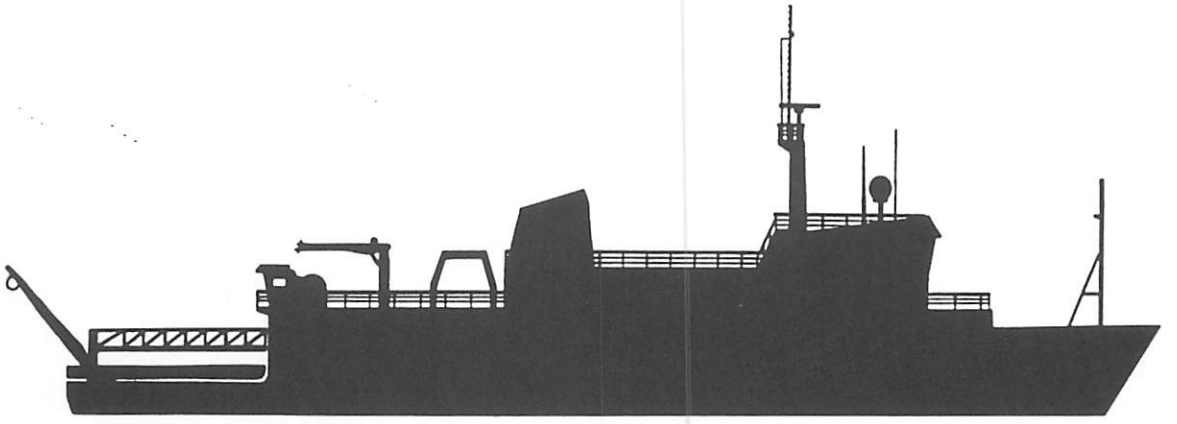
EW9502



R/V MAURICE EWING

LAMONT-DOHERTY GEOLOGICAL OBSERVATORY

COLUMBIA UNIVERSITY

LAMONT DATA REDUCTION CRUISE SUMMARY
==========

CRUISE: EW9502

START: 27 March 1995 [086] Balboa, Panama

END: 27 April 1995 [117] Manzanillo, Mexico

Project Title: "Investigation of upper plate response to subducting plate morphology and seamounts as subduction zone asperites: Cooperative German, Costa Rican and United States project"

SURVEY AREA: NP13 - Pacific margin of Costa Rica

CHIEF SCIENTIST(s): Kirk McIntosh - The Univeristy of Texas Institute for Geophysics, Austin, Texas
Tom Shipley - The Univeristy of Texas Institute for Geophysics, Austin, Texas

DATA REDUCTION: William J. Robinson

****

TIME:

Instrument: TrueTime (Kinemetrics) GPS Synchronized clock, Model GPS-DC
Logging: 60 second intervals
Notes:
(1) the True Time clock was used to synch the CPU clocks

Instrument: Datum
Logging: 60 second intervals
Notes:
(1) The Datum clock exhibited problems throughout cruise EW9502. The times from the printer port ("tr2." data) had the wrong day of year until day 100 and the time was usually 1 second ahead of the CPU clock which is synched to the True Time.

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) Port stop in Caldera, Costa Rica from day 111 at 1200 to day 112 at 1100.

GPS SATELLITE FIXES:

Instrument: Magnavox MX-4200D Global Positioning System receiver
(there are two MX-4200D receivers)
Logging: 10 second intervals
Checking:
minimun number of sats: 3
dilution of precision (DOPs) maximum: north = 4.0, east = 4.0
compared GPS speed and course with Furuno smooth speed and heading
checked that GPS was satisfactory for gravity eotvos correction
Interpolation: interpolated positions at 00, 30 seconds of each minute
Smoothing: smoothed interpolated positions with 5 point running average
Notes:

(1) The GPS data designated "gp3" came the the Magnavox MX4200D receiver that was receiving the differential corrections via a MARISAT link.
(2) the GPS data designated "gp4" came from the other Magnavox MX4200D which was not receiving the differential corrects. This receiver was turned off on day 088 to avoid possible confusion.
(3) The "gp3" data stream was without the differential corrections from between day 097 at 1629 to day 098 at 0240. This seems to have been caused by a switching of the serial lines between the two MX-4200s and without putting the other receiver in differential mode. The GPS data during this period was heavily smoothed with a 41 point (20 minute) running average and decimated to 20 minute intervals. In addition the GPS was deleted at turns.
(4) Port stop in Caldera, Costa Rica from day 111 at 1200 to day 112 at 1100.
(5) The differential correction to the GPS was not available for days 112 thru 117. The GPS data during this period was heavily smoothed with a 41 point (20 minute) running average and decimated to 20 minute intervals. In addition the GPS was deleted at turns.

Instrument: Trimble NT200D
Logging: 10 second intervals
Notes:
(1) the data from the Trimble was not processed
(2) Port stop in Caldera, Costa Rica from day 111 at 1200 to day 112 at 1100.

NAVIGATION:

A "1 minute navigation" is produced from the GPS MX-4200D ("gp3") 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.
Sound Velocity: All days use a sound velocity of 1500 meters per second
Final data: interpolated depth value (meters) at 00 seconds of each minute
Notes:
(1) Port stop in Caldera, Costa Rica from day 111 at 1200 to day 112 at 1100.

(2) The process that adjusts the CPU time of the computer (SGI: "olive") that interfaces to the Hydrosweep died sometime between day 090 and 092. This adjustment of CPU time to the broadcasted UTC time from the TrueTime clock is done normally once a minute. Without this adjustment the CPU clock began to drift positively and between day 090 and day 111 gained 8 seconds. This drift shows up in the ping times for the Hydrosweep data. This drift is apparent because the Hydrosweep data is broadcast on the realtime net and captured on a Sun computer and time tagged there. This Sun computer's CPU time is also adjusted to to the UTC time. To correct for this clock drift the differences between the ping times and Sun computer time tag were calculated from data in shallow water, were travel times were very minor. Nine consecutive values from each hour were calculated by subtracting the ping times from the Sun computer time tags. A mean of these 9 values was in turn calculated

and plotted. (See plots.) While there is some scatter in these mean values the trend is clear. During the periods when the CPU clock is being adjusted the Sun computer time tag is about 4-5 seconds later than the ping time in shallow waters. The per day adjustment was derived from taking the mean of the mean values calculated from the 9 consecutive hourly values. The adjusted were:

Day	Adjustment to HS ping times (secs)
090	0
091	-1
092	-1
093	-2
094	-3
095	-3
096	-3
097	-4
098	-4
099	-5
100	-5
101	-5
102	-5
103	-6
104	-6
105	-6
106	-6
107	-7
108	-7
109	-7
110	-8
111	-8

The process to adjust the CPU time was restarted during the port stop in Caldera (days 111-112) and no adjustements were done for days 112 thru 117. Also, no adjustments were needed for days 086 thru 089 at the beginning of the cruise.

MAGNETICS:

Logging: not collected

GRAVITY:

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 6 second intervals.
Smoothing: mean gravity values at 00 seconds of each minute calculated from the milligal values +-30 seconds of this time.
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: 15.0 mGal from pre-cruise tie at Balboa
Drift rate: 0.06042 mGal per day
Pre-cruise Tie date: 27 March 1995 (day 086) at 1323 Z
Balboa, Panama
Post-cruise Tie date: 14 May 1995 (day 134) at 0600 Z
San Diego, CA, U.S.A.
Final data: Free Air Anomaly value at 00 seconds of each minute.

1980 theoretical gravity formula.

Notes:

(1) Port stop in Caldera, Costa Rica from day 111 at 1200 to day 112 at 1100.

SEISMIC:

Instruments: 20-30 ocean bottom seismometers and hydrophones were deployed in three experiment areas. Shooting was from the R/V Ewing 20 gun array and selected land shots. There were also 30+ land instruments. Single channel seismics were also collected.

Notes:

(1) the shot times put in the header records are from the TrueTime clock.

(2) the problematic behavior of the Datum clock caused frequent stops/restarts of the Seismic handler program on the Sun logging computer resulting in missed shots and shots without times put in the headers.

Lamont Gravity Tie Report

R/V Ewing gravity meters:
Bell Aerospace BGM-3 marine gravity meter
bias = 852680.0;
scale = 5.0940744;

Port: Balboa, Panama

Date: 21,26,27 March 1995

Operator: Joe Stennett

Reference Station: The gravity tie used the Wollard and Rose reference in Cristobal. A reading with the Lacoste and Romberg was done there on March 21st. The pier value was established by a LaCoste and Romberg reading on March 26th. The height adjustment and BGM value was established on March 27th.

Pier/Ship's position:
Balboa Harbor, Pier #

Position with differential GPS
08 57.278 N 079 33.975 W

Portable gravity meter:
LaCoste & Romberg model G-237
Temperature of meter: 49 C

Readings and calculations:

Date	Time	Location	L-R Reading
21Mar95	1130L	Ref	1934.01
26Mar95	xxxx	Pier	1919.25

Lacoste difference in LR units:
delta_LR = pier_LR - ref_LR
delta_LR = 1919.25 - 1934.01
delta_LR = -14.76

Difference in mgal:
note: 1 LR unit = 1.06 mGals
delta_mgal = delta_LR * constant
delta_mgal = -14.76 * 1.06
delta_mgal = -15.65
delta_mgal = -15.7

Pier gravity value:
pier_grv_val = ref_val + delta_mgal
pier_grv_val = 978253.6 + (-15.7)
pier_grv_val = 978237.9

Height correction:
On March 27, 1995 (day 086) at 1323 Z
Difference between pier and gravity lab = 10.0 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 = 10.0 m * 0.31 mGal/m

```
        hgt_corr = 3.10 mGal

Gravity at BGM level:
        grv_at_BGM_level =  pier_grv_val + hgt_corr
        grv_at_BGM_level =  978237.9 + 3.1
        grv_at_BGM_level =  978241.0

BGM-3 reading:
        On March 27, 1995 (day 086) at 1323 Z
        BGM_grv_val = 978256.0 mgal

BGM-3 Mistie:
        BGM_mistie = BGM_grv_val - grv_at_BGM_level
        BGM_mistie = 978256.0 - 978241.0
        BGM_mistie = 15.0 mgal

BGM-3 DC shift:
        BGM_dc_shift = 15.0 mgal
```

085 - Mar 26
086 - Mar 27 Depart Balboa, Panama; Gravity tie Ht:10m at 1323Z
087 - Mar 28
088 - Mar 29
089 - Mar 30 start shooting
090 - Mar 31
091 - Apr 01
092 - Apr 02
093 - Apr 03
094 - Apr 04
095 - Apr 05
096 - Apr 06
097 - Apr 07
098 - Apr 08
099 - Apr 09
100 - Apr 10
101 - Apr 11
102 - Apr 12
103 - Apr 13
104 - Apr 14
105 - Apr 15
106 - Apr 16
107 - Apr 17
108 - Apr 18
109 - Apr 19
110 - Apr 20 end shooting
111 - Apr 21 arrive Caldera 1200Z
112 - Apr 22
113 - Apr 23
114 - Apr 24
115 - Apr 25
116 - Apr 26
117 - Apr 27 Arrive Manzanillo

134 - May 14 Gravity Tie San Diego CA

CRUISE GRAVITY TIE-IN:

Port: San Diego, CA, U.S.A.
Date: May 14, 1995 (JD 134)
Operator: Bruce Francis
Reference Station:
Relative Station "DN9" made to an absolute benchmark at Elliot Field (20 miles away)
Date: 16 June 1989
Position: N 32 42.003' W 117 09.624'
Gravity value: 979512.231 mGals
Station is located at San Diego 10'th Ave. Pier, across from berth 3 warehouse loading dock door # 9, at a large cleat on the berm of the pier.

Pier/Ship's position: from the Gravity Tie Report:
R/V Ewing was docked at San Diego 10'th Ave. Pier, across from 10'th Ave terminal building. The tie point was taken 4'th bollard from the end of the pier.

Gravity meter: L & R Model G s/n: 237
Temperature of meter: 49 C.

TIME	LOCATION	L&R READING	G	Potsdam Corr?
0600Z	Pier	3136.22+- .05		
0605Z	Ref	3135.88+- .05	979512.23	corrected

READ FROM DEVICES BY DATA LOGGING COMPUTER:
0600Z BGM filtered mgals: 979545.70

"C" deck was 0.3 m ABOVE pier.
"C" deck is 5.5 m. above gravity meter.
Difference between pier and gravity lab: 5.5 - .3 = 5.2m

GRAVITY AT SENSOR CALCULATION: Lacoste difference in LR units:

```
delta_LR = pier_LR - ref_LR
0.34     = 3136.22 - 3135.88
```

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

```
delta_mgal = delta_LR * constant
0.36       = 0.34     *   1.06
```

Pier gravity value in mgal: ref_val = G (+ 13.6 if Potsdam Corrected)

```
pier_grv_val = ref_val    + delta_mgal
979526.19    = 979512.23 + 0.36  + 13.6
```

Height correction in mgal: (constant is + if meter is below pier)

```
hgt_corr = hgt * constant
1.61 mGal =  5.2 m * 0.31 mGal/m
```

Gravity at gravity meter level in mgal:

```
grv_at_meter_level =  pier_grv_val + hgt_corr
     979527.80     =    979526.19  + 1.61
```

DRIFT CALCULATION:

BELL GRAVIMETER:

The count was filtered with a 60 filter width, run thru filter1d -FG480, and s_bgm

Mistie in mgal:

```
mistie = BGM_filt_grv - grv_at_meter_level
```

17.90 = 979545.70 - 979527.80

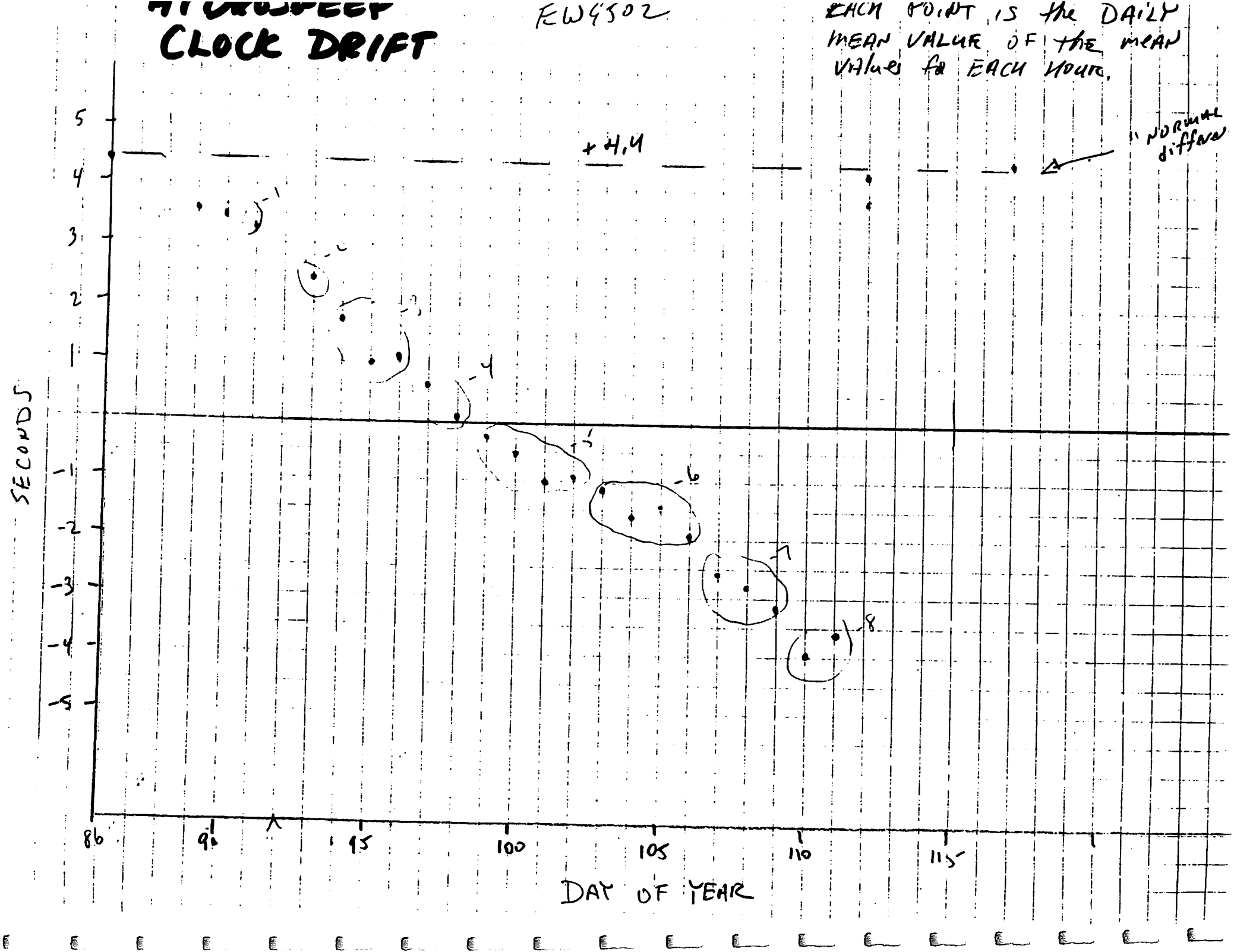
Drift in mgal since last tie:
prev_mistie: 15.0 mgal on date 27 March, 1995 (JD 086)
drift = mistie - prev_mistie
2.90 = 17.90 - 15.0

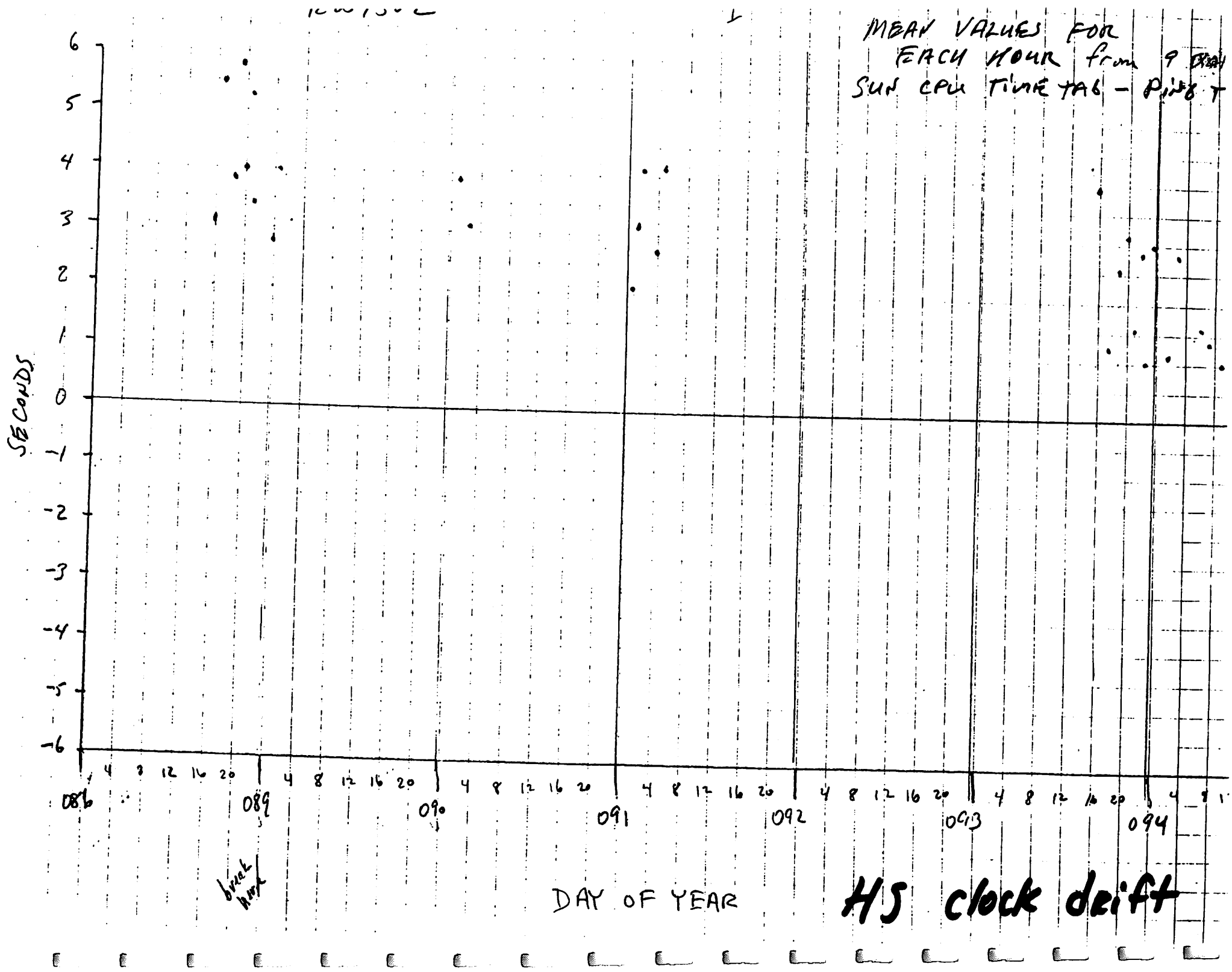
drift/day = 2.90/(134-86)
= 0.06042 mGals/day

CLOCK DRIFT

FEW4502

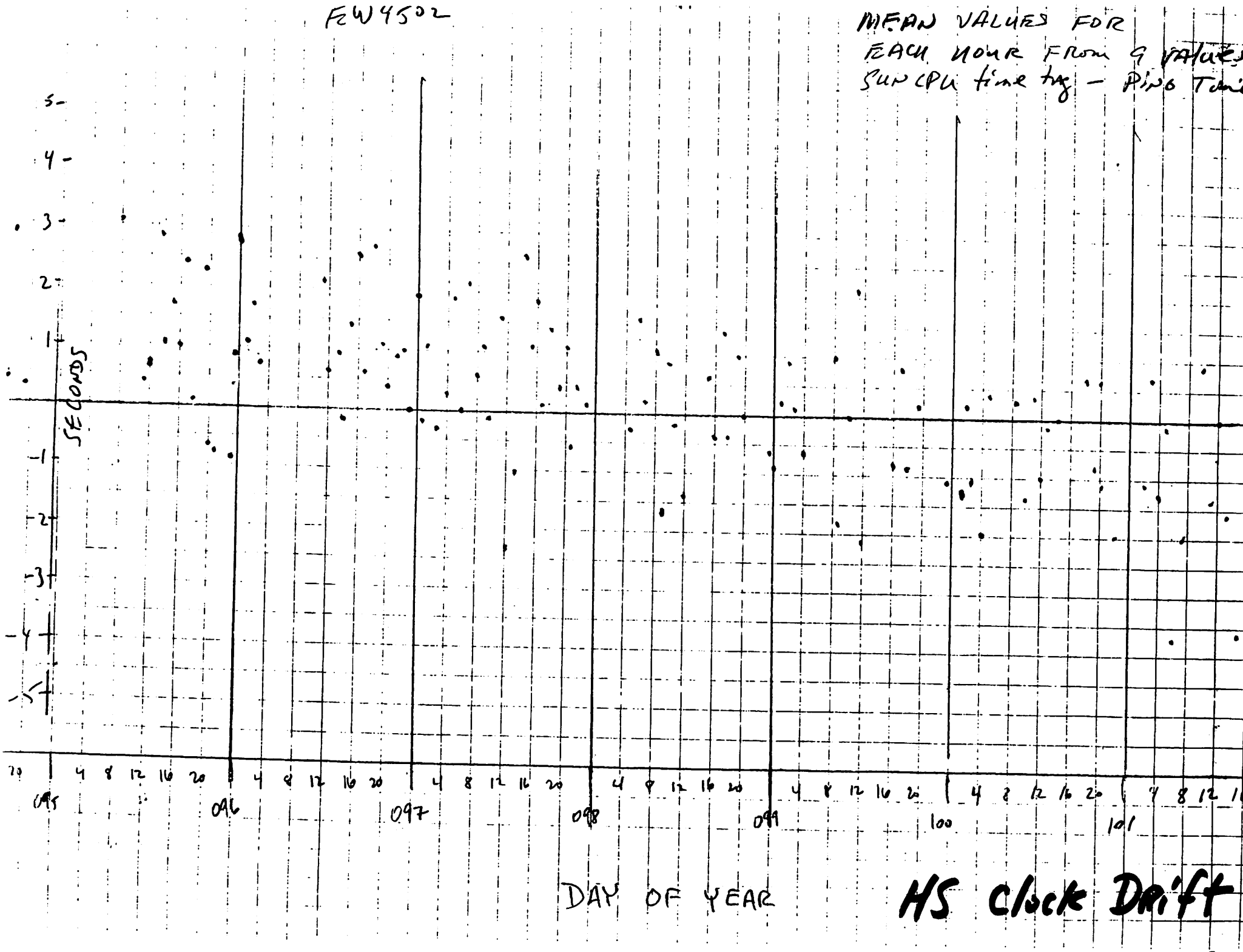
EACH POINT IS the DAILY MEAN VALUE OF THE MEAN VALUES for EACH HOUR.



