LAMONT DATA REDUCTION CRUISE SUMMARY

CRUISE: EW9513

START: 28 December 1995 [363 GMT] Auckland, New Zealand

END: 03 February 1996 [033 GMT] Lyttelton, New Zealand

SURVEY AREA: Tasman Sea Plate Boundaries

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DATA REDUCTION: William J. Robinson

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TIME:

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

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) Data gaps:
018 0413-0441 - power failure

GPS SATELLITE FIXES:

Instrument: Magnavox MX-4200D Global Positioning System receiver
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 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 large errors, up to 4-5 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) Data gaps:
018 0413-0441 - power failure

Instrument: Trimble NT200D
Logging: 10 second intervals
Notes:
(1) the data from the Trimble was not processed

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) Data gaps:
015 0649-0713 - bad data
015 1211-1239 - bad data
015 1437-1446 - bad data
018 0413-0441 - power failure

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) Data gaps:
364 0401-0412 - noisy data
364 0502-0508 - noisy data
012 0338-0100 - dredging
014 2021-2044 - noisy data cable problem
015 0446-0454 - noisy data
015 0456-0507 - noisy data
015 0555-0601 - noisy data
015 0646-0659 - noisy data
015 0729-0746 - noisy data
015 0806-0817 - noisy data
015 0825-0828 - noisy data
015 0858-0902 - noisy data
015 0904-0917 - noisy data
016 0003-0230
016 0240-0303 - noisy data

016 0944-1010 - noisy data
016 1025-1039 - noisy data
017 1738-1837 - noisy data
018 0414-0441 - power failure; filled with 5 min readings
031 0336-0439 - noisy data

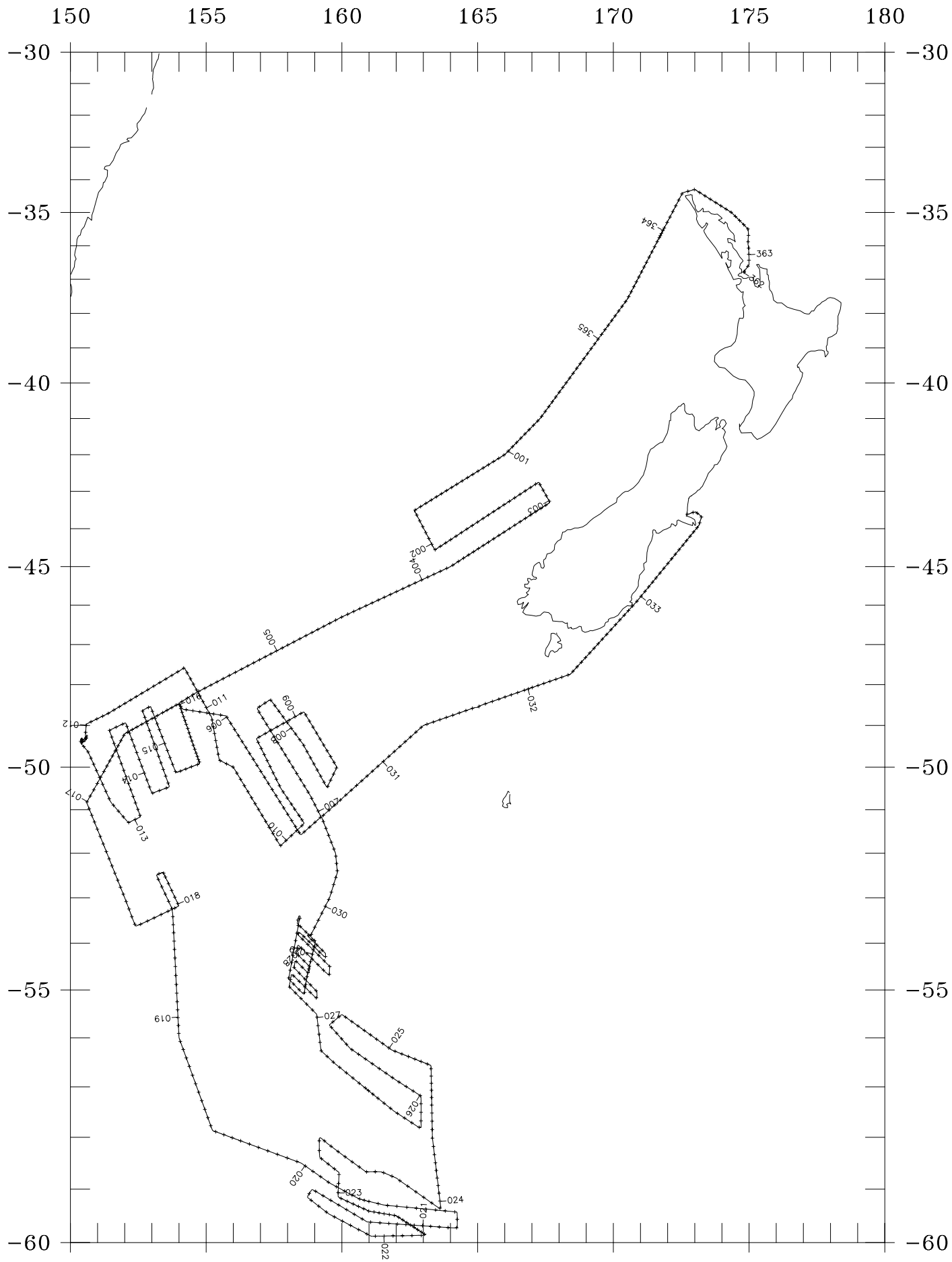
GRAVITY:

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: 19.6 mGal from pre-cruise tie at Auckland, New Zealand
Drift rate: 0.0023 mGal per day
Pre-cruise Tie date: 23 December 1995 (day 357) at 2350Z, Auckland, New Zealand
Post-cruise Tie date: 04 February 1996 (day 035) at 0219Z, Lyttelton, New Zealand
Final data: Free Air Anomaly value at 00 seconds of each minute.
1980 theoretical gravity formula.
Notes:
(1) Data gaps:
018 0413-0441 - power failure
018 0442-0441 - table locked (after power failure) - bad data
019 0000-0538 - table locked (after power failure) - bad data

SEISMIC:

Instruments: Seismic streamer and R/V Ewing 2 water-gun array

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



EW9513 Auckland – Lyttelton Dec '95 – Feb '96

Lamont Gravity Tie Report

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

Port: Lyttelton, New Zealand

Date: 04 February 1996

Operator: Joe Stennett

Reference Station:
The pier gravity is referenced to ACIC 0217-0
which is in Christchurch at the botanical gardens.

Pier/Ship's position:
The Ewing is only 20 meters north of the tie
established in March 1992.

Pier gravity: 980539.9 mGal

GPS position: 43 36.4 S 172 43.2 E

Ship heading 036 deg.

Portable gravity meter:
LaCoste & Romberg

Returned to the stable, intermediate tie beside
"1962" marking on walkway across the RR tracks.
In March 1992 the L&R read 4095.5 and
in Feb 1996 the reading is 4090.9

Readings and calculations:
Pier gravity value:
pier_grv_val = 980539.9

Height correction:
On Feb 4, 1996 (day 035) at 0219 Z
C deck is 80 cm below the pier at time of reading.
Difference between pier and gravity lab = 6.3 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 = 6.3 m * 0.31 mGal/m
hgt_corr = 1.95 mGal

Gravity at BGM level:
grv_at_BGM_level = pier_grv_val + hgt_corr
grv_at_BGM_level = 980539.9 + 1.95
grv_at_BGM_level = 980541.85

BGM-3 reading:
On February 4, 1996 (day 035) at 0219 Z
BGM_grv_val = 980561.6 mgal

BGM-3 Mistie:
BGM_mistie = BGM_grv_val - grv_at_BGM_level
BGM_mistie = 980561.6 - 980541.9
BGM_mistie = 19.7 mgal

BGM-3 DC shift:

BGM_dc_shift = 19.7 mgal

BGM-3 Drift:

prev_BGM_mistie: 19.6 mgal on December 23, 1995 (day 357)

BGM_drift = BGM_mistie - prev_BGM_mistie
BGM_drift = 19.7 - 19.6
BGM_drift = 0.1 mgal

num_days = day - pre_day
num_days = 035(+365) - 357
num_days = 400 - 357
num_days = 43

BGM_drift_per_day = BGM_drift / num_days
BGM_drift_per_day = 0.1 / 43
BGM_drift_per_day = 0.0023 mGal / day

EW9513.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 "ew9513" or NULL
(2) data id "gp3.r"
(3) dayofyear "365"

example:

gp3.r365

Note: The cruise id is NULL for the data files for ew9513.

".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

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.

Note the variation in the positioning of these times as noted below in the Hydrosweep,

nav block (seismic) data use shot times instead of CPU times.

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, magnetics, sea temperature, meterological data, thermosalinograph.

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,-00
002,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,-00
002,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,-00
002,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,-00
002,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
```

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
```

```
Shot times (ts2):
-----------------

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

Partial Nav Block data (nb2) - has realtime navigation:
---

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:

```
==> 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 (ts2.n):
---

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

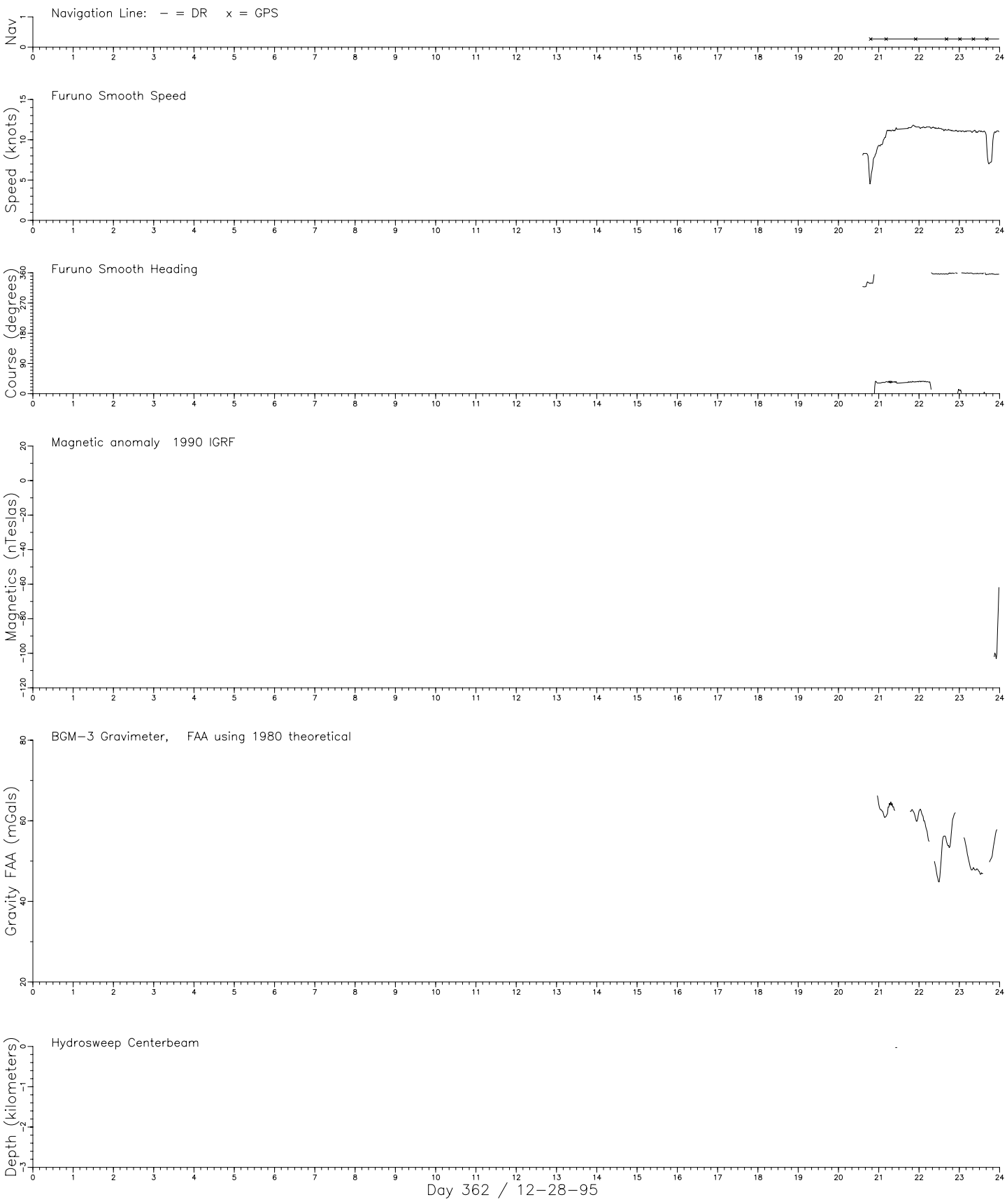
same as ct.r below

ct.r - sea temperature after cleaning stage

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

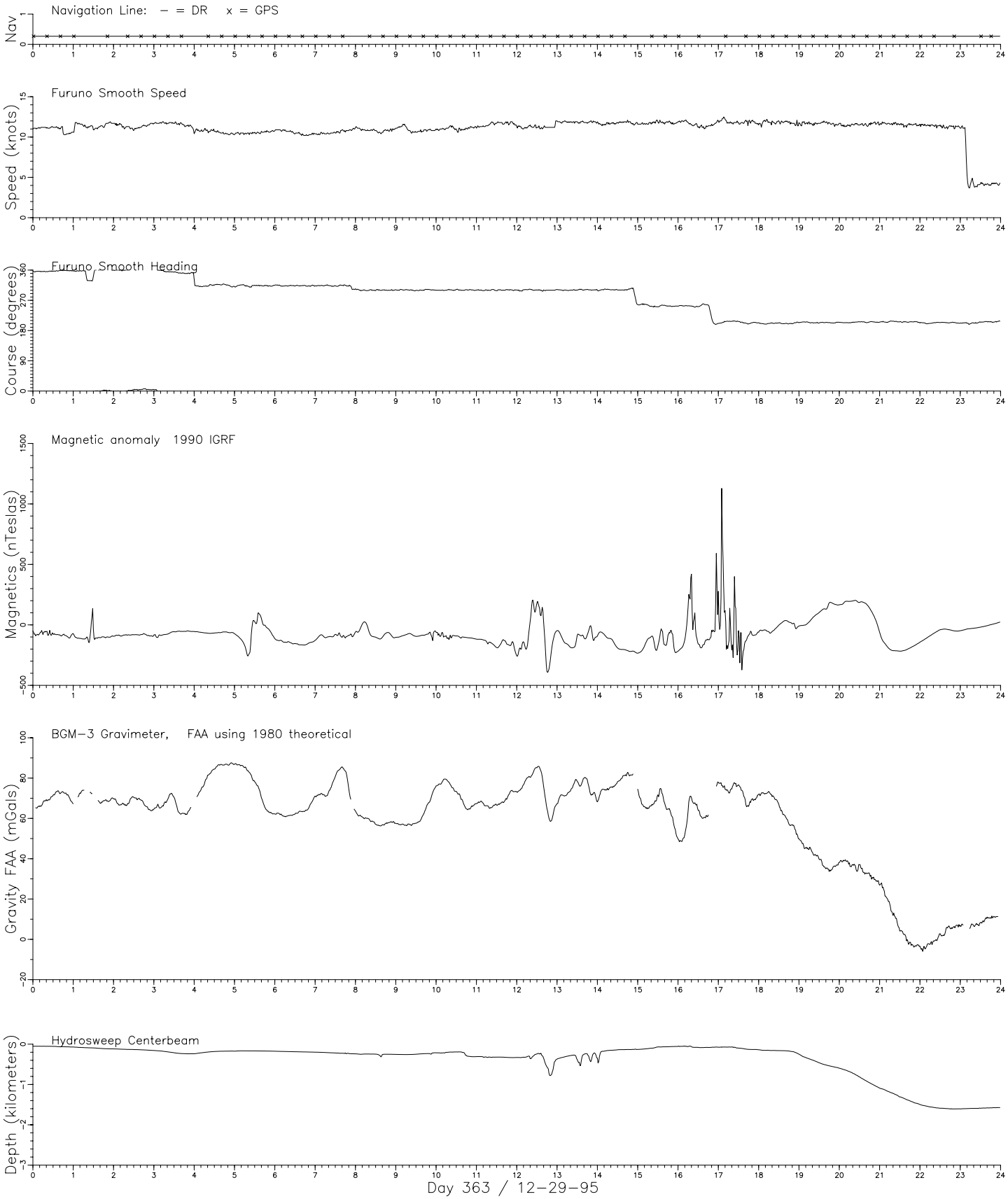
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

Navigation file: n.362 Speed/Course file: fu.s362 Magnetics file: mg.n362 Gravity file: vt.n362 Bathymetry file: hb.n362



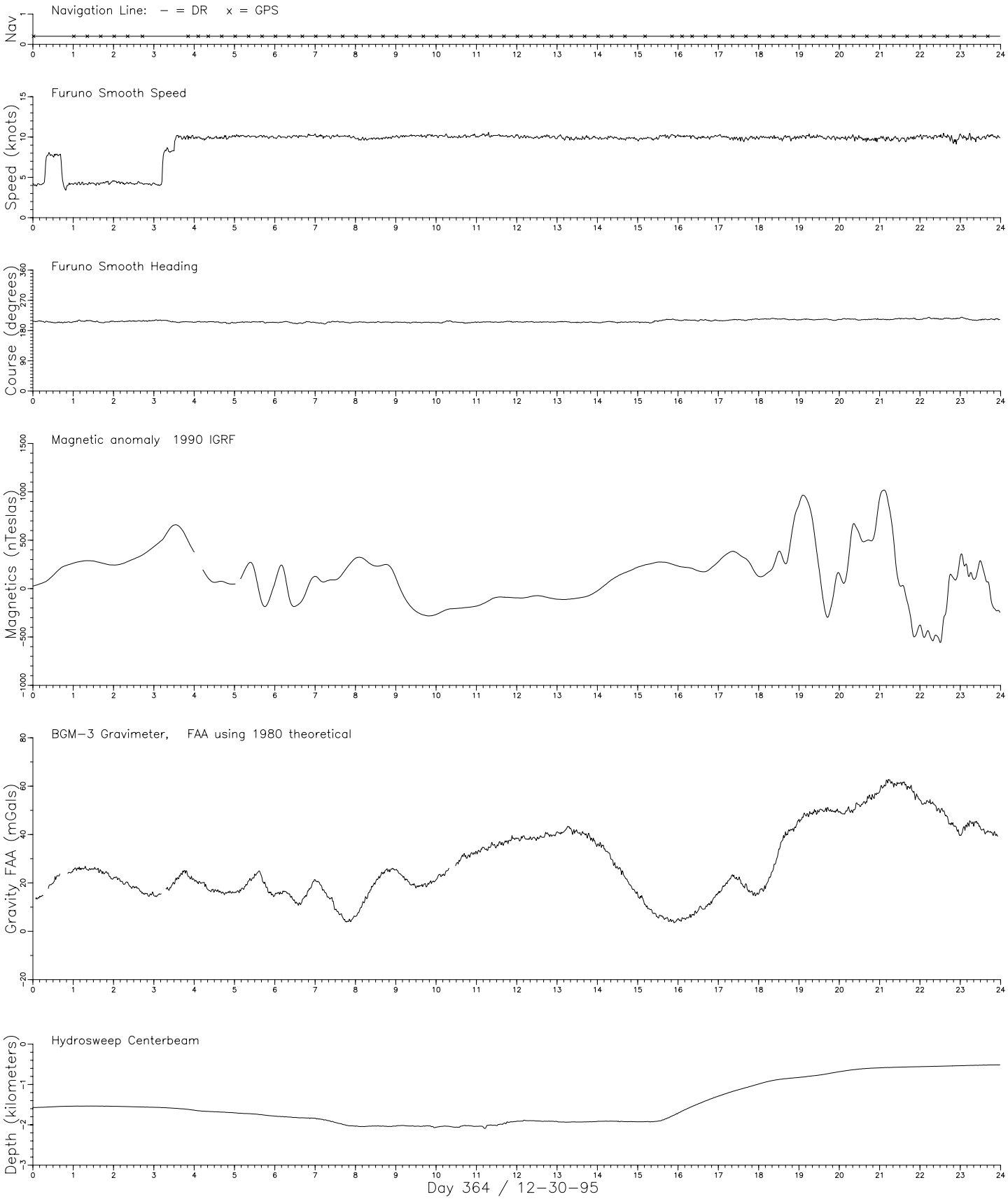
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

