

UNITED STATES DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY

MAGNETIC OBSERVATORY HOURLY AVERAGE DIGITAL DATA

for

MAGSAT CORRELATION (Sept 1979 - June 1980)

by

Barbara Dodge, Suzanne Weston, and Joseph C. Cain

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This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards. Any use of trade names is for descriptive purposes only and does not imply endorsement by the USGS.

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Magnetic Observatory Hourly Average Digital Data

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Introduction

With the need (e.g. see the papers in Geophysical Research Letters, 9, No. 4, p. 239-376, April, 1982) for inclusion of external variations in the analysis of Magsat data as well as for the joint analysis of such variations from both Magsat and surface stations, it is useful to review those ground data presently available in digital form. The purpose of this report is to summarize the digital data availability for this interval, illustrate the present status, and document the corrections and problems remaining in data quality.

Since the hourly averages from magnetic observatories are the easiest to obtain and are useful for many of the computations involving external field corrections, they are the first to be compiled. These have been obtained through the World Data Center for Geomagnetism and (for the U.S. stations) from the U.S.G.S. The final form for our own use, from which expanded copies can be made, is a CDC packed format. This format and others available are described subsequently and in Appendix B.

Correction, editing, and addition of new data are proceeding in a routine way so that the summary plots presented herein do not necessarily represent the final form. This report thus is expected to change slightly according to the date of issue until the "final" corrections are applied. The data sources, though all digital, are diverse and include printed hourly values, various type formats, and punched cards. Whereas most data were in absolute form, some were hourly scalings which required application of calibrations. Besides obvious data errors, discontinuities frequently were observed in the absolute levels of the data. The data processing thus included designing and applying criteria for correcting suspected errors.

Improvements in the hourly data for this and other intervals are proceeding with priorities on this interval highest and prior years (1900-1979) next. We thus anticipate several reports of this genre which compile and illustrate the hourly value geomagnetic data as they are being processed. Since the data are being prepared for analytic use, they may deviate from those in the WDC (though WDC will be provided copies on request) with the summary of how the data were corrected indicated in these reports.

## Data Summary and Displays

The present stage of data availability is illustrated by the figure showing the locations of data availability using their IAGA 3-letter code. (IAGA News - Dec. 1977 No. 16). (This code was translated from the NOAA 2 or 3 letter codes). These stations and the months represented are given in Table 1, and their locations shown in Fig. 1.

Daily averages of the hourly values are plotted in the series of plots in Appendix C. Also, in the separate jacket is a microfiche copy (42x reduction) of the plotted hourly values (Appendix D). An example of the hourly value plots from the microfiche are given in Figs. 2, 3 and 4 for Bangui Observatory for October 1979. Each plot is labelled by the 3 letter IAGA code for the observatory, the month, year and component. The ordinates are absolute nT or degrees with a floating scale and limits to match the maximum and minimum for that component-month.

## Data Processing

The following U.S. observatories are operated by the U.S. Geological Survey. Details of the data processing are given below:

<u>Station Code</u>	<u>Operation</u>
BOU, CMO	Nov. and Dec. 1979 were obtained on digital magnetic tape from WDC-A in USGS/NOAA format. (See Appendix B).
BOU, CMO, BRW,	Jan.-June 1980 were obtained from L. Wilson in the USGS/NOAA format. The hourly average was abstracted as given.
FRD, GUA, HON, NEW, SJG and TUC	Nov., Dec., (1979) and Jan. (1980) were copied from WDC-A tapes in hourly-value IAGA format. Feb., Mar. and April 1980 were received as hourly scalings on punched cards. Calibration data were provided by Richard Green (USGS) and applied to the scalings. The rest of the data were supplied from NOAA on Tape and/or cards.

## Foreign Observatories

NKK, SVE	Data were received for Nov., 1979 - June 1980, in a printed table and transferred to punched cards.
EBR, ESK, FUR, HUA, MBO, GNA PMG, PPT, TOL, VSS, BNG, CNB	Data were received either on WDC tapes in hourly-value IAGA format or on punched cards from WDC.

A plot of the locations of each of these stations is shown in Figure 4 with each labeled by its IAGA code.

TABLE 1

Station Code	Station Name	Latitude	Longitude	Data Extent
BNG	Bangui, Africa	4°26'	18°34'	Sept 79-May 80
BOU	Boulder, CO,USA	40°08'	-106°46'	Nov 79-June 80
BRW	Pt. Barrow, Alaska	71°18'	-157°15'	Jan 80-June 80
CMO	College, Alaska	65°52'	-148°10'	Nov 79-June 80
CNB	Canberra, Australia	-35°18'	149°00'	Sept 79-June 80
EBR	Ebro/Tortosa, Spain	40°49'	00°30'	Sept 79
ESK	Eskadalemuir, UK	55°19'	-4°48'	Sept 79-June 80
FRD	Fredericksburg, VA, USA	38°12'	-78°38'	Nov 79-April 80
FUR	Fürstenfeldbrücke, DFR	48°10'	11°17'	Sept 79-April 80
GNA	Gnangara, Australia	31°47'	115°57'	Sept 79-June 80
GUA	Guam	13°35'	144°52'	Nov 79-April 80
HON	Honolulu, Hawaii,USA	21°19'	156°00'	Nov 79-April 80
HUA	Huancayo, S.A.	-12°03'	-112°40'	Sept 79-April 80
MBO	M'Bour, Africa	14°24'	-17°02'	Sept 79-May 80
NEW	Newport, Canada	48°16'	-118°53'	Nov 79-April 80
NKK	Novokazalinsk, Russia	45°46'	62°07'	Nov 79-June 80
PMG	Port Moresby,			
	New Guinea	09°24'	147°09'	Sept 79-May 80
PPT	Papeete, Tahiti	-17°33'	-150°23'	Sept 79-May 80
SIT	Sitka, Alaska	57°04'	-136°40'	Jan 80-June 80
SJG	San Juan, Puerto Rico	18°07'	-67°51'	Nov 79-April 80
SVE	Sverdlovsk, Russia	56°50'	60°38'	Nov 79-June 80

TOL	Toledo, Spain	39°53'	-5°57'	Sept 79-April 80
TUC	Tucson, AZ, USA	32°15'	-111°10'	Nov 79-April 80
VSS	Vassouras, Brazil	-22°24'	-44°21'	Sept 79-Dec. 79
				Feb 80-April 80

# WORLD IN GEOMAGNETIC COORDINATE, MERCATOR PROJECTION

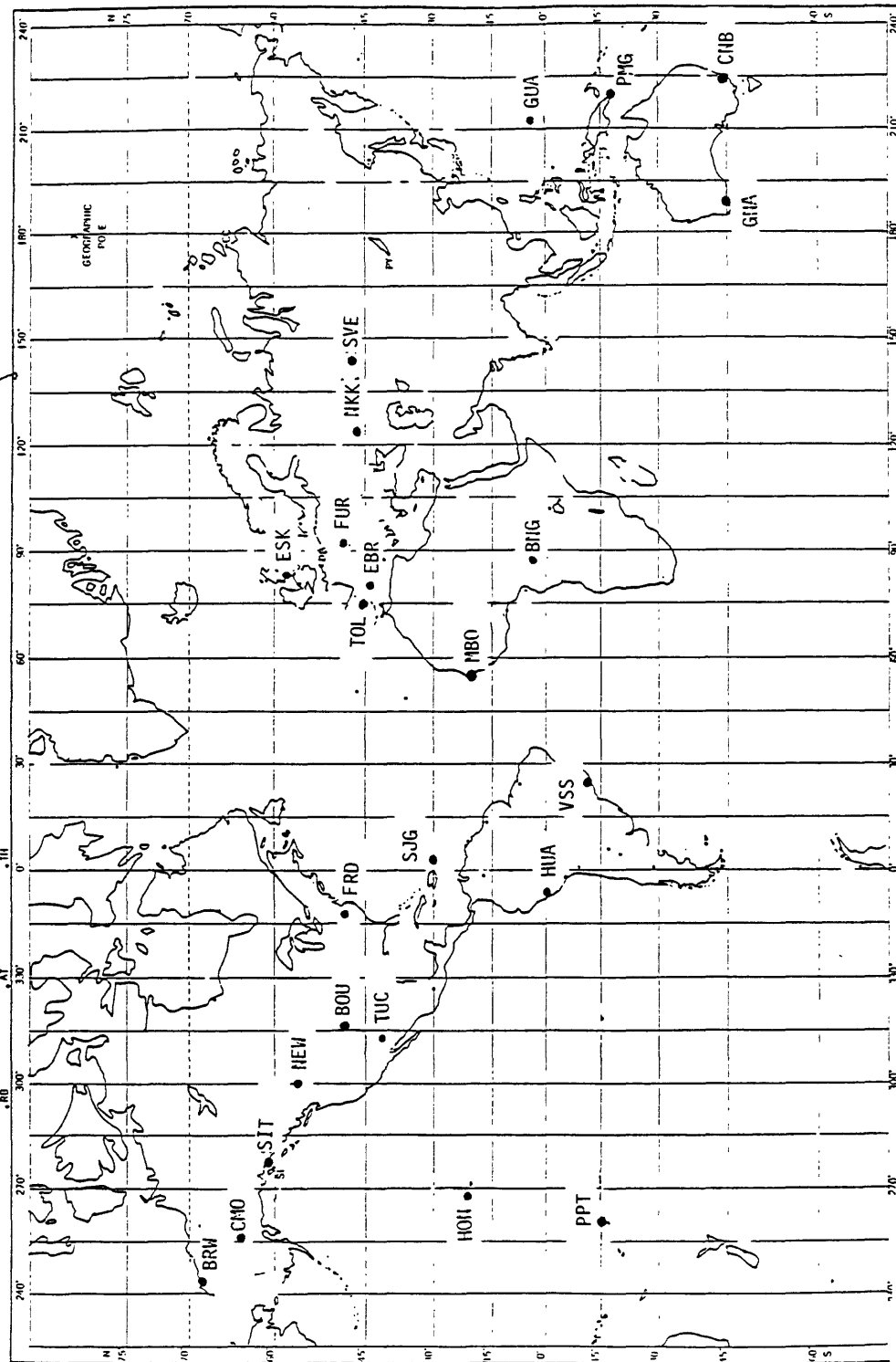
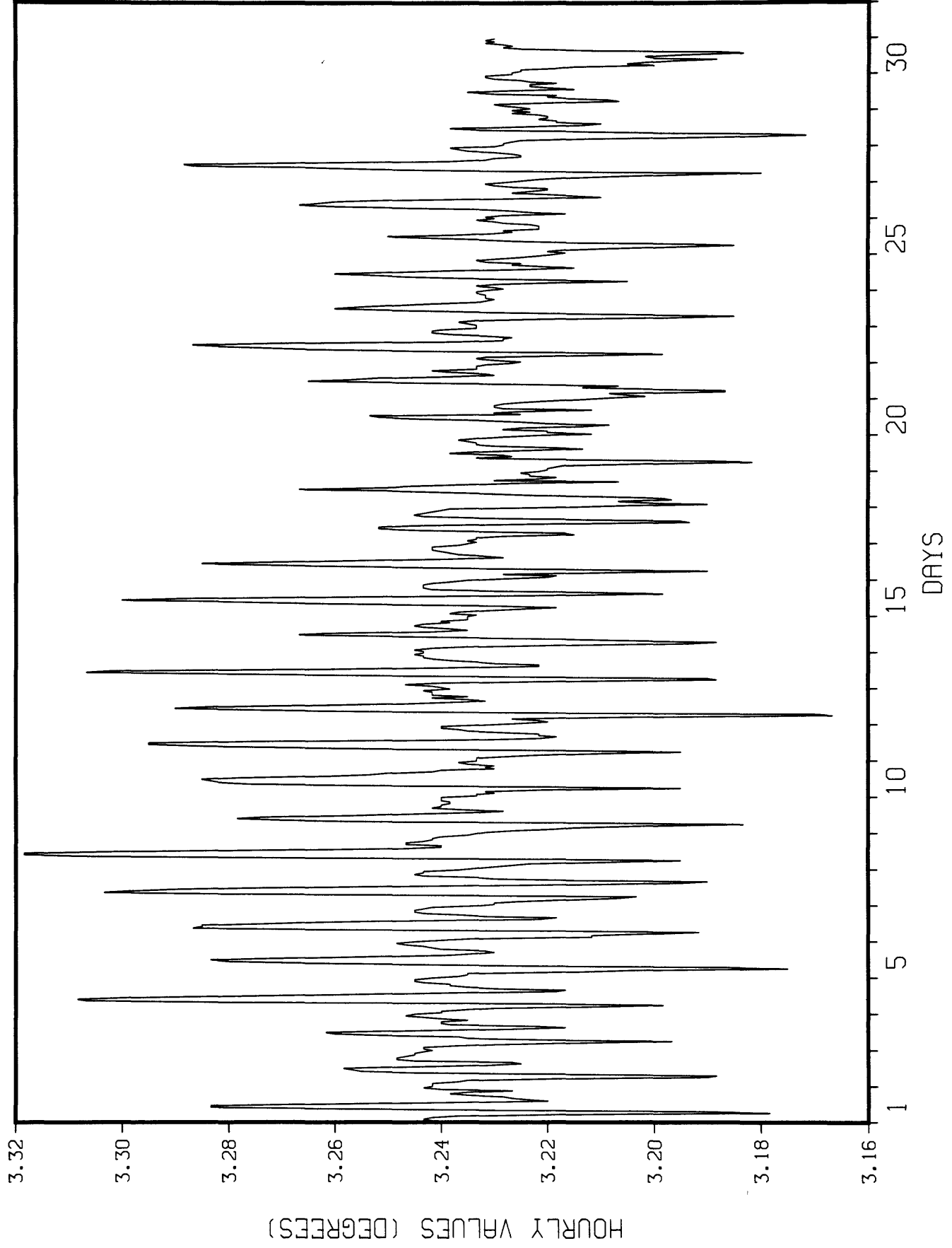


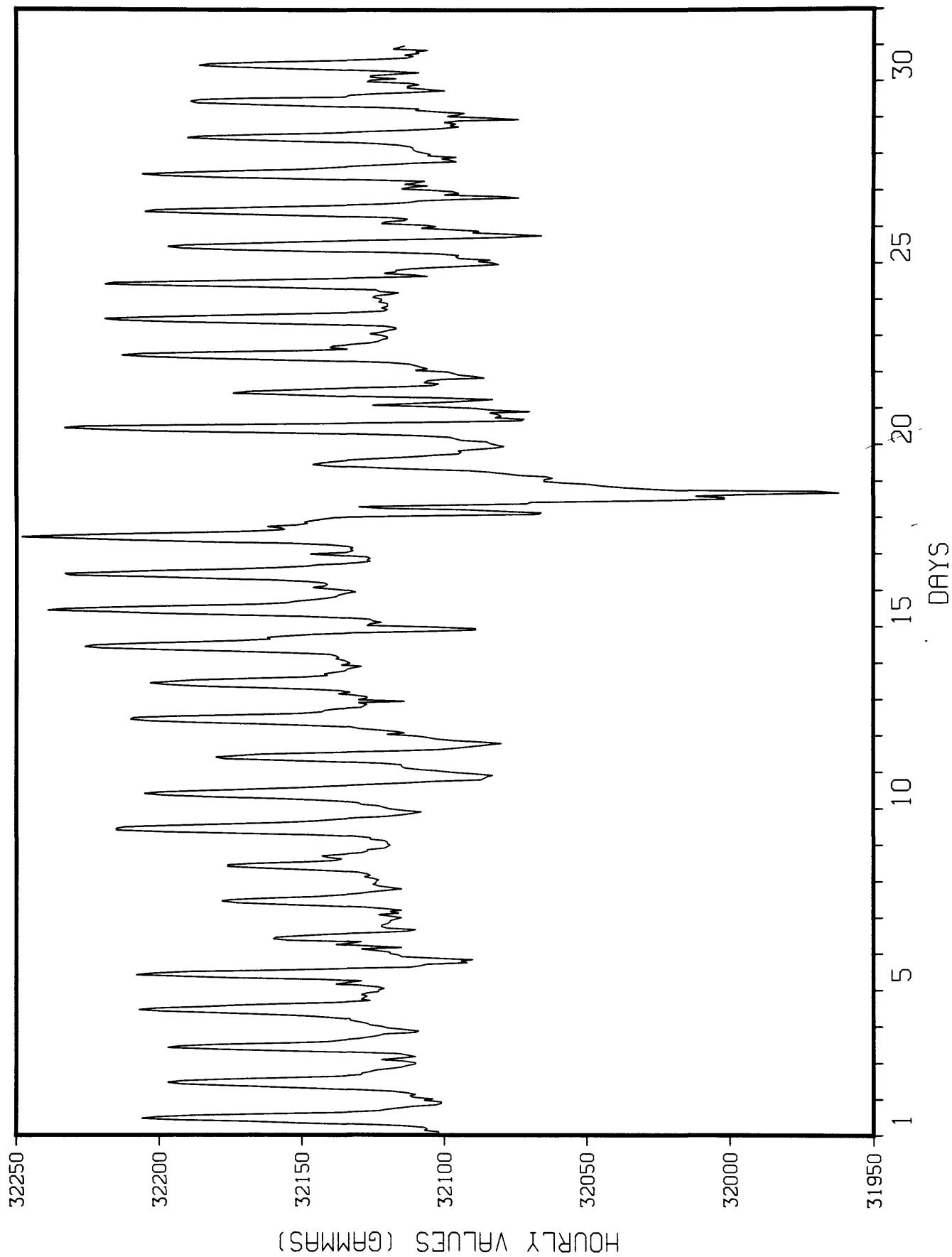
Figure 1. MAP Showing Locations of Observations for Magsat Period Hourly Data

# SEP 79 D BNG HOURLY VALUES

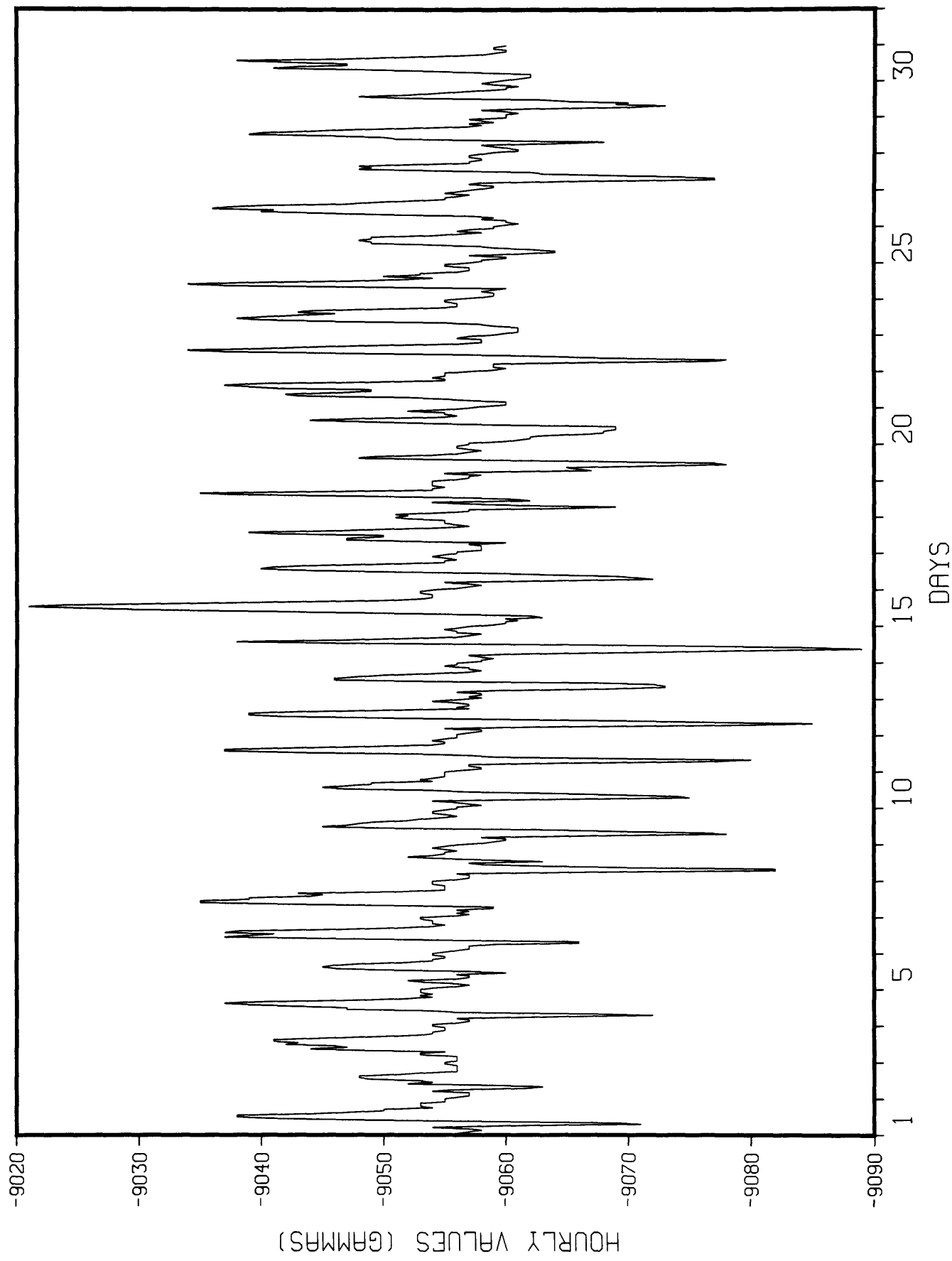




# SEP 79 H BNG HOURLY VALUES



# SEP 79 Z BNG HOURLY VALUES



The type of quality control used in the compilation of these data varied from the routine checking of data sequence (primarily for punched card input) to visual inspection of data for discontinuities on printout and plots such as given in this report.

