DATA REDUCTION CRUISE SUMMARY

EW-9701

A study of continental shelf and slope

stability along the east coast of the United States

Tampa, Fla - Savannah, GA

03/31/97 (JD 090) - 04/29/96 (JD 119)

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R/V MAURICE EWING

Participants:

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R/V Ewing Crew:

Ian Young - Master R/V EWING
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SCIENCE OVERVIEW:

The U.S. Navy is continuing to evaluate continental shelf and slope stability along the east coast of the United States. Three study areas have been chosen along the eastern margin to observe variations in seafloor stability that occur along different slope environments over short time periods (approx. 2 wks.). The survey objectives are to (1) collect detailed geologic and oceanographic measurements across three differing slope environments, (2) assess the interaction of shelf and slope oceanographic and sedimentary processes on the seafloor stability over short time periods, (3) identify any resultant seafloor features and conditions and (4) determine potentially unstable or hazardous seafloor slopes.

TRUE TIME CLOCK:

Instrument: *Kinemetric/TrueTime Division Model GPS-DC GPS Synchronized Clock*
Logging: 1 minute intervals
NOTE: The True Time clock is used to adjust the CPU clock of the logging computer. The logging computer captures the continuous time records from the clock and provides these as a service to the rest of the network via a UDP broadcast. This enables the computers on the network to adjust their CPU times to UTC time.

DAY	TIME	COMMENTS
090	1820	start of cruise, started logging/processing
095	2330	port stop in Newark, NJ - logging suspended
108	1230	leaving Port Newark, started logging/processing
119	2000	end of cruise, stopped logging/processing

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

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090	1820	start of cruise, started logging/processing
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GPS SATELLITE FIXES:

Instrument: *Magnavox MX-4200 Global Positioning System receiver 1 & 2*
GPS Trimble NT200D receiver
Logging: 10 second intervals on all four receivers

Checking: (GPS-MX 4200 1 & 2, GPS Trimble NT200D receiver)
minimum number of SATs: 3
dilution of precision maximum: north = 4.0, east = 4.0
speed maximum: 20.0
compared GPS speed and course with Furuno smooth speed and heading
reject fixes with high drifts in navigation
reject fixes producing Eotvos correction errors in gravity larger than 5 mGals

Interpolation: interpolated positions at 00, 30 seconds of each minute
Smoothing: smoothed interpolated positions with 9 point running average.

Note:
The Selective Availability (SA) enforced by the Department of Defense (DoD) causes us to take a GPS fix every twenty minutes, and DR in between.

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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: 1 minute navigation.

FORMAT: n.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, in NetCDF format.

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SEA TEMPERATURE:

Instrument: *Omega DP10 Series*
Logging: 1 minute intervals
Checking: none
Smoothing: none

Chief scientist's final data: none.
Lamont database: one minute data, merged with navigation.

FORMAT: ct.nddd
yy+ddd:hh:mm:ss:mmm N 12 12.1234 E 123.1234 26.3
yr day time lat lon sea_temp (in ºC)

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090	1820	start of cruise, started logging/processing
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BATHYMETRY:

Instrument: *Krupp Atlas Hydrosweep Center Beam*
Logging: At each ping of *Hydrosweep*, data is being broadcast real time to the network, which is received by data logger. The logger computer then extracted the center beam depth.
Checking: Visual checking aided by graphic editor to remove major spikes.

Chief scientist's final data: final calibrated and cleaned center beam data, two nearest point to the minute interpolated to even minute.
Merged with final navigation. Depth is in meters.

FORMAT: hb.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: final calibrated and cleaned data, interpolated to even minute.
Merged with final navigation. NetCDF format. Depth is in meters.

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MAGNETIC:

Instrument: *Varian V75 magnetometer*
Logging: 6 second intervals
Checking: visual check of plot of data
Reference field: International Geomagnetic Reference Field 1990
(*IGRF 1990*) model of the main field at 1985.0 and a predictive model of the secular variation for adjusting to dates between 1990.0 and 1995.0.
Residual field: Applied by bi-linear interpolation across a 1 degree square.

Chief Scientist's final data: interpolated total intensity value at 00 second of each minute.

