

LITTLE_R

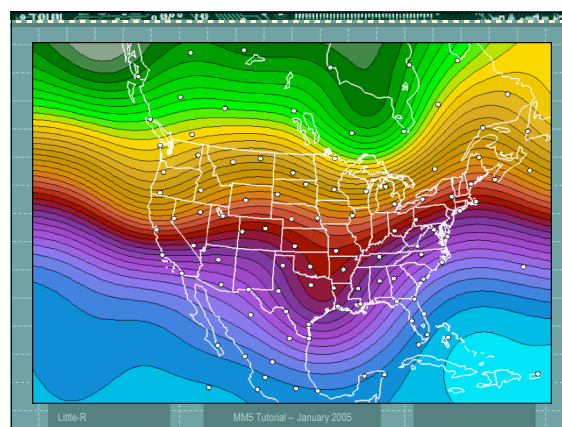
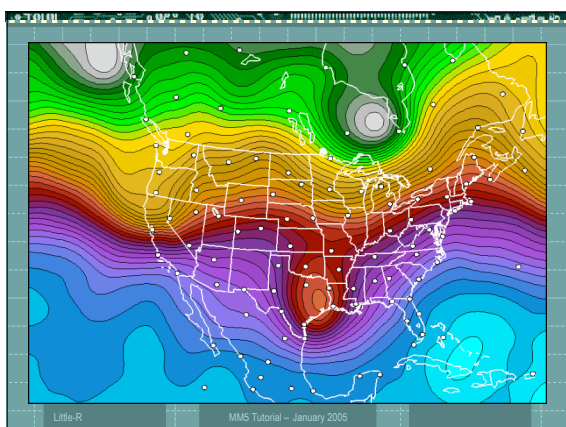
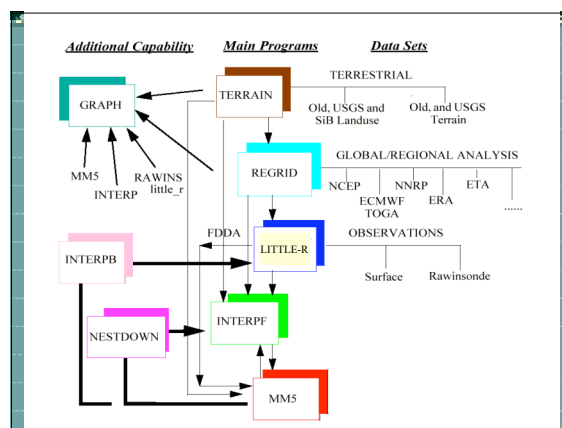
Kevin W. Manning
NCAR/MMM
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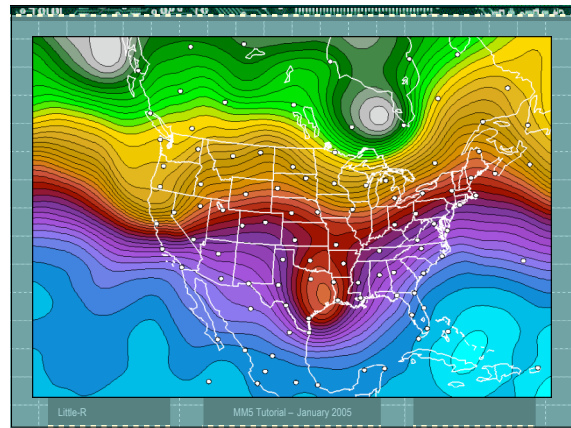
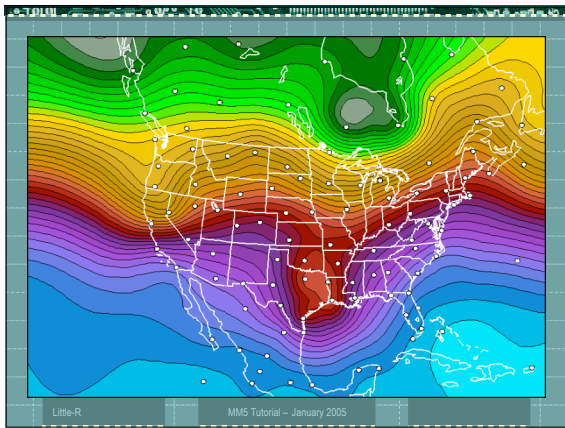
Objective Analysis

- ♦ To improve a *first-guess* gridded analysis by incorporating additional observational information
 - ♦ Traditionally, this first-guess analysis comes from low-resolution global analysis and forecast grids
 - ♦ Nowadays, higher-resolution, regional scale analyses are more readily available
 - ♦ In some circumstances, high-resolution analyses may mean that you can legitimately skip the objective analysis step in running MM5