Our objective here is to maintain the file in absolute form as well as possible. To this end tabular bases were used in the processing along with the calibration data as necessary, and tabular bases were carried along to the final form. However, due to the packing format, the tabular base used may or may not correspond to that of the original data. The data packing program used as its tabular base the nearest degree (if angular data) or nearest 100 nT (if force units) to the monthly average for that station element.

Specific problems that were noted and corrected for selected stations are as follows:

For stations Papeete (PPT) and Bangui (BNG) some data were received for the same months on more than one tape. In some cases it differed so that the most logical set of data (when compared to data already in the data file) was chosen. Now and then, on data received on cards there was an obvious typographical error, e.g.: values of 459 thru 475 would have a number of 2460 in the middle. This would be changed to 460.

It was also necessary in some cases to convert element numbers to element letters. 1=D, 2=F, 3=H, 4=I, 5=X, 6=Y, 7=Z (Ref. IAGA News #15 - Nov. 1976 - page 91).

#### Digital formats

The form used for storing the data is a CDC packed binary on 6250 bpi, 9-track, tape in internal CDC format. A "standard" IAGA format (see IAGA News, no. 15, pp. 89, November, 1976) is also used for distribution of data to non-CDC users. We have observed various slight differences in interpretation of the IAGA format in the data we have received, and thus detail in appendix B our version. This "standard" is essentially a 120 character format depicting one days data. For economy of storage these 120 character logical records are normally blocked by 20 for a 2400 character physical record (except that the last record of a file may range from 120 to 2400 in multiples of 120).

The CDC binary format is designed to allow an element-month to be a logical record regardless of whether it is hourly averages or minute values. The logic is that a header with the observatory code, year-1900, month, element code, and a tabular base is followed by an array containing 4 tabular values in integer form (15 bits) packed into each 60-bit CDC word. Thus the absolute value is given by either  $ITAB*100 + IHR$  in nanoteslas (for force measurements) or  $(ITAB*600 + IHR)/600$  in degrees of arc for angular measurements. The IHR are thus either the unpacked tabular values in integer nanoteslas or in units of 0.1 minutes of arc. The records are thus variable in length according to the number of days in a month. In both the CDC packed and IAGA form, the code "9999" is used to designate a missing value.

More details of these formats and others we have read are given in Appendix B.

#### Note to users

The data illustrated are available for Magsat or other users from USGS on a reciprocity basis or via the WDC-A (Ron Buhmann, 303-497-6128).

In the event specific errors are detected or other data become available, we would like to obtain copies of same to improve our file.

The plots herein may exhibit specific problems as noted in Appendix C. These are being investigated so that the data available at a given time may differ from those reported herein.

## Appendix A

COMPUTER PROGRAMS: listed on attached microfiche

CALIB	was used to calibrate data received uncalibrated. We were still using 7 packed word format at that time.
CALSCOB	scans header information and summarizes data - see Table 2.
DIGIT26	uses digital minute data picking off the hourly mean writing to a packed 6 word file.
NREAD	reads IAGA format ignoring daily mean and bad formats.
NREADTB	same as NREAD, but computes TAB BASE.
PDM7980	uses output from UNPKAUG to plot daily averages. Puts both years on one plot.
PHV	makes plots of hourly values
UNPACK	unpacks packed file and writes out in IAGA format (except that daily means are not computed on output, see Table 3.
UNPKAVG	unpacks data and computes daily mean

Table 2. Sample of output from CALSCOB

BNG	79	D	0	0	0	0	0	0	0	0	30	31	30	31
		H	0	0	0	0	0	0	0	0	30	31	30	31
		Z	0	0	0	0	0	0	0	0	30	31	30	31
BNG	80	D	31	29	31	30	31	0	0	0	0	0	0	0
		H	31	29	31	30	31	0	0	0	0	0	0	0
		Z	31	29	31	30	31	0	0	0	0	0	0	0
BOU	79	D	0	0	0	0	0	0	0	0	0	0	30	31
		H	0	0	0	0	0	0	0	0	0	0	30	31
		Z	0	0	0	0	0	0	0	0	0	0	30	31
BOU	80	D	31	29	31	30	31	30	0	0	0	0	0	0
		H	31	29	31	30	31	30	0	0	0	0	0	0
		Z	31	29	31	30	31	30	0	0	0	0	0	0
BRW	80	D	31	29	31	30	31	30	0	0	0	0	0	0
		H	31	29	31	30	31	30	0	0	0	0	0	0
		Z	31	29	31	30	31	30	0	0	0	0	0	0
CMO	79	D	0	0	0	0	0	0	0	0	0	0	30	31
		H	0	0	0	0	0	0	0	0	0	0	30	31
		Z	0	0	0	0	0	0	0	0	0	0	30	31
CMO	80	D	31	29	31	30	31	30	0	0	0	0	0	0
		H	31	29	31	30	31	30	0	0	0	0	0	0
		Z	31	29	31	30	31	30	0	0	0	0	0	0
CNB	79	D	0	0	0	0	0	0	0	0	30	31	30	30
		F	0	0	0	0	0	0	0	0	30	31	30	30
		I	0	0	0	0	0	0	0	0	30	31	30	30
CNB	80	D	31	29	31	30	31	30	0	0	0	0	0	0
		F	31	29	31	30	31	30	0	0	0	0	0	0
		I	31	29	31	30	31	30	0	0	0	0	0	0
EBR	79	D	0	0	0	0	0	0	0	0	30	0	0	0
		H	0	0	0	0	0	0	0	0	30	0	0	0
		Z	0	0	0	0	0	0	0	0	30	0	0	0
ESK	79	D	0	0	0	0	0	0	0	0	30	31	30	31
		H	0	0	0	0	0	0	0	0	30	31	30	31
		Z	0	0	0	0	0	0	0	0	30	31	30	31
ESK	80	D	31	29	31	30	31	30	0	0	0	0	0	0
		H	31	29	31	30	31	30	0	0	0	0	0	0
		Z	31	29	31	30	31	30	0	0	0	0	0	0
FRD	79	D	0	0	0	0	0	0	0	0	0	0	30	31
		H	0	0	0	0	0	0	0	0	0	0	30	31
		Z	0	0	0	0	0	0	0	0	0	0	30	31
FRD	80	D	31	29	31	30	0	0	0	0	0	0	0	0
		H	31	29	31	30	0	0	0	0	0	0	0	0
		Z	31	29	31	30	0	0	0	0	0	0	0	0
FUR	79	D	0	0	0	0	0	0	0	0	30	31	30	31
		H	0	0	0	0	0	0	0	0	30	31	30	31
		Z	0	0	0	0	0	0	0	0	30	31	30	31

TABLE 3. ONE ELEMENT MONTH - OUR FORMAT

BNG79 9D 1	3	145	146	145	142	130	107	114	138	158	170	170	158	143	132	134	136	137	141	143	141	136	144	146	145
BNG79 9D 2	3	145	145	142	141	131	114	113	130	147	153	154	155	147	139	135	136	147	149	149	148	147	147	146	145
BNG79 9D 3	3	146	146	142	137	127	118	132	141	142	151	156	157	147	137	130	133	143	144	144	141	144	146	148	147
BNG79 9D 4	3	144	144	141	138	126	119	133	168	184	185	179	167	156	144	131	130	138	141	143	143	146	147	147	145
BNG79 9D 5	3	142	141	141	129	122	105	112	134	149	160	168	170	163	152	143	140	138	139	144	145	146	148	149	147
BNG79 9D 6	3	144	140	127	127	121	115	128	156	172	171	171	163	158	146	133	131	139	142	146	147	147	146	145	140
BNG79 9D 7	3	138	138	135	129	124	122	143	171	182	179	174	165	148	129	117	114	129	138	140	146	147	146	146	142
BNG79 9D 8	3	140	138	136	134	125	117	130	163	184	191	191	182	164	149	144	144	148	148	146	145	145	144	141	140
BNG79 9D 9	3	139	136	131	129	121	110	127	153	162	167	164	154	148	140	137	142	145	144	144	143	143	144	144	144
BNG79 9D10	3	140	140	138	139	132	117	132	154	166	169	170	171	167	157	152	150	145	144	138	139	138	141	142	140
BNG79 9D11	3	140	140	137	133	126	117	128	149	162	172	177	177	165	141	133	131	133	133	137	141	142	144	144	139
BNG79 9D12	3	135	132	133	136	125	100	102	132	153	165	174	170	157	148	142	139	141	145	141	145	145	145	146	143
BNG79 9D13	3	144	145	148	144	132	113	114	134	152	168	184	181	159	145	133	133	138	140	143	145	146	146	147	146
BNG79 9D14	3	146	147	145	141	130	116	113	122	129	140	149	160	157	145	141	143	146	147	146	143	144	141	141	141
BNG79 9D15	3	140	143	142	139	135	131	137	150	162	169	180	173	155	133	119	126	138	145	146	146	146	145	143	141
BNG79 9D16	3	137	132	131	137	125	114	127	142	153	163	171	163	153	143	137	139	142	143	144	145	145	145	142	141
BNG79 9D17	3	140	141	140	140	137	129	130	138	147	151	151	147	132	116	117	129	140	146	147	146	145	144	143	131
BNG79 9D18	3	124	114	121	124	118	119	125	134	138	144	150	160	150	148	141	136	124	138	133	131	134	134	135	133
BNG79 9D19	3	132	132	131	130	121	109	114	130	140	136	137	143	140	135	128	132	138	140	140	141	142	140	137	133
BNG79 9D20	3	127	132	132	137	135	128	125	132	135	139	147	151	152	135	138	135	127	137	138	138	137	135	132	128
BNG79 9D21	3	125	121	123	125	112	112	121	128	124	133	148	159	154	151	143	138	139	143	145	140	140	140	139	136
BNG79 9D22	3	135	138	140	139	129	119	127	147	159	164	169	172	162	142	137	137	136	139	143	145	145	144	140	140
BNG79 9D23	3	140	141	142	140	133	118	111	121	133	143	151	156	153	149	145	140	139	138	139	139	140	140	139	139
BNG79 9D24	3	137	138	140	138	131	123	132	142	148	152	156	149	143	134	129	133	136	135	139	140	138	135	133	131
BNG79 9D25	3	130	132	130	125	118	111	116	130	136	140	145	150	142	138	136	137	133	133	133	134	137	138	140	138
BNG79 9D26	3	139	137	130	134	136	139	148	156	160	158	156	150	138	126	129	132	136	134	132	132	136	138	139	137
BNG79 9D27	3	135	133	130	124	117	108	127	143	153	159	172	173	159	143	139	138	135	135	136	138	141	142	143	138
BNG79 9D28	3	137	137	136	135	128	112	103	107	120	129	140	143	135	128	126	131	131	133	132	132	133	136	134	136
BNG79 9D29	3	134	135	137	138	131	124	125	130	132	131	138	141	137	129	132	134	131	134	131	134	135	138	139	136
BNG79 9D30	3	136	135	135	131	129	120	123	121	118	113	120	121	117	110	113	127	135	137	136	137	139	138	139	138

[BANGUI - NO DAILY MEANS INCLUDED. WOULD BE NEXT 4 SPACES AFTER LAST COLUMN OF NUMBERS.]

## Appendix B

CDC Binary Format

Format of Hourly Tape Records (modified IAGA/)

Format of the Digital Tape Record as received from the U.S.G.S.

Format of Card Records as received from NOAA.



## Appendix B

### DIGITAL FORMATS

#### CDC Binary (60 bit words):

The final binary CDC format is illustrated best by the following FORTRAN statements that are used to read the data:

```
DIMENSION IVAR(24,31) IPAHR(6,31)
```

where:      IVAR            = one element month of data 24 hourly values for  
                                 a maximum of 31 days per month.

            IPAHR        = one element month of data packed into 6 CDC words  
                                 per day for a maximum of 31 days per month.

```
READ (1)OB, IYR, MO, IE, KK, JJD4, ITAB, ((IPAHR(i,j), i = 1, jjd4), j = 1,  
kk))
```

where:      OB            = observatory code  
            iyr           = year  
            mo            = month  
            ie            = element  
            kk            = days in month  
            jjd4          = 6 data are packed in 6 words  
            itab          = tabular base  
            Ipahr        = packed data  
                            i = 6 words per day  
                            j = max. 31 days per ele. mo.

The unit of data thus becomes an observatory element-month, with 4-hours of data packed into one CDC 60-bit word, or one (integer) tabular value per 15 bits. The pack and unpack programs are listed in Appendix A. Missing values are indicated by tabular values of 9999. Thus if IHR is the unpacked tabular value for a given hour, the absolute value is

$HR = ITAB*100 + IHR$  for H, X, Y, Z or F in nT.

or

$HR = (ITAB*600 + IHR)/600.$  for D and I in degrees.

The records are variable length and range from 175 to 193 words per element month. This format has been found useful since it occupies about half the disc or tape space of the standard IAGA format, yet it is easy to manipulate, unpack and scan for summaries. It can also be used to pack other sample rates (e.g. minute values) by altering JJD4.

#### IAGA

The standard IAGA format (IAGA News #15 November 1976) page 89 can also be output on tape in several densities and codes (9-track ASCII, EBCDIC or 7-track BCD). An example of the IAGA format is seen in Table 4. Note that the

TABLE 4. ONE ELEMENT MONTH - IAGA FORMAT

BNG79 9D 1	3	145	146	145	142	130	107	114	138	158	170	170	158	143	132	134	136	137	141	143	141	136	144	146	145	141
BNG79 9D 2	3	145	145	142	141	131	114	113	130	147	153	154	155	147	139	135	136	147	149	149	148	147	147	146	145	141
BNG79 9D 3	3	146	146	142	137	127	118	132	141	142	151	156	157	147	137	130	133	143	144	144	141	144	146	148	147	141
BNG79 9D 4	3	144	144	141	138	126	119	133	168	184	185	179	167	156	144	131	130	138	141	143	143	146	147	147	145	147
BNG79 9D 5	3	142	141	141	129	122	105	112	134	149	160	168	170	163	152	143	140	138	139	144	145	146	148	149	147	142
BNG79 9D 6	3	144	140	127	127	121	115	128	156	172	171	171	163	158	146	133	131	139	142	146	147	147	146	145	140	143
BNG79 9D 7	3	138	138	135	129	124	122	143	171	182	179	174	165	148	129	117	114	129	138	140	146	147	146	146	142	143
BNG79 9D 8	3	140	138	136	134	125	117	130	163	184	191	191	182	164	149	144	144	148	148	146	145	145	144	141	140	149
BNG79 9D 9	3	139	136	131	129	121	110	127	153	162	167	164	154	148	140	137	142	145	144	144	143	143	144	144	144	142
BNG79 9D10	3	140	140	138	139	132	117	132	154	166	169	170	171	167	157	152	150	145	144	138	139	138	141	142	140	146
BNG79 9D11	3	140	140	137	133	126	117	128	149	162	172	177	177	165	141	133	131	133	133	137	141	142	144	144	139	143
BNG79 9D12	3	135	132	133	136	125	100	102	132	153	165	174	170	157	148	142	139	141	145	141	145	145	145	146	143	141
BNG79 9D13	3	144	145	148	144	132	113	114	134	152	168	184	181	159	145	133	133	138	140	143	145	146	146	147	146	145
BNG79 9D14	3	146	147	145	141	130	116	113	122	129	140	149	160	157	145	141	143	146	147	146	143	144	141	141	141	140
BNG79 9D15	3	140	143	142	139	135	131	137	150	162	169	180	173	155	133	119	126	138	145	146	146	146	145	143	141	145
BNG79 9D16	3	137	132	131	137	125	114	127	142	153	163	171	163	153	143	137	139	142	143	144	145	145	145	142	141	142
BNG79 9D17	3	140	141	140	140	137	129	130	138	147	151	151	147	132	116	117	129	140	146	147	146	145	144	143	131	138
BNG79 9D18	3	124	114	121	124	118	119	125	134	138	144	150	160	150	148	141	136	124	138	133	131	134	134	135	133	133
BNG79 9D19	3	132	132	131	130	121	109	114	130	140	136	137	143	140	135	128	132	138	140	140	141	142	140	137	133	133
BNG79 9D20	3	127	132	132	137	135	128	125	132	135	139	147	151	152	135	138	135	127	137	138	138	137	135	132	128	135
BNG79 9D21	3	125	121	123	125	112	112	121	128	124	133	148	159	154	151	143	138	139	143	145	140	140	140	139	136	134
BNG79 9D22	3	135	138	140	139	129	119	127	147	159	164	169	172	162	142	137	137	136	139	143	145	145	144	140	140	143
BNG79 9D23	3	140	141	142	140	133	118	111	121	133	143	151	156	153	149	145	140	139	138	139	139	139	140	140	139	138
BNG79 9D24	3	137	138	140	138	131	123	132	142	148	152	156	149	143	134	129	133	136	135	139	140	138	135	133	131	138
BNG79 9D25	3	130	132	130	125	118	111	116	130	136	140	145	150	142	138	136	137	133	133	133	134	137	138	140	138	133
BNG79 9D26	3	139	137	130	134	136	139	148	156	160	158	156	150	138	126	129	132	136	134	132	132	136	138	139	137	139
BNG79 9D27	3	135	133	130	124	117	108	127	143	153	159	172	173	159	143	139	138	135	135	136	138	141	142	143	138	140
BNG79 9D28	3	137	137	136	135	128	112	103	107	120	129	140	143	135	128	126	131	131	133	132	132	133	136	134	136	129
BNG79 9D29	3	134	135	137	138	131	124	125	130	132	131	138	141	137	129	132	134	134	131	134	135	138	139	139	136	133
BNG79 9D30	3	136	135	135	131	129	120	123	121	118	113	120	121	117	110	113	127	135	137	136	137	139	138	139	138	127

[BANGUI - LAST COLUMN CONTAINS DAILY MEANS]

example includes the daily mean, although we do not read or store that value in our packed files.

#### Position

1-3	Observatory mnemonic code (IAGA News Bulletin No. 32h Geomagnetic Data 1977
4-5	Year-1900; i.e., 71
6-7	Month: 01 to 12
8	Element: D, H, F, X, Y, or Z
9-10	Day: 01-31
11-16	Arbitrary
17-20	Tabular base in degrees for D, or in hundreds of gammas for the intensity elements
21-116	Twenty-four values
117-120	Daily mean value

The 26 values in positions 17-120 will have the range -999 to 9998. The tabular base is adjusted to avoid a four-digit negative number in positions 21-116. A missing value is identified by a 9999 data group. A 9999 may appear in position 117-120 (daily mean) when there are one or more missing hourly values for the day. Negative signs may appear in the first, second or third position in any data group. For example, -001, b-01, or bb-1 may appear on tapes.

The records are sequenced according to observatory mnemonic, year, month, element, hour.

The following Fortran statements are an example of how these records may be read:

```
      READ (m,n) OB, IYR, MO, E, iday, (IVALS(I), I = 1, 26)
      n FORMAT (A3, 2I2, A1, I2, 6X, 26I4)
```

To conserve tape storage, the records are blocked 20 (the last block may have fewer than 20 records). The last block is followed by at least one tape mark.

#### USGS minute values

The magnetic tape is unlabeled, 9 track, 800 bpi, EBCDIC, with blocksize of 4800 characters.

Each block contains 12 logical records with the following format: North polar distance, longitude, year, month, day, element, hour, observatory, blank spaces, sixty data values, and an hourly mean as shown below.

NPD	Long	Yr	Mo	Da	E	Hr	Obs	blanks
1-6	7-12	13-14	15-16	17-18	19	20-21	22-23	24-34

Data-1	Data-60	hr mean
35-40	389-394	395-400

NPD is the observatory North polar distance ( $0^{\circ}$ - $180^{\circ}$ ) from the North Geographic pole in hundredths of a degree and is allotted 6 characters.

Long is the geographic longitude ( $0^{\circ}$ - $360^{\circ}$ ) measured East from Greenwich in hundredths of a degree and also has a 6-character field.

Yr, Mo, and Da are each two-digit numbers giving the date.

E is the element symbol D, H, Z or F designating magnetic field components Declination, Horizontal, Vertical or Total Intensity respectively.

HR is a two-digit number indicating the hours of the day, i.e., 00, 01, 23

Obs is the observatory two letter code (not IAGA code).

