

## **A Guide to the Workstation Eta**

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May 1999  
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## Initial setup

- 1) Extract the contents of the tar file with the following command:

```
tar -xf wrkst_package.tar
```

This will extract the contents of this file into a directory named *worketa*.

- 2) Delete any files in the */worketa/dprep/exe* and */worketa/dprep/lib* directories (note: portions of pathnames before *worketa* will not be included in this manual).

- 3) change directories to *worketa/dprep/install*.

- 4) enter the command: **configure**

This will automatically configure the paths in the makefile used in the next step.

- 5) enter the command: **make**

Running this makefile creates the executables for the dprep (data preparation) part of the package.

- 6) Delete any files in the */worketa/eta/exe* and */worketa/eta/lib* directories (although as delivered these directories should be empty).

- 7) Create the software libraries which are required when compiling the model. These compilations *require* a FORTRAN 90 compiler; tests using FORTRAN 77 on several platforms were unsuccessful.

a) go to *worketa/libraries/bacio.source*.

- define the system that the bacio library is being built for in the file *clib.h*. For machines other than LINUX, SGI, or HP the recommendation is to create distinct versions with the HP and SGI settings and then see if either of them will link properly with the code being compiled. The compilations in steps 14b and 16a utilize the bacio library.

- Edit the definition of CPU type in the script *comp.com* as the HP C-compiler required some special compiler options to handle the C part of the code.

- Enter the command **comp.com** to create the file *bacio* in *worketa/libraries*.

b) go to *worketa/libraries/w3lib.source*

- enter the command **sh compall.future.sh** to create the file *w3lib* in *worketa/libraries*.

c) go to *worketa/libraries/iplib.source*

- enter the command **sh compallip.sh** to create the file *iplib* in *worketa/libraries*.

- 8) Extract the topography data

The topography data were downloaded (or should have been) when this package was downloaded. The data should now be placed into *worketa/eta/static/topo*. The

topography data are tarred into latitudinal strips extending from 180°W to 40°W; the data stored in */pub/gcp/wrkstn\_eta/* on the *ftp.ncep.noaa.gov* FTP server cover between 10°N and 80°N. These files should be uncompressed (**uncompress \*.Z**) and untarred (**tar -xf topofile**). Delete the tar files once the topography data has been extracted. Users not covered by the included topography data will need to contact me to get the data (e-mail: *mpyle@ncep.noaa.gov*).

The individual topography files cover a 10° × 10° region and the file names (e.g., *U20N130W*) give the latitude/longitude value of the southwest corner of the file.

9) Set up the surface and fixed fields

a) land/sea mask data; first go to *worketa/eta/bin*

The package as delivered is defaulted to use *US\_2m\_slm.ieee*, a high resolution (2' lat/lon) dataset covering from 10°N, 180°W to 80°N, 30°W. The other two datasets (*global\_4m.ieee*, *global\_8m.ieee*) are global and are at 4 minute and 8 minute resolution, respectively. Users covered by the regional 2 minute dataset need only to uncompress the *US\_2m\_slm.ieee.Z* file.

Users outside of the greater North America region will need to change the subroutine call in *worketa/eta/src/prep/sfc/etatopo.f* at about line 667 (or search for the string *ETA\_SEA*) and choose between the 8 minute and 4 minute data. Sample calls for using each input data set are included as comments within the code. In addition to changing this code, uncompress either the 4 or 8 minute dataset in *worketa/eta/bin* corresponding to the resolution specified by the subroutine call.

b) enter the command: **uncompress a\*.Z i\*.Z r\*.Z v\*.Z**

This will uncompress other surface/fixed fields such as albedo and vegetation type. These files are described below in #3 of "Getting the input data".

10) change directories to *worketa/eta/src/configure*.

11) Edit the *make.inc* file to set the desired compiler options. Examples that were tested on SGI and HP workstations using FORTRAN 90 are included in this directory. Some faulty behavior was experienced when running a 45-level version of the model compiled with the -O3 (aggressive optimization) option on an SGI. The recommended highest optimization level to use is -O2 (or an equivalent less than most aggressive optimization for a compiler).