Objective Analysis in MM5

- ♦ Traditional methods (Today's talk)
 - ♦ MM5-System programs LITTLE_R and RAWINS
 - ♦ Direct observations of T, U, V, RH at surface and on pressure levels
 - ♦ LITTLE_R recommended for new (really, any) users.
- ♦ 3D Variational Analysis (Later talk by D. Barker)
 - ♦ Direct and indirect observations on model levels

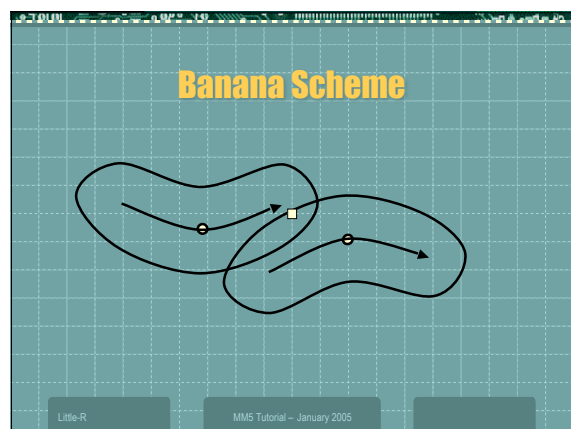
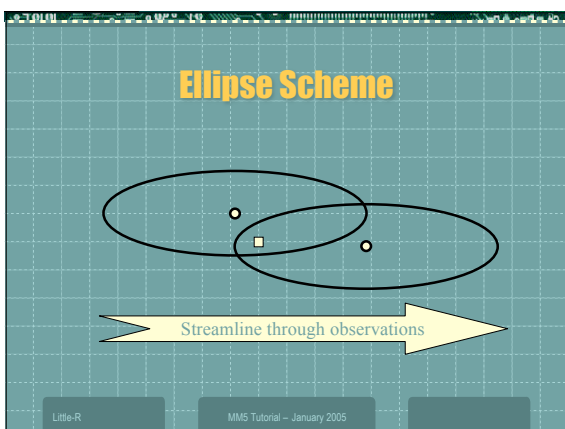
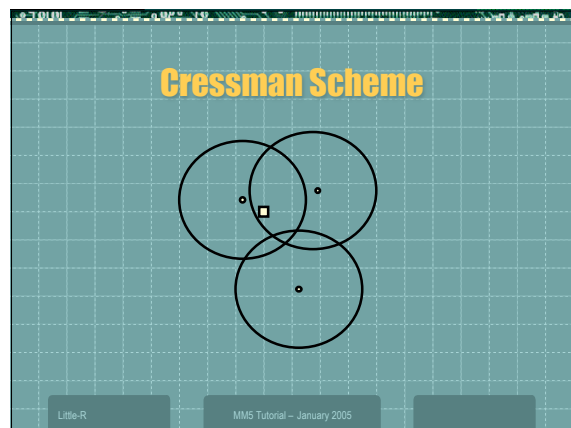