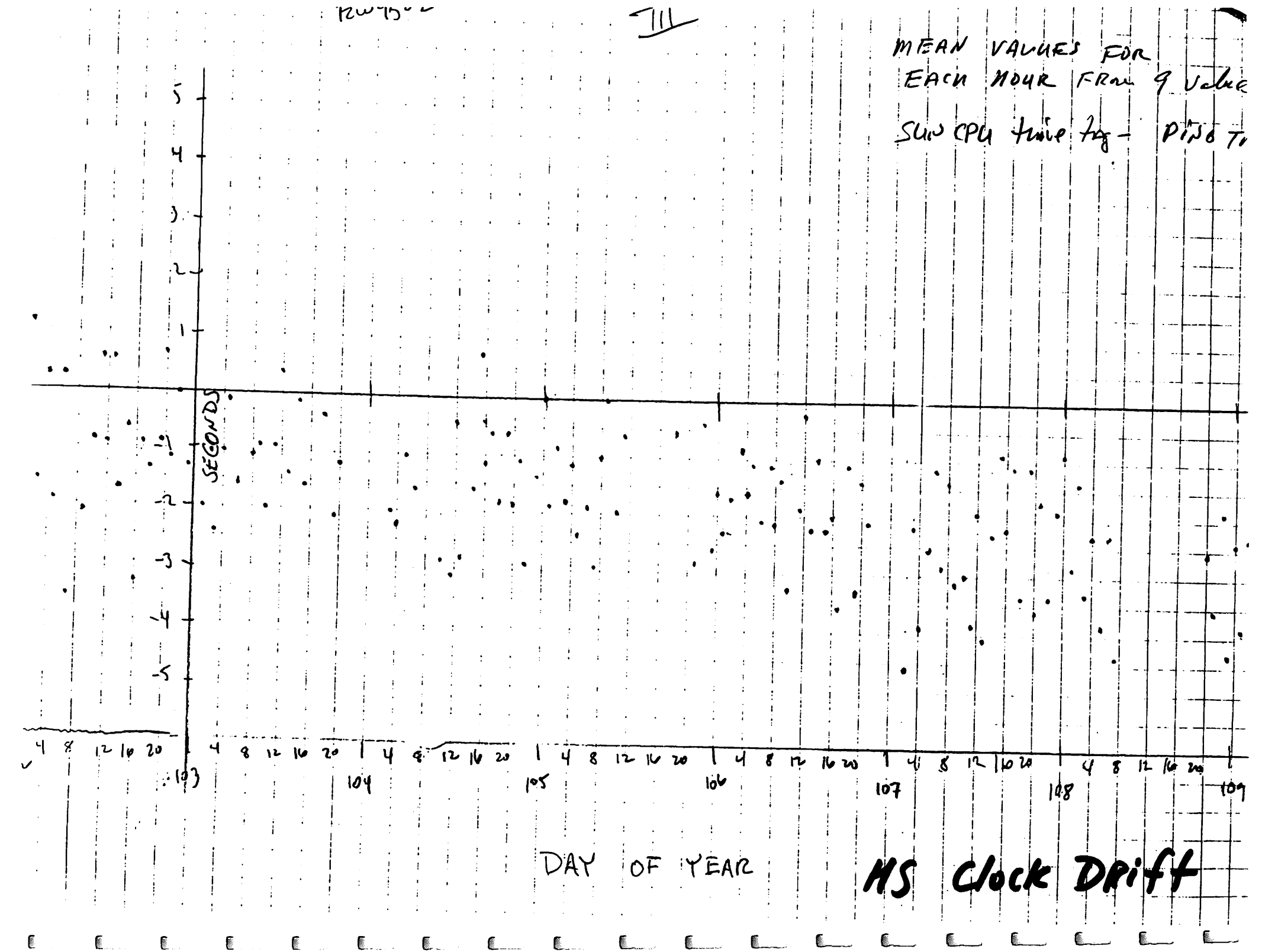

MEAN VALUES FOR
EACH HOUR from 9
SUN CPU TIME TAG - P
SECONDS
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
4 8 12 16 20
086
089
090
091
092
093
094
DAY OF YEAR
HS clock drift

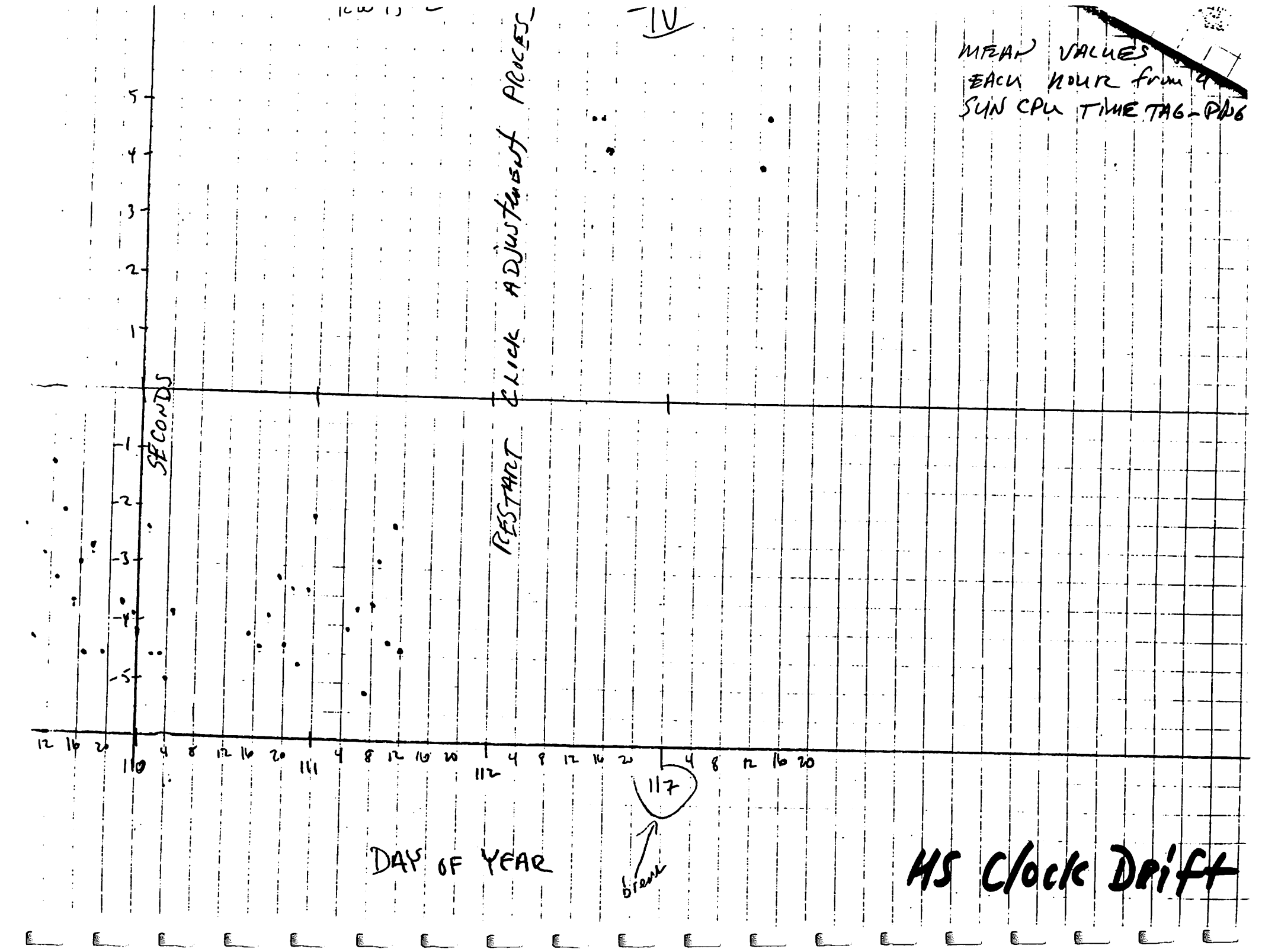
FEW4502

MEAN VALUES FOR EACH HOUR FROM 9 VALUES SUN CPU time tag – Ping Time



HS Clock Drift


MEAN VALUES FOR
EACH HOUR FROM 9 Value
SUN CPU time tag - PING T
SECONDS
5
4
3
2
1
-1
-2
-3
-4
-5
4 8 12 16 20
103
104
105
106
107
108
109
DAY OF YEAR
HS Clock Drift


IV
MEAN VALUES
EACH HOUR from 4
SUN CPU TIME TAG - PDB
CLOCK ADJUSTMENT PROCESS
RESTART
SECONDS
5
4
3
2
1
-1
-2
-3
-4
-5
12 16 20 110 4 8 12 16 20 111 4 8 12 16 20 112 4 8 12 16 20 117 4 8 12 16 20
DAY OF YEAR
Drew
HS Clock Drift

EW9502.README

Files:

Daily files:

The logged and reduced data are organized as sets of daily files.
A filename is composed of 3 parts:

(1) cruise id "ew9502" or NULL
(2) data id "gp3.r"
(3) dayofyear "103"

example:

gp3.r103

Note: The cruise id is NULL for the data files for ew9502.

".Z" files: files that end with a ".Z" have been compressed with the UNIX "compress" command. Use the "uncompress" command to make them readable

Directories:

LOGGER - contains the data files logged during the cruise with some minor editing or cleaning. These are referred to as the ".d" files.

SCCS - the directory holds the reduced files in the "sccs" format. The Source Code Control System (SCCS) that is used for program source files is also used for maintaining the data files. The SCCS facility serves as a backup and history mechanism for the data reduction process. Most files in SCCS are compressed, use the uncompress command and then issue the sccs command

```
sccs get filename
```

to get a copy of the file.

REPORT - cruise report files and PostScript plot files

XBT - data from xbt taken during the leg

shells - shell scripts that drive the data reduction

tmp - a temporary working directory

Time tagging:

During the logging process each record is tagged with the CPU's time. This tag usually appears at the beginning of the record as

yy+ddd:hh:mm:ss:mmm

where "yy" is the year, "ddd" is the day of year, "hh" is the hour, "mm" is the minute, "ss" is the second and "mmm" is the millisecond of the CPU time.

There are some variations in the positioning of these times as noted below in the Hydrosweep, gun depths and nav block (seismic) data.

One of the processes on the logging computer logs the GPS TrueTime clock once a minute and continuously sets the CPU clock to UTC time from the TrueTime clock.

The following data sets use this CPU time tag as their "offical" time: Furuno, BGM-3 gravity, sea temperature, meterological data.

The logged GPS data are also time tagged with this CPU stamp but all navigation derived from GPS uses the GPS position times.

Flag field:

The third column is used as a flag field to indicate a bad or rejected record.

"+" = initial field
"-" = rejected record

GPS MX-4200 (gp):
---

gp3 = GPS MX-4200D "3"
gp4 = GPS MX-4200D "4"

gp3.d - logged data (multiple records)

```
   93+258:00:22:12.282 $PMVXG,000,NAV,9,6,0000,0*02
   yy day  cpu_time              status

   93+258:00:22:20.834 $PMVXG,001,002220,1832.421,S,03837.602,W,00026.1,2*4E
   yy day  cpu_time              time      lat         lon

   93+258:00:22:21.066 $PMVXG,011,233.5,012.3,,,,,,,,*4F
   yy day   cpu_time             course speed

   93+258:00:22:21.467 $PMVXG,022,260539.67,00.8,00.8,00.0,20,17,03,16,25,23*74
   yy day   cpu_time             fix time  EDOP NDOP VDOP PRN 1-6
```

gp3.r - gps 4200 after cleaning

   same as gp3.d

gp3.i - interpolated positions at 00,30 sec of each minute

```
   yy+ddd:hh:mm:ss.mmm N 12 12.1234 W 123 12.1234  gp3
   yy day   time          lat        lon           id
```

gp3.s - smoothed postions at 00,30 sec of each minute

```
   yy+ddd:hh:mm:ss.mmm N 12 12.1234 W 123 12.1234  gp3
   yy day   time          lat        lon           id
```

GPS Trimble NT200D (gp1):
---

gp1.d - logged data (multiple records)

GPS Position:

95+102:00:00:47.018 $GPGGA,000047,0929.387,N,08503.621,W,1,6,001,00030,M,-00002
,M,,

yy day cpu_time position rec

GPS Position:
$GPGGA,XXXXXX,XXXX.XXX,N,XXXXX.XXX,W,X,X,XXX,uXX,M,uXX,M,XXXX,XXXX

Data Field:	Description
1	UTC of Position Fix
2	Latitude in Degrees, Minutes, and Decimal Minutes
3	N=North, S=South Latitude
4	Longitude in Degrees, Minutes, and Decimal Minutes
5	E=East, W=West Longitude
6	GPS Quality: 0=GPS Unavailable, 1=GPS Fix, 2=DGPS Fix
7	Number of satellites used
8	Horizontal Dilution of Precision (HDOP)
9,10	Antenna height in meters (u=+/-)
11,12	Geoidal height in meters (u=+/-)
13	Age of differential GPS data
14	DGPS reference station ID

NOTE: During Differential mode, it outputs the lat and lon with 4 decimal digits accuracy in the minutes. But, when it is running on a non-differential mode, it drops down to three decimal digits. Something to take into account when writing program for it.

Actual Track and Ground Speed:

95+102:00:00:47.053 $GPVTG,229,T,226,M,005.3,N,009.9,K
yy day cpu_time actual track and ground speed rec

Actual Track and Ground Speed:
$GPVTG,XXX,T,XXX,M,XXX.X,N,XXX.X,K

Data Field:	Description
1,2	COG; True
3,4	COG; Magnetic
5,6	SOG; Knots
7,8	SOG; Kilometer/hour

Heading and water speed: (this is an input from Furuno)

95+102:00:00:47.035 $GPVHW,249,T,246,M,05.30,N,09.82,K
yy day cpu_time heading and wayer speed rec

Heading and water speed:
$GPVTG,XXX,T,XXX,M,XXX.X,N,XXX.X,K

Data Field:	Description
1,2	Heading; True
3,4	heading; Magnetic
5,6	Speed; Knots
7,8	Speed; Kilometer/hour

Trimble Sample:

```
95+102:00:00:47.018 $GPGGA,000047,0929.387,N,08503.621,W,1,6,001,00030,M,-00002
,M,,
95+102:00:00:47.035 $GPVHW,249,T,246,M,05.30,N,09.82,K
95+102:00:00:47.053 $GPVTG,229,T,226,M,005.3,N,009.9,K
95+102:00:00:56.969 $GPGGA,000056,0929.376,N,08503.626,W,1,6,001,00062,M,-00002
,M,,
95+102:00:00:56.988 $GPVHW,252,T,249,M,05.20,N,09.63,K
95+102:00:00:57.114 $GPVTG,230,T,227,M,005.3,N,009.9,K
95+102:00:01:06.981 $GPGGA,000106,0929.366,N,08503.630,W,1,6,001,00103,M,-00002
,M,,
95+102:00:01:06.999 $GPVHW,254,T,251,M,05.60,N,10.37,K
95+102:00:01:07.018 $GPVTG,231,T,228,M,005.3,N,009.8,K
```

gp1.r - Trimble GPS after cleaning

same as gp1.d

Furuno Speed and Heading (fu):

fu.d - speed & heading logged data (before cleaning stage)

```
yy+ddd:hh:mm:ss.mmm - 12.1 123.1 123.1
yr day   time      trk spd  hdg  gyro
```

trk: "-" = water track, "+" = bottom track

fu.r - speed & heading data after cleaning stage

same as fu.d

fu.s - smooth speed and heading data

```
yy+ddd:hh:mm:ss.mmm - 12.1 123.1 20
yr day   time      trk spd  hdg  number_pts
                                 in minute
```

Fix File (x):

x. - fix file

```
yy+ddd:hh:mm:ss.mmm N 12 12.1234 W 123 12.1234  id
yy day   time          lat        lon           id_string
```

id strings: "gp3" = GPS

One Minute Navigation (n):

n. - 1 minute navigation from the "x." file and "fu.s" file

```
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
```

id strings: "gp3" = GPS #1
"dr" = Dead Reckoned position corrected for set and drift error

Magnetics (mg):
---

mg.d - total intensity logged data

same as mg.r below

mg.r - total intensity magnetics after cleaning stage

```
yy+ddd:hh:mm:ss.mmm 41200.8
yr day   time       total_intensity
```

mg.m - median total intensity magnetics values at 00 seconds.
(median of values +-30 seconds)

```
yy+ddd:hh:mm:ss.mmm 41200.8
yr day   time       total_intensity
```

mg.n - median values merged with navigation; anomalies 1990 IGRF

```
yy+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
```

Hydrosweep center beam bathymetry (hb):
---

hb.d - center beam logged data

same as hb.r below

hb.r - center beam data after "cleaning" of hb.d file

```
yy+ddd:hh:mm:ss.mmm hh:mm:ss.mmm S 3445
yr day   time        2nd_time  mode depth_in_meters
          ^            ^
          |_ Ping time |_ CPU time tag
```

mode: "S" for survey
note: 2nd time is CPU time tag

hb.i - interpolated center beam depth at 00 sec of each minute

```
yy+ddd:hh:mm:ss.mmm 3445
yr day  ping_time   depth_in_meters
```

hb.n - interpolated center beam merged with navigation

```
yy+ddd:hh:mm:ss:mmm N 12 12.1234 E 123.1234  2222.0
yr day  ping_time      lat         lon       depth_in_meters
```

Gun depths (dg):
---

dg.d - gun depths logged data

same as dg.r below

dg.r - gun depths after cleaning stage

```
yy+ddd:hh:mm:ss.mmm  63  72  74  ...  76  74  61  68  59
yr day  shot_time    gun depths (in meters x 10)
          ^
          | time tag here is the shot time not CPU time tag
```

Shot times (ts1 and ts2):
---

ts1 = Datum clock
ts2 = TrueTime Clock

ts2.d - shot times logged data

same as ts.r below

ts2.r - shot times after cleaning stage

```
yy+ddd:hh:mm:ss.mmm 00:02:30.113 TrueTime
yr day cpu_time     shot_time     clock
```

samples:

```
==> ts1.r098 <==
95+098:00:01:28.643 00:01:28.2666477 Datum S65
yr day cpu_time     shot_time          clock status

==> ts2.r098 <==
95+098:00:01:28.645 00:01:28.266 TrueTime
yr day cpu_time     shot_time     clock
```

BGM-3 Gravity (vt):
---

vc.d - BGM-3 "counts" logged data

same as vc.r below

vc.r - BGM-3 "counts" after "cleaning" of vc.d file

```
yy+ddd:hh:mm:ss.mmm 01:025069 00
yr day     time    int count  status
```

int - count interval; 01 = 1 second

vt.r - mGal gravity values calculated from the counts

```
yy+ddd:hh:mm:ss.mmm 979171.448000
yr day     time     grav
```

vt.s - smooth BGM-3 values at 00 secs of each minute.
(mean of values +-30 secs)

```
yy+ddd:hh:mm:ss.mmm 979171.448000
yr day     time     grav
```

vt.n - "vt.s" merged with nav with EOTVOS correction and FAA
Note: "vt30.n" is merged data using 1930 theoretical formula

```
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    raw_vel   smo_vel
                       shift   N    E     N    E
```

Partial Nav Block data (nb1 and nb2):
---

nb1 = uses Datum clock
nb2 = uses TrueTime Clock

nb2.d - nav block logged data

same as nb.r below

nb2.r - nav block after cleaning stage

```
yy+ddd:hh:mm:ss.mmm 15913 N 53 17.4460 W 166 59.4243 MCS1234c
yr day shot_time    shot #  latitude   longitude     line
```

Note: latitude and longitude are those values at shot time - a calculated realtime position

Samples:

```
==> nb1.r098 <==
95+098:00:01:28.2666477 14222 N 09 27.7300 W 085 05.1187 ex2-1
yr day shot_time        shot_#  latitude   longitude     line

==> nb2.r098 <==
95+098:00:01:28.266 14222 N 09 27.7300 W 085 05.1187 ex2-1
yr day shot_time    shot_#  latitude   longitude     line
```

Shot time/Nav Block data remerged with final nav (ts1.n and ts2.n):
---

ts1.n uses Datum clock
ts2.n uses TrueTime Clock

ts2.n - shot time data merged with post processed navigation

```
94+195:00:02:50.371 15913 N 53 17.4459 W 166 59.4171 MCS1234c
yr day shot_time    shot #  latitude   longitude     line
```

latitude and longitude are from the post processed navigation

Sample:

```
==> ts2.n098 <==
95+098:00:01:28.266 14222 N 09 27.7288 W 085 05.0991 ex2-1
yr day shot_time    shot_#  latitude   longitude     line
```

