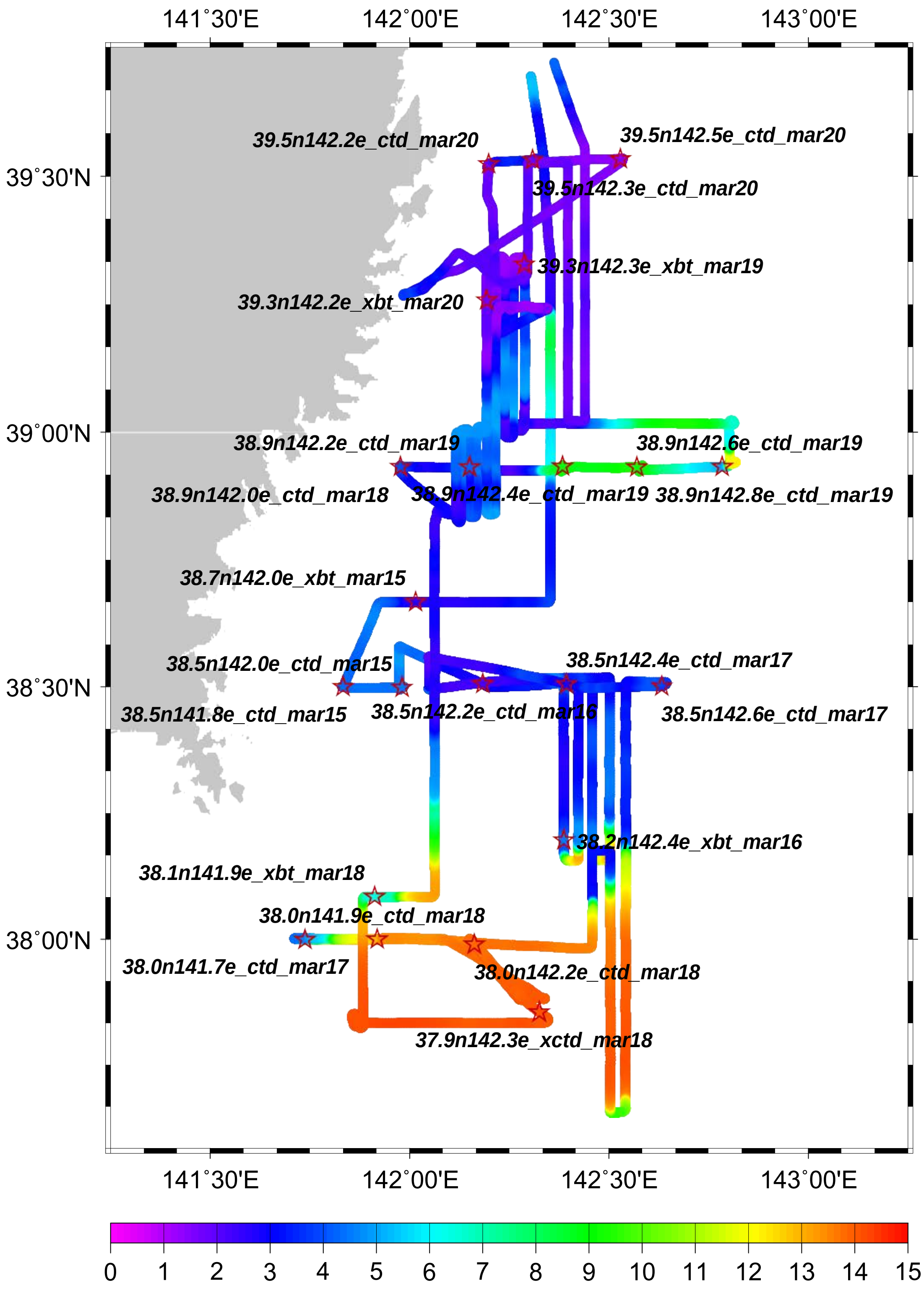
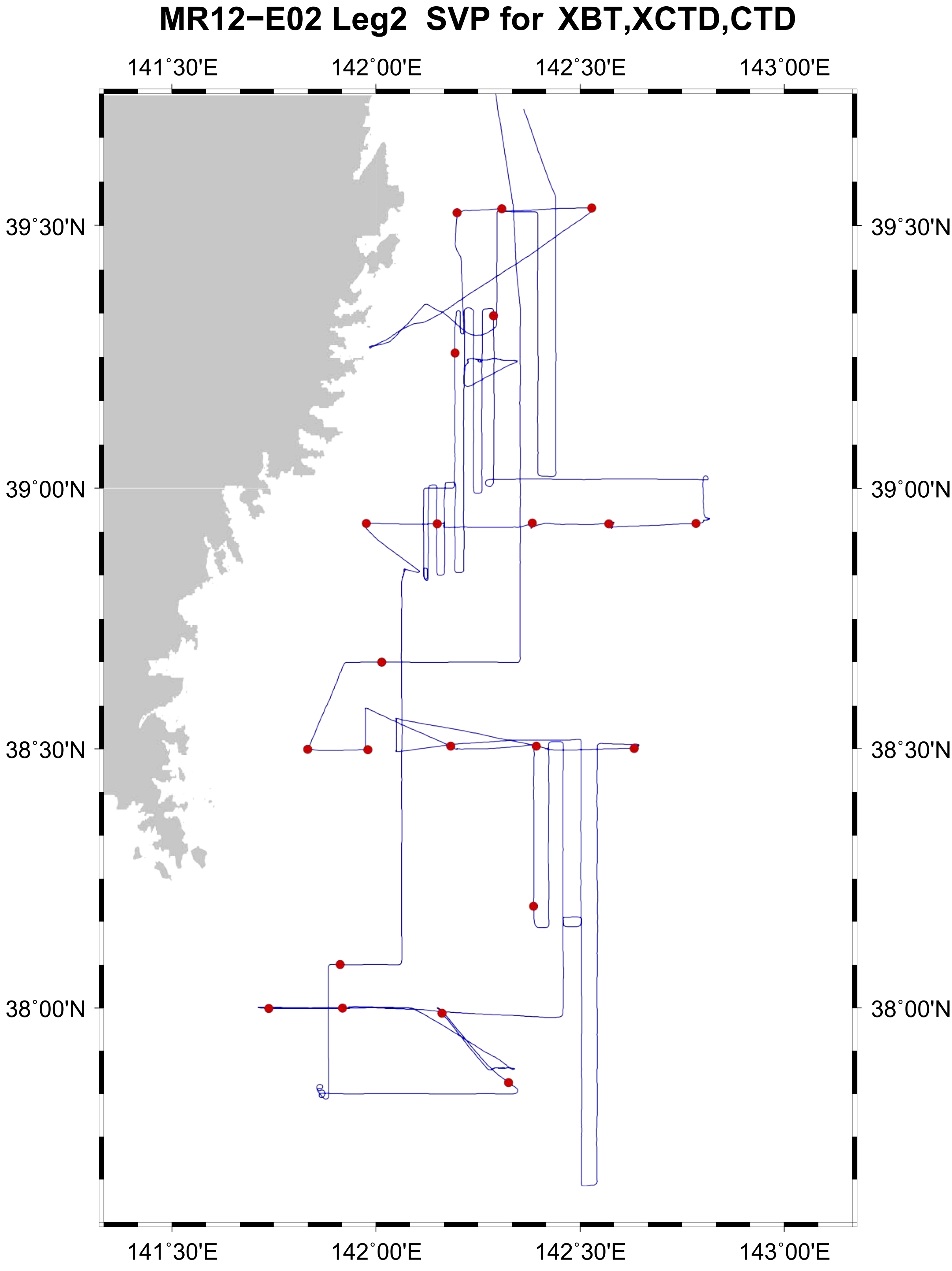


MR12−E02 Leg2 SST&SVP





2. Participants

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1st Officer: Hajime Matsuo
2nd Officer: Haruka Wakui
3rd Officer: Hiroki Kobayashi
Chief Engineer: Hiroyuki Suzuki
1st Engineer: Hiroyuki Tohken
2nd Engineer: Toshio Kiuchi
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3. Investigations

3-1. Introduction

The purpose of this cruise is to understand impacts on marine ecosystems by the 2011 Earthquake of the Pacific coast of Tōhoku and Tsunami, and to contribute for recover and rebuild of Sanriku fisheries activities in terms of marine science. Target areas are continental slope and shelf off Sanriku. This cruise is conducted under the TEAMS project, namely Tohoku Ecosystem-Associated of Marine Sciences. Detail investigation subjects are topographic surveys, mapping of scattered debris, distribution patterns and diversity of benthic organisms, seawater and sediments geochemistry, and sediments components. Based on these data and samples, we will construct habitat map for ecosystem management in Sanriku areas.

本航海は，2011 年 3 月 11 日の東北地方太平洋沖地震と津波により引き起こされた東北地方沖の海洋生態系への影響を評価し，被災地の効果的、効率的な漁業の復興に貢献することを目的とする。この航海は，東北マリンサイエンス拠点形成事業の一環として実施し，海洋研究開発機構は三陸沖の沖合底層生態系を対象に調査を行う. 具体的には，地形と瓦礫の精密マッピング，生物分布と多様性，海水化学成分、堆積物地質構造と成分分析，生物の有害物質蓄積量に関するデータとサンプル取得を主に行い，生態系ハビタットマッピングの構築情報として利用する。

3-2. Facilities

3-2-1. Deep towing TV camera system

4,000m 級ディープ・トウ カメラシステム（以下、4KC）は、テレビカメラをはじめ各種の海底観察装置やデータ伝送装置を搭載した水中部（曳航体）と、水中部との通信、データの処理、表示および記録を行う船上部により構成されている。両者は線長 4,500m の曳航ケーブルを介して接続され、内蔵された同軸ケーブルによって信号を伝送している。

〇水中部

水中部の最大使用深度は 4,000m である。水中部は、専用オープンフレーム（長さ 3.6m、幅 1.15m、

高さ 1.62m）に搭載されており、空中重量は 700kg、水中重量は 500kg である。主な搭載機器は 3CCD カメラ（1 基）、CCD 白黒カメラ（1 基）、デジタルカメラ（ソニーサイバーショット DSC-F717×1 基）、スティルカメラ（Benthos 372A×1 基）、ストロボ（Benthos 382A×1 基、Metz 製 MECABLITZ36 C-2 改造型×1 基）、水中ライト 250W（DEEPSEA LIGHT×4 灯）、CTD センサ（SBE9Plus）、溶存酸素センサ（SBE43）、透過度計（ALPHATRACKA MKⅡ）、高度計（Tritech LRPA200）、信号伝送装置水中部、音響トランスポンダ（BENTHOS XT-6001-10 Tx:14.0kHz Rx:13.0kHz）である。

この他、本航海では生物採取のため、4KC フレーム下部にディープ・トウ用小型ドレッジ（以下、ドレッジ）を搭載した。ドレッジには搭載用のフックとマスターリングが取り付けられている。搭 載方法はドレッジに取り付けられたフックを曳航体フレームに取り付け、マスターリングを切り離 し装置（MR-5000B）に取り付けた。ドレッジを切り離した際のチェーンの長さは 3m に設定し、ドレッジオペレーションは高度 2m を維持した。

写真 3-2-1-1 に 4KC 水中部の写真、図 3-2-1-1 に同機器系統図、図 3-2-1-2 にディープ・トウ用小型ドレッジの構成図を示す。

写真 3-2-1-1　4,000m 級ディープ・トウ　カメラ水中部

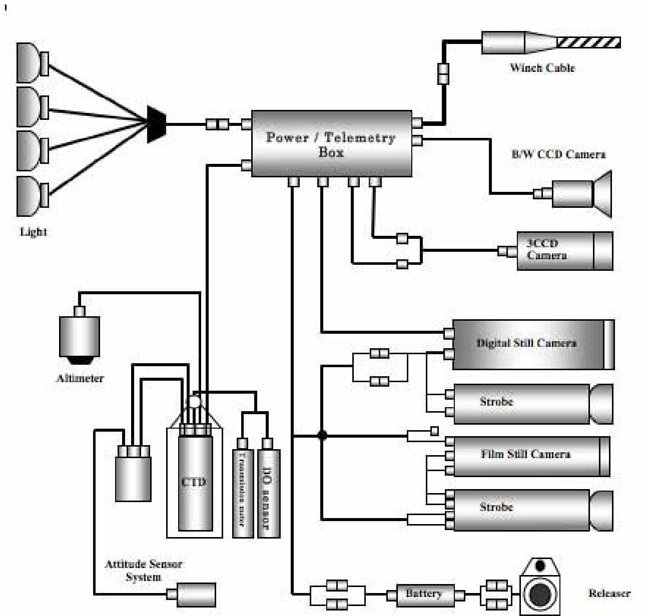


図 3-2-1-1　4,000m 級ディープ・トウ　カメラ水中部　機器系統図

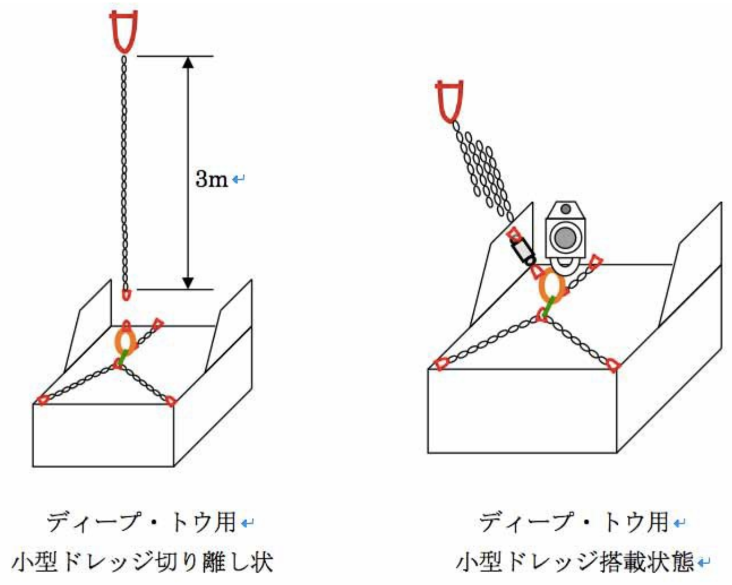


図 3-2-1-2 ディープ・トウ用小型ドレッジ構成図

チェーン
- 吊り用チェーン（3m）
- ３点吊りチェーン（前２本 0.3m、後１本 0.36m）

茶：吊りシャックル（KANSAI　0.6ｔ）
橙：マスターリング（マスターリングＭ　1.25t）
赤：3 点吊りシャックル（0.2ｔ　ＩＲＯＮ　ＴＡＩＹＯ）
緑：ヒューズ用番線（φ3.2mm）　シャックルとマスターリングを 4 回巻き付け

○船上部

4,000m 級ディープ・トウ カメラコンテナ内には、信号伝送装置船上部、CTD　デッキユニット（SBE11Plus）、スーパーインポーズ装置、テレビモニタおよび HDD-DVD レコーダー（3 台）が搭載されている。映像はテレビモニタにて監視し、DVD　に録画した。また、映像には測線名、日付、時刻の他、曳航体の深度、方位、高度計、水温のデータ等をスーパーインポーズした。

調査中、水中部から伝送される各種データや映像の監視、映像録画、デジタルカメラおよびスティルカメラの撮影を行った。

また、ジンバルシーブから伝送される線長、張力、シーブ角度を監視する線長計、多ペンレコーダー、曳航支援パソコン、ウインチオペレーション用モニタが設置されており、調査中はジンバルシーブデータの監視、ウインチオペレーションが行われた。ウインチオペレーションは、リアルタイムの CTD 深度、および高度データを用いて操作した。

○二重外装同軸ケーブル

水中部（曳航体）と船上部は、外径 17.4mm の二重鋼線外装が施された同軸ケーブルで接続されている。総ケーブル長は 4,500m である。表表 3-2-1-1 に二重外装同軸ケーブルの特性を示す。

表3-2-1-1　二重外装同軸ケーブル特性

項目		特性値
導体抵抗 (20℃)	内部導体	3.49 Ω/km以下
	外部導体	4.06 Ω/km以下
絶縁抵抗 (DC500Ω)	内・外導体間	5,000MΩ・km以上
	外部導体・外装間	5,000MΩ・km以上

絶縁耐力	内・外導体間	AC 9,100V
	外部導体・外装間	AC 3,800V
標準静電容量(1kHz)		125.4nF/km
標準減衰量(100kHz)		6.7dB/km
特性インピーダンス(1MHz)		40±3Ω
ケーブル破断強度		15ton以上
重量		870kg/km（水中）

○測位システム

調査中の曳航体位置の測位には、母船の D-GPS 及び曳航体搭載のトランスポンダによる音響航法装置（SSBL：Super Short Base Line）を用いた。

3-2-2. Hydrographic observations.

3-2-2-1. CTD cast and water sampling

Objective

Investigation of oceanic structure and water sampling.

Parameters

Temperature (Primary and Secondary), Conductivity (Primary and Secondary), Pressure, Dissolved Oxygen, Fluorescence, Transmission Voltage, Dissolved Oxygen Voltage, Photosynthetically Active Radiation (PAR), Altimeter

Instruments and Methods

CTD/Carousel Water Sampling System, which is a 36-position Carousel water sampler (CWS) with Sea-Bird Electronics, Inc. CTD (SBE9plus), was used during this cruise. 12-litter Niskin Bottles, washed by neutral detergent, were used for sampling seawater. The sensors attached on the CTD were temperature (Primary and Secondary), conductivity (Primary and Secondary), pressure, dissolved oxygen, fluorescence, transmission voltage, RINKO-III (dissolved oxygen sensor), PAR sensor, and altimeter. The Practical Salinity was calculated by measured values of pressure, conductivity and temperature. The CTD/CWS was deployed from starboard on working deck.

The CTD raw data were acquired on real time using the Seasave-Win32 (ver.7.21d) provided by Sea-Bird Electronics, Inc. and stored on the hard disk of the personal computer. Seawater was sampled during the up cast by sending fire commands from the personal computer. We usually stop at each layer for 30 seconds to stabilize then fire. 16 casts of CTD measurements were conducted (Table 3-2-2-1). During the up cast of D07M01 (300-146dbar), unusual profile was observed in the secondary temperature and conductivity data. During the down cast of C06M01 (762-1163dbar), noisy profile was observed in the transmission data. Data processing procedures and used utilities of SBE Data Processing-Win32 (ver.7.18d) and SEASOFT were as follows:

(The process in order)

DATCNV: Convert the binary raw data to engineering unit data. DATCNV also extracts bottle information where scans were marked with the bottle confirm bit during acquisition. The duration was set to 3.0 seconds, and the offset was set to 0.0 seconds.

RINKOCOR (original module): Corrected the hysteresis of RINK-III voltage.

RINKOCORROS (original module): Corrected the hysteresis of RINKO-III voltage for bottle data.

BOTTLESUM: Create a summary of the bottle data. The data were averaged over 3.0 seconds.

