

LAMONT DATA REDUCTION CRUISE SUMMARY

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CRUISE: EW9011

START: 16 December 90 (350) Recife, Brazil

END: 25 January 91 (025) Punta Arenas, Chile

SURVEY AREA: Mid-Atlantic Ridge between 24-31 South Latitude

CHIEF SCIENTIST(S): Jeff Fox, Graduate School of Oceanography, URI
Nancy Grindlay, Graduate School of Oceanography, URI

DATA REDUCTION: William J. Robinson

TIME:

Instrument: Kinematics True Time clock model 468 DC

2 clocks designated "tr1" and "tr2"

Logging: 60 second intervals

Notes:

used clock tr2 for time calibration for days 350-018

used clock tr1 for time calibration for days 019-025

SPEED AND HEADING:

Instrument: Furuno CI-30 2-axis doppler speed log, Sperry MK-27 gyro

Logging: 3 second intervals

Checking: visual check of plot of data

Smoothing: mean value of all good values within the same minute

Notes:

| day | time | comment |
|-----|------|---------|
|-----|------|---------|

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|-----|-----------|--|
| 002 | 1928-1942 | network problem; logging computer reboot |
|-----|-----------|--|

| | | |
|-----|-----------|-------------------------|
| 016 | 0522-0532 | logging computer reboot |
|-----|-----------|-------------------------|

TRANSIT SATELLITE FIXES:

Instrument: Magnavox MX-1107RS dual frequency Transit satellite receiver

Logging: all fixes

Checking: reject receiver flagged fixes, fixes with high drifts in navigation and fixes producing Eotvos correction errors in gravity

Notes:

Used Transit fixes only on days 022 and 023.

GPS SATELLITE FIXES:

Instrument: Magnavox T-Set Global Positioning System 5 channel receiver

Logging: T-Set #1 at 2 second intervals, T-Set #2 at 20 second intervals.

Note: T-Set #1 is logged at 2 second intervals to provide realtime

positioning for the Hydrosweep; this GPS data is decimated to 20 second intervals before used in reduction.

Checking:

minimum number of sats: 3
dilution of precision maximum: north = 4.0, east = 4.0
carrier signal-noise ratio minimum: 35.0
compared GPS speed and course with Furuno smooth speed and heading
compared positions with Transit-Furuno navigation
reject fixes producing Eotvos correction errors in gravity

Interpolation: interpolated positions at 00, 30 seconds of each minute

Smoothing: smoothed interpolated positions with 9 point running average

Notes:

Used GPS #1 for navigation

NAVIGATION:

A "1 minute navigation" is produced from the above sources. Acceptable fixes are merged at 1 per minute with priority given to GPS, then to Transit. The smooth speed and heading data is used to fill any gaps of 2 minutes or longer between fixes by computing 1 minute DR'ed positions corrected for set and drift between fixes. The DR'ed positions are produced at 00 seconds of each minute.

BATHYMETRY:

Instrument: Krupp-Atlas Hydrosweep DS

Logging: each ping

Checking: visual check of plot of data; bad points removed with an interactive graphics editor.

Interpolation: interpolated depth value at 00 seconds of each minute

Chief scientist's data: interpolated depth value at 00 seconds of each minute. Depth is in meters.

Notes:

| day | time | comment |
|-----|-----------|--|
| --- | ----- | ----- |
| 350 | -2359 | no logging (200 mile limit) |
| 351 | 0000-2021 | no logging (200 mile limit) |
| 353 | 1538-2359 | no logging (200 mile limit) |
| 354 | 0000-2359 | no logging (200 mile limit) |
| 355 | 0000-0712 | no logging (200 mile limit) |
| 359 | 1105-1132 | gap |
| 365 | 1024-1054 | gap |
| 002 | 1928-1942 | network problem; logging computer reboot |
| 011 | 2219-2226 | gap |
| 016 | 0522-0532 | logging computer reboot |
| 023 | 1139 | stopped logging (200 mile limit) |

The Hydrosweep's performance was often very poor during this cruise and thus there are numerous small gaps in the center beam data.

