

LAMONT DATA REDUCTION CRUISE SUMMARY
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CRUISE: EW-9007

START: 26/08/90 238 Bergen, Norway

END: 23/09/90 266 Bergen, Norway

PURPOSE: Geophysical investigation of the AEGIR Ridge & the slump
area S. of Voring Plateau of the Norwegian Sea.

CHIEF SCIENTISTS: Dan Chayes, NRL

DATA REDUCTION: Stefanus Budhypramono

TRUE TIME CLOCK:

Instrument: Kinematic True Time Division Model 468-DC

Logging: 1 minute intervals

Checking: visual check of plot of data

Note: There are two true time clock on board the ships. Both are being
logged.

mutant True Time #1 is connected to the antenna and has been proven to give

record. True Time #2 on the other hand is connected to a 5065A Rubidium
time. Vapor Frequency Standard and has been proven to provide more accurate

Therefore, True Time #2 is eing used to calibrate data files on this
cruise.

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

Note:

DAY	TIME	COMMENTS
-----	-----	-----
252	1656-1720	Lost power due to tripping of power break

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

Note: Throughout the cruise transit sat #2 (bridge) was being used to
reduce

navigation
DAY TIME COMMENTS

252 1656-1720 Lost power due to tripping of power break

GPS SATELLITE FIXES:

Instrument: Magnavox T-Set Global Positioning System receiver
Logging: 2 second intervals on GPS set #1 and
20 second intervals on GPS set #2

Checking:

minimum number of sats: 2
dilation of precision maximum: north = 10.0, east = 10.0
carrier signal-noise ratio minimum: 35.0
standard deviation maximum: north = 10.0, east = 10.0
time step maximum: 3
speed maximum: 15.0
compared GPS speed and course with Furuno smooth speed and heading
compared positions with Transit-Furuno navigation
reject fixes with high drifts in 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
Note: Throughout the cruise, GPS set #1 was being used to reduce
navigation. The 2 second data was being reduced to 20 second prior
to processing.

DAY	TIME	COMMENTS
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250	0442	GPS set #2's power supply burnt out
252	1751	GPS set #2 is back
252	1656-1720	Lost power due to tripping of power break

INTERNAV LORAN FIXES:

Instrument: Internav Loran LC408
Logging: 1 (one) minute intervals
Checking:

reject fixes with high drifts in 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
Note:

DAY	TIME	COMMENTS
-----	-----	-----
239	0000	Loran started picking up station
252	1656-1720	Lost power due to tripping of power break
253	1720	Had problem locking any satellite
255	1530	Loran started tracking again

NORTHSTAR LORAN FIXES:

Instrument: DMEC Northstar 6000 Automatic Receiver

Logging: 20 second intervals

Checking:

 reject fixes with high drifts in 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

Note:

DAY	TIME	COMMENTS
-----	-----	-----
239	0000	Loran started picking up station
252	1656-1720	Lost power due to tripping of power break

NAVIGATION:

A "1 minute navigation" is produced from the above sources. Acceptable fixes are merged at 1 per minute with priority given to GPS. 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.

Chief scientist's final data: final calibrated and cleaned data

FORMAT: 9007n.ddd

 yy+ddd:hh:mm:ss.mmm N 12 12.1234 E 123 12.1234 id 123.1 12.1
 yr day time lat lon id set drift

Lamont database: 1 minute navigation.

BATHYMETRY:

Instrument: Krupp Atlas Hydrosweep Center Beam

Logging: At each ping of Hydrosweep, data is being broadcasted real time to the network, which in turn is being received by data logger. The logger computer then extracted the center beam depth. Intervals vary, dependent on depth: about every 12 sec. at 4000 m., more often at less depth.

Checking: visual check of plot of data

Chief scientist's final data: final calibrated and cleaned data
Depth is in meters.

FORMAT: 9007hb.nddd

yy+ddd:hh:mm:ss:mmm N 12 12.1234 E 123 12.1234 2222.0
yr day time lat lon depth_in_meters

Lamont database: Same as above. Depth is in fathoms.

Note:

DAY	TIME	COMMENTS
238	0939	started logging
252	1656-1720	Lost power due to tripping of power break
266	1623	stopped logging

MAGNETICS:

Instrument: Varian V75 magnetometer

Logging: 20 second intervals

Checking: visual check of plot of data

Reference field: International Geomagnetic Reference Field 1985
(IGRF 1985)

model of the main field at 1985.0 and a predictive model of the
secular variation for adjusting to dates between 1985.0 and 1990.0

Residual field: Applied by bilinear interpolation across a 1 degree
square.