12) This package was configured with a model top pressure of 25 hPa, which is identical to operational Eta runs made at NCEP. The package has only been provided with files enabling model top pressures of 25 and 50 hPa. To change the top pressure, edit the file *worketa/eta/src/interp/initbc/interp.f*. The variable is named *pt* and is defined in a data statement near the top of the subroutine *vinterp* (value is specified in Pa).

13) change directories to *worketa/eta/install* and enter the command: **configure**

This will configure the paths in the makefile and the namelist file (*ETAIN*) that is used by the workstation Eta.

14a) Edit the *parmeta* file in *worketa/eta/src/include* to set the IM (the number of mass gridpoints along the first row, essentially half the total number of gridpoints in the west-east direction due to the horizontal staggering of mass and wind points), JM (number of gridpoints in the north-south direction), and LM (number of vertical levels, which needs to be 38, 45, 50, or 60 to work with the deta and radiation files included with the package; see step 15 of this section).

Copy the *parmeta* file to the directory *../../post*.

14b) Go to *worketa/eta/install* and enter the command: **make**

This will compile the model code, as well as codes used to initialize and interpolate the data coming into the model (initial degribbing is done by the dprep code). The model dimensions are set during compilation by the *parmeta* file modified in the previous step.

15) change directories to *worketa/eta/bin*. The model uses files to specify the relative thicknesses of the eta levels and the radiative properties of the atmosphere.

a) The eta levels file is configured based on the number of vertical levels (LM). In the *deta\_files* subdirectory are files for 38, 45, 50, and 60 level configurations of the Eta. Copy the version corresponding to the LM set when compiling the model in the previous step to the file *deta* in *worketa/eta/bin*.

b) change directories to *worketa/eta/runs*.

c) The radiation file depends on both the number of vertical levels and the pressure at the top of the model domain. In the *rad\_files* subdirectory are files for 38, 45, 50, and 60 level configurations of the Eta with top pressures of 25 and 50 hPa. Copy the proper radiation file to the file *co2.dat* in *worketa/eta/runs*.

16) Compile the programs used by the post-processor

a) go to *worketa/copygb* and enter **make** to create the executable.

b) go to *worketa/post* and modify the *parmeta* file (if it was not copied to this directory in step 14a) so it has the same dimensions (IM, JM, LM) used to compile the model. LSM controls the number of pressure levels that output can be generated for in the post.

The compiler options are set through the variable FFLAG in the makefile. The post generally runs quickly enough without much optimization, but quicker run-time performance can be achieved through FFLAG defined optimizations.

Enter **make** to create the executable.

17) You are now done with the initial set up (meaning you will not have to repeat these steps unless you configure the model on a different disk space, or want to change the model dimensions).

## Getting the input data

1) Go to *worketa/dprep/bin* and decide on an input data set. Currently the workstation Eta can be initialized from AVN data, and from Eta data on grids 104, 212, and 221 (in tiled form; see #2 of this section). A plot showing the area covered by the Eta output grids and the operational 32 km Eta domain is located in the files *regions.plt* and *regions.pdf*, which are postscript and pdf versions of the same plot. The raw GRIB data are obtained via FTP from *ftp.ncep.noaa.gov*. Scripts have been included which will get the data and put it into the format needed to initialize the workstation Eta. The scripts are used in the following way:

**data\_prep\_model.com** *input1 input2 input3*

*model* is the form of data to get (AVN, 104, 212, or 221\_tiled).

*input1* is the model cycle (00, 06, 12, or 18). It assumes the current day.

*input2* is the last hour of input model data to get (should be no larger than the intended length of the workstation Eta forecast).

*input3* is the interval in hours between the input model forecasts (the frequency with which the lateral boundary conditions are updated; typically 3 or 6 depending on available bandwidth and disk storage).

EXAMPLE: If the user wanted grid 212 data for a 24 hour model run based on the 00Z cycle at 3 hour time resolution, the following command would be entered:

**data\_prep\_212.com** *00 24 03*

When running the “data\_prep” scripts the actual work is done by two subscripts. The first gets the data via FTP and the second does the degribbing.

