11 I/O FORMAT

11.1 The MM5V1/2 Modeling System Output Format

An MM5 modeling system output file at any one time consists of the following:

Header

3-D fields (if any)

2-D fields (if any)

1-D fields (if any)

0-D fields (if any)

Header contains four 2-D arrays:

```
Integer        MIF(1000,20)
Real           MRF(1000,20)
Character*80 MIFC(1000,20),MRFC(1000,20)
```

```
READ (IUNIT) MIF,MRF,MIFC,MRFC
```

The MM5V1/2 input/output format consists of record header and the data. The header itself contains four two-dimensional (2-D) arrays: MIF, MIFC, MRF, MRFC. Array MIF stores integer information. Array MIFC is the character array describing the contents of array MIF. Array MRF stores floating point information. Array MRFC is the character array describing the contents of array MRF. The MIF and MRF arrays are initiated in the TERRAIN program (the first program of the modeling system) with values of 999 and 999. respectively. Additional informations filled into the arrays as the user runs through the modeling system.

11.2 Header Arrays

First Dimension Index

1 - 100: Coarse domain information for program 1, and runtime options for rest

101 - 200: Current domain Information for program 1, and pressure or sigma info for rest

201 - 300: Output fields information

301 - 1000: Miscellaneous information from the namelists

The header stores information regarding this particular data set and its upstream data. The first array index for these 2-D arrays range from 1 to 1000. Many of the first array indices are not used by the MM5V1 modeling system. They are reserved to store information that may generate by the future developments of the modeling system. The first array index ranges from 1 to 100 are used to describe the coarse domain set up for program 1. The information for the current domain set up is stored from 100 to 200 for program 1.

The second array index of MIF, MIFC, MRF, and MRFC represents the program number. The program number for the programs in the MM5 modeling system are

Second Dimension Index	Program Name
1	TERRAIN
2	DATAGRID
3	RAWINS
4	RAWINS surface FDDA
5	Model input
6	Model output on Sigma levels
7	Interpolated model output on P levels

The value of MIF(1,1) is set to be the program number, which tells you what output it is.

11.3 Special Header Locations

MIF(1,1):	Name of the output
MIF(101,X):	Number of pressure levels
MRF(101,X):	Number of sigma levels
MIF(201,X):	Number of 3-D fields
MIF(202,X):	Number of 2-D fields
MIF(203,X):	Number of 1-D fields
MIF(204,X):	Number of 0-D fields
MIFC(205,X):	Field identification
MIF(205,X) = 0	cross point, non-coupled

MIF(205,X) = 1	cross point, coupled
MIF(205,X) = 10	dot point, non-coupled
MIF(205,X) = 11	dotpoint, coupled

Array MIF(101,X) is the number of vertical pressure levels in output (where X is the program number). Arrays MIF(102,X) to MIF(101+MIF(101,X),X) are the pressure level values. MRF(101,X) is the number of sigma levels in output. Arrays MRF(102,X) to MRF(101+INT(MRF(101,X),X) are the value of the sigma levels.

The MIF(201,X),MIF(202,X), MIF(203,X), and MIF(204,X) arrays are the number of 3-D, 2-D, 1-D, and 0-D fields in output respectively. Starting with MIFC(205,X), the MIFC array describes the field identification. These include: abbreviation name (8 characters), unit(16 characters), and full name of the fields. The 3-D fields are described first followed by the 2-D, 1-D, and 0-D fields. The corresponding MIF arrays are one of the following four numbers: 0, 1, 10, and 11. These numbers represent: the field is cross point non-coupled (0), dot point non-coupled (10), cross point coupled (1), or dot point coupled (11).

Utility on the mesouser disk to process the MM5V1 modeling system outputs:

on paiute/ouray/chipeta	~mesouser/Util/rdmm5v1.f
	~mesouser/Util/mm5v1.ieee.deck
	~/mesouser/Util/ieee.csh
on ftp	/mesouser/Util/rdmm5v1.f
	/mesouser/Util/mm5v1.ieee.deck
	/mesouser/Util/ieee.csh

To use the script, ieee.csh, either type

ieee.csh mminput_domain1 bdyout_domain1

to convert both domain 1 mminput file and boundary file or

ieee.csh mminput_domain1

to convert domain 1 mminput file only.

11.4 Header Record for TERRAIN Output

```
MIF(  1,1)            1   PROGRAM NAME : TERRAIN
MIF(  2,1)           35   COARSE DOMAIN GRID DIMENSION IN I (N-S) DIRECTION
MIF(  3,1)           41   COARSE DOMAIN GRID DIMENSION IN J (E-W) DIRECTION
MIF(  4,1)            1   MAP PROJECTION. 1: LAMBERT CONFORMAL, 2: POLAR STEREO-
                          GRAPHIC, 3: MERCATOR
MIF(  5,1)            1   IS COARSE DOMAIN EXPANDED?, 1: YES, 0: NO
MIF(  6,1)           45   EXPANDED COARSE DOMAIN GRID DIMENSION IN I DIRECTION
MIF(  7,1)           51   EXPANDED COARSE DOMAIN GRID DIMENSION IN J DIRECTION
MIF(  8,1)            5   GRID OFFSET IN I DIR DUE TO COARSE GRID EXPANSION
MIF(  9,1)            5   GRID OFFSET IN J DIR DUE TO COARSE GRID EXPANSION
MIF(101,1)            1   DOMAIN ID
```

```
MIF(102,1)              1   MOTHER DOMAIN ID
MIF(103,1)              0   NEST LEVEL (0: COARSE MESH)
MIF(104,1)             35   DOMAIN GRID DIMENSION IN I DIRECTION
MIF(105,1)             41   DOMAIN GRID DIMENSION IN J DIRECTION
MIF(106,1)              1   I LOCATION IN THE MOTHER DOMAIN OF THE DOMAIN POINT (1,1)
MIF(107,1)              1   J LOCATION IN THE MOTHER DOMAIN OF THE DOMAIN POINT (1,1)
MIF(108,1)              1   DOMAIN GRID SIZE RATIO WITH RESPECT TO COARSE DOMAIN
MIF(109,1)              1   DOMAIN GRID SIZE RATIO WITH RESPECT TO MOTHER DOMAIN
MIF(110,1)              2   DOES THIS DOMAIN HAS A TWO-WAY INTERACTIVE NEST (1: NO, 2:
                            YES)
MIF(111,1)              1   SMOOTHER (1: 1-2-1, 2:SMOOTHER-DESMOOTHER)
MIF(112,1)              0   DOMAIN IS IN WHICH HEMISPHERE? 0:NORTHERN, 1:SOUTHERN, 2:
                            BOTH
MIF(201,1)              0   NUMBER OF 3-D FIELDS IN OUTPUT
MIF(202,1)              2   NUMBER OF 2-D FIELDS IN OUTPUT
MIF(203,1)              0   NUMBER OF 1-D FIELDS IN OUTPUT
MIF(204,1)              0   NUMBER OF 0-D FIELDS IN OUTPUT
MIF(205,1)              0   TERRAIN  M CROSS NONCOUPLED
MIF(206,1)              0   LAND USE CATEGORY CROSS NONCOUPLED
MRF(  1,1)          90.00   COARSE DOMAIN GRID DISTANCE (KM)
MRF(  2,1)          36.00   COARSE DOMAIN CENTER LATITUDE (DEGREE)
MRF(  3,1)         -85.00   COARSE DOMAIN CENTER LONGITUDE (DEGREE)
MRF(  4,1)           0.72   CONE FACTOR
MRF(  5,1)          60.00   TRUE LATITUDE 1 (DEGREE)
MRF(  6,1)          30.00   TRUE LATITUDE 2 (DEGREE)
MRF(  7,1)          90.00   POLE POSITION IN DEGREE LATITUDE
MRF(  8,1)         360.00   APPROX EXPANSION (KM)
MRF(101,1)          90.00   DOMAIN GRID DISTANCE (KM)
MRF(102,1)           1.00   I LOCATION IN THE COARSE DOMAIN OF THE DOMAIN POINT (1,1)
MRF(103,1)           1.00   J LOCATION IN THE COARSE DOMAIN OF THE DOMAIN POINT (1,1)
MRF(104,1)          35.00   I LOCATION IN THE COARSE DOMAIN OF THE DOMAIN POINT
                            (IX,JX)
MRF(105,1)          41.00   J LOCATION IN THE COARSE DOMAIN OF THE DOMAIN POINT
                            (IX,JX)
MRF(106,1)           0.50   TERRAIN DATA RESOLUTION (IN DEGREE)
MRF(107,1)           0.50   LANDUSE DATA RESOLUTION (IN DEGREE)
```

11.4.1 TERRAIN output fields

2-D Field Name	Field ID (8 characters)	Unit	cross/dot
Terrain elevation	TERRAIN	m	c
Land Use	LAND USE	categories	c

11.5 Header Record for DATAGRID Output

```
MIF(  1,1)          2   OUTPUT FROM PROGRAM DATAGRID
MIF(  1,2)   93031300   MDATE:  THE DATE FOR THIS PARTICULAR DATAGRID TIME PERIOD
MIF(  2,2)          1   IFILE:  THE NUMBER FOR THIS PARTICULAR DATAGRID TIME
                        PERIOD
MIF(  3,2)          4   IFILES:  TOTAL NUMBER OF DATAGRID TIME PERIODS
MIF(  4,2)   93031300   ISTRTDAT:  8-DIGIT STARTING DATE FOR DATAGRID DATA
MIF(  5,2)         12   ITIMINT:  TIME INTERVAL (HOURS) FOR DATAGRID OUTPUT
MIF(  6,2)          1   IFIRST:  SOURCE FOR FIRST-GUESS FIELDS.  1=NMC; 2=ECMWF;
                        3=UNIDATA; 4=TOGA
MIF(  7,2)          1   SSTSRC:  SOURCE FOR SEA-SURFACE TEMPERATURES: 1=NMC;
                        2=NAVY; 3=CLIM; 4=UNIDATA
MIF(  8,2)          0   IHEMIS: HEMISPHERE: 0=NORTH; 1=SOUTH; 2=BOTH
MIF(  9,2)          0   ISEQ:  SEQUENCE NUMBER OF THE FIRST MISSING DATA SET
MIF( 10,2)          0   JSEQ:  NUMBER OF CONSECUTIVE MISSING NMC DATA SETS
MIF( 11,2)          0   IFCST: TIME OF FORECAST (ZERO IF THIS IS NOT FORECAST
                        DATA)
MIF( 12,2)   99999999   ISNOW1:  SNOW COVER DATE PRIOR TO FORECAST (NMC FIRST-
                        GUESS ONLY)
MIF( 13,2)   99999999   ISNOW2:  SNOW COVER DATE DURING FORECAST (NMC FIRST-GUESS
                        ONLY)
MIF( 14,2)          0   ISNOW3:  (T/F) SNOW-COVER DATA IS ON AN EARLIER FILE.
                        1=YES; 0=NO.
MIF( 15,2)   99999999   SNOECM:  SNOW COVER DATE FOR ECMWF FIRST-GUESS DATA
MIF( 16,2)   99999999   MISNV1:DATE OF FIRST MISSING SST FOR NAVY SST INPUT
MIF( 17,2)   99999999   MISNV2:DATE OF SECOND MISSING SST FOR NAVY SST INPUT
MIF( 18,2)         10   INY:  PRINT OUTPUT INTERVAL IN THE I (Y) DIRECTION
MIF( 19,2)         10   JNX:  PRINT OUTPUT INTERVAL IN THE J (X) DIRECTION
MIF( 20,2)          5   KSIGT:  NUMBER OF SIGNIFICANT DIGITS IN THE PRINT OUTPUT
MIF( 21,2)       1993   IYEAR: THE YEAR OF THIS PARTICULAR DATAGRID TIME PERIOD
MIF( 22,2)          3   IMONTH: THE MONTH OF THIS PARTICULAR DATAGRID TIME PERIOD
MIF( 23,2)         13   IDAY: THE DAY OF THIS PARTICULAR DATAGRID TIME PERIOD
MIF( 24,2)          0   IHOUR: THE HOUR OF THIS PARTICULAR DATAGRID TIME PERIOD
MIF( 25,2)          0   IMINUTE: THE MINUTE OF THIS PARTICULAR DATAGRID TIME
                        PERIOD
MIF( 31,2)       1993   ISTYEAR:  FOUR-DIGIT YEAR OF START TIME
MIF( 32,2)          3   ISTMONTH:  INTEGER MONTH OF START TIME
MIF( 33,2)         13   ISTDAY:  DAY OF THE MONTH OF THE START TIME
MIF( 34,2)          0   ISTHOUR:  HOUR OF THE START TIME
MIF( 35,2)          0   ISTMINUTE:  MINUTE OF THE START TIME
MIF(101,2)         11   NPLEV:  NUMBER OF LEVELS IN DATAGRID OUTPUT
MIF(102,2)       1001   IPRES:  DATAGRID PRESSURE LEVEL (MB) (1001 MEANS SURFACE
                        LEVEL)
MIF(103,2)       1000   IPRES:  DATAGRID PRESSURE LEVEL (MB)
MIF(104,2)        850   IPRES:  DATAGRID PRESSURE LEVEL (MB)
MIF(105,2)        700   IPRES:  DATAGRID PRESSURE LEVEL (MB)
MIF(106,2)        500   IPRES:  DATAGRID PRESSURE LEVEL (MB)
MIF(107,2)        400   IPRES:  DATAGRID PRESSURE LEVEL (MB)
MIF(108,2)        300   IPRES:  DATAGRID PRESSURE LEVEL (MB)
MIF(109,2)        250   IPRES:  DATAGRID PRESSURE LEVEL (MB)
```