ALIGNCTD: Convert the time-sequence of sensor output into the pressure sequence to ensure that all calculations were made using measurements from the same parcel of water. Dissolved oxygen data are systematically delayed with respect to depth mainly because of the long time constant of the dissolved oxygen sensor and of an additional delay from the transit time of water in the pumped pluming line. This delay was compensated by 6 seconds advancing dissolved oxygen sensor (SBE43) output (dissolved oxygen voltage) relative to the temperature data. RINKO-III data and transmission voltage data are also delayed by

slightly slow response time to the sensor. The delay was compensated by 1 second or 2 seconds advancing.
WILDEDIT: Mark extreme outliers in the data files. The first pass of WILDEDIT obtained an accurate estimate of the true standard deviation of the data. The data were read in blocks of 1000 scans. Data greater than 10 standard deviations were flagged. The second pass computed a standard deviation over the same 1000 scans excluding the flagged values. Values greater than 20 standard deviations were marked bad. This process was applied to pressure, depth, temperature, conductivity and dissolved oxygen voltage (SBE43).
CELLTM: Remove conductivity cell thermal mass effects from the measured conductivity. Typical values used were thermal anomaly amplitude alpha = 0.03 and the time constant 1/beta = 7.0.
FILTER: Perform a low pass filter on pressure with a time constant of 0.15 second. In order to produce zero phase lag (no time shift) the filter runs forward first then backward
WFILTER: Perform a median filter to remove spikes in the fluorescence data and transmission voltage data. A median value was determined by 49 scans of the window.
*For the cast of C06M01, WFILTER (median: windows size = 9) was added to reduce the noise of transmission data.
SECTIONU (original module of SECTION): Select a time span of data based on scan number in order to reduce a file size. The minimum number was set to be the starting time when the CTD package was beneath the sea-surface after activation of the pump. The maximum number of was set to be the end time when the package came up from the surface.
LOOPEDIT: Mark scans where the CTD was moving less than the minimum velocity of 0.0 m/s (traveling backwards due to ship roll).
DESPIKE (original module): Remove spikes of the data. A median and mean absolute deviation was calculated in 1-dbar pressure bins for both down and up cast, excluding the flagged values. Values greater than 4 mean absolute deviations from the median were marked bad for each bin. This process was performed 2 times for temperature, conductivity, dissolved oxygen voltage (SBE43) and RINKO-III voltage.
DERIVE: Compute dissolved oxygen (SBE43).
BINAVG: Average the data into 1-dbar pressure bins.
DERIVE: Compute the Practical Salinity, potential temperature, and sigma-theta.
SPLIT: Separate the data from an input .cnv file into down cast and up cast files.
Configuration file: MR12E02A.con
Specifications of the sensors are listed below.
CTD: SBE911plus CTD system
Under water unit:
Temperature sensors: Primary: SBE03-04/F (S/N 031359, Sea-Bird Electronics, Inc.), Calibrated Date: 18 May. 2011. Secondary: SBE03-04/F (S/N 031524, Sea-Bird Electronics, Inc.), Calibrated Date: 29 Jul. 2011
Conductivity sensors: Primary: SBE04-04/0 (S/N 041203, Sea-Bird Electronics, Inc.) Calibrated Date: 25 May. 2011. Secondary: SBE04-04/0 (S/N 041206, Sea-Bird Electronics, Inc.). Calibrated Date: 14 Jun. 2011
SBE9plus (S/N 09P54451-1027, Sea-Bird Electronics, Inc.)
Pressure sensor: Digiquartz pressure sensor (S/N 117457). Calibrated Date: 19 May. 2011
Dissolved Oxygen sensor: SBE43 (S/N 430394, Sea-Bird Electronics, Inc.). Calibrated Date: 25 Oct. 2011
Fluorescence: Chlorophyll Fluorometer (S/N 3054, Seapoint Sensors, Inc.)
Transmissometer: C-Star (S/N CST-1363DR, WET Labs, Inc.)
Dissolved Oxygen sensors: RINK-III (S/N 0024, Alec Electronics Co. Ltd.) . RINK-III (S/N 0079, Alec Electronics Co. Ltd.)
Photosynthetically Active Radiation: PAR sensor (S/N 0049, Satlantic Inc.). Calibrated Date: 22 Jan. 2009
Altimeter: Benthos PSA-916T (S/N 1157, Teledyne Benthos, Inc.)
Carousel water sampler: SBE32 (S/N 3227443-0391, Sea-Bird Electronics, Inc.)
Deck unit: SBE11plus (S/N 11P7030-0272, Sea-Bird Electronics, Inc.)

3-2-2-2. Salinity measurement

Objective
To measure bottle salinity obtained by CTD casts, bucket sampling, and The Continuous Sea Surface Water Monitoring System (TSG).

Methods

a. Salinity Sample Collection

Seawater samples were collected with 12 liter Niskin-X bottles, bucket, and TSG. The salinity sample bottles of the 250ml brown grass bottles with screw caps were used for collecting the sample water. Each bottle was rinsed three times with the sample water, and was filled with sample water to the bottle shoulder. The salinity sample bottles for TSG were sealed with plastic inner caps and screw caps because we took into consideration the possibility of storage for about a month. These caps were rinsed three times with the sample water before use. The bottle was stored for more than 16 hours in the laboratory before the salinity measurement. The number of samples is shown as follows;

Table 2.2.2-1 The number of samples

Sampling type	Number of samples
CTD and Bucket	225
TSG	3
Total	231

b. Instruments and Method

The salinity analysis on R/V MIRAI was carried out during the cruise of MR12-E02Leg2 using the salinometer (Model 8400B “AUTOSAL”; Guildline Instruments Ltd.: S/N 62827) with an additional peristaltic-type intake pump (Ocean Scientific International, Ltd.). A pair of precision digital thermometers (Model 9540; Guildline Instruments Ltd.: S/N 66723 and 62521) were used. The thermometer monitored the ambient temperature and the bath temperature of the salinometer. The specifications of AUTOSAL salinometer and thermometer are shown as follows;

Salinometer (Model 8400B “AUTOSAL”; Guildline Instruments Ltd.)
Measurement Range : 0.005 to 42 (PSU)
Accuracy : Better than ±0.002 (PSU) over 24 hours without re-standardization
Maximum Resolution : Better than ±0.0002 (PSU) at 35 (PSU)
Thermometer (Model 9540: Guildline Instruments Ltd.)
Measurement Range : -40 to +180 deg C
Resolution : 0.001
Limits of error ±deg C : 0.01 (24 hours @ 23 deg C ±1 deg C)
Repeatability : ±2 least significant digits

The measurement system was almost the same as Aoyama *et al.* (2002). The salinometer was operated in the air-conditioned ship's laboratory at a bath temperature of 24 deg C. The ambient temperature varied from approximately 21.9 deg C to 23.4 deg C, while the bath temperature was very stable and varied within +/- 0.004 deg C on rare occasion. The measurement for each sample was done with the double conductivity ratio and defined as the median of 31 readings of the salinometer. Data collection was started 5 seconds after filling the cell with the sample and it took about 10 seconds to collect 31 readings by a personal computer. Data were taken for the sixth and seventh filling of the cell after rinsing five times. In the case of the difference between the double conductivity ratio of these two fillings being smaller than 0.00002, the average value of the double conductivity ratio was used to calculate the bottle salinity with the algorithm for practical salinity scale, 1978 (UNESCO, 1981). If the difference was greater than or equal to 0.00003, an eighth filling of the cell was done. In the case of the difference between the double conductivity ratio of these two fillings being smaller than 0.00002, the average value of the double conductivity ratio was used to calculate the bottle salinity. In the case of the double conductivity ratio of eighth filling did not satisfy the criteria above, we measured a ninth filling of the cell and calculated the bottle salinity. The measurement was conducted in about 4 - 10 hours per day and the cell was cleaned with soap after the measurement of the day.

3-2-2-3. Dissolved oxygen

Objectives

Determination of dissolved oxygen in seawater by Winkler titration.

Parameter

Dissolved Oxygen

Instruments and Methods: Following procedure is based on an analytical method, entitled by "Determination of dissolved oxygen in sea water by Winkler titration", in the WHP Operations and Methods (Dickson, 1996).

a. Instruments

Burette for sodium thiosulfate and potassium iodate; APB-620 manufactured by Kyoto Electronic Co. Ltd. / 10 cm^3 of titration vessel

Detector; Automatic photometric titrator (DOT-01X) manufactured by Kimoto Electronic Co. Ltd.

Software; DOT Terminal version 1.2.0

b. Reagents

Pickling Reagent I: Manganese chloride solution (3 mol dm^{-3})

Pickling Reagent II: Sodium hydroxide (8 mol dm^{-3}) / sodium iodide solution (4 mol dm^{-3})

Sulfuric acid solution (5 mol dm^{-3})

Sodium thiosulfate (0.025 mol dm^{-3})

Potassium iodide (0.001667 mol dm^{-3})

CSK standard of potassium iodide: Lot EPJ3885, Wako Pure Chemical Industries Ltd., 0.0100N

c. Sampling

Seawater samples were collected with Niskin bottle attached to the CTD-system and surface bucket sampler. Seawater for oxygen measurement was transferred from sampler to a volume calibrated flask (ca. 100 cm^3). Three times volume of the flask of seawater was overflowed. Temperature was measured by digital thermometer during the overflowing. Then two reagent solutions (Reagent I and II) of 0.5 cm^3 each were added immediately into the sample flask and the stopper was inserted carefully into the flask. The sample flask was then shaken vigorously to mix the contents and to disperse the precipitate finely throughout. After the precipitate has settled at least halfway down the flask, the flask was shaken again vigorously to disperse the precipitate. The sample flasks containing pickled samples were stored in a laboratory until they were titrated.

d. Sample measurement

At least two hours after the re-shaking, the pickled samples were measured on board. 1 cm^3 sulfuric acid solution and a magnetic stirrer bar were added into the sample flask and stirring began. Samples were titrated by sodium thiosulfate solution whose morality was determined by potassium iodate solution. Temperature of sodium thiosulfate during titration was recorded by a digital thermometer. During this cruise, we measured dissolved oxygen concentration using 2 sets of the titration apparatus. Dissolved oxygen concentration (μmol kg^{-1}) was calculated by sample temperature during seawater sampling, CTD salinity, flask volume, and titrated volume of sodium thiosulfate solution without the blank.

e. Standardization and determination of the blank

Concentration of sodium thiosulfate titrant was determined by potassium iodate solution. Pure potassium iodate was dried in an oven at 130 ^{o}C. 1.7835 g potassium iodate weighed out accurately was dissolved in deionized water and diluted to final volume of 5 dm^3 in a calibrated volumetric flask (0.001667 mol dm^{-3}). 10 cm^3 of the standard potassium iodate solution was added to a flask using a volume-calibrated dispenser. Then 90 cm^3 of deionized water, 1 cm^3 of sulfuric acid solution, and 0.5 cm^3 of pickling reagent solution II and I were added into the flask in order. Amount of titrated volume of sodium thiosulfate (usually 5 times measurements average) gave the morality of sodium thiosulfate titrant.

The oxygen in the pickling reagents I (0.5 cm^3) and II (0.5 cm^3) was assumed to be 3.8 x 10^{-8} mol (Murray *et al.*, 1968). The blank due to other than oxygen was determined as follows. 1 and 2 cm^3 of the standard potassium iodate solution were added to two flasks respectively using a calibrated dispenser. Then 100 cm^3 of deionized water, 1 cm^3 of sulfuric acid solution, and 0.5 cm^3 of pickling reagent solution II and I each were added into the flask in order. The blank was determined by difference between the first (1 cm^3 of KIO_3) titrated volume of the sodium thiosulfate and the second (2 cm^3 of KIO_3) one. The results of 3 times blank determinations were averaged. Table 3-2-2-3 shows results of the standardization and the blank determination during this cruise.

Table 3-2-2-3 Results of the standardization and the blank determinations during this cruise.

Data	KIO_3 ID	$Na_2S_2O_3$	DOT-01X(No.7)		DOT-01X(No.8)	
			E.P.	Blank	E.P.	Blank
2012/3/16	CSK	20110602-06-01	3.962	-	3.965	-
2012/3/16	20110524-07-03	20110602-06-01	3.967	-0.004	3.970	0.000
2012/03/20	20110524-07-07	20110602-06-01	3.966	-0.002	3.969	0.001
2012/03/20	20110524-07-07	20110602-06-02	3.965	-0.004	3.968	0.001

f. Repeatability of sample measurement

Replicate samples were taken at every CTD casts. Total amount of the replicate sample pairs of good measurement was 52. The standard deviation of the replicate measurement was 0.16 mmol kg^{-1} that was calculated by a procedure in Guide to best practices for ocean CO_2 measurements Chapter4 SOP23 Ver.3.0 (2007).

3-2-2-4. Nutrients of Sampled Water

Objectives

The objectives of nutrients analyses during the R/V Mirai MR12-E02Leg2 cruise.

Parameters

Nitrate, Nitrite, Phosphate, Silicate and Ammonia.

Instrument and methods

Nutrient analysis was performed on the BL-Tech QUAATRO 2-HR system. The laboratory temperature was maintained between 20-22 deg C.

a. Measured Parameters

Nitrate + nitrite and nitrite were analyzed according to the modification method of Grasshoff (1970). The sample nitrate was reduced to nitrite in a cadmium tube inside of which was coated with metallic copper. The sample streamed with its equivalent nitrite was treated with an acidic, sulfanilamide reagent and the nitrite forms nitrous acid which reacted with the sulfanilamide to produce a diazonium ion. N-1-Naphthylethylene-diamine added to the sample stream then coupled with the diazonium ion to produce a red, azo dye. With reduction of the nitrate to nitrite, both nitrate and nitrite reacted and were measured; without reduction, only nitrite reacted. Thus, for the nitrite analysis, no reduction was performed and the alkaline buffer was not necessary. Nitrate was computed by difference. Absorbance of 550 nm by azo dye in analysis is measured using a 1 cm length cell for Nitrate and 3 cm length cell for Nitrite. The silicate method was analogous to that described for phosphate. The method used was essentially that of Grasshoff et al. (1983), wherein silicomolybdic acid was first formed from the silicate in the sample and added molybdic acid; then the silicomolybdic acid was reduced to silicomolybdous acid, or "molybdenum blue" using ascorbic acid as the reductant. The analytical methods of the nutrients, nitrate, nitrite, silicate and phosphate, during this cruise were same as the methods used in Kawano et al. (2009). Absorbance of 630 nm by silicomolybdous acid in analysis is measured using a 1 cm length cell. The phosphate analysis was a modification of the procedure of Murphy and Riley (1962). Molybdic acid was added to the seawater sample to form phosphomolybdic acid which was in turn reduced to phosphomolybdous acid using L-ascorbic acid as the reductant. Absorbance of 880 nm by phosphomolybdous acid in analysis is measured using a 1 cm length cell. The ammonia in seawater was mixed with an alkaline containing EDTA, ammonia as gas state was formed from seawater. The ammonia (gas) was absorbed in sulfuric acid by way of 0.5 μm pore size membrane filter (ADVANTEC PTFE) at the dialyzer attached to analytical system. The ammonia absorbed in sulfuric acid was determined by coupling with phenol and hypochlorite to form indophenols blue. Wavelength using ammonia analysis was 630 nm, which was absorbance of indophenols blue.

b. Nutrients Standard

Specifications: For nitrate standard, “potassium nitrate 99.995 suprapur®” provided by Merck, CAS No.: 7757-91-1, was used. For nitrite standard, “sodium nitrate” provided by Wako, CAS No.: 7632-00-0, was used. The assay of nitrite salts was determined according JIS K8019 were 98.31%. We used that value to adjust the weights taken. For phosphate standard, “potassium dihydrogen phosphate anhydrous 99.995 suprapur®” provided by Merck, CAS No.: 7778-77-0, was used. For the silicate standard, we use “Silicon standard solution SiO_2 in NaOH 0.5 mol/l CertiPUR®” provided by Merck, CAS No.: 1310-73-2, of which lot number HC074650 was used. For the ammonia standard, “ammonia sulfate” provided by Wako, CAS No.: 7783-20-2, was used. Ultra pure water (Milli-Q) freshly drawn was used for preparation of reagent, standard solutions and for measurement of reagent and system blanks.

Concentrations of nutrients for A, B and C standards

Concentrations of nutrients for A, B and C standards (working standards) were set as shown in Table 1. Then the actual concentration of nutrients in each fresh standard was calculated based on the ambient temperature, solution temperature and determined factors of volumetric laboratory wares.

The calibration curves for each run were obtained using 5 levels working standards, C-1, C-2, C-3, C-4 and C-5.

Table 1. Nominal concentrations of nutrients for A, B and C standards.

	A	B	C-1	C-2	C-3	C-4	C-5
NO_3 (μM)	22000	900	0.03	9.2	18.3	36.6	55.0
NO_2 (μM)	4000	20	0.00	0.4	0.8	1.6	2.0
SiO_2 (μM)	36000	2800	0.80	28	56	111	167
PO_4 (μM)	3000	60	0.04	0.6	1.2	2.4	3.6
NH_4 (μM)	4000	200	0.00	0.0	2.0	4.0	6.0

c. Sampling Procedures

Sampling of nutrients followed that oxygen, salinity and trace gases. Samples were drawn into two of virgin 10 ml polyacrylates vials without sample drawing tubes. These were rinsed three times before filling and vials were capped immediately after the drawing. The vials were put into water bath adjusted to ambient temperature, 21 ± 1 deg. C, in about 30 minutes before use to stabilize the temperature of samples. The samples of bottle 15 and 21 were measured in duplicate and the rest were measured in single on each sample run. No transfer was made and the vials were set an auto sampler tray directly. Samples were analyzed after collection basically within 24 hours.

Sets of 5 different concentrations for nitrate, nitrite, silicate, phosphate and Ammonia of the shipboard standards were analyzed at beginning and end of each group of analysis. The standard solutions of highest concentration were measured every 10 - 13 samples and were used to evaluate precision of nutrients analysis during the cruise. We also used reference material for nutrients in seawater, RMNS (KANSO Co., Ltd., lots BS, BU, BT and BV).

d. Low Nutrients Sea Water (LNSW)

Surface water having low nutrient concentration was taken and filtered using 0.45 μm pore size membrane filter. This water was stored in 20 liter cubitainer with paper box. The concentrations of nutrient of this water were measured carefully in Aug 2010.

3-2-2-5. Chlorophyll a

Objective

Phytoplankton biomass can estimate as the concentration of chlorophyll *a* (chl-*a*), because all oxygenic photosynthetic plankton contain chl-*a*. Phytoplankton exist various species in the ocean. The objective of this study is to investigate the vertical distribution of phytoplankton.

Sampling

Samplings of total chl-*a* were conducted from 12 depths between the surface and 200 m at all observational stations.

Instruments and Methods

Water samples (0.5L) for total chl-*a* were filtered (<0.02 MPa) through 25mm-diameter Whatman GF/F filter. Phytoplankton pigments retained on the filters were immediately extracted in a polypropylene tube with 7 ml of N,N-dimethylformamide (Suzuki and Ishimaru, 1990). Those tubes were stored at –20°C under the dark condition to extract chl-*a* for 24 hours or more. Fluorescences of each sample were measured by Turner Design fluorometer (10-AU-005), which was calibrated against a pure chl-*a* (Sigma-Aldrich Co.). We applied two kind of fluorometric determination for the samples of total chl-*a*: "Non-acidification method" (Welschmeyer, 1994) and "Acidification method" (Holm-Hansen *et al*., 1965).

3-2-2-6. Sea surface water monitoring

Objective

Our purpose is to obtain salinity, temperature, dissolved oxygen, and fluorescence data continuously in near-sea surface water.

Instruments and Methods

The Continuous Sea Surface Water Monitoring System (Marine Works Japan Co. Ltd.) has four sensors and automatically measures salinity, temperature, dissolved oxygen and fluorescence in near-sea surface water every one minute. This system is located in the "*sea surface monitoring laboratory*" and connected to shipboard LAN-system. Measured data, time, and location of the ship were stored in a data management PC. The near-surface water was continuously pumped up to the laboratory from about 4 m water depth and flowed into the system through a vinyl-chloride pipe. The flow rate of the surface seawater was adjusted to be 4.5 $dm^3 min^{-1}$. Specifications of the each sensor in this system are listed below.

a. Instruments

Software: Seamoni-kun Ver.1.20

Sensors: Specifications of the each sensor in this system are listed below.