Chief Scientist's final data: final calibrated and cleaned data

FORMAT: 9007mg.nddd

yr+ddd:hh:mm:ss.mmm	N 12	12.1234	E 123	12.1234	41200.8	-367.1
yr	day	time	lat	lon	total_	anomaly
					intensity	

Lamont Database: interpolated total intensity value at 00 seconds
of each minute

Note:

DAY	TIME	COMMENTS
-----	-----	-----
239	0200	started logging
252	1656-1720	Lost power due to tripping of power break
261	1330	Maggie was taken out of the water due to Hurricane Isador
262	1300	Maggie went back to the water
263	0456-0709	Maggie was giving false reading
264	0513	Maggie off the water

BGM-3 GRAVITY:

Instrument: Bell Aerospace BGM-3 marine gravity meter
Logging: 1 second intervals
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 for days 246-266
Free air smoothing: 15 min. cubic-spline filter
Chief scientist's final data: Observed, Eotvos, Free Air Anomaly value
at 00 seconds of each minute. 1980 theoretical gravity formula:
 $Y_o = 978.0327 * (1 + a - b)$ where
 $a = .0053024 * \sin(\theta) * \sin(\theta)$ and
 $b = .0000058 * \sin(2 * \theta) * \sin(2 * \theta)$.
and final calibrated and cleaned data

FORMAT: 9007vt.nddd

```
yy+ddd:hh:mm:ss.mmm N 10 20.1234 W 120 23.1234 1980 77.1  
yr day time lat lon theog FAA  
  
979317.5 64.1 1.5 10.2 -1.7 9.7 -1.6 9.8  
raw_grav eotvos drift dc_shift raw_vel smo_vel
```

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

Note: Early in the cruise, the BGM-3's interface is still not
functioning properly. The result was the data logger getting double
counts every few seconds. On day day 246, Joe Stennett, acting
Science Officer fixed the interface. The BGM-3 was operating very
well, though we noticed a lot of bad spikes, which we suspected is
the result of the computer not being to give an accurate time tag
for data coming in at that frequency (once every second). We
also noticed that the BGM-3 performance is slightly worse during
rough weather. This is also speculated due to bad sensor.

DAY	TIME	COMMENTS
246	0000	BGM-3 was fixed, no more double/zero count
252	1656-1720	Lost power due to tripping of power break
259	0000-1000	BGM-3 data was bad

KSS-30 GRAVITY:

Instrument: KSS-30 marine gravity meter
Logging: 6 second intervals
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 for days 238-252
Free air smoothing: 15 min. cubic-spline filter
Chief scientist's final data: Observed, Eotvos, Free Air Anomaly value
at 00 seconds of each minute. 1980 theoretical gravity formula:
 $Y_0 = 978.0327 * (1 + a - b)$ where
 $a = .0053024 * \sin(\theta) * \sin(\theta)$ and
 $b = .0000058 * \sin(2 * \theta) * \sin(2 * \theta)$.
and final calibrated and cleaned data

FORMAT: 9007vk.nddd

```
yy+ddd:hh:mm:ss.mmm N 10 20.1234 W 120 23.1234 1980 77.1  
yr day time lat lon theog FAA  
  
979317.5 64.1 1.5 10.2 -1.7 9.7 -1.6 9.8  
raw_grav eotvos drift dc_shift raw_vel smo_vel
```

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

Note: KSS-30 gravimeter ceased to work on day 253 due to severe
weather. It is speculated that the sensor has gone bad.
And after further processing, it is determined that the meter was
not sufficient for this cruise; hence the data is NOT being used.

DAY	TIME	COMMENTS
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238	0000	started logging
245	0000-2359	KSS-30's sensor went bad due to rough weather.
246	0000-2359	KSS-30's sensor went bad due to rough weather.
247	0000-2359	KSS-30's sensor went bad due to rough weather.
248	0000-1550	KSS-30's sensor went bad due to rough weather.
252	1656-1720	Lost power due to tripping of power break
253	0300	KSS-30 is declared not working

PRE-CRUISE GRAVITY TIE-IN:

Port: Bergen, Norway

Date: Aug 23, 1990

Operator: Joe Stennett

Reference Station: ACIC 2030-1

Pier/Ship's position: from the Gravity Tie Report:

Ship is docked at the very end of the pier near the custom house
(Tollbodkaien) Skotegrunnaskai Pier #2.

Gravity meter: L & R Model G, serial number 237.

Temperature of meter: 49 C.

Readings and Calculations:

TIME	LOCATION	L&R READING	G	Potsdam Cor?
0816Z	Pier	5427.632+- .05		
0857Z	Ref	5426.940+- .05		981951.1 NOT corrected
0918Z	Pier	5427.635+- .05		

	G READING
0920Z BGM	981949.3
0920Z KSS-30	1784.91

Pier reading .3 m above waist deck. Waste deck is 5.5 m above
gravity lab. $5.5 + .3 = 5.8$ m.