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MIF(110,2)           200  IPRES:  DATAGRID PRESSURE LEVEL (MB)
MIF(111,2)           150  IPRES:  DATAGRID PRESSURE LEVEL (MB)
MIF(112,2)           100  IPRES:  DATAGRID PRESSURE LEVEL (MB)
MIF(201,2)             5  NUMBER OF 3-D FIELDS IN DATAGRID OUTPUT
MIF(202,2)            13  NUMBER OF 2-D FIELDS IN DATAGRID OUTPUT
MIF(203,2)             0  NUMBER OF 1-D FIELDS IN DATAGRID OUTPUT
MIF(204,2)             0  NUMBER OF 0-D FIELDS IN DATAGRID OUTPUT
MIF(205,2)             0  T K TEMPERATURE CROSS
MIF(206,2)            10  U M/S U COMPONENT DOT
MIF(207,2)            10  V M/S V COMPONENT DOT
MIF(208,2)            10  H M GEOPOTENTIAL HEIGHT DOT
MIF(209,2)             0  RH % RELATIVE HUMIDITY CROSS
MIF(210,2)             0  TERRAIN  M TERRAIN ELEVATION CROSS
MIF(211,2)             0  LAND USE CATEGORIES 1-13 CATAGORIES OF LAND USE CROSS
MIF(212,2)             0  MAPFACCR (DIMENSIONLESS)  MAP-SCALE FACTOR CROSS
MIF(213,2)            10  MAPFACDT (DIMENSIONLESS)  MAP-SCALE FACTOR DOT
MIF(214,2)            10  CORIOLIS 1/S CORIOLIS PARAMETER DOT
MIF(215,2)             0  LATITCRS DEGREES LATITUDE (SOUTH NEGATIVE) CROSS
MIF(216,2)             0  LONGICRS DEGREES LONGITUDE (WEST NEGATIVE) CROSS
MIF(217,2)            10  LATITDOT DEGREES LATITUDE (SOUTH NEGATIVE) DOT
MIF(218,2)            10  LONGIDOT DEGREES LONGITUDE (WEST NEGATIVE) DOT
MIF(219,2)             0  SNOWCOVR (DIMENSIONLESS)  FLAGS FOR SNOW COVER DATA CROSS
MIF(220,2)            10  PSEALVLD HPA SEA-LEVEL PRESSURE DOT
MIF(221,2)             0  PSEALVLC HPA SEA-LEVEL PRESSURE CROSS
MIF(222,2)             0  TSEASFC  K SEA-SURFACE TEMPERATURE CROSS
MRF(  1,2)        100.00  PTOP:  THE PRESSURE (MB) OF THE MODEL TOP
MRF( 21,2)          0.00  SECOND:  THE SECONDS OF THIS PARTICULAR DATAGRID TIME
                          PERIOD (FLOAT)
MRF( 31,2)          0.00  STSECOND:  SECONDS OF THE START TIME (FLOAT)
```

11.5.1 DATAGRID output fields

3-D Field Name	Field ID (8 characters)	Unit	cross/dot
Temperature	T	K	c
U wind	U	m/s	d
V wind	V	m/s	d
Geopotential Height	H	m	d
Relative Humidity	RH	%	c

2-D Field Name			
Terrain elevation	TERRAIN	m	c
Land Use	LAND USE	categories	c
Map-scale factor	MAPFACCR	dimensionless	c
Map-scale factor	MAPFACDT	dimensionless	d
Coriolis parameter	CORIOLIS	1/s	d
Latitude	LATITCRS	degree	c
Longitude	LONGICRS	degree	c

Latitude	LATITDOT	degree	d
Longitude	LONGIDOT	degree	d
Snow cover	SNOWCOVR	dimensionless	c
Sea-level pressure	PSEALVLD	hPa	d
Sea-level pressure	PSEALVLC	hPa	c
Sea-surface temperature	TSEASFC	K	c

11.6 Header Record for RAWINS Output

MIF(1,1)	3	OUTPUT FROM PROGRAM RAWINS
MIF(1,3)	93031300	MDATE: DATE FOR THIS PARTICULAR RAWINS TIME PERIOD (YYM-MDDHH)
MIF(2,3)	1	IFILE: NUMBER FOR THIS PARTICULAR RAWINS TIME PERIOD
MIF(3,3)	4	IFILES: TOTAL NUMBER OF RAWINS TIME PERIODS
MIF(4,3)	93031300	ISTRTDAT: STARTING TIME FOR RAWINS DATA
MIF(5,3)	12	TIME INTERVAL FOR RAWINS DATA OUTPUT
MIF(6,3)	1	IFAC: (Y/N) FIRST-GUESS FIELD WAS USED IN ANALYSIS (1=Y; 0=N)
MIF(7,3)	3	IWTSCM: 1=CRESSMAN; 2=ELLIPTICAL; 3=BANANA; 4=MULTIQUAD-RIC INTERPOLATION
MIF(8,3)	1	IWIND: FIRST-GUESS FOR SURFACE WINDS: 1= SURFACE GEO-STROPHIC; 2 = 1000MB.
MIF(9,3)	1	IWT: (Y/N) WEIGHTS SQUARED IN OBJECTIVE ANALYSIS. (1=Y; 0=N)
MIF(10,3)	1	SMOOTH: (Y/N) FIELDS SMOOTHED AFTER OBJECTIVE ANALYSIS (1=Y; 0=N)
MIF(11,3)	0	NOBLND: (Y/N) OBJECTIVE ANALYSIS PERFORMED (0=Y;1=N)
MIF(12,3)	0	RWSUBM: 0=NO AUTOBOGUS; 1=AUTOBOGUS 1 SUBMITTAL; 2=AUTOBOGUS 2 SUBMITTAL
MIF(13,3)	1	ISFC: (Y/N) SURFACE STATIONS USED (1=Y; 0=N)
MIF(14,3)	1	FDDASF: (Y/N) FDDA SURFACE FILE CREATED(1=Y; 0=N)
MIF(15,3)	3	INTF4D: TIME INTERVAL FOR FDDA OUTPUT FILE
MIF(16,3)	1	LAGTEM: (Y/N) 3 HR LAG TIME FOR SFC FIRST-GUESS AT NON-STD TIMES (1=Y;2=N)
MIF(21,3)	1993	IYEAR: THE YEAR OF THIS PARTICULAR RAWINS TIME PERIOD
MIF(22,3)	3	IMONTH: THE MONTH OF THIS PARTICULAR RAWINS TIME PERIOD
MIF(23,3)	13	IDAY: THE DAY OF THIS PARTICULAR RAWINS TIME PERIOD
MIF(24,3)	0	IHOUR: THE HOUR OF THIS PARTICULAR RAWINS TIME PERIOD
MIF(25,3)	0	IMINUTE: THE MINUTE OF THIS PARTICULAR RAWINS TIME PERIOD
MIF(31,3)	93	ISTYEAR: FOUR-DIGIT YEAR OF START TIME
MIF(32,3)	3	ISTMONTH: INTEGER MONTH OF START TIME
MIF(33,3)	13	ISTDAY: DAY OF THE MONTH OF THE START TIME
MIF(34,3)	0	ISTHOUR: HOUR OF THE START TIME
MIF(35,3)	0	ISTMINUTE: MINUTE OF THE START TIME
MIF(101,3)	22	NTOTLV: NUMBER OF LEVELS IN RAWINS OUTPUT
MIF(102,3)	1001	RAWINS PRESSURE LEVEL (1001 MEANS SURFACE LEVEL)
MIF(103,3)	1000	RAWINS PRESSURE LEVEL
MIF(104,3)	975	RAWINS PRESSURE LEVEL
MIF(105,3)	950	RAWINS PRESSURE LEVEL

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MIF(106,3)            925   RAWINS PRESSURE LEVEL
MIF(107,3)            900   RAWINS PRESSURE LEVEL
MIF(108,3)            850   RAWINS PRESSURE LEVEL
MIF(109,3)            800   RAWINS PRESSURE LEVEL
MIF(110,3)            750   RAWINS PRESSURE LEVEL
MIF(111,3)            700   RAWINS PRESSURE LEVEL
MIF(112,3)            650   RAWINS PRESSURE LEVEL
MIF(113,3)            600   RAWINS PRESSURE LEVEL
MIF(114,3)            550   RAWINS PRESSURE LEVEL
MIF(115,3)            500   RAWINS PRESSURE LEVEL
MIF(116,3)            450   RAWINS PRESSURE LEVEL
MIF(117,3)            400   RAWINS PRESSURE LEVEL
MIF(118,3)            350   RAWINS PRESSURE LEVEL
MIF(119,3)            300   RAWINS PRESSURE LEVEL
MIF(120,3)            250   RAWINS PRESSURE LEVEL
MIF(121,3)            200   RAWINS PRESSURE LEVEL
MIF(122,3)            150   RAWINS PRESSURE LEVEL
MIF(123,3)            100   RAWINS PRESSURE LEVEL
MIF(201,3)              5   NUMBER OF 3-D FIELDS IN RAWINS OUTPUT
MIF(202,3)             13   NUMBER OF 2-D FIELDS IN RAWINS OUTPUT
MIF(203,3)              0   NUMBER OF 1-D FIELDS IN RAWINS OUTPUT
MIF(204,3)              0   NUMBER OF 0-D FIELDS IN RAWINS OUTPUT
MIF(205,3)              0   T  K  TEMPERATURE  CROSS
MIF(206,3)             10   U  M/S  U COMPONENT OF HORIZONTAL WIND  DOT
MIF(207,3)             10   V  M/S  V COMPONENT OF HORIZONTAL WIND  DOT
MIF(208,3)             10   H  M  GEOPOTENTIAL HEIGHT  DOT
MIF(209,3)              0   RH  %  RELATIVE HUMIDITY  CROSS
MIF(210,3)              0   TERRAIN  M  TERRAIN ELEVATION  CROSS
MIF(211,3)              0   LAND USE CATEGORIES  1-13 CATEGORIES OF LAND USE  CROSS
MIF(212,3)              0   MAPFACCR (DIMENSIONLESS)  MAP SCALE FACTOR  CROSS
MIF(213,3)             10   MAPFACDT (DIMENSIONLESS)  MAP SCALE FACTOR  DOT
MIF(214,3)             10   CORIOLIS 1/S  CORIOLIS PARAMETER  DOT
MIF(215,3)              0   LATITCRS DEGREES  LATITUDE (SOUTH NEGATIVE)  CROSS
MIF(216,3)              0   LONGICRS DEGREES  LONGITUDE (WEST NEGATIVE)  CROSS
MIF(217,3)             10   LATITDOT DEGREES  LATITUDE (SOUTH NEGATIVE)  DOT
MIF(218,3)             10   LONGIDOT DEGREES  LONGITUDE (WEST NEGATIVE)  DOT
MIF(219,3)              0   SNOWCOVR (DIMENSIONLESS)  FLAGS FOR SNOW-COVER DATA  CROSS
MIF(220,3)             10   PSEALVLD HPA  SEA-LEVEL PRESSURE  DOT
MIF(221,3)              0   PSEALVLC HPA  SEA-LEVEL PRESSURE  CROSS
MIF(222,3)              0   TSEASFC  K  SEA-SURFACE TEMPERATURE  CROSS
MRF(  1,3)          10.00   ERRMXT:  MAXIMUM TEMPERATURE DIFFERENCE ALLOWED (DEGREES)
MRF(  2,3)          13.00   ERRMXW:  MAXIMUM WIND DIFFERENCE ALLOWED(M/S)
MRF(  3,3)           6.00   ERRMXP:  MAXIMUM PRESSURE DIFFERENCE ALLOWED (MB)
MRF(  4,3)           1.25   BUDWGT:  TOLERANCE FOR BUDDY CHECK (0.0 = NO BUDDY CHECK)
MRF( 21,3)           0.00   SECOND:  THE SECONDS OF THIS PARTICULAR RAWINS TIME PERIOD
                            (FLOAT)
MRF( 31,3)           0.00   STSECOND:  SECONDS OF THE START TIME (FLOAT)
```

11.6.1 RAWINS output fields

3-D Field Name	Field ID (8 characters)	Unit	cross/dot
Temperature	TEMP	K	c
U wind	U	m/s	d
V wind	V	m/s	d
Geopotential Height	H	m	d
Relative Humidity	RH	%	c

2-D Field Name			
Terrain elevation	TERRAIN	m	c
Land Use	LAND USE	categories	c
Map-scale factor	MAPFACCR	dimensionless	c
Map-scale factor	MAPFACDT	dimensionless	d
Coriolis parameter	CORIOLIS	1/s	d
Latitude	LATITCRS	degree	c
Longitude	LONGICRS	degree	c
Latitude	LATITDOT	degree	d
Longitude	LONGIDOT	degree	d
Snow cover	SNOWCOVR	dimensionless	c
Sea-level pressure	PSEALVLD	hPa	d
Sea-level pressure	PSEALVLC	hPa	c
Sea-surface temperature	TSEASFC	K	c