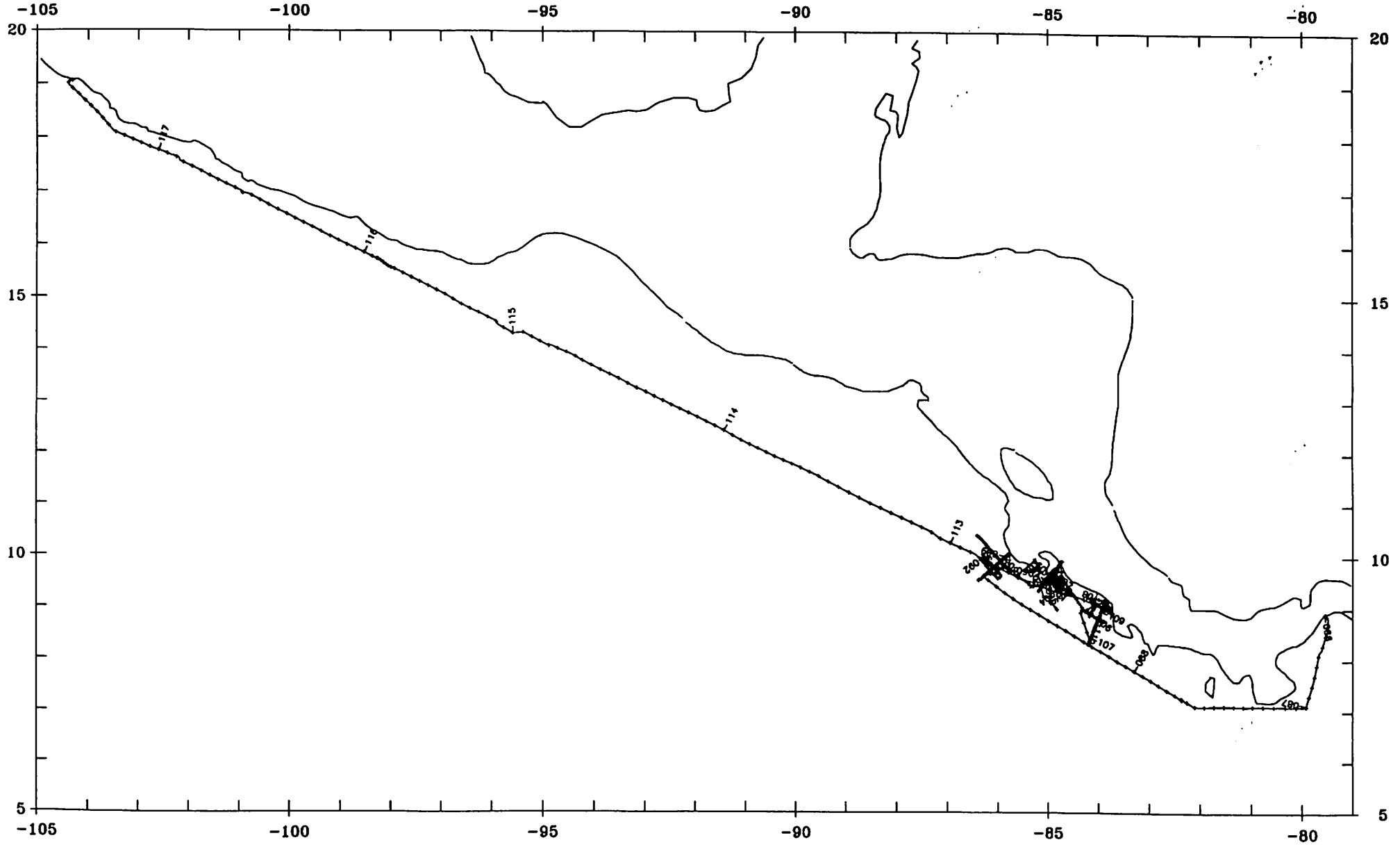
Sea temperature (ct):
---

ct.d - sea temperature logged data

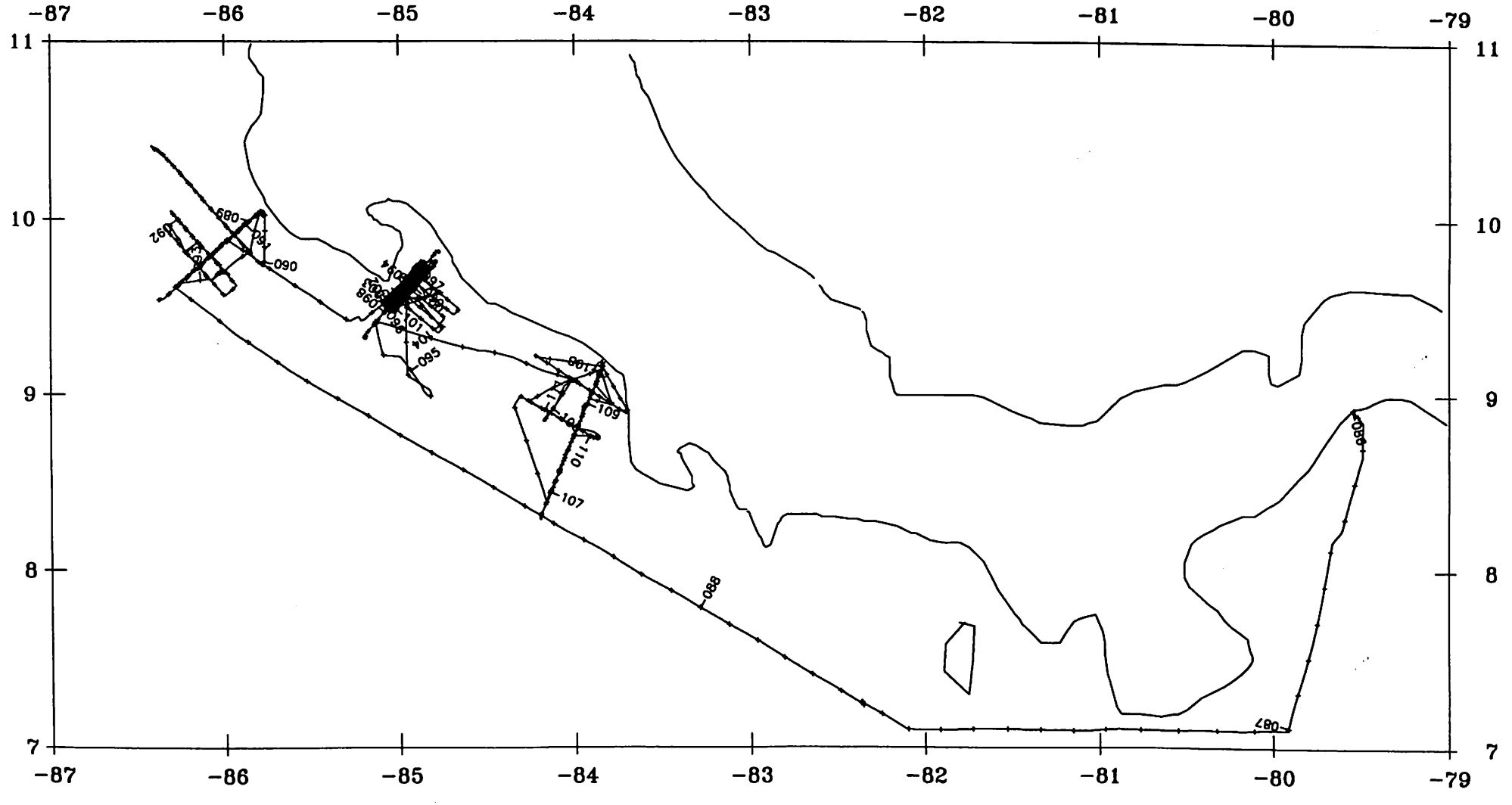
same as ct.r below

ct.r - sea temperature after cleaning stage

```
yy+ddd:hh:mm:ss.mmm 0007.6 00
yr day   time       temp (degrees C)
```



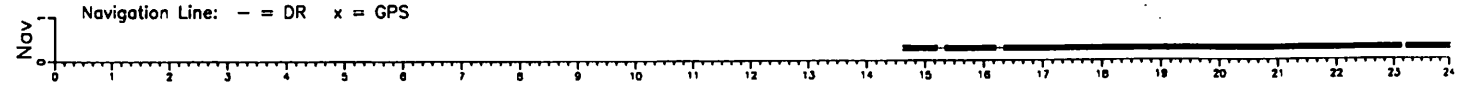
EW9502 March 27 - April 27 1995

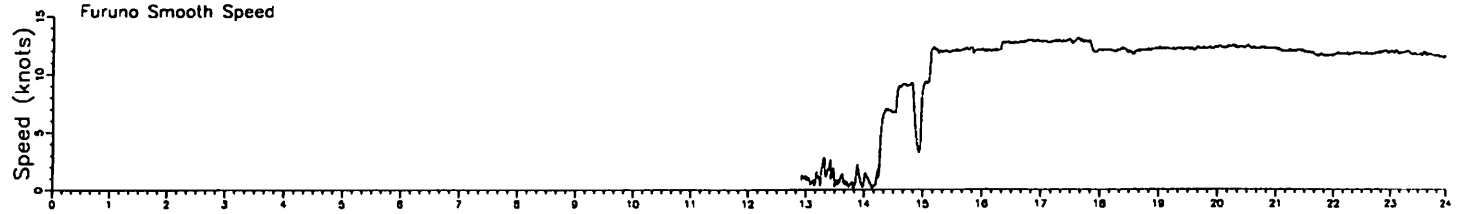


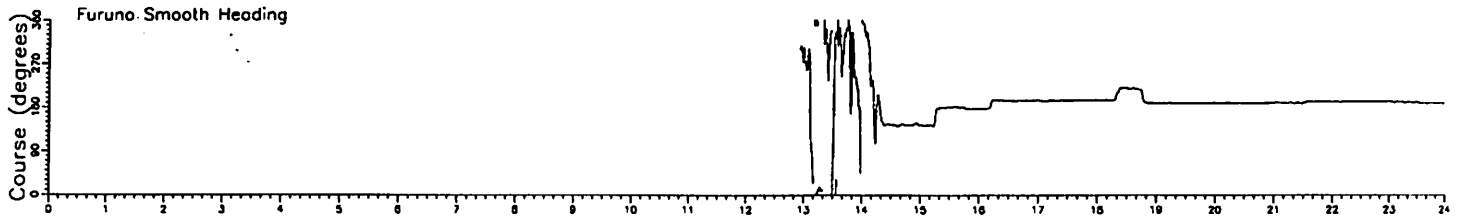
EW9502 March 27 - April 20 1995

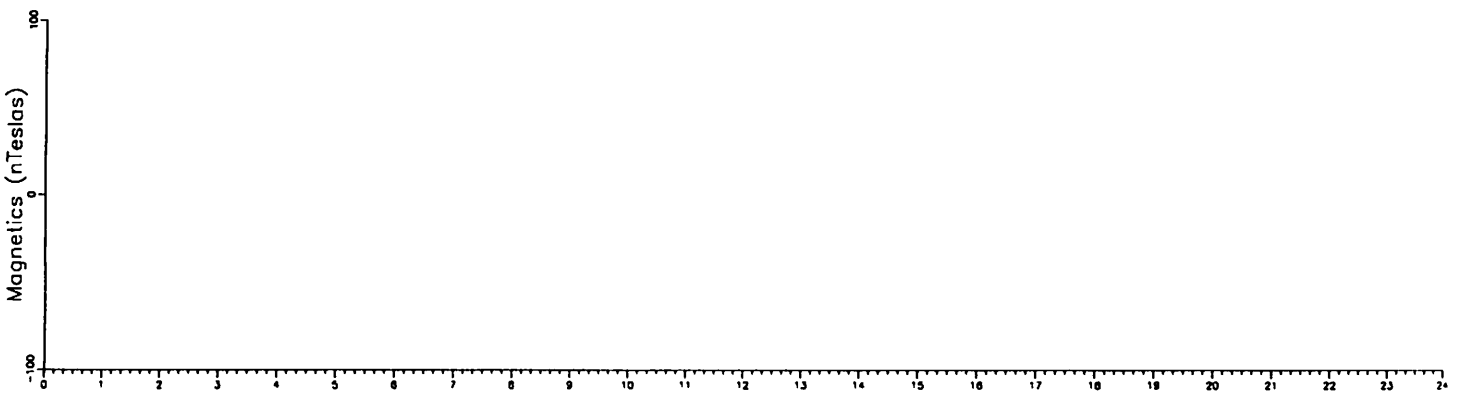
EW9502 Balboa, Panama – Manzanillo, Mexico

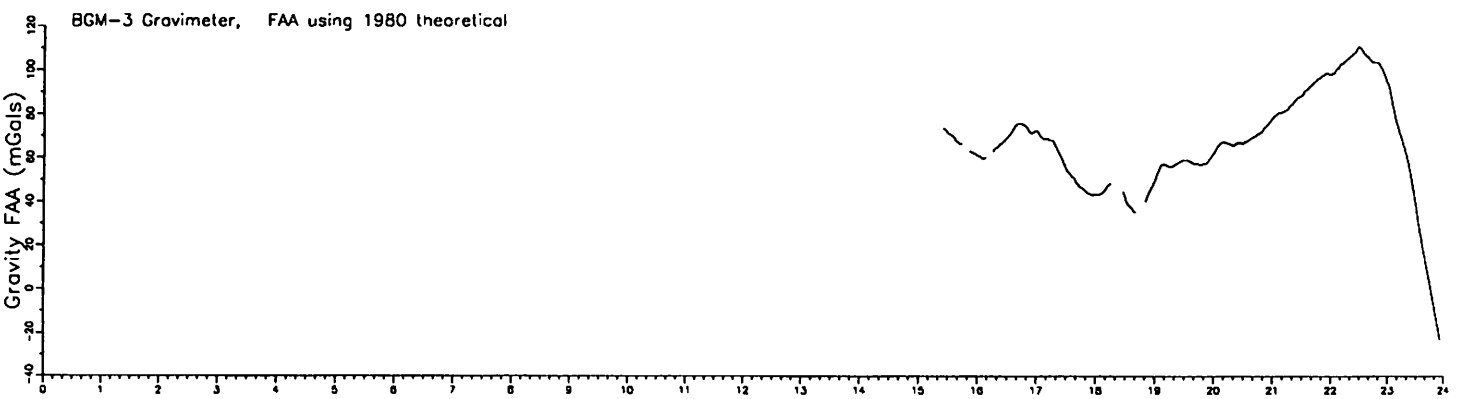
Navigation file: n.086 Speed/Course file: fu.s086 Gravity file: vt.n086. Bathymetry file: hb.n086

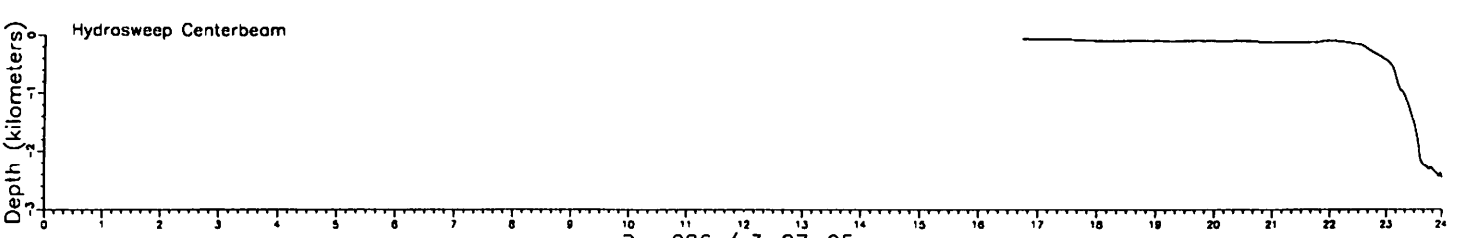








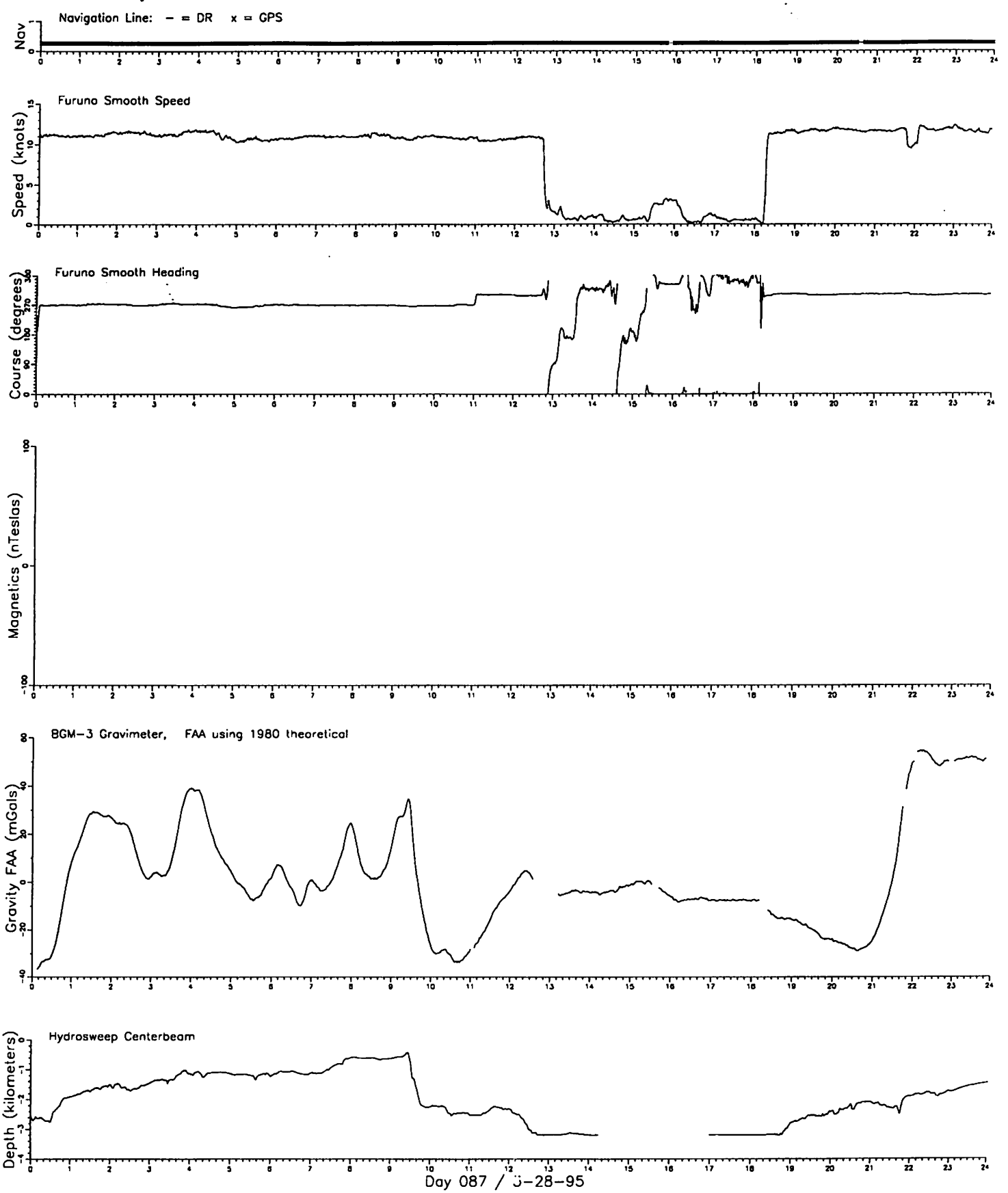




Day 086 / 3-27-95

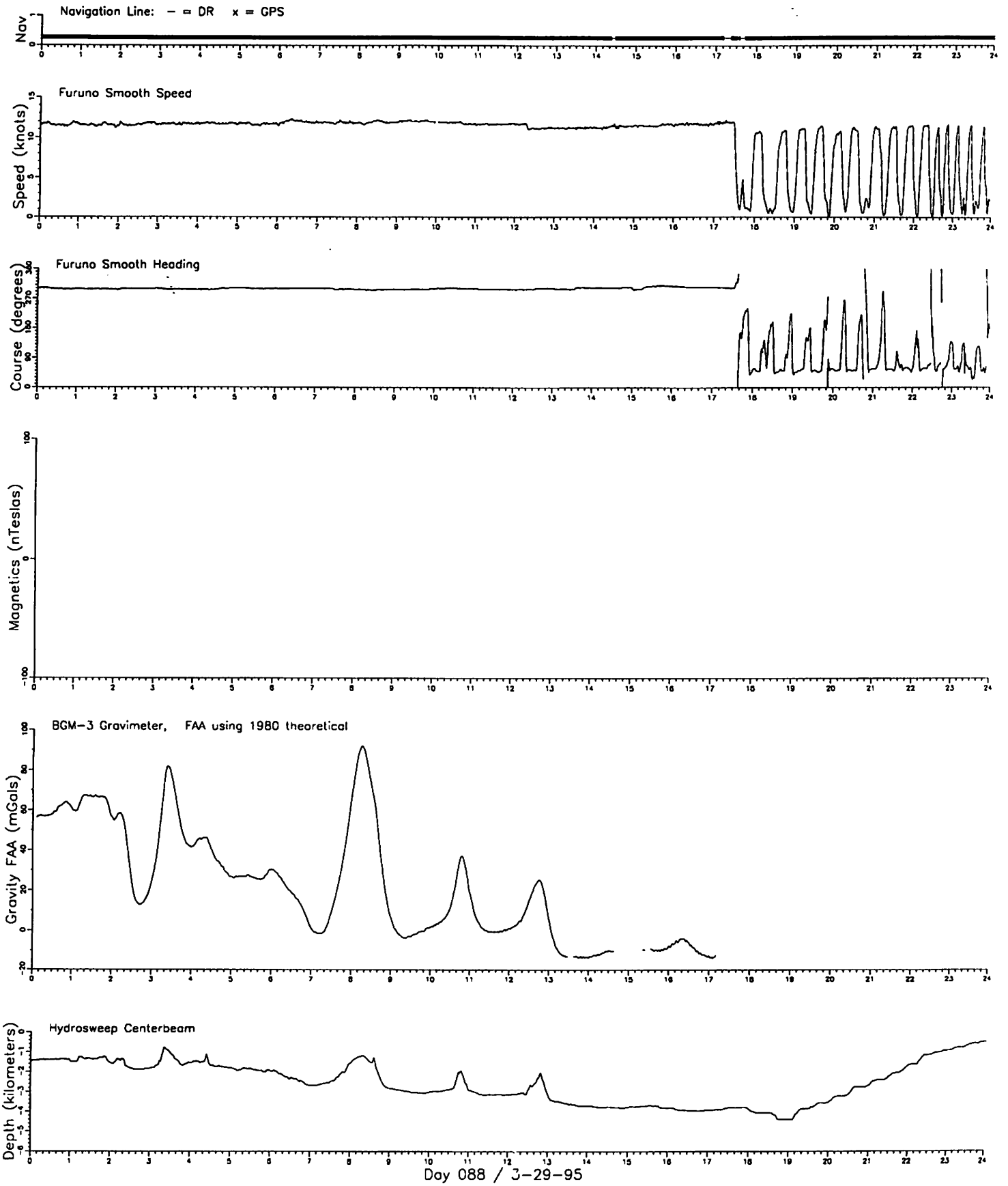
EW9502 Balboa, Panama – Manzanillo, Mexico

Navigation file: n.087 Speed/Course file: fu.s087 Gravity file: vt.n087 Bathymetry file: hb.n087



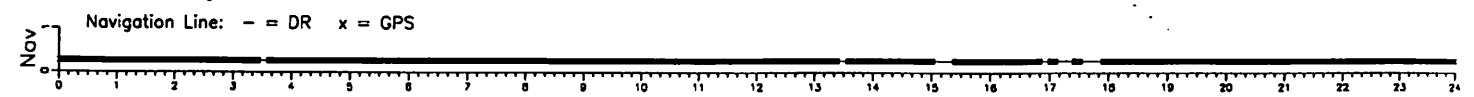
EW9502 Balboa, Panama – Manzanillo, Mexico

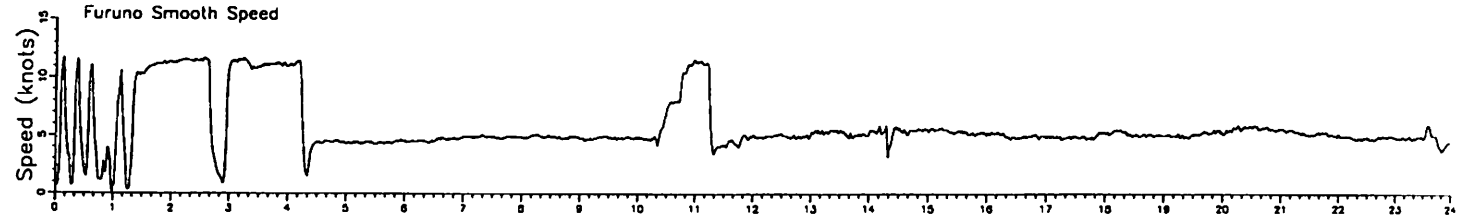
Navigation file: n.088 Speed/Course file: fu.s088 Gravity file: vt.n088 Bathymetry file: hb.n088

