

Annual activity report of oceanographic observations by Training ship Kagoshima-maru

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Abstract

In order to facilitate the effective use of training ship Kagoshima-maru, we report the annual activity of oceanographic observations and sample collections made by this ship during April 2013 to March 2014. Training ship Kagoshima-maru conducted a total of 17 cruises. The total number of the cruise days and participants was 168 days and 572 persons, respectively. Training ship Kagoshima-maru covered the western North Pacific Ocean, East China Sea and its neighboring areas.

Introduction

Kagoshima-maru is a training ship of the Faculty of Fisheries, Kagoshima University, which was constructed in March 2012. Since Training ship Kagoshima-maru was officially approved for a shared-use training ship by Ministry of Education, Culture, Sports, Science and Technology, Japan (MEXT), various shared-use programs have been conducted between the Faculty of Fisheries, Kagoshima University and the other educational and scientific institutions. Here, we report an annual summary of oceanographic observations and sample collections carried out during April 2013 to March 2014 by Training ship Kagoshima-maru in order to promote such shared-use programs.

Specifications and operations of shipboard instruments

This section provides general information on specifications and operating procedures of shipboard instruments for oceanographic observations and sample collections. Details of the information will be found at the publications listed below.

A Conductivity-Temperature-Depth Profiler System with a 24-position Carousel Multiple Sampler (CTD-CMS) was used for hydrographic observations using the sensors for conductivity, temperature and pressure (SBE 9plus: Sea-Bird Electronics, Inc.), dissolved oxygen (SBE45: Sea-Bird Electronics, Inc.), altimeter (Benthos PSA-916D: Teledyne Benthos, Inc.), fluorescence (ECO-FL: WET Labs, Inc.), and PAR (QSP-2300L: Biospherical Instruments, Inc.). Occasionally, an Expendable Bathythermograph (XBT T-5 or T-7: Tsurumi-Seiki- Kosakusho Co., Ltd) was used for

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recording the vertical profile of water temperature during cruising. Optionally, a Fast Repetition Rate Fluorescence (FRRF: Kimoto Electric Co., Ltd.) was attached with a CMS flame to measure the physiological activity of the phytoplankton community. Several 12-liter X-Niskin Bottles attached with CMS were used for collecting seawater. Occasionally, seawater samples were collected by normal Niskin or GO-FLO bottles attached to a wire at the desired depths. These bottles were closed by messengers. CTD-CMS, Niskin and GO-FLO were deployed from starboard on the working deck.

For monitoring bathymetry and underwater substrates, Training ship Kagoshima-maru has two different sonar instruments, an Acoustic Doppler Current Profiler (Ocean Surveyor ADCP: Teledyne-RD Instruments, Inc.) and a Scientific Echo Sounder (EK 60: Simrad). Available working frequencies were 75 kHz for the Acoustic Doppler Current Profiler (ADCP) and 12, 38, 120 and 200 kHz for the Scientific Echo Sounder (SES). ADCP and SES were used for measuring water current velocities over a depth range and for monitoring bathymetry and underwater substrate classification, respectively.

A Vertical Multiple-opening Plankton Sampler (VMPS: Tsurumi-Seiki-Kosakusho Co., Ltd), was employed during hydrographic observations using the sensors for conductivity, temperature and pressure (SBE 52MP: Sea-Bird Electronics Inc.) and fluorescence (ECO FLNTU(RT)D: WET Labs, Inc.) and collecting depth-stratified zooplankton samples. The mouth opening was 0.25 m². Four multiple nets were attached and two different mesh openings (0.1 mm and 0.064 mm) were used. A flow meter (Rigo Co., Ltd) was mounted in the mouth of the frame to register the volume of water that passed through the net. The VMPS was deployed from starboard on the working deck.

A Multiple Opening Closing Net and Environmental Sensing System (MOCNESS: Biological Environmental Sampling System, Inc.) were used for collecting depth-stratified zooplankton samples during the cruises. The mouth opening was 4 m². Six multiple nets were attached and two different mesh openings (0.335 mm and 0.125 inch) were used. The sensors were for conductivity, temperature and pressure (Sea-Bird Electronics, Inc.), altimeter (Teledyne Benthos, Inc.), and fluorescence (WET Labs, Inc.). A flow meter (Tsurumi-Seiki-Kosakusho Co., Ltd) was mounted in the mouth of the frame to register the volume of water that

passed through the net. MOCNESS was deployed from the rear on the working deck.

A North Pacific Standard (NORPAC) net was used for collecting zooplankton samples during the cruises. The mouth diameter was 0.45 m. The two different mesh openings used were 0.1 mm and 0.335 mm, respectively. A flow meter (Rigo Co., Ltd) was mounted in the mouth of the frame to register the volume of water that passed through the net. NORPAC was deployed from starboard on the working deck.

A Larval net (LN) was used for collecting fish larvae near the surface. The mouth diameter was 1.6 m and the mesh opening was 5.0 mm. A flow meter (GO-2030R: General Oceanics, Inc.) was mounted in the mouth of the frame to register the volume of water that passed through the net. The Larval net was deployed from starboard on the working deck.

An Electronic Plankton Counting and Sizing System (EPCS: Nippon Kaiyo Co., Ltd.) was used for the continuous monitoring of oceanographic conditions and collecting water samples during the cruises. Seawater was pumped up from the bottom of the ship (ca. 5 m). The sensors were for conductivity, temperature and pressure (SBE 4: Sea-Bird Electronics, Inc.), fluorescence (10-AU: Turner Designs Inc.) and particle count and sizing by Laser Optical Particle Counter (LOPC: ODIM Brook Ocean, Inc.). Optionally, a Fast Repetition Rate Fluorescence system (FRRF: Kimoto Electric Co., Ltd.) was attached at the end of the flow line to measure physiological activity of the phytoplankton community.