Temperature and Conductivity sensor

Model:	SBE-45, SEA-BIRD ELECTRONICS, INC.
Serial number:	4557820-0319
Measurement range:	Temperature -5 to +35 ^oC, Conductivity 0 to 7 S m^{-1}
Initial accuracy:	Temperature 0.002 ^oC, Conductivity 0.0003 S m^{-1}
Typical stability (per month):	Temperature 0.0002 ^oC, Conductivity 0.0003 S m^{-1}
Resolution:	Temperatures 0.0001 ^oC, Conductivity 0.00001 S m^{-1}

Bottom of ship thermometer

Model:	SBE 38, SEA-BIRD ELECTRONICS, INC.
Serial number:	3857820-0540
Measurement range:	-5 to +35 ^oC
Initial accuracy:	±0.001 ^oC
Typical stability (per 6 month):	0.001 ^oC
Resolution:	0.00025 ^oC

Dissolved oxygen sensor

Model:	OPTODE 3835, AANDERAA Instruments.
Serial number:	1519
Measuring range:	0 - 500 mmol dm^{-3}
Resolution:	<1 mmol dm^{-3}
Accuracy:	<8 mmol dm^{-3} or 5% whichever is greater

Settling time: <25 s

Fluorometer

Model: C3, TURNER DESIGNS

Serial number: 2300123

Measurements

Periods of measurement, maintenance, and problems during MR12-E02 are listed in Table 3-2-2-6-1.

Table 3-2-2-6-1 Events list of the surface seawater monitoring during MR12-E02 leg2

System Date [UTC]	System Time [UTC]	Events	Remarks
2012/3/15	13:18	All the measurements started and data was available.	Leg 2 start.
2012/3/21	02:00	All the measurements stopped.	Leg2 end.

3-2-2-7. Carbonate system (dissolved inorganic carbon and total alkalinity)

Purpose of the study

Concentration of CO_2 in the atmosphere is now increasing owing to human activities such as burning of fossil fuels, deforestation, and cement production. The ocean plays an important role in buffering the increase of atmospheric CO_2. Anthropogenic CO_2 emitted into the atmosphere as a result of human activities was globally taken up by oceans at a rate of 2.2 ± 0.4 Pg C y–1 during the 1990s [IPCC, 2007]. Ocean acidification is a direct consequence of the ocean absorbing large amounts of the anthropogenic CO_2. The CO_2 uptake by the oceans has led to lowering both pH and $CaCO_3$ saturation states with regard to the mineral phases due to increasing hydrogen ions (H+) and declining carbonate ion (CO_3^{2-}), respectively. Because oceanic biological activity has an important role concerned to CO_2 cycle in the ocean through its photosynthesis and respiration, the chemical changes associated with ocean acidification have the potential to affect ocean biogeochemistry and ecosystems in a myriad of ways. Therefore, it is important to clarify the mechanism of the oceanic CO_2 absorption and ocean acidification and to estimate CO_2 absorption capacity and decrease of pH and $CaCO_3$ saturation states in recent years. When CO_2 dissolves in water, chemical reaction takes place and CO_2 alters its appearance into several species. Concentrations of the individual species of the CO_2 system in solution cannot be measured directly, but calculated from two of four parameters: total dissolved inorganic carbon (DIC), total alkalinity (TA), pH and pCO_2. This study presents the distribution of DIC and TA in March off Sanriku of the north-eastern Japan.

Sampling

Seawater samples of TA and DIC were collected by 12 liter Niskin bottles mounted on the CTD/Carousel Water Sampling System and a bucket at stations C-4, D-4, D-6 and E-7 and brought the total to ~70. Seawaters were sampled in a 250ml glass bottle for DIC and a 100 ml glass bottle (SCHOTT DURAN) for TA that was previously soaked in 5 % non-phosphoric acid detergent (pH = 13) solution at least 3 hours and was cleaned by fresh water for 5 times and Milli-Q deionized water for 3 times. A sampling silicone rubber tube with PFA tip was connected to the Niskin bottle when the sampling was carried out. The glass bottles were filled from the bottom, without rinsing, and were overflowed for 20 seconds. After collecting the samples on the deck, the glass bottles were carried to the laboratory. Within one hour after the sampling, 1 % by the bottle volume was removed from the glass bottle and poisoned with 0.04% by volume of over saturated solution of mercury chloride. Then, the samples of DIC were sealed by greased ground glass stoppers. All samples preserved at ~ 5°C cold until analysis in our land laboratory.

Analysis

DIC and TA samples were measured by using coulometric and potentiometric techniques, respectively, according to Dickson et al., 2007. The DIC and TA values will be determined with calibration against certified reference material provided by Prof. A. G. Dickson (Scripps Institution of Oceanography).

3-2-2-8. Dissolved organic carbon

Purpose of the study

Fluctuations in the concentration of dissolved organic carbon (DOC) in seawater have a potentially great impact on the carbon cycle in the marine system, because DOC is a major global carbon reservoir. A change by < 10% in the size of the oceanic DOC pool, estimated to be ~ 700 GtC, would be comparable to the annual primary productivity in the whole ocean. In fact, it was generally concluded that the bulk DOC in oceanic water, especially in the deep ocean, is quite inert based upon ^{14}C-age measurements. Nevertheless, it is widely observed that in the ocean DOC accumulates in surface waters at levels above the more constant concentration in deep water, suggesting the presence of DOC associated with biological production in the surface ocean. This study presents the distribution of DOC in March off Sanriku of the north-eastern Japan.

Sampling

Seawater samples were collected at stations C-4, D-6 and E-7 and brought the total to ~90. Seawater from each Niskin bottle was transferred into 60 ml High Density Polyethylene bottle (HDPE) rinsed with same water three times. Water taken from the surface to 250 m is filtered using precombusted (450°C) GF/F inline filters as they are being collected from the Niskin bottle. At depths > 250 m, the samples are collected without filtration. After collection, samples are frozen upright and preserved at ~ -20 °C cold until analysis in our land laboratory. Before use, all glassware was muffled at 550 °C for 5 hrs.

Analysis

Prior to analysis, samples are returned to room temperature and acidified to pH < 2 with concentrated hydrochloric acid. DOC analysis was basically made with a high-temperature catalytic oxidation (HTCO) system improved a commercial unit, the Shimadzu TOC-V (Shimadzu Co.). In this system, the non-dispersive infrared was used for carbon dioxide produced from DOC during the HTCO process (temperature: 680 °C, catalyst: 0.5% Pt-Al_2O_3).

3-2-2-9. Phytoplankton

Purpose of the study

The main objective of this study is to estimate phytoplankton abundances and their taxonomy in March off Sanriku of the north-eastern Japan. .Phytoplankton abundances were measured with microscopy for large size phytoplankton.

Sampling

Samplings were conducted using Niskin bottles, except for the surface water, which was taken by a bucket. Samplings were carried out at the three observational stations of B-3, C-4, D-5, D-6 and E-7.

Methods

Water samples were placed in 500 ml plastic bottle in 1000 ml plastic bottle. Samples were fixed with neutral-buffered formalin solution (1% final concentration). The microscopic measurements are scheduled after the cruise.

3-2-3. Gravity & Magneto meters

Gravitymeter

The LaCoste and Romberg air-sea gravity meter S-116 (Micro-g LaCoste, LLC) is equipped on-board *R/V MIRAI*. Table 3.2.3-1 shows system configuration of MIRAI gravity meter.

Table 3.2.3-1 system configuration

LaCoste and Romberg air-sea gravity meter meter (S-116)	
Range:	12,000 mGal
Drift rate:	<±3.0 mGal/month
Temperature setpoint:	46 to 55 deg-C
Resolution:	0.01 mGal
Static repeatability:	0.05 mGal
Accuracy at sea:	1.0 mGal or better
Sampling rate:	1 sec
Relative gravity	Counter unit [CU] To change gravity [mGal] = (coef1: 0.9946) * [CU]

Three-component magnetometer

The shipboard three-component magnetometer system (Tierra Tecnica SFG1214) is equipped on-board *R/V*

MIRAI. Three-axes flux-gate sensors with ring-cored coils are fixed on the fore mast. Outputs of the sensors are digitized by a 20-bit A/D converter (1 nT/LSB), and sampled at 8 times per second. Ship's heading, pitch, and roll are measured utilizing a ring-laser gyro installed for controlling attitude of a Doppler radar. Ship's position (GPS) and speed data are taken from LAN every second.

3-2-4. Seabeam 2112

The “SEABEAM 2112.004” (SeaBeam Instruments Inc.) is the Multi-narrow Beam Echo Sounding system (MBES) equipped on-board *R/V MIRAI*. This system is including the Sub-Bottom Profiler (SBP) system. Table 3.2.4-1 shows system configuration and performance of SEABEAM 2112.004 system.

Table 3.2.4-1 System configuration and performance

SEABEAM 2112.004 (12 kHz system)	
Frequency:	12 kHz
Transmit beam width:	2 degree
Transmit power:	20 kW
Transmit pulse length:	3 to 20 msec.
Depth range:	100 to 11,000 m
Beam spacing:	1 degree athwart ship
Swath width:	150 degree (max) 120 degree to 4,500 m 100 degree to 6,000 m 90 degree to 11,000 m
Depth accuracy:	Within < 0.5% of depth or +/-1m, whichever is greater, over the entire swath. (Nadir beam has greater accuracy; typically within < 0.2% of depth or +/-1m, whichever is greater)

Sub-Bottom Profiler (4kHz system)	
Frequency:	4 kHz
Transmit beam width:	5 degree
Sweep:	50 msec (select: 5, 25, 50, 100 msec)
Depth Penetration:	As much as 75 m (varies with bottom composition)
Resolution of sediments:	Under most condition within < tens-of-centimeters range (dependent upon depth and sediment type)

3-3. Cruise log

Logbook MR12-E02 15/March/12 – 22/March/12, for 8 days

Date	Time	Description	Position, depth
15-Mar-12	15:00	Depart from the Hachinohe port	
	22:49	Start MBES, SBP survey	
16-Mar-12	04:24	XBT	38-40.00N, 142-00.88E
	05:42	Arrive at stn.D-3. Finish MBES, SBP survey	38-30.0N, 141-50E
	06:00~06:31	CTD(D-3)	38-29.99N, 141-49.44E, Depth:187m
	06;36	Left stn. D-3	
	07:12	Arrive at stn. D-4.	38-30N,141-59E
	07:15~07:55	CTD(D-4)	38-29.97N, 141-59.00E, Depth:316m
	08:00	Arrive at DT-3C site	38-30N,141-58.5E
	08:15	Start DT-3C	38-29.71N,141-58.57E, Depth:321m
	16:16	FinishDT-3C	38-34.66N,141-58.46E, Depth:318m
	17:30	Arrive at stn.D-5.	38-30N, 142-12E
	17:32~18:28	CTD(D-5)	38-29.97N, 142-11.93E, Depth:621m
	18:30	Start MBES, SBP survey	
	21:08	XBT	38-11.80N, 142-23.18E
17-Mar-12	05:54	Finish MBES, SBP survey	

		Arrive at DT-7C site	38-30.06N, 142-03.00E
	06:26	Start DT-7C	38-29.79N, 142-02.99E Depth:440m
	12:50	Finish DT-7C	38-33.52N, 142-02.99E Depth:440m
	13:00	Left stn.Dt-7C	
	14:36	Arrive at stn.D-6.	38-30N,142-25E
	14:36~15:45	CTD(D-6)	38-30.0N, 142-25.60E, Depth:998m
	15:48	Left stn.D-6	
	16:42	Arrive at stn.D-7.	38-30N,142-38E
	15:47~18:11	CTD(D-7)	38-30.29N, 142-38.19E, Depth:1334m
	18:12	Left stn.D-7.	
		Start MBES, SBP survey	
18-Mar-12	08:18	Finish MBES, SBP survey	
		Arrive at stn.E-5.	38-00N,141-43E
	08:21~08:47	CTD(E-5)	38-00.06N, 141-42.79E, Depth:147m
	08:48	Left stn.E-5	
	09:42	Arrive at stn.E-6.	38-00N,141-56E
	09:48~10:22	CTD(E-6)	38-00.06N, 141-56.03E, Depth:290m
	10:24	Left stn.E-6	
	12:18	Arrive at DT-8C site	37-53N,142-20E
	12:24	Start DT-8C	37-52.93N,142-20.31E, Depth :917m
	16:56	Finish DT-8C	37-52.82N,142-17.03E, Depth:863m
	17:06	Left stn.DT-8C	
	18:00	Arrived at stn.E-7	38-00N,142-09E
	18:05~ 18:59	CTD(E-7)	38-00.00N, 142-09.18E Depth:683m
	19:00	Left stn.E-7.	
		Start MBES, SBP survey	
	20:01	XCTD	37-51.30N,142-19.51E
19-Mar-12	00:56	XBT	38-05.06N,141-54.75E
	05:48	Finish MBES, SBP survey	
		Arrive at DT-9C site	
	06:23	Start DT-9C	38-49.81N,142-03.97E, Depth:351m
	08:05	FinishDT-9C	38-50.62N,142-04.17E Depth:347m
	08:12	Left stn.DT-8C	
	09:18	Arrive at stn.C-3	38-56N,141-57E
	09:20~09:50	CTD(C-3)	38-55.96N, 141-58.79E, Depth:200m
	09:54	Left stn.C-3	
	10:42	Arrive at stn.C-4	38-56N,142-10E
	10:46~11:32	CTD(C-4)	38-55.79N, 142-10.05E, Depth:487m
	11:36	Left stn.C-4	
	12:54	Arrive at stn.C-5	38-56N,142-23E
	12:58~14:12	CTD(C-5)	38-55.85N, 142-22.97E, Depth:1020m
	14:18	Left stn.C-5	
	15:06	Arrive at stn.C-6	38-56N,142-35E
	15:11~16:33	CTD(C-6)	38-55.81N, 142-34.80E, Depth:1202m
	16:36	Left stn.C-6	
	17:36	Arrive at stn.C-7	38-56N,142-48E
	17:39~19:05	CTD(C-7)	38-56.33N, 142-48.45E, Depth:1288m
	19:06	Left stn.C-7.	
		Start MBES, SBP survey	
20-Mar-12	00:12	XBT	39-19.70N,142-17.27E

	05:54	Finish MBES, SBP survey	
		Arrive at DT-10C site	
	06:24	Start DT-10C	39-14.60N,142-20.29E, Depth898m
	13:25	Finish DT-10C	34-14.49N,142-15.08E, Depth556m
	14:00	Start DT-11C	34-14.66N,142-15.36E, Depth633m
	17:21	Finish DT-11C	34-14.61N,142-13.47E, Depth501m
	17:30	Left stn.DT-11C site	
		Start MBES, SBP survey	
21-Mar-12	03:47	XBT	39-15.48N,142-11.60E
	05;48	Finish MBES, SBP survey	
		Arrive at stn.B-2.	39-32N,142-12E
	06:00 ~06:34	CTD(B-2)	39-31.27N, 142-11.80E Depth:238m
	06:36	Left stn.B-2	
	07:06	Arrive at stn.B-3.	39-32N,142-19E
	07:11 ~08:01	CTD(B-3)	39-11.82N, 142-18.94E Depth:590m
	08:06	Left stn.B-3	
	08:54	Arrive at stn.B-4.	39-32N,142-32E
	08:59 ~10:06	CTD(B-4)	39-31.97N, 142-32.01E Depth:960m
	10:06	Left stn.B-4 &go to Kamaishi	
	12:52	2 sientists disembarked .	
		Left Kamaishi for Hachinohe.	
		Start MBES, SBP survey	
		Finish MBES, SBP survey	
22-Mar-12		Enter the Hachinohe port	

3-4. General investigation results

3-4-1. Deep Tow Investigations

Towing List

※本リストは曳航記録の時刻をもとに作成した

日付 (LST)	測線 No.		時間 (LST)	曳航体				水深 (m)：A+B	海域	備考
				緯度	経度	A:CTD 深度(m)	B:高度(m)			
2012/3/8 (Leg1)	DT-1 C	Start	9:06	37_52.973N	142_22.634E	898.8	50.0	948.8	仙台沖	4KC＋Seabat7125 による精密地形調査と瓦礫マッピングを実施。 曳航高度は 50～80m（15:30 以降 100m）、曳航速度は 1.0knt（15:30 以降 1.5knt）。 Start　時の高度値は、高度計不安定のため本船直下水深と CTD 深度との差を用いた。
		End	16:30	37_52.872N	142_12.170E	649.4	102.8	752.2		
2012/3/9 (Leg1)	DT-2 C	Start	9:33	38_05.068N	142_22.679E	924.0	84.9	1008.8	仙台沖	4KC＋Seabat7125 による精密地形調査と瓦礫マッピングを実施。 曳航高度は 80m、曳航速度は 1.5knt。 ①漁船接近により測線中断。ケーブル長 200m まで巻き上げ、本船を東へ回頭。 　元の測線の南側を東進する測線へ移動開始。 ②曳航高度 80m まで降下し、測線再開。
		①	14:00	38_04.847N	142_14.737E	801.3	67.0	868.4		
		②	14:34	38_04.728N	142_14.589E	782.7	81.6	864.3		
		End	16:30	38_04.765N	142_18.060E	857.8	81.1	938.9		
2012/3/11 (Leg1)	DT-3 C	Start	9:22	38_30.125N	141_58.500E	218.3	100.0	318.3	仙台沖	4KC＋Seabat7125 による精密地形調査と瓦礫マッピングを実施。 曳航高度は 100m、曳航速度は 1.3knt。 Seabat7125 との干渉を避けるため高度計は使用していない。 本船直下水深と CTD 深度との差を 100m に保持した。
		End	16:30	38_39.316N	141_58.503E	207.8	100.0	307.8		
2012/3/12 (Leg1)	DT-4 C	Start	7:29	38_30.060N	142_03.001E	342.8	100.0	442.8	仙台沖	4KC＋Seabat7125 による精密地形調査と瓦礫マッピングを実施。 曳航高度は 100m、曳航速度は 1.3knt。 Seabat7125 との干渉を避けるため高度計は使用していない。 本船直下水深と CTD 深度との差を 100m に保持した。
		End	14:17	38_39.177N	142_03.035E	295.1	100.0	395.1		
2012/3/14 (Leg1)	DT-5 C	Start	7:30	38_50.032N	142_04.024E	249.5	110.0	359.5	仙台沖	4KC＋Seabat7125 による精密地形調査と瓦礫マッピングを実施。 曳航高度は 110m、曳航速度は 1.5knt。 Seabat7125　との干渉を避けるため高度計は使用していない。
		End	13:40	38_58.967N	142_06.691E	241.6	110.0	351.6		