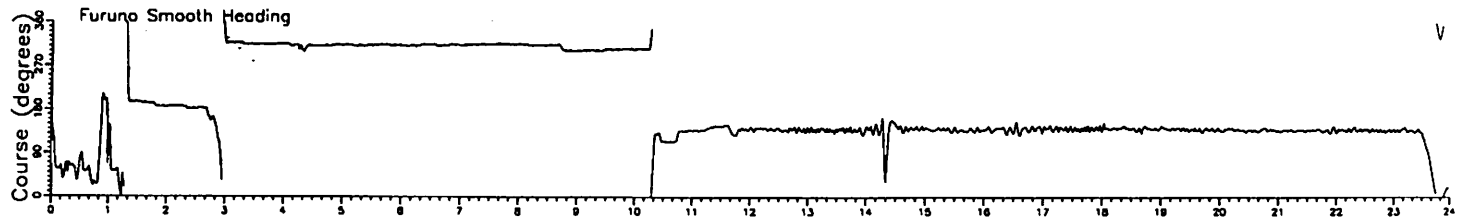


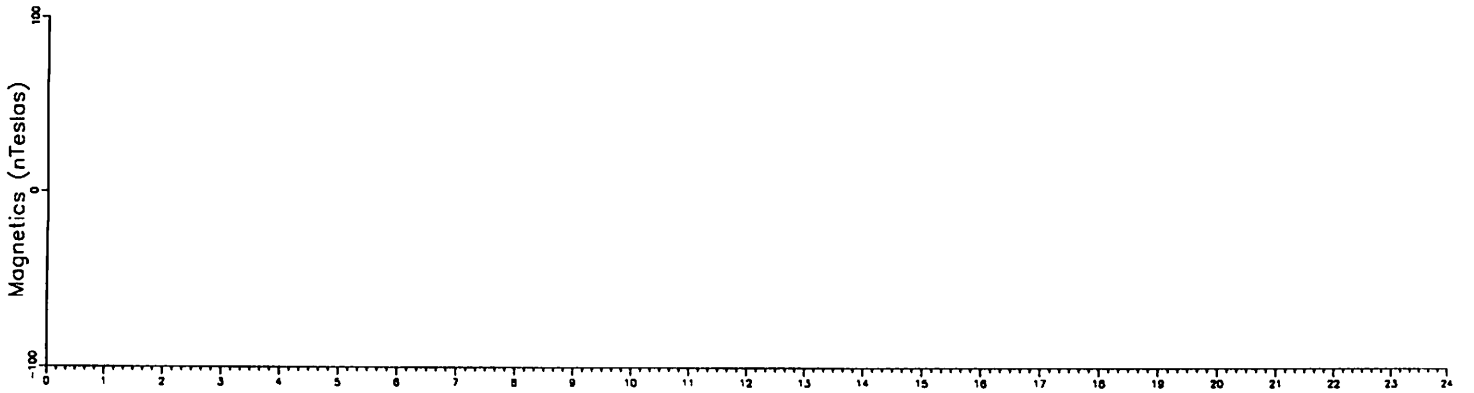
EW9502 Balboa, Panama – Manzanillo, Mexico

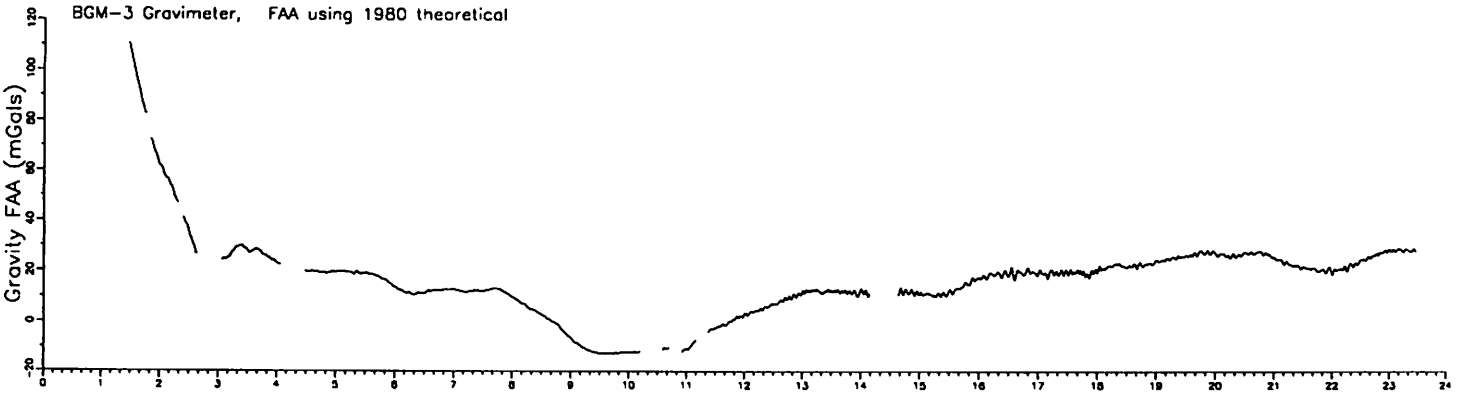
Navigation file: n.089 Speed/Course file: fu.s089 Gravity file: vt.n089. Bathymetry file: hb.n089

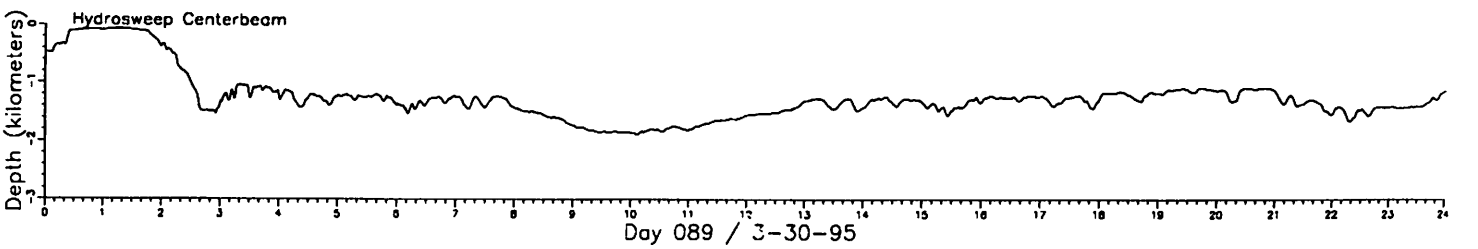








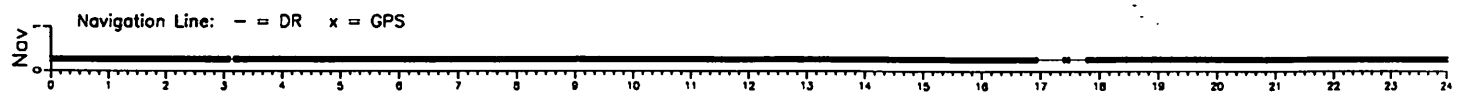


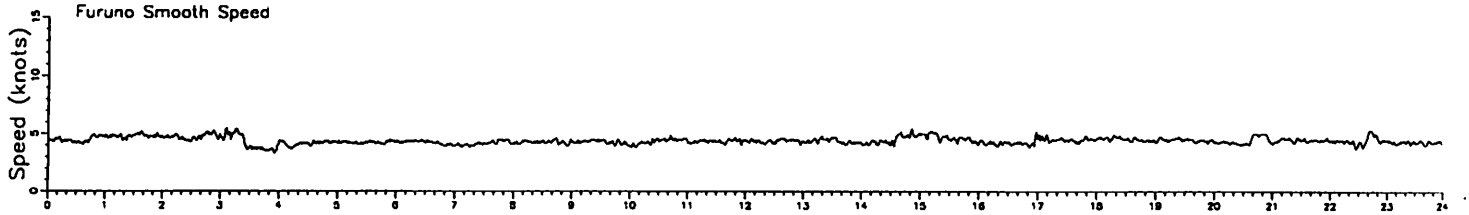


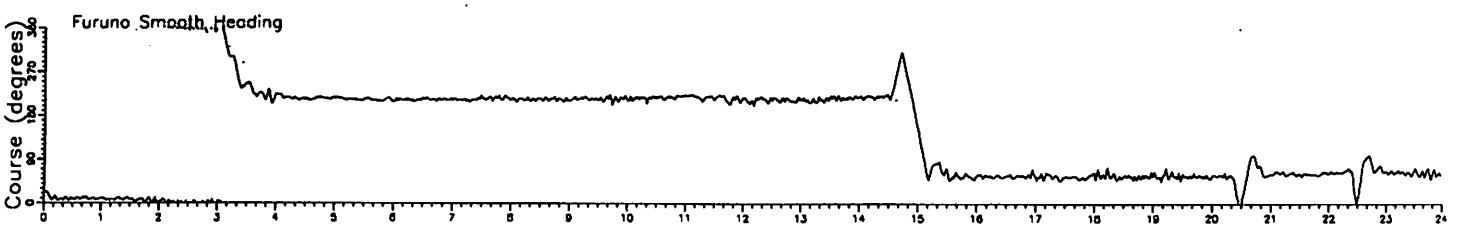
Day 089 / 3–30–95

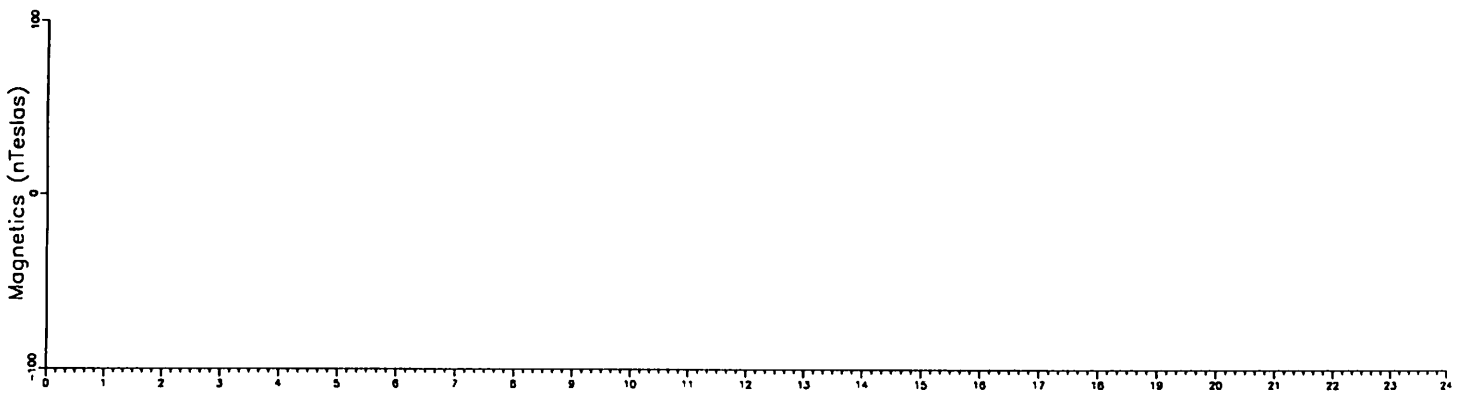
EW9502 Balboa, Panama – Manzanillo, Mexico

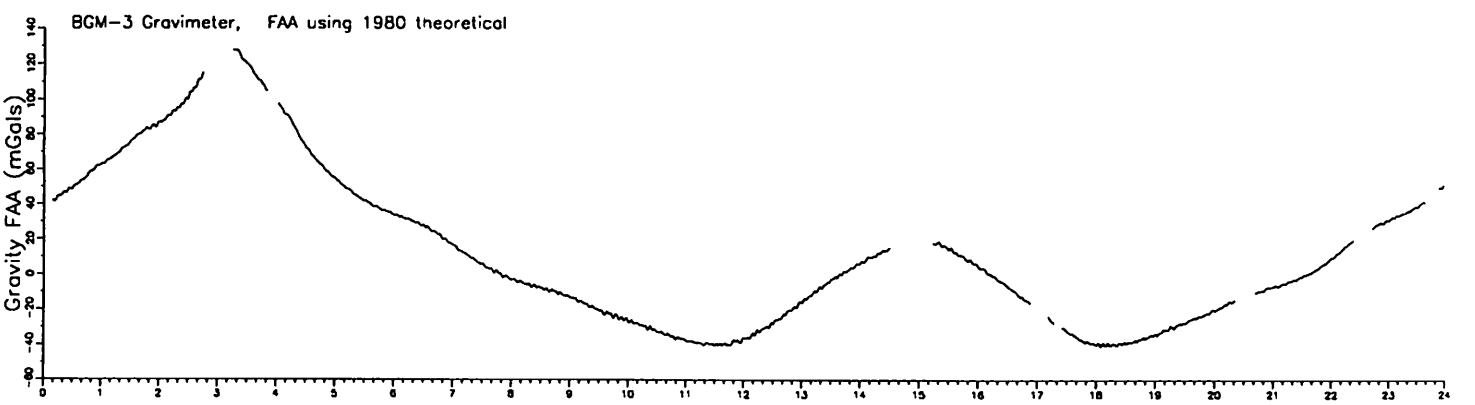
Navigation file: n.090 Speed/Course file: fu.s090 Gravity file: vt.n090. Bathymetry file: hb.n090

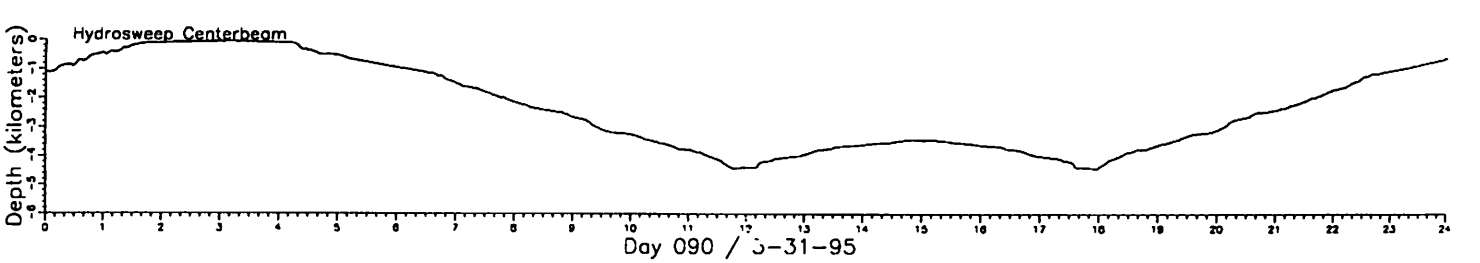








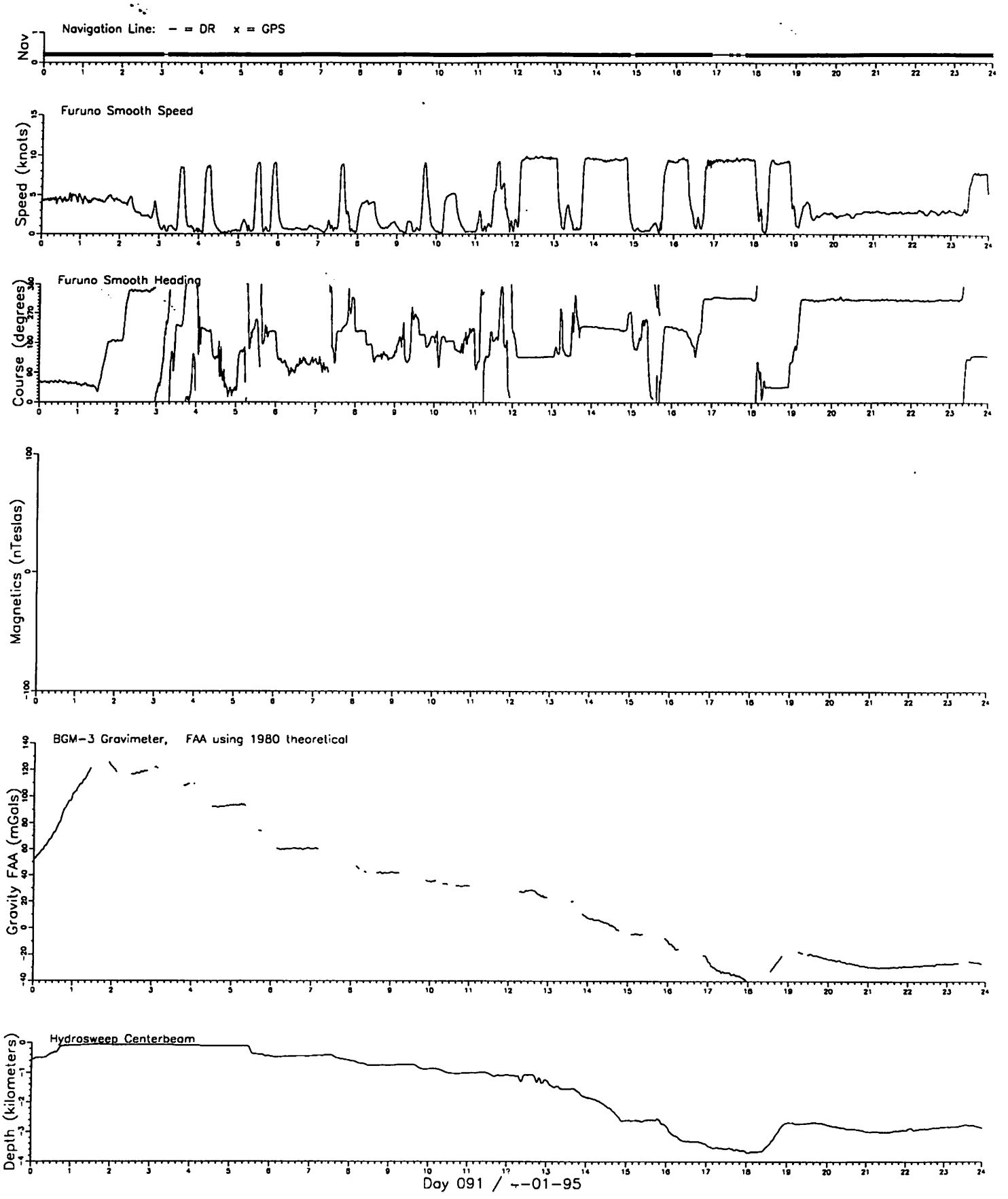




Day 090 / 3-31-95

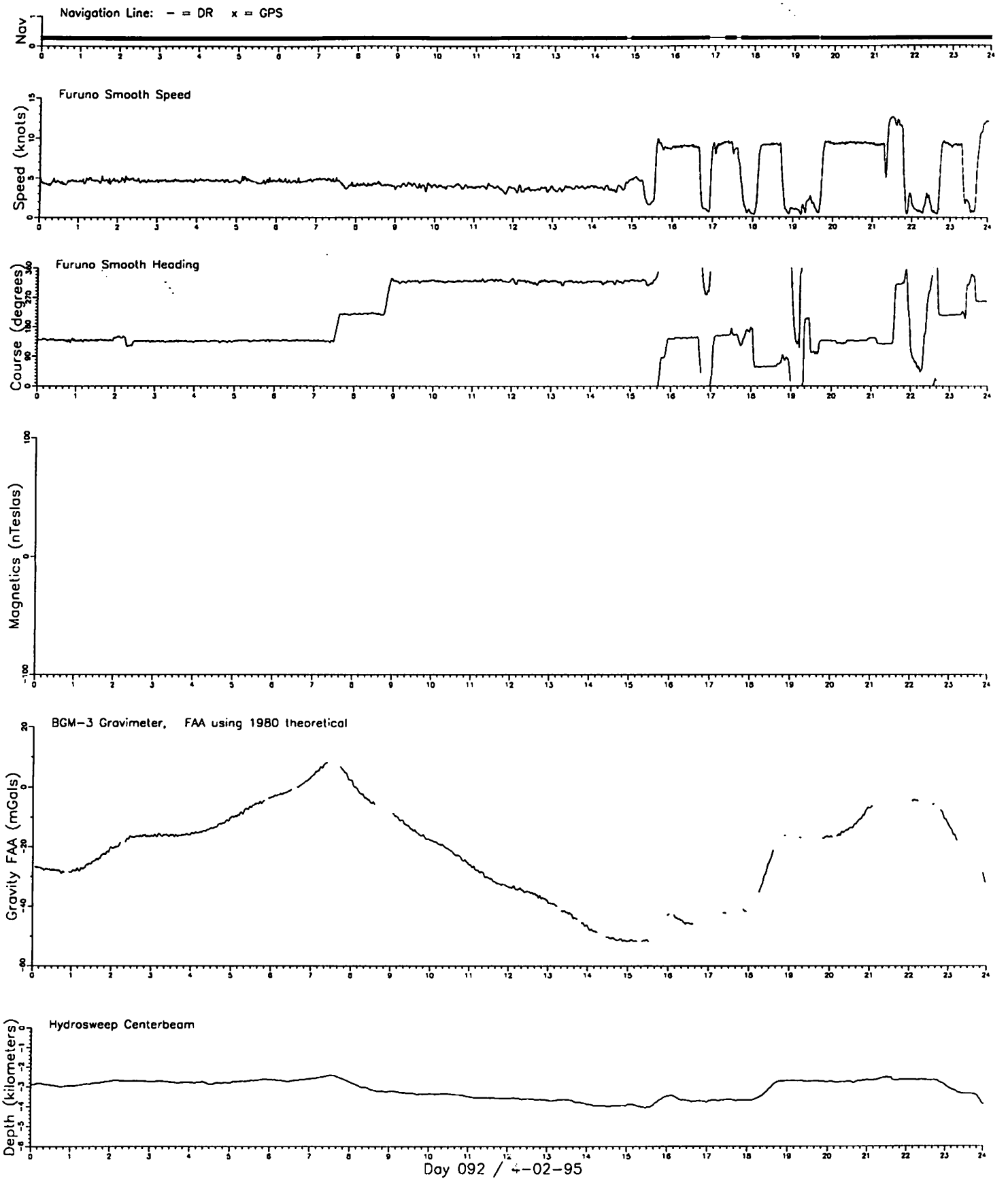
EW9502 Balboa, Panama – Manzanillo, Mexico

Navigation file: n.091 Speed/Course file: fu.s091 Gravity file: vt.n091 Bathymetry file: hb.n091



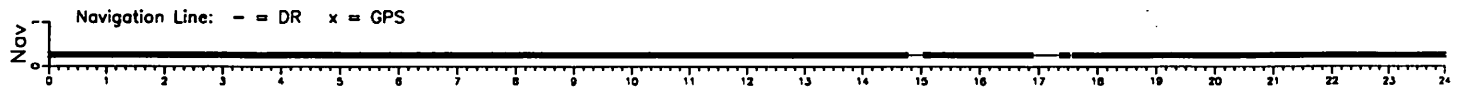
EW9502 Balboa, Panama – Manzanillo, Mexico