2) Special comments about the grid 221 data, which is obtained in “tiled” form:

a) The region covered by each of the 36 tiles is displayed on the webpage <http://nic.fb4.noaa.gov:8000/research/tiles.221.html>. Some tiles along the boundary of this region are not completely filled with data, as this output grid extends beyond the computational domain of the operational Eta along much of the boundary.

b) The user of this dataset will have to edit the files *get\_data\_221\_tiles.com* and *etagrid\_221\_tile.sh* to obtain the tiles needed for a particular domain. The code which merges these tiles is fairly general, so any normal square/rectangular region should work.

c) The tiled grid 221 dataset is the optimal dataset for initialization of the workstation Eta (in this author’s opinion). It provides 32 km horizontal resolution data, and with tiling a limited volume of data will cover a typical workstation domain. The huge region covered includes almost the entire computational domain of the operational Eta, opening up a vast region to workstation Eta runs.

d) At most the two most recent cycles will be available on the FTP server. This output typically arrives on the FTP server a couple of hours after the grid 104

and grid 212 output, although this may change in the future when this tiled output becomes part of the standard set of output products.

### 3) Surface fields

#### a) Obtaining the time-dependent fields

*sstgrb*, *sstgrb.index*, *imssnow.grb*, *snowdepth.grb*

Go to *worketa/eta/bin* and run the script *get\_sfcfields.com*. This script will FTP the most recent versions of these fields into the local directory. The model will run using old snow and SST files, but for better results these should be updated several times a week (particularly if the snowcover is varying over the computational domain).

#### b) Descriptions of the included time-independent fields located in *worketa/eta/bin*:

*islope\_1d\_ieee*, *isltyp\_1d\_ieee*, *ivgtyp\_1d\_ieee*:

These specify the slope, soil, and vegetation types. As indicated by their names these are IEEE binary files.

*alb1\_ieee*, *alb2\_ieee*, *alb3\_ieee*, *alb4\_ieee*:

These are seasonal albedo files which are interpolated in time to get a starting value of albedo. This albedo value is refined by code that considers surface characteristics, such as snow or sea-ice cover.

*veg.eta.grb*:

This file contains the vegetation fraction, stored as a monthly value which is interpolated in time to reflect the vegetation fraction on the day of the model run.

*imsmask.ascii*:

This file contains the land/sea mask used when processing the IMS snow data (this is a high-resolution NESDIS product which is used to define snow and ice cover, but not depth).

*rfusaflw\_ieee*:

This file contains the land/sea mask used when processing the Air Force snow data (a lower-resolution product that is used to define the model snowdepth).

## Setting up the model run

- 1) Go to *worketa/eta/bin* and edit the namelist file *ETAIN* to set up the model run

TLM0D,TPH0D: These are the center longitude (°E positive, °W negative) and latitude of the model domain.

IM,JM,LM: The dimensions of the computational domain. IM, JM, and LM were set in the file *parmeta* in *worketa/eta/src/include* when the model was compiled. The values specified in this file must agree with the compiled model dimensions.

DLMD,DPHD: The grid spacing in degrees in the east-west and north-south directions within the rotated lat-lon coordinate of the Eta model. An approximate relationship between DLMD/DPHD and horizontal resolution is given below in the description of DT.

DT: The fundamental timestep of the model (in seconds), which depends upon horizontal resolution. Some possible values are given below; when setting up a new model configuration it is good to start with these conservative values for DT. Using an overly long time step will have grave consequences (the first indication will be an unsteadiness in the pressure depth of the model atmosphere, which will be reflected in the standard output as “big pd change(mb):” followed by a value). Note that the given values of DT divide into 3600 evenly so the proper number of physics/adjustment steps will be performed each hour.

<i>DLMD/DPHD</i>	<i>resolution(km)</i>	<i>DT(s)</i>
.066	10	20
.098	15	30
.213	32	72
.32	48	100

W, IDTAD: W controls suppression of gravity wave noise, and IDTAD is the frequency of advection as a multiple of the fundamental time step (typically 0.25 and 2, respectively; do not need to be changed).

IMONTH,IDATE,IYEAR,ISTRTIM: Together these specify the initial time of the run. ISTRTIM is the hour of the starting time (e.g., a run based on 12Z data has ISTRTIM=12)

NSOIL: The number of soil levels (should be 4).

NINIT: The number of input data files.