These readings are from the center beam of the swaths during the actual survey using whatever sound velocity was in effect at the time.

MAGNETICS:

Instrument: Varian V75 magnetometer
Logging: 20 second intervals
Checking: visual check of plot of data
Interpolation: interpolated magnetics value at 00 seconds of each minute
Reference field: International Geomagnetic Reference Field 1990 (IGRF 1990)
model of the main field at 1990.0 and a predictive model of the
secular variation for adjusting to dates between 1990.0 and 1995.0
Chief scientist's data: interpolated total intensity value at 00 seconds
of each minute.
Lamont database: interpolated total intensity value at 00 seconds
of each minute.

Notes:

| day | time | comment |
|-----|-----------|--|
| --- | ----- | ----- |
| 350 | -2359 | no logging (200 mile limit) |
| 351 | 0000-2021 | no logging (200 mile limit) |
| 352 | 0000-2359 | very noisy data |
| 353 | 0000-1128 | very noisy data |
| 353 | 1128-2359 | no logging (200 mile limit) |
| 354 | 0000-2359 | no logging (200 mile limit) |
| 355 | 0000-0800 | no logging (200 mile limit) |
| 359 | 1105-1132 | gap |
| 360 | 1925-2010 | maggie onboard; ship stopped to examine a buoy |
| 001 | 0245-0315 | maggie onboard; engine problem |
| 002 | 1928-1942 | network problem; logging computer reboot |
| 009 | 1719-1753 | maggie off; ship stopped |
| 014 | 1246-1347 | logging gap; serial line problem |
| 016 | 0522-0532 | logging computer reboot |
| 023 | 1140 | stopped logging (200 mile limit) |

The magnetometer's data was noisy during the cruise and required extensive editing and thus there are numerous small gaps.

BGM-3 GRAVITY:

Instrument: Bell Aerospace BGM-3 marine gravity meter
Logging: 1 second counts
Filtering of counts and Mgals: Two stages- First a 60 second Gaussian
filter of counts to mGals followed by a 480 second median filter of the
mGal values.
Merge with navigation: calculate Eotvos correction and Free Air Anomaly.
Checking: visual check of plot of data to determine satisfactory Eotvos
corrections, reject spikes of data at turns
Velocity smoothing: 5 point running average of velocities from the navigation
Dc shift: 20.4 mGal
Drift rate: 0.1906 mGal/day
Chief scientist's data: Free Air Anomaly value at 00 seconds of
each minute. 1980 theoretical gravity formula.

Notes:

| day | time | comment |
|-----|-------|---------|
| --- | ----- | ----- |

| | | |
|-----|-----------|---|
| 350 | -2359 | no logging (200 mile limit) |
| 351 | 0000-2010 | no logging (200 mile limit) |
| 351 | 2223-2359 | logging problem; serial line disconnected |
| 351 | 0000-0301 | logging problem; serial line disconnected |
| 002 | 1927-1941 | network problem; logging computer reboot |
| 016 | 0521-0531 | logging computer reboot |
| 023 | 1140 | stopped logging (200 mile limit) |

The BGM-3 during the period of July 1990 to October 1991 had an abnormally high drift. The BGM-3 data during this cruise still appears to be good and is corrected for this drift.

KSS-30 GRAVITY:

Instrument: Bodenseewerks KSS-30 Marine Gravity meter

Logging: mGal at 6 second intervals

Smoothing: mean values at 00 seconds of each minute calculated from the logged values +/-30 seconds of this time. This stage also adjusts the times of the smoothed values for a 75 delay due to the filtering of the gravity by the KSS-30

Merge with navigation: calculate Eotvos correction and Free Air Anomaly.

Checking: visual check of plot of data to determine satisfactory Eotvos corrections, reject spikes of data at turns

Velocity smoothing: 5 point running average of velocities from the navigation

Dc shift: -980164.48 mGal

Drift rate: 0.0779 mGal/day

Chief scientist's data: Free Air Anomaly value at 00 seconds of each minute. 1980 theoretical gravity formula.