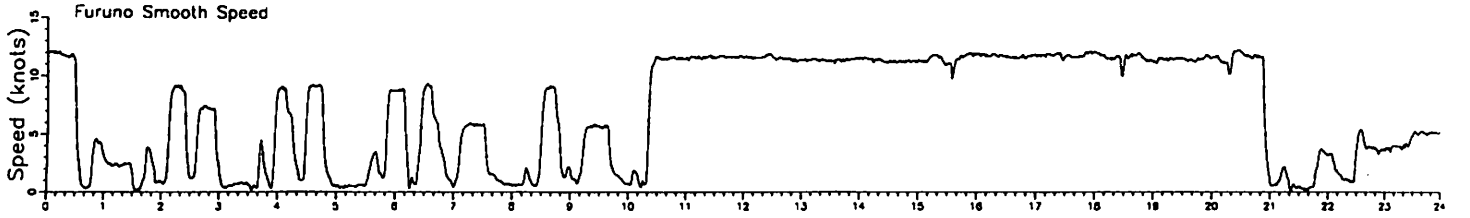
Navigation file: n.092 Speed/Course file: fu.s092 Gravity file: vt.n092 Bathymetry file: hb.n092

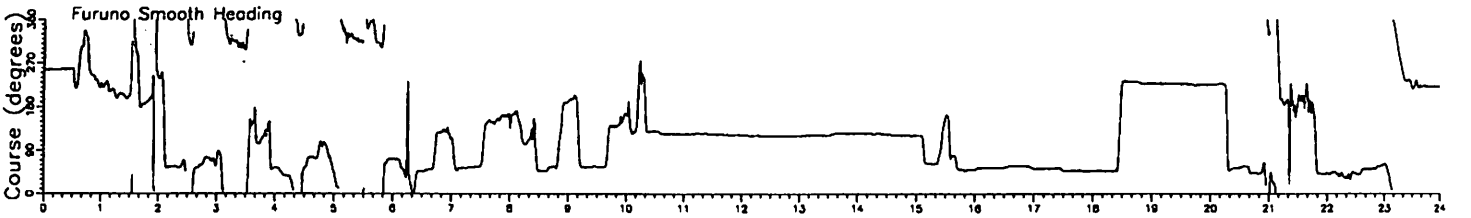


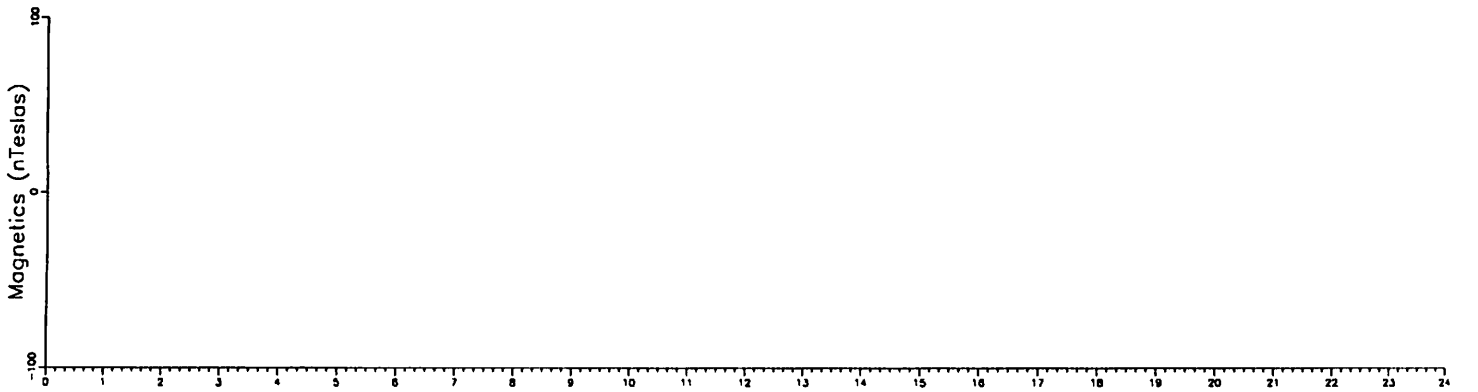
EW9502 Balboa, Panama – Manzanillo, Mexico

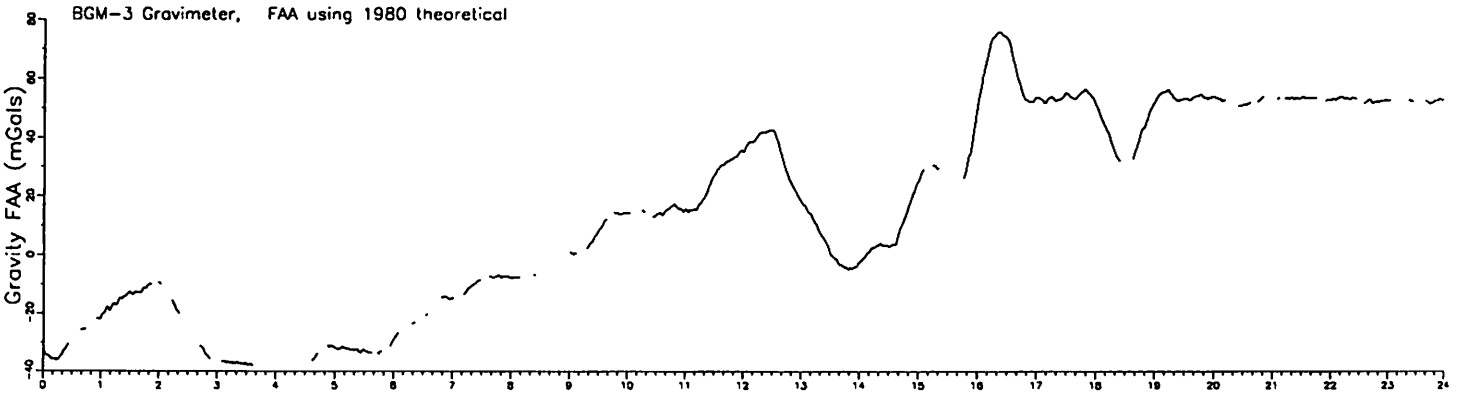
Navigation file: n.093 Speed/Course file: fu.s093 Gravity file: vt.n093 . Bathymetry file: hb.n093

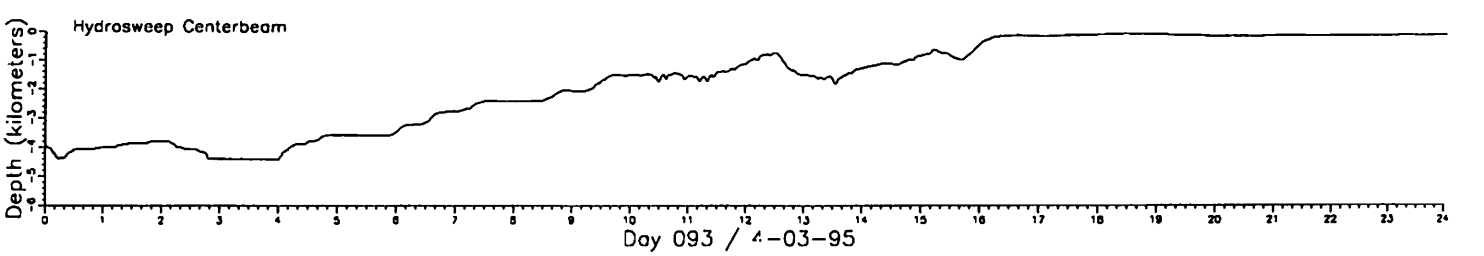






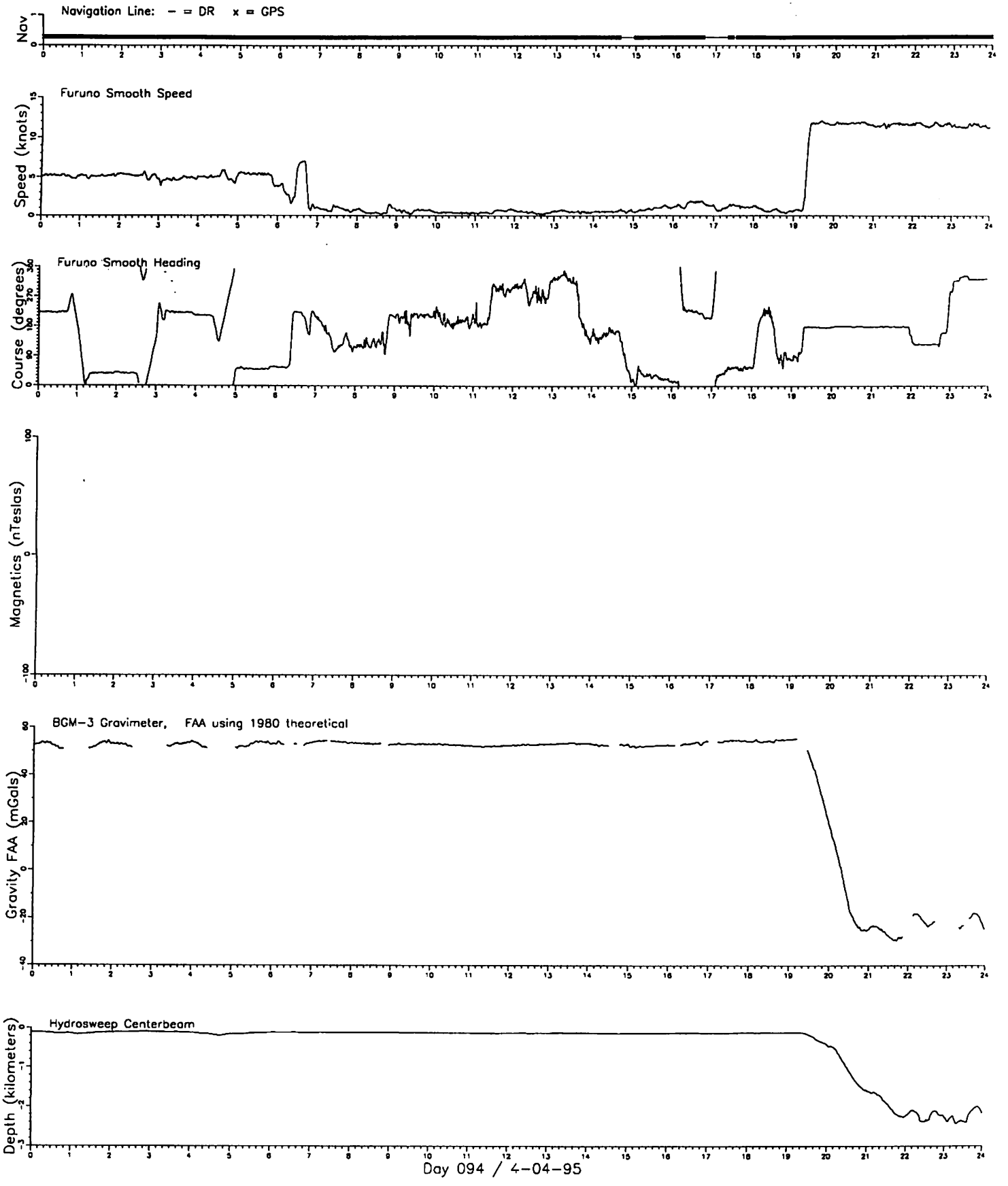






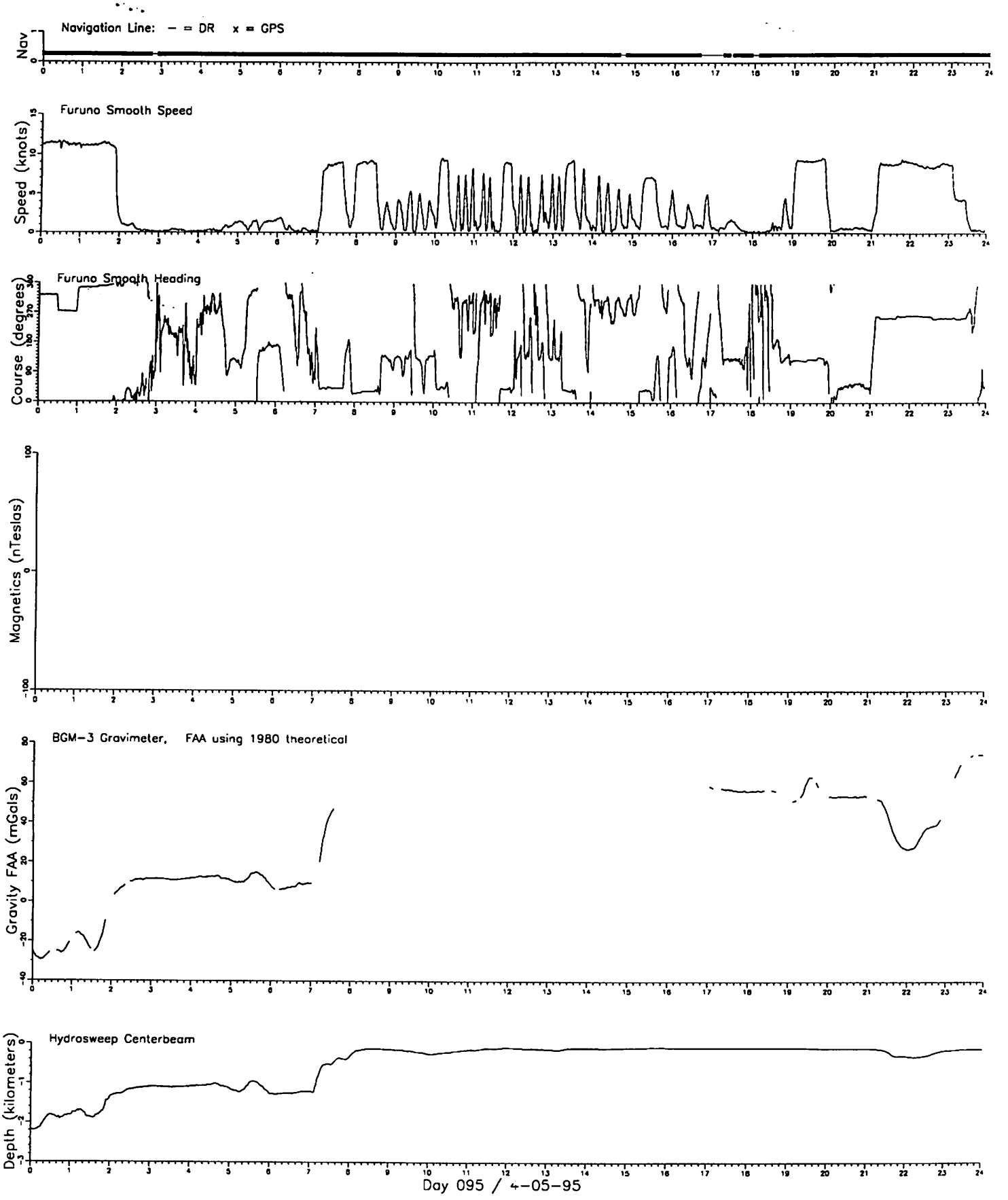
EW9502 Balboa, Panama – Manzanillo, Mexico

Navigation file: n.094 Speed/Course file: fu.s094 Gravity file: vt.n094 Bathymetry file: hb.n094



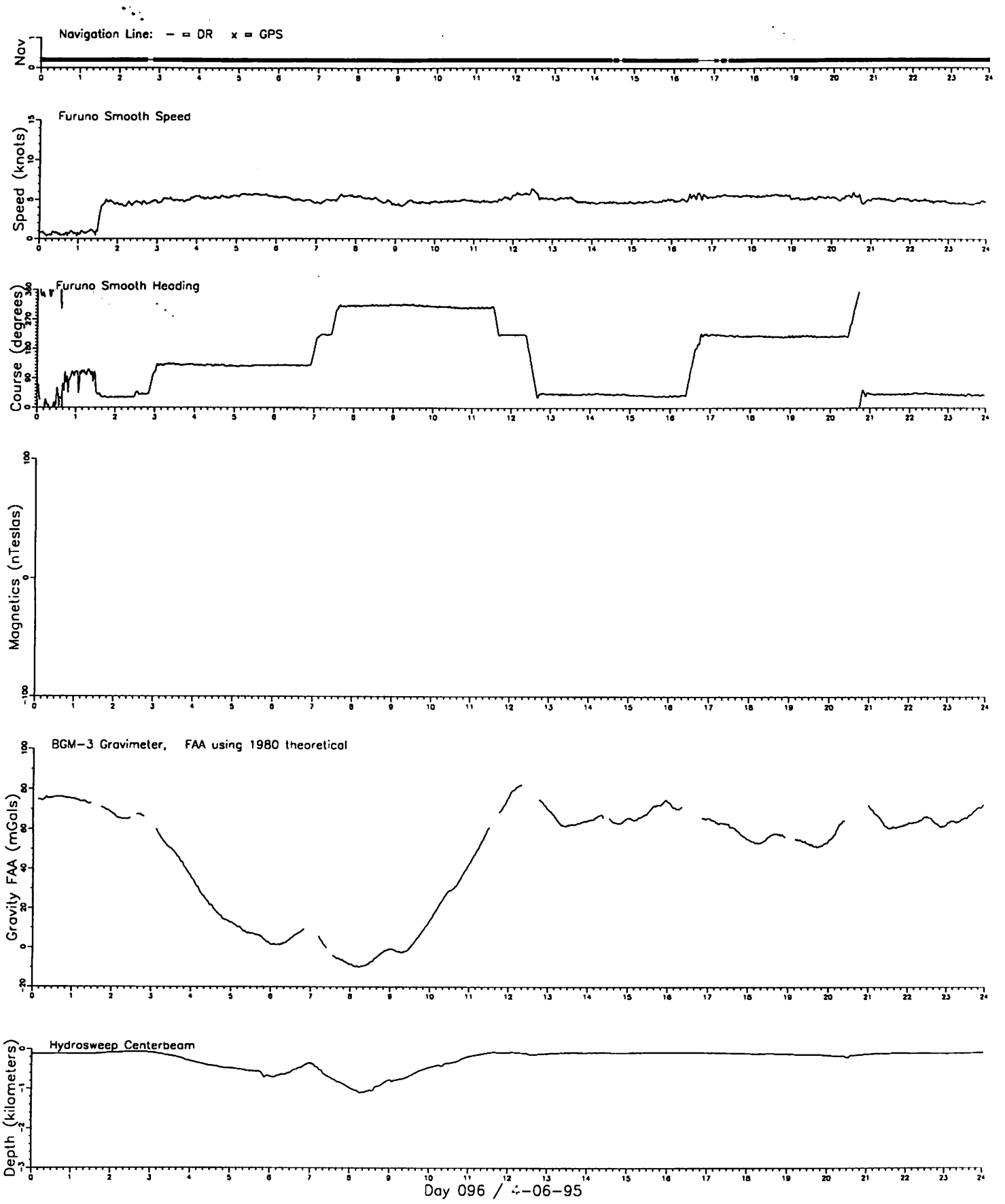
EW9502 Balboa, Panama – Manzanillo, Mexico

Navigation file: n.095 Speed/Course file: fu.s095 Gravity file: vt.n095 Bathymetry file: hb.n095



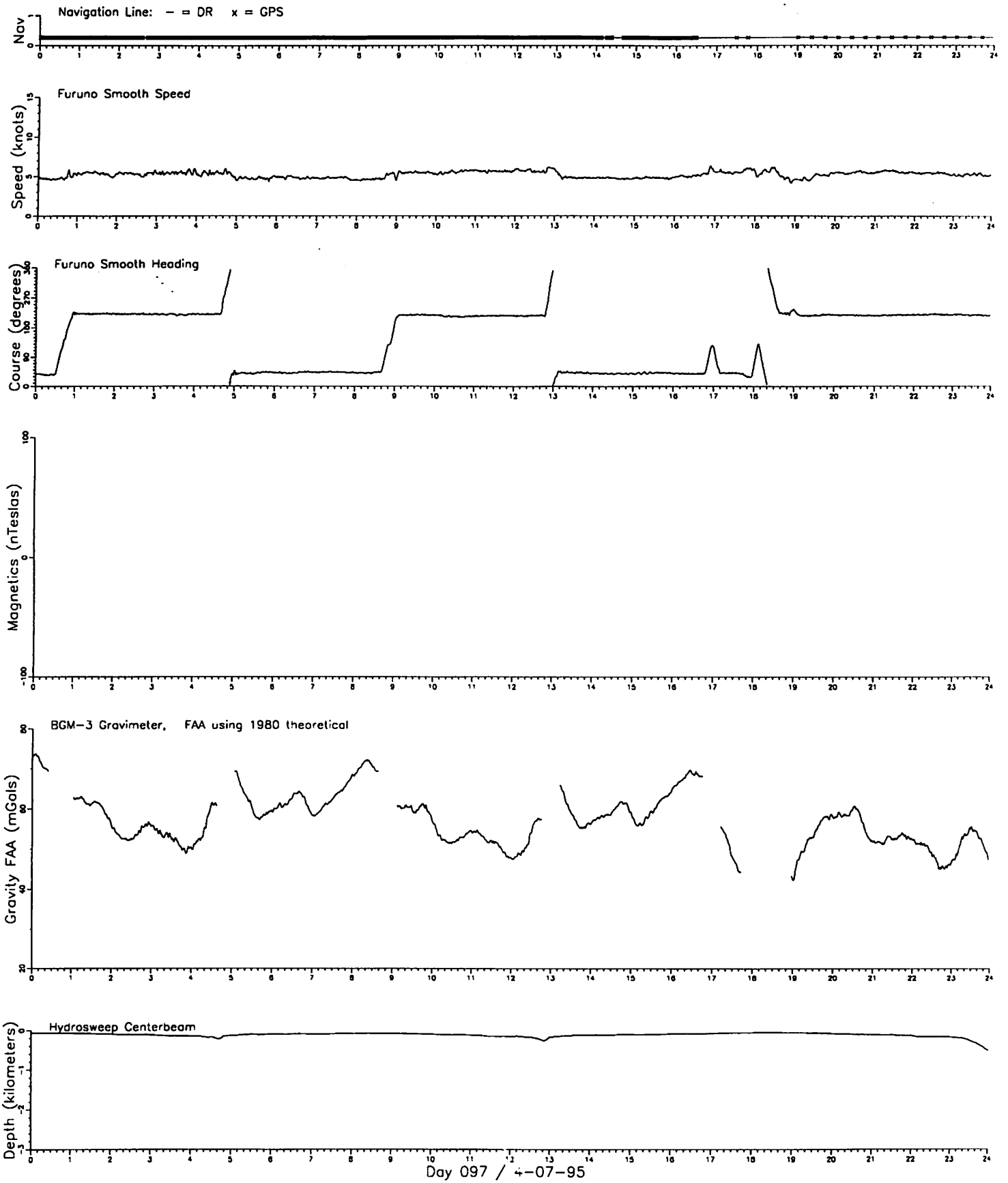
EW9502 Balboa, Panama – Manzanillo, Mexico

Navigation file: n.096 Speed/Course file: fu.s096 Gravity file: vt.n096 Bathymetry file: hb.n096