INIT\_IN(#): The names of the input data files. The naming convention is *YYJJJCCHH.ETAmo*d, where *YY* is the 2-digit year, *JJJ* is the Julian day, *CC* is the cycle time, *HH* is the hour of the forecast, and *mo*d is the extension given to the particular input dataset (104, 212, \_avn, \_tile). The easiest way to get these file names is to look in the directory *worketa/data/prep/* for the most recent

data files, although it is possible to set up an automated system to automatically do this if running in real-time (see Appendix: Automating the process). The number of files described should equal the *NINIT* value specified above.

**INIT\_OUT:** The directory where the initial and boundary condition files will be written (should not need to be changed as this path was set during a configure step above).

**TBOCO:** Interval in hours between input model data (typically 3 or 6).

**NHOUR:** Total number of hours for which boundary condition files are created. Should be equal to  $(NINIT - 1) \times TBOCO$ .

**FCST\_OUT:** no longer used

**TOPO\_IN:** Location where the raw ( $10^\circ \times 10^\circ$ ) topo files are stored. This was set during a configure step above and should not need to be changed.

**TOPO\_OUT:** File that stores the topography data for the current model domain (topography that has not yet been discretized in the vertical to coincide with eta surfaces).

The remaining items in this file should not be changed, as most of these logical switches are obsolete or currently are not working.

2a) edit the file *new\_prep.sh* and define the variable *head* at the top of the script to the value appropriate to the hardware being used. Most machines use “fort.” to represent symbolic links, while HP’s use “ftn”.

2b) enter the command: **new\_prep.sh**

This script runs programs that generate a topography file and the initial and lateral boundary conditions. The topography need only be generated once per domain, so the line of the script running *etatopo.exe* could be commented out if the same domain is being run repeatedly (the output topography is stored in the **TOPO\_OUT** file defined above and will be overwritten each time that *etatopo.exe* is run). This script generates two files of standard output, *topo.out* and *initbc.out*.

3) enter the command: **cd ../runs**

4) edit the *fcstdata* file

```
&FCSTDATA
TSTART=00.0,TEND=24.00,TCP=99.0,RESTR=.FALSE.,SUBPOST=.FALSE.,
NMAP=5,TSHDE=00.0,06.0,12.0,18.0,24.0,99.0,99.0,99.0,99.0,
          99.0,99.0,99.0,99.0,99.0,99.0,99.0,99.0,99.0,
          99.0,99.0,99.0,99.0,99.0,99.0,99.0,99.0,99.0,
          99.0,99.0,99.0,99.0,99.0,99.0,99.0,99.0,99.0,
          99.0,99.0,99.0,99.0,99.0,99.0,99.0,99.0,99.0,
SPL=10000.,15000.,20000.,25000.,30000.,35000.,40000.,45000.,50000.,
      55000.,60000.,65000.,70000.,75000.,80000.,85000.,90000.,92500.,
      95000.,100000.
```



```
NPHS=8,NCNVC=8,NRADSH=1,NRADLH=2,NTDDMP=1,  
TPREC=6.0,THEAT=6.0,TCLOD=6.0,  
TRDSW=6.0,TRDLW=6.0,TSRFC=6.0  
&END
```

TEND: Sets the forecast length in hours.

NMAP: Specifies the number of times for which the model will create output files.

TSHDE: List of the forecast hours for which the model will generate output. The model will only consider the first NMAP values in the list, so do not worry about the long list of 99.0 values.

SPL: These are the pressure levels (in Pa) for which isobaric output will be generated by the post-processor. The number of levels should equal the LSM value defined in the *parmeta* file used when compiling the post-processor.

NPHS: The frequency in fundamental model timesteps of calls to the physics package. The physics are typically run less frequently (with a larger number of timesteps between physics calls) as the resolution increases and the timestep shortens. NPHS is typically set to an even number such that  $NPHS \times DT$  is approximately 600 (surface physics run every  $\approx 10$  minutes). For a 10 km resolution run with a 20 second time step, the surface physics are run every 30th timestep and  $NPHS = 30$ .

NCNVC: The frequency in timesteps at which the convective parameterization is called. Should be set to the same value as NPHS.

NRADSH,NRADLH: The interval in hours between calls to the radiation schemes (shortwave and longwave). These values are typically 1 and 2, respectively.