Blanks are 11 character spaces left empty for future additions.

Data 1-60 are one-minute values of the given element for that data hour, either in tenths of millivolts or to the nearest gamma for H, Z, and F and to the nearest 1/10 minute for D, each in a 6-character field.

HR-Mean is the average of the preceding 60 one-minute values.

Each element value will be given in a six-digit field including a minus sign for negative values and blank for positive values.

Missing data value spaces will be padded with 99999.

Cards as received from NOAA

Columns 1-3	Observatory Name
4-5	Year
6-7	Month (Zero fill to left)
8	Element
9	Card Number (1 = first 12 hours, 2 = second 12 Hours)
10-11	Day (Zero fill to left)
12-20	Blank
21-68	Ordinate Value (Four columns for each hour, BLANK Fill to left, minus signs in the first high order position, if no value appears for hour leave blank, zero is a value) CARD #2 ONLY

Columns 69-74 Sum, blank fill to left, minus signs in the high order position, if no value leave blank)

## Appendix C

### DAILY MEANS PLOTS

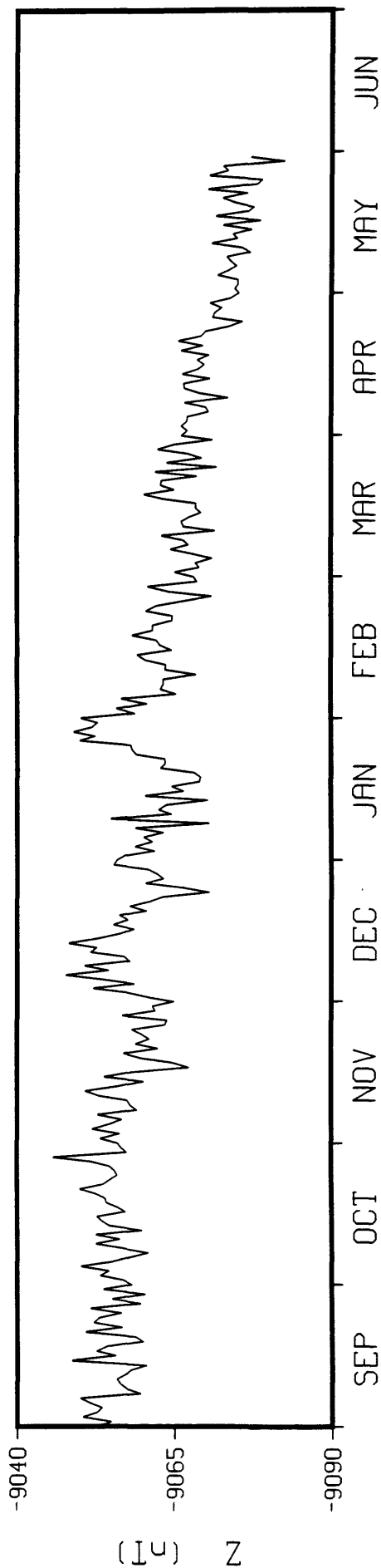
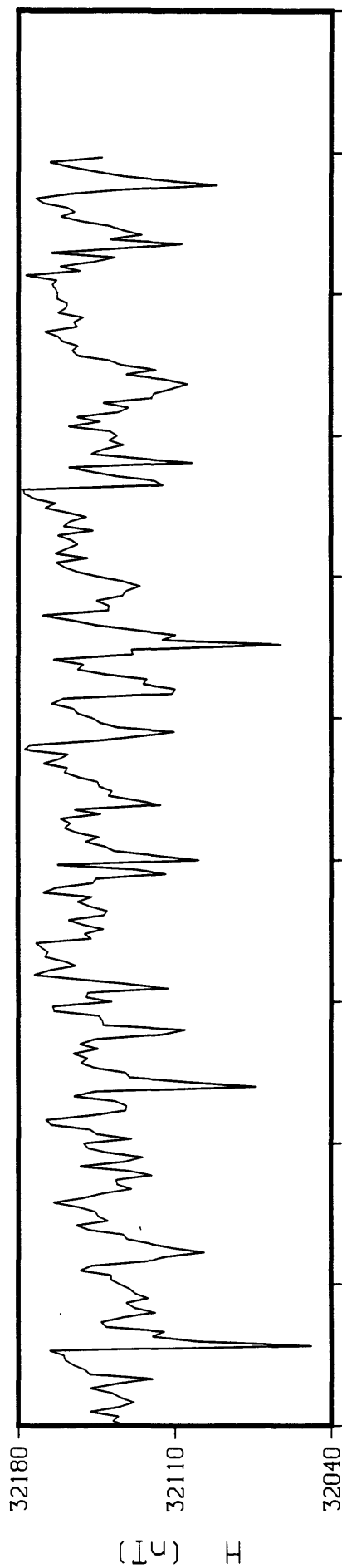
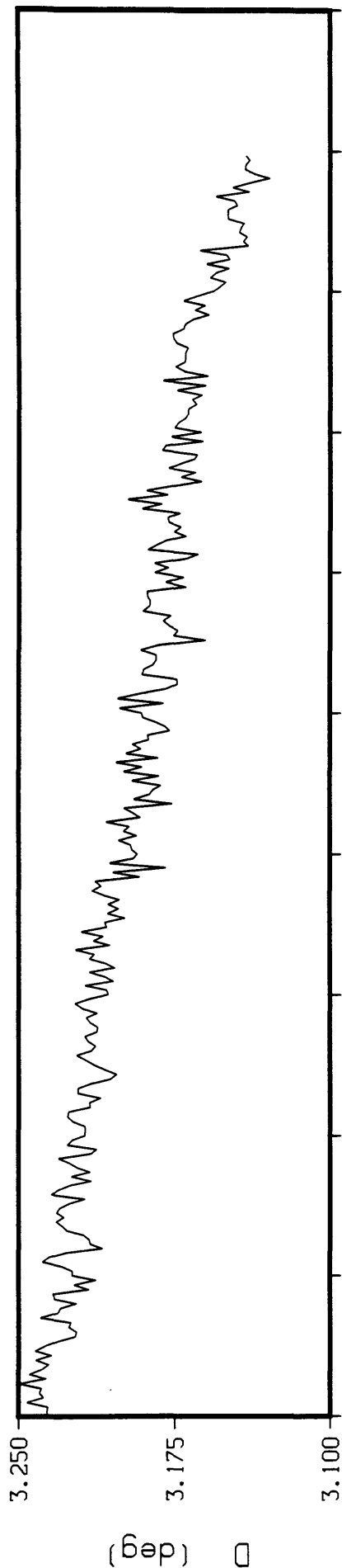
Attached are plots of the daily means computed from the hourly values for each observatory. The scale in either nanotesla or degrees of arc are noted on the ordinates, the station code is given at the top (see Table 1 in the main body of the report), and the year and month is at the bottom.

Missing data are indicated by breaks in the plots with the exception of VSS where a straight line connects the last point for 1979 with the first for 1980.

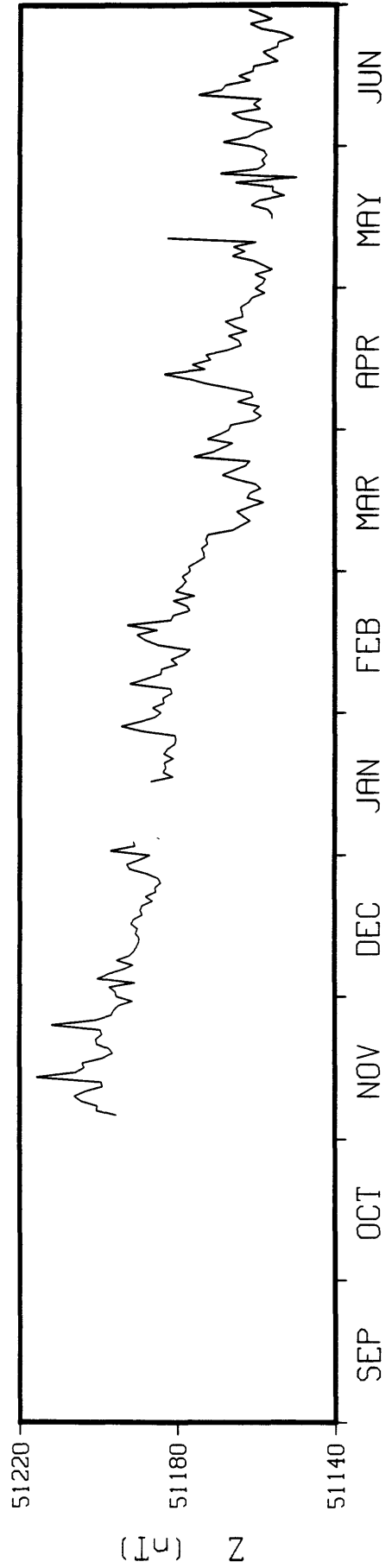
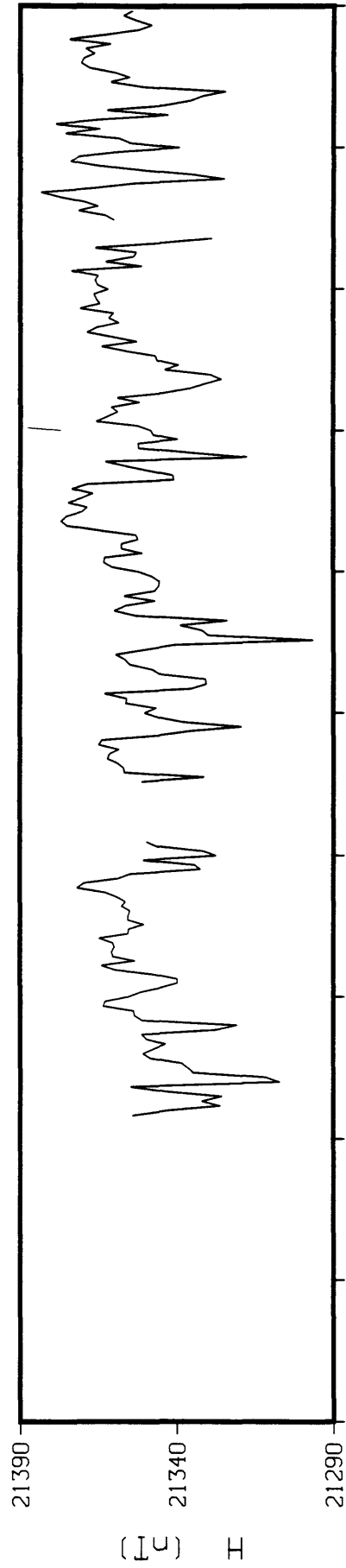
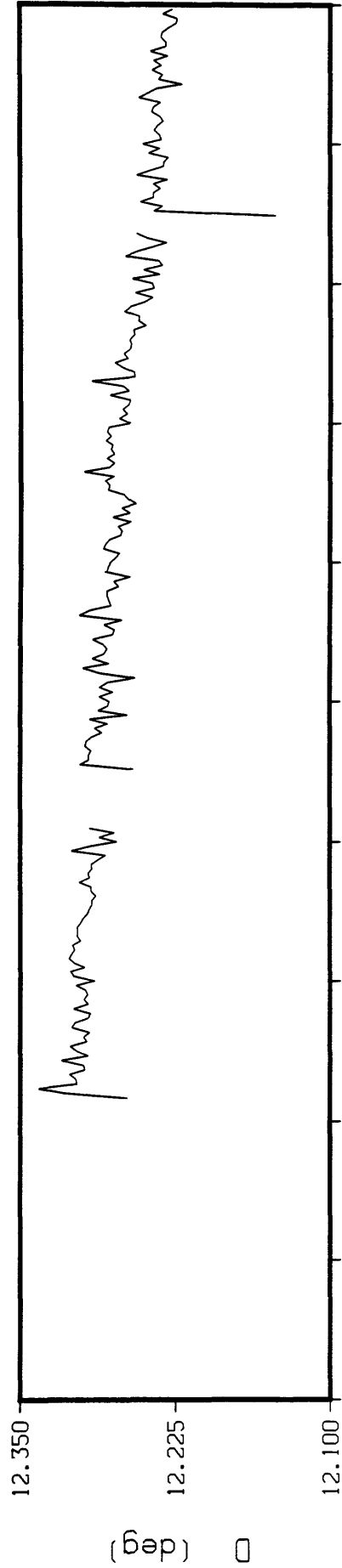
Obvious or suspected errors that are under investigation include:

BOU:	D spike in mid May 1980
BRW:	D spike in mid June 1980
CNB:	D spike in mid Feb 1980
ESK:	Z spike in late April 1980
GNA:	Z displacement of Jan 1980
HON:	H spike Dec 79 and D spikes in early Mar 1980
HUA:	Z spike late April 1980
NKK:	various spikes in all components
SVE:	H, Z displacements in Dec. 1979
TOL:	D, Z displacements in Mar 1980
VSS:	Z displacement in Dec 1979

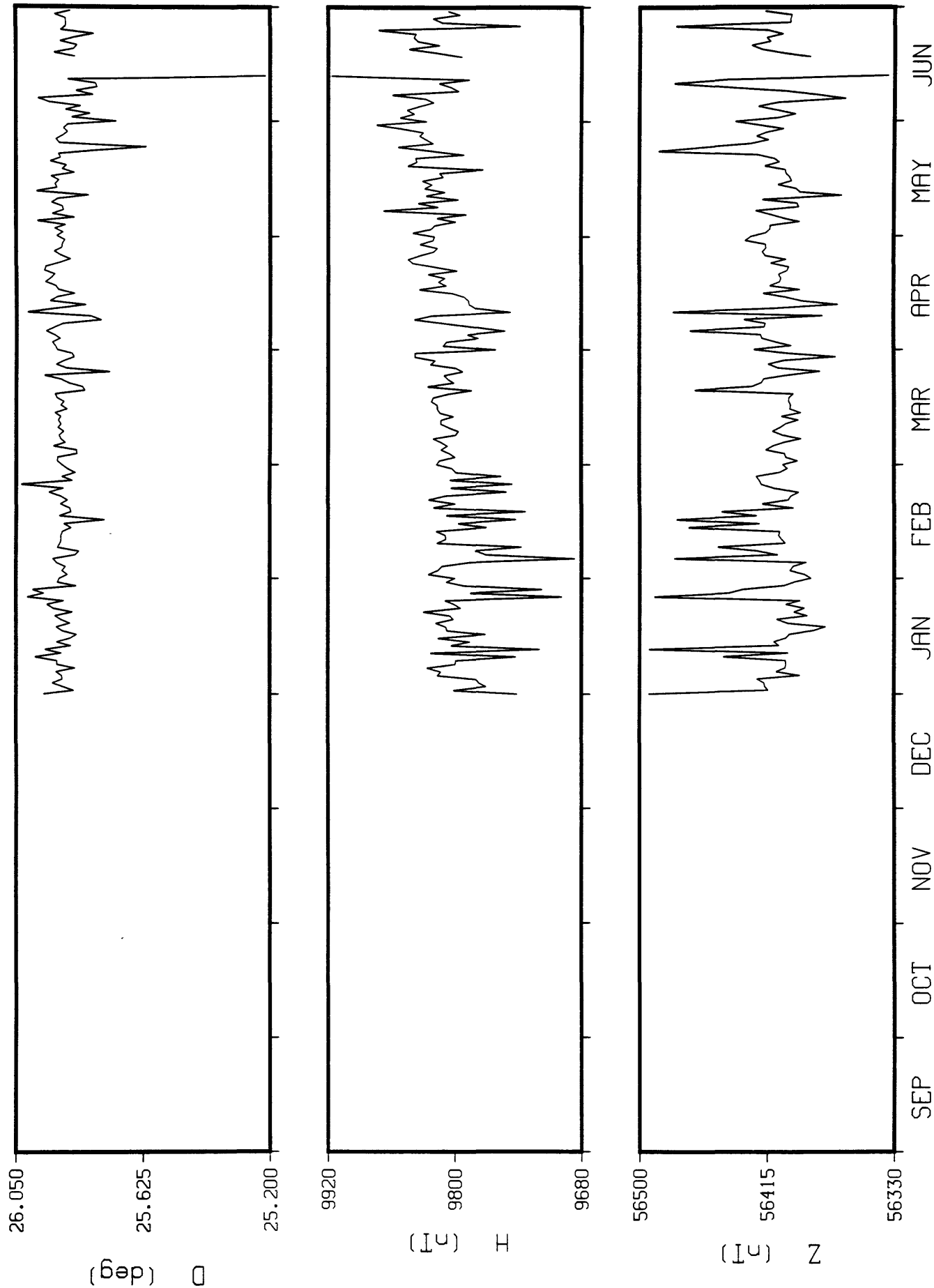
# 1979-1980 BNG DAILY MEANS



# 1979-1980 BOU DAILY MEANS

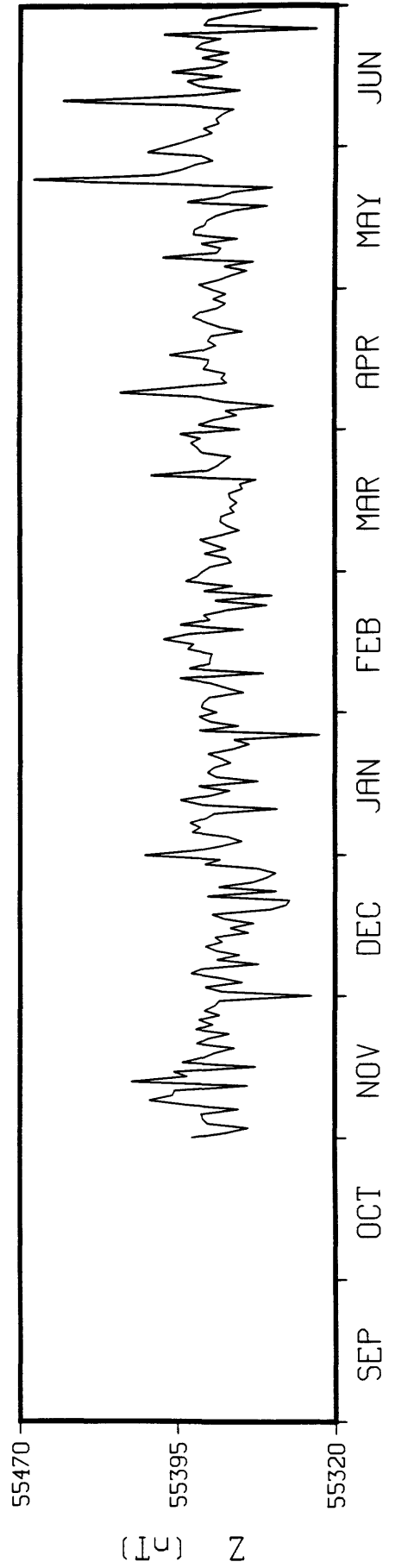
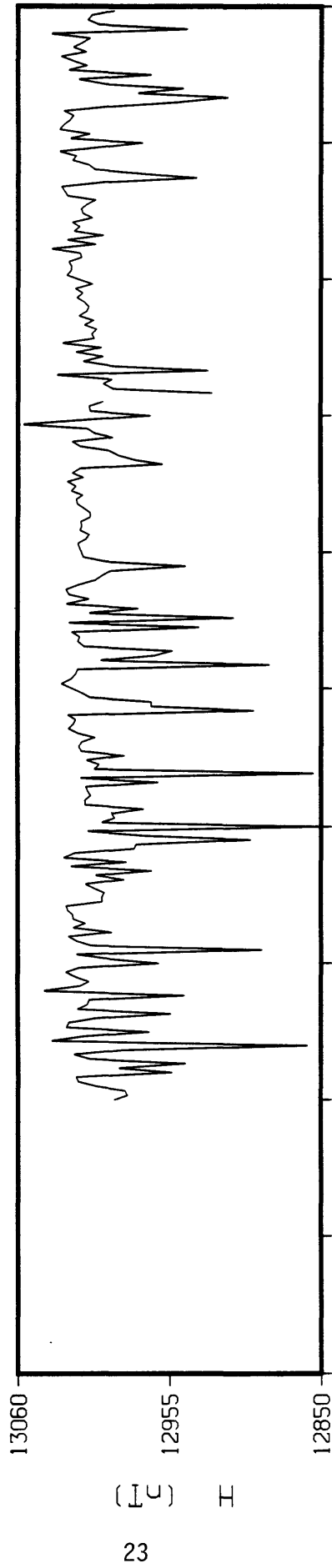
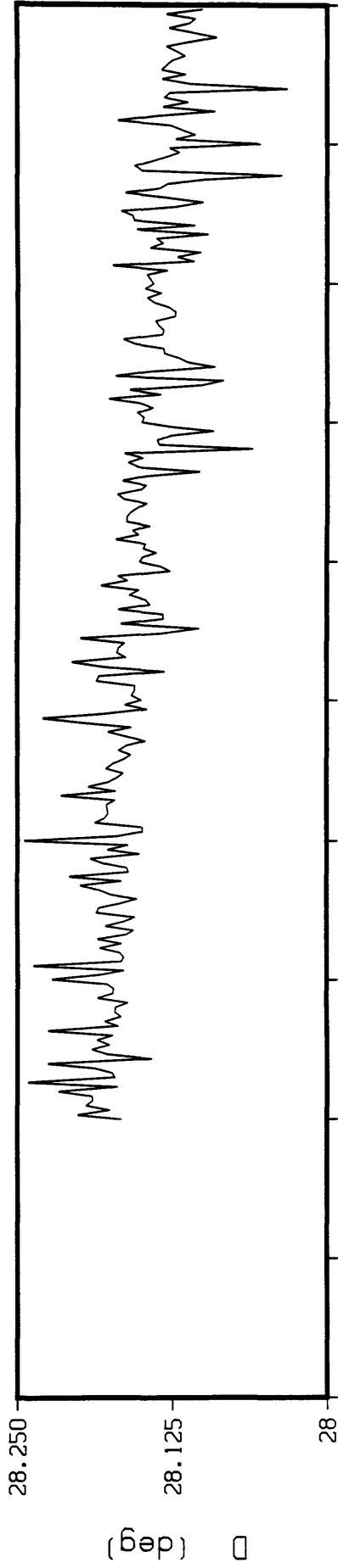


