MM5 Output Format
Chapter 13

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General comments:

- MM5 V3 format is new, and different from V1 format (MM5 V2 uses V1 format)
- MM5 V3 format is easier to use than V1 format
- V2-to-V3, and V3-2-V2 (model output only) conversion programs are available *(see Chapter 14: Utility Programs)*

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MM5 V3 Format:

flag (0/1)
data
flag (0/1)
data
flag (0/1)
data
flag (2)
flag (0/1)
data
flag (0/1)
data
flag (0/1)
data
flag (2)

CAR

MM5 V3 Format:

flag (0)
data } BIG header
flag (1)
data } subheader + field
flag (1)
data } subheader + field
flag (2)
flag (0/1)
data
flag (0/1)
data
flag (0/1)
data
flag (2)

CAR

Big Header → 0 - BIG HEADER

Output at analysis time:
1 - U
1 - V
1 - T
..
..
1 - T10
2

Output at 3hr:
1 - U
1 - V
1 - T
..
..
1 - T10
2

Output at 6hr:
1 - U
1 - V
1 - T
..
..
1 - T10
2

Run MM5 for 6 hours, output model data every 3 hours

MM5 V3 Format:

```
10      continue
        read (input_unit, end=900) flag
        if (flag.eq.0) then
        read (input_unit) big_header
        go to 10
        else if (flag.eq.1) then
        read (input_unit) sub_header
        read (input_unit) field
        go to 10
        else if (flag.eq.2) then
        print *, 'end of time period'
        go to 10
        end if
900     continue
```

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Big header:

Four arrays: BHI,BHR,BHIC,BHRC

- BHI(50,20): integer array
- BHIC(50,20): character array describing BHI
- BHR(20,20): real array
- BHRC(20,20): character array describing BHR

Big header:

- **Values in BHI and BHR:**
  - are common attributes of the output file
  - most of these reflect the choices a user made in running a particular program (such as those defined in a namelist)
- **Example:**

BHI(16,1) : BHIC(16,1)
35 : Domain Grid Dimension in I Dir

Big header:

- **BHI(1,1): indicating which program this file contains**

1. TERRAIN
2. REGRID
3. RAWINS / LITTLE_R
4. RAWINS / LITTLE_R Surface analysis
5. MMINPUT
6. LOWBDY
7. BDYOUT
8. MMOUTP
11. MMOUT

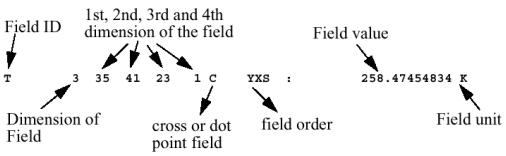
Sub-header:

- **Contains 16 records:**
  - ndim (3/2/1)
  - start_index (4 values), normally 1's
  - end_index (4 values), IX,JX,KX,1
  - xtime (model integration time in minutes)
  - staggering (dot or cross point field)
  - ordering (most 3D arrays are in yxz order)
  - current date (valid date for this forecast time)
  - name of the field
  - unit
  - description of the field

Headers:

- **List of big headers and available output fields for each of the MM5 programs is on pages 13-7 to 13-19**
- **All MM5 program output files that conform to MM5 format may be read by *readv3.f* program (available in mesouser/MM5V3/Util directory)**

Sample Values:



Special Format:

- **Observational nudging data MM5OBS_DOMAINx**
- **Surface observation output from RAWINS:**
  - SFC4DOBS_DOMAINx file
- **Upperair observation output from RAWINS:**
  - UPR4DOBS_DOMAINx file
- **Raw observation output from RAWINS:**
  - RAOBS_DOMAINx file

Note: these data files cannot be read by *readv3.f*

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MM5OBS_DOMAINx

WRITE (13) TIMEOB,RIO,RJO,RKO,(VAROBS(IVAR),IVAR=1,5)