Core, Dredge and Grab samplers were used for collecting bottom mud and benthic organisms. The Grab samplers were Ekman-Birge and Smith-McEntire types (Rigo Co., Ltd). The Core sampler has composed of 4 cylinders (Rigo Co., Ltd). Grab and core samplers were deployed from starboard on the working deck. We used a Niino-type Dredge sampler (Rigo Co., Ltd), which was obliquely towed from the afterdeck.

During some cruises fishery operations were conducted simultaneously, like Drum Seine Gera (DSG), Long-line Fishing (LF) and Bottom Trawl (BT); the details of the methodologies will be described in the other reports.

Overview of cruises and observations

Training ship Kagoshima-maru conducted 18 cruises during April to December 2013 and 1 cruise from February to March 2014 (Table 1). The total number of the cruise days and participants was 168 days and 572 persons, respectively. Training ship Kagoshima-maru covered the western North

Table 1. Cruise information on Training ship Kagoshima-maru during April 2013 to March 2014.

Cruise ID	Period		Days	Cruise track	Users	Number of persons		
	Start	End				SC	ST	OP
KG13-01	Apr 07	Apr 08	2	Fig. 2	KUFF	3	37	
KG13-02	Apr 13	Apr 14	2	Fig. 3	KUFF	3	37	
KG13-03	Apr 20	Apr 21	2	Fig. 4	KUFF	3	36	
KG13-04	Apr 27	Apr 30	4	Fig. 5	KUFF			2
KG13-05	May 14	May 20	7	Fig. 6	KUFF	3	18	2
KG13-06	May 24	May 30	7	Fig. 7	KUFF	2	21	1
					NUBS	1	18	
KG13-07	Jun 02	Jun 02	1	Fig. 8	KUFF	2	8	1
					OUJ		17	2
KG13-08	Jun 08	Jun 22	15	Fig. 9	KUFF	3	26	3
					UTSS	1	3	
KG13-09	Jun 25	Jul 01	7		KUFF	1	9	5
					FFKU	5	10	
					KUST	1	1	
					FSKU	1		
KG13-10	Jul 06	Jul 27	22	Fig. 10	KUFF		1	
KG13-11	Aug 20	Sep 24	36	Fig. 11	KUFF	1	18	
					UPV	1	18	2
KG13-12	Oct 07	Oct 13	7	Fig. 12	KUFF	2	27	5
					KUFA	1	8	
KG13-13	Oct 18	Oct 31	14	Fig. 13	KUFF	4	35	
KG13-14	Nov 05	Nov 12	8	Fig. 14	KUFF	3	25	2
					FAKU	1	10	
KG13-15	Nov 15	Nov 19	5	Fig. 15	KUFF	1	9	
					KUST	1	29	
KG13-16	Nov 21	Nov 26	6	Fig. 16	KUFF	1	9	
					MUFA	2	31	
KG13-17	Feb 17	Mar 11	23	Fig. 17	KUFF		39	

Abbreviations

Users

KUFF	Faculty of Fisheries, Kagoshima University
NUBS	College of Bioresources Science, Nihon University
KUFA	Faculty of Agriculture, Kinki University
FSKU	Faculty of Sciences, Kyushu University
FAKU	Faculty of Agriculture, Kyushu University
MUFA	Faculty of Agriculture, Miyazaki University
UTSS	Graduate School of Science, the University of Tokyo
KUST	Graduate School of Science and Technology, Kumamoto University
OUJ	The Open University of Japan
FFKU	Faculty of Fisheries, Kasetsart University
UPV	University of the Philippines Visayas

Number of persons

SC	Scientist
ST	Student
OP	Other person

Table 2. General information on oceanographic observations by Training ship Kagoshima-maru in 17 cruises during April 2013 to March 2014.

Cruise ID	Period		Days	Contact person	Major objectives	Shipboard instruments
	Start	End				
KG13-01	Apr 07	Apr 08	2	Dr. Y. Yamanaka	Freshman seminar	CTD-CMS, NORPAC, SMGS,
KG13-02	Apr 13	Apr 14	2	Dr. Y. Yamanaka	Freshman seminar	CTD-CMS, NORPAC, SMGS,
KG13-03	Apr 20	Apr 21	2	Dr. Y. Yamanaka	Freshman seminar	CTD-CMS, NORPAC, SMGS,
KG13-04	Apr 27	Apr 30	4	Capt. M. Higashi	Open ship	
KG13-05	May 14	May 20	7	Dr. S. Fuwa	Fishing gear operation	DSG
KG13-06	May 24	May 30	7	Dr. Y. Kaminishi	Fishing gear operation	CTD-CMS, BT
KG13-07	Jun 02	Jun 02	1	Dr. Y. Yamanaka	On-board training and seminar	CTD-CMS, NORPAC, SMGS,
KG13-08	Jun 08	Jun 22	15	Dr. A. Nishina	Hydrographic observation	CTD-CMS, NB, ADCP, FRRF, EPCS
KG13-09	Jun 25	Jul 01	7	Capt. M. Higashi	Fishing gear operation and hydrographic observation	CTD-CMS, NORPAC, BT
KG13-10	Jul 06	Jul 27	22	Capt. M. Higashi	Trail	
KG13-11	Aug 20	Sep 24	36	Capt. M. Higashi	Navigation and fishing gear operation	CTD-CMS, LF, LN
KG13-12	Oct 07	Oct 13	7	Dr. K. Anraku	Fishing gear operation	CTD-CMS, BT
KG13-13	Oct 18	Oct 31	14	Dr. S. Fuwa	Fishing gear operation and hydrographic observation	CTD-CMS, NORPAC, SMGS, LN
KG13-14	Nov 05	Nov 12	8	Dr. T. Kobari	Hydrographic observation and biological sample collection	CTD-CMS, ADCP, NB, EPCS, FRRF, VMPS, MOCNESS, NORPAC, LN, BT
KG13-15	Nov 15	Nov 19	5	Capt. M. Higashi	Hydrographic observation and biological sample collection	CTD-CMS, NORPAC, SMGS, LN, DS
KG13-16	Nov 21	Nov 26	6	Capt. M. Higashi	Fishing gear operation and hydrographic observation	CTD-CMS, NORPAC, LN, MOCNESS, BT
KG13-17	Feb 17	Mar 11	23	Capt. M. Higashi	Navigation and fishing gear operation	CTD-CMS, BT