# 1979-1980 BRW DAILY MEANS

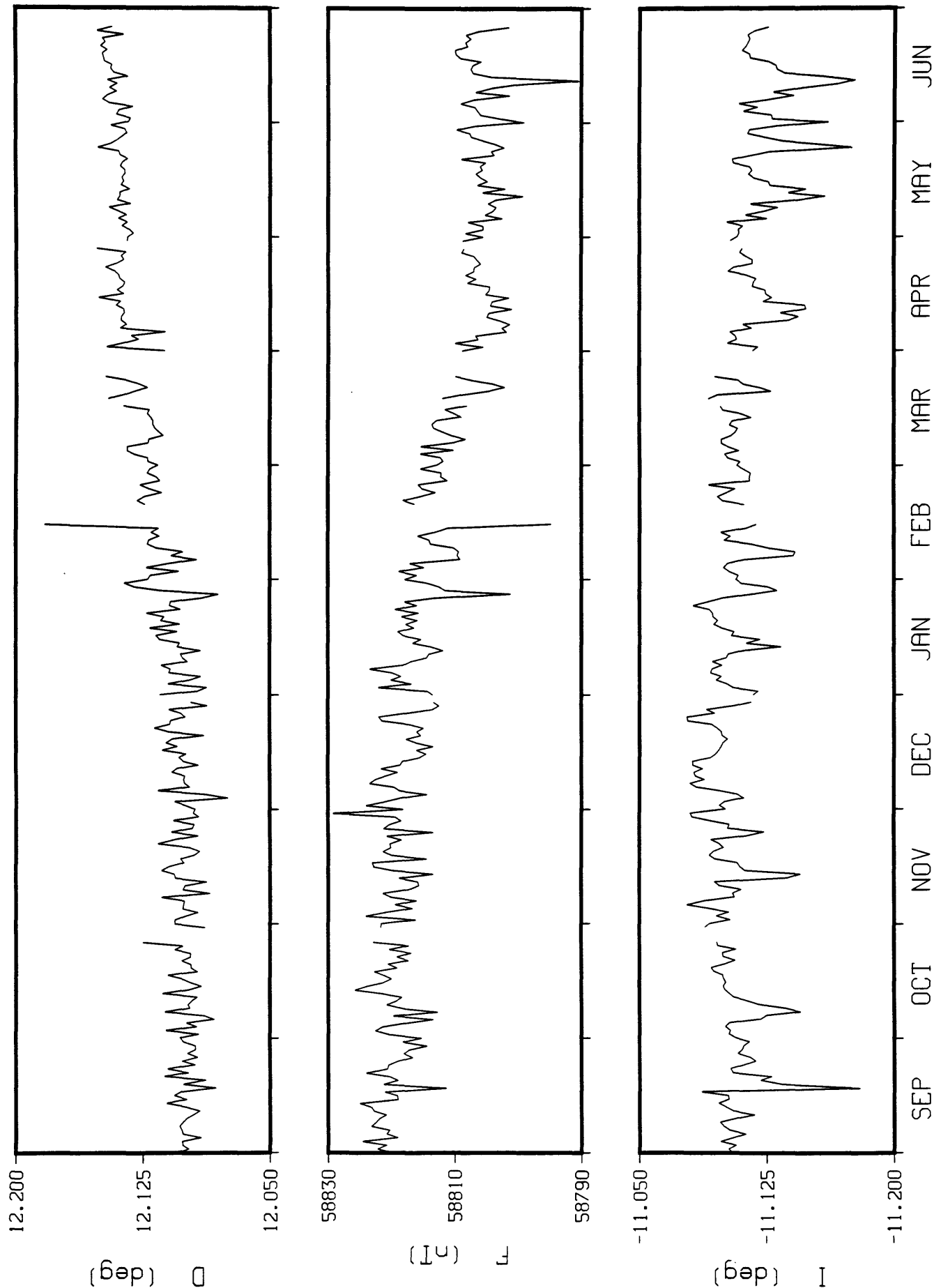




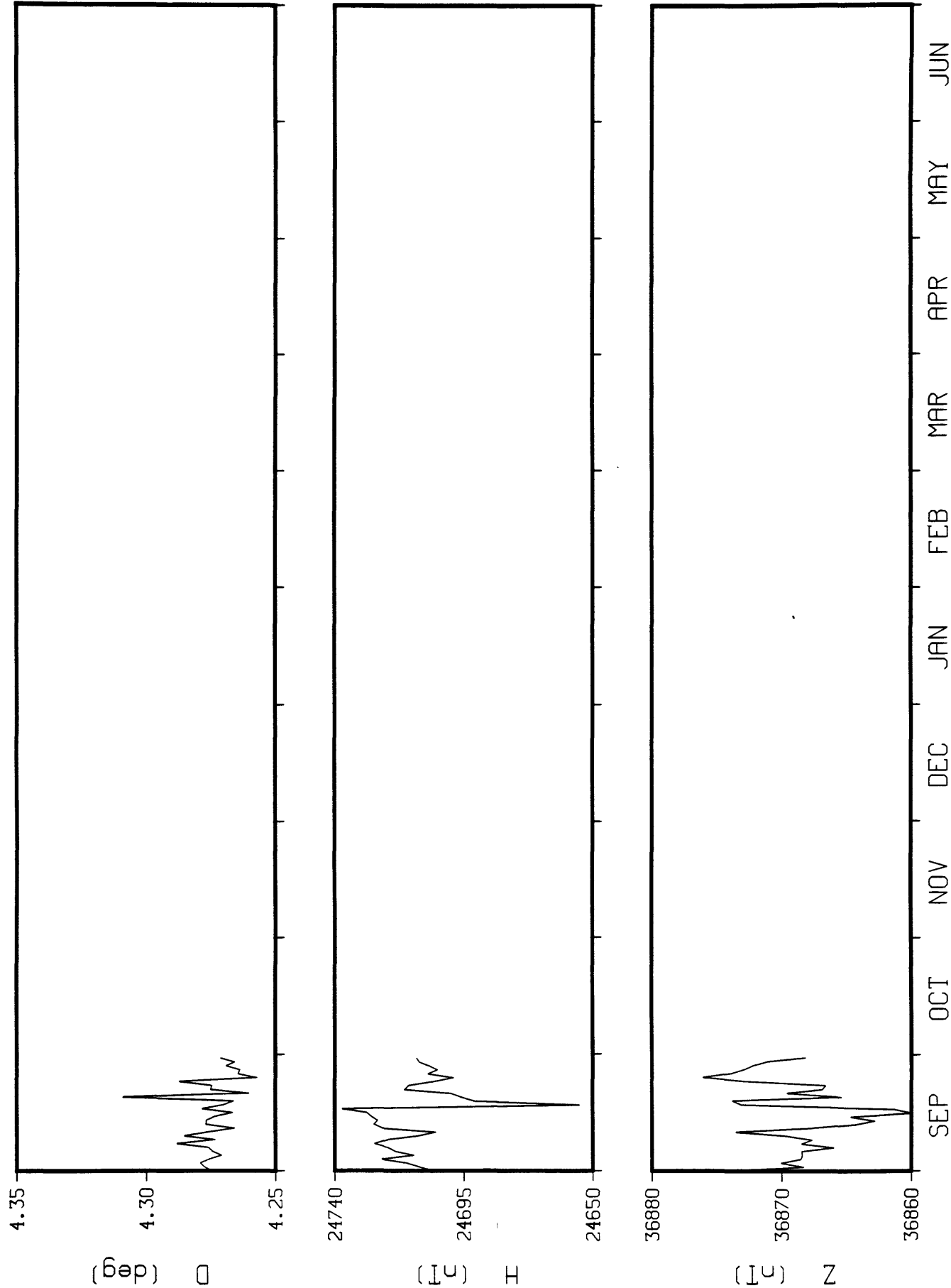
# 1979-1980 CMO DAILY MEANS



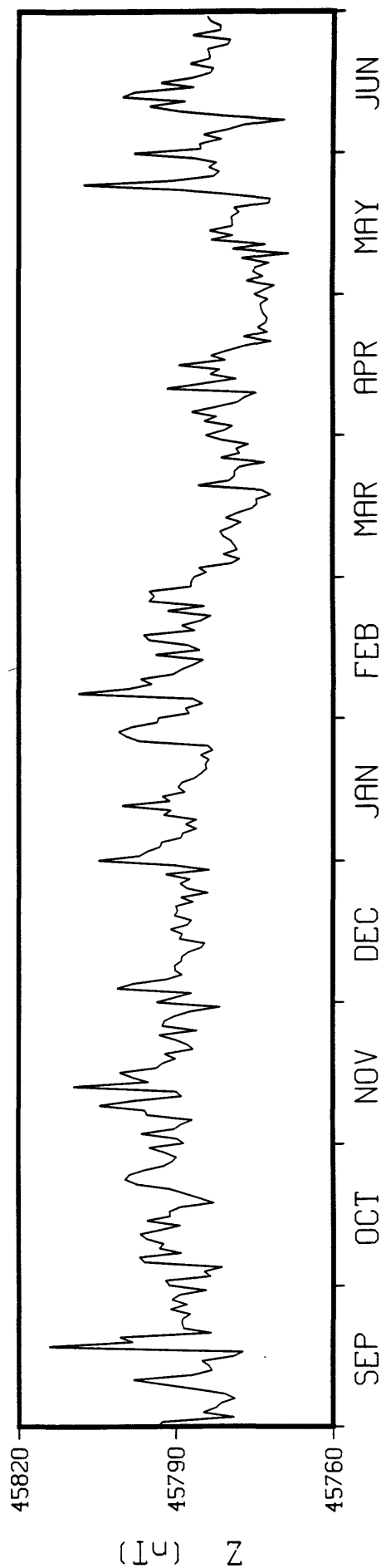
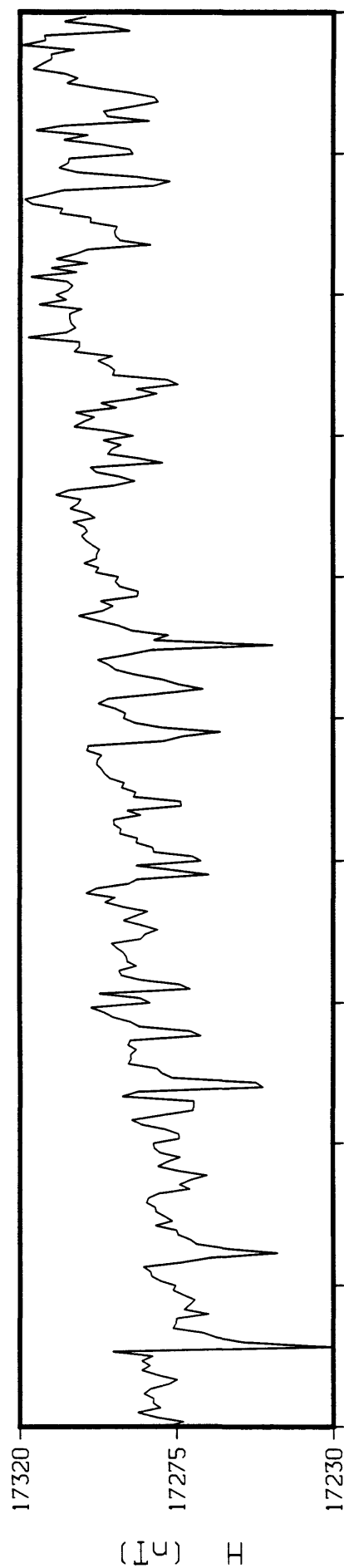
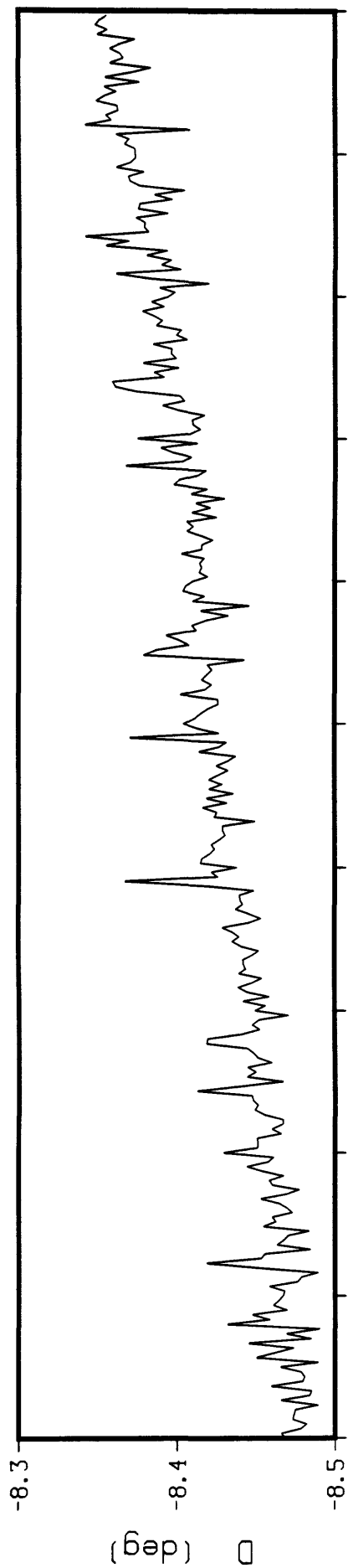
# 1979-1980 CNB DAILY MEANS



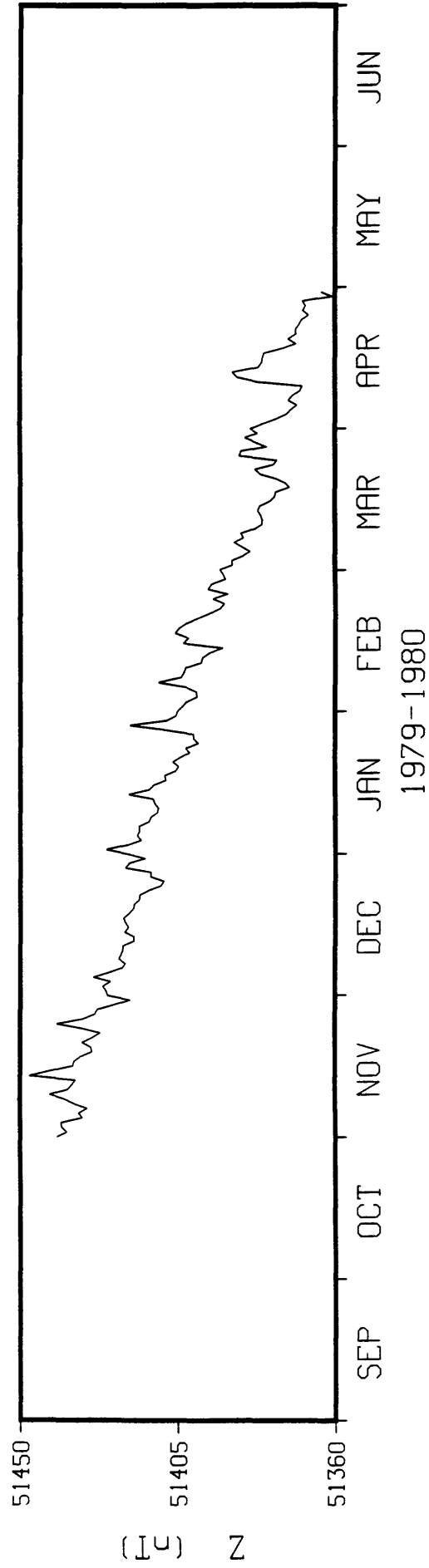
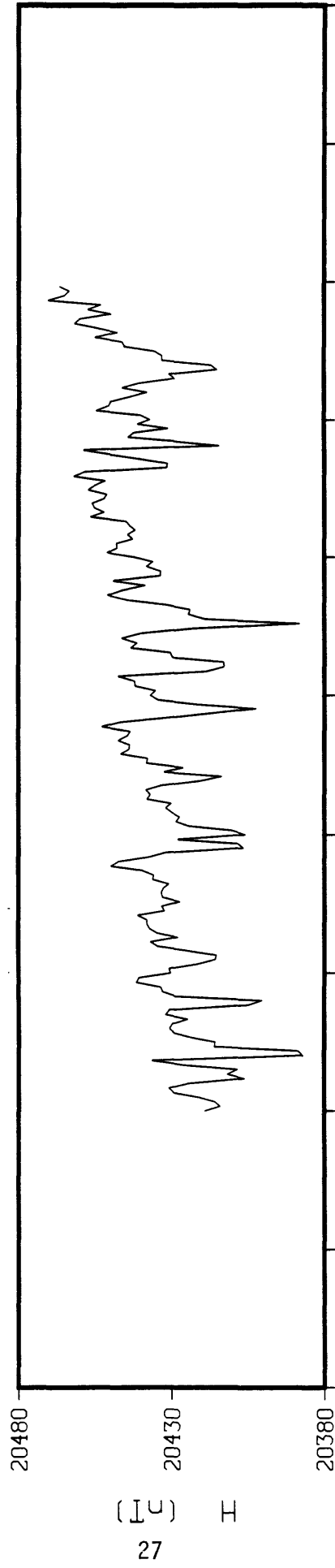
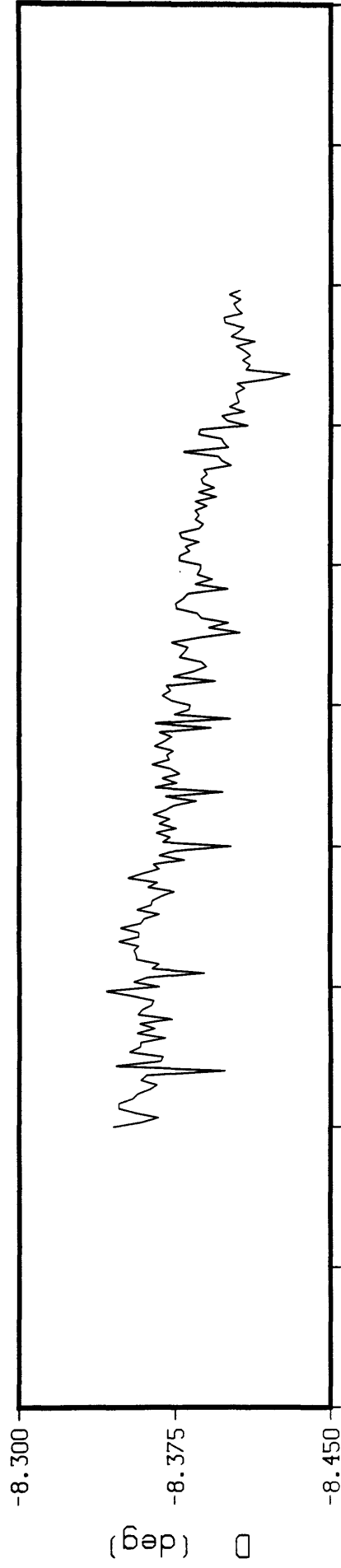
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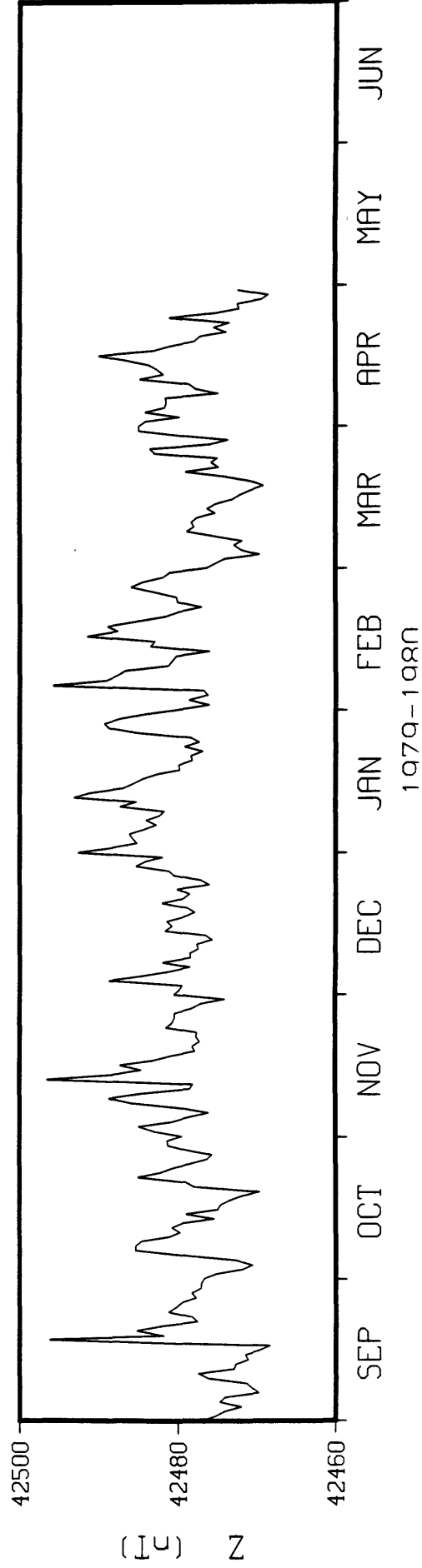
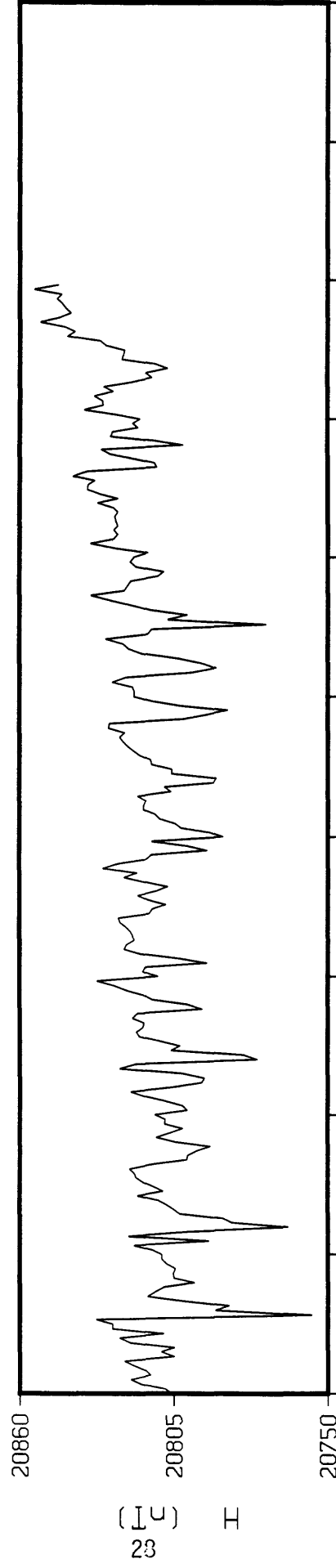
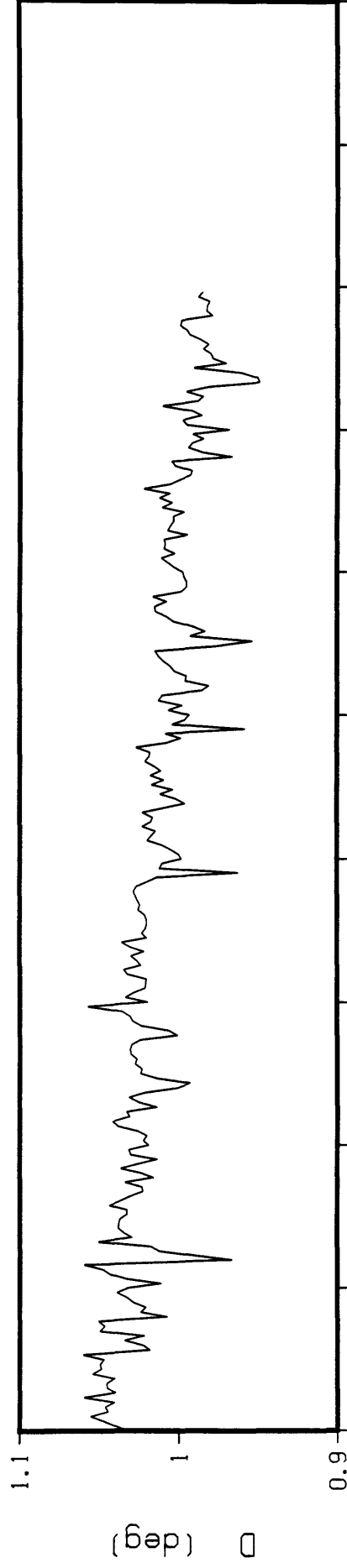
# 1979-1980 ESK DAILY MEANS



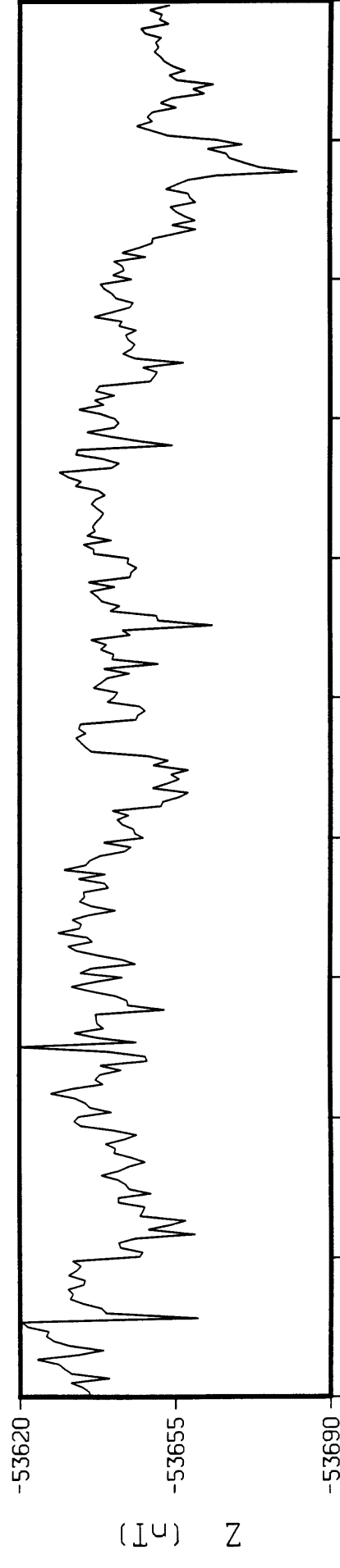
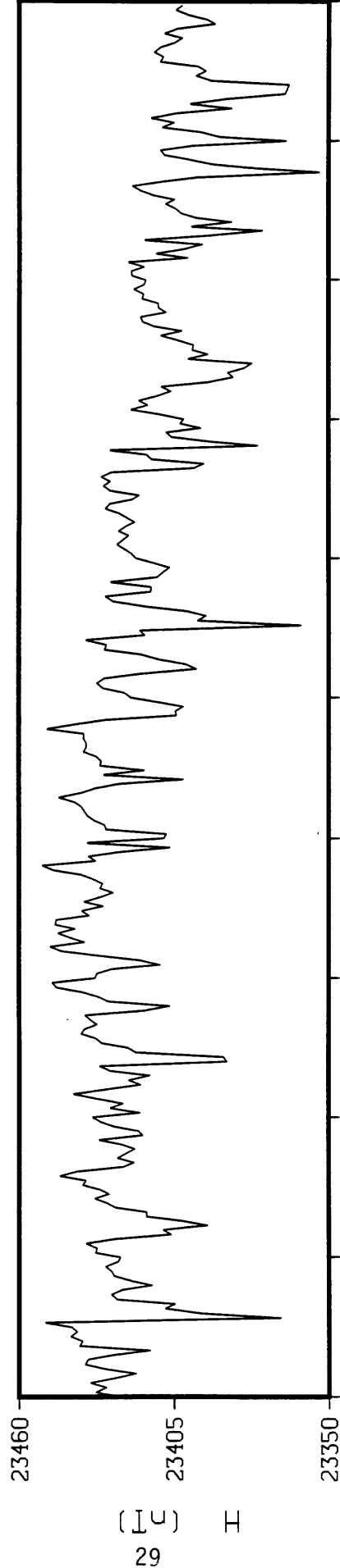
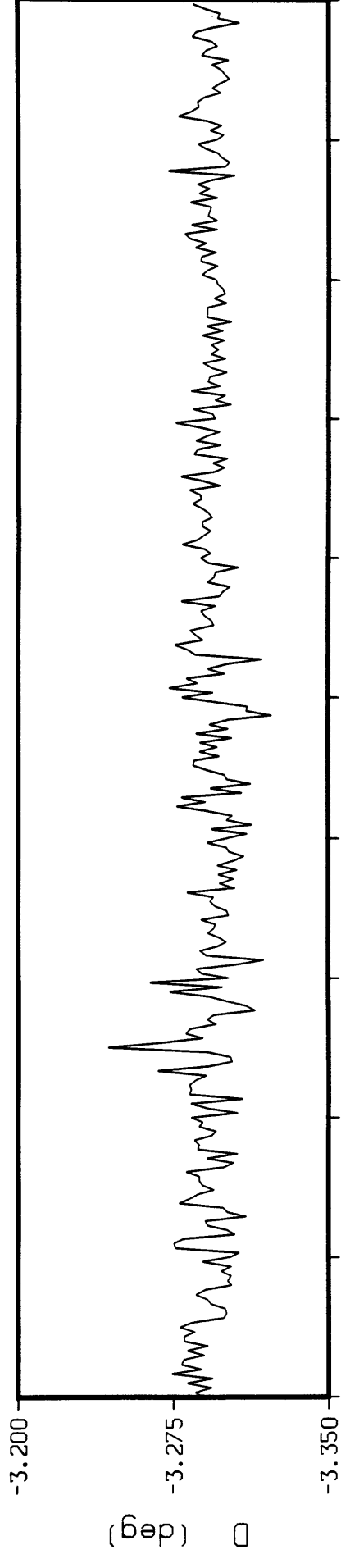
# 1979-1980 FRD DAILY MEANS



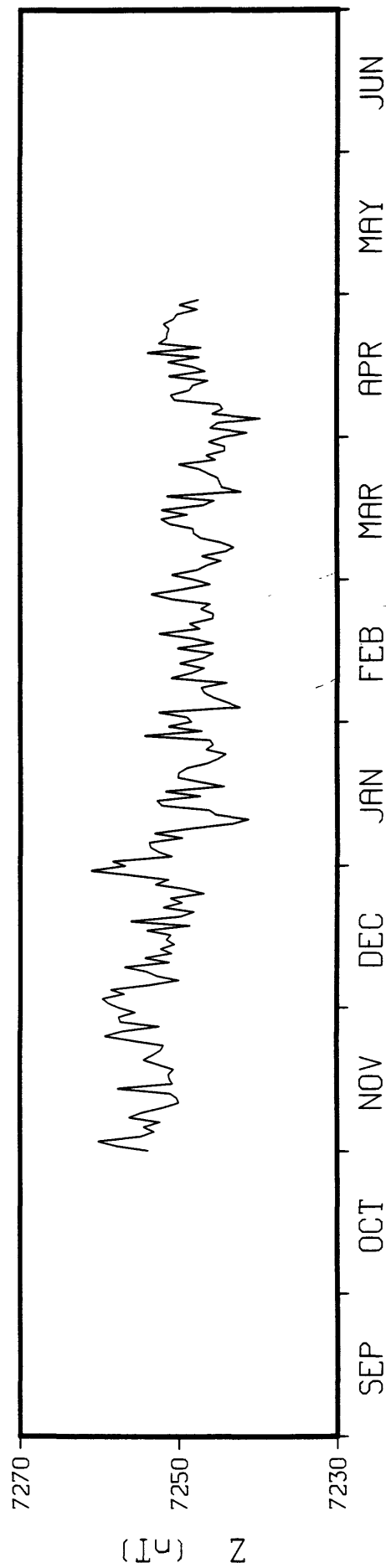
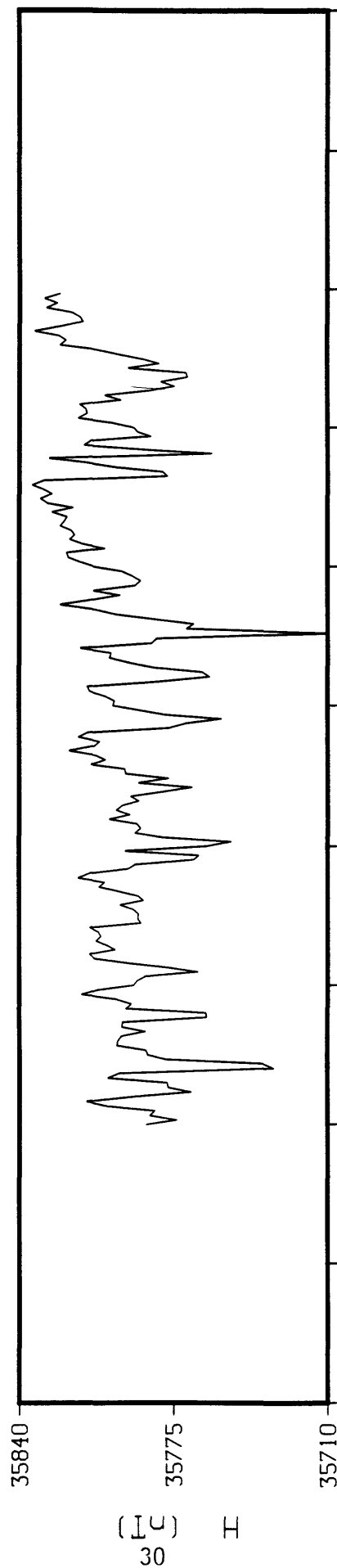
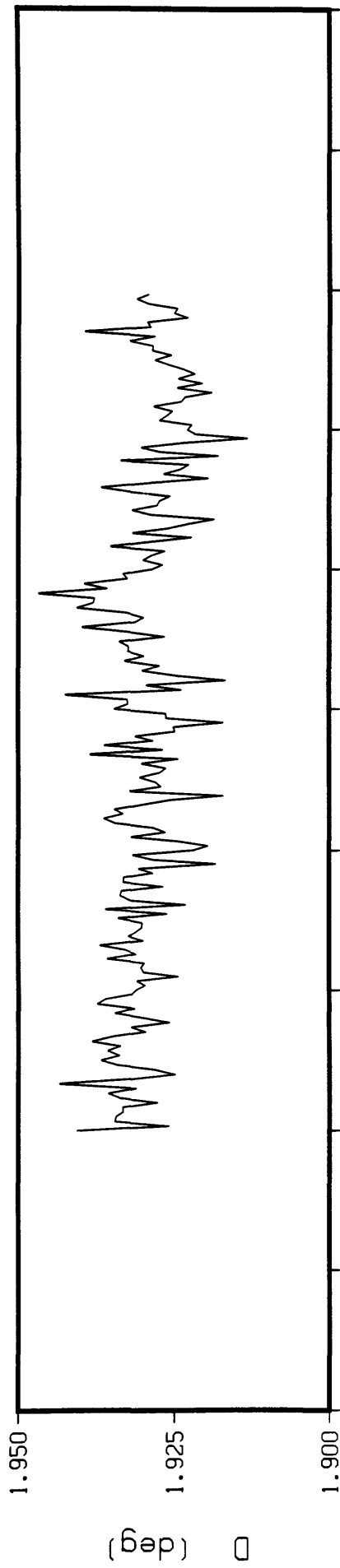
# 1979-1980 FUR DAILY MEANS



# 1979-1980 GNA DAILY MEANS

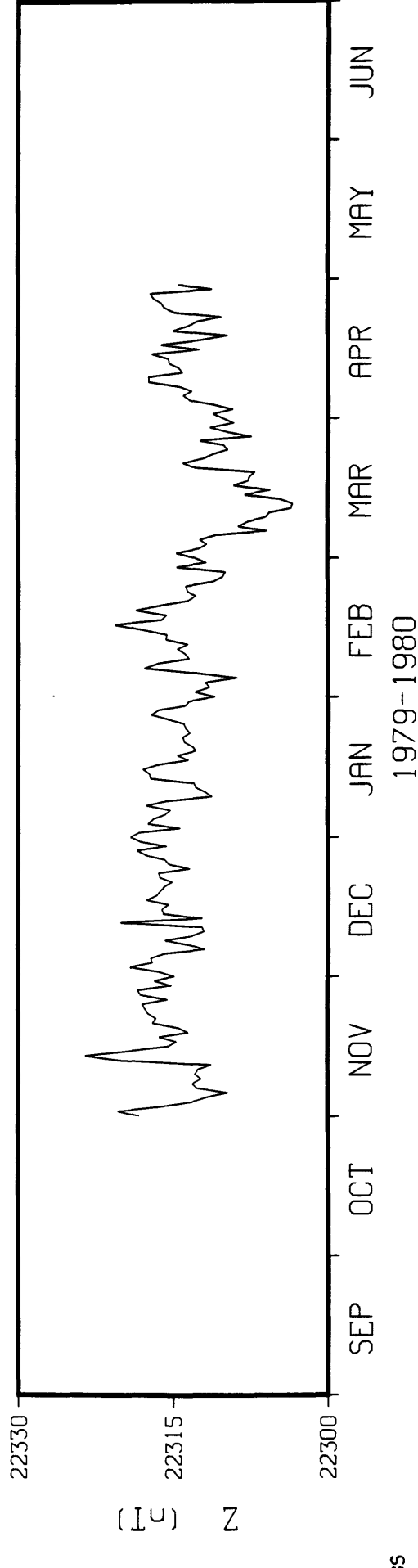
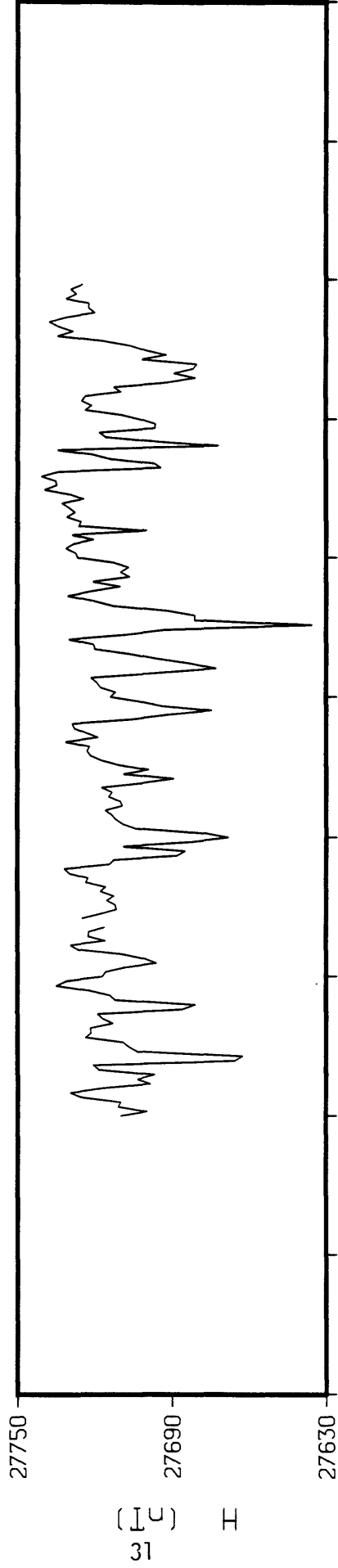
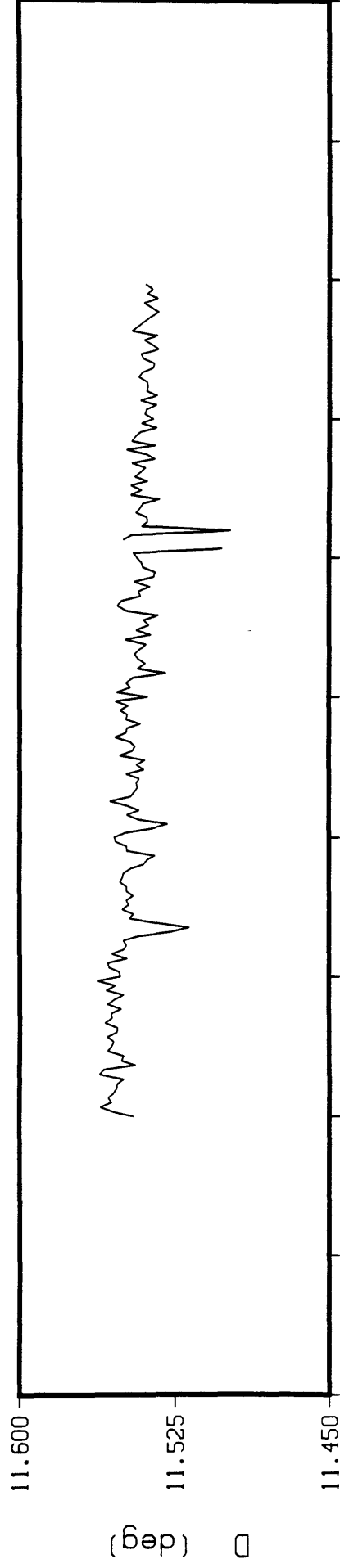


# 1979-1980 GUA DAILY MEANS

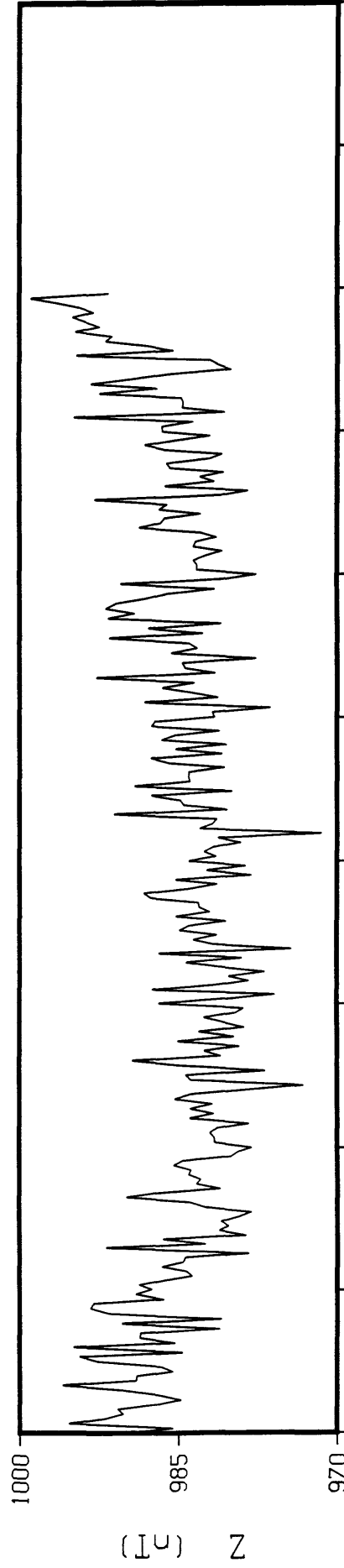
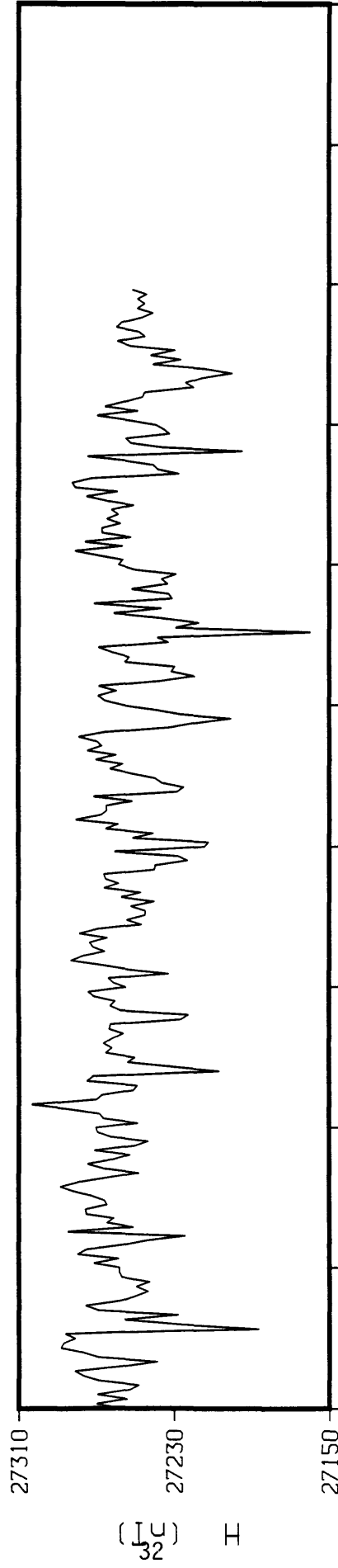
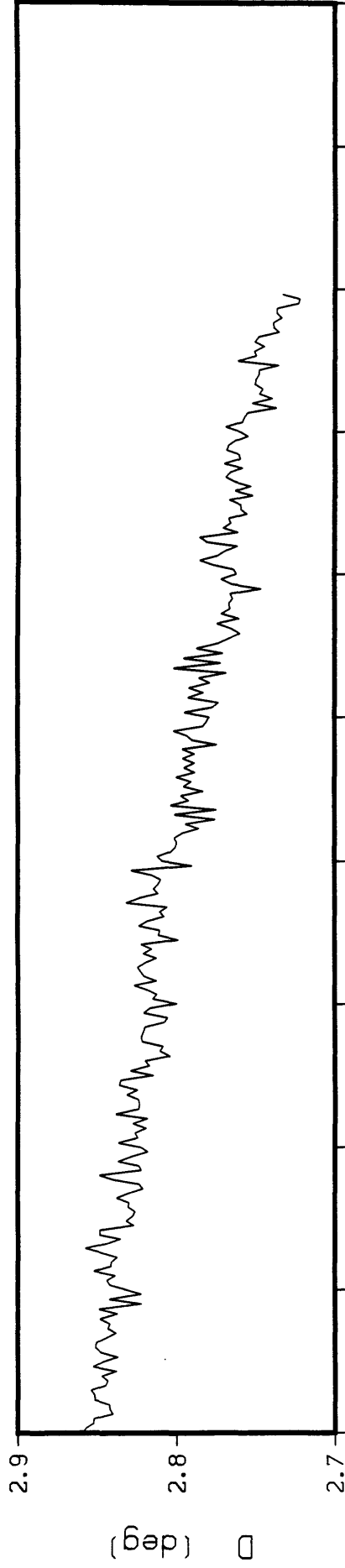




# 1979-1980 HON DAILY MEANS



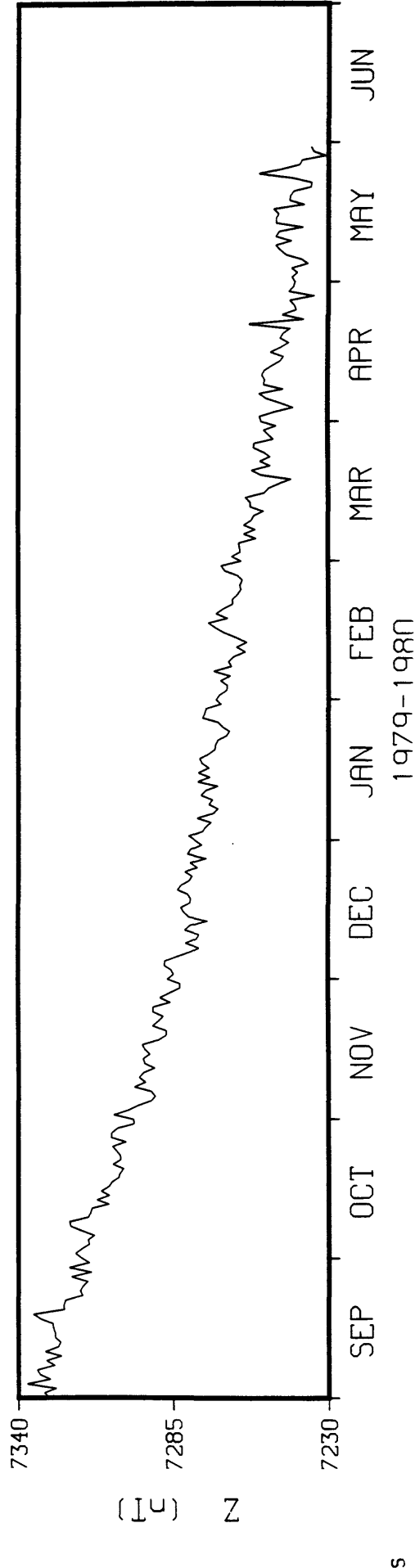
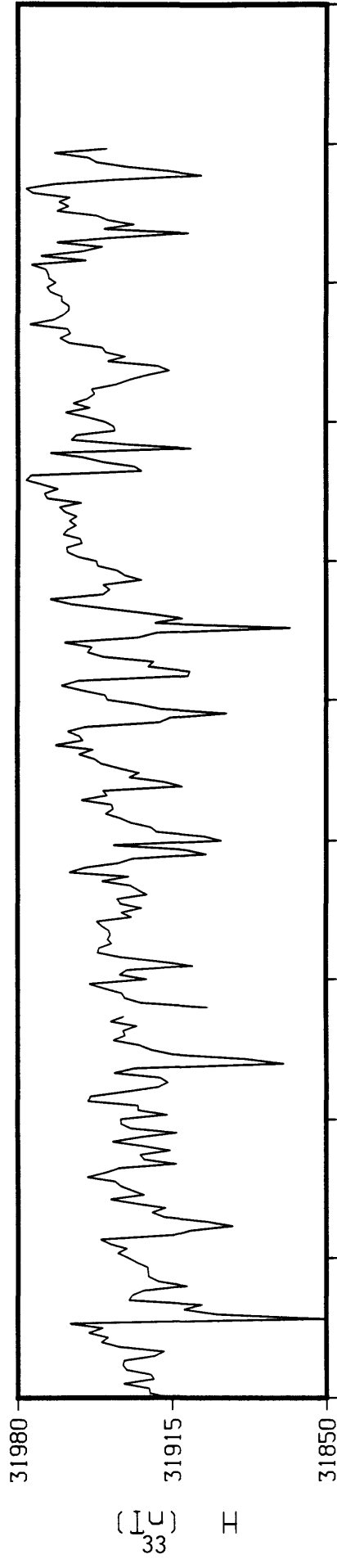
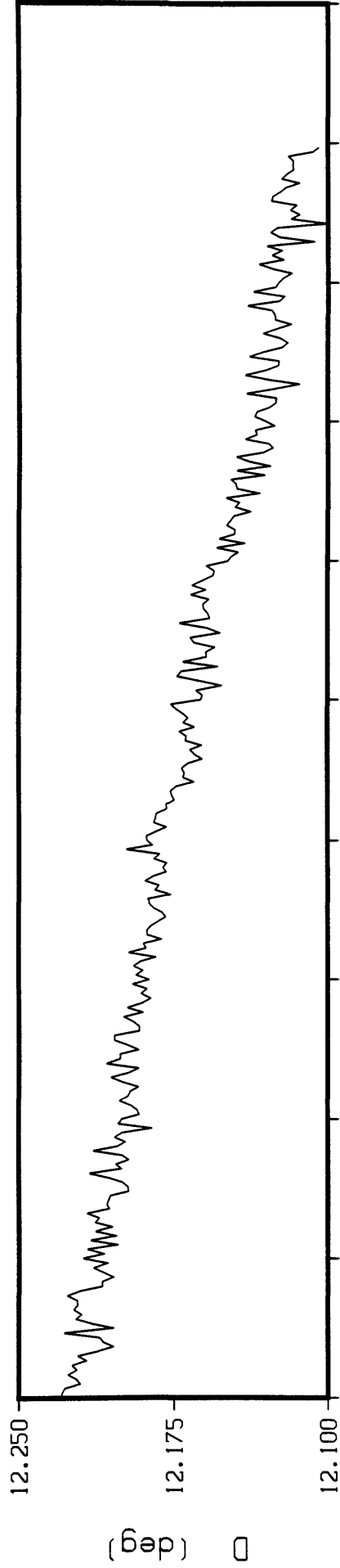
# 1979-1980 HUA DAILY MEANS



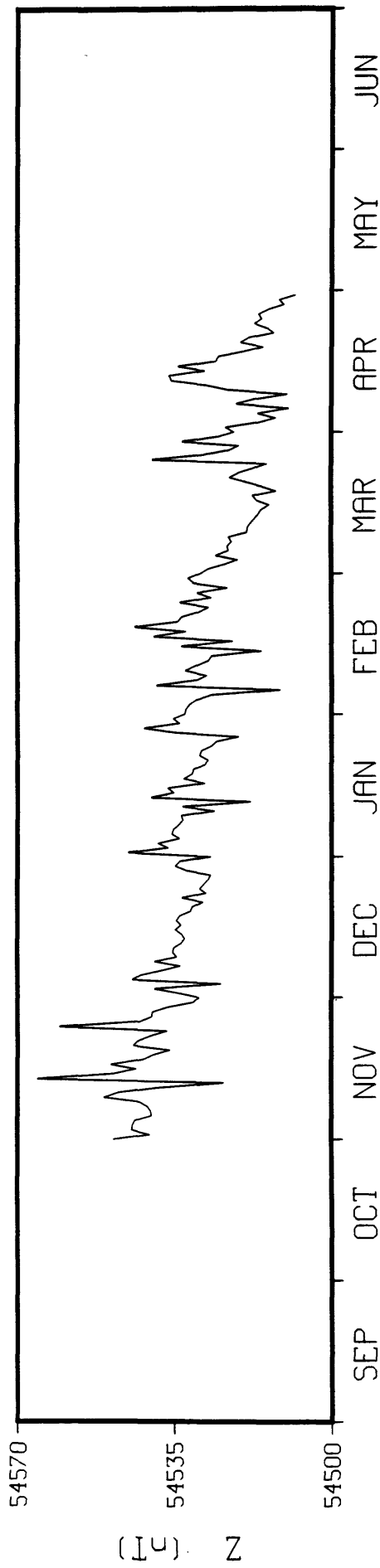
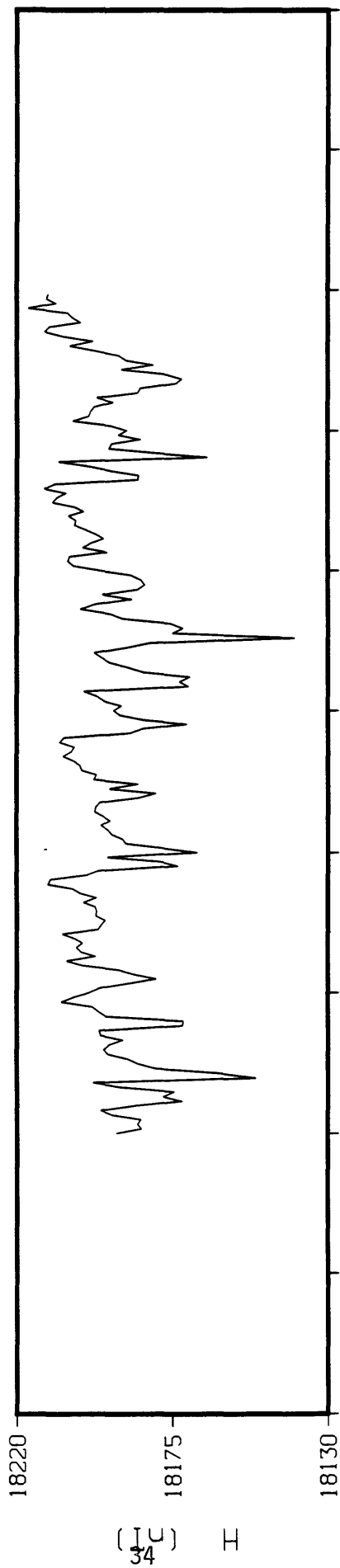
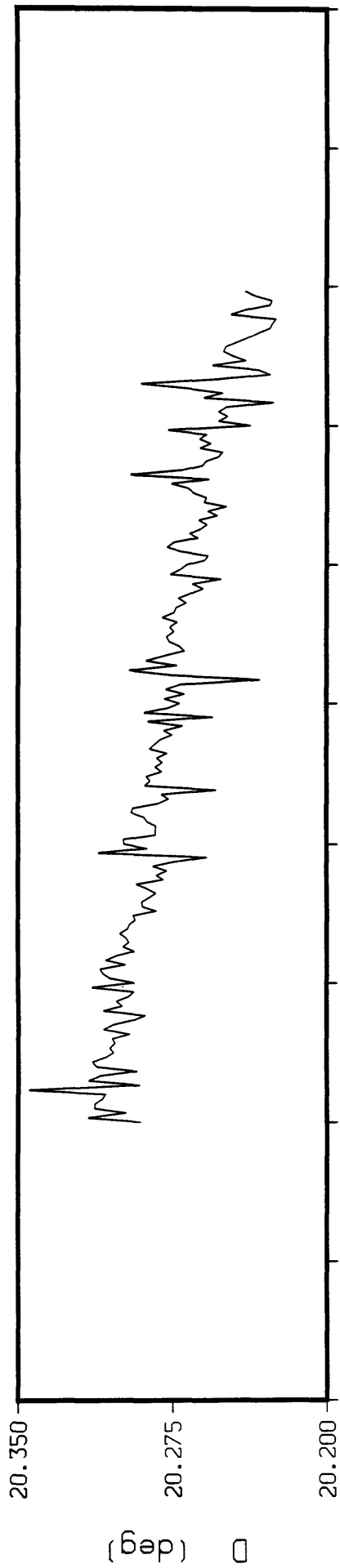
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1070-1080

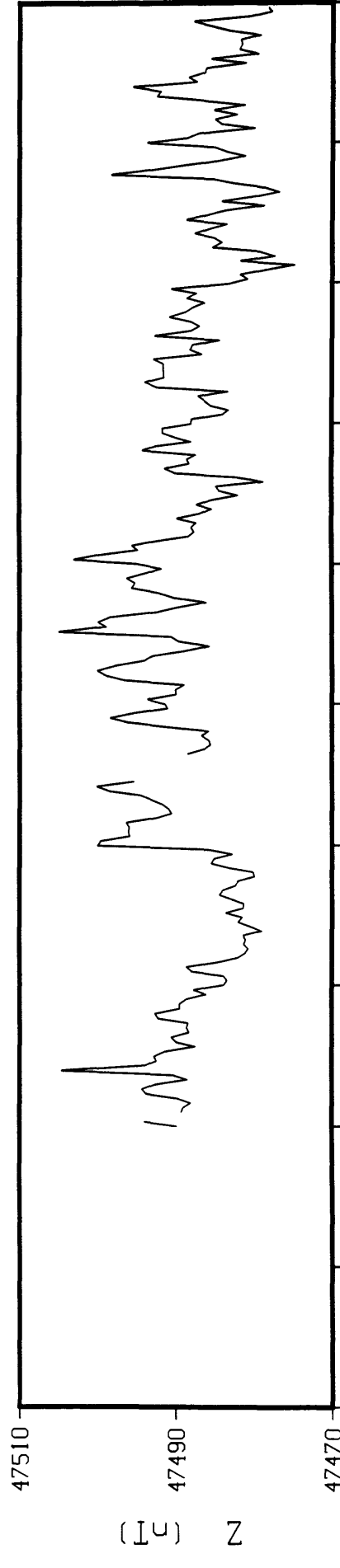
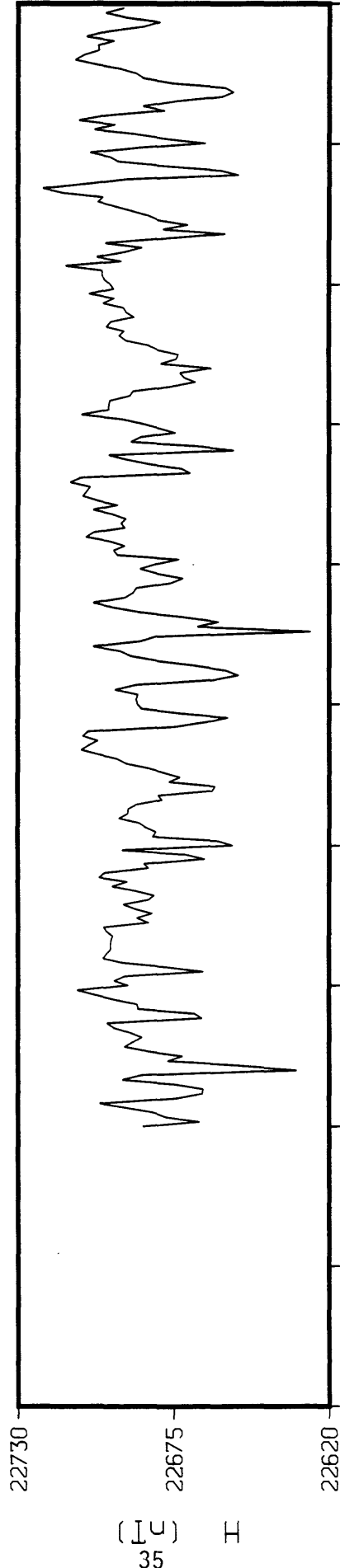
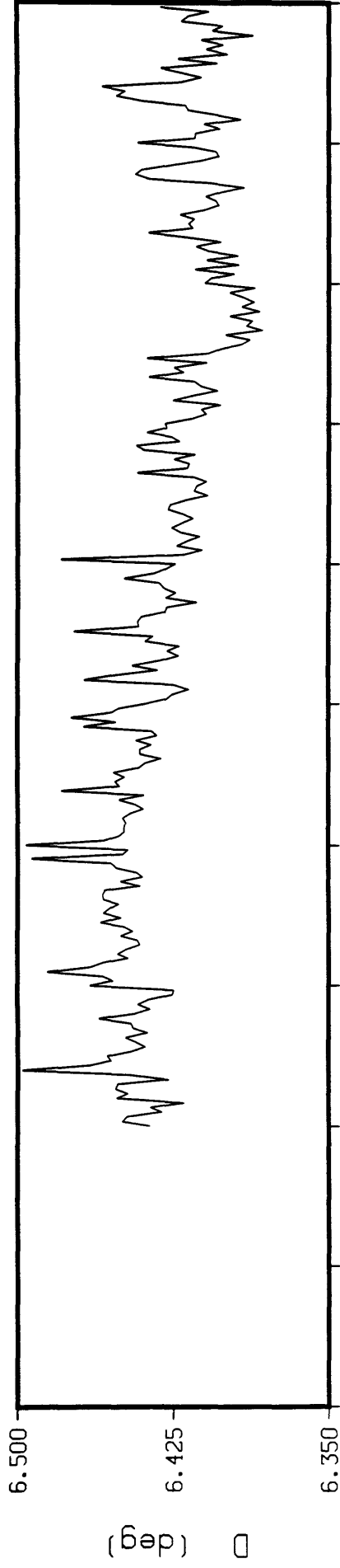
# 1979-1980 MBO DAILY MEANS



# 1979-1980 NEW DAILY MEANS

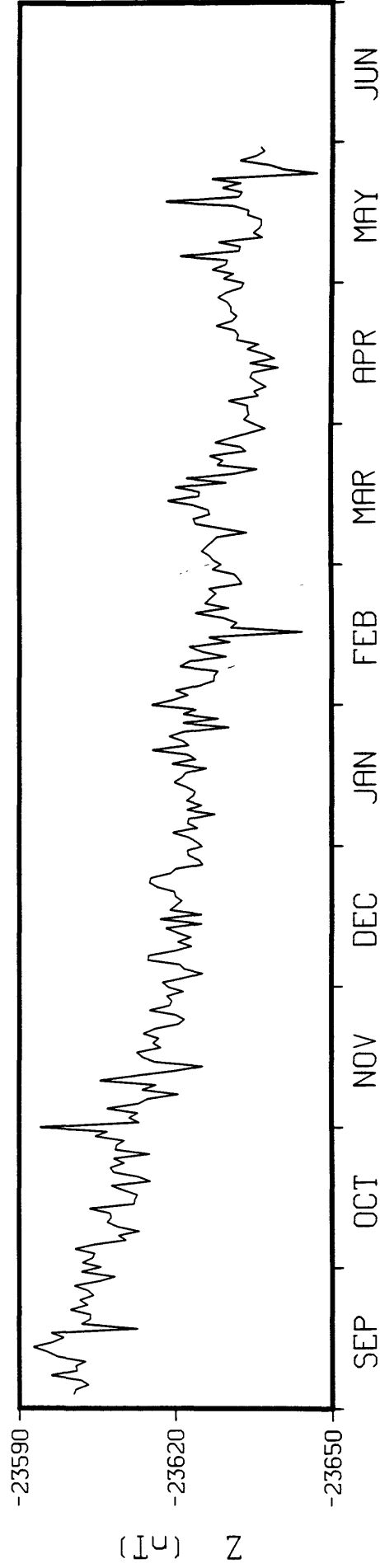
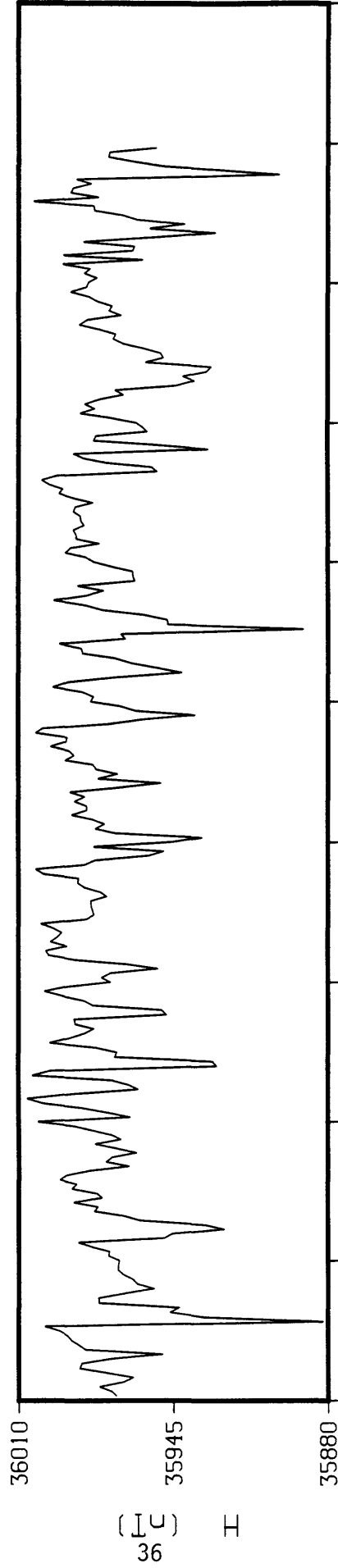
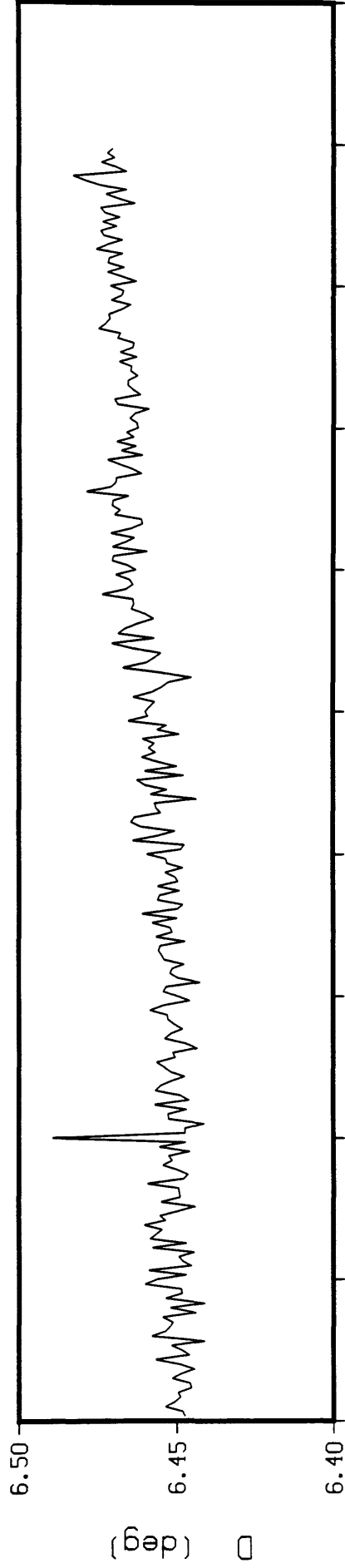


# 1979-1980 NKK DAILY MEANS

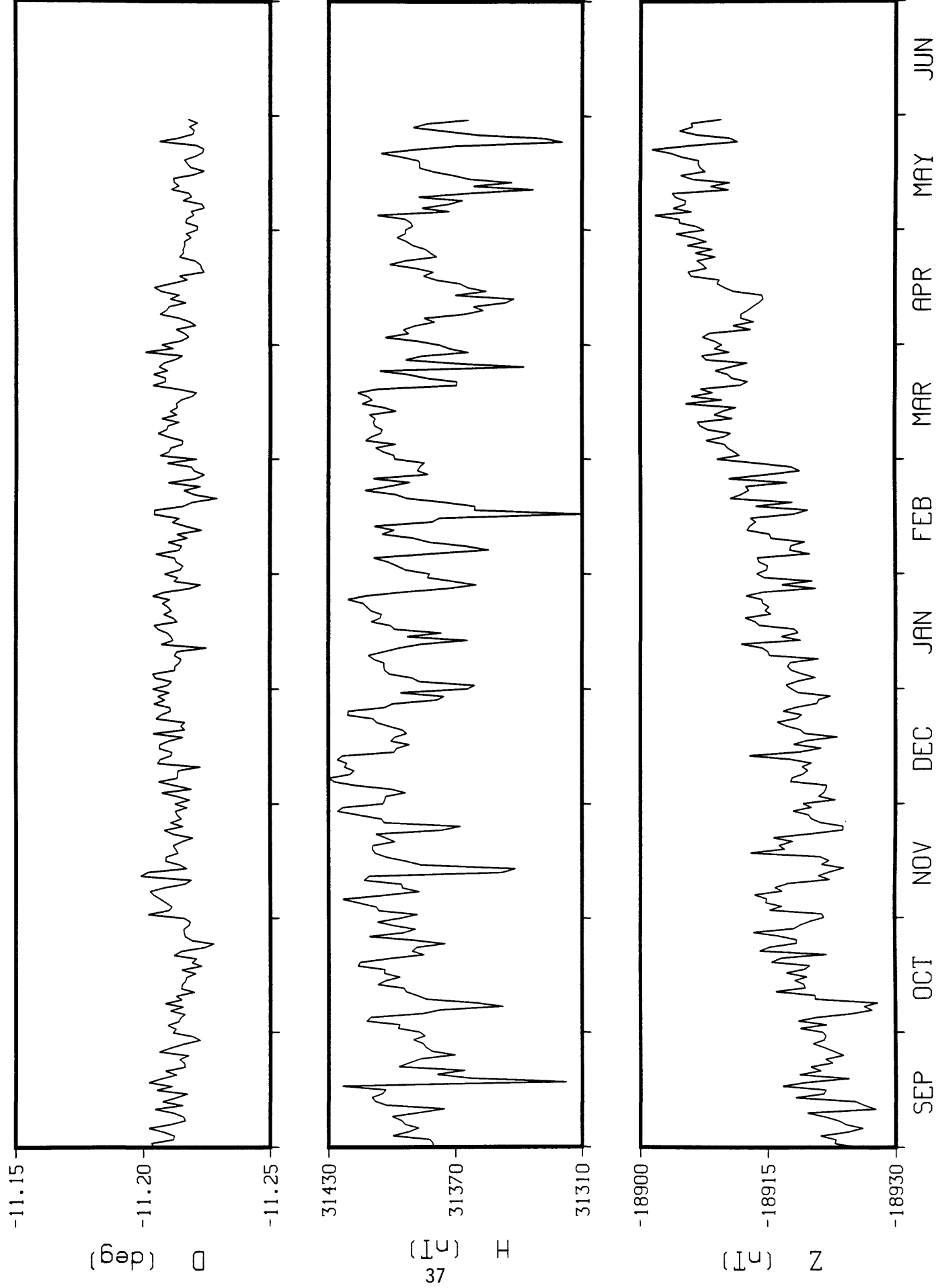


SEP OCT NOV DEC JAN FEB MAR APR MAY JUN  
1979-1980

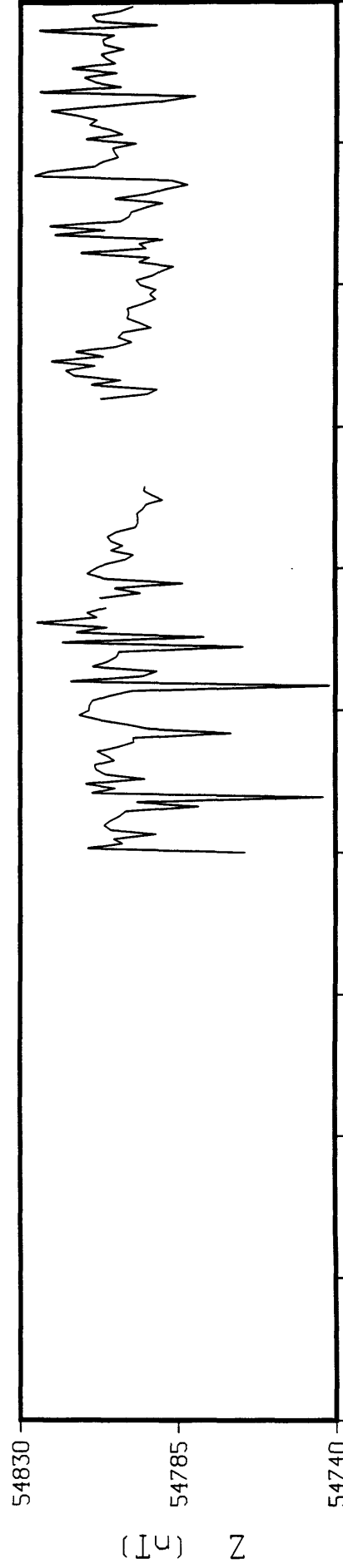
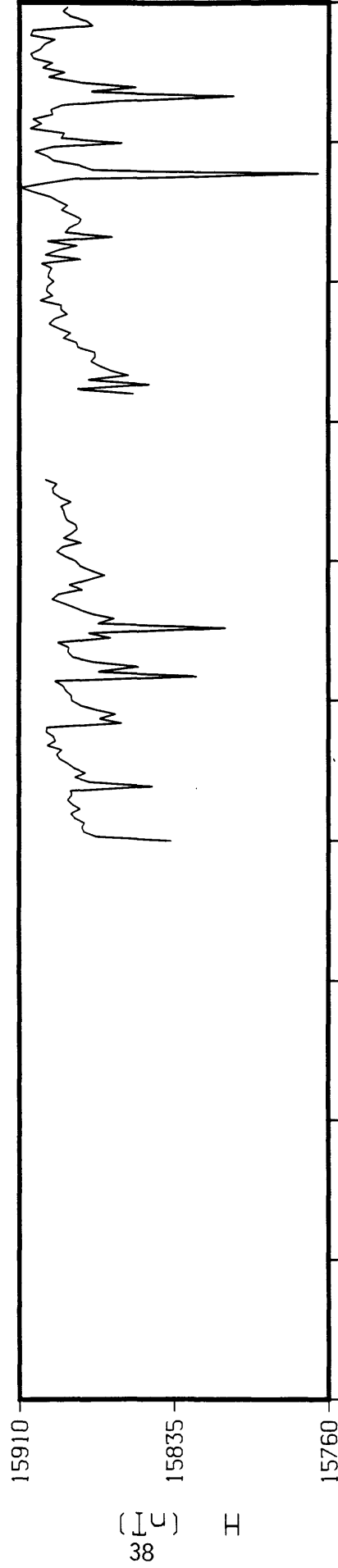
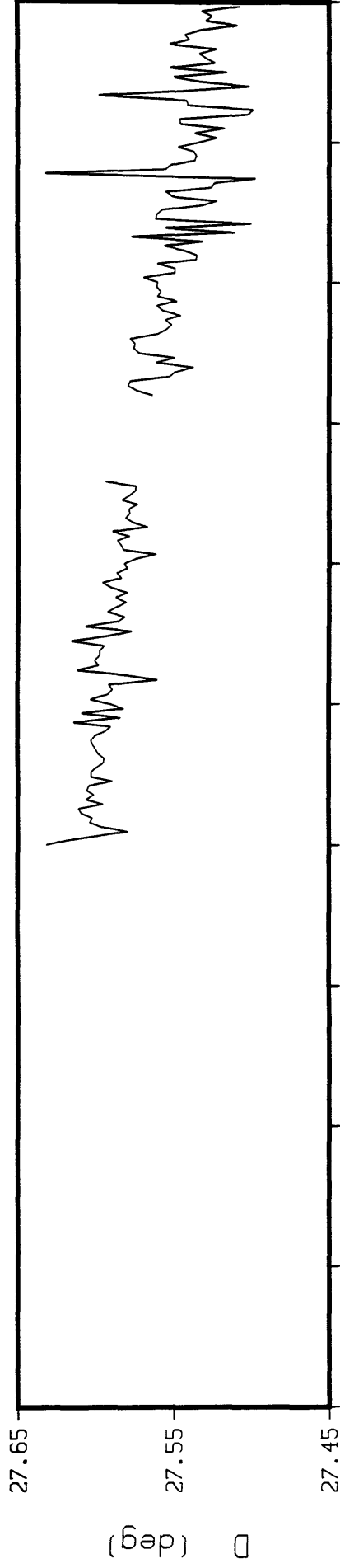
# 1979-1980 PMG DAILY MEANS



# 1979-1980 PPT DAILY MEANS

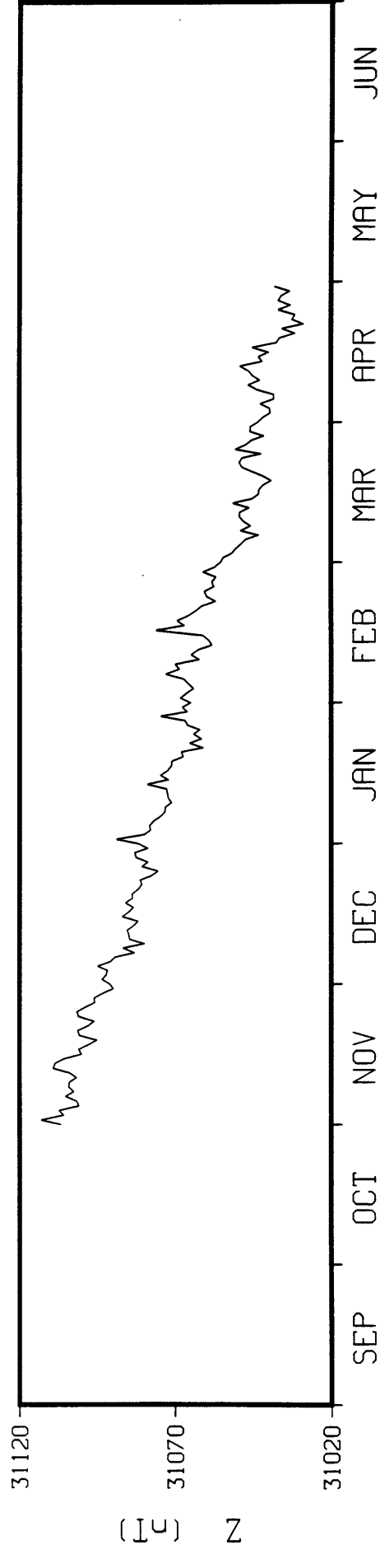
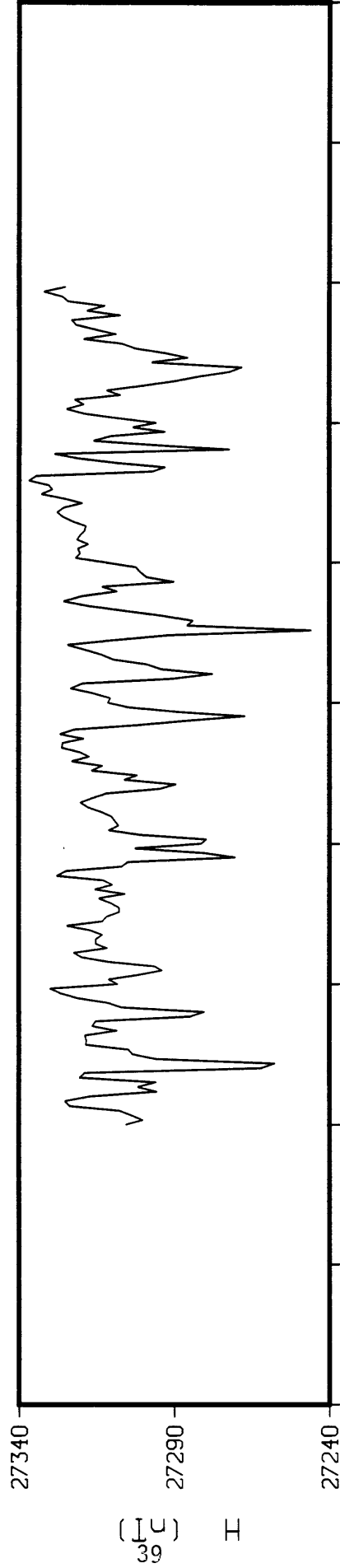
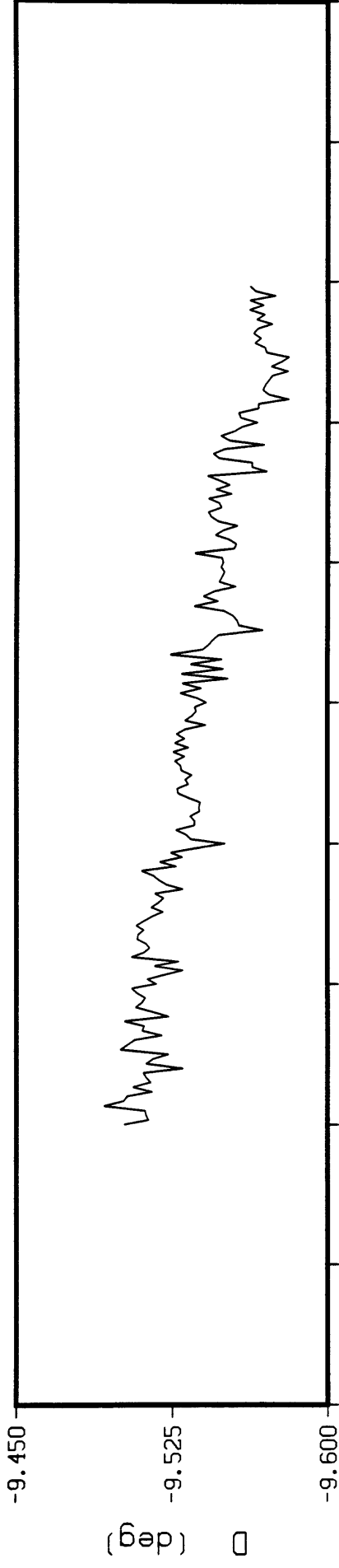


# 1979-1980 SIT DAILY MEANS

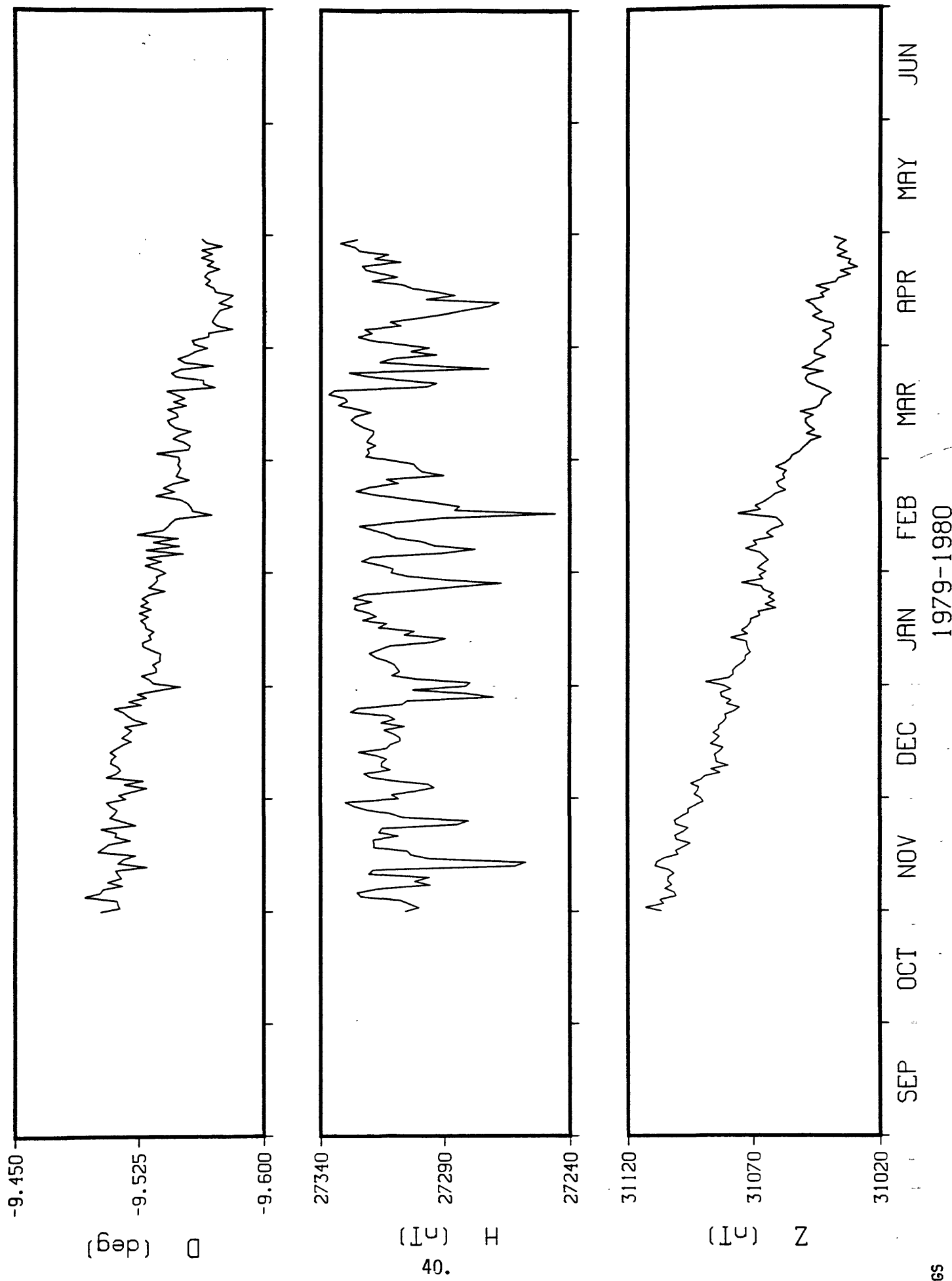




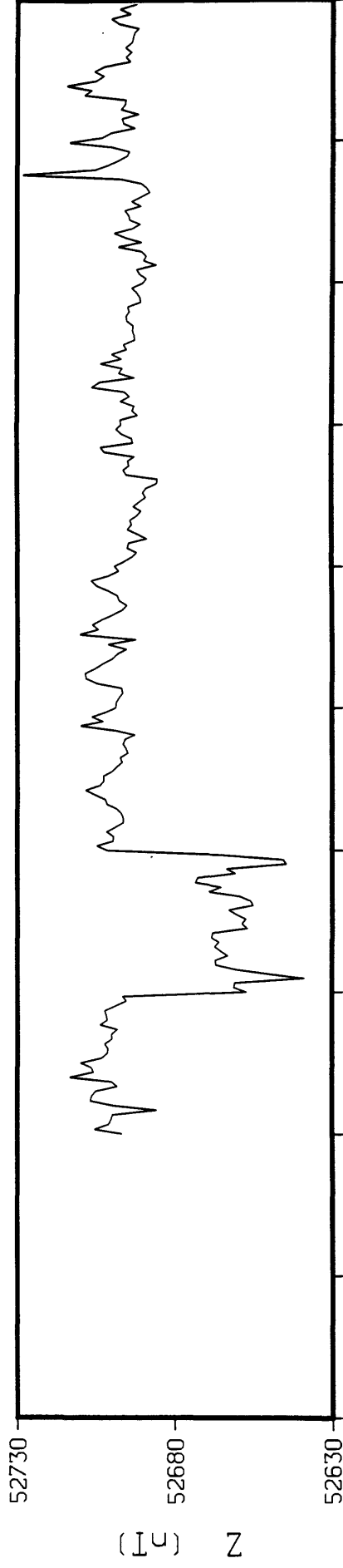
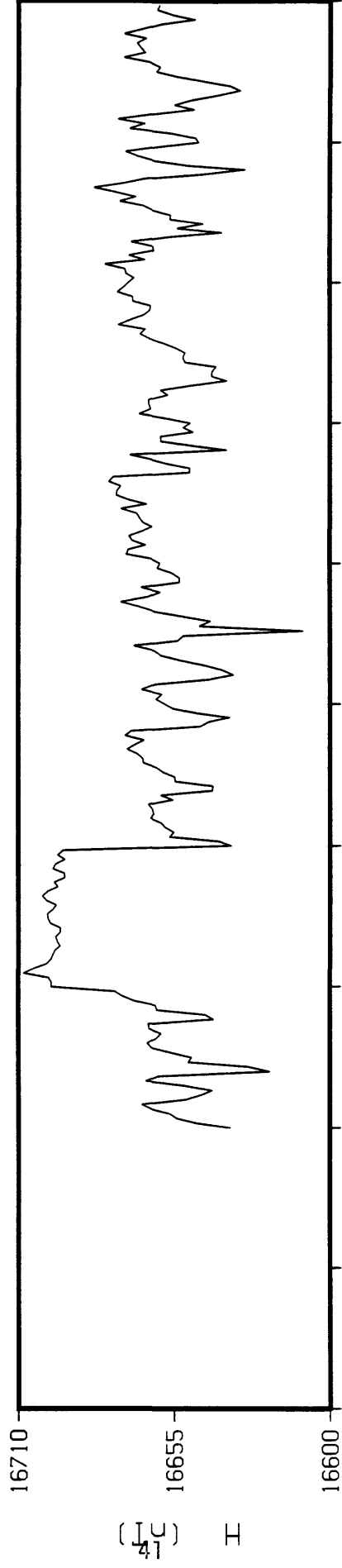
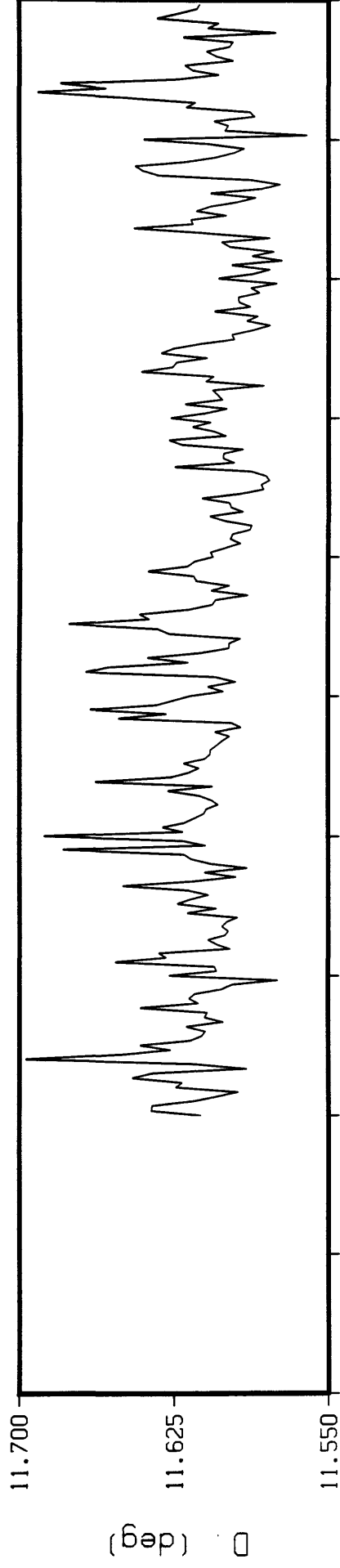
# 1979-1980 SJG DAILY MEANS



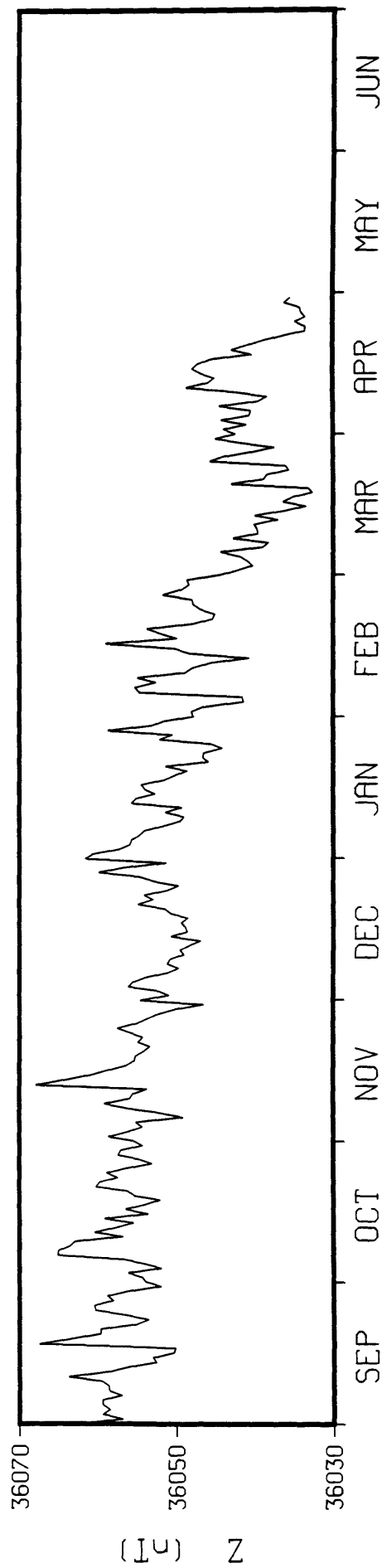
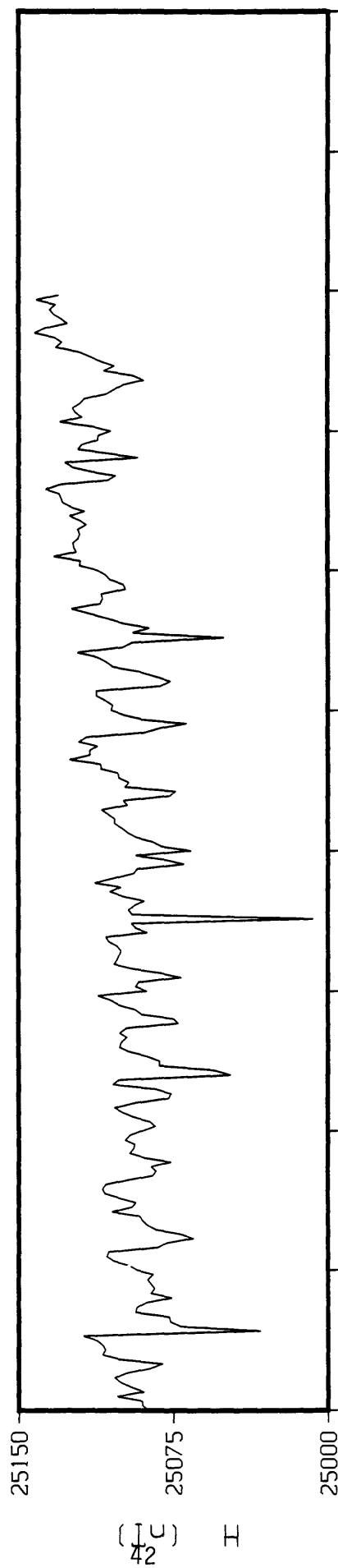
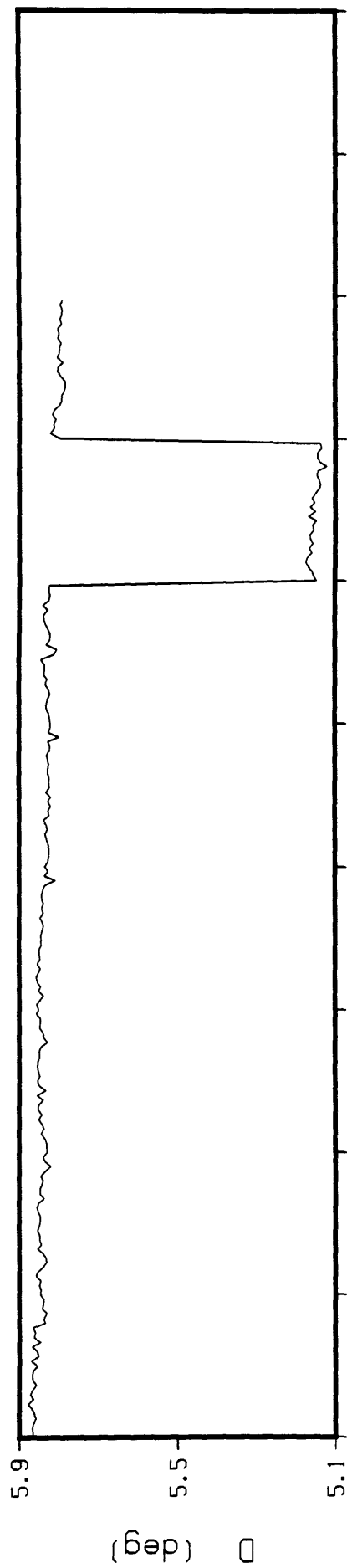
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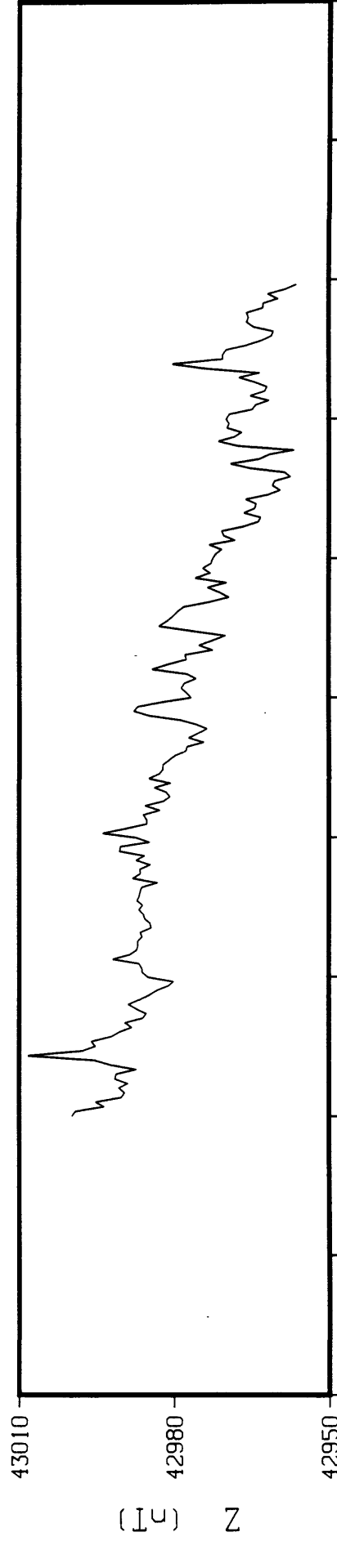
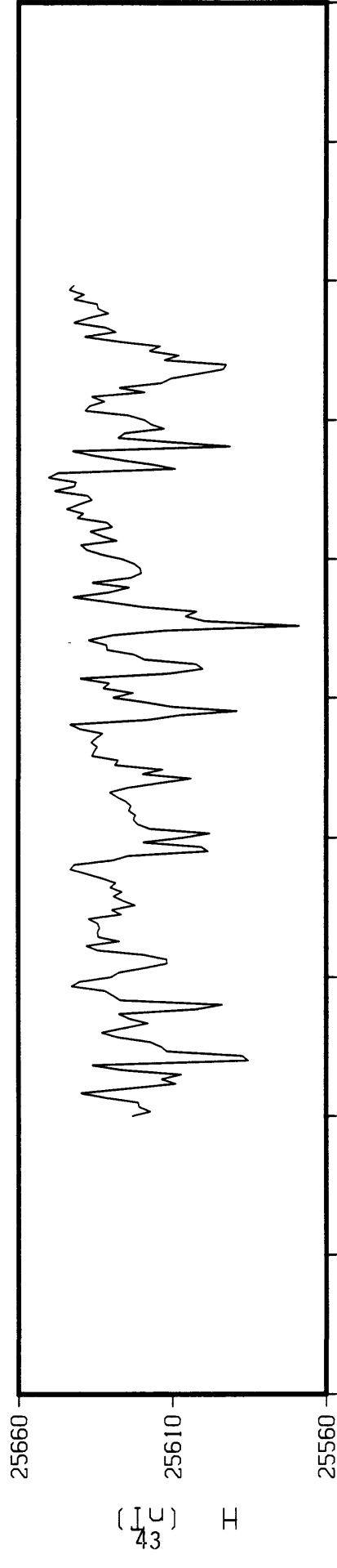
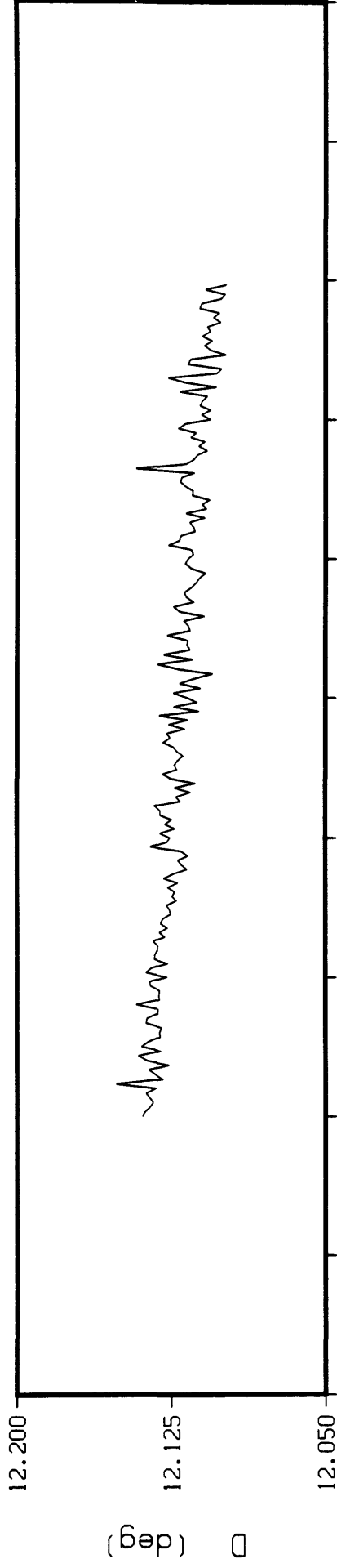
# 1979-1980 SVE DAILY MEANS



# 1979-1980 TOL DAILY MEANS



# 1979-1980 TUC DAILY MEANS



# 1979-1980 VSS DAILY MEANS