Lamont database: Free Air Anomaly value at 00 seconds of each minute. 1930 theoretical gravity formula.

Notes:

| day | time | comment |
|-----|-----------|--|
| --- | ----- | ----- |
| 350 | -2359 | no logging (200 mile limit) |
| 351 | 0000-2010 | no logging (200 mile limit) |
| 002 | 1927-1943 | network problem; logging computer reboot |
| 016 | 0521-0532 | logging computer reboot |
| 023 | 1140 | stopped logging (200 mile limit) |

The KSS-30 gravity data was used for the Lamont database.

Pre-cruise Gravity Tie Report
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R/V Ewing gravity meters:

Bell Aerospace BGM-3 marine gravity meter
scale factor = 4.952164
bias = 855758.1

Bodenseewerk KSS-30 marine gravimeter

Port: Recife, Brazil

Date: December 16, 1990 (day 350)

Operator: Joe Greer

Reference Station: Lighthouse

DOD02242-3
JGB 32884M WH 1059
Reference value = 978162.52

It seems that this reference value is "corrected"
for Potsdam error. A value of 13.6 mgal will be added
to this reference value to make the value uncorrected.

reference value = 978162.52
+ Potsdam error = 13.6

reference value = 978176.12

Pier/Ship's position:

Fuel Dock slot #2

Portable gravity meter:

LaCoste & Romberg model G #237
Temperature of meter: 49 deg C.

Readings and calculations:

| Time | Location | L-R Reading |
|-------|----------|----------------|
| 1845Z | Pier | 1867.60 +- .05 |
| 1915Z | Ref | 1868.71 +- .05 |
| 1933Z | Pier | 1867.59 +- .05 |

Lacoste difference in LR units:

delta_LR = pier_LR - ref_LR
delta_LR = 1867.69 - 1868.71
delta_LR = -1.11

Difference in mgal:

note: 1 LR unit = 1.06 mGals
delta_mgal = delta_LR * constant
delta_mgal = (-1.11) * 1.06
delta_mgal = -1.18 mgal

Pier gravity value:

$\text{pier_grv_val} = \text{ref_val} + \text{delta_mgal}$
 $\text{pier_grv_val} = 978176.12 + (-1.18)$
 $\text{pier_grv_val} = 978174.94 \text{ mgal}$

Height correction:

Pier reading is 0.3 m below waist deck.
Waste deck is 5.5 m above gravity lab.
Difference between pier and gravity lab = 5.2 meters

note: free-air constant of +0.31 mgal per meter going towards
the center of earth; -0.31 mgal per meter going away.

$\text{hgt_corr} = \text{hgt} * \text{constant}$
 $\text{hgt_corr} = 5.2 \text{ m} * 0.31 \text{ mGal/m}$
 $\text{hgt_corr} = 1.61 \text{ mGal}$

Gravity at BGM/KSS level:

$\text{grv_at_BGM/KSS_level} = \text{pier_grv_val} + \text{hgt_corr}$
 $\text{grv_at_BGM/KSS_level} = 978174.94 + (1.61)$
 $\text{grv_at_BGM/KSS_level} = 978176.55 \text{ mgal}$

BGM-3 reading:

On December 16, 1991 (day 350) at 1845 Z
 $\text{BGM_grv_val} = 978196.9 \text{ mgal}$

BGM-3 Mistie:

$\text{BGM_mistie} = \text{BGM_grv_val} - \text{grv_at_BGM_level}$
 $\text{BGM_mistie} = 978196.9 - 978176.5$
 $\text{BGM_mistie} = 20.4 \text{ mgal}$

BGM-3 DC shift:

$\text{BGM_dc_shift} = 20.4 \text{ mgal}$

BGM-3 Drift:

$\text{prev_BGM_mistie}: 12.9 \text{ mgal}$ on November 22, 1990 (day 326)

$\text{BGM_drift} = \text{BGM_mistie} - \text{prev_BGM_mistie}$
 $\text{BGM_drift} = 20.4 - 12.9$
 $\text{BGM_drift} = 7.5 \text{ mgal}$