Abbreviations

CTD-CMS	Conductivity, Temperature and Depth Sensors with Carousel Multisampler
ADCP	Vessel-mounted Acoustic Doppler Current Profiler
NB	Niskin Bottle
EPCS	Electronic Plankton Counting and Sizing System
FRRF	Fast Repetition Rate Fluorometry
VMPS	Vertical Multiple-opening Plankton Sampler
MOCNESS	Multiple Opening Closing Net and Environmental Sensing System
NORPAC	North Pacific Standard Net
LN	Larval Net
SMGS	Smith-McEntire Grab Sampler
DS	Dredge Sampler
DSG	Drum Seine Gera
LF	Longline Fishing
BT	Bottom Trawl

Pacific Ocean, East China Sea and their neighboring areas (Fig. 1).

General information on the oceanographic observations are shown in Table 2. Freshman seminars for undergraduate students have been regularly conducted during the cruises in April (KG 13-01, KG 13-02 and KG 13-03). On-board trainings for undergraduate students from the Faculty of Fisheries, Kagoshima University, were done during 12 cruises (KG 13-05, KG 13-06, KG 13-07, KG 13-08, KG 13-09, KG 13-11, KG 13-12, KG 13-13, KG 13-14, KG 13-15, KG 13-16, KG 13-17). The major objectives of these cruises were fishing gear operation, hydrographic observations and biological sample collections. CTD-CMS was conducted during 14 cruises and was the most frequent operations among the cruises carried by Training ship Kagoshima-maru. NORPAC net was the next frequent operation. The detailed information on data and samples during these cruises is available by contacting the persons listed in Table 2.

Lists of research presentations and publications

This section provides information on research presentations and published papers relating to the observations carried out using the Training ship Kagoshima-maru in the period from April 2013 to March 2014.

Presentations

- 1) Makihara W. and T. Kobari (2014). Geographical variations in zooplankton biomass in Kuroshio and its neighboring waters.

Spring Meeting of the Oceanographic Society of Japan, Tokyo, Japan. (Poster presentation)

- 2) Nishina A., H. Nakamura, J. H. Park, D. Hasegawa, T. Hibiya and Y. Tanaka (2014). Deep Water Formation Process in the Okinawa Trough. Ocean Sciences Meeting 2014, Honolulu, Hawaii. (Poster presentation)
- 3) Nishina A., H. Nakamura, J. H. Park, D. Hasegawa, T. Hibiya and Y. Tanaka (2014). Deep Water Formation Process in the southern Okinawa Trough. Spring Meeting of the Oceanographic Society of Japan, Tokyo, Japan. (Oral presentation)

Publications

- 1) Nakamura, H., A. Nishina, Z. Liu, F. Tanaka, M. Wimbush and J.-H. Park (2013). Intermediate and Deep Water Formation in the Okinawa Trough, *J. Geophys. Res.*, **118**: 6881 - 6893.
- 2) Na, H, M. Wimbush, J.-H. Park, H. Nakamura and A. Nishina (2014). Observations of flow variability through the Kerama Gap between the East China Sea and the Northwestern Pacific, *J. Geophys. Res.*, **119**: 689 - 703.

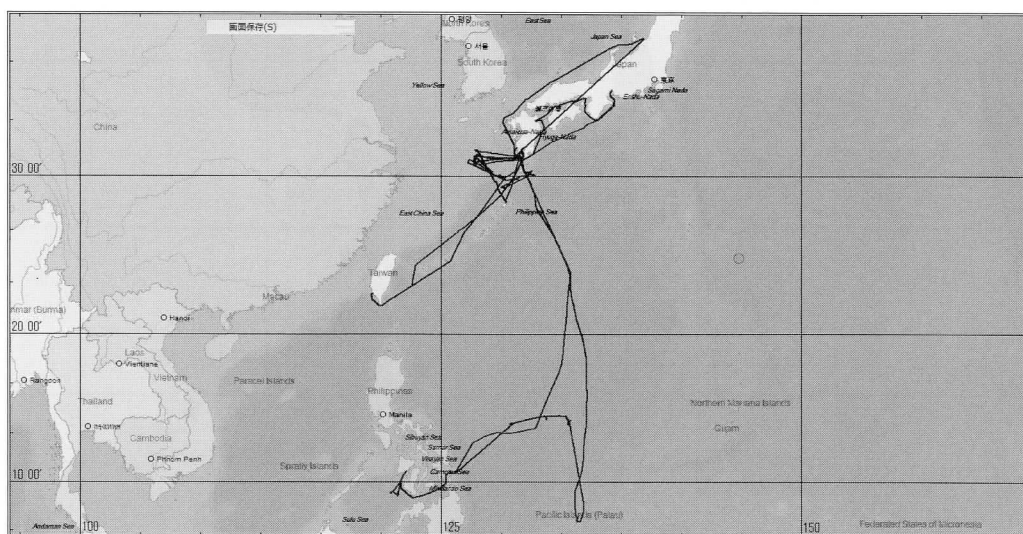


Fig. 1. Cruise tracks of Training ship Kagoshima-maru during April 2013 to March 2014.