Lacoste difference in LR units:

$\text{delta_LR} = \text{pier_LR} - \text{ref_LR}$
.7 = $5427.63 - 5426.94$

Difference in mgal: (1 LR unit = 1.06 mGals)

$\text{delta_mgal} = \text{delta_LR} * \text{constant}$
.7 = .7 * 1.06

Pier gravity value in mgal: $\text{ref_val} = G - 13.6 = 981951.1 - 13.6 =$
981937.5

$\text{pier_grv_val} = \text{ref_val} + \text{delta_mgal}$
981938.2 = $981937.5 + .7$

Height correction:

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.

$\text{hgt_corr} = \text{hgt} * \text{constant}$
1.7 mGal = $5.8 * 0.31$ mGal/m

Gravity at gravity lab level in mgal:

$\text{grv_at_lab_level} = \text{pier_grv_val} + \text{hgt_corr}$
981939.9 = $981938.2 + 1.7$

BELL GRAVIMETER

Mistie in mgal:

$$\begin{aligned} \text{mistie} &= \text{BGM_grv_val} - \text{grv_at_lab_level} \\ 9.4 &= 981949.3 - 981939.9 \end{aligned}$$

Drift in mgal since last tie:

$$\begin{aligned} \text{prev_mistie: } &0.81 \text{ mgal on 23 July 1990} \\ \text{drift} &= \text{mistie} - \text{prev_mistie} \\ 8.59 &= 9.4 - 0.81 \end{aligned}$$

KSS-30

$$\begin{aligned} \text{KSS_grav_val} &= \text{kss_unbiased_output} + \text{bias} \\ 981955.20 &= 1784.91 + 980170.29 \end{aligned}$$

Mistie in mgal:

$$\begin{aligned} \text{mistie} &= \text{KSS_grv_val} - \text{grv_at_lab_level} \\ 15.3 &= 981955.2 - 981939.9 \end{aligned}$$

Drift in mgal since last tie:

prev_mistie: 12.93 mgal on 23 July 1990

$$\begin{aligned} \text{drift} &= \text{mistie} - \text{prev_mistie} \\ 2.37 &= 15.3 - 12.93 \end{aligned}$$

POST-CRUISE GRAVITY TIE-IN:

 Port: Bergen, Norway

Date: Sep 24, 1990

Operator: Joe Stennett

Reference Station: No tie, used value from previous tie

Pier/Ship's position: from the Gravity Tie Report:

Ship is docked at the very end of the pier near the custom house
 (Tollbodkaien) Skotegrunnaskai Pier #2.

Gravity meter: L & R Model G, serial number 237.

Temperature of meter: 49 C.

Readings and Calculations:

TIME	LOCATION	L&R READING	G	Potsdam Corr?
23 Aug 90 0816Z	Pier	5427.632+-	.05	
23 Aug 90 0857Z	Ref	5426.940+-	.05	981951.1 NOT corrected
23 Aug 90 0918Z	Pier	5427.635+-	.05	

G READING

24 Sep 90 1800Z	BGM	981955.2
24 Sep 90 1800Z	KSS-30	1785.83

Pier reading .5 m above waist deck. Waste deck is 5.5 m above
 gravity lab. 5.5 + .5 = 6.0 m.

Lacoste difference in LR units:

delta_LR = pier_LR - ref_LR
 .7 = 5427.63 - 5426.94

Difference in mgal: (1 LR unit = 1.06 mGals)

delta_mgal = delta_LR * constant
 .7 = .7 * 1.06

Pier gravity value in mgal: ref_val = G - 13.6 = 981951.1 - 13.6 =
 981937.5

pier_grv_val = ref_val + delta_mgal
 981938.2 = 981937.5 + .7

Height correction:

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

Gravity at gravity lab level in mgal:

grv_at_lab_level = pier_grv_val + hgt_corr
 981940.1 = 981938.2 + 1.9

BELL GRAVIMETER

Mistie in mgal:

mistie = BGM_grv_val - grv_at_lab_level
15.1 = 981955.2 - 981940.1

Drift in mgal since last tie:

prev_mistie: 9.4 mgal on 23 Aug 1990
drift = mistie - prev_mistie
5.7 = 15.1 - 9.4

==> DC Shift = prev_mistie
= 9.4
Drift/Day = drift/(tot. # of day)
= 5.7/(267-235)
= 5.7/32 = 0.178125

KSS-30

KSS_grav_val = kss_unbiased_output + bias
981956.12 = 1785.83 + 980170.29

Mistie in mgal:

mistie = KSS_grv_val - grv_at_lab_level
16.02 = 981956.12 - 981940.1

Drift in mgal since last tie:

prev_mistie: 15.3 mgal on 23 Aug 1990
drift = mistie - prev_mistie
.72 = 16.02 - 15.3

==> DC Shift = prev_mistie - bias
= 15.3 - 980170.29
= -980154.99
Drift/Day = drift/(tot. # of day)
= .72/(267-235)
= .72/32 = 0.0225