NTDDMP: The frequency in fundamental timesteps that the divergence damping is applied (typically 1).

The remaining values specify the number of hours over which the following types of parameters accumulate prior to being reset to zero. They should be set considering the frequency at which output is generated (i.e., resetting precipitation totals every 2 h will be problematic if output is generated every three hours).

TPREC: precipitation

THEAT: average latent heating associated with precipitation

TCLOD: average cloud fractions

TRDSW: short wave radiation

TRDLW: long wave radiation

TSRFC: surface fluxes (e.g., average sensible heat flux)

5) enter the command: **run.com** or **run.com out**

The first option will start the model running with output listed to the screen, while adding the argument *out* to the command will direct the standard output to the file *eta.out*.

As the model runs, it will generate *restrt* and *rdtnd* files (with names such as *restrt00.t00s* and *rdtnd00*) The *restrt* files are the important output, as they contain the information used by the post-processor. The *rdtnd* files are radiation tendencies and are not used.

## The post-processor

1a) Set the variable *head* in the script file *outjob\_special*. Most machines require this to be set to “fort.”, while HPs need this to be “ftn”.

1b) Run the post-processor with the following command:

```
outjob_special stime etime tint
```

where *stime* is the starting time (typically 00), *etime* is the final forecast hour, and *tint* is the interval at which restrt files were created during the run.

### Controlling the post

The *cntrl.parm* file (unit 14) controls the fields and levels that are written to the output GRIB file. Each parameter is controlled by two lines in this file. The first line describes the field, sets the Q and S values (no longer used by the post), and defines the precision and smoothing.

SCAL defines the precision that is written out to the GRIB data. Positive values give the number of significant digits to maintain, while negative values describe binary scaling (precise to  $2^{SCAL}$ ;  $SCAL = -3.0$  gives output precise to the nearest  $\frac{1}{8}$ ). Higher resolution runs should output the data with more precision if performing complex diagnostics on the data that involve higher order derivatives (e.g., Q vectors, vorticity advection).

The final item on the first line is the smoothing block SMTH. The first value controls the number of smoothing passes applied to the staggered (where mass and wind points are separate) grid and the second value controls the number of smoothing passes applied to the filled grid (the post “fills” the native grid so there are mass and wind data at all gridpoints). The third value activates a 25-point Black filter on the output grid, which for the workstation post is the filled grid. The Black filter removes small scale features and largely preserves extrema in the data even after multiple applications. As seen in the included *cntrl.parm* file, smoothing typically is not performed on most fields.

The second line controls the output levels (and whether a field will be created at all) by providing on/off switches for the output.

For multi-level data the switches (1 = generate, 0 = do not generate) control which levels to create output for, with the lowest pressure level (furthest from ground) controlled by the leftmost element of the string. This ordering can be reversed by using 2’s in place of 1’s; 2’s make the switches be applied from the ground up. For isobaric data the levels being switched on and off correspond to the SPL values in the *fcstdata* file, and the first LSM values in the string are used. For single level data, the leftmost number is used as the switch (1 = generate, 0 = do not generate).

**Examples** (assuming LSM=39, with SPL values defined every 25 hPa from 50 hPa to 1000 hPa):

```

(MESINGER MEAN SLP ) Q=( 8), S=( 138), SCAL=(-0.1), SMTH=(00 00 00)
L=(10000 00000 00000 00000 00000 00000 00000 00000 00000 00000 00000 00000)

(TEMP ON PRESS SFCS ) Q=( 16), S=( 8), SCAL=(-3.0), SMTH=(00 00 00)
L=(00000 00000 00000 00000 00000 11111 11111 11110 00000 00000 00000 00000)

(TEMP ON PRESS SFCS ) Q=( 16), S=( 8), SCAL=(-3.0), SMTH=(00 00 00)
L=(22222 22222 22220 00000 00000 00000 00000 00000 00000 00000 00000 00000)

(SPEC HUM ON ETA SFCS) Q=( 95), S=( 149), SCAL=( 2.7), SMTH=(00 00 00)
L=(22220 00000 00000 00000 00000 00000 00000 00000 00000 00000 00000 00000)

```

### Translations:

The first output field is a special sea level pressure reduction designed for use with the Eta model.  $SCAL = -0.1$  specifies that the value is stored to a precision of  $2^{-0.1}$ , or pretty close to the nearest Pa.