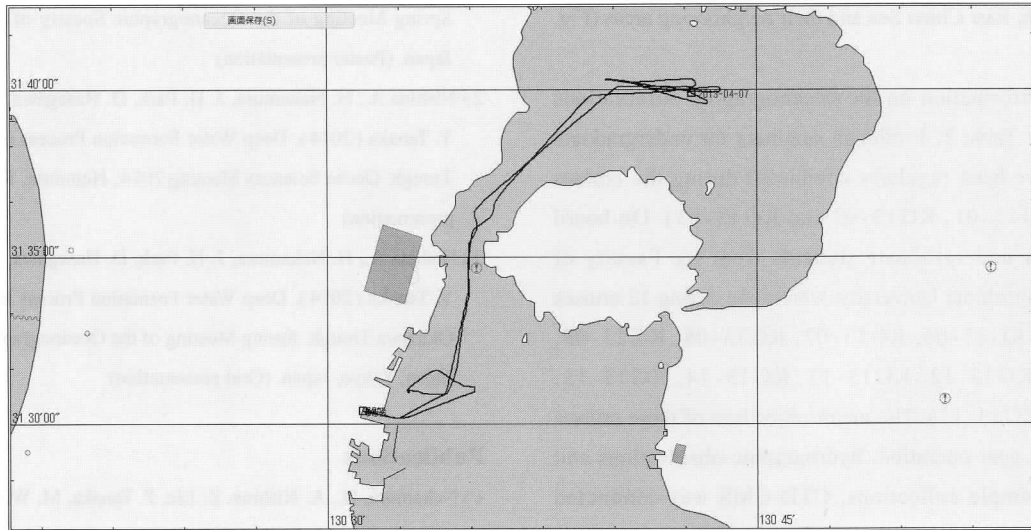


Fig. 2. Cruise tracks of Training ship Kagoshima-maru during KG 13-01.

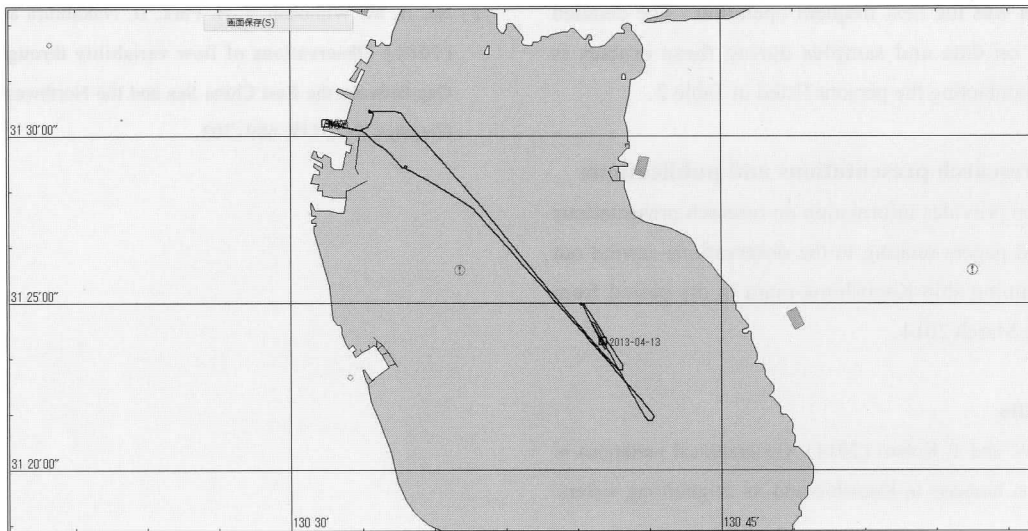


Fig. 3. Cruise tracks of Training ship Kagoshima-maru during KG 13-02.

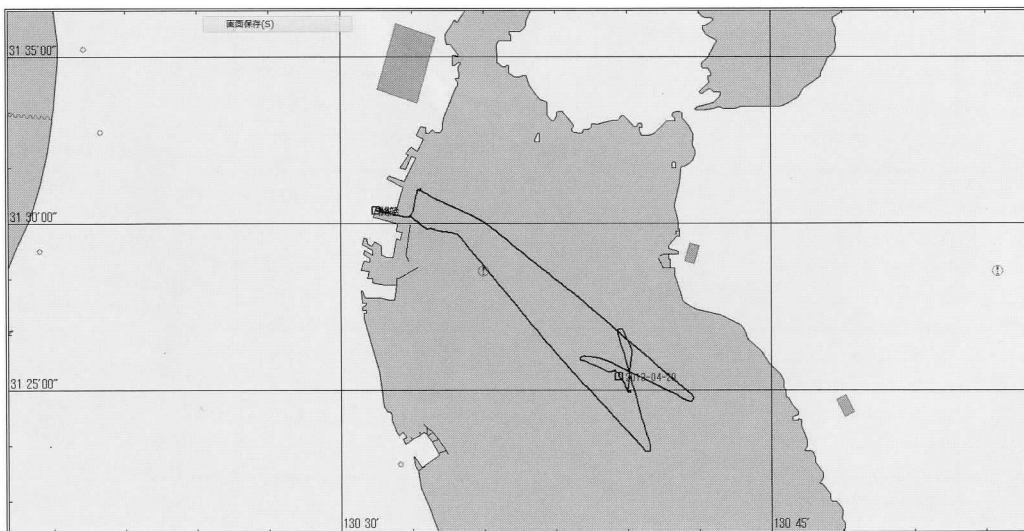


Fig. 4. Cruise tracks of Training ship Kagoshima-maru during KG 13-03.

