LAMONT DATA REDUCTION CRUISE SUMMARY

CRUISE: EW9208

START: 14 July 1992 [196] San Juan, Puerto Rico

END: 18 August 1992 [231] Bridgetown, Barbados

PURPOSE: Morphological and geophysical investigation of Western North Atlantic Crustal Structure between 25-27 degrees north latitude and 44-49 degrees west longitude.

CHIEF SCIENTIST(S): Brian Tucholke - Woods Hole Oceanographic Institution
Marty Kleinrock - Woods Hole Oceanographic Institution

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
Notes:

(1)

day	time	comment
204	2301-2329	gap: power failure
215	2119-2223	gap: logging computer problem

TRANSIT SATELLITE FIXES:

Instrument: Magnavox MX-1107RS dual frequency Transit satellite receiver
Logging: all fixes from two receivers Transit #1 (lab) and Transit #2 (bridge)

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 use in the reduction.
Checking:
minimun number of sats: 3
dilution of precision maximum: north = 4.0, east = 4.0
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 41 point running average
Notes:
(1) The GPS data has a sinusoidal-like wave in it which is assumed to come from some degrading of the GPS quality for civilian users. This wave seems to vary in period and shape and is not a perfect sine curve. The periods are less than 20 minutes. The amplitudes and period will vary over 24 hours but always seem to be present in the data.
This degrading produces a false ship's track for realtime navigation and introduces extreme errors, up to 10 mGals, in the Eotvos correction for the gravity. To handle this problem the following steps have been used to process the GPS:
1. the smoothing has been increased from a 9 point (4 minute) running average of the interpolated positions to a 41 point (20 minute) running average.
2. this smooth GPS data is deleted at turns because the heavy smoothing greatly "widens" the turns.
3. the remaining smooth GPS data is decimated to 20 minute intervals

These GPS processing steps, together with using the smooth speed and heading data from the Furuno for DR'ing between the decimated GPS positions produces good navigation and gravity data.

(2)

day	time	comment
204	2301-2329	gap: power failure
215	2119-2223	gap: logging computer problem

NAVIGATION:

A "1 minute navigation" is produced from the GPS and Furuno sources. The smooth speed and heading data is used to fill the gaps between the processed GPS positions by computing 1 minute DR'ed positions corrected for set and drift. The DR'ed positions are produced at 00 seconds of each minute.

BATHYMETRY:

Instrument: Atlas Hydrosweep DS
Logging: every ping
Checking: visual check of plot of data. Bad data points removed with an interactive graphics editor.
Final data: interpolated depth value (meters) at 00 seconds of each minute
Notes:
(1) these readings are the center beam of the swaths during the the actual survey

(2) the Hydrosweep performance was subpar for the cruise; resulting in periods of poor data. Below are listed gaps of 10 minutes or longer. Most gaps are the result of bad data or periods when the Hydrosweep was down during attempts to correct its problem.

day	time	comment
196	2253-2308	gap:
196	2347-2359	gap:
197	0000-0044	gap:
197	0208-0248	gap:
197	0306-1124	gap:
198	1406-2359	gap:
199	0000-0228	gap:
199	0743-0950	gap:
199	1221-2359	gap:
200	0000-1741	gap:
200	2010-2301	gap:
201	0018-0041	gap:
201	2147-2204	gap:
201	2226-2244	gap:
203	0231-0241	gap:
203	1105-1148	gap:
204	1025-1053	gap:
204	2301-2324	gap: power failure
205	0041-0050	gap:
205	0400-0413	gap:
205	1447-1456	gap:
206	0202-0232	gap:
206	0239-0253	gap:
206	1837-1850	gap:
206	2306-2329	gap:
206	2337-2347	gap:
207	1543-1635	gap:
208	0104-0118	gap:
208	1922-1944	gap:
208	2111-2127	gap:
209	1720-1913	gap:
209	2019-2323	gap:
210	2017-2026	gap:
213	1254-1303	gap:
213	2127-2201	gap:
214	0557-0821	gap:
214	0920-0937	gap:
214	1107-1121	gap:
214	1142-1301	gap:
214	1806-1826	gap:
215	0922-0952	gap:
215	2119-2258	gap: logging computer problem
215	2313-2359	gap:
216	0000-0055	gap:
216	1356-1624	gap:
216	1646-1703	gap:
216	1749-1803	gap:
216	1815-1917	gap:
216	2123-2133	gap:
216	2155-2359	gap:
217	0904-0955	gap:
219	1015-1101	gap:
224	2104-2113	gap:
227	1656-1818	gap:
228	0116-0128	gap:

228	0514-0550	gap:
228	1406-1431	gap:
228	1457-1921	gap:
228	2331-2359	gap:
229	0000-0015	gap:
229	1912-2253	gap:
230	0029-0039	gap:
230	1517-1526	gap:
230	2020-2029	gap:

MAGNETICS:

Instrument: Varian V75 magnetometer
Logging: 6 second intervals
Checking: visual check of plot of data. Bad data points removed with
an interactive graphics editor.
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
Final data: median values at 00 seconds of each minute calculated from
the values +-30 seconds of this time.
Notes:
(1)

day	time	comment
196	-2359	no data collected
197	0000-2359	mostly no data collected (some noisy data)
198	1200-1223	gap: noisy/garbage data
198	1236-1249	gap: noisy/garbage data
198	1346-1441	gap: noisy/garbage data
201	2107-2344	gap:
204	2301-2329	gap: power failure
214	1712-1910	gap:
215	2119-2223	gap: logging computer problem
227	1742-1902	gap:
227	2233-2311	gap:
228	1730-1915	gap:
230	2021-2359	no data collected
231	0000-	no data collected

GRAVITY:

Instrument: Bodenseewerks KSS-30 Marine Gravity meter
Logging: mGal values 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 second delay due to the
filtering of the gravity by the KSS-30.
Merge with navigation: calculate Eotvos correction and Free Air Anomaly.
The velocities, from the navigation, used in the Eotvos
correction are smoothed with a 5 point running average for all days
Checking: visual check of plot of data to determine satisfactory Eotvos
corrections, delete spikes of data at turns

Dc shift: -980169.32 mGal
Drift rate: -0.0053 mGal per day
Tie date: 13 July 1992 (day 195) at 1945 Z
Final 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:
(1)

day	time	comment
204	2301-2329	gap: power failure
215	2119-2223	gap: logging computer problem

Instrument: Bell Aerospace BGM-3 marine gravity meter
Logging: 1 second counts
Filtering: an observed gravity value in mGal is calculated by filtering the 1 second counts with a 360 second Gaussian filter, scaling the result and adding a bias. A value in mGal is calculated at 00 seconds of each minute.
Merge with navigation: calculate Eotvos correction and Free Air Anomaly. The velocities, from the navigation, used in the Eotvos correction are smoothed with a 5 point running average for all days
Checking: visual check of plot of data to determine satisfactory Eotvos corrections, delete spikes of data at turns
Dc shift: -7.7 mGal
Drift rate: 0.0342 mGal per day
Tie date: 13 July 1992 (day 195) at 1945 Z
Final data: Free Air Anomaly value at 00 seconds of each minute. 1980 theoretical gravity formula.
Notes:
(1)

day	time	comment
204	2301-2329	gap: power failure
215	2119-2223	gap: logging computer problem

LAMONT GRAVITY TIE REPORT

R/V Ewing gravity meters: Bell Aerospace BGM-3 marine gravity meter
Bodenseewerk KSS-30 marine gravimeter

The Bell BGM-3 was re-installed on the R/V Ewing after having been return to Bell Aerospace for repair. New bias and scale factor are:

bias = 852680
scale factor = 5.0940744

Port: San Juan, Puerto Rico

Date: 9 July 1992 & 13 July 1992 (see NOTE below)

Operator: Joe Stennett

Reference Station:
ACIC 0272-7 which is at the "Frontier" Pier, along the San Antonio Channel. The reading was taken in front of the dining hall which has a sign "Frontier Pier" on it.

Pier/Ship's position:
R/V Ewing was located at berth "D" on the San Antonio Channel.

Portable Gravity meter: L & R meter G-237
meter at 49.2 deg. C.

Readings and Calculations:

Time	Location	L-R reading
1541 L	pier	2342.17
1611 L	reference	2342.00
1657 L	pier	2342.15

Reference value = 978680.7 mgal

Pier gravity value:
pier_grv_val = 978680.9 mGal

NOTE: the BGM-3 and KSS-30 were not being logged on July 9th.
the gravimeters were logged at the pier on July 13 (day 195).

On 13 July 92 at 1945 Z the BGM/KSS was 5.0 meters below the pier.

Height correction in mgal:
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 = 5.0 * .31
hgt_corr = 1.6

Gravity at BGM/KSS level:
grv_at_BGM/KSS_level = pier_grv_val + hgt_corr

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      grv_at_BGM/KSS_level = 978680.9 + 1.6
      grv_at_BGM/KSS_level = 978682.5

BGM-3 reading:
      On day 195 at 1945 Z
      BGM_grv_val = 978674.8

BGM-3 Mistie:
      BGM_mistie = BGM_grv_val - grv_at_BGM_level
      BGM_mistie = 978674.8 - 978682.5
      BGM_mistie = -7.7

BGM-3 DC shift:
      BGM_dc_shift = -7.7 mGal

BGM drift:
      no drift since BGM-3 was just re-installed on the ship.