										本船直下水深と CTD 深度との差を 110m に保持した。
2012/3/16 （Leg2）	DT-6 C	Start	8:36	38_29.836N	141_58.511E	316.7	3.0	319.7	仙台沖	4KC による生物、瓦礫分布調査を実施。 曳航高度は 3m、曳航速度は 0.6knt。 Start、End の高度値は 3.0m 一定とする。
		End	16:00	38_34.494N	141_58.494E	315.9	3.0	318.9		
2012/3/17 （Leg2）	DT-7 C	Start	6:45	38_29.871N	142_02.996E	429.5	3.0	432.5	仙台沖	4KC による生物、瓦礫分布調査を実施。 曳航高度は 3m、曳航速度は 0.6knt。 Start、End 及び特異点の高度値は 3.0m 一定とする。 ①ドレッジャーを切り離し。
		①	12:23	38_33.225N	142_02.995E	421.3	3.0	424.3		
		End	12:30	38_33.294N	142_03.008E	420.2	3.0	423.2		
2012/3/18 （Leg2）	DT-8 C	Start	13:05	37_52.921N	142_20.046E	907.1	3.0	910.1	仙台沖	4KC による生物、瓦礫分布調査を実施。 曳航高度は 3m、曳航速度は 0.6knt。 Start、End 及び特異点の高度値は 3.0m 一定とする。 ①ドレッジャーを切り離し後、亡失。
		①	16:25	37_52.995N	142_17.502E	872.1	3.0	875.1		
		End	16:30	37_52.989N	142_17.435E	870.0	3.0	873.0		
2012/3/19 （Leg2）	DT-9 C	Start	6:43	38_49.897N	142_03.997E	339.6	3.0	342.6	仙台沖	4KC による生物、瓦礫分布調査を実施。 曳航高度は 3m、曳航速度は 0.6knt。 Start、End 及び特異点の高度値は 3.0m 一定とする。 ①ドレッジャーを切り離し。 海況悪化のため、7:45 に揚収を開始した。
		①	7:40	38_50.487N	142_04.221E	345.7	3.0	348.7		
		End	7:45	38_50.539N	142_04.239E	347.6	3.0	350.6		
2012/3/20 （Leg2）	DT-10 C	Start	6:54	39_14.592N	142_20.123E	881.2	3.0	884.2	大槌沖	4KC による生物、瓦礫分布調査を実施。 曳航高度は 3m、曳航速度は 0.6knt。 Start、End、変針点及び特異点の高度値は3.0m 一定とする。大槌沖海底谷に沿って、①、②、③、④、⑤の 5 地点で変針した。 □ 曳航体の挙動が不安定のため、一旦揚収。 *この地点を次側線の開始予定点とする。
		①	8:50	39_14.651N	142_18.511E	789.8	3.0	792.8		
		②	10:07	39_14.840N	142_17.402E	733.4	3.0	736.4		
		③	10:46	39_14.751N	142_16.851E	716.2	3.0	719.2		
		④	11:03	39_14.690N	142_16.633E	716.4	3.0	719.4		

		ロ	12:05	39_14.663N	142_15.782E	671.0	3.0	674.0		
		ロ	13:00	39_14.698N	142_15.176E	627.3	3.0	630.3		
		End	13:03	39_14.704N	142_15.144E	620.8	3.0	623.8		
2012/3/20（Leg2）	DT-11C	Start	14:23	39_14.683N	142_15.297E	619.9	3.0	622.9	大槌沖	4KC による生物、瓦礫分布調査を実施。 曳航高度は 3m、曳航速度は 0.6knt。 Start、End 及び特異点の高度値は 3.0m 一定とする。 ①DT-10C 測線終了地点通過。 ②変針点。 ③海底谷奥部を通過。 ④ドレッジャーを切り離し。
		①	14:37	39_14.701N	142_15.185E	627.4	3.0	630.4		
		②	16:00	39_14.782N	142_14.404E	562.0	3.0	565.0		
		③	16:20	39_14.818N	142_15.223E	553.5	3.0	556.5		
		④	16:55	39_14.744N	142_13.775E	505.7	3.0	508.7		
		End	17:00	39_14.744N	142_13.730E	503.9	3.0	506.9		

曳航測線の概要を以下に記す。測線の緯度・経度、水深等のデータは、表 3-4-1-1 を参照。
○DT-6C
4KC による生物、瓦礫分布調査を実施した。曳航高度は 3m、曳航速度は 0.6knt とした。海底の生物、瓦礫観察のため、測線開始、終了の曳航高度は 3.0m 一定とした。
○DT-7C
4KC による生物、瓦礫分布調査を実施した。曳航高度は 3m、曳航速度は 0.6knt とした。本測線では測線終了前（12:23）にドレッジャーを切り離し、生物の採取を実施した。海底の生物、瓦礫観察のため、測線開 始、終了、ドレッジャー切り離しの曳航高度は 3.0m 一定とした。
○DT-8C
4KC による生物、瓦礫分布調査を実施した。曳航高度は 3m、曳航速度は 0.6knt とした。本測線では測線終了前（16:25）にドレッジャーを切り離した。しかし、4KC 揚収後、ドレッジャーが亡失していることを確認した。海底の生物、瓦礫観察のため、測線開始、終了、ドレッジャー切り離しの曳航高度は 3.0m 一定とした。
○DT-9C
4KC による生物、瓦礫分布調査を実施した。曳航高度は3m、曳航速度は0.6knt とした。海況悪化のため、7:45 に揚収を開始した。本測線では揚収開始前（7:40）にドレッジャーを切り離し、生物の採取を実施した。海底の生物、瓦礫観察のため、測線開始、終了、ドレッジャー切り離しの曳航高度は 3.0m 一定とした。
○DT-10C
4KC による生物、瓦礫分布調査を実施した。曳航高度は 3m、曳航速度は 0.6knt とした。海底の生物、瓦礫観察のため、測線開始から終了の曳航高度は 3.0m 一定とした。本測線では、大槌沖海底谷に沿って 5 地点で変針した。調査中、曳航体の挙動が不安定のため、一旦揚収したが、異常はみられなかった。
○DT-11C
4KC による生物、瓦礫分布調査を実施した。曳航高度は3m、曳航速度は0.6knt とした。14:37 に DT-10C 測線終了地点を通過した。本測線では、大槌沖海底谷に沿って 1 地点で変針し、16:20 に海底谷奥部を通過した。揚収開始前（16:55）にドレッジャーを切り離し、生物の採取を実施した。海底の生物、瓦礫観察 のため、測線開始、終了、ドレッジャー切り離しの曳航高度は 3.0m 一定とした。

DT-6C
Date: March 16, 2012
Name of Researcher: Katsunori Fujikura (BioGeos, JAMSTEC)
Survey site: Off Sendai
Landing (Start towing) Point: 8:36 38-29.836’N 141-58.511’E, 316.7m
Leaving (Finish towing) Point: 16:00 38-34.494’N 141-58.494’E, 315.9m
Summary: Dense beds formed by brittle star, *Ophiura sarsii* from the start point to its approximately 3 miles away. Then number of *O. sarsii* decreased and a few species of sea anemone increased. As fishery recourses species, zewai crab *Chionoecetes opilio*, a few species of snail Buccinidae spp. were frequently observed. Interestingly, almost *C. opilio* lived with large sea anemone, *Liponema brevicornis*. This is probably new to science. Like white wood branched, probably dead Primnoidae spp.? were often occurred. Topography of surveyed area was almost flat. Thin muddy sediments covered on bottom in *O. sarsii* distribution areas but almost no muddy sediments were in out of *O. sarsii* distribution areas. Some artificial debris were observed on sea bottom with sea anemones attached on them.

DT-7C
Date: March 16, 2012
Name of Researcher: Kazumasa Oguri (BioGeos/MARITEC, JAMSTEC)
Survey site: Off Sendai
Landing (Start towing) Point: 6:46 38-29.87’N 142-02.9’E, 427.5m
Leaving (Finish towing) Point: 12:31 38-33.29’N 142-03.01’E, 412.3m
Summary: Sediment surface was flat and no mounds or other steep topographies were observed. Sediment consisted of very fine sand. Above sediment surface, sporadic dense turbidity was seen. Dense beds formed by brittle star, *Ophiura sarsii* seen in the yesterday’s dive (DT6C) had disappeared. However, benthic organisms such as large sea anemone, *Liponema brevicornis* were commonly seen. For important species for fisheries, zewai crab *Chionoecetes opilio*, conger eel, butt and red fish (so called Kinki) were appeared. Like

white wood branched, probably dead *Primnoidae* spp.? were often occurred.

DT-8C
Date: March 18, 2012
Name of Researcher: Yasuo Furushima (BioGeos, JAMSTEC)
Survey site: Off Sendai
Landing (Start towing) Point: 13:05 37-52.92'N 142-20.04'E, 911.2m
Leaving (Finish towing) Point: 16:31 37-52.99'N 142-17.42'E, 871.6m
Summary: This observation line goes up a slope towards the west from sea bottom of about 900m depth. Sea surface temperature of deep tow starting point was around 10 degrees Celsius. Because water temperature and transparency are high in comparison with the yesterday's observation point, it is very likely that this area is affected by the Kuroshio Current. The sea bottom of 910m of towing investigation starting point was mud of a fine particle. We observed a lot of sea cucumbers and conger, however, as for the biomass, comparatively small. Conger are main fishery resources. The sediment surface was mud all the time, and ichnolite was sometimes observed. In addition, several hole considered that organisms developed was confirmed. Moreover, a trace when a troller passed was observed in the bottom. This result indicates that current of near bottom is weak. In this observation line, most of the large-sized debris was not observed.

DT-9C
Date: March 19, 2012
Name of Researcher: Shinji Tsuchida (BioGeos, JAMSTEC)
Survey site: Off Sendai
Landing (Start towing) Point: 06:43 38-49.956'N 142-03.999'E, 342.7m
Leaving (Finish towing) Point: 07:45 38-50.637'N 142-04.253'E, 342.7m
Summary:
During descending many planktonic animals and marine snow were observed from surface to near the bottom. Dense bed of brittle star, Ophiura sarsii was observed from the start point of towing, 06:43:43 to 07:04:30. Then the number of benthic animals including O. sarsii, actiniarians, buccinid snails were decreased. We also, observed some kind of important species on fishery, such as snow crab Chionoecetes opilio, snail Buccinidae spp. , some kind of cod??, octopus and squid. Lots of marine debris such as sunken woods, plastinc bags, cans and so on were recorded. Most of them were covered by actiniaria anemone. Sea bottom was covered by soft muddy sediments, but it looked hard underneath the surface.

DT-10C
Date: March 20, 2012
Name of Researcher: Kazumasa Oguri (BioGeos/MARITEC, JAMSTEC)
Survey site: Off Sendai
Landing (Start towing) Point: 6:52:53 39-14.59'N 142-20.179'E, 887m
Leaving (Finish towing) Point: 13:05 39-14.08'N 142-15.14'E, 620m
Summary:
The deep tow was climbed in the deep sea canyon. Sediment consisted of muddy to very fine sand. Above sediment surface, dense turbidity was seen in the deeper part, but it became reducing to move shallower region. Sea slug and red fish were abundant, suggesting that the canyon environment were rich in small organisms, enhanced organic carbon focusing. Artificial debris were often observed. Some debris identified as part of fisheries boats or the equipments from the boats. Echinodermata (mainly brittle star) lived on hard ground such as debris or rock surface.

DT-11C
Date: March 20, 2012
Name of Researcher: Katsunori Fujikura (BioGeos, JAMSTEC)
Survey site: Off Sendai
Landing (Start towing) Point: 8:36 38-29.836'N 141-58.511'E, 316.7m

Leaving (Finish towing) Point: 16:00 38-34.494’N 141-58.494’E, 315.9m

Summary: Observation using a deep-tow was conducted along a canyon off Otsuchi, Iwate. A lot of debris same as DT-10C were distributed more than hitherto survey areas. Species diversity and number of individuals of benthic animals in canyon were higher than those of out of Canyon. Red rock fish, probably important fishery species “Kichiji” frequently occurred in Canyon. As fishery recourses species, beni-zewai crab *Chionoecetes japonicus* lived with large sea anemone, *Liponema brevicornis*. same as *C. opilio*. Species diversity, animal population, debris and geologic characteristics were very different in comparison between inside and outside of Canyon.

3-4-2. CTD Hydrocast Investigations
Hydrocast List

Table 3-2-2-1. MR12-E02 Leg2 CTD Casttable

Stnnbr	Castno	Date(UTC)	Time(UTC)		BottomPosition		Depth	Wire Out	HT Above Bottom	Max Depth	Max Pressure	CTD Filename	Remark
		(mmddyy)	Start	End	Latitude	Longitude							
D03	1	031512	21:06	21:28	38-29.99N	141-49.94E	198.0	182.1	9.4	186.5	188.0	D03M01	
D04	1	031512	22:22	22:51	38-29.97N	141-59.00E	331.0	313.8	12.0	317.4	320.0	D04M01	
D05	1	031612	08:38	09:25	38-29.98N	142-11.93E	632.0	619.4	8.3	622.3	628.0	D05M01	
D06	1	031712	05:41	06:43	38-29.99N	142-25.10E	1010.0	997.7	9.8	998.0	1008.0	D06M01	
D07	1	031712	07:53	09:07	38-30.19N	142-38.19E	1350.0	1338.1	8.7	1335.5	1350.0	D07M01	T2, S2 unusual profile (upcast 300-146 dbar)
E05	1	031712	23:26	23:44	38-00.06N	141-42.78E	162.0	142.9	8.7	148.8	150.0	E05M01	
E06	1	031812	00:53	01:19	38-00.06N	141-56.03E	301.0	286.6	9.2	291.6	294.0	E06M01	
E07	1	031812	09:11	09:56	37-59.97N	142-09.17E	691.0	682.1	8.7	683.7	690.0	E07M01	
C03	1	031912	00:25	00:47	38-55.96N	141-58.59E	212.0	195.1	9.1	201.4	203.0	C03M01	
C04	1	031912	01:52	02:29	38-55.79N	142-10.05E	497.0	482.1	9.8	486.7	491.0	C04M01	
C05	1	031912	04:04	05:09	38-55.85N	142-22.97E	1027.0	1020.0	7.0	1021.7	1032.0	C05M01	
C06	1	031912	06:17	07:29	38-55.81N	142-34.80E	1211.0	1210.4	7.4	1203.3	1216.0	C06M01	Transmission profile was noisy (down cast 762-1163 dbar)
C07	1	031912	08:45	10:03	38-56.32N	142-48.44E	1303.0	1288.6	8.1	1290.1	1304.0	C07M01	
B02	1	032012	21:05	21:31	39-31.27N	142-11.80E	249.0	235.7	10.1	238.0	240.0	B02M01	
B03	1	032012	22:16	22:58	39-31.82N	142-18.93E	598.0	588.7	6.6	591.6	597.0	B03M01	
B04	1	032112	00:05	01:03	39-31.97N	142-32.01E	971.0	959.7	7.7	961.4	971.0	B04M01	

Preliminary results

(1) CTD cast and water sampling

Preliminary Results: During this cruise, 16 casts of CTD observation were carried out. Date, time and locations of the CTD casts are listed in Table 3-2-2-1.

Data archive: CTD data will be submitted to the Data Management office (DMO), JAMSTEC, and will be opened to public via "JAMSTEC Data Site for Research Cruises".

(2) Salinity measurement

a. Standard Seawater: Standardization control of the salinometer was set to 490 and all measurements were done at this setting. The value of STANDBY was 24+5417 +/- 0001 and that of ZERO was 0.0-0000 +/- 0001. The conductivity ratio of IAPSO Standard Seawater batch P153 was 0.99979 (the double conductivity ratio was 1.99958) and was used as the standard for salinity. We measured 13 bottles of P153. The specifications of SSW used in this cruise are shown as follows ;

Batch : P153, conductivity ratio : 0.99979, salinity : 34.992, Use by : 8th-March-2014

Fig.2.2.2-1 shows the history of the double conductivity ratio of the Standard Seawater batch P153 before correction. The average of the double conductivity ratio was 1.99959 and the standard deviation was 0.00001, which is equivalent to 0.0002 in salinity.

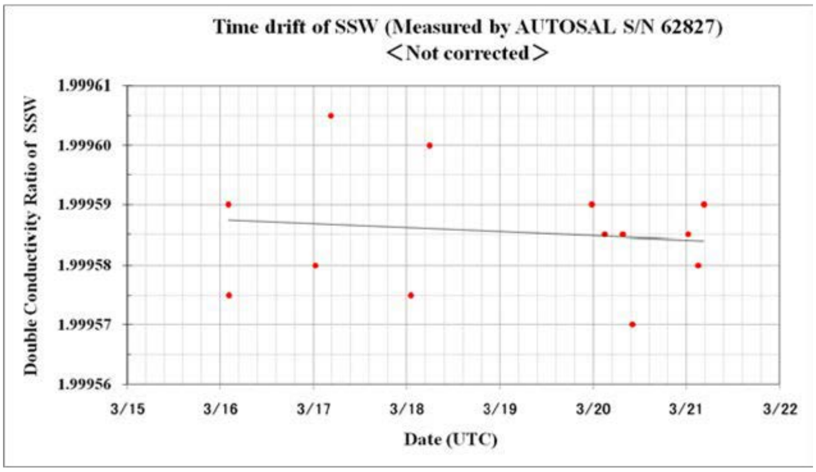


Fig. 2.2.2-1 The history of the double conductivity ratio for the Standard Seawater. batch P153 (Before correction)

Fig.2.2.2-2 shows the history of the double conductivity ratio of the Standard Seawater batch P153 after correction. The average of the double conductivity ratio after correction was 1.99958 and the standard deviation was 0.00001, which is equivalent to 0.0002 in salinity.

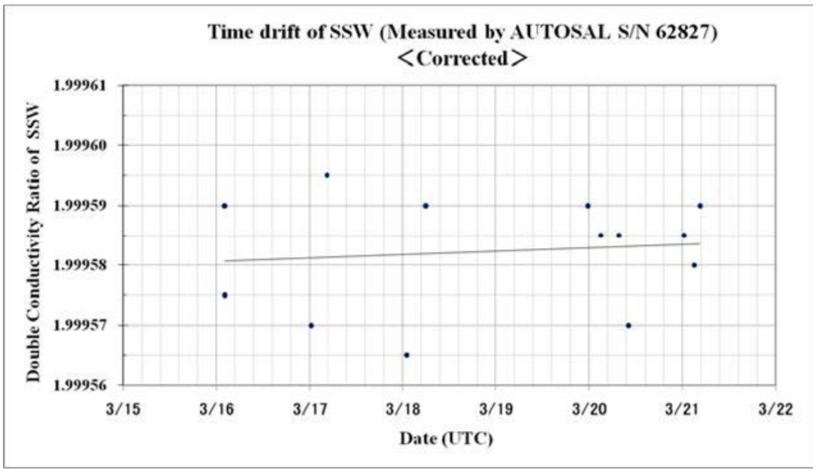


Fig. 2.2.2-2 The history of the double conductivity ratio for the Standard Seawater. batch P153 (After correction)

b. Sub-Standard Seawater: Sub-standard seawater was made from deep-sea water filtered by a pore size of 0.45 micrometer and stored in a 20-liter container made of polyethylene and stirred for at least 24 hours before measuring. It was measured about every 6 samples in order to check for the possible sudden drifts of the salinometer.

c. Replicate Samples: We estimated the precision of this method using 29 pairs of replicate samples taken from the same Niskin bottle. Fig.2.2.2-3 shows the histogram of the absolute difference between each pair of the replicate samples. The average and the standard deviation of absolute deference among 29 pairs of replicate samples were 0.0002 and 0.0002 in salinity, respectively.