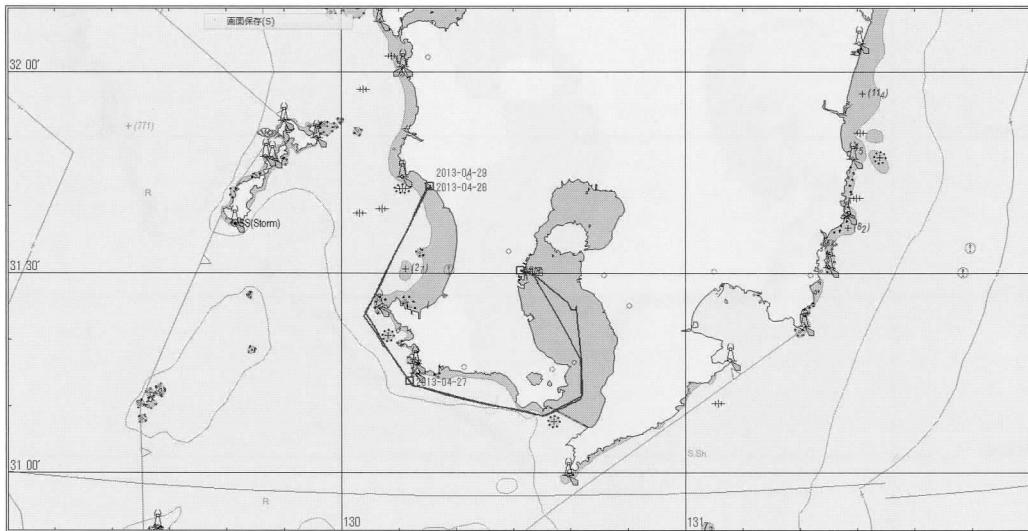


Fig. 5. Cruise tracks of Training ship Kagoshima-maru during KG 13-04.

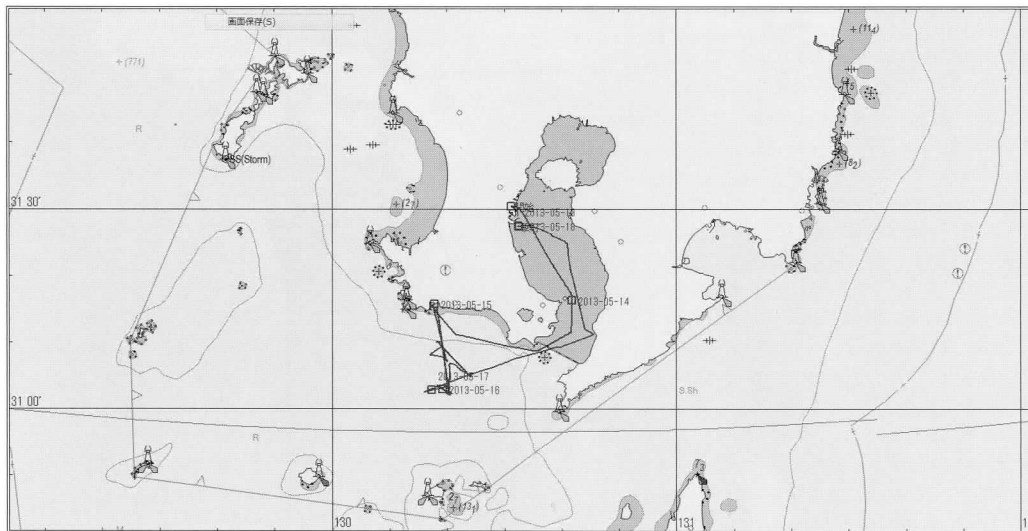


Fig. 6. Cruise tracks of Training ship Kagoshima-maru during KG 13-05.

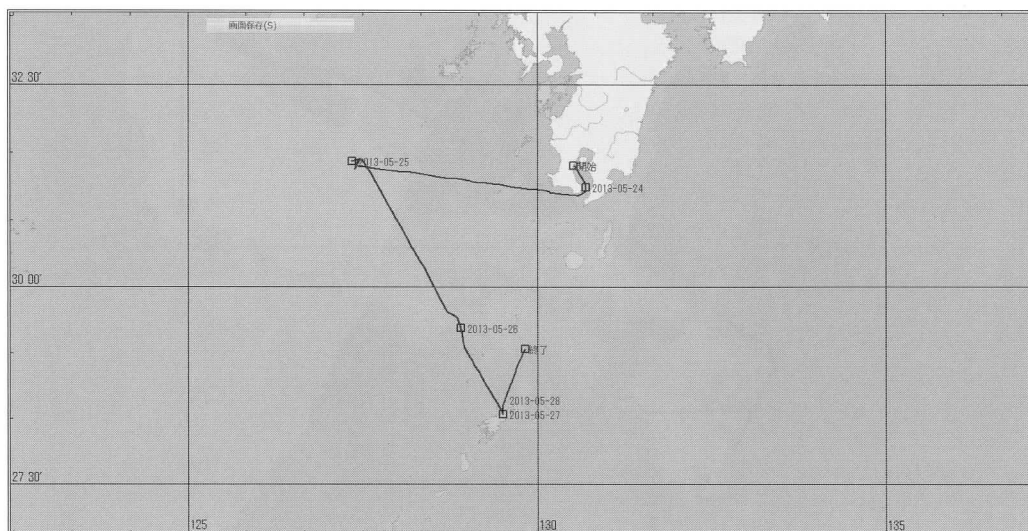


Fig. 7. Cruise tracks of Training ship Kagoshima-maru during KG 13-06.

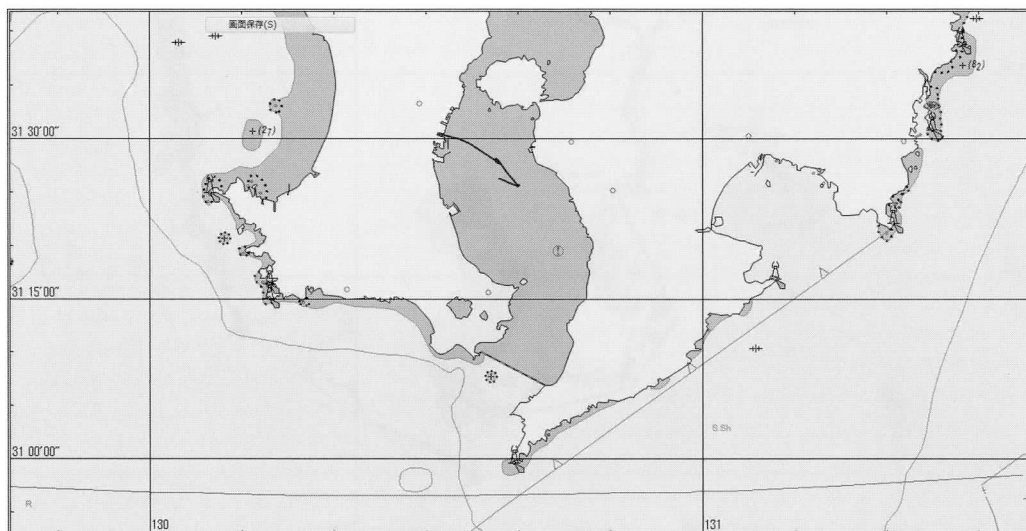


Fig. 8. Cruise tracks of Training ship Kagoshima-maru during KG 13-07.