The second example is isobaric temperature. The initial 25 0's turn off output of this field between 50 hPa and 650 hPa, and then subsequent 14 1's turn on output between 675 hPa and 1000 hPa.  $SCAL = -3.0$  writes out the data to the nearest 0.125.

The third output field is identical to the second, but by using 2's instead of 1's it is clearer that output is being generated for the 14 output pressure levels closest to the ground.

The fourth output field is for specific humidity on Eta surfaces. The 2's indicate that the output switches are working from the ground up. Thus data will be written for the four lowest Eta surfaces above ground.  $SCAL = 2.7$  will maintain 2-3 significant digits (higher levels of precision create larger GRIB files, fractional values approach the precision of the next higher integer value but store fewer bits).

### Adding a field

Many more fields are included in a sample file *cntrl.example*; the easiest way to add a field is to copy one of these into the *cntrl.parm* file. The file *AVBL\_RAWD* in *worketa/post* lists all fields available for posting, but in a different format.

Suppose a posting of highest freezing level data is desired. Searching through the *AVBL\_RAWD* file finds the proper two lines.

```

DATA IFILV(165),AVBL(165),IQ(165),IS(165)
& /1,'HIGHEST FREEZE LVL ',007,204/

```

The crucial piece of information from above is actually the character string in quotes on the second line. The numbers listed after the character string (7 and 204 above) give the GRIB specification of the field described by the character string. The first value is the GRIB parameter number (007 = geopotential height) and the second is vertical coordinate (204 = highest tropospheric freezing level; this is a special NCEP definition). The number preceding the character string on line two is a switch that indicates whether the variables are stored on mass (1) or wind (0) gridpoints.

To add this field into the *cntrl.parm* file, this character string (including any spaces) is placed between parenthesis on the first line of the *cntrl* file. Proper formatting is crucial in the *cntrl.parm* file; make sure any lines added match the format of the other lines in the file. Q and S can be set to any value as they will be replaced by the GRIB definitions described above as the program runs. For this example they are set to the GRIB values. Scaling and smoothing are set to their desired values, and since this is “single level” data, only the leftmost element of the second line is set to 1. The lines added to the *cntrl.parm* file would look something like this:

```
(HIGHEST FREEZE LVL ) Q=( 7), S=( 204), SCAL=(-2.0), SMTH=(00 00 00)
L=(10000 00000 00000 00000 00000 00000 00000 00000 00000 00000 00000 00000)
```

### Interpolation to other grid projections

The workstation post creates GRIB output on the native e-grid (files with names like *EGRD3Dhh.t00s*), but this output on the rotated latitude-longitude projection of the Eta model is not readily degribbed by most software packages. The *outjob\_special* script uses the included GRIB utility *copygb* to interpolate the native grid data onto regular lat-lon (*latlon\_hh*) and Lambert Conic Conformal grids (*lmcb\_hh*), where *hh* represents the forecast hour. These interpolated GRIB files on standard map projections should be much easier to degrib.

One item to point out about *copygb* is that the binary precision specified in the *cntrl.parm* file will not automatically carry over to the *copygb* output files. The *copygb* lines within the *outjob\_special* script specify a scaling though the “-s” flag, but this scaling is applied equally to all fields. This indiscriminate scaling might make the *lmcb* and *latlon* files unnecessarily large. A way to maintain control over the precision of various fields is to use more decimal scaling (*SCAL* > 0) in the *cntrl.parm* file. Decimal scaling from the original *EGRD3D* file will automatically carry over to the interpolated GRIB fields without using a “-s” option. A possible solution is given in the *cntrl.dec* file which avoids using binary scaling. To use decimal scaling exclusively the following changes would need to be made to the *outjob\_special* file: 1) change the symbolic link from *cntrl.parm* to *cntrl.dec*; 2) remove the “-s” 2,-3” from the *copygb.x* lines. This purely decimal scaling option was not thoroughly tested, so it may require some tuning by the user.

