

## For Using Data

Data Policy	JAMSTEC
Principal Investigator	Data Management Office
Use Constraints	See Terms and Conditions about constrain of use.
Data Citation	See Terms and Conditions about data citation.

## Quality

DMO-Processed

## Instrument

Three component magnetometer



## Overview

The data provided is for corrected three component geomagnetic field anomalies. Three-axes flux-gate sensors with ring-cored coils were fixed on the roof of the foremast. They measure the following items :

h-component : along track line component, positive for the bow direction pitch.

s-component : across track line component, positive for the starboard side roll.

v-component : vertical component, positive for the downward direction.

The effect of ship motion was eliminated by roll and pitch data which was provided by a tilt sensor.

The apparent magnetic influence can be detected through a "Figure of 8 turn" (a pair of clockwise and anti-clockwise turns) on each cruise. If no Figure of 8 turn on the cruise was completed, the latest Figure of 8 turn from the previous cruise was applied. As a quality control, data of low reliability was removed (see Data processing for quality control criteria). Synthetic geomagnetic field values were calculated from IGRF models.

## Measurement System

## 1) Magnetometer

Manufacturer :	Tierra Technica Ltd.
Type :	SFG-2018
Measurement range :	$\pm 100,000$ nT
Accuracy :	less than 100 nT
Resolution :	1 nT
Location :	Dry Laboratory

## 2) Magnetic Sensor

Manufacturer :	Tierra Technica Ltd.
Form :	flux-gate sensors with ring-cored coils
Location :	Foremast

## 3) Attitude sensor and Gyro compass

Manufacturer :	IXBLUE
Type :	PHINS
Accuracy :	Roll, Pitch : 0.01 degree
	Gyro : 0.01 degree *Secant (Lat.)
Location :	In the doppler radar dome

## Duration of the Figure of 8 turn

In MR23-06C cruise

Date (UTC)

2023/08/31 20:14:00 - 2023/08/31 20:36:00

2023/09/18 01:33:00 - 2023/09/18 01:55:00

2023/09/26 06:03:00 - 2023/09/26 06:25:00

## Data processing

The following corrections and calculations were performed.

1) Ship magnetization correction

$$Hob = ARPYF + Hp \cdots (i)$$

Hob : Observed magnetic field vector (Ship coordinates)

A : Effect of induced magnetization of the ship

R : Matrix of rotation due to the roll

P : Matrix of rotation due to the pitch

Y : Matrix of rotation due to the heading

F : Geomagnetic field vector

Hp : Ship's permanent magnetic moment

Following the equation(i), we calculate the geomagnetic field F.

$$RPYF = BHob + Hpb \cdots (ii)$$

B : coefficient of Figure of 8 turn

Hpb : Permanent magnetic field vector of the ship

Reference : Isezaki,N., A new shipboard three-component magnetometer, GEOPHYSICS.

VOL.51,NO10(1986);P1992-1998

2) International Geomagnetic Reference Field (IGRF)

Synthetic geomagnetic field values are calculated from IGRF 13th Generation models by using navigation data ; latitude, longitude and date.

Reference : IAGA Division V-MOD Geomagnetic Field Modeling

[<http://www.ngdc.noaa.gov/IAGA/vmod/igrf.html>]

3) Calculation of the geomagnetic field anomaly

$$An = F - Figf$$

An : Geomagnetic field anomaly vector

F : Geomagnetic field vector

Figf : Synthetic geomagnetic field vector from IGRF

4) Quality control of data

Following criteria were used for removal of data of low reliability:

- Time error (inversion of time, continuation of same timestamps)
- Summation of the difference of heading by one second exceeding 20 degree per 5 minutes
- Ground speed of the ship below 3 knot or exceeding 20 knot
- X, Y, or Z component of geomagnetic field anomaly exceeding  $\pm 4000\text{nT}$

5) Filtering of the geomagnetic field anomaly

Due to the residual undulation of the ship, a 120 second length Gaussian filter was applied for each component of the geomagnetic field anomaly data.