11.7 Header Record for RAWINS Surface FDDA Output

```
MIF(  1,1)          4   RAWINS SURFACE FDDA OUTPUT
MIF(  1,4)   93031300   MDATE: DATE FOR THIS PARTICULAR RAWINS FDDA TIME PERIOD
MIF(  2,4)          1   IFILE:  NUMBER FOR THIS PARTICULAR RAWINS FDDA TIME PERIOD
MIF(  3,4)         13   IFILES:  TOTAL NUMBER OF RAWINS FDDA DATA SETS
MIF(  4,4)   93031300   ISTRTDAT:  STARTING DATE FOR RAWINS FDDAOUTPUT
MIF(  5,4)          3   INTF4D:  TIME INTERVAL FOR RAWINS FDDA OUTPUT
MIF(  6,4)          1   0: FIELD IS BAD; INSUFFICIENT DATA. 1: GOOD ANALYSIS
MIF(  7,4)          1   0: FIELD IS BAD; INSUFFICIENT DATA. 1: GOOD ANALYSIS
MIF(  8,4)          1   0: FIELD IS BAD; INSUFFICIENT DATA. 1: GOOD ANALYSIS
MIF(  9,4)          1   0: FIELD IS BAD; INSUFFICIENT DATA. 1: GOOD ANALYSIS
MIF( 10,4)          1   0: FIELD IS BAD; INSUFFICIENT DATA. 1: GOOD ANALYSIS
MIF( 11,4)          1   0: FIELD IS BAD; INSUFFICIENT DATA. 1: GOOD ANALYSIS
MIF( 12,4)          1   0: FIELD IS BAD; INSUFFICIENT DATA. 1: GOOD ANALYSIS
MIF( 13,4)          1   0: FIELD IS BAD; INSUFFICIENT DATA. 1: GOOD ANALYSIS
MIF( 21,4)       1993   IYEAR:  THE YEAR OF THIS PARTICULAR RAWINS SURFACE FDDA
                        TIME PERIOD
MIF( 22,4)          3   IMONTH:  THE MONTH OF THIS PARTICULAR RAWINS SURFACE FDDA
                        TIME PERIOD
MIF( 23,4)         13   IDAY:  THE DAY OF THIS PARTICULAR RAWINS SURFACE FDDA TIME
                        PERIOD
```

```
MIF( 24,4)              0   IHOUR:  THE HOUR OF THIS PARTICULAR RAWINS SURFACE FDDA
                            TIME PERIOD
MIF( 25,4)              0   IMINUTE:  THE MINUTE OF THIS PARTICULAR RAWINS SURFACE
                            FDDA TIME PERIOD
MIF( 31,4)             93   ISTYEAR:  FOUR-DIGIT YEAR OF START TIME
MIF( 32,4)              3   ISTMONTH:  INTEGER MONTH OF START TIME
MIF( 33,4)             13   ISTDAY:  DAY OF THE MONTH OF THE START TIME
MIF( 34,4)              0   ISTHOUR:  HOUR OF THE START TIME
MIF( 35,4)              0   ISTMINUTE:  MINUTE OF THE START TIME
MIF(101,4)              1   NUMBER OF LEVELS FOR RAWINS FDDA FILE OUTPUT
MIF(102,4)           1001   SURFACE LEVEL FOR RAWINS FDDA FILE OUTPUT
MIF(201,4)              0   NUMBER OF 3-D FIELDS IN RAWINS FDDA OUTPUT
MIF(202,4)              8   NUMBER OF 2-D FIELDS IN RAWINS FDDA OUTPUT
MIF(203,4)              0   NUMBER OF 1-D FIELDS IN RAWINS FDDA OUTPUT
MIF(204,4)              0   NUMBER OF 0-D FIELDS IN RAWINS FDDA OUTPUT
MIF(205,4)             10   U  M/S  U COMPONENT OF SURFACE WIND (2-D FIELD)  DOT
MIF(206,4)             10   V  M/S  V COMPONENT OF SURFACE WIND (2-D FIELD)  DOT
MIF(207,4)              0   T  K  SURFACE TEMPERATURE (2-D FIELD)  CROSS
MIF(208,4)              0   Q  KG/KG  SURFACE MIXING RATIO (2-D FIELD)  CROSS
MIF(209,4)              0   PSTARCRS KPA  SURFACE PRESSURE MINUS PTOP  CROSS
MIF(210,4)              0   RH %  SURFACE RELATIVE HUMIDITY (2-D FIELD)  CROSS
MIF(211,4)              0   PSEALVLC HPA  SEA-LEVEL PRESSURE  CROSS
MIF(212,4)              0   TOBBOX  OBSERVATIONS  OBSERVATION DENSITY  CROSS
MRF( 21,4)           0.00   SECOND:  THE SECONDS OF THIS PARTICULAR RAWINS SURFACE
                            FDDA TIME PERIOD (FLOAT)
MRF( 31,4)           0.00   STSECOND:  SECONDS OF THE START TIME (FLOAT)
```

11.7.1 Surface FDDA output fields :

2-D Field Name	Field ID (8 characters)	Unit	Cross/Dot
U component of surface wind	U	m/s	d
V component of surface wind	V	m/s	d
Surface temperature	T	K	c
Surface mixing ratio	Q	kg/kg	c
Pstar (surface pressure - PTOP)	PSTARCRS	kPa	c
Surface relative humidity	RH	%	c
Sea level pressure	PSEALVLC	hPa	c
Observation density	TOBBOX	dimensionless	c

11.8 Header Record for Model Input

```
MIF(  1,1)              5   NONHYDROSTATIC MODEL INPUT FOR MM5
MIF(  1,5)       93031300   DATE FOR THIS PARTICULAR MMINPUT TIME PERIODS
MIF(  2,5)              1   IFILE:  NUMBER FOR THIS PARTICULAR MMINPUT TIME PERIODS
MIF(  3,5)              4   IFILES:  TOTAL NUMBER OF MMINPUT TIME PERIODS
MIF(  4,5)       93031300   ISTRTDA:  STARTING TIME FOR MMINPUT DATA
```

```
MIF(  5,5)              1  0: HYDROSTATIC, 1: NONHYDROSTATIC MODEL INPUT
MIF(101,5)              0  NPLEV:  NUMBER OF PRESSURE LEVELS IN MMINPUT DATA
MIF(201,5)              6  NUMBER OF 3-D FIELDS IN MMINPUT DATA
MIF(202,5)             12  NUMBER OF 2-D FIELDS IN MMINPUT DATA
MIF(203,5)              0  NUMBER OF 1-D FIELDS IN MMINPUT DATA
MIF(204,5)              0  NUMBER OF 0-D FIELDS IN MMINPUT DATA
MIF(205,5)             11  U  KPA M/S  U COMPONENT OF HORIZONTAL WIND  COUPLED DOT
MIF(206,5)             11  V  KPA M/S  V COMPONENT OF HORIZONTAL WIND  COUPLED DOT
MIF(207,5)              1  W  KPA M/S  VERTICAL WIND COMPONENT (FULL LEVELS)  COUPLED
                           CROSS
MIF(208,5)              1  PP KPA PA  PRESURE PURBATION  COUPLED CROSS
MIF(209,5)              1  Q  KPA KG/KG  MIXING RATIO  COUPLED CROS
MIF(210,5)              1  T  KPA K  TEMPERATURE  COUPLED CROSS
MIF(211,5)              0  PSTARCRS KPA  (REFERENCE) SURFACE PRESSURE MINUS PTOP
                           CROSS
MIF(212,5)             10  CORIOLIS 1/S  CORIOLIS PARAMETER  DOT
MIF(213,5)              0  MAPFACCR (DIMENSIONLESS)  MAP SCALE FACTOR  CROSS
MIF(214,5)             10  MAPFACDT (DIMENSIONLESS)  MAP SCALE FACTOR  DOT
MIF(215,5)              0  LATITCRS DEGREE  LATITUTE (SOUTH NEGATIVE)  CROSS
MIF(216,5)              0  LONGICRS DEGREE  LONGITUDE (WEST NEGATIVE)  CROSS
MIF(217,5)             10  LATITDOT DEGREE  LATITUTE (SOUTH NEGATIVE)  DOT
MIF(218,5)             10  LONGIDOT DEGREE  LONGITUDE (WEST NEGATIVE)  DOT
MIF(219,5)              0  GROUND T K  GROUND TEMPERATURE  CROSS
MIF(220,5)              0  TERRAIN  M  TERRAIN ELEVATION  CROSS
MIF(221,5)              0  LAND USE CATEGORY  1-13 CATEGORIES OF LAND USE  CROSS
MIF(222,5)              0  SNOWCOVR (DIMENSIONLESS)  FLAGS FOR SNOW COVER DATA
MRF(  1,5)           0.00  XTIME:  MODEL INPUT TIME PAST START TIME (ISTRTDA) IN MIN-
                           UTES
MRF(  2,5)      100000.00  NONHYDROSTATIC BASE STATE SEA LEVEL PRESSURE (PA)
MRF(  3,5)         275.00  NONHYDROSTATIC BASE STATE SEA LEVEL TEMPERATURE (K)
MRF(  4,5)          50.00  NONHYDROSTATIC BASE STATE LAPSE RATE D(T)/D(LN P)
MRF(101,5)          23.00  NUMBER OF HALF SIGMA LEVELS
MRF(102,5)           0.03  HALF SIGMA LEVEL  1
MRF(103,5)           0.08  HALF SIGMA LEVEL  2
MRF(104,5)           0.12  HALF SIGMA LEVEL  3
MRF(105,5)           0.17  HALF SIGMA LEVEL  4
MRF(106,5)           0.22  HALF SIGMA LEVEL  5
MRF(107,5)           0.28  HALF SIGMA LEVEL  6
MRF(108,5)           0.32  HALF SIGMA LEVEL  7
MRF(109,5)           0.38  HALF SIGMA LEVEL  8
MRF(110,5)           0.43  HALF SIGMA LEVEL  9
MRF(111,5)           0.47  HALF SIGMA LEVEL  10
MRF(112,5)           0.52  HALF SIGMA LEVEL  11
MRF(113,5)           0.57  HALF SIGMA LEVEL  12
MRF(114,5)           0.62  HALF SIGMA LEVEL  13
MRF(115,5)           0.68  HALF SIGMA LEVEL  14
MRF(116,5)           0.73  HALF SIGMA LEVEL  15
MRF(117,5)           0.77  HALF SIGMA LEVEL  16
MRF(118,5)           0.82  HALF SIGMA LEVEL  17
MRF(119,5)           0.87  HALF SIGMA LEVEL  18
MRF(120,5)           0.91  HALF SIGMA LEVEL  19
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MRF(121,5)          0.94   HALF SIGMA LEVEL  20
MRF(122,5)          0.97   HALF SIGMA LEVEL  21
MRF(123,5)          0.99   HALF SIGMA LEVEL  22
MRF(124,5)          1.00   HALF SIGMA LEVEL  23
```

11.8.1 Model input fields

Nonhydrostatic

3-D Field Name	Field ID (8 characters)	Unit	cross/dot
U wind	U	kPa m/s	d
V wind	V	kPa m/s	d
Vertical wind (W,on full sigma)	W	kPa m/s	c
Pressure purturbation	PP	kPa pa	c
Mixing ratio	Q	kPa kg/kg	c
Temperature	T	kPa K	c

Hydrostatic

3-D Field Name	Field ID (8 characters)	Unit	cross/dot
U wind	U	kPa m/s	d
V wind	V	kPa m/s	d
Mixing ratio	Q	kPa kg/kg	c
Temperature	T	kPa K	c

2-D Field Name			
Pstar (surface pressure - PTOP)	PSTARCRS	kPa	c
Coriolis parameter	CORIOLIS	1/s	d
Map-scale factor	MAPFACCR	dimensionless	c
Map-scale factor	MAPFACDT	dimensionless	d
Latitude	LATITCRS	degree	c
Longitude	LONGICRS	degree	c
Latitude	LATITDOT	degree	d
Longitude	LONGIDOT	degree	d
Ground temperature	GROUND T	K	c
Terrain elevation	TERRAIN	m	c
Land Use	LAND USE	categories	c
Snow cover	SNOWCOVR	dimensionless	c

11.9 Header Record for Model Output

```
MIF(  1,1)            6 OUTPUT FROM PROGRAM MM5 V2 RELEASE-2-11
MIF(  1,6)     93031300 DATE FOR THIS PARTICULAR MMOUTPUT TIME PERIOD. YYMMDDHH (YEAR,
                        MONTH, DAY, HR)
```

