

nc2grib

Operations Guide

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NC2GRIB – GFE NetCDF to GRIB1 Translator
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1. Overview

The nc2grib routine converts a NetCDF file in the format created by the Graphical Forecast Editor (GFE) ifpnetCDF command to a GRIB1 file. That file will then be used by FEWS import operations as part of the forcings input data. This document covers the process, installation, configuration, and operational use of nc2grib. In addition, a short overview of the GFE ifpnetCDF command, sample script, and explanations of error/warning messages are provided.

nc2grib can only be used for the following physical elements:

- a. Precipitation (forecast and observed)
- b. Temperature (forecast and observed)
- c. Potential Evapo-Transpiration (forecast/observed)
- d. Freezing Level (forecast/observed)

Note that nc2grib currently treats temperature data as “generic” temperature (code = 11) and does not distinguish max and min temperatures.

NWRFC generates NetCDF files in MPE and sends them to nc2grib to generate the grib files while other sites generate grib files directly from MPE. The reasons they give for doing this are:

- a. It is much easier to control the naming convention of grib files via nc2grib and it conforms with the other grid namings from GFE that need to be rendered.
- b. It reduces storage requirements by saving a single NetCDF file in lieu of the many .grib files that follow. One can generate any .grib file necessary on demand with NetCDF.

2. Update History

In October 2011, Bob Wavrin (NCRFC) requested that nc2grib be modified to allow for 15 days' worth of data. The FogBugz case number associated with this request was 446.

His description of the problem:

"What I do here is create a MaxT/MinT for each day so that the NetCDF is only a day long and I have 15 different NetCDFs for each T type. I then pass the start/end dates to nc2grib. If you want me to create one big 15 day file I can do that or I can just put the 15 individual files in the /home/ncfuser directory. Just let me know. It will take a few minutes to create the 15 day NetCDF."

According to Dave Miller (original author of the code), the original requirement was to handle 10 days' worth of data. This is in line with the max number of days used by

MPE/DailyQC. According to Dave, there are a number of instances of hard coded values of 240 (10 x 24 hrs) in the code.

In October 2011, the nc2grib code was modified to add the **nc2g_num_days** token which specifies the number of days to process. The default value (if token is not defined) is 10. The hard coded values of 240 were replaced by a variable whose value is (num_days * 24).

In November 2011, the nc2grib code was moved to the OHD Core package in the CHPS repository and the version number of the nc2grib code was changed to follow the CHPS build numbers. Use of the previous version number was dropped.

In March 2012, users at BPA discovered that the fix described above generated grib files with correct filenames but that the files contained forecast times which were incorrect. Another code fix was made to nc2grib and BPA verified that both the filenames and the contents were correct.

In August 2012, MARFC reported problems converting NetCDF files generated by AWIPS-II. The below is an e-mail from Joe Ostrowski:

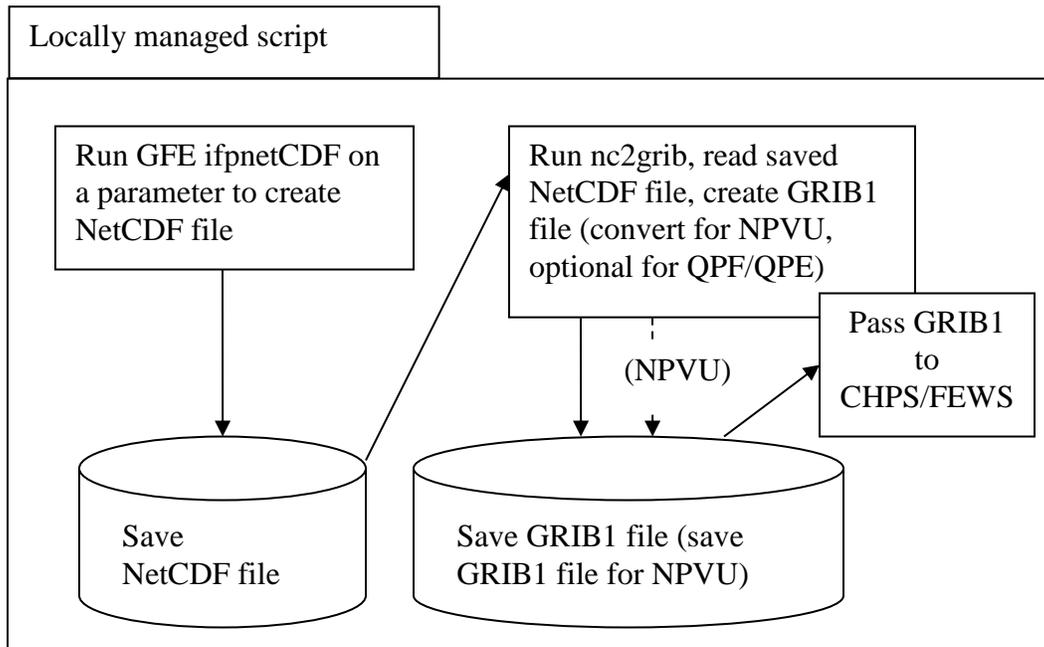
"Prior to the May release of AWIPS 2, the order of variables in the A2-generated file was reversed from that in AWIPS 1, that is, the history variable came first followed by the data variable. This prevented nc2grib from doing its job as it presumes the data variable is always the first one."

