

**For Using Data**

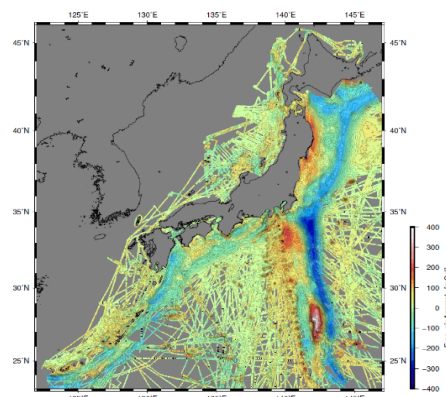
Data Policy	JAMSTEC For more details, please refer to "Terms and Conditions".
Principal Investigator	Data Management Office
Data Citation	JAMSTEC (2025) The marine gravity data set 2024 acquired by JAMSTEC shipboard gravimeters around Japan. JAMSTEC. doi:10.17596/0004038 (accessed YYYY-MM-DD)
Use Constraints	Please cite the paper: Nagaki, H., M. Morioka, M. Sakamoto, K. Fukuda, and H. Kawakami (2025) Marine gravity data observed by JAMSTEC shipboard gravimeters in the seas around Japan. <a href="https://doi.org/10.11366/sokuchi.71.12">https://doi.org/10.11366/sokuchi.71.12</a>

**Overview**

This dataset is a compilation of JAMSTEC marine free-air gravity anomaly data around Japan, integrating shipboard gravimeter data from 728 cruises of the R/V KAIREI, S/V YOKOSUKA, R/V MIRAI, and R/V SHINSEI-MARU published Data and Sample Research System for Whole Cruise Information in JAMSTEC (DARWIN;<https://www.godac.jamstec.go.jp/darwin/>).

**Details of the JAMSTEC integrated marine gravimeter dataset**

File Name: JAMSTEC\_ShipboardGravity\_freeairanomaly\_2024.dat  
Area: 122E - 147E / 23N - 47N  
Mesh size: Latitude 1 degree, Longitude 1degree  
Integrated source data: JAMSTEC shipboard gravimeter data observed 2001 to 2023

**Specifications of the JAMSTEC onboard gravimeter used to compile this dataset**

Ship Name	R/V KAIREI	S/V YOKOSUKA	R/V MIRAI	R/V SHINSEI-MARU
Type of Gravimeter	KSS 31	Model "S" Air-Sea	Model "S" Air-Sea	Model "S" Air-Sea
Manufacturer	Bodenseewerk	Micro-g LaCoste	Micro-g LaCoste	Micro-g LaCoste
Installation period	Completion ~ 2016	1994 ~ 2022	Completion ~	Completion ~
Measurement range	10,000 mGal	12,000 mGal	12,000 mGal	20,000 mGal
Accuracy	1.0 mGal	1.0 mGal	1.0 mGal	1.0 mGal
Drift rate	< 3.0 mGal/month	< 3.0 mGal/month	< 3.0 mGal/month	< 3.0 mGal/month
Location	Gravity meter room	No.1 research room	Gravity meter room	Gravity meter room
photo				

**Format Description for JAMSTEC\_ShipboardGravity\_freeairanomaly\_2024.dat**

No.	Column	Content	Format	Unit	Remarks
1	1 - 9	Latitude	8.5f	degree	Geodetic system : WGS84 No sign for the northern hemisphere. Negative for the southern hemisphere.
2	10	,		comma	
3	11 - 20	Longitude	9.5f	degree	Geodetic system : WGS84 No sign for eastern hemisphere. Negative for the western hemisphere.
4	21	,		comma	
5	22 - 28	Free-air anomaly	7.2f	mGal	
6	29 - 30	Terminator	a2		[CR][LF]

## Gravity Data Processing for Each Cruise

### Absolute gravity in Ports

Altitude conversion formula

$$Ag = Pg + \beta * HS/100 + (HD - HSG)/100 * (\beta - 4\pi * k * \rho_w)$$

$Ag$  : The absolute gravity at the shipboard sensor position (mGal)

$Pg$  : The absolute gravity of the portable gravity meter (mGal)

$HSG$  : Height of the shipboard gravity meter from the ship bottom

$HS$  : Sea level (cm)