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MIF(  2,6)      93031300 ISTRTDA:  STARTING TIME FOR MODEL RUN.
MIF(  3,6)             0 IDRY: 0=MOISTURE INCLUDED, 1=MOISTURE EXCLUDED
MIF(  4,6)             2 IMOIST:  2=EXPLICIT CLOUD AND RAIN PREDICTION, 1=NO
MIF(  5,6)             1 INHYD: 1=NONHYDROSTATIC RUN, 0=HYDROSTATIC MODEL RUN
MIF(  6,6)             1 ITGFLG:  1=BUDGE, 3=CONSTANT GROUND TEMPT
MIF(  7,6)             0 IICE:  1=PREDICT SNOW, ICE, 0=NO
MIF(  8,6)             0 INAV:  1=TURBULENT KINETIC ENERGY, 0=NO
MIF(  9,6)             0 IICEG: 1=PREDICT SNOW,ICE,GRAUPEL,NUMBER CONCENTRATION 0=NO
MIF( 10,6)            10 MAXMV:  MAXIMUM NUMBER OF MOVES ALLOWED
MIF( 11,6)             0 DATE FOR THIS PARTICULAR MMOUTPUT TIME PERIOD. MM (MINUTES)
MIF( 12,6)             0 DATE FOR THIS PARTICULAR MMOUTPUT TIME PERIOD. HH (HOURS)
MIF( 13,6)            13 DATE FOR THIS PARTICULAR MMOUTPUT TIME PERIOD. DD (DAYS)
MIF( 14,6)             3 DATE FOR THIS PARTICULAR MMOUTPUT TIME PERIOD. MO (MONTH)
MIF( 15,6)            93 DATE FOR THIS PARTICULAR MMOUTPUT TIME PERIOD. YR (YEAR)
MIF( 16,6)            19 DATE FOR THIS PARTICULAR MMOUTPUT TIME PERIOD. YC (CENTURY)
MIF(101,6)           999
MIF(201,6)             9 NUMBER OF 3-D FIELDS IN MM5 OUTPUT
MIF(202,6)            26 NUMBER OF 2-D FIELDS IN MM5 OUTPUT
MIF(203,6)             0 NUMBER OF 1-D FIELDS IN MM5 OUTPUT
MIF(204,6)             0 NUMBER OF 0-D FIELDS IN MM5 OUTPUT
MIF(205,6)            11 U   KPA M/S  U COMPONENT OFHORIZONTAL WIND COUPLED DOT
MIF(206,6)            11 V   KPA M/S  V COMPONENT OFHORIZONTAL WIND COUPLED DOT
MIF(207,6)             1 T   KPA K  TEMPERATURE  COUPLED CROSS
MIF(208,6)             1 Q   KPA KG/KG  MIXING RATIO  COUPLED CROSS
MIF(209,6)             1 CLW KPA KG/KG CLOUD WATER MIXING RATIO COUPLED CROSS
MIF(210,6)             1 RNW KPA KG/KG  RAIN WATER MIXING RATIO  COUPLED CROSS
MIF(211,6)             0 RAD  TEND K/DAY ATMOSPHERIC RADIATION TENDENCY CROSS
MIF(212,6)             1 W   KPA M/S  VERTICAL WIND COMPONENT (FULL LEVELS) COUPLE CROSS
MIF(213,6)             1 PP   KPA PA  PRESSURE PERTURBATION  COUPLED CROSS
MIF(214,6)             0 PSTARCRS KPA  (REFERENCE) SURFACE PRESSURE MINUS PTOP  CROSS
MIF(215,6)             0 GROUND T K  GROUND TEMPERATURE  CROSS
MIF(216,6)             0 RAIN CON CM  ACCUMULATED CONVECTIVE PRECIPITATION  CROSS
MIF(217,6)             0 RAIN NON CM  ACCUMULATED NONCONVECTIVE PRECIPITATION  CROSS
MIF(218,6)             0 TERRAIN  M  TERRAIN ELEVATION  CROSS
MIF(219,6)             0 MAPFACCR (DIMENSIONLESS)  MAP SCALE FACTOR  CROSS
MIF(220,6)            10 MAPFACDT (DIMENSIONLESS)  MAP SCALE FACTOR  DOT
MIF(221,6)            10 CORIOLIS 1/S  CORIOLIS PARAMETER  DOT
MIF(222,6)             0 RES TEMP K INFINITE RESERVOIR SLAB TEMPERATURE  CROSS
MIF(223,6)             0 LATITCRS DEGREES  LATITUDE (SOUTH NEGATIVE)  CROSS
MIF(224,6)             0 LONGICRS DEGREES  LONGITUDE (WEST NEGATIVE)  CROSS
MIF(225,6)             0 LAND USE CATEGORIES  1-13 CATEGORIES OF LAND USE  CROSS
MIF(226,6)             0 SNOWCOVR (DIMENSIONLESS)  FLAGS FOR SNOW COVER DATA  CROSS
MIF(227,6)             0 PBL HGT  M  PBL HEIGHT  CROSS
MIF(228,6)             0 REGIME  (DIMENSIONLESS)  PBL REGIME  CROSS
MIF(229,6)             0 SHFLUX  W/M^2  SENSIBLE HEAT FLUX  CROSS
MIF(230,6)             0 LHFLUX  W/M^2  LATENT HEAT FLUX  CROSS
MIF(231,6)             0 UST  M/S  FRICTIONAL VELOCITY  CROSS
MIF(232,6)             0 SWDOWN W/M^2  SURFACE DOWNWARD SHORTWAVE RADIATION  CROSS
MIF(233,6)             0 LWDOWN W/M^2  SURFACE DOWNWARD LONGWAVE RADIATION  CROSS
MIF(234,6)             0 SOIL T 1 K  SOIL TEMPERATURE IN LAYER  1  CROSS
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MIF(235,6)            0 SOIL T 2 K  SOIL TEMPERATURE IN LAYER  2  CROSS
MIF(236,6)            0 SOIL T 3 K  SOIL TEMPERATURE IN LAYER  3  CROSS
MIF(237,6)            0 SOIL T 4 K  SOIL TEMPERATURE IN LAYER  4  CROSS
MIF(238,6)            0 SOIL T 5 K  SOIL TEMPERATURE IN LAYER  5  CROSS
MIF(239,6)            0 SOIL T 6 K  SOIL TEMPERATURE IN LAYER  6  CROSS
MIF(301,6)            0 IFREST:  1 = RESTARTED JOB;  0 = NOT A RESTARTED JOB
MIF(302,6)            0 IXTIMR:  TIME OF RESTART
MIF(303,6)            1 IFSAVE:  1 = DATA SAVED FOR RESTART; 0 = DATA NOT SAVED FOR
                        RESTART
MIF(304,6)            1 IFTAPE:  1 = OUTPUT DATA SAVED FOR GRIN; 0 = NO OUTPUT FOR GRIN
MIF(305,6)           45 MASCHK:  MASS CONSERVATION CHECK FREQUENCY (MINUTES)
MIF(306,6)            2 IFRAD: 0=NO RADIATIVE COOLING; 1=SIMPLE RADIATION; 2=CLOUD
                        RADIATION; 3=CCM2
MIF(307,6)            1 ICUSTB:  1=STABILITY CHECK IN CUMULUS SCHEME ACTIVATED; 0 =
                        NOT ACTIVATED
MIF(308,6)            1 IEXICE:  1=ICE-PHYSICS EFFECTS IN EXPLICIT SCHEME; 0=NO ICE-
                        PHYSICS EFFECTS
MIF(309,6)            0 IFDRY:  1=FAKE DRY RUN;  2=NOT A FAKE DRY RUN
MIF(310,6)            1 IMVDIF:  1=MOIST-ADIABATIC VERTICAL DIFFUSION IN CLOUDS
                        INCLUDED; 0=NOT INCLUDED
MIF(311,6)            0 IBMOIST:  1=BOUNDARY AND INITIAL WATER/ICE SPECIFIED; 0=NOT
                        SPECIFIED
MIF(312,6)            1 ICOR3D:  1=FULL CORIOLIS WITH VERTICAL COMPONENT; 0=VERTICAL
                        COMPONENT NEGLECTED
MIF(313,6)            1 IFUPR:  1 = UPPER RADIATIVE BOUNDARY CONDITION USED;  0 =
                        U.R.B.C. NOT USED
MIF(314,6)            3 IBOUDY: 0=FIXED 1=RELAX 2=TIME DEPDT 3=TIME/IO DEPDT 4=SPONGE
MIF(315,6)            5 IBLTYP: 0=FRICTIONLESS; 1=BULK PBL; 2=BLACKADAR PBL; 3=B-T;
                        4=ETA M-Y ;5=MRF
MIF(316,6)            0 IDRY:  0=MOIST RUN; 1=DRY RUN
MIF(317,6)            2 IMOIST:  0=DRY, WITH PASSIVE MOISTURE; 1=NO EXPLICIT MOIST;
                        2=EXPLICIT MOISTURE
MIF(318,6)            3 ICUPA: 1-7/NO/ANTHES-KUO/GRELL/ARAKAWA- SCHUBERT/F-C/KAIN-
                        FRITSCH/BETTS-MILLER
MIF(319,6)            1 ISSFLX:  1=SURFACE HEAT AND MOISTURE FLUXES CALCULATED; 0=NOT
                        CALCULATED
MIF(320,6)            1 ITGFLG:  1=TG CALCULATED FROM BUDGET; 2=SINUSOIDAL FUNCTION;
                        3=SPECIFIED CONSTS
MIF(321,6)            1 ISFPAR:  1=SFC/LAND-USE PARAMETERS VARIABLE; 0=SFC/LAND-USE
                        PARAMETERS CONSTANT
MIF(322,6)            1 ICLOUD:  1=CLOUD EFFECTS ON RADIATION COSIDERED; 0=CLOUD
                        EFFECTS NOT CONSIDERED
MIF(323,6)            0 ICDCON:  1=DRAG COEFFS ARE CONSTANT F(TER-ELEV) IN BULK PBL;
                        0=COEFFS VARIABLE
MIF(324,6)            0 IFSNOW:  1=SNOW-COVER EFFECTS CONSIDERED0=NOT CONSIDERED
MIF(325,6)            0 IMOIAV:  1=MOISTURE AVAILABILITY A FUNCTION OF TIME; 0=MOIST.
                        AVAIL. A CONSTANT
MIF(326,6)            1 IVMIXM:  1=VERTICAL MIXING OF MOMENTUM CONSIDERED; 0=NOT CON-
                        SIDERED
MIF(327,6)            1 IEVAP:  -1=EVAP OF RAIN NOT CONSIDERED; 0=EVAP NOT CONSIDERED;
                        1=EVAP CONSIDERED
MIF(328,6)            0 ISHALLO:  1=SHALLOW CONVECTION SCHEME USED; 0=SHALLOW CONVEC-
                        TION SCHEME NOT USED
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MIF(329,6)	1 IOVERW: 1=NEST INITIAL CONDITIONS OVERWRITTEN WITH USER ANALYSIS; 0=INTERPOLATE
MIF(330,6)	0 IMOVE: 1=THIS DOMAIN MOVES; 0=THIS DOMAIN DOES NOT MOVE
MIF(331,6)	1 IMOVCO: MOVE NUMBER
MIF(332,6)	3 IFEED: 0=ONE-WAY FDBCK; 1=MM4 FDBCK; 2=NO SMOOTH; 3=LIGHT SMOOTH; 4=HEAVY SMOOTH
MIF(333,6)	0 IABSOR: 1=SPONGE ABSORBER AT TOP; 0=NO SPONGE AT TOP
MIF(334,6)	0 I4D(3D): 1=3-D ANALYSIS NUDGING; 0=NO 3-D ANALYSIS NUDGING
MIF(335,6)	1 IWIND(3D): 1=3-D ANALYSIS NUDGING OF WIND; 0=NO 3-D ANALYSIS NUDGING OF WIND
MIF(336,6)	1 ITEMP(3D): 1=3-D ANALYSIS NUDGING OF TEMP; 0=NO 3-D ANALYSIS NUDGING OF TEMP
MIF(337,6)	1 IMOIS(3D): 1=3-D ANALYSIS NUDGING MOISTURE: 0=NO 3-D ANALYSIS NUDGING MOISTURE
MIF(338,6)	0 IROT: 1=3-D ANALYSIS NUDGING OF ROTATIONAL WIND; 0 = ROT. WIND NOT NUDGED
MIF(339,6)	0 I4D(SFC): 1=SFC ANALYSIS NUDGING; 0=NO SFC ANALYSIS NUDGING
MIF(340,6)	1 IWIND(SFC): 1=SFC ANALYSIS NUDGING OF WIND; 0=NO SFC ANALYSIS NUDGING OF WIND
MIF(341,6)	1 ITEMP(SFC): 1=SFC ANALYSIS NUDGING OF TEMP; 0=NO SFC ANALYSIS NUDGING OF TEMP
MIF(342,6)	1 IMOIS(SFC): 1=SFC ANALYSIS NUDGING MOISTURE: 0=NO SFC ANALYSIS NUDGING MOISTURE
MIF(343,6)	0 INONBL(U): 0 = B.L. NUDGING OF U INCLUDED; 1 = B.L. NUDGING OF U EXCLUDED
MIF(344,6)	0 INONBL(V): 0 = B.L. NUDGING OF V INCLUDED; 1 = B.L. NUDGING OF V EXCLUDED
MIF(345,6)	1 INONBL(T): 0 = B.L. NUDGING OF T INCLUDED; 1 = B.L. NUDGING OF T EXCLUDED
MIF(346,6)	1 INONBL(M.R.): 0 = B.L. NUDGING OF M.R. INCLUDED; 1 = B.L. NUDGING M.R. EXCLUDED
MIF(347,6)	0 I4DI: 1=OBSERVATIONS NUDGING; 2=NO OBSERVATIONS NUDGING
MIF(348,6)	1 ISWIND: 1=OBS NUDGING OF THE WIND FIELD; 2=NO OBS NUDGING OF THE WIND FIELD
MIF(349,6)	1 ISTEMP: 1=OBS NUDGING OF THE TEMP FIELD; 2=NO OBS NUDGING OF THE TEMP FIELD
MIF(350,6)	1 ISMOIS: 1=OBS NUDGING OF THE MIXING RATIO FIELD; 2=NO OBS NUDGING OF MIX. RAT.
MIF(351,6)	2 IONF: FREQUENCY (COARSE-GRID TIMESTEPS) TO COMPUTE OBS-NUDGING WEIGHTS
MIF(353,6)	4 IMPHYS: 1-7 DRY/STABLE PPT/WARM RAIN/SIMPLE ICE/REISNER MIXED/GODDARD/REISNER2
MIF(354,6)	1 ITPDIF: =1, HORIZONTAL DIFFUSION OF PERTURBATION TEMPERATURE ONLY, =0, FULL T
MIF(355,6)	1 ISOIL: =1, MULTI-LAYER SOIL TEMPERATURE MODEL, =0, BLACKADAR SLAB MODEL
MIF(356,6)	1 IVQADV: =0, LOG, =1, LINEAR INTERPOLATION OF MOISTURE IN VERTICAL ADVECTION
MIF(357,6)	1 IVTADV: =0, THETA, =1, LINEAR INTERPOLATION OF TEMPERATURE IN VERTICAL ADVECTN
MIF(358,6)	0 IDYNIN: =1, USING RAMPING FUNCTION AT END OF FDDA, =0, NO RAMP
MIF(359,6)	0 ITHADV: =0, STANDARD, = 1, USING POTENTIAL TEMPERATURE IN TEMP ADVECTION
MIF(401,6)	0 IMOVET: TIME OF MOVE (MINUTES FROM START OF FORECAST)