The file *outjob.input\_lat* contains a string of numbers beginning with 255 that describes the lat-lon output domain. These numbers have the format:

```
255 0 IDIM JDIM LAT1 LON1 128 LAT2 LON2 DLAT DLON 64
```

where

IDIM, JDIM: The dimensions of the output regular lat-lon grid. These values should not be confused with the IM and JM of the model.

LAT1, LON1: The latitude and longitude of the southwest corner of the output grid. The values are expressed in millidegrees. For example, a corner point at 15°N, 112.5°W would be expressed as 15000 -112500.

LAT2, LON2: As with LAT1, LON1, but for the northeast corner of the output grid.

DLAT, DLON: These are the spacings between output gridpoints in millidegrees of latitude and longitude, with a default value of 250.

The file *outjob\_input\_lmhc* has a slightly different string of numbers:

```
255 3 IDIM JDIM LAT1 LON1 8 CLON DX DY 0 64 TLAT1 TLAT2
```

where

IDIM, JDIM: These are the dimensions of the Lambert Conformal grid.

LAT1, LON1: The southwest corner specified as in the lat-lon output grid.

CLON: The center longitude of the lambert conformal projection. It will default to be the same as TLM0D (the center longitude of the model).

DX,DY: These are the grid spacings at the true latitude in the X and Y directions. Values are expressed in meters, and default to the approximate spacing of the filled native e-grid (with both mass and wind data at all points).

TLAT1, TLAT2: These are the “true latitudes” of the lambert conformal projection. By default they both are equal to TPH0D (the center latitude of the model).

These values should provide sufficient information to “degrib” the data regardless of the software package being used.

- There is a great deal of flexibility built into the post-processor. Unused data can be eliminated by commenting out any unneeded portions of *outjob\_special* (e.g., eliminate the latlon or lmhc output). Fields or levels that are not needed can be controlled through the *cntrl.parm* file. The “outjob\_input” files can be edited to create output for a specific domain.

#### Aside for GEMPAK users:

A simple degribbing script compatible with GEMPAK is included in the package. Running *outjob\_special* with five arguments instead of three will automatically degrib either the lmhc or latlon data into a GEMPAK datafile in the directory *worketa/gem\_out*. The fourth argument is either lmhc or latlon, and the fifth argument is the name of the GEMPAK datafile.

EXAMPLE: To run the post for 12 h worth of data, with output every 3 h, and to degrib the Lambert Conformal data into the file *lmhc\_test.grd*, the following command would be used:

```
outjob_special 00 12 03 lmhc lmhc_test.grd
```

## Appendix: Automating the process

If the workstation Eta were to be run in real-time over the same domain, the editing process on the *ETAIN* file would become tedious. After all, the only items being changed are date specifications. A crude sample of how the process can be automated is included with the files *ETAIN\_raw* and *new\_prep.sh\_auto* in the *worketa/eta/bin* directory. The script *new\_prep.sh\_auto* uses the command *sed* to substitute the current date for variables in the *ETAIN\_raw* file, and output the *ETAIN* file. To facilitate running *new\_prep.sh\_auto* as a crontab job it was required to change directories to an explicit path (equivalent to *worketa/eta/bin*) so the relative paths in the rest of the script would make sense. Similar directory specifications are needed for the “data-prep” job in *worketa/dprep/bin* and with *run.com* in *worketa/eta/runs*.

## Appendix: The digital filter

The Eta model has a filter that can be applied at the beginning of the forecast to give smoother fields over the first few hours of the forecast. To use it, the call to DIGFILT in *worketa/eta/src/model/EBU.f* at line 253 needs to be uncommented. Then in *worketa/eta/src/model/DIGFILT.f* the parameter NTIM needs to be set. NTIM is the number of timesteps that the model will integrate forward and backward from the 0 h forecast time. Larger values of NTIM will cut off lower frequency phenomena, and will provide more smoothing of the fields. Overly large values of NTIM will cause the model to fail. A good starting point for NTIM is a value that will give  $\text{NTIM} \times \text{DT} \approx 2400$  s. Filtering is most useful when going from a coarse initial analysis to a very high resolution Eta model run. Filtered and unfiltered forecasts converge fairly quickly; filtered runs may give more aesthetically pleasing results during the initial 3-6 h of the forecast (the part of the forecast where the accuracy of workstation model results are most questionable).

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