

## 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 :              | SFG1214              |
| 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 : | Honeywell                                 |
| Type :         | DRUH                                      |
| Accuracy :     | Roll, Pitch : less than $\pm 0.03$ degree |
|                | Gyro : less than $\pm 0.06$ degree        |
| Location :     | In the doppler radar dome                 |

## Duration of the Figure of 8 turn

In MR99-K02 and MR99-K04 cruise

Date (UTC)

1999/05/20 23:07:00 - 1999/05/20 23:35:00

1999/08/14 22:00:00 - 1999/08/14 22:45:00

## 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

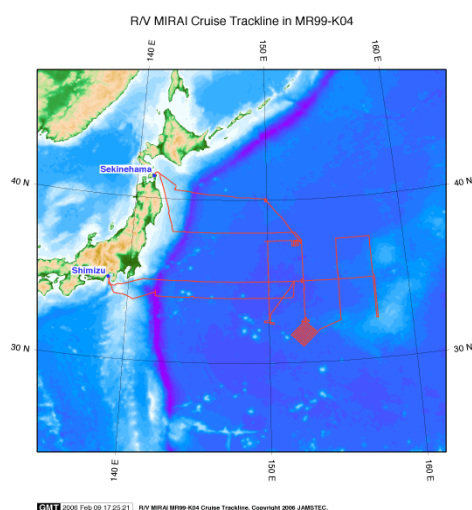
| B       |         |        | Hpb       |
|---------|---------|--------|-----------|
| 0.9859  | 0.0084  | 0.0215 | 2277.8548 |
| -0.0104 | 1.0489  | 0.0099 | -223.2553 |
| 0.0342  | -0.0047 | 0.9300 | 2241.7999 |

## 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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### MR99-K04

|                  |                             |
|------------------|-----------------------------|
| Ship Name:       | MIRAI                       |
| Period:          | 1999/07/23 - 1999/08/19     |
| Chief Scientist: | Hirofumi Yamamoto (JAMSTEC) |
| Project Name:    |                             |

## 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.<br>Negative for the southern hemisphere. |
| 4   | 27 -36  | Longitude   | f10.5    | degree | No sign for eastern hemisphere.<br>Negative for the western hemisphere.       |
| 5   | 38 -43  | X component of<br>geomagnetic field<br>anomaly    | f6.0     | nT     | Positive on the north   |
| 6   | 45 -50  | Y component of<br>geomagnetic field<br>anomaly    | f6.0     | nT     | Positive on the east  |
| 7   | 52 -57  | Z component of<br>geomagnetic field<br>anomaly    | f6.0     | nT     | Positive for downward   |
| 8   | 59 -64  | Absolute value of<br>geomagnetic field<br>anomaly | f6.0     | nT     |   |