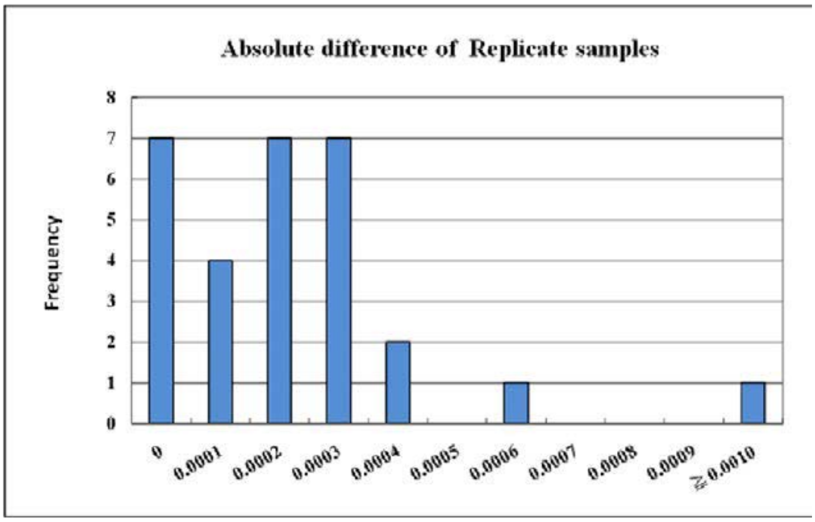


Fig. 2.2.2-3 The histogram of the double conductivity ratio for the absolute difference of replicate samples

d. Data archive: These raw datasets will be submitted to JAMSTEC Data Management Office (DMO).

(3) Dissolved oxygen

a. Standardization and determination of the blank: Concentration of sodium thiosulfate titrant was determined by potassium iodate solution. Pure potassium iodate was dried in an oven at 130 ^oC. 1.7835 g potassium iodate weighed out accurately was dissolved in deionized water and diluted to final volume of 5 dm^3 in a calibrated volumetric flask (0.001667 mol dm^{-3}). 10 cm^3 of the standard potassium iodate solution was added to a flask using a volume-calibrated dispenser. Then 90 cm^3 of deionized water, 1 cm^3 of sulfuric acid solution, and 0.5 cm^3 of pickling reagent solution II and I were added into the flask in order. Amount of titrated volume of sodium thiosulfate (usually 5 times measurements average) gave the morality of sodium thiosulfate titrant. The oxygen in the pickling reagents I (0.5 cm^3) and II (0.5 cm^3) was assumed to be 3.8 x 10^{-8} mol (Murray *et al.*, 1968). The blank due to other than oxygen was determined as follows. 1 and 2 cm^3 of the standard potassium iodate solution were added to two flasks respectively using a calibrated dispenser. Then 100 cm^3 of deionized water, 1 cm^3 of sulfuric acid solution, and 0.5 cm^3 of pickling reagent solution II and I each were added into the flask in order. The blank was determined by difference between the first (1 cm^3 of KIO_3) titrated volume of the sodium thiosulfate and the second (2 cm^3 of KIO_3) one. The results of 3 times blank determinations were averaged. Table 3-2-2-3 shows results of the standardization and the blank determination during this cruise.

Table 3-2-2-3 Results of the standardization and the blank determinations during this cruise.

Data	KIO_3 ID	$Na_2S_2O_3$	DOT-01X(No.7)		DOT-01X(No.8)	
			E.P.	Blank	E.P.	Blank
2012/3/16	CSK	20110602-06-01	3.962	-	3.965	-
2012/3/16	20110524-07-03	20110602-06-01	3.967	-0.004	3.970	0.000
2012/03/20	20110524-07-07	20110602-06-01	3.966	-0.002	3.969	0.001

2012/03/20	20110524-07-07	20110602-06-02	3.965	-0.004	3.968	0.001

b. Repeatability of sample measurement: Replicate samples were taken at every CTD casts. Total amount of the replicate sample pairs of good measurement was 52. The standard deviation of the replicate measurement was 0.16mmol kg^{-1} that was calculated by a procedure in Guide to best practices for ocean CO_2 measurements Chapter4 SOP23 Ver.3.0 (2007).

C. Data archive: All data will be submitted to Chief Scientist.

(4) Nutrients of Sampled Water

a. Results: Analytical precisions in this cruise were 0.09% for nitrate, 0.19% for nitrite, 0.18% for silicate, 0.18% for phosphate, 0.34% for Ammonia in terms of median of precision, respectively. Summary of precisions are shown as shown in Table 2.

Table 2. Summary of precision based on the replicate analyses at MR12-E02Leg2.

	Nitrate CV %	Nitrite CV %	Phosphate CV %	Silicate CV %	Ammonia CV%
Median	0.09	0.19	0.18	0.18	0.34
Mean	0.11	0.19	0.21	0.21	0.30
Maximum	0.15	0.24	0.31	0.20	0.37
Minimum	0.08	0.15	0.18	0.09	0.21
N	5	5	5	5	5

b. Data Archive: All data will be submitted to JAMSTEC Data Management Office (DMO) and is currently under its control.

(5) Chlorophyll a

Preliminary Results: The results of total chl-*a* at station D and station E were shown in Figure 1, 2.

Data archives: The processed data file of pigments will be submitted to the JAMSTEC Data Integration and Analysis Group (DIAG) within a restricted period. Please ask PI for the latest information.

Table 1. Analytical conditions of "Non-acidification method" and "Acidification method" for chlorophyll *a* with Turner Designs fluorometer (10-AU-005).

	Non-acidification method	Acidification method
Excitation filter (nm)	436	340-500
Emission filter (nm)	680	>665
Lamp	Blue Mercury Vapor	Daylight White

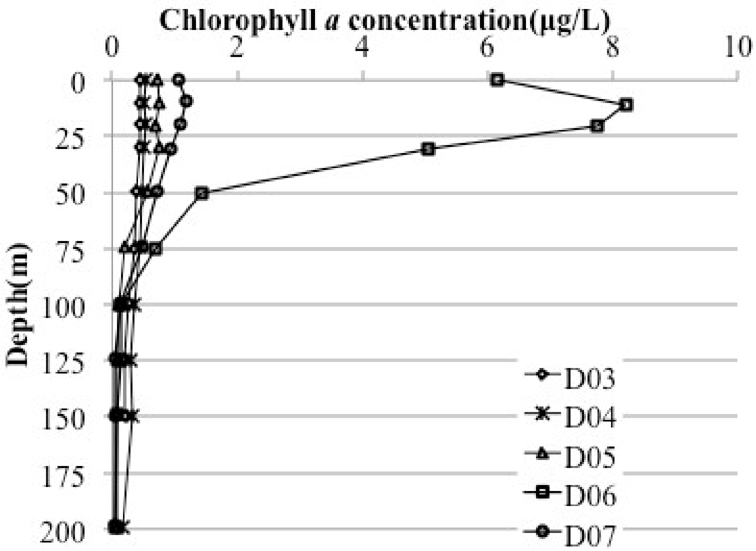


Figure1. Vertical distribution of chlorophyll *a* at Stn.D

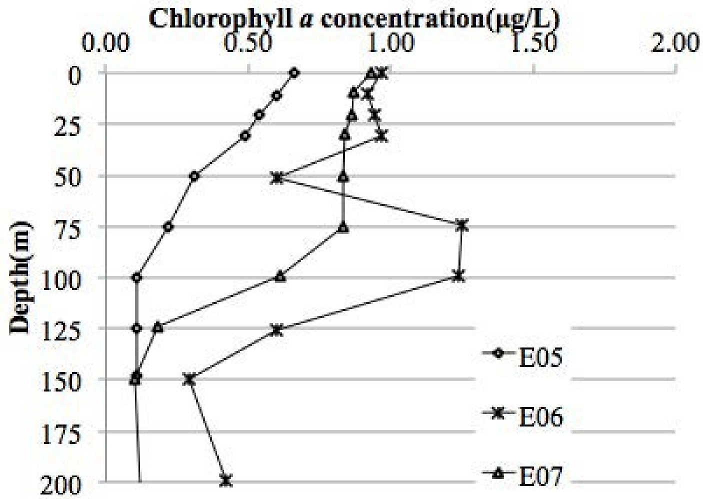
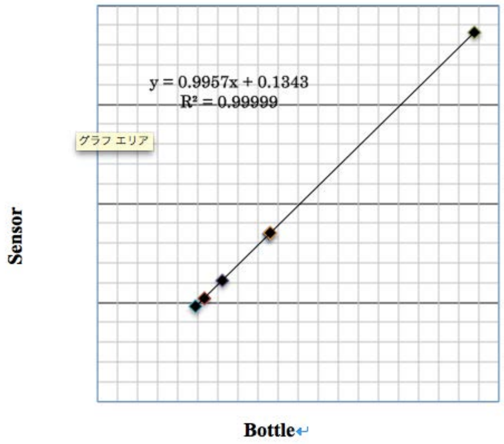


Figure2. Vertical distribution of chlorophyll *a* at Stn.E

(6) Sea surface water monitoring

Preliminary Result: We took the surface water samples to compare sensor data with bottle data of salinity and dissolved oxygen and fluorescence. The results are shown in Fig. 3-2-2-6-1-1~2. (Fluorescence is not measurement now.). All the salinity samples were analyzed by the Guideline 8400B "AUTOSAL", and dissolve oxygen samples were analyzed by Winkler method, and fluorescence were analyzed by 10-AU.

Data archive: These data obtained in this cruise will be submitted to the Data Management Office (DMO) of JAMSTEC, and will be opened to the public via "R/V Mirai Data Web Page" in JAMSTEC home page.



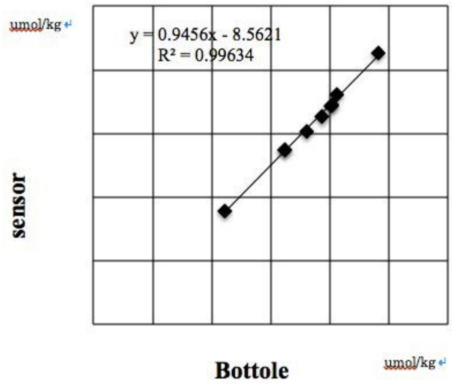


Fig 3-2-2-6-1-1 Correlation of salinity between sensor data and bottle data

Fig3-2-2-6-1-2 Correlation of dissolved oxygen between sensor data and bottle data.

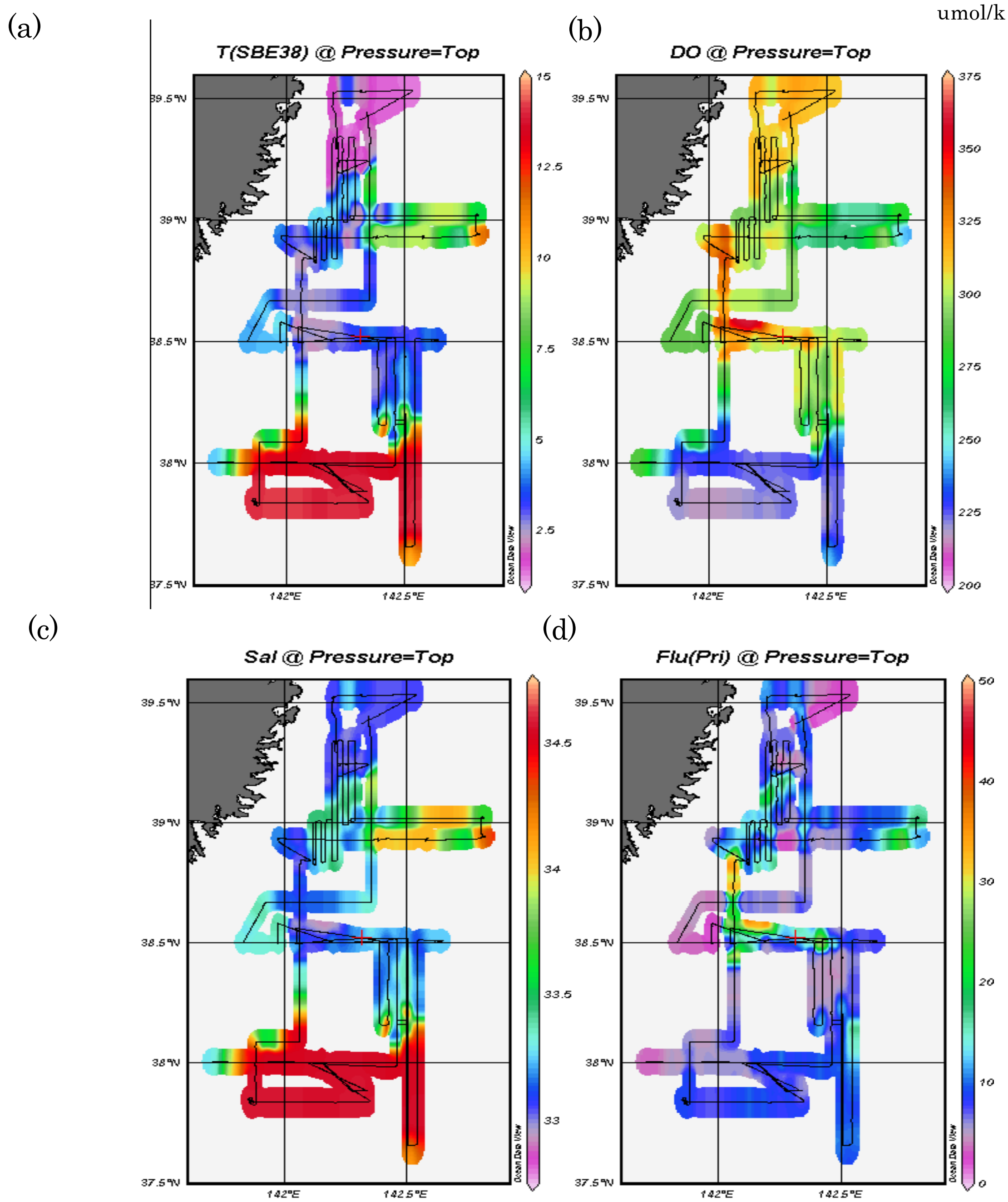


Fig3-2-2-6-1-3. Spatial and temporal distribution of (a) temperature, (b) dissolved oxygen (c) salinity, and (d) fluorescence in MR12-E02 leg2 cruise.

(7) Carbonate system (dissolved inorganic carbon and total alkalinity)
Preliminary result: The distributions of DIC and TA will be determined as soon as possible after this cruise.
Data Archive: All data will be submitted to JAMSTEC Data Management Office (DMO) within 2 years.

(8) Dissolved Organic Carbon
Preliminary result: The distributions of DOC will be determined as soon as possible after this cruise.
Data Archive: All data will be submitted to JAMSTEC Data Management Office (DMO) within 2 years.

(9) Phytoplankton abundance
Preliminary result: The phytoplankton abundances and their taxonomy will be determined as soon as possible after this cruise.
Data Archive: All data will be submitted to JAMSTEC Data Management Office (DMO) within 2 years.

3-4-3. Topographic Investigations

Introduction

The objective of MBES is collecting continuous bathymetric and SBP data along ship's track to make a contribution to geological and geophysical investigations and global datasets.

Data acquisition

The "SEABEAM 2112.004" on R/V MIRAI was used for bathymetry and seafloor mapping during the MR12-E02 Leg2 cruise from 15 March 2012 to 22 March 2012.

To get accurate sound velocity of water column for ray-path correction of acoustic multibeam, we used Surface Sound Velocimeter (SSV) data to get the sea surface (6.2m) sound velocity, and the deeper depth sound velocity profiles were calculated by temperature and salinity profiles from XBT, XCTD and CTD data by the equation in Del Grosso (1974) during the cruise.

Preliminary results

We carried out survey mapping during this cruise. Figure 3.4.3-1 shows survey ma of preliminary result, include MR12-E02 Leg1 data.

Data archives

Bathymetric and SBP data obtained during this cruise will be submitted to the Data Management Group (DMG) in JAMSTEC, and will be archived there.

MBES List

all	day	Filename (sb20*.mb41)	Lon	Lat	Event	処理不要	Caris Import	Swath Filter	Caris Edit			SVP	Remarks
									toku	yoshi	kimu		
1	1	1203150936	142.091272	40.194792	システム起動、収録開始							12E02_39.0n142.2e_xbt_mar14	
2	2	1203150947	142.118863	40.162145								12E02_39.0n142.2e_xbt_mar14	
3	3	1203150959	142.148827	40.126178								12E02_39.0n142.2e_xbt_mar14	
4	4	1203151011	142.178067	40.090637								12E02_39.0n142.2e_xbt_mar14	
5	5	1203151022	142.206867	40.055718								12E02_39.0n142.2e_xbt_mar14	
6	6	1203151035	142.235342	40.012228			1	1				12E02_39.0n142.2e_xbt_mar14	
7	7	1203151047	142.244928	39.970745			1	1				12E02_39.0n142.2e_xbt_mar14	
8	8	1203151059	142.256172	39.927292			1	1				12E02_39.0n142.2e_xbt_mar14	
9	9	1203151112	142.266192	39.881568			1	1				12E02_39.0n142.2e_xbt_mar14	
10	10	1203151125	142.275523	39.837212			1	1				12E02_39.0n142.2e_xbt_mar14	
11	11	1203151139	142.286473	39.786365			1	1				12E02_39.0n142.2e_xbt_mar14	
12	12	1203151156	142.297565	39.727137			1	1				12E02_39.0n142.2e_xbt_mar14	
13	13	1203151216	142.311417	39.657538			1	1				12E02_39.0n142.2e_xbt_mar14	
14	14	1203151238	142.327327	39.580695			1	1				12E02_39.0n142.2e_xbt_mar14	
15	15	1203151304	142.338678	39.493250			1	1				12E02_39.0n142.2e_xbt_mar14	
16	16	1203151324	142.343515	39.420645			1	1				12E02_38.8n142.1e_xbt_mar12	
17	17	1203151328	142.345125	39.406307			1	1				12E02_39.0n142.2e_xbt_mar14	
18	18	1203151348	142.354378	39.337493	39°20′通過、南向き測線 in		1	1	1			12E02_39.0n142.2e_xbt_mar14	
19	19	1203151418	142.352985	39.251040			1	1	1			12E02_39.0n142.2e_xbt_mar14	
20	20	1203151449	142.352497	39.165307			1	1		1		12E02_39.0n142.2e_xbt_mar14	
21	21	1203151519	142.353435	39.080920			1	1		1		12E02_38.5n142.0e_xbt_mar11	
22	22	1203151552	142.353590	38.989298			1	1		1		12E02_38.5n142.0e_xbt_mar11	
23	23	1203151625	142.353532	38.896813			1	1		1		12E02_38.5n142.0e_xbt_mar11	
24	24	1203151658	142.353087	38.807023			1	1		1		12E02_38.5n142.0e_xbt_mar11	
25	25	1203151702	142.353358	38.795987			1	1		1		12E02_38.5n142.2e_xbt_mar13	
26	26	1203151731	142.353372	38.714180			1	1	1			12E02_38.5n142.2e_xbt_mar13	
27	27	1203151746	142.353528	38.672172	変針	*	0	0	0	0	0	12E02_38.5n142.2e_xbt_mar13	
28	28	1203151750	142.347050	38.666482	西向き in		1	1		1		12E02_38.5n142.2e_xbt_mar13	SBP 測線#1
29	29	1203151800	142.308927	38.666535			1	1		1		12E02_38.5n142.2e_xbt_mar13	SBP 測線#1
30	30	1203151803	142.300055	38.666558			1	1		1		12E02_38.8n142.2e_xbt_mar13	SBP 測線#1
31	31	1203151827	142.212237	38.666857			1	1		1		12E02_38.8n142.2e_xbt_mar13	SBP 測線#1
32	32	1203151848	142.136820	38.666237			1	1		1		12E02_38.8n142.2e_xbt_mar13	SBP 測線#1
33	33	1203151907	142.068502	38.666775			1	1		1		12E02_38.8n142.2e_xbt_mar13	SBP 測線#1
34	34	1203151923	142.011353	38.666915			1	1		1		12E02_38.8n142.2e_xbt_mar13	SBP 測線#1