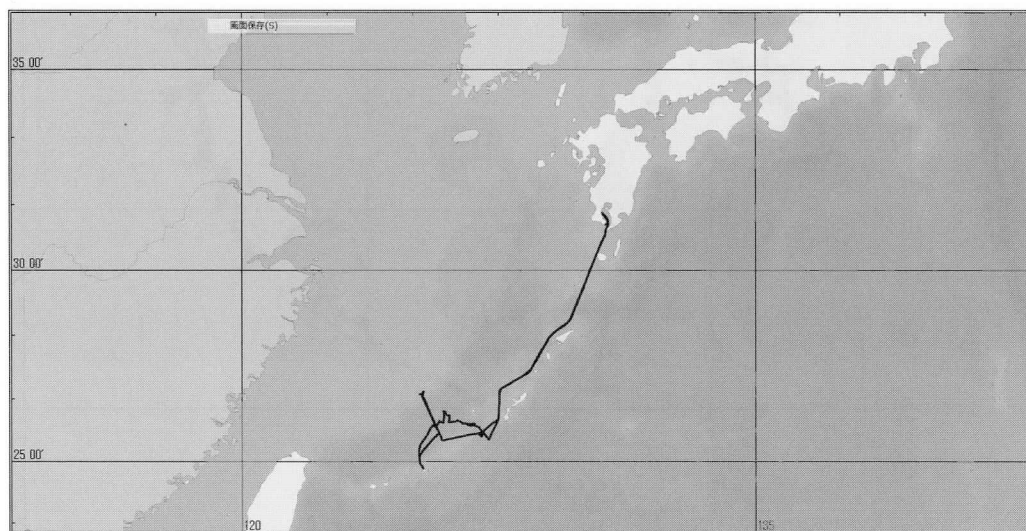


Fig. 9. Cruise tracks of Training ship Kagoshima-maru during KG 13-08.

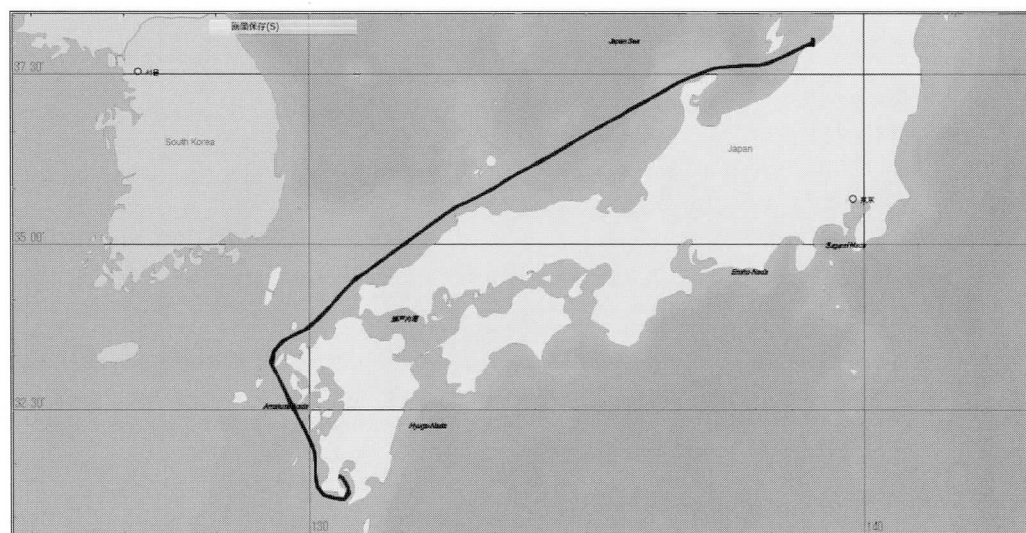


Fig. 10. Cruise tracks of Training ship Kagoshima-maru during KG 13-10.

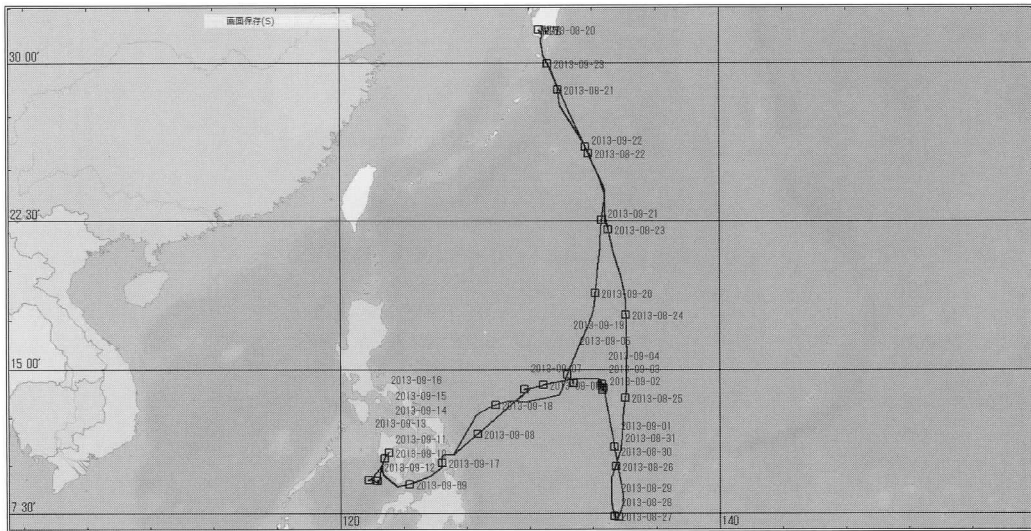


Fig. 11. Cruise tracks of Training ship Kagoshima-maru during KG 13-11.