FORMAT: mg.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_intensity anomaly
```

Lamont Database: interpolated total intensity value at 00 second of each minute NetCDF format.

NOTE:

DAY	TIME	COMMENTS
109	0049	maggie in the water
111	1700	maggie out of the water ; end of survey

WEATHER STATION:

Instrument: *R.M./. Young Precision Meteorological Instruments 26700 Series*
Logging: 1 minute interval
Checking: none

Chief scientist's final data: none.
Lamont database: as is.

FORMAT: wx.rddd

Port bird is bird #1; starboard bird is bird #2.

```
94+022:00:00:00.244   3.4 231 9.3   15.4    13.2     21.1   271   261
date    time                  tspd tdir wsi1  wss1  wsm1  wsx1 wdc1 wds1

  6       12.6  15.9    15.6    20.7   261   253       6     66.7  66.7
wdm1 wsi2  wss2  wsm2 wsx2 wdc2 wds2 wdm2 tcur    tavg

66.5  67.0 66 58  68 1016.8
tmin  tmax  rh rhn rhx   baro
```

tspd = true speed
tdir = true wind direction
wsi1/2 = wind speed, instantaneous, bird #1/#2
wss1/2 = wind speed, 60 second average, bird #1/#2
wsm1/2 = wind speed, 60 minute average, bird #1/#2
wsx1/2 = wind speed, 60 minute maximum, bird #1/#2
wdc1/2 = wind direction, current, bird #1/#2
wds1/2 = wind direction, 60 second average, bird #1/#2
wdm1/2 = wind direction, 60 minute average, bird #1/#2

tcur = temperature, current
tavg = temperature, 60 minute average
tmin = temperature, 60 minute minimum
tmax = temperature, 60 minute maximum

rh = relative humidity
rhn = relative humidity, 60 minute minimum
rhx = relative humidity, 60 minute maximum

baro = barometric pressure

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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 throughout the cruise.
Processing:

Since current BGM-3 output has double counts every few minutes the following scheme has been implemented until the hardware and interface code has been fixed:

(1) Run a 1 minute Gaussian filter through the data. This will narrow the output spikes and make them stand out better. Output interval has been hard-wired to every 15 seconds.

(2) Pass the output through filter1d (see gmtsystem) using -FG480 (an 8 minute Gaussian filter with robust option, i.e., ignore "outlier" points (i.e. the spikes).

Calculation:

eotvos_corr = 7.5038 * vel_east * cos(lat) + .004154 * vel*vel
corrected_grv = raw_grv + eotvos_corr - drift - dc_shift
faa = corrected_grv - theoretical_grv

Chief scientist's final data: Observed, Eotvos, Free Air Anomaly value at 00 seconds of each minute.

1980 theoretical gravity formula:

$$Y_0 = 978.0327 \times (1 + .0053024 \times \sin(\square) \times \sin(\square) - .0000058 \times \sin(2 \times \square) \times \sin(2 \times \square))$$

FORMAT: vt.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.
1980 International gravity formula.

Note:

A '-' sign after the year in the record signifies a flagged record due to turn.

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PRE-CRUISE GRAVITY TIE-IN:

Port: Tampa, Fla.
Date: March 30, 1997 (JD 089)
Operator: Joe Stennett
Reference Station:
Beechcraft General Aviation at Tampa International Airport.
Date: 01 Nov. 1971
Gravity value: 979203.31 mGals (NOT Potsdam Corrected)
Pier/Ship's position:
Position: N 27º 55.965' W 82º 25.932'
Pier reading was taken at the end of Pier 200 in Tampa International Repair.

TIME	LOCATION	L&R READING	G	Potsdam Corr?
1836Z	Ref	2829.9 +- .05	979203.31	NOT!!
1920Z	Pier	2827.9 +- .05		