35	35	1203151938	141.958575	38.666547			1	1		1		12E02_38.7n142.0e_xbt_mar15	SBP 測線#1
36	36	1203151942	141.944662	38.666507			1	1		1		12E02_38.7n142.0e_xbt_mar15	SBP 測線#1
37	37	1203151946	141.929657	38.666408	変針	*	0	0	0	0	0	12E02_38.7n142.0e_xbt_mar15	
38	38	1203151950	141.918980	38.658715			1	1		1		12E02_38.7n142.0e_xbt_mar15	
39	39	1203152003	141.896492	38.614367			1	1		1		12E02_38.7n142.0e_xbt_mar15	
40	40	1203152015	141.876550	38.578123			1	1		1		12E02_38.7n142.0e_xbt_mar15	
41	41	1203152021	141.866193	38.560010			1	1		1		12E02_38.5n142.1e_xbt_mar12	
42	42	1203152034	141.844558	38.519330			1	1		1		12E02_38.5n142.1e_xbt_mar12	
43	43	1203152041	141.835390	38.501120	変針、D-3 着	*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
44	44	1203152053	141.833028	38.499557		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
45	45	1203152106	141.832700	38.499932		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
46	46	1203152118	141.831973	38.499837		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
47	47	1203152131	141.832457	38.499755	変針	*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
48	48	1203152132	141.832857	38.499660	D-3 発		1	1		1		12E02_38.5n142.1e_xbt_mar12	
49	49	1203152144	141.872863	38.497190			1	1		1		12E02_38.5n142.1e_xbt_mar12	
50	50	1203152150	141.898458	38.497128			1	1		1		12E02_38.5n142.1e_xbt_mar09	
51	51	1203152200	141.941150	38.498048			1	1		1		12E02_38.5n142.1e_xbt_mar12	
52	52	1203152211	141.981593	38.498442	変針、D-4 着	*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
53	53	1203152226	141.983613	38.499595		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
54	54	1203152241	141.982855	38.499830		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
55	55	1203152253	141.981897	38.499683	DT06 着	*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
56	56	1203152256	141.979950	38.498653		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
57	57	1203152311	141.975802	38.495162		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
58	58	1203152325	141.975762	38.495905	DT06 曳航開始	*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
59	59	1203152340	141.975003	38.498715		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
60	60	1203152354	141.974978	38.501295		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
61	1	1203160009	141.974723	38.503860		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
62	2	1203160023	141.974903	38.506295		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
63	3	1203160037	141.974898	38.508890		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
64	4	1203160051	141.974863	38.511283		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
65	5	1203160106	141.974973	38.513950		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
66	6	1203160120	141.974997	38.516337		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
67	7	1203160135	141.974915	38.519017		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
68	8	1203160149	141.975042	38.521503		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
69	9	1203160203	141.975053	38.524062		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
70	10	1203160217	141.975078	38.526393		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	

71	11	1203160232	141.975127	38.529128		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
72	12	1203160246	141.975108	38.531465		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
73	13	1203160300	141.975007	38.533863		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
74	14	1203160315	141.974998	38.536272		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
75	15	1203160329	141.974972	38.538710		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
76	16	1203160343	141.974865	38.541148		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
77	17	1203160357	141.974940	38.543653		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
78	18	1203160412	141.975070	38.546292		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
79	19	1203160426	141.975155	38.548643		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
80	20	1203160441	141.975117	38.551255		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
81	21	1203160454	141.975018	38.553675		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
82	22	1203160509	141.975012	38.556328		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
83	23	1203160523	141.974960	38.558785		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
84	24	1203160538	141.975123	38.561345		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
85	25	1203160552	141.975175	38.563813		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
86	26	1203160606	141.975225	38.566408		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
87	27	1203160620	141.975132	38.568973		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
88	28	1203160635	141.975170	38.571630		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
89	29	1203160649	141.975132	38.574065	DT06 曳航終了	*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
90	30	1203160704	141.974888	38.576142	変針	*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
91	31	1203160717	141.974420	38.578143	変針	*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
92	32	1203160728	141.980823	38.576842	D-5 へ移動開始		1	1		1		12E02_38.5n142.1e_xbt_mar12	
93	33	1203160744	142.032457	38.558165			1	1		1		12E02_38.5n142.1e_xbt_mar12	
94	34	1203160802	142.103118	38.533273			1	1		1		12E02_38.5n142.1e_xbt_mar12	
95	35	1203160822	142.184705	38.504922			1	1		1		12E02_38.5n142.1e_xbt_mar12	
96	36	1203160826	142.195157	38.500165	変針、D-5 着	*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
97	37	1203160849	142.199003	38.499698		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
98	38	1203160913	142.198170	38.500142		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
99	39	1203160936	142.218772	38.499790	D-5 発		1	1		1		12E02_38.5n142.1e_xbt_mar12	
100	40	1203160952	142.283187	38.500782			1	1		1		12E02_38.5n142.2e_xbt_mar13	
101	41	1203161012	142.365622	38.506255			1	1		1		12E02_38.5n142.2e_xbt_mar13	
102	42	1203161014	142.377208	38.507863	変針	*	0	0	0	0	0	12E02_38.5n142.2e_xbt_mar13	
103	43	1203161019	142.387388	38.500622	南向き in		1	1		1		12E02_38.5n142.2e_xbt_mar13	
104	44	1203161053	142.386440	38.406397			1	1		1		12E02_38.5n142.2e_xbt_mar13	
105	45	1203161126	142.386812	38.312310			1	1		1		12E02_38.5n142.2e_xbt_mar13	
106	46	1203161201	142.386505	38.214182			1	1		1		12E02_38.5n142.2e_xbt_mar13	

107	47	1203161215	142.387062	38.174335			1	1		1		12E02_38.2n142.4e_xbt_mar16	
108	48	1203161218	142.388648	38.163940	変針	*	0	0	0	0	0	12E02_38.2n142.4e_xbt_mar16	音速不適切
109	49	1203161229	142.423897	38.159913	北向き in		1	1		1		12E02_38.1n142.2e_xbt_mar08	
110	50	1203161241	142.423010	38.194552			1	1		1		12E02_38.2n142.4e_xbt_mar16	
111	51	1203161317	142.421998	38.300232			1	1		1		12E02_38.2n142.4e_xbt_mar16	
112	52	1203161353	142.423792	38.405368			1	1		途中		12E02_38.2n142.4e_xbt_mar16	
113	53	1203161424	142.423373	38.492563			1	1				12E02_38.5n142.2e_xbt_mar13	
114	54	1203161430	142.422997	38.509290	変針	*	0	0	0	0	0	12E02_38.5n142.2e_xbt_mar13	
115	55	1203161442	142.459243	38.508487	南向き in		1	1				12E02_38.5n142.2e_xbt_mar13	
116	56	1203161515	142.457812	38.412232			1	1				12E02_38.2n142.4e_xbt_mar16	
117	57	1203161553	142.458480	38.303548			1	1				12E02_38.2n142.4e_xbt_mar16	
118	58	1203161631	142.458332	38.193065			1	1				12E02_38.2n142.4e_xbt_mar16	
119	59	1203161642	142.460038	38.161250	変針	*	0	0	0	0	0	12E02_38.2n142.4e_xbt_mar16	
120	60	1203161644	142.464822	38.157327	変針	*	0	0	0	0	0	12E02_38.1n142.2e_xbt_mar08	
121	61	1203161654	142.502220	38.164405	北向き in		1	1				12E02_38.1n142.2e_xbt_mar08	
122	62	1203161719	142.501505	38.236547			1	1				12E02_38.2n142.4e_xbt_mar16	
123	63	1203161759	142.501420	38.353850			1	1				12E02_38.2n142.4e_xbt_mar16	
124	64	1203161838	142.501633	38.468605			1	1				12E02_38.2n142.4e_xbt_mar16	
125	65	1203161854	142.501788	38.515160	変針	*	0	0	0	0	0	12E02_38.2n142.4e_xbt_mar16	
126	66	1203161858	142.493392	38.518335	西向き in		1	1				12E02_38.5n142.2e_xbt_mar13	
127	67	1203161932	142.365333	38.516628			1	1				12E02_38.5n142.2e_xbt_mar13	
128	68	1203161941	142.333837	38.516647			1	1				12E02_38.5n142.2e_xbt_mar13	
129	69	1203162007	142.225455	38.510965			1	1				12E02_38.5n142.2e_xbt_mar13	
130	70	1203162029	142.128838	38.502438			1	1				12E02_38.5n142.2e_xbt_mar13	
131	71	1203162048	142.053248	38.494628	変針、DT07 着	*	0	0	0	0	0	12E02_38.5n142.2e_xbt_mar13	
132	72	1203162106	142.048772	38.496208		*	0	0	0	0	0	12E02_38.5n142.2e_xbt_mar13	
133	73	1203162123	142.049865	38.496243		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
134	74	1203162141	142.049938	38.498337		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
135	75	1203162145	142.049938	38.498947	DT07 曳航開始	*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
136	76	1203162204	142.050043	38.501940		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
137	77	1203162222	142.050067	38.504895		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
138	78	1203162240	142.050192	38.507895		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
139	79	1203162257	142.050118	38.510790		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
140	80	1203162315	142.050107	38.513765		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
141	81	1203162334	142.050175	38.516653		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
142	82	1203162351	142.049977	38.519652		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	

143	1	1203170010	142.050040	38.522673		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
144	2	1203170028	142.050138	38.525628		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
145	3	1203170045	142.050072	38.528587		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
146	4	1203170104	142.050008	38.531667		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
147	5	1203170121	142.050097	38.534497		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
148	6	1203170139	142.049927	38.537493		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
149	7	1203170157	142.049957	38.540450		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
150	8	1203170215	142.049895	38.543478		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
151	9	1203170233	142.049908	38.546558		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
152	10	1203170251	142.049760	38.549530		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
153	11	1203170309	142.049595	38.552522		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
154	12	1203170326	142.050153	38.555402	DT07 曳航終了	*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
155	13	1203170344	142.048280	38.557940		*	0	0	0	0	0	12E02_38.5n142.1e_xbt_mar12	
156	14	1203170402	142.051618	38.558503	DT07 発		1	1				12E02_38.5n142.1e_xbt_mar12	
157	15	1203170420	142.116012	38.548483			1	1				12E02_38.5n142.1e_xbt_mar12	
158	16	1203170441	142.204992	38.536190			1	1				12E02_38.5n142.1e_xbt_mar12	
159	17	1203170506	142.308123	38.519328			1	1				12E02_38.5n142.1e_xbt_mar12	
160	18	1203170531	142.411295	38.502250			1	1				12E02_38.5n142.2e_ctd_mar16	
161	19	1203170533	142.414173	38.501593	変針、D-6 着	*	0	0	0	0	0	12E02_38.5n142.2e_ctd_mar16	
162	20	1203170608	142.418837	38.500265		*	0	0	0	0	0	12E02_38.5n142.2e_ctd_mar16	
163	21	1203170642	142.422387	38.499493		*	0	0	0	0	0	12E02_38.5n142.2e_ctd_mar16	
164	22	1203170653	142.440942	38.497928	D-6 発		1	1				12E02_38.5n142.2e_ctd_mar16	
165	23	1203170728	142.585142	38.500300			1	1				12E02_38.5n142.4e_ctd_mar17	
166	24	1203170740	142.630308	38.501165	変針、D-7 着	*	0	0	0	0	0	12E02_38.5n142.4e_ctd_mar17	
167	25	1203170822	142.637680	38.503413		*	0	0	0	0	0	12E02_38.5n142.4e_ctd_mar17	
168	26	1203170904	142.642907	38.506337		*	0	0	0	0	0	12E02_38.5n142.4e_ctd_mar17	
169	27	1203170915	142.636470	38.509102	D-7 発、西向き in		1	1				12E02_38.5n142.4e_ctd_mar17	
170	28	1203170938	142.551068	38.510842	変針	*	0	0	0	0	0	12E02_38.5n142.4e_ctd_mar17	
171	29	1203170943	142.541900	38.503255	南向き in		1	1				12E02_38.5n142.4e_ctd_mar17	
172	30	1203171023	142.540478	38.398487			1	1				12E02_38.5n142.4e_ctd_mar17	
173	31	1203171102	142.542105	38.300353			1	1				12E02_38.5n142.4e_ctd_mar17	
174	32	1203171141	142.542537	38.203627			1	1				12E02_38.5n142.4e_ctd_mar17	
175	33	1203171155	142.542478	38.170707			1	1				12E02_38.1n142.2e_xbt_mar08	
176	34	1203171232	142.541920	38.088343			1	1				12E02_38.1n142.2e_xbt_mar08	
177	35	1203171309	142.541073	38.006893			1	1				12E02_38.1n142.2e_xbt_mar08	
178	36	1203171343	142.541722	37.930587			1	1				12E02_38.1n142.2e_xbt_mar08	

179	37	1203171417	142.541600	37.850673			1	1				12E02_38.1n142.2e_xbt_mar08	
180	38	1203171451	142.540245	37.761550			1	1				12E02_38.1n142.2e_xbt_mar08	
181	39	1203171529	142.541175	37.672723			1	1				12E02_38.1n142.2e_xbt_mar08	
182	40	1203171533	142.541488	37.662972	変針	*	0	0	0	0	0	12E02_38.1n142.2e_xbt_mar08	
183	41	1203171548	142.502670	37.659015	北向き in		1	1				12E02_38.1n142.2e_xbt_mar08	
184	42	1203171626	142.503533	37.762120			1	1				12E02_38.1n142.2e_xbt_mar08	
185	43	1203171659	142.503685	37.858132			1	1				12E02_38.1n142.2e_xbt_mar08	
186	44	1203171732	142.503557	37.952822			1	1				12E02_38.1n142.2e_xbt_mar08	
187	45	1203171807	142.503220	38.052700			1	1				12E02_38.1n142.2e_xbt_mar08	
188	46	1203171843	142.502847	38.157677			1	1				12E02_38.5n142.4e_ctd_mar17	
189	47	1203171848	142.502995	38.169488	変針	*	0	0	0	0	0	12E02_38.5n142.4e_ctd_mar17	
190	48	1203171902	142.458220	38.172662	南向き in		1	1				12E02_38.5n142.4e_ctd_mar17	
191	49	1203171930	142.459017	38.098940			1	1				12E02_38.5n142.4e_ctd_mar17	
192	50	1203171945	142.459703	38.060755			1	1				12E02_38.1n142.2e_xbt_mar08	
193	51	1203172010	142.458028	37.990133	変針、E-5 へ	*	0	0	0	0	0	12E02_38.1n142.2e_xbt_mar08	
194	52	1203172039	142.353788	37.984720	西向き		1	1				12E02_38.2n142.4e_xbt_mar07	SBP 測線#2.5
195	53	1203172108	142.238345	37.988873			1	1				12E02_38.2n142.4e_xbt_mar07	SBP 測線#2.5
196	54	1203172133	142.137627	37.994718			1	1				12E02_38.2n142.4e_xbt_mar07	SBP 測線#2.5
197	55	1203172149	142.071715	37.998000			1	1				12E02_38.0n141.9e_ctd_mar18	音速再適用済、#2.5
198	56	1203172205	142.005128	38.000042			1	1				12E02_38.0n141.9e_ctd_mar18	音速再適用済、#2.5
199	57	1203172218	141.948975	37.999865			1	1				12E02_38.0n141.9e_ctd_mar18	音速再適用済、#2.5
200	58	1203172233	141.890653	37.998668			1	1				12E02_38.0n141.9e_ctd_mar18	音速再適用済、#2.5
201	59	1203172245	141.840168	37.998912			1	1				12E02_38.0n141.9e_ctd_mar18	音速再適用済
202	60	1203172258	141.791788	37.999340			1	1				12E02_38.0n141.7e_ctd_mar17	音速再適用済
203	61	1203172311	141.740170	37.999367			1	1				12E02_38.0n141.7e_ctd_mar17	音速再適用済
204	62	1203172318	141.716532	38.000132	変針、E-5 着	*	0	0	0	0	0	12E02_37.9n142.1e_xbt_mar10	
205	63	1203172331	141.712993	38.001005		*	0	0	0	0	0	12E02_37.9n142.1e_xbt_mar10	
206	64	1203172343	141.711013	38.001168		*	0	0	0	0	0	12E02_37.9n142.1e_xbt_mar10	
207	65	1203172350	141.713680	38.001193	E-5発、東向き		1	1				12E02_38.0n141.7e_ctd_mar17	音速再適用済
208	1	1203180004	141.767440	38.001073			1	1				12E02_38.0n141.7e_ctd_mar17	音速再適用済
209	2	1203180008	141.782362	38.000718			1	1				12E02_38.0n141.7e_ctd_mar17	音速再適用済
210	3	1203180020	141.834350	38.000257			1	1				12E02_38.0n141.9e_ctd_mar18	音速再適用済
211	4	1203180033	141.892880	38.000713			1	1				12E02_38.0n141.9e_ctd_mar18	音速再適用済
212	5	1203180044	141.931913	37.999015	変針、E-6 着	*	0	0	0	0	0	12E02_37.9n142.1e_xbt_mar10	
213	6	1203180057	141.934007	38.000952		*	0	0	0	0	0	12E02_37.9n142.1e_xbt_mar10	
214	7	1203180111	141.933372	38.001373		*	0	0	0	0	0	12E02_37.9n142.1e_xbt_mar10	