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MIF(402,6)            0 IMOVET:  TIME OF MOVE (MINUTES FROM START OF FORECAST)
MIF(403,6)            0 IMOVET:  TIME OF MOVE (MINUTES FROM START OF FORECAST)
MIF(404,6)            0 IMOVET:  TIME OF MOVE (MINUTES FROM START OF FORECAST)
MIF(405,6)            0 IMOVET:  TIME OF MOVE (MINUTES FROM START OF FORECAST)
MIF(406,6)            0 IMOVET:  TIME OF MOVE (MINUTES FROM START OF FORECAST)
MIF(407,6)            0 IMOVET:  TIME OF MOVE (MINUTES FROM START OF FORECAST)
MIF(408,6)            0 IMOVET:  TIME OF MOVE (MINUTES FROM START OF FORECAST)
MIF(409,6)            0 IMOVET:  TIME OF MOVE (MINUTES FROM START OF FORECAST)
MIF(410,6)            0 IMOVET:  TIME OF MOVE (MINUTES FROM START OF FORECAST)
MIF(411,6)            0 IMOVEI:  I INCREMENT OF MOVE
MIF(412,6)            0 IMOVEI:  I INCREMENT OF MOVE
MIF(413,6)            0 IMOVEI:  I INCREMENT OF MOVE
MIF(414,6)            0 IMOVEI:  I INCREMENT OF MOVE
MIF(415,6)            0 IMOVEI:  I INCREMENT OF MOVE
MIF(416,6)            0 IMOVEI:  I INCREMENT OF MOVE
MIF(417,6)            0 IMOVEI:  I INCREMENT OF MOVE
MIF(418,6)            0 IMOVEI:  I INCREMENT OF MOVE
MIF(419,6)            0 IMOVEI:  I INCREMENT OF MOVE
MIF(420,6)            0 IMOVEI:  I INCREMENT OF MOVE
MIF(421,6)            0 IMOVEJ:  J INCREMENT OF MOVE
MIF(422,6)            0 IMOVEJ:  J INCREMENT OF MOVE
MIF(423,6)            0 IMOVEJ:  J INCREMENT OF MOVE
MIF(424,6)            0 IMOVEJ:  J INCREMENT OF MOVE
MIF(425,6)            0 IMOVEJ:  J INCREMENT OF MOVE
MIF(426,6)            0 IMOVEJ:  J INCREMENT OF MOVE
MIF(427,6)            0 IMOVEJ:  J INCREMENT OF MOVE
MIF(428,6)            0 IMOVEJ:  J INCREMENT OF MOVE
MIF(429,6)            0 IMOVEJ:  J INCREMENT OF MOVE
MIF(430,6)            0 IMOVEJ:  J INCREMENT OF MOVE
MRF(  1,6)         0.00 XTIME:  MODEL FORECAST TIME PAST MDATE  (MINUTES)
MRF(  2,6)    100000.00 P0: REFERENCE PRESSURE IN NONHYDROSTATICMODEL RUN (PA)
MRF(  3,6)       275.00 TS0:  SEA LEVEL TEMPERATURE IN NONHYDROSTATIC MODEL (K)
MRF(  4,6)        50.00 TLP: TEMPERATURE LAPSE RATE IN NONHYDROSTATIC MODEL (K/500 MB)
MRF(101,6)        23.00 MKX: NUMBER OF LAYERS IN MM5 OUTPUT
MRF(102,6)         0.03 HALF SIGMA LEVEL  1
MRF(103,6)         0.08 HALF SIGMA LEVEL  2
MRF(104,6)         0.13 HALF SIGMA LEVEL  3
MRF(105,6)         0.17 HALF SIGMA LEVEL  4
MRF(106,6)         0.22 HALF SIGMA LEVEL  5
MRF(107,6)         0.28 HALF SIGMA LEVEL  6
MRF(108,6)         0.32 HALF SIGMA LEVEL  7
MRF(109,6)         0.38 HALF SIGMA LEVEL  8
MRF(110,6)         0.43 HALF SIGMA LEVEL  9
MRF(111,6)         0.47 HALF SIGMA LEVEL  10
MRF(112,6)         0.52 HALF SIGMA LEVEL  11
MRF(113,6)         0.57 HALF SIGMA LEVEL  12
MRF(114,6)         0.63 HALF SIGMA LEVEL  13
MRF(115,6)         0.68 HALF SIGMA LEVEL  14
MRF(116,6)         0.73 HALF SIGMA LEVEL  15
MRF(117,6)         0.77 HALF SIGMA LEVEL  16
```

```
MRF(118,6)          0.82 HALF SIGMA LEVEL  17
MRF(119,6)          0.87 HALF SIGMA LEVEL  18
MRF(120,6)          0.91 HALF SIGMA LEVEL  19
MRF(121,6)          0.94 HALF SIGMA LEVEL  20
MRF(122,6)          0.97 HALF SIGMA LEVEL  21
MRF(123,6)          0.99 HALF SIGMA LEVEL  22
MRF(124,6)          1.00 HALF SIGMA LEVEL  23
MRF(301,6)        360.00 SAVFRQ:  TIME INTERVAL (MINUTES) THAT DATA WERE SAVED FOR
                         RESTART
MRF(302,6)        180.00 TAPFRQ:  TIME INTERVAL (MINUTES) THAT DATA WERE SAVED FOR GRIN
MRF(303,6)         30.00 RADFRQ:  FREQUENCY THAT SOLAR RADIATION IS COMPUTED (MINUTES)
MRF(304,6)          1.00 HYDPRE:  1.0 = WATER LOADING EFFECTS IN HYDROSTATIC EQN;
                         0.0=NO WATER LOADING
MRF(305,6)          1.00 XMOIST:  1.0=MOISTURE EFFECTS IN THERMODNAMIC EQN CONSIDERED;
                         0.0=NOT CONSIDERED
MRF(306,6)          0.00 XSTNES:  STARTING TIME (MINUTES) OF DOMAIN
MRF(307,6)       1440.00 XENNES:  ENDING TIME (MINUTES) OF DOMAIN
MRF(308,6)         60.00 TIMAX:  SIMULATION END TIME (MINUTES)
MRF(309,6)        240.00 TISTEP:  COARSE-DOMAIN TIME STEP IN SECONDS
MRF(310,6)          0.10 ZZLND:  ROUGHNESS LENGTH (M) OVER LAND (WHEN ISFPAR=1)
MRF(311,6)          0.00 ZZWTR:  ROUGHNESS LENGTH (M) OVER WATER (WHEN ISFPAR=1)
MRF(312,6)          0.15 ALBLND:  ALBEDO OVER LAND (WHEN ISFPAR=1)
MRF(313,6)          0.04 THINLD:  THERMAL INERTIA OVER LAND (WHEN ISFPAR=1)
MRF(314,6)          0.30 XMAVA:  MOISTURE AVAILABLITY OVER LAND AS A FRACTION OF 1
                          (WHEN ISFPAR=1)
MRF(315,6)          1.00 CONF:  CONDENSATION THRESHOLD
MRF(316,6)          0.00 FDASTA:  STARTING TIME FOR FDDA (MINUTES)
MRF(317,6)        780.00 FDAEND:  ENDING TIME FOR FDDA (MINUTES)
MRF(318,6)        720.00 DIFTIM(3D):  TIME INTERVAL (MINUTES) BETWEEN 3-D ANALYSES FOR
                         NUDGING
MRF(319,6)        180.00 DIFTIM(SFC): TIME INTERVAL (MINUTES) BETWEEN SURFACE ANALYSES
                         FOR NUDGING
MRF(320,6)      0.25E-03 GV(3D):  NUDGING COEFFICIENT FOR 3-D ANALYSIS FDDA OF WINDS
MRF(321,6)      0.25E-03 GT(3D):  NUDGING COEFFICIENT FOR 3-D ANALYSIS FDDA OF TEMP
MRF(322,6)      0.10E-04 GQ(3D):  NUDGING COEFFICIENT FOR 3-D ANALYSIS FDDA OF MIXING
                         RATIO
MRF(323,6)      0.50E+07 GR(3D):  NUDGING COEFFICIENT FOR 3-D ANALYSIS FDDA OF ROTA-
                         TIONAL WIND COMPONENT
MRF(324,6)      0.25E-03 GV(SFC):  NUDGING COEFFICIENT FOR SFC ANALYSIS FDDA OF WINDS
MRF(325,6)      0.25E-03 GT(SFC):  NUDGING COEFFICIENT FOR SFC ANALYSIS FDDA OF TEMP
MRF(326,6)      0.10E-04 GQ(SFC):  NUDGING COEFFICIENT FOR SFC ANALYSIS FDDA OF MIXING
                         RATIO
MRF(327,6)      0.25E+03 RINBLW:  RADIUS OF INFLUENCE FOR SURFACEANALYSIS NUDGING
MRF(328,6)      0.40E-03 GIV:  NUDGING COEFFICIENT FOR OBS NUDGING OF THE WIND FIELD
MRF(329,6)      0.40E-03 GIT:  NUDGING COEFFICIENT FOR OBS NUDGING OF THE TEMP FIELD
MRF(330,6)      0.40E-03 GIQ:  NUDGING COEFFICIENT FOR OBS NUDGING OF THE MIXING RATIO
                         FIELD
MRF(331,6)      0.24E+03 RINXY:  OBS NUDGING RADIUS OF INFLUENCE (KM) IN THE HORIZONTAL
MRF(332,6)      0.10E-02 RINSIG:  OBS NUDGING RADIUS OF INFLUENCE (SIGMA UNITS) IN THE
                         VERTICAL
MRF(333,6)      0.67E+00 TWINDO:  OBS NUDGING HALF PERIOD (MINUTES) OF THE TIME WINDOW
```

11.9.1 Model output fields (most coupled with P_{star}, F^*P^*)

Nonhydrostatic

3-D Field Name	Field ID (8 characters)	Unit	Cross/Dot	
U wind	U	kpa m/s	d	
V wind	V	kpa m/s	d	
Temperature	T	kpa K	c	
Mixing ratio	Q	kpa kg/kg	c	
Cloud water	CLW	kpa kg/kg	c	if IMPHYS≥3
Rain water	RNW	kPa kg/kg	c	if IMPHYS≥3
Ice water	ICE	kPa kg/kg	c	if IMPHYS≥5
Snow water	SNOW	kPa kg/kg	c	if IMPHYS≥5
Graupel	GRAUPEL	kPa kg/kg	c	if IMPHYS≥6
Number concentration of ice	NCI	kPa number/m^3	c	if IMPHYS≥6
Turbulent kinetic energy	TKE	J/kg	c	if IBLTYP=3
Atmospheric radiative tendency	RAD TEND	K/day	c	if IFRAD≥2
Vertical wind (W, on full sigma)	W	kPa m/s	c	
Pressure perturbation	PP	kPa pa	c	

Note: the unit of P* is kPa

Hydrostatic

3-D Field Name	Field ID (8 characters)	Unit	Cross/Dot	
U wind	U	kPa m/s	d	
V wind	V	kPa m/s	d	
Temperature	T	kPa K	c	
Mixing ratio	Q	kPa kg/kg	c	
Cloud water	CLW	kpa kg/kg	c	if IMPHYS≥3
Rain water	RNW	kPa kg/kg	c	if IMPHYS≥3
Ice water	ICE	kPa kg/kg	c	if IMPHYS≥5
Snow water	SNOW	kPa kg/kg	c	if IMPHYS≥5
Graupel	GRAUPEL	kPa kg/kg	c	if IMPHYS≥6
Number concentration of ice	NCI	kPa number/m^3	c	if IMPHYS≥6
Turbulent kinetic energy	TKE	J/kg	c	if IBLTYP=3
Atmospheric radiative tendency	RAD TEND	K/day	c	if IFRAD≥2

2-D Field Name	Field ID (8 characters)	Unit	Cross/Dot
Pstar (surface pressure - PTOP)	PSTARCRS	kPa	c
Ground temperature	GROUND T	K	c
Accumulated non-onvective rain	RAIN CON	cm	c
Accumulated convective rain	RAIN NON	cm	c
Terrain elevation	TERRAIN	m	c
Map-scale factor	MAPFACCR	dimensionless	c
Map-scale factor	MAPFACDT	dimensionless	d
Coriolis parameter	CORIOLIS	1/s	d
Infinite reservior temperature	RES TEMP	K	c
Latitude	LATITCRS	degree	c
Longitude	LONGICRS	degree	c
Land Use	LAND USE	categories	c
Snow cover	SNOWCOVR	dimensionless	c
PBL height	PBL HGT	m	c
PBL regime	REGIME	catagory (1-4)	c
Sensible heat flux	SHFLUX	W/m^2	c
Latent head flux	LHFLUX	W/m^2	c
Frictional velocity	UST	m/sec	c
Surface downward shortwave rad	SWDOWN	W/m^2	c
Surface downward longwave rad	LWDOWN	W/m^2	c
Soil temperature in layers 1-6	SOIL T n	K	c

11.10 Header Record for Interpolated Model Output