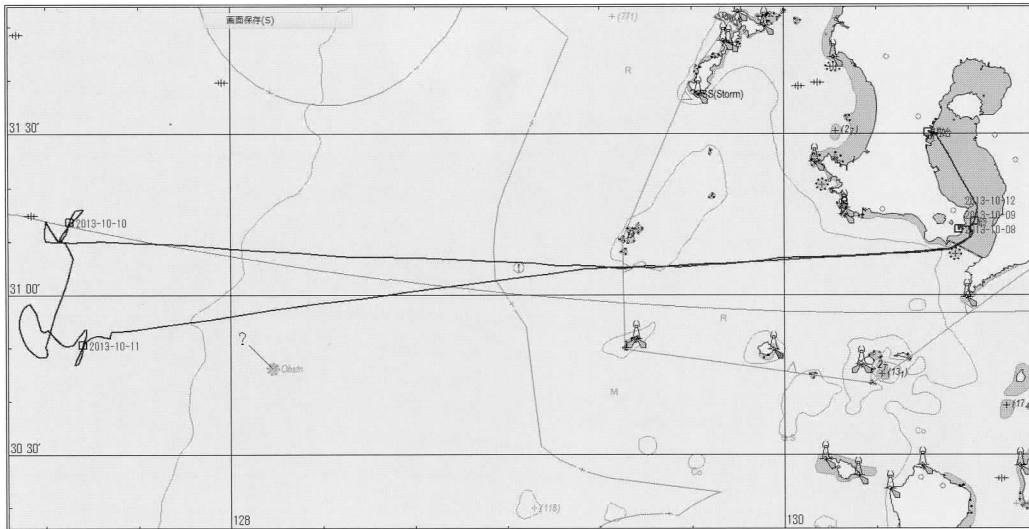


Fig. 12. Cruise tracks of Training ship Kagoshima-maru during KG 13-12.

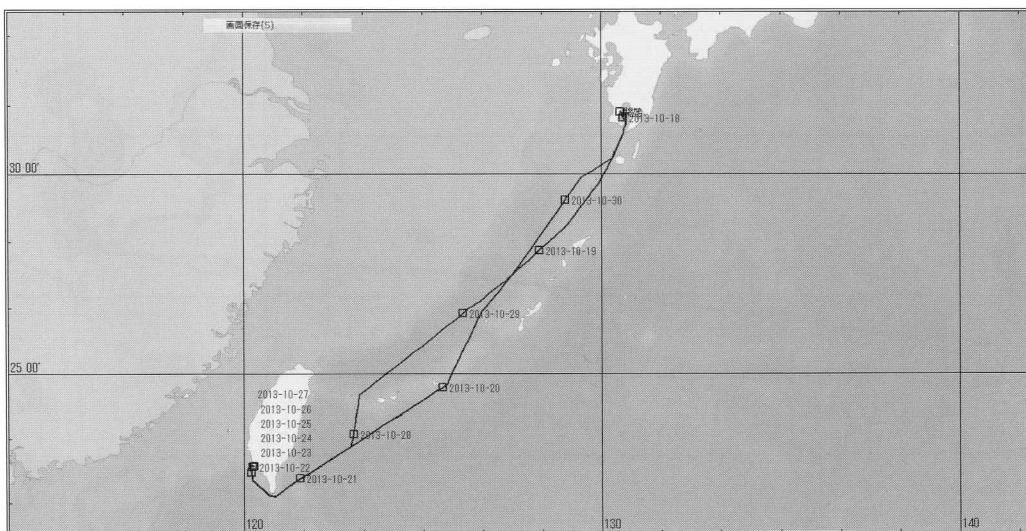


Fig. 13. Cruise tracks of Training ship Kagoshima-maru during KG 13-13.

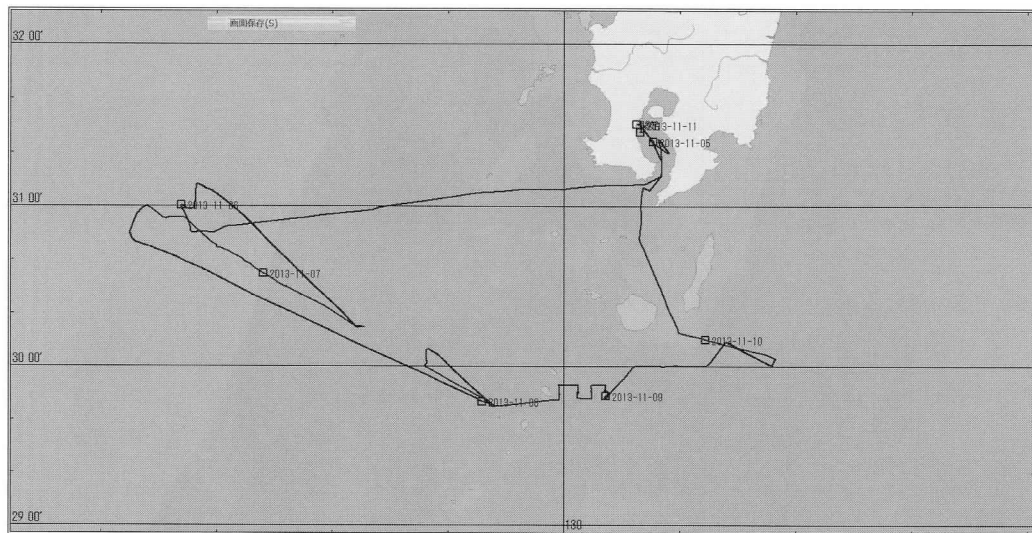


Fig. 14. Cruise tracks of Training ship Kagoshima-maru during KG 13-14.