Navigation file: n.363 Speed/Course file: fu.s363 Magnetics file: mg.n363 Gravity file: vt.n363 Bathymetry file: hb.n363



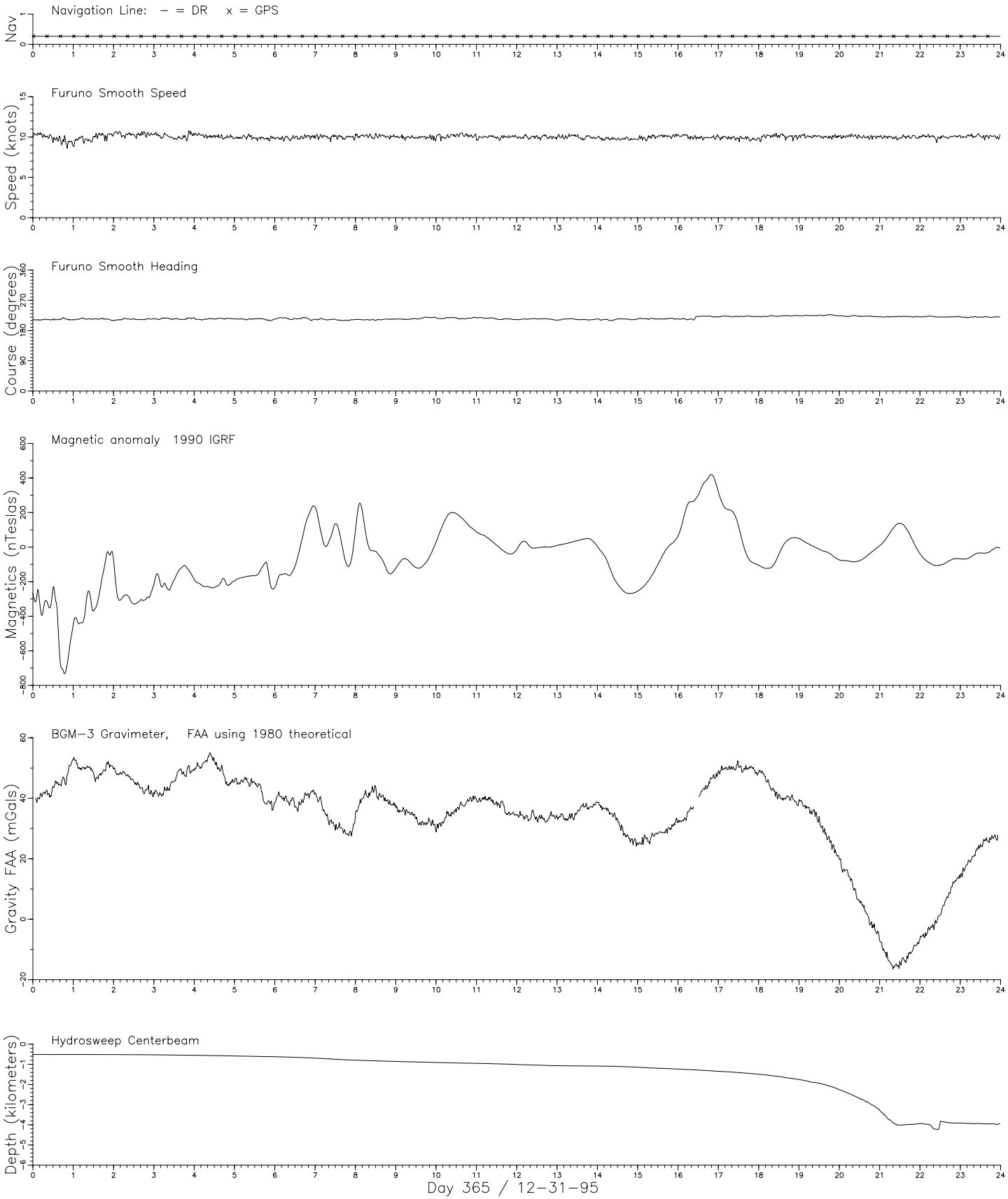
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

Navigation file: n.364 Speed/Course file: fu.s364 Magnetics file: mg.n364 Gravity file: vt.n364 Bathymetry file: hb.n364



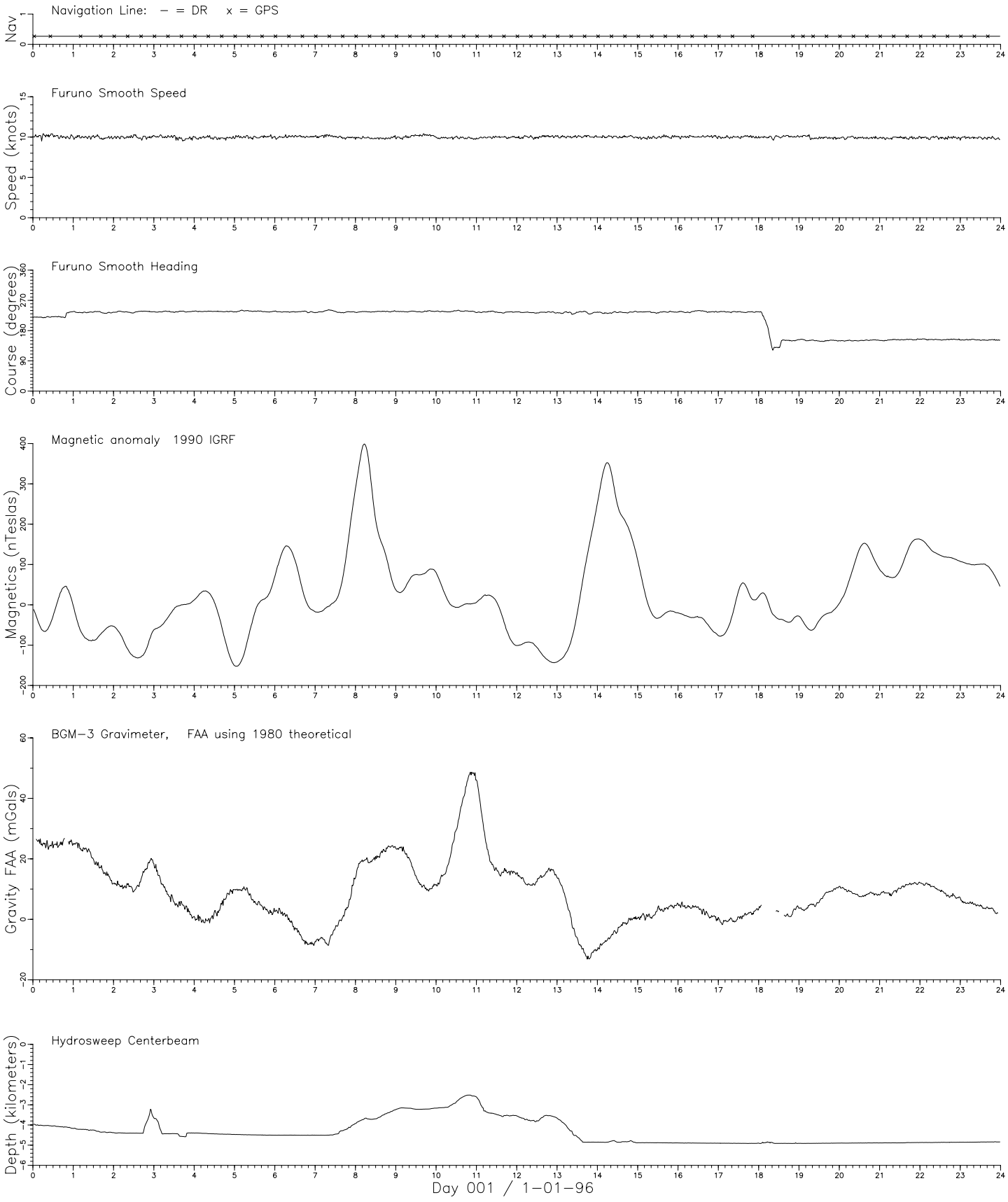
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

Navigation file: n.365 Speed/Course file: fu.s365 Magnetics file: mg.n365 Gravity file: vt.n365 Bathymetry file: hb.n365



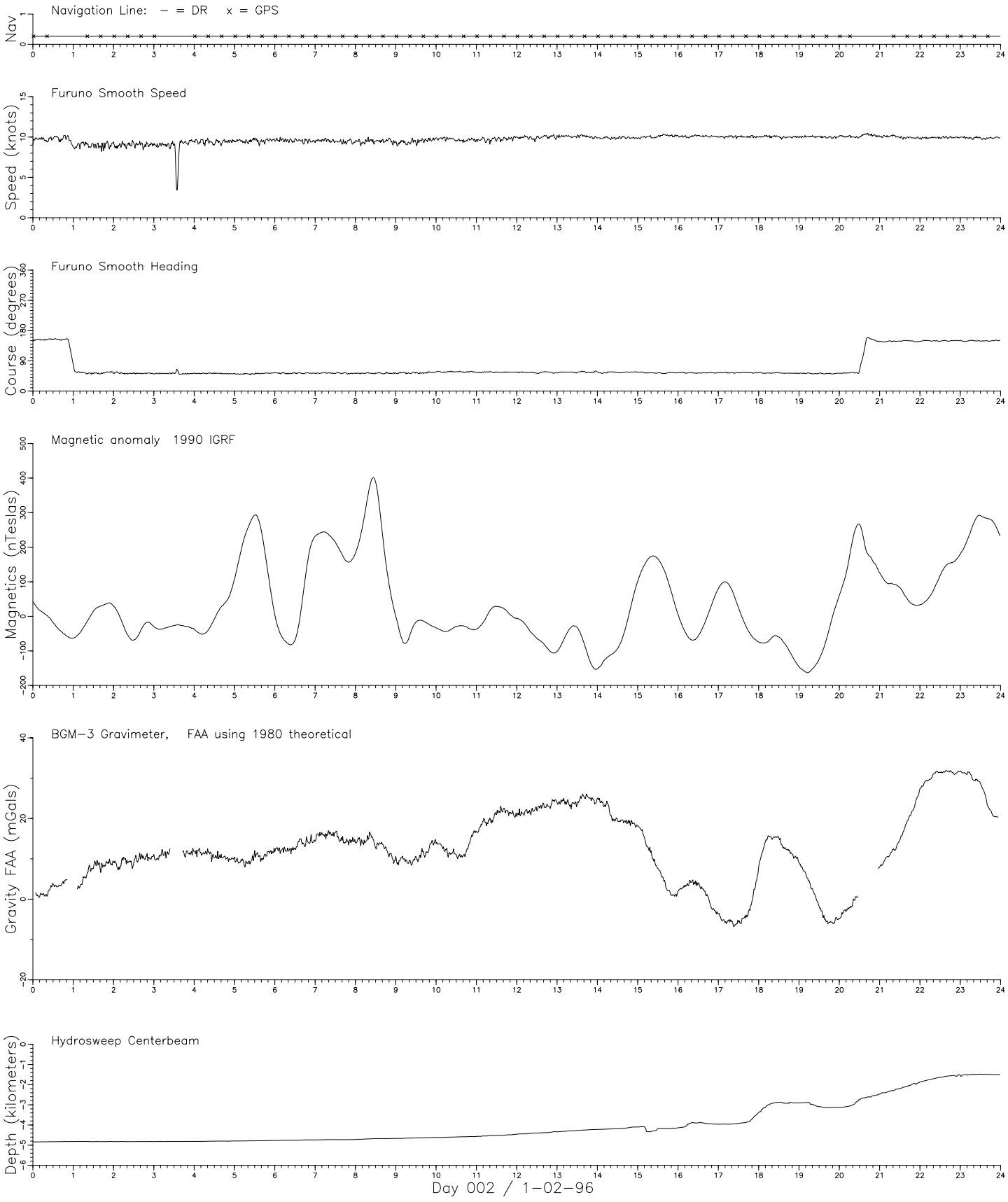
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

Navigation file: n.001 Speed/Course file: fu.s001 Magnetics file: mg.n001 Gravity file: vt.n001 Bathymetry file: hb.n001



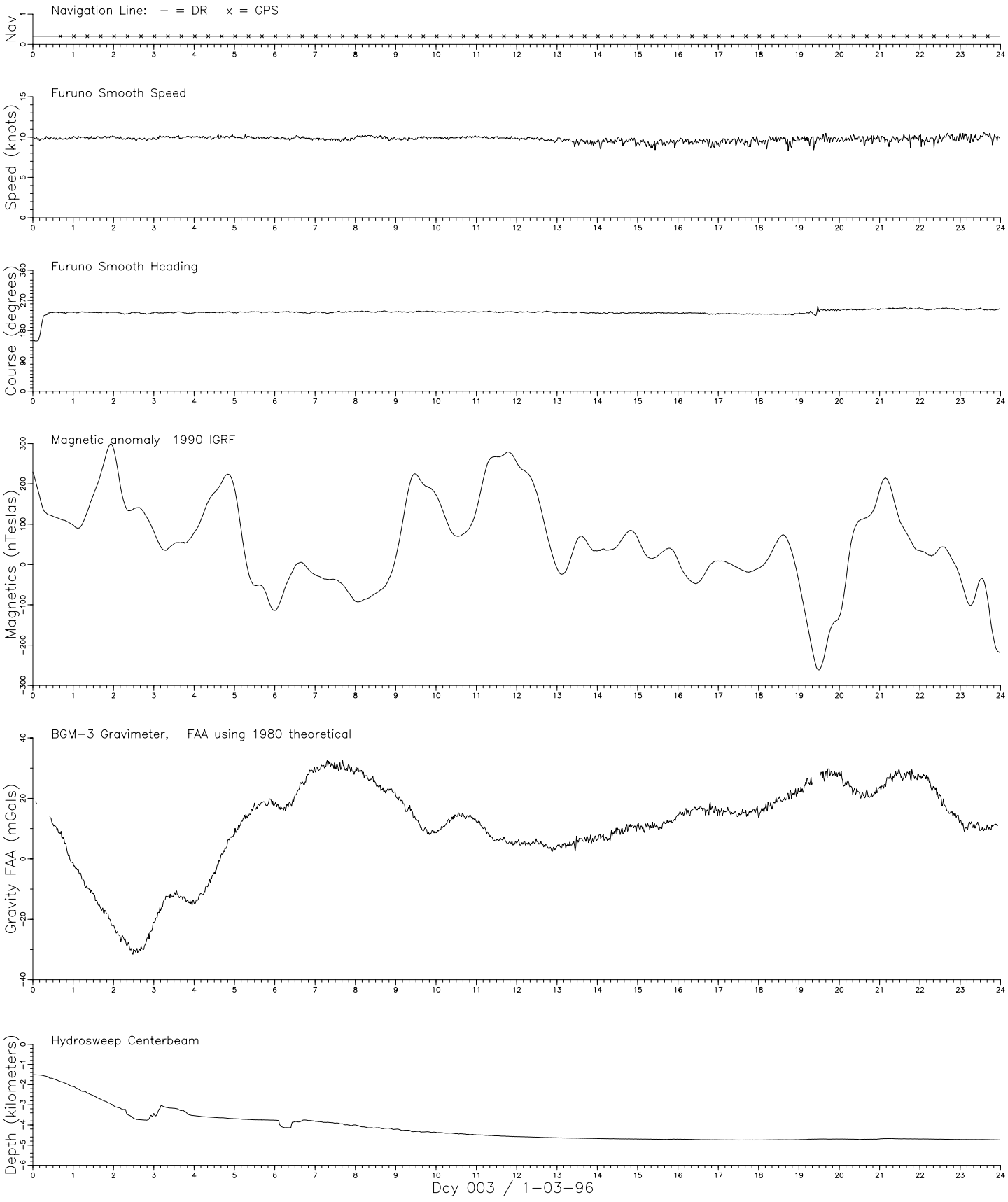
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

Navigation file: n.002 Speed/Course file: fu.s002 Magnetics file: mg.n002 Gravity file: vt.n002 Bathymetry file: hb.n002



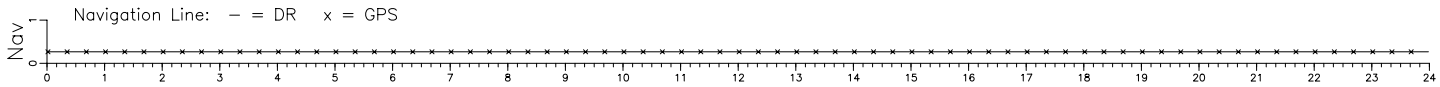
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

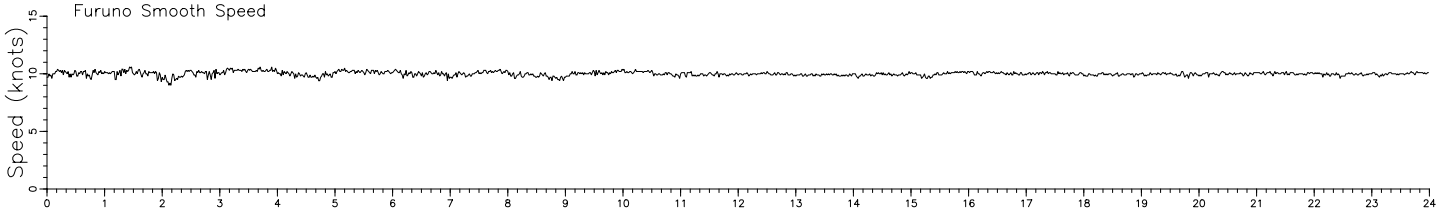
Navigation file: n.003 Speed/Course file: fu.s003 Magnetics file: mg.n003 Gravity file: vt.n003 Bathymetry file: hb.n003

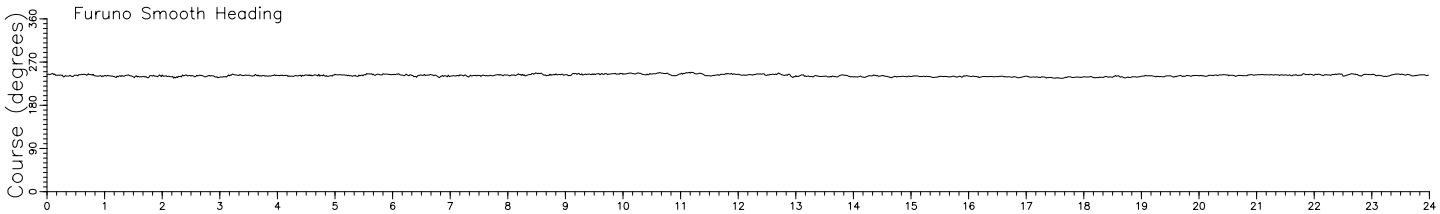


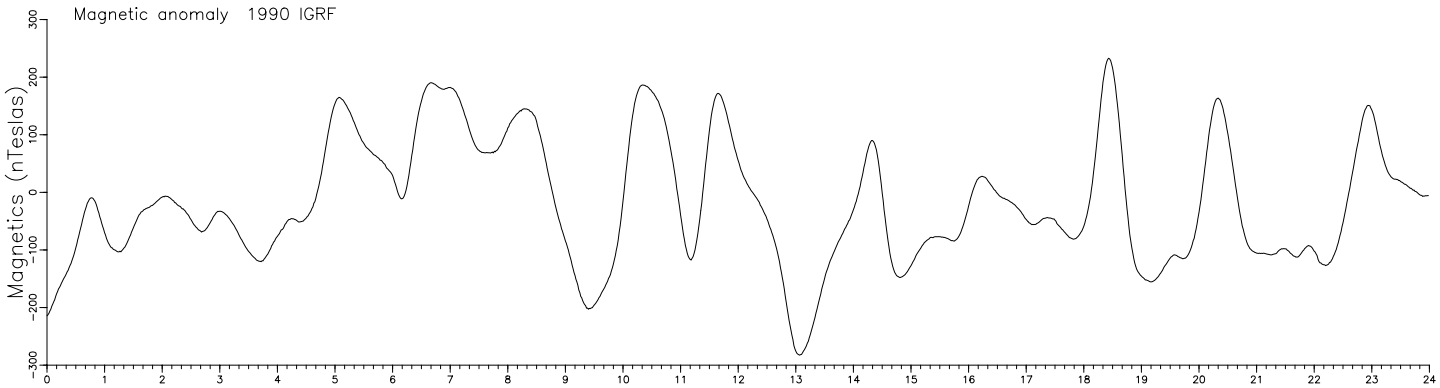
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