6) Output of the data

Time (UTC)

Latitude (degree)

Longitude (degree)

X : Northward (positive on the north) component of geomagnetic field anomaly (nT)

Y : Eastward (positive on the east) component of geomagnetic field anomaly (nT)

Z : Vertical (positive for downward) component of geomagnetic field anomaly (nT)

T : Absolute value of geomagnetic field anomaly (nT)

**Coefficient of the Figure of 8 turn and Permanent magnetic field vector of the ship**

This coefficient was calculated from the above-mentioned Figure of 8 turn

B			Hpb
0.9918	0.0350	0.0316	3443.1715
-0.0349	1.0465	0.0061	-1480.4599
0.0344	0.0020	0.9417	2227.4535

**Note**

1) File naming rule : Cruise ID\_corr.stcm

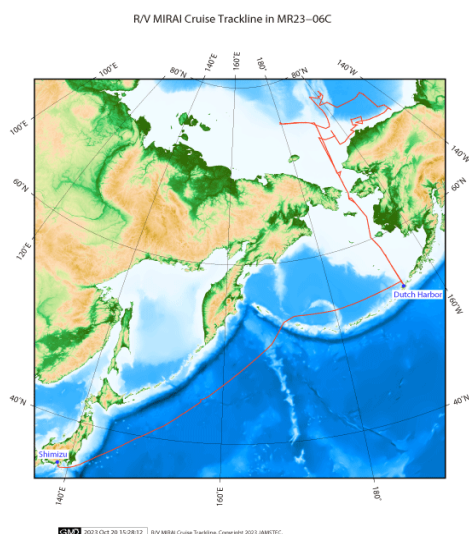
2) Data interval : 10 seconds

3) Geodetic system : WGS84

4) If you would like the raw data set, please contact DMO at "dmo@jamstec.go.jp".

## Related Information

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### MR23-06C

Ship Name:

MIRAI

Period:

2023/08/25 - 2023/10/04

Chief Scientist:

Amane Fujiwara (JAMSTEC)

Proposal:

Arctic Expedition for Environmental Studies  
Observational study of the Arctic environmental changes: Pacific-Arctic interaction, biogeochemical transport, mixing and marine ecosystem

Quantification of the microplastic inventory in the waters of the western Arctic Ocean and microplastic influx from the Pacific Ocean

Changes in clouds and aerosols over the ice-free Arctic Ocean

Possibility of the expanding distribution in plankton and fishes associated with sea ice reduction in the Pacific sector of the Arctic Ocean

Observation of air-sea-wave-ice interaction over the Pacific Arctic region

Investigating the physical and ecophysiological basis of fall phytoplankton blooms in the Chukchi and Beaufort seas

Nitrogen Fixation in a Changing Arctic Ocean An Overlooked Source of Nitrogen

Exploring microplankton interactions and their functional roles in a changing Arctic

Determining the contribution of siphonophores to mesopelagic backscatter in the Arctic

Better understanding of climate-driven changes of biogeochemical dynamics in the western Arctic Ocean via R/V Mirai 2023 Cruise A perspective of stable carbon isotope

Temporal variations of the carbonate chemical components the Arctic Ocean within summertime

Observation of water vapor isotopic ratios  
Observation of atmospheric greenhouse gases and related species in the North Pacific region

## Format Description for STCM Corrected

No.	Column	Content	Format	Unit	Remarks
1	1 - 8	Date	i4,i2,i2		YYYYMMDD (UTC)
2	10 - 15	Time	i2,i2,i2		hhmmss (UTC)
3	17 -25	Latitude	f9.5	degree	No sign for the northern hemisphere. Negative for the southern hemisphere.
4	27 -36	Longitude	f10.5	degree	No sign for eastern hemisphere. Negative for the western hemisphere.
5	38 -43	X component of geomagnetic field anomaly	f6.0	nT	Positive on the north
6	45 -50	Y component of geomagnetic field anomaly	f6.0	nT	Positive on the east
7	52 -57	Z component of geomagnetic field anomaly	f6.0	nT	Positive for downward
8	59 -64	Absolute value of geomagnetic field anomaly	f6.0	nT	