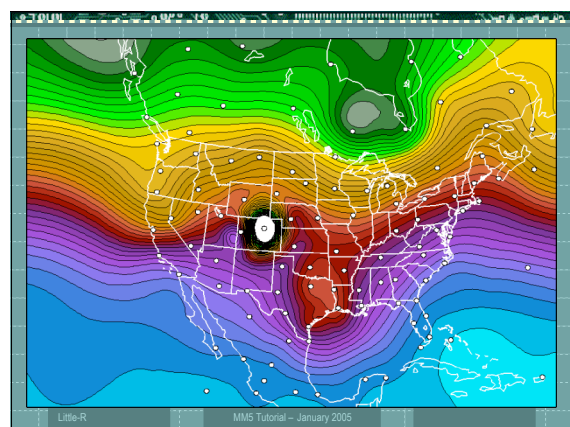
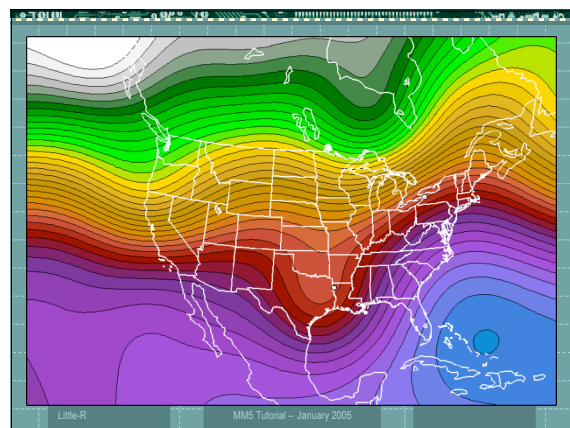
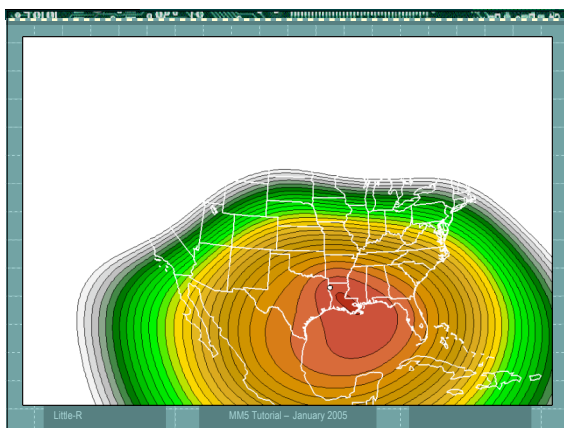
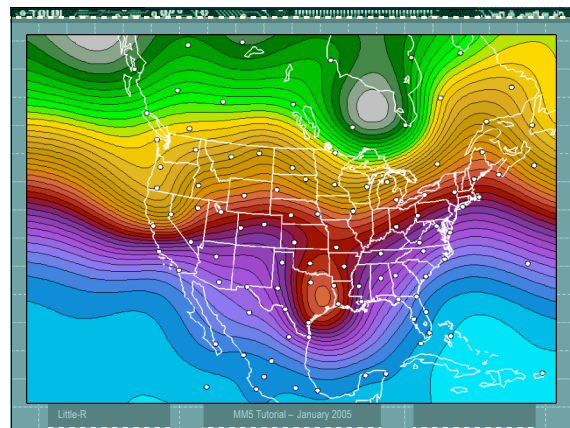
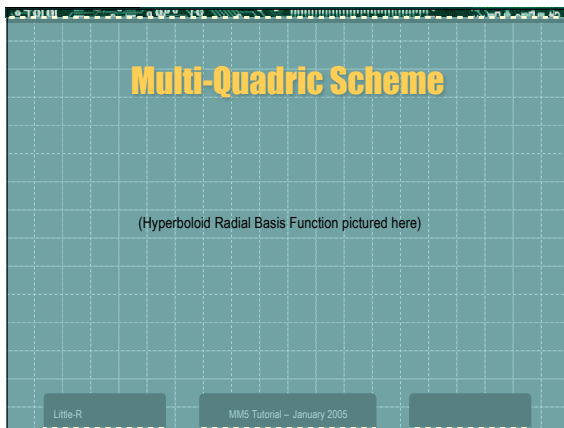


Objective Analysis techniques in **LITTLE_R**

- ◆ Cressman-based analysis
 - ◆ With ellipse and banana extensions
- ◆ Multi-Quadric analysis

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Quality Control for observations

- ♦ Tests on individual reports
 - ♦ Gross error checks
 - ♦ Remove spikes from temperature and wind profiles (optional, and really, not recommended)
 - ♦ Adjust temperature profiles to remove superadiabatic layers (optional, and really, not recommended)
 - ♦ No comparisons to other soundings or to first-guess field

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Quality Control for observations

- ♦ ERRMAX test
 - ♦ Limited user control over data removal
 - ♦ Observations are compared to first-guess field
 - ♦ If the difference between the observation and the first-guess exceeds a threshold, the observations are discarded
 - ♦ Threshold varies depending on field, level, time of day.
 - ♦ Works well with good first-guess field.

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Quality Control for observations

- ♦ Buddy test
 - ♦ Limited user control over data removal
 - ♦ Observations are compared to the first guess and to nearby observations
 - ♦ If an observation deviates from the first guess in a manner inconsistent with the deviations of surrounding stations from the first guess, then that observation is discarded
 - ♦ Works well in regions of good data density

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Surface FDDA Option

- ♦ Creates a separate surface analysis file for later use by the MM5 Surface FDDA Grid Nudging option.
- ♦ Surface analyses usually created more frequently than upper-air analyses

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Observations

- ♦ ASCII text files
- ♦ Each time period is stored in a separate file
- ♦ LITTLE_R combines reports, removes duplicates, interpolates to analysis levels

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How to run LITTLE_R

- ♦ Get the source code
- ♦ Compile
- ♦ Prepare observations files
- ♦ Edit the namelist
- ♦ Run the program
- ♦ Check your output

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Observations Header Format

latitude	F20.5	Station latitude
longitude	F20.5	Station longitude
id	A40	Station ID
name	A40	Station name
platform	A40	Measurement device
source	A40	Source of observations
elevation	F20.5	Station elevation (m)
Num_vld_flg	I10	Number of valid fields
Num_error	I10	Number of errors in decoding
Num_warning	I10	Number of warnings in decoding

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Observations Header Format

(continued)

Seq_num	I10	Sequence number of this report
Num_dups	I10	Number of duplicates found for this report
Is_sound	L10	Multiple or single levels
bogus	L10	Bogus or normal report
discard	L10	Duplicate and Discarded report
sut	I10	Time of report (s since 1970-01-01)
julian	I10	Day of the year of the report
Date_char	A20	Report time (YYYYMMDDHHmmss)
Slp, qc	F13.5,I7	SLP Value and QC flag
Ref_pres, qc	F13.5,I7	Reference pressure value and QC flag

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Observations Header Format

(continued)

Ground_T, QC	F13.5,I7	Ground T and QC flag
SST, QC	F13.5,I7	SST and QC flag
Psf, QC	F13.5,I7	Surface P and QC flag
Precip, QC	F13.5,I7	Accumulated Precip and QC flag
T_max, QC	F13.5,I7	Daily maximum T and QC flag
T_min, QC	F13.5,I7	Daily minimum T and QC flag
T_min_night, QC	F13.5,I7	Overnight min T and QC flag
P_tend03, QC	F13.5,I7	3-hr pressure tendency and QC
P_tend24, QC	F13.5,I7	24-r pressure tendency and QC
Cloud_cvr, QC	F13.5,I7	Cloud cover (oktas) and QC flag
Ceiling, QC	F13.5,I7	Height of cloud base and QC flag

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Observations Data Record Format

Pressure, QC	F13.5,I7	Pressure
Height, QC	F13.5,I7	Height
Temperature, QC	F13.5,I7	Temperature
Dew_point, QC	F13.5,I7	Dewpoint
Speed, QC	F13.5,I7	Wind speed
Direction, QC	F13.5,I7	Wind direction
U, QC	F13.5,I7	U-component of wind
V, QC	F13.5,I7	V-component of wind
Rh, QC	F13.5,I7	Relative Humidity
Thickness, QC	F13.5,I7	Thickness

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Observations End-Report Format

Num_vld_flg	I7	Number of valid fields
Num_error	I7	Errors encountered in decoding
Num_warning	I7	Warnings encountered in decoding

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Quality-Control Flags

- Binary flags indicating which warning and error conditions have been met

Pressure interpolated from first-guess height	2**1	2
Temperature and dewpoint both 0	2**4	16
Wind speed and direction both 0	2**5	32
Wind speed negative	2**6	64
Wind direction < 0 or > 360	2**7	128
Level vertically interpolated	2**8	256
Value vertically extrapolated from a single level	2**9	512
Sign of temperature reversed	2**10	1012
Superadiabatic level detected	2**11	2048
Vertical spike in wind speed or direction	2**12	4096
Convective adjustment applied to temperature field	2**13	8192
No neighboring observations for buddy check	2**14	16384
Error maximum test failed	2**15	32768
Buddy test failed	2**16	65536
Observation outside domain	2**17	131072

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LITTLE_R Namelist

- ◆ Convenient way to set user options for a particular LITTLE_R job
 - ◆ A standard Fortran 90 method of I/O
- ◆ File called namelist.input
- ◆ A *namelist record* begins with &<name> and ends with /
 - ◆ It can extend over many lines in the namelist file

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Namelist Record 1

Start_year	Four-digit starting year
Start_month	Two-digit starting month (01-12)
Start_day	Two-digit starting day (01-31)
Start_hour	Two-digit starting hour (00-23)
End_year	Ending year
End_month	Ending month
End_day	Ending day
End_hour	Ending hour
interval	Time interval (s) to process

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Namelist Record 2

fg_filename	File name of the single file containing first-guess fields
obs_filename	One or more file names of the observation files; one file required for each time period
sfc_obs_filename	One or more file names of the surface fdda observation files; one file required for each surface analysis time period. Used only if F4D=.TRUE.

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Namelist Record 3

Max_number_of_obs	Maximum number of observations to be processed in Little_R
Fatal_if_exceed_max_obs	T/F flag to stop the program if more observations are found

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Namelist Record 4

Qc_test_error_max	Turn on error-max test (T/F)
Qc_test_buddy	Turn on buddy test (T/F)
Qc_test_vert_consistency	Turn on vertical tests (T/F)
Qc_test_convective_adj	Remove superadiabatic (T/F)
Max_error_t	Max T difference (K)
Max_error_uv	Max u or v difference (m/s)
Max_error_rh	Max RH difference (%)
Max_error_p	Max SLP difference (Pa)

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Namelist Record 4 (continued)

Max_buddy_t	Threshold for T buddy check
Max_buddy_uv	Threshold for u/v buddy check
Max_buddy_rh	Threshold for RH buddy check
Max_buddy_p	Threshold for SLP buddy check
Buddy_weight	Scaling for buddy thresholds
Max_p_extend_t	Pressure range (Pa) through which a single T report may be extended
Max_p_extend_w	Pressure range (Pa) through which a single wind report may be extended

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Namelist Record 5

- ♦ A Bunch of print flags for various categories of printout
 - ♦ ".TRUE." will turn on a lot of printout
 - ♦ ".FALSE." will turn off printout
 - ♦ Recommend setting *print_obs_files* to .TRUE.

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Namelist Record 6

- ♦ There is **NO** ... Namelist Record 6

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Namelist Record 7

use_first_guess	.TRUE.
f4d	Turn on (.TRUE.) or off (.FALSE.) the creation of surface analysis files
intf4d	Time interval (s) for surface analyses
lagtem	Use a lag-time (.TRUE.) or temporal interpolation (.FALSE.) for surface analysis first guess.

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Namelist Record 8

Smooth_type	1-2-1 or smoother/desmoother
Smooth_sfc_wind	No. of smoothing passes for sfc wind
Smooth_sfc_temp	No. of smoothing passes for sfc T
Smooth_sfc_rh	No. of smoothing passes for sfc RH
Smooth_sfc_slp	No. of smoothing passes for SLP
Smooth_upper_wind	No. of smoothing passes for upper-air wind
Smooth_upper_temp	No. of smoothing passes for upper-air T
Smooth_upper_rh	No. of smoothing passes for upper-air RH

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Namelist Record 9

OA_type	"MQD" or "Cressman"
MQD_minimum_num_obs	Minimum number of obs for MQD
MQD_maximum_num_obs	Maximum number of obs for MQD
Radius_influence	Radius of influence for Cressman
OA_min_switch (T/F)	Switch to Cressman if too few obs for MQD
OA_max_switch (T/F)	Switch to Cressman if too many obs for MQD

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Fetch.deck

```
#!/bin/csh
## for serial job
# @ environment = COPY_ALL;
# @ job_name = REGRID.job
# @ output = fetch.out
# @ error = fetch.err
# @ checkpoint = no
# @ wall_clock_limit = 1500
# @ class = com_reg
# @ queue

if ( ! -e /ptmp/$USER ) then
  mkdir /ptmp/$USER
endif
set TMPDIR=/ptmp/$USER
od $TMPDIR

# *****
# ***** fetch interactive/batch C shell *****
# ***** NCAR IBM's only *****
# ***** E90 only *****
# *****
```

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```

# This shell fetches ADP data from the NCAR MSS system and
# converts it into a format suitable for the little_r
# program. The data are stored on the NCAR MSS.
#
# Three types of data files are created:
#
#   obs:DATE : Upper-air and surface data used as
#               input to little_r
#
#   surface_obs_r:DATE : Surface data needed for FDPA in
#               little_r (if no FDPA will be done,
#               these are not needed, since they are
#               also contained in obs:DATE)
#
#   upper-air_obs_r:DATE : Upper-air data (this file is contained
#               in obs:DATE file, and is not needed
#               for input to little_r)
#
# This should be the user's case or experiment (used in MSS name).
# This is where the data will be stored on the MSS.
#
set ExpName = MM5V3/TEST # MSS path name for output

```

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```

set RetPd = 365 # MSS retention period in days
#
# The only user inputs to the fetch program are the beginning
# and ending dates of the observations, and a bounding box for the
# observation search. These dates are given in YYYYMMDDHH. The
# ADP data are global, and include the surface observations and
# upper-air soundings. A restrictive bounding box (where
# possible) reduces the cost substantially.
#
# Note: No observational data are available prior to 1973, and
# no or limited surface observations are available
# prior to 1976.
#
set starting_date = 1993031300
set ending_date = 1993031400
#
set lon_e = 180
set lon_w = -180
set lat_s = -90
set lat_n = 90
#
# *****
# ***** END OF USER MODIFICATIONS *****
# *****

```

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