README for Gravity Data

Measurement System

    Name: Shipboard Gravity-meter
    Manufacturer: LaCoste & Romberg LLC
    Type: S-116
    Range: 12,000 mGal
    Accuracy: 1.0 mGal
    Drift rate: better than 3.0 mGal/month

    Name: Portable Gravity-meter
    Manufacturer: Scintrex Ltd.
    Type: CG-5
    Range: 8,000 mGal
    Accuracy: STD 0.01 mGal
    Drift rate: better than 0.02 mGal/day

Absolute gravity at the port "Sekinehama"

    Absolute gravity is measured by a portable gravity-meter before/after the cruise at the Mirai's mother port "Sekinehama". This system refers the value taken at the gravity station of the Geospatial Information Authority of Japan.

    << Pre-cruise >>

Date (UTC):	01:13:13 05 Aug 2011
Absolute gravity (mGal):	980368.16
Sea level (cm):	262
Draft (cm):	630
Absolute gravity at sensor position (mGal):	980371.94
Value of Shipboard gravity meter (mGal):	12722.23

    << Post-cruise >>

Date (UTC):	04:27:28 09 Feb 2012
Absolute gravity (mGal):	980368.16
Sea level (cm):	265
Draft (cm):	605
Absolute gravity at sensor position (mGal):	980371.94
Value of Shipboard gravity meter (mGal):	12684.90

Data Processing
The following procedures have been conducted.

<1> Drift correction
D = ((Vge - Vgs) - (Age - Ags)) / (Te - Ts)
where
D: Drift value (mGal/day)
Vgs: Shipboard-sensor measured gravity at the cruise start (mGal)
Vge: Shipboard-sensor measured gravity at the cruise end (mGal)
Ags: Absolute gravity at the shipboard sensor position at the cruise start (mGal)
Age: Absolute gravity at the shipboard sensor position at the cruise end (mGal)
Ts: Cruise start time (day)
Te: Cruise end time (day)

<2> Eoetvoes correction
$E = 7.503 \times S \times \cos(\phi) \times \sin(\alpha) + 0.004154 \times S^2$
where
E: Eoetvoes correction (mGal)
S: Ground speed of the ship (knot)
ϕ: Latitude (radian)
α: Course of the ship (radian)

Remarks.
The navigation data such as S, ϕ are the 4-min average values. Before calculating the average, if data show the following values, such data were removed from each data set; (1) apparent time record error, (2) ship speed over 20 knot, and (3) indication of ship course beyond 0-360 degree range. If the number of data used for a 4-min average calculation did not occupy more than 50% of good data, the average was expressed as a missing value.

<3> Absolute gravity calculation
G = Ags + (Vg - Vgs) - D x (T - Ts) + E - H x 2n x k x ρ w
where
G: Absolute gravity at the sea surface (mGal)
Vg: Shipboard-sensor measured gravity (mGal)
T: Measurement time (day)
H: Sensor position from sea surface (m)
k: Gravitational constant
ρ w: Density of sea water
(2n x k x ρ w) = 0.0431

<4> Calculation of free-air anomaly

$Gf = G - y + \delta$

where

Gf: Free-air anomaly (mGal)

y: Normal gravity (mGal)

$= 978032.67715(1 + 0.005279041 \sin^2 \phi + 0.0000232718 \sin^4 \phi$
$+ 0.0000001262 \sin^6 \phi + 0.0000000007 \sin^8 \phi)$

δ : 0.87 - 0.0000965 x 0 (mGal)

<5> Quality control of processed data

In case data show any of the followings, those data have been removed.

(a) Abrupt free-air anomaly change exceeding 10 mGal/km

(b) Change of Eoetvoes correction exceeding 3 mGal/min

(c) Ground speed of the ship below 3 knot.

Data Format

The following parameters are stored as ASCII file.

Date in UTC	(yyyymmdd)	i8
Time in UTC	(hhmmss)	1x,i6
Latitude	(degree North)	f10.5
Longitude	(degree East)	f11.5
Absolute gravity at sea surface	(mGal)	f10.2
Free-air anomaly	(mGal)	f8.2

Observation Period

Leg-1 12:00 25 Sept 2011 - 23:57 25 Oct 2011
Leg-2 00:00 29 Oct 2011 - 11:12 16 Nov 2011

Remarks

WGS84 was adopted as a geodetic system.

This data set has been produced by JAMSTEC Data Research Center for Marine-Earth Sciences who manages JAMSTEC data sets. Thus, data are same as that found in their data site "http://www.godac.jamstec.go.jp/darwin/e".

For more information

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