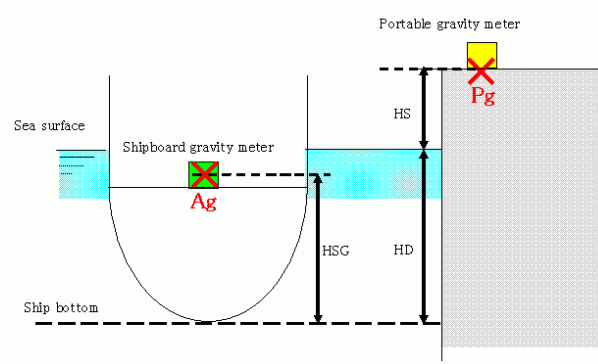
$HD$  : Draft (cm)

$\beta$  : Free-air gradient 0.3086 (mGal/m)

$k$  : Gravitational constant

$\rho_w$  : Density of sea water

$$4\pi * k * \rho_w = 0.0864$$



### Data processing

According to the filter process of the gravity meter system, the gravity data has a time lag of

1) Drift correction

$$D = ((Vg - Vgs) - (Age - Ags)) / (Te - Ts)$$

$D$  : Drift value (mGal/day)

$Vgs$  : The shipboard gravity at the start of the cruise (mGal)

$Vg$  : The shipboard gravity at the end of the cruise (mGal)

$Ags$  : The absolute gravity at the shipboard sensor position at the start of the cruise (mGal)

$Age$  : The absolute gravity at the shipboard sensor position at the end of the cruise (mGal)

$Ts$  : The start time of the cruise (day)

$Te$  : The end time of the cruise (day)

2) Eotvos correction

$$E = 7.503 * S * \cos(\phi) * \sin(\alpha) + 0.004154 * S^2$$

$E$  : Eotvos correction (mGal)

$S$  : Ground speed of the ship (knot)

$\phi$  : Latitude

$\alpha$  : Course of the ship (measured clockwise from the north)

Reference : Blakely, R.J., Potential theory in gravity & magnetic applications, Cambridge University Press, New York, 441pp, 1995

\* The navigation data such as  $S$ ,  $\phi$  and  $\alpha$  are the 4-min average values. Before average

• Time error (inversion of time, continuation of same timestamps)

• Ship speed exceeding 20 knot

• Course of the ship except 0-360 degree

3) Calculation of the absolute gravity

$$G = Ags + (Vg - Vgs) - D * (T - Ts) + E - H * (\beta - 4\pi * k * \rho_w)$$

$G$  : The absolute gravity at sea surface (mGal)

$Ags$  : The absolute gravity at the shipboard sensor position at the start of the cruise (mGal)

$Vgs$  : The shipboard gravity at the start of the cruise (mGal)

$Vg$  : The shipboard gravity at the measurement time (mGal)

D : Drift value (mGal/day)  
 Ts : The start time of the cruise (day)  
 T : The measurement time (day)  
 E : Eoetvoes correction (mGal)  
 H : Height from sea surface of the shipboard sensor position (m)  
 $\beta$  : Free-air gradient 0.3086 (mGal/m)  
 k : Gravitational constant  
 $\rho_w$  : Density of sea water  
 $4\pi * k * \rho_w = 0.0864$   
 4) Calculation of the Free-air anomaly  
 $G_f = G - \gamma + \delta$   
 Gf : The Free-air anomaly (mGal)  
 G : Absolute gravity at sea surface (mGal)  
 $\gamma$  : Normal gravity (mGal)  
 \* The normal gravity formula of the Geodetic Reference System 1980  

$$\gamma = 978032.67715(1 + 0.0052790414\sin^2\phi + 0.0000232718\sin^4\phi + 0.0000001262\sin^6\phi + 0.0000000007\sin^8\phi)$$
  
 $\delta$  : Atmospheric correction at sea surface  
 $\delta = 0.87 - 0.0000965 * 0$  (mGal)  
 5) Output of the data  
 Time (UTC)  
 Latitude (degree)  
 Longitude (degree)  
 Processed absolute gravity at sea surface (mGal)  
 Free-air anomaly (mGal)

#### Quality control of data

Following criteria were used for removal of low reliability data:

- Abrupt free-air anomaly change exceeding 10 mGal/km
- Change in Eoetvoes correction exceeding 3 mGal/min
- Ground speed of the ship below 3 knot
- In cases where measurements were deemed unreliable due to data failure or equipment malfunctions, the data for the affected period was deleted

## **Terms and Conditions**

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### **Data Policy**

Basic Policies on the Handling of Data and Samples by JAMSTEC

[https://www.jamstec.go.jp/e/database/data\\_policy.html](https://www.jamstec.go.jp/e/database/data_policy.html)

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7. For publicizing the results obtained by using the provided data and samples, see \* below.  
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\* For details on terms and conditions of use, etc., please check the URL below.

<https://www.godac.jamstec.go.jp/darwin/en/note.html>