```
MIF(  1,7)      93031300 DATE FOR THIS PARTICULAR MMOUTPUT TIME PERIOD. YYMMDDHH (YEAR,
                         MONTH, DAY, HR)
MIF(  2,7)      93031300 ISTRTDA:  STARTING TIME FOR MODEL RUN.
MIF(  3,7)             0 IDRY: 0=MOISTURE INCLUDED, 1=MOISTURE EXCLUDED
MIF(  4,7)             2 IMOIST:  2=EXPLICIT CLOUD AND RAIN PREDICTION, 1=NO
MIF(  5,7)             1 INHYD: 1=NONHYDROSTATIC RUN, 0=HYDROSTATIC MODEL RUN
MIF(  6,7)             1 ITGFLG:  1=BUDGE, 3=CONSTANT GROUND TEMPT
MIF(  7,7)             0 IICE:  1=PREDICT SNOW, ICE, 0=NO
MIF(  8,7)             0 INAV:  1=TURBULENT KINETIC ENERGY, 0=NO
MIF(  9,7)             0 IICEG: 1=PREDICT SNOW, ICE, GRAUPEL, NUMBER CONCENTRATION,
                         0=NO
MIF( 10,7)            10 MAXMV:  MAXIMUM NUMBER OF MOVES ALLOWED
MIF( 11,7)             0 DATE FOR THIS PARTICULAR MMOUTPUT TIME PERIOD. MM (MINUTES)
MIF( 12,7)             0 DATE FOR THIS PARTICULAR MMOUTPUT TIME PERIOD. HH (HOURS)
MIF( 13,7)            13 DATE FOR THIS PARTICULAR MMOUTPUT TIME PERIOD. DD (DAYS)
MIF( 14,7)             3 DATE FOR THIS PARTICULAR MMOUTPUT TIME PERIOD. MO (MONTH)
MIF( 15,7)            93 DATE FOR THIS PARTICULAR MMOUTPUT TIME PERIOD. YR (YEAR)
MIF( 16,7)            19 DATE FOR THIS PARTICULAR MMOUTPUT TIME PERIOD. YC (CENTURY)
MIF(101,7)            22 NUMBER OF PRESSURE LEVELS IN THE INTERPOLATED MODEL OUTPUT
MIF(102,7)          1001 IPRES:  PRESSURE LEVEL (MB)  1, 1001 MEANS SURFACE
MIF(103,7)          1000 IPRES:  PRESSURE LEVEL (MB)  2
```

```
MIF(104,7)          975 IPRES:  PRESSURE LEVEL (MB)  3
MIF(105,7)          950 IPRES:  PRESSURE LEVEL (MB)  4
MIF(106,7)          925 IPRES:  PRESSURE LEVEL (MB)  5
MIF(107,7)          900 IPRES:  PRESSURE LEVEL (MB)  6
MIF(108,7)          850 IPRES:  PRESSURE LEVEL (MB)  7
MIF(109,7)          800 IPRES:  PRESSURE LEVEL (MB)  8
MIF(110,7)          750 IPRES:  PRESSURE LEVEL (MB)  9
MIF(111,7)          700 IPRES:  PRESSURE LEVEL (MB)  10
MIF(112,7)          650 IPRES:  PRESSURE LEVEL (MB)  11
MIF(113,7)          600 IPRES:  PRESSURE LEVEL (MB)  12
MIF(114,7)          550 IPRES:  PRESSURE LEVEL (MB)  13
MIF(115,7)          500 IPRES:  PRESSURE LEVEL (MB)  14
MIF(116,7)          450 IPRES:  PRESSURE LEVEL (MB)  15
MIF(117,7)          400 IPRES:  PRESSURE LEVEL (MB)  16
MIF(118,7)          350 IPRES:  PRESSURE LEVEL (MB)  17
MIF(119,7)          300 IPRES:  PRESSURE LEVEL (MB)  18
MIF(120,7)          250 IPRES:  PRESSURE LEVEL (MB)  19
MIF(121,7)          200 IPRES:  PRESSURE LEVEL (MB)  20
MIF(122,7)          150 IPRES:  PRESSURE LEVEL (MB)  21
MIF(123,7)          100 IPRES:  PRESSURE LEVEL (MB)  22
MIF(201,7)           11 NUMBER OF 3-D FIELDS IN MM5 OUTPUT
MIF(202,7)           30 NUMBER OF 2-D FIELDS IN MM5 OUTPUT
MIF(203,7)            0 NUMBER OF 1-D FIELDS IN MM5 OUTPUT
MIF(204,7)            0 NUMBER OF 0-D FIELDS IN MM5 OUTPUT
MIF(205,7)           10 U  M/S  U COMPONENT OF HORIZONTAL WIND  DOT
MIF(206,7)           10 V  M/S  COMPONENT OF HORIZONTAL WIND  DOT
MIF(207,7)            0 W  M/S  RITICAL VELOCITY  CROSS
MIF(208,7)            0 PP PA PRESSURE PERTURBATION CROSS
MIF(209,7)            0 RAD TEND K/DAY  ATMOSPHERIC RADIATION TENDENCY  CROSS
MIF(210,7)            0 Q  KG/KG  MIXING RATIO  CROSS
MIF(211,7)            0 RH %  RELATIVE HUMIDITY  CROSS
MIF(212,7)            0 CLW  KG/KG  CLOUD WATER  CROSS
MIF(213,7)            0 RNW  KG/KG  RAIN WATER  CROSS
MIF(214,7)            0 T  K  TEMPERATURE  CRO
MIF(215,7)            0 H  M  GEOPOTENTIAL HEIGHT  CROSS
MIF(216,7)            0 P SFC  MB  SURFACE PRESSURE  CROSS
MIF(217,7)            0 PSEALVLC MB  SEA LEVEL PRESSURE  CROSS
MIF(218,7)            0 TERRAIN  M  TERRAIN ELEVATION  CROSS
MIF(219,7)            0 MAPFACCR (DIMENSIONLESS)  MAP SCALE FACTOR  CROSS
MIF(220,7)           10 MAPFACDT (DIMENSIONLESS)  MAP SCALE FACTOR  DOT
MIF(221,7)           10 CORIOLIS 1/S  CORIOLIS PARAMETER  DOT
MIF(222,7)            0 LATITCRS DEGREE  LATITUTE (SOUTH NEGATIVE)  CROSS
MIF(223,7)           10 LATITDOT DEGREE  LATITUTE (SOUTHNEGATIVE)  DOT
MIF(224,7)            0 LONGICRS DEGREE  LONGITUDE (WESTNEGATIVE)  CROSS
MIF(225,7)           10 LONGIDOT DEGREE  LONGITUDE (WESTNEGATIVE)  DOT
MIF(226,7)            0 LAND USE CATEGORY  1-13 CATEGORIES OF LAND USE  CROSS
MIF(227,7)            0 SNOWCOVR (DIMENSIONLESS)  FLAGS FOR SNOW COVER DATA  CROSS
MIF(228,7)            0 RAIN NON CM  ACCUMULATED NON-COVECTIVE RAIN  CROSS
MIF(229,7)            0 RAIN CON CM  ACCUMULATED CONVECTIVE RAIN  CROSS
MIF(230,7)            0 RAIN TOT CM  ACCUMULATED TOTAL RAIN  CROSS
MIF(231,7)            0 GROUND T K  GROUND TEMPERATURE  CROSS
```

```
MIF(232,7)            0 RES TEMP K  INFINITE RESERVIOR SLAB TEMPERATURE  CROSS
MIF(233,7)            0 PBL HGT  M  PBL HEIGHT  CROSS
MIF(234,7)            0 REGIME  (DIMENSIONLESS)  PBL REGIME  CROSS
MIF(235,7)            0 SHFLUX  W/M^2  SENSIBLE HEATFLUX  CROSS
MIF(236,7)            0 LHFLUX  W/M^2  LATENT  HEATFLUX  CROSS
MIF(237,7)            0 UST  M/S  FRICTIONAL VELOCITY  CROSS
MIF(238,7)            0 SWDOWN  W/M^2  SURFACE DOWNWARD SHORTWAVE RADIATION  CROSS
MIF(239,7)            0 LWDOWN  W/M^2  SURFACE DOWNWARD LONGWAVE RADIATION  CROSS
MIF(240,6)            0 SOIL T 1 K  SOIL TEMPERATURE IN LAYER  1  CROSS
MIF(241,6)            0 SOIL T 2 K  SOIL TEMPERATURE IN LAYER  2  CROSS
MIF(242,6)            0 SOIL T 3 K  SOIL TEMPERATURE IN LAYER  3  CROSS
MIF(243,6)            0 SOIL T 4 K  SOIL TEMPERATURE IN LAYER  4  CROSS
MIF(244,6)            0 SOIL T 5 K  SOIL TEMPERATURE IN LAYER  5  CROSS
MIF(245,6)            0 SOIL T 6 K  SOIL TEMPERATURE IN LAYER  6  CROSS
```

11.10.1 Interpolated model output fields

Nonhydrostatic

3-D Field Name	Field ID (8 characters)	Unit	Cross/Dot	
U wind	U	m/s	d	
V wind	V	m/s	d	
Vertical wind	W	m/s	c	
Pressure purturbation	PP	mb	c	
Mixing ratio	Q	kg/kg	c	
Relative humidity	RH	%	c	
Cloud water	CLW	kg/kg	c	if IMPHYS≥3
Rain water	RNW	kg/kg	c	if IMPHYS≥3
Ice water	ICE	kg/kg	c	if IMPHYS≥5
Snow water	SNOW	kg/kg	c	if IMPHYS≥5
Graupel	GRAUPEL	kg/kg	c	if IMPHYS≥6
Number concentration of ice	NCI	number/m^3	c	if IMPHYS≥6
Temperature	T	K	c	
Geopotential height	H	m	c	

Hydrostatic

3-D Field Name	Field ID (8 characters)	Unit	Cross/Dot	
U wind	U	m/s	d	
V wind	V	m/s	d	
Mixing ratio	Q	kg/kg	c	
Relative humidity	RH	%	c	
Cloud water	CLW	kg/kg	c	if IMPHYS≥3
Rain water	RNW	kg/kg	c	if IMPHYS≥3
Ice water	ICE	kg/kg	c	if IMPHYS≥5
Snow water	SNOW	kg/kg	c	if IMPHYS≥5

Graupel	GRAUPEL	kg/kg	c	if IMPHYS≥6
Number concentration of ice	NCI	number/m^3	c	if IMPHYS≥6
Temperature	T	K	c	
Geopotential height	H	m	c	

2-D Field Name	**Field ID (8 characters)**	**Unit**	**Cross/Dot**
Surface pressure	P SFC	mb	c
Sea level pressure	PSEALVLC	mb	c
Terrain elevation	TERRAIN	m	c
Map-scale factor	MAPFACCR	dimensionless	c
Map-scale factor	MAPFACDT	dimensionless	d
Coriolis parameter	CORIOLIS	1/s	d
Latitude	LATITCRS	degree	c
Latitude	LATITDOT	degree	d
Longitude	LONGICRS	degree	c
Longitude	LONGIDOT	degree	d
Land Use	LAND USE	categories	c
Snow cover	SNOWCOVR	dimensionless	c
Accumulated non-convective rain	RAIN NON	cm	c
Accumulated convective rain	RAIN CON	cm	c
Accumulated total rain	RAIN TOT	cm	c
Ground temperature	GROUND T	K	c
Infinite reservior temperature	RES TEMP	K	c
Surface downward shortwave rad	SWDOWN	W/m^2	c
Surface downward longwave rad	LWDOWN	W/m^2	c
Soil temperature in layers 1-6	SOIL T n	K	c

11.11 A Program to Read MM5 Output

A program to read MM5 output is shown below. The program has an option to decouple all coupled 3-D fields.

```
        PROGRAM RDMM5V2

C     ... This program is able to read the MM5 version 1 and version 2
C         formatted data (including TERRAIN, DATAGRID, RAWINS, RAWINS
C         surface 4DDA, the initial condition data from INTERP, MM5,
C         and pressure level interpolated MM5).

C     ... To compile this program: f77 (f90) (-convert big_endian) rdmm5v2.f
C         link your output to input unit 71, i.e. ln -s mmout fort.71
C         To run the program: a.out

C     ... Header data sizes

C         MIF : Array store integer variables information
C         MIFC: Character array describs the MIF array
C         MRF : Array store real variables information
C         MRFC: Character array describs the MRF array
```

```
      INTEGER MIF(1000,20)
      REAL MRF(1000,20)
      CHARACTER*80 MIFC(1000,20),MRFC(1000,20)

C     ... The input unit is 71

      PARAMETER (INPUT1=71)

      LOGICAL RdData, DeCouple

C   RdData : .TRUE.  Print record header information and output data
C            .FALSE.  Print record header infomation only
C
      RdData = .TRUE.
C     RdData = .FALSE.