KSS-30 reading:

On December 16, 1991 (day 350) at 1845 Z
 $\text{KSS_grv_val} = -1987.93 \text{ mgal}$

KSS-30 DC shift:

$\text{KSS_dc_shift} = \text{KSS_grv_val} - \text{grv_at_KSS_level}$
 $\text{KSS_dc_shift} = (-1987.93) - (978176.55)$
 $\text{KSS_dc_shift} = -980164.48 \text{ mgal}$

KSS-30 Mistie:

$\text{BIAS} = 980170.29$
 $\text{KSS_mistie} = \text{BIAS} + \text{KSS_grv_val} - \text{grv_at_KSS_level}$
 $\text{KSS_mistie} = (980170.29 + (-1987.93)) - 978176.55$

KSS_mistie = 5.81 mgal

KSS-30 drift:

prev_KSS_mistie: 6.8 mgal on November 22, 1990 (day 326)

KSS_drift = KSS_mistie - prev_KSS_mistie

KSS_drift = 5.81 - 6.8

KSS_drift = -0.99 mgal

Post-cruise Gravity Tie Report
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R/V Ewing gravity meters:

Bell Aerospace BGM-3 marine gravity meter
scale factor = 4.952164
bias = 855758.1

Bodenseewerk KSS-30 marine gravimeter

Port: Punta Arenas, Chile

Date: January 28, 1991 (day 028)

Reference Station:

Punta Arenas
GW 97 Pendulum Station
Filtration Plant
Reference value = 981315.9

Pier/Ship's position:

The R/V Ewing was near the end of the Punta Arenas pier.

Readings and calculations:

The pier gravity value established from the tie of R/V Conrad cruise c2901 on 13 February 1988. The Conrad was 100 m. from the end of the pier.

Pier gravity value:

pier_grv_val = 981335.3 mgal

Height correction:

Pier reading 0.5 m above waist deck.
Waste deck is 5.5 m above gravity lab.
Difference between pier and gravity lab: 6.0 m.

note: free-air constant of +0.31 mgal per meter going towards
the center of earth; -0.31 mgal per meter going away.

hgt_corr = hgt * constant
hgt_corr = 6.0 m * 0.31 mGal/m
hgt_corr = 1.9 mGal

Gravity at BGM/KSS level:

grv_at_BGM/KSS_level = pier_grv_val + hgt_corr
grv_at_BGM/KSS_level = 981335.3 + 1.9
grv_at_BGM/KSS_level = 981337.2 mgal

BGM-3 reading:

On January 28, 1991 (day 028) at 1738 Z
BGM_grv_val = 981365.8 mgal

BGM-3 Mistie:

BGM_mistie = BGM_grv_val - grv_at_BGM_level

BGM_mistie = 981365.8 - 981337.2
BGM_mistie = 28.6 mgal

BGM-3 DC shift:
BGM_dc_shift = 28.6 mgal

BGM-3 Drift:
prev_BGM_mistie: 20.4 mgal on December 16, 1990 (day 350)

BGM_drift = BGM_mistie - prev_BGM_mistie
BGM_drift = 28.6 - 20.4
BGM_drift = 8.2 Mgal

KSS-30 reading:
On January 28, 1991 (day 028) at 1738 Z
KSS_grv_val = 1176.07 mgal

KSS-30 DC shift:
KSS_dc_shift = KSS_grv_val - grv_at KSS_level
KSS_dc_shift = 1176.07 - 981337.2
KSS_dc_shift = -980161.1

KSS-30 Mistie:
BIAS = 980170.29
KSS_mistie = BIAS + KSS_grv_val - grv_at_KSS_level
KSS_mistie = (980170.29 + (1176.07)) - 981337.2
KSS_mistie = 9.16 mgal

KSS-30 drift:
prev_KSS_mistie: 5.81 mgal on December 16, 1990 (day 350)

KSS_drift = KSS_mistie - prev_KSS_mistie
KSS_drift = 9.16 - 5.81
KSS_drift = 3.35 mgal