KSS-30 reading:
      On day 195 at 1945 Z
      KSS_grv_val = -1486.82
   (note: used the value at 195 1946:15 from the KSS data file
          to adjust for the 75 second filtering delay.)

KSS-30 DC shift:
      KSS_dc_shift = KSS_grv_val - grv_at_KSS_level
      KSS_dc_shift = (-1486.82) - (978682.5)
      KSS_dc_shift = -980169.32

KSS-30 Mistie:
      BIAS of 980170.29
      KSS_mistie = (BIAS  +  KSS_grv_val) - grv_at_KSS_level
      KSS_mistie = (980170.29 + (-1486.82)) - 978682.5
      KSS_mistie = 0.97

KSS-30 drift:
      prev_KSS_mistie: -1.47 mgal on 3 June 1992 (day 155)

      KSS_drift = KSS_mistie - prev_KSS_mistie
      KSS_drift = 0.97 - (-1.47)
      KSS_drift = 2.44
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LAMONT GRAVITY TIE REPORT

R/V Ewing gravity meters: Bodenseewerk KSS-30 marine gravimeter
Bell Aerospace BGM-3 marine gravity meter
scale factor = 5.0940744
bias = 852680

Port: Bridgetown, Barbados

Date: 20 August 1992 (jday 233)

Operator: Joe Stennett and Bill Robinson

Reference Station:
ACIC 0865-4
Adopted value: 978294.44 mgals
Estimated Accuracy: +- 0.5 mgals
Date: 2/72
Location: Station is located on the Deep Water Pier, two feet north of third bollard (bollard #34) from the northern end of pier.

Pier/Ship's position:
R/V Ewing is moored on the Deep Water Pier with bollard #31 at mid-ships.

Readings and Calculations:
Since the gravimeters were located only 3 bollard lengths from the reference station location, the reference value was used for pier gravity value.

Reference value = 978294.44 mgal

Pier gravity value:
pier_grv_val = 978294.44 mGal

On 20 August 92 at 1510 Z the BGM/KSS was 6.0 meters below the pier. (The gravity meters are 5.5 meters below C-deck, which was 0.5 meters below the pier.)

Height correction in mgal:
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 * .31
hgt_corr = 1.9

Gravity at BGM/KSS level:
grv_at_BGM/KSS_level = pier_grv_val + hgt_corr
grv_at_BGM/KSS_level = 978294.44 + 1.9
grv_at_BGM/KSS_level = 978296.3

BGM-3 reading:
On 20 August 92 (day 233) at 1510 Z
BGM_grv_val = 978289.9

BGM-3 Mistie:
BGM_mistie = BGM_grv_val - grv_at_BGM_level
BGM_mistie = 978289.9 - 978296.3
BGM_mistie = -6.4

BGM-3 DC shift:
BGM_dc_shift = -6.4 mGal

BGM drift:
pre_BGM_mistie: -7.7 mgal on 13 July 1992 (day 195)
BGM_drift = BGM_mistie - pre_BGM_mistie
BGM_drift = (-6.4) - (-7.7)
BGM_drift = 1.3 mgal

BGM drift rate per day = BGM_drift/number of days from last tie
BGM drift rate per day = 1.3/38
BGM drift rate per day + 0.0342

KSS-30 reading:
On day 233 at 1510 Z
KSS_grv_val = -1873.19
(note: used the value at 233 1511:16 from the KSS data
file to adjust for the 75 second filtering delay.)

KSS-30 DC shift:
KSS_dc_shift = KSS_grv_val - grv_at_KSS_level
KSS_dc_shift = (-1873.19) - (978296.3)
KSS_dc_shift = -980169.5

KSS-30 Mistie:
BIAS of 980170.29
KSS_mistie = (BIAS + KSS_grv_val) - grv_at_KSS_level
KSS_mistie = (980170.29 + (-1873.19)) - 978296.3
KSS_mistie = 0.8

KSS-30 drift:
prev_KSS_mistie: 0.97 mgal on 13 July 1992 (day 195)

KSS_drift = KSS_mistie - prev_KSS_mistie
KSS_drift = (0.8) - (0.97)
KSS_drift = -0.2

KSS-30 drift rate per day = KSS_drift/number of days from last tie
KSS-30 drift rate per day = -0.2/38
KSS-30 drift rate per day = -0.0053