

# Status Report on MM5 Pre- and Post-processing Programs in Version 3

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## 1. INTRODUCTION

MM5 modeling system Version 3 has been released for nearly a year. The current release for all pre-processing programs is 3-3, the same as that for MM5. Each of the releases have included bug fixes and improvements. Most bugs and errors tend to occur when dealing with land-sea masked fields, and the improvements typically are geared toward making the programs more flexible and friendlier to use. Another significant improvement of the pre- and post-processing programs is that all of them are ported to Linux systems running Portland Group Fortran compilers. For new users to the Version 3 system, we have developed an online tutorial that will take you step by step to learn how to use the system.

## 2. IMPROVEMENTS

There are a number of improvements that are either already in or are going into the preprocessing program tar files. Here is a brief summary:

### a. TERRAIN

The current terrain elevation data have come from several sources, and there are occasional errors in some of the datasets. Because of the availability of global 30 second elevation data, it makes sense to recreate elevation data at other resolutions from the same source. The low-resolution datasets are obtained by calculating an area mean. The new datasets will be available in the 3-4 release to be available later this summer. A user will see some differences between the new and old datasets at all resolutions other than 30 second. The difference may be caused by how the original data were created, for example. We recommend that a user should check the new data carefully after running TERRAIN.

On the assumption that most people will be doing simulations at resolutions in the range of a few kilometers, we have also created an additional input data for all variables at 2 minutes resolution (about 4 km). This fills a gap between the 1 km (30 second) and 10 km (5 minute) datasets we have so far. But the main advantage of using this dataset is the 4-fold reduction of TERRAIN's runtime memory, which in turn would allow users to use the high-resolution data over a larger area for the same memory on a computer. Again this new resolution data will be available in the next release. After the next release, program TERRAIN will have choice of six reso-

lutions for data input, with NTYPE=5 corresponding to 2' data, and =6 to 30 sec data.

### b. REGRID

Bilinear interpolation was added to program regridder since release 3-2. In the earlier versions (including the one in V2), only a linear interpolation scheme was available. While the linear interpolation works quite well when one looks at the primitive fields (such as u, and v), the bilinearly interpolated fields would provide a smoother derived fields, such as divergence and vorticity. Bilinear interpolation is now the default interpolation scheme in regridder. One may activate the linear interpolation by using the namelist option *linear\_interpolation = .TRUE..*

A new capability added to regridder is to use time-invariant fields in all time periods, such as SST and snow cover. This is done by using namelist variable: *constants\_full\_name* (one must specify the full name for this file, in contrast to using only the root name for other input files). This option allows a user to easily supplement such a field for a dataset that lacks it.

Some datasets do not provide surface fields. This can create problems when REGRID output is used as a first guess for objective analysis in RAWINS and LITTLE\_R. A new function in regridder now estimates surface fields like u, v, temperature and relative humidity based incoming pressure level data and terrain. Sea-level pressure is still expected in the input at the moment. When a surface field is estimated by regridder, a print statement will appear to warn the user.

If a dataset does not provide adequate surface temperature over water when ice is present, regridder now allows a user to turn that part of water into land with permanent ice landuse category. This is done by setting the temperature below which a user wishes to turn water into land through the namelist option *sst\_to\_ice\_threshold*.

All these options are available in the current tar file in the mesouser directory.

### c. RAWINS

Many of you are aware that the surface observations archived at NCAR have changed somewhat since April 1997. After that time, RAWINS' function to create 3 hourly surface analyses to be used in MM5 model by surface analysis nudging has become disabled. Thanks to Kesu Zhang of SUNY, Albany, we have a modification to the code that allows us to overcome

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\* The National Center for Atmospheric Research is sponsored of the National Science Foundation.

the problem. We should be able to provide this in the standard V3 tar file.

