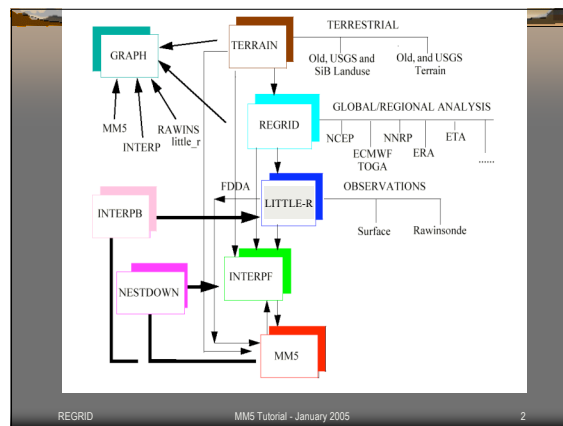


REGRID

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NCAR / MMM

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Purpose

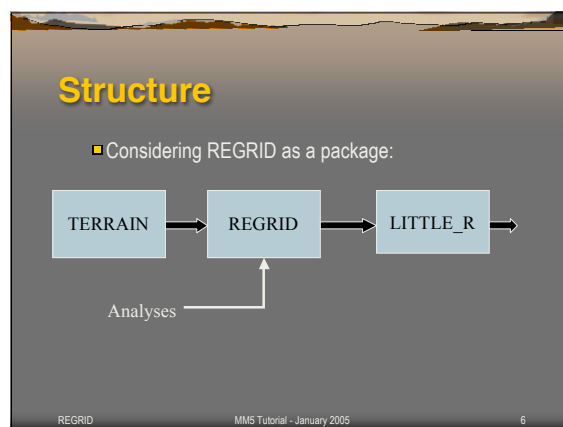
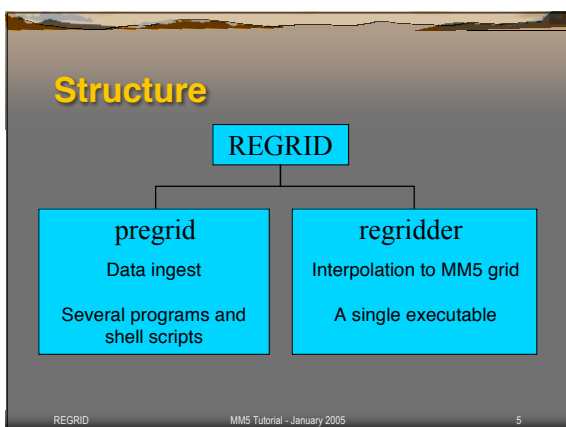
- Read archived meteorological analyses/forecast
 - Traditionally, these have been global analyses
 - Now, these are often regional analyses and forecasts
- Interpolate to horizontal MM5 grid
 - two-dimensional interpolation
 - pressure-levels
 - surface level
- TC-Bogus

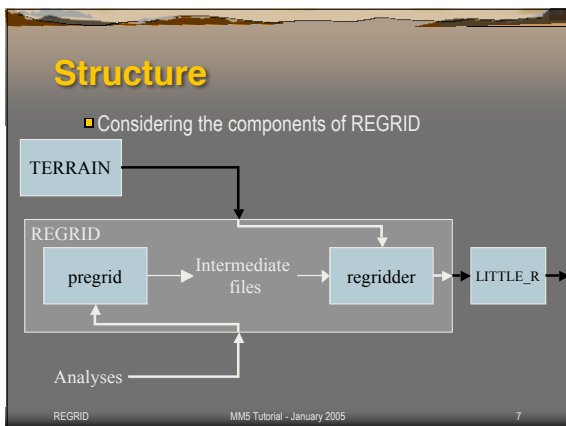
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Purpose (Bonus notes – FREE)

- Regional modeling is an initial and boundary value problem
 - Initial conditions required at model time zero
 - Lateral boundary conditions required for the *entire* simulation/forecast period
- REGRID, then, requires as input data for the *entire* simulation/forecast period
 - Instantaneous fields periodically (usually every 3-12 hours) from start time to end time
 - After the initial time, only the data in the boundary zone are used through the end of the forecast