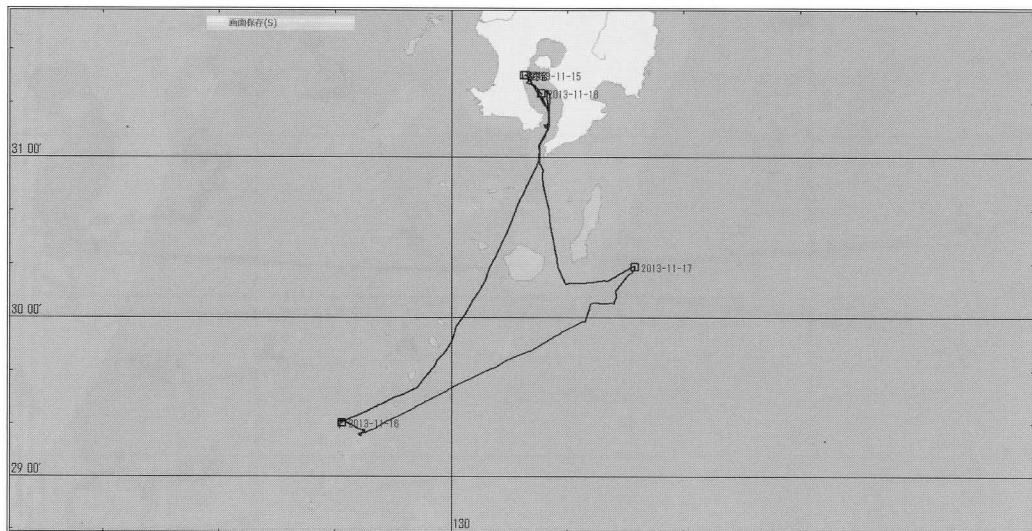


Fig. 15. Cruise tracks of Training ship Kagoshima-maru during KG 13-15.

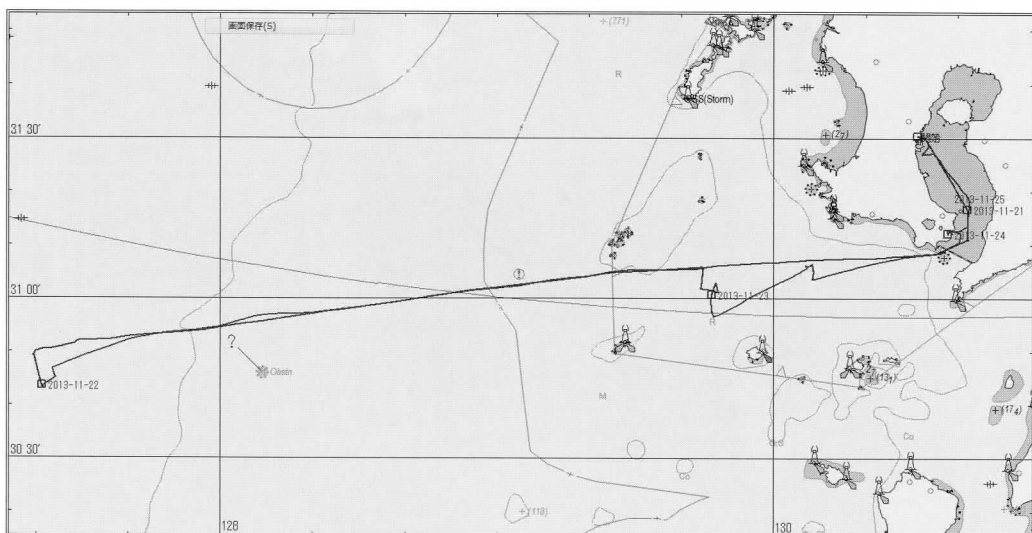


Fig. 16. Cruise tracks of Training ship Kagoshima-maru during KG 13-16.

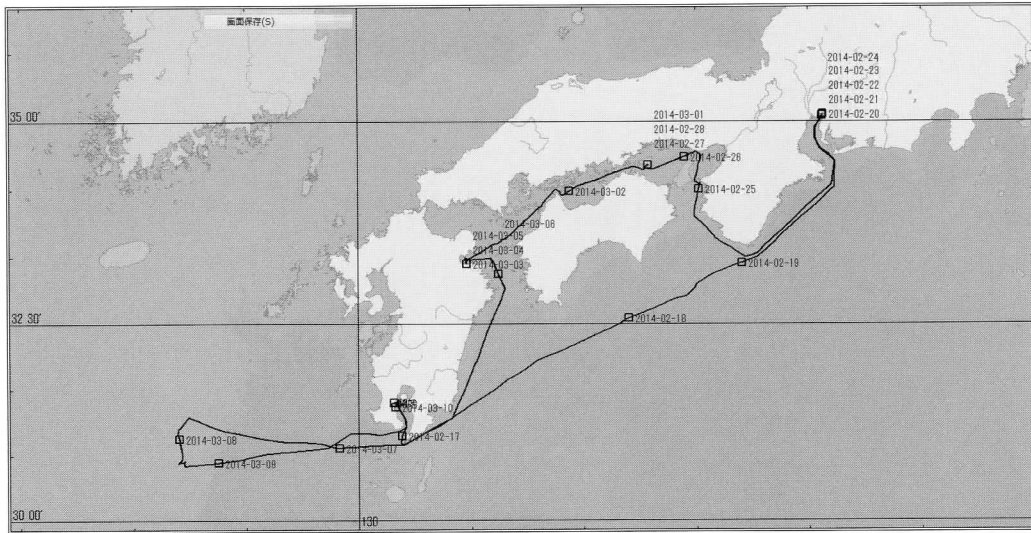


Fig. 17. Cruise tracks of Training ship Kagoshima-maru during KG13 - 17.