- **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***
  (may be a fraction of a grid)
- **RJO: x-location - J dot-point location on *coarse mesh***
  (may be a fraction of a grid)
- **RKO: z-location - *K half-σ level* *(must be on half σ levels)***
- **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 mb**
  (only used in hydrostatic model – set to 99999)

MM5OBS_DOMAINx

- **Coordinate specifications of the file are *ALL* with respect to the coarse grid**
- **Model will do interpolation to nest locations**
- **MM5OBS_DOMAIN1 and MM5OBS_DOMAIN2**
  - identical
  - except if one have high resolution data you want to exclude from domain1

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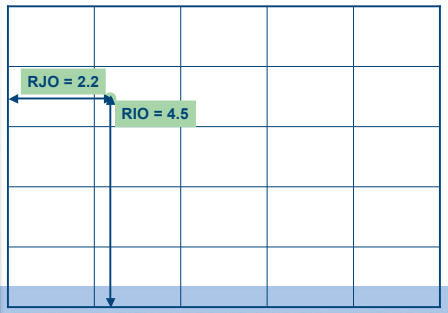
MM5OBS_DOMAINx: *Example*



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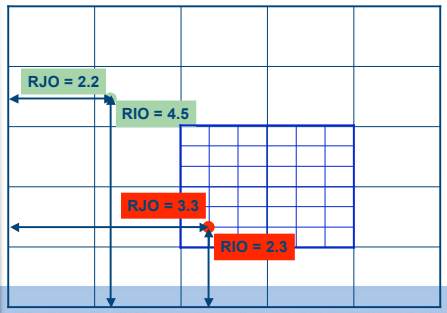
MM5OBS_DOMAINx : *Example*



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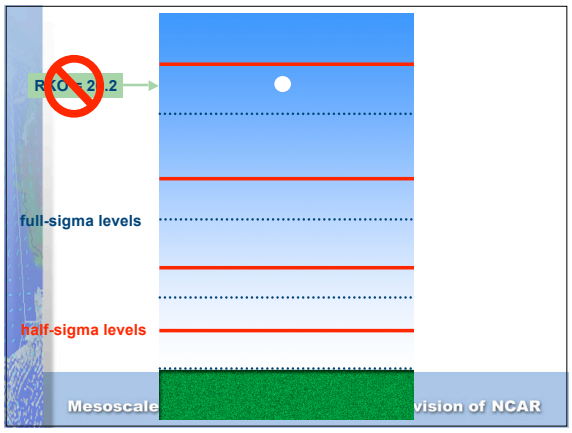

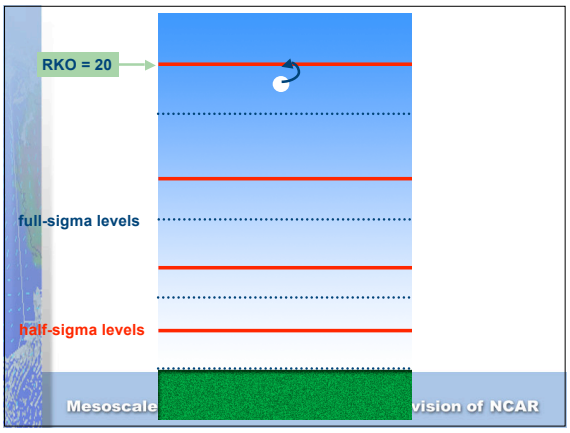

Utility Programs

Chapter 14

ftp://ftp.ucar.edu/mesouser/MM5V3/Util/

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v22v3: conversion program

- **Convert V2 REGRID, RAWINS/LITTLE_R, INTERP output files to V3 format**
- **Purpose: to help users who have V2 data and want to run V3 MM5**
- **v22v3.exe *v2-filename***
- **v22v3.exe *mminput_domain1***
  bdyout_domain1

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v32v2: conversion program

- **Convert V3 INTERPF and MM5 outputs to V3 format**
- **Purpose: to help users who have diagnostic programs which work with V2 data**
- **V32v2.exe *v3-mm5-filename***