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Input to pregrid

- Meteorological analyses
 - Often GRIB
 - namely, GRIB edition 1 (and fairly "normal" GRIB, at that)
 - No support (yet) for GRIB edition 2
- Vtables
- Namelist

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Output From pregrid

- Intermediate Files

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Input to regridder

- Intermediate files from pregrid
- Terrain files (from program TERRAIN)
- Namelist
- Optional analyses of surface characteristics (REGRID Intermediate Format)

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Output From regridder

- REGRID_DOMAIN#

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Intermediate Data Format

- General format description
- File naming conventions
- File format
- Special field names

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Intermediate Data Format

- General format description
 - 2D Horizontal slabs
 - Each slab contains a single level of a single variable
 - Any number of slabs may be written to a single file
 - Slabs in a given file need not be from the same data source, or on the same grid or map projection
 - All the slabs in a given file should represent data valid at a single instant in time

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Intermediate Data Format

- File naming conventions
 - <prefix>:<yyyy-mm-dd_hh>
 - Examples:
 - ON84:1985-03-19_00
 - GDAS:2004-01-06_12
 - FILE:2001-01-01_00

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Intermediate Data Format

- File format
 - Unformatted FORTRAN records (sequential access)
 - Four records for each horizontal slab:
 - Record 1: Format version number
 - Record 2: Common grid (map) information
 - HDATE, XFCST, FIELD, UNITS, DESC, XLVL, NX, NY, IPROJ
 - Record 3: Specific grid (map) information
 - startlat, startlon, delta-lat, delta-lon
 - startlat, startlon, delta-x, delta-y, truelat1
 - startlat, startlon, delta-x, delta-y, xlonc, truelat1, truelat2
 - startlat, startlon, delta-x, delta-y, xlonc, truelat1
 - Record 4: Horizontal slab

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Intermediate Data Format

- Special field names
 - Certain field names are recognized for certain uses within the MM5 system (see tutorial notes for table).
 - Slabs identified by an unrecognized field name are simply interpolated horizontally and written out by regridder

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T	*	Air Temperature (K)
U	*	Grid-relative u component of the horizontal wind (m s ⁻¹)
V	*	Grid-relative v component of the horizontal wind (m s ⁻¹)
RH	*	Relative Humidity (%)
HGT	*	Geopotential height (gpm)
PMSL	*	Sea-level pressure (Pa)
SST or TSEASFC	**	Sea-surface Temperature (K)
SKINTEMP	**	Skin Temperature (K)
SNOWCOVR		Binary flag: snow (1.0) or no snow (0.0) on the ground
SOILT<###>	=	Ground temperature of a layer below ground (K)
SOILM<###>	=	Soil Moisture of a layer below ground (m ³ m ⁻³)
SEAICE	=	Binary flag: sea ice (1.0) or no sea ice (0.0) on the water
LANDSEA	=	Binary flag: land (1.0) or water (0.0)
SOILHGT	=	Terrain elevation of input data set (m)

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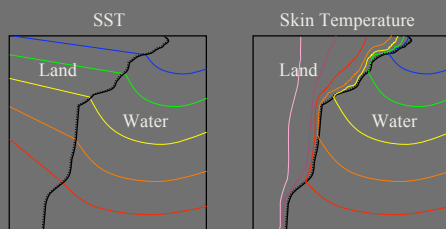
WEASD		Water equivalent of accumulated snow depth (kg m ⁻²)
SPECHUMD	▲	Specific Humidity (kg kg ⁻¹)
DEWPT	▲	Dewpoint (K)
DEPR	▲	Dewpoint depression (K)
VAPP	▲	Vapor Pressure (Pa)
GEOPT	▲	Geopotential (m ² s ⁻²)

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SST and Skin Temperature



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Pregrid Vtables

- How to tell pregrid what to access
 - Used mostly for GRIB datasets
 - GRIB conventions of referencing fields, level types, and levels are converted to MM5-system conventions of field name, units, and description.