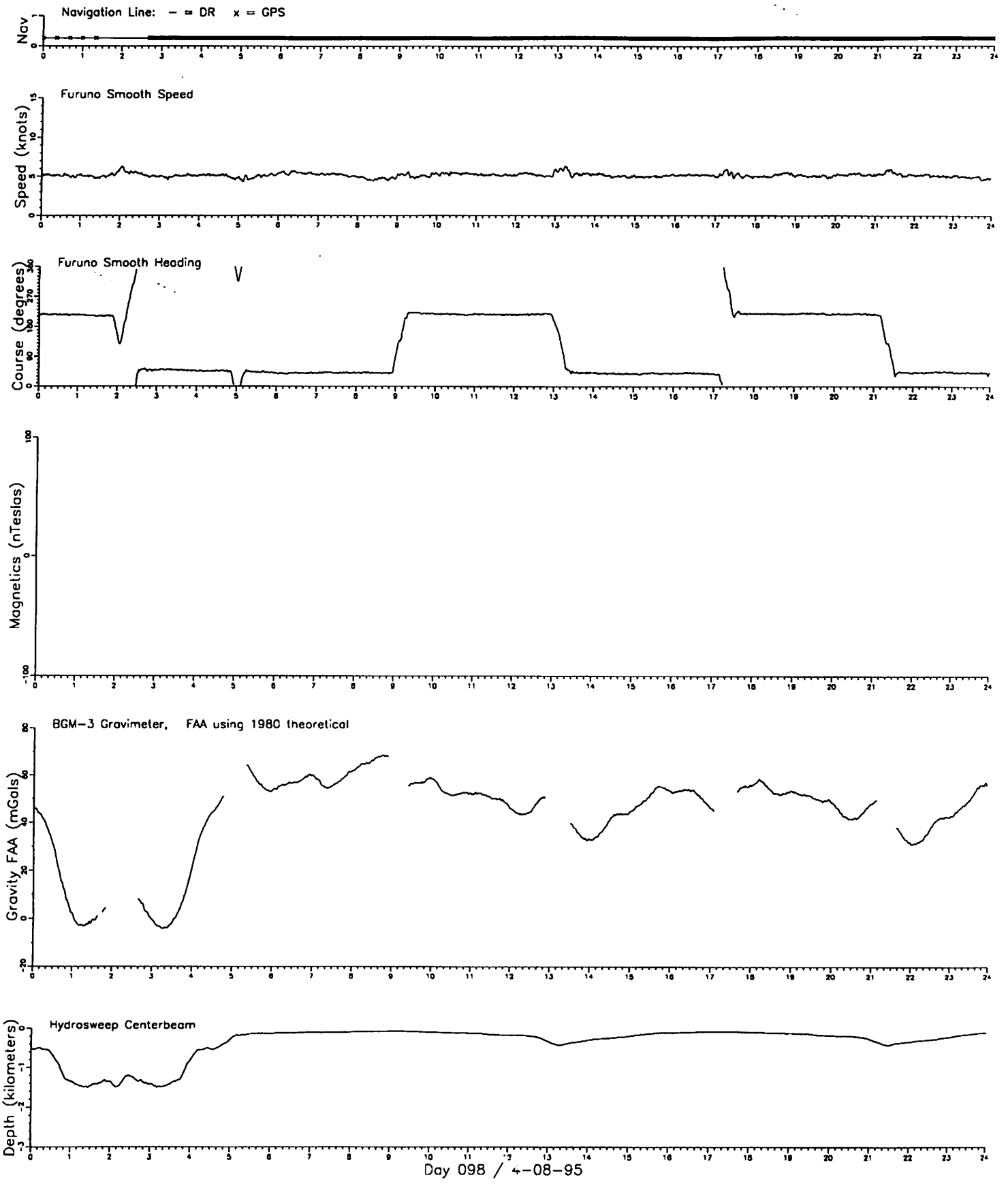
EW9502 Balboa, Panama – Manzanillo, Mexico

Navigation file: n.097 Speed/Course file: fu.s097 Gravity file: vt.n097 Bathymetry file: hb.n097



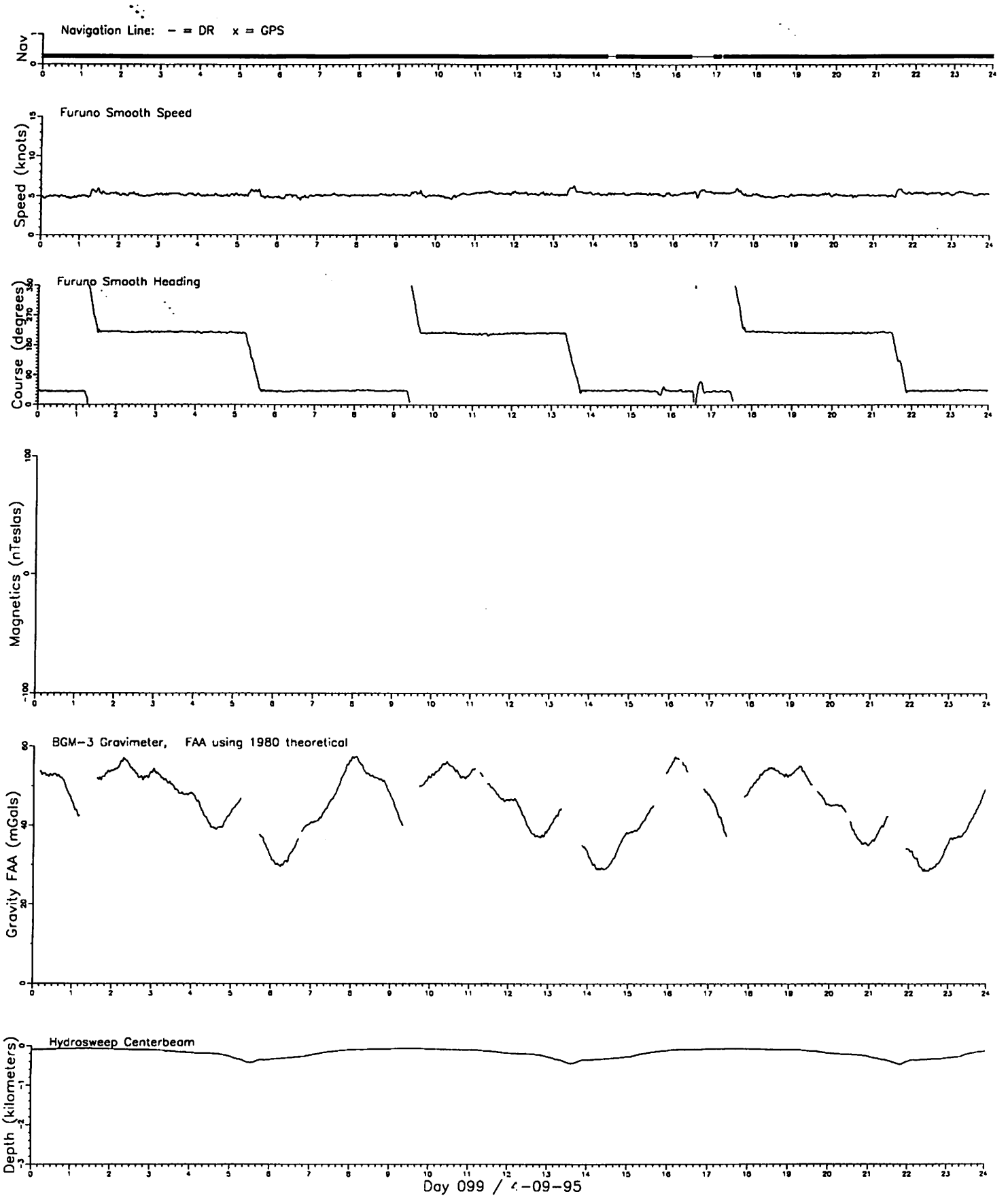
EW9502 Balboa, Panama – Manzanillo, Mexico

Navigation file: n.098 Speed/Course file: fu.s098 Gravity file: vt.n098. Bathymetry file: hb.n098



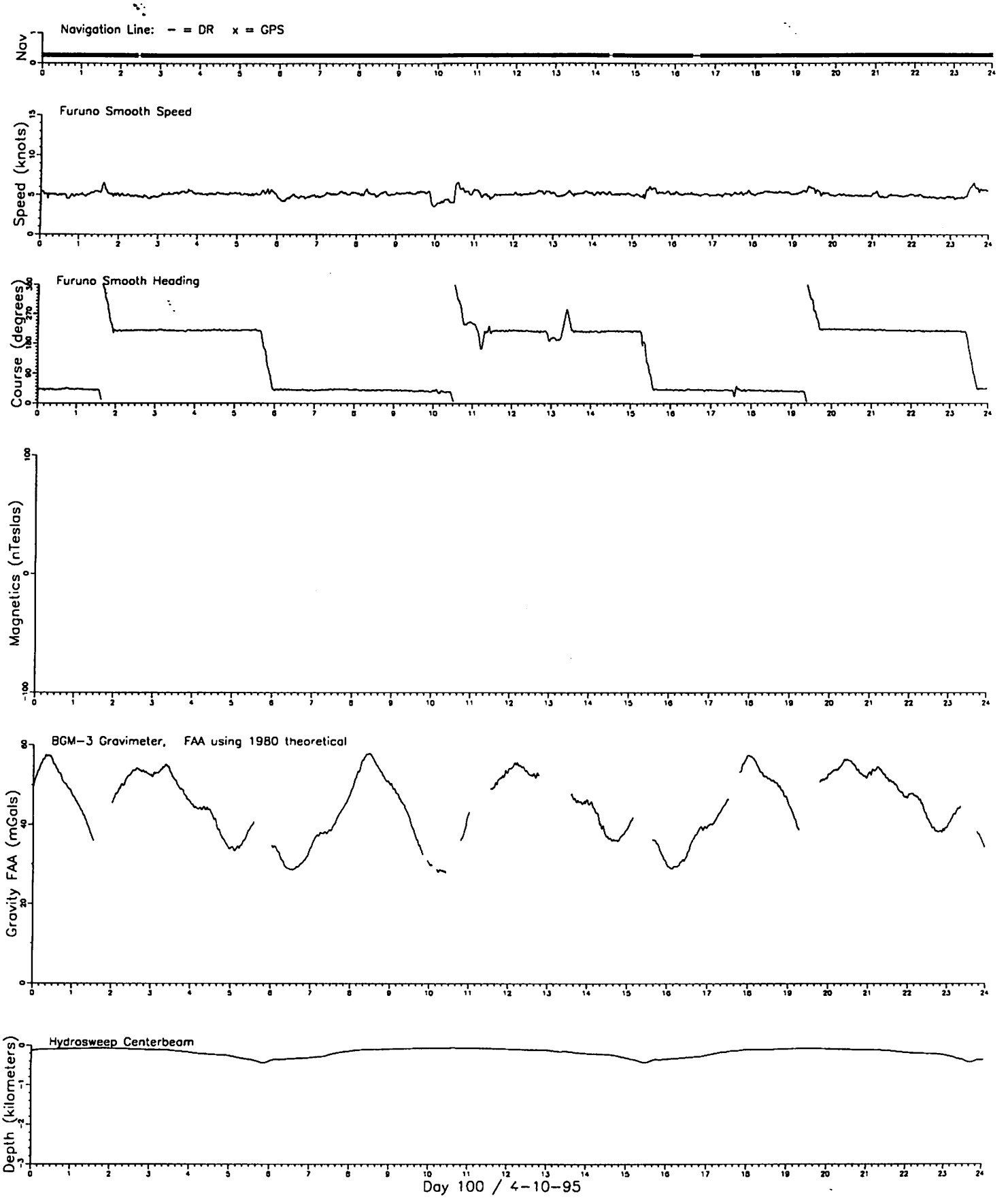
EW9502 Balboa, Panama – Manzanillo, Mexico

Navigation file: n.099 Speed/Course file: fu.s099 Gravity file: vt.n099 Bathymetry file: hb.n099



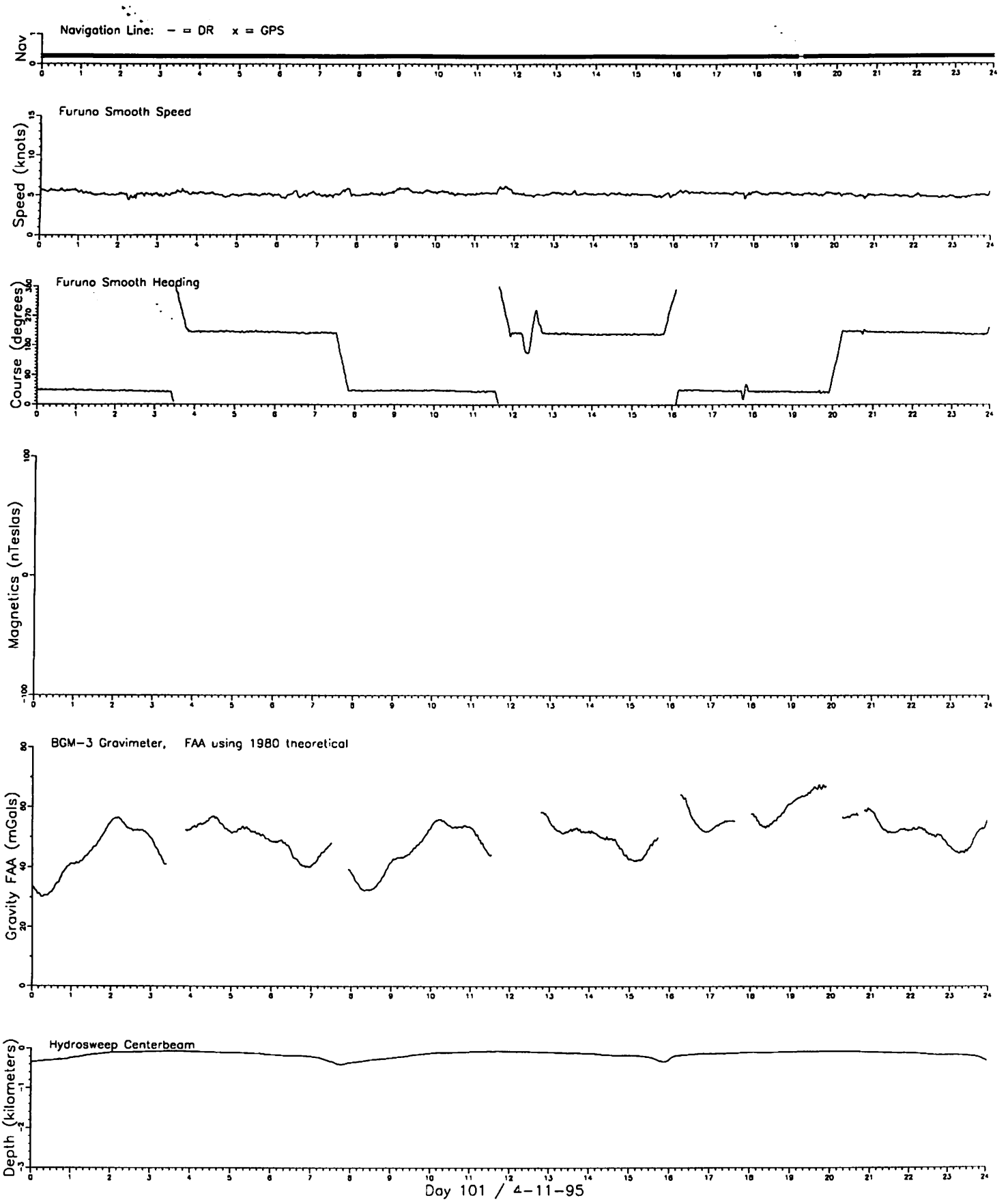
EW9502 Balboa, Panama – Manzanillo, Mexico

Navigation file: n.100 Speed/Course file: fu.s100 Gravity file: vt.n100 Bathymetry file: hb.n100



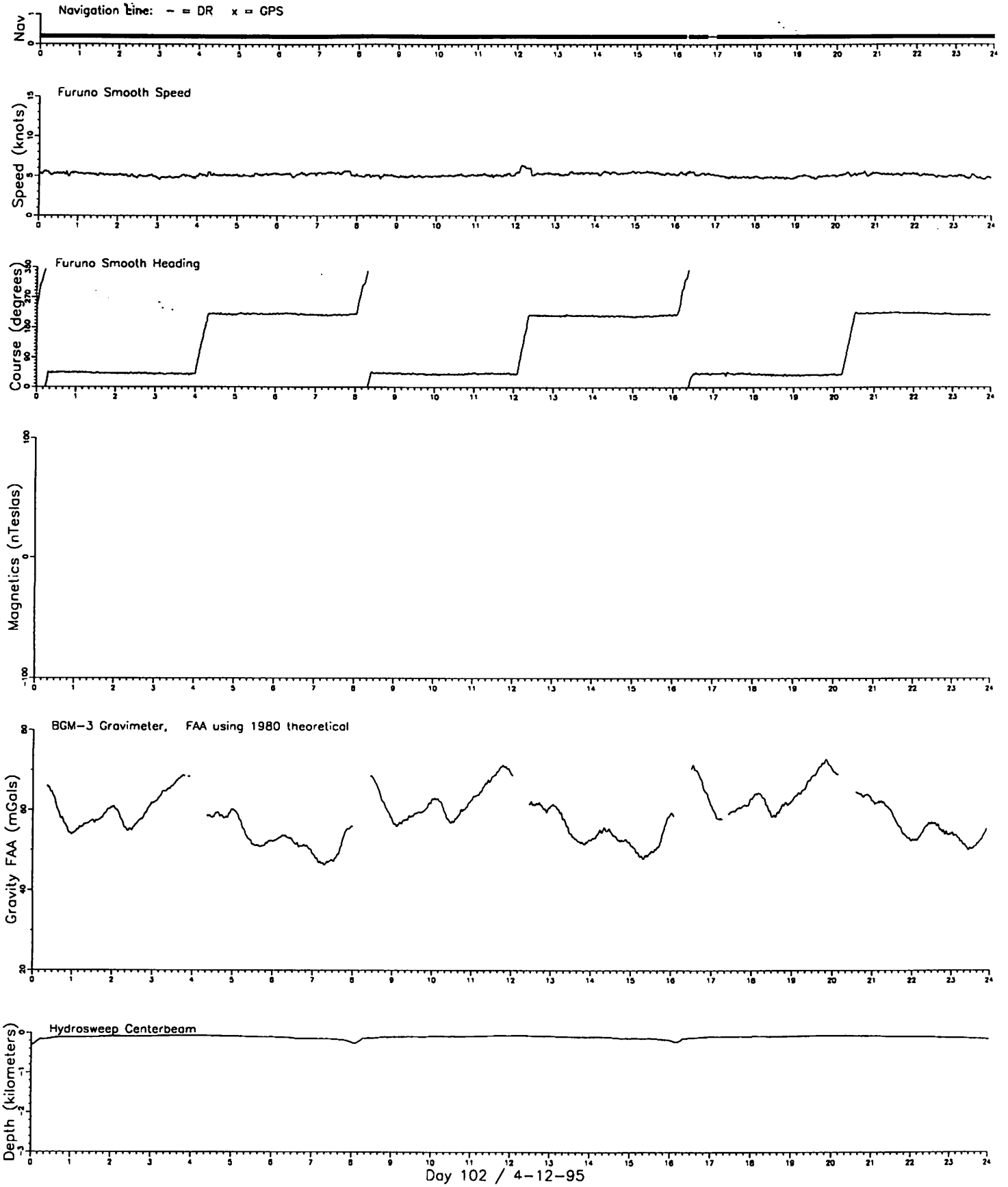
EW9502 Balboa, Panama – Manzanillo, Mexico

Navigation file: n.101 Speed/Course file: fu.s101 Gravity file: vt.n101 Bathymetry file: hb.n101



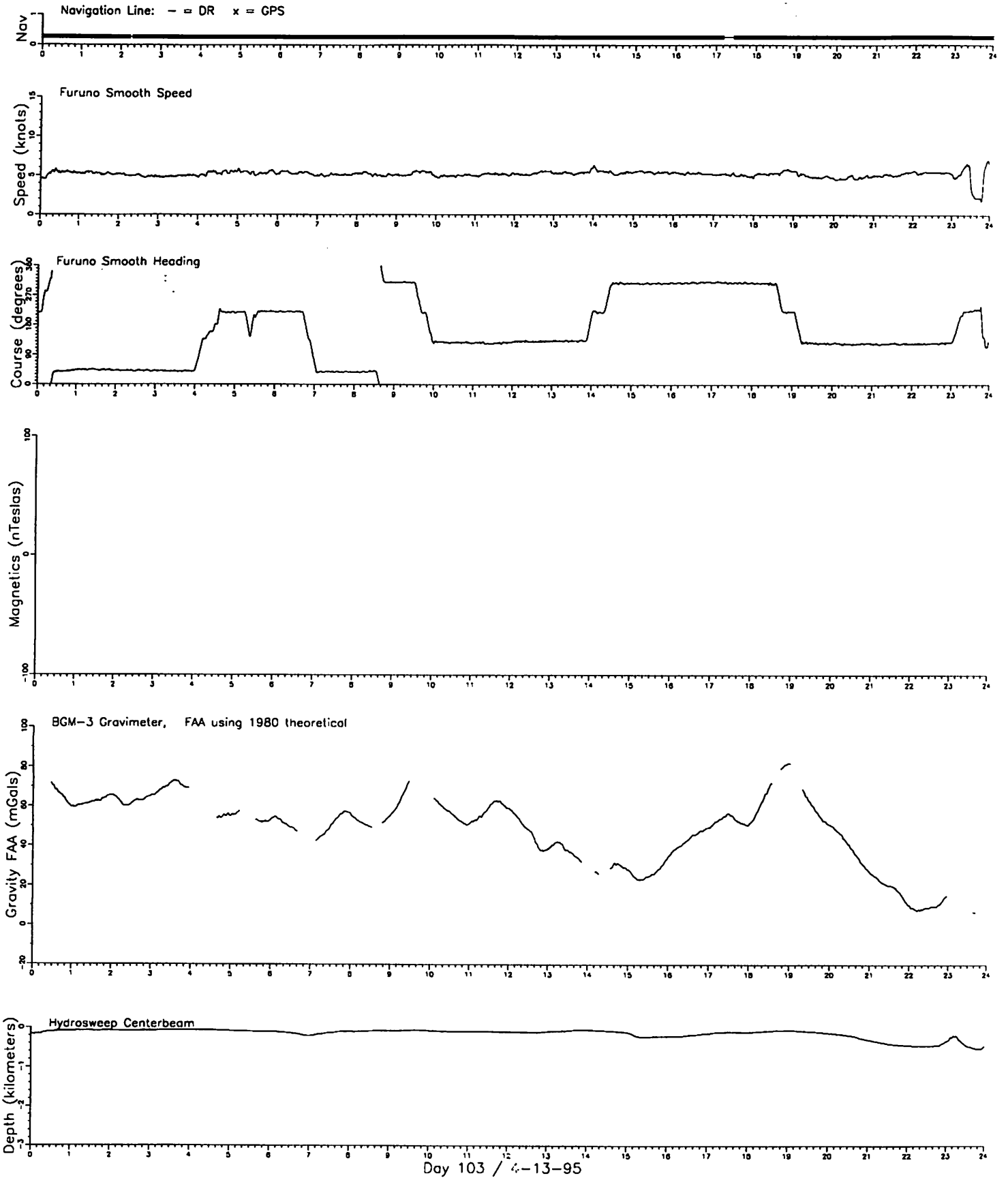
EW9502 Balboa, Panama – Manzanillo, Mexico

Navigation file: n.102 Speed/Course file: fu.s102 Gravity file: vt.n102 Bathymetry file: hb.n102