I (Dan Stein) was assigned to investigate this issue and modify nc2grib so that it would read variables from the NetCDF files regardless of their order. After conferring with Dave Miller, we saw that `variableID[0]` was hard-coded in the program file `main_nc2grib.c` so that only the first variable in the NetCDF file was examined. If there was no match, the program printed an error message and exited.

I modified the tool to begin with `variableID[0]` and search through all the variables in the NetCDF file (inside a while loop), looking for a match with the variable specified in the `gfe2grib.txt` configuration file (see 5. `gfe2grib.txt` configuration file Structure below). My changes were mostly confined to lines 926 – 1002 in `main_nc2grib.c`.

On October 2, 2012, we delivered the modified nc2grib to Joe Ostrowski (MARFC) for testing before delivering it to a wider audience. As of this writing, the plan is to deliver the updated version of the tool along with the next CHPS release (4.0.1).

3. GFE NetCDF to GRIB1 Process using nc2grib:



This diagram displays the process flow of converting a GFE NetCDF file to GRIB1 using nc2grib:

- Routines are called and data is passed within a locally managed script. This script is created by the site so the nc2grib executable can be tailored to operations.
- After establishing any required environmental variables, the script first calls the GFE ifpnetCDF command to create the NetCDF file for a particular GFE parameter, e.g., QPF, temperature.
- The resulting NetCDF file is saved to a predetermined place on disk.
- The script next calls the nc2grib command with the specified site options.
- The resulting GRIB1 file(s) are saved to disk. In addition, for precipitation products, nc2grib will create a GRIB1 file for distribution to National Precipitation Verification Unit (NPVU) if desired.
- The GRIB1 file(s) will then be imported into CHPS/FEWS.

4. Installation

- Copy the executables **nc2grib.LX** and **copygb.LX** from the ftp location on your AWIPS system, possibly /home/ncfuser, to /awips/hydroapps/precip_proc/bin. (The **copygb.LX** executable is a “helper” routine called by nc2grib and makes it possible to convert the precipitation grids on the site’s grids to the grid used by NPVU)
- Create a new directory, /awips/hydroapps/precip_proc/local/data/app/nc2grib.
- Copy the **gfe2grib.txt** file to the /awips/hydroapps/precip_proc/local/data/app/nc2grib directory. The location of this file may change but for now, the program is looking for it at this location.

- d. (See section 7.1. Pertinent tokens which should be set:) In the `.Apps_defaults_site` file, create a **fewsgrib_dir** token and define that directory according to your FEWS directory configuration (as this project progresses, this may change). This is the default directory for the GRIB files if another path isn't specified via command line options.
- e. In the `.Apps_defaults_site` file, create an **nc2g_app_dir** token and point it to the `/awips/hydroapps/precip_proc/local/data/app/nc2grib` directory. This gives `nc2grib` the path to the **gfe2grib.txt** file.
- f. In the `.Apps_defaults_site` file, create a **netcdf_dir** token and define that directory. This will provide the `nc2grib` command a default location for the NetCDF files should one not be specified via command line options.
- g. Optionally, in the `.Apps_defaults_site` file, create the token **nc2g_num_days** which specifies the number of days to process. The default value (if token is not defined) is 10 days. NOTE: If more than 10 days of data will be processed, the GRIB time range indicator (column 4, described below) should be set to the value of 10.