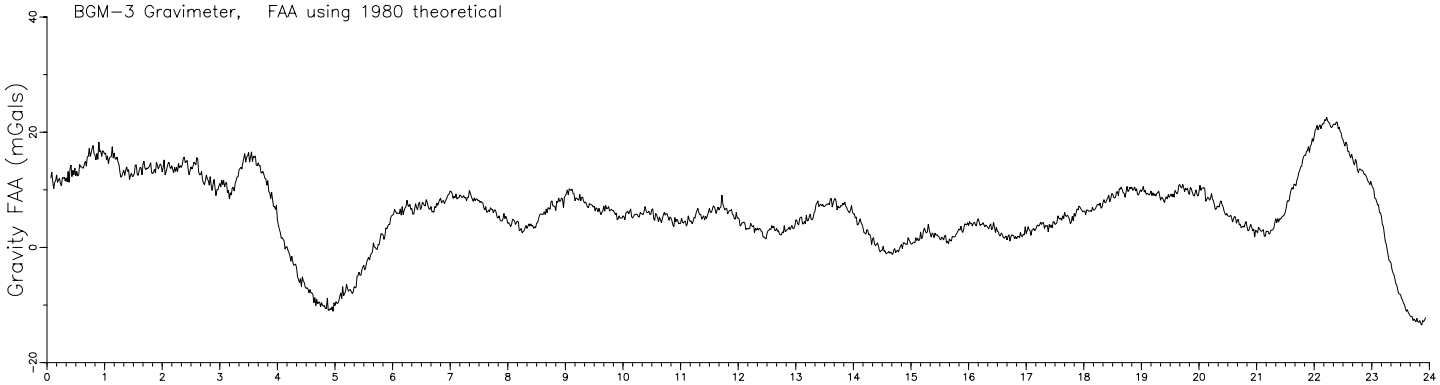
Navigation file: n.004 Speed/Course file: fu.s004 Magnetics file: mg.n004 Gravity file: vt.n004 Bathymetry file: hb.n004

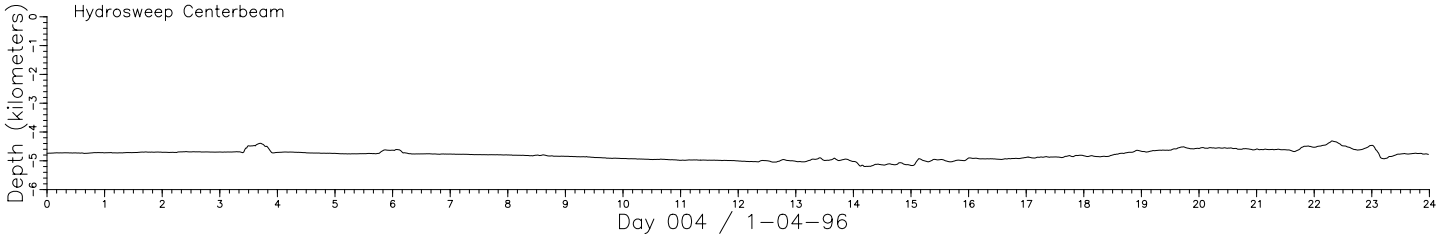






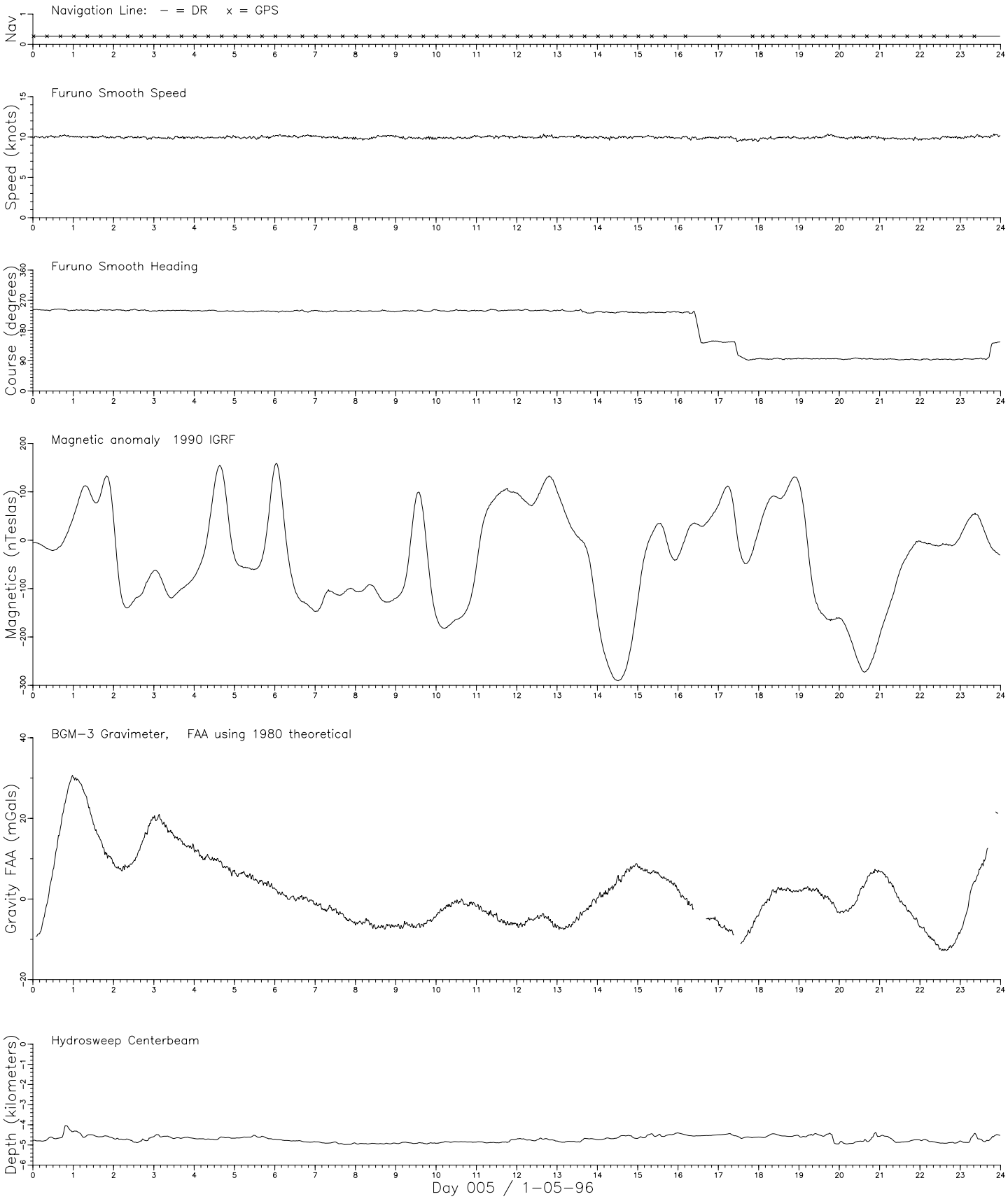






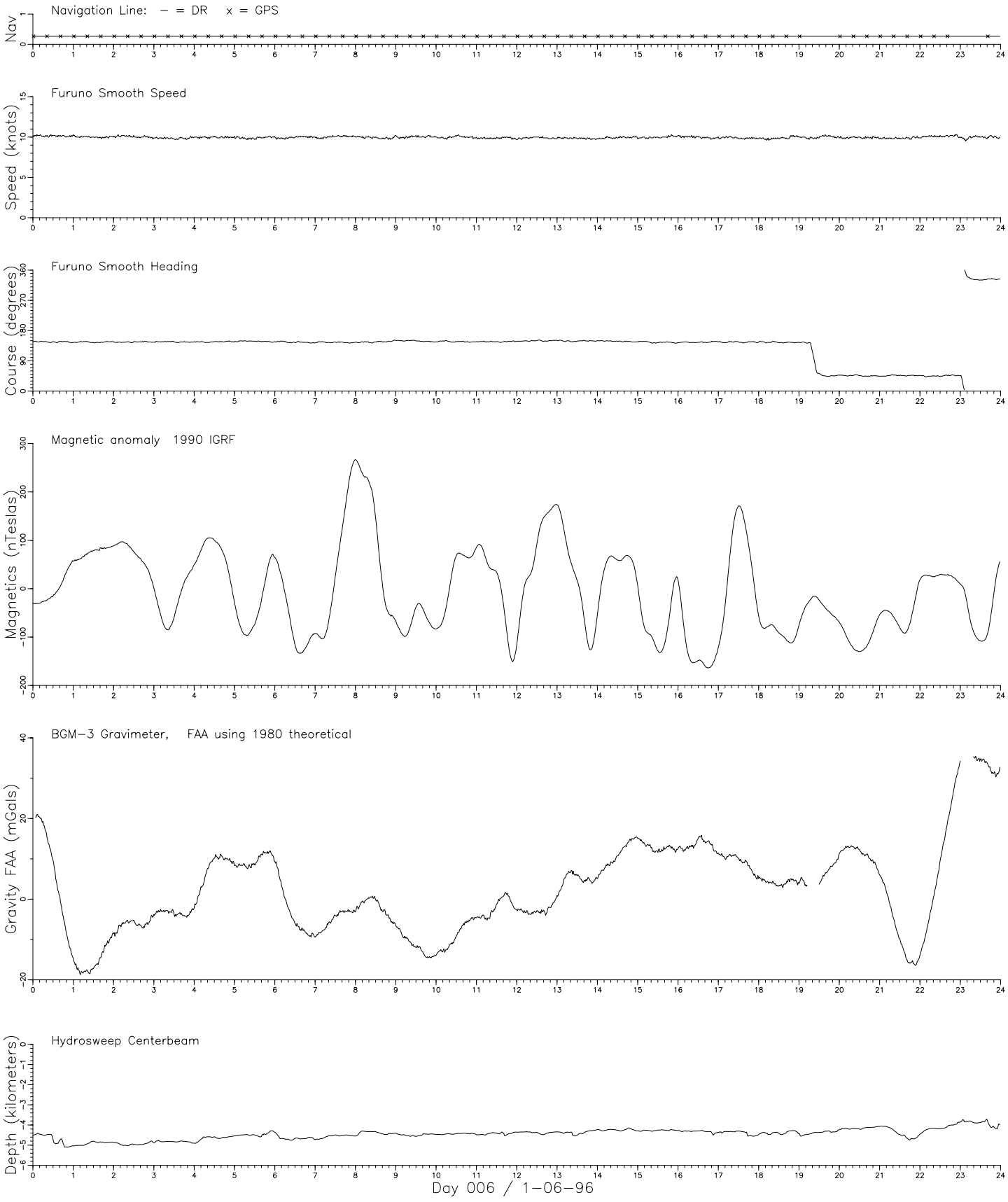
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

Navigation file: n.005 Speed/Course file: fu.s005 Magnetics file: mg.n005 Gravity file: vt.n005 Bathymetry file: hb.n005



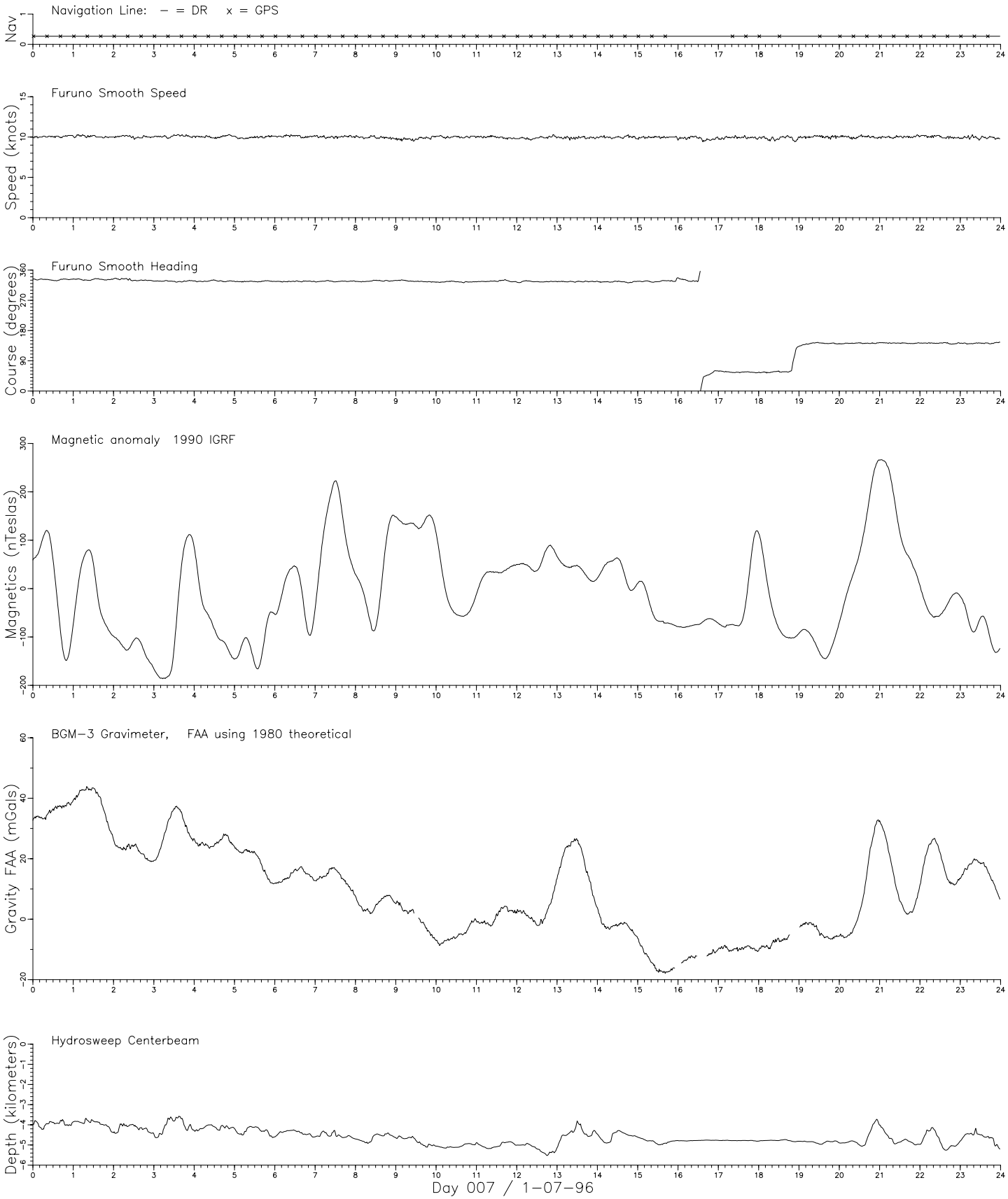
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

Navigation file: n.006 Speed/Course file: fu.s006 Magnetics file: mg.n006 Gravity file: vt.n006 Bathymetry file: hb.n006



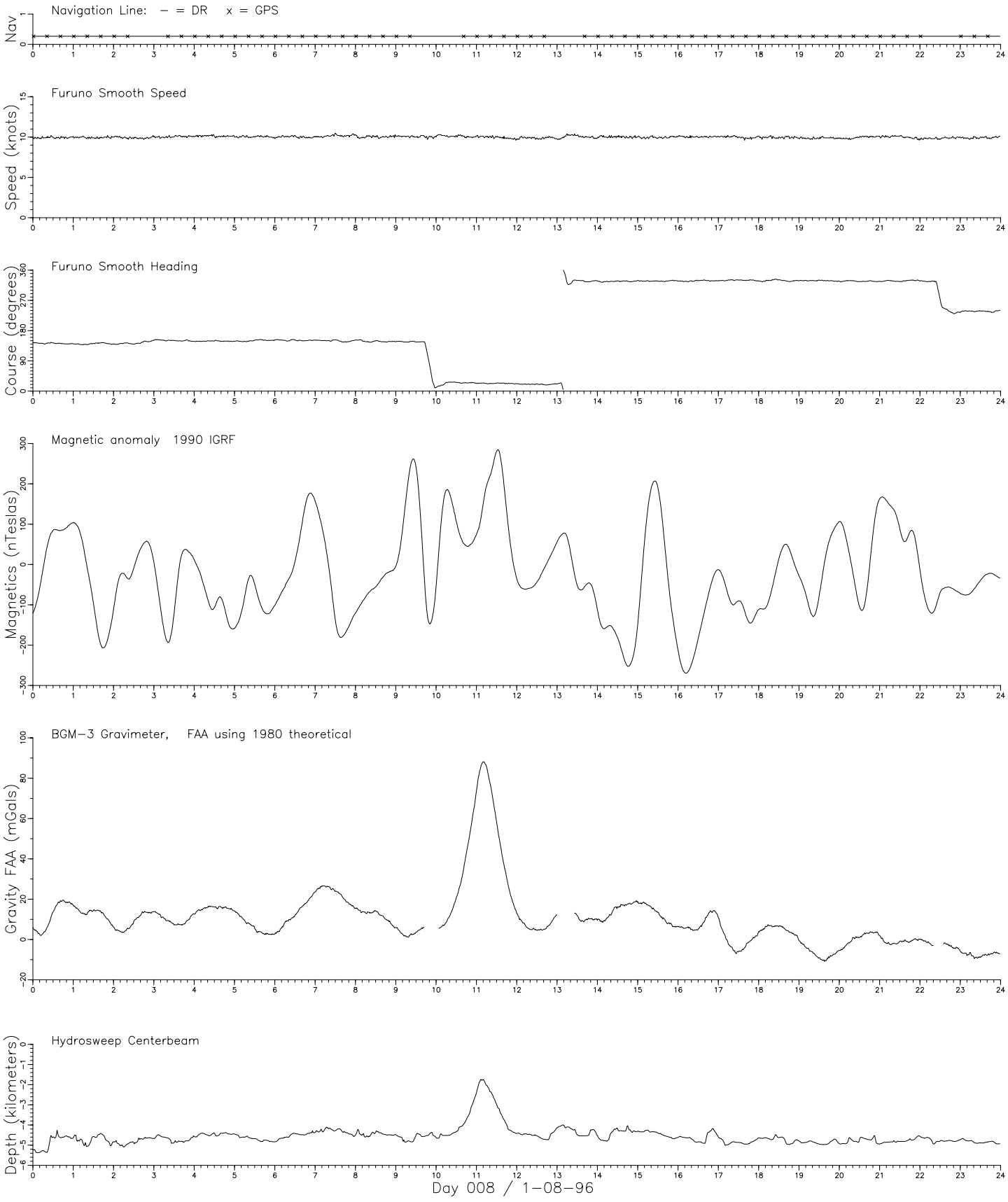
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

Navigation file: n.007 Speed/Course file: fu.s007 Magnetics file: mg.n007 Gravity file: vt.n007 Bathymetry file: hb.n007