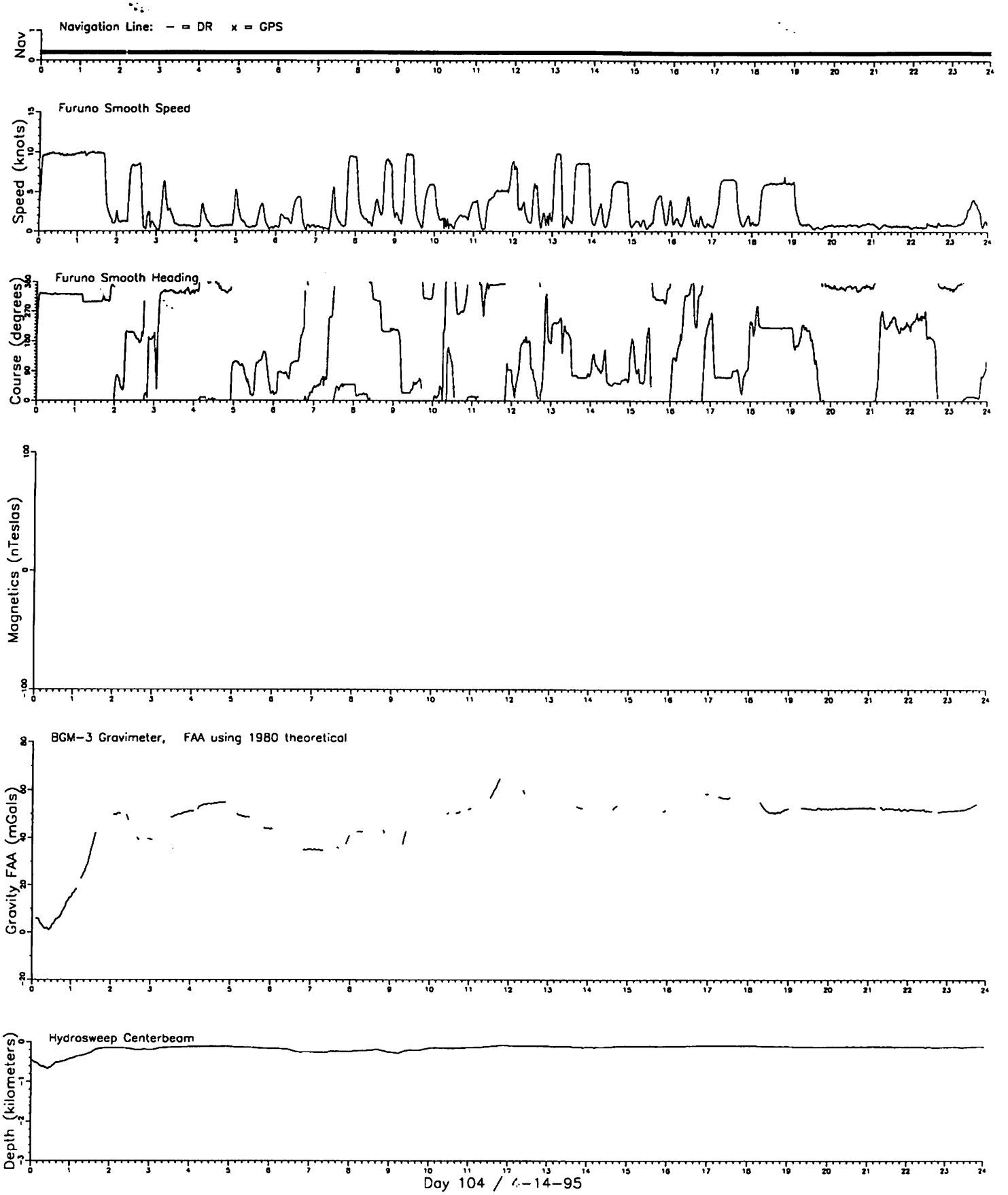
EW9502 Balboa, Panama – Manzanillo, Mexico

Navigation file: n.103 Speed/Course file: fu.s103 Gravity file: vt.n103 Bathymetry file: hb.n103



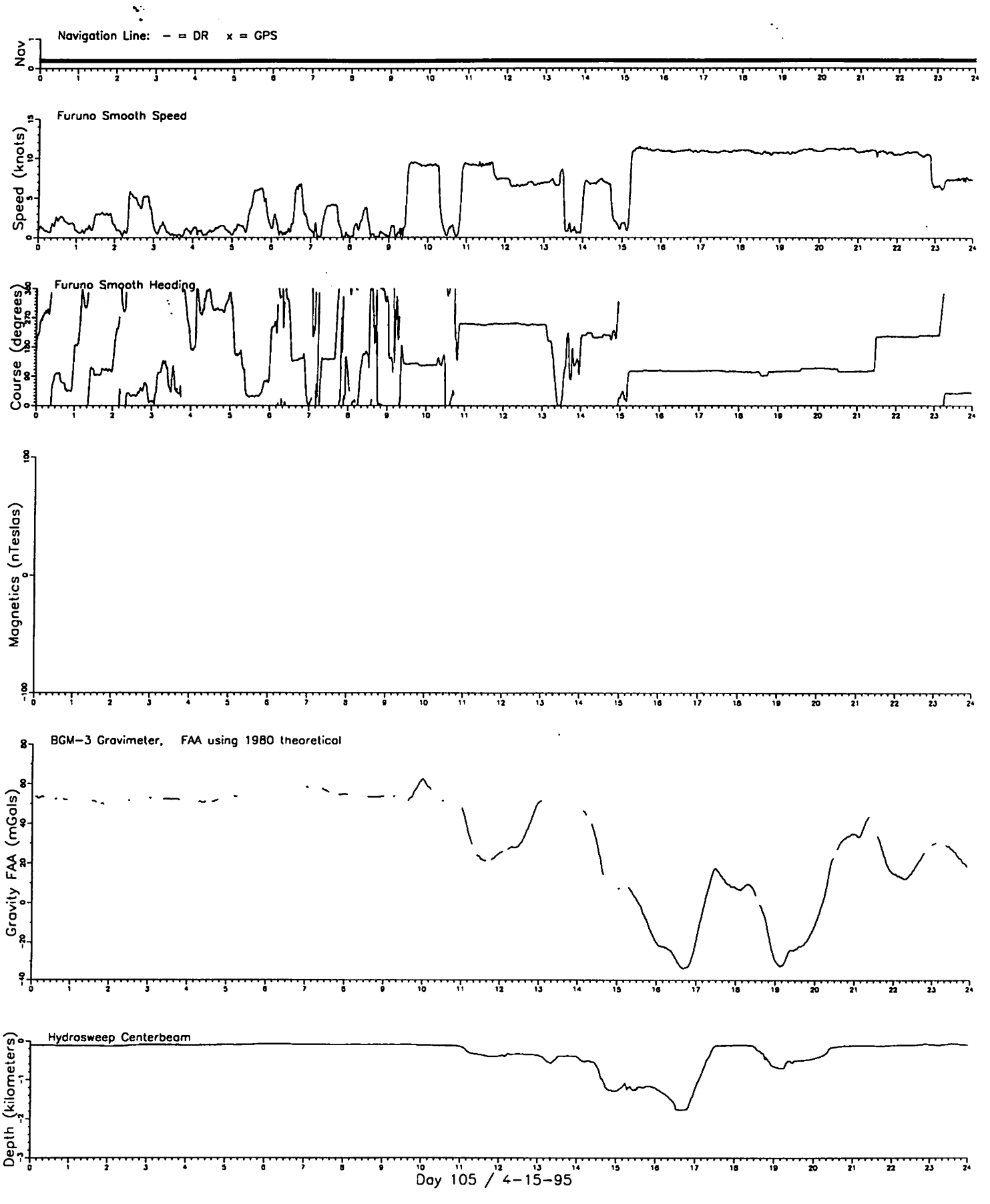
EW9502 Balboa, Panama – Manzanillo, Mexico

Navigation file: n.104 Speed/Course file: fu.s104 Gravity file: vt.n104. Bathymetry file: hb.n104



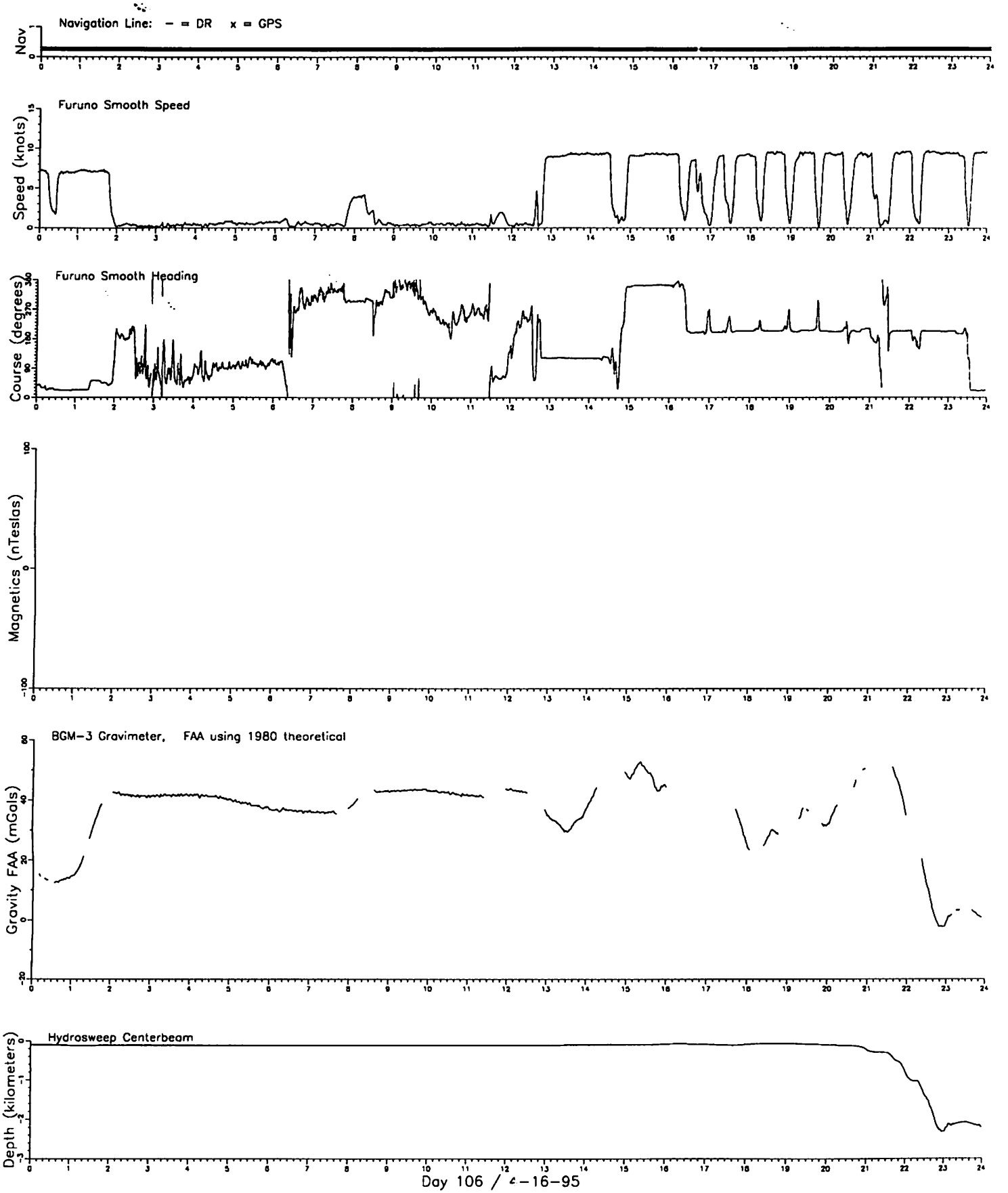
EW9502 Balboa, Panama – Manzanillo, Mexico

Navigation file: n.105 Speed/Course file: fu.s105 Gravity file: vt.n105 Bathymetry file: hb.n105



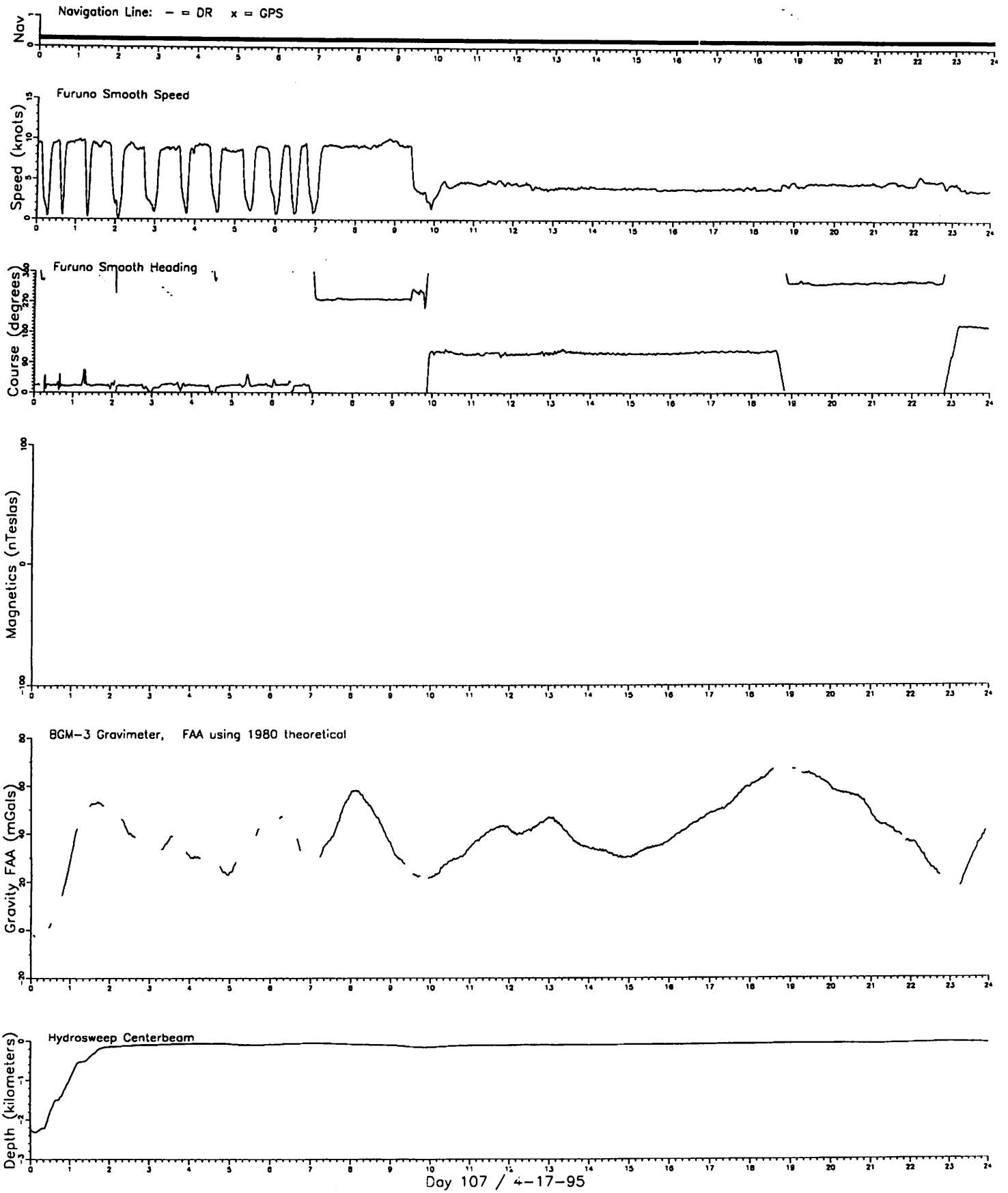
EW9502 Balboa, Panama – Manzanillo, Mexico

Navigation file: n.106 Speed/Course file: fu.s106 Gravity file: vt.n106 Bathymetry file: hb.n106



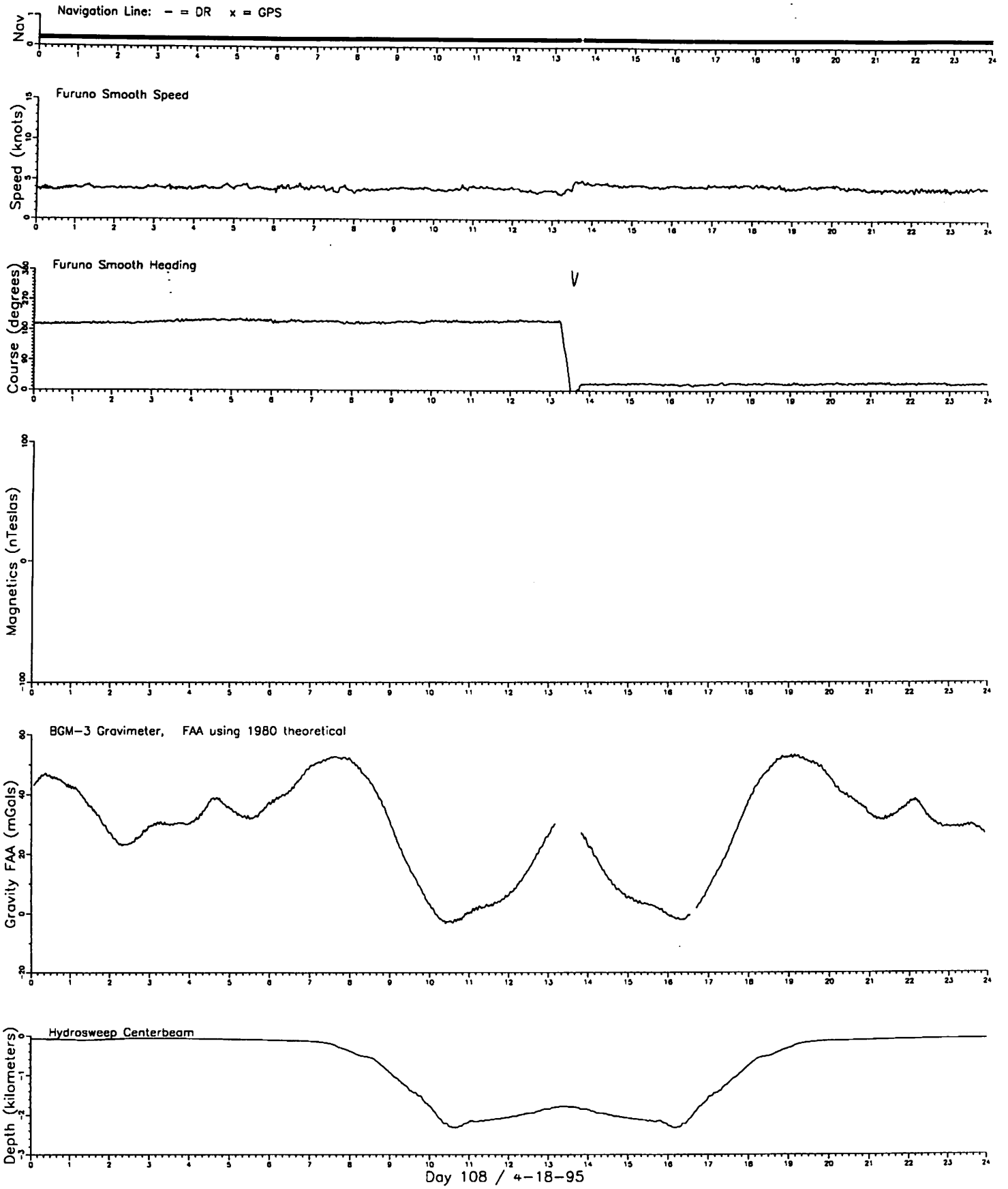
EW9502 Balboa, Panama – Manzanillo, Mexico

Navigation file: n.107 Speed/Course file: fu.s107 Gravity file: vt.n107 Bathymetry file: hb.n107



EW9502 Balboa, Panama – Manzanillo, Mexico

Navigation file: n.108 Speed/Course file: fu.s108 Gravity file: vt.n108 Bathymetry file: hb.n108



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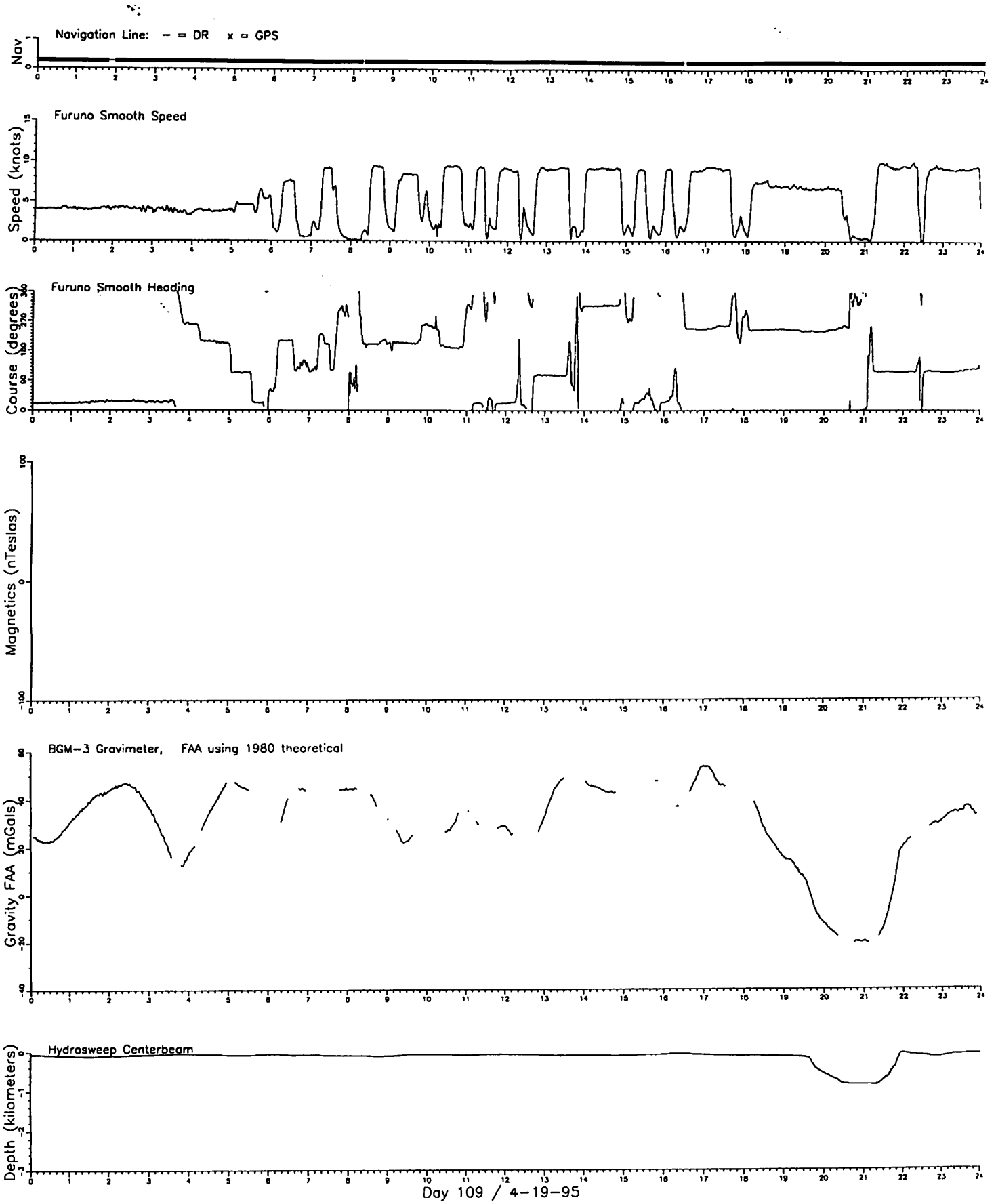
Navigation file: n.109 Speed/Course file: fu.s109 Gravity file: vt.n109 Bathymetry file: hb.n109