5. gfe2grib.txt configuration file Structure

This configuration file is used to match the process ID given on the command line (described below and in section 7. Command Line Usage) with the GFE parameter named by the site so that the various GRIB parameters can be read in and used to properly form the GRIB message. An example `gfe2grib.txt` file is:

```
# This is a comment
QPF6 QPF_SFC      180 61 3 4 1
QPF1 QPF1hr_SFC  180 61 3 4 1
QTE  T_SFC        30 11 2 3 1
QTF  T_SFC        30 11 2 3 1 # This is another comment
EPE  PotET_SFC    30 57 3 0 1
EPF  PotET_SFC    30 57 3 0 1
FZE  FzLevel_SFC  30  7 2 0 1
FZF  FzLevel_SFC  30  7 2 0 1
QPE  qpe_grid     172 61 3 4 1
```

As of version 3.1, comments are allowed in the `gfe2grib.txt` file as long as the comment is on its own line or follows the seven columns of information. The comments must start with a '#' sign and must not be located in between the columns. When `nc2grib` processes the file, the comments will be ignored if placed properly. On any given line, all information after the '#' sign will be ignored.

The first line in the file is used to describe the different fields:

- **QPF6** – This is the process ID given on the command line when running `nc2grib`. It is matched against the GFE parameter name described next and then used to retrieve all the GRIB values in the line. This process ID is named by the site/user locally, although the defaults can be used as-is. Note that there must not be

duplicate process IDs in this column and that the length of this ID should not be more than 10 characters.

- QPF_SFC – This is the name of the data variable encoded from GFE. Some of these will be the default value assigned by GFE. However, sites can also create others as needed with site-specific names (contained in localConfig.py). Note that the length of this name should not be more than 19 characters. To see a summary of the contents of the NetCDF file, including the data variables inside, type:

```
ncdump -h <NetCDF file name>
```

The next five numbers are GRIB parameters:

- 180 – This is the GRIB generating process. 180 is a special case that designates QPF. This code should be used for QPF files sent to NPVU. The value of 30 indicates forecaster-generated and is a generic all-purpose value if other values in the GRIB tables don't match.
- 61 – This is the GRIB parameter value, in this case Accumulated Precipitation. In the example gfe2grib.txt file above, the GRIB parameter value of 11 is Temperature, 57 is Evaporation, and 7 is Geopotential Height. At present, the process IDs should relate to one of these four GRIB parameters.
- 3 – The GRIB decimal precision; in this case 3 decimal places.
- 4 – The GRIB time range indicator, in this case, the value of 4 represents Accumulation. This value is used to determine the valid time of the product. The other values shown in this column, 3 and 0, indicate Average and Observed respectively. The time range indicator is important in determining grid reference and valid times. NOTE: For cases of more than 10 days of data, set this parameter to 10. See the discussion of token **nc2g_num_days** above.
- 1 – The GRIB time unit. In most cases this is an hour as specified here. However, it could be different for specific parameters.

Note that the last line in the example gfe2grib.txt listing has a QPE process ID. For sites able to use DailyQC for QPE grids, here is the value that should be used for the GRIB generating process:

172 – For Daily QC grids (6 and 24 hour). Note that 172 can be used for other QPE grids that don't fit into other QPE processes.

These values and others can be found in the /awips/fxa/data/grib2Models.txt file on the AWIPS system. Note that for MPE QPE, these processes are listed:

160 – For 1 hour MPE grids automatically generated

161 – For 1 hour MPE grids manually generated

However, the MPE NetCDF files are not currently in the same format as those produced by the ifpnetCDF command. This may change in future versions.