#### d. INTERPF

If a user didn't provide gridded a pressure level analysis for at least one diurnal cycle, INTERPF used to stop and request for more data. This is because INTERPF calculates a substrate (or approximately 10 cm soil) temperature based on diurnally averaged surface air temperature. Having temperature fields available in a full diurnal cycle would allow a better estimate of this quantity. Now, if a user intentionally activates the namelist option *less\_than\_24h*, INTERPF would allow the user to continue. This is merely a convenience provided by the program, but one must know what one is doing.

To avoid confusion by introducing the output option using *ifdatim* in V3, we have modified INTERPF to default to output all time periods in MMINPUT file. One may use this option to output only the initial time, or any number of time periods beginning with the initial time.

In the next release (3-4), INTERPF will be outputting a time-varying SST field in the LOWBDY file. This is to allow users who make long range simulations to vary SST. Later a time-varying snow field will be included too.

#### e. NESTDOWN

The program NESTDOWN may be used to generate nest input to MM5 either from MMINPUT (from INTERPF) or MMOUT (from MM5) files. The program has been improved to deal with land-sea masked fields for the land-surface model option.

Similar to INTERPF, a convenient option of using *less\_than\_24h* is provided. But a user must use it with caution.

As in REGRID, a user may also turn part of the water surface into land with permanent ice as the landuse category by using the namelist option *sst\_to\_ice\_threshold*.

### 3. MODELING SYSTEM PROGRAMS ON LINUX

Based on some users' pioneering work on porting the MM5 modeling system pre- and post-processing programs to PCs running Linux, we finally completed this development. For most programs, only minor changes were required for such a port. To compile these programs, it requires the Portland Group Fortran 90 and C compiler ([www.pgroup.com](http://www.pgroup.com)). Compile options for all programs are now in the current tar files.

### 4. NEW MAKEFILES

All pre- and post-processing programs can now be compiled by simply typing 'make' (although for some Fortran 77 programs, it is still easier to use the deck). A new Makefile structure is installed for all programs and they are available in the current tar files.

### 5. V3 UTILITY PROGRAMS

Several utility programs have been developed to be used with V3 system.

#### a. v32v2

This program converts V3 model output data to V2 format. This was intended to help users with transition from V2 to V3, and still be able to use other programs that were developed for V2. This also allows a user to convert V3 model data to V2 format, and use the backend Interp function in V2.

#### b. tovis5d for V3

A new tovis5d program is available to use with V3 (and V2) data. This program can convert not only the V3 model variables to vis5d input data, it can also diagnose a few other fields and then convert them to vis5d data. In short, this new programs combine the functions in tovis5d and diagmm5 in V2 into one program. This program is developed by Wei Huang of NCAR.

#### c. RIP for V3

Beginning this summer and with release 3-4, mesouser will start to support the plotting program RIP (acronym for Read-Interpolate-Plot) developed by Mark Stoelinga of University of Washington. This package has become very popular among MM5 users, and provides a good alternative to the program GRAPH. This program is also based on NCAR Graphics.

Speaking of NCAR Graphics, it (at least part of it) has recently become free for downloading. This will greatly help MM5 users to effectively use the entire supported system.

### 5. USER SERVICE

For new users to MM5 and MM5 Version 3, we have developed an online tutorial that will show you how to use the modeling system step by step. The URL is [www.mmm.ucar.edu/mm5/mm5v3/tutorial/teachyourself.html](http://www.mmm.ucar.edu/mm5/mm5v3/tutorial/teachyourself.html). We welcome everyone to try it and pass this to people who are new to the MM5 model or are thinking of using the modeling system.

Since the release of the OSU land-surface model option in V3, there have been many questions regarding the application of the scheme. In order to more effectively help the users, we plan on creating an email list so that anyone can subscribe to it, and exchange ideas and experience with the use of this option.

We also plan to post some popular email exchanges among users. The intent here is to create a forum to encourage users to find solutions to problems that have been dealt with before.

*Acknowledgement:* MM5 modeling system is collectively developed by Jimy Dudhia, Dave Gill, Yong-Run Guo, Kevin Manning, and Wei Wang of NCAR/MMM.