LAMONT DATA REDUCTION CRUISE SUMMARY

CRUISE: EW9103

START: 12 May 91 (132) Papeete, Tahiti

END: 10 June 91 (161) Papeete, Tahiti

SURVEY AREA: Marquesas and Society Islands

CHIEF SCIENTIST: Marcia McNutt, MIT

DATA REDUCTION: William J. Robinson

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TIME:

Instrument: Kinemetrics GPS Synchronized clock, model GPS-DC
Logging: 60 second intervals

SPEED AND HEADING:

Instrument: Furuno CI-30 2-axis doppler speed log
Logging: 3 second intervals
Checking: visual check of plot of data
Smoothing: mean value of all good values within the same minute

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

GPS SATELLITE FIXES:

Instruments: Magnavox T-Set Global Positioning System 5 channel receivers
Logging: T-Set #1 at 2 second intervals, T-Set #2 at 20 second intervals.
Notes: 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:
minimun number of sats: 3
dilution of precision maximum: north = 6.0, east = 6.0
carrier signal-noise ratio minimun: 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.

Instrument: 3.5 KHZ PDR
Logging: continuous paper plots

Notes:
The Hydrosweep values are from the center beam of the swaths during the actual survey using whatever sound velocity was in effect at the time.

The bathymetry data is a composite of the Hydrosweep center beam depths and 5 minute readings from the PDR records during periods when the Hydrosweep was off. There are some gaps when the PDR was off or of very poor quality.

day	comment
132	all HS
133	all PDR
134	all PDR
135	all HS
136	HS:0000-2008, PDR:2030-2355
137	PDR:0000-0330, HS:0333-2355
138	PDR:0000-0300, HS:0321-0551, PDR:0555-2355
139	PDR:0000-1940, HS:1945-2359
140	all HS
141	HS:0000-0645, PDR:0650-2035, HS:2041-2359
142	HS:0000-0921, PDR:0925-2045, HS:2049-2359
143	all HS
144	all HS
145	all HS
146	HS:0000-0250, PDR:0255-0725, HS:0730-2359
147	HS:0000-0003, PDR:0130-0645, HS:0650-0959, PDR:1030-1800, HS:1805-2359
148	all HS
149	all HS
150	all HS
151	HS:0000-1713, PDR:1730-1800, HS:1815-2359

152 HS:0000-0942, PDR:0955-1045, HS:1050-1808, PDR:1810-1935, HS:1936-2359
153 HS:0000-0003, PDR:0010-0530, HS:0533-1643, PDR:1730-1750, HS:1757-2359
154 all HS
155 all HS
156 all HS
157 all HS
158 HS:0000-2034, PDR:2040-2355
159 PDR:0000-0310
160 HS:0000-0108, PDR:0115-0215, HS:0223-0507, PDR:0510-0600, HS:0609-2359
161 all HS

MAGNETICS:

Instrument: Varian V75 magnetometer
Logging: 20 second intervals
Checking: visual check of plot of data; bad points removed with an
    interactive graphics editor.
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
134	1802-2359	maggie onboard; deploying streamer
135	0000-1049	maggie onboard; deploying streamer
158	0116-0946	maggie onboard; retrieving streamer

BGM-3 GRAVITY:

Instrument: Bell Aerospace BGM-3 marine gravity meter
Logging: 1 second counts
Filtering of counts: 360 second Gaussian filter
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: 53.8 mGal
Drift rate: 0.3138 mGal/day
Chief scientist's data: Free Air Anomaly value at 00 seconds of
    each minute. 1980 theoretical gravity formula.

Notes:
    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: -980162.99 mGal
Drift rate: -0.1611 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:
    The KSS-30 gravity data was used for the Lamont database.

Lamont Gravity Tie Report

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: Papeete, Tahiti

Date: May 10, 1991 (day 130)

Operator: Joe Stennett

Reference Station: Code THT-N Papeete - Quai d'Honneur
17 35.5 S 149 34.1 W . Alt = 2 m.

The tie point is in front of the customs house
on the Quai d'Honneur whcih is the "downtown"
pier in Papeete. This is one of a chain of stations
which have only local designations.

Reference value = 978699.3 mGal

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 = 978699.3
+ Potsdam error = 13.6
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reference value = 978712.9 mGal

Pier/Ship's position: The ship is docked in front of the custom house,
Area of Quai d'Honnenur.