C   Decouple: set to .TRUE. if you want to decouple 3D fields from Pstar
C     only needed for MM5 sigma-level output
C
      Decouple = .FALSE.
C     Decouple = .TRUE.

C     ... Read in the header to figure out sizes and the
C         file type.

      READ(INPUT1,END=999,ERR=888) MIF,MRF,MIFC,MRFC

      PRINT *,'MM5 Version 2 record header information'

C  get record header information

      PRINT *,'    `
      PRINT *,'    `
      CALL GETGIST(MIF,MRF,MIFC,MRFC)
      PRINT *,'    `
      PRINT *,'    `

      IF (RDDATA) THEN

C     ... For our benefit, here is the ordering of the output types
C         based upon mif(1,1):
C           1 TERRAIN
C           2 DATAGRID
C           3 RAWINS 3-D analysis
C           4 RAWINS surface 4DDA
C           5 MM5 initial condition from INTERP
C           6 MM5
C           7 Interpolated model output on pressure levels from INTERP

      INDEX=MIF(1,1)
      IF(INDEX.EQ.1) THEN
         PRINT *,'READING TERRAIN OUTPUT'
         KX = 1
      ELSEIF(INDEX.EQ.2) THEN
         PRINT *,'READING DATAGRID OUTPUT'
         KX = MIF(101,2)
      ELSEIF(INDEX.EQ.3) THEN
         PRINT *,'READING RAWINS 3-D ANALYSIS OUTPUT'
         KX = MIF(101,3)
      ELSEIF(INDEX.EQ.4) THEN
         PRINT *,'READING RAWINS SURFACE 4DDA OUTPUT'
         KX = 1
      ELSEIF(INDEX.EQ.5) THEN
         PRINT *,'READING MODEL INITIAL CONDITION'
         KX = INT(MRF(101,5))
         PRINT *,'NUMBER OF VERTICAL LEVELS = ', KX
      ELSEIF(INDEX.EQ.6) THEN
         PRINT *,'READING MM5 OUTPUT'
         KX = INT(MRF(101,6))
         PRINT *,'NUMBER OF VERTICAL LEVELS = ', KX
      ELSEIF(INDEX.EQ.7) THEN
         PRINT *,'READING INTERPOLATED MODEL OUTPUT ON P'
         KX = MIF(101,7)
```

```
            PRINT *,'NUMBER OF VERTICAL LEVELS = `, KX
         END IF
         IF (INDEX.NE.1) PRINT *,'DATE = `,MIF(1,INDEX)
         IF (INDEX.NE.5.AND.INDEX.NE.6) DECOUPLE = .FALSE.
         PRINT *,'    `

C        ... The horizontal dimension of the data is from the
C            MIF arrays.  If this is TERRAIN or DATAGRID, we need
C            to see if the data is expanded.

         IX = MIF(104,1)
         JX = MIF(105,1)
         IF((INDEX.LE.2).AND.                  ! this is datagrid or terrain
     *      (mif(101,1).EQ.mif(102,1)).AND. ! this is the mother domain
     *      (mif(5,1).eq.1)) THEN            ! this is an expanded domain
            IX=MIF(6,1)
            JX=MIF(7,1)
         ENDIF

         PRINT *,'DATA DIMENSIONS FOR IX,JX,KX ARE `, IX,JX,KX

C        ... The number of arrays of various sizes is also available.
C            NUM3D : Number of 3-D fields in this output
C            NUM2D : Number of 2-D fields in this output
C            NUM1D : Number of 1-D fields in this output
C            NUM0D : Number of 0-D fields in this output

         NUM3D = MIF(201,INDEX)
         NUM2D = MIF(202,INDEX)
         NUM1D = MIF(203,INDEX)
         NUM0D = MIF(204,INDEX)
         PRINT *,'NUM3D,NUM2D,NUM1D,NUM0D = `, NUM3D,NUM2D,NUM1D,NUM0D

C        ... Define a 4th dimension to store data if decouple = .T.

         IF (DECOUPLE) THEN
            INUM = NUM3D
         ELSE
            INUM = 1
         END IF

C        ... We have all of the required info to do the read/write
C            operations.  After the input file is rewound, we call
C            the driver routine.

         REWIND (INPUT1)
         CALL RDMM5(INPUT1,IX,JX,KX,NUM3D,NUM2D,NUM1D,NUM0D,DECOUPLE,INUM)

         print *,'Successful completion of the reading program.'

         END IF

         STOP 99999
888      CONTINUE
         PRINT *, `ERROR IN READING MM5V2 DATA'
         STOP 888
999      CONTINUE
         PRINT *, `OOPS, EOF ON THE FIRST HEADER READ'
         STOP 999
         END

c-------------------------------------------------------------------------

         SUBROUTINE RDMM5(IUNIT,IX,JX,KX,NUM3D,NUM2D,NUM1D,NUM0D,
     *           DECOUPLE,INUM)

C        ... We need dummy space for each of the array types.

         DIMENSION DUM3D(IX,JX,KX), DUM3D2(IX,JX,KX,INUM),
     *             DUM2D(IX,JX),    DUM2D2(IX,JX),
     *             DUM1D(KX),
     *             PSTAR(IX,JX),  PSTARD(IX,JX)
```

```
C     ... Again, our friends, the header values.

      INTEGER MIF(1000,20)
      REAL MRF(1000,20)
      CHARACTER*80 MIFC(1000,20),MRFC(1000,20)

C     ... The first 8 characters of each different array name is
C         the name of the variable.  Terribly handy.

      CHARACTER*8 ID
      LOGICAL DECOUPLE

C     ... Here is the beginning of the BIG read loop.  Note that
C         we read until we run out of data.

5     CONTINUE

C     ... Not too surprising, we start off reading in the header data.
C         If things are OK, we continue on, else we head to the end
C         of this loop.

      READ(IUNIT,END=999,ERR=888) MIF,MRF,MIFC,MRFC

C     ... Some older versions of the MM5 format data have 10 digit
C         jazz used for dates.  We need to zap those right away.

      DO 10 J=1,20
      DO 10 I=1,1000
         IF(MIF(I,J).GT.1E9) THEN
            print *,'Fixing mif(',i,j,'), it now is ',MIF(I,J)/100
            MIF(I,J)=MIF(I,J)/100
         END IF
 10   CONTINUE

C     ... Loop over all of the 3D arrays.

      PRINT *, '     '
      DO 120 I=1,NUM3D
         IDOT=1-MIF(204+I,MIF(1,1))/10
         ID=MIFC(204+I,MIF(1,1))(1:8)
         IF(ID.EQ.'W       ' .AND. MIF(  10,1).EQ.2) THEN
              READ(IUNIT) DUM2D,DUM3D
              IF (DECOUPLE) THEN
              DO KK = 1,KX
              DO II = 1,IX
              DO JJ = 1,JX
                 IF (KK.EQ.1) DUM2D2(II,JJ) = DUM2D(II,JJ)
                 DUM3D2(II,JJ,KK,I) = DUM3D(II,JJ,KK)
              END DO
              END DO
              END DO
              END IF
         ELSE
              READ (IUNIT) DUM3D
              IF (DECOUPLE) THEN
              DO KK = 1,KX
              DO II = 1,IX
              DO JJ = 1,JX
                 DUM3D2(II,JJ,KK,I) = DUM3D(II,JJ,KK)
              END DO
              END DO
              END DO
              END IF
         ENDIF
         PRINT *,'3D FIELD ID= ',ID,'    IDOT= ',IDOT,
     *          '      SAMPLE VALUE= ',DUM3D(10,10,10)
 120  CONTINUE

C     ... Loop over all of the 2D arrays.

      PRINT *,'    '
      DO 140 I=1,NUM2D
         IDOT=1-MIF(204+NUM3D+I,MIF(1,1))/10
```

```
         ID=MIFC(204+NUM3D+I,MIF(1,1))(1:8)
         READ (IUNIT) DUM2D
         IF (DECOUPLE .AND. ID.EQ.'PSTARCRS') THEN
         DO II = 1,IX
         DO JJ = 1,JX
            PSTAR(II,JJ) = DUM2D(II,JJ)
         END DO
         END DO
         END IF
         PRINT *,'2D FIELD ID= `,ID,'    IDOT= `,IDOT,
     *          `     SAMPLE VALUE= `,DUM2D(10,10)
140   CONTINUE

C     ... Loop over all of the 1D arrays.

      PRINT *,'   `
      DO 160 I=1,NUM1D
         ID=MIFC(204+NUM3D+NUM2D+I,MIF(1,1))(1:8)
         READ (IUNIT) DUM1D
         PRINT *,'1D FIELD ID= `,ID,
     *          `     SAMPLE VALUE= `,DUM1D(10)
160   CONTINUE

C     ... Loop over all of the 0D arrays.

      PRINT *,'   `
      DO 180 I=1,NUM0D
         ID=MIFC(204+NUM3D+NUM2D+NUM1D+I,MIF(1,1))(1:8)
         READ (IUNIT) DUM0D
         PRINT *,'0D FIELD ID= `,ID,
     *          `     SAMPLE VALUE= `,DUM0D
180   CONTINUE


C DECOUPLE 3D VARIABLE FROM PSTAR

      IF (DECOUPLE) THEN

      PRINT *,'   `
      PRINT *,'DECOUPLED FIELDS'
      PRINT *,'   `
C
C     DECOUPLED 3-D FIELDS (if running default configuration):
C        I= 1: U (m/s) map coordinate
C        I= 2: V (m/s) map coordinate
C        I= 3: T (K)
C        I= 4: Q (kg/kg)
C        I= 5: CLOUD WATER (kg/kg)
C        I= 6: RAIN WATER (kg/kg)
C        I= 7: RAD TENDENCY (K/day)
C        I= 8: W (vertical velocity in m/s, at full sigma levels)
C        I= 9: PP (perturbation pressure in Pa)
C
C     CALCULATE DOT-POINT PSTAR FROM CROSS-POINT PSTAR
C
      CALL CRS2DOT(PSTAR,PSTARD,IX,JX)
C
      DO 200 I=1,NUM3D
         IDOT=1-MIF(204+I,MIF(1,1))/10
         ID=MIFC(204+I,MIF(1,1))(1:8)
         IF(ID.NE.'RAD TEND' .AND. ID.NE.'TKE     `) THEN
            DO KK = 1,KX
            DO II = 1,IX-IDOT
            DO JJ = 1,JX-IDOT
              IF (ID.EQ.'U       `.OR.ID.EQ.'V       `) THEN
                DUM3D2(II,JJ,KK,I) = DUM3D2(II,JJ,KK,I)/PSTARD(II,JJ)
              ELSE
                DUM3D2(II,JJ,KK,I) = DUM3D2(II,JJ,KK,I)/PSTAR(II,JJ)
                IF (ID.EQ.'W       `.AND.KK.EQ.1) THEN
                  DUM2D2(II,JJ) = DUM2D2(II,JJ)/PSTAR(II,JJ)
                END IF
              END IF
            END DO
```

```
              END DO
              END DO
              PRINT *,'3D FIELD ID= `,ID,'     IDOT= `,IDOT,
     *             `     SAMPLE VALUE= `,DUM3D2(10,10,10,I)
           END IF
200     CONTINUE

        END IF

C       ... Here is the end of our BIG read loop.

        GO TO 5

C       ... The nasty error condition of "probs in header".

888     CONTINUE
        PRINT *, `ERROR IN READING MM5V2 DATA'
        STOP `ERROR IN READING DATA'

C       ... This is where the normal return is located.  We just
C           ran out of data, but we expected that!