These numbers are subject to change depending on how they need to be defined for FEWS. However, it's recommended that the following numbers be used for the indicated processes as these determine correct valid times and match the GFE parameter with the GRIB parameter number.

```
Forecast precipitation:          180 61 3 4 1
Observed precipitation:         172 61 3 4 1 (for 6 to 24 hour Daily QC)
Observed precipitation:         161 61 3 4 1 (for 1 hour MPE, manual)
Temperature:                    30  11 2 3 1
(forecast/observed)
Potential Evapo-Transpiration
(forecast/observed) :          30 57 3 0 1
Freezing Level:                 30  7 2 0 1
(forecast/observed)
```

For more information on the various tables used for formatting GRIB messages, see NCEP Office Note 388: <http://www.nco.ncep.noaa.gov/pmb/docs/on388/>

6. ifpnetCDF Command Overview

The nc2grib executable has been tailored to read a NetCDF file produced by the GFE ifpnetCDF command or by other applications using the same format. It comes with the GFE package and its purpose is to create a NetCDF file from the GFE database. Usage of the ifpnetCDF command can be found in the GFE on-line help or here:

<http://gfsuite.noaa.gov/AWIPS/ob7.2a/doc/onlinehelp/ifpnetCDF.html>

NOTE that this command would be called AFTER the particular grids have been created.

6.1. Basic ifpnetCDF command structure:

```
ifpnetCDF -o (NetCDF filename) -d (GFE database ID) -p (parameter ID) -s (start time)
-e (end time)
```

For example:

```
ifpnetCDF -o TUAQPF_2009040100f024.cdf -d TUA_GRID__Fcst_00000000_0000
-p QPF -s 20090401_1800 -e 20090402_0000
```

As the diagram in section 2 indicated, the ifpnetCDF command would normally be called within a script which contains the necessary output file path, GFE parameter, and start/end times of the parameter grids in script variables. The usage of ifpnetCDF depends on site GFE parameters (standard and site-defined) and whether the resulting NetCDF file contains multiple grids or not. The latter is controlled by the type of parameter and the start/end times.

Examples:

This will save one six-hour QPF grid to the NetCDF file:

```
ifpnetCDF -o TARQPF_2009040100f024.cdf -d
TAR_GRID_Fcst_00000000_0000 -p QPF -s 20090501_1800 -e
20090502_0000
```

This will save a NetCDF file with forecast temperature grids (GFE parameter “T”) valid within the time period of May 30, 2009 to June 8, 2009:

```
ifpnetCDF -o ptr.t1hr.2009-05-30.12z.cdf -d
PTR_GRID_Fcst_00000000_0000 -p T -s 20090530_1200 -e 20090608_1200
```

7. Command Line Usage

This version of nc2grib contains a completely revamped command line usage which offers sites more flexibility with regards to input/output paths and filenames. Note that its use is intended within a locally managed script with the arguments to the options below as script variables.

Usage:

`./nc2grib.LX -n (input NetCDF path) -i (NetCDF file) -t (output grib path) -o (output grib file) -b (basis time) -p (process ID) -g (one GRIB filename) -q -f -r -N -v -h`
where:

-n (input NetCDF path) Optional, requires argument	Refers to the path containing the NetCDF file generated by the GFE routine ifpnetCDF. If not used, the token netcdf_dir will be used to retrieve this information.
-i (input NetCDF file) Required, requires argument	Refers to the NetCDF file generated in the format used by the GFE routine ifpnetCDF. NOTE that this command line option and its argument must be specified in the call to nc2grib.
-t (output grib path) Optional, requires argument	Refers to the path of the GRIB file(s) generated nc2grib. If not used, the token fewsgrib_dir will be used to retrieve this information.
-o (output grib file) Optional, optional argument	Refers to the GRIB file generated by nc2grib. If this option is not specified or specified without an argument, then the input file name without the .cdf extension will be used to form the output filename.

Example: -i QPE6hr.cdf will result in QPE6hr_YYYYMMDDHHhNNN.grb being produced (with date/hour characters filled in).

-b (basis time in YYYYMMDDHH Format)
Required for forecast grids, requires argument

Refers to the basis time for forecast GRIB files. Used primarily for forecast grids and QPE grids being sent to NPVU.