Readings and calculations:

Pier gravity value:
The reference station was only 50 meters from the
ship so it is used as the pier gravity value.

pier_grv_val = 978712.9 mGal

Height correction:
Pier reading is 1.0 m below waist deck.
Waste deck is 5.5 m above gravity lab.
Difference between pier and gravity lab = 4.5 meters

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

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      hgt_corr = 4.5 m * 0.31 mGal/m
      hgt_corr = 1.4 mGal

Gravity at BGM/KSS level:
      grv_at_BGM/KSS_level = pier_grv_val + hgt_corr
      grv_at_BGM/KSS_level = 978712.9 + 1.4
      grv_at_BGM/KSS_level = 978714.3 mGal
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BGM-3 reading:
On May 10, 1991 (day 130) at 0300 Z
BGM_grv_val = 978768.1 mgal

BGM-3 Mistie:
BGM_mistie = BGM_grv_val - grv_at_BGM_level
BGM_mistie = 978768.1 - 978714.3
BGM_mistie = 53.8 mgal

BGM-3 DC shift:
BGM_dc_shift = 53.8 mgal

KSS-30 reading:
On May 10, 1991 (day 130) at 0300 Z
KSS_grv_val = -1448.69 mGal

KSS-30 DC shift:
KSS_dc_shift = KSS_grv_val - grv_at KSS_level
KSS_dc_shift = (-1448.69) - (978714.3)
KSS_dc_shift = -980162.99 mgal

KSS-30 Mistie:
BIAS = 980170.29
KSS_mistie = BIAS + KSS_grv_val - grv_at_KSS_level
KSS_mistie = (980170.29 + (-1448.69)) - 978714.3
KSS_mistie = 7.3 mGal

Lamont Gravity Tie Report

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: Papeete, Tahiti

Date: June 15, 1991 (day 166)

Operator: William J. Robinson, Suzanne O'Hara

Reference Station: Code THT-N Papeete - Quai d'Honneur
17 35.5 S 149 34.1 W . Alt = 2 m.

The tie point is in front of the customs house
on the Quai d'Honneur whcih is the "downtown"
pier in Papeete. This is one of a chain of stations
which have only local designations.

Reference value = 978699.3 mGal

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 = 978699.3
+ Potsdam error = 13.6
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reference value = 978712.9 mGal

Pier/Ship's position: The ship is docked in front of the custom house,
Area of Quai d'Honnenur.

Readings and calculations:

Pier gravity value:
The reference station was only 50 meters from the
ship so it is used as the pier gravity value.

pier_grv_val = 978712.9 mGal

Height correction:
Pier reading is 1.0 m below waist deck.
Waste deck is 5.5 m above gravity lab.
Difference between pier and gravity lab = 4.5 meters

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 = 4.5 m * 0.31 mGal/m
      hgt_corr = 1.4 mGal

Gravity at BGM/KSS level:
      grv_at_BGM/KSS_level = pier_grv_val + hgt_corr
      grv_at_BGM/KSS_level = 978712.9 + 1.4
      grv_at_BGM/KSS_level = 978714.3 mGal
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BGM-3 reading:
      On June 15, 1991 (day 166) at 2205Z
      BGM_grv_val = 978779.4 mgal

BGM-3 Mistie:
      BGM_mistie = BGM_grv_val - grv_at_BGM_level
      BGM_mistie = 978779.4 - 978714.3
      BGM_mistie = 65.1 mgal

BGM-3 DC shift:
      BGM_dc_shift = 65.1 mgal

BGM-3 Drift:
      prev_BGM_mistie: 53.8 mgal on May 10, 1991 (day 130)

      BGM_drift = BGM_mistie - prev_BGM_mistie
      BGM_drift = 65.1 - 53.8
      BGM_drift = 11.3 mgal

      num_days = day - pre_day
      num_days = 166 - 130
      num_days = 36

      BGM_drift_per_day = BGM_drift / num_days
      BGM_drift_per_day = 11.3 / 36
      BGM_drift_per_day = 0.3138 mGal / day

KSS-30 reading:
      On June 15, 1991 (day 166) at  2205Z
      KSS_grv_val = -1454.49 mGal

KSS-30 DC shift:
      KSS_dc_shift = KSS_grv_val - grv_at KSS_level
      KSS_dc_shift = (-1454.49) - (978714.3)
      KSS_dc_shift = -980168.79 mgal

KSS-30 Mistie:
      BIAS = 980170.29
      KSS_mistie = BIAS + KSS_grv_val - grv_at_KSS_level
      KSS_mistie = (980170.29 + (-1454.49)) - 978714.3
      KSS_mistie =  1.5 mGal

KSS-30 drift:
      prev_KSS_mistie: 7.3 mgal on May 10, 1991 (day 130)

      KSS_drift = KSS_mistie - prev_KSS_mistie
      KSS_drift = 1.5 - 7.3
      KSS_drift = -5.8 mgal

      num_days = day - pre_day
      num_days = 166 - 130
      num_days = 36

      KSS_drift_per_day = KSS_drift / num_days
      KSS_drift_per_day = -5.8 / 36
      KSS_drift_per_day = -0.1611 mGal / day
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