999     CONTINUE

        RETURN
        END

        SUBROUTINE GETGIST(MIF,MRF,MIFC,MRFC)
C
C       PURPOSE  INTERPRET THE VERSION 1 HEADER INFO
C
        INTEGER MIF(1000,20)
        REAL MRF(1000,20)
        CHARACTER*80 MIFC(1000,20),MRFC(1000,20)

        DO 30 J=1,20
        DO 10 I=1,1000
           IF(MIF(I,J).NE.-999) PRINT 100,I,J,MIF(I,J),MIFC(I,J)
  10    CONTINUE
        DO 20 I=1,1000
           IF(I.LT.320) THEN
           IF(MRF(I,J).NE.-999.) PRINT 110,I,J,MRF(I,J),MRFC(I,J)
           ELSE IF(I.GE.320 .AND. I.LE.333) THEN
           IF(MRF(I,J).NE.-999.) PRINT 120,I,J,MRF(I,J),MRFC(I,J)
           END IF
  20    CONTINUE
  30    CONTINUE

 100    FORMAT(`MIF(`,I3,',',I1,') = `,I10,' : `,A80)
 110    FORMAT(`MRF(`,I3,',',I1,') = `,F10.2,' : `,A80)
 120    FORMAT(`MRF(`,I3,',',I1,') = `,E10.2,' : `,A80)
        RETURN
        END

        SUBROUTINE CRS2DOT(SLAB1,SLAB2,IS1,IS2)
C
C...INTERPOLATE IN HORIZONTAL FROM CROSS TO DOT POINTS
C
        DIMENSION SLAB1(IS1,IS2),SLAB2(IS1,IS2)
        IE=IS1-1
        JE=IS2-1
        DO 10 I=2,IE
        DO 10 J=2,JE
        SLAB2(I,J)=0.25*(SLAB1(I,J)+SLAB1(I-1,J)+SLAB1(I,J-1)
     1                  +SLAB1(I-1,J-1))
10      CONTINUE
        DO 20 I=2,IE
        SLAB2(I,1)=0.5*(SLAB1(I,1)+SLAB1(I-1,1))
        SLAB2(I,IS2)=0.5*(SLAB1(I,JE)+SLAB1(I-1,JE))
20      CONTINUE
        DO 30 J=2,JE
        SLAB2(1,J)=0.5*(SLAB1(1,J)+SLAB1(1,J-1))
        SLAB2(IS1,J)=0.5*(SLAB1(IE,J)+SLAB1(IE,J-1))
```

```
30    CONTINUE
      SLAB2(1,1)=SLAB1(1,1)
      SLAB2(1,IS2)=SLAB1(1,JE)
      SLAB2(IS1,IS2)=SLAB1(IE,JE)
      SLAB2(IS1,1)=SLAB1(IE,1)
      RETURN
      END
```

11.12 Special Data Format in MM5 Modeling System

There are several data files in the MM5 modeling system that do not conform with the above format; therefore special programs are needed to read these files. These are a file required for observational nudging, a file for boundary conditions, three observation output files from Rawins.

11.12.1 Data format for observational nudging

This input file to MM5 model is a binary file containing 9 real numbers per record, and data are in order of increasing time. The READ statement in the model is the following:

READ (NVOL,END=111) TIMEOB,RIO,RJO,RKO,(VAROBS(IVAR),IVAR=1,5)

where NVOL is the input fortran unit number.

11.12.2 Description of observational nudging variables

Name	Description
TIMEOB:	Julian date in dddhh. Example: 16623.5 - Julian day 166 and hour 2330 UTC
RIO:	y-location - I dot-point location on coarse mesh
RJO:	x-location - J dot-point location on coarse mesh
RKO:	z-location - K half-σ level
IVAR(1):	u wind - in m/sec rotated to model grid
IVAR(2):	v wind - in m/sec rotated to model grid
IVAR(3):	temperature - in Kelvin
IVAR(4):	water vapor mixing ratio - in kg/kg
IVAR(5):	Pstar - in cb (only used in hydrostatic model)

A user may include more information at the end of a record which are not read by the model but can be used to identify the station and data type. The no-data value is 99999.. If running the model in nonhydrostatic mode, 99999. can be used to fill up the Pstar spot.

11.12.3 Data format for MM5 boundary file

The output format for the MM5 model lateral boundary file (bdyout) is different than the rest of the MM5V1 modeling system inputs/outputs. Since only 5 grid values on each boundaries need to be defined in the bdyout file, there is no V1 header in the output. The following Fortan program is used to read in the bdyout file.

```
      SUBROUTINE RDBC(IX,JX,KX,IUNIT,INHYD,IMOIST,IICE,IGRAUPEL)
C
        PARAMETER(ND=5)

        DIMENSION TRESC(IX,JX)
        REAL      EB3D(IX,KX,ND),WB3D(IX,KX,ND),NB3D(JX,KX,ND),
     1            SB3D(JX,KX,ND),ET3D(IX,KX,ND),WT3D(IX,KX,ND),
     2            NT3D(JX,KX,ND),ST3D(JX,KX,ND)
        REAL      PEB(IX,ND),PWB(IX,ND),PNB(JX,ND),
     1            PSB(JX,ND),PET(IX,ND),PWT(IX,ND),
     2            PNT(JX,ND),PST(JX,ND)

        REAL      WEB(IX,KX+1,ND), WWB(IX,KX+1,ND)  ,
     *            WNB(JX,KX+1,ND), WSB(JX,KX+1,ND)  ,
     *            WET(IX,KX+1,ND), WWT(IX,KX+1,ND)  ,
     *            WNT(JX,KX+1,ND), WST(JX,KX+1,ND)
C
        READ (IUNIT,ERR=888) TRESC
        PRINT *,'READ MM5V1 BOUNDAY FILE OUTPUT'
        PRINT *,'USER SET INHYD,IMOIST,IICE,IGRAUPEL= ',
     1           INHYD,IMOIST,IICE,IGRAUPEL
 10     CONTINUE
        READ (IUNIT,END=999) TBEGIN,TEND,MDBEGIN,MDEND
        PRINT *,'READ BOUNDARY FILE BETWEEN ',TBEGIN,' AND ',
     1           TEND,' MINUTES'
C
C        ... P* AND TENDENCY
C
         READ  (IUNIT) PEB,PWB,PNB,PSB
         READ  (IUNIT) PET,PWT,PNT,PST
C
C        ... P*U, P*V, P*T, P*Q, AND TENDENCIES
C
         DO 700 IVARIABS=1,4
            READ  (IUNIT) EB3D,WB3D,NB3D,SB3D
            READ  (IUNIT) ET3D,WT3D,NT3D,ST3D
700      CONTINUE
         PRINT *,'READ P*U, P*V, P*T, P*Q, AND TENDENCIES'
C
C        ... P*W, P*PP', AND TENDENCIES
C
         IF(INHYD.EQ.1) THEN
            READ  (IUNIT) WEB,WWB,WNB,WSB
            READ  (IUNIT) WET,WWT,WNT,WST
            READ  (IUNIT) EB3D,WB3D,NB3D,SB3D
            READ  (IUNIT) ET3D,WT3D,NT3D,ST3D
          PRINT *,'READ P*W, P*PP, AND TENDENCIES'
         END IF
C
C        ... P*CLW, P*RNW, AND TENDENCIES
C
         IF(IMOIST.EQ.2) THEN
            READ  (IUNIT) EB3D,WB3D,NB3D,SB3D
            READ  (IUNIT) ET3D,WT3D,NT3D,ST3D
            READ  (IUNIT) EB3D,WB3D,NB3D,SB3D
            READ  (IUNIT) ET3D,WT3D,NT3D,ST3D
          PRINT *,'READ P*CLW, P*RNW, AND TENDENCIES'
         END IF
C
```

```
C         ... P*ICEW, P*SNOWW, AND TENDENCIES
C
          IF(IICE.EQ.1) THEN
             READ  (IUNIT) EB3D,WB3D,NB3D,SB3D
             READ  (IUNIT) ET3D,WT3D,NT3D,ST3D
             READ  (IUNIT) EB3D,WB3D,NB3D,SB3D
             READ  (IUNIT) ET3D,WT3D,NT3D,ST3D
           PRINT *,'READ P*ICEW, P*SNOWW, AND TENDENCIES'
          END IF
C
C         ... P*GRAW, P*NPART, AND TENDENCIES
C
          IF(IGRAUPEL.EQ.1) THEN
             READ  (IUNIT) EB3D,WB3D,NB3D,SB3D
             READ  (IUNIT) ET3D,WT3D,NT3D,ST3D
             READ  (IUNIT) EB3D,WB3D,NB3D,SB3D
             READ  (IUNIT) ET3D,WT3D,NT3D,ST3D
           PRINT *,'READ P*GRAW, P*NPART, AND TENDENCIES'
          END IF
        GO TO 10
C
888     CONTINUE
        PRINT *,'INPUT DATA IS NOT IN MM5V1 FORMAT'
        CALL ABORT
999     CONTINUE
        RETURN
        END
```

11.12.4 Description of boundary file variables

Name		Description	Unit	Cross/Dot
TRESC	2D	coarse grid reservior temperature	K	c
PEB	2D	east boundary p*	kPa	c
PWB	2D	west boundary p*	kPa	c
PNB	2D	north boundary p*	kPa	c
PSB	2D	south boundary p*	kPa	c
PEBT	2D	east boundary tendency p*	kPa	c
PWBT	2D	west boundary tendency p*	kPa	c
PNBT	2D	north boundary tendency p*	kPa	c
PSBT	2D	south boundary tendency p*	kPa	c
EB3D	3D	east boundary coupled fields		
WB3D	3D	west boundary coupled fields		
NB3D	3D	north boundary coupled fields		
SB3D	3D	south boundary coupled fields		
ET3D	3D	east boundary tendency coupled fields		
WT3D	3D	west boundary tendency coupled fields		
NT3D	3D	north boundary tendency coupled fields		
ST3D	3D	south boundary tendency coupled fields		
WEB	3D	east boundary coupled vertical velocity	kPa m/s	c
WWB	3D	west boundary coupled vertical velocity	kPa m/s	c
WNB	3D	north boundary coupled vertical velocity	kPa m/s	c

WSB	3D	south boundary coupled vertical velocity	kPa m/s	c
WET	3D	east boundary tendency coupled vertical velocity	kPa m/s	c
WWT	3D	west boundary tendency coupled vertical velocity	kPa m/s	c
WNT	3D	north boundary tendency coupled vertical velocity	kPa m/s	c
WST	3D	south boundary tendency coupled vertical velocity	kPa m/s	c

3D Field Name	**Unit**	**Cross/Dot**
u-component wind	kPa m/s	d
v-component wind	kPa m/s	d
temperature	kPa K	c
mixing ratio	kPa kg/kg	c

if nonhydrostatic

pressure pertubation	kPa pa	c
vertical wind (W)	kPa m/s	c

if boundary data is from a previous MM5 run and explicit moisture scheme is used:

if (IMPHYS≥3)

Cloud water	kPa kg/kg	c
Rain water	kPa kg/kg	c

if (IMPHYS≥5)

Ice water	kPa kg/kg	c
Snow water	kPa kg/kg	c

if(IMPHYS≥6)

Graupel	kPa kg/kg	c
Number of ice concentration	kPa number/m3	c

11.12.5 Data format for surface observations file

This is an output file written by program Rawins after the surface data have gone through error checks. Only those surface observations that have passed the error checks are included. These are the surface observations that were used in the objective analysis. The local file name is sfc4dobs.out, the NCAR MSS filename is SFC4DOBS_DOMAINx, and the fortran unit number in program Rawins is unit 60. This file may be used to construct an observation nudging file for use in MM5.

This file is an unformatted fortran output file. Each record contains surface observations for a single station. The fortran READ statement for each record is:

```
READ (60) JDATE, JSTA, JLAT, JLON, JSFCEL, XU, XV, XT, XRH, XSLP
```

11.12.6 Description of surface observation variables

Name	Description
JDATE	8-digit MDATE, yymmddhh (integer)
JSTA	station identifier (character*8)
JLAT	station latitude * 10 (integer)
JLON	station longitude * 10 (integer)
JSFCEL	station elevation (integer)
XU	u component of wind rotated to model grid (m/s)
XV	v component of wind rotated to model grid (m/s)
XT	temperature (C)
XRH	Rawins' RH form; to obtain real RH: RH=100*(1.-XRH*XRH)
XSLP	sea-level pressure (mb)

11.12.7 Data format for upper-air observations file

This is an output file written by program Rawins after the upper-air data have gone through error checks. Only those upper-air observations that have passed the error checks are included. These are the upper-air observations that were used in the objective analysis. The local file name is upr4dobs.out, the NCAR MSS filename is UPR4DOBS_DOMAINx, and the fortran unit number in program Rawins is unit 61. This file may be used to construct an observation nudging file for use in MM5.

This file is an unformatted fortran output file. Each record contains the upper-air observations for a single station. The fortran READ statement for each record is:

```
READ (61) JDATE, JSTA, JLAT, JLON, JSFCEL, JTOTLV,
          (XP(L), L=1, JTOTLV), (XU(L), L=1, JTOTLV), (XV(L), L=1, JTOTLV),
          (XT(L), L=1, JTOTLV), (XRH(L), L=1, JTOTLV)
```

11.12.8 Description of upper-air observation variables

Name	Description
JDATE	8-digit MDATE, yymmddhh (integer)
JSTA	station identifier (character*6)
JLAT	station latitude * 10 (integer)
JLON	station longitude * 10 (integer)
JSFCEL	station elevation (integer)
JTOTLV	number of data levels
XP	pressure values

XU	u component of wind rotated to model grid (m/s)
XV	v component of wind rotated to model grid (m/s)
XT	temperature (C)
XRH	Rawins' RH form; to obtain real RH: RH=100*(1.-XRH*XRH)

11.12.9 Data format for raw upperair observations file

This is an output file written by program Rawins before the upper-air data have gone through error checks. The local file name is rawobs.out, NCAR MSS filename is RAOBS_DOMAINx, and fortran unit number in program Rawins is unit 11.

This file is an unformated fortran output file. Each record contains the upper-air observations for a single station. The fortran READ statement for each record is:

```
READ (11) JIDENT, NTT, POT, TOT, HOT, ZOT, NWW, PWW, PWT, DOT, SOT,
          LAT, LON, JSFCEL, JYR, JMO, JDY, JHR
```

11.12.10 Description of raw upperair observation variables

Name	Description
JIDENT	station identifier (character*6)
NTT	number of pressure levels for temperature and height
POT	pressure values for temp and height reports
TOT	temperature (C)
HOT	dew point temperature (C)
ZOT	height (m)
NWW	number of pressure levels for wind reports
PWT	pressure values for wind reports
DOT	wind direction (this is NOT rotated to model grid)
SOT	wind speed (knots)
LAT	station latitude * 10
LON	station longitude * 10
JSFCEL	station elevation (integer)
JYR	year
JMO	month
JDY	day
JHR	hour