

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

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TRUE TIME CLOCK:

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Instrument: Kinemetric 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.

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

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

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

SPEED AND HEADING:

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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
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252	1656-1720	Lost power due to tripping of power break
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TRANSIT SATELLITE FIXES:

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

# GPS SATELLITE FIXES:

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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

dilution 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:

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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
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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:

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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:

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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:

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

MAGNETICS:

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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
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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:

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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
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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:

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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:  
$$Y_o = 978.0327 * ( 1 + a - b )$$
 where  
$$a = .0053024 * \sin( \theta ) * \sin( \theta )$$
 and  
$$b = .0000058 * \sin( 2 * \theta ) * \sin( 2 * \theta )$$
  
and final calibrated and cleaned data

FORMAT: 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:

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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:

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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.

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

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

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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

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$$\begin{aligned} \text{KSS\_grav\_val} &= \text{kss\_unbiased\_output} + \text{bias} \\ 981955.20 &= 1784.91 + 980170.29 \end{aligned}$$

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:

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 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:

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 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

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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

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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