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get_*data*.deck

- **NCAR/SCD computers**
  - get_on84
  - get_ncep
  - get_fnl
  - get_nnrp
  - get_awip
  - get_era
  - get_toga

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fetch jobs:

- **IBM job decks that fetch NCAR archived observations for RAWINS and LITTLE_R**
- **Fetch has two different "versions"**
  - One that get data in RAWINS format
  - One that will get the data (RAWINS format) and convert it to LITTLE_R format

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ieeev3.csh

- **converts MM5 modeling system output data from Cray binary to standard IEEE data.**
- **it only runs on Cray's**
- **How to Run It -**

  ieeev3.csh *v3-filename-in-Cray-format*

- **It creates an IEEE file with the name *v3-filename-in-Cray-format.ieee***

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Cray-to-IBM

- **converts MM5 modeling system output data from Cray binary to standard IEEE data.**
- **it only runs on IBM's**
- **How to Run It -**

  xlf90 -o *cray2ibm.exe cry2ibm.f* -L/usr/local/lib32/r8i4 -lncaru

  xlf90 -o *cray2ibm.exe cry2ibm-intermediate.f* -L/usr/local/lib32/r8i4 -lncaru

- **cray2ibm.exe *v3-mm5-filename***

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tovis5d program:

- **Convert MM5 sigma-level data to Vis5D format**
- **Convert MMINPUT and MMOUT data to vis5d format**
- **tovis5d.csh *mm5-filename***

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readv3.f

- **Read V3 MM5 formatted data, print out header, and sample values in the output file**
- **Compile:**
  - f90 –free –convert big_endian *readv3.f* (DEC)
  - pgf90 -Mfreeform -pc 32 -byteswapio *readv3.f* (Linux)
  - f90 -freeform *readv3.f* (SGI)
- **a.out *v3-filename*** **EXAMPLE**

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Converter for GrADS:

- **Convert MM5 V3 format data to GrADS format. Program available at:**

  ftp://ftp.ucar.edu/mesouser/MM5V3/MM5toGrADS.TAR.gz

- **Converter developed by George Bryan from PSU. Popular under MM5 users. Supported by mesouser since Jan 2002.**

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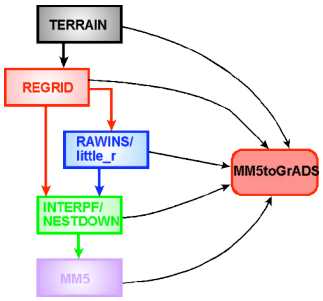
Converter for GrADS:



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Converter for GrADS:

- f90 – so make use of allocatable arrays, and only needs to be compiled once (make)
- No extra libraries needed to COMPILE
- GrADS software needed for display of data
  - http://grads.iges.org/grads/grads.html
  - http://grads.iges.org/grads/gadoc
- *Interactive*, so user must have a basic understanding of the GrADS software

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What can be done:

- Run converter only once (don't have to rerun to generate new images)
- Script based or command line
  - Run interactive
  - Run automatic with scripts
  - Create menus driven displays
- Create new fields interactively
  - Adding diagnostics on the fly
  - Manipulate fields (t ; t-273 ; rn+rc)
- Shades, contours, overlay (any number)
- Vectors, barbs

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What can be done:

- Vectors, barbs
- Change color/interval interactively
- Animations (x,y,z,t)
- Cross sections
- Soundings
- Multiple frames on one "page"
- Zoom
- Multiple files open at one time
- Quality slides (publish quality)
- Create large data files