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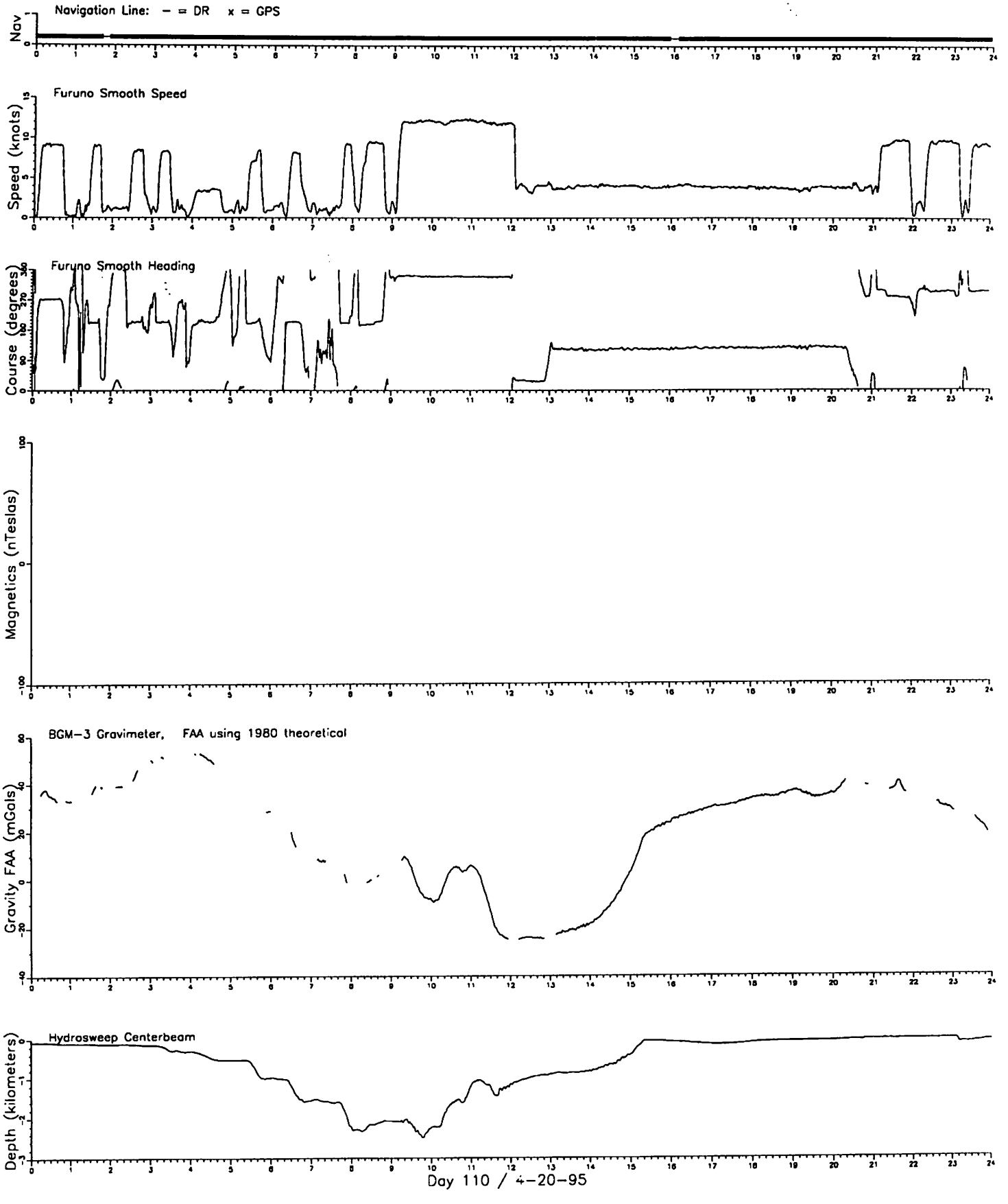
Navigation file: n.110 Speed/Course file: fu.s110 Gravity file: vt.n110 Bathymetry file: hb.n110



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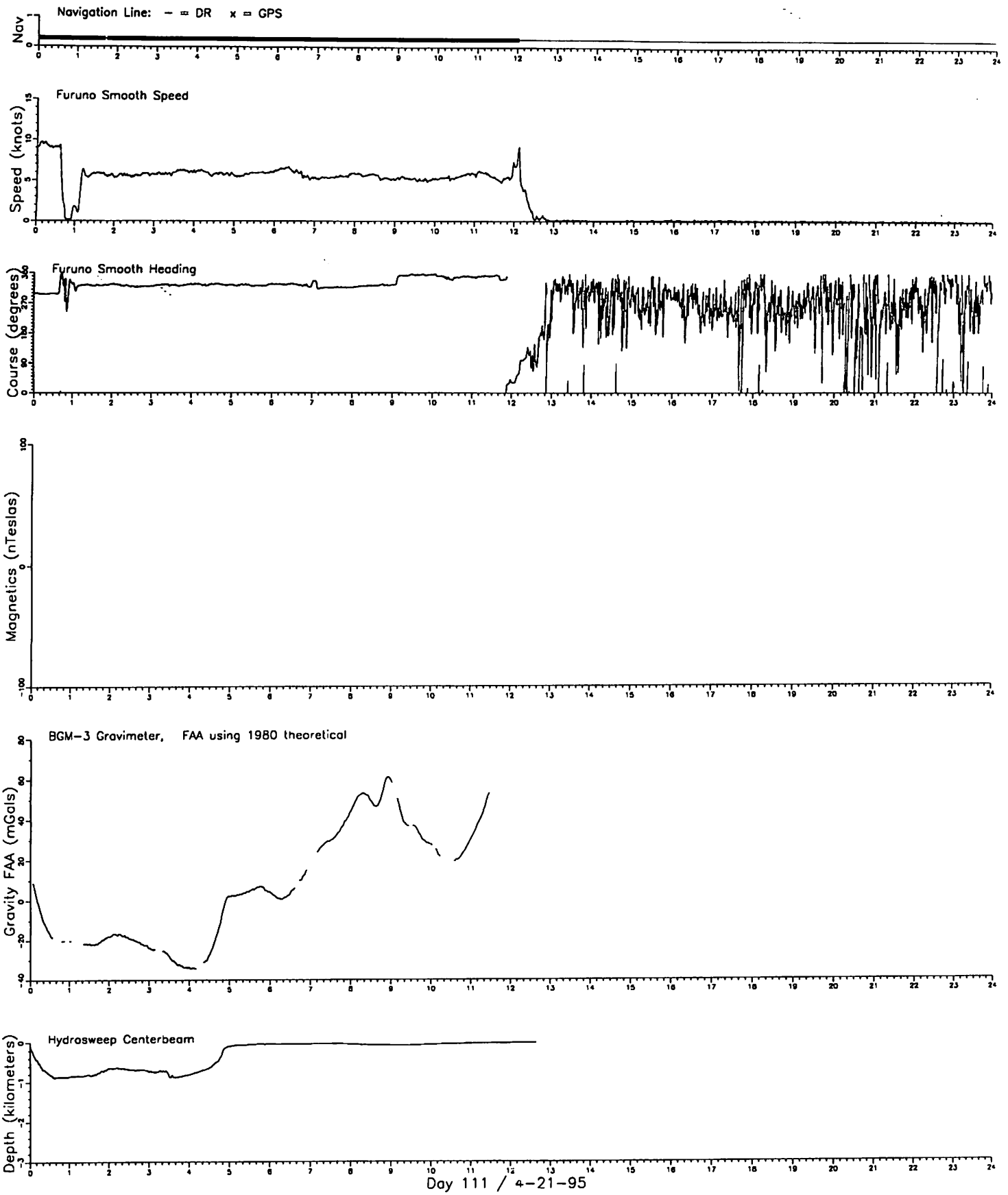
Navigation file: n.111 Speed/Course file: fu.s111 Gravity file: vt.n111 Bathymetry file: hb.n111



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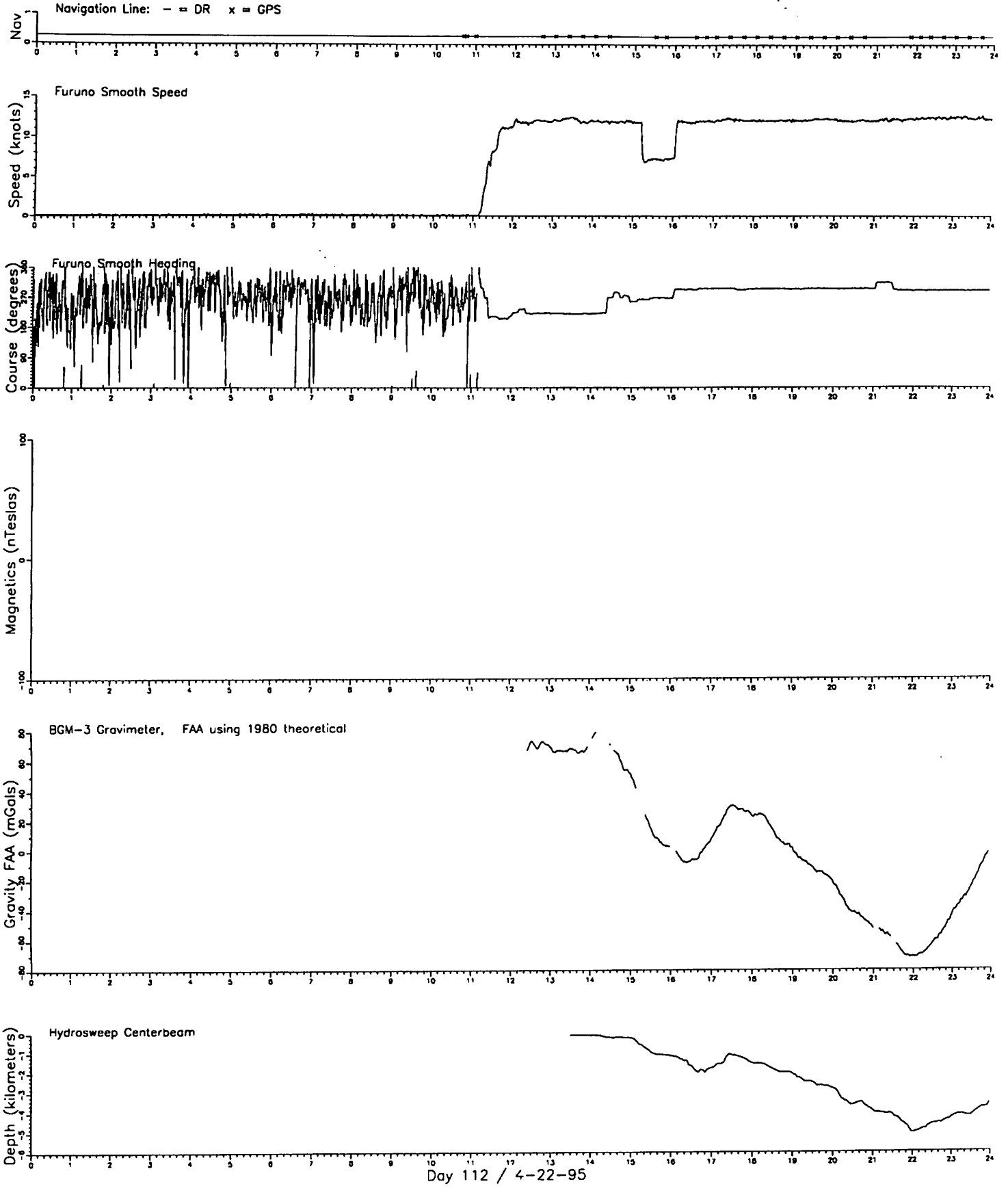
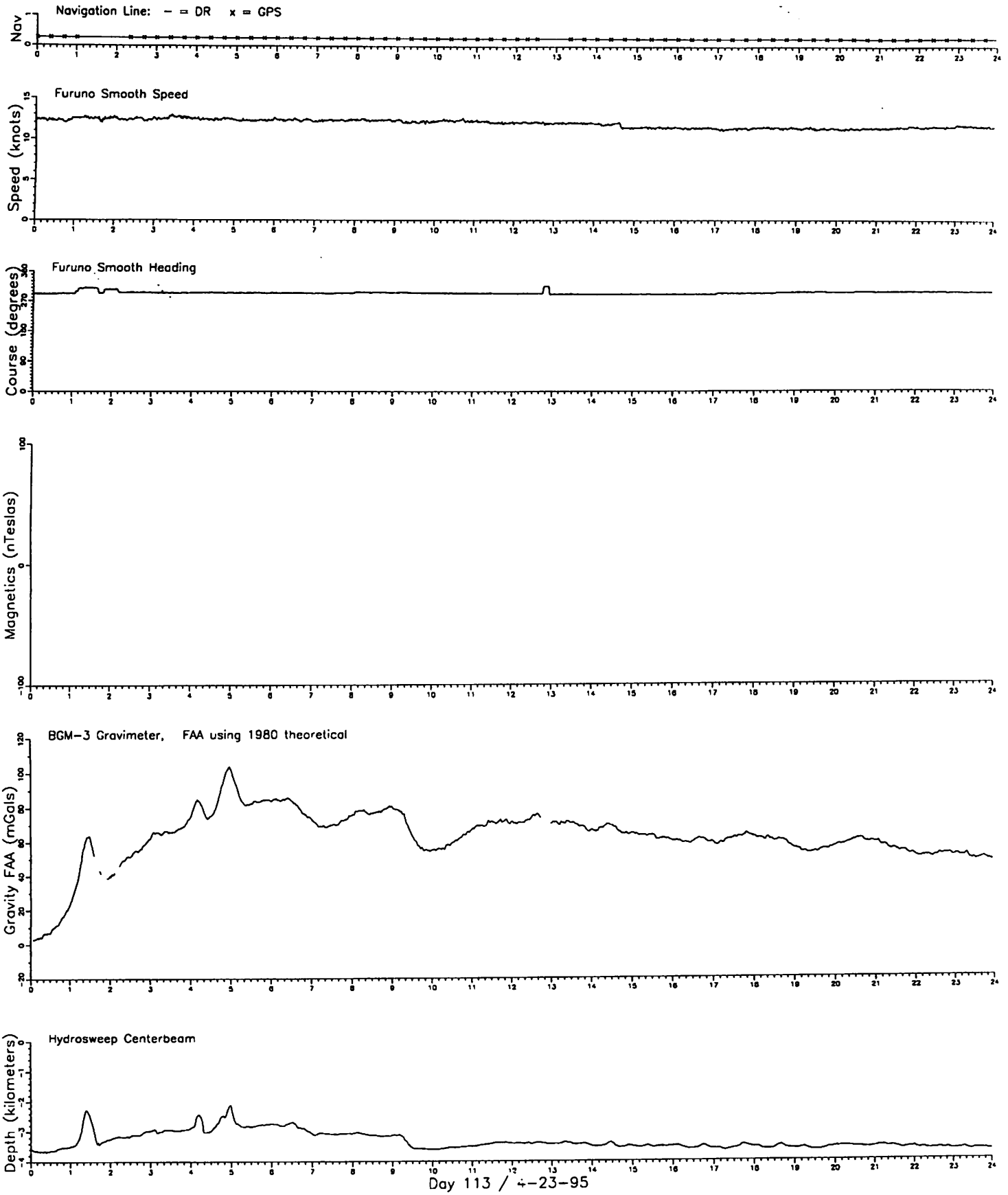
Navigation file: n.112 Speed/Course file: fu.s112 Gravity file: vt.n112. Bathymetry file: hb.n112



EW9502 Balboa, Panama – Manzanillo, Mexico

Navigation file: n.113 Speed/Course file: fu.s113 Gravity file: vt.n113. Bathymetry file: hb.n113



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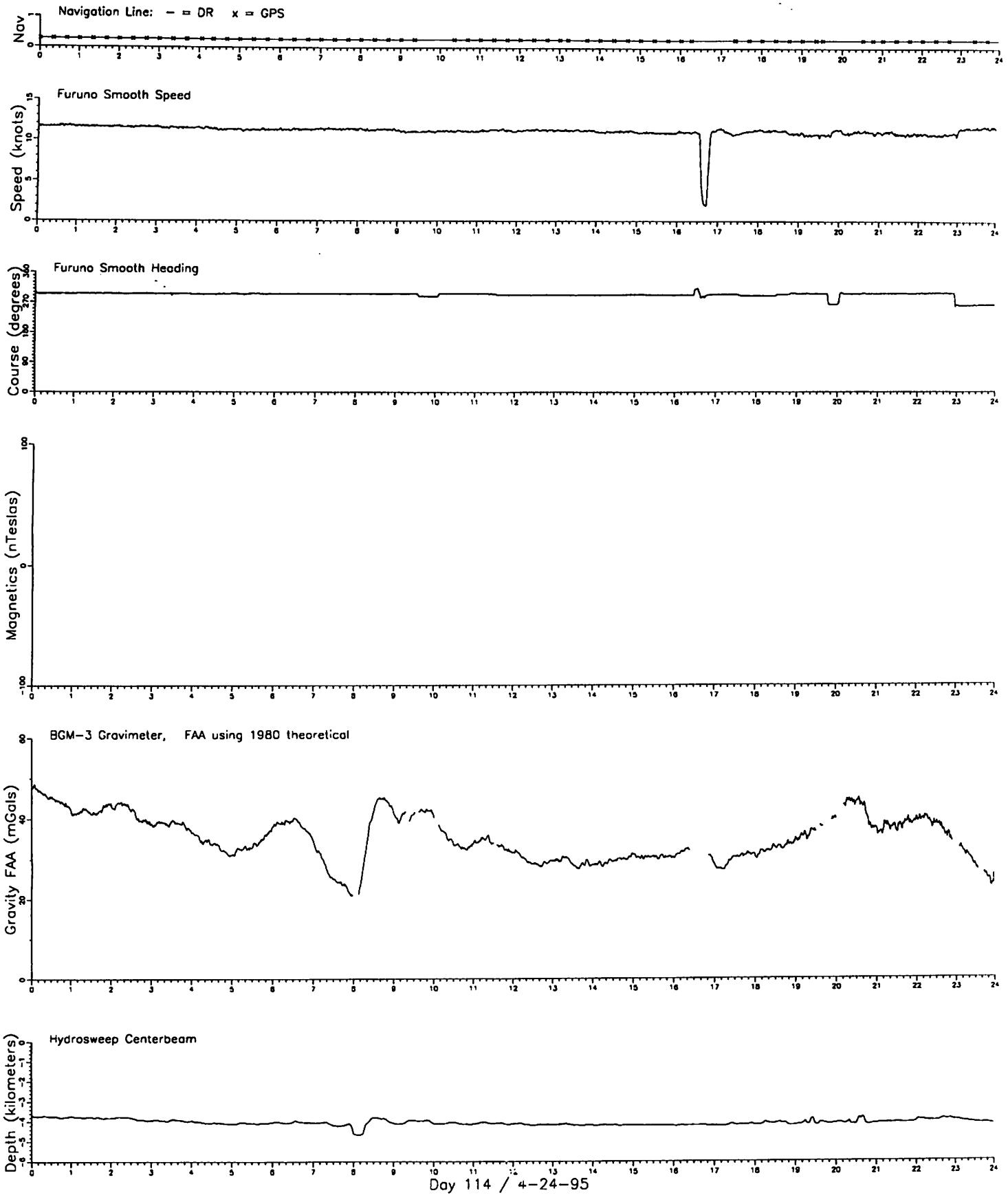
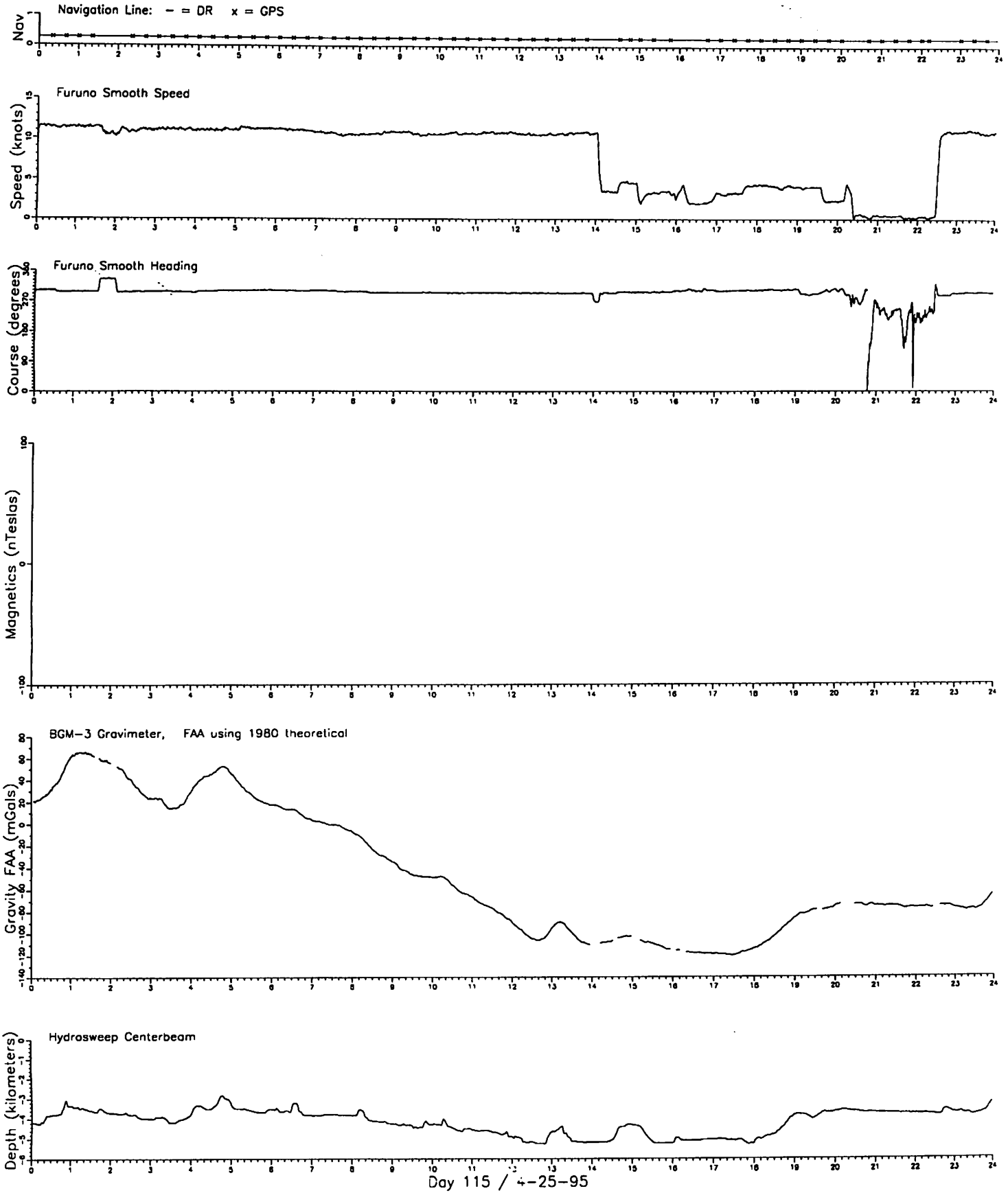
Navigation file: n.114 Speed/Course file: fu.s114 Gravity file: vt.n114 Bathymetry file: hb.n114



EW9502 Balboa, Panama – Manzanillo, Mexico

Navigation file: n.115 Speed/Course file: fu.s115 Gravity file: vt.n115 Bathymetry file: hb.n115



EW9502 Balboa, Panama – Manzanillo, Mexico

Navigation file: n.117 Speed/Course file: fu.s117 Gravity file: vt.n117 . Bathymetry file: hb.n117