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Vtable examples

```

GRIB | Level | Level | Level | REGRID | REGRID | REGRID |
Code | Code | 1 | 2 | Name | Units | Description |
-----|-----|-----|-----|-----|-----|-----|
11 | 100 | * | | T | K | Temperature |
11 | 105 | 2 | | T | K | Temperature at 2 m |
-----|-----|-----|-----|-----|-----|
GRIB | Level | Level | Level | REGRID | REGRID | REGRID |
Code | Code | 1 | 2 | Name | Units | Description |
-----|-----|-----|-----|-----|-----|-----|
11 | 100 | * | | T | K | Temperature |
51 | 100 | * | | SPECCHUMD | kg kg(-1) | |
100 | * | | | RH | % | Relative Humidity |
-----|-----|-----|-----|-----|-----|

```

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Vtable examples

```

GRIB | Level | Level | Level | REGRID | REGRID | REGRID |
Code | Code | 1 | 2 | Name | Units | Description |
-----|-----|-----|-----|-----|-----|-----|
11 | 100 | * | | T | K | Temperature |
33 | 100 | * | | U | m s(-1) | U |
34 | 100 | * | | V | m s(-1) | V |
51 | 100 | * | | SPECCHUMD | kg kg(-1) | |
52 | 100 | * | | RH | % | Relative Humidity |
7 | 100 | * | | RGT | m | Height |
11 | 105 | 2 | | T | K | Temperature |
52 | 105 | 2 | | RH | % | Relative Humidity |
33 | 105 | 10 | | U | m s(-1) | U |
34 | 105 | 10 | | V | m s(-1) | V |
130 | 102 | 0 | | PMSL | Pa | Sea-level Pressure |
-----|-----|-----|-----|-----|-----|

```

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Pregrid Utility Programs

- `gribprint [-v | -V] <grib file>`
- `plotfmt <intermediate file>`
- `get_nccep.deck`
- `get_on84.deck`
- `get_nnrp.deck`
- `get_era.deck`

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How to Run REGRID

- 📄 Get the source code
- 📄 Make the executables
- 📄 Get the analysis files
- 📄 Edit pregrid.csh
- 📄 Make sure pregrid.csh is executable (`chmod u+x pregrid.csh`)
- 📄 Run pregrid.csh
- 📄 Check the output of pregrid
- 📄 Edit regrider namelist file
- 📄 Run regrider

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How to Run REGRID

- Get the source code
- Make the executables
- Get the analysis files
 - Understand your data
- Edit pregrid.csh
- Make sure pregrid.csh is executable (`chmod u+x pregrid.csh`)
- Run pregrid.csh
- Check the output of pregrid
- Edit regridded namelist file
- Run regridded

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Get the source code

- <ftp://ftp.ucar.edu/mesouser/MM5V3/REGRID.TAR.gz>
- `gunzip REGRID.TAR.gz`
- `tar -xvf REGRID.TAR`
- This makes top-level directory REGRID

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Make the executables

- `cd REGRID`
- `make`
 - Many fairly common configurations are recognized by our makefiles
 - If the "make" does not make all executables, you may need to go into the makefile and tune some of the compiler and load options yourself

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Get the analysis files

- From NCAR's archives
- From some other source of archives
- From real-time ftp sites

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pregrid.csh

- Shell script designed as a higher-level user interface for the pregrid programs.

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pregrid.csh

```
#!/bin/csh -f
set echo

# Put your input files for pregrid into the directory you specify as DataDir

set DataDir = /usr/tmp/username/REGRID

# Specify the source of 3-d analyses

set SRC3D = ON84 # Old ON84-formatted NCEP GDAS analyses
set SRC3D = NCEP # Newer GRIB-formatted NCEP GDAS analyses
set SRC3D = GRIB # Many GRIB-format datasets

# InFiles: Tell the program where you have put the analysis files,
# and what you have called them. If SRC3D has the value "GRIB",
# then the Vtables you specify below in the script variable VT3D will
# be used to interpret the files you specify in the ${InFiles} variable

set InFiles = ( ${DataDir}/NCEP* )
```

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```

# Specify the source of SST analyses
#
set SRCSTS = ON84
set SRCSTS = NCEP
set SRCSTS = NAVY
set SRCSTS = $SRC3D

# InSST: Tell the program where the files with SST analyses are. Do
# this only if SST analyses are coming from files not named above in
# InFiles. If SRCSTS has the value "GRIB", then the Vtables you
# specify below in the script variable VTSST will be used to interpret
# the files you specify in the ${InSST} variable.

set InSST = ( )

# Select the source of snow-cover analyses (entirely optional)
#
set SRCENOW = $SRC3D
set SRCENOW = ON84
set SRCENOW = GRIB

# InSnow: Set InSnow only if the snow-cover analyses are from files
# not listed in InFiles. If SRCENOW has the value "GRIB", then the
# Vtables you specify below in the script variable VTSNOW will be used
# to interpret the files you specify in the ${InSnow} variable.

set InSnow = ( )

```

```

# Select the source of soil model analyses (entirely optional)
#
set SRC3D = $SRC3D

# InSoil: Set InSoil only if the soil analyses are from files
# not listed in InFiles. If SRC3D has the value "GRIB", then the
# Vtables you specify below in the script variable VTSOIL will be
# used to interpret the files you specify in the ${InSoil} variable.

set InSoil = ( )

# Build the Namelist
#
if ( -e ./pregrid.namelist ) then
  rm ./pregrid.namelist
endif
cat << End_Of_Namelist | sed -e 's/.*//; s/ *$// ' > ./pregrid.namelist
&record1

# Set the starting date of the time period you want to process:
START_YEAR = 1993 # Year (Four digits)
START_MONTH = 03 # Month ( 01 - 12 )
START_DAY = 13 # Day ( 01 - 31 )
START_HOUR = 00 # Hour ( 00 - 23 )

END_YEAR = 1993 # Year (Four digits)
END_MONTH = 03 # Month ( 01 - 12 )
END_DAY = 14 # Day ( 01 - 31 )
END_HOUR = 00 # Hour ( 00 - 23 )

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```

```

# Define the time interval to process.
INTERVAL = 43200 # Time interval (seconds) to process.
# This is most sanely the same as the time interval for
# which the analyses were archived, but you can really
# interpolate in time and/or skip over time periods for
# your regridding pleasure.

/
End_Of_Namelist

# Tell the pregrid programs which Vtables to use. Do this only
# if you have selected GRIB-formatted input using SRC = GRIB above.
# The directories referenced here are relative to REGRID/pregrid/.
#
# The Vtable files specified in VTS3D will be applied to the files
# specified in the InFiles variable. Similarly, the Vtable files
# specified in VTSST, VTSNOW, and VTSOIL will be applied to the files
# listed above in InSST, InSNOW, and InSoil, respectively.
#
set VTS3D = ( grib.misc/Vtable.NNRP3D )
set VTSST = ( grib.misc/Vtable.NNRPST )
set VTSNOW = ( grib.misc/Vtable.xxxxSNOW )
set VTSOIL = ( grib.misc/Vtable.xxxxSOIL )

=====
#####
END USER MODIFICATION
#####
=====

```

regridder namelist

■ File resides in the "regridder" directory, called "namelist.input"

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namelist.input RECORD1

- START_YEAR: 4-digit year
- START_MONTH: 2-digit month of year
- START_DAY: 2-digit day of month
- START_HOUR: 2-digit hour of day
- END_YEAR: 4-digit year
- END_MONTH: 2-digit month of year
- END_DAY: 2-digit day of month
- END_HOUR: 2-digit hour of day
- INTERVAL: Seconds between times to process

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namelist RECORD1 example

```

&RECORD1
  START_YEAR = 1993
  START_MONTH = 03
  START_DAY = 13
  START_HOUR = 00

  END_YEAR = 1993
  END_MONTH = 03
  END_DAY = 14
  END_HOUR = 00

  INTERVAL = 43200
/

```

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namelist.input RECORD2

- **ptop_in_Pa:**
 - Pressure level (in Pa) of the highest level you want to process. This level must exist in the input data.
- **new_levels_in_Pa:**
 - List of new pressure levels (not already in the input data) that you want to add to the regridder processing
- **sst_to_ice_threshold:**
 - SST below which the water will be considered sea-ice.
- **linear_interpolation**
 - Logical flag to use 4-point bilinear interpolation (.TRUE.) or 16-point overlapping parabolic interpolation (.FALSE.)

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namelist RECORD2 example

```
&RECORD2
  ptop_in_pa      = 10000
  new_levels_in_Pa = 95000, 90000, 85000, 80000, 75000,
                    70000, 65000, 60000, 55000, 50000,
                    45000, 40000, 35000, 30000, 25000,
                    20000, 15000, 10000
  sst_to_ice_threshold = -9999
  linear_interpolation = .FALSE.
/
```

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namelist.input RECORD3

- **root:**
 - What files to look for. A list of path-names to the intermediate files created by pregrid, up to but not including the ":". Date information is generated internally by regridder and tacked onto the root names you provide.
- **constants_full_name:**
 - The complete path-name of a file that has fields which are to be kept constant for all time periods.
- **terrain_file_name:**
 - The complete path-name of the terrain file created by program TERRAIN. Most often this will be "TERRAIN_DOMAIN1".

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namelist RECORD3 example

```
&RECORD3
  root              = '../pregrid/FILE', ../pregrid/SNOW'
  constants_full_name = '../SST_CONSTANT'
  terrain_file_name  = '../TERRAIN_DOMAIN1'
/
```

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namelist RECORD4 example

```
&RECORD4
  print_echo      = .FALSE.
  print_debug     = .FALSE.
  print_mask      = .FALSE.
  print_interp    = .FALSE.
  print_link_list_store = .FALSE.
  print_array_store = .FALSE.
  print_header    = .FALSE.
  print_output    = .FALSE.
  print_file      = .FALSE.
  print_f77_info  = .TRUE.
/
```

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namelist RECORD5 example

```
&RECORD5
  insert_bogus_storm = .TRUE.
  num_storm          = 3
  latC_loc           = 20., 10., 40.
  lonC_loc           = -50., -30., -60.
  vmax              = 50., 45., 20.
/
```

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Complete regridder namelist

```

&record1
  start_year = 1993
  start_month = 03
  start_day = 13
  start_hour = 00
  end_year = 1993
  end_month = 03
  end_day = 14
  end_hour = 00
  interval = 43200
/

&record2
  ptop_in_Pa = 10000
  new_levels_in_Pa = 97500, 95000, 92500, 90000,
    87500, 85000, 82500, 80000,
    77500, 75000, 72500, 70000,
    67500, 65000, 62500, 60000,
    57500, 55000, 52500, 50000,
    47500, 45000, 42500, 40000,
    37500, 35000, 32500, 30000,
    27500, 25000, 22500, 20000,
    17500, 15000, 12500, 10000
  sst_to_ice_threshold = -9999
  linear_interpolation = .FALSE.
/

```

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```

&record3
  root = './pregrid/ONS4'
        = './pregrid/ONS4_SST'
        = './pregrid/ONS4_SNOW'
  terrain_file_name = './TERRAIN/TERRAIN_DOMAIN1' /
  constants_full_name = './pregrid/SST_FILE:1993-03-13_00'
/

&record4
  print_echo = .FALSE.
  print_debug = .FALSE.
  print_mask = .FALSE.
  print_interp = .FALSE.
  print_link_list_store = .FALSE.
  print_array_store = .FALSE.
  print_header = .FALSE.
  print_output = .FALSE.
  print_file = .FALSE.
  print_tc = .FALSE.
  print #77 info = .TRUE.
/

```

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```

&record5
  insert_bogus_storm = .FALSE.
  num_storm = 1
  latC_loc = 36.0
  lonC_loc = -35.0
  vmax_meters_per_second = 35.0
  rmax = 90000.0
  vmax_ratio = 0.75
/

```

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Data

- REGRID has been used successfully with a variety of data sets, including:
 - Archived data sets:
 - NCEP GDAS (Global Data Assimilation System)
 - NCEP/NCAR Reanalysis
 - NCEP EDAS (Eta Data Assimilation System)
 - ECMWF TOGA Analysis
 - ECMWF Reanalysis

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Data

- Real-time data sets:
 - NCEP Eta analysis and forecast
 - NCEP AVN analysis and forecast

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