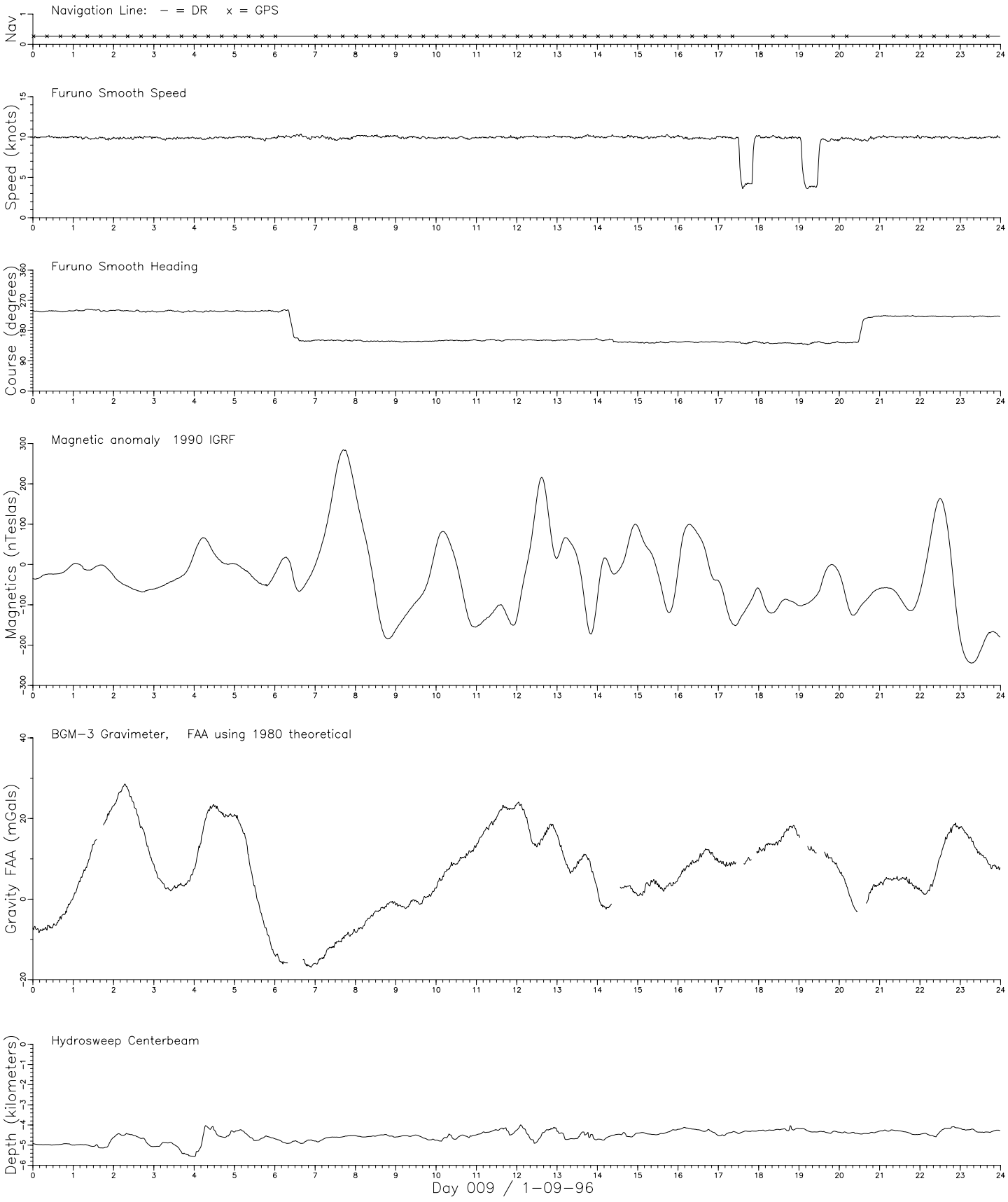
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

Navigation file: n.008 Speed/Course file: fu.s008 Magnetics file: mg.n008 Gravity file: vt.n008 Bathymetry file: hb.n008



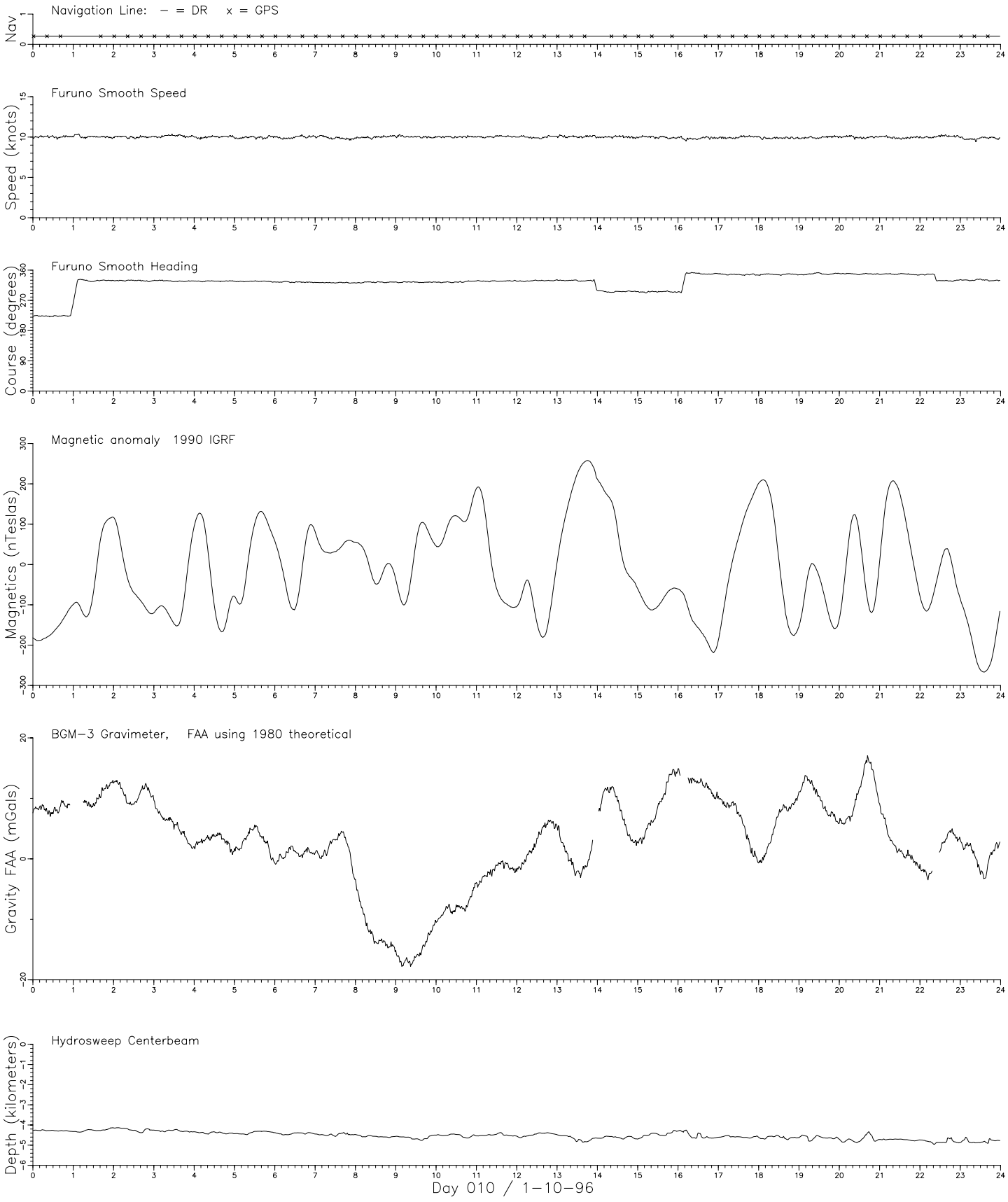
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

Navigation file: n.009 Speed/Course file: fu.s009 Magnetics file: mg.n009 Gravity file: vt.n009 Bathymetry file: hb.n009



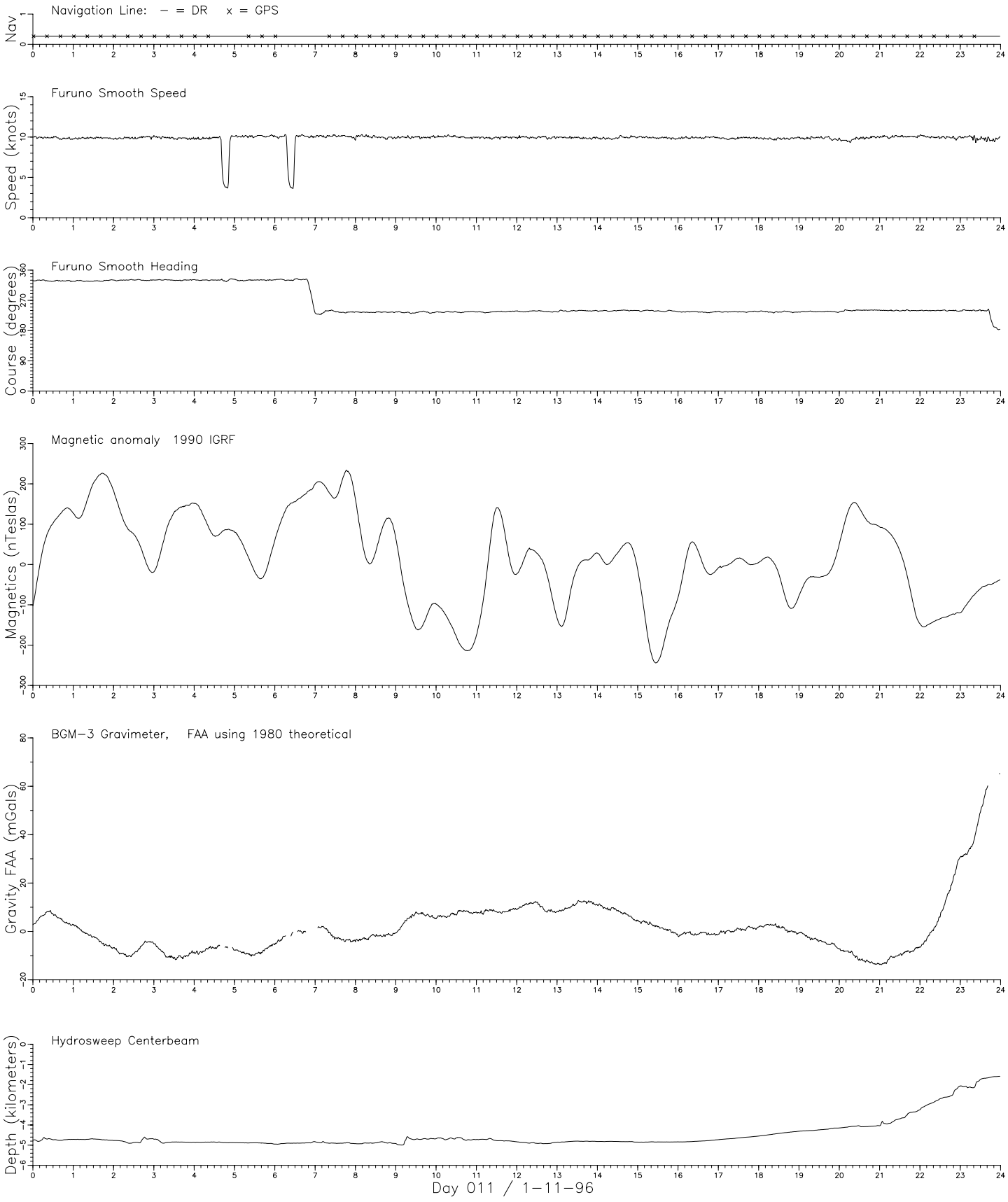
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

Navigation file: n.010 Speed/Course file: fu.s010 Magnetics file: mg.n010 Gravity file: vt.n010 Bathymetry file: hb.n010



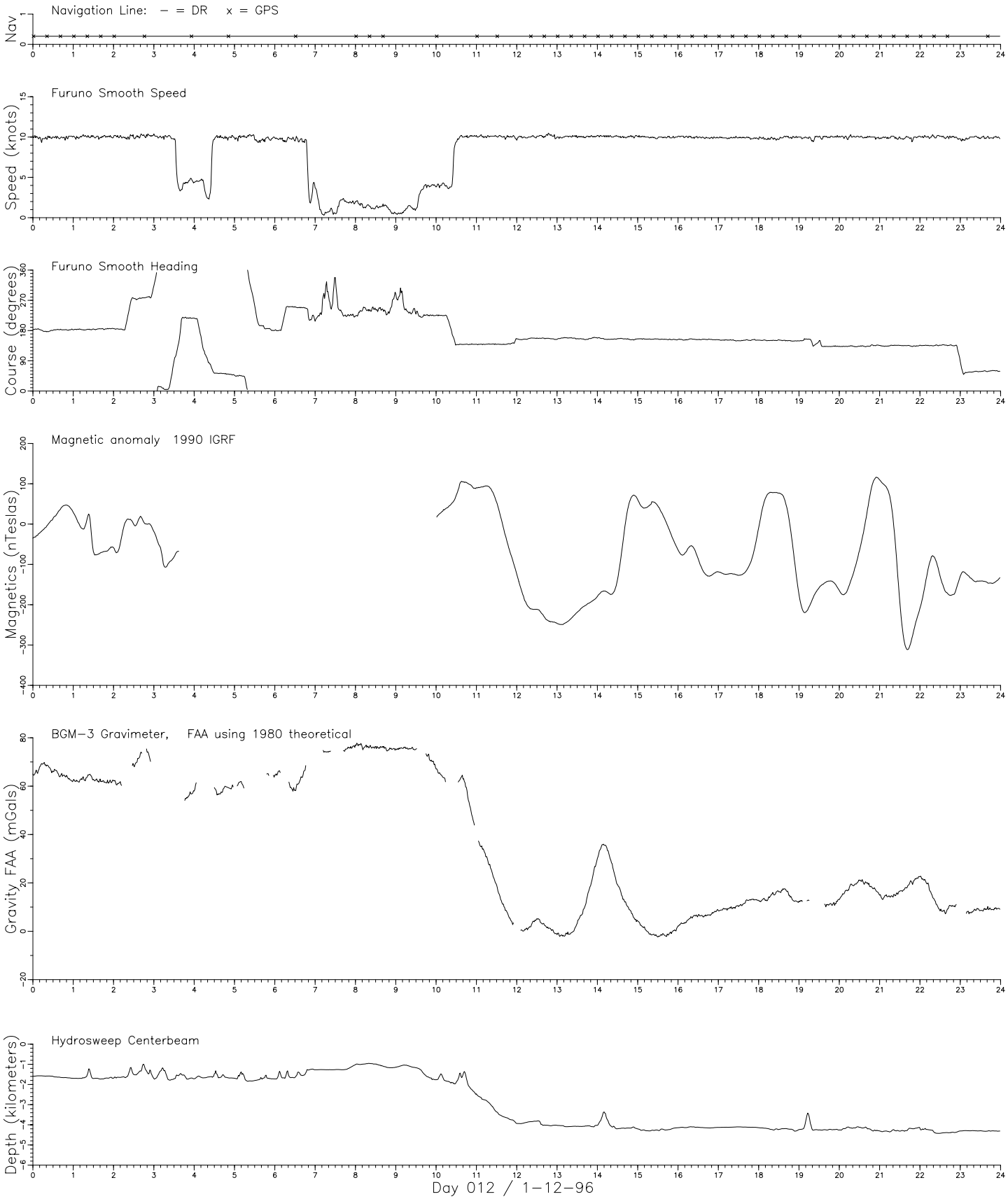
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

Navigation file: n.011 Speed/Course file: fu.s011 Magnetics file: mg.n011 Gravity file: vt.n011 Bathymetry file: hb.n011



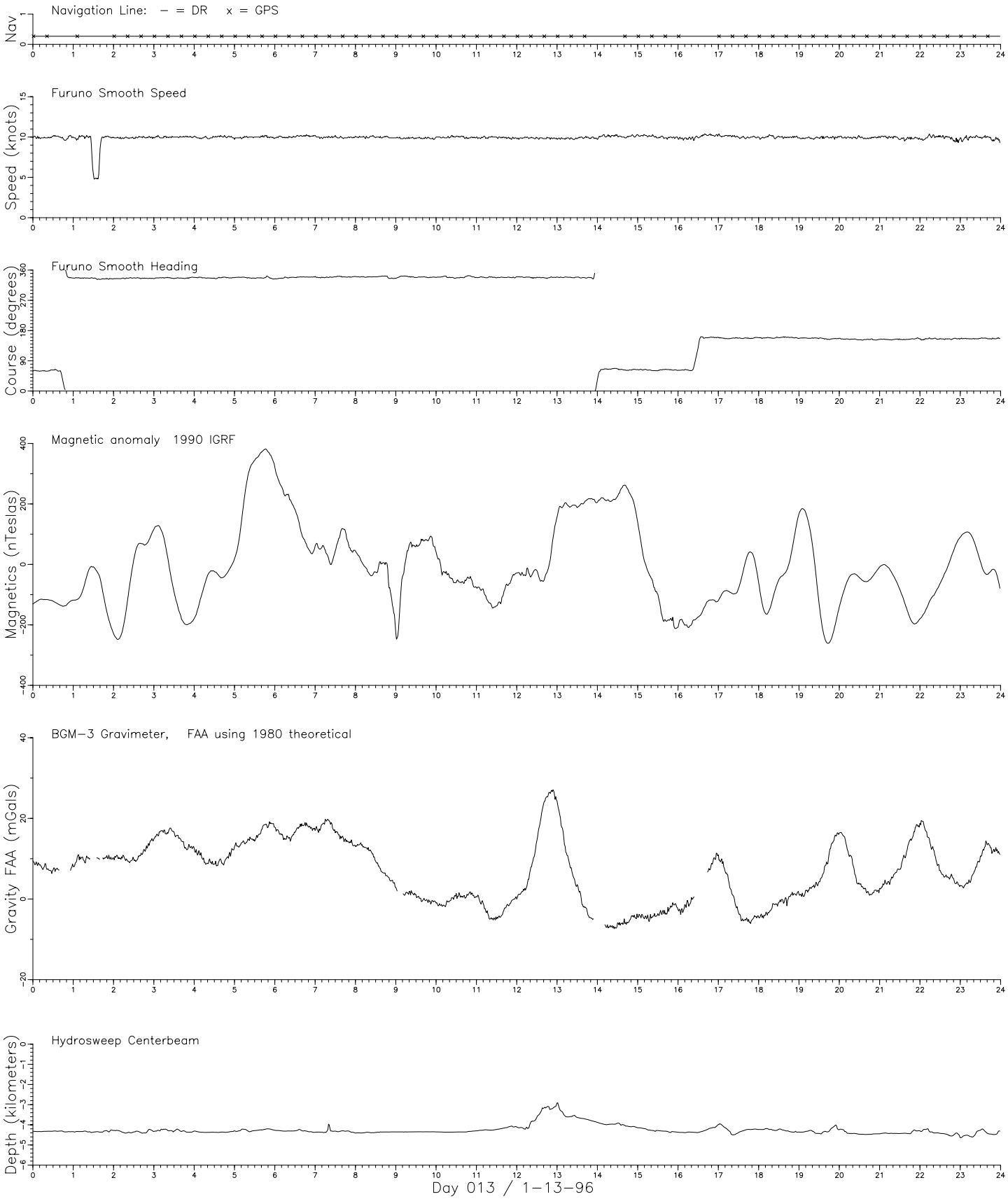
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

Navigation file: n.012 Speed/Course file: fu.s012 Magnetics file: mg.n012 Gravity file: vt.n012 Bathymetry file: hb.n012



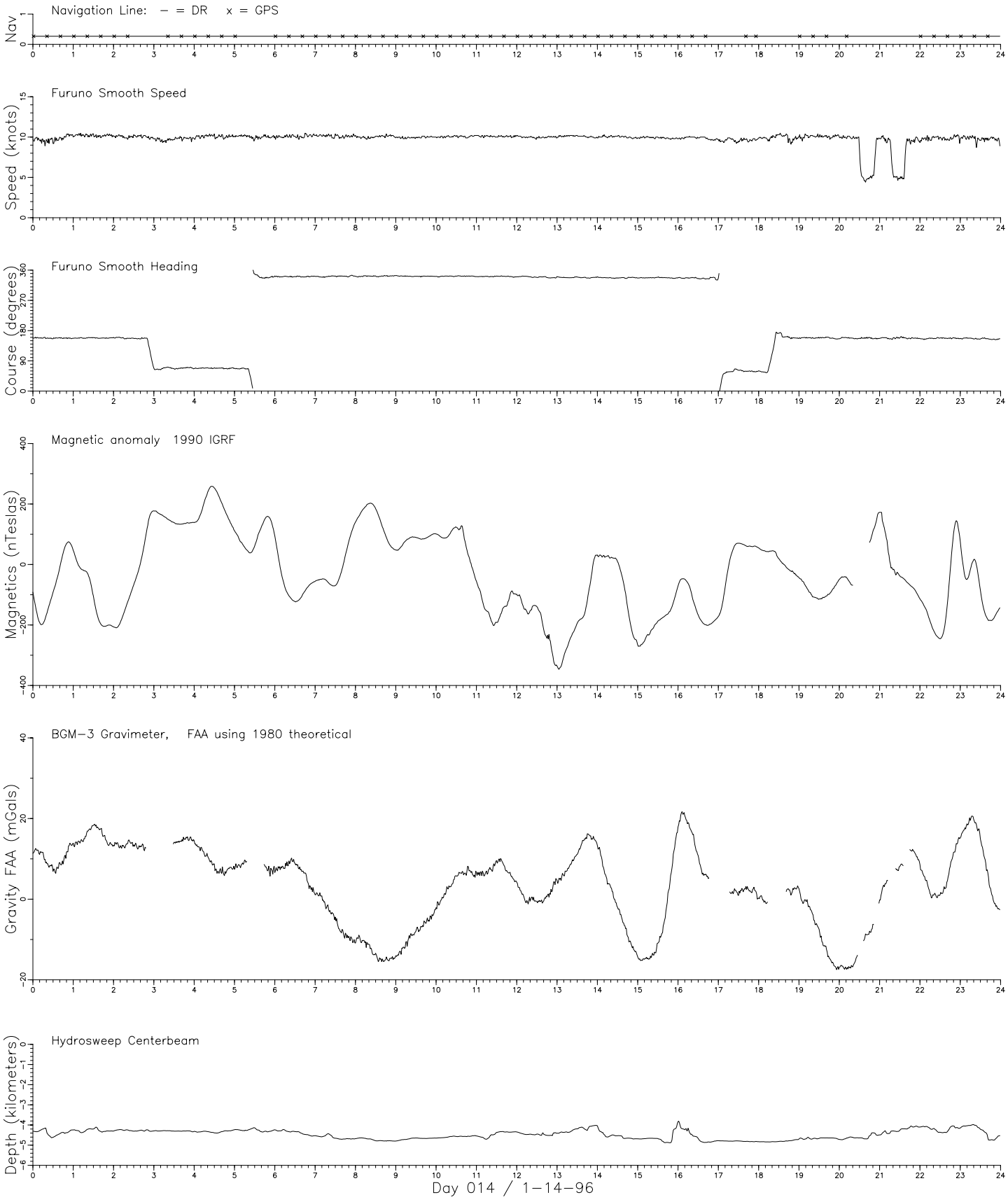
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

Navigation file: n.013 Speed/Course file: fu.s013 Magnetics file: mg.n013 Gravity file: vt.n013 Bathymetry file: hb.n013



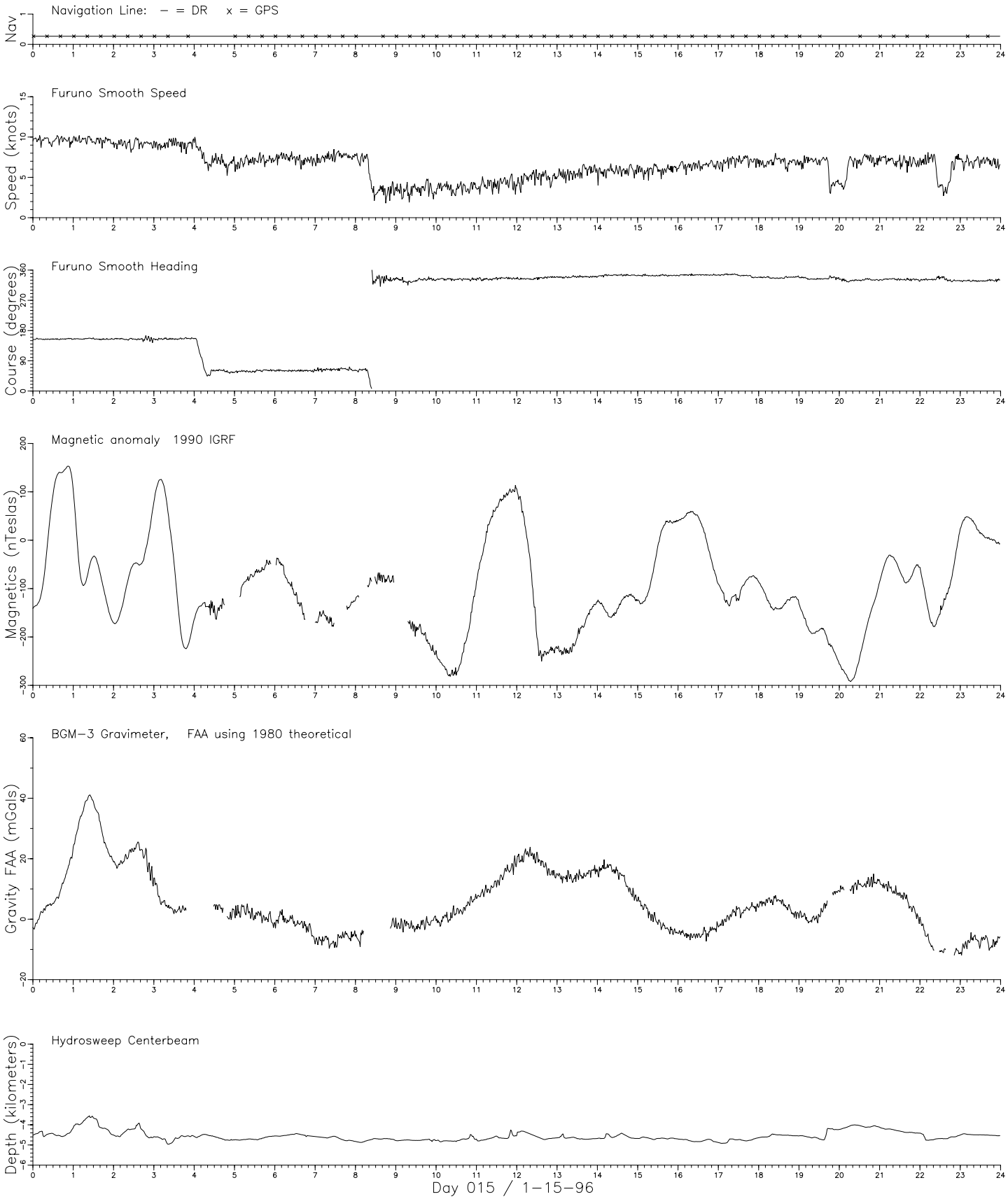
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

Navigation file: n.014 Speed/Course file: fu.s014 Magnetics file: mg.n014 Gravity file: vt.n014 Bathymetry file: hb.n014



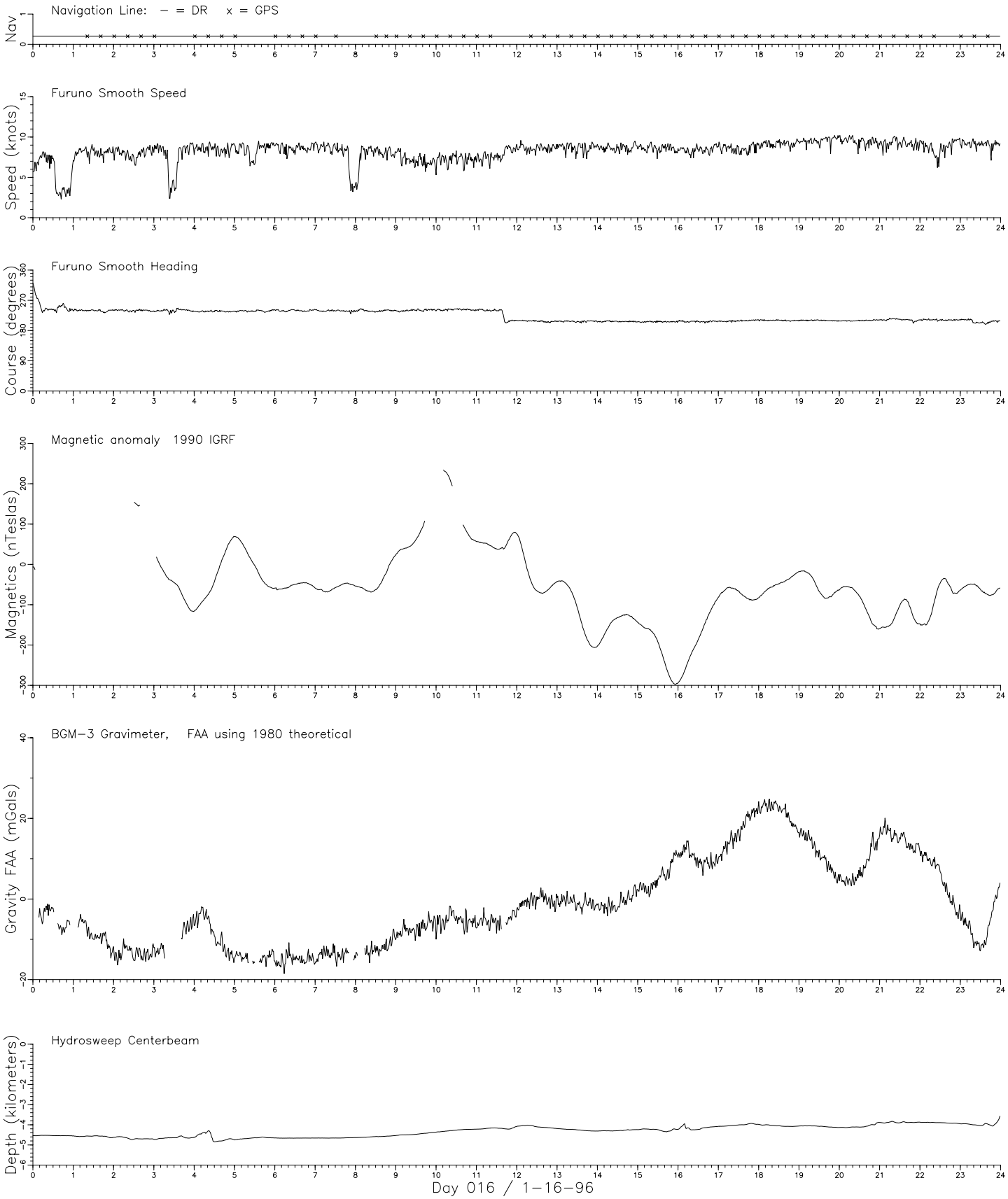
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

Navigation file: n.015 Speed/Course file: fu.s015 Magnetics file: mg.n015 Gravity file: vt.n015 Bathymetry file: hb.n015



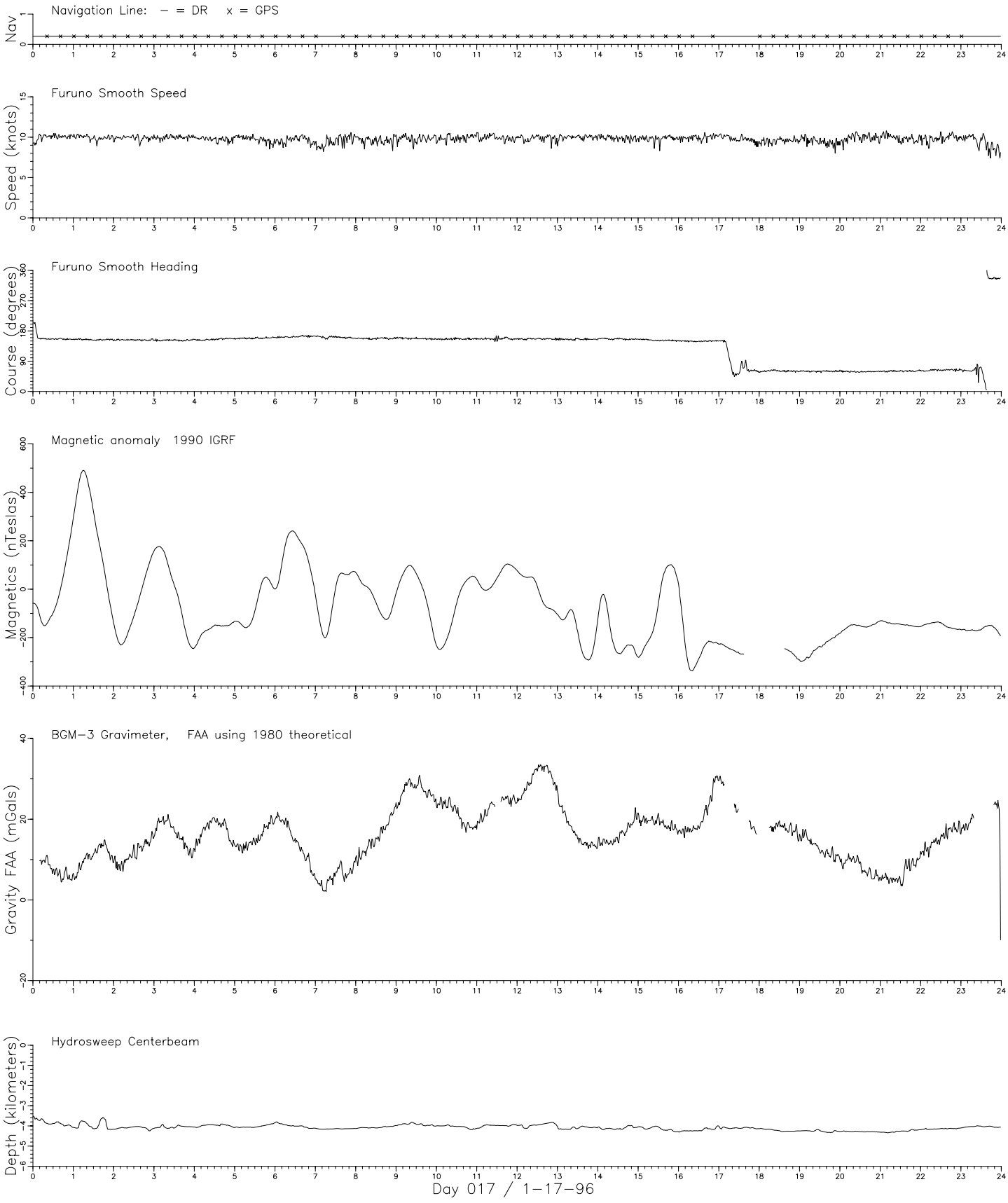
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

Navigation file: n.016 Speed/Course file: fu.s016 Magnetics file: mg.n016 Gravity file: vt.n016 Bathymetry file: hb.n016



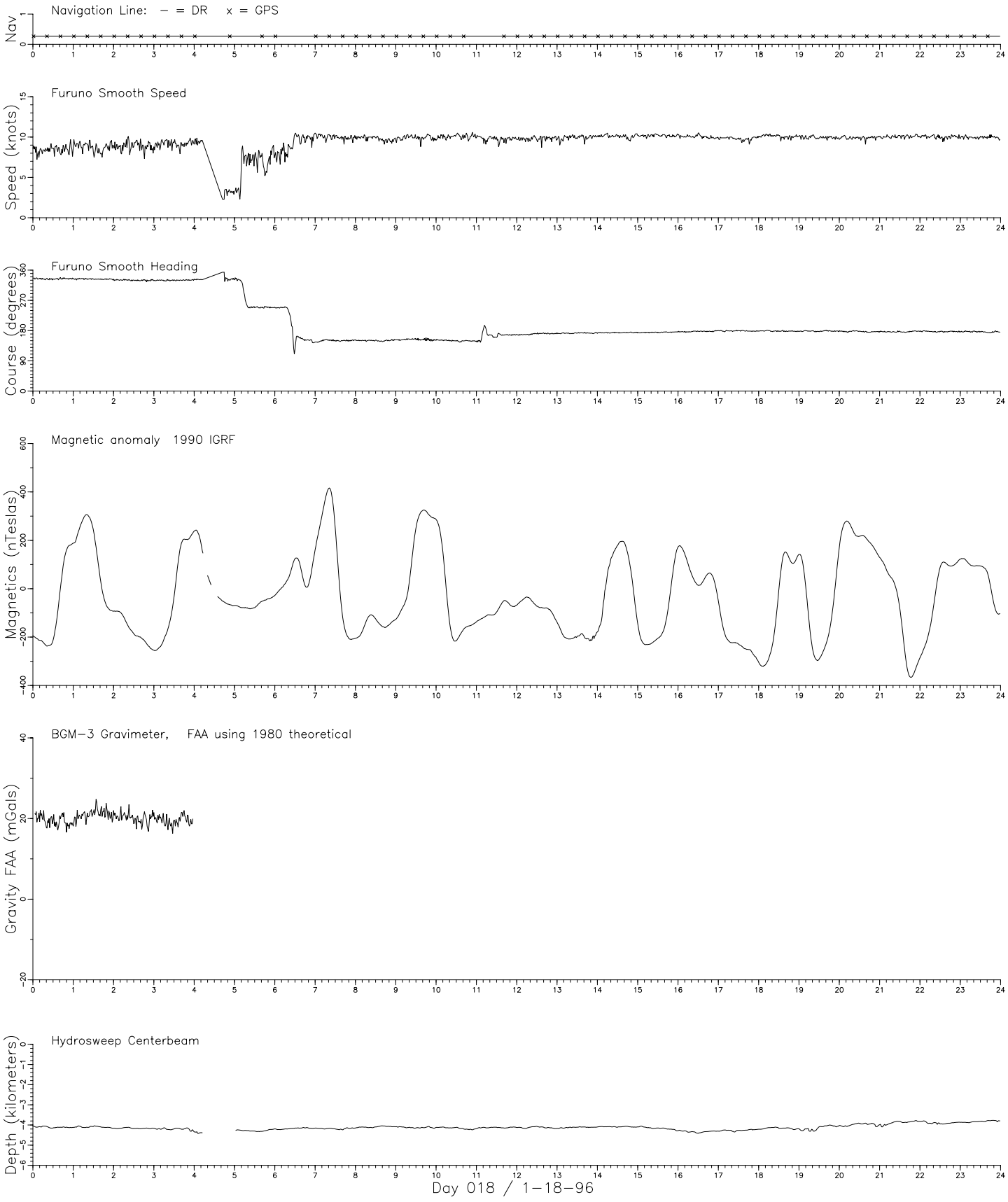
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

Navigation file: n.017 Speed/Course file: fu.s017 Magnetics file: mg.n017 Gravity file: vt.n017 Bathymetry file: hb.n017



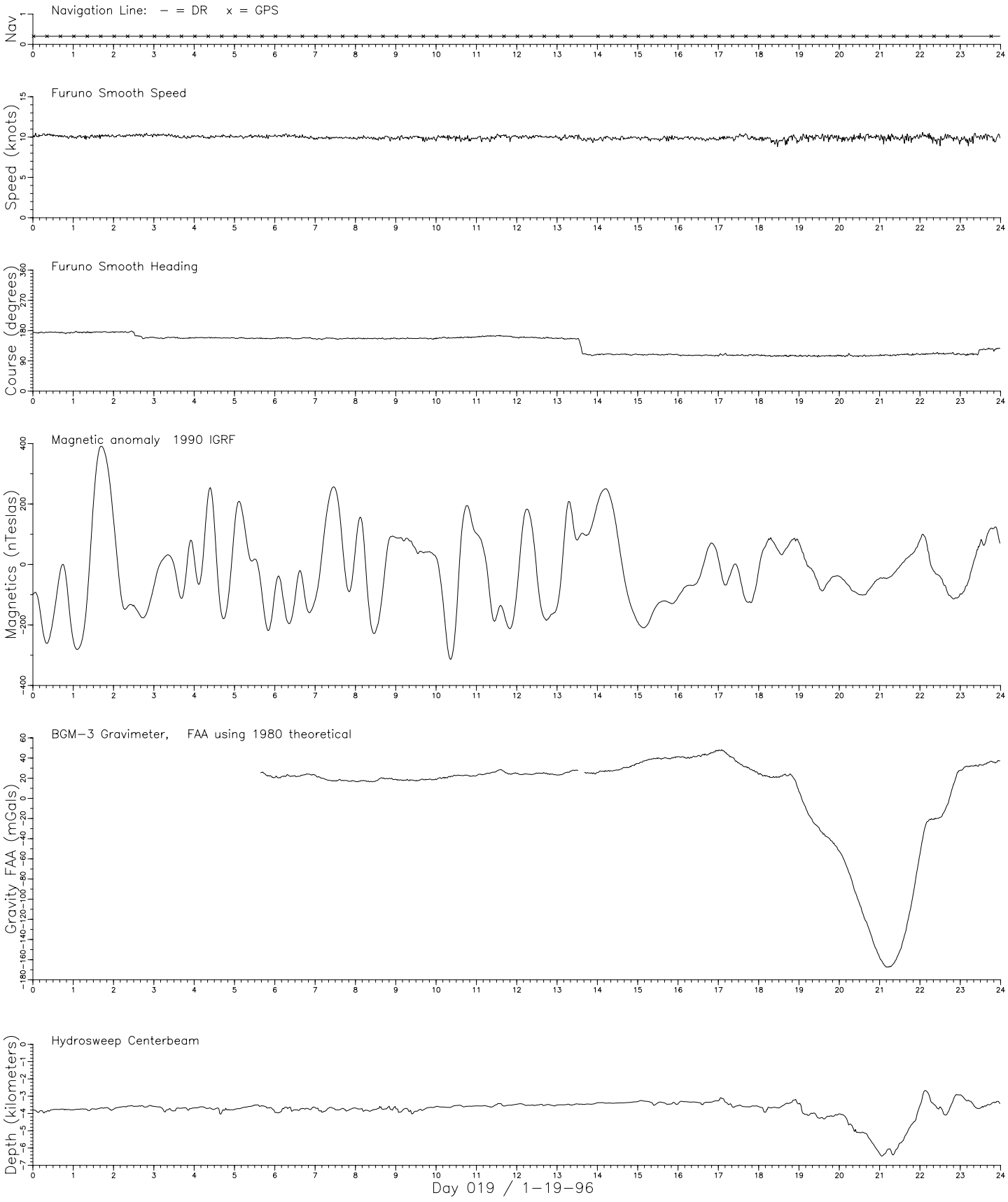
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

Navigation file: n.018 Speed/Course file: fu.s018 Magnetics file: mg.n018 Gravity file: vt.n018 Bathymetry file: hb.n018



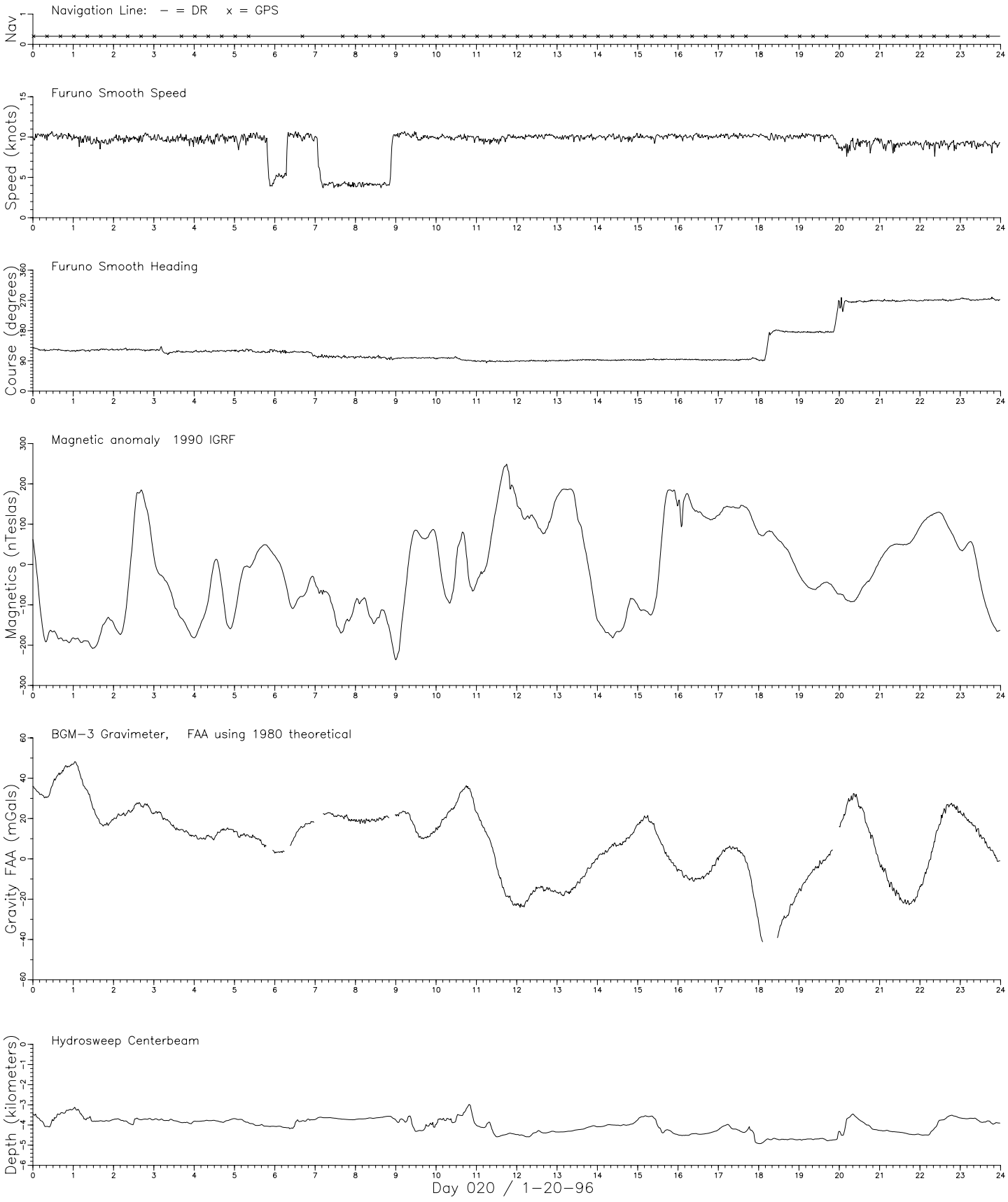
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

Navigation file: n.019 Speed/Course file: fu.s019 Magnetics file: mg.n019 Gravity file: vt.n019 Bathymetry file: hb.n019



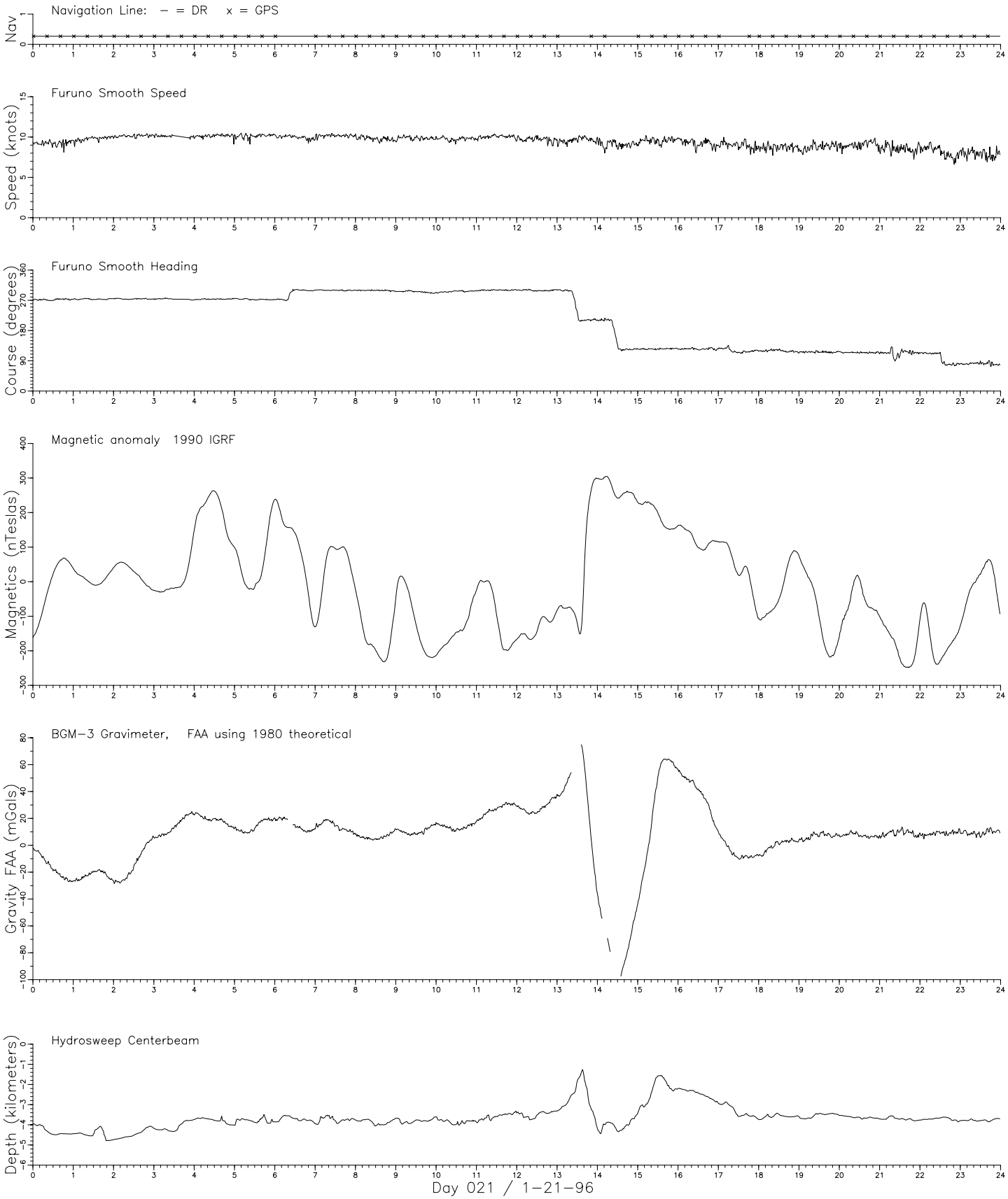
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

Navigation file: n.020 Speed/Course file: fu.s020 Magnetics file: mg.n020 Gravity file: vt.n020 Bathymetry file: hb.n020



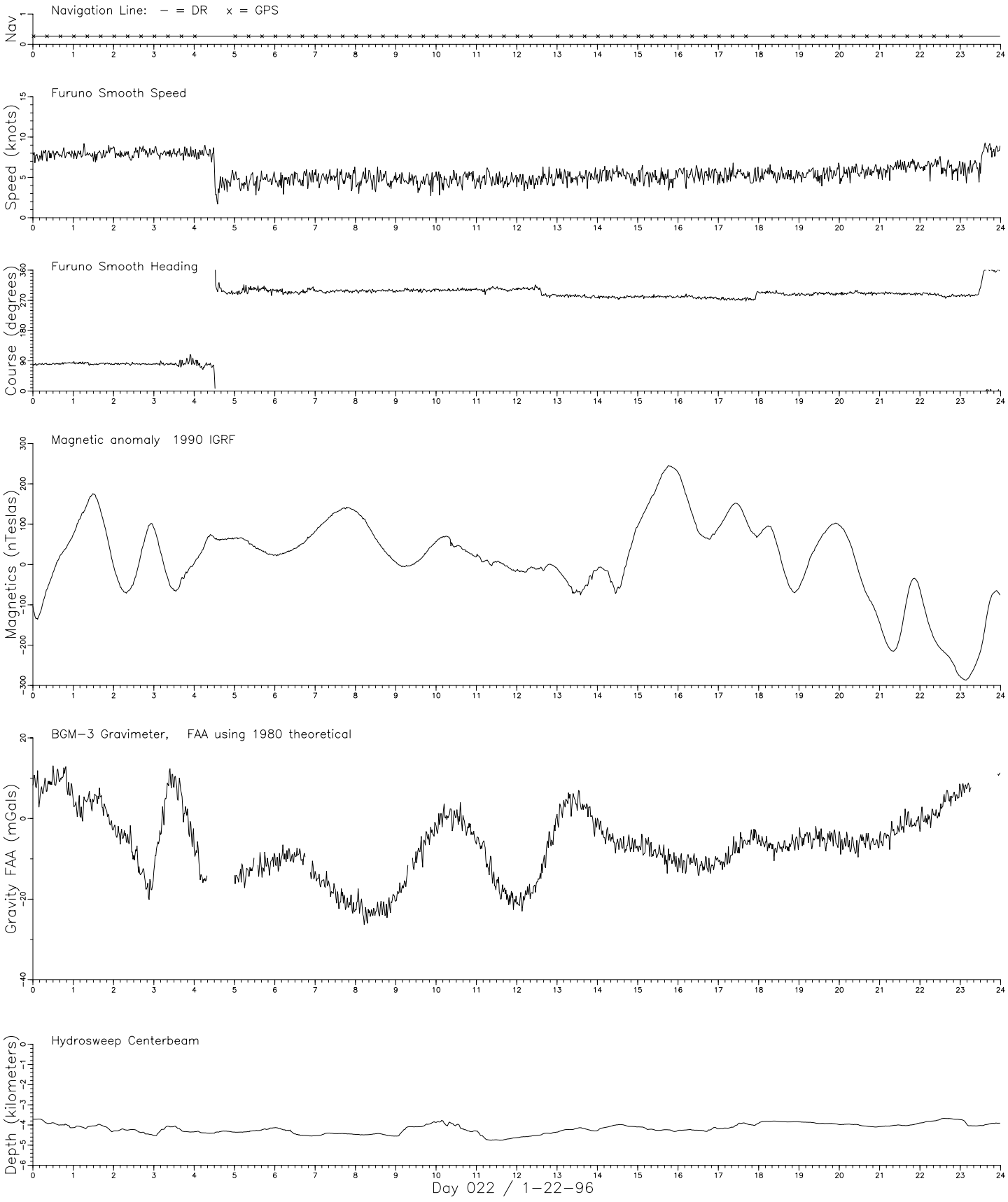
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

Navigation file: n.021 Speed/Course file: fu.s021 Magnetics file: mg.n021 Gravity file: vt.n021 Bathymetry file: hb.n021



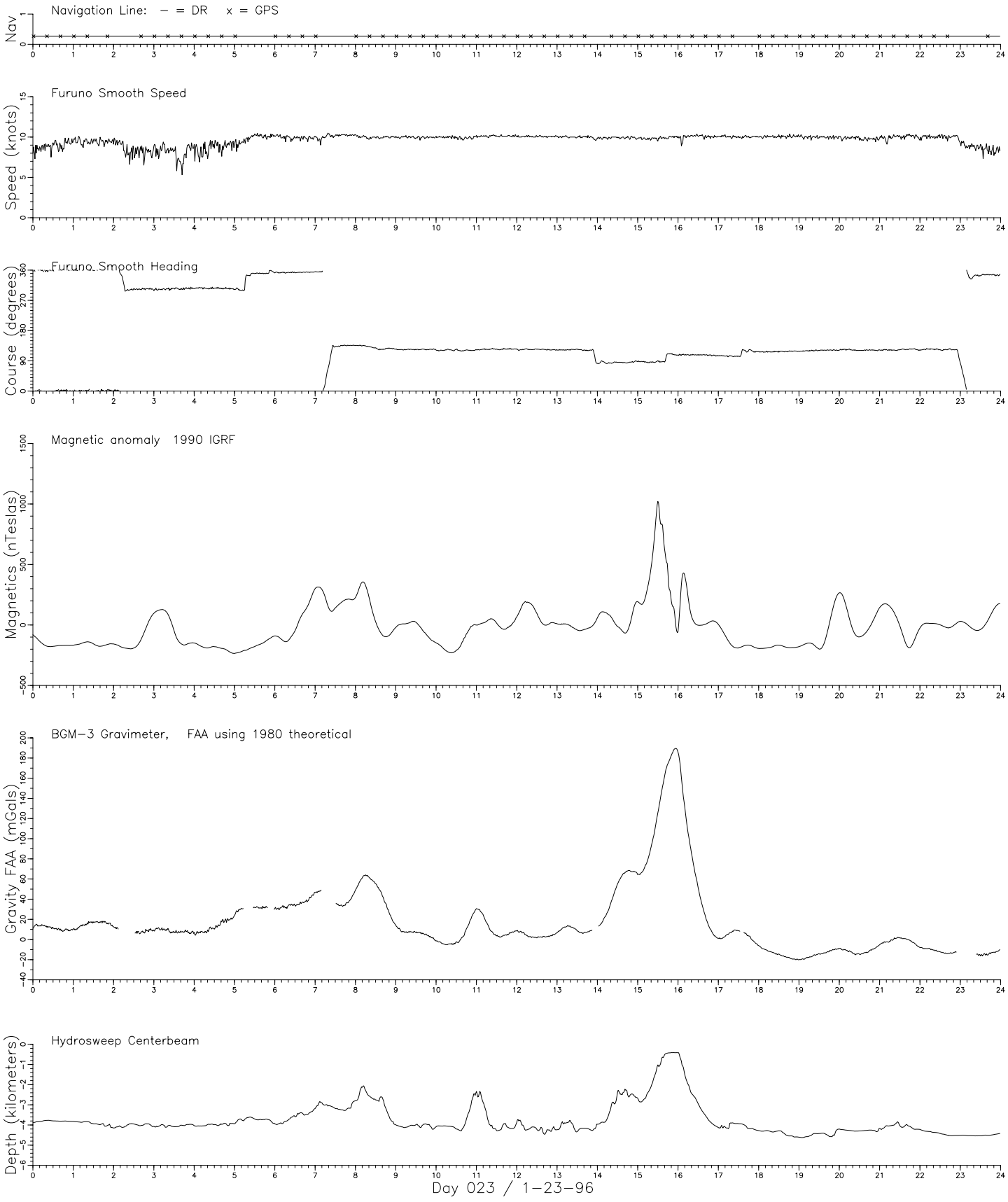
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

Navigation file: n.022 Speed/Course file: fu.s022 Magnetics file: mg.n022 Gravity file: vt.n022 Bathymetry file: hb.n022



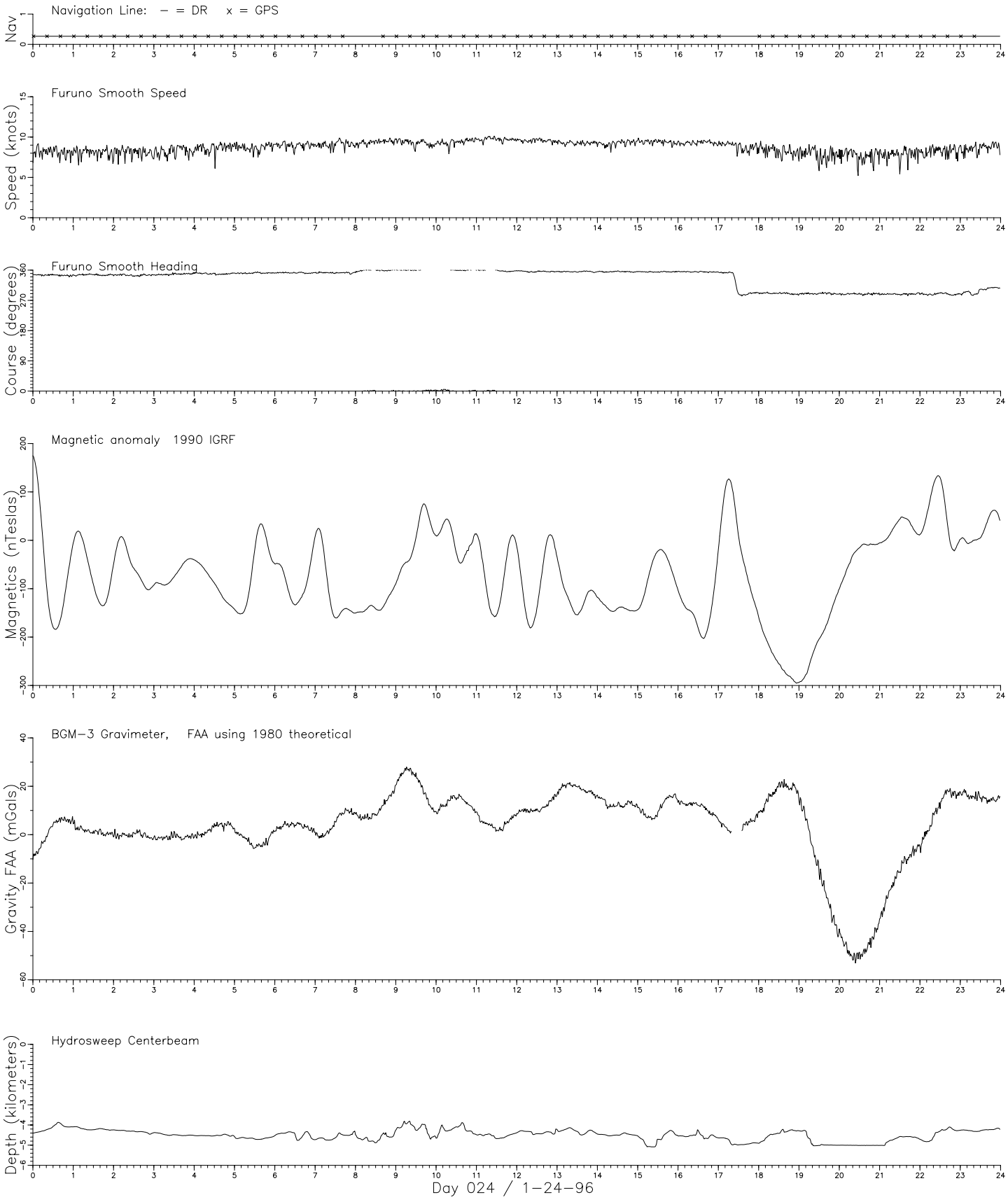
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

Navigation file: n.023 Speed/Course file: fu.s023 Magnetics file: mg.n023 Gravity file: vt.n023 Bathymetry file: hb.n023



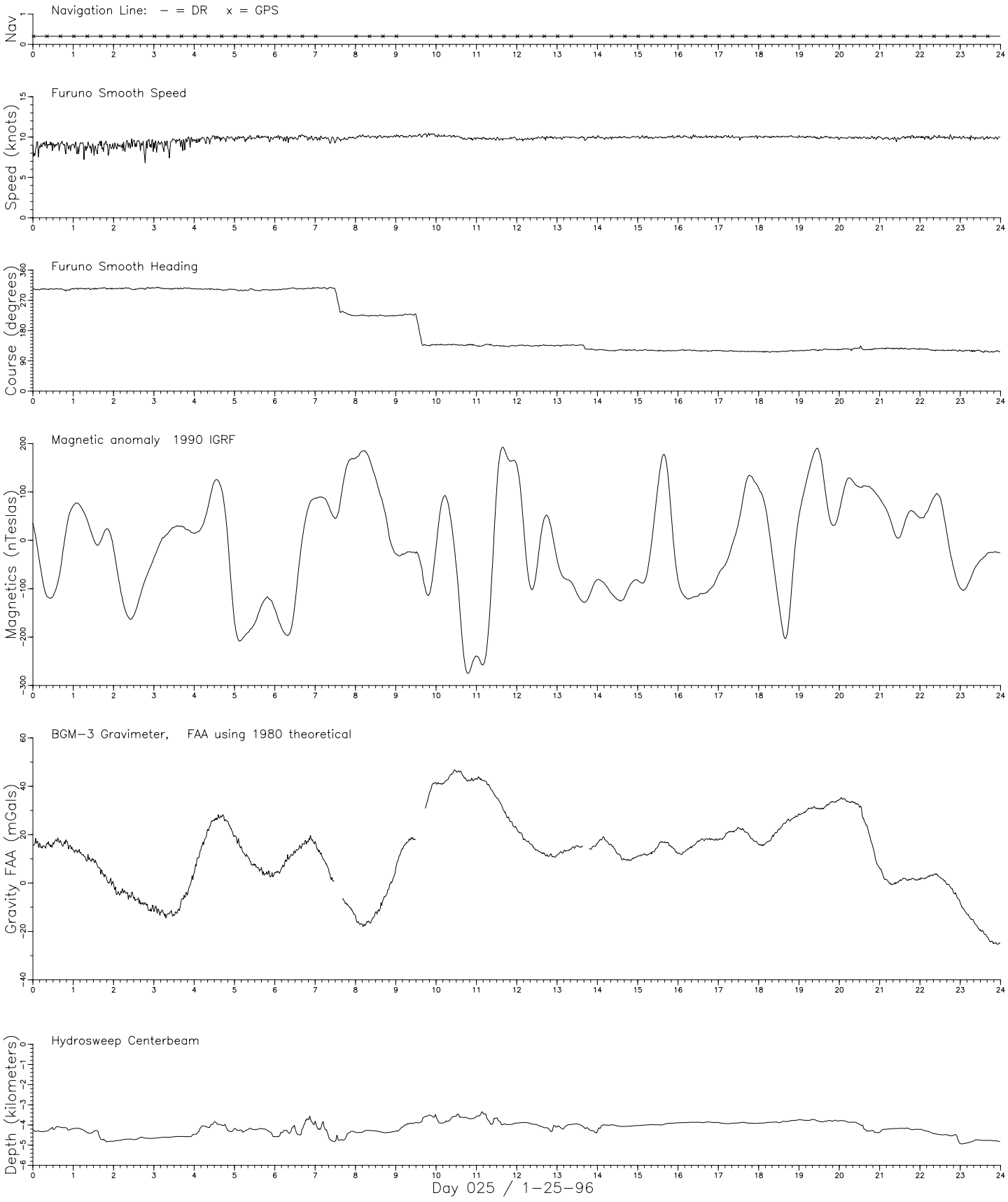
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

Navigation file: n.024 Speed/Course file: fu.s024 Magnetics file: mg.n024 Gravity file: vt.n024 Bathymetry file: hb.n024



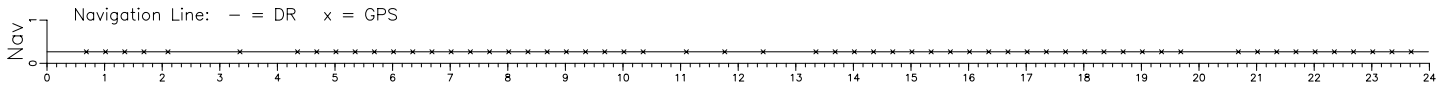
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

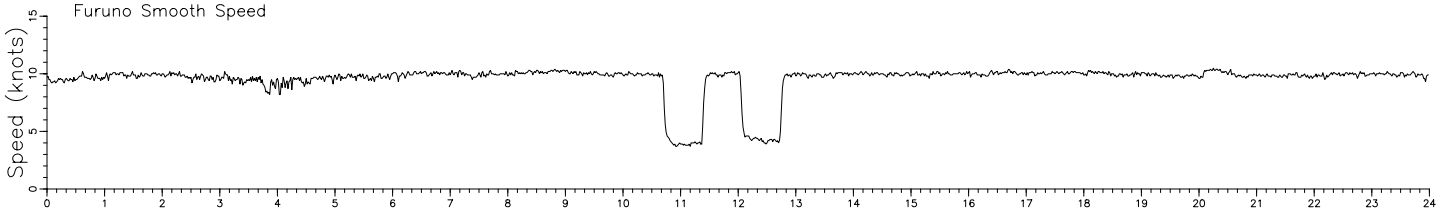
Navigation file: n.025 Speed/Course file: fu.s025 Magnetics file: mg.n025 Gravity file: vt.n025 Bathymetry file: hb.n025

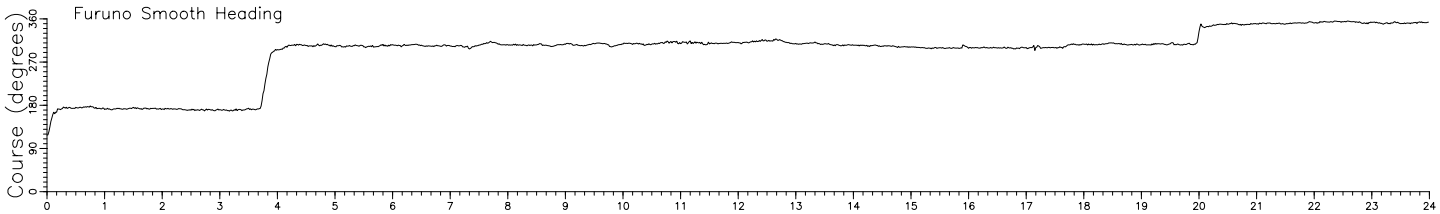


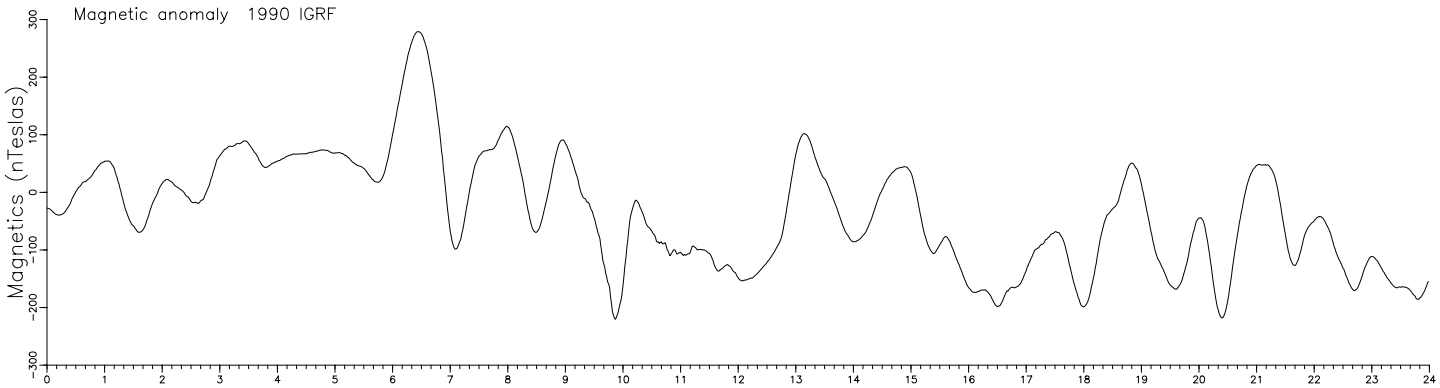
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

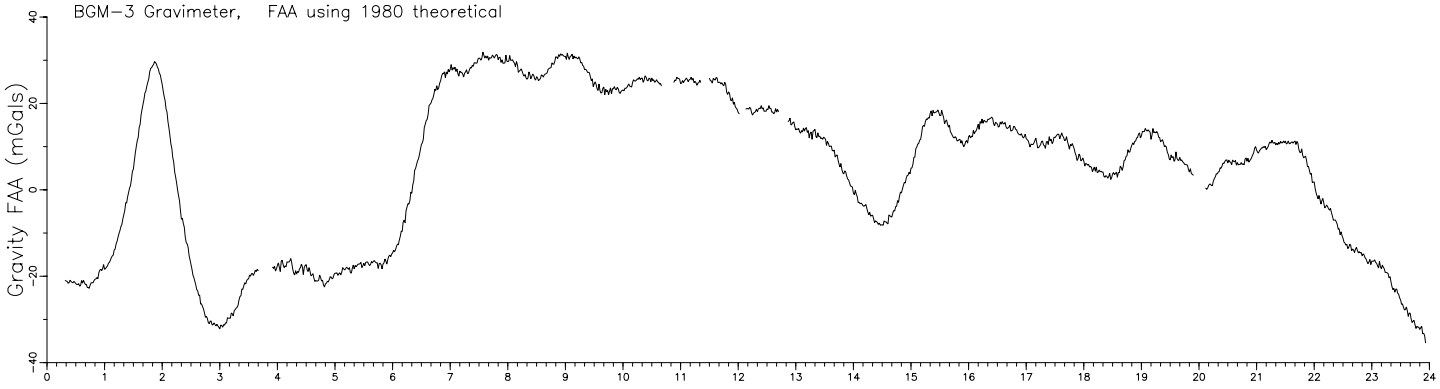
Navigation file: n.026 Speed/Course file: fu.s026 Magnetics file: mg.n026 Gravity file: vt.n026 Bathymetry file: hb.n026

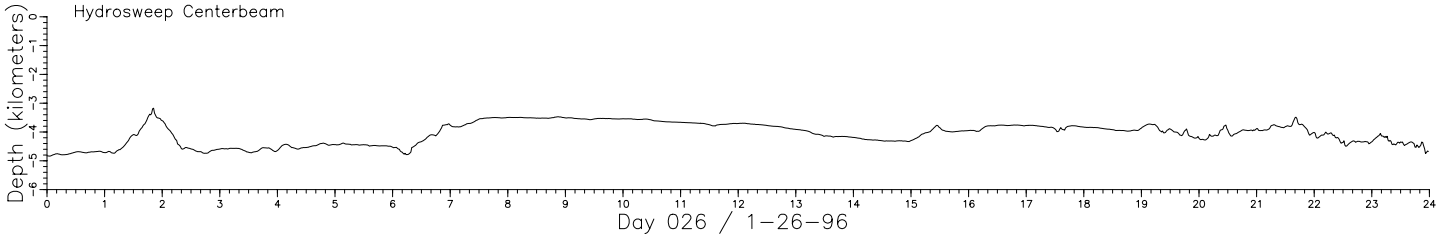






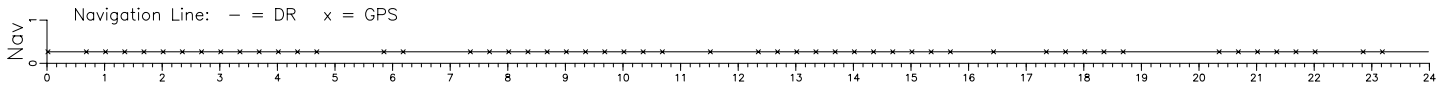


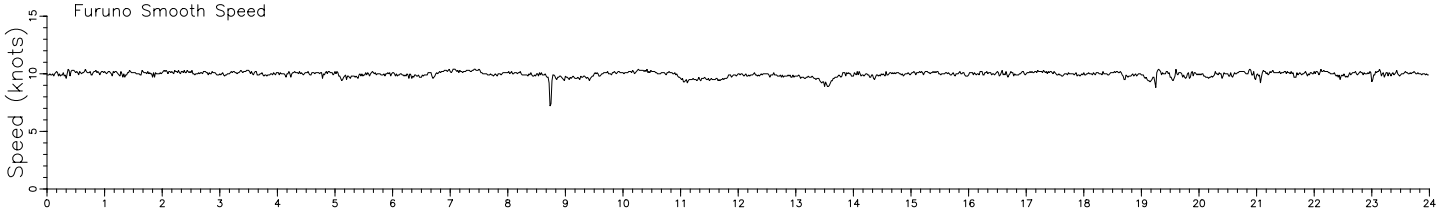


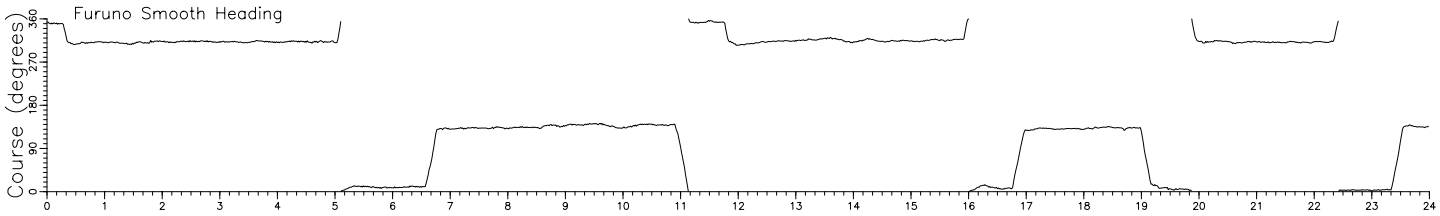


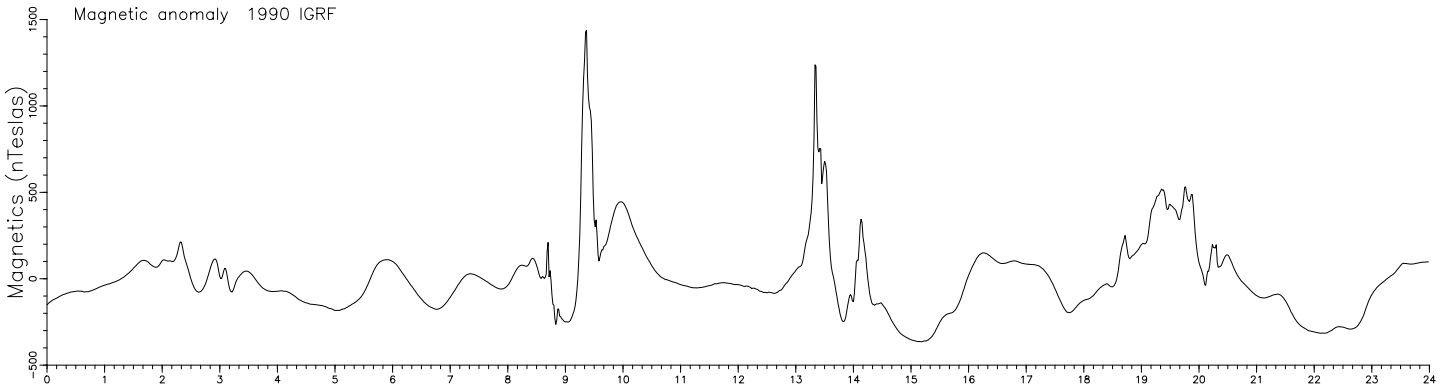
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

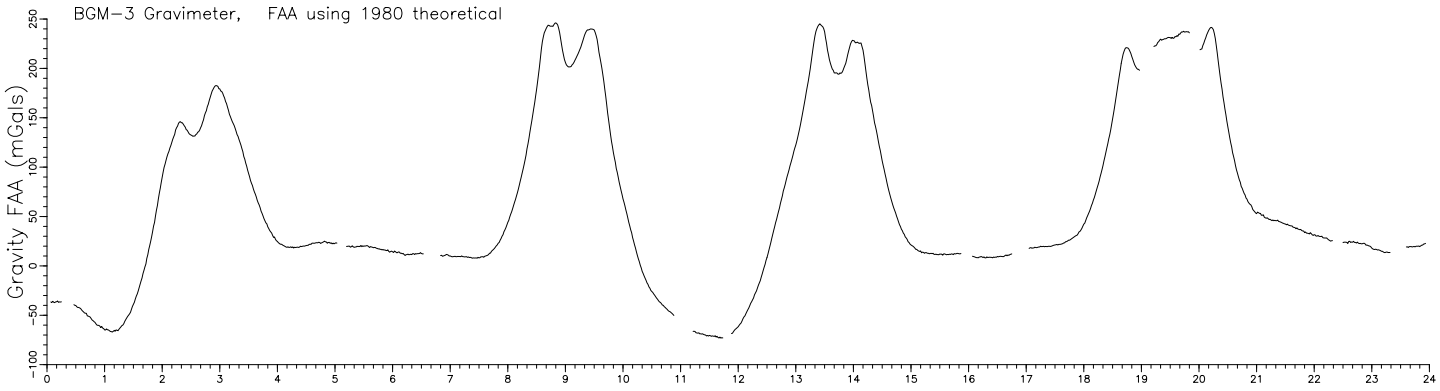
Navigation file: n.027 Speed/Course file: fu.s027 Magnetics file: mg.n027 Gravity file: vt.n027 Bathymetry file: hb.n027

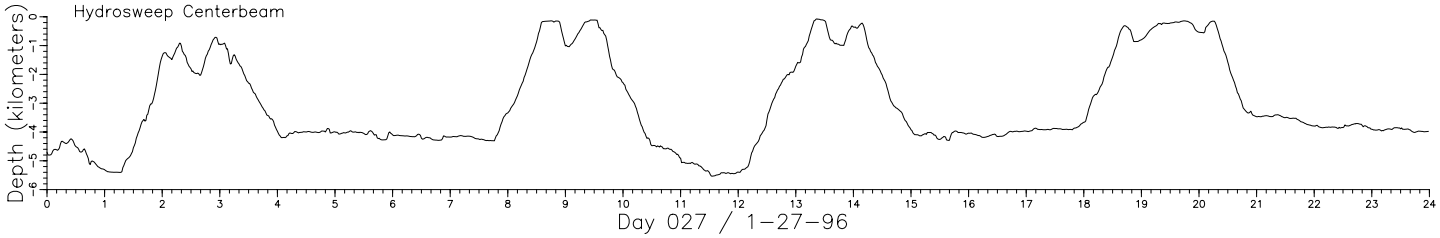






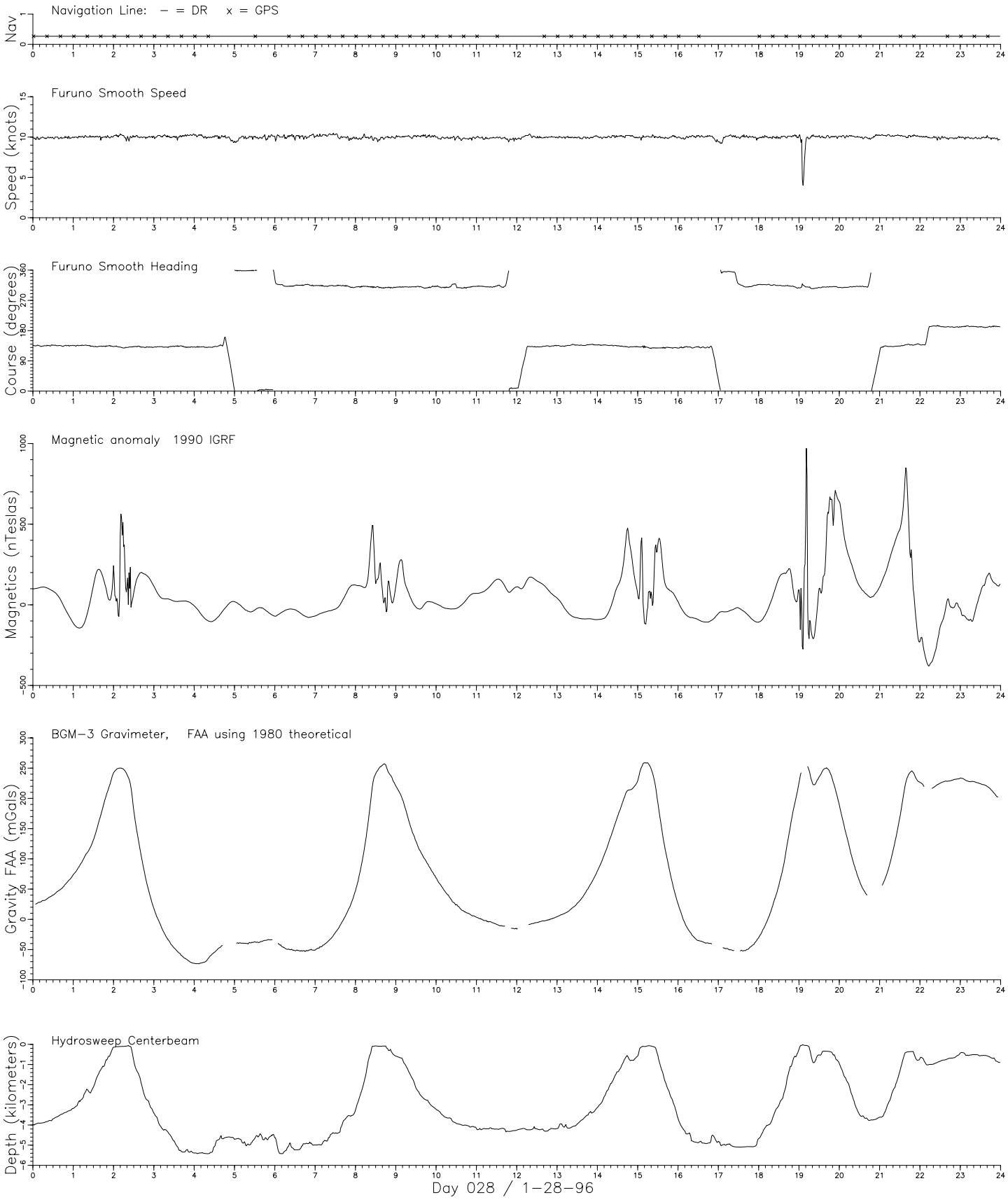






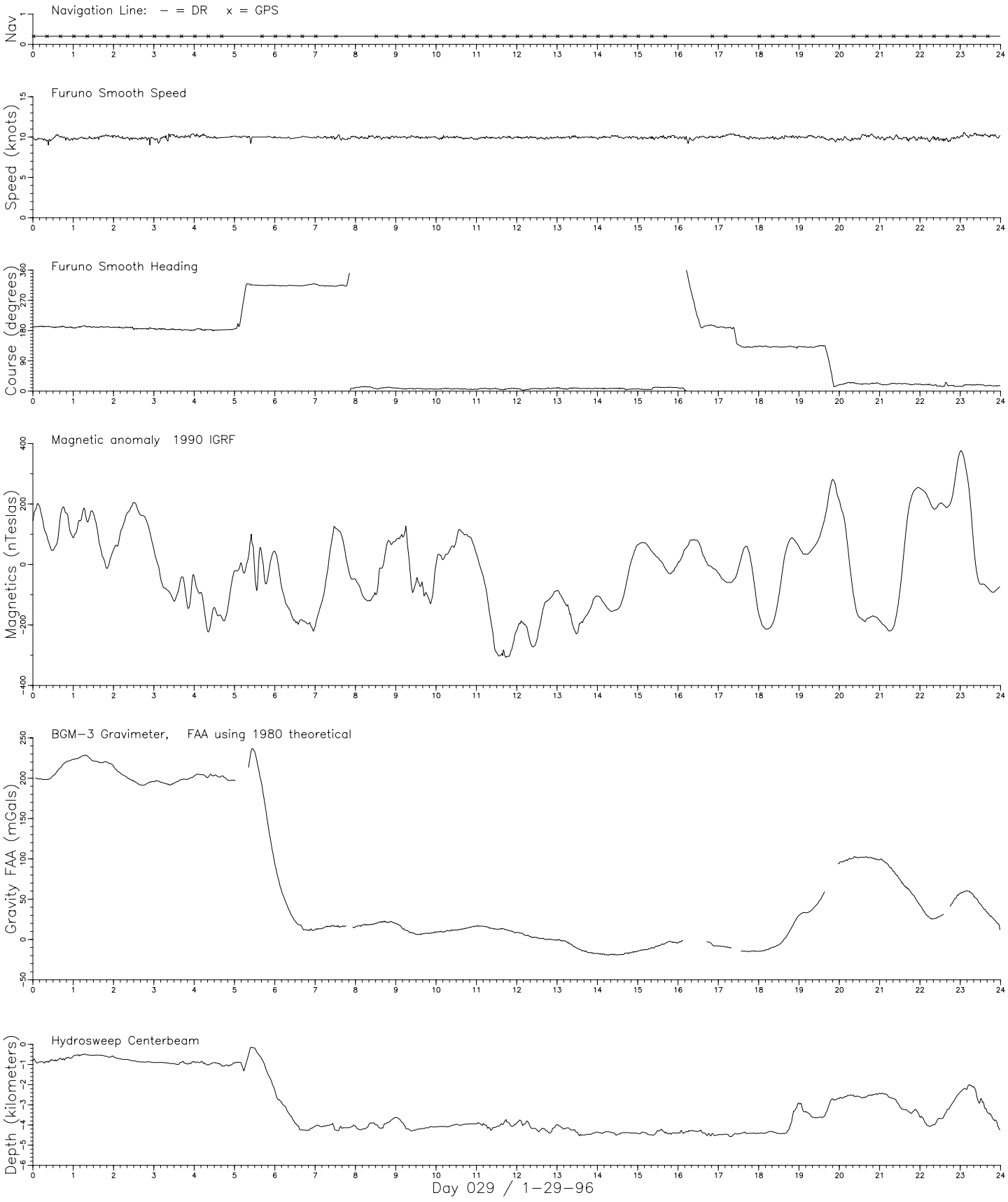
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

Navigation file: n.028 Speed/Course file: fu.s028 Magnetics file: mg.n028 Gravity file: vt.n028 Bathymetry file: hb.n028



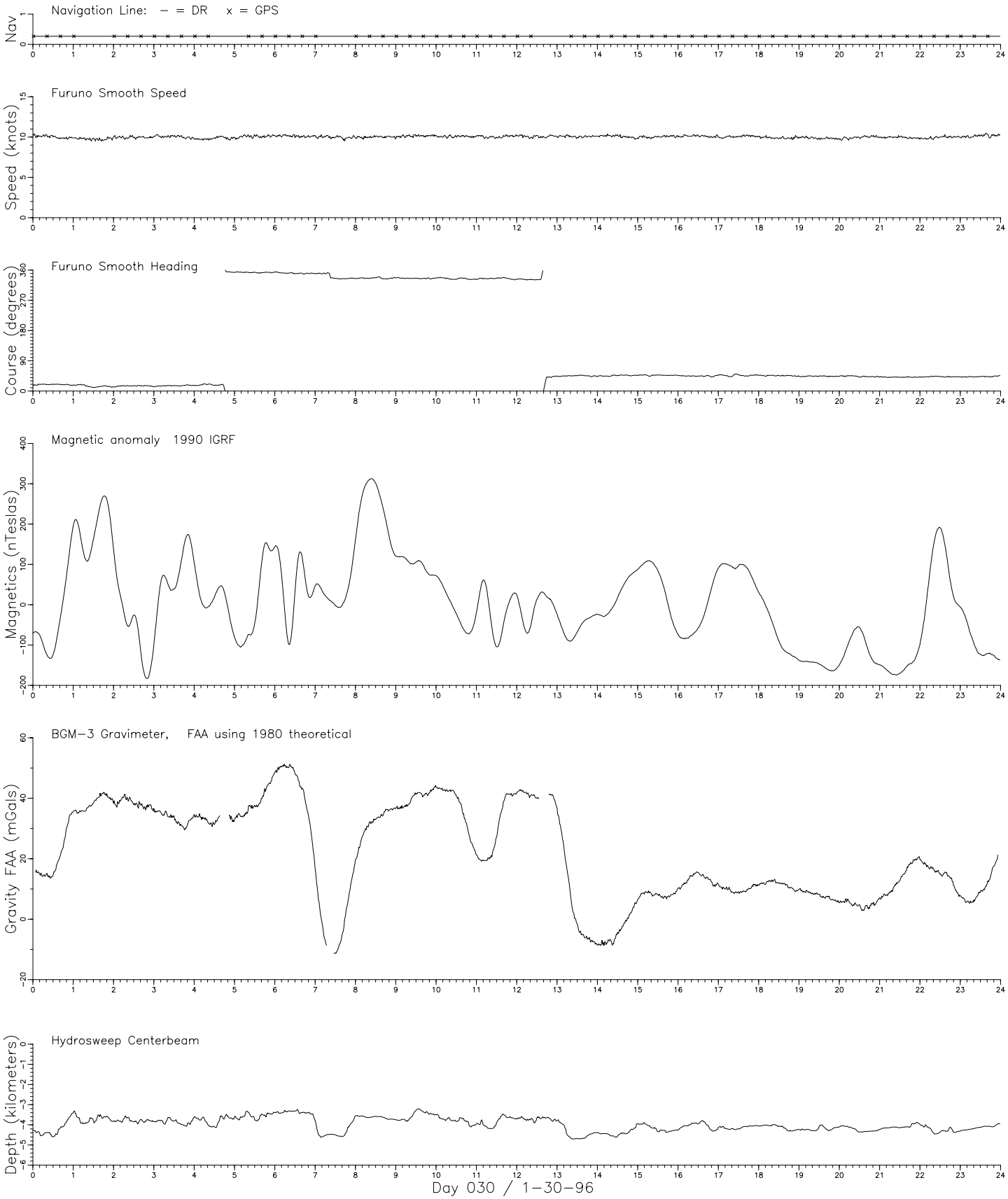
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

Navigation file: n.029 Speed/Course file: fu.s029 Magnetics file: mg.n029 Gravity file: vt.n029 Bathymetry file: hb.n029



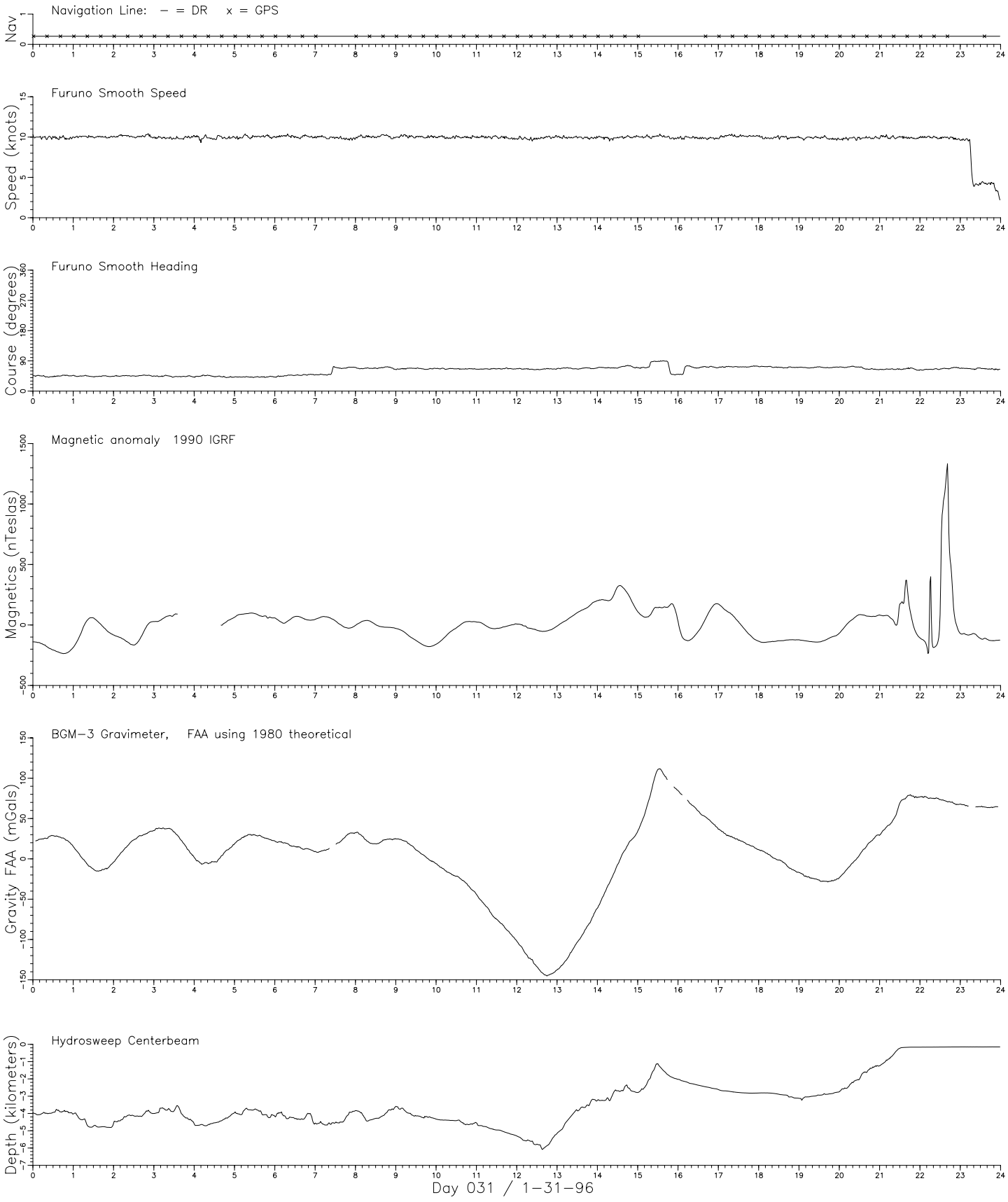
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

Navigation file: n.030 Speed/Course file: fu.s030 Magnetics file: mg.n030 Gravity file: vt.n030 Bathymetry file: hb.n030



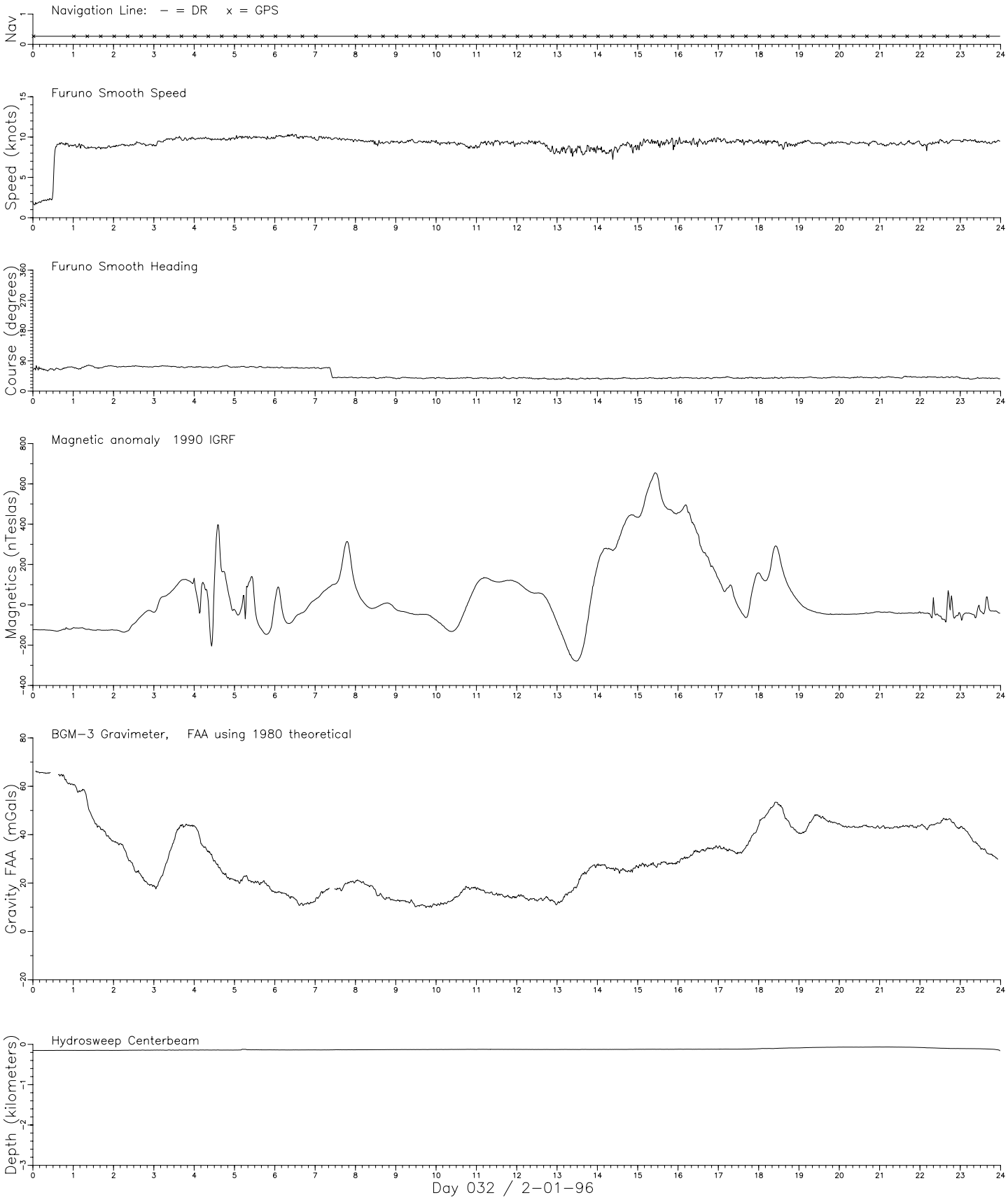
EW9513 Auckland, New Zealand – Lyttelton, New Zealand

Navigation file: n.031 Speed/Course file: fu.s031 Magnetics file: mg.n031 Gravity file: vt.n031 Bathymetry file: hb.n031



EW9513 Auckland, New Zealand – Lyttelton, New Zealand

Navigation file: n.032 Speed/Course file: fu.s032 Magnetics file: mg.n032 Gravity file: vt.n032 Bathymetry file: hb.n032



EW9513 Auckland, New Zealand – Lyttelton, New Zealand

Navigation file: n.033 Speed/Course file: fu.s033 Magnetics file: mg.n033 Gravity file: vt.n033 Bathymetry file: hb.n033