215	8	1203180124	141.933810	38.002000			1	1				12E02_38.0n141.9e_ctd_mar18	音速再適用済
216	9	1203180138	141.984905	38.001983			1	1				12E02_38.0n141.9e_ctd_mar18	音速再適用済
217	10	1203180152	142.043202	38.000942			1	1				12E02_38.0n141.9e_ctd_mar18	音速再適用済
218	11	1203180154	142.053757	38.000668			1	1				12E02_38.0n141.9e_ctd_mar18	
219	12	1203180203	142.090470	37.999073	DT08 へ	*	0	0	0	0	0	12E02_38.0n141.9e_ctd_mar18	
220	13	1203180225	142.169357	37.963538								12E02_38.0n141.9e_ctd_mar18	
221	14	1203180251	142.258345	37.919043								12E02_38.0n141.9e_ctd_mar18	
222	15	1203180314	142.330207	37.882443	変針、DT08 着	*	0	0	0	0	0	12E02_38.0n141.9e_ctd_mar18	
223	16	1203180343	142.336370	37.882447	DT08 曳航開始	*	0	0	0	0	0	12E02_38.0n141.9e_ctd_mar18	
224	17	1203180413	142.331632	37.883190		*	0	0	0	0	0	12E02_38.0n141.9e_ctd_mar18	位置情報補正済み
225	18	1203180423	142.329495	37.883520		*	0	0	0	0	0	12E02_38.0n141.9e_ctd_mar18	
226	19	1203180452	142.323282	37.883720		*	0	0	0	0	0	12E02_38.0n141.9e_ctd_mar18	
227	20	1203180521	142.316263	37.883225		*	0	0	0	0	0	12E02_38.0n141.9e_ctd_mar18	
228	21	1203180550	142.310237	37.883398		*	0	0	0	0	0	12E02_38.0n141.9e_ctd_mar18	
229	22	1203180619	142.304013	37.883403		*	0	0	0	0	0	12E02_38.0n141.9e_ctd_mar18	
230	23	1203180647	142.298005	37.883525		*	0	0	0	0	0	12E02_38.0n141.9e_ctd_mar18	
231	24	1203180715	142.291930	37.883565	DT08 曳航終了	*	0	0	0	0	0	12E02_38.0n141.9e_ctd_mar18	
232	25	1203180743	142.286588	37.881928		*	0	0	0	0	0	12E02_38.0n141.9e_ctd_mar18	
233	26	1203180811	142.270390	37.884315	E-7 へ							12E02_38.0n141.9e_ctd_mar18	
234	27	1203180838	142.203120	37.949433								12E02_38.0n141.9e_ctd_mar18	
235	28	1203180854	142.163472	37.988778								12E02_37.9n142.1e_xbt_mar10	
236	29	1203180902	142.150437	38.000387	変針。E-7 着	*	0	0	0	0	0	12E02_37.9n142.1e_xbt_mar10	
237	30	1203180925	142.152883	37.999707		*	0	0	0	0	0	12E02_37.9n142.1e_xbt_mar10	
238	31	1203180948	142.153992	37.998090		*	0	0	0	0	0	12E02_37.9n142.1e_xbt_mar10	
239	32	1203181001	142.156953	37.997352	E-7 発		1	1				12E02_37.9n142.1e_xbt_mar10	
240	33	1203181026	142.220685	37.938157			1	1				12E02_37.9n142.1e_xbt_mar10	
241	34	1203181054	142.301728	37.869090			1	1				12E02_37.9n142.1e_xbt_mar10	
242	35	1203181107	142.347278	37.841625	変針	*	0	0	0	0	0	12E02_37.9n142.1e_xbt_mar10	
243	36	1203181112	142.336175	37.833157	西向き in		1	1				12E02_37.9n142.3e_xctd_mar18	SBP 測線#3
244	37	1203181140	142.238725	37.833267			1	1				12E02_37.9n142.3e_xctd_mar18	SBP 測線#3
245	38	1203181205	142.154772	37.833160			1	1				12E02_37.9n142.3e_xctd_mar18	SBP 測線#3
246	39	1203181226	142.083290	37.834075			1	1				12E02_37.9n142.3e_xctd_mar18	SBP 測線#3
247	40	1203181245	142.016257	37.833798			1	1				12E02_37.9n142.3e_xctd_mar18	SBP 測線#3
248	41	1203181303	141.953422	37.833252			1	1				12E02_37.9n142.3e_xctd_mar18	SBP 測線#3
249	42	1203181313	141.920620	37.833442			1	1				12E02_38.0n141.9e_ctd_mar18	SBP 測線#3
250	43	1203181329	141.865797	37.834672	8 の字航走	*	0	0	0	0	0	12E02_38.0n141.9e_ctd_mar18	

251	44	1203181344	141.869650	37.840713		*	0	0	0	0	0	12E02_38.0n141.9e_ctd_mar18	
252	45	1203181400	141.870030	37.846838		*	0	0	0	0	0	12E02_38.0n141.9e_ctd_mar18	
253	46	1203181416	141.879915	37.823485		*	0	0	0	0	0	12E02_38.0n141.9e_ctd_mar18	
254	47	1203181418	141.883982	37.828097	北向き in		1	1				12E02_38.0n141.9e_ctd_mar18	
255	48	1203181435	141.883915	37.877502			1	1				12E02_38.0n141.9e_ctd_mar18	
256	49	1203181451	141.883117	37.920748			1	1				12E02_38.0n141.9e_ctd_mar18	
257	50	1203181506	141.883232	37.962785			1	1				12E02_38.0n141.9e_ctd_mar18	
258	51	1203181519	141.883187	37.998677			1	1				12E02_38.0n141.9e_ctd_mar18	
259	52	1203181532	141.883413	38.037950			1	1				12E02_38.0n141.9e_ctd_mar18	
260	53	1203181545	141.883218	38.072923			1	1				12E02_38.0n141.9e_ctd_mar18	
261	54	1203181547	141.883482	38.079935	変針	*	0	0	0	0	0	12E02_38.0n141.9e_ctd_mar18	
262	55	1203181550	141.892172	38.084577	東向き in		1	1				12E02_38.0n141.9e_ctd_mar18	
263	56	1203181553	141.902663	38.084543			1	1				12E02_38.5n142.1e_xbt_mar12	SBP 測線#2
264	57	1203181607	141.954657	38.083382			1	1				12E02_38.5n142.1e_xbt_mar12	SBP 測線#2
265	58	1203181610	141.963260	38.083485			1	1				12E02_38.1n141.9e_xbt_mar18	SBP 測線#2
266	59	1203181623	142.013685	38.084095			1	1				12E02_38.1n141.9e_xbt_mar18	SBP 測線#2
267	60	1203181634	142.054633	38.083378	変針	*	0	0	0	0	0	12E02_38.1n141.9e_xbt_mar18	
268	61	1203181638	142.063407	38.090105	北向き in		1	1				12E02_38.1n141.9e_xbt_mar18	
269	62	1203181643	142.063628	38.102948			1	1				12E02_38.0n142.2e_ctd_mar18	
270	63	1203181659	142.063397	38.149273			1	1				12E02_38.0n142.2e_ctd_mar18	
271	64	1203181705	142.063332	38.166968			1	1				12E02_38.1n141.9e_xbt_mar18	
272	65	1203181720	142.063237	38.210395			1	1				12E02_38.1n141.9e_xbt_mar18	
273	66	1203181736	142.063152	38.256122			1	1				12E02_38.1n141.9e_xbt_mar18	
274	67	1203181751	142.063103	38.299947			1	1				12E02_38.1n141.9e_xbt_mar18	
275	68	1203181807	142.064070	38.347517			1	1				12E02_38.1n141.9e_xbt_mar18	
276	69	1203181812	142.063995	38.360427			1	1				12E02_38.5n142.1e_xbt_mar12	
277	70	1203181830	142.063303	38.413568			1	1				12E02_38.5n142.1e_xbt_mar12	
278	71	1203181844	142.063255	38.452982			1	1				12E02_38.7n142.1e_xbt_mar10	
279	72	1203181903	142.063827	38.508257			1	1				12E02_38.7n142.1e_xbt_mar10	
280	73	1203181921	142.064388	38.562263			1	1				12E02_38.7n142.1e_xbt_mar10	
281	74	1203181940	142.062940	38.617065			1	1				12E02_38.7n142.1e_xbt_mar10	
282	75	1203181957	142.062502	38.668692			1	1				12E02_38.7n142.1e_xbt_mar10	
283	76	1203182015	142.063047	38.721087			1	1				12E02_38.7n142.1e_xbt_mar10	
284	77	1203182031	142.063482	38.770898			1	1				12E02_38.7n142.1e_xbt_mar10	
285	78	1203182047	142.063415	38.816965	変針、DT09 着	*	0	0	0	0	0	12E02_38.7n142.1e_xbt_mar10	
286	79	1203182053	142.064595	38.825720		*	0	0	0	0	0	12E02_38.7n142.1e_xbt_mar10	

287	80	1203182109	142.064968	38.828063		*	0	0	0	0	0	12E02_38.7n142.1e_xbt_mar10	
288	81	1203182124	142.066183	38.830318		*	0	0	0	0	0	12E02_38.7n142.1e_xbt_mar10	
289	82	1203182140	142.066605	38.831968	曳航開始	*	0	0	0	0	0	12E02_38.7n142.1e_xbt_mar10	
290	83	1203182154	142.067607	38.834530		*	0	0	0	0	0	12E02_38.7n142.1e_xbt_mar10	
291	84	1203182211	142.068947	38.837618		*	0	0	0	0	0	12E02_38.7n142.1e_xbt_mar10	
292	85	1203182226	142.069235	38.840132		*	0	0	0	0	0	12E02_38.7n142.1e_xbt_mar10	
293	86	1203182244	142.070712	38.843510	曳航終了	*	0	0	0	0	0	12E02_38.7n142.1e_xbt_mar10	
294	87	1203182301	142.069590	38.844610		*	0	0	0	0	0	12E02_38.7n142.1e_xbt_mar10	
295	88	1203182315	142.086327	38.841952		*	0	0	0	0	0	12E02_38.7n142.1e_xbt_mar10	
296	89	1203182325	142.100958	38.844915	C-3 へ		1	1				12E02_38.7n142.1e_xbt_mar10	
297	90	1203182340	142.058637	38.869367			1	1				12E02_39.0142.2e_xbt_mar14	
298	91	1203182353	142.017388	38.893595			1	1				12E02_39.0142.2e_xbt_mar14	
299	1	1203190007	141.978957	38.920495	C-3 着	*	0	0	0	0	0	12E02_39.0142.2e_xbt_mar14	
300	2	1203190008	141.976728	38.923537		*	0	0	0	0	0	12E02_39.0142.2e_xbt_mar14	
301	3	1203190020	141.976385	38.933832		*	0	0	0	0	0	12E02_39.0142.2e_xbt_mar14	
302	4	1203190034	141.976490	38.932558		*	0	0	0	0	0	12E02_39.0142.2e_xbt_mar14	
303	5	1203190046	141.975960	38.931427		*	0	0	0	0	0	12E02_39.0142.2e_xbt_mar14	
304	6	1203190058	141.996097	38.932705	C-4 へ		1	1				12E02_39.0142.2e_xbt_mar14	
305	7	1203190112	142.054003	38.931487			1	1				12E02_39.0142.2e_xbt_mar14	
306	8	1203190119	142.081217	38.930983			1	1				12E02_38.9n142.0e_ctd_mar19	
307	9	1203190135	142.147763	38.932020			1	1				12E02_38.9n142.0e_ctd_mar19	
308	10	1203190138	142.158513	38.932157	C-4 着	*	0	0	0	0	0	12E02_38.9n142.0e_ctd_mar19	
309	11	1203190156	142.167402	38.930977		*	0	0	0	0	0	12E02_38.9n142.0e_ctd_mar19	
310	12	1203190214	142.166645	38.928373		*	0	0	0	0	0	12E02_38.9n142.0e_ctd_mar19	
311	13	1203190233	142.169027	38.924718		*	0	0	0	0	0	12E02_38.9n142.0e_ctd_mar19	
312	14	1203190236	142.174475	38.924875	C-5 へ		1	1				12E02_38.9n142.0e_ctd_mar19	
313	15	1203190257	142.233685	38.925305			1	1				12E02_38.9n142.0e_ctd_mar19	
314	16	1203190307	142.265487	38.925132			1	1				12E02_38.9n142.2e_ctd_mar19	
315	17	1203190336	142.347208	38.925393			1	1				12E02_38.9n142.2e_ctd_mar19	
316	18	1203190341	142.361992	38.927482			1	1				12E02_38.9n142.2e_ctd_mar19	
317	19	1203190348	142.379738	38.931310	C-5 着	*	0	0	0	0	0	12E02_38.9n142.2e_ctd_mar19	
318	20	1203190422	142.383052	38.931103		*	0	0	0	0	0	12E02_38.9n142.2e_ctd_mar19	
319	21	1203190456	142.380667	38.925678		*	0	0	0	0	0	12E02_38.9n142.2e_ctd_mar19	
320	22	1203190518	142.389572	38.927302	C-6 へ		1	1				12E02_38.9n142.2e_ctd_mar19	
321	23	1203190549	142.521885	38.930340			1	1				12E02_38.9n142.4e_ctd_mar19	
322	24	1203190604	142.579763	38.932898			1	1				12E02_38.9n142.4e_ctd_mar19	

323	25	1203190611	142.582545	38.934725	C-6 着	*	0	0	0	0	0	12E02_38.9n142.4e_ctd_mar19	
324	26	1203190649	142.579322	38.929338		*	0	0	0	0	0	12E02_38.9n142.4e_ctd_mar19	
325	27	1203190727	142.576550	38.924262	C-7 へ		1	1				12E02_38.9n142.4e_ctd_mar19	
326	28	1203190800	142.668912	38.928418			1	1				12E02_38.9n142.6e_ctd_mar19	
327	29	1203190831	142.797708	38.933175			1	1				12E02_38.9n142.6e_ctd_mar19	
328	30	1203190912	142.807452	38.938820	C-7 着	*	0	0	0	0	0	12E02_38.9n142.6e_ctd_mar19	
329	31	1203190953	142.812630	38.939777		*	0	0	0	0	0	12E02_38.9n142.6e_ctd_mar19	
330	32	1203191016	142.802893	38.955228	サーベイ開始、北向き		1	1				12E02_38.9n142.6e_ctd_mar19	
331	33	1203191040	142.800793	39.017347	変針	*	0	0	0	0	0	12E02_38.9n142.6e_ctd_mar19	
332	34	1203191049	142.809953	39.015645	西向き in		1	1				12E02_38.9n142.6e_ctd_mar19	
333	35	1203191057	142.786442	39.016412			1	1				12E02_38.9n142.8e_ctd_mar19	
334	36	1203191133	142.656078	39.017507			1	1				12E02_38.9n142.6e_ctd_mar19	
335	37	1203191211	142.509433	39.016273			1	1				12E02_38.9n142.6e_ctd_mar19	
336	38	1203191228	142.441478	39.016893			1	1				12E02_38.9n142.4e_ctd_mar19	
337	39	1203191253	142.341098	39.017025			1	1				12E02_38.9n142.2e_ctd_mar19	
338	40	1203191309	142.278028	39.016373	変針	*	0	0	0	0	0	12E02_38.9n142.2e_ctd_mar19	
339	41	1203191322	142.287772	39.016997	北向き in		1	1				12E02_38.9n142.2e_ctd_mar19	
340	42	1203191346	142.289302	39.085598			1	1				12E02_38.9n142.0e_ctd_mar19	
341	43	1203191412	142.290400	39.161250			1	1				12E02_38.9n142.0e_ctd_mar19	
342	44	1203191435	142.289232	39.226183			1	1				12E02_38.9n142.2e_ctd_mar19	
343	45	1203191501	142.287915	39.300208			1	1				12E02_38.9n142.2e_ctd_mar19	
344	46	1203191514	142.288043	39.337290	変針	*	0	0	0	0	0	12E02_38.9n142.2e_ctd_mar19	
345	47	1203191524	142.261352	39.335712	南向き in		1	1				12E02_38.9n142.2e_ctd_mar19	
346	48	1203191537	142.260947	39.296653			1	1				12E02_39.3n142.3e_xbt_mar19	
347	49	1203191600	142.259420	39.228908			1	1				12E02_39.3n142.3e_xbt_mar19	
348	50	1203191625	142.259622	39.158392			1	1				12E02_39.3n142.3e_xbt_mar19	
349	51	1203191650	142.259663	39.082617			1	1				12E02_39.3n142.3e_xbt_mar19	
350	52	1203191715	142.259950	39.007482			1	1				12E02_39.3n142.3e_xbt_mar19	
351	53	1203191719	142.260098	38.996075	変針	*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
352	54	1203191725	142.244043	38.990053	変針	*	0	0	0	0	0	12E02_38.9n142.2e_ctd_mar19	
353	55	1203191728	142.239108	38.995668			1	1				12E02_38.9n142.2e_ctd_mar19	
354	56	1203191752	142.238128	39.066272			1	1				12E02_38.9n142.2e_ctd_mar19	
355	57	1203191805	142.238585	39.105620			1	1				12E02_38.9n142.0e_ctd_mar19	
356	58	1203191827	142.238865	39.170893			1	1				12E02_38.9n142.0e_ctd_mar19	
357	59	1203191848	142.238162	39.233367			1	1				12E02_38.9n142.0e_ctd_mar19	
358	60	1203191908	142.238637	39.292068			1	1				12E02_38.9n142.0e_ctd_mar19	

359	61	1203191923	142.238635	39.334968			1	1				12E02_39.3n142.3e_xbt_mar19	
360	62	1203191924	142.238670	39.336735	変針	*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
361	63	1203191932	142.215952	39.336037			1	1				12E02_39.3n142.3e_xbt_mar19	
362	64	1203191950	142.217225	39.284978			1	1				12E02_39.3n142.3e_xbt_mar19	
363	65	1203192009	142.216477	39.229608			1	1				12E02_39.3n142.3e_xbt_mar19	
364	66	1203192019	142.216155	39.201695	変針	*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
365	67	1203192043	142.304500	39.225742			1	1				12E02_39.3n142.3e_xbt_mar19	
366	68	1203192055	142.344650	39.240345	変針、DT10 着	*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
367	69	1203192124	142.338220	39.243275		*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
368	70	1203192153	142.333393	39.243663		*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
369	71	1203192154	142.333173	39.243670	曳航開始（DT10）	*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
370	72	1203192220	142.327400	39.243492		*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
371	73	1203192248	142.320848	39.243463		*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
372	74	1203192315	142.314862	39.243495		*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
373	75	1203192342	142.308602	39.244163		*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
374	1	1203200009	142.302333	39.245495		*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
375	2	1203200036	142.295767	39.246643		*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
376	3	1203200101	142.289720	39.247460		*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
377	4	1203200125	142.284068	39.246473		*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
378	5	1203200150	142.278455	39.245380		*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
379	6	1203200212	142.273143	39.244545		*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
380	7	1203200235	142.267870	39.244438		*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
381	8	1203200257	142.263062	39.244488		*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
382	9	1203200318	142.258235	39.244437		*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
383	10	1203200340	142.254470	39.245735		*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
384	11	1203200401	142.251462	39.245180	曳航終了	*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
385	12	1203200422	142.250653	39.242292		*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
386	13	1203200444	142.256698	39.243612	再投入	*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
387	14	1203200505	142.256023	39.244650		*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
388	15	1203200524	142.253412	39.245138	曳航開始（DT11）	*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
389	16	1203200544	142.249865	39.244970		*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
390	17	1203200605	142.247157	39.245177		*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
391	18	1203200625	142.243973	39.246090		*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
392	19	1203200645	142.240915	39.246427		*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
393	20	1203200705	142.238032	39.246797		*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
394	21	1203200725	142.234528	39.247113		*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	

