U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE
NATIONAL METEOROLOGICAL CENTER

OFFICE NOTE 339

THE REGIONAL PROFILE DATA BASE

JAMES J. TUCCILLO

MARCH 1988

THIS IS AN UNREVIEWED MANUSCRIPT, PRIMARILY INTENDED FOR
INFORMAL EXCHANGE OF INFORMATION AMONG NMC STAFF MEMBERS

THE REGIONAL PROFILE DATABASE

James J. Tuccillo
Development Division
National Meteorological Center
7 November 1987

I. INTRODUCTION

The Regional Profile Database is a VSAM based random access database of NGM forecast sigma layer and diagnostic data at selected locations over North America. This database was designed as the basis for generating new model products which are not possible with the normal 12 hour gridded fields on pressure surfaces. Meteograms (time histories), soundings and other products are available for operational and R&D use. This TPB will describe the contents of the database, how to access it and present a few examples of products from the database.

II. CONTENTS OF THE DATABASE

The database has two components :

- PROFOPN
- PROFSYN

They have different characteristics based on their anticipated use and are described below.

a) PROFOPN

This component of the database contains the entire NGM sigma layer specification of momentum, temperature, pressure and moisture as well as many other diagnostic quantities at a network of station over North America. These quatities are derived via bi-linear interpolation from the model grids to the station latitude and longitude. The information is stored with a time frequency of 1 hour and is available for the latest 18 cycles (or 9 days). The WMO station number, latitude and longitude, 3 letter identifier and descriptive name of the 181 stations in the network is presented in Table1. Figure 1 shows the geographical distribution of the stations. All reasonable requests for additions to the list of stations will be honored within 24 hours.

There are 49 profiles (0 hour plus every hour out through 48 hours) available every cycle. Since there are 181 stations for the latest 18 cycles of the RAFS the total number of profiles is

$$49 * 181 * 18 = 159,642.$$

This component of the database has a high temporal resolution which allows for detailed examination of the forecast. The length of the database (9 days) is such that post mortems of significant weather events is possible without having to rerun the NGM.

b) PROFSYN

This component of the database contains the profiles at the same network of station as PROFOPN except the information is stored every 12 hours out through 48 hours. The information is available for the latest 72 cycles (36 days) as opposed to the 18 cycles of PROFOPN. The number of profiles is therefor

$$5 * 181 * 72 = 65,160.$$

Since verification in the form of a 00 hour forecast is available only every 12 hours, this component of the database is used for verifying the NGM forecast of length 12, 24 , 36 and 48 hours. With 36 days online, monthly summaries of the performance of the NGM at any of the 181 stations in the database is possible.

III. ACCESSING THE DATABASE - RETRIEVAL OF RAW NUMBERS

Access to the database, through the NMC NAS 9000 computer system, for the purpose of retrieving the actual forecast values is made possible through a series of subroutines. The current library of routines will undoubtedly grow and updated versions of this document will be prepared. Currently, the following routines are available.

1) GUVTQP - returns the 16 sigma layer values of zonal and meridional wind, temperature, specific humidity and pressure and the surface pressure, surface elevation and skin temperature.

2) GCLDS - returns the fractional coverage of low, middle and high clouds and the pressure of the sigma layer

where they are present from the interactive cloud model in the NGM.

3) GRDTN - returns the 16 sigma layer values of total radiational heating.

4) GPRCP - returns the accumulated grid scale and sub-grid scale precipitation over the past hour.

5) GSEB - returns the terms of the surface energy budget and the skin and sub-soil temperatures from the surface energy budget in the NGM.

These subroutines are called by supplying the year, month, day, and hour that the forecast was initialized plus the forecast hour and station number. The information listed above plus an error flag is returned. Detailed descriptions of the calling sequence plus the physical units of the returned quantities are presented in Appendix A (see TPB #363 for details regarding radiation and other physical processes in the NGM). Appendix B provides information on the structure of the VSAM files.

The following program and JCL demonstrates how to retrieve the sigma layer values of wind, temperature, moisture and pressure as well as surface pressure, terrain elevation and skin temperature using GUVTQP. This job is setup for an user onsite at NMC and must run on the NAS 9000 computer system: the location of the database. Remote users of the NAS 9000 system will need to adjust the JCL appropriately.

```
//WWXXX      JOB ( XXXXXXXXXX,XXXXXXXX),YOURNAME,
//             MSGCLASS=T,MSGLEVEL=(2,0),
//             NOTIFY=$WDXXXX,
//             TIME=2,REGION=1500K
//*FORMAT    PR,DDNAME=,DEST=NASJS3.WWB37
//*
//*           THIS JOB DEMONSTRATES HOW TO USE SUBROUTINE GUVTQP
//*           TO RETRIEVE AN NGM FORECAST SOUNDING
//*
//*           USE JOHN STACKPOLE'S FORTRAN 77 PROC TO
//*           COMPILE, LINK EDIT AND GO
//*
//STEP1      EXEC JS7XCLG,SYSOUT='*'
//FORT.SYSIN DD *
C
```

```
C   THIS PROGRAM WILL RETRIEVE NGM FORECAST VALUES
C   THE NGM CURRENTLY HAS 16 SIGMA LAYERS
C
    DIMENSION U(16), V(16), T(16), Q(16), P(16)
C
C   RETRIEVE 17 HOUR FORECAST INITIALIZED ON 23 SEPT 1987 AT 12 Z
C   FOR DULLES, VA. ( WMO STATION NUMBER = 72403 )
C
    IYR = 87
    IMN = 9
    IDY = 23
    IHR = 12
    IVERF = 0
    IFHR = 17
    ISTA = 72403
C
C   INPUT ARGUMENTS ON FIRST LINE, OUTPUT ARGUMENTS ON SECND LINE
C
    CALL GUVTQP ( IYR, IMN, IDY, IHR, ISTA, IFHR, IVERF,
   1              U, V, T, Q, P, PSTAR, TSKIN, ZSTAR, ALAT, ALON, NZ, IER)
C
    IF ( IER .NE. 0 ) THEN
      WRITE ( 6, 100 ) IER
100   FORMAT(' PROBLEM WITH GUVTQP, IER =', 15)
    END IF
C
C   AT THIS POINT ARRAYS U, V, T, Q, P HOLD THE 16 SIGMA LAYER VALUES
C   FOR A 17 HOUR FORECAST AT DULLES
C
C      ***** CODE TO PROCESS THE INFORMATION ****
C
    STOP
    END
/*
//*
//*      LINK EDIT THE NEEDED SUBROUTINES
//*
//LKED.MYLIB  DD  DSN=NWS.WD22.JJT.REG.LOADLIB, DISP=SHR
//LKED.SYSIN DD *
        INCLUDE MYLIB( RPACODE )
        ENTRY MAIN
/*
//*
```

```
//*      UNIT 99 IS THE VSAM DATASET
//*
//GO.FT99K01 DD DSN=NWS.WD22.JJT.REG.PROFOPN.CLUSTER,DISP=SHR
//
```

During the LINK EDIT step, you must include member RPACODE from the following load library.

NWS.WD22.JJT.REG.LOADLIB.

This member contains the object code for the routines to read the database.

During the GO step you must define unit 99 as the database dataset. For the two components of the database listed above the datasets are

NWS.WD22.JJT.REG.PROFOPN.CLUSTER

NWS.WD22.JJT.REG.PROFSYN.CLUSTER.

Choose one or the other depending on your need. In the above example the hourly component, PROFOPN, is used.

IV. ACCESSING THE DATABASE - NMCiDAS GRAPHICS

Graphical display of the raw data in the database is possible through the NMCiDAS graphics package of Development Division. Meteograms (time histories), time/height crossections and sounding plots are available at any of the 181 stations in the database. Figures 2 - 5 present examples of the output. Appendix C contains the documentation of the NMCiDAS commands relative to the database. Additional information is available from the Development Division. (This capability is available to those physically located in the World Weather Building).

V. ACCESSING THE DATABASE - VDUC

Those users on the VDUC loop may access the database through a series of VDUC commands which have been developed in the Development Division of NMC. These commands are evolving rapidly and interested individuals should contact Development Division for the most recent versions of the commands.

VI. ACCESSING THE DATABASE - PC PLOTTING PROGRAM

Remote sites with access to the NMC NAS 9000 system can easily access the database and plot soundings using a plotting package developed for an IBM PC or MS DOS compatible clone. The general procedure would be to logon the NAS 9000 system and run an existing program in TSO foreground to extract the vertical profiles of wind, temperature, moisture and pressure from the database for the desired forecast. This information would be downloaded to a PC and and the sounding program would be executed on the PC to plot the soundings either on the CRT or line printer. A documentation of the program is included in Appendix D. A demonstration disk of the sounding plotting program with several data file from a recent NGM forecast is available upon request.

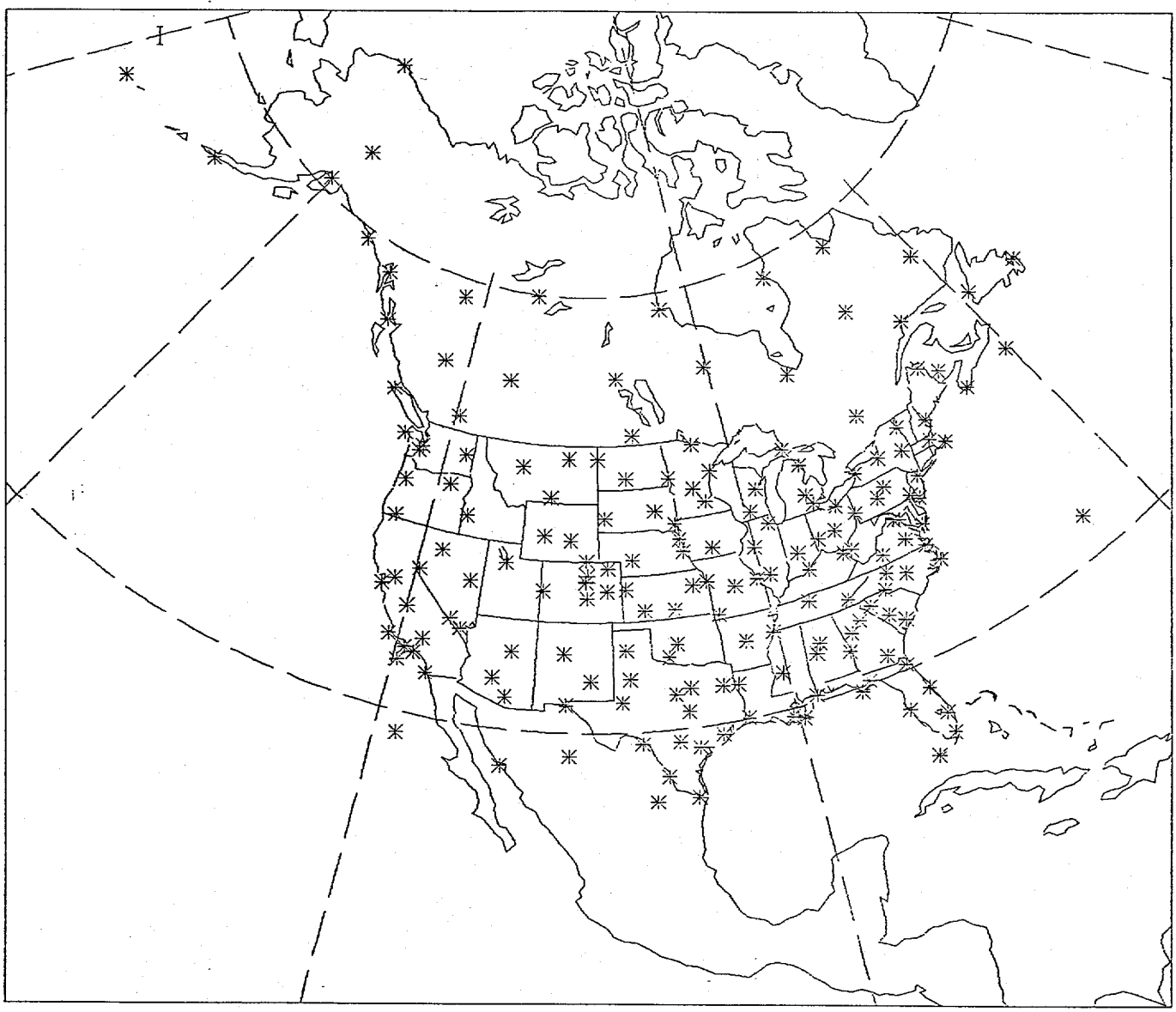


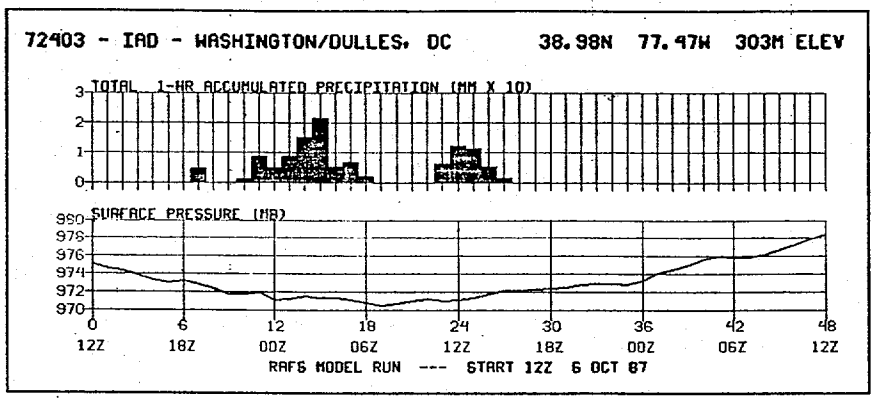
Figure 1. Geographical distribution of stations in the archive.

00001	40.78N	77.85W	SCE	STATE COLLEGE, PA		150	APPROX.
00002	39.77N	104.88W	DNV	DENVER, CO	(PROFILER)	1650	
00003	40.18N	104.73W	PLT	PLATTEVILLE, CO	(PROFILER)	1500	
00004	40.63N	102.94W	FLM	FLEMING, CO	(PROFILER)	1260	
00005	39.12N	103.05W	FLG	FLAGLER, CO	(PROFILER)	900	
70026	71.30N	156.78W	BRW	BARROW, AK		12	
70261	64.82N	147.87W	FAI	FAIRBANKS, AK		135	
70273	61.17N	150.02W	ANC	ANCHORAGE, AK		45	
70316	55.20N	162.72W	CDB	COLD BAY, AK		30	
70361	59.52N	139.67W	YAK	YAKUTAT, AK		12	
70381	58.22N	134.35W	JNU	JUNEAU/INTL	AK	5	
70398	55.03N	131.57W	ANN	ANNETTE IS., AK		37	
70454	51.88N	176.65W	ADK	ADAK, AK		4	
71109	50.68N	127.37W	YZT	PORT HARDY, BC		17	
71115	50.23N	119.28W	WVK	VERNON, BC		556	
71119	53.55N	114.10W		EDMONTON/STONY PLAIN, AB		766	
71399	43.72N	65.25W	WOS	SHELBURNE, NS		30	
71600	43.93N	60.02W	WSA	SABLE ISLAND, NS		4	
71701	45.83N	66.43W	YCX	CAMP GAGETOWN, NB		51	
71722	46.38N	75.97W	WMW	MANIWAKI, PQ		170	
71801	47.67N	52.75W	YYT	ST. JOHNS, NF		140	
71811	50.22N	66.27W	YZV	SEPT ILES, PQ		53	
71815	48.53N	58.55W	YJT	STEPHENVILLE, NF		61	
71816	53.30N	60.37W	YYR	GOOSE BAY, NF		36	
71826	53.20N	70.90W	WNI	NITCHEQUON, PQ		539	
71836	51.27N	80.65W	YMO	MOOSONEE, ON		10	
71848	53.83N	89.87W	WTL	TROUT LAKE, ON		222	
71853	49.78N	99.65W	WLO	CAMP SHILO, MB		373	
71867	53.97N	101.10W	YQD	THE PAS, MB		273	
71896	53.88N	122.67W	YXS	PRINCE GEORGE, BC		676	
71906	58.10N	68.42W	YVP	FORT CHIMO, PQ		36	
71907	58.45N	78.12W	YPH	INOUCDJOUAC, PQ		7	
71913	58.75N	94.07W	YYQ	CHURCHILL, MB		30	
71934	60.03N	111.93W	YSM	FORT SMITH, NT		203	
71945	58.83N	122.60W	YYE	FORT NELSON, BC		382	
72201	24.58N	81.70W	EYW	KEY WEST, FL		3	
72202	25.47N	80.16W	MIA	MIAMI/INTL	FL	3	
72203	26.68N	80.10W	PBI	WEST PALM BEACH, FL		7	
72206	30.30N	81.41W	JAX	JACKSONVILLE/INTL	FL	9	
72208	32.90N	80.03W	CHS	CHARLESTON, SC		13	
72210	27.70N	82.38W	TBW	TAMPA, FL		13	
72213	31.25N	82.40W	AYS	WAYCROSS, GA		44	
72214	30.22N	84.22W	TLH	TALLAHASSEE/MUNI	FL	25	
72219	33.38N	84.25W	ATL	ATLANTA/W.B.HARTSFIELD	GA	312	
72220	29.73N	84.98W	AQQ	APALACHICOLA, FL		7	
72223	30.41N	88.14W	MOB	MOBILE/BATES FLD	AL	66	
72225	32.33N	84.83W	LSF	FORT BENNING, GA		130	
72228	33.47N	86.83W	BHM	BIRMINGHAM, AL		227	
72229	32.90N	87.25W	CKL	CENTREVILLE, AL		140	
72231	29.58N	90.14W	MSY	NEW ORLEANS/MOISANT	LA	1	
72232	29.33N	89.40W	BVE	BOOTHVILLE, LA		1	
72235	32.32N	90.08W	JAN	JACKSON, MS		91	
72240	30.12N	93.22W	LCH	LAKE CHARLES, LA		5	
72243	29.42N	95.22W	IAH	HOUSTON, TX		13	
72247	32.35N	94.65W	GGG	LONGVIEW, TX		124	
72248	32.27N	93.49W	SHV	SHREVEPORT/RGNL	LA	78	
72250	25.90N	97.43W	BRO	BROWNSVILLE, TX		7	
72252	27.32N	99.27W	LRD	LAREDO/INTL	TX	156	
72253	29.32N	98.27W	SAT	SAN ANTONIO/INTL	TX	246	
72255	28.85N	96.92W	VCT	VICTORIA, TX		33	
72257	31.10N	97.33W	HLR	FORT HOOD, TX		270	
72259	32.53N	97.02W	DFW	DALLAS/FT WORTH RGNL	TX	182	
72260	32.22N	98.18W	SEP	STEPHENVILLE, TX		399	
72261	29.37N	100.92W	DRT	DEL RIO, TX		314	
72265	31.95N	102.18W	MAF	MIDLAND, TX		873	
72267	33.38N	101.49W	LBB	LUBBOCK/INTL	TX	996	
72268	33.30N	104.53W	ROW	ROSWELL, NM		1104	
72270	31.80N	106.40W	ELP	EL PASO, TX		1193	
72274	32.12N	110.93W	TUS	TUCSON, AZ		789	
72278	33.25N	112.00W	PHX	PHOENIX/SKY HARBOR INTL	AZ	342	
72290	32.82N	117.13W	MYF	SAN DIEGO/MONTGOMERY, CA		124	
72291	33.25N	119.45W	NSI	SAN NICOLAS IS., CA		153	
72295	33.93N	118.40W	LAX	LOS ANGELES, CA		34	
72304	35.27N	75.55W	HAT	HATTERAS, NC		4	

Table 1. WMO station number, latitude and longitude, 3 letter identifier, and name of the stations in the archive.

72306	35.52N	78.47W	RDU	RALEIGH-DURHAM	NC	133
72308	36.53N	76.11W	ORF	NORFOLK/INTL	VA	8
72310	33.57N	81.07W	CAE	COLUMBIA/METRO	SC	64
72311	33.95N	83.32W	AHN	ATHENS, GA		246
72312	34.53N	82.13W	GSP	GREER/GREENVILLE	SC	293
72314	35.13N	80.55W	CLT	CHARLOTTE/DOUGLAS MUNI	NC	228
72317	36.08N	79.95W	GSO	GREENSBORO, NC		275
72326	35.49N	83.58W	TYS	KNOXVILLE/MCGHEE TYSON	TN	301
72327	36.25N	86.57W	BNA	NASHVILLE/BERRY, TN		180
72334	35.02N	90.00W	MEM	MEMPHIS/INTL	TN	101
72340	34.83N	92.25W	1M1	LITTLE ROCK, AR		172
72349	36.88N	93.90W	UMN	MONETT, MO		438
72353	35.40N	97.60W	OKC	OKLAHOMA CITY/W. ROGERS,	OK	392
72355	34.60N	98.40W	FSI	FORT SILL, OK		360
72363	35.23N	101.70W	AMA	AMARILLO, TX		1094
72365	35.05N	106.62W	ABQ	ALBUQUERQUE, NM		1619
72374	35.02N	110.73W	INW	WINSLOW, AZ		1487
72381	34.92N	117.90W	EDW	EDWARDS AFB, CA		705
72386	36.05N	115.10W	LAS	LAS VEGAS/MCCARRAN INTL	NV	662
72387	36.62N	116.02W	DRA	MERCURY/DESERT ROCK, NV		1007
72389	36.77N	119.72W	FAT	FRESNO, CA		100
72391	34.12N	119.12W	NTD	POINT MUGU NAS, CA		4
72393	34.75N	120.57W	VBG	VANDENBERG AFB, CA		100
72401	37.50N	77.33W	RIC	RICHMOND/BYRD, VA		51
72402	37.85N	75.48W	WAL	WALLOPS ISLAND, VA		4
72403	38.98N	77.47W	IAD	WASHINGTON/DULLES, DC		85
72405	38.85N	77.03W	DCA	WASHINGTON/NATIONAL, DC		5
72407	39.45N	74.58W	ACY	ATLANTIC CITY, NJ		23
72408	39.92N	75.18W	PHL	PHILADELPHIA, PA		5
72411	37.19N	79.58W	ROA	ROANOKE/WOODRUM MUNI	VA	358
72414	38.38N	81.77W	CRW	CHARLESTON, WV		182
72423	38.18N	85.73W	SDF	LOUISVILLE, KY		151
72425	38.37N	82.55W	HTS	HUNTINGTON, WV		246
72428	40.00N	82.52W	CMH	COLUMBUS/PORT INTL	OH	249
72429	39.87N	84.12W	DAY	DAYTON, OH		298
72433	38.65N	88.97W	SLO	SALEM, IL		175
72434	38.62N	90.18W	STL	ST. LOUIS, MO		139
72438	39.44N	86.16W	IND	INDIANAPOLIS/INTL	IN	243
72445	38.49N	92.13W	COU	COLUMBIA/RGNL	MO	271
72446	39.16N	94.44W	MCI	KANSAS CITY/INTL	MO	312
72450	37.65N	97.43W	ICT	WICHITA, KS		406
72451	37.77N	99.97W	DDC	DODGE CITY, KS		791
72456	39.07N	95.63W	TOP	TOPEKA, KS		268
72465	39.22N	101.41W	GLD	GOODLAND/RENNER FLD	KS	1115
72468	38.70N	104.77W	FCS	FORT CARSON, CO		1789
72469	39.75N	104.87W	DEN	DENVER/STAPLETON, CO		1611
72476	39.12N	108.53W	GJT	GRAND JUNCTION, CO		1472
72483	38.30N	121.30W	SAC	SACRAMENTO/EXECUTIVE	CA	6
72486	39.28N	114.85W	ELY	ELY, NV		1908
72488	39.30N	119.47W	RNO	RENO/INTL	NV	1344
72493	37.75N	122.22W	OAK	OAKLAND, CA		6
72509	42.36N	71.09W	BOS	BOSTON, MA		30
72514	41.25N	76.92W	IPT	WILLIAMSPORT, PA		161
72518	42.75N	73.80W	ALB	ALBANY, NY		86
72519	43.12N	76.12W	SYR	SYRACUSE, NY		128
72520	40.53N	80.23W	PIT	PITTSBURGH, PA		359
72524	41.50N	81.60W	CLE	CLEVELAND, OH		213
72528	42.93N	78.73W	BUF	BUFFALO, NY		218
72530	41.98N	87.90W	ORD	CHICAGO/O'HARE, IL		203
72532	40.67N	89.68W	PIA	PEORIA, IL		200
72537	42.23N	83.33W	DTW	DETROIT, MI		191
72546	41.32N	93.38W	DSM	DES MOINES/MUNI	IA	292
72553	41.37N	96.02W	OMA	OMAHA, NE		400
72557	42.24N	96.22W	SUX	SIOUX CITY/MUNI	IA	334
72562	41.13N	100.68W	LBF	NORTH PLATTE, NE		847
72564	41.15N	104.82W	CYS	CHEYENNE, WY		1872
72569	42.55N	106.27W	CPR	CASPER/NATRONA CO	WY	1612
72572	40.77N	111.97W	SLC	SALT LAKE CITY, UT		1288
72576	42.82N	108.73W	LND	LANDER, WY		1695
72583	40.90N	117.80W	WMC	WINNEMUCCA, NV		1312
72597	42.37N	122.87W	MFR	MEDFORD, OR		401
72606	43.65N	70.32W	PWM	PORTLAND, ME		20
72617	44.27N	73.08W	BTV	BURLINGTON/INTL	VT	102
72637	42.97N	83.73W	FNT	FLINT, MI		236

72639	45.03N	83.33W	APN	ALPENA/PHELPS COLLINS	MI	210
72641	43.08N	89.19W	MSN	MADISON/TRUAX FLD	WI	262
72645	44.48N	88.13W	GRB	GREEN BAY, WI		210
72651	43.33N	96.44W	FSD	SIOUX FALLS/FOSS	SD	435
72654	44.38N	98.22W	HON	HURON, SD		392
72655	45.55N	94.07W	STC	ST. CLOUD, MN		315
72658	44.52N	93.13W	MSP	MINNEAPOLIS/ST PAUL	MN	256
72662	44.05N	103.07W	RAP	RAPID CITY, SD		966
72677	45.47N	108.32W	BIL	BILLINGS/LOGAN INTL	MT	1099
72681	43.57N	116.22W	BOI	BOISE, ID		871
72688	45.41N	118.50W	PDT	PENDLETON/MUNI AMOS	OR	455
72694	44.92N	123.02W	SLE	SALEM, OR		61
72712	46.87N	68.02W	CAR	CARIBOU, ME		191
72734	46.47N	84.37W	SSM	SAULT STE. MARIE, MI		221
72745	46.50N	92.11W	DLH	DULUTH/INTL	MN	436
72747	48.57N	93.38W	INL	INTERNATIONAL FALLS, MN		359
72753	46.53N	96.47W	FAR	FARGO/HECTOR	ND	274
72764	46.77N	100.75W	BIS	BISMARCK, ND		503
72767	48.18N	103.63W	ISN	WILLISTON, ND		592
72768	48.22N	106.62W	GGW	GLASGOW, MT		696
72775	47.48N	111.37W	GTF	GREAT FALLS, MT		1118
72785	47.63N	117.53W	GEG	SPOKANE, WA		720
72793	47.45N	122.30W	SEA	SEATTLE, WA		130
72797	47.95N	124.55W	UIL	QUILLAYUTE, WA		56
74207	47.08N	122.58W	GRF	FORT LEWIS/GRAY, WA		92
74486	40.78N	73.77W	JFK	NEW YORK/KENNEDY, NY		8
74494	41.67N	69.97W	CHH	CHATHAM, MA		16
74794	28.47N	80.55W	XMR	CAPE CANAVERAL, FL		3
76151	28.88N	118.30W	ILS	ISLA GUADALUPE, B.C.		6
76225	28.70N	106.07W	CUU	CHIHUAHUA, CHIH.		1429
76256	27.95N	110.80W		EMPALME, SON.		12
76394	25.87N	100.20W	MTY	MONTERREY AEROPUERTO, N.L.		450
78016	32.37N	64.68W	XKF	KINDLEY FIELD, BERMUDA		27



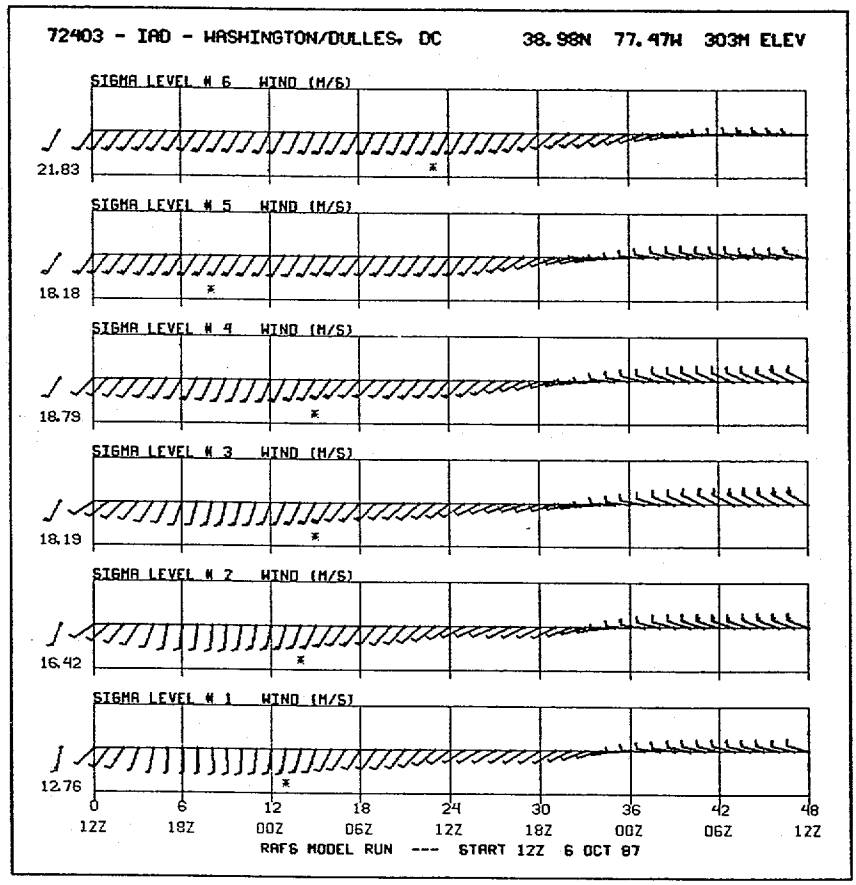
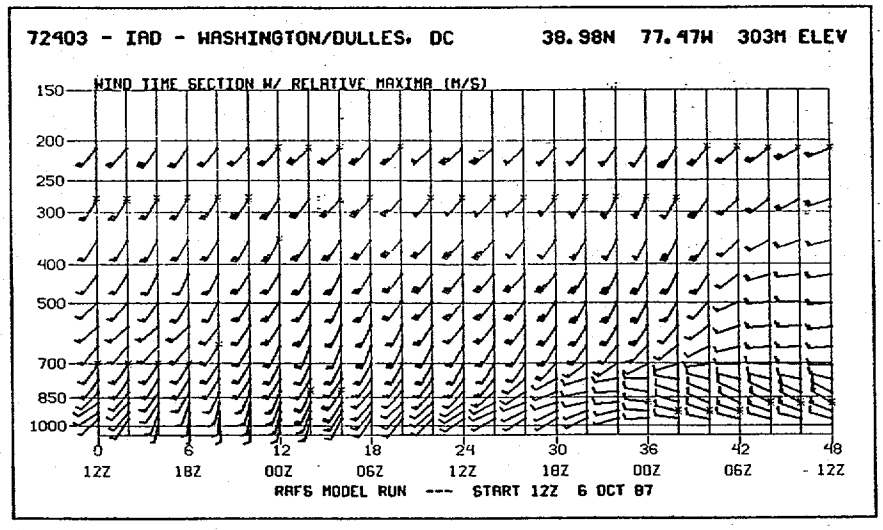


Figure 2. An example of meteogram output from the NMCiDAS graphics package.



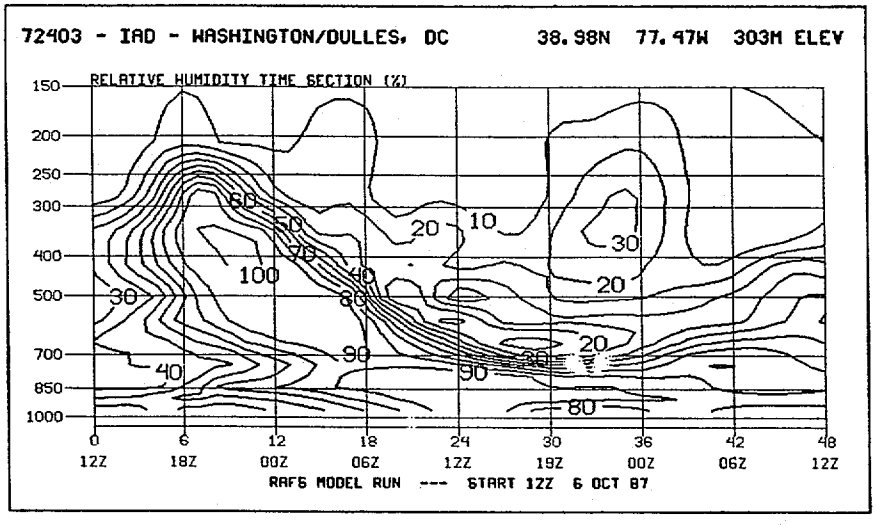


Figure 3. An example of time/height crossections from the NMCiDAS graphics package.

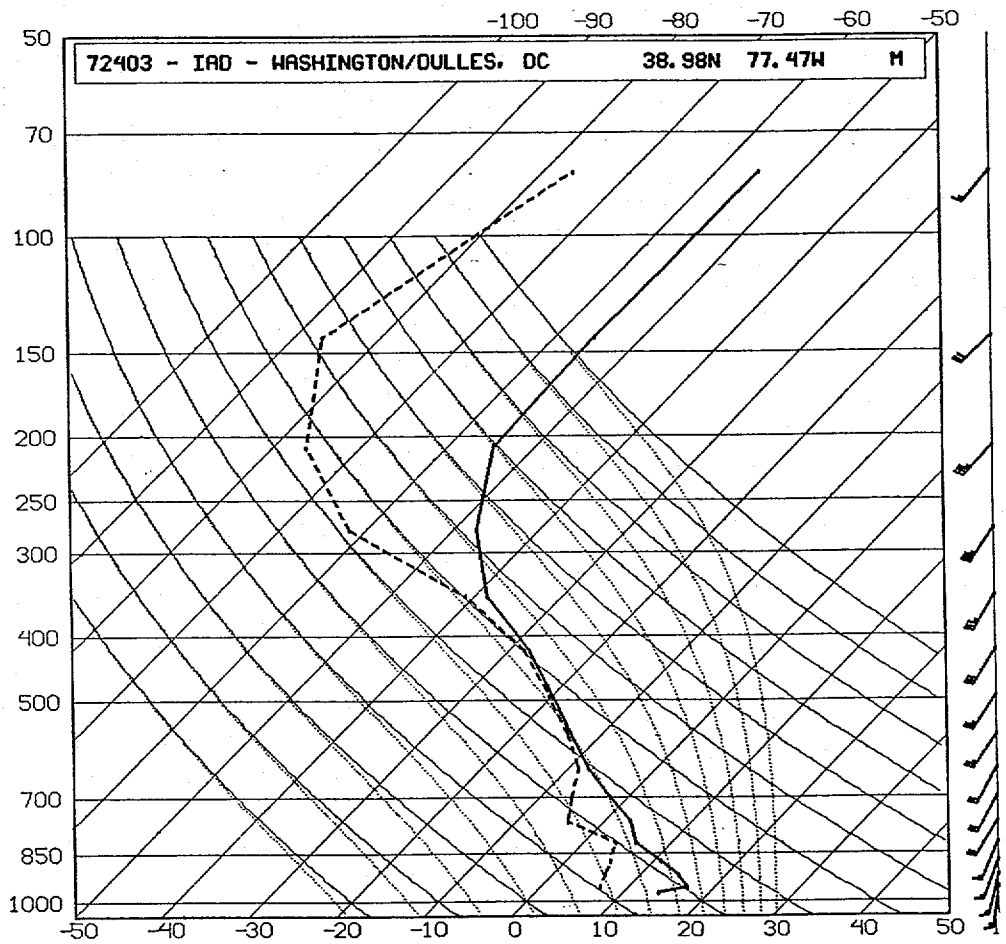


Figure 4. An example of a sounding plot from the NMCiDAS graphics package.

APPENDIX A

DESCRIPTION OF THE ROUTINES TO ACCESS THE ARCHIVE

In this section, the calling sequence of the routines to access the archive are presented .

```
      SUBROUTINE GUVTQP ( IYR,IMN,IDY,IHR,ISTA,IFHR,IVERF,
     *                    U,V,T,Q,P,PSTAR,TSKIN,TERR,ALAT,ALON,NZ,IERR)

      NAME        : GUVTQP
      PURPOSE     : RETURN U,V,T,Q, AND P INFORMATION
      AUTHOR      : J. J. TUCCILLO
      DATE        : 06 JULY 1987

         THE INPUT ARGUMENTS ARE :

      IYR      -      YEAR
      IMN      -      MONTH
      IDY      -      DAY
      IHR      -      CYCLE
      IST      -      BLOCK AND STATION NUMBER ( EG. 72403 FOR DULLES )
      IFHR     -      FORECAST LENGTH IN SECS OR HOURS
      IVERF    -      = 0, FORECAST ORIGINATING AT IYR, IMN, IDY, IHR
                        1, FOREACST VERIFYING AT IYR, IMN, IDY, IHR

         THE OUTPUT ARGUMENTS ARE :

      U(NZ)    -      EAST-WEST WIND COMPONENT          ( M/S        )
      V(NZ)    -      NORTH-SOUTH WIND COMPONENT        ( M/S        )
      T(NZ)    -      TEMPERATURE                       ( DEGREES K  )
      Q(NZ)    -      SPECIFIC HUMIDITY                 ( GRMS/GRM   )
      P(NZ)    -      PRESSURE AT LAYER MIDPOINT        ( MBS        )
      PSTAR    -      TERRAIN PRESSURE                  ( MBS        )
      TSKIN    -      SKIN TEMPERATURE                  ( DEGREES K  )
      TERR     -      TERRAIN HEIGHT                    ( METERS     )
      ALAT     -      LATITUDE                          ( DEGREES    )
      ALON     -      LONGITUDE                         ( DEGREES    )
      NZ       -      NUMBER OF LAYERS RETURNED
      IERR     -      = 0, RECORD FOUND
                        1, RECORD NOT FOUND
                        2, BACKDATE IS NOT AN INCREMENT OF 12
                        3, ERROR OPENING THE ARCHIVE
                        4, ERROR READING THE ARCHIVE

      END END END OF DOCUMENTATION
```

```
SUBROUTINE SPRCP ( IYR,IMN,IDY,IHR,ISTA,IFHR,IVERF,
*                  GSP,SGSP,ALAT,ALON,NZ,IERR)

NAME        : SPRCP
PURPOSE     : RETURN PRECIPITATION INFORMATION
AUTHOR      : J. J. TUCCILLO
DATE        : 06 JULY 1987

   THE INPUT ARGUMENTS ARE :

IYR      -      YEAR
IMN      -      MONTH
IDY      -      DAY
IHR      -      CYCLE
IST      -      STATION INDEX
IFHR     -      FORECAST LENGTH IN SECONDS OR HOURS
IVERF    -      = 0, FORECAST ORIGINATING AT IYR, IMN, IDY, IHR
                  1, FOREACST VERIFYING AT IYR, IMN, IDY, IHR

   THE OUTPUT ARGUMENTS ARE :
                IDIF = 1
GSP      -      IDIF HOUR ACC GRID SCALE PR     ( METERS     )
SGSP     -      IDIF HOUR ACC SUB-GRID SCALE PR( METERS     )
ALAT     -      LATITUDE                        ( DEGREES    )
ALON     -      LONGITUDE                       ( DEGREES    )
NZ       -      NUMBER OF LAYERS RETURNED
IERR     -      = 0, RECORD FOUND
                  1, RECORD NOT FOUND
                  2, BACKDATE IS NOT AN INCREMENT OF 12
                  3, ERROR OPENING THE ARCHIVE
                  4, ERROR READING THE ARCHIVE

END END END OF DOCUMENTATION
```

```
SUBROUTINE SCLDS ( IYR,IMN,IDY,IHR,ISTA,IFHR,IVERF,
*      ALA,AMA,AHA,ALW,AMW,AHW,ACA,ACWB,ACWT,ALAT,ALON,NZ,IERR)

NAME        : SCLDS
PURPOSE     : RETURN CLOUD INFORMATION
AUTHOR      : J. J. TUCCILLO
DATE        : 06 JULY 1987

   THE INPUT ARGUMENTS ARE :

IYR      -      YEAR
IMN      -      MONTH
IDY      -      DAY
IHR      -      CYCLE
IST      -      STATION INDEX
IFHR     -      FORECAST LENGTH IN HOURS OR SECONDS
IVERF    -      = 0, FORECAST ORIGINATING AT IYR, IMN, IDY, IHR
                  1, FOREACST VERIFYING AT IYR, IMN, IDY, IHR

   THE OUTPUT ARGUMENTS ARE :

ALA      -      LOW CLOUD AMOUNT                ( 0 - 1      )
AMA      -      MID CLOUD AMOUNT                ( 0 - 1      )
AHA      -      HI  CLOUD AMOUNT                ( 0 - 1      )
ALW      -      LOW CLOUD PRESSURE              ( MBS        )
AMW      -      MID CLOUD PRESSURE              ( MBS        )
AHW      -      HI  CLOUD PRESSURE              ( MBS        )
ACA      -      CONVECTIVE CLOUD AMOUNT         ( 0 - 1      )
ACWB     -      PRESSURE AT BASE OF CLOUD       ( MBS        )
ACWT     -      PRESSURE AT TOP OF CLOUD        ( MBS        )
ALAT     -      LATITUDE                        ( DEGREES    )
ALON     -      LONGITUDE                       ( DEGREES    )
NZ       -      NUMBER OF LAYERS RETURNED
IERR     -      = 0, RECORD FOUND
                  1, RECORD NOT FOUND
                  2, BACKDATE IS NOT AN INCREMENT OF 12
                  3, ERROR OPENING THE ARCHIVE
                  4, ERROR READING THE ARCHIVE

END END END OF DOCUMENTATION
```

```
SUBROUTINE GSEB ( IYR,IMN,IDY,IHR,ISTA,IFHR,IVERF,
*       ASWR,ALWR,ASHF,ALHF,ASSF,TSKIN,TSUB,ALAT,ALON,NZ,IERR)

NAME        : GSEB
PURPOSE     : RETURN SURFACE ENERGY BUDGET INFORMATION
AUTHOR      : J. J. TUCCILLO
DATE        : 06 JULY 1987

   THE INPUT ARGUMENTS ARE :

IYR     -     YEAR
IMN     -     MONTH
IDY     -     DAY
IHR     -     CYCLE
IST     -     STATION INDEX
IFHR    -     FORECAST LENGTH IN HOURS OR SECONDS
IVERF   -     = 0, FORECAST ORIGINATING AT IYR, IMN, IDY, IHR
                1, FOREACST VERIFYING AT IYR, IMN, IDY, IHR

   THE OUTPUT ARGUMENTS ARE :

ASWR    -     SHORTWAVE RADIATION                ( W/M**2     )
ALWR    -     NET LONGWAVE RADIATION             ( W/M**2     )
ASHF    -     SENSIBLE HEAT FLUX                 ( W/M**2     )
ALHF    -     LATENT HEAT FLUX                   ( W/M**2     )
ASSF    -     SUB-SOIL FLUX                      ( W/M**2     )
TSKIN   -     SKIN TEMPERATURE                   ( DEGREES K  )
TSUB    -     SUB-SOIL TEMPERATURE               ( DEGREES K  )
ALAT    -     LATITUDE                           ( DEGREES    )
ALON    -     LONGITUDE                          ( DEGREES    )
NZ      -     NUMBER OF LAYERS RETURNED
IERR    -     = 0, RECORD FOUND
                1, RECORD NOT FOUND
                2, BACKDATE IS NOT AN INCREMENT OF 12
                3, ERROR OPENING THE ARCHIVE
                4, ERROR READING THE ARCHIVE

END END END OF DOCUMENTATION
```

```
SUBROUTINE GRDTN ( IYR,IMN,IDY,IHR,ISTA,IFHR,IVERF,
*                  RADN,ALAT,ALON,NZ,IERR)

NAME        : GRDTN
PURPOSE     : RETURN RADIATION HEATING RATES
AUTHOR      : J. J. TUCCILLO
DATE        : 06 JULY 1987

   THE INPUT ARGUMENTS ARE :

IYR     -     YEAR
IMN     -     MONTH
IDY     -     DAY
IHR     -     CYCLE
IST     -     STATION INDEX
IFHR    -     FORECAST LENGTH IN SECONDS OR HOURS
IVERF   -     = 0, FORECAST ORIGINATING AT IYR, IMN, IDY, IHR
                1, FOREACST VERIFYING AT IYR, IMN, IDY, IHR

   THE OUTPUT ARGUMENTS ARE :

RADN(NZ)-     TOTAL RADIATIVE HEATING            ( DEG K/DAY )
ALAT    -     LATITUDE                           ( DEGREES   )
ALON    -     LONGITUDE                          ( DEGREES   )
NZ      -     NUMBER OF LAYERS RETURNED
IERR    -     = 0, RECORD FOUND
                1, RECORD NOT FOUND
                2, BACKDATE IS NOT AN INCREMENT OF 12
                3, ERROR OPENING THE ARCHIVE
                4, ERROR READING THE ARCHIVE

END END END OF DOCUMENTATION
```

APPENDIX B

STRUCTURE OF THE ARCHIVE

The archive is based on a VSAM keyed access file structure with each record representing one profile. The records are inserted into and retrieved from the file based on the first 12 bytes of the record ; the key. The key, by definition, is unique for each record. The remainder of the record represents data ; the latitude, longitude, winds, temperature, moisture, pressure etc. The record structure is presented below :

BYTES	DESCRIPTION	REPRESENATION
1 - 4	Initialization Time	Packed IBM Integer*4
5 - 8	Forecast Time in Secs	IBM Integer*4
9 - 12	WMO Station Number	IBM Integer*4
13 - 16	Station Latitude	IBM Real*4
17 - 20	Station Longitude	IBM Real*4
21 - 604	Forecast Values	IBM Real*4

The structure of the forecast values in bytes 21 - 604 will not be presented here. The sturcture of the data within these bytes is based on the organization of arrays within the NGM code. Since the internal structure of the NGM changes from time to time, the organization of values within bytes 21 - 604 will also change. The user need only be aware of the fact that the subroutines presented in Appendix A do the actual decoding of the records and will be updated and recompiled for the load library when ever necessary.

APPENDIX C

COMMAND: Plot Sounding

KEY-IN: PS

PROGRAMMER: D. W. Plummer

DATE: 13 JUL 87
DOC BY: programmer

COMMAND FORMAT:

PS STATION TYPE PSPEC KOLOR DSI TIMPER

EXPLANATION:

This command is used for plotting an atmospheric sounding. Up to two soundings may be plotted on either a skew-T or Stuve diagram. The plotted data may be from the NMCIDAS observed data database, model output from the profile archives or from an unformatted file.

PARAMETER DESCRIPTION:

STATION - the block and station number or three letter identifier of the forecast station.

TYPE - type of diagram, either SKEWT or STUVE.

PSPEC - panel specification, either 11 or 12 or 22

- 11 - one sounding only
  - temperature will be solid; dew point will be dashed.
  - winds labelled as 1.
- 12 - the first of 2 soundings
  - both temperature and dew point will be solid.
  - winds labelled as 1.
- 22 - the second of two soundings
  - both temperature and dew point will be dashed.
  - winds labelled as 2.

KOLOR - color of temperature, dew point and winds

DSI - data set index

- 11 - observed data sounding
- 5x - model output sounding from profile archives. model run and time defined by DD command.
- 91 - unformatted file data in unit 91
  This file should have a record length of 80 with the records containing (unformatted):

COMMAND: PS (continued)

RECORD	INFORMATION (I-integer;R-real)
1)	station(I), latitude(R), longitude(R)
2)	NZ (I, number of levels)
3)	u(R), v(R), t(R), td(R), p(R), z(R) for level 1
4)	u(R), v(R), t(R), td(R), p(R), z(R) for level 2
.	.
.	.
.	.
NZ+2)	u(R), v(R), t(R), td(R), p(R), z(R) for level NZ

TIMPER - time period of observed data sounding from NMCIDAS database.

EXAMPLES:

GD ARCH 87 7 14 00 1
- stages observed data from 00Z 14 Jul 1987 to the NMCIDAS observed data database first time period.

PS 72403 SKEWT 11 3 11 1
- plots the Dulles sounding for 00Z 14 Jul 1987.

DD 51 ARCH RAFX 87 7 13 00 12
PS 72403 SKEWT 11 3 51
- plots the Dulles sounding for 12Z 13 Jul 1987 as forecast by the parallel regional cycle starting 00Z 13 Jul 1987.

DD 51 ARCH RAFX 87 7 13 00 24
PS 72403 SKEWT 12 3 51
- plots the Dulles sounding for 00Z 14 Jul 1987 as forecast by the parallel regional cycle starting 00Z 13 Jul 1987.

DD 52 ARCH RAFX 87 7 13 12 12
PS 72403 SKEWT 22 3 52
- plots the Dulles sounding for 00Z 14 Jul 1987 as forecast by the parallel regional cycle starting 12Z 12 Jul 1987. Both plots will appear on the same thermodynamic diagram.

PS 72403 SKEWT 11 3 91
- plots a generic sounding from unit 91.

COMMAND: Meteogram

KEY-IN: MG

PROGRAMMER: D. W. Plummer

DATE: 13 JUL 87
DOC BY: programmer

COMMAND FORMAT:

MG STATION DSI NPARMS T1 L1 T2 L2 ... Tnparms Lnparms

EXPLANATION:

This command is used for plotting a meteogram forecast from one of the model profile archives. The profile archives contain sigma level u,v,t,q and p as well as many surface quantities. Several diagnostic variables are available as well. The data may be plotted as a single level time series or as a multi-level time section.

PARAMETER DESCRIPTION:

STATION - the block and station number or three letter identifier of the forecast station.

DSI - dataset index specifying the model run and starting date.

NPARMS - the number of parameters (Tn and Ln combinations) to be included in the diagram.

Tn - type specifiers

Ln - level specifiers

The following types are available for the following levels (level definitions follow) :

TYPE	DESCRIPTION / VALID LEVELS
U	u-component (m/s) isl,ALL,TROP,thick
V	v-component (m/s) isl,ALL,TROP,thick
T	dry temperature (C) isl,SFC,ALL,TROP,thick
Q	specific humidity (g/kg) isl,ALL,TROP,thick
P	pressure (mb) SFC,MSL,ALL,TROP,thick
VEL	wind speed (m/s) isl,ALL,TROP,thick
RH	relative humidity (%) isl,ALL,TROP,thick

COMMAND: MG (continued)

POT	potential temperature (K)	isl,ALL,TROP,thick
TD	dew point temperature (C)	isl,ALL,TROP,thick
TDEP	dew point depression (C)	isl,ALL,TROP,thick
DIR	wind direction (graphic)	isl,ALL,TROP,thick
QS	saturation specific humidity (g/kg)	isl,ALL,TROP,thick
WNDF	wind flag (graphic,m/s)	isl,ALL,TROP,thick
RADN	radiational heating rate (C/day)	isl,ALL,TROP,thick
APCP	accumulated total precipitation (mm) - bar chart	hour increment
ACPP	accum. convective precip. (mm) - bar chart	hour increment
NCPP	accum. non-conv. precip. - bar chart	hour increment
PPCT	ratio of conv. precip. to total (%) - bar chart	hour increment
CLDL	cloud amount, low (%) - bar chart	any
CLDM	cloud amount, middle (%) - bar chart	any
CLDH	cloud amount, high (%) - bar chart	any
SWR	short wave radiation (W/m**2)	any
LWR	long wave radiation (W/m**2)	any
SHF	sensible heat flux (W/m**2)	any
LHF	latent heat flux (W/m**2)	any
SLF	soil flux (W/m**2)	any
TSS	subsoil temperature	any
SEB	surface energy budget (W/m**2) (SWR & LWR & SHF & LHF & SLF)	any
TSSK	TSS & T SFC (skin)	any

COMMAND: MG (continued)

LEVEL DEFINITIONS:

isl - individual sigma level. This results in a time series.
(1 <= isl <= NZ)
where NZ is the total number of model sigma levels.

SFC - surface. For surface quantities only.

MSL - mean sea level. For pressure only.

ALL - all vertical levels. This results in a time section with vertical range from 1050 mb to sigma level NZ.

TROP - all vertical levels to the tropopause. This results in a time section with vertical range from 1050 mb to 200 mb.

thick - all vertical levels bounded by the pressure levels specified by thick.
thick = LL*10 + UL/10
where LL is the lower level in mb
and UL is the upper level in mb.

any - anything, but something must be specified. (INFO works well)

EXAMPLES:

DD 51 ARCH RAFX 87 7 13 00
MG 72403 51 1 T 1
- plots a time series of the first sigma level temperature.

MG 72403 51 6 T 6 T 5 T 4 T 3 T 2 T 1
- plots 6 time series of the lowest 6 sigma level temperatures.

MG 72403 51 1 T SFC
- plots a time series of the surface (skin) temperature.

MG 72403 51 1 P MSL
- plots a time series of mean sea level pressure.

MG 72403 51 1 VEL ALL
- plots a time section of wind speed for all levels.

MG 72403 51 1 POT TROP
- plots a time section of potential temperature from 1050 mb to 200 mb.

COMMAND: MG (continued)

MG 72403 51 2 POT TROP WNDF TROP
- plots time sections of potential temperature and wind flags from 1050 mb to 200 mb.

MG 72403 51 1 RH 10050
- plots a time section of relative humidity from 1000 mb to 500 mb.

MG 72403 51 1 APCP 3
- plots a time series of accumulated precipitation at 3 hour intervals.

MG 72403 51 1 ACPP 6
- plots a time series of accumulated convective precipitation at 6 hour intervals.

MG 72403 51 1 PPCT 12
- plots a time series of convective precipitation percentage at 12 hour intervals.

MG 72403 51 1 CLDL INFO
- plots a time series of low cloud amount (bar graph).

MG 72403 51 3 CLDH INFO CLDM INFO CLDH INFO
- plots 3 time series of high, middle and low cloud amounts.

MG 72403 51 6 SWR INFO LWR INFO SHF INFO LHF INFO SLF INFO
- plots 6 time series of radiation parameters.

MG 72403 51 1 TSSK INFO
- plots overlayed time series of skin temperature and subsoil temperature.

MG 72403 51 1 PTV TROP
- plots overlayed time sections of potential temperature and wind speed.

MG 72403 51 1 PTVQ 10050
- plots overlayed time sections of potential temperature, wind speed and specific humidity from 1000 mb to 500 mb.

APPENDIX D

A PC BASED SYSTEM FOR PLOTTING NGM FORECAST SOUNDINGS

James J. Tuccillo
National Meteorological Center
World Weather Building
W/NMC22 , Room 204
Washington, D.C. 20233

NOTE : IF THIS DOCUMENTATION DOES NOT INCLUDE A DEMO FLOPPY DISK THEN WRITE ME AT THE ABOVE ADDRESS FOR A COPY.

I. INTRODUCTION

This document and the enclosed floppy disk will demonstrate an IBM PC, or clone, based sounding plotting program for the interactive plotting of Nested Grid Model (NGM) forecast soundings at a time frequency of 1 hour or greater. The current NWS diplays systems, AFOS and FAX, do not allow for the display of vertical profiles of wind, temperature and moisture. This system will allow one to display these quantities on an Emagram. The enclosed floppy disk contains the software for plotting soundings and a data file from a recent NGM forecast. This is for demonstation purposes. A procedure for using this capability in real time will be suggested in Section 3.

II. RUNNING THE DEMONSTRATION

To use this system you will need the following equipment:

- an IBM PC or XT or clone with at least 256K of memory
- MS-DOS Operating System
- printer if you want hard copies.

The enclosed floppy disk contains the following files:

- SNDSLOW.EXE
- SNDFAST.EXE
- DULLES

The first two files are the executable sounding plotting programs. If your system has an 8087 math co-processor use SNDFAST.EXE otherwise use SNDSLOW.EXE. The second file is a data files for Dulles, Va. The current operational profile archive has 181 stations, Dulles is provided for demonstration purposes.

After booting the system place the demonstration disk in the 'A' drive if you have a system with a hard disk or in the 'B' drive if you have a 2 floppy drive system. Set the drive to either 'A' or 'B' as appropriate. Turn on your printer if you want hard copy.

To begin execution type either SNDFAST or SNDSLOW (depending on whether you have an 8087 co-processor or not). At this time a display panel should appear on the CRT. If I lose you or it doesn't seem to be working call me at 301-763-8161. Hit return and the next display screen will ask you for a data file. Type in the name of one of the above data files and hit return. **Use upper case letters for this and all other input**. Next you will be prompted for whether you want to plot on the screen ('S') or the printer ('P'). If you selected 'P', the printer, you will be prompted for the type of printer you have available. Enter the number from the list displayed. Plotting on the screen may not work depending on your CRT, plotting on the printer should work for everyone. You will now start to see messages diplayed on the CRT indicating that sounding information is being loaded off disk into memory. When it is done it will prompt you with the following :

> (Q=QUIT,M=MENU,P=PLOT)

Type 'M' and a menu of the available data in the data file you selected will be displayed. The menu may scroll off the screen, type 'CTRL-S' to stop and start the scrolling. The number in the first column is how you select which sounding you wish to plot. The year, month, day, and hour of initialization, the WMO block and station number and the forecast hour follow.

Type 'P' to plot a sounding. You will be prompted for one of the numbers displayed in the first column of the menu display. This is how you indicate which sounding you wish to plot. A 'Please wait...' message will be displayed while the plotting instructions are being generated. When it is done it will display another prompt

> (Q=QUIT,M=MENU,P=PLOT)

Type 'P' again to generate the plotting instructions for another sounding, or 'M' if you need to see the menu again. You will continue to receive a prompt until you type 'Q'

The actual plotting on the screen or printer will take place when you type 'Q' for quit. Typing 'P' generates plotting instructions and stores them on disk. You can generate as many soundings as you wish but they will not be plotted

on the screen or printer until you end execution of the program by typing 'Q' when the prompt appears.

A sample plot is presented on the following page. The thin solid line is the temperature profile, the thin dashed line is the dewpoint profile, and the wind vectors in knots (earth coordinates) are on the right hand side. The temperature, dewpoint, and winds are the actual sigma layer values of the NGM. There is no interpolation to pressure. You are seeing the actual model representation of these quantities. The heights of the mandatory pressure surfaces, derived by vertically integrating the sigma layer temperatures to the pressure surfaces, are displayed on the right. At the top of the plot is the year, month, day and hour that the model was initialized on and the forecast hour. For example a 12 hour forecast initialized on 2 June 1987 at 12Z would be valid at 3 June 1987 at 00Z.

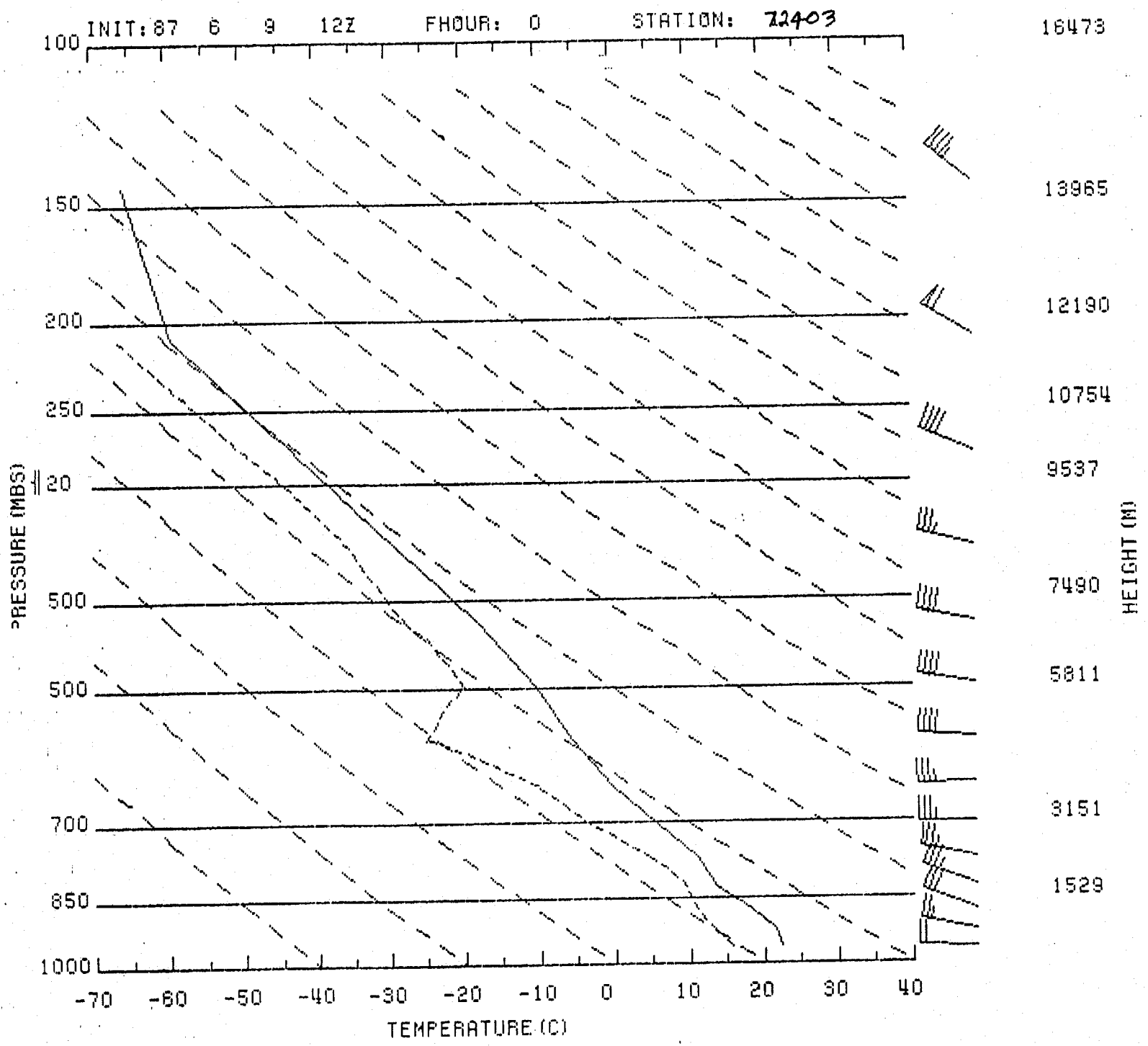
At the bottom of the plot the surface pressure (pressure at the terrain of the model), the skin temperature from the surface energy budget (see TPB # 363 for details), the first sigma layer temperature (mean temperature of the bottom 35mbs of the NGM) and the Lifted Index are printed. The Lifted Index is computed by lifting a parcel with the average temperature and specific humidity of the lowest 75mb of the NGM and may differ from the 'Best Lifted Index' displayed on AFOS and FAX.

III. SUGGESTED PROCEDURE FOR REAL TIME USE

This program could be used in real time if the user has access to the NMC computers. You would need a modem and communications software (which is readily available). The procedure would be as follows:

1) Logon to the NMC mainframe
2) Execute an existing program to create a file of sounding data.
3) Download that file to your PC
4) Logoff the NMC mainframe
5) Execute SNDFAST (or SNDSLOW) on the downloaded data

Some of the communications software is "smart" enough that they can be setup to execute the above steps automatically.


INIT: 87 6 9 12Z
FHOUR: 0
STATION: 72403
PRESSURE (MBS)
100
150
200
250
20
500
500
700
850
1000
-70 -60 -50 -40 -30 -20 -10 0 10 20 30 40
TEMPERATURE (C)
16473
13965
12190
10754
9537
7490
5811
3151
1529
HEIGHT (M)