TIME	GRAVITY	G READING
2000Z	BGM-3	979241.0

Readings and Calculations:
"C" deck was 0.5 m ABOVE the pier at 2000Z ;"C" deck is 5.5 m above the gravity meter.
Difference between pier and gravity lab: 5.0 m

Lacoste difference in LR units:
delta_LR = pier_LR - ref_LR
-2 = 2827.9 - 2829.9

Difference in mGals: (1 LR unit = 1.06 mGals)
delta_mgal = delta_LR x constant
-2.12 = -2 x 1.06

Pier gravity value in mGals: ref_val = G (+13.6 if Potsdam corrected)
pier_grv_val = ref_val + delta_mgal
979201.68 = 979203.8 + (-2.12)

Height correction:
Height correction in mGals:
note: free-air constant of +0.31 mGals per meter going towards the center of earth; -0.31 mGals per meter going away.
hgt_corr = hgt x constant
1.55 mGals = 5.0 x 0.31 mGals/m

Gravity at gravity meter level in mGals:
grv_at_meter_level = pier_grv_val + hgt_corr

979203.23 = 979201.68 + 1.55

BGM_filt_grv = (scale factor x counts) + bias = 979241.0
using s.f. 5.0940744 and bias 8526800.
The count was filtered with a 360 filter width (Gaussian filter)

Mistie in mGals:

mistie	= BGM_grv_val	- grv_at_meter_level
37.77	= 979241.0	- 979203.23

Drift in mGals since last tie:

prev_mistie: 25.25 mGals on date Nov. 21, 1996 (JD 326)

drift	= mistie - prev_mistie
12.52	= 37.77 - 25.25

==> ***DC Shift*** = prev_mistie
= 25.25

Drift/Day = drift / (tot. # of day)
= 12.52/ (366-326+89)
= 0.097054 mGals/day

POST-CRUISE GRAVITY TIE-IN:

Port: Port Newark, NJ
Date: April 9, 1997 (JD 099)
Operator: Chris Leidhold, Budhy
Reference Station:
Oceanography gravity station, Room 106, Oceanography Bldg, LDEO
Pier/Ship's position:
EW-9004: Port Newark berth 9 near bollard (by mark) P9/2. Ship riding at 44.
EW-9701: Port Newark pier 6, almost directly across the channel from ship's location back in EW-9004.

Readings and Calculations:

EW-9004 - July 5, 1990				
TIME	LOCATION	L&R READING	G	Potsdam Corr?
1200Z	Ref	3828.90 +- .05	980240.96	YES!!
1421Z	Pier	3817.67 +- .05		
1626Z	Ref	3829.08 +- .05		
EW-9701 - April 9, 1997				
TIME	LOCATION	L&R READING	G	Potsdam Corr?
1320Z	EW-9004 pier	3808.64 +- .05		
1335Z	EW-9701 pier	3808.54 +- .05		
1335z	BGM-3		980280.0	

"C" deck was 0. m ABOVE the pier.
"C" deck is 5.5 m above the gravity meter.
Difference between pier and gravity lab: 5.5 - 0. = 5.5 m

Lacoste difference in LR units:
delta_LR = pier_LR - ref_LR
-11.42 = 3817.67 + (3808.54 - 3808.64) - 3829.99

Difference in mGals: (1 LR unit = 1.06 mGals)
delta_mgal = delta_LR x constant
-12.11 = -11.42 x 1.06

Pier gravity value in mGals: ref_val = G (+13.6 if Potsdam corrected)
pier_grv_val = ref_val + delta_mgal
980242.45 = 980240.96 + (-12.11) + 13.6

Height correction:

Height correction in mGals:

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

hgt_corr = hgt x constant

1.7 mGals = 5.5 x 0.31 mGals/m

Gravity at gravity meter level in mGals:

grv_at_meter_level = pier_grv_val + hgt_corr

980244.15 = 980242.45 + 1.70

BGM-3:

BGM_filt_grv = (scale factor x counts) + bias =980280.0
using s.f. 5.0940744 and bias 8526800.
The count was filtered with a 360 filter width (Gaussian filter)

Mistie in mGals:

mistie = BGM_grv_val - grv_at_meter_level

35.85 = 980280.0 - 980244.15

Drift in mGals since last tie:

prev_mistie: 37.77 mGals on date March 30, 1997 (JD 089)

drift = mistie - prev_mistie

-1.92 = 35.85 - 37.77

==> ***DC Shift*** = prev_mistie
= 37.77 mGals

Drift/Day = drift / (tot. # of day)
=-1.92/ (99-89) = -0.192 mGals/day