Example: -b 2009051412

-p (process ID)
Required, requires argument

Refers to the parameter process ID relating to a GFE parameter such as QPF. Needs to match against a process in the gfe2grib.txt configuration file. **NOTE that this command line option and its argument must be specified in the call to nc2grib.**

-q (QPE flag)
Required for QPE grids being sent to NPVU

This indicates that the process specified by -p is an estimated/observed grid where the time determinations of the grid correspond to those expected by NPVU. This option is most likely used for QPE grids and is required in that case. Otherwise, the degribbing scripts at NPVU can't read the grids properly.

-g (one GRIB file flag)
Optional, requires argument

If one GRIB file for all grids is desired, specify this flag on the command line with an output file name that will be used to combine all individual GRIB files into one.

-f (format flag)
Optional

Tells the routine to use the grid's valid time within the filename format specifiers instead of basis time information. Note that this option or lack thereof has no effect if the routine assigns a default filename format.

-r (reverse flag)
Optional, can be used in conjunction with -b and -q options

Used in conjunction with -b and -q options and formatted output (see examples for output file), this flag tells nc2grib to put the hours past basis time before the period interval within the formatted filename. Otherwise, the default is that the period interval comps before the hours past basis time. No effect if -f option is used.

-N (NPVU file flag)
Optional, used for NPVU GRIB

Tells nc2grib to also generate a QPF forecast GRIB with an appropriate WMO header so that it can be read and used by NPVU.

-v (verbose debugging flag) Optional	Optional flag used to print out expanded debugging information for each GRIB1 file.
-h (display help flag) Optional	Displays a usage help message

7.1. Pertinent tokens which should be set:

(Refer to section 4. Installation for a discussion of these tokens)

nc2g_app_dir - contains the directory where the gfe2grib.txt file is located.

fewsgrib_dir - contains a default directory location for generated GRIB files. If not overridden by the -t option above, it MUST be specified for nc2grib to run.

netcdf_dir - contains default location of the generated NetCDF files. If not overridden by the -n option above, it MUST be specified for nc2grib to run.

Examples:

(within a script)

```
export netcdf_dir=/awips/hydroapps/rfc/public/gfe_netcdf
export fewsgrib_dir=/awips/hydroapps/rfc/pulbic/fews_gribdir

./nc2grib.LX -n $netcdf_dir -i ptrObsT1hr_2009041411.cdf -t
$fewsgrib_dir -o ptr.oGRID.T%%dhr.%Y-%m-%d.%Hz -p QTE -v -f > debug.txt
```

will read a NetCDF file from the /awips/hydroapps/rfc/public/gfe_netcdf directory (which in this case contains 1-hour observed values from NWRFC) and output the resulting GRIB file (or files if the NetCDF file contains more than one grid) to the /awips/hydroapps/rfc/pulbic/fews_gribdir. The output filename contains site-specified formatting within the filename prefix which follows the -o option and is indicated by the presence of the percent symbols (%). Details about this site-specified formatting are discussed in section 7 below. The -f option indicates to use the grid valid time when substituting date/time information in the filename prefix. So, in the above example if the QTE is 1 hour, the final file name will be ptr.oGRID.T1hr.2009-05-11.12z.grb. The QTE process ID will be matched to the corresponding temperature GFE parameter. The -v indicates verbose debugging information is desired and all output will be saved to debug.txt.

```
./nc2grib.LX -n $netcdf_dir -i precip_fwr_grid_2009051400.cdf -t $fewsgrib_dir
-b 2009051400 -o QPF.FWR.%%03dhr.%Y-%m-%d.%Hz -p QPF -N -v
```

Much like the previous example, this will create a secondary file for NPVU as indicated by the -N command line option. The filename will contain the format indicated plus “_NPVU” in the filename. Note the use of basis time in the command line for the forecast grid(s). As the -f option is not indicated here, the basis time will be substituted in the site-

specified formatting. In this instance for a 24 hour forecast grid within the NetCDF file, the final output filename would be:

```
QPF.FWR.024hr.2009-05-14.00z.grb
```

8. Output Files

8.1. With -o command line option

Specifying the -o command line option allows for customizing output filenames that makes sense to site operations. Note that in all cases, some sort of date/time formatting must be included in the filename as the NetCDF file may contain multiple grids and attaching or specifying date/time information will prevent overwriting of output files with the same name. The following examples describe this in more detail:

8.1.1. Filename prefix, no date/time information

```
-o tar.6hrQPF
```

This will add a prefix to the default date/time group used by nc2grib. An output file will then have the format in this example of tar.6hrQPF_YYYYMMDDHHhFFF.grb, where YYYY is the year, MM is the month, DD is the day, HH is the hour, and FFF is the number of forecast hours past the basis time.

8.1.2. Site-specified date/time format and number of hours

8.1.2.1. strftime function date/time format conversion values

```
-o ptr.fgrid.qpf_f%%03d.%Y-%m-%d.%Hz
```

For the moment, ignore the “%%03d” part above. It will be discussed after this section. Following the date/time format conversion specifics in the strftime function (see manual page on your Linux system for strftime, i.e. man strftime at the command prompt), these allow sites to specify how and where date/time information are displayed in the output filename(s). So, if this is QPF valid at 6z, June 1, 2009:

```
ptr.fgrid.qpf_f%%03d.2009-06-01.06z.grb
```

The most common strftime format conversion values are:

- %Y 4-digit year
- %m 2-digit month
- %d 2-digit day of month
- %H 2-digit hour (24-hour format)

Others are listed on strftime's manual page. **Be advised, however, not all may work for nc2grib (%D for instance).** Creation of the GRIB filename will fail in these instances.

8.1.2.2. Forecast hours, hours past basis time

Now, the “%%03d” portion in 8.1.2.1. strftime function date/time format conversion values above designates either the number of forecast hours of the grid or the number of hours past basis time for estimate/observed grids. **NOTE: One such string with double percent symbols (%%) should exist in the output filename template, especially if the basis time is specified on the command line. In the case where there is no “%%” in the filename template and the basis time is included, the routine will use a default filename instead and warn that it has done so.**

The “0” indicates to pad the field width of “3” with zeros if the resulting value length is less than that. So, if this is the 24 hour forecast, the resulting filename would be:

```
ptr.fgrid.qpf_f024.2009-06-01.06z.grb
```

Another valid representation would be to use “%%d” instead:

```
ptr.fgrid.qpf_f%%d.2009-06-01.06z.grb
```

This would result in:

```
ptr.fgrid.qpf_f24.2009-06-01.06z.grb
```

PLEASE NOTE: One of these formats should be used as others may cause spaces to be produced in the resulting filename. nc2grib will fail should this occur.

In addition, if this is the valid time of the grid, the -f option needs to also be specified.

8.1.2.3. Period time interval for NetCDF files created by MPE DailyQC

If one wishes to specify the basis time within the filename template and one is converting a NetCDF file from MPE DailyQC (which contains QPE grids), an area within the filename template has to also contain the period time interval in the same manner as the hours past basis time:

```
qpe%%02d_mpe_%%03dhr_%Y%m%d_%H
```

Normally, not specifying the period time interval when this is a forecast grid or using the -f option for valid time in the filename wouldn't cause a problem. However, MPE

DailyQC produces four 6-hour and one 24-hour QPE grids within the same NetCDF file, with the last 6-hour having the same number of hours past the basis time as the 24-hour QPE grid. So, without designating a place for the period time interval, the 24-hour QPE grid would overwrite the last 6-hour QPE grid as it's possible they would have the same filenames. By designating the period time interval, the last two filenames according to the template above would be:

qpe06_mpe_024hr_20090601_12.grb

qpe24_mpe_024hr_20090601_12.grb

if basis time were 2009060112. One can reverse the order of the period time interval and the number of hours by specifying the -r option in the command line.

8.2. Without -o command line option

As the -o command line option is optional, the nc2grib routine has a default file naming convention should the -o option not be used or if -o is used without an argument. This will be based on the input NetCDF filename without the .cdf extension. The default output GRIB1 filenames have the formats:

For estimate/observed grids:

(input filename w/o .cdf extension)_YYYYMMDDHHhFFF.grb

For forecast grids:

(input filename w/o .cdf extension)_YYYYMMDDHHfFFF.grb

(input filename w/o .cdf extension)_YYYYMMDDHHfFFF_NPVU.grb

Where:

YYYYMMDDHH – date/time, e.g. 2009041012. This is the valid date/time for estimate/observed grids and the basis time for forecast grids.

FFF – time interval of observed/estimate grids or the number of forecast hours from the basis time, e.g. 024, 072, 240.

NPVU – designates this as a QPF grid for distribution to NPVU.

8.3. One file containing all GRIB messages, -g option

Specifying the -g option allows for the creation of a file that contains all the GRIB messages created. A filename containing the messages must be specified after the -g option on the nc2grib command line or the program will display the usage statement and exit. **This filename is site-specified and can be anything that's operationally meaningful.** Note that all intermediate, individual GRIB files will be removed after they're combined into this file, so the -o and -f options may not be very useful in this instance.

However, NPVU files described in the next section will still be individually produced and not combined. This is because NPVU expects a unique WMO header before the start of the GRIB message. Each QPF grid is identified by this header. Due to their lower resolution, these grids don't take up as much space as the site GRIB files though.

8.4. National Precipitation Verification Unit (NPVU) files

Specifying the -N option will create an additional GRIB file for precipitation grids that are designated to go to the National Precipitation Verification Unit (NPVU) and the characters “_NPVU” will be added to the resulting filename.

At present, nc2grib will produce QPE and QPF NPVU files with appropriate WMO headers for the 0 to 72 hour time periods. All QPE files will fall under the ZETA98 WMO header. QPF files fall under the YEI?98 and YEI?88 headers where "?" is a wildcard character which indicates the number of forecast hours past basis time. For example, YEIS98 indicates the 48-hour QPF forecast.

If the -N option is specified and the number of forecast hours doesn't match one of the 6-hour forecast time periods, the YEIZ98 header will be used and it signifies that the forecast hours will be contained in the GRIB message.

For QPF, nc2grib converts site grids at their native resolution and projection to the grid that NPVU is expecting, which is NCEP GRID 218 at approximately 10 km resolution.

However, note that for QPE grids, nc2grib is expecting these in the standard HRAP grid size as that's what is sent to NPVU. No conversion is done for QPE at present (could change in a future version depending on test results with NPVU).

8.5. -q option and QPE grids

If nc2grib is processing QPE grids and these are to be also sent to NPVU, the -q option must be specified on the nc2grib command line as well as the -b option with the basis time. This is because NPVU processes these grids in a similar fashion to forecast grids. NPVU is looking for the basis time as a reference and nc2grib will need this information as well. So, the -q option tells nc2grib to determine the reference and valid time GRIB values using the basis time instead of the normal method for estimate/observed grids. While the -q option could be used for other estimate/observed grids, it will more than likely only be needed for NetCDF QPE files which are to be sent to NPVU. Example of command line for QPE grids:

```
./nc2grib.LX -n $netcdf_dir -i precip_ptr_grid_20090805.nc -t $fewsgrib_dir -o qpe%02d_mpe_%03dhr_%Y%m%d_%Hz -b 2009080412 -p QPE -q -N -v > debugptrQPE.txt
```

9. Sample Script

A bare minimum script in Korn shell (called run_nc2grib):

```
#!/bin/ksh
#
# run_nc2grib

# This allows you to call this script from outside of ./precip_proc/bin
RUN_FROM_DIR=`dirname $0`

# set up SOME environment variables for WHFS applications
. $RUN_FROM_DIR/../../set_hydro_env

# GAD_DIR is directory which holds the gad program
(get_apps_defaults.LX)
GAD_DIR=/awips/hydroapps/public/bin

# Create error log file name
logname=`date -u +nc2grib.%Y%m%d%H%M%S`

PPROC_BIN=`$GAD_DIR/get_apps_defaults$OS_SUFFIX pproc_bin_dir`

NETCDF_DIR=`$GAD_DIR/get_apps_defaults$OS_SUFFIX netcdf_dir`

GRIB_DIR=`$GAD_DIR/get_apps_defaults$OS_SUFFIX fewsgrib_dir`

$PPROC_BIN/nc2grib.LX -n $NETCDF_DIR -i precip_ptr_grid_2009051412.cdf
-t $GRIB_DIR -o PTR.QPF.%%dhr.%%Y-%%m-%%d.%%Hz -b 2009051412 -p QPF6 -N -v
-f > $logname

exit 0
```

and to run the script:

```
./run_nc2grib
```

10. Error and Warning Messages

These are the more important error and warning messages one might see in a log file. Not all messages have been listed.

a) Option -x requires a value

Where -x is the option value. This means you've specified a command line option that requires an argument but haven't provided the argument. See Section 7.

Command Line Usage above.

- b) *Unrecognized program command line option: -x*

Where -x is the option value. You've specified an option that's not one of the ones listed in Section 7. Command Line Usage above.

- c) *One or both of the -i (input NetCDF file) or the -p (process ID) option/command line arguments was missing when running nc2grib. These must be specified as inputs to nc2grib at a minimum in order for it to run. Check usage of nc2grib below.*

At a minimum, the input NetCDF file and the process ID have to be specified in order for nc2grib to run as long as the input and output directories are also specified. If either the -i or -p with an argument is missing from the command line, nc2grib will print this error along with a usage description and end.

- d) *"Known GFE NetCDF parameter name not found. Modify gfe2grib.txt file and rerun."*

This means that the GFE process identified in the nc2grib command line wasn't found in the gfe2grib.txt configuration file. Ensure also that the **nc2g_app_dir** token is correctly established and that the gfe2grib.txt file in the directory the token points to is correct.

- e) *"The variable name in the GFE NetCDF file does not match the one associated with the process id in the gfe2grib.txt file. Please specify the correct process id and try again"*

The GFE parameter (second column in the gfe2grib.txt file) doesn't match the GFE variable in the input NetCDF file. Ensure the process on the command line is correct and that the NetCDF file has the correct GFE parameter.

- f) *"Unknown projection read from netcdf...Exiting"*

Presently, nc2grib only handles Polar Stereographic and Lambert Conformal map projections. Latitude/Longitude grids may be handled in the future.

- g) *"The forecast time is either less than 0 or greater than 10 days (240 hours). Therefore, the basis time may not be specified correctly or may need to be specified on the command line according to guidance. Please check your command options or the NetCDF file creation and try again. for debug fcsth = (number of forecast hours)"*

Or:

- h) *"The estimated/observed time period is either less than 0 or greater than 10 days (240 hours). Therefore, valid times within the input NetCDF filename may not have been generated correctly. Or this is actually a forecast grid and the -b option should be used so it will be processed correctly. Check your options and ensure this is an*

estimate or observed grid. You could also try to generate the file again. For debug esth = (time between observed/estimate valid times in NetCDF file)”

These messages alert the user to either an incorrectly generated NetCDF file or the use of the -b option for estimate grids or lack thereof for forecast grids. For forecast grids, the program is keying off the entered basis date/time of the forecast grid(s). Therefore, an error in the basis time format or a lack of the basis time in the command line may cause an error in basis time determination.

For estimate or observed grids, there may be more than 240 grids which are more than what the program is currently designed to process. Or if a basis time was inadvertently specified on the command line, nc2grib will process these grids like forecast grids when they're not, and this error occurs.

There are also instances of logic problems in the routine which have been known to generate this error as well due to a path and filename issue. These errors should be reported for troubleshooting.

i) *"Unknown time range. Check the gfe2grib.txt file”*

This message refers to the sixth column value in the gfe2grib.txt file. As of version 2, there are only three time ranges for the data when putting it into GRIB: 0, 3, and 4. If it's not one of those, then the message above appears.

j) *"All data retrieved from the NetCDF file was missing. Exiting program...”*

For some reason, all the data in the NetCDF file was found to be missing. Check to see that it was created properly.

k) *"DEBUG WARNING: All data retrieved from the NetCDF file was zero."
"This may be normal in the case of QPF”*

As indicated, this is only a warning message but may be correct in the case of QPF and QPE which may have a field of all zeros. Check the creation of the NetCDF file if this behavior is not normal for the particular field.

l) *"NPVU GRIB file could not be opened.”*

Or:

m) *"NPVU GRIB data file could not be opened.”*

When making the GRIB file for NPVU, nc2grib has to copy the GRIB file with the data to a temporary file, create a file with just the WMO header, and then append the GRIB data in the temporary file to that file. The first message is indicating it can't open the file with the WMO header in it and the second is that the temporary data file

couldn't be opened. This may indicate an environmental problem in a script setup of the path and filenames.

- n) *"WARNING: One or more date, time wildