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NATIONAL METEOROLOGICAL CENTER

OFFICE NOTE 84

(REVISED)
(see overleaf)

Packing and Identification of NMC Grid-Point Data

Automation Division Staff

February 10, 1994

Changes, additons, and corrections since the last full printing, dated January 19, 1993:

January 1993	p.10	interpretation of parameter 159 clarified
	p.11-13	units of 179,199,210,211
		new parameters 219 & 220
	p.27ff	new grid types: 87, 88, 89, 90, 91, 92, 93, 98, 104, 105, 106, 107; 153 deleted
	p.28	RUC added to run marker table.
	p.29ff	new generating programs:80,81,83,84,85,86
March 1993	p.10ff	Added parameters 138, 157, 158
	p.9	Deleted parameter 118 (redundant with 157)
November 1993	p.20	Added Grid 4
February 1994	p.4	Correction to specification of location of T
	p.21	Added grid 18 (12 hex)
	p.30	Model 78 (4E hex) changed to indicate 28 layers
	p.30.1	Added model No. 87, 88

Then reprinted in entirety with new pagination, one hopes for the last time, as this identification system will not be carried over to UNIX based operating systems. GRIB will be used instead.

Note: This publication is available via **Internet** on the NOAA Information Center server.

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INTRODUCTION

This Office Note provides information related to NMC grid point data fields. It describes the structure and packing of the data and the system used to identify the fields. A large number of requirements have been accommodated since these procedures were introduced many years ago and, as might be expected, some exceptions have crept into usage. These generally involve a minor amount of non-conformity to the standard units and to the packing procedures. The exceptions, where known, are indicated.

The "Office Note 84" packing and identification method, as it is known locally, is an internal NMC standard; external transmissions generally use one or more World Meteorological Organization (WMO) code forms. In particular, grid-point data are represented in Code FM 92 GRIB (GRIdded Binary). Documentation on GRIB is available from the NMC Automation Division as Office Note 388. The documentation is also available on the **nic.fb4.noaa.gov** server. An effort is under way to convert NMC's internal data storage to GRIB to avoid the necessity of routinely changing data from one representation form to another and to bring NMC into line with the international standards.

NMC PACKED BINARY DATA FORMAT

Most NMC grid point data fields are packed by transforming 32-bit full-word floating point numbers into 16-bit half-word integers using a scaling algorithm which will be described later. A 12-word label is prefixed to each packed data array, serving two purposes: 1) to uniquely identify the data field; and 2) to hold count and scaling information so that the data may be unpacked and converted back into an array of floating point numbers.

Spectral coefficients are stored without packing. In this case, each complex coefficient is composed of two 32-bit full-word floating point numbers.

DATA PACKING AND UNPACKING

The method for scaling and packing the data is as follows.

First, compute a reference value A by finding the maximum and minimum data values, QMAX and QMIN, respectively. Use these two values to determine the mid-range of the data array:

$$A = (QMAX + QMIN) / 2.0$$

Next, find the binary scaling value n, the least integer such that:

$$(QMAX - A) < 2^{**}n$$

("**" denotes exponentiation.)

The reference value A is stored as a 32-bit IBM floating point number in word 10 of the 12-word label. The binary scaling value n is stored as a halfword integer in the right half of word 11. (See Figure 1.)

Then the data array is scaled according to:

$$H(j) = (Q(j) - A) * 2^{**}(15 - n), \; j=1,J$$

where $Q(j)$ is a 32-bit floating point number to be packed, and J is the number of data points. The scaled values $H(j)$ are rounded, converted to halfword integers, and stored in sequence following word 12 of the label. The points are taken in the order they occur in storage. Negative values of n and $H(j)$ are stored in two's complement form.

NMC data fields can be packed and unpacked by this method with NMC library subroutines W3AI00 and W3AI01. The casual users of NMC packed fields need not concern themselves further with the packing details except to note that 15-bit precision is maintained. The precision retained by the scaling algorithm depends inversely on the range of values in the original array; i.e., the smaller the range, the greater the precision retained. Using a reference value which is the mid-range of the data array and forming departures from that value yields the same precision as using a reference value which is the minimum of the data array and then forming positive departures with 16-bit precision.

In packing a data field, the reference value A and the scaling factor n can, of course be preset by the creator of the field rather than using the packing subroutine W3AI00. This procedure affects only the precision of the data generated and does not prohibit the use of the unpacking subroutine W3AI01, as long as all 12 ID label words are properly set.

IDENTIFYING THE DATA FIELDS

Each packed data field is uniquely identified by the first 5 words of its 12-word label. These 5 words specify the data type, the type and value of the (constant) surface on which the data are given, the forecast (projection) time (including the value zero), the grid type, and any other parameters needed. See Figure 1.

Most NMC data fields can be thought of as some quantity Q on a horizontal or quasi-horizontal surface S at some level of value L. For example, a 500-hPa height field would be identified by specifying Q = height, S = pressure, and $L = 500$. Another example is Q = pressure, S = mean sea level, and $L = 0$ (not applicable). If the quantity Q is for a layer, the domain of the layer is given by $S1$ at $L1$ and $S2$ at $L2$. In this case, the surface of $S1$ is the one geometrically above the surface of S2. For example, the thickness of the 500 to 1000-hPa layer is specified by Q = height, S1 and S2 = pressure, $L1 = 500$, and $L2 = 1000$. Another possibility is that the quantity Q is formed by differencing two fields of the same data type, e.g., constant pressure height for different levels (thickness) or constant pressure height for the same level for different times (tendency). The identifications for these examples, as well as for many other possibilities, can be constructed by carefully considered combinations of the markers T, M, X, and N, as described in Tables 2 through 5, below.

The numerical value of the level L for the corresponding surface S is coded in words 2 and 4 of the label as follows:

Represent L as:

$$L = C * 10**E$$

where C is a 5-digit signed decimal integer whose high-order digit is zero unless L is a negative number, and E is a signed integer. The convention for representing the signed integers C and E is to set the high-order bit on for negative values. For example, if L = 500:

$$C = 50000$$

$$E = -2$$

so that:

$$L = 50000 * 10**(-2)$$

Again, if L = 0.83333

$$C = 83333$$

$$E = -5$$

so that:

$$L = 83333 * 10**(-5)$$

LABEL ELEMENT VALUES

Table 1 gives the code figures for Q and S, the data type and surface, both in word 1 (and possibly word 3) of the label.

Table 2 gives the values for the marker T which is used to specify time intervals. It also explains how the values of F1 and F2 are to be interpreted. T is found in word 2; F1 and F2 are in words 1 and 3 respectively.

Table 3 gives values for the marker M which is used to specify data fields involving layers, and to indicate whether fields have been initialized. M is in word 3.

Table 4 gives values to be used for the exception marker X, found in word 3, which is used to specify a data field whose date/time (YYMMDDII) precedes that of the date/time found in the data set identifier table. This option is used, for example, to store first guess fields from an earlier cycle in a current cycle data set.

Table 5 gives values for the miscellaneous marker N, which is used to specify types of spectral coefficient data and also to indicate that forecast times are in units of half-days rather than hours. N is in word 4.

Table 6 gives values for the markers CM and CD, word 5, which specify climatological data fields.

Table 7 gives values for the marker K which identifies the grid for which the data are given. K is in word 7. Table 7 lists the grids currently in operational use at NMC as well as others which have been used in the past. The grids thought to be active as of the date of this Office Note are indicated in the table with an "A".

The vertical grid lines of an NMC grid can be considered columns (i) and the horizontal grid lines can be considered rows (j). The coordinate system is the normal right-hand Cartesian system in which i increases from left to right and j increases from bottom to top. Grid point values are stored in consecutive array locations starting with the bottom row. Succeeding rows are stored in a like manner progressing from the bottom to the top of the grid. This follows the usual FORTRAN indexing procedure for a two-dimensional array.

For polar stereographic projection grids, the orientation is defined as the longitude value which parallels the vertical grid lines and for which latitude increases as j increases. This longitude may lie within or without the domain of the grid and may or may not coincide with a grid line.

Table 8 gives the values for the marker KS which identifies how the field was derived; e.g., by spectral methods, by departures from climatological normals, etc.

Values from the tables described above, used in combination with values for surfaces (C1,E1 and C2,E2) and values for forecast hours F1 and F2, are sufficient to identify a data field.

The first 4 bits of Word 6 indicate the source of the first guess for the analysis: 0 for the AVN run, 1 for the FNL run. The next 4 contain a count of number of additional physical records that constitute one (large) logical record. The physical record size and the number is set with the data set is initially allocated with VSAM I/O. If the number of physical records is likely to exceed the number of logical records (individual packed fields) because of the use of large logical records, this must be taken into account during the original allocation of the files. The remaining portions of the word are for internal (computer) use and can be ignored.

Word 7 gives the date and time of either the nominal observation time of the data used in the analysis, or the initial time of the forecast. The time II is specified in Universal Coordinated Time (UTC) in hours: 00-23 (midnight UTC II = 00, noon UTC II = 12). YY is the year of the century, 00-99, MM is the month of the year, 1-12, and DD is the day of the month, 1-31. The date and time are entered as 8-bit integers in the format YYMMDDII.

The remainder of the label should be filled out as shown in Figure 1. Most users rely upon standard NMC library subroutines to accomplish packing the data. These subroutines will also initialize words 9 and 10 and the scaling value in word 11.

The user must supply J, the number of data points, in the right-hand (low-order) side of word 8 for the packing subroutine (W3AI01). Note that there are only 16 bits available to specify the number of data points. This means that a single field is limited to no more than approximately

65,000 data points. Special versions of the packer/unpacker are available to take care of such very large records. They make use of the "reserved" word 12 to hold the data point count. Note also, for records larger that about 32,000 data points that the number of bytes in the record (word 9) will be incorrect. Generally there are approximately two times as many bytes in the record as data points; for byte counts that are too large to fit into word 9, the number will simply be truncated at the high end. Neither the packer nor the unpacker make any use of the byte count.

Table 9 gives the values of the marker R, word 8, which specifies the run within a cycle.

Table 10 gives the values for the marker G, word 8, which specifies the program which generated the field. Programs which are currently in operational use as of the date of this Office Note are indicated by an "A". Table 10, incidentally, is a concise history of operational numerical weather prediction at NMC.

Tables 9 and 10 are intended primarily for internal NMC use. The markers R and G in some data fields may have these parameters specified in a manner other than that given in this Office Note.

Table 11 contains the hexadecimal representations of some commonly used values of C. Negative values of C and E are indicated by turning on the high-order bit of these parameters, thus using sign-and-magnitude representation.

Table 12 shows examples of identifying some common data fields.

Table 13 gives the values for the marker P, word 11, which specifies the number of bits which have been used to pack each grid point value. While the most common number of bits used is 16 (for which P = 0), there are some fields which have been packed using fewer bits. In these cases, the data array is scaled according to:

$$H(j) = (Q(j) - A) * 2**((P-1) - n), \quad j=1,J$$

Table 1 - Q and S

PARAMETERS AND SURFACES

Number Hex	Number Dec	Abbreviation (*)	Item	Units
			Height wrt mean sea level	
1	1	-HGT--	Geopotential	gpm
2	2	-P-ALT	Pressure altitude	gpm
			Distance wrt Earth's surface	
6	6	-DIST-	Geometric distance above	m
7	7	-DEPTH	Geometric distance below	m
8	8	-PRES-	Atmospheric pressure	hPa
9	9	-PTEND	Pressure tendency	hPa/sec
			Temperature	
10	16	-TMP--	Sensible air temperature	degree K
11	17	-DPT--	Dewpoint temperature	degree K
12	18	-DEPR-	Dewpoint depression	degree K
13	19	-POT--	Potential temperature	degree K
14	20	-T-MAX	Maximum temperature	degree K
15	21	-T-MIN	Minimum temperature	degree K
16	22	-TSOIL	Soil temperature	degree K
17	23	-EPOT-	Equivalent potential temp.	degree K
18	24	-VTMP-	Virtual temperature	degree K
			Vertical motion	
28	40	-V-VEL	Vertical velocity dp/dt	hPa/sec
29	41	-NETVD	Net vertical displacement	hPa
2A	42	-DZDT-	Vertical velocity dz/dt	m/sec
2B	43	-OROW-	Orographic component dz/dt	m/sec
2C	44	-FRCVV	Frictional component dz/dt	m/sec

Table 1 - Q and S (cont)

Number Hex	Dec	Abbreviation	Item	Units
			Wind	
30	48	-U-GRD	U comp. of wind wrt grid	m/sec
31	49	-V-GRD	V comp. of wind wrt grid	m/sec
32	50	-WIND-	Wind speed	m/sec
33	51	-T-WND	Thermal wind speed	m/sec
34	52	-VW-SH	Vertical speed shear	1/sec
35	53	-U-DIV	Divergent u comp wrt grid	m/sec
36	54	-V-DIV	Divergent v comp wrt grid	m/sec
37	55	-WDIR-	Direction from which wind is blowing (wrt North)	degree
38	56	-WWND-	Westerly comp. of wind	m/sec
39	57	-SWND-	Southerly comp. of wind	m/sec
3A	58	-RATS-	Ratio of speeds	non-dim.
3B	59	-VECW-	Vector wind (spectral)	m/sec
3C	60	-SFAC-	Steadiness factor	percent
3D	61	-GUST-	Wind gustiness	m/sec
3E	62	D-DUDT	Diffusive u-comp. accel.	m/sec**2
3F	63	D-DVDT	Diffusive v-comp. accel.	m/sec**2
			Fluid flow functions	
47	71	MGSTRM	Montgomery Stream Function	m**2/sec**2
48	72	-ABS-V	Absolute vorticity	1/sec
49	73	-REL-V	Relative vorticity	1/sec
4A	74	-DIV--	Divergence	1/sec
4B	75	-POT-V	Potential vorticity	deg K/hPa/sec
50	80	-STRM-	Stream function	m**2/sec
51	81	-V-POT	Velocity potential	m**2/sec
52	82	-U-STR	Westerly comp. wind stress	N/m**2
53	83	-V-STR	Southerly comp. wind stress	N/m**2
54	84	-TUVRD	Westerly wind comp. acceleration by vert. diffusion	N/m**2
55	85	-TVVRD	Southerly wind comp. acceleration by vert. diffusion	N/m**2
56	86	XGWSTR	x-component of gravity wave drag	N/m**2
57	87	YGWSTR	y-component of gravity wave drag	N/m**2

Table 1 - Q and S (cont)

Number Hex	Number Dec	Abbreviation	Item	Units
			Moisture	
58	88	-R-H--	Relative humidity	percent
59	89	-P-WAT	Precipitable water	kg/m**2
5A	90	-A-PCP	Accumulated total precip	meter
5B	91	-P-O-P	Probability of precipitation	percent
5C	92	-P-O-Z	Prob. of frozen precipitation	percent
5D	93	-SNO-D	Snow depth	m
5E	94	-ACPCP	Accumulated convective precip	m
5F	95	-SPF-H	Specific humidity	kg/kg
60	96	-L-H2O	Liquid water	kg/kg
61	97	-RRATE	Rainfall rate	kg/m**2/sec
62	98	-TSTM-	Probability of thunderstorm	percent
63	99	-CSVR-	Conditional probability of severe local storm	percent
64	100	-CTDR-	Conditional probability of major tornado outbreak	percent
65	101	-MIXR-	Mixing ratio	kg/kg
66	102	-PSVR-	Unconditional probability of severe local storm	percent
67	103	-MCONV	Moisture convergence	kg/kg/sec
68	104	-VAPP-	Vapor pressure	hPa
69	105	-NCPCP	Accumulated non-convective precipitation	m
6A	106	-ICEAC	Ice accretion rate	m/s
6B	107	-NPRAT	Non-convective precip rate	kg/m**2/sec
6C	108	-CPRAT	Convective precipitation rate	kg/m**2/sec
6D	109	-TQDEP	Deep conv. moisture tndcy.	kg/kg/sec
6E	110	-TQSHL	Shallow conv. moisture tndcy	kg/kg/sec
6F	111	-TQVDF	Vertical diffusion moisture tendency	kg/kg/sec

Table 1 - Q and S (cont)

Number Hex	Number Dec	Abbreviation	Item	Units
			Stability	
70	112	-LFT-X	@Lifted index	degree K
71	113	-TOTOS	@Total totals	degree K
72	114	-K-X--	@K-index	degree K
73	115	-C-INS	@Convective instability	degree K
74	116	-4LFTX	4-layer lifted index	degree K
75	117	-A-EVP	Accumulated evaporation	meters
77	119	-CIN--	Convective inhibition (negative buoyant energy)	m**2/sec**2
			Wave components	
78	120	-L-WAV	Long wave component of geopotential	gpm
79	121	-S-WAV	Short wave component of geopotential	gpm
			Miscellaneous surfaces/levels	
80	128	-MSL--	Mean sea level (NWS reduction)	-----
81	129	-SFC--	Earth's surface (base of atmosphere)	-----
82	130	-TRO--	Tropopause	-----
83	131	-MWSL-	Maximum wind speed level	-----
84	132	-PLYR-	Oceanographic primary layer	-----
85	133	-A-LEV	Ship Anemometer Level (19.5m)	-----
86	134	-T-AIL	Top of Aircraft Icing Layer	-----
87	135	-B-AIL	Bottom of Aircraft Icing Layer	-----
88	136	-MSLSA	Mean sea level (Standard Atmosphere Reduction)	-----
89	137	-MSLMA	Mean sea level (MAPS System Reduction)	-----
8A	138	-MSLET	Mean Sea Level (ETA, Fedor Messinger reduction method)	-----

Table 1 - Q and S (cont)

Number Hex	Dec	Abbreviation	Item	Units
			Sigma domain	
90	144	-BDY--	Boundary	----
91	145	-TRS--	Troposphere	-----
92	146	-STS--	Stratosphere	-----
93	147	-QCP--	Quiet cap	-----
94	148	-SIG--	Entire atmosphere	-----
			Miscellaneous parameters	
9D	157	-CAPE-	Convective Available Potential Energy	J/kg
9E	158	-TKE--	Turbulent Kinetic Energy	J/kg
9F	159	-CONDP	Condensation pressure of parcel lifted from indicated level/surface (S).	hPa
A0	160	-DRAG-	Drag coefficient approx. range: 100-1200 (on maps 5&27) 0.001-0.009 (on maps 29&30)	non-dim.
A1	161	-LAND-	Land/sea flag values... on map 5: land=-1, sea=0; on maps 29,30,33,34: land=+1, sea=0	non-dim.
A2	162	-KFACT	K factors (700 hPa to 500 hPa normal ratio)	non-dim.
A3	163	-10TSL	Conversion consts (1000 hPa to sea level pressure)	hPa/m
A4	164	-7TSL-	Sea level pressure specification from 700 hPa heights	hPa/m
A5	165	-RCPOP	Regression coefficients for probability of precip.	percent/m
A6	166	-RCMT-	Regression coefficients for mean temperature	deg K/m
A7	167	-RCMP-	Regression coefficients for mean precipitation	m(precip)/m
A8	168	-ORTHP	Orthogonal pressure function	hPa

Table 1 - Q and S (cont)

Number Hex	Dec	Abbreviation	Item	Units
A9	169	-ALBDO	Albedo approx. range: 0.06 - 0.80	non-dim.
AA	170	-ENFLX	Energy flux	watt/m**2
AB	171	-TTHTG	Temperature tendency from heating	deg K/sec
AC	172	-ENRGY	Energy statistics	(various)
AD	173	-TOTHF	Total heat flux downward	watt/m**2
AE	174	-SPEHF	Sensible + evaporative heat flux upward	watt/m**2
AF	175	-SORAD	Solar heat flux downward	watt/m**2
B0	176	-LAT--	Latitude	degree N
B1	177	-LON--	Longitude	degree W
B2	178	-RADIC	Radar intensity	non-dim.
B3	179	------	Ceiling Height (TDL)	hft@@
B4	180	------	Visibility	m
B5	181	------	Liquid Precip. (Y/N) (TDL)	binary
B6	182	------	Freezing Precip. (Y/N) (TDL)	binary
B7	183	------	Frozen Precip. (Y/N) (TDL)	binary
B8	184	-PROB-	Probability	percent
B9	185	-CPROB	Conditional probability	percent
BA	186	-USTAR	Surface friction velocity	m/sec
BB	187	-TSTAR	Surface friction temperature	degree K
BC	188	-MIXHT	Mixing height	m
BD	189	-MIXLY	Number of mixed layers next to the surface	(integer)
			Radiation Parameters	
BE	190	-DLRFL	Downward flux of long-wave radiation	watt/m**2
BF	191	-ULRFL	Upward flux of long-wave radiation	watt/m**2
C0	192	-DSRFL	Downward flux of short-wave radiation	watt/m**2
C1	193	-USRFL	Upward flux of short-wave radiation	watt/m**2
C2	194	-UTHFL	Upward turbulent flux of sensible heat	watt/m**2
C3	195	-UTWFL	Upward turbulent flux of water	kg/m**2/sec

Table 1 - Q and S (cont)

Number Hex	Dec	Abbreviation	Item	Units
C4	196	-TTLWR	Temperature tendency from long-wave radiation	deg K/sec
C5	197	-TTSWR	Temperature tendency from short-wave radiation	deg K/sec
C6	198	-TTRAD	Temperature tendency from all radiation	deg K/sec
C7	199	-MSTAV	Moisture availability	fractional: 1.0-0.0
C8	200	-RDNCE	**Radiance	watt/m**2/sr/m
C9	201	-BRTMP	**Brightness temperature	degree K
CA	202	-TCOZ-	**Total column ozone	kg/m**2
CB	203	-OZMR-	**Ozone mixing ratio	kg/kg
CC	204	-SWABS	Rate of absorption of short-wave radiation	watt/m**2
			Tendency Parameters	
CD	205	-TTLRG	Temperature tendency from large scale precipitation	deg K/sec
CE	206	-TTSHL	Temperature tendency from shallow convection	deg K/sec
CF	207	-TTDEP	Temperature tendency from deep convection	deg K/sec
D0	208	-TTVDF	Temperature tendency from vertical diffusion	deg K/sec
D1	209	-STCOF	Soil thermal coefficient	joules/m**2/deg
			Cloud-cover variables	
D2	210	CDLYR	Amount of non-convective cloud	fract:1.0-0.0
D3	211	CDCON	Amount of convective cloud	fract:1.0-0.0
D4	212	PBCLY	Pressure at the base of a non-convective cloud	hPa
D5	213	PTCLY	Pressure at the top of a non-convective cloud	hPa
D6	214	PBCON	Pressure at the base of a convective cloud	hPa

Table 1 - Q and S (cont)

Number Hex	Dec	Abbreviation	Item	Units
D7	215	PTCON	Pressure at the top of a convective cloud	hPa
D8	216	SFEXC	Exchange coefficient at surface	(kg/m**3)*m/sec
D9	217	ZSTAR	Surface roughness length	m
DA	218	STDZG	Standard deviation of ground height	m
DB	219		height of bottom of lowest cloud layer	hft
DC	220		height of bottom of highest cloud layer	hft
			Oceanographic variables	
130	304	-UOGRD	U comp. of current wrt grid	m/sec
131	305	-VOGRD	V comp. of current wrt grid	m/sec
180	384	-WTMP-	Water temperature	degree K
181	385	-WVHGT	Height of wind-driven waves	m
182	386	-SWELL	Height of sea swells	m
184	388	-WVPER	Period of wind-driven waves	sec
185	389	-WVDIR	Direction from which waves are moving (wrt North)	degree
186	390	-SWPER	Period of sea swells	sec
187	391	-SWDIR	Direction from which swells are moving (wrt North)	degree
188	392	-ICWAT	Ice-free water surface	percent
190	400	-HTSGW	Significant wave height (combined sea and swell)	m
191	401	-PERPW	Primary wave period	sec
192	402	-DIRPW	Direction from which primary waves are moving (wrt North)	degree
193	403	-PERSW	Secondary wave period	sec
194	404	-DIRSW	Direction from which secondary waves are moving (wrt North)	degree
195	405	-WCAPS	White cap coverage	percent

Notes:

* Abbreviations are 6 characters. A dash (-) is used to indicate a blank when printed.

** These data types do not use the standardized ON84 identification scheme and may have been stored in non-standard units. Contact NMC/CAC/AIB for further information.

@ 273.15 degrees has been added to the original data values.

@@ Has been stored in units of 100s of feet.

wrt means "with respect to"

Table 2 - T
TIME MARKER

(4 bits)

T (Dec)	Meaning	F1 (*)	F2 (*)
0	Instantaneous field. E.g., 500-hPa height forecast: Q F1 = 0 denotes an analysis unless M set equal to 8, 9, or 10. (See Table 3.)	Fcst time of Q	0
1	Field formed from 2 fields whose valid times are equal but whose forecast times may or may not be equal. E.g., difference between 2 analyses (times equal), or difference between a forecast and the verifying analysis (times unequal): Q2 - Q1	Fcst time of Q2	Fcst time of Q2 minus fcst time of Q1
2	Field formed from 2 fields whose forecast times are equal but whose valid times are unequal. E.g., a tendency field formed by differencing 2 analyses which are 12 hours apart: Q2 - Q1	Fcst time of Q1 and Q2	Valid time of Q2 minus valid time of Q1
3	Field formed from 2 fields whose initial times are equal but whose forecast times are unequal. E.g., a forecast tendency field: Q2 - Q1	Fcst time of Q2	Fcst time of Q2 minus fcst time of Q1
4	Field of normal values averaged over a number of days, where F1 = number of days and F2 = 0, or averaged over a number of years, where F1 = 0 and F2 = number of years.	Days used in average -or- 0	0 -or- Years used in average
5	Non-instantaneous field. E.g., a field of forecast probability of precipitation during some time period.	Fcst time at end of period	Fcst time at end of period minus fcst time at beginning.

T (Dec)	Meaning	F1 (*)	F2 (*)
6	Field of time-averaged values. E.g., a 5-day height mean: (Q1+Q2+Q3+Q4+Q5)/5 with F1 the fcst time of Q1 in half days and F2 = 8 half days.	Fcst time of bgng of period in half days, high-order bit on if negative	Length of period in half days
7	Field of differences between 2 fields of time-averaged values of type T=6. E.g., the difference of two 5-day height means Q2 - Q1, Q2 centered at D+8, Q1 centered at D+3.	Fcst time of Q2 in half days	Fcst time of Q2 minus fcst time of Q1 in half days
10	Same meaning as case T=2 except F1 and F2 are in days.		

(*) F1 and F2 are in hours unless N=15 (Table 5) or unless half days, days or years are specified.

Table 3 - M

LEVEL DIFFERENCE AND INITIALIZATION MARKER

(4 bits)

M	Value
0	Indicates S2 and L2 are not applicable. (In this case S2 = L2 = 0)
1	Indicates a field formed by taking the value of Q at S1 minus the value of Q at S2.
2	Indicates a field of Q for a layer bounded by S1 and S2.
3 - 7	Available
8 - 10	Same meanings as 0-2 above except the field has been initialized by a model identified by the Generating Code in Table 10. Such initialized fields are often referred to as "00-hour forecasts".
11 - 15	Available

Table 4 - X

EXCEPTION MARKER

(8 bits)

X	Value
0	Indicates the date/time of the field is the same as the date/time of the file in which the field is stored.
1	Indicates the date/time of the field is 6 hours prior to the date/time of the file in which the field is stored.
2	Indicates the date/time of the field is 12 hours prior to the date/time of the file in which the field is stored.
...	...
n	Indicates the date/time of the field is 6*n hours prior to the date/time of the file which the field is stored.
...	...
80	Special use marker to indicate a field produced with spectral wave truncation.
100	Field formed from combination of NMC and ECMWF fields.
101	Field formed from combination of NMC and UKMET fields.
255	Not applicable.

Table 5 - N

MISCELLANEOUS MARKER

(4 bits)

N	Value
0	None of the following
1	Spectral specification
2	Zonal coefficient
3	Spectral amplitude
4	Spectral phase angle
5	Summation over wave numbers 0 - 5
...	...
15	F1 and/or F2 are in half days

Table 6 - CM and CD

CLIMATOLOGY MARKERS

(8 bits each)

CM	Month-Hour
00	Not applicable
01	JAN - 0000 UTC
02	FEB - 0000 UTC
	...
12	DEC - 0000 UTC
13	JAN - 1200 UTC
14	FEB - 1200 UTC
	...
24	DEC - 1200 UTC

CD	Day of Month
00	Not applicable
01	1st day of month
02	2nd day of month
	...
31	31st day of month

Table 7 - K

GRID TYPE
("A" indicates a currently active Grid Type)

K Hex	Dec	GRID TYPE	Grid Increment
0	0 A	1977-point N. Hemisphere polar stereographic grid (octagon) oriented 80W; Pole at (24,26).	381 km at 60N
1	1 A	1679-point (73x23) Mercator grid with (1,1) at (0W,48.09S), (73,23) at (0W, 48.09N); I increasing eastward, Equator at J=12.	5 degs of longitude
2	2	1752-point (73x24) Mercator grid for latitudes 49.73S to 49.73N.	5 degs of longitude
3	3	3021-point (53x57) N. Hemisphere polar stereographic grid oriented 80W; Pole (27,29).	381 km at 60N
4	4 A	259920-point (720x361) global lon/lat grid;(1,1) at 0E, 90N; matrix layout; prime meridian not duplicated	0.5 deg
5	5 A	3021-point (53x57) N. Hemisphere polar stereographic grid oriented 105W; Pole at (27,49).	190.5 km at 60N
6	6	1977-point octagonal subset of grid type 5; Pole at (24,46).	190.5 km at 60N
7	7	2329-point N. Hemisphere polar stereographic grid (octagon) oriented 80W.	381 km at 60N
8	8	5104-point (116x44) Mercator grid with (1,1) at (3.1035E,48.67S) and (116,44) at (0W,61.05N); I increasing eastward, Equator at J=19.	3.1035 degs of longitude
9	9 A	Station grid (US and Canada) for TDL wind, cloud, flight weather, sunshine, dewpoint, temperature, and max/min products. Number of stations varies from product to product, but usually ranges from 143 to over 200.	
A	10 A	Station grid (US cities) for TDL probability of precipitation type (POPT).	

Table 7 - K (cont.)
GRID TYPE

K Hex	K Dec	GRID TYPE	Grid Increment
B	11	286 US cities for TDL precipitation amount.	
C	12	1702-point (74x23) Mercator grid for latitudes 48.09S to 48.09N.	5 degs of longitude
D	13	576-point (36x16) N. Hemisphere longitude/latitude LRPG diamond array--pole stored at top of every 10 degs of longitude--for latitudes 15S to 90N.	
E	14	108 U.S. stations for TDL max/min temps.	
F	15	40 U.S. stations for TDL max/min temps.	
10	16	1560-point (39x40) N. Hemisphere polar stereographic grid (Eastern U.S.) oriented 80W.	95.25 km at 60N
11	17 A	221-point (17x13) N. Hemisphere polar stereographic grid oriented 105W; Pole at (7,21). US grid used for TDL trajectory model.	381 km at 60N
12	18	4205-point (129x29) lat/lon tropical strip (35S to 35N) (0 - 360E) (1,1) at 35S, 0 deg. (from ECMWF)	2.5 degs
13	19	1977-point S. Hemisphere polar stereographic grid (octagon) oriented 100E; Pole at (24,26).	381 km at 60S
14	20	2655-point (45x59) Mercator grid for latitudes 30S to 30N.	1.5 degs of longitude
15	21 A	1387-point (73x19) N. Hemisphere longitude/latitude grid for latitudes 0N to 90N.	5 degs
16	22 A	1387-point (73x19) S. Hemisphere longitude/latitude grid for latitudes 90S to 0S.	5 degs

Table 7 - K (cont.)
GRID TYPE

K Hex	K Dec	GRID TYPE	Grid Increment
17	23	783-point (29x27) N. Hemisphere polar stereographic grid oriented 105W. US grid is used for NMC/TDL boundary layer model.	190.5 km at 60N
18	24 A	651-point (31x21) N. Hemisphere polar stereographic grid oriented 98W; Pole at (15,41). US grid is used for TDL probability of precipitation, max/min temperature, dewpoint, surface temperature, and sunshine.	190.5 km at 60N
19	25	3021-point (53x57) S. Hemisphere polar stereographic grid oriented 100E; Pole at (27,29).	381 km at 60S
1A	26 A	2385-point (53x45) N. Hemisphere polar stereographic grid oriented 105W; Pole at at (27,49).	90.5 km 60N
1B	27 A	4225-point (65x65) N. Hemisphere polar stereographic grid oriented 80W; Pole at (33,33).	381 km at 60N
1C	28 A	4225-point (65x65) S. Hemisphere polar stereographic grid oriented 100E; Pole at (33,33).	381 km at 60S
1D	29 A	5365-point (145x37) N. Hemisphere longitude/latitude grid for latitudes 0N to 90N; (1,1) at (0E,0N).	2.5 degs
1E	30 A	5365-point (145x37) S. Hemisphere longitude/latitude grid for latitudes 90S to 0S; (1,1) at (0E,90S).	2.5 degs

Table 7 - K (cont.)
GRID TYPE

K Hex	K Dec	GRID TYPE	Grid Increment
1F	31 A	327-point TDL field composed of 4 grids: US, Alaska, Hawaii, and Puerto Rico. The US grid is a 255-point (17x15) N. Hemisphere polar stereographic grid oriented 80W; Pole at (13,22). Alaska grid is a 56-point (7x8) N. Hemisphere polar stereographic grid oriented 80W; pole at (11,8). The Hawaii grid is a 12-point (3x4) N. Hemisphere polar stereographic grid oriented 80W; Pole at (23,7). The Puerto Rico grid is a 4-point (2x2) N. Hemisphere polar stereographic grid oriented 80W; Pole at (-4,23). (These grids are used to archive MRF Model data).	381 km at 60N
20	32 A	744-point (31x24) N. Hemisphere polar stereographic grid oriented 105W; Pole at (13,42). The TDL grid (US) is used to archive LFM data.	190.5 km at 60N
21	33 A	8326-point (181x46) N. Hemisphere longitude/latitude grid for latitudes 0N to 90N; (1,1) at (0E,0N).	2 degs
22	34 A	8326-point (181x46) S. Hemisphere longitude/latitude grid for latitudes 90S to 0S; (1,1) at (0E,90S).	2 degs
23	35	228 U.S. cities for TDL MOS max/min temperatures.	
24	36 A	1558-point (41x38) N. Hemisphere polar stereographic grid oriented 105W; Pole at (19,42). The TDL grid (N. America) is used to archive LFM and NGM data.	190.5 km at 60N
25	37	5365-point (145x37) N. Hemisphere longitude/latitude grid for latitudes 1.25 to 88.75N; (1,1) at (1.25E,1.25N); row 37 is fictitious.	2.5 degs
26	38	5365-point (145x37) S. Hemisphere longitude/latitude grid for latitudes 88.75S to 1.25S; (1,2) at (1.25E,88.75S); row 1 is fictitious.	2.5 degs

Table 7 - K (cont.)
GRID TYPE

K Hex	Dec	GRID TYPE	Grid Increment
27	39	8326-point (181x46) N. Hemisphere longitude/latitude grid for latitudes 1N to 89N, (1,1) at (1E,1N); row 46 is fictitious.	2 degs
28	40	8326-point (181x46) S. Hemisphere longitude/latitude grid for latitudes 89S to 1S, (1,2) at (1E,89S); row 1 is fictitious.	2 degs
29	41	850-point (34x25) N. Hemisphere longitude/latitude grid for latitudes to 46N; (1,1) at (87W,22N).	1 deg 22N
2A	42	available.	
2B	43	4225-point (65x65) N. Hemisphere polar stereographic grid oriented 105W; Pole at (33,33).	381 km at 60N
2C	44	4225-point (65x65) S. Hemisphere polar stereographic grid oriented 75E; Pole (33,33).	381 km at 60S
2D	45	2425-point (97x25) N. Hemisphere longitude/latitude grid for latitudes 0N to 90N; (1,1) at (0E,0N).	3.75 degs
2E	46	2425-point (97x25) S. Hemisphere longitude/latitude grid for latitudes 90S to 0N; (1,1) at (0E,90S).	3.75 degs
2F	47 A	10057-point (113x89) N. Hemisphere polar stereographic grid oriented 105W; Pole at (41,161).	47.625 km at 60N
30	48	3477-point (61x57) N. Hemisphere polar stereographic grid oriented 105W; Pole at (27,49).	190.5 km at 60N
31	49	16641-point (129x129) N. Hemisphere polar stereographic grid oriented 80W; Pole at (65,65).	190.5 km at 60N

Table 7 - K (cont.)
GRID TYPE

K Hex	Dec	GRID TYPE	Grid Increment
32	50	16641-point (129x129) S. Hemisphere polar stereographic grid oriented 100E; Pole at (65,65).	190.5 km at 60S
33	51 A	16641-point (129x129) N. Hemisphere polar stereographic grid oriented 105W; Pole at (65,65).	190.5 km at 60N
34	52	available.	
35	53	5967-point (117x51) Mercator grid with (1,1) at (0W,61.05S) and (117,51) at (0W,61.05N); I increasing eastward, Equator at J=26.	3.1035 degs of longitude
36	54 A	1050-point (35x30) N. Hemisphere polar stereographic grid oriented 80W; Pole at (1,75). The TDL grid (eastern US) is used for a boundary layer model.	95.25 km at 60N
37	55 A	6177-point (87x71) N. Hemisphere polar stereographic grid oriented 105W; Pole at (44,38). (2/3 bedient NH sfc anl)	254 km at 60N
38	56 A	6177-point (87x71) N. Hemisphere polar stereographic grid oriented 105W; Pole at (40,73). (1/3 bedient NA sfc anl)	127 km at 60N
39	57	available	
3A	58	100 U.S. cities for 24-hour accumulated precipitation.	
3B	59	5293-point (79x67) subset of grid type 56 (used for LFM-II mountains); Pole at (40,73).	127 km at 60N
3C	60 A	3249-point (57x57) N. Hemisphere polar stereographic grid oriented 105W; Pole at (29,49).	190.5 km at 60N
3D	61 A	Spectral coefficients, scalar fields. (961 COMPLEX*8 words).	30 modes

Table 7 - K (cont.)
GRID TYPE

K Hex	K Dec	GRID TYPE	Grid Increment
3E	62 A	Spectral coefficients, U- or V-component fields. (992 COMPLEX*8 words).	30 modes
3F	63 A	1095-point (73x15) longitude/latitude grid for latitudes 35S to 35N; (1,1) at (0,35S) and I increasing eastward.	5 degs
40	64	875-point (35x25) longitude/latitude grid; lat: 18.5N to 30.5N, long: 97.5W to 80.5W; Gulf of Mexico wave forecasts.	0.5 deg
41	65	available	
42	66	2701-point (73x37) longitude/latitude grid for latitudes 90S to 90N; (1,1) at (0,90S); I increasing eastward.	5 deg
43	67 A	13689-point (117x117) N.W. Atlantic polar stereographic grid oriented 80W; Pole at (9,317).	23.8125 km at 60N
44	68 A	13689-point (117x117) Gulf of Mexico polar stereographic grid oriented 105W; Pole at (-35,361).	23.8125 km at 60N
45	69 A	13689-point (117x117) Gulf of Alaska polar stereographic grid oriented 105W; Pole at (177,209).	23.8125 km at 60N
46	70 A	13689-point (117x117) Calif. Pacific polar stereographic grid oriented 105W; Pole at (169,285).	23.8125 km at 60N
47	71 A	13689-point (117x117) Mexican Pacific polar stereographic grid oriented 105W; Pole at (137,377).	23.8125 km at 60N
48	72	406-point (29x14) Mercator grid with (1,1) at (170.00E,46.40N) and (29,14) at (120.00W,64.40N).	2.5 degs of longitude
49	73	13056-point (128x102) global Gaussian longitude/latitude grid.	R40 trans

Table 7 - K (cont.)
GRID TYPE

K Hex	Dec	GRID TYPE	Grid Increment
4A	74 A	10800-point (180x60) N. Hemisphere longitude/latitude grid for latitudes 0N to 90N; (1,1) at (0E,0N).	2.0 deg lon 1.5 deg lat
4B	75 A	12321-point (111x111) N. Hemisphere Lambert Conformal grid. No fixed location; used by QLM Hurricane model.	40 km at 30&60 deg N
4C	76 A	12321-point (111x111) S. Hemisphere Lambert Conformal grid. No fixed location; used by QLM Hurricane model.	40 km at 30&60 deg S
4D	77 A	12321-point (111x111) N.& S. Hemisphere Mercator grid. No fixed location; used by QLM Hurricane model.	40 km at equator
50	80 A	2976-point (62x48) N. Hemisphere polar stereographic grid oriented 105W; Pole at (24.683025,85.27335). (MAPS analysis/forecast grid.)	80.0 km at 40N
51	81 A	7921-point (89x89) N. Hemisphere polar stereographic grid oriented 80W; pole at (44.5,44.5)	190.5 km at 60N
52	82	15372-point (244x63) N. Hemisphere T80 Gaussian transform lat/lon grid	variable
53	83	15372-point (244x63) S. Hemisphere T80 Gaussian transform lat/lon grid	variable
54	84	1344-point (42x32) N. Hemisphere polar stereographic grid oriented 105W; Pole at (16.08811,61.33562). (AFOS B03 p-s projection)	111.0 km at 40N
55	85 A	32400-point (360x90) N. Hemisphere longitude/latitude grid; longitudes: 0.5E to 359.5E (0.5W); latitudes: 0.5N to 89.5N; origin (1,1) at (0.5E,0.5N)	1 deg

Table 7 - K (cont.)
GRID TYPE

K Hex	K Dec	GRID TYPE	Grid Increment
56	86 A	32400-point (360x90) S. Hemisphere longitude/latitude grid; longitudes: 0.5E to 359.5E (0.5W); latitudes: 89.5S to 0.5S; origin (1,1) at (0.5E,89.5S)	1 deg
57	87 A	5022-point (81x62) N. Hemisphere polar stereographic grid oriented 105W. Pole at (31.91,112.53) (60 km at 40N) Used in MAPS/Rapid Update Cycle	68.153 km at 60N
58	88 A	262144-point (512x512) N. Hemisphere polar stereographic grid oriented 80W. Pole at (257,256) Shared Processing Net.	47.625 km at 60N
59	89 A	262144-point (512x512) S. Hemisphere polar stereographic grid oriented 100E. Pole at (257,256) Shared Processing Net.	47.625 km at 60S
5A	90 A	12902 point (92x141 semi-staggered) lat. long., rotated such that center located at 52.0N, 111.0W; LL at 37.5W, 35S Unfilled E grid for 80 km ETA model	lat. 14/26 deg lon. 15/26 deg
5B	91 A	25803 point (183x141) lat. long., rotated such that center located at 52.0N, 111.0W; LL at 37.5W,35S Filled E grid for 80 km ETA model	lat. 14/26 deg lon. 15/26 deg
5C	92 A	24162 point (127x191 semi-staggered) lat. long., rotated such that center located at 41.0N, 97.0W; LL at 35W,25S Unfilled E grid for 40 km ETA model	lat. 15/57 deg lon. 5/18 deg
5D	93 A	48323 point (253x191) lat. long., rotated such that center located at 41.0N, 97.0W; LL at 35W ,25S Filled E grid for 40 km ETA model	lat. 15/57 deg lon. 5/18 deg
62	98 A	18048-point (192x94) global T62 spectral Gaussian transform grid. Matrix layout. Origin at 0.0E and Gaussian lat 88.542N 192 columns (long.); 94 rows (lat.)	variable

Table 7 - K (cont.)
GRID TYPE

K Hex	Dec	GRID TYPE	Grid Increment
64	100 A	6889-point (83x83) N. Hemisphere polar stereographic grid oriented 105W; Pole at (40.5,88.5). (NGM Original C Grid)	91.452 km at 60N
65	101 A	10283-point (113x91) N. Hemisphere stereographic grid oriented 105W; Pole at (58.5,92.5). (NGM Expanded C Grid)	91.452 km at 60N
66	102 A	14375-point (115x125) N. Hemisphere stereographic grid oriented 105W; Pole at (13,241). (HPB precip. analysis)	31.75 km at 60N
67	103 A	3640-point (65x56) N. Hemisphere polar stereographic grid oriented 105W; Pole at (25.5,84.5) (Used by ARL)	91.452 km at 60N
68	104 A	16170-point (147x110) N.Hemisphere polar stereographic grid oriented 105W; pole at (75.5,109.5). (NGM Super C grid)	90.75464 km at 60N
69	105 A	6889-point (83x83) N.Hemisphere polar stereographic grid oriented 105W; pole at (40.5,88.5). (Subset of NGM Super C grid)	90.75464 km at 60N
6A	106 A	19305 point (165x117) N. Hemisphere stereographic grid oriented 105W; pole at (80,176) Hi res ETA (2 x resolution of Super C)	45.37732 km at 60N
6B	107 A	11040 point (120x92) N. Hemisphere stereographic grid oriented 105W; pole at (46,167) subset of Hi res ETA; for ETA & MAPS/RUC	45.37732 km at 60N
7E	126 A	72960-point (384x190) global T126 spectral Gaussian transform grid. Matrix layout. Origin at 0.0E and Gaussian lat 89.277N 384 columns (long.); 190 rows (lat.)	variable
D6	214 A	6693-point (97x69) N. Hemisphere polar stereographic grid oriented 150W; Pole at (49,101); AWIPS Alaskan area.	47.625 km at 60N
FF	255	Not applicable.	

Table 8 - KS

DERIVATION MARKER

(8 bits)

KS	Derivation method
0	None of the following
1	Hough spectral method
2	Field formed by subtracting a climatological normal from each data value; e.g., a field of departure from normal heights.

Table 9 - R

RUN MARKER

(8 bits)

R	Run
0	Early run (ERL)
1	Initializing run (NMC)
2	Regional run (RGL)
3	Aviation run (AVN)
4	Medium Range Forecast run (MRF)
5	Final operational run in a given observational cycle (FNL)
6	Hurricane Run (HCN)
7	Rapid Update Cycle (RUC)
15	Runs from non-NMC networks
255	Not applicable

Table 10 - G

GENERATING PROGRAM

(8 bits)
"A" indicates a currently active Generating Program

G Hex	Dec	Name of program generating data	Map Label
0	0	Objective analysis (Cressman octagon)	
1	1 A	Barotropic fcst model	BATRO
2	2	Mesh model 1958	
3	3	Mesh model 1964 (imprv. terr.)	
4	4	Reed 1000-hPa fcst model	
5	5	3-level baroclinic fcst model	
6	6	4-level baroclinic fcst model	
7	7	4-layer Primitive Equation model (PE)	
8	8	6-layer PE model	
9	9 A	Maximum and minimum temperature fcst	
A	10 A	Sea height and swell fcst	NOWAV
B	11	Tropical analysis	
C	12	Tropical fcst	
D	13	Bat analysis	
E	14	Tropical fcst	
F	15	Tropical fcst with satellite modification	
10	16	Sub-synoptic advection model	
11	17	Compute long wave components	
12	18 A	Trajectory forecast	
13	19 A	Successive Correction Method analysis	SCM
14	20	Limited-area successive correction method	LFM1
15	21	Perfect prog precipitation fcst	
16	22 A	Hough analysis	HOUGH
17	23	Eddy analysis and SANBAR fcst (NHC Miami)	
18	24	NWRC/NCAR climatology data	
19	25 A	Snow cover	SNOW
1A	26	Planetary boundary layer analysis and fcst	
1B	27	Extended fcst data processor	
1C	28	PE and trajectory model output statistics	
1D	29	9-layer global PE model (5-deg mesh)	
1E	30	9-layer N.H. PE model (2.5-deg mesh)	
1F	31	6-layer PE model (360/195 version)	6LPE
20	32	Sea surface temp., satellite derived	
21	33	Land shelter temperature analysis	
22	34	Energy statistics code	
23	35	9-layer global PE model (2.5-deg mesh)	
24	36	As above except used for 6-hour cycle	

Table 10 Generating Program (cont.)

G Hex	Dec	Name of program generating data	Map Label
25	37	3-layer global PE model	
26	38	7-layer PE Hemis. fine mesh model, 190.5 km	7LPE
27	39 A	Nested Grid Model	NGM
28	40	9-layer N. H. PE model (2-deg mesh)	
29	41	LFM with 127-km grid increment	LFM2
2A	42	7-layer PE model (381 km grid)	7LCM
2B	43 A	Global Optimum Interpolation analysis	GOI
2C	44 A	Sea surface temperature analysis	NOW
2D	45	Spectral Model Global 24-mode 12-layer	SMG2C
2E	46	Spectral Model Global 30-mode 12-layer	SMG3C
2F	47	Spectral Model Hemis. 24-mode-12 layer	SMH2C
30	48	Spectral model Hemis. 30-mode-12 layer	SMH3C
31	49	Ozone Analysis TIROS Operational	TOVS
32	50	Spectral model Global 24-mode 6-layer	SMG26
33	51	Spectral model Global 30-mode 6-layer	SMG36
34	52	Ozone Analysis Nimbus 7	SBUV
35	53 A	LFM with Fourth-Order differencing	LFM
36	54	Spectral model Hemis. 24-mode 6-layer	SMH26
37	55 A	N. American sea level pressure analysis	NMSFC
38	56 A	N. H. sea level pressure analysis	NHSFC
39	57 A	European Center for Medium-range Wea. Fcst.	ECMWF
3A	58	Fleet Numerical Oceanography Center	FNOC
3B	59	Air Force Global Weather Central	AFGWC
3C	60	NWS Central Region	CRGN
3D	61	NWS Western Region	WRGN
3E	62	NWS Eastern Region	ERGN
3F	63 A	Spectral model Global 40-mode 12-layer	SMG4C
40	64 A	Regional Optimum Interpolation Analysis	ROI
41	65 A	Spectral model Global 40-mode 18-layer	SMG4I
42	66 A	U.K. Meteorological Office	UKMET
43	67 A	Statistical correction by linear regression	SCLR
44	68	10-layer hurricane model	HCN
45	69 A	T80 L18 Spectral Forecast Model	MRF
46	70 A	Quasi-Lagrangian Hurricane Model	QLM
47	71 A	Statistical Blending (MRFG)	SBLND
48	72 A	Isentropic Analysis	ISENA
49	73 A	Statistical Fog & Visibility (MPB)	SFVSB
4A	74 A	Gulf of Mexico Wind/Wave	GMEXW
4B	75 A	Gulf of Alaska Wind/Wave	GAKWV
4C	76 A	Bias Corrected MRF	MRFBC
4D	77 A	Japanese Meteorological Agency	JMET
4E	78 A	T126 L28 Spectral Forecast Model	SM126

Table 10 Generating Program (cont.)

G Hex	Dec	Name of program generating data	Map Label
4F	79 A	Backup from Earlier Run	BCKUP
50	80 A	T62 L18 Spectral Forecast Model	SMT62
51	81 A	Spectral Statistical Interpolation Analysis	SSI
53	83 A	ETA Model - 80 km version	ETA80
54	84 A	ETA Model - 40 km version	ETA40
55	85 A	ETA Model - 30 km version	ETA30
56	86 A	RUC/MAPS Model, from Forecast Systems Lab (Isentropic; scale: 60km at 40N)	RUC60
57	87 A	Ensemble Forecasts (CAC)	ENSMB
58	88 A	Wave model with additional physics (MPB)	PWAV

Table 11

HEXADECIMAL EQUIVALENTS FOR FREQUENTLY USED VALUES OF C

(Coding of L)

Decimal	Hexadecimal
10000	02710
16667	04116
15000	03A98
15240	03B88
18290	04772
20000	04E20
21340	0535C
25000	061A8
27315	06AB3
27430	06B26
30000	07530
30480	07710
33333	08235
35000	088B8
36580	08EE4
40000	09C40
41667	0A2C3
42670	0A6AE
45000	0AFC8
50000	0C350
55000	0D6D8
58333	0E3DD
60000	0EA60
65000	0FDE8
66667	1046B
70000	11170
75000	124F8
80000	13880
83333	14585
85000	14C08
90000	15F90
91400	16508
91667	16613
95000	17318
99000	182B8

Table 12

EXAMPLES OF IDENTIFIER WORDS FOR COMMON FIELDS

(1) 1000-hPa height analysis for N.H. (grid type 27):

00100800 00271081 00000000 00000000 0000001B

(2) 500-hPa height analysis for N.H. (grid type 27):

00100800 00C35082 00000000 00000000 0000001B

(3) 500-hPa temperature analysis for N.H. (grid type 27):

01000800 00C35082 00000000 00000000 0000001B

(4) 500-hPa 12-hour height forecast for LFM (grid type 26):

0010080C 00C35082 00000000 00000000 0000001A

(5) 12-hour forecast of potential temperature for the boundary layer, expressed in sigma coordinates, for the N.H. 2.5 long/lat (grid type 29):

0130900C 00000000 20009000 00271084 0000001D

(6) 100-hPa forecast height tendency, for 6 to 18 hours after an initial time, which is 12 hours prior to the date/time of the file (grid type 27):

00100812 30271082 0020000C 00000000 0000001B

(7) Precipitation at the surface which is forecast to be accumulated between 24 and 30 hours after the initial time (grid type 27):

05A0811E 30000000 00000006 00000000 0000001B

Table 13 - P

PACKING MARKER

(4 bits)

P	Value
0	16 bits used for packing
2	2 bits used for packing
4	4 bits used for packing
8	8 bits used for packing
12	12 bits used for packing

```
                Figure 1 - NMC Format for Packed Data Fields
W                  Upper left: Table reference, if any
o                  Upper right: Field size in bits
r         Bit . . . .
d  0        3 4     7 8    11 12   15 16            23 24        31
-----------------------------------------------------------------
  |1                     12|1                        12|          8|
1 | Q  Data type          | S1  Type of surface 1 | F1  Time 1   |
-----------------------------------------------------------------
  |2  T  4|       Numerical value of            20|              8|
2 |Marker | C1    Surface 1 = C1 * 10**E1         | E1            |
-----------------------------------------------------------------
  |3  M  4|4  Exception  8|1                      12|            8|
3 |Marker | X Marker       | S2  Type of surface 2 | F2  Time 2   |
-----------------------------------------------------------------
  |5  N  4|       Numerical value of            20|              8|
4 |Marker | C2    Surface 2 = C2 * 10**E2         | E2            |
-----------------------------------------------------------------
  |6  Climat day 8|6  Climat    8|8  Derivation 8|7             8|
5 | CD of month   | CM Month Hour | KS  Method     | K  Grid type |
-----------------------------------------------------------------
  | =0,1 4|# of  4| Internal I/O 8|    For internal use       16|
6 |1st GES|add.rec|   use only    | NW  by I/O routines only     |
-----------------------------------------------------------------
  |               8|              8|               8|   Initial  8|
7 | YY  Year       | MM  Month     | DD  Day        | II Hour      |
-----------------------------------------------------------------
  |9   Run        8|10 Generating 8|                           16|
8 | R  Marker      | G  Program    | J  Number of data points    |
-----------------------------------------------------------------
  |    Number of bytes            16|   Exclusive OR             16|
9 | B  in Record                    | Z  Checksum                  |
-----------------------------------------------------------------
1 |                                                             32|
0 | A  Reference value, REAL*4 floating point                     |
-----------------------------------------------------------------
1 | 13 P 4|                      12|   Scaling value            16|
1 | Marker|       Reserved          | n  (INTEGER*2)               |
-----------------------------------------------------------------
1 |                                                             32|
2 | Reserved                                                      |
-----------------------------------------------------------------
1 |                              16|                           16|
3 | Data point 1                    | Data point 2                 |
-----------------------------------------------------------------
1 |                              16|                           16|
4 | Data point 3                    | Data point 4                 |
-----------------------------------------------------------------
                               etc.
```

Notes: next page...

In word 6, bits 0-3 indicate source of GES ...   0 = AVN run   1 = FNL run

In word 6, bits 4-7 are used to accommodate logical records that exceed the maximum physical record length set when the file was allocated. Such records are split into additional physical records. You must account for those additional records in the original allocation of the data set.