395	22	1203200744	142.230477	39.246427	曳航終了	*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
396	23	1203200804	142.226378	39.246027		*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
397	24	1203200822	142.224985	39.243235		*	0	0	0	0	0	12E02_39.3n142.3e_xbt_mar19	
398	25	1203200841	142.218003	39.227903	サーベイ開始、南向き in		1	1				12E02_39.3n142.3e_xbt_mar19	
399	26	1203200902	142.215267	39.171275			1	1				12E02_39.3n142.3e_xbt_mar19	
400	27	1203200907	142.215288	39.156620			1	1				12E02_38.9n142.2e_ctd_mar19	
401	28	1203200928	142.215270	39.097648			1	1				12E02_38.9n142.2e_ctd_mar19	
402	29	1203200949	142.214352	39.040585			1	1				12E02_38.9n142.0e_ctd_mar19	
403	30	1203201010	142.214690	38.983723			1	1				12E02_38.9n142.0e_ctd_mar19	
404	31	1203201031	142.215028	38.925085			1	1				12E02_38.9n142.0e_ctd_mar19	
405	32	1203201034	142.215725	38.914853			1	1				12E02_38.9n142.2e_ctd_mar19	
406	33	1203201057	142.215358	38.851653			1	1				12E02_38.9n142.2e_ctd_mar19	
407	34	1203201059	142.215208	38.845222	変針	*	0	0	0	0	0	12E02_38.9n142.2e_ctd_mar19	
408	35	1203201108	142.193270	38.844190	北向き in		1	1				12E02_38.9n142.2e_ctd_mar19	
409	36	1203201130	142.193607	38.905158			1	1				12E02_38.9n142.2e_ctd_mar19	
410	37	1203201135	142.192943	38.918782			1	1				12E02_38.8n142.2e_xbt_mar13	
411	38	1203201155	142.194273	38.977792			1	1				12E02_38.8n142.2e_xbt_mar13	
412	39	1203201205	142.195507	39.006445	変針	*	0	0	0	0	0	12E02_38.9n142.0e_ctd_mar19	
413	40	1203201215	142.169903	39.006343	南向き in		1	1				12E02_38.9n142.0e_ctd_mar19	
414	41	1203201233	142.167892	38.955333			1	1				12E02_38.9n142.0e_ctd_mar19	
415	42	1203201242	142.168313	38.928783			1	1				12E02_38.8n142.2e_xbt_mar13	
416	43	1203201302	142.169030	38.870383			1	1				12E02_38.8n142.2e_xbt_mar13	
417	44	1203201313	142.168088	38.839138	変針	*	0	0	0	0	0	12E02_38.8n142.2e_xbt_mar13	
418	45	1203201321	142.149417	38.837663	北向き in		1	1				12E02_38.8n142.2e_xbt_mar13	
419	46	1203201341	142.148325	38.894748			1	1				12E02_38.8n142.2e_xbt_mar13	
420	47	1203201400	142.148148	38.949210			1	1				12E02_38.8n142.2e_xbt_mar13	
421	48	1203201406	142.148298	38.967458			1	1				12E02_38.9n142.0e_ctd_mar19	
422	49	1203201418	142.149040	39.001080	変針	*	0	0	0	0	0	12E02_38.9n142.0e_ctd_mar19	
423	50	1203201426	142.129638	39.000163	南向き in		1	1				12E02_38.9n142.0e_ctd_mar19	
424	51	1203201442	142.128467	38.956095			1	1				12E02_38.9n142.0e_ctd_mar19	
425	52	1203201458	142.128252	38.913600			1	1				12E02_38.9n142.0e_ctd_mar19	
426	53	1203201508	142.128545	38.884130			1	1				12E02_38.9n142.2e_ctd_mar19	
427	54	1203201526	142.128317	38.832897			1	1				12E02_38.9n142.2e_ctd_mar19	
428	55	1203201528	142.128392	38.828218	変針	*	0	0	0	0	0	12E02_38.9n142.2e_ctd_mar19	
429	56	1203201535	142.116930	38.830887	変針	*	0	0	0	0	0	12E02_38.9n142.2e_ctd_mar19	SBP 再起動のため
430	57	1203201540	142.116908	38.844012	変針	*	0	0	0	0	0	12E02_38.9n142.2e_ctd_mar19	SBP 再起動のため

431	58	1203201556	142.118565	38.830542	北向き in		1	1				12E02_38.9n142.2e_ctd_mar19	
432	59	1203201614	142.117008	38.882113			1	1				12E02_38.9n142.2e_ctd_mar19	
433	60	1203201625	142.116563	38.915097			1	1				12E02_38.9n142.0e_ctd_mar19	
434	61	1203201641	142.116413	38.958977			1	1				12E02_38.9n142.0e_ctd_mar19	
435	62	1203201654	142.117070	38.996557	変針	*	0	0	0	0	0	12E02_38.9n142.0e_ctd_mar19	
436	63	1203201656	142.123370	39.000332	東向き in		1					12E02_38.9n142.0e_ctd_mar19	
437	64	1203201713	142.186248	38.999822	変針	*	0	0	0	0	0	12E02_38.9n142.0e_ctd_mar19	
438	65	1203201716	142.191713	39.003132	北向き in		1	1				12E02_38.9n142.0e_ctd_mar19	
439	66	1203201736	142.193555	39.059270			1	1				12E02_38.9n142.0e_ctd_mar19	
440	67	1203201754	142.193323	39.111463			1	1				12E02_38.9n142.0e_ctd_mar19	
441	68	1203201756	142.193332	39.117762			1	1				12E02_38.9n142.2e_ctd_mar19	
442	69	1203201815	142.193563	39.171707			1	1				12E02_39.3n142.3e_xbt_mar19	
443	70	1203201834	142.193050	39.224495			1	1				12E02_39.3n142.3e_xbt_mar19	
444	71	1203201852	142.193475	39.272717			1	1				12E02_39.3n142.3e_xbt_mar19	
445	72	1203201857	142.193390	39.288492			1	1				12E02_39.3n142.2e_xbt_mar20	
446	73	1203201914	142.197593	39.334815			1	1				12E02_39.3n142.2e_xbt_mar20	
447	74	1203201915	142.199017	39.337522			1	1				12E02_39.3n142.2e_xbt_mar20	
448	75	1203201918	142.206110	39.334548			1	1				12E02_39.3n142.2e_xbt_mar20	
449	76	1203201930	142.206557	39.298050			1	1				12E02_39.3n142.2e_xbt_mar20	
450	77	1203201948	142.212778	39.340225			1	1				12E02_39.3n142.2e_xbt_mar20	
451	78	1203202006	142.210122	39.398608			1	1				12E02_39.3n142.2e_xbt_mar20	
452	79	1203202021	142.204955	39.443882			1	1				12E02_39.3n142.2e_xbt_mar20	
453	80	1203202035	142.195685	39.487295			1	1				12E02_39.3n142.2e_xbt_mar20	
454	81	1203202047	142.199715	39.522098	変針、B-2 着	*	0	0	0	0	0	12E02_39.3n142.2e_xbt_mar20	
455	82	1203202101	142.197962	39.523070		*	0	0	0	0	0	12E02_39.3n142.2e_xbt_mar20	
456	83	1203202114	142.196497	39.520472		*	0	0	0	0	0	12E02_39.3n142.2e_xbt_mar20	
457	84	1203202126	142.195418	39.518017		*	0	0	0	0	0	12E02_39.3n142.2e_xbt_mar20	
458	85	1203202138	142.201198	39.521753	B-3 へ		1	1				12E02_39.3n142.2e_xbt_mar20	
459	86	1203202151	142.257052	39.529145			1	1				12E02_39.3n142.2e_xbt_mar20	
460	87	1203202201	142.298830	39.531212			1	1				12E02_39.5n142.2e_ctd_mar21	
461	88	1203202205	142.313105	39.532187	変針、B-3 着	*	0	0	0	0	0	12E02_39.5n142.2e_ctd_mar21	
462	89	1203202228	142.315698	39.530463		*	0	0	0	0	0	12E02_39.5n142.2e_ctd_mar21	
463	90	1203202250	142.314538	39.526945		*	0	0	0	0	0	12E02_39.5n142.2e_ctd_mar21	
464	91	1203202304	142.318893	39.527455	B-4 へ		1	1				12E02_39.5n142.2e_ctd_mar21	
465	92	1203202331	142.432793	39.531460			1	1				12E02_39.5n142.2e_ctd_mar21	
466	93	1203202336	142.456573	39.532567			1	1				12E02_39.5n142.3e_ctd_mar21	

467	94	1203202358	142.533938	39.534238	変針、B-4 着	*	0	0	0	0	0	12E02_39.5n142.3e_ctd_mar21	
468	1	1203210031	142.533310	39.532782		*	0	0	0	0	0	12E02_39.5n142.3e_ctd_mar21	
469	2	1203210105	142.532635	39.529457		*	0	0	0	0	0	12E02_39.5n142.3e_ctd_mar21	
470	3	1203210108	142.530670	39.528042	釜石へ		1	1				12E02_39.5n142.3e_ctd_mar21	
471	4	1203210141	142.396130	39.454198			1	1				12E02_39.5n142.3e_ctd_mar21	
472	5	1203210207	142.277445	39.394095			1	1				12E02_39.5n142.3e_ctd_mar21	
473	6	1203210225	142.212278	39.361188			1	1				12E02_39.5n142.3e_ctd_mar21	
474	7	1203210240	142.159298	39.332990			1	1				12E02_39.5n142.3e_ctd_mar21	
475	8	1203210253	142.122725	39.317842			1	1				12E02_39.5n142.3e_ctd_mar21	
476	9	1203210300	142.104348	39.314330			1	1				12E02_39.3n142.2e_xbt_mar20	
477	10	1203210312	142.074543	39.306447			1	1				12E02_39.3n142.2e_xbt_mar20	
478	11	1203210324	142.046068	39.293623			1	1				12E02_39.3n142.2e_xbt_mar20	
479	12	1203210337	142.014455	39.279007			1	1				12E02_39.3n142.2e_xbt_mar20	
480	13	1203210349	141.990113	39.268837	Ping 停止、システム再起動	*	0	0	0	0	0	12E02_39.3n142.2e_xbt_mar20	釜石沖着
481	14	1203210420	142.057020	39.296985	収録再開	*	0	0	0	0	0	12E02_39.3n142.2e_xbt_mar20	釜石沖発
482	15	1203210431	142.089932	39.324167			1	1				12E02_39.3n142.2e_xbt_mar20	
483	16	1203210443	142.124518	39.350638			1	1				12E02_39.3n142.2e_xbt_mar20	
484	17	1203210458	142.179160	39.325093			1	1				12E02_39.3n142.2e_xbt_mar20	
485	18	1203210515	142.239263	39.291450	変針データ含む		1	1				12E02_39.3n142.2e_xbt_mar20	
486	19	1203210538	142.295882	39.332050			1	1				12E02_39.3n142.2e_xbt_mar20	
487	20	1203210603	142.296343	39.401303	北向き in		1	1				12E02_39.3n142.2e_xbt_mar20	
488	21	1203210627	142.296887	39.467397			1	1				12E02_39.3n142.2e_xbt_mar20	
489	22	1203210647	142.297387	39.524975	変針	*	0	0	0	0	0	12E02_39.3n142.2e_xbt_mar20	
490	23	1203210650	142.308677	39.528123	東向き in		1	1				12E02_39.3n142.2e_xbt_mar20	
491	24	1203210713	142.391508	39.525488	変針	*	0	0	0	0	0	12E02_39.3n142.2e_xbt_mar20	
492	25	1203210716	142.397123	39.520570	南向き in		1	1				12E02_39.3n142.2e_xbt_mar20	
493	26	1203210746	142.396920	39.436232			1	1				12E02_39.3n142.2e_xbt_mar20	
494	27	1203210817	142.397210	39.347520			1	1				12E02_39.3n142.2e_xbt_mar20	
495	28	1203210820	142.397293	39.339918			1	1				12E02_39.3n142.3e_xbt_mar19	
496	29	1203210853	142.397517	39.250282			1	1				12E02_39.3n142.3e_xbt_mar19	
497	30	1203210926	142.396787	39.156748			1	1				12E02_39.3n142.3e_xbt_mar19	
498	31	1203211002	142.397388	39.058865			1	1				12E02_39.5n142.3e_ctd_mar20	
499	32	1203211013	142.396830	39.028087	変針	*	0	0	0	0	0	12E02_39.5n142.3e_ctd_mar20	
500	33	1203211019	142.415453	39.022615	変針	*	0	0	0	0	0	12E02_39.5n142.3e_ctd_mar20	
501	34	1203211028	142.440577	39.029300	北向き in		1	1				12E02_39.5n142.3e_ctd_mar20	
502	35	1203211105	142.439635	39.133393			1	1				12E02_39.5n142.3e_ctd_mar20	

503	36	1203211140	142.440445	39.231628			1	1				12E02_39.5n142.3e_ctd_mar20	
504	37	1203211215	142.439575	39.328398			1	1				12E02_39.5n142.3e_ctd_mar20	
505	38	1203211249	142.440093	39.424127			1	1				12E02_39.5n142.3e_ctd_mar20	
506	39	1203211322	142.439723	39.515530			1	1				12E02_39.5n142.3e_ctd_mar20	
507	40	1203211335	142.440205	39.552585	八戸へ（少し変針）		1	1				12E02_39.5n142.3e_ctd_mar20	
508	41	1203211404	142.400732	39.634122			1	1				12E02_39.5n142.3e_ctd_mar20	
509	42	1203211429	142.368703	39.705405			1	1				12E02_39.5n142.3e_ctd_mar20	
510	43	1203211452	142.339480	39.771678			1	1				12E02_39.5n142.3e_ctd_mar20	
511	44	1203211512	142.312630	39.830393			1	1				12E02_39.5n142.3e_ctd_mar20	
512	45	1203211529	142.288670	39.881798			1	1				12E02_39.5n142.3e_ctd_mar20	
513	46	1203211544	142.266828	39.927848			1	1				12E02_39.5n142.3e_ctd_mar20	
514	47	1203211558	142.250300	39.967848			1	1				12E02_39.5n142.3e_ctd_mar20	
515	48	1203211609	142.237428	40.004222								12E02_39.5n142.3e_ctd_mar20	
516	49	1203211623	142.225032	40.043323								12E02_39.5n142.3e_ctd_mar20	
517	50	1203211634	142.216947	40.079455								12E02_39.5n142.3e_ctd_mar20	
518	51	1203211648	142.207408	40.120203								12E02_39.5n142.3e_ctd_mar20	
519	52	1203211700	142.198595	40.157263								12E02_39.5n142.3e_ctd_mar20	
520	53	1203211713	142.189713	40.194735								12E02_39.5n142.3e_ctd_mar20	
521	54	1203211726	142.180410	40.235338								12E02_39.5n142.3e_ctd_mar20	
522	55	1203211739	142.171278	40.274288								12E02_39.5n142.3e_ctd_mar20	
523	56	1203211753	142.161955	40.316967								12E02_39.5n142.3e_ctd_mar20	
524	57	1203211806	142.153422	40.356283								12E02_39.5n142.3e_ctd_mar20	
525	58	1203211821	142.142818	40.401490								12E02_39.5n142.3e_ctd_mar20	
526	59	1203211836	142.132678	40.448543								12E02_39.5n142.3e_ctd_mar20	
527	60	1203211853	142.121043	40.498297								12E02_39.5n142.3e_ctd_mar20	
528	61	1203211908	142.109973	40.544737								12E02_39.5n142.3e_ctd_mar20	
529	62	1203211925	142.092623	40.589932								12E02_39.5n142.3e_ctd_mar20	
530	63	1203211940	142.035042	40.600833								12E02_39.5n142.3e_ctd_mar20	
531	64	1203211953	141.982528	40.612768								12E02_39.5n142.3e_ctd_mar20	
532	65	1203212005	141.943993	40.629025								12E02_39.5n142.3e_ctd_mar20	
533	66	1203212017	141.897205	40.646473								12E02_39.5n142.3e_ctd_mar20	
534	67	1203212028	141.850240	40.657242	八戸沖、システム停止							12E02_39.5n142.3e_ctd_mar20	
535													

3-4-4. Gravity, Gradio & Magnet meters Investigations

Introduction

Measurements of magnetic force on the sea are required for the geophysical investigations of marine magnetic anomaly caused by magnetization in upper crustal structure.We measured geomagnetic field using a three-component magnetometer (Tierra Tecnica SFG1214).

The local gravity is an important parameter in geophysics and geodesy. We measured relative gravity using LaCoste and Romberg air-sea gravity meter S-116 (Micro-g LaCoste, LLC).

Data acquisition

i)Three-component magnetometer

We measured during the MR12-E02 Leg2 cruise from 15 March 2012 to 22 March 2012.

ii)Gravimeter

We measured relative gravity during the MR12-E02 Leg2 cruise from 15 March 2012 to 22 March 2012.

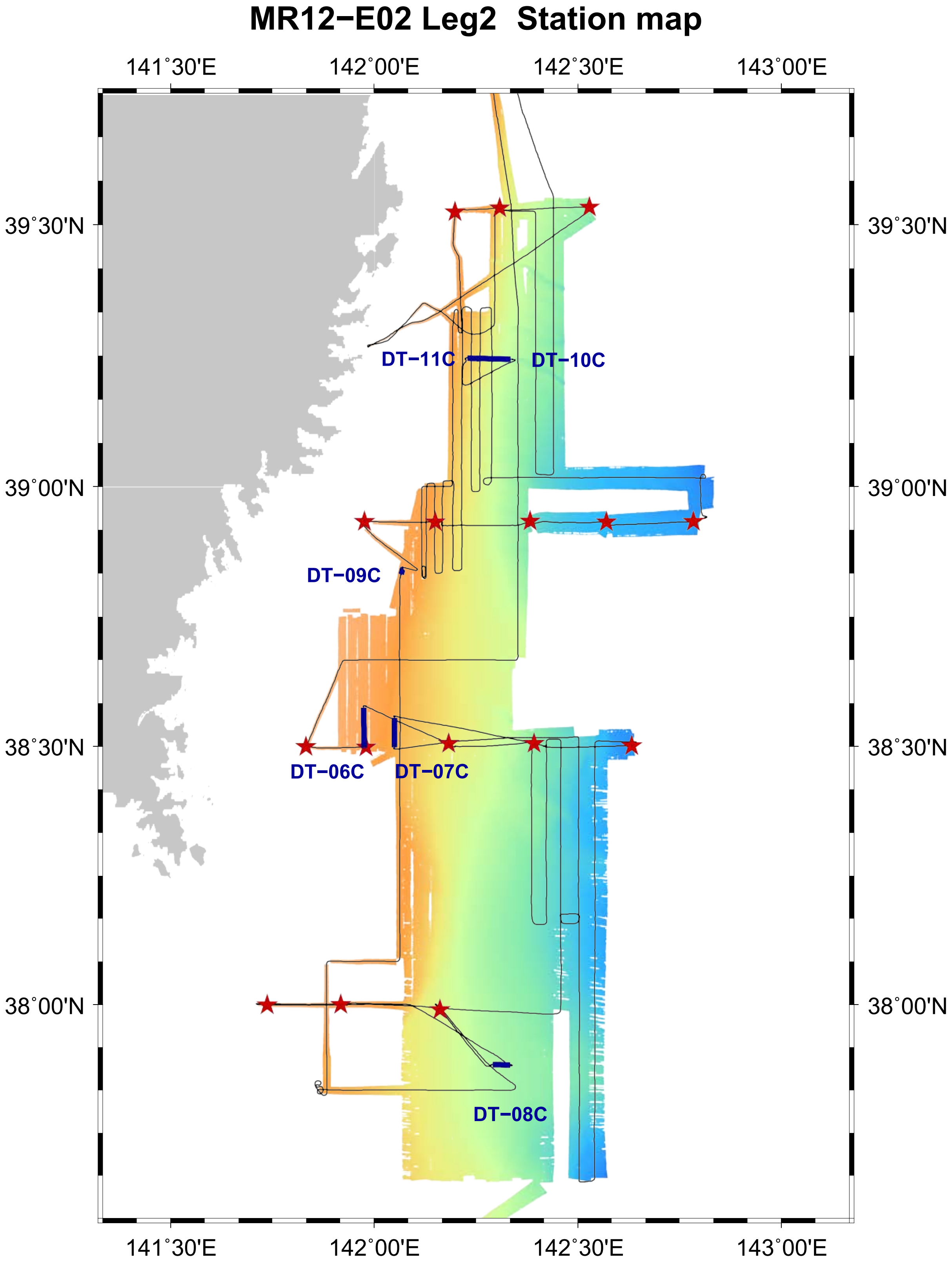
To convert the relative gravity to absolute one, we measured gravity, using portable gravity meter (Scintrex gravity meter CG-5), at Yokohama before cruise, and will measure after MR12-E02 Leg3 at Yokohama, as the reference point.

Preliminary results

The results will be published after primary processing.

Data archives

All data obtained during this cruise will be submitted to the Data Management Group (DMG) in JAMSTEC, and will be archived there.



4. Future plan

Based on cruise data and samples, we will analyse biological, ecological, chemical, geological and oceanographical studies to estimate impact by the 2011 mega-earthquake. These results not only science but also general cruise dialy will be published to various science activities, papaers, symposiums, workshops and etc, and via web pages, medias and so on.

5. About data

Include any information that may be necessary for analysis and QC planning and secondary use (publications, provisions, etc.)

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.