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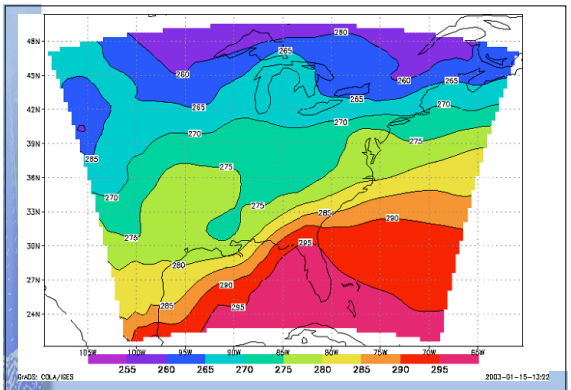

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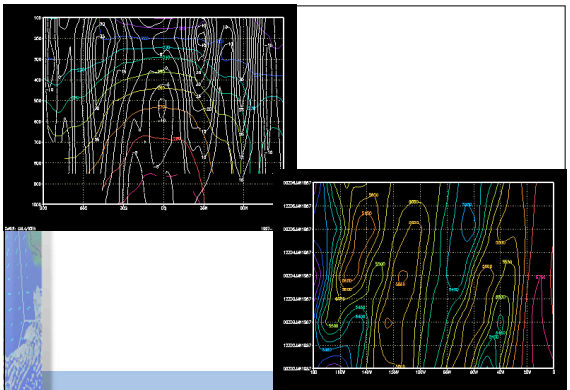

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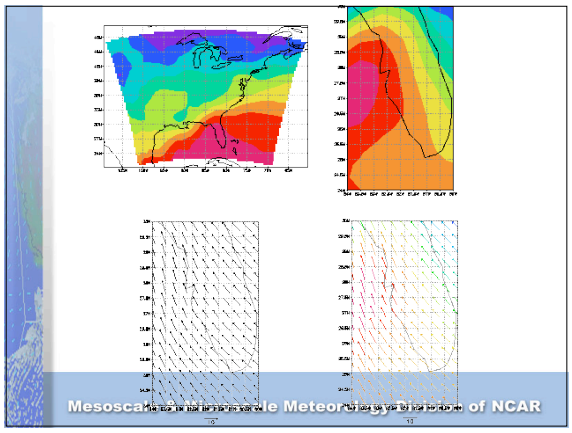

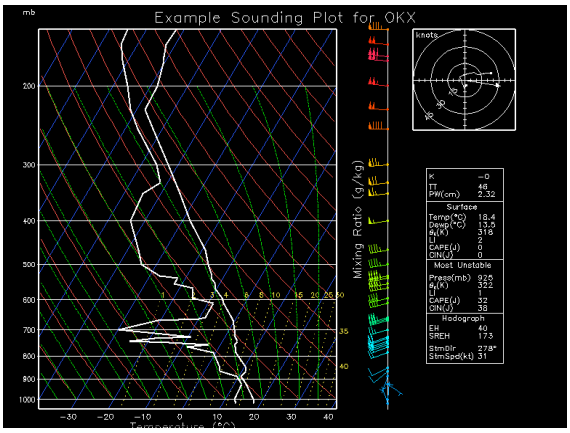

Converter for GrADS - *namelist*:

- **RECORD1**
  - TIMIN – start time
  - TIMAX – end time
  - NSKIP – skip increment
  - IFLINUX – byteswapping
  - IFMAP – interpolate to map background
  - IFSFC – surface plots only
  - IFSKEW – sounding plots
  - ZTYPE – native (pressure/sigma)
    - plev - interpolate to pressure (specify the pressure levels)

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Converter for GrADS - *namelist*:

- **RECORD10**
  - native 3D variables
- **RECORD11**
  - derived 3D variables
- **RECORD12**
  - native 2D variables
- **RECORD13**
  - derived 2D variables

RECORD10,11,12,13 are lists of switches to either plot ("1") or skip ("0") a specific variable

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Converter for GrADS:

- **How to Run converter**
- **Edit namelist**
- **Edit script (mm5_to_grads.csh)**
  - Only input and output names
- **Output: grads .ctl and .dat files**
- **To view:**
  grads –l –c "*open grads_output*"

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