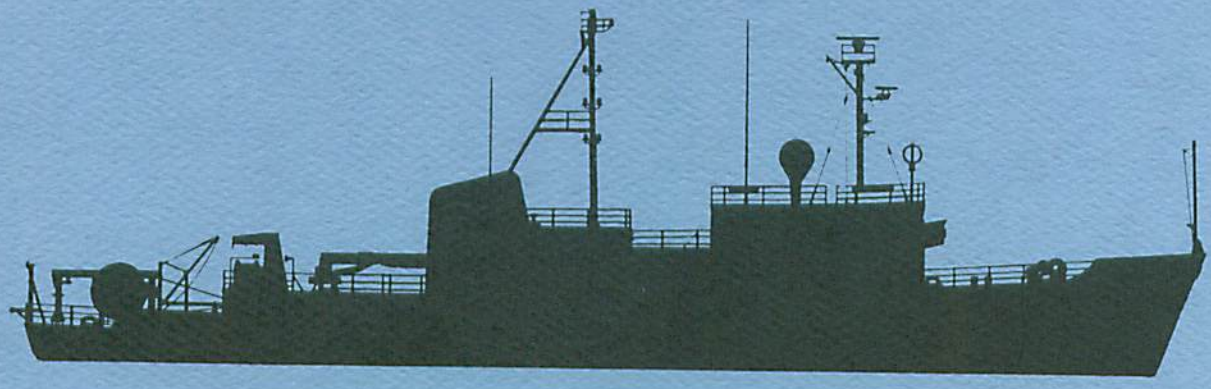

ROBERT D. CONRAD

LAMONT-DOHERTY GEOLOGICAL OBSERVATORY

COLUMBIA UNIVERSITY

CRUISE C2911

LAMONT DATA REDUCTION CRUISE SUMMARY

CRUISE: C2911

START: 02 Nov 88 (307) Barcelona, Spain

END: 29 Nov 88 (334) Cadiz, Spain

PURPOSE: MCS 2-ship survey of Gulf of Valencia with R/V Charcot
MCS survey of Alboran Sea.

CHIEF SCIENTIST: Anthony Watts, Lamont-Doherty Geological Observatory

DATA REDUCTION: William J. Robinson

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TIME:

The cruise was in an area outside of the range of the satellite for the True Time clock. On 3 Nov 88 (308) the True time clock was set via a computer program to a time of about .5 seconds slower then the time shown on the Transit satellite display; it had been about 2 seconds slower. On 9 Nov 88 (314) at about 2330, a power failure to the clock occured. On 10 Nov 88 (315) at about 0015, the True time clock was reset to a time about 1 second slower than the Transit time.

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
Notes:

day	time	comment
316	0400-0406	Furuno on bottom track
316	1545-1547	Furuno on bottom track (data deleted)
316	1613-1621	Furuno on bottom track (data deleted)
316	1630-1634	Furuno on bottom track (data deleted)
316	1715-1727	Furuno on bottom track
316	1803-2329	Furuno on bottom track
316	2331-2342	Furuno on bottom track
318	1314-1522	Furuno on bottom track
318	1621-1633	Furuno on bottom track
318	1658-2359	Furuno on bottom track
319	0000-0040	Furuno on bottom track
319	1316-2032	Furuno on bottom track
329	0221-0322	Furuno on bottom track
331	0030-0404	Furuno on bottom track

TRANSIT SATELLITE FIXES:

Instrument: Magnavox MX-1107RS dual frequency Transit satellite receiver
Logging: all fixes
Checking: reject receiver flagged fixes, fixes with high drifts in navigation and fixes producing Eotvos correction errors in gravity

GPS SATELLITE FIXES:

Instrument: Magnavox T-Set Global Positioning System receiver
Logging: 30 second intervals
Checking:
    minimum number of sats: 2
    dilution of precision maximum: north = 8.0, east = 8.0
    carrier signal-noise ratio minimum: 35.0
    standard deviation maximum: north = 10.0, east = 10.0
    time step max: 3
    speed max: 15.0 knots
    compared GPS speed and course with Furuno smooth speed and heading
    compared positions with Transit-Furuno navigation
    reject fixes with high drifts in navigation
    reject fixes producing Eotvos correction errors in gravity
Interpolation: interpolated positions at 00, 30 seconds of each minute
Smoothing: smoothed interpolated positions with 9 point running average

Notes:
    The GPS receiver was not working during the following days:
         3 Nov 88 (308) - 6 Nov 88 (311)
        13 Nov 88 (318) - 16 Nov 88 (321)

NAVIGATION:

A "1 minute navigation" is produced from the above sources. Acceptable fixes are merged at 1 per minute with priority given to GPS, then to Transit. 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.
Lamont database: 1 minute navigation.

BATHYMETRY:

Instrument: Raytheon LSR 3.5 kilohertz Precision Depth Recorder (PDR)
Logging: readings at 5 minute intervals from continuous PDR paper records
Checking: visual check of plot of data
Chief scientist's final data: PDR depth values at 5 minute intervals.
    Depth is in meters.
Lamont database: PDR record depth values at 5 minute intervals.
    Depth is in fathoms.
Notes:

day	time	comment
309	2130-2359	records unreadable
310	0000-0745	records unreadable

MAGNETICS:

Instrument: Varian V75 magnetometer
Logging: 20 second intervals
Checking: visual check of plot of data
Reference field: International Geomagnetic Reference Field 1985 (IGRF 1985) model of the main field at 1985.0 and a predictive model of the secular variation for adjusting to dates between 1985.0 and 1990.0.
Chief scientist's final data: interpolated total intensity value at 00 seconds of each minute and corresponding magnetic anomalies.
Lamont database: interpolated total intensity value at 00 seconds of each minute.
Notes:

day	time	comment
313	1401-1717	bad data
318	1700-2359	bad data
319	0000-2359	bad data and off for repair
320	0000-0740	off for repair
320	2325-2359	off
321	0000-1157	off
322	0000-2359	off
323	0000-2359	off
324	0000-2359	off
325	0000-1926	off
327	0201-1037	off

GRAVITY:

Instrument: Bell Aerospace BGM-3 marine gravity meter
Logging: 1 minute intervals
Merge with navigation: calculate Eotvos correction and Free Air Anomaly.
Checking: visual check of plot of data to determine satisfactory Eotvos corrections, reject spikes of data at turns.
Velocity smoothing: 5 point running average for all days
Drift rate: 0.1257 mGal per day
Dc shift: 10.7 mGal
Chief scientist's final data: Free Air Anomaly value at 00 seconds of each minute. Used 1980 theoretical gravity formula.
Lamont database: Free Air Anomaly value at 00 seconds of each minute. Used 1930 International gravity formula.
Notes:

Used the CPU time tag as the times for gravity values instead of the HP gravity time. The HP time which is HHMM seems to drift quite a bit and the CPU time after its adjustments was considered more stable. CPU time adjusted to true time clock and 180 second adjustment for delay due to gravity system filtering.

PRE-CRUISE GRAVITY TIE-IN:

Port: Barcelona, Spain
Date: 27 Oct 88
Operator: Joe Stennett

The record of this gravity tie could not be located at the time of the final reduction of the gravity data and the production of this summary. The post cruise tie notes refer to a tie in Barcelona (see below) and Joe Stennett verbally acknowledge doing a tie.

Gravity ties in Barcelona were also done by Bernie Coakley (L-DGO) and Montserrat Torne (Catalonia Geological Survey)

POST-CRUISE GRAVITY TIE-IN:

Port: Cadiz, Spain
Date: 01 Dec 88
Operator: Joe Stennett
Reference Station: The reference station was in a now closed railroad station in Rota. The reading was made outside the building.
Pier/Ship's position: The pier gravity tie was at bollard 14 near the signal tower in Cadiz harbor. This point is directly opposite a gate which opens into a plaza.
Gravity meter: LaCoste-Romberg model G #70. Temperature at 50 deg. C and the thermostat cycling.
Readings and Calculations:

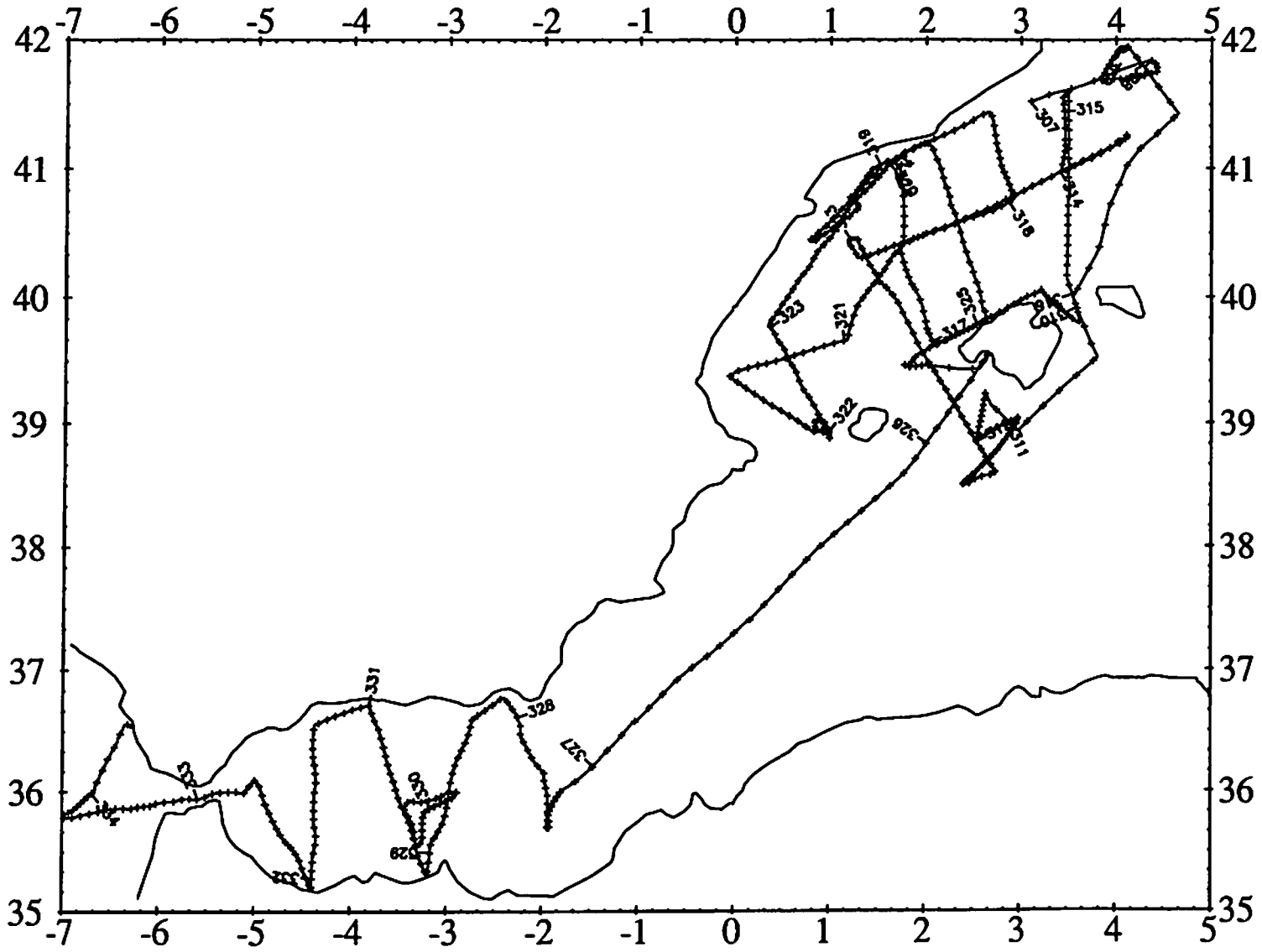
Time	Loc.	L-R reading	BGM or Ref.	
1502Z	pier	3361.82		
1610Z	ref	3377.13	979849.64	Ref
1715Z	pier	3361.80	979863.6	BGM

At 1715 the BGM was 3 meters below the pier.

LaCoste delta value: -15.52 = 3361.81 - 3377.13
Delta value in mGal: -16.1 mGal = -15.52 * 1.04
Pier gravity value: 979833.5 mGal = 979849.6 + (-16.1)
Height correction: +1.2 mGal
Gravity value at BGM level: 979834.7 mGal = 979833.5 + 1.2
BGM is reading 28.9 mGal high (979863.6 - 979834.7)
In Barcelona the BGM was 10.7 mGal high. If we assume a correction of 13.8 mGal, Potsdam error, needs to be made here; then the BGM is 15.1 mGal high.
On 27 Oct 88 the BGM was 10.7 mGal high.
Drift since 27 Oct 88: 4.4 mGal = 15.1 - 10.7
Drift rate: 0.1257 mGal per day = 4.4 mGal / 35 days

ADDITIONAL DATA SETS:

(1) BGM-3 gravity 10 second "counts"
(2) seismic shot times
(3) external shot times
(4) raydist ranges
(5) trisponder ranges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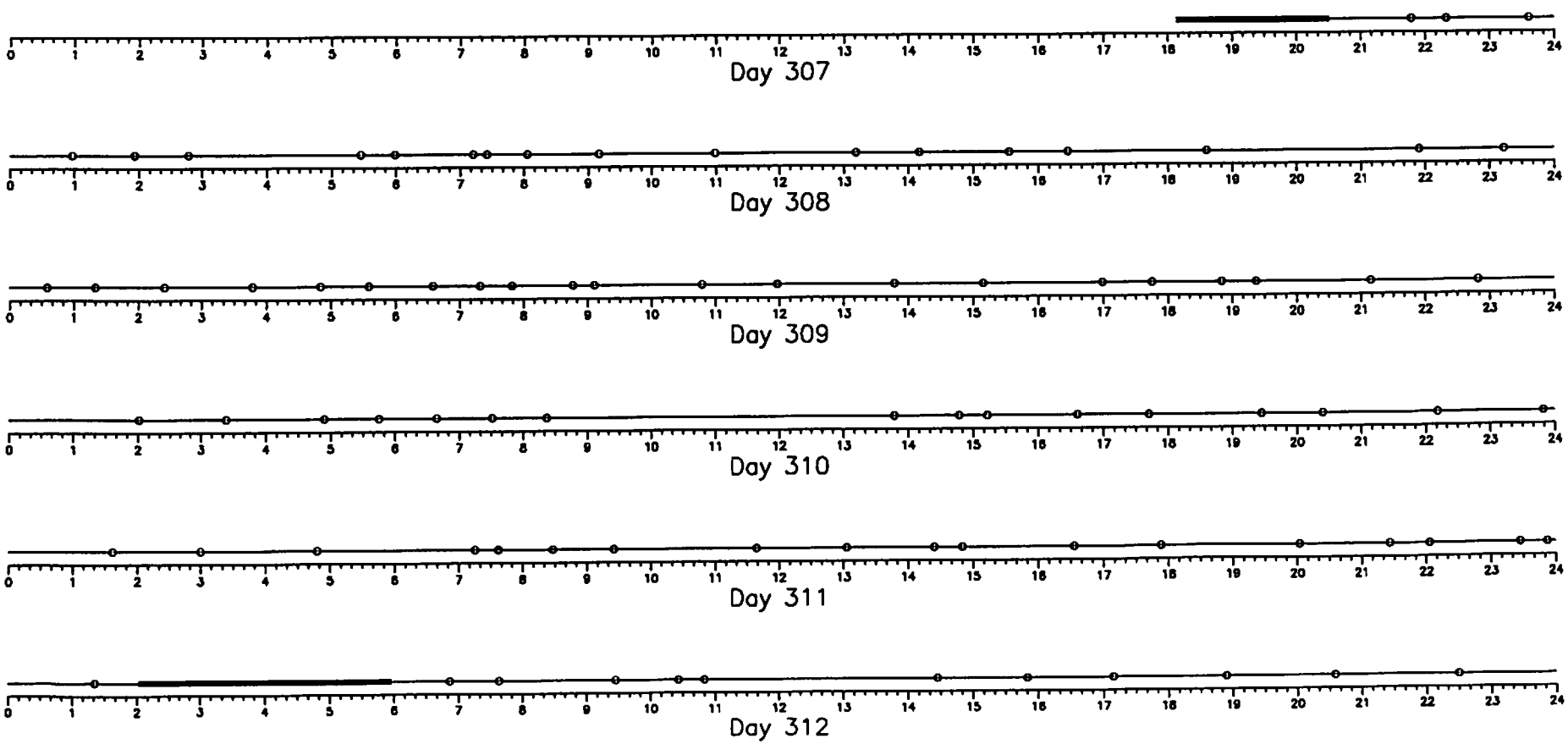
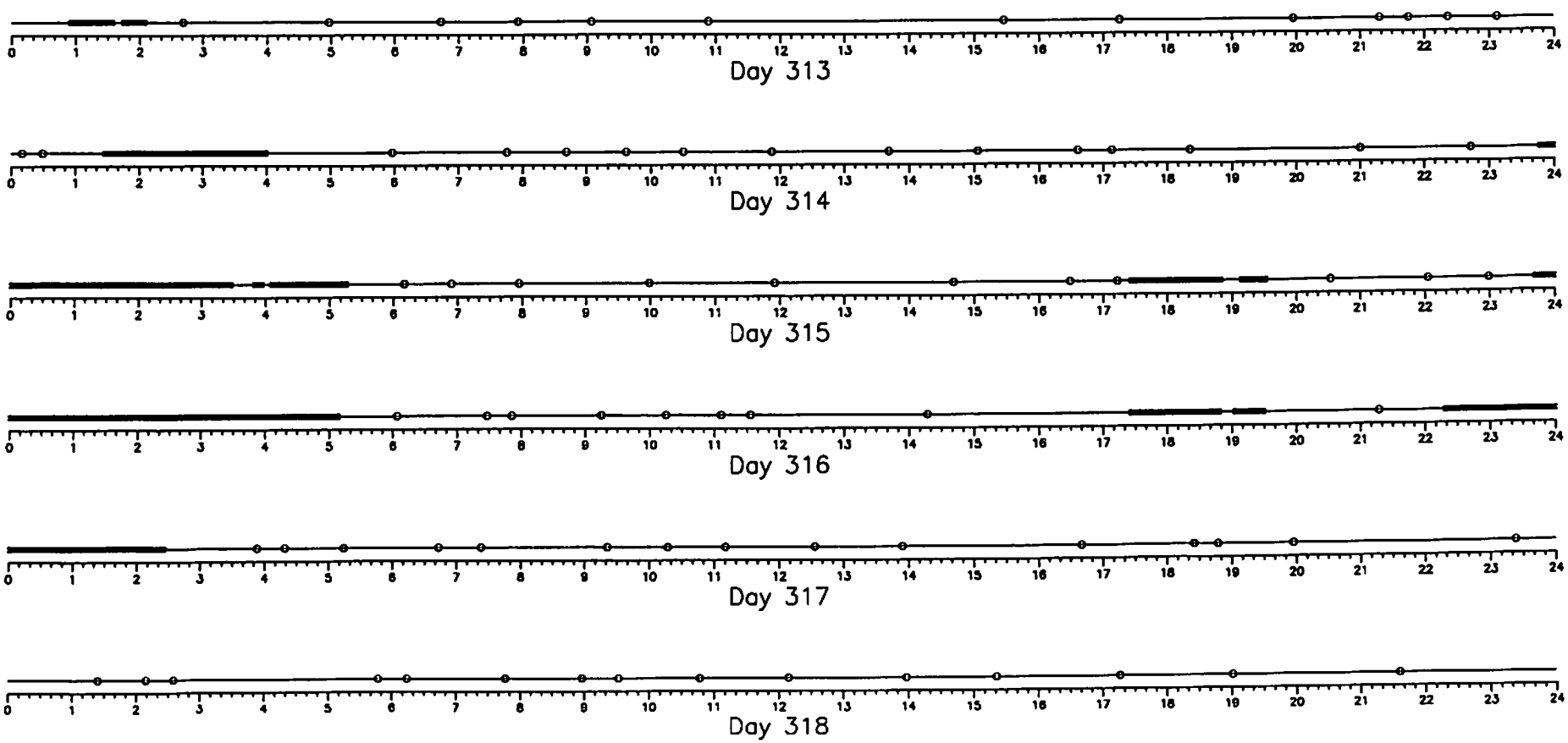
C2911 Barcelona–Cadiz

Lamont daily navigation line: x = GPS o = transit – = dr



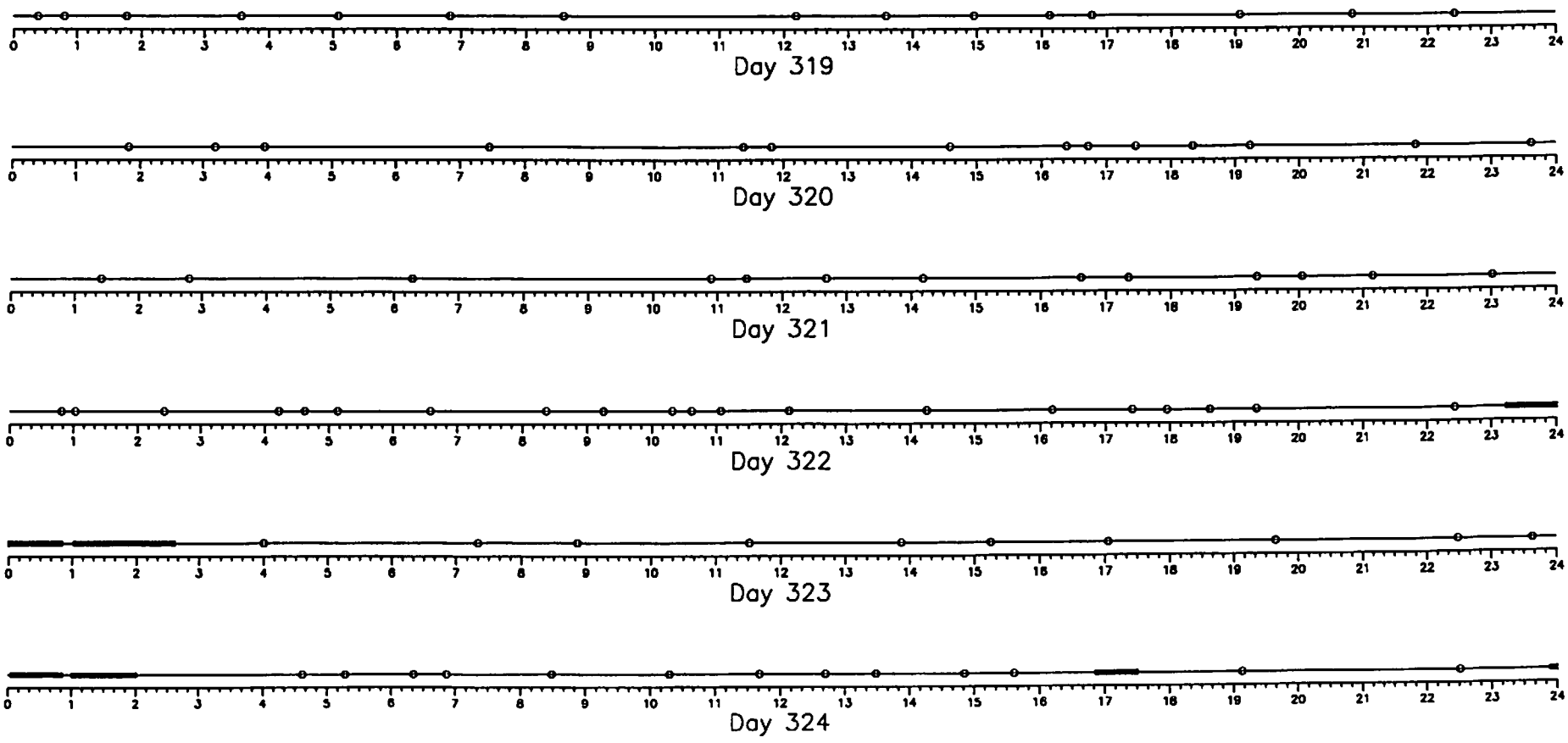
C2911 Barcelona–Cadiz

Lamont daily navigation line: x = GPS o = transit – = dr



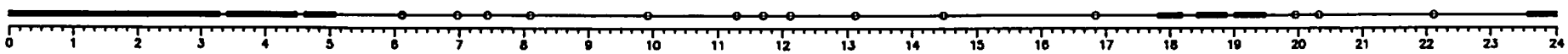
C2911 Barcelona–Cadiz

Lamont daily navigation line: x = GPS o = transit – = dr



C2911 Barcelona–Cadiz

Lamont daily navigation line: x = GPS o = transit – = dr



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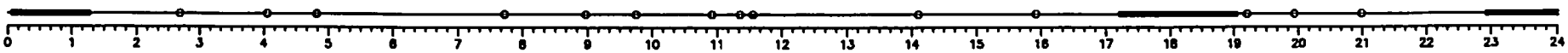

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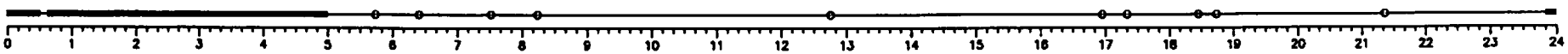

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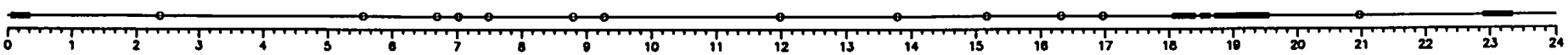

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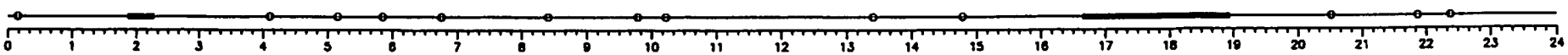

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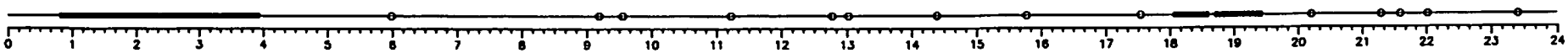
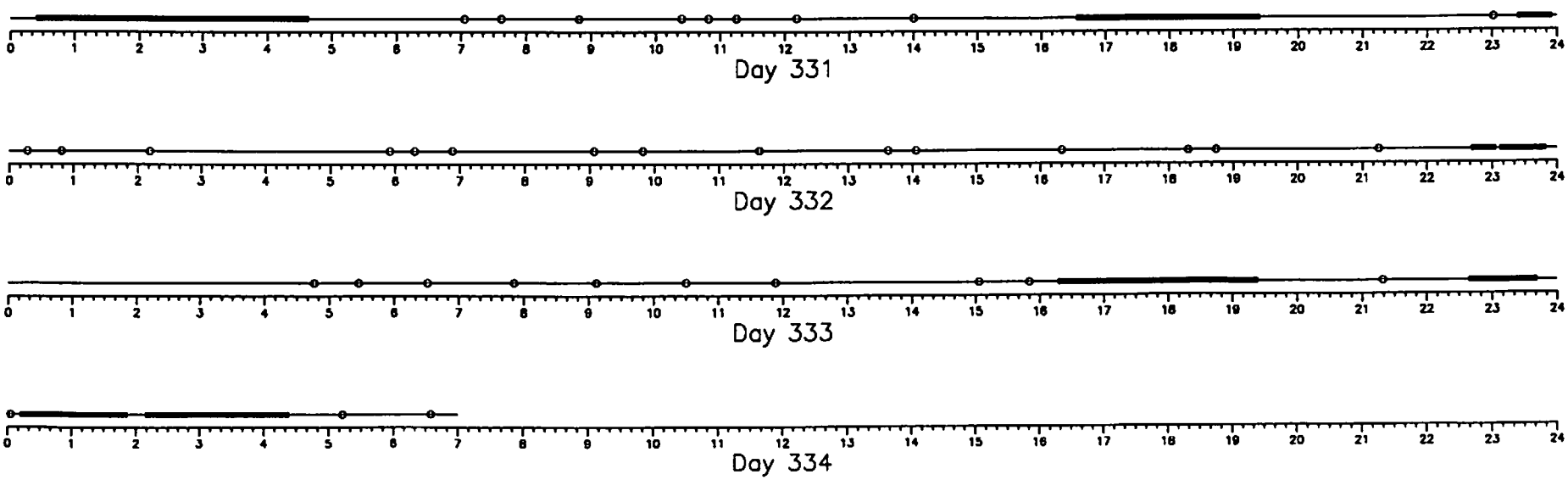


Day 330

C2911 Barcelona–Cadiz

Lamont daily navigation line: x = GPS o = transit – = dr



C2911 Barcelona–Cadiz Smooth Speed and Heading

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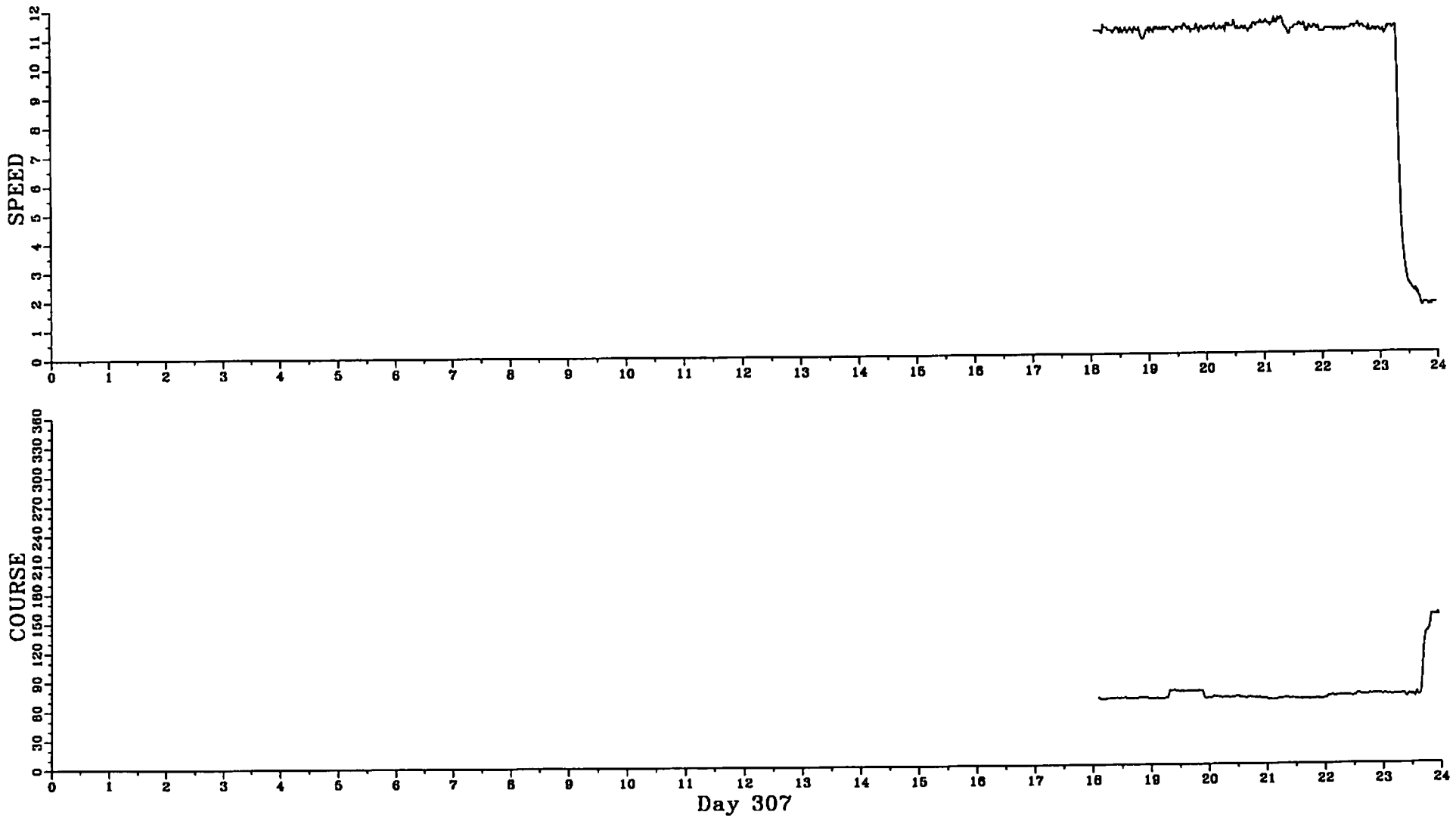

C2911 Barcelona–Cadiz Smooth Speed and Heading

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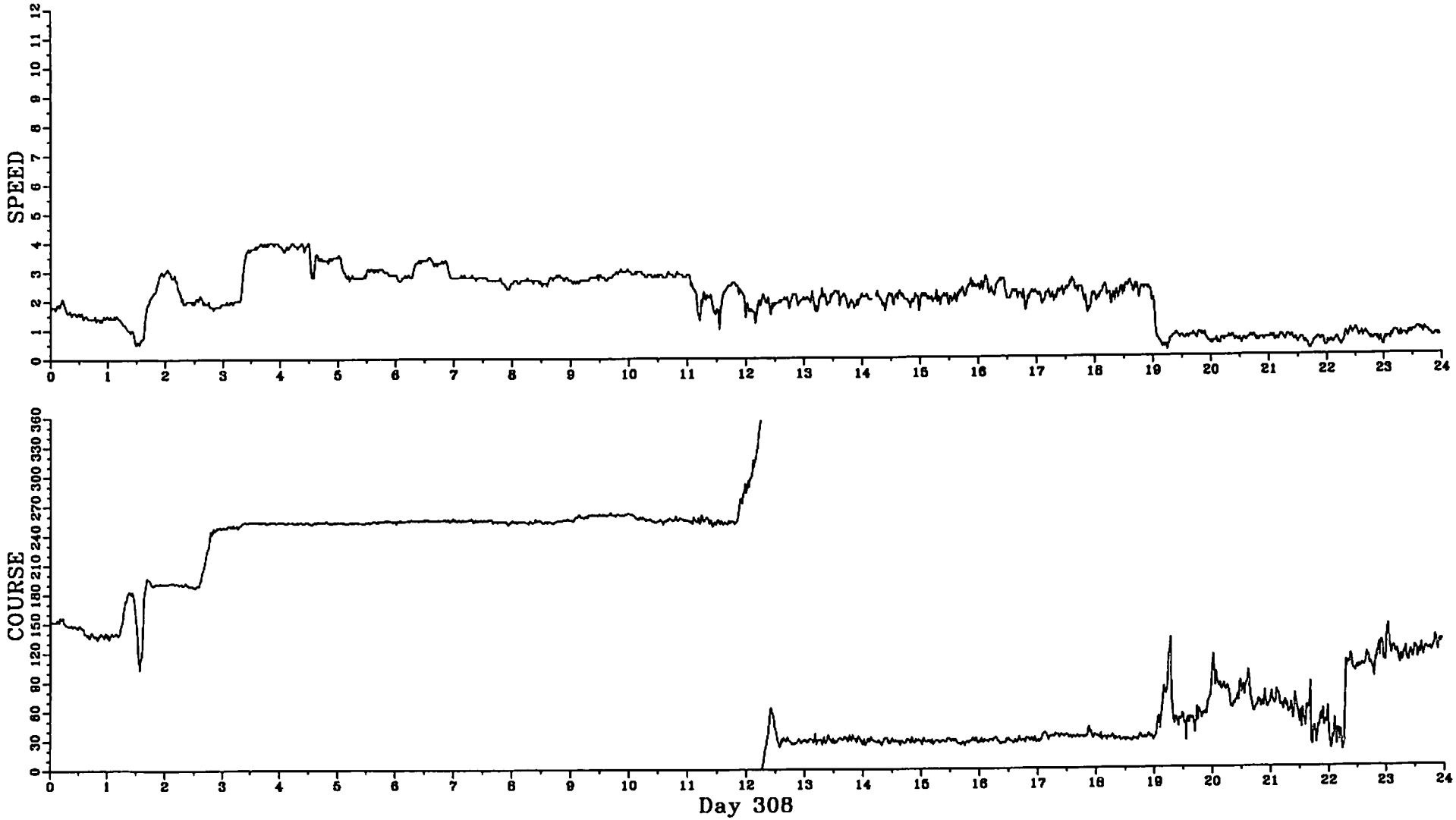

C2911 Barcelona–Cadiz Smooth Speed and Heading

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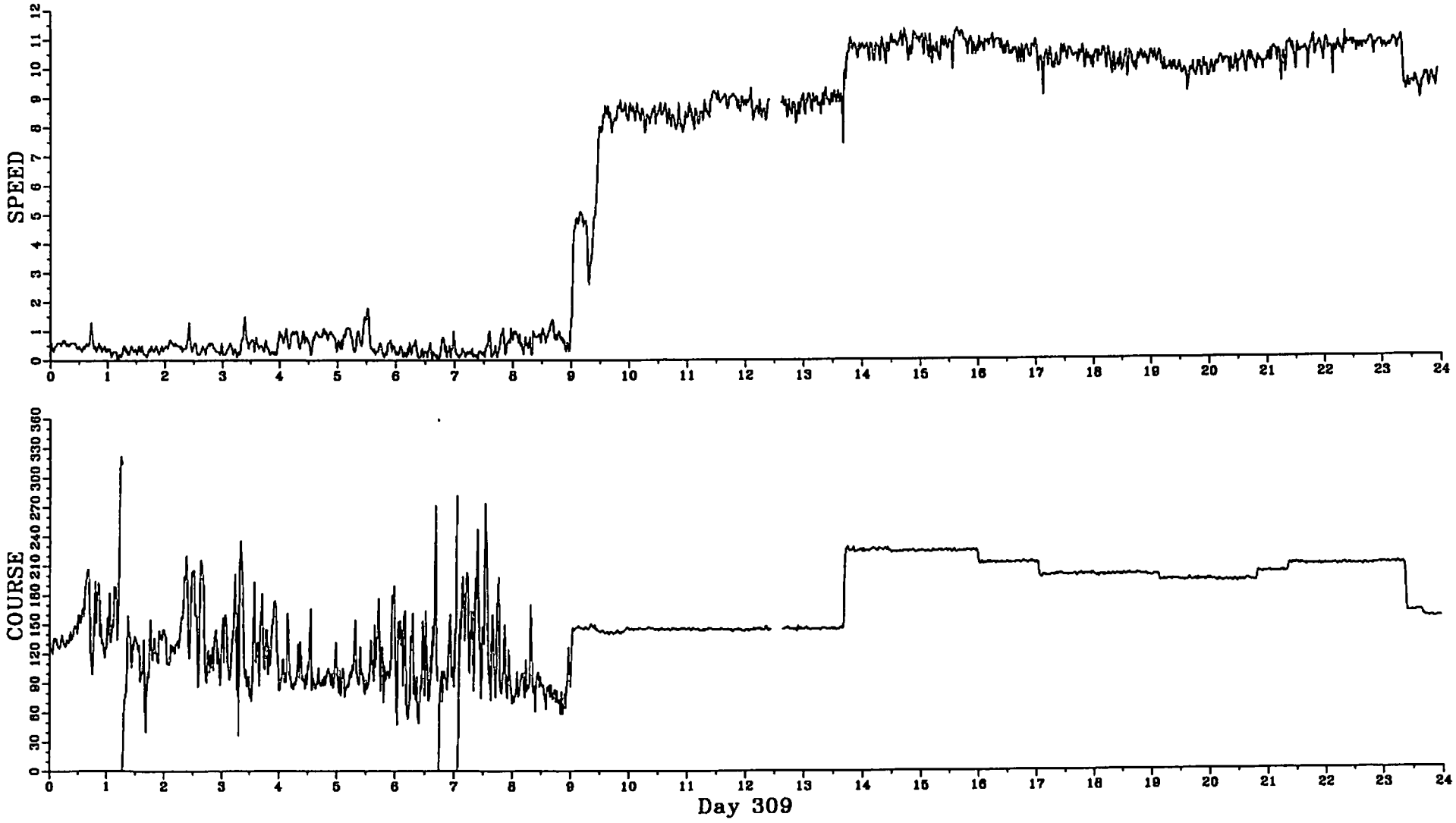

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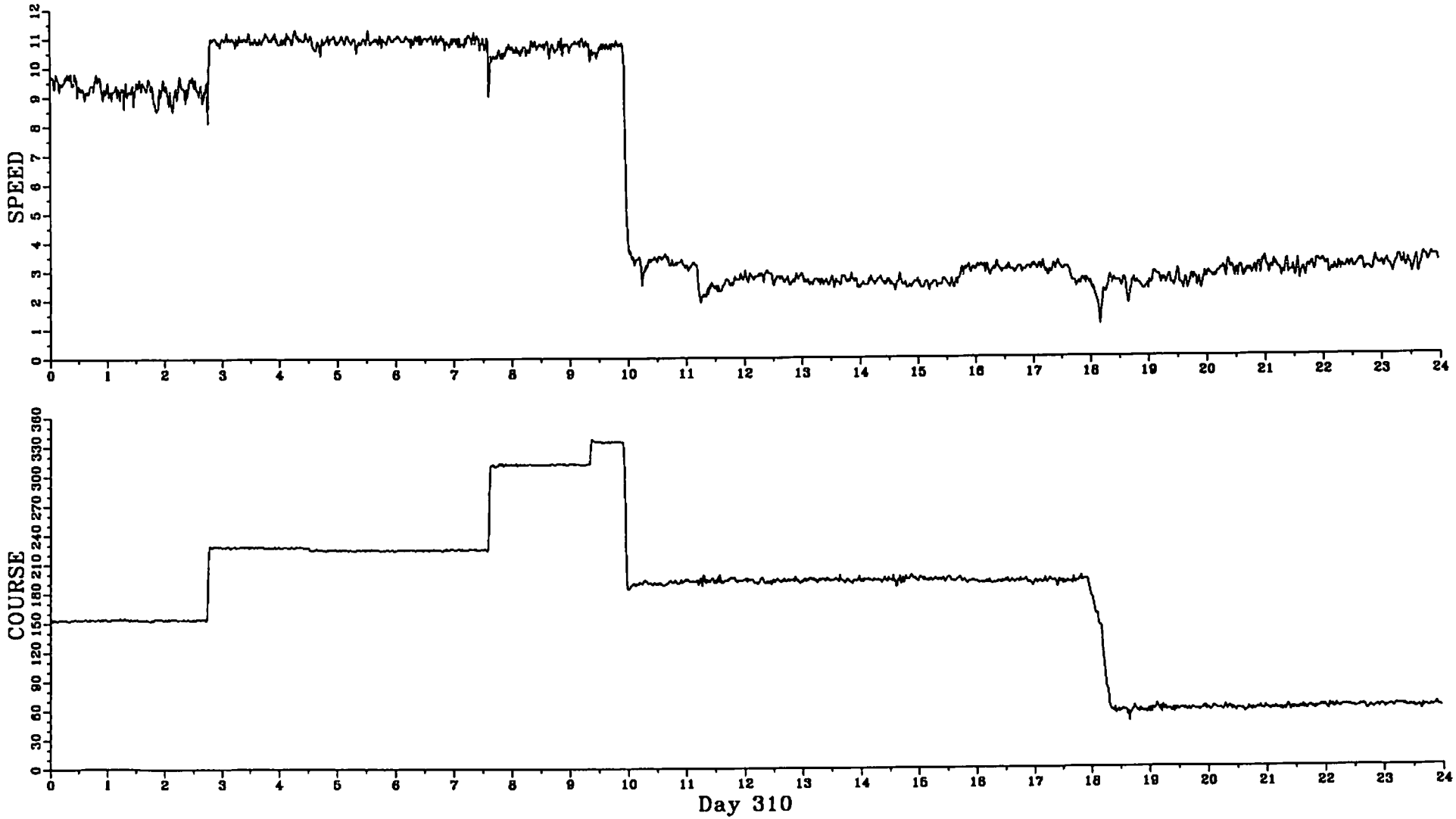

C2911 Barcelona–Cadiz Smooth Speed and Heading

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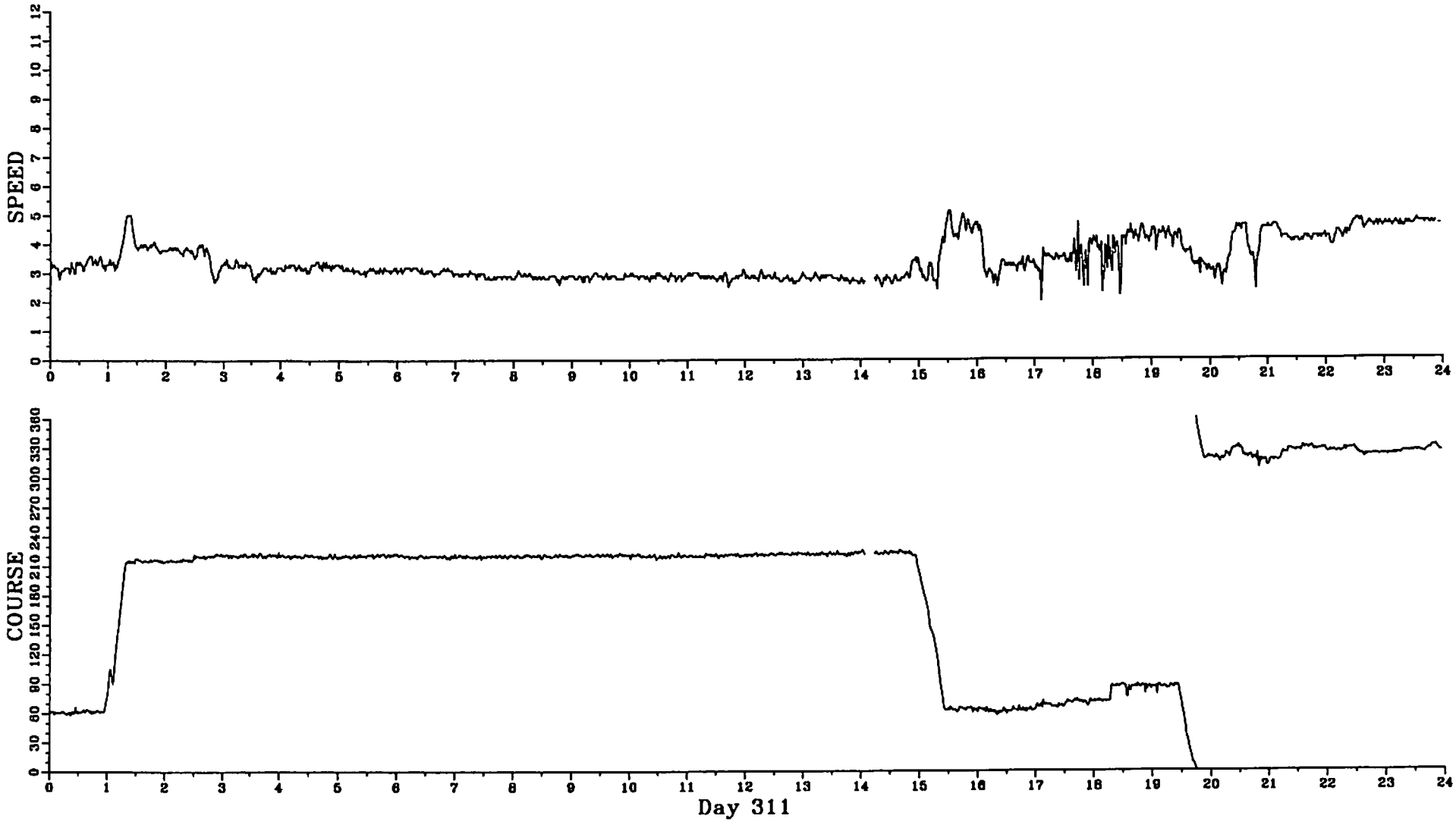

C2911 Barcelona–Cadiz Smooth Speed and Heading

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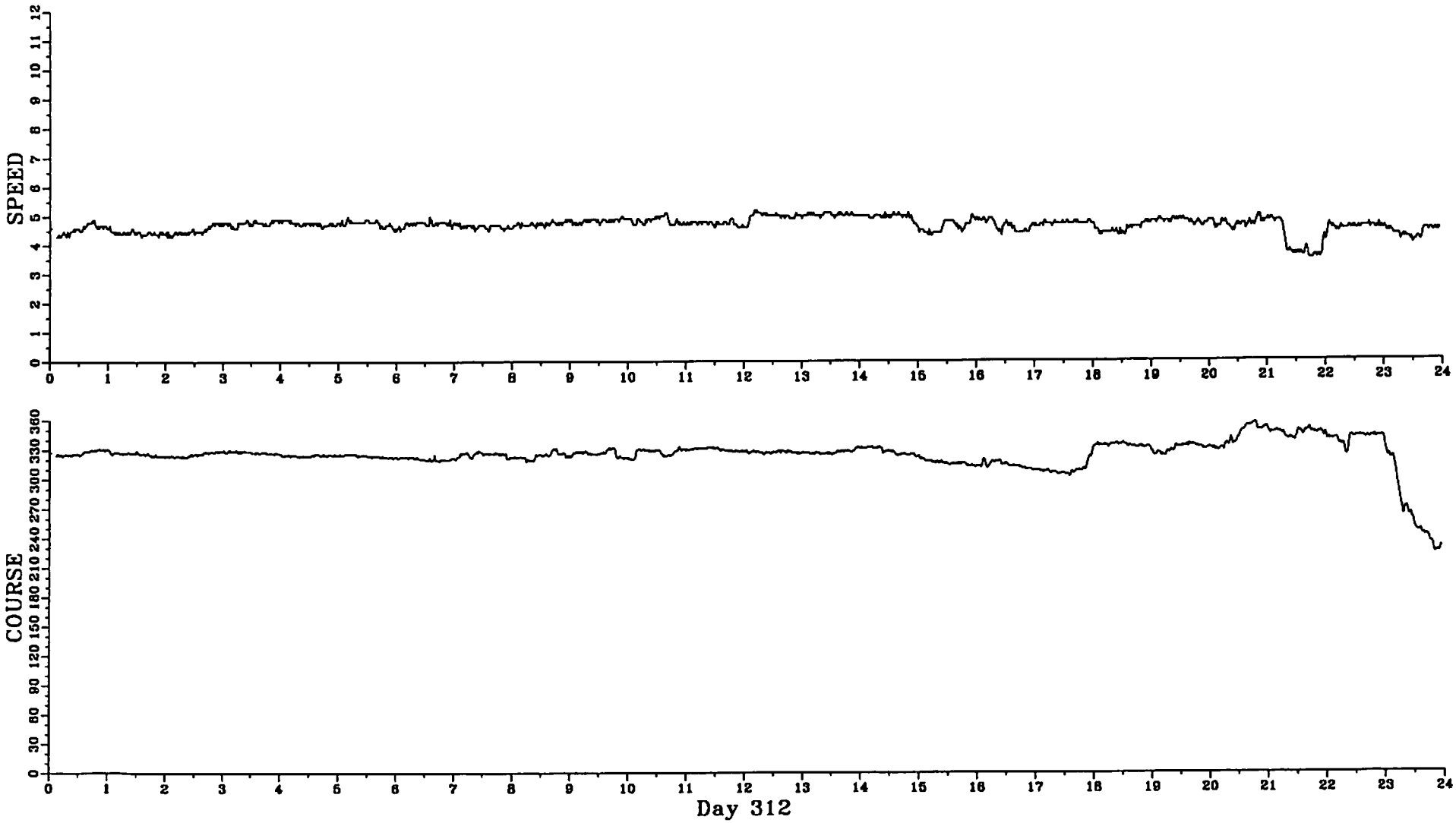

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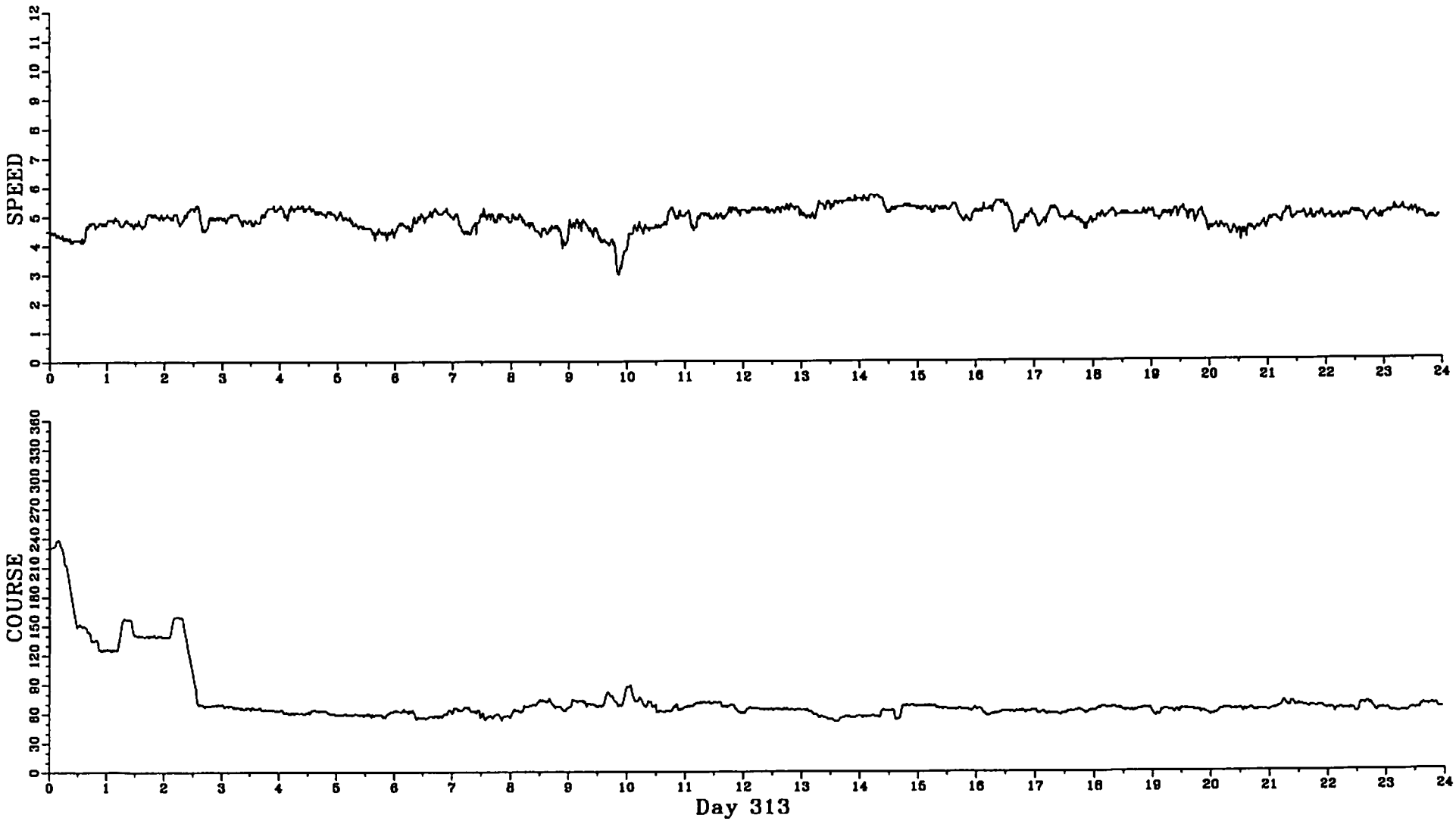

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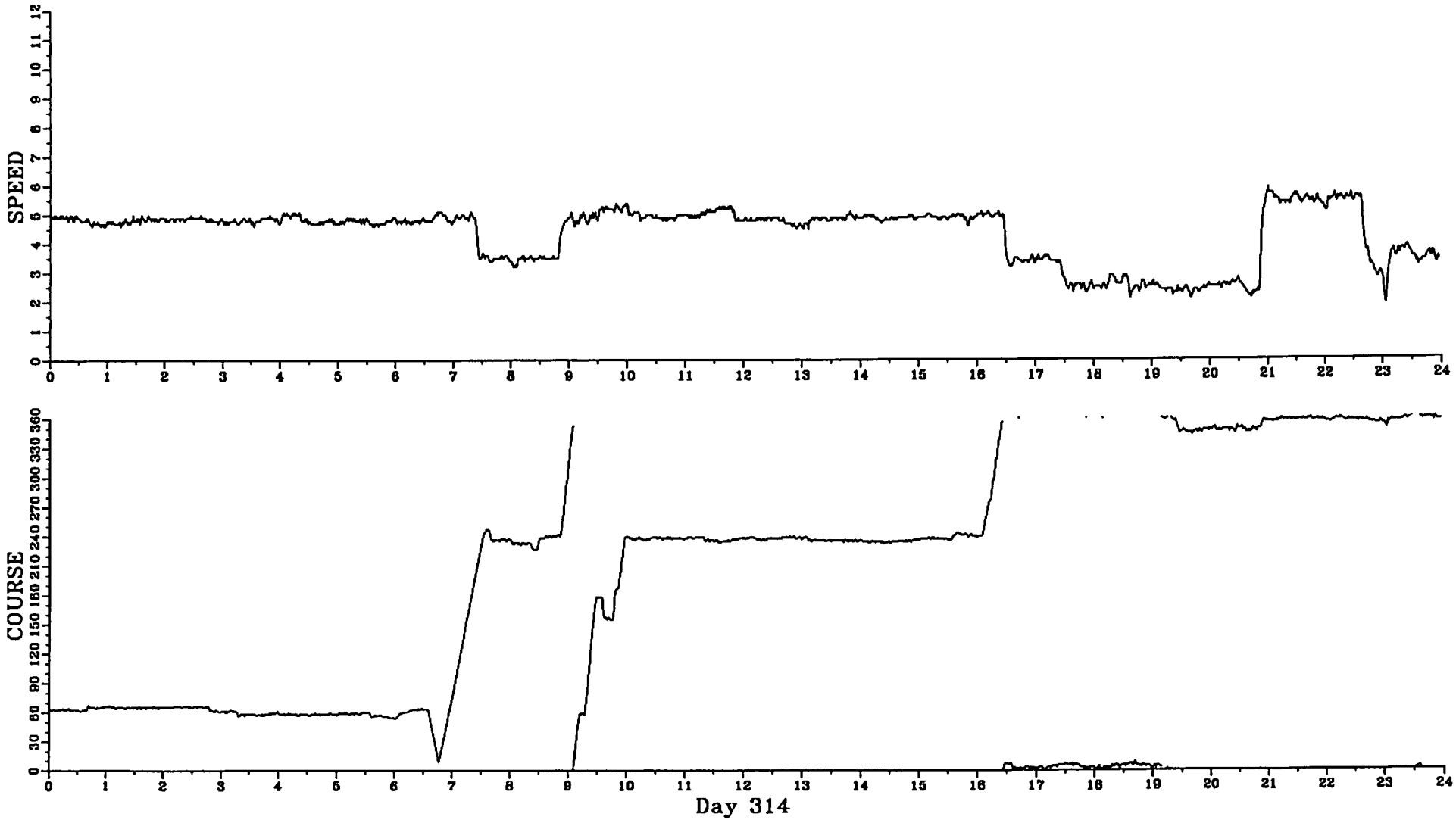

C2911 Barcelona–Cadiz Smooth Speed and Heading

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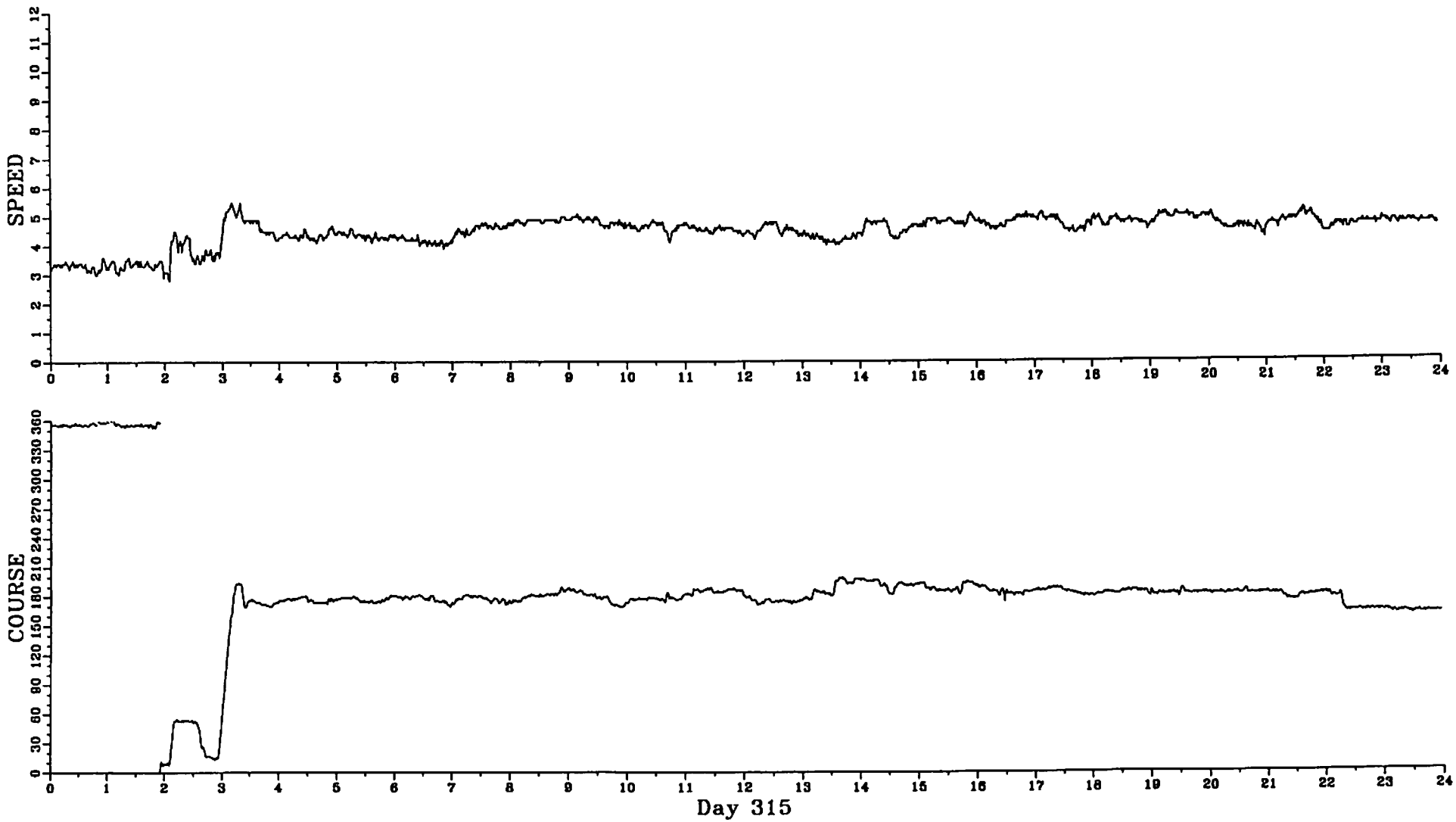

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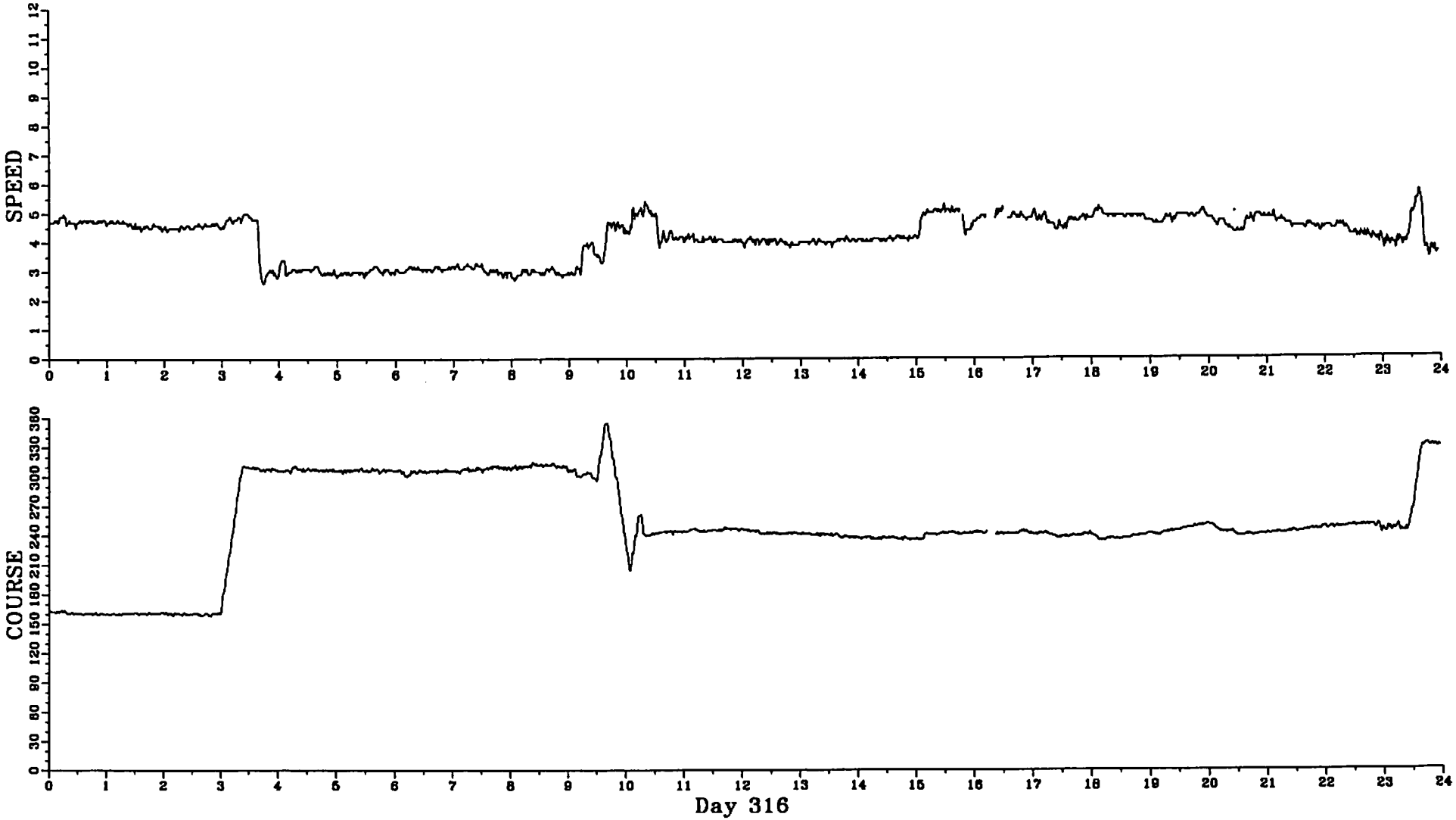

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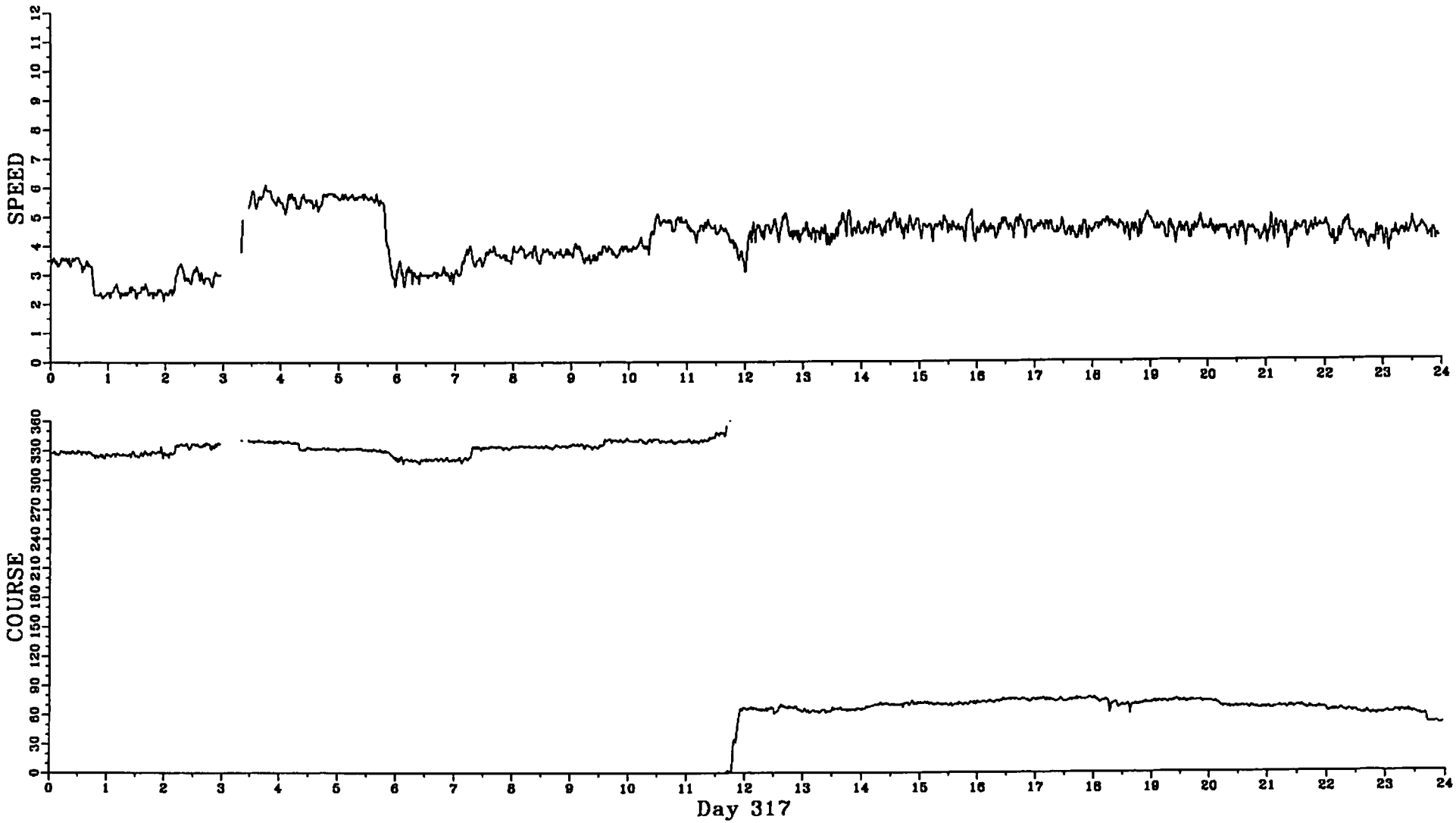

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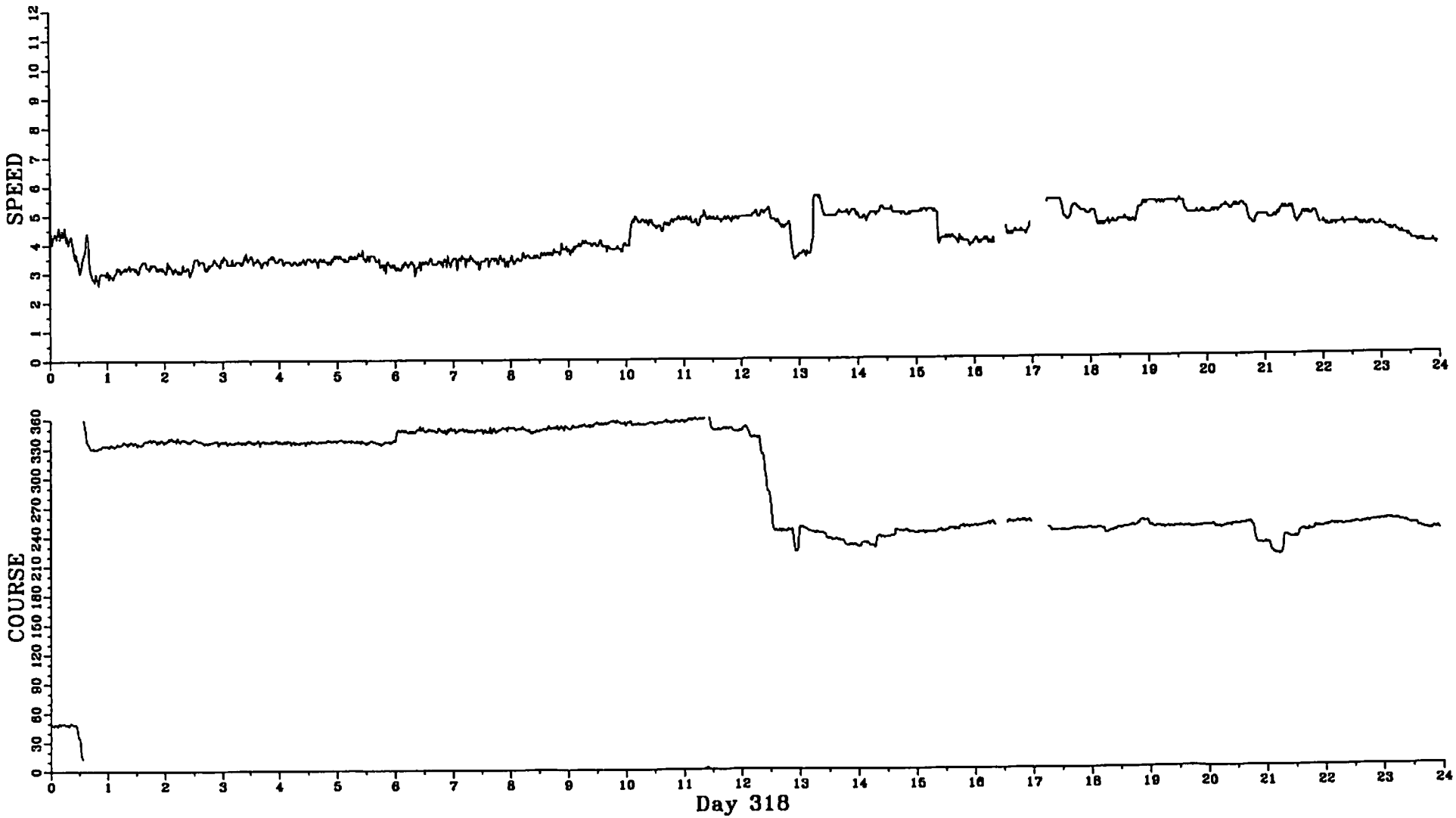

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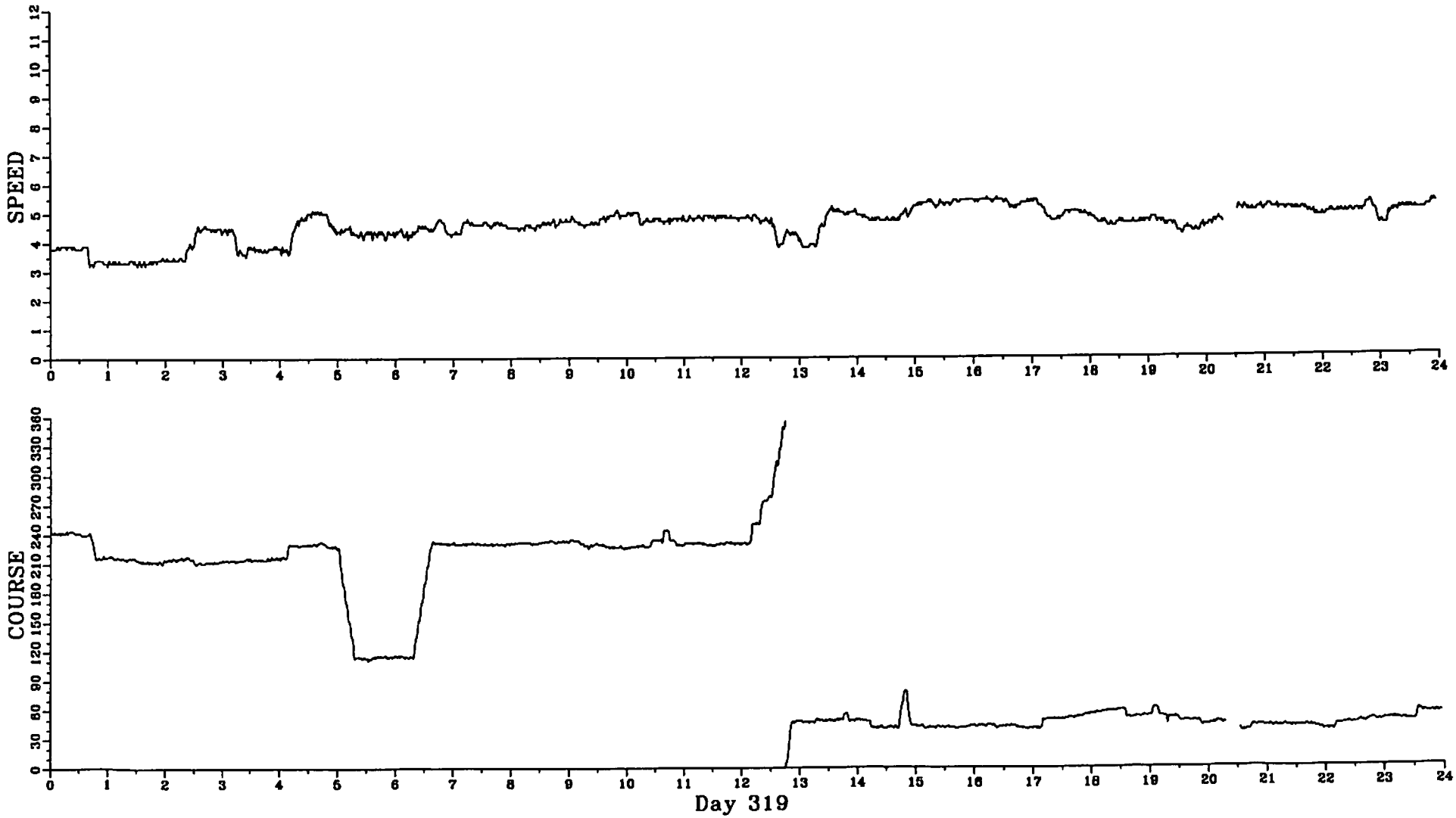

C2911 Barcelona–Cadiz Smooth Speed and Heading

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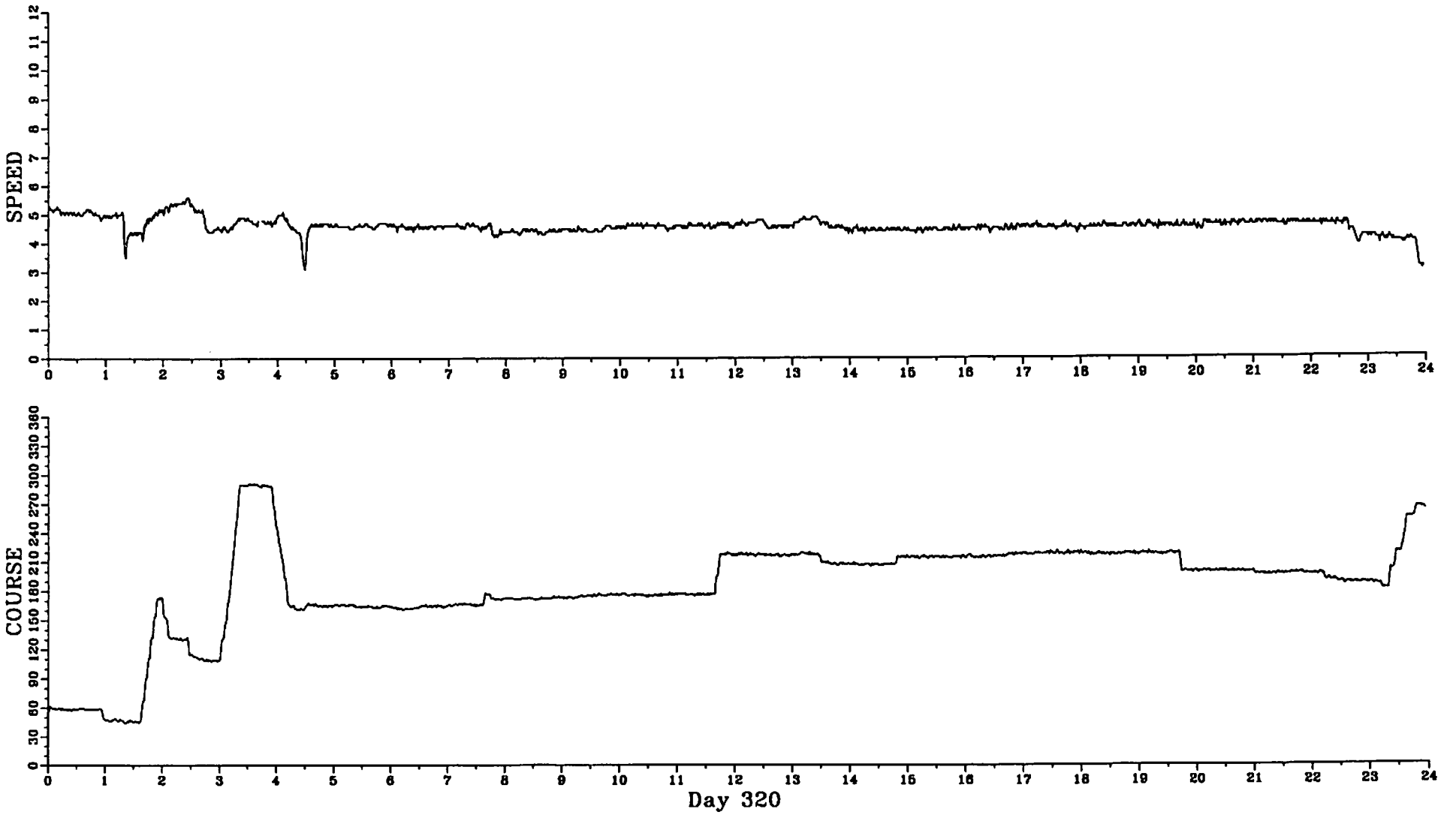

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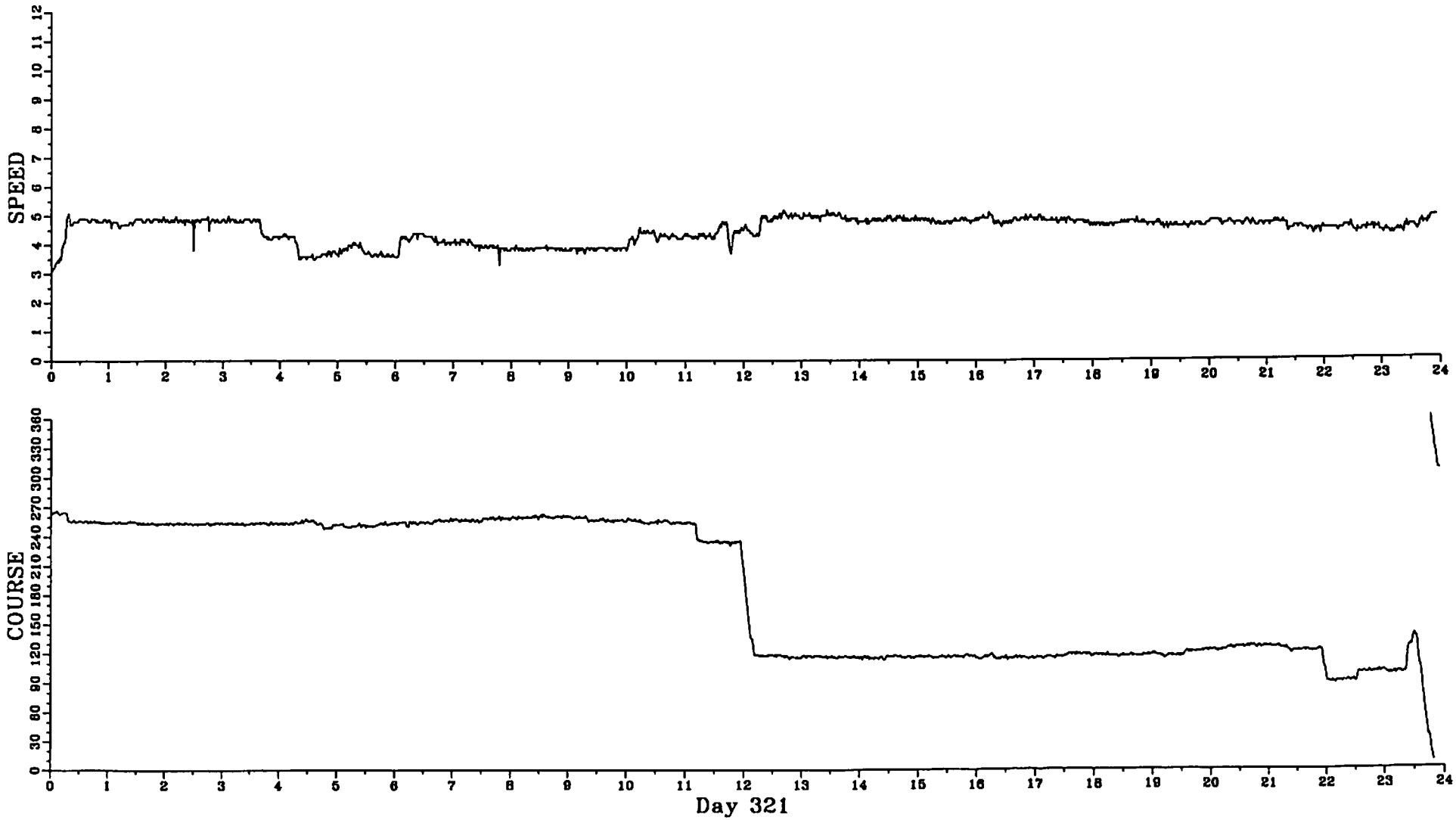

C2911 Barcelona–Cadiz Smooth Speed and Heading

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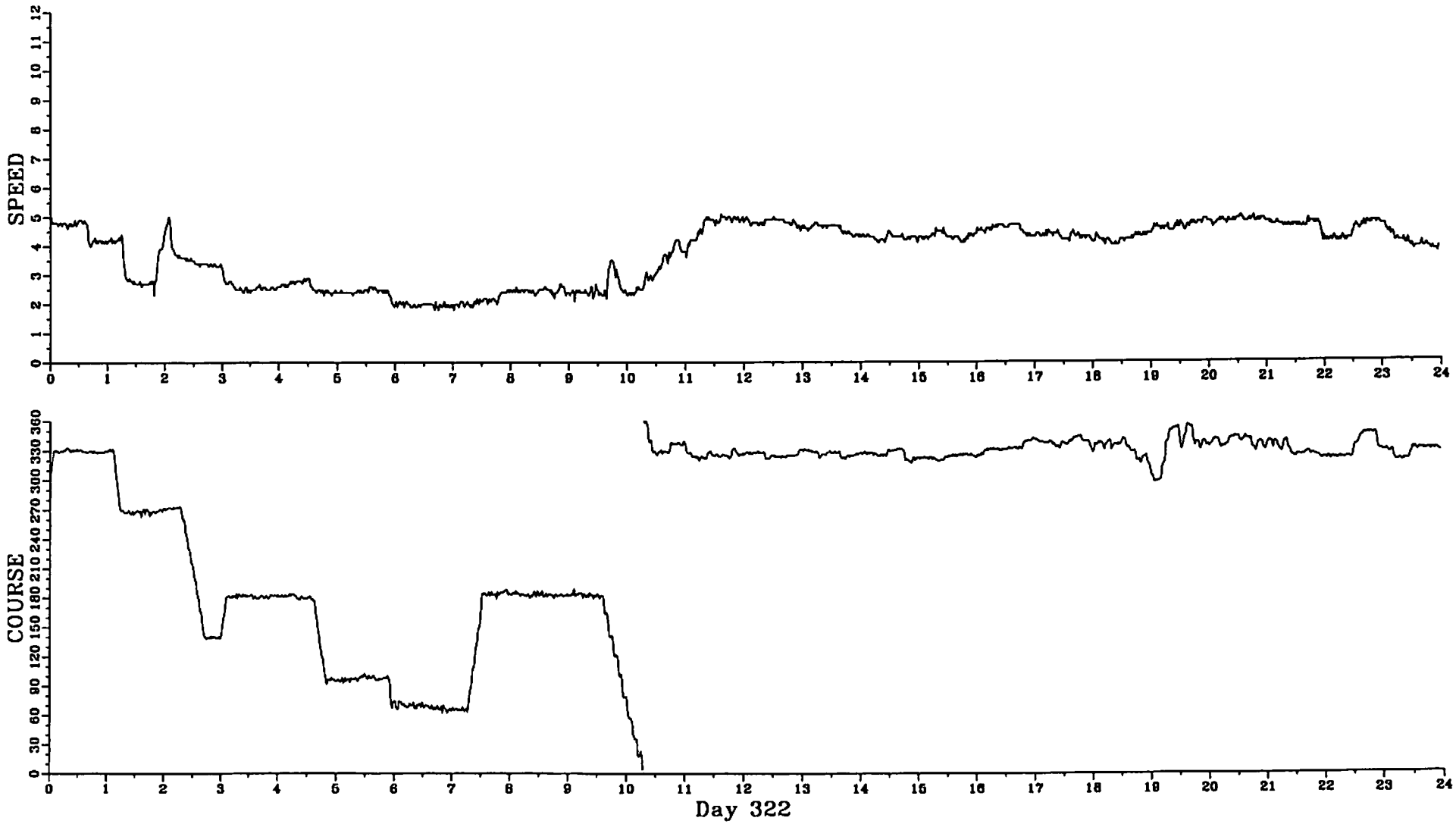

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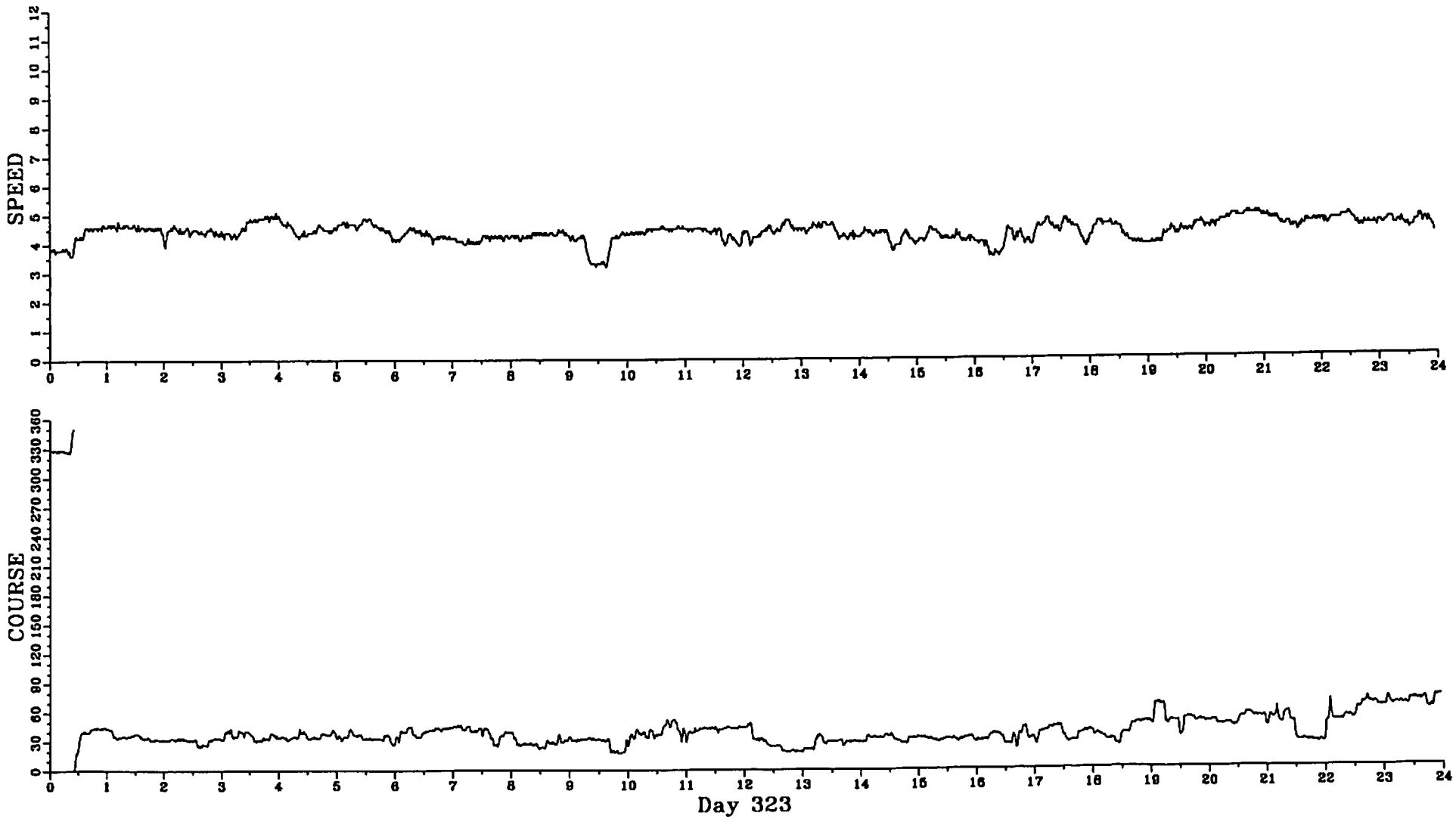

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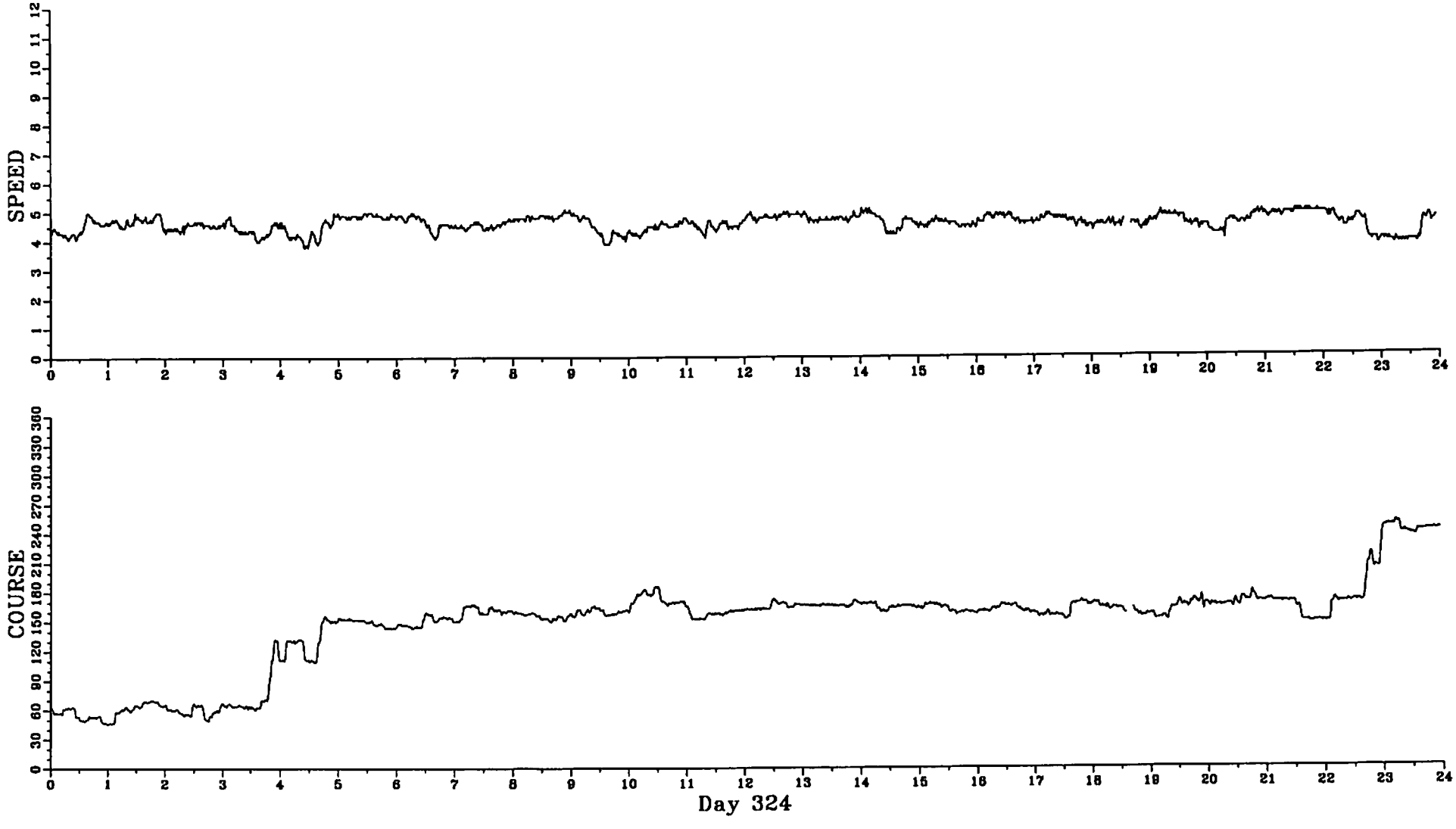

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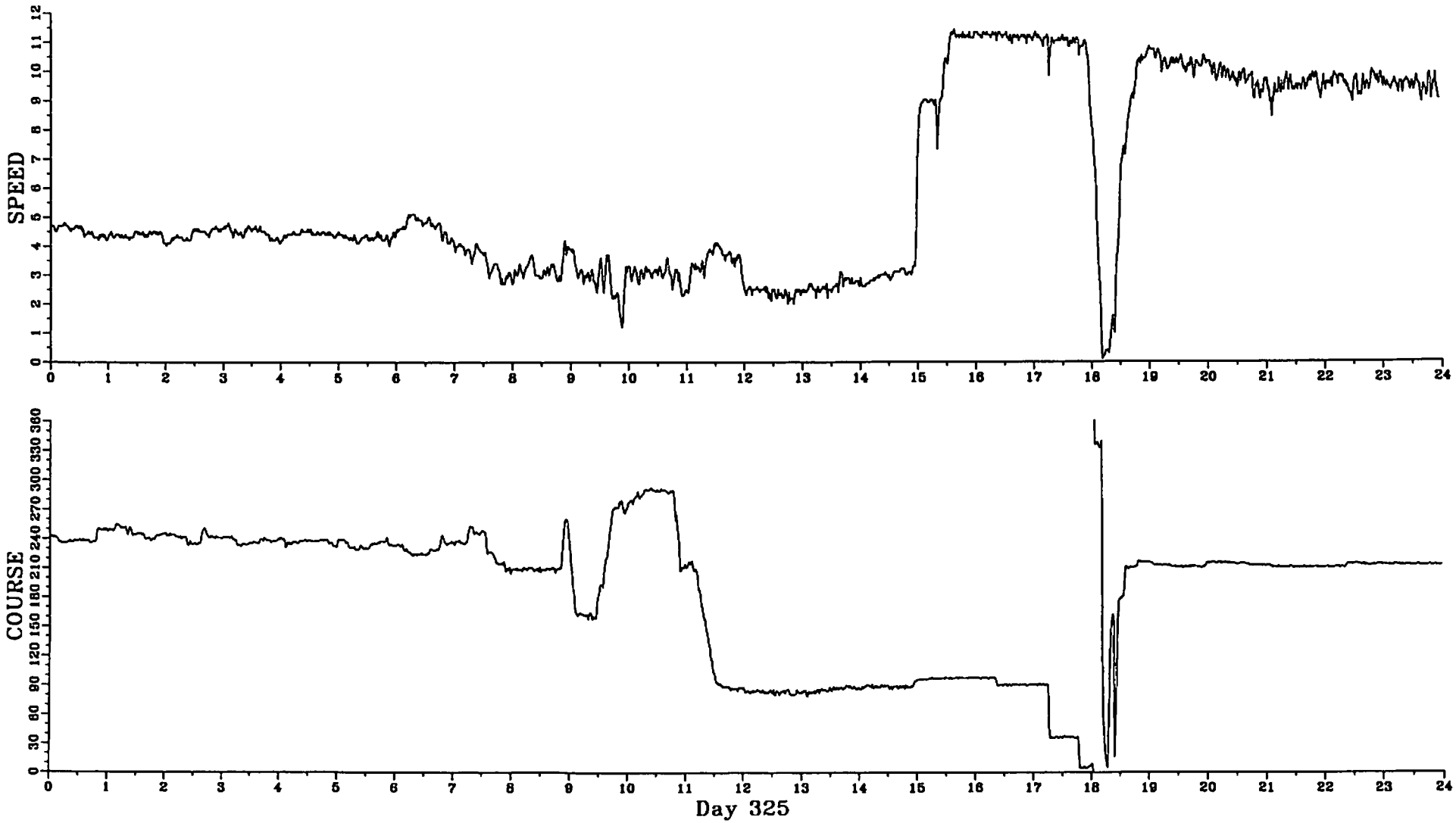

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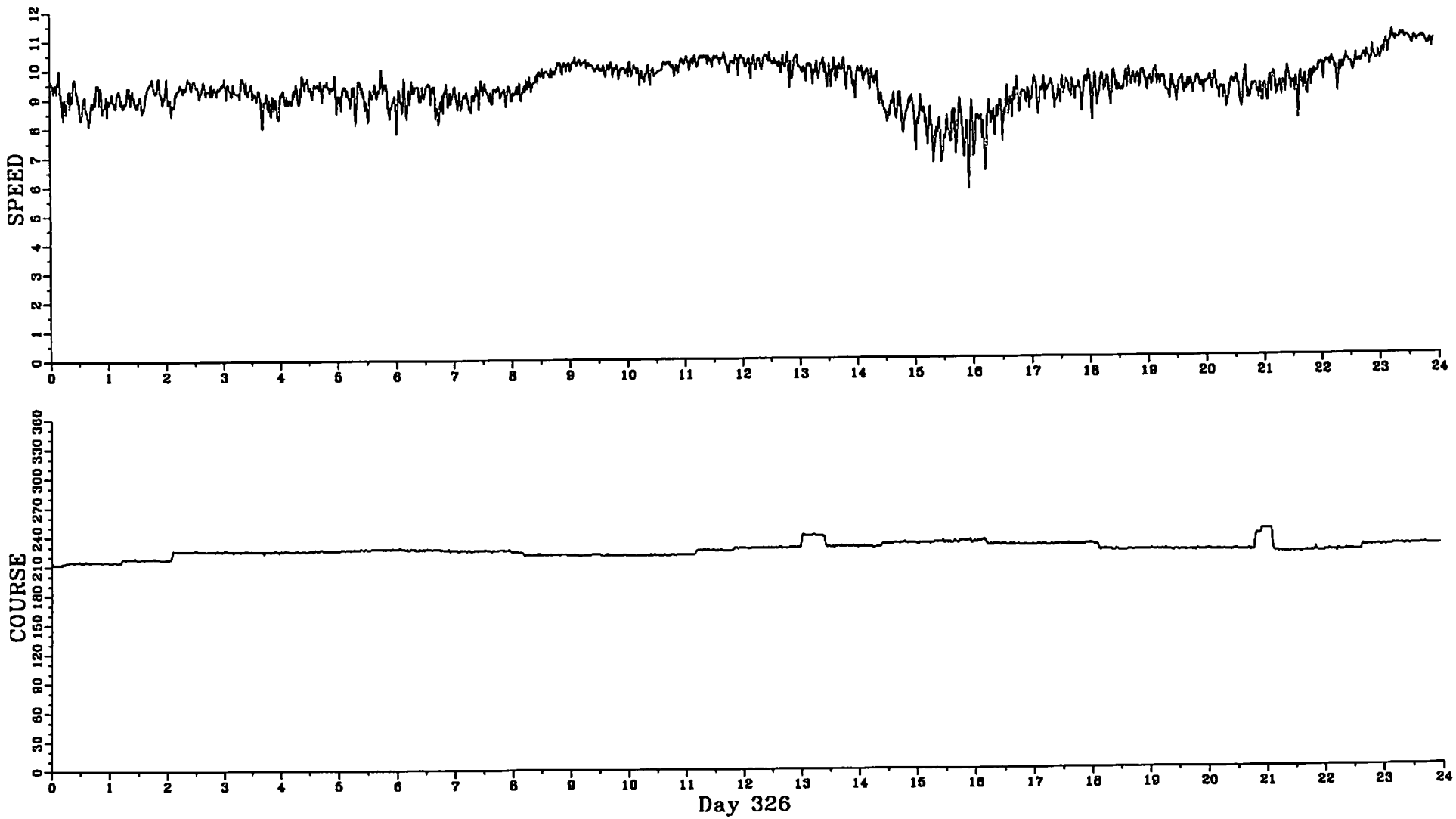

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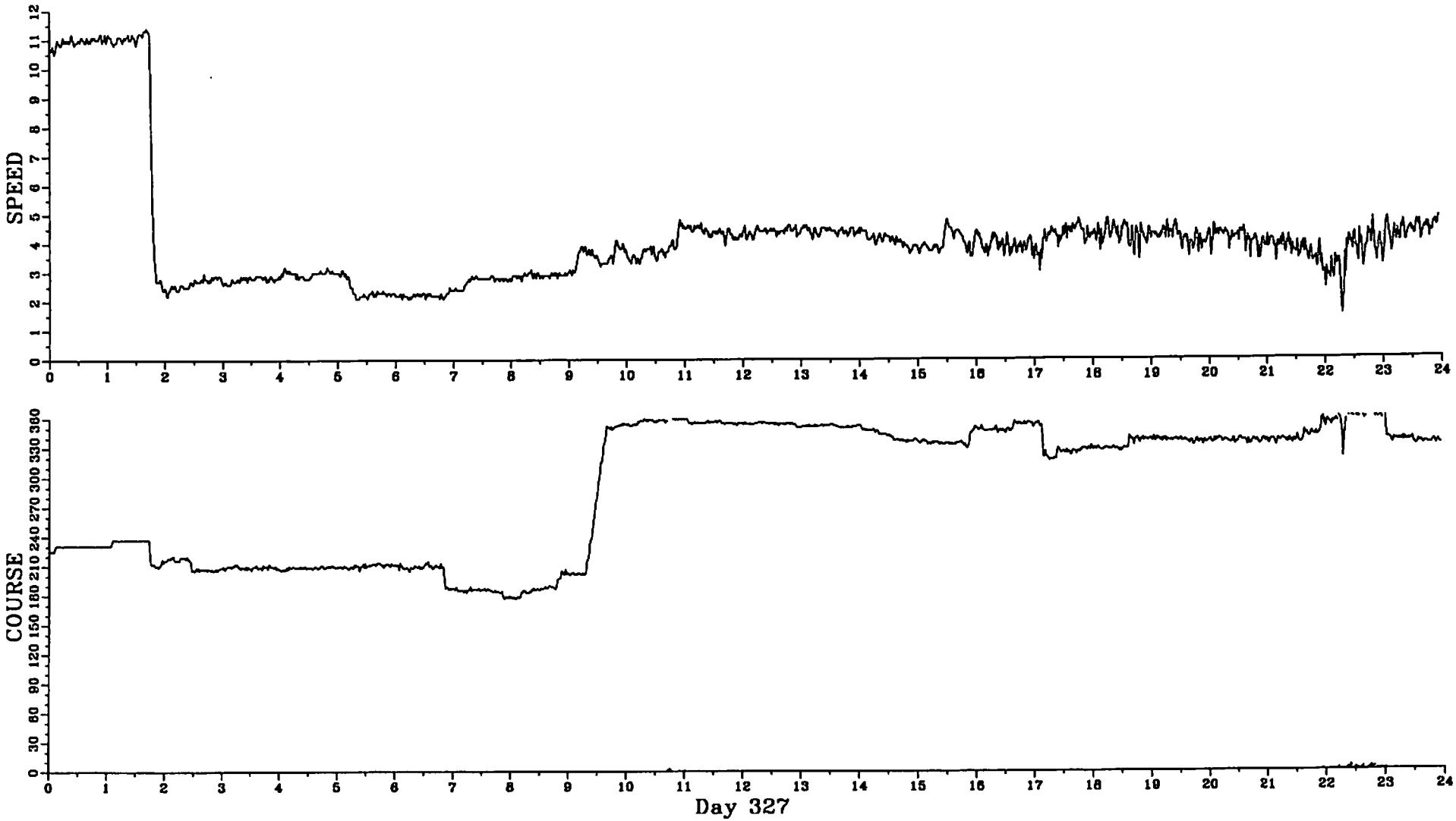

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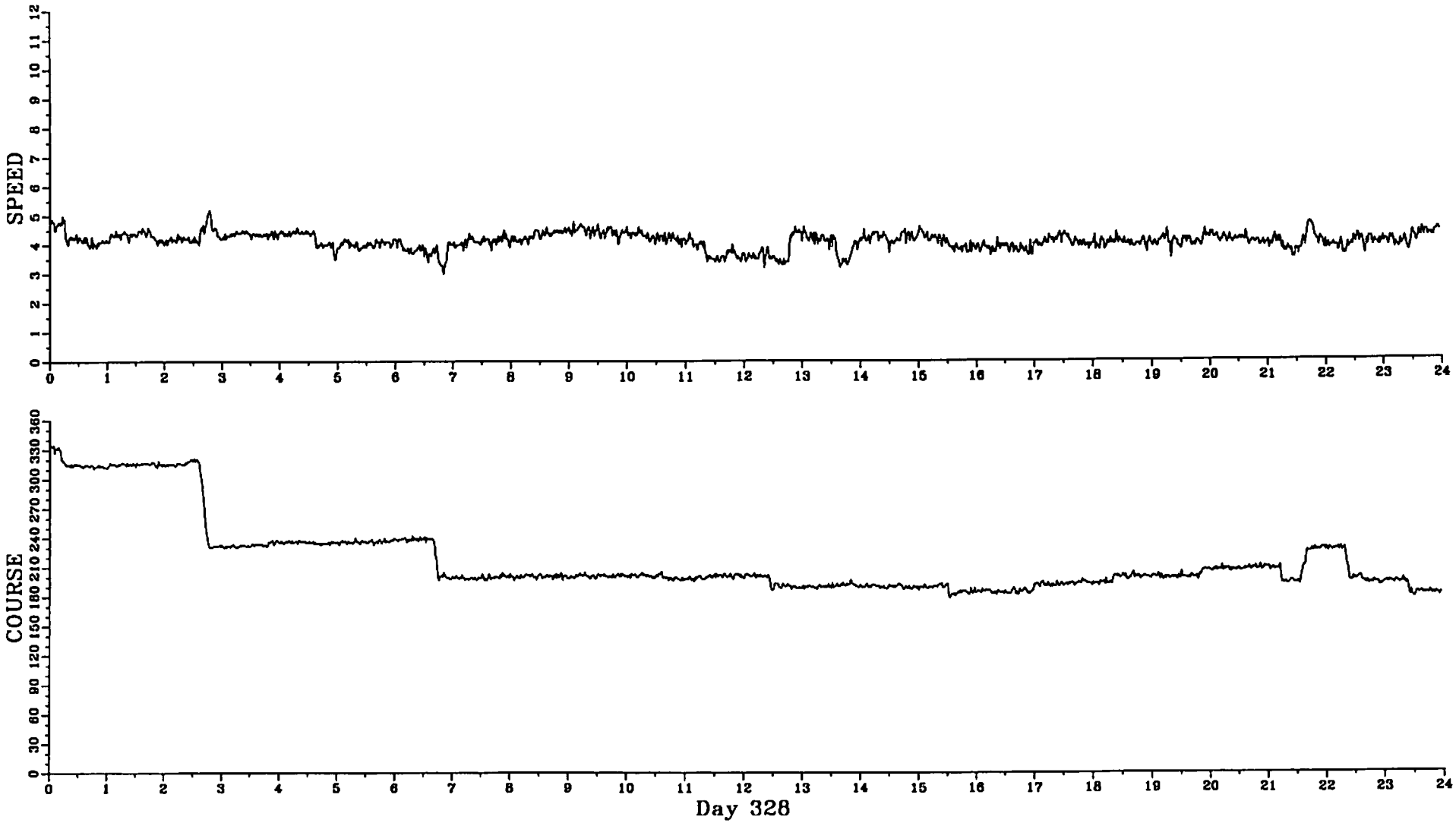

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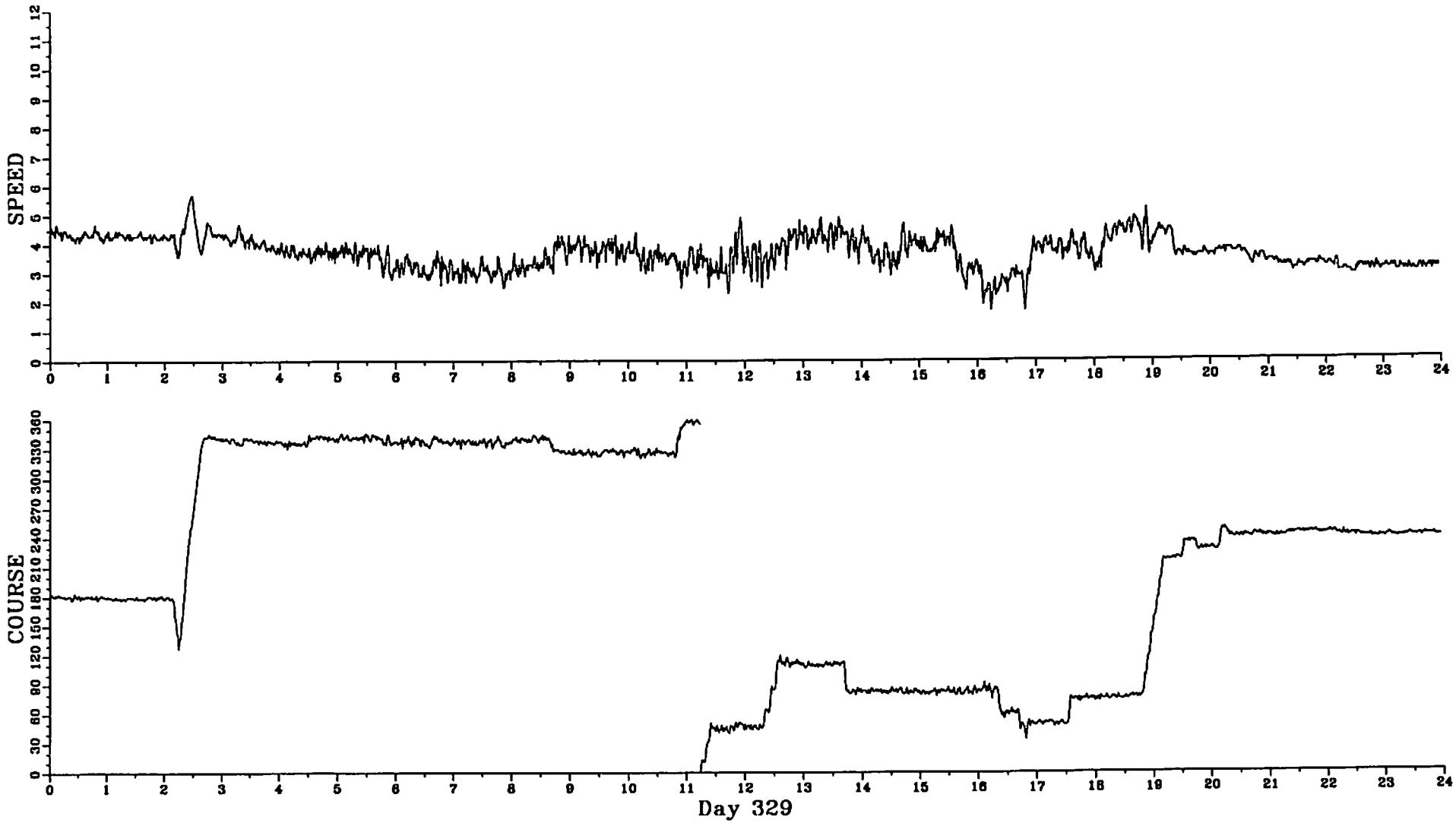

C2911 Barcelona–Cadiz Smooth Speed and Heading

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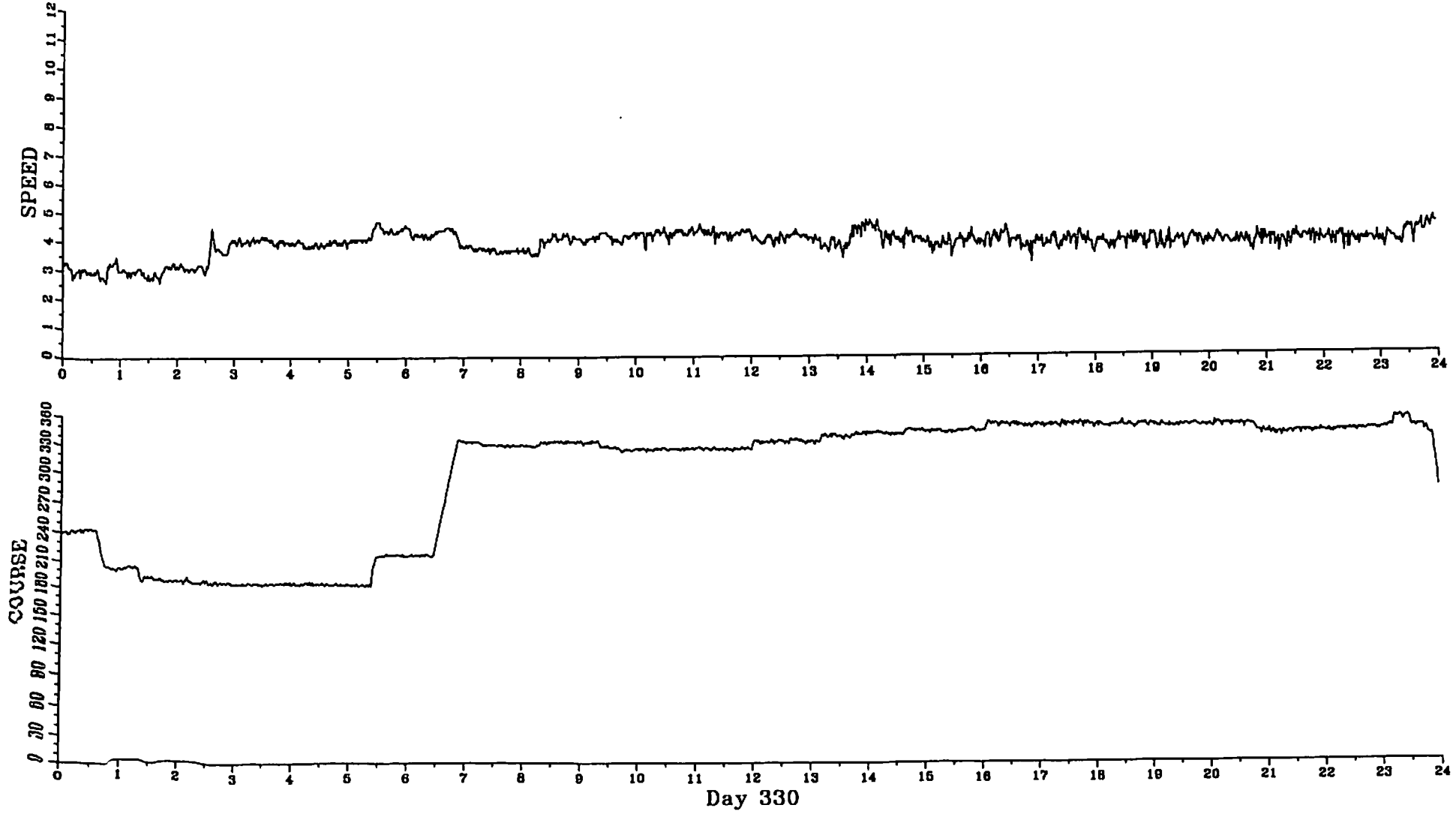

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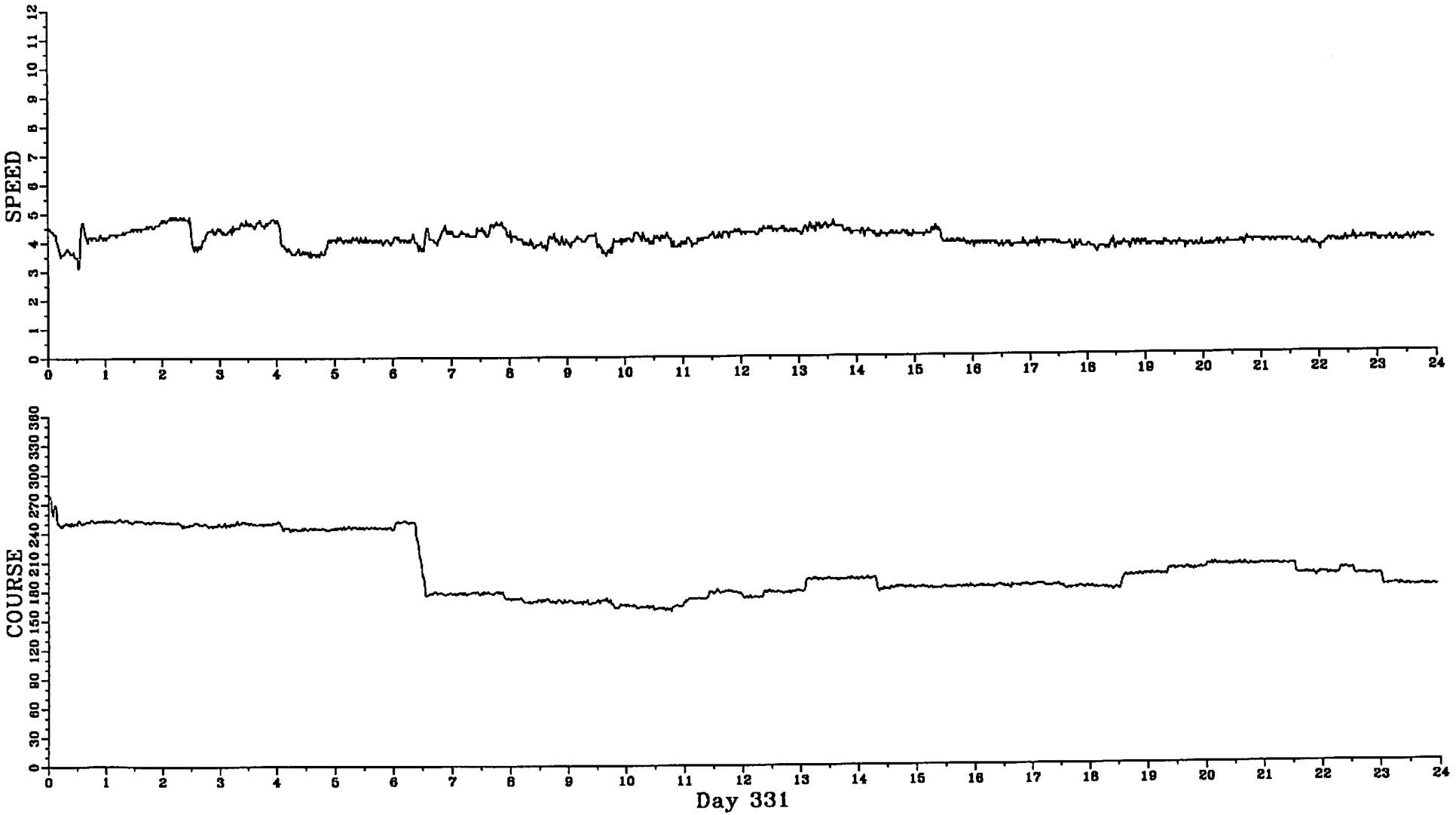

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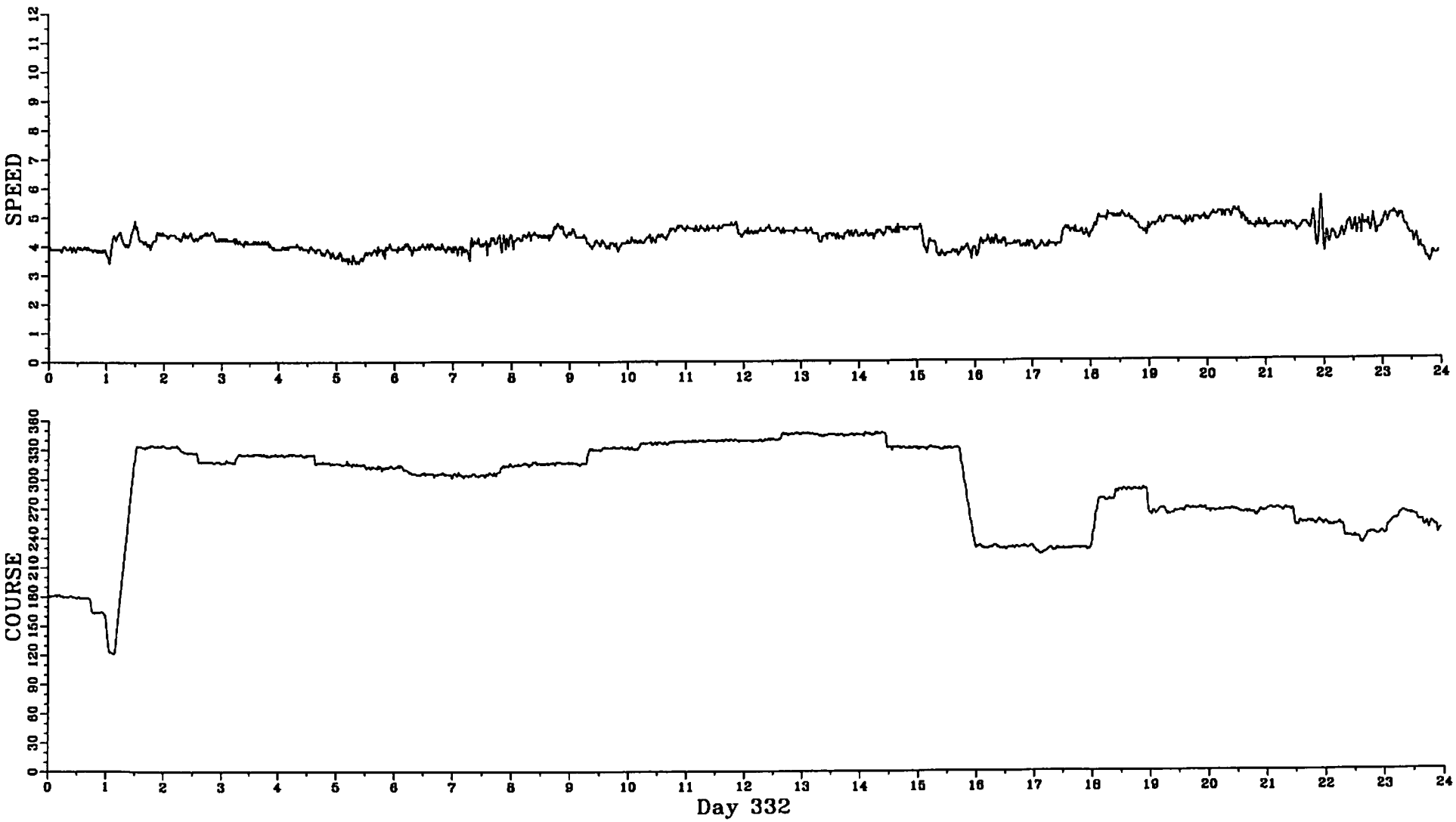
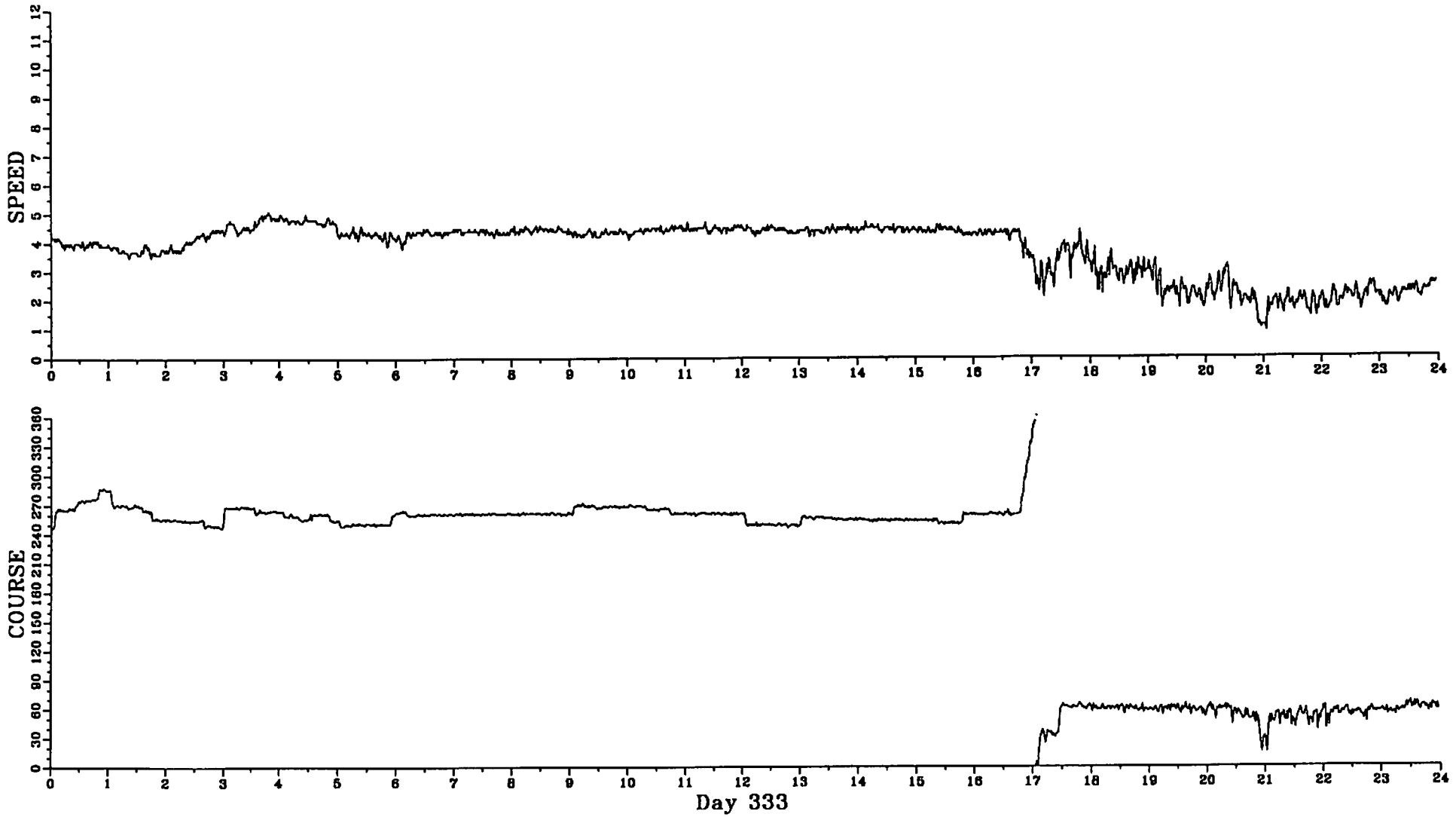


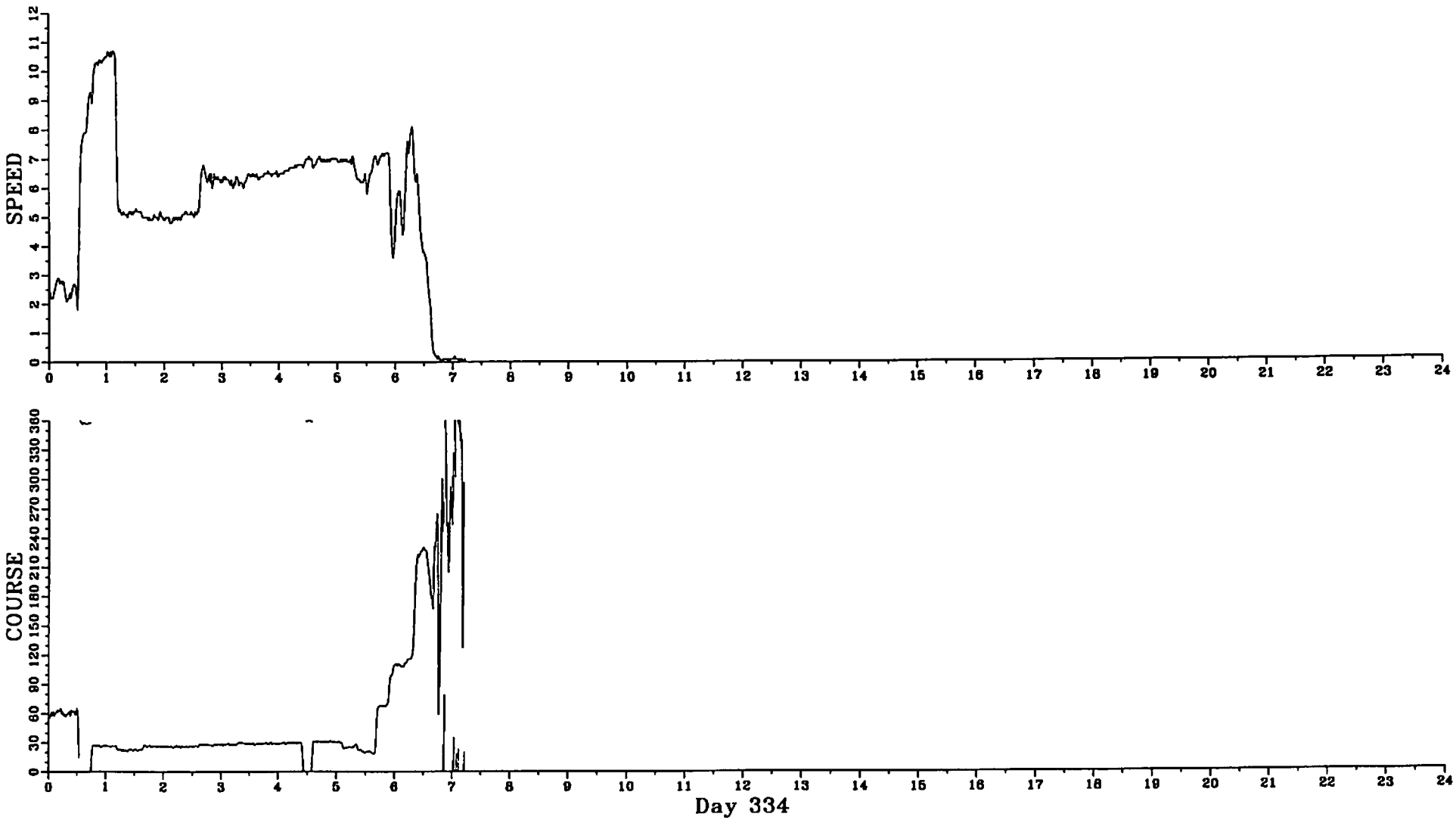
C2911 Barcelona–Cadiz Smooth Speed and Heading

Data file: fu.s333



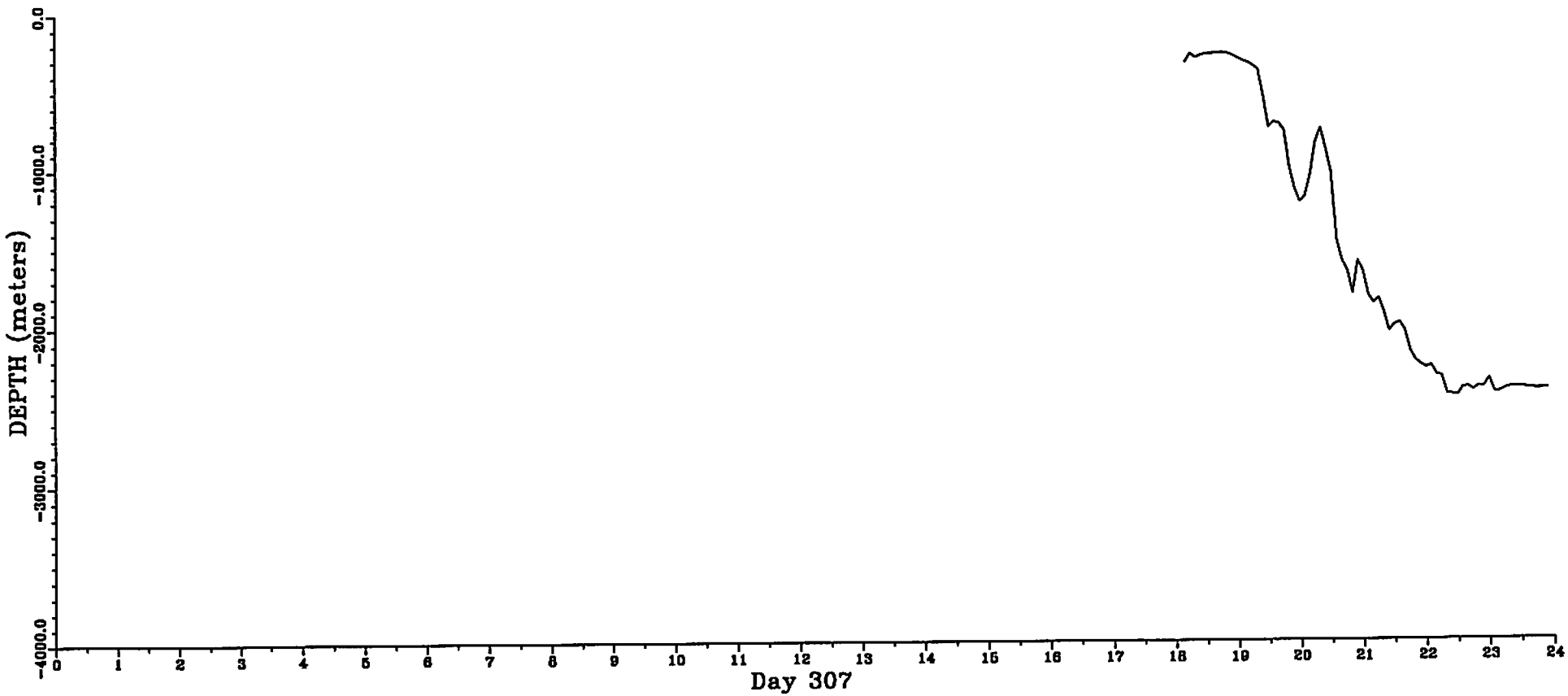
C2911 Barcelona–Cadiz Smooth Speed and Heading

Data file: fu.s334



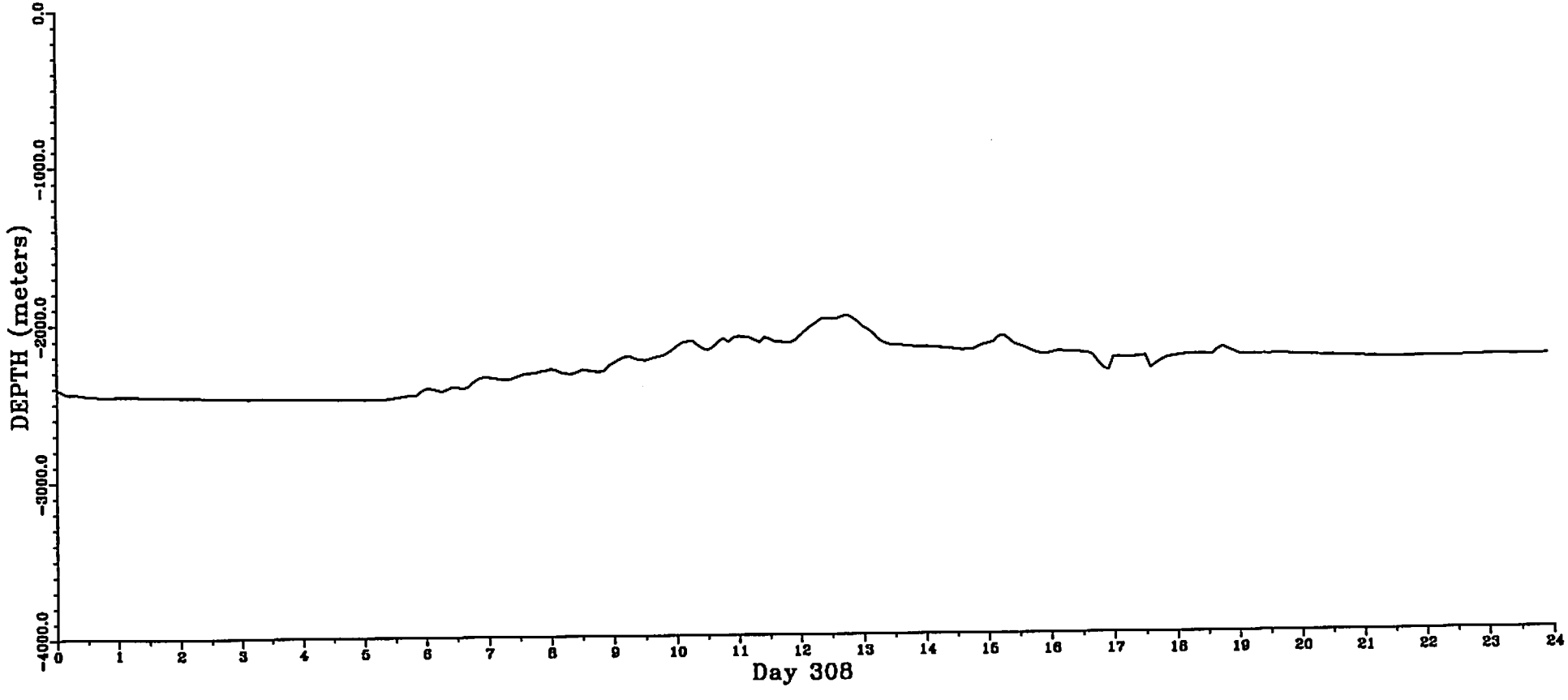
C2911 PDR depths at 5 minute intervals

Data file: bt.d307



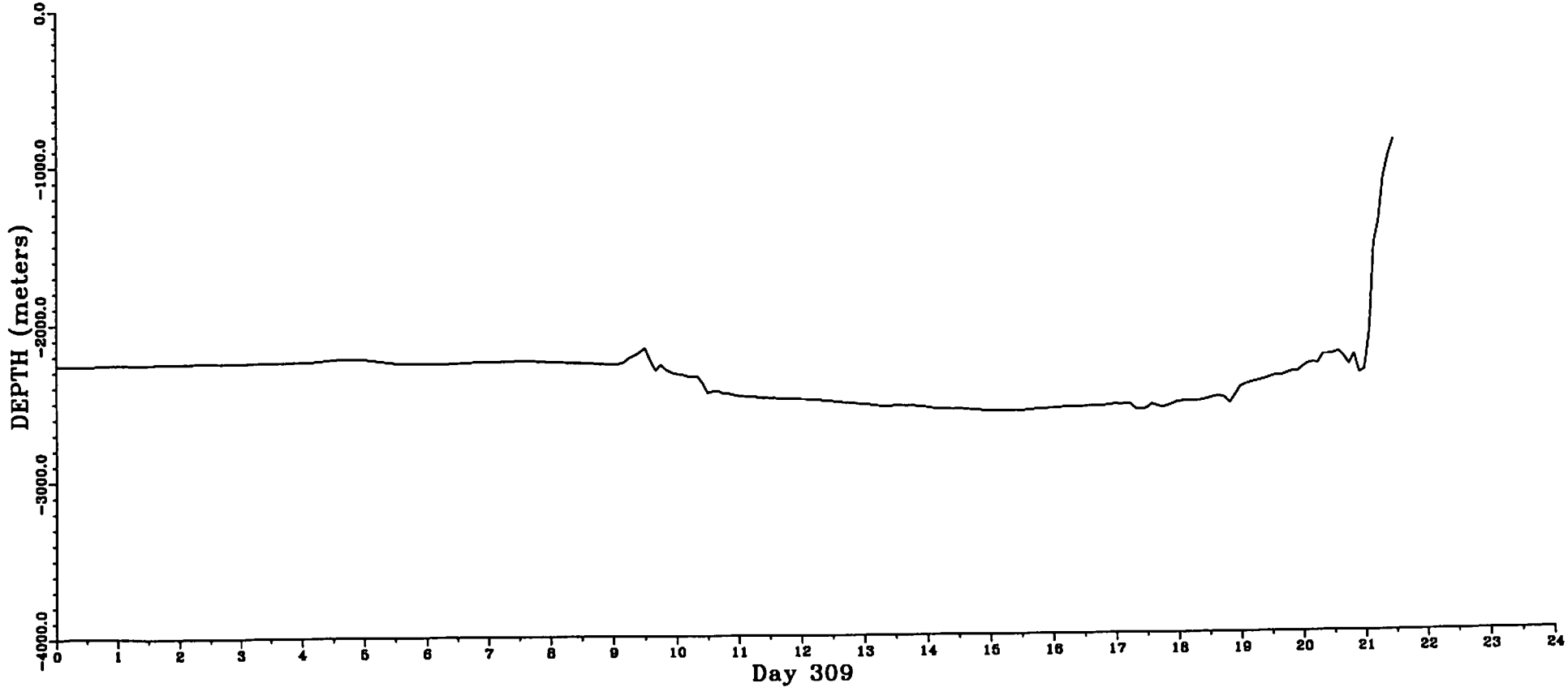
C2911 PDR depths at 5 minute intervals

Data file: bt.d308



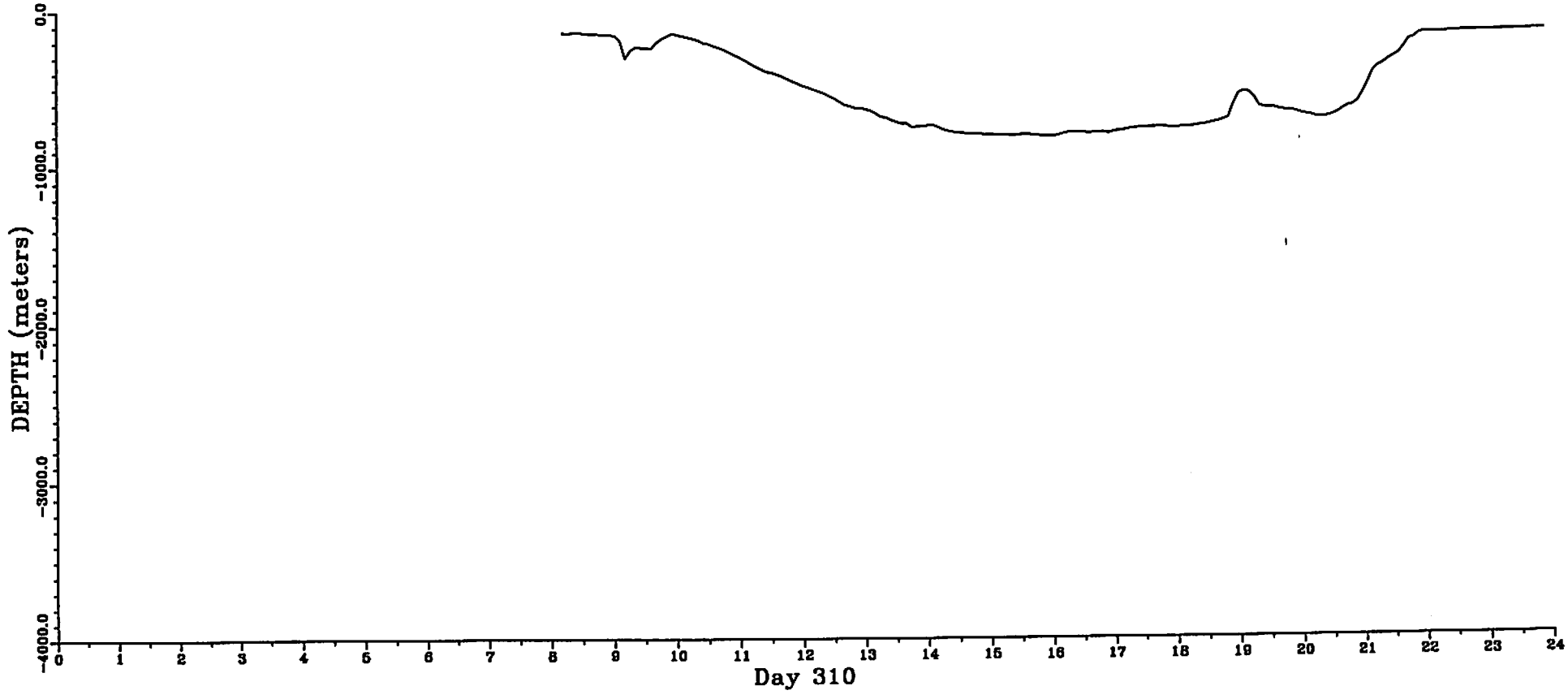
C2911 PDR depths at 5 minute intervals

Data file: bt.d309



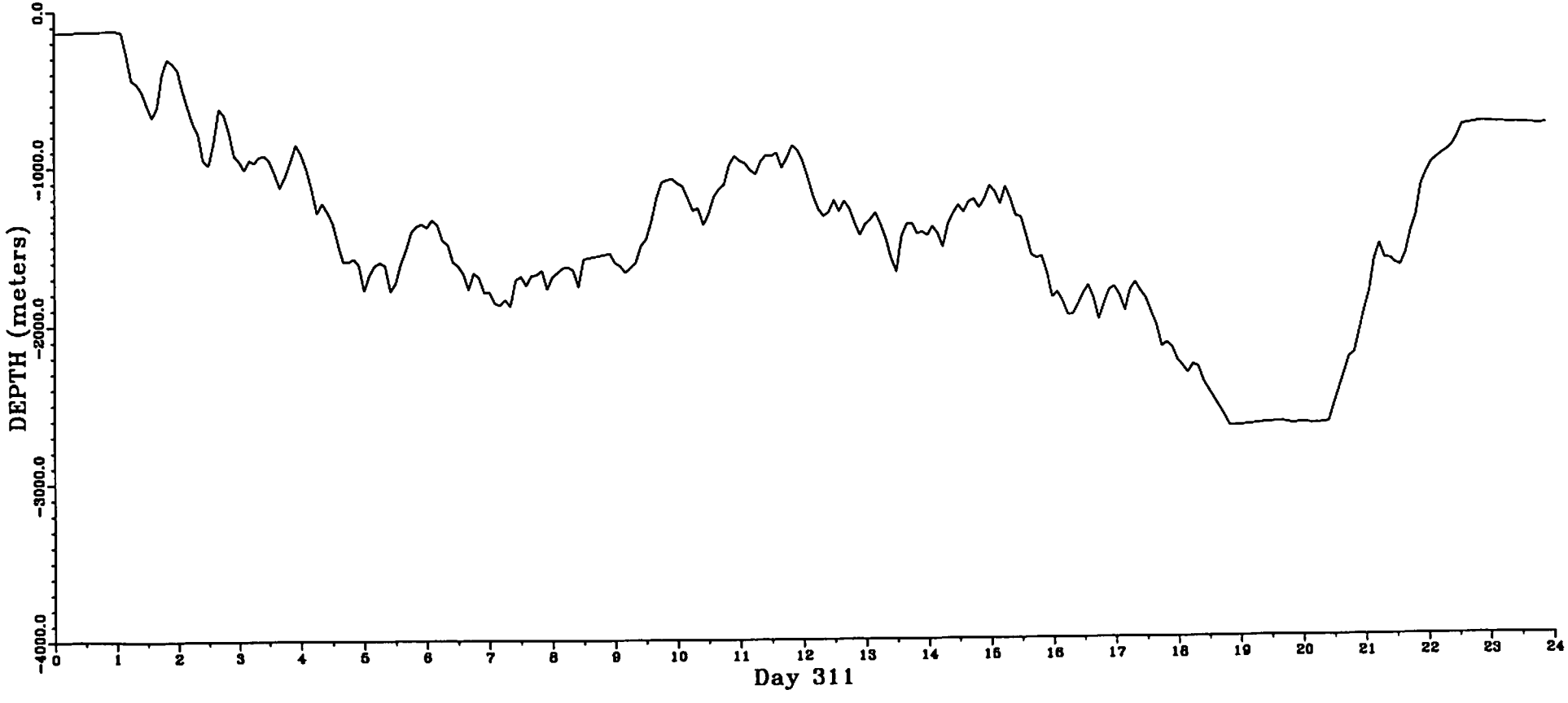
C2911 PDR depths at 5 minute intervals

Data file: bt.d310



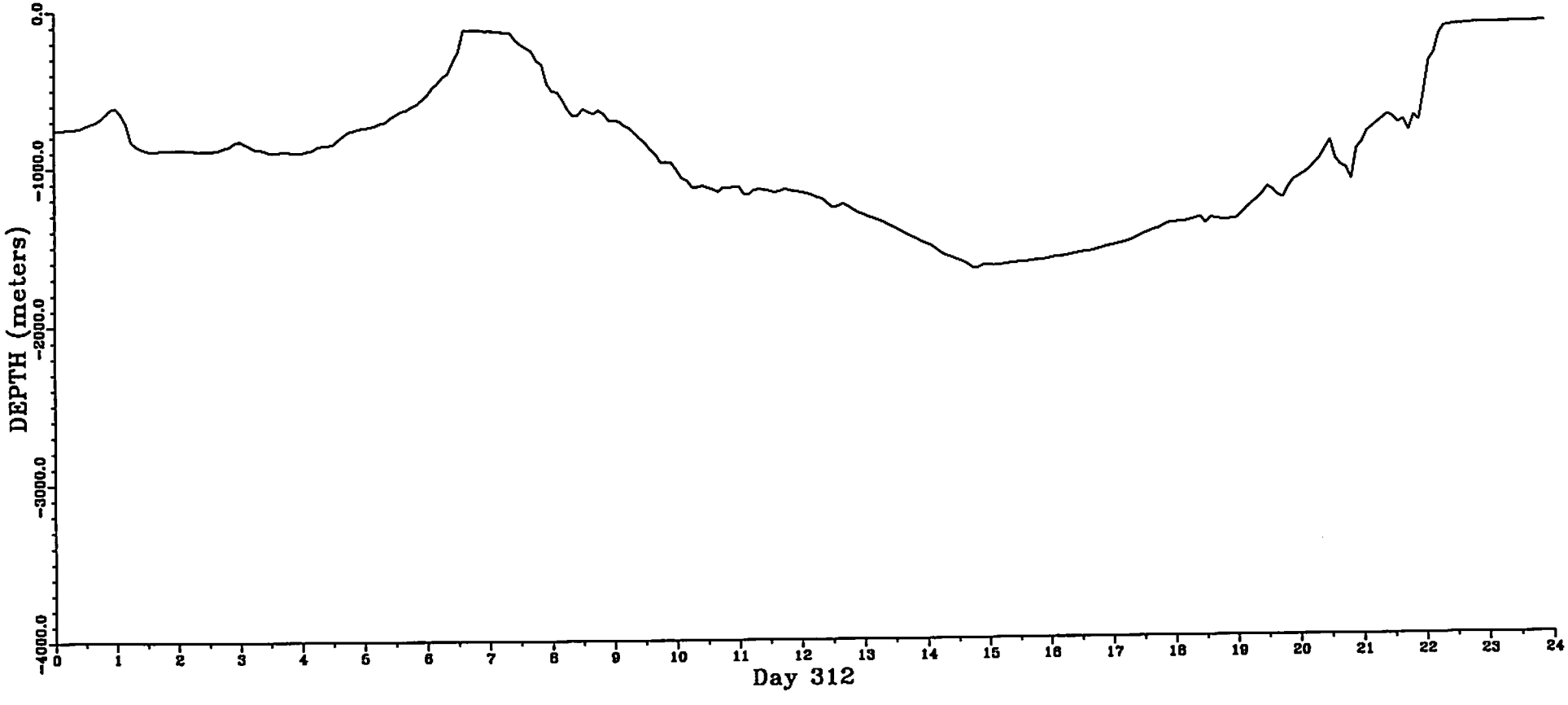
C2911 PDR depths at 5 minute intervals

Data file: bt.d311



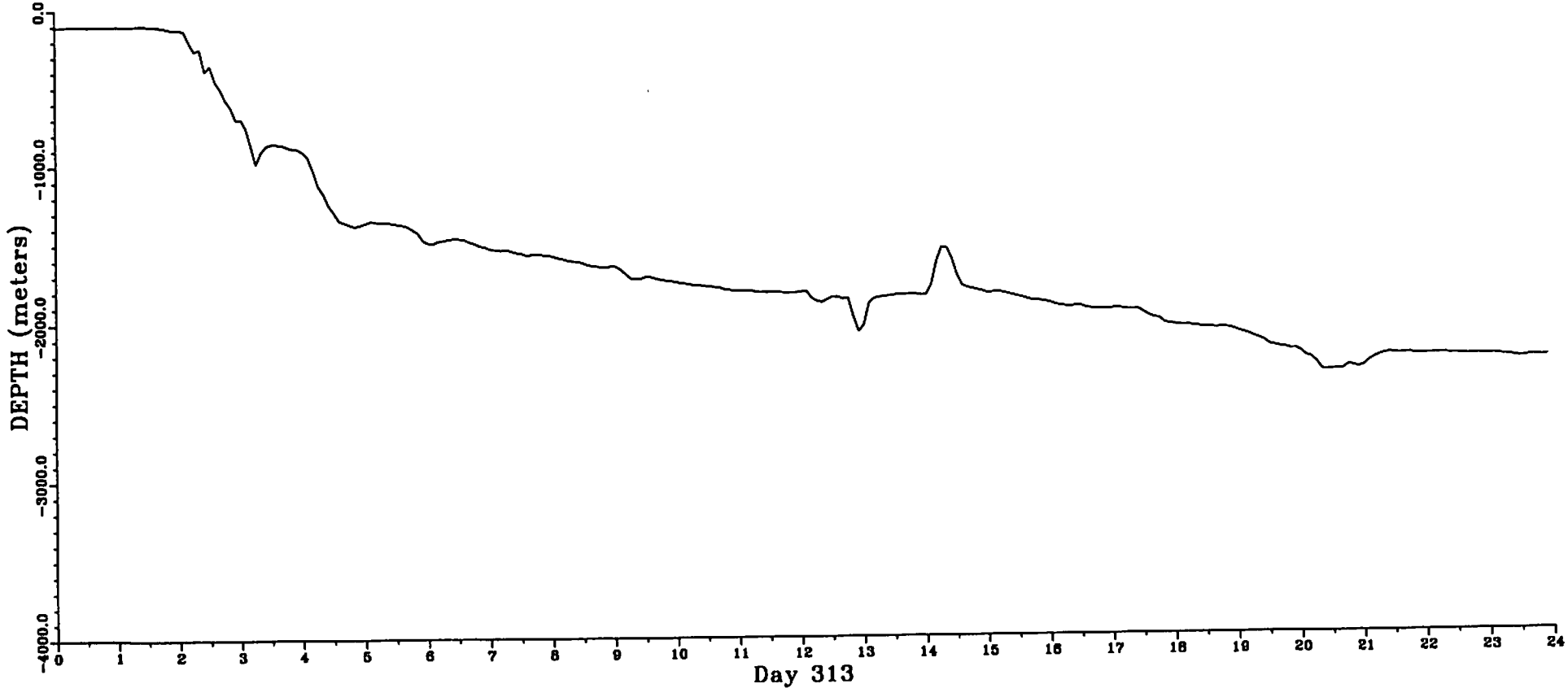
C2911 PDR depths at 5 minute intervals

Data file: bt.d312



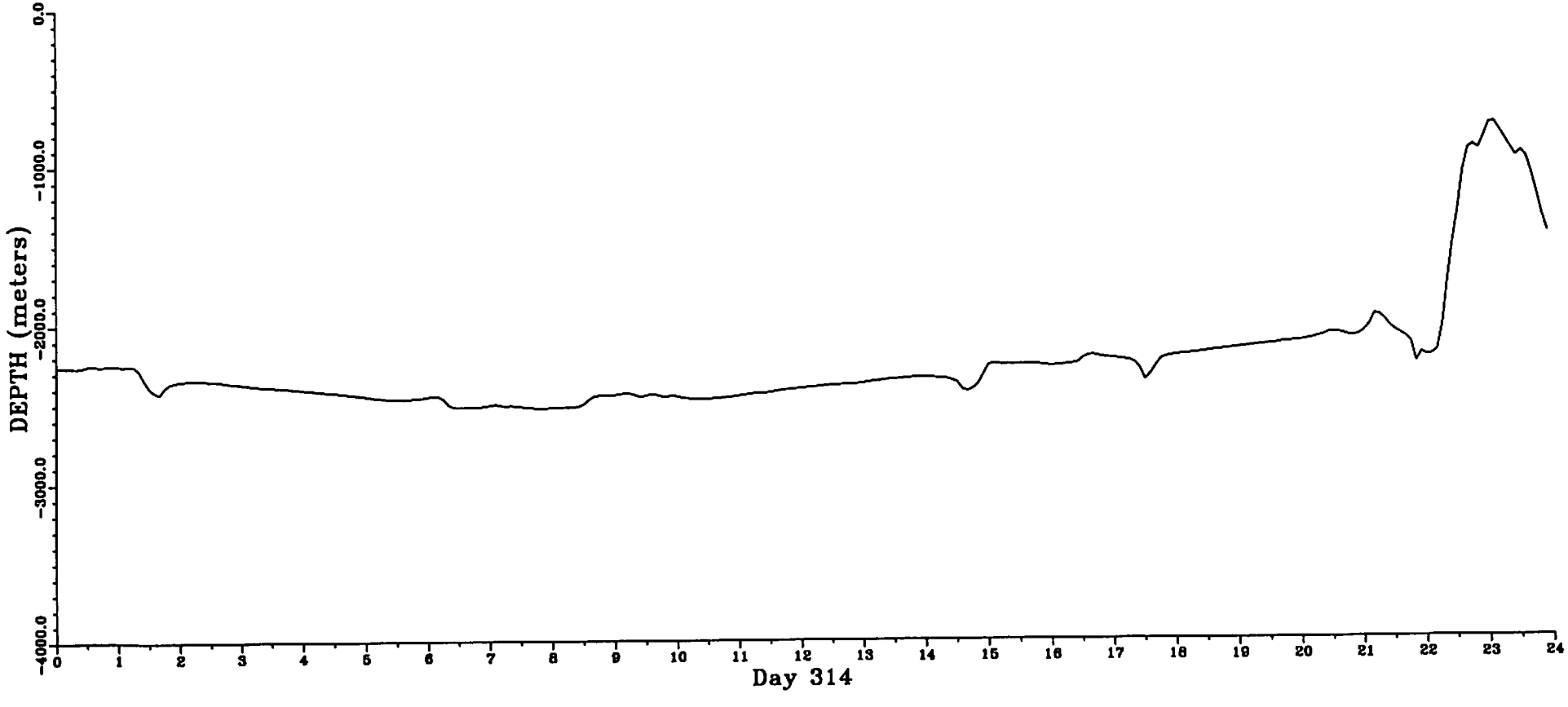
C2911 PDR depths at 5 minute intervals

Data file: bt.d313



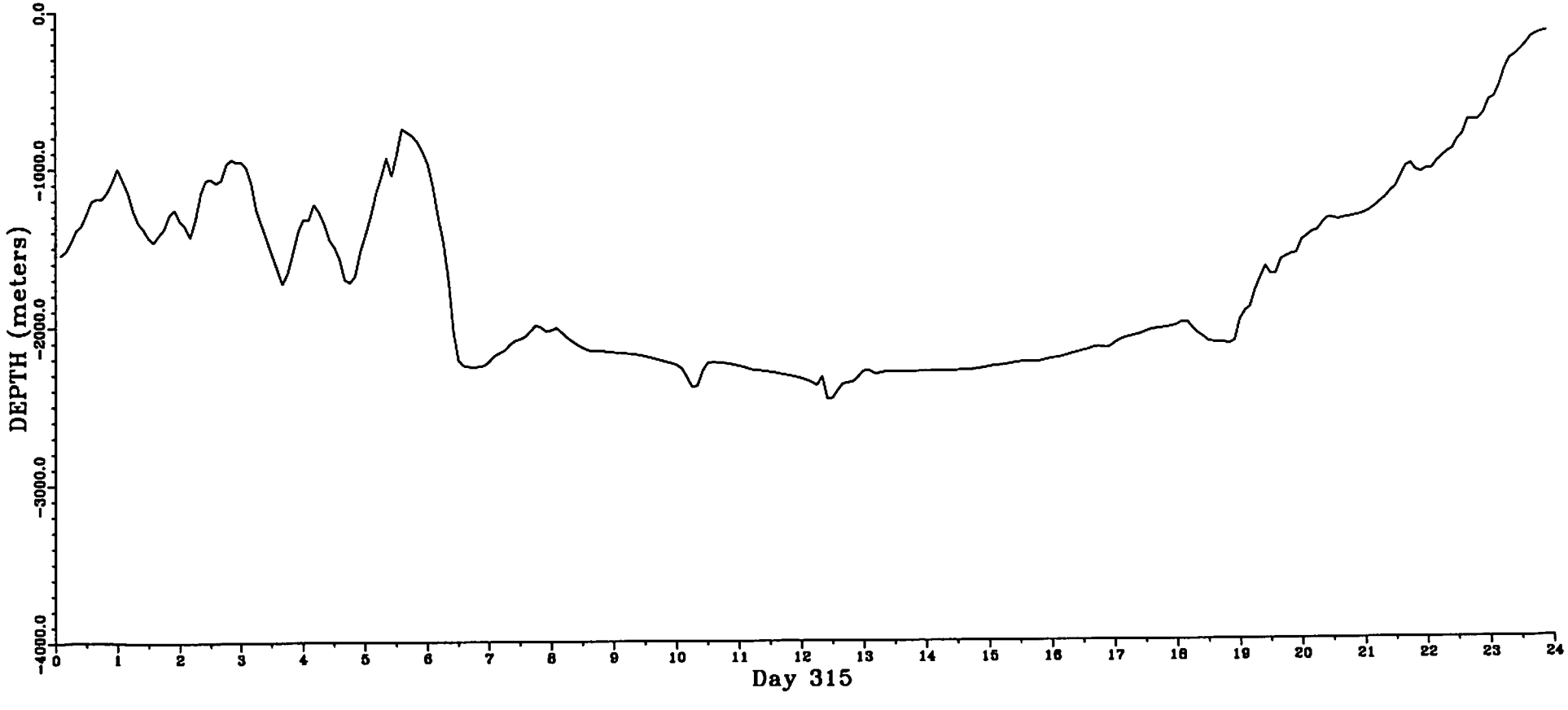
C2911 PDR depths at 5 minute intervals

Data file: bt.d314



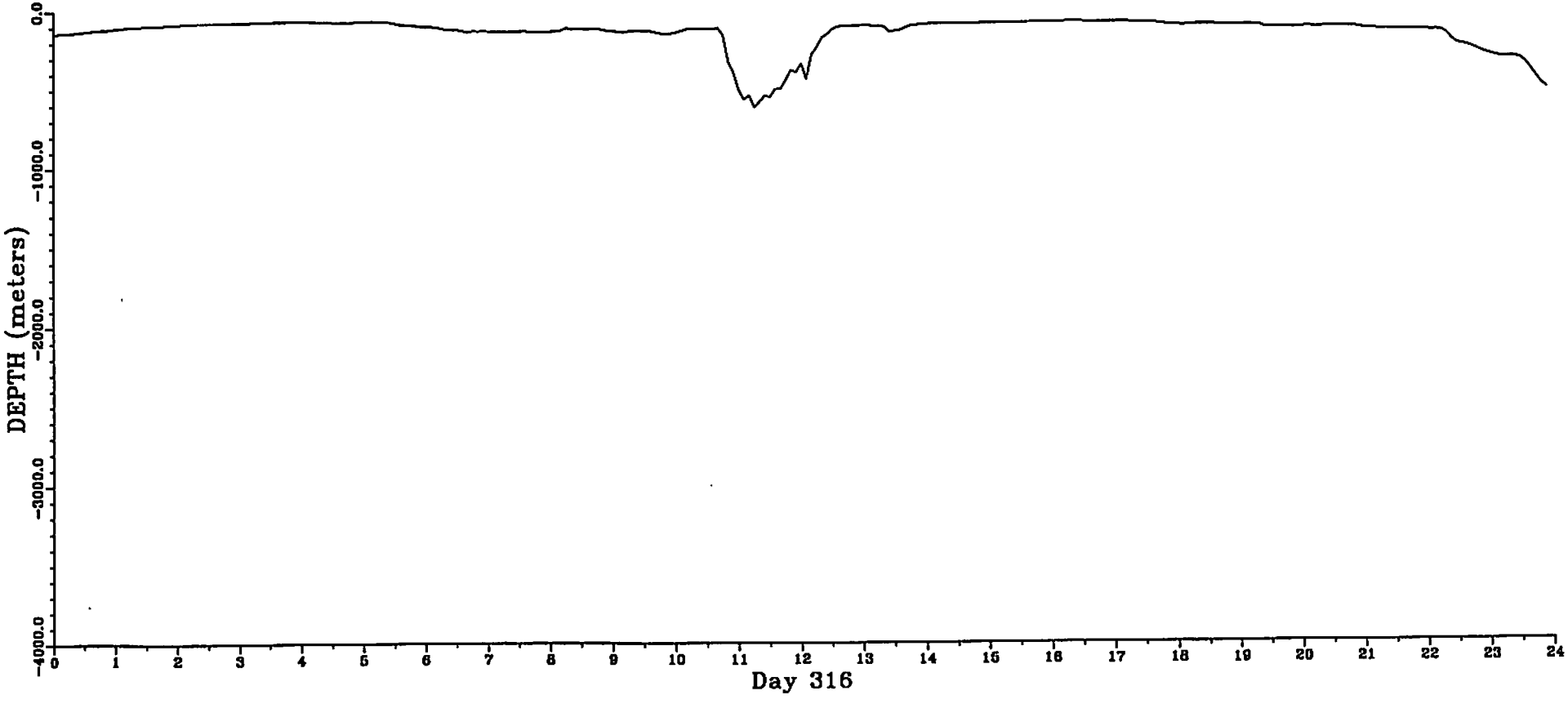
C2911 PDR depths at 5 minute intervals

Data file: bt.d315



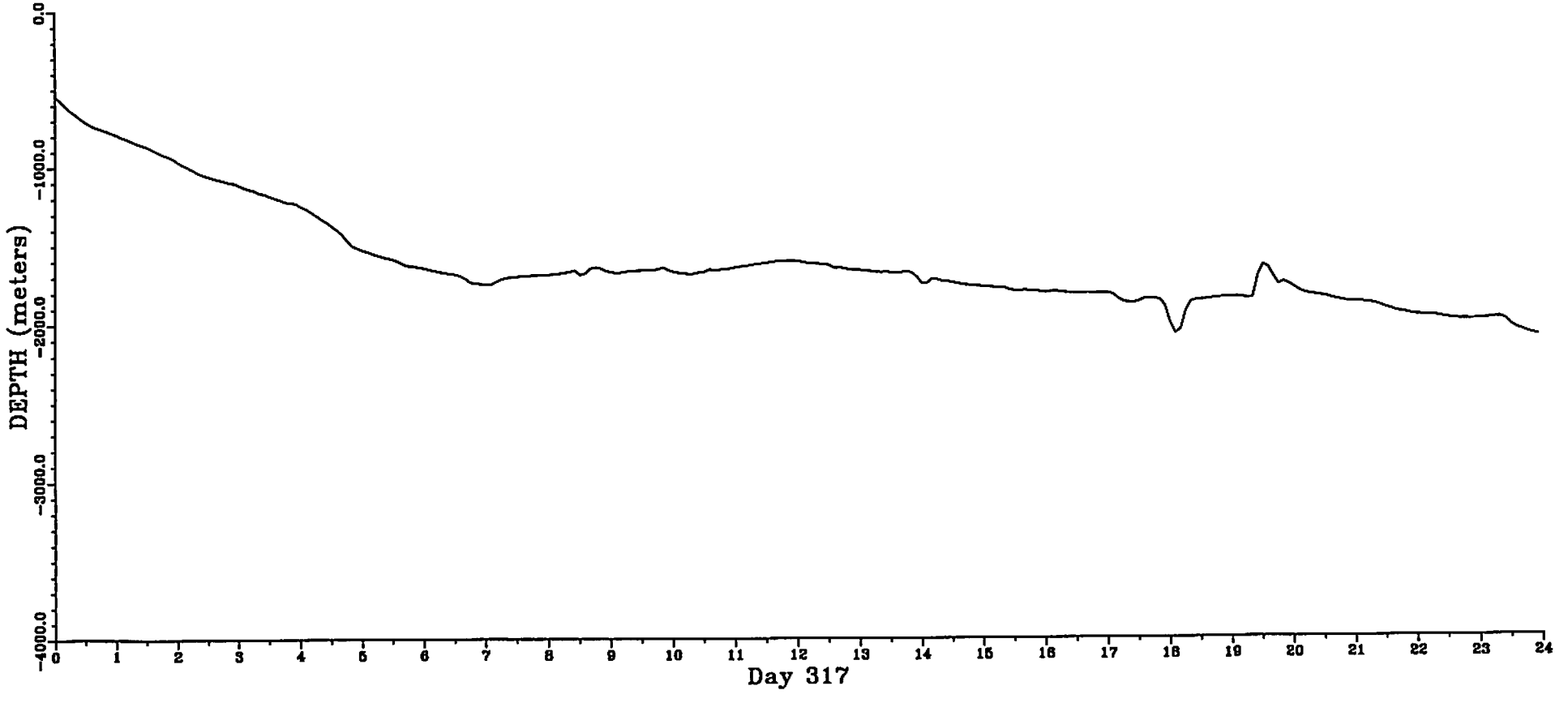
C2911 PDR depths at 5 minute intervals

Data file: bt.d316



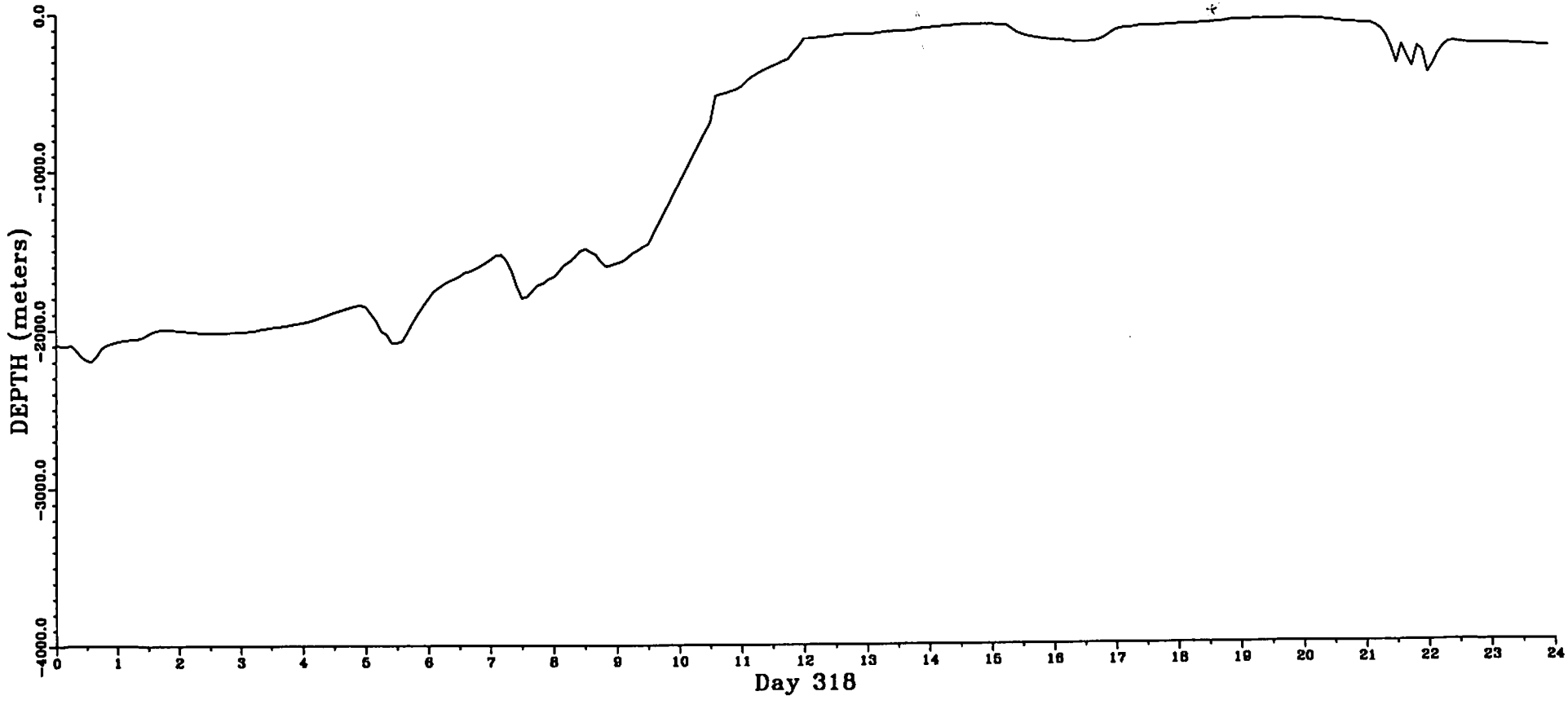
C2911 PDR depths at 5 minute intervals

Data file: bt.d317



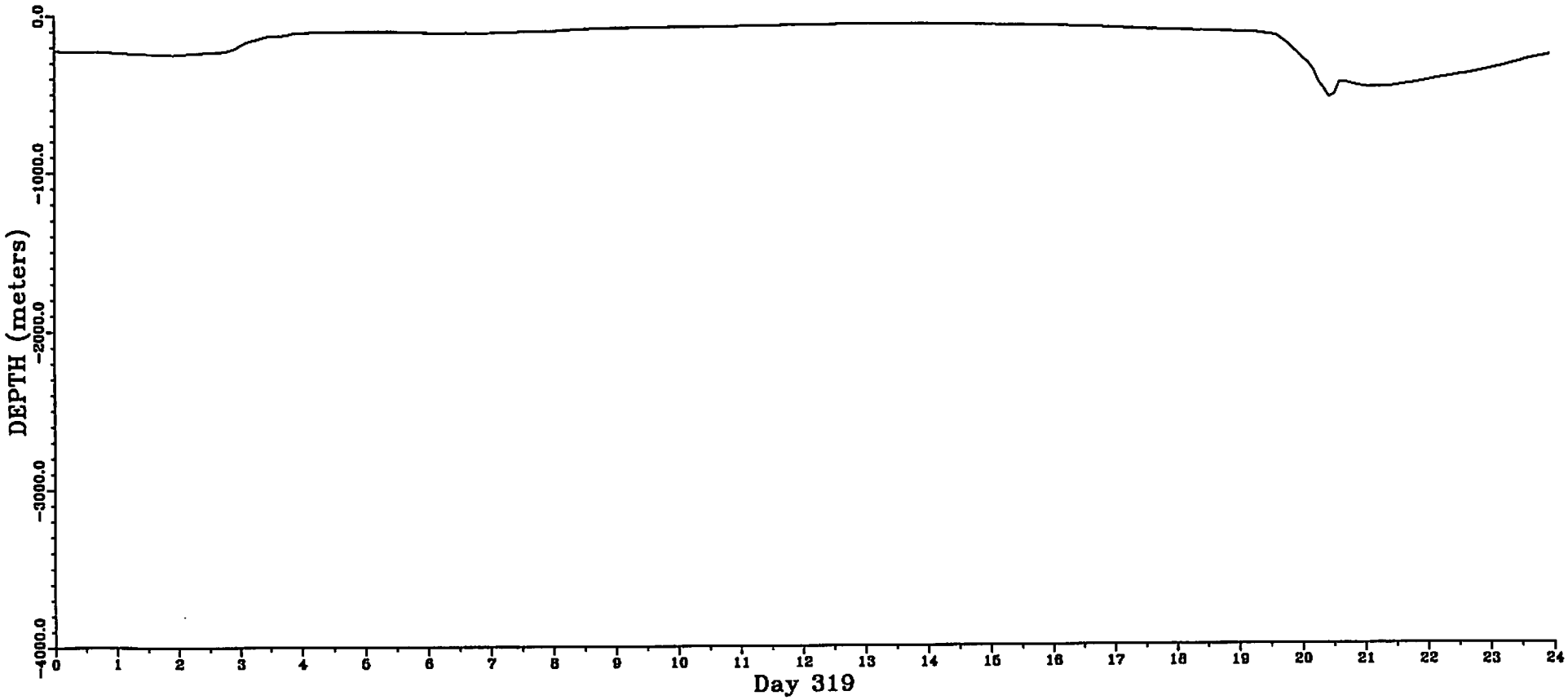
C2911 PDR depths at 5 minute intervals

Data file: bt.d318



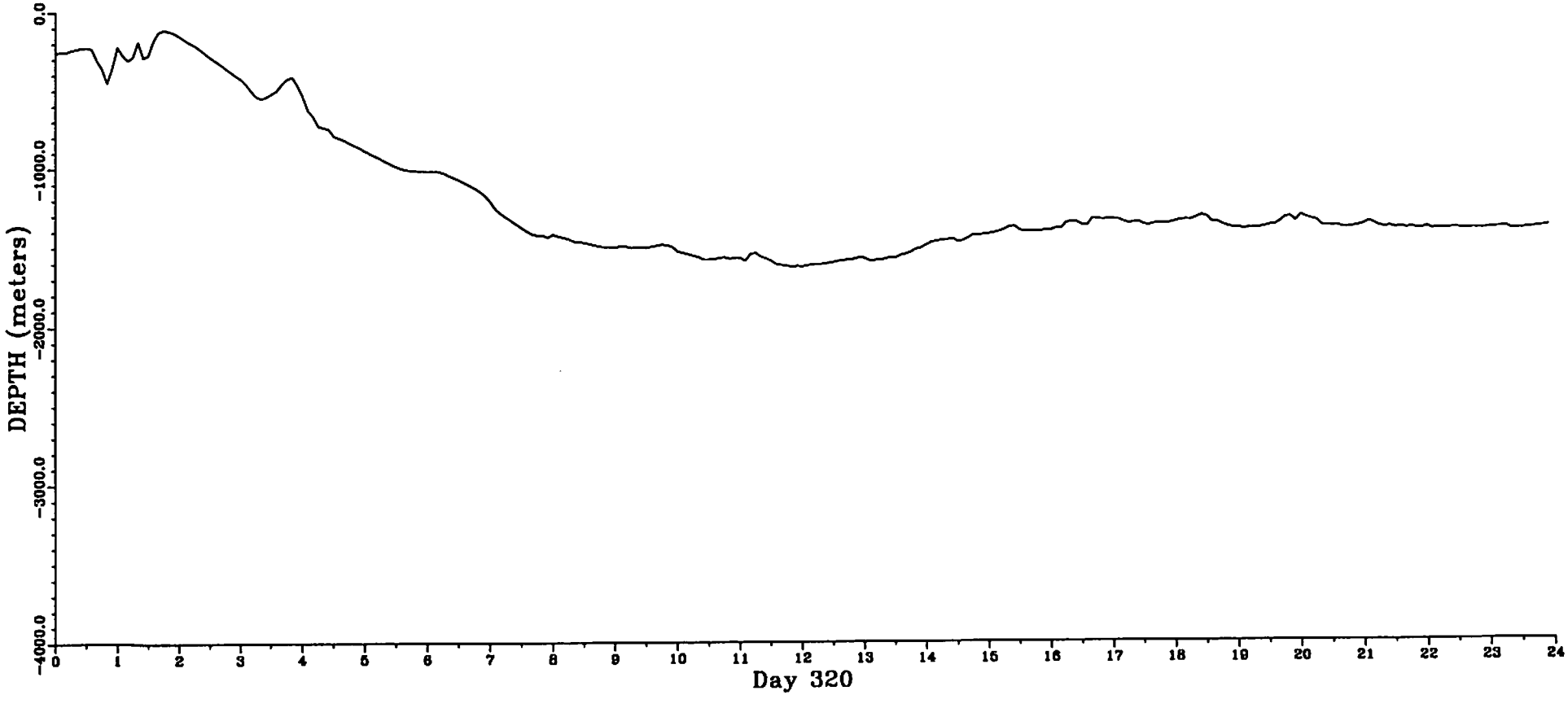
C2911 PDR depths at 5 minute intervals

Data file: bt.d319



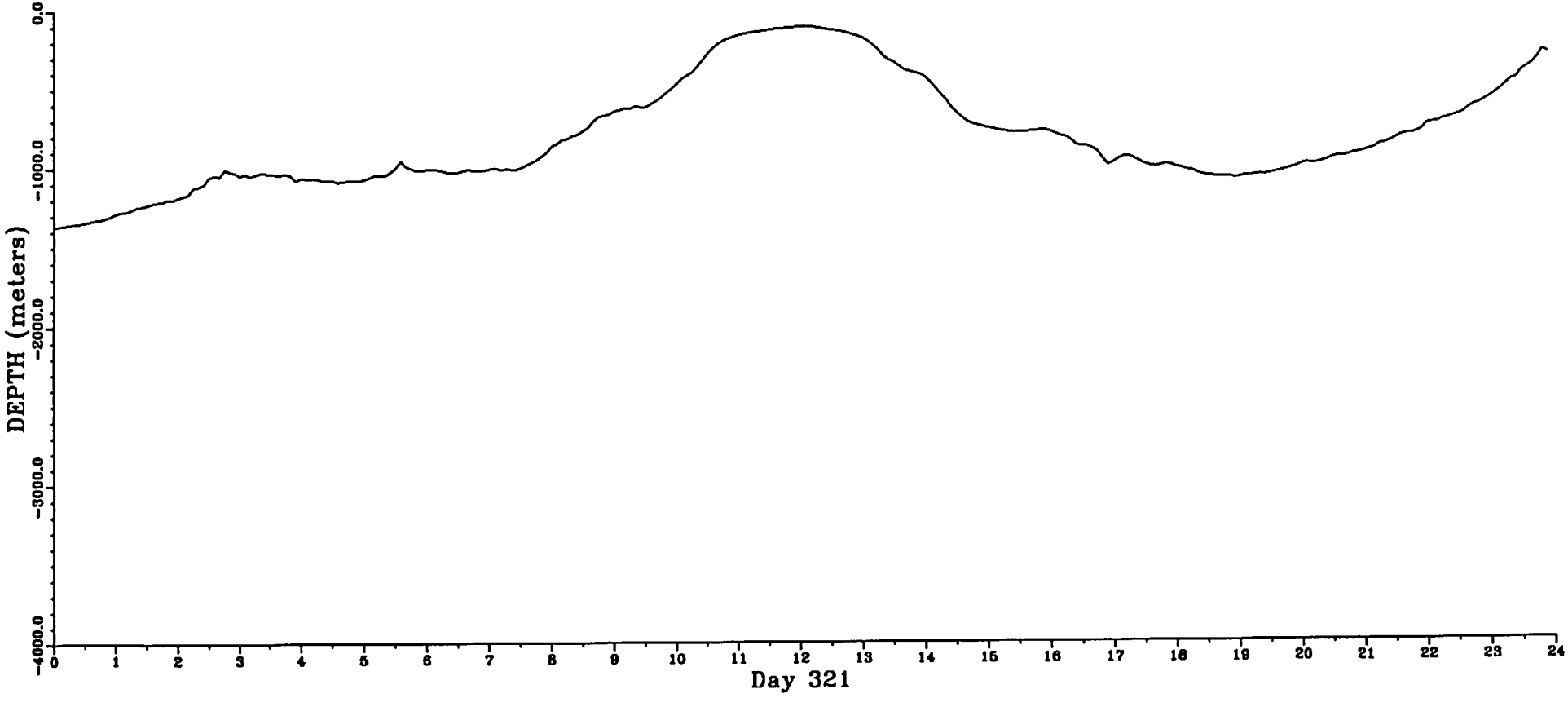
C2911 PDR depths at 5 minute intervals

Data file: bt.d320



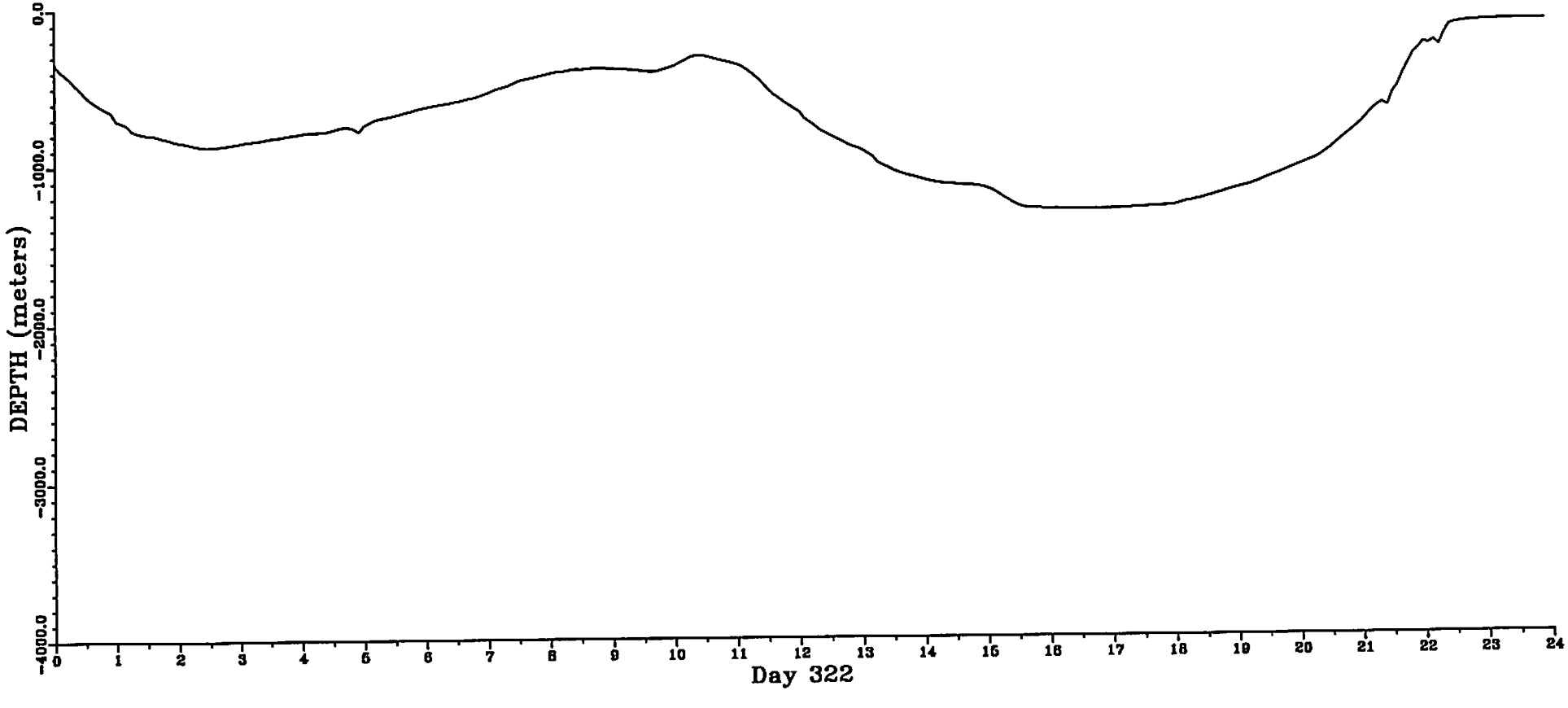
C2911 PDR depths at 5 minute intervals

Data file: bt.d321



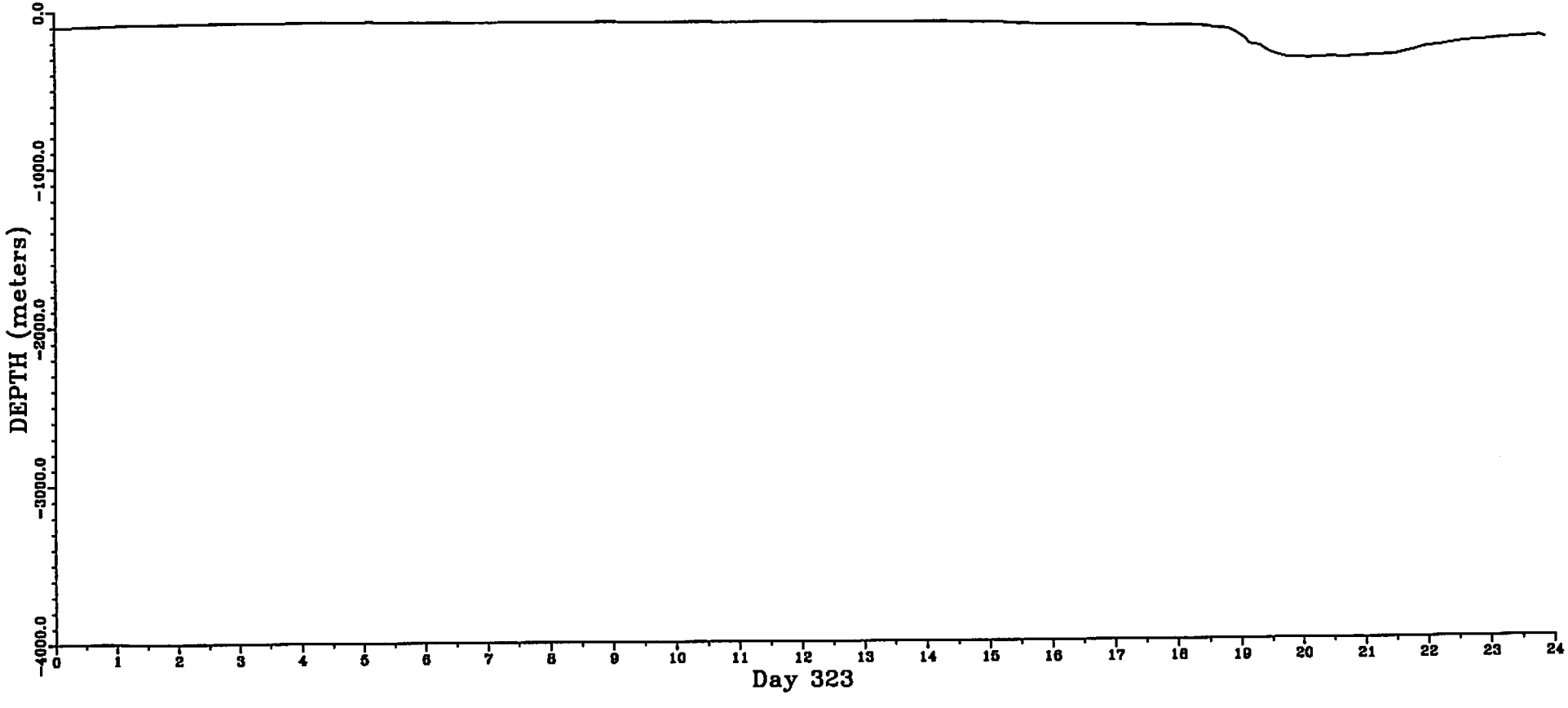
C2911 PDR depths at 5 minute intervals

Data file: bt.d322



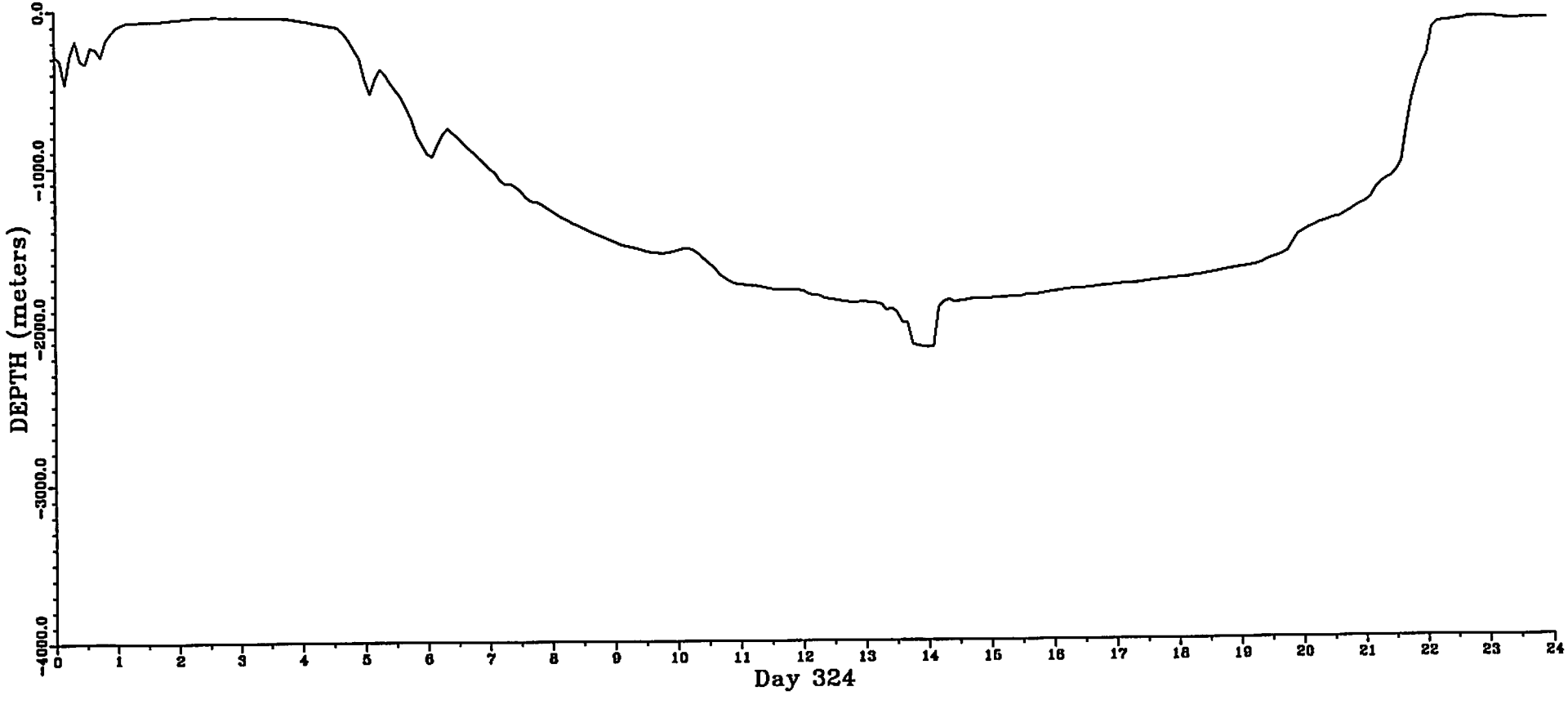
C2911 PDR depths at 5 minute intervals

Data file: bt.d323



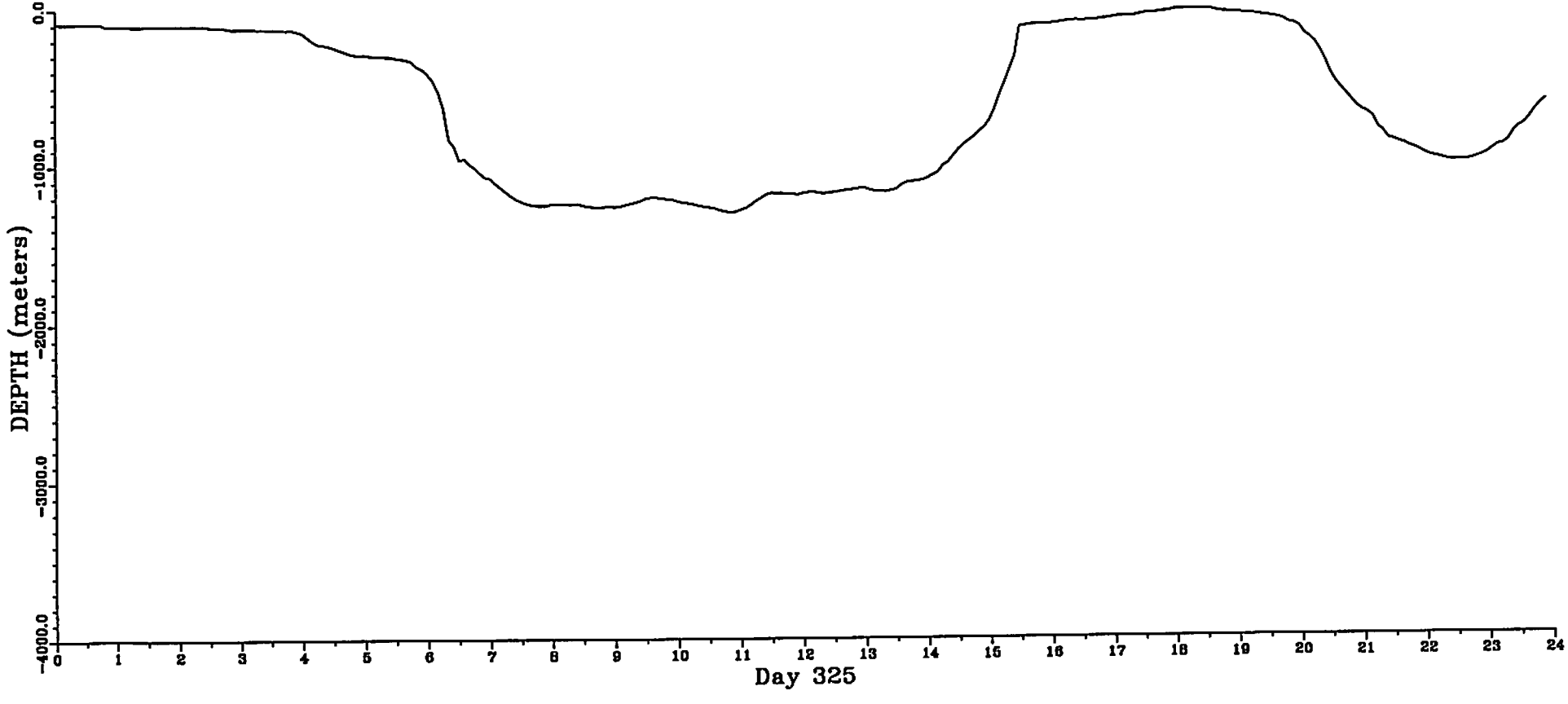
C2911 PDR depths at 5 minute intervals

Data file: bt.d324



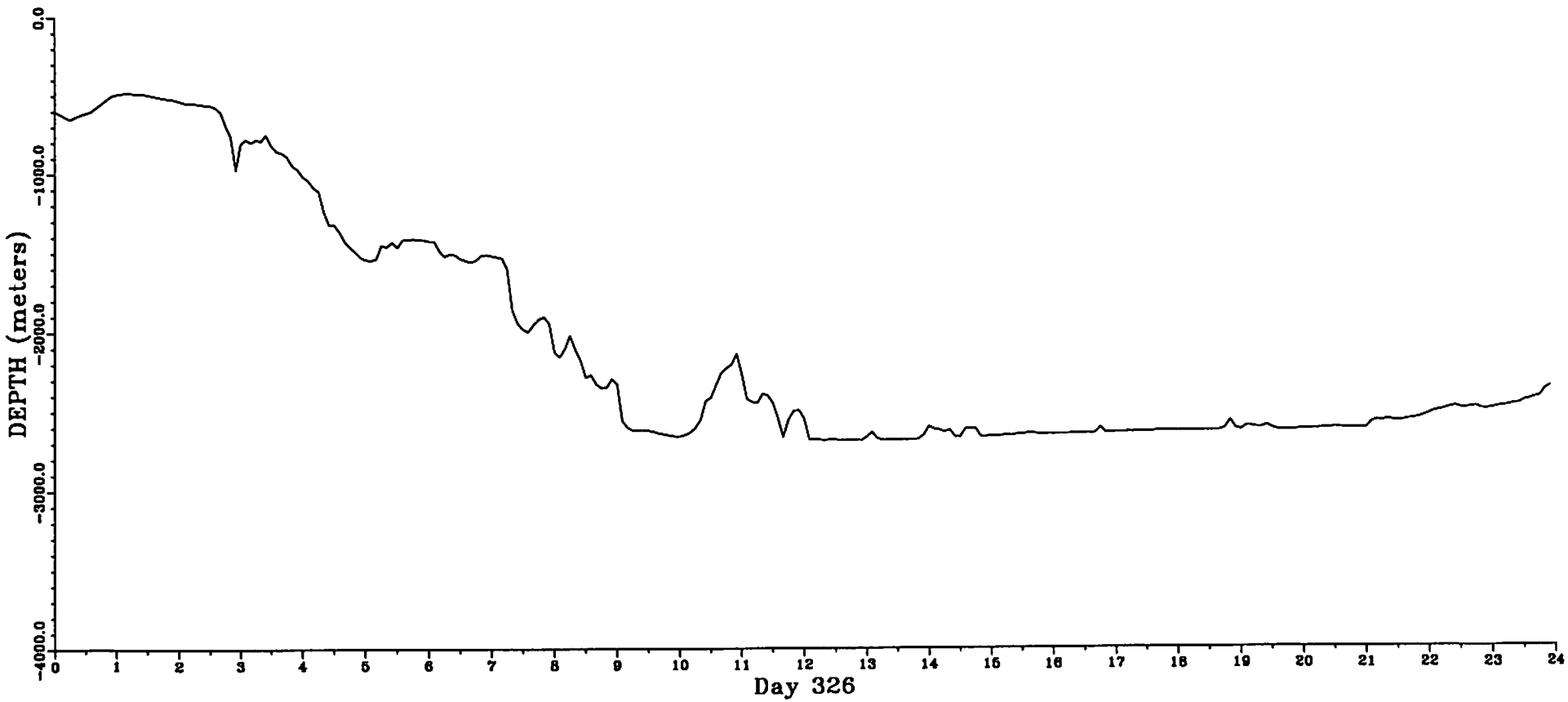
C2911 PDR depths at 5 minute intervals

Data file: bt.d325



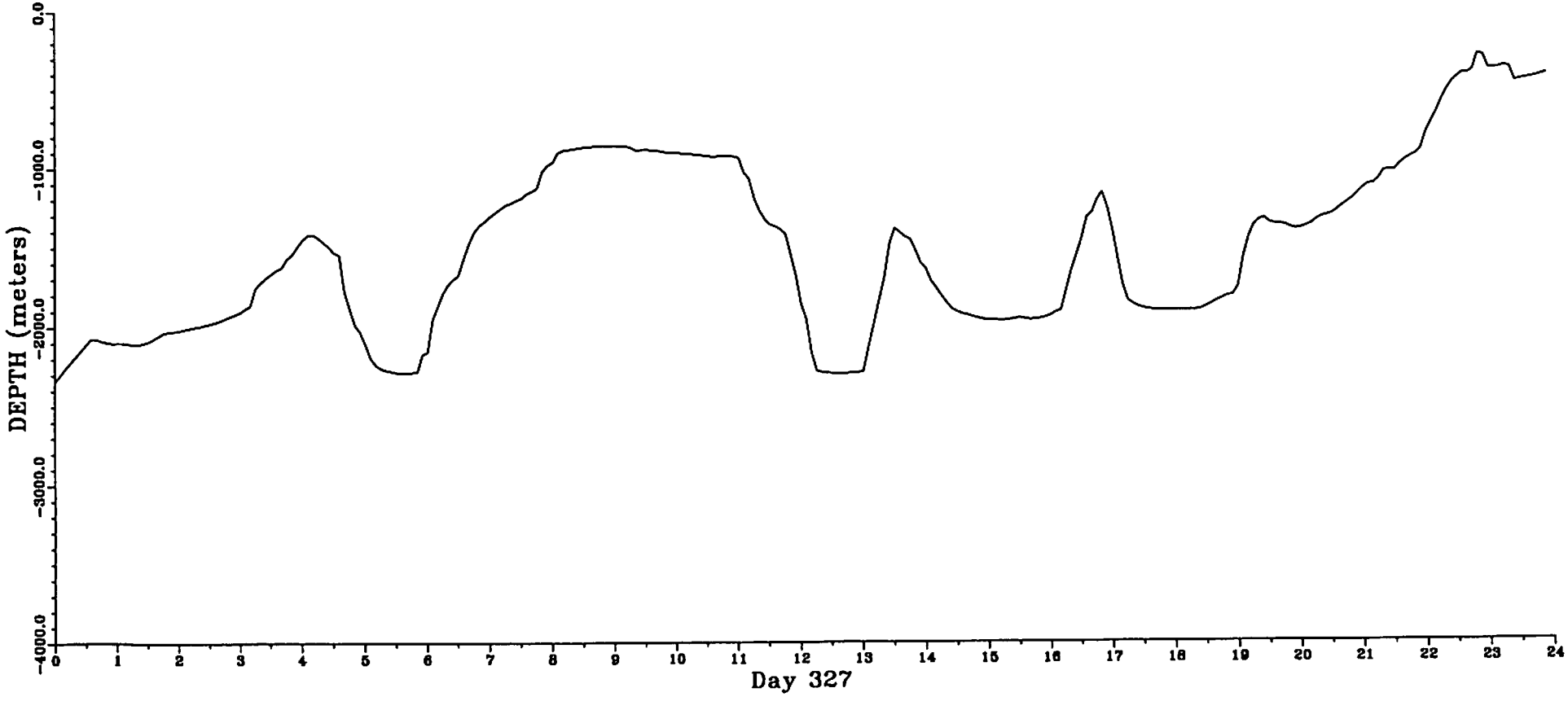
C2911 PDR depths at 5 minute intervals

Data file: bt.d326



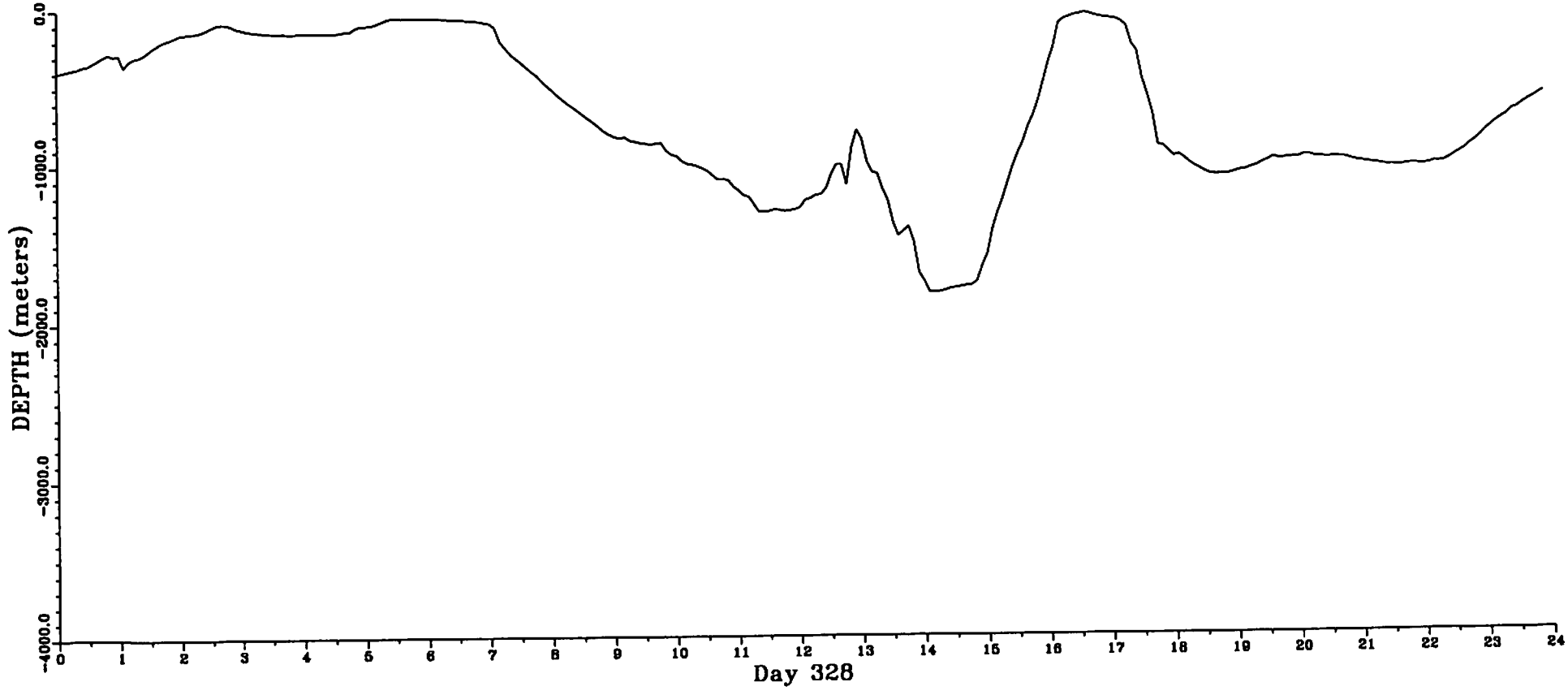
C2911 PDR depths at 5 minute intervals

Data file: bt.d327



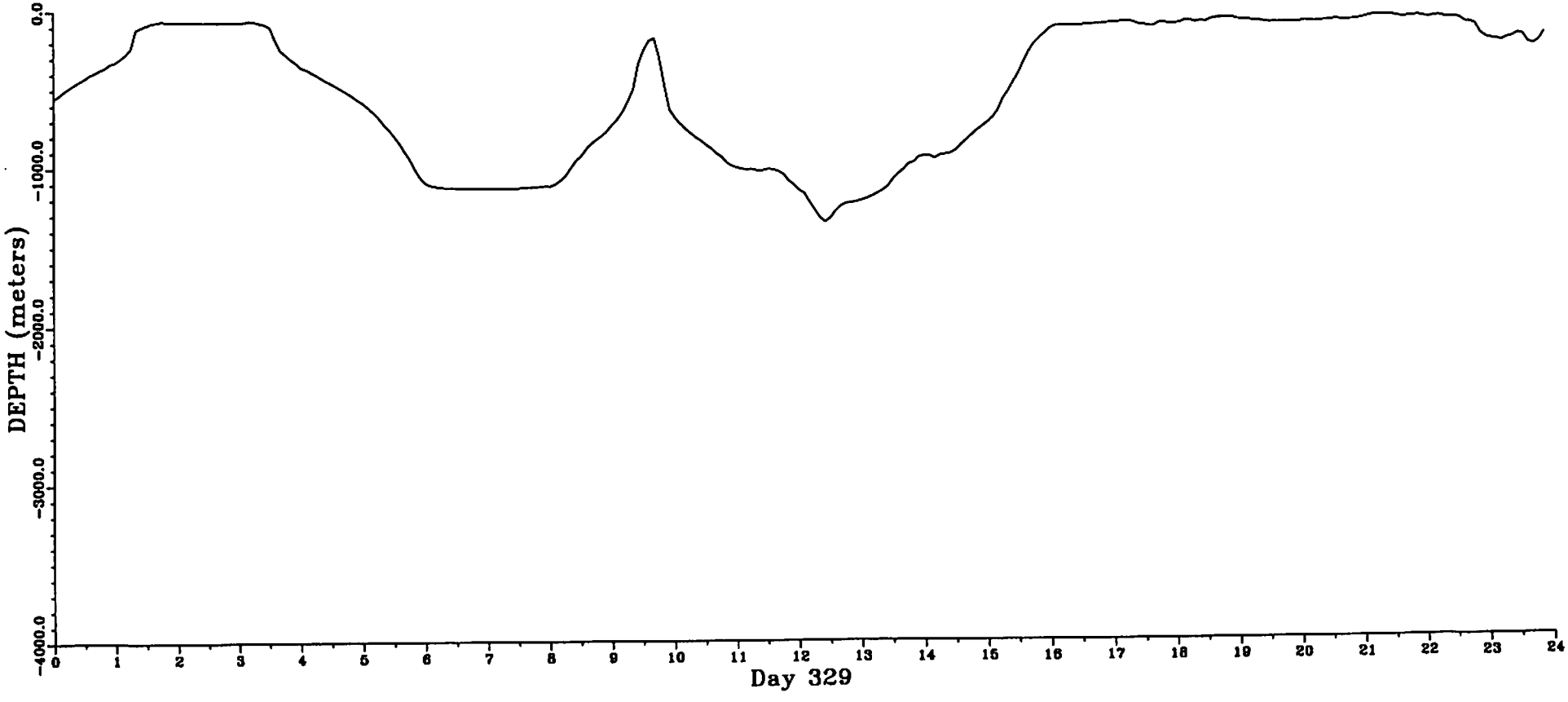
C2911 PDR depths at 5 minute intervals

Data file: bt.d328



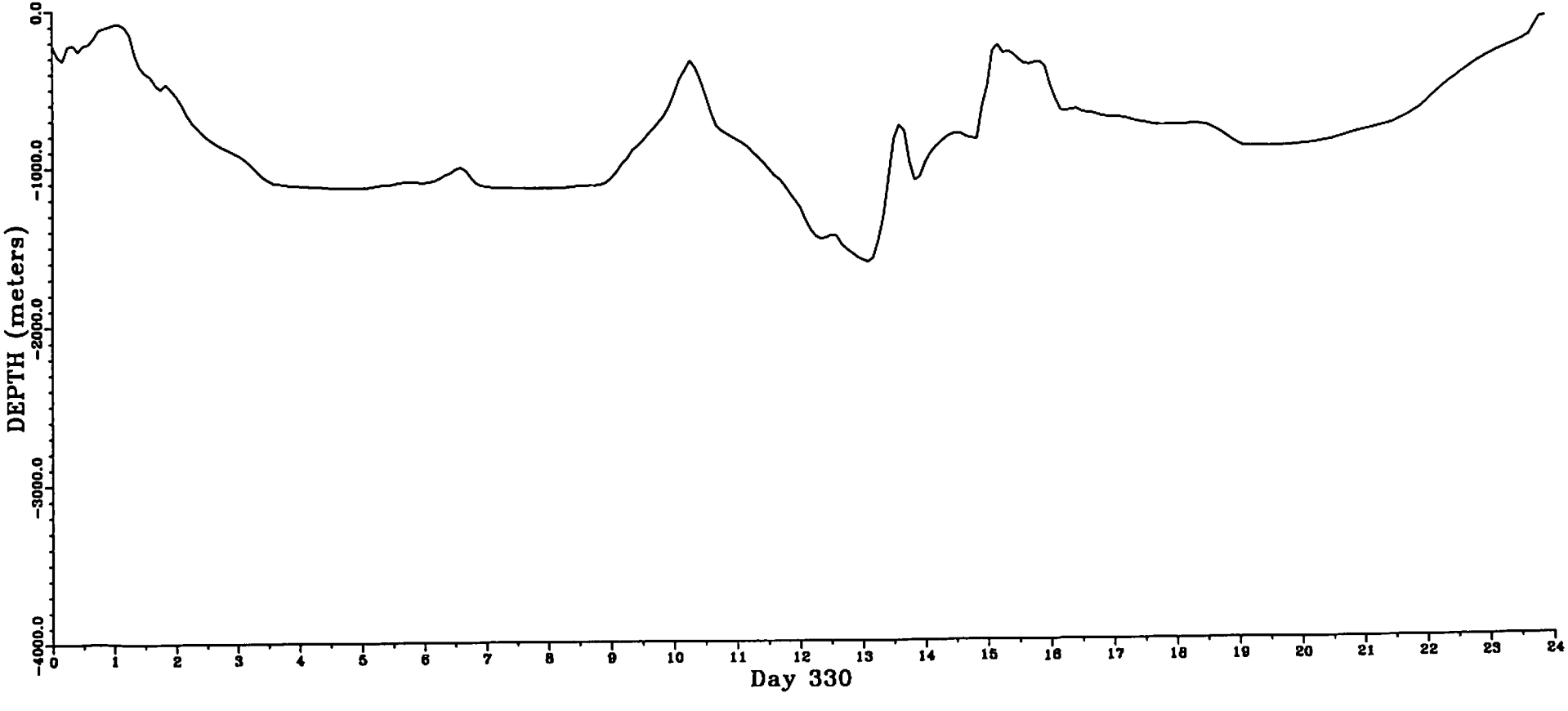
C2911 PDR depths at 5 minute intervals

Data file: bt.d329



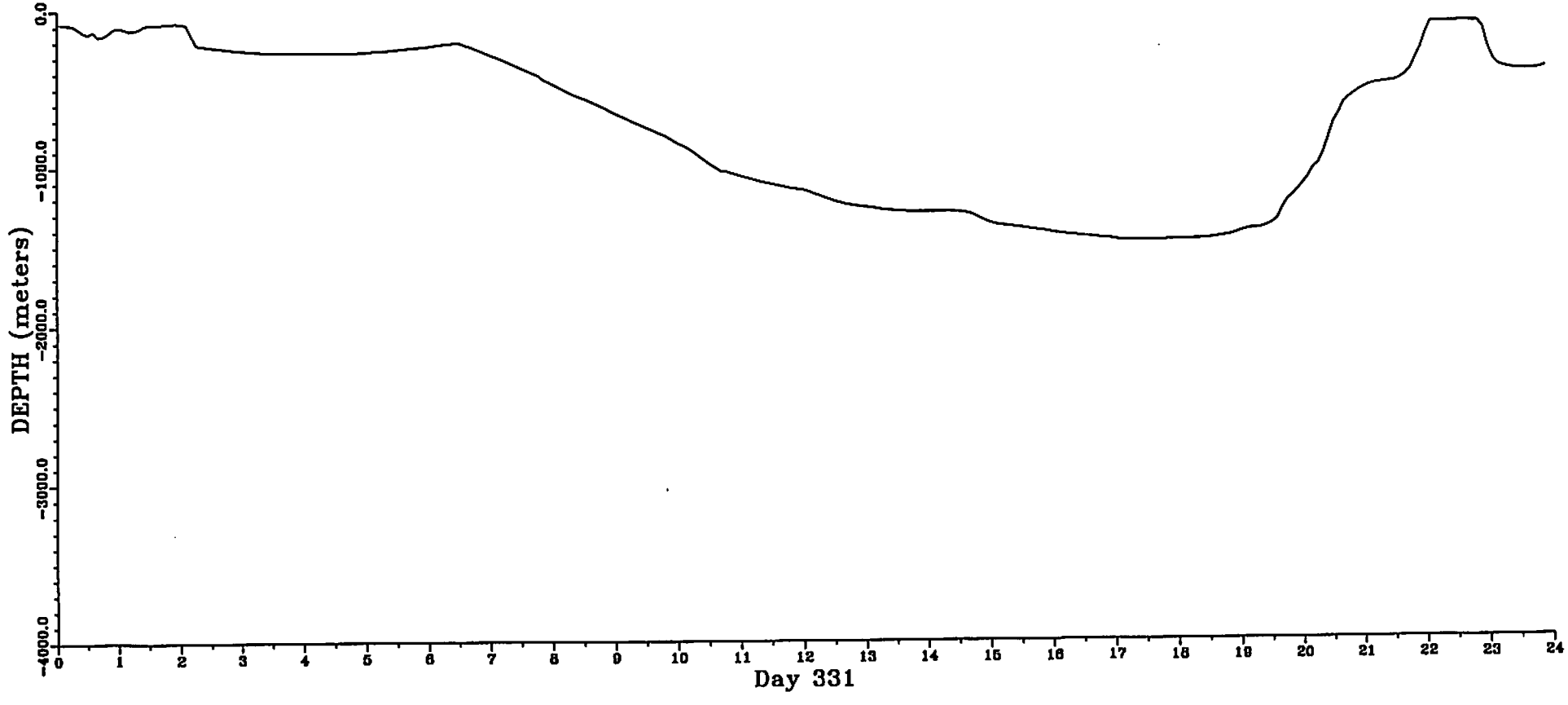
C2911 PDR depths at 5 minute intervals

Data file: bt.d330



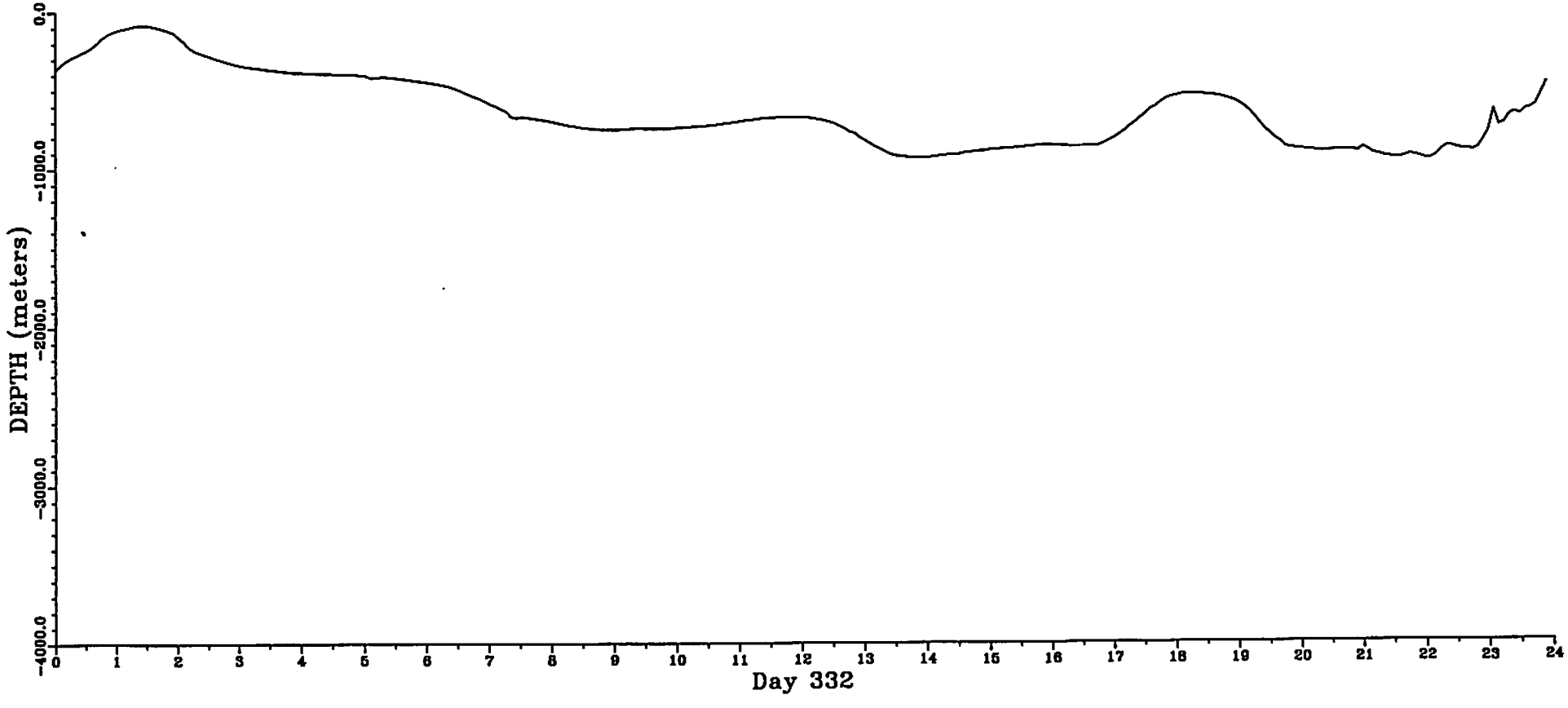
C2911 PDR depths at 5 minute intervals

Data file: bt.d331



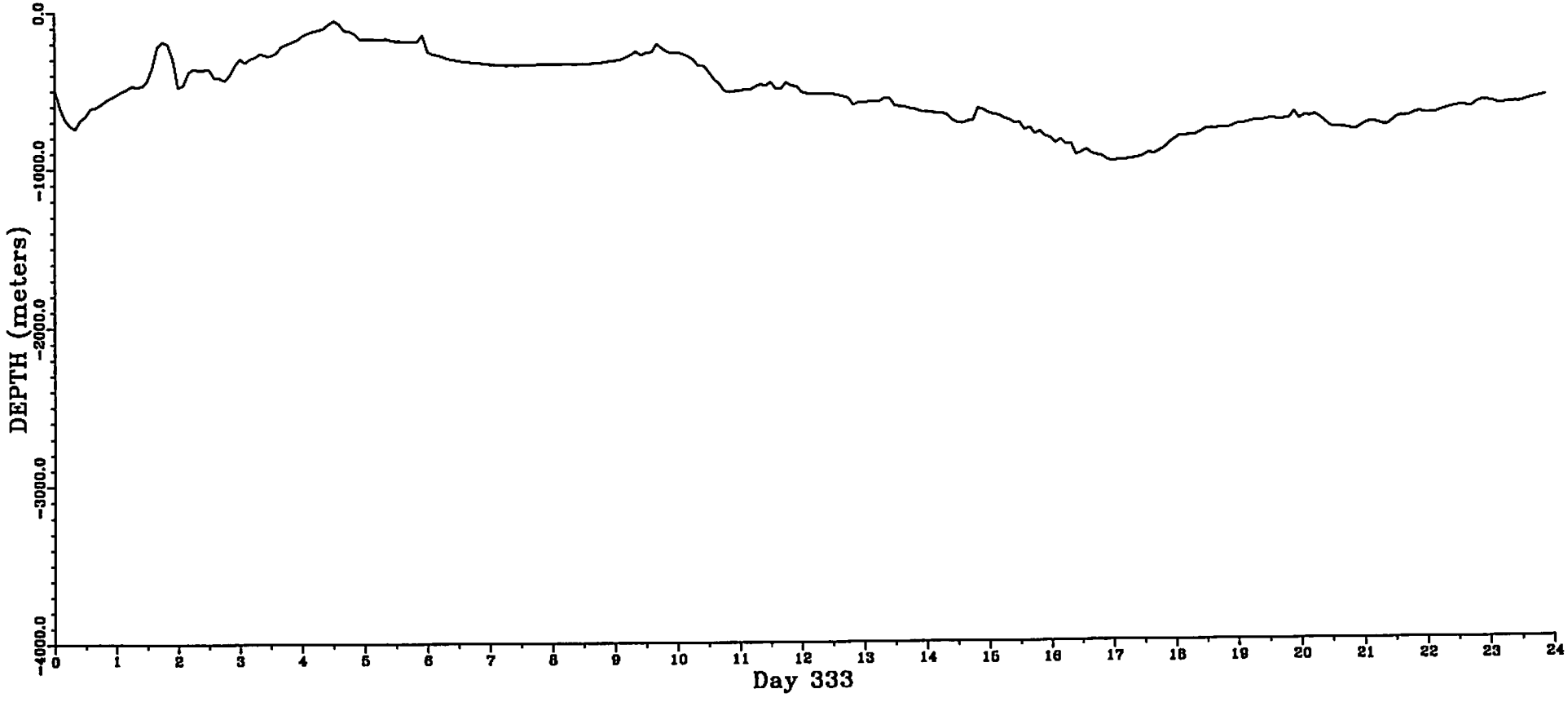
C2911 PDR depths at 5 minute intervals

Data file: bt.d332



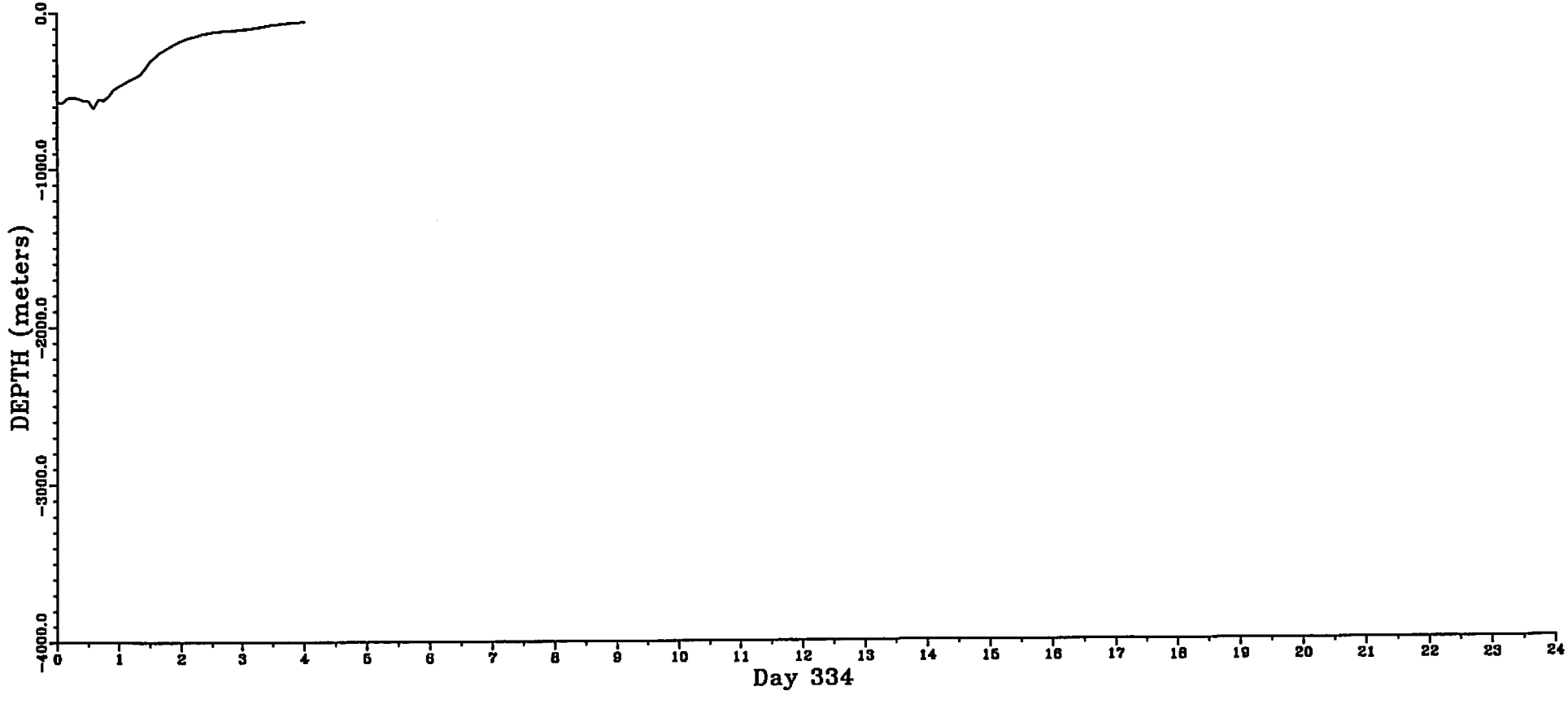
C2911 PDR depths at 5 minute intervals

Data file: bt.d333



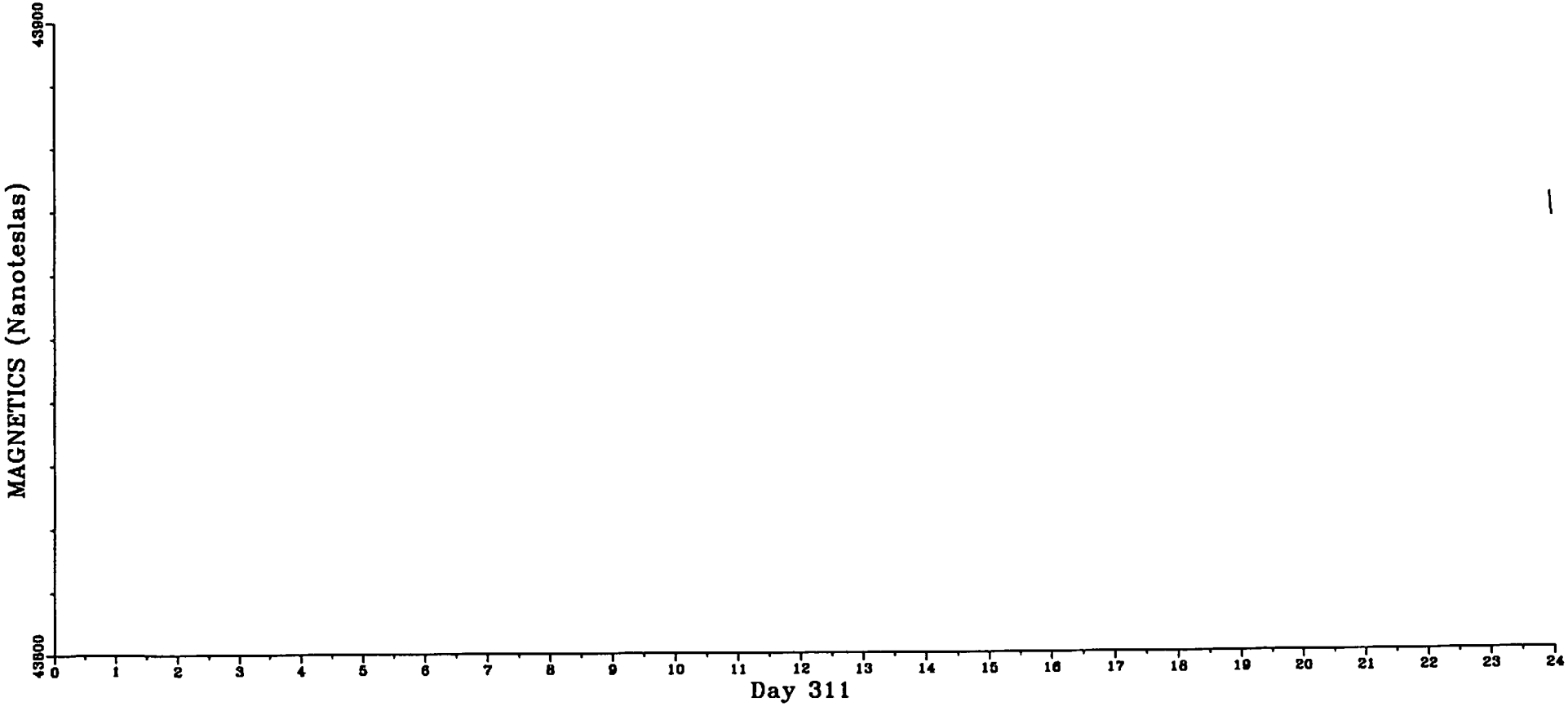
C2911 PDR depths at 5 minute intervals

Data file: bt.d334



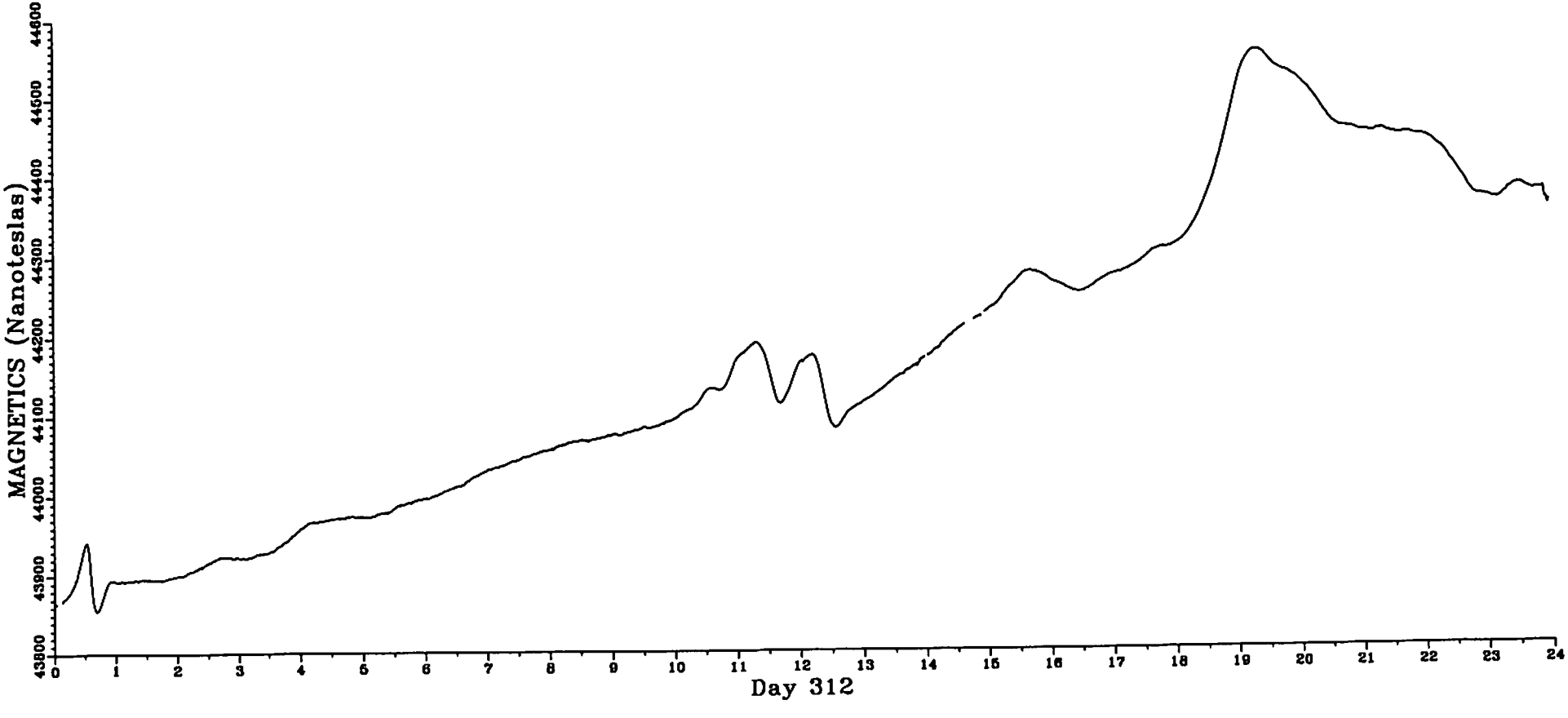
C2911 Total Intensity Magnetics interpolated value at 00 sec of each minute

Data file: mg.n311



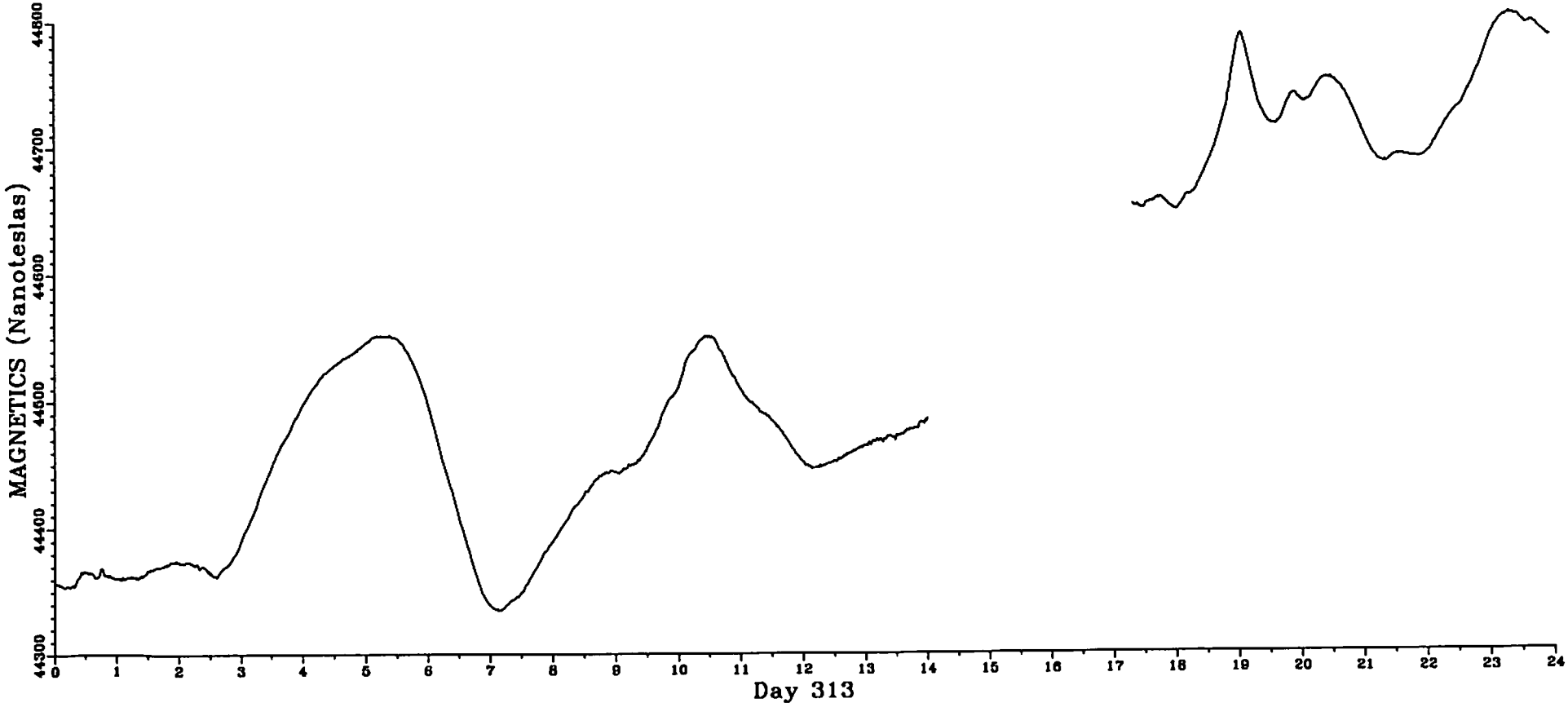
C2911 Total Intensity Magnetics interpolated value at 00 sec of each minute

Data file: mg.n312



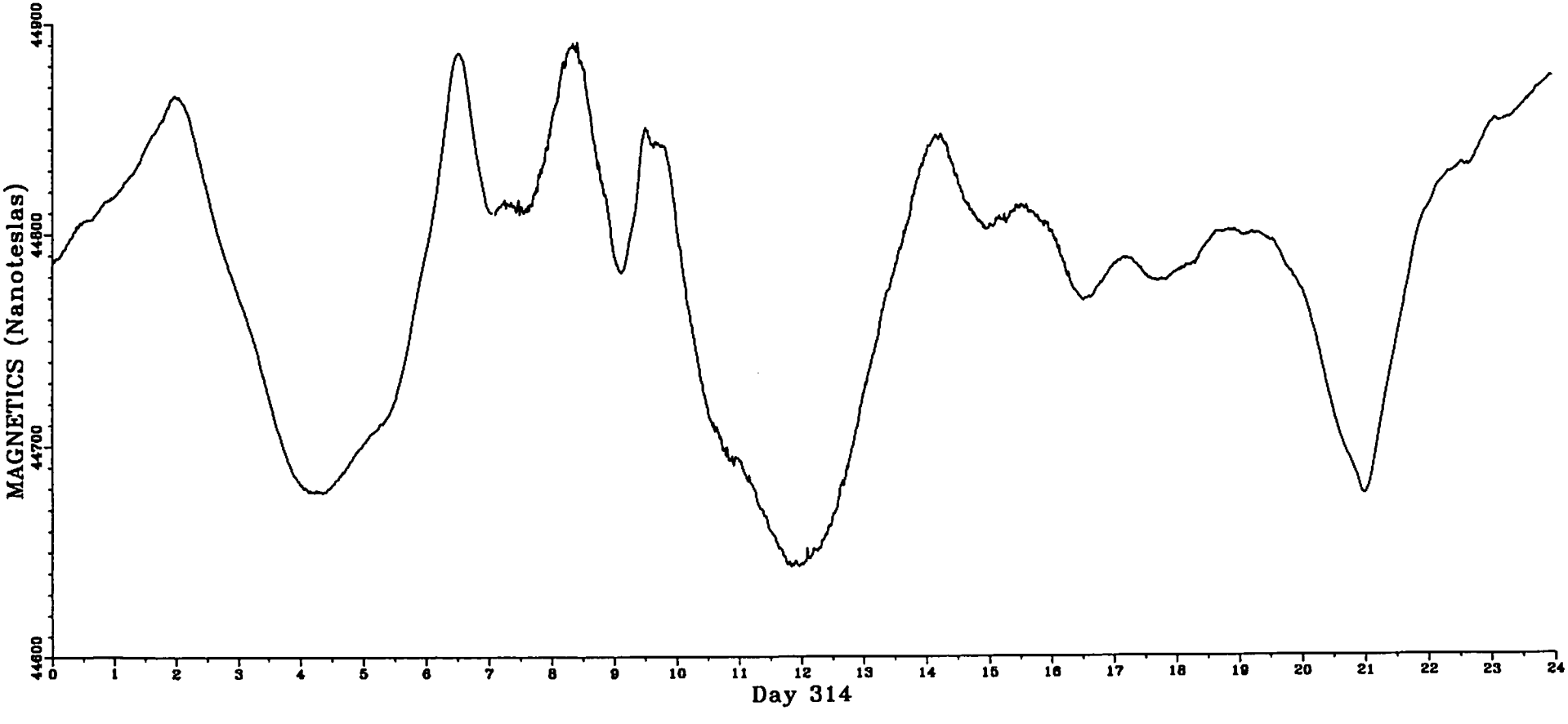
C2911 Total Intensity Magnetics interpolated value at 00 sec of each minute

Data file: mg.n313



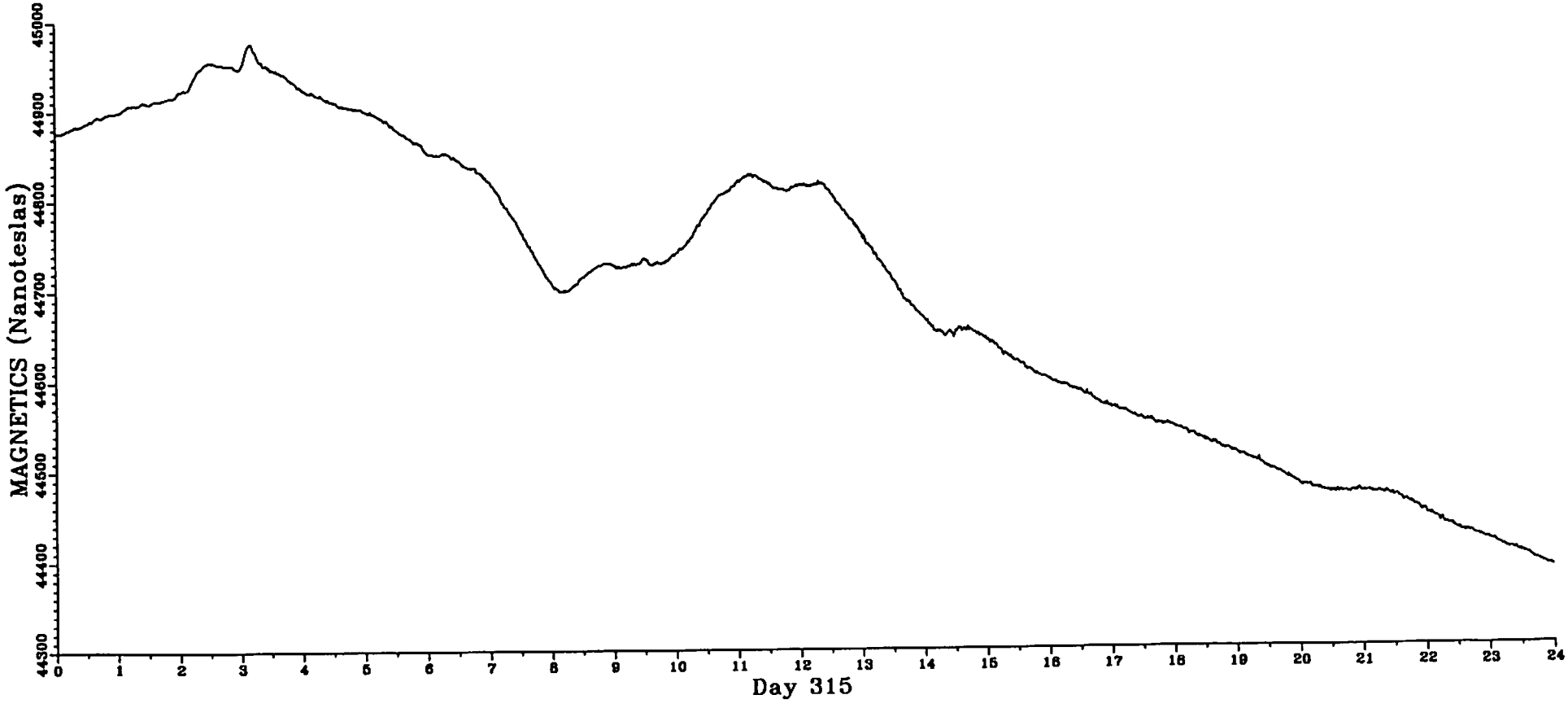
C2911 Total Intensity Magnetics interpolated value at 00 sec of each minute

Data file: mg.n314



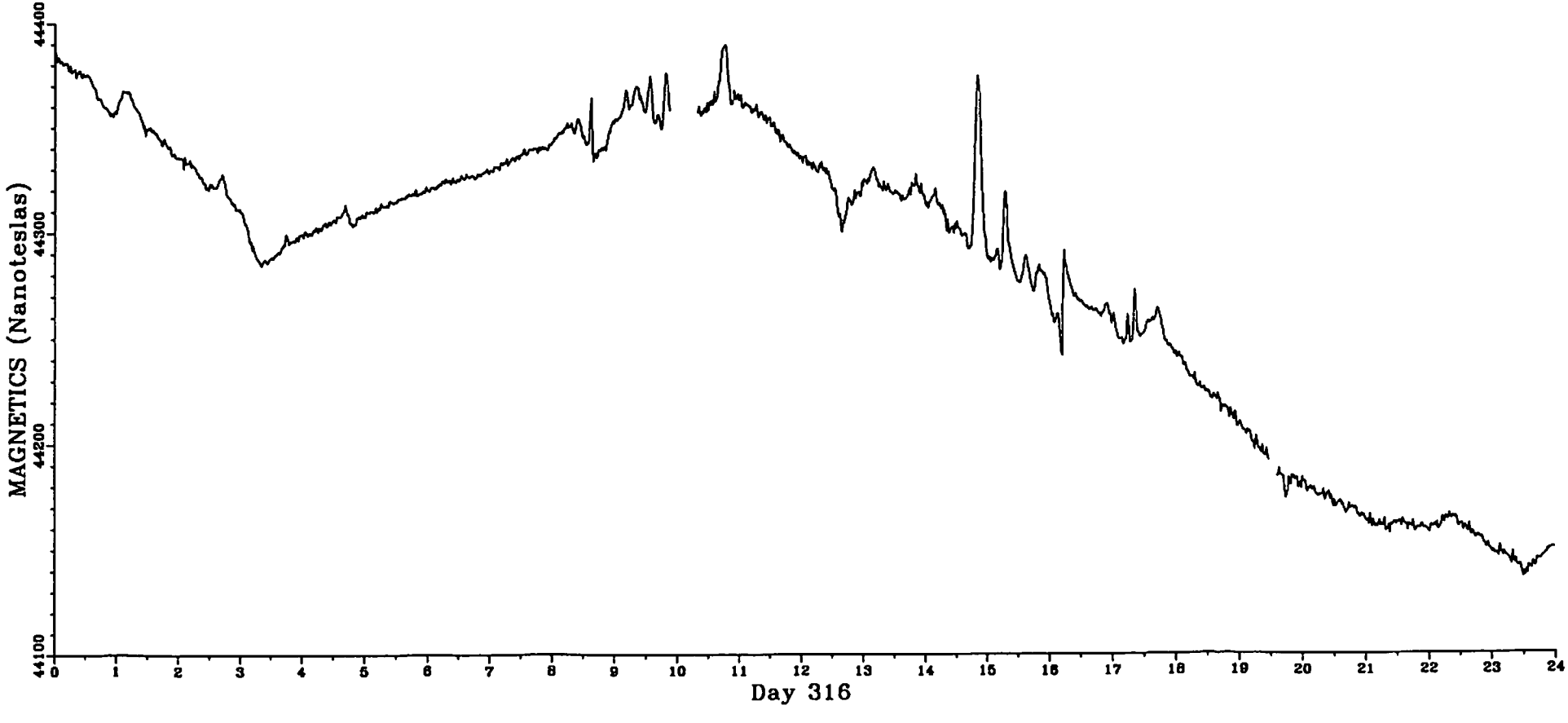
C2911 Total Intensity Magnetics interpolated value at 00 sec of each minute

Data file: mg.n315



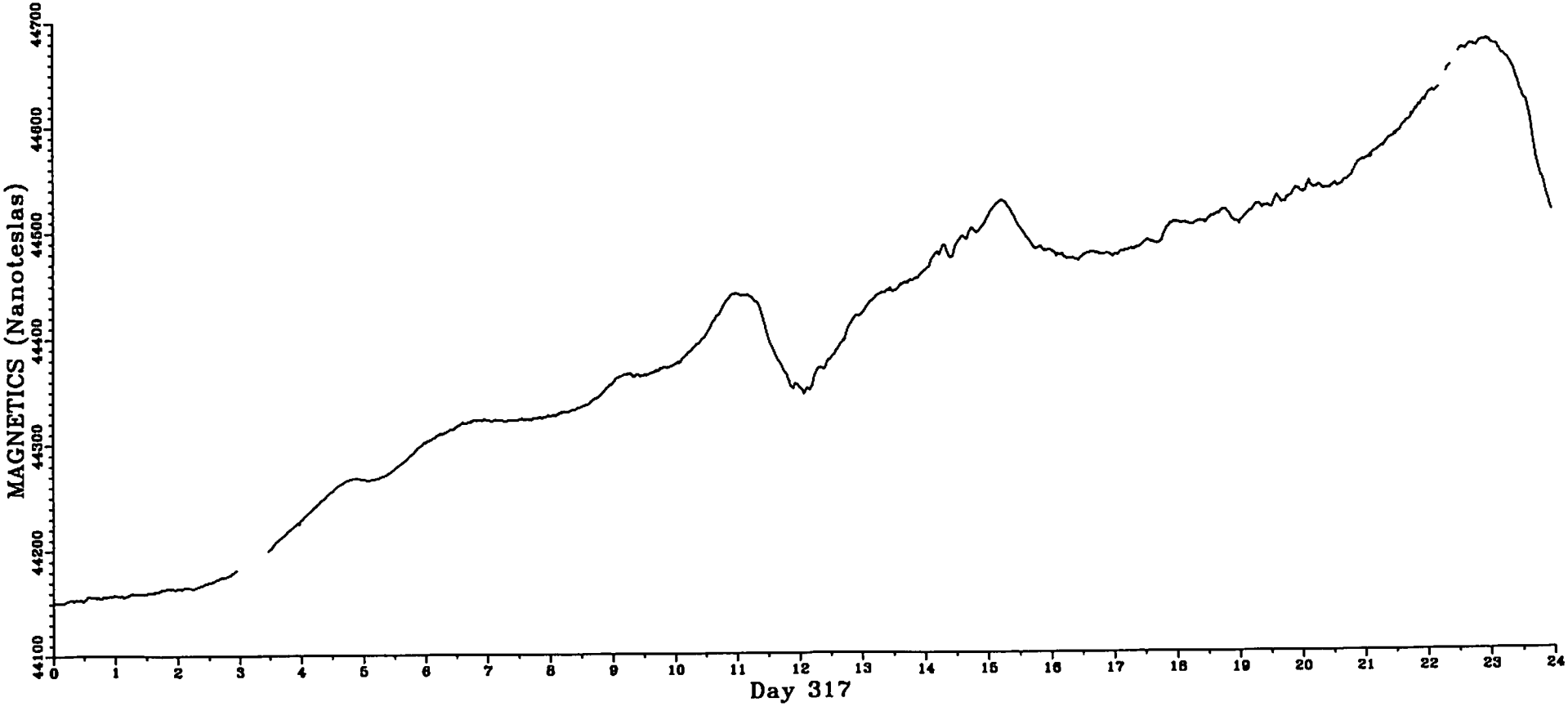
C2911 Total Intensity Magnetics interpolated value at 00 sec of each minute

Data file: mg.n316



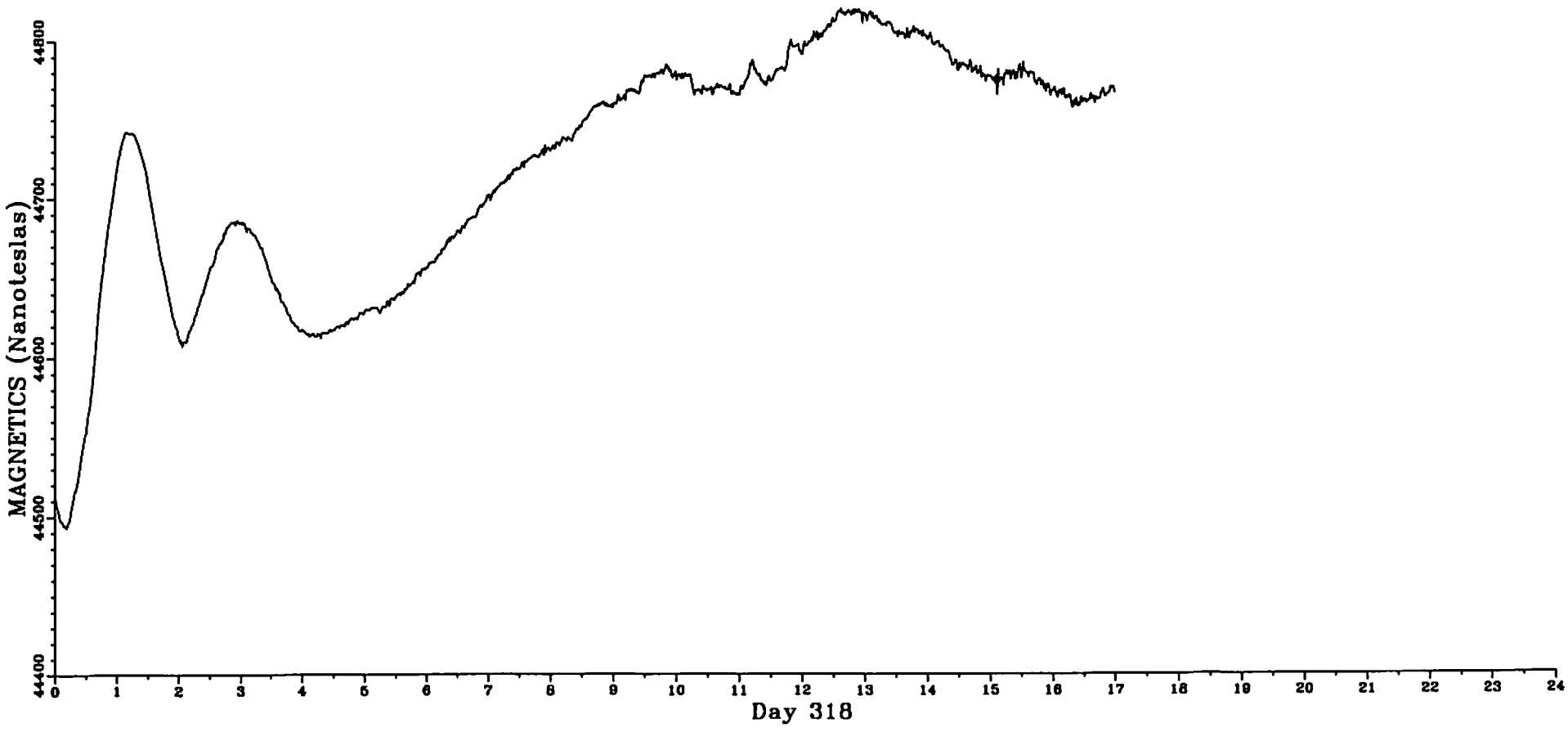
C2911 Total Intensity Magnetics interpolated value at 00 sec of each minute

Data file: mg.n317



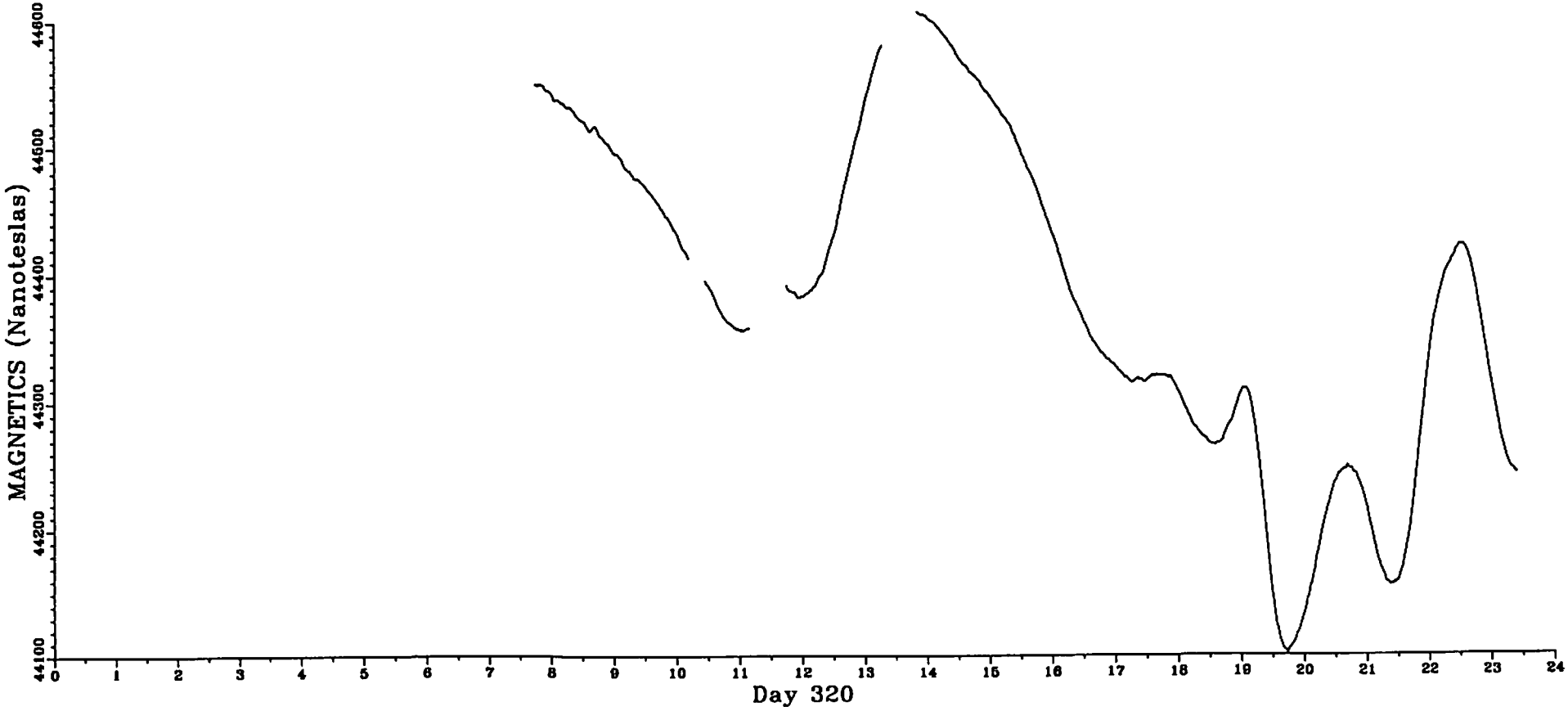
C2911 Total Intensity Magnetics interpolated value at 00 sec of each minute

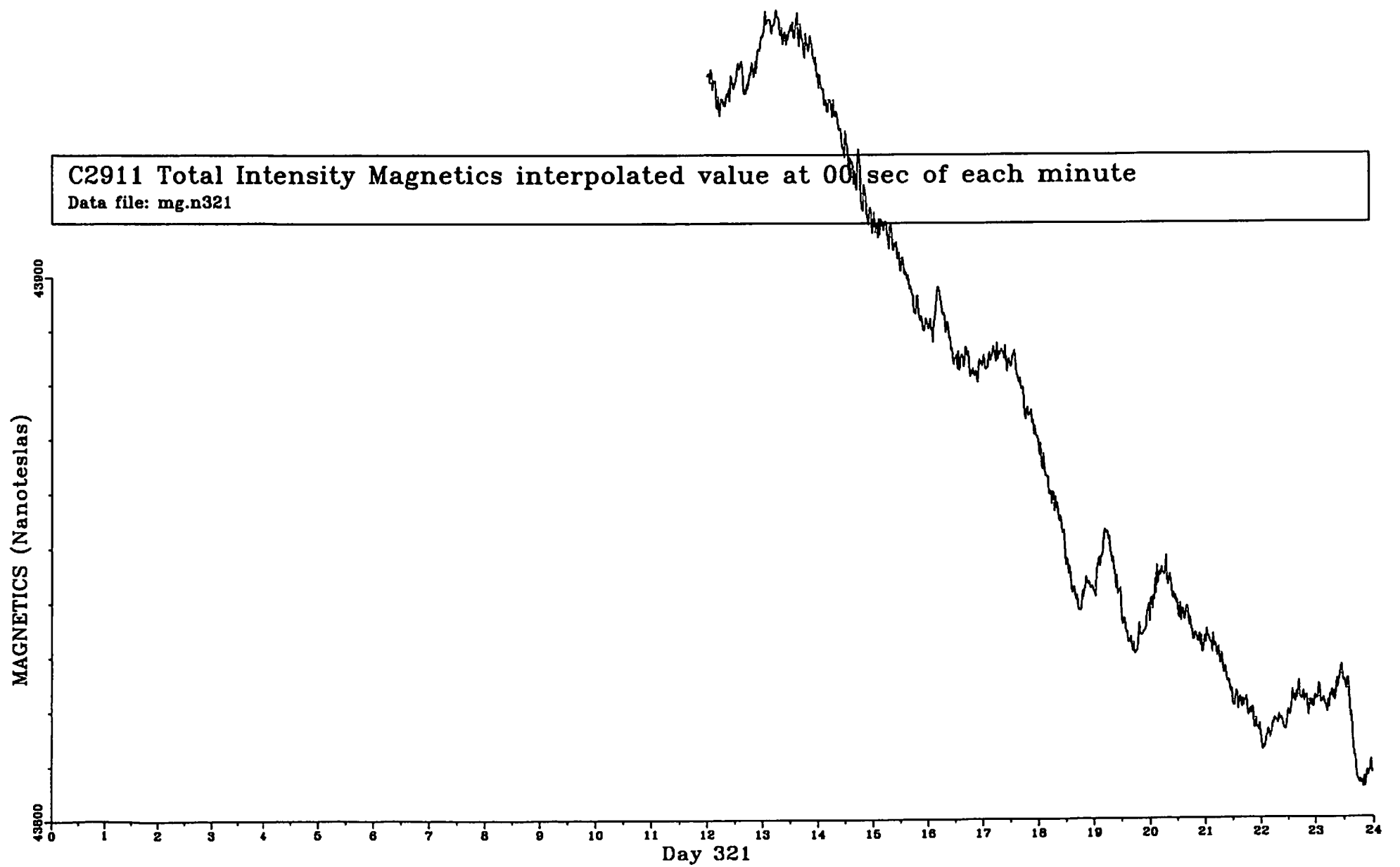
Data file: mg.n318



C2911 Total Intensity Magnetics interpolated value at 00 sec of each minute

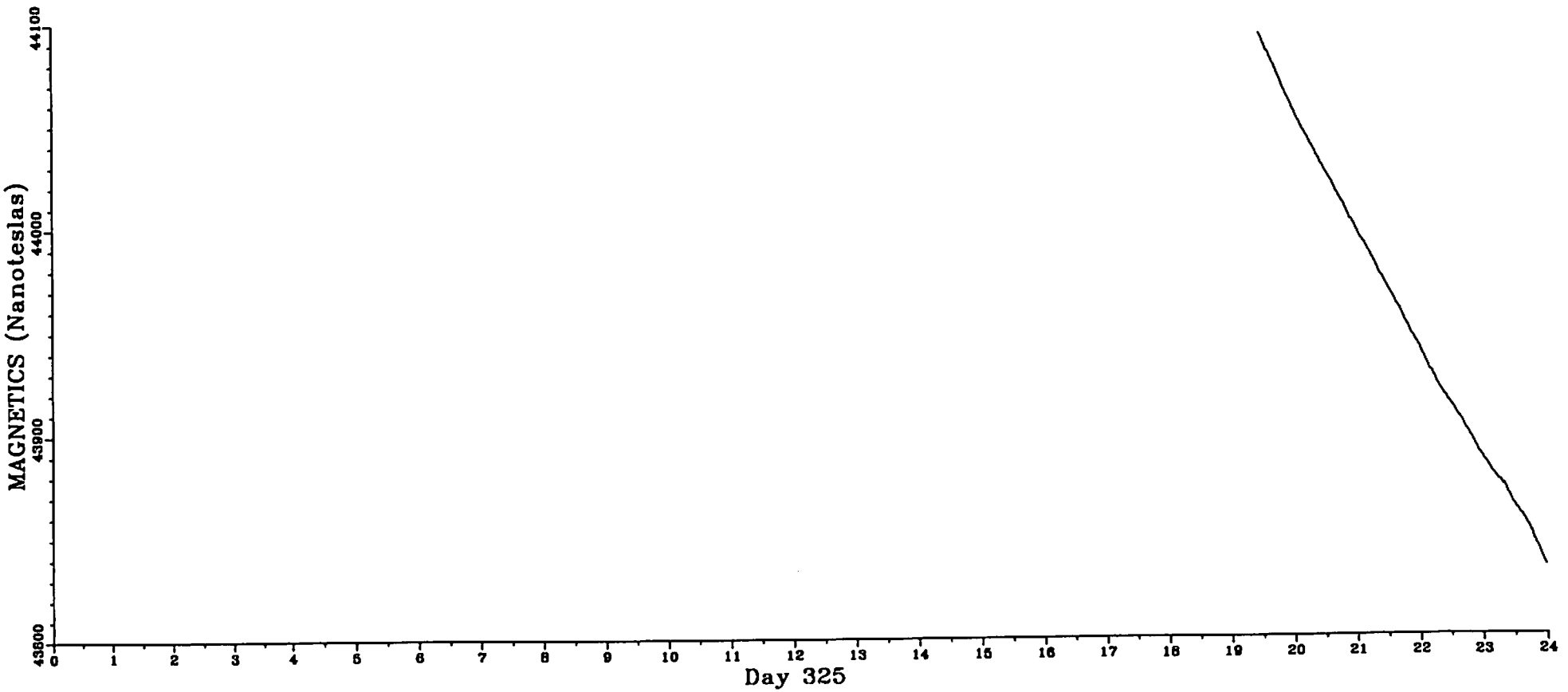
Data file: mg.n320




C2911 Total Intensity Magnetics interpolated value at 00 sec of each minute
Data file: mg.n321
MAGNETICS (Nanoteslas)
43900
43800
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
Day 321

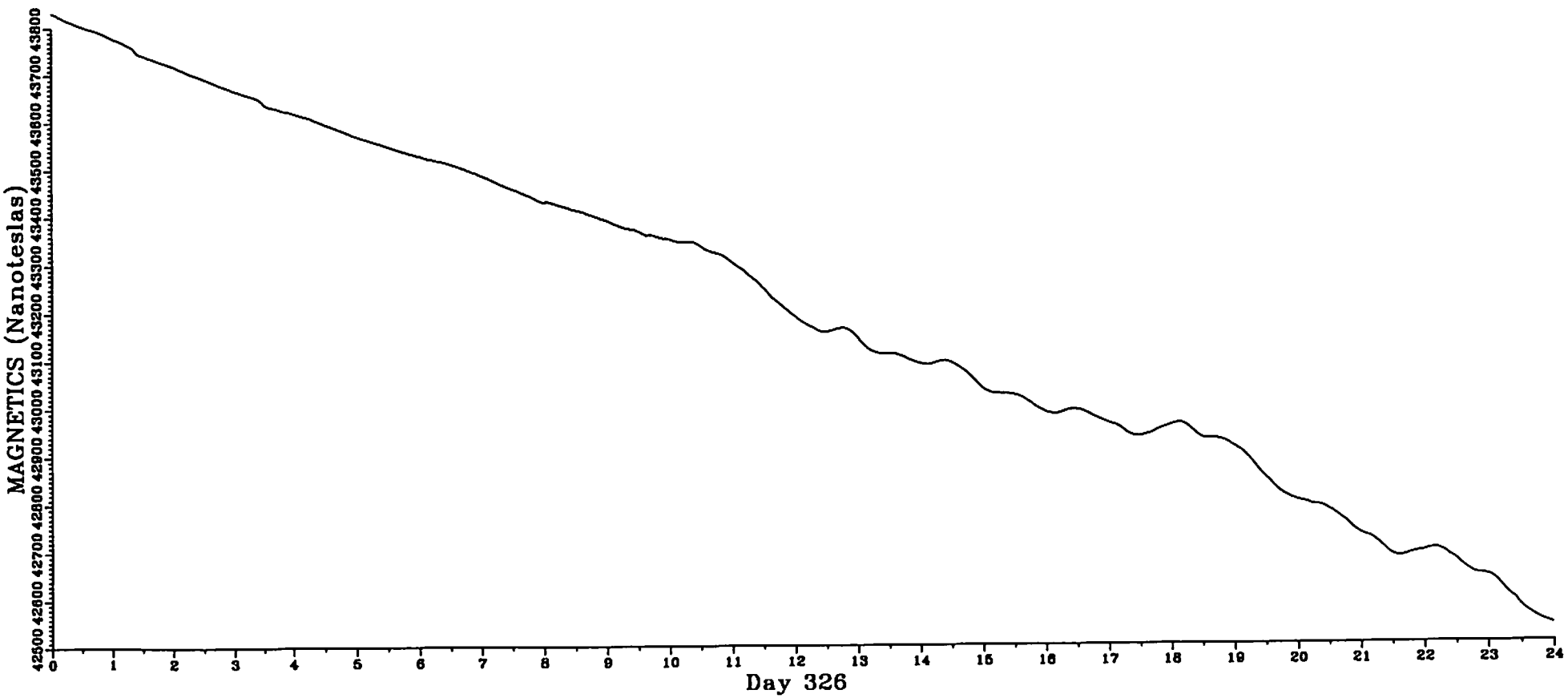
C2911 Total Intensity Magnetics interpolated value at 00 sec of each minute

Data file: mg.n325



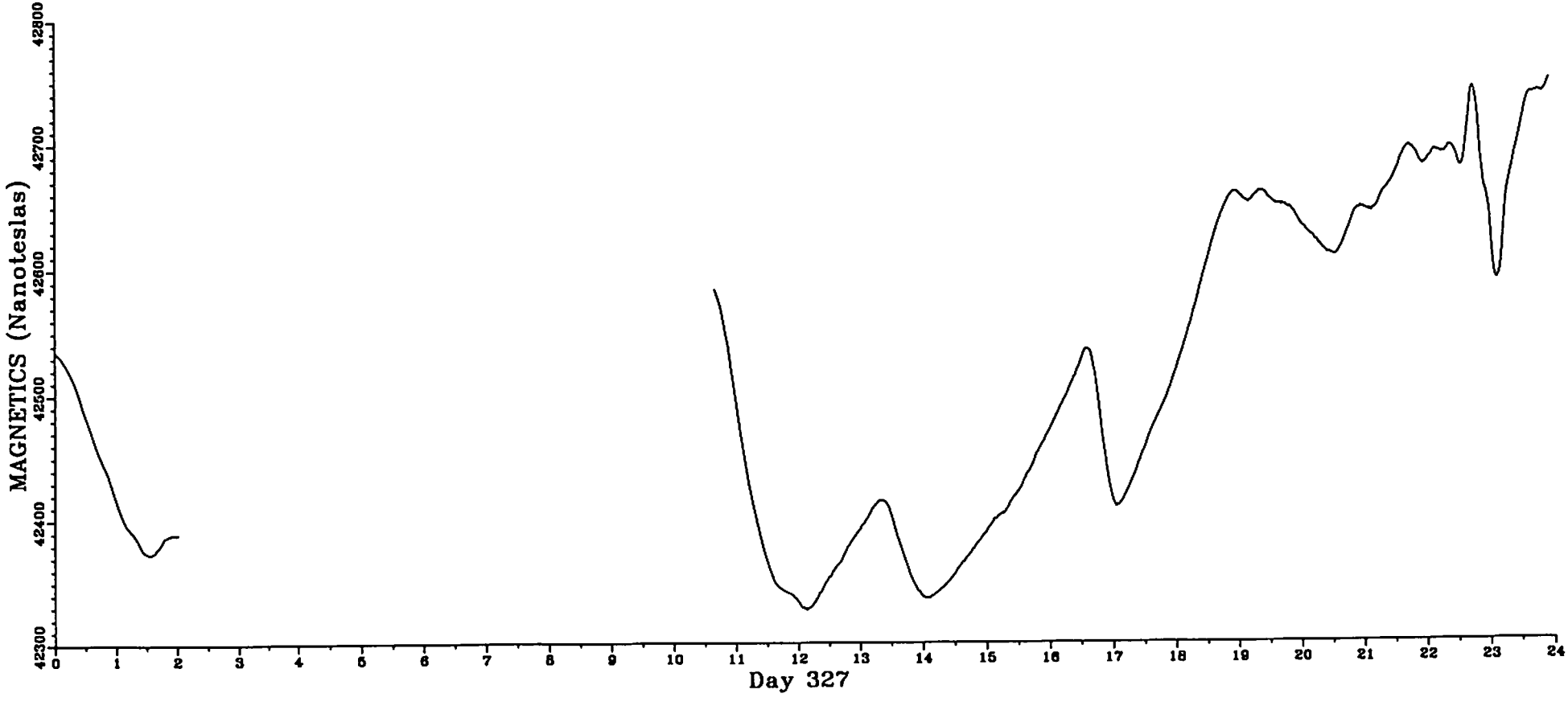
C2911 Total Intensity Magnetics interpolated value at 00 sec of each minute

Data file: mg.n326



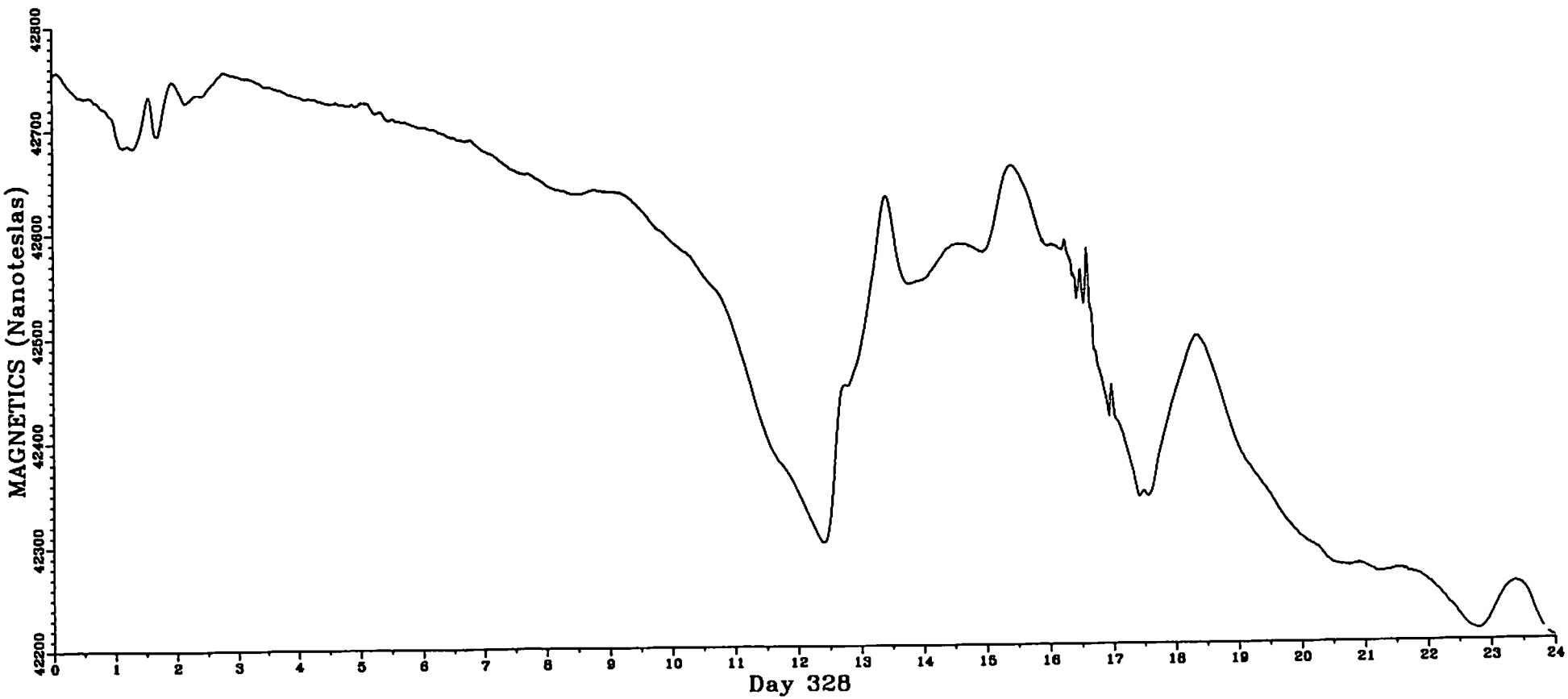
C2911 Total Intensity Magnetics interpolated value at 00 sec of each minute

Data file: mg.n327



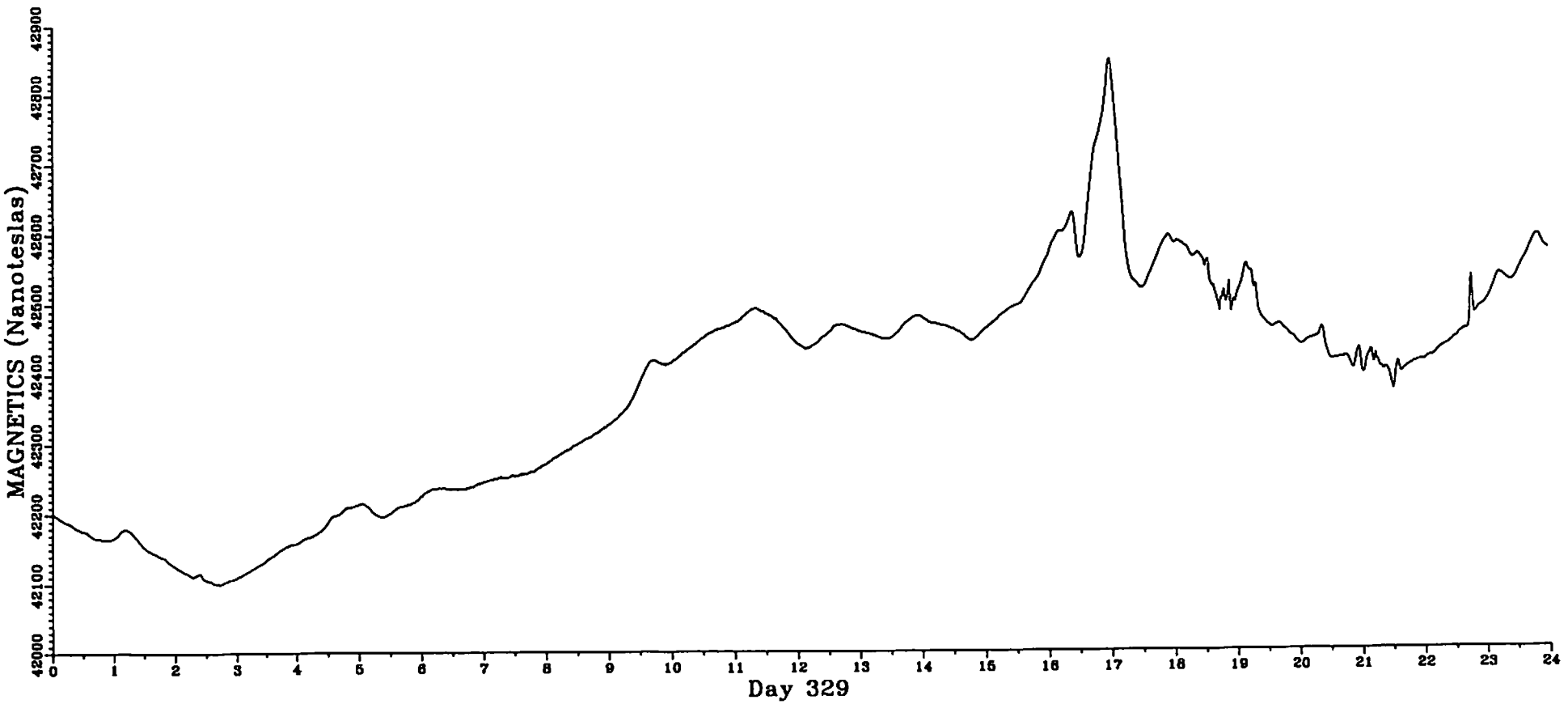
C2911 Total Intensity Magnetics interpolated value at 00 sec of each minute

Data file: mg.n328



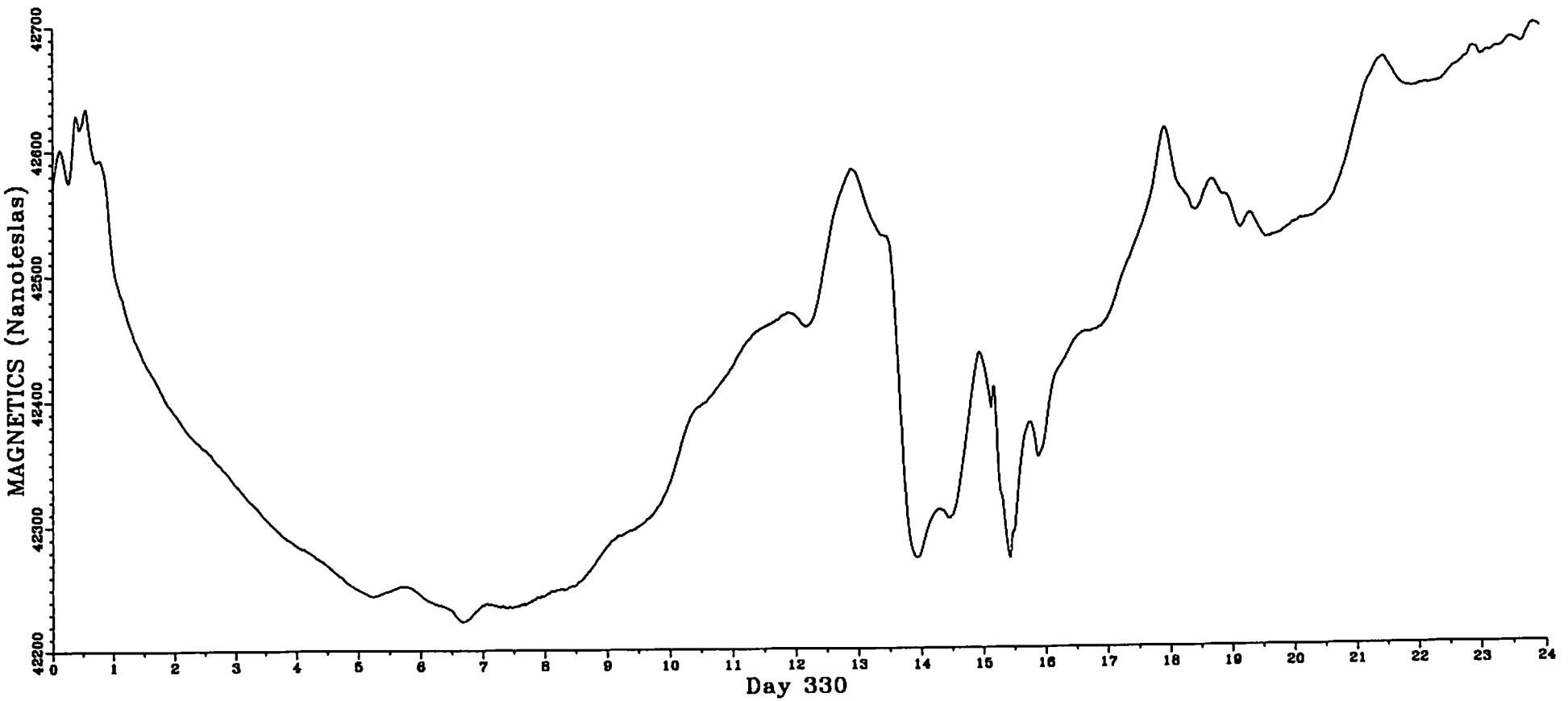
C2911 Total Intensity Magnetics interpolated value at 00 sec of each minute

Data file: mg.n329



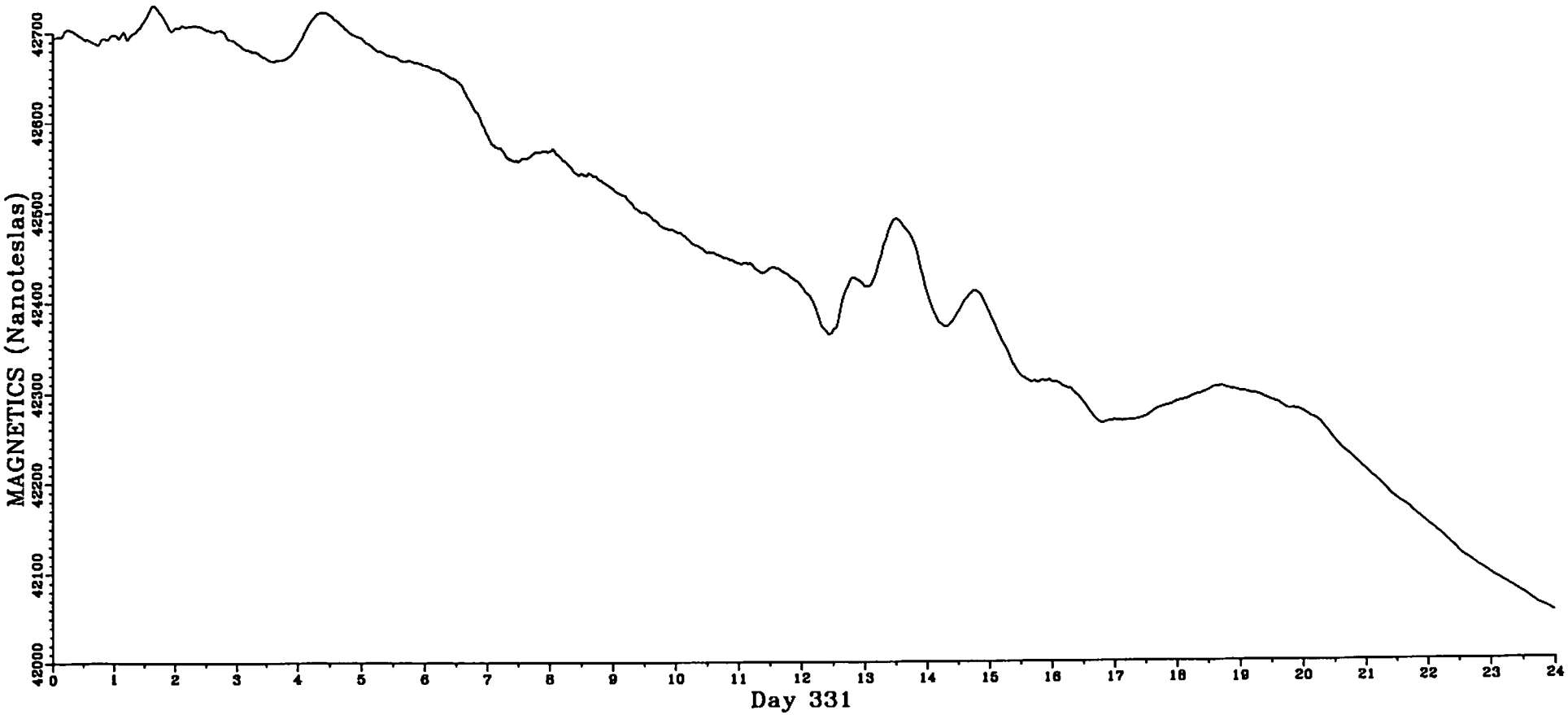
C2911 Total Intensity Magnetics interpolated value at 00 sec of each minute

Data file: mg.n330



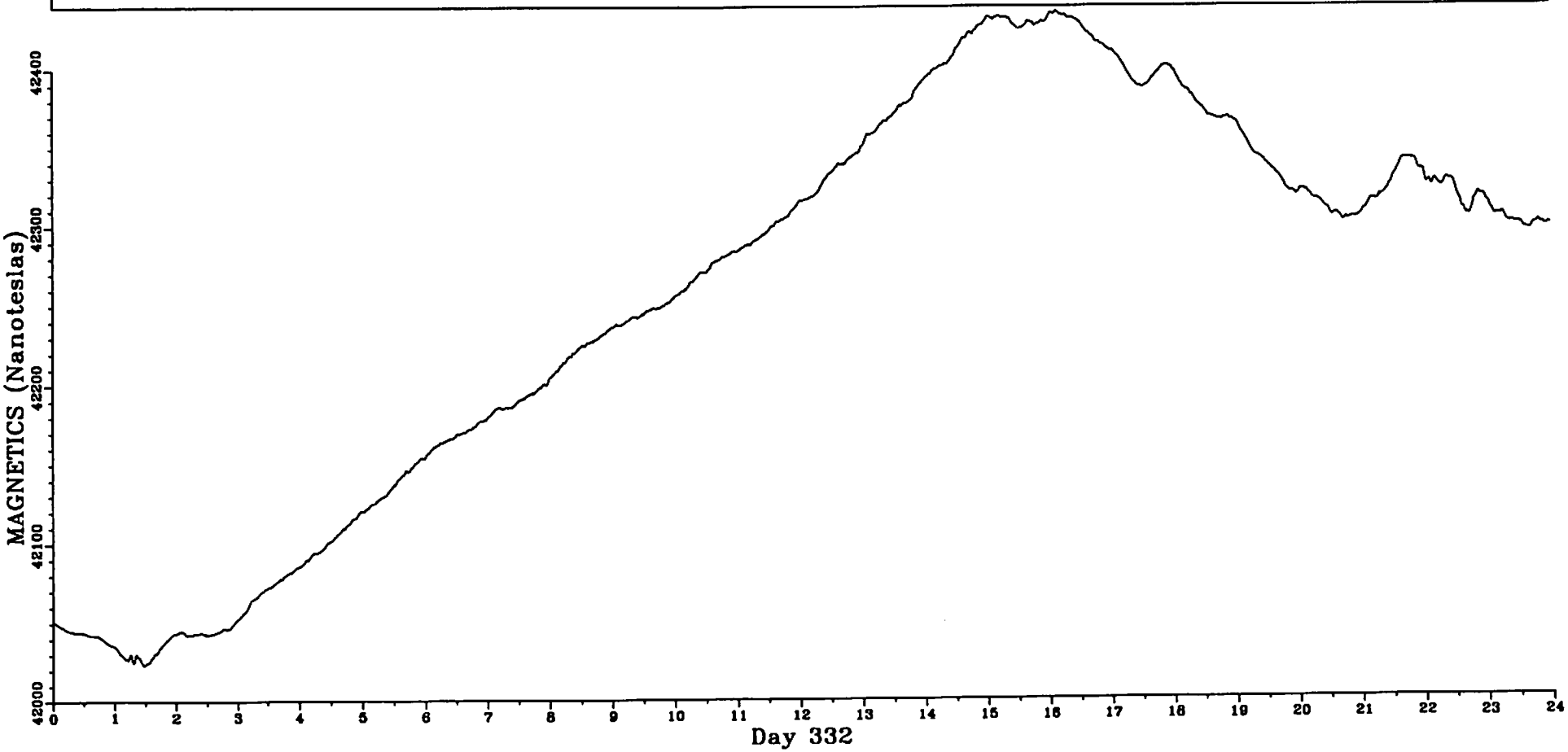
C2911 Total Intensity Magnetics interpolated value at 00 sec of each minute

Data file: mg.n331



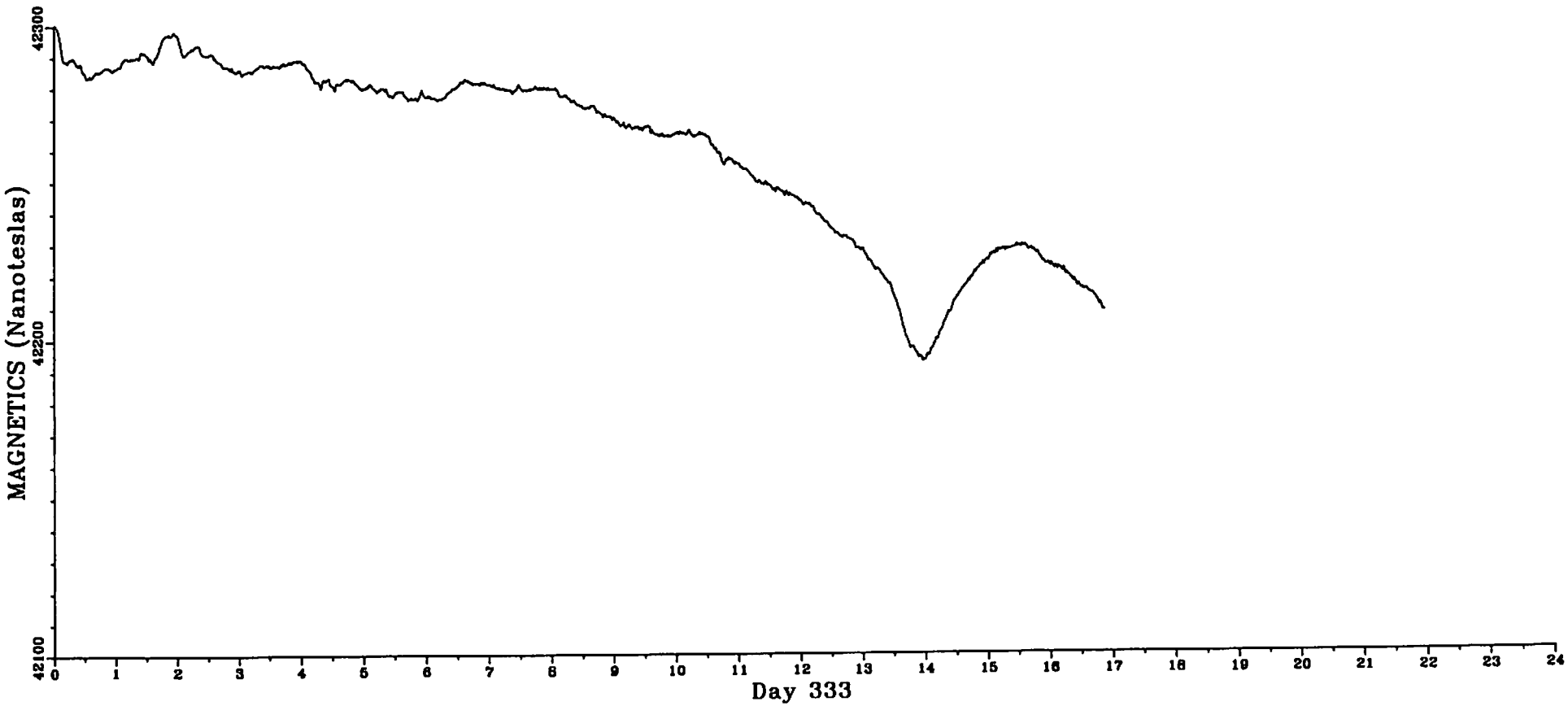
C2911 Total Intensity Magnetics interpolated value at 00 sec of each minute

Data file: mg.n332



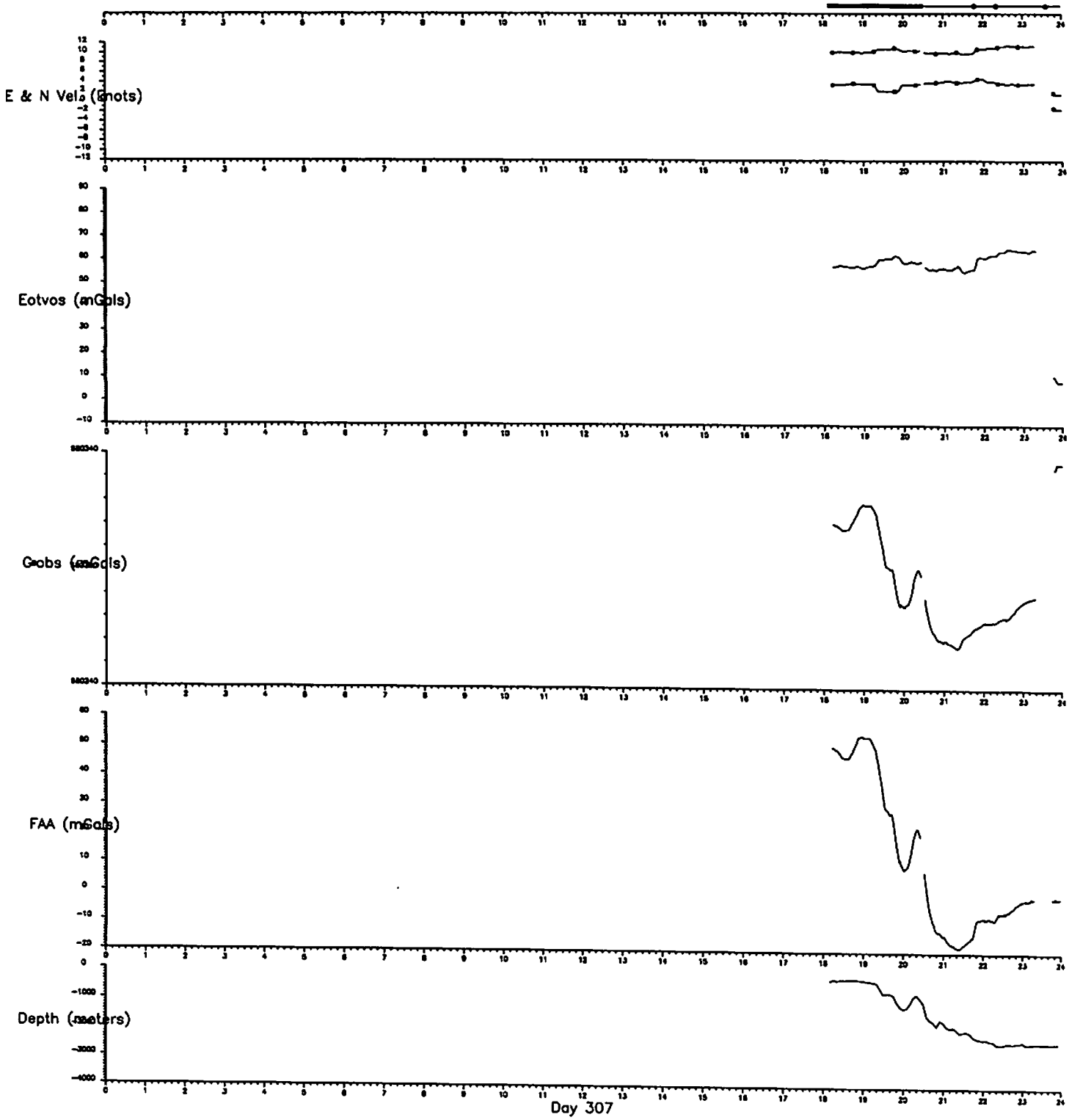
C2911 Total Intensity Magnetics interpolated value at 00 sec of each minute

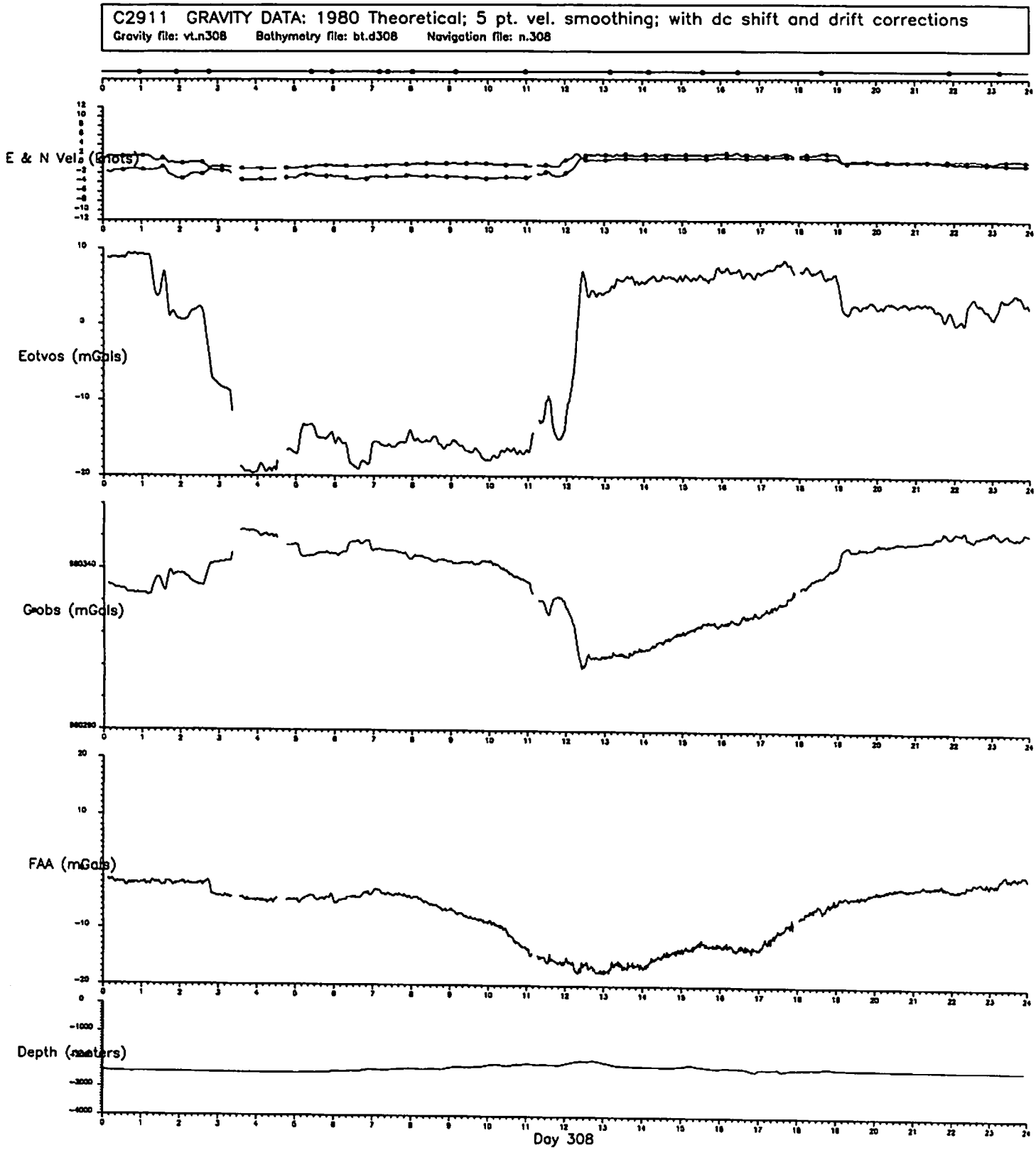
Data file: mg.n333

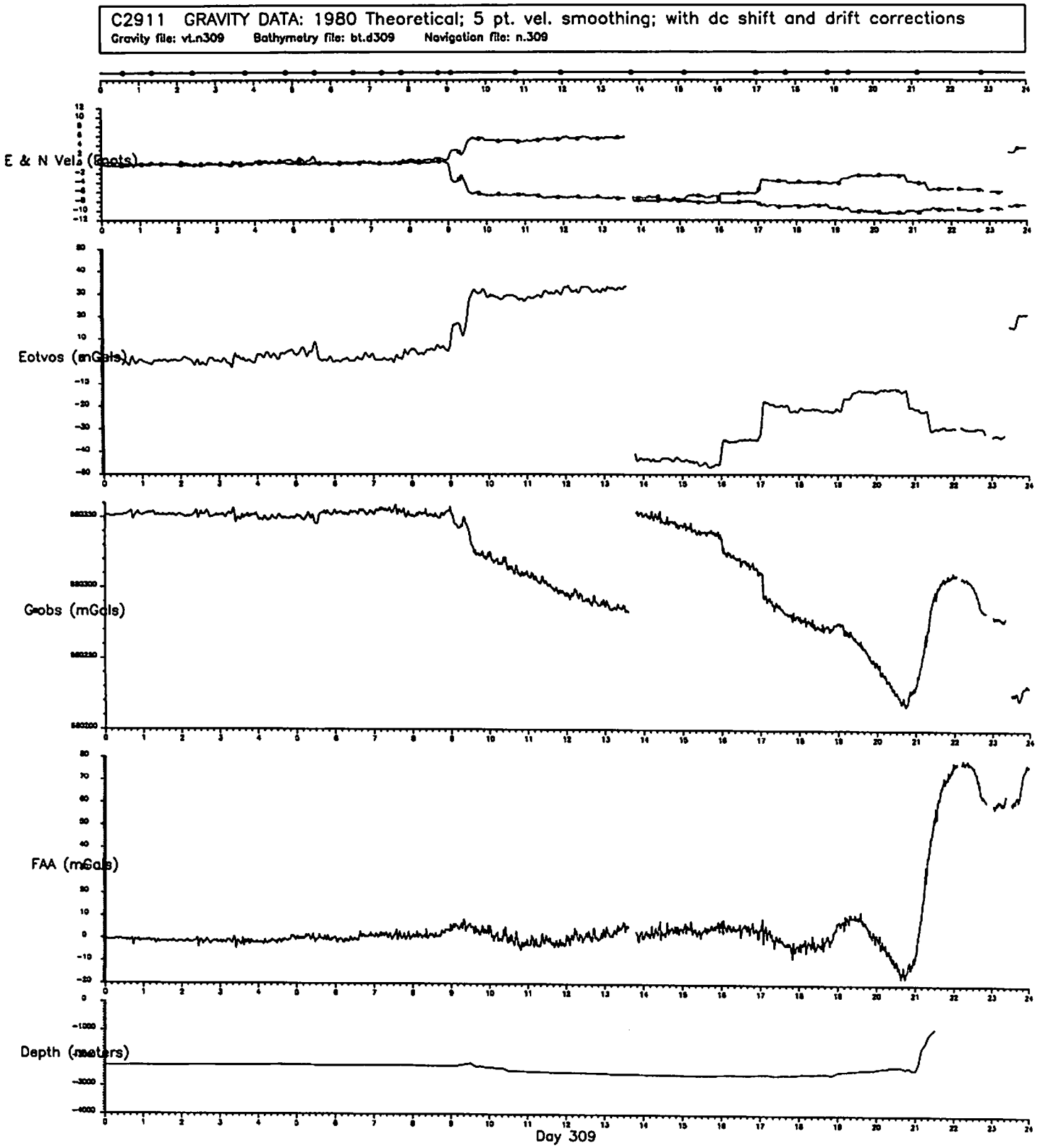


C2911 GRAVITY DATA: 1980 Theoretical; 5 pt. vel. smoothing; with dc shift and drift corrections

Gravity file: vt.n307 Bathymetry file: bt.d307 Navigation file: n.307

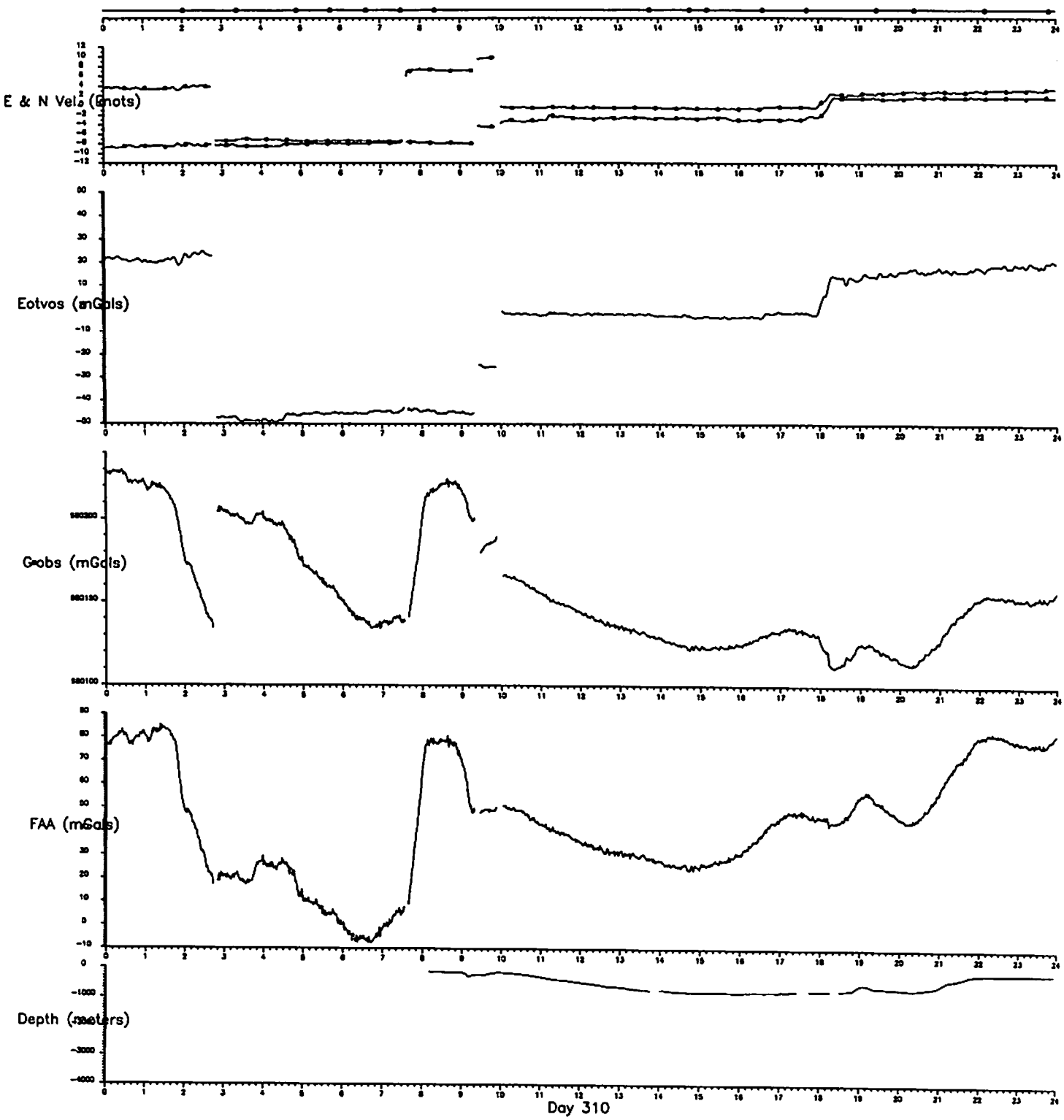


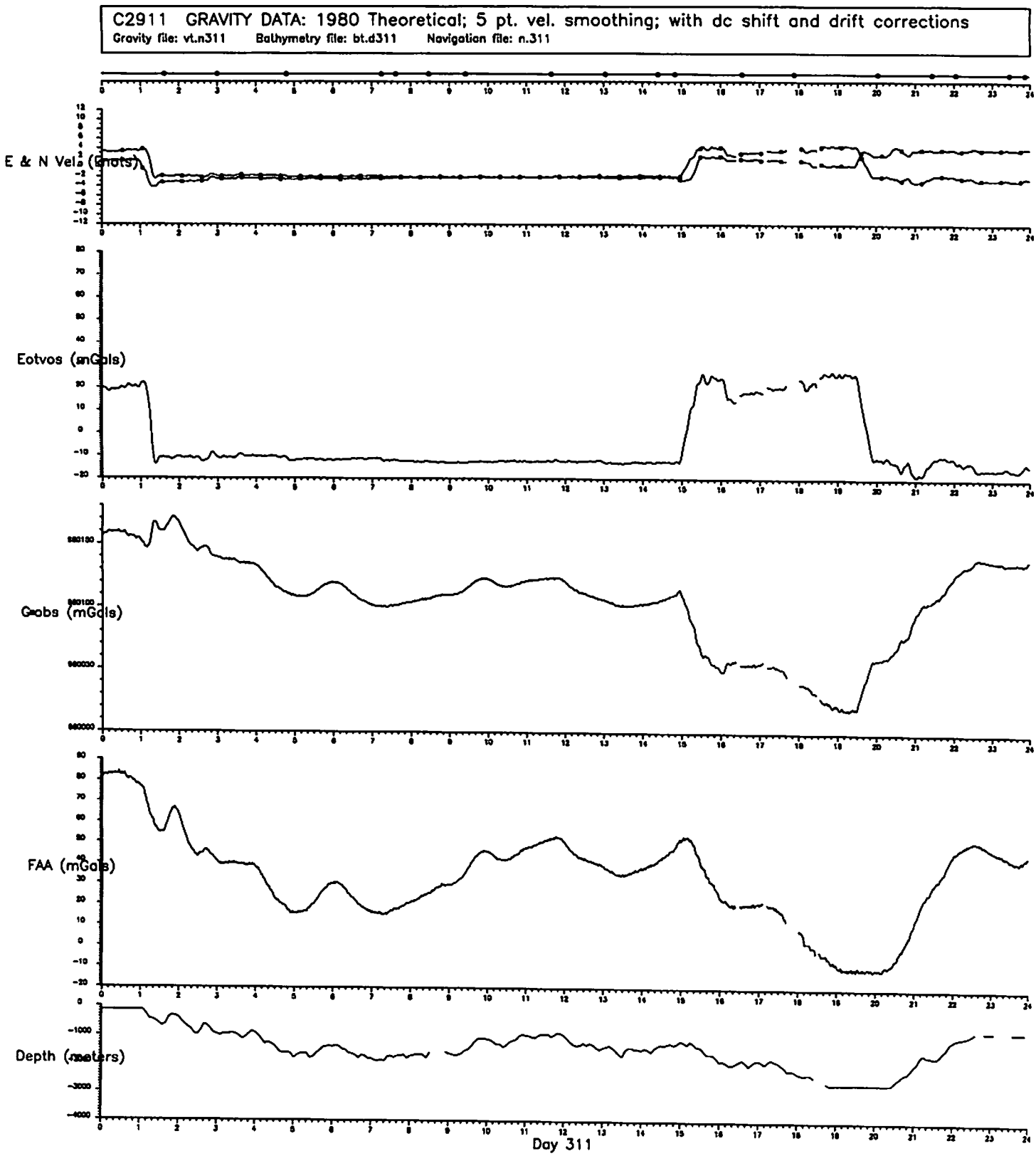

C2911 GRAVITY DATA: 1980 Theoretical; 5 pt. vel. smoothing; with dc shift and drift corrections
Gravity file: vt.n308 Bathymetry file: bt.d308 Navigation file: n.308
E & N Vels (Knots)
Eotvos (mGals)
Gobs (mGals)
FAA (mGals)
Depth (meters)
Day 308


C2911 GRAVITY DATA: 1980 Theoretical; 5 pt. vel. smoothing; with dc shift and drift corrections
Gravity file: vt.n309 Bathymetry file: bt.d309 Navigation file: n.309
E & N Vels (knots)
Eotvos (mGals)
Gobs (mGals)
FAA (mGals)
Depth (meters)
Day 309

C2911 GRAVITY DATA: 1980 Theoretical; 5 pt. vel. smoothing; with dc shift and drift corrections

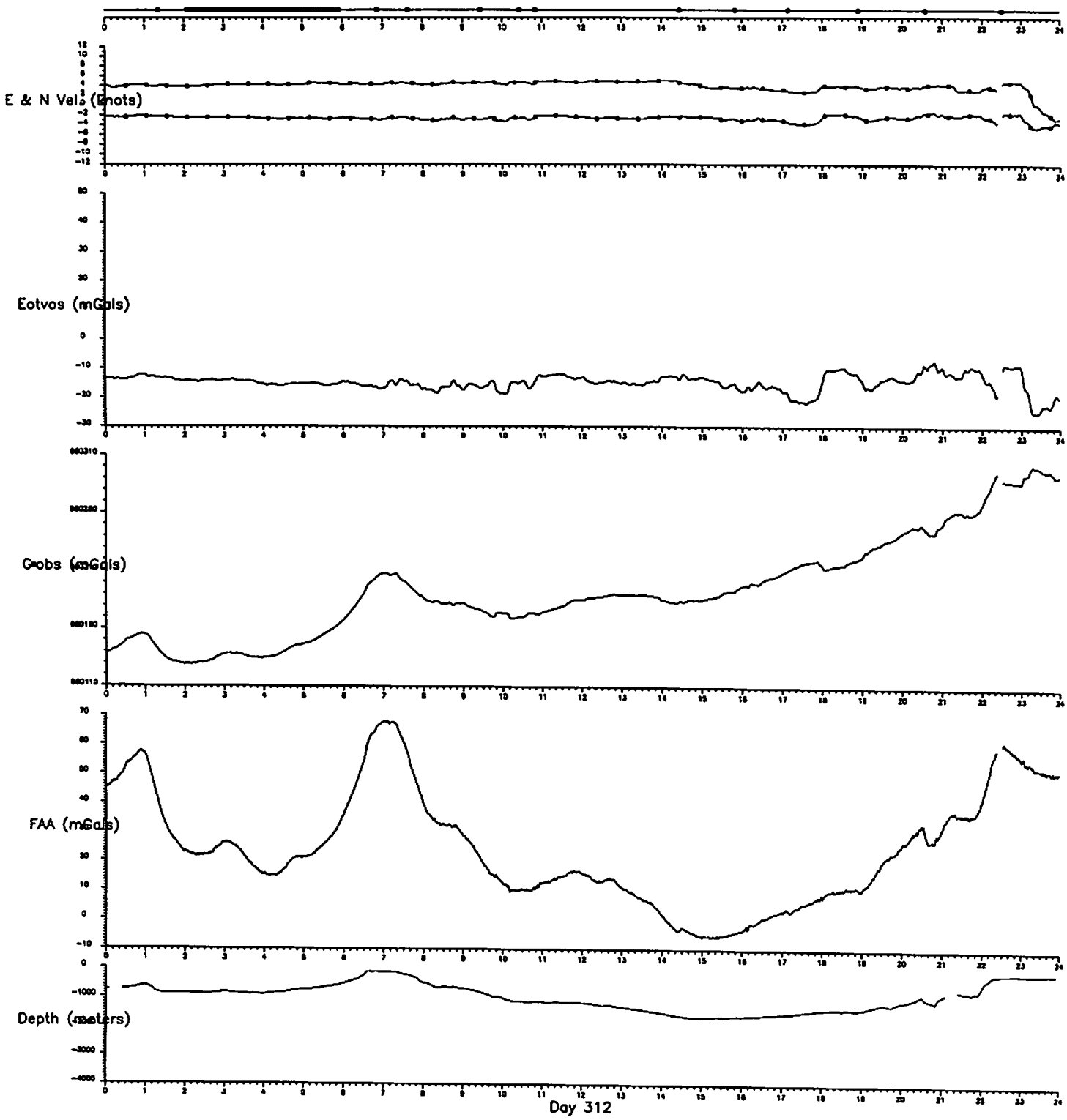
Gravity file: vt.n310 Bathymetry file: bt.d310 Navigation file: n.310

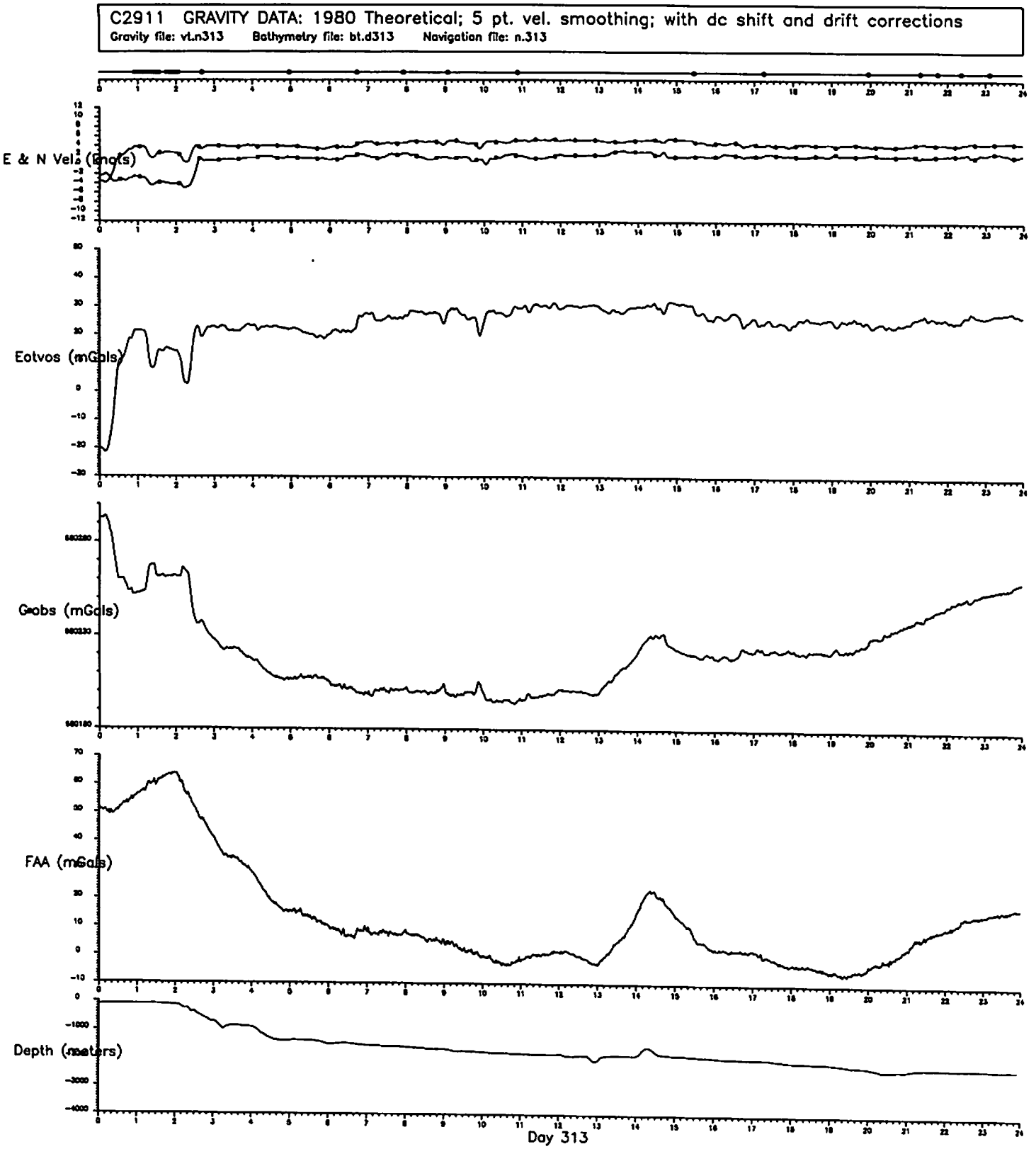



C2911 GRAVITY DATA: 1980 Theoretical; 5 pt. vel. smoothing; with dc shift and drift corrections
Gravity file: vt.n311 Bathymetry file: bt.d311 Navigation file: n.311
E & N Vels (knots)
Eotvos (mGals)
Gobs (mGals)
FAA (mGals)
Depth (meters)
Day 311

C2911 GRAVITY DATA: 1980 Theoretical; 5 pt. vel. smoothing; with dc shift and drift corrections

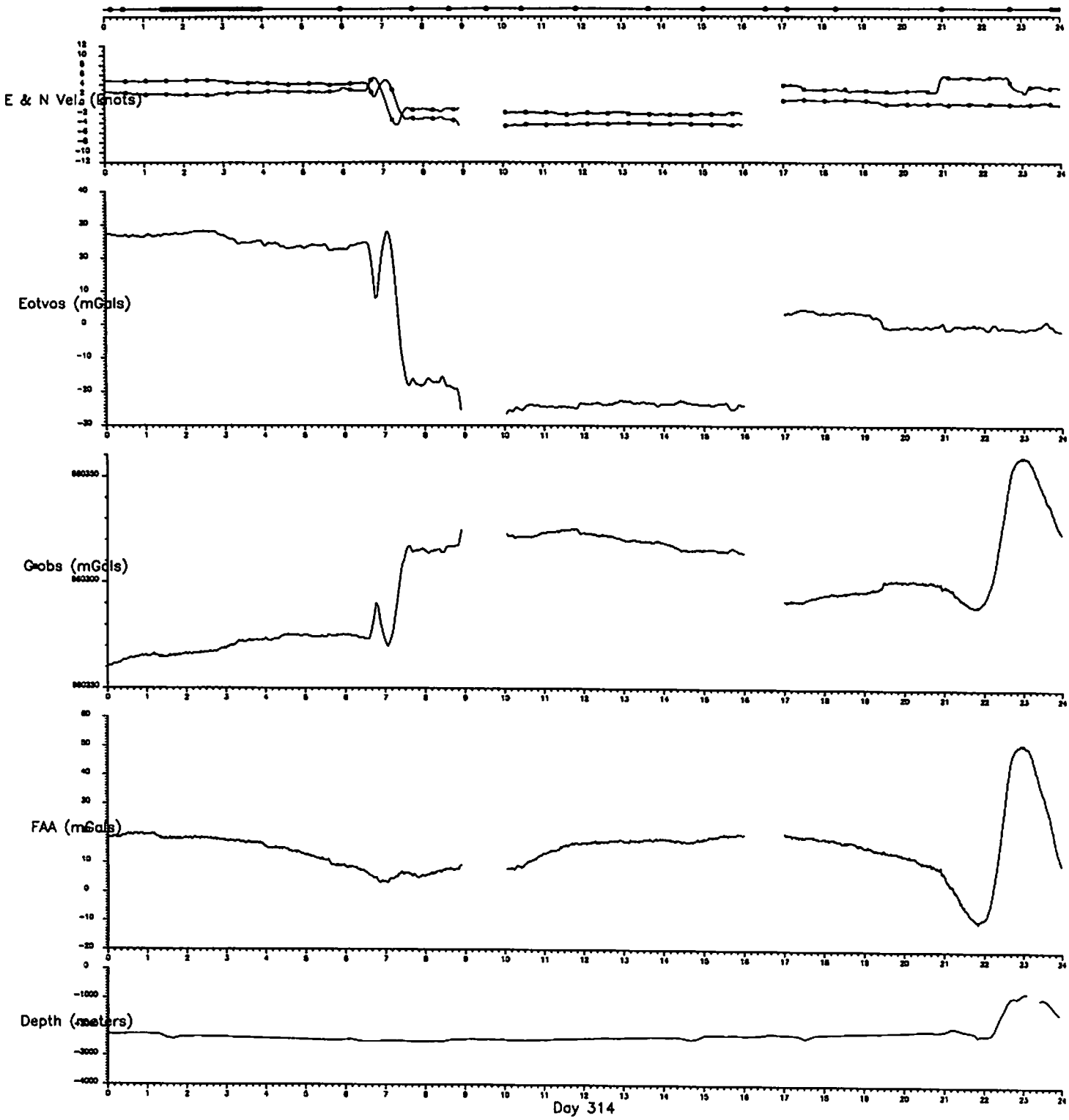
Gravity file: vt.n312 Bathymetry file: bt.d312 Navigation file: n.312

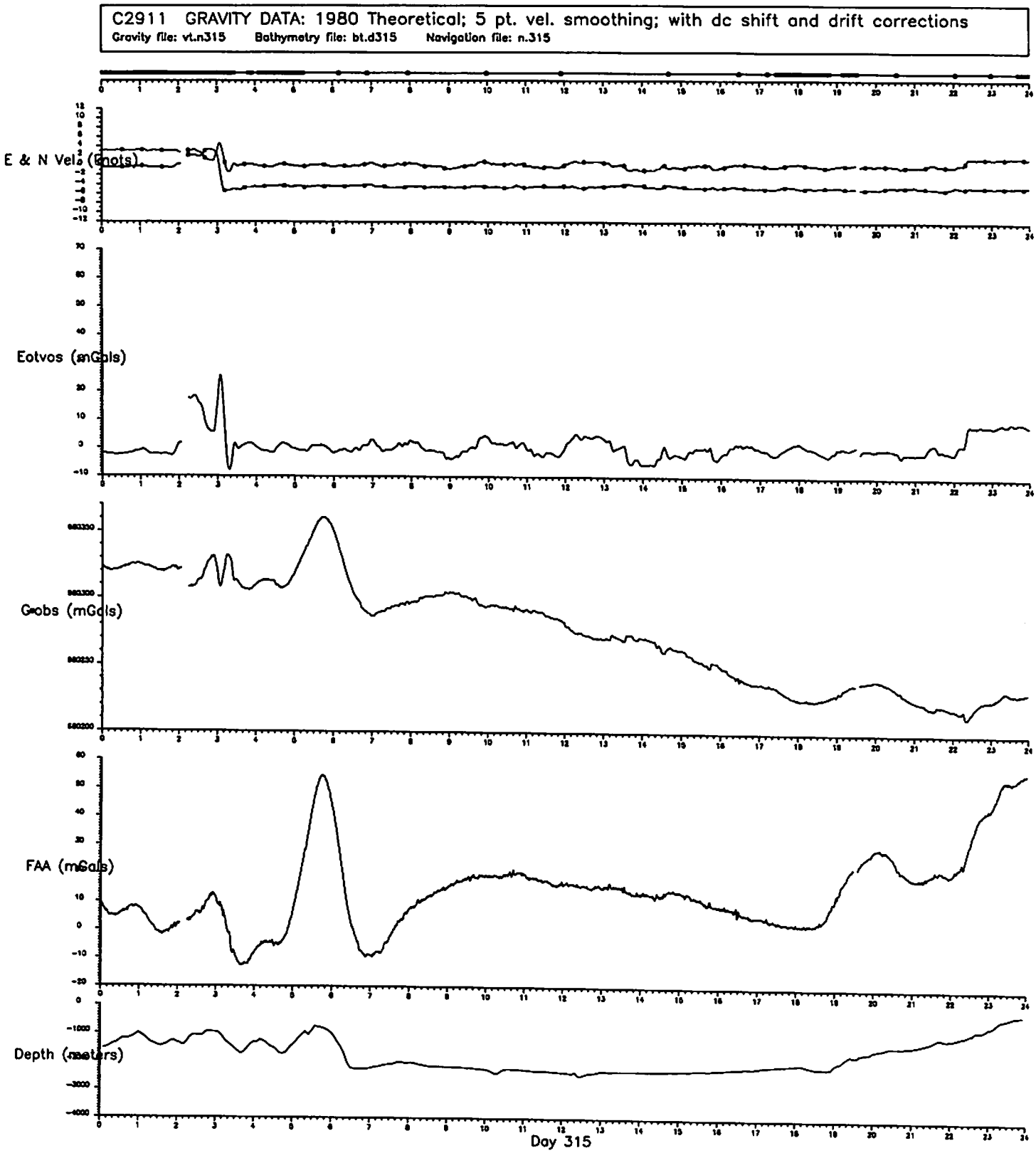


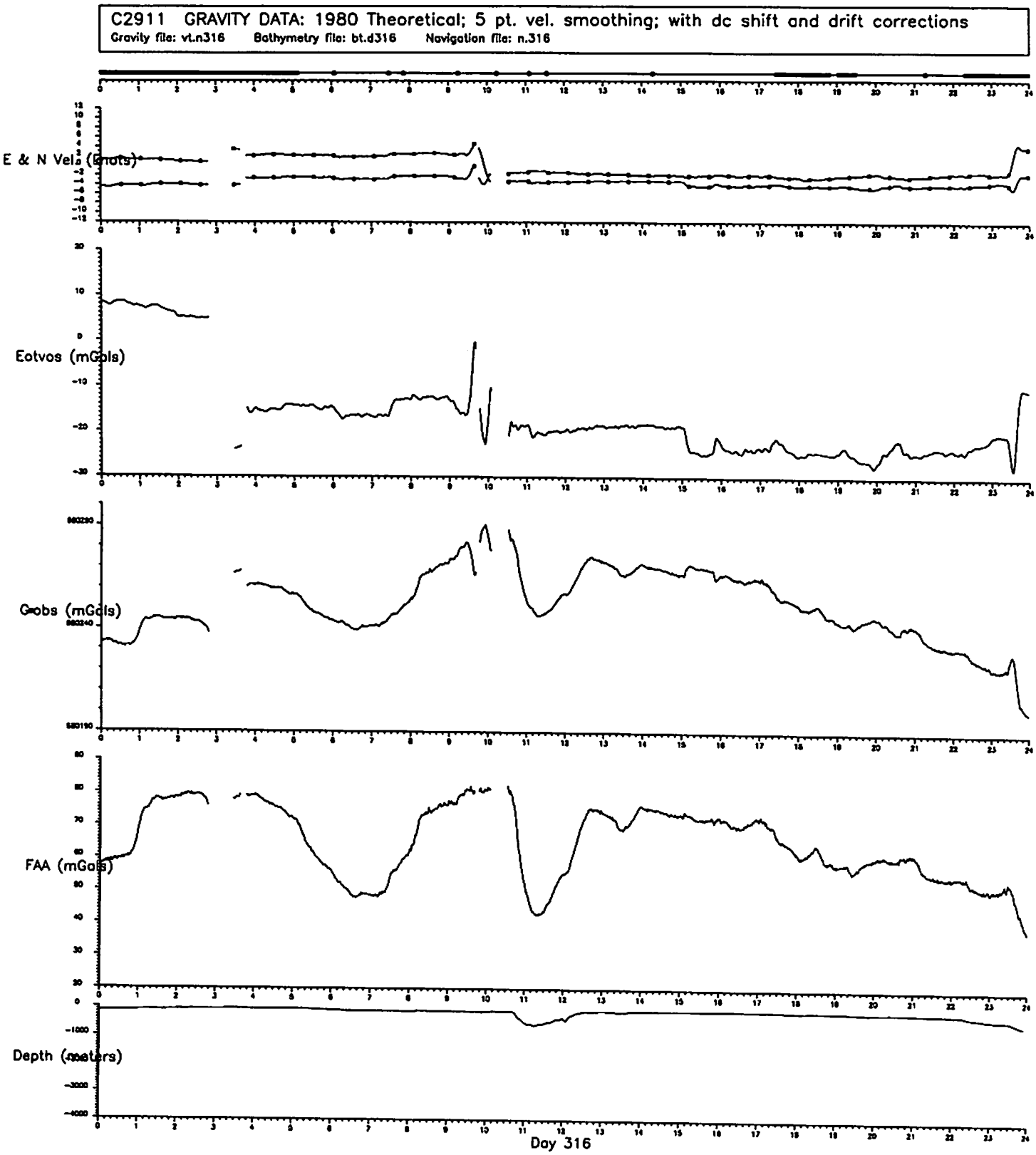

C2911 GRAVITY DATA: 1980 Theoretical; 5 pt. vel. smoothing; with dc shift and drift corrections
Gravity file: vt.n313 Bathymetry file: bt.d313 Navigation file: n.313
E & N Vels (knots)
Eotvos (mGals)
Gobs (mGals)
FAA (mGals)
Depth (meters)
Day 313

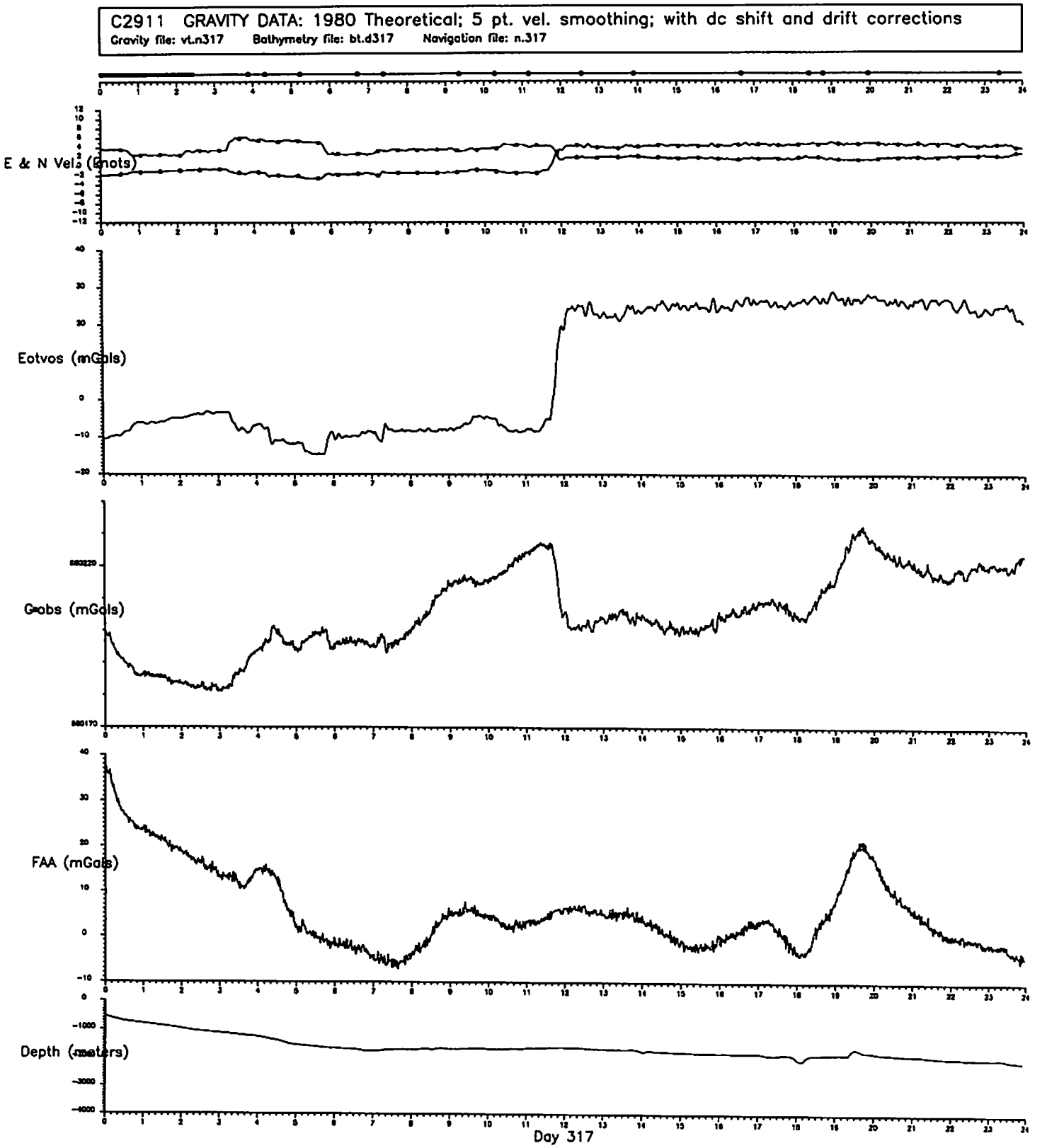
C2911 GRAVITY DATA: 1980 Theoretical; 5 pt. vel. smoothing; with dc shift and drift corrections

Gravity file: vt.n314 Bathymetry file: bt.d314 Navigation file: n.314



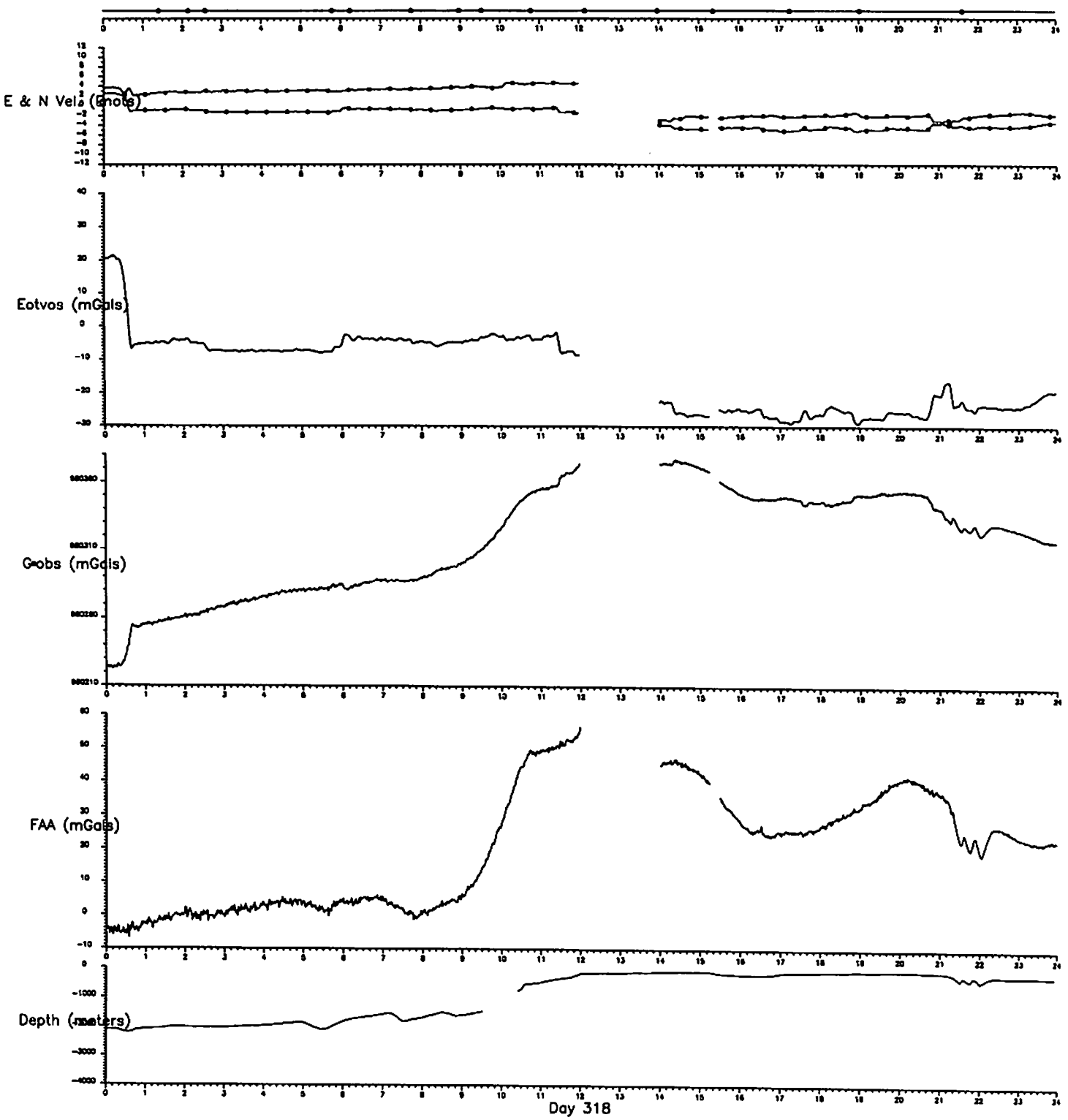

C2911 GRAVITY DATA: 1980 Theoretical; 5 pt. vel. smoothing; with dc shift and drift corrections
Gravity file: vt.n315 Bathymetry file: bt.d315 Navigation file: n.315
E & N Velo (knots)
Eotvos (mGals)
Gobs (mGals)
FAA (mGals)
Depth (meters)
Day 315


C2911 GRAVITY DATA: 1980 Theoretical; 5 pt. vel. smoothing; with dc shift and drift corrections
Gravity file: vt.n316 Bathymetry file: bt.d316 Navigation file: n.316
E & N Vels (knots)
Eotvos (mGals)
Gobs (mGals)
FAA (mGals)
Depth (meters)
Day 316


C2911 GRAVITY DATA: 1980 Theoretical; 5 pt. vel. smoothing; with dc shift and drift corrections
Gravity file: vt.n317 Bathymetry file: bt.d317 Navigation file: n.317
E & N Vels (knots)
Eotvos (mGals)
Gobs (mGals)
FAA (mGals)
Depth (meters)
Day 317

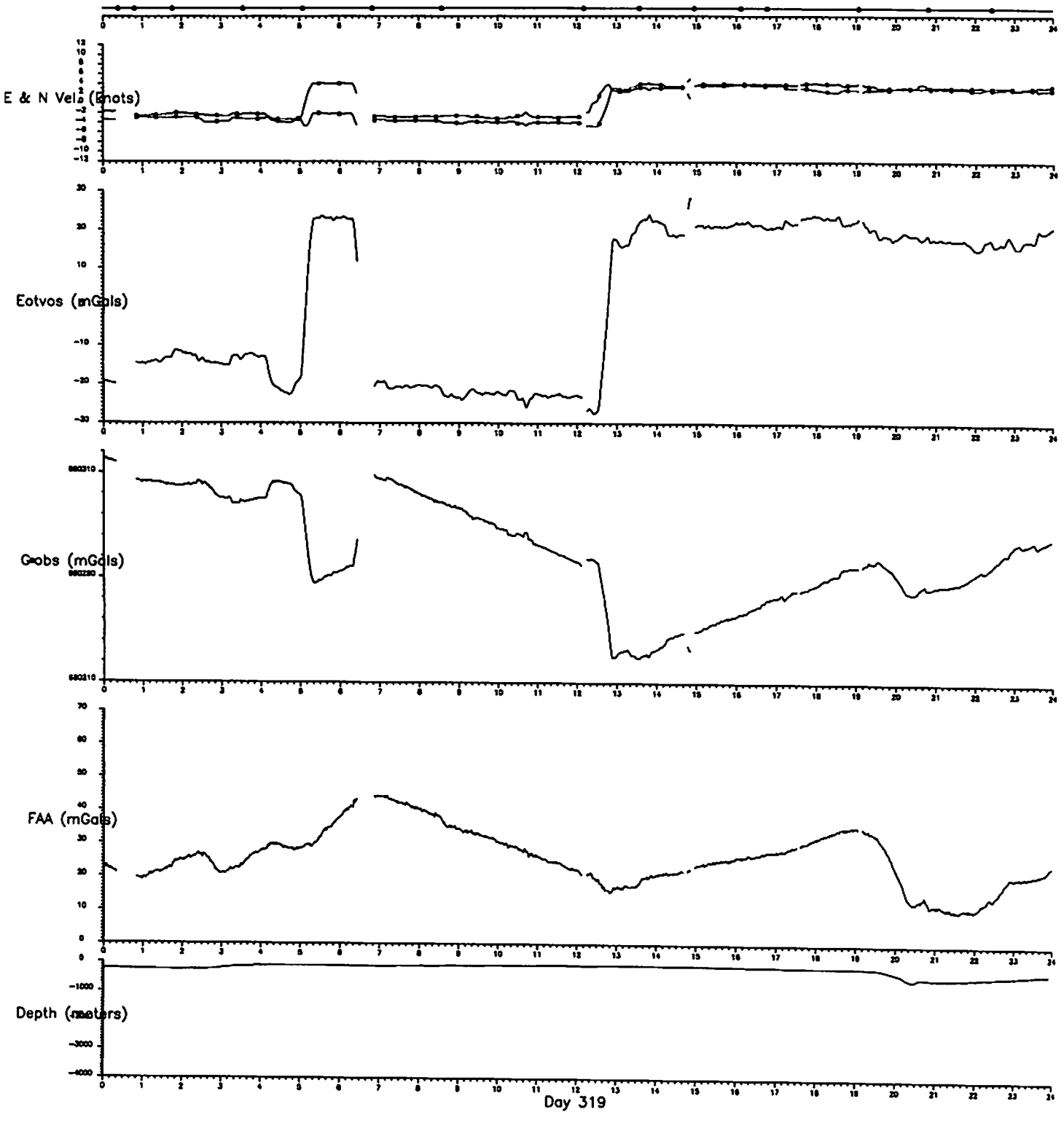
C2911 GRAVITY DATA: 1980 Theoretical; 5 pt. vel. smoothing; with dc shift and drift corrections

Gravity file: vt.n318 Bathymetry file: bt.d318 Navigation file: n.318



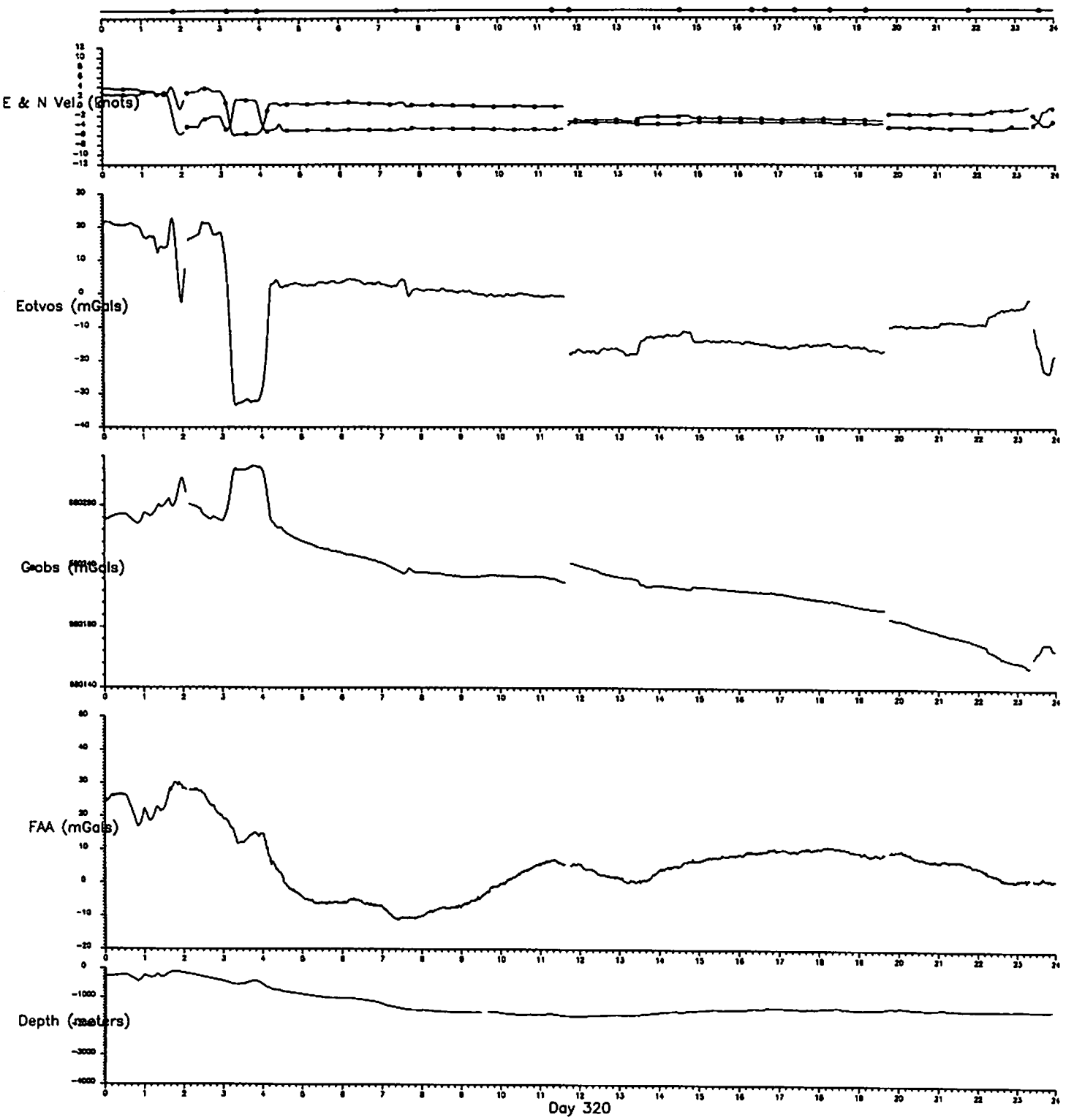
C2911 GRAVITY DATA: 1980 Theoretical; 5 pt. vel. smoothing; with dc shift and drift corrections

Gravity file: vt.n319 Bathymetry file: bt.d319 Navigation file: n.319



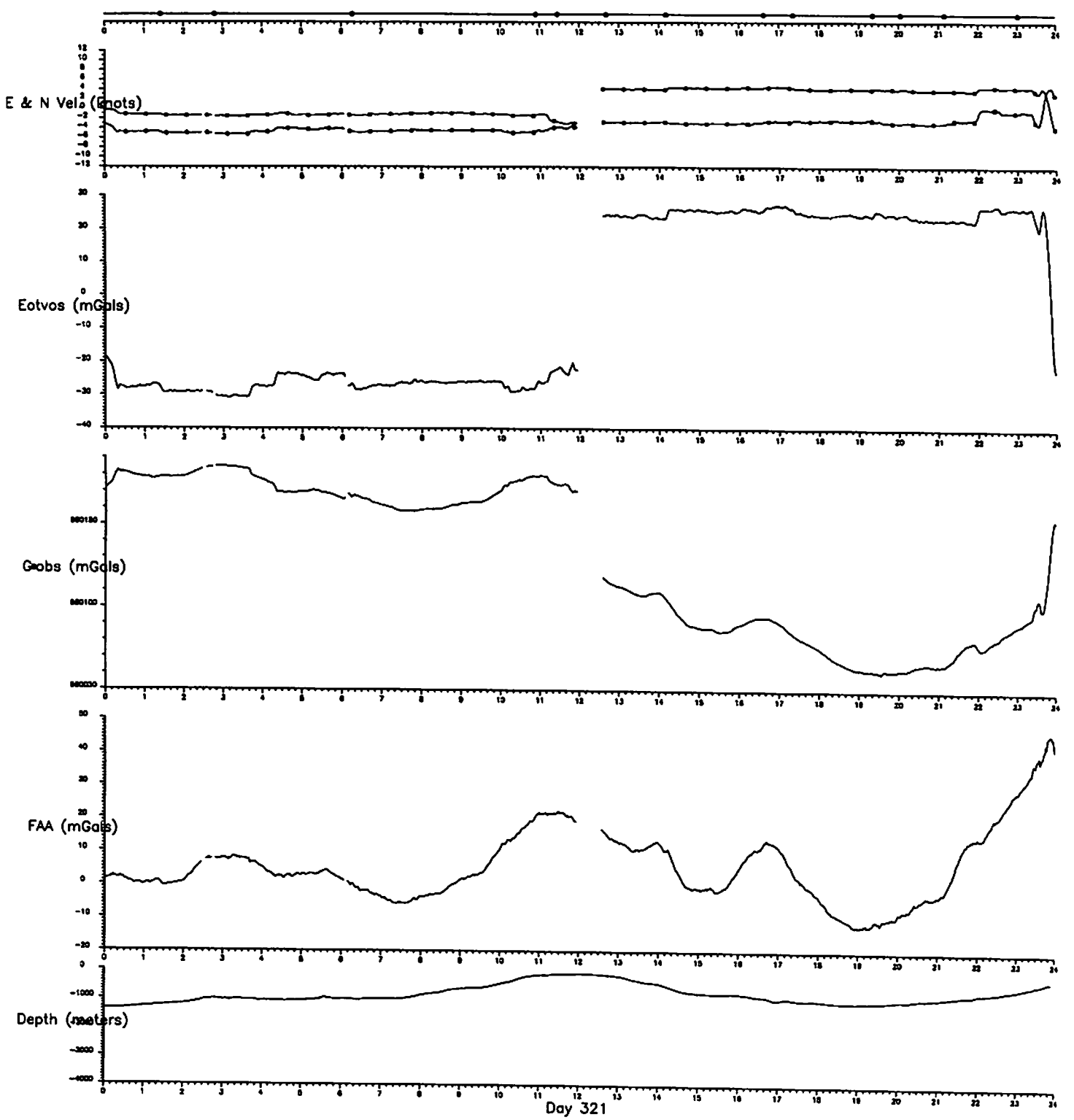
C2911 GRAVITY DATA: 1980 Theoretical; 5 pt. vel. smoothing; with dc shift and drift corrections

Gravity file: vl.n320 Bathymetry file: bt.d320 Navigation file: n.320



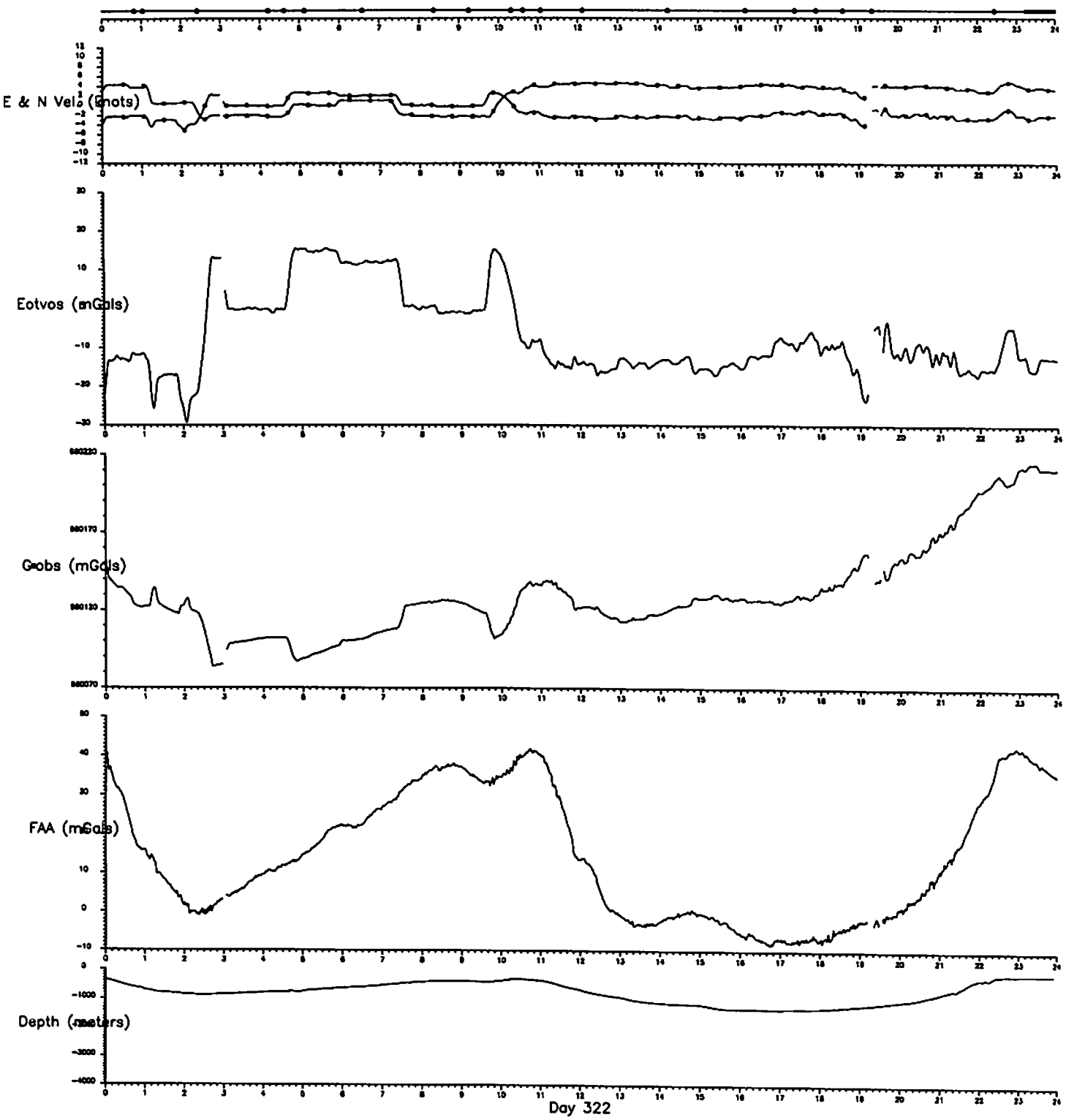
C2911 GRAVITY DATA: 1980 Theoretical; 5 pt. vel. smoothing; with dc shift and drift corrections

Gravity file: vt.n321 Bathymetry file: bt.d321 Navigation file: n.321



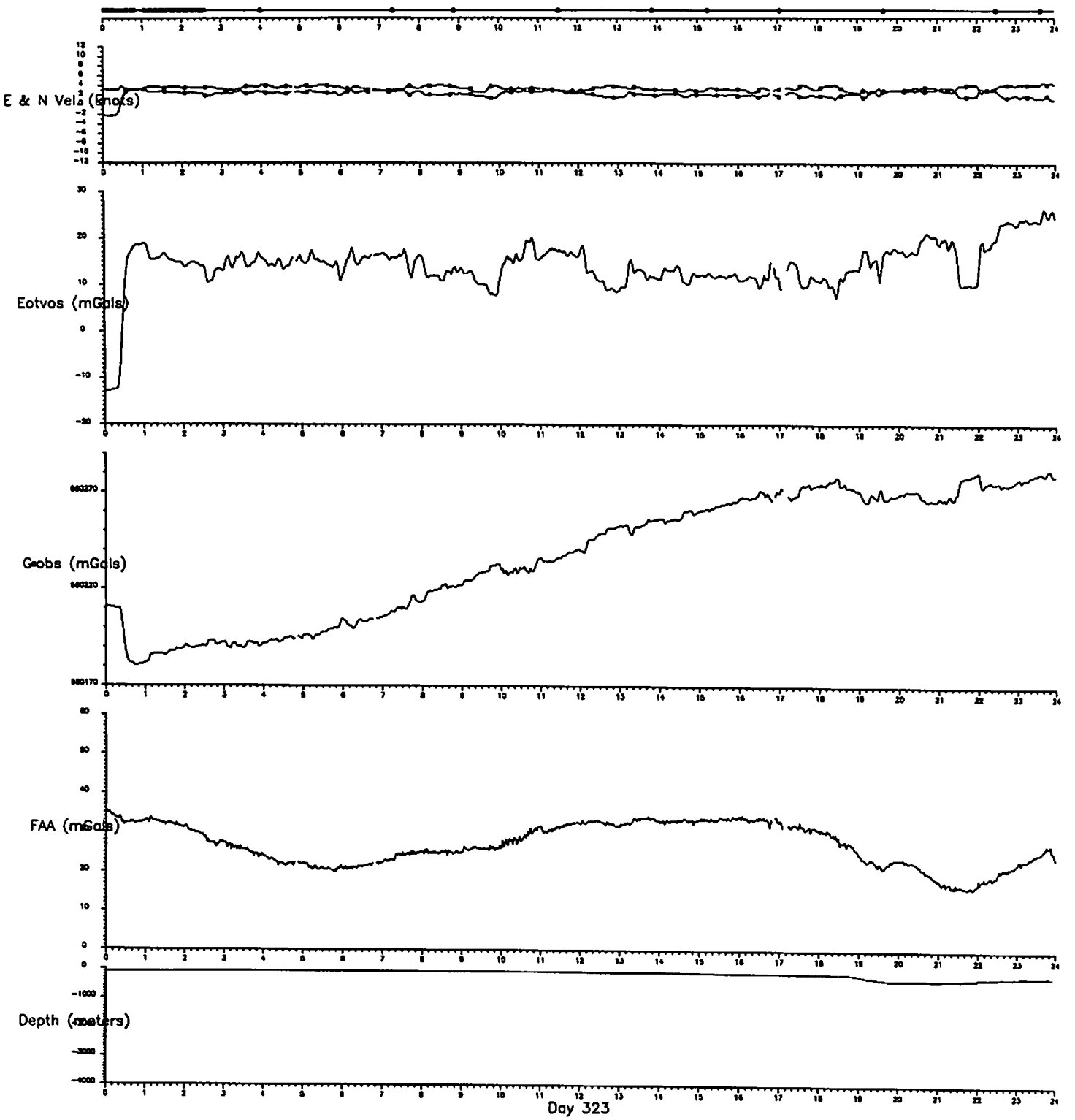
C2911 GRAVITY DATA: 1980 Theoretical; 5 pt. vel. smoothing; with dc shift and drift corrections

Gravity file: vt.n322 Bathymetry file: bt.d322 Navigation file: n.322



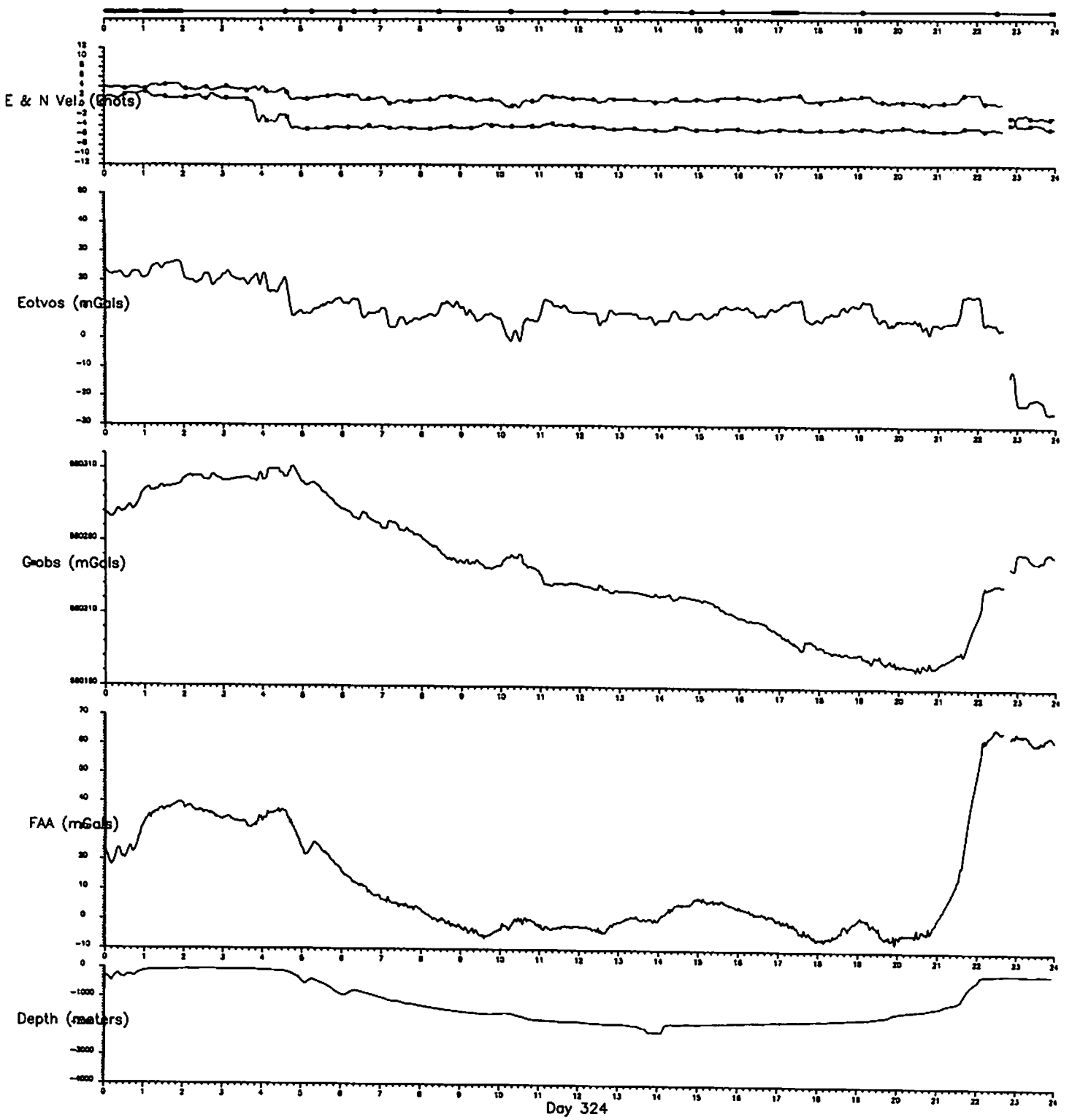
C2911 GRAVITY DATA: 1980 Theoretical; 5 pt. vel. smoothing; with dc shift and drift corrections

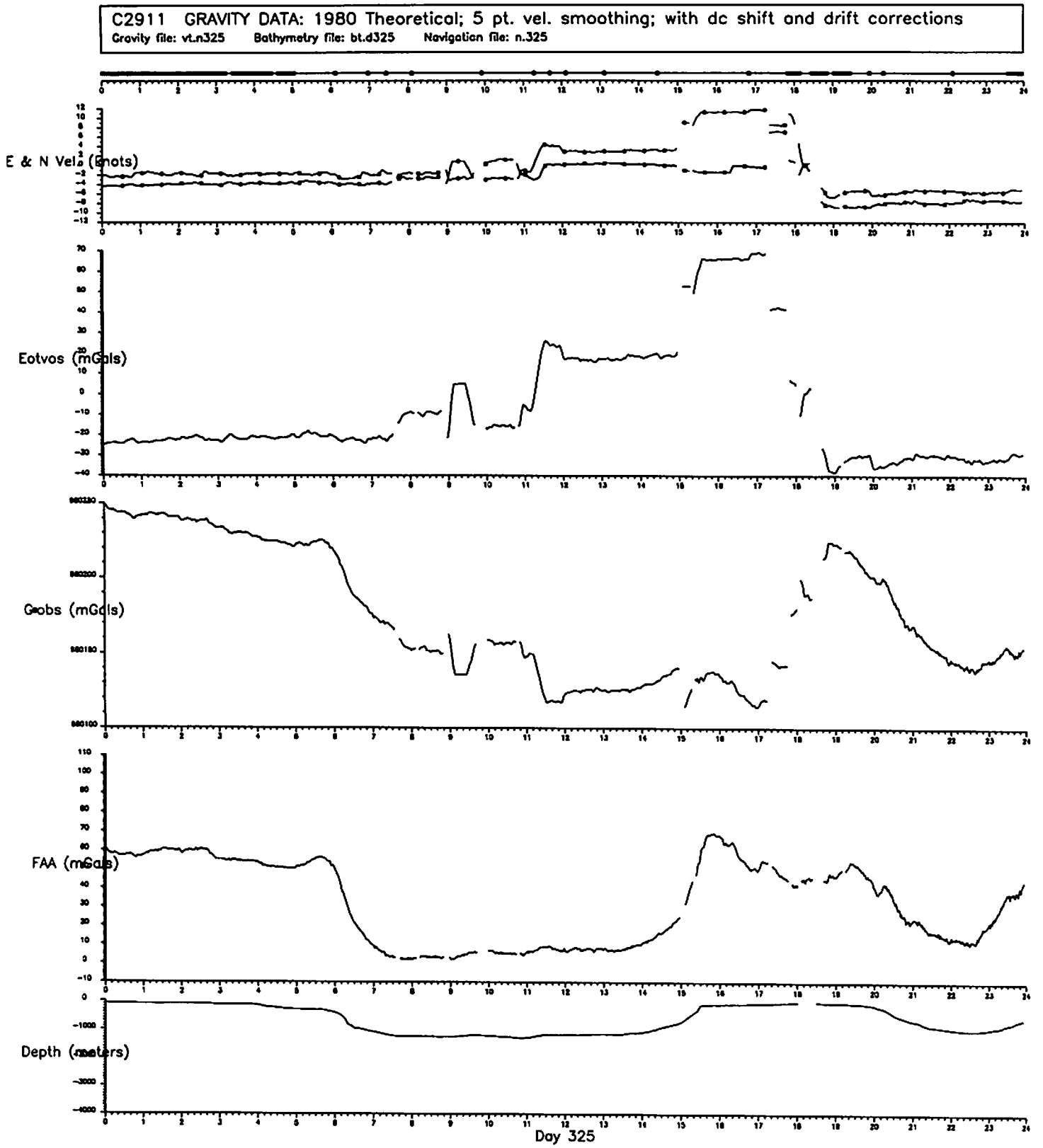
Gravity file: vt.n323 Bathymetry file: bt.d323 Navigation file: n.323



C2911 GRAVITY DATA: 1980 Theoretical; 5 pt. vel. smoothing; with dc shift and drift corrections

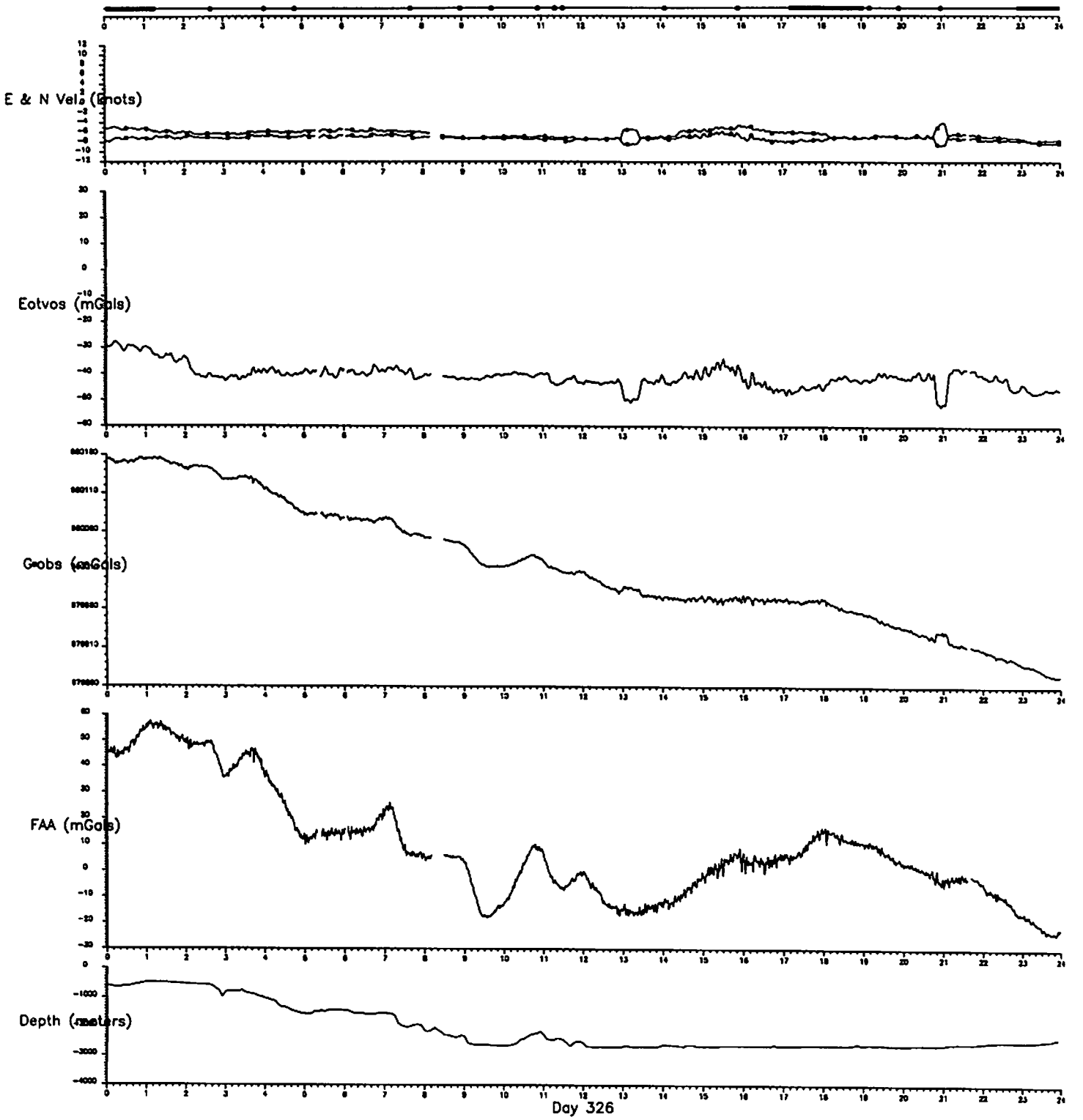
Gravity file: vt.n324 Bathymetry file: bt.d324 Navigation file: n.324




C2911 GRAVITY DATA: 1980 Theoretical; 5 pt. vel. smoothing; with dc shift and drift corrections
Gravity file: vt.n325 Bathymetry file: bt.d325 Navigation file: n.325
E & N Vels (knots)
Eotvos (mGals)
Gobs (mGals)
FAA (mGals)
Depth (meters)
Day 325

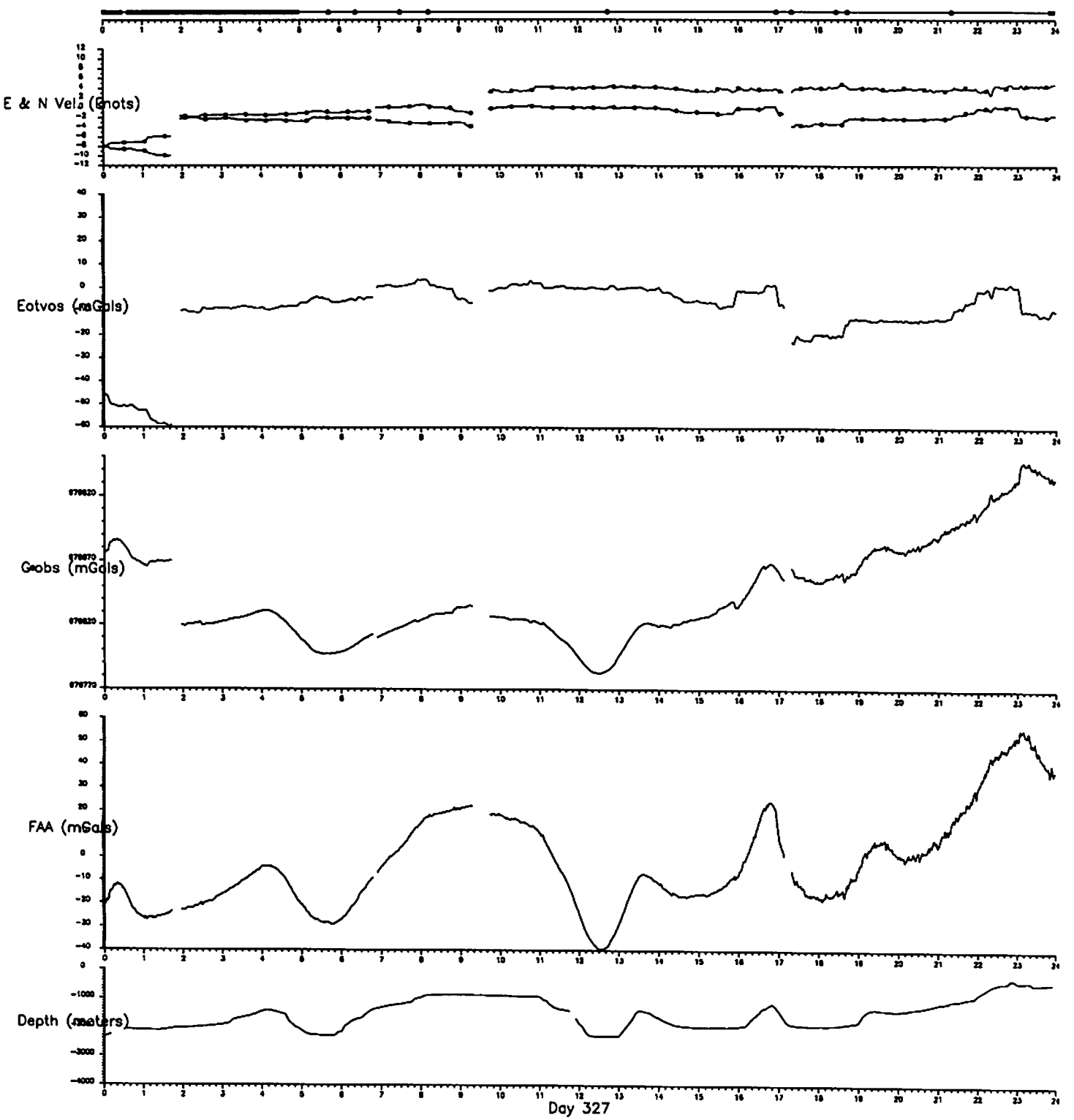
C2911 GRAVITY DATA: 1980 Theoretical; 5 pt. vel. smoothing; with dc shift and drift corrections

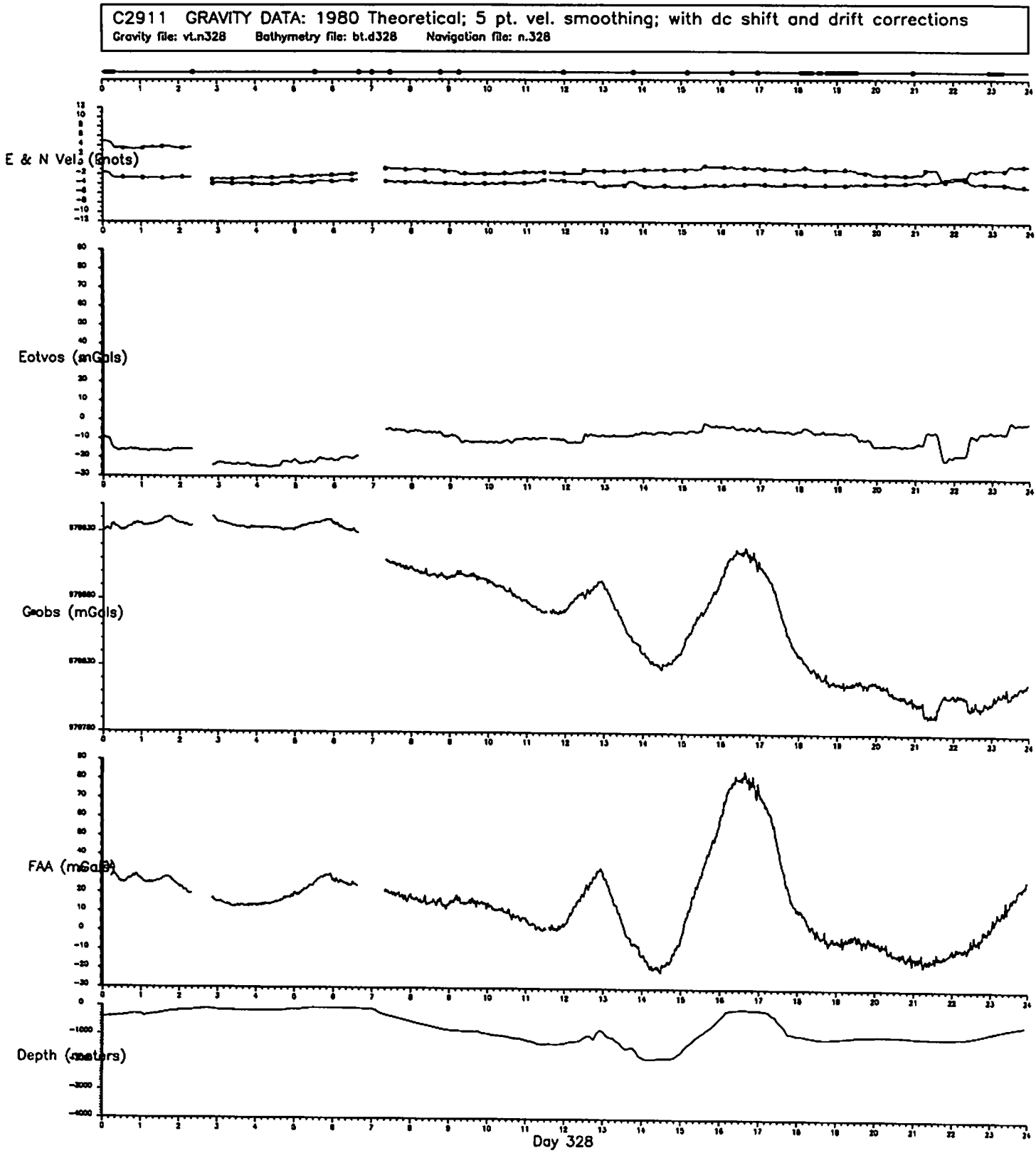
Gravity file: vt.n326 Bathymetry file: bt.d326 Navigation file: n.326



C2911 GRAVITY DATA: 1980 Theoretical; 5 pt. vel. smoothing; with dc shift and drift corrections

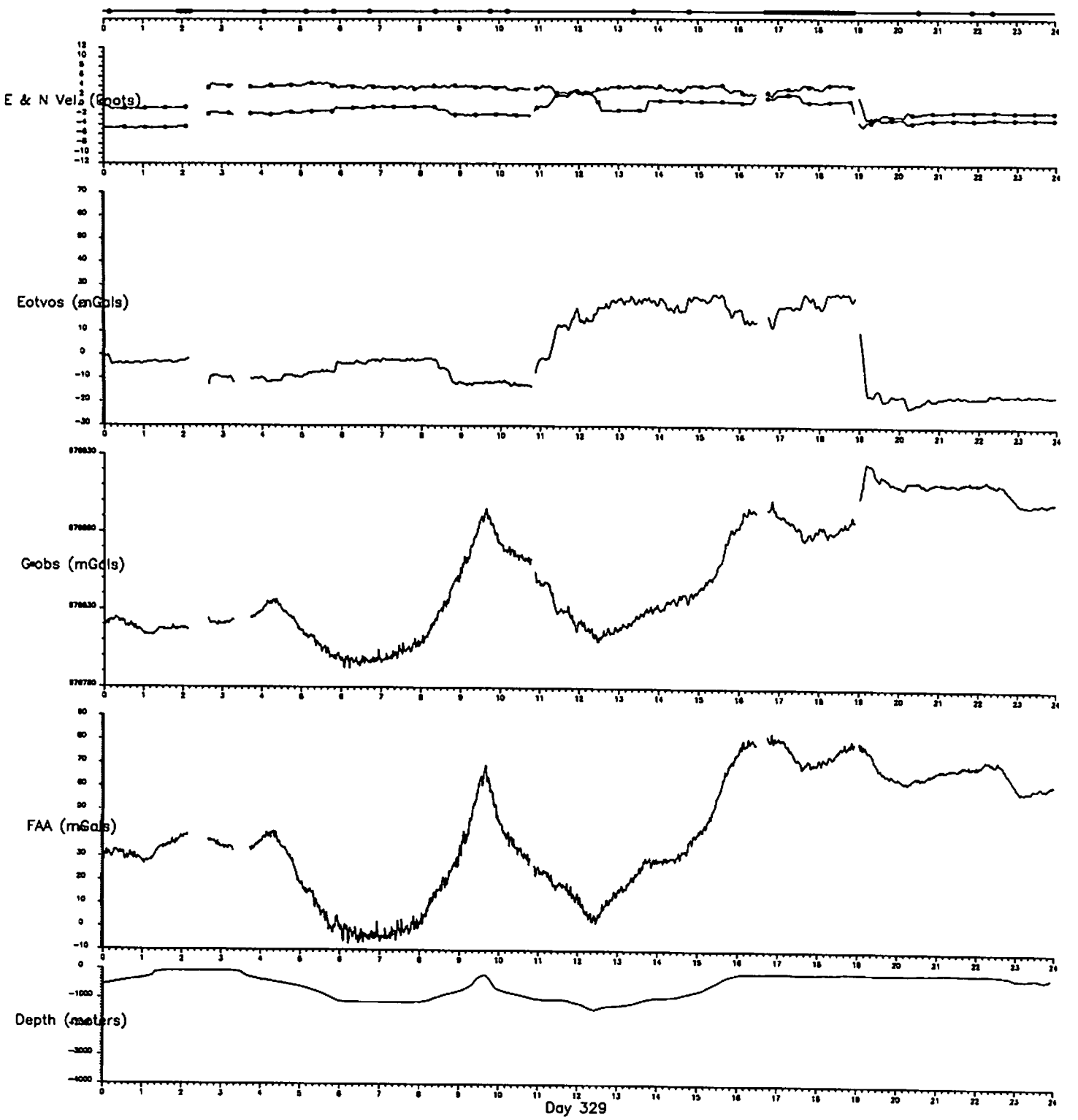
Gravity file: vt.n327 Bathymetry file: bt.d327 Navigation file: n.327

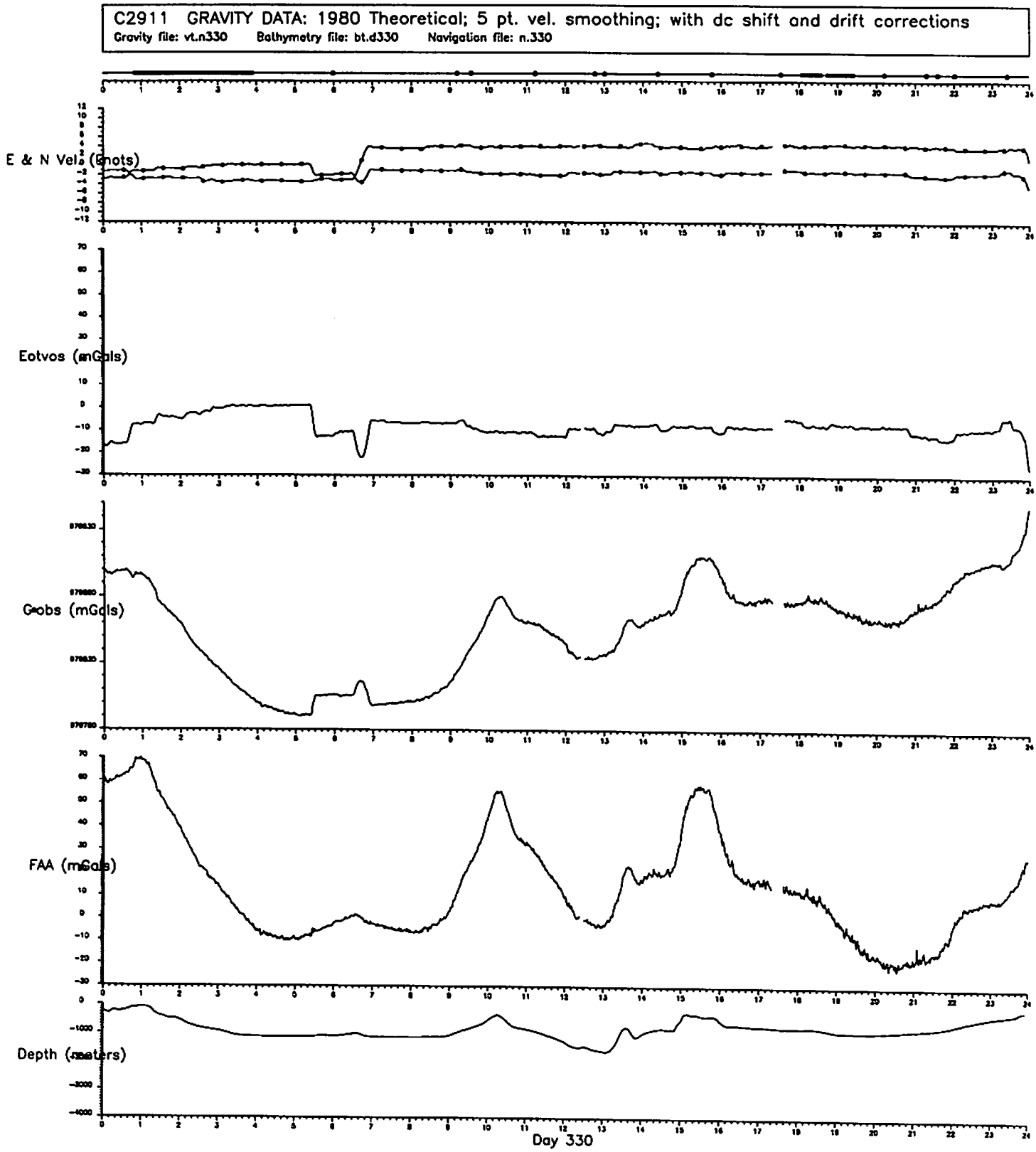



C2911 GRAVITY DATA: 1980 Theoretical; 5 pt. vel. smoothing; with dc shift and drift corrections
Gravity file: vt.n328 Bathymetry file: bt.d328 Navigation file: n.328
E & N Vels (knots)
Eotvos (mGals)
Geobs (mGals)
FAA (mGals)
Depth (meters)
Day 328

C2911 GRAVITY DATA: 1980 Theoretical; 5 pt. vel. smoothing; with dc shift and drift corrections

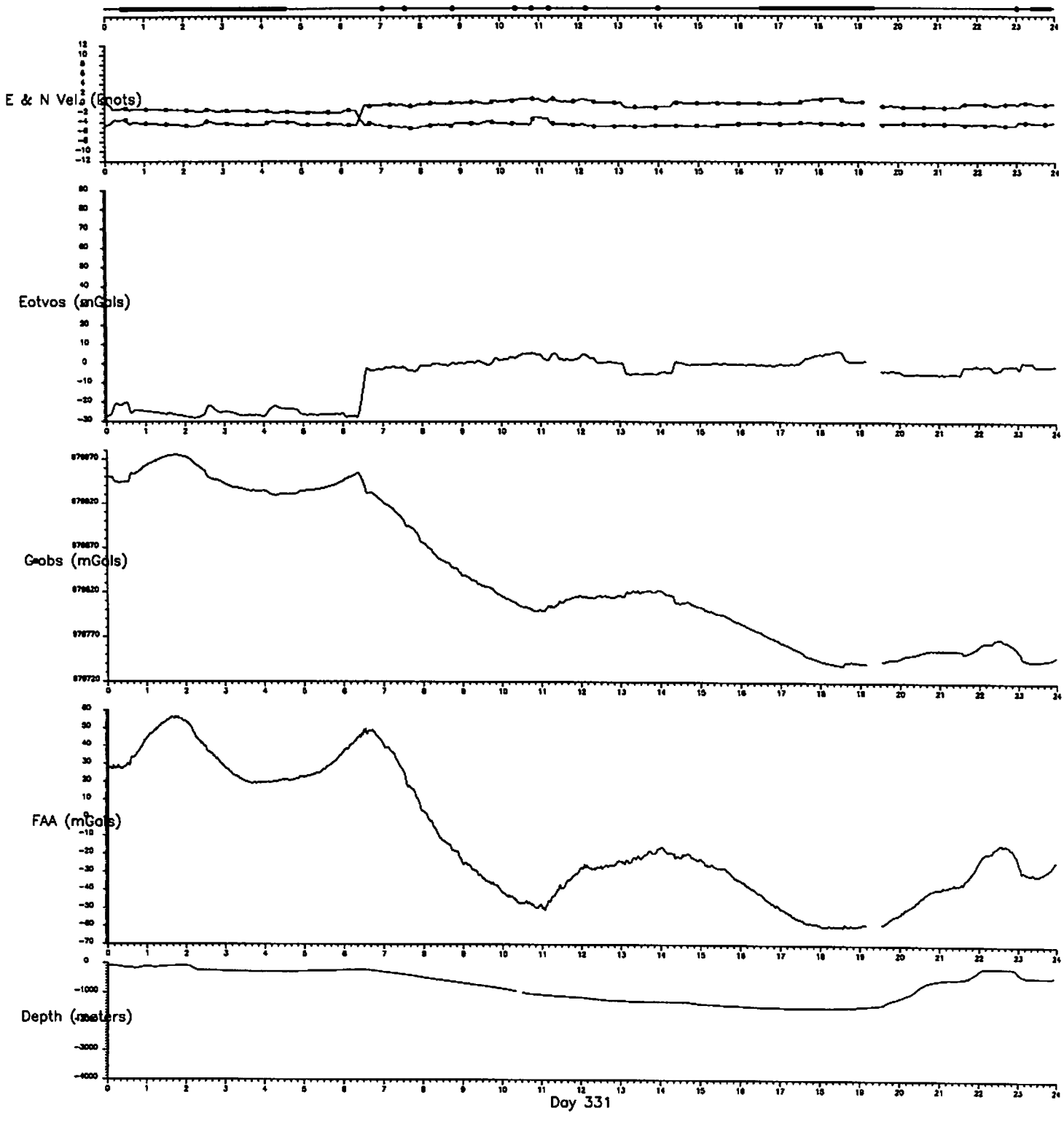
Gravity file: vt.n329 Bathymetry file: bt.d329 Navigation file: n.329

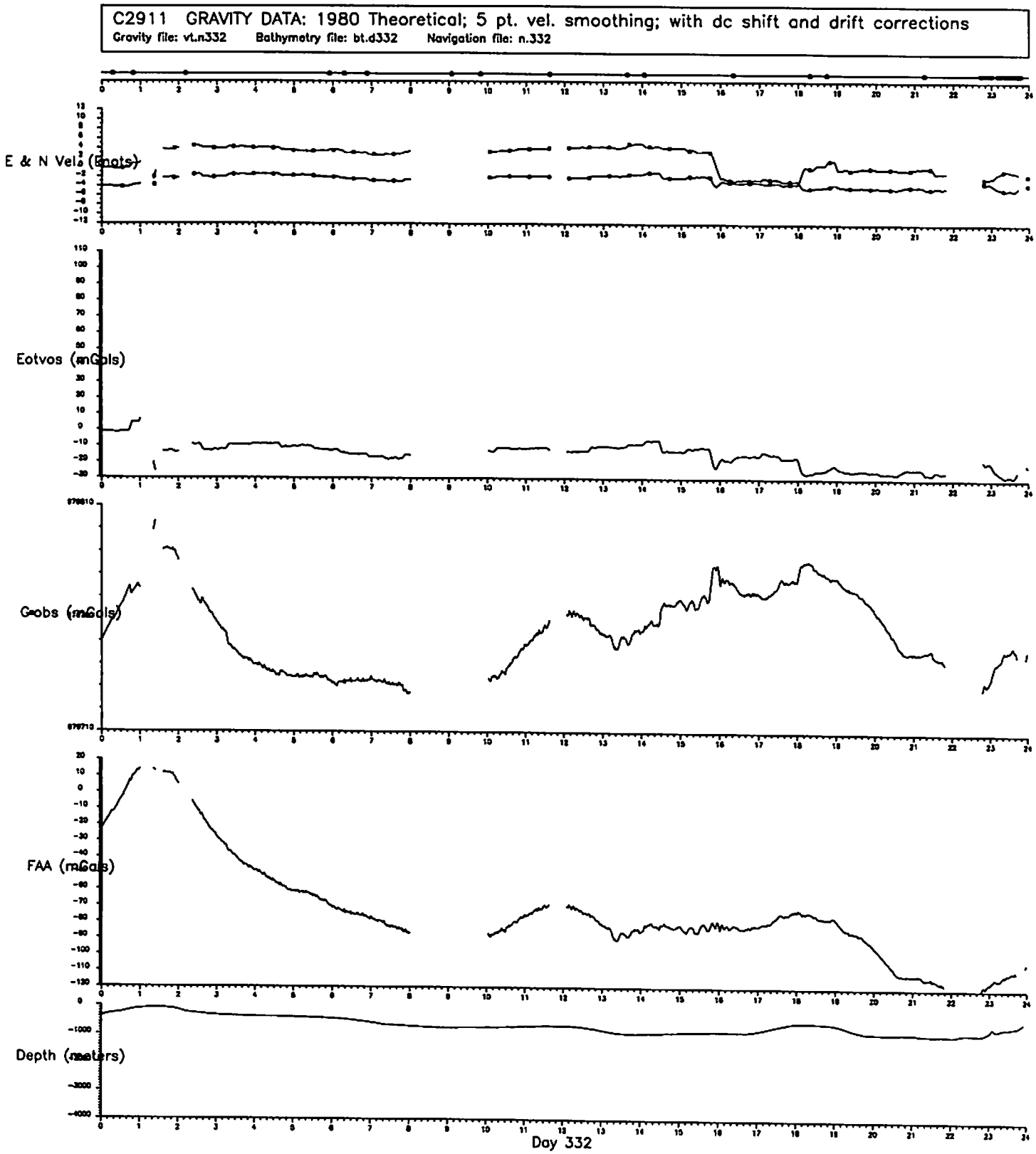



C2911 GRAVITY DATA: 1980 Theoretical; 5 pt. vel. smoothing; with dc shift and drift corrections
Gravity file: vt.n330 Bathymetry file: bt.d330 Navigation file: n.330
E & N Vels (knots)
Eotvos (mGals)
Gobs (mGals)
FAA (mGals)
Depth (meters)
Day 330

C2911 GRAVITY DATA: 1980 Theoretical; 5 pt. vel. smoothing; with dc shift and drift corrections

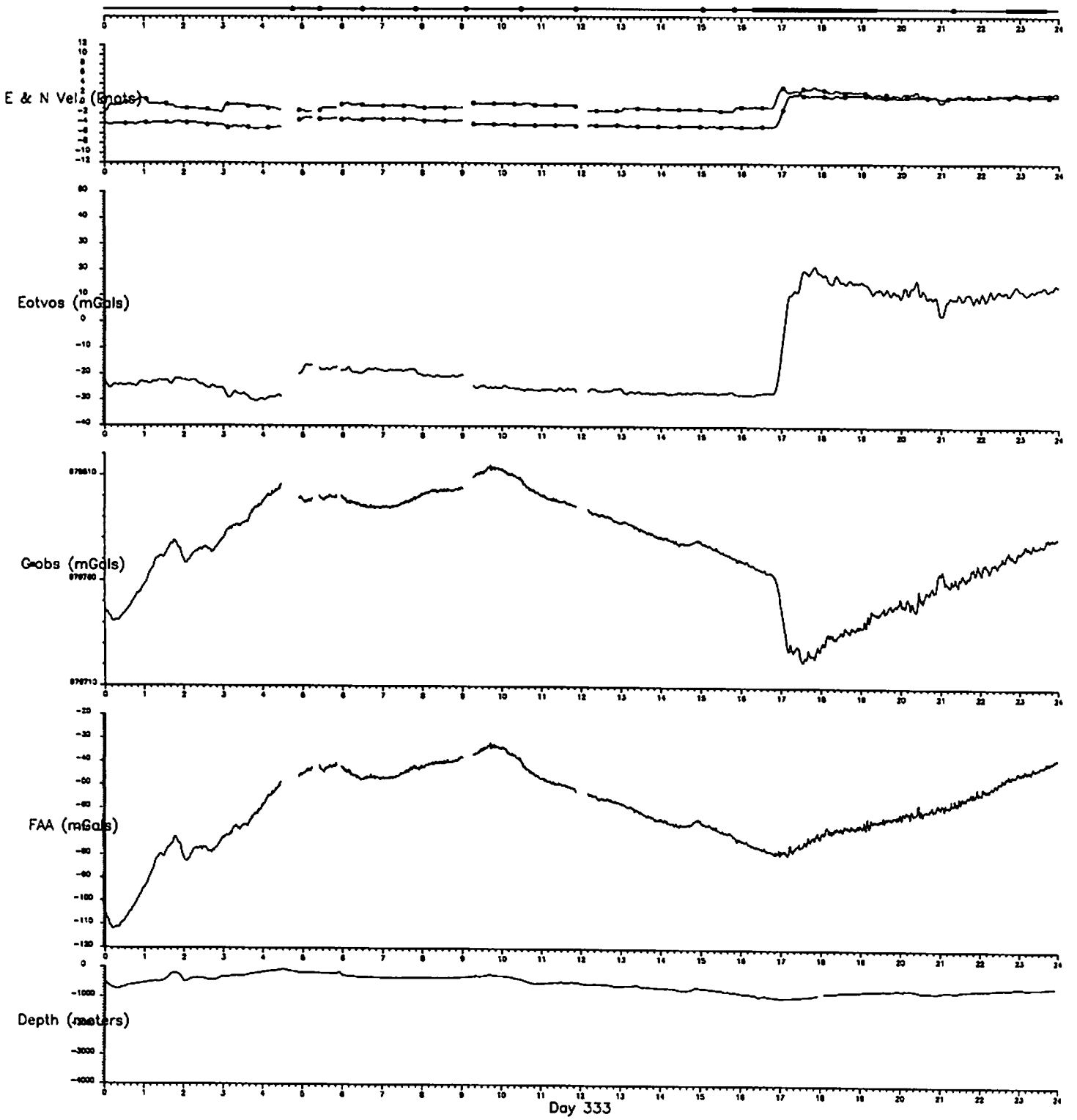
Gravity file: vt.n331 Bathymetry file: bt.d331 Navigation file: n.331




C2911 GRAVITY DATA: 1980 Theoretical; 5 pt. vel. smoothing; with dc shift and drift corrections
Gravity file: vt.n332 Bathymetry file: bt.d332 Navigation file: n.332
E & N Vels (knots)
Eotvos (mGals)
Gobs (mGals)
FAA (mGals)
Depth (meters)
Day 332

C2911 GRAVITY DATA: 1980 Theoretical; 5 pt. vel. smoothing; with dc shift and drift corrections

Gravity file: vt.n333 Bathymetry file: bt.d333 Navigation file: n.333



C2911 GRAVITY DATA: 1980 Theoretical; 5 pt. vel. smoothing; with dc shift and drift corrections

Gravity file: vt.n334 Bathymetry file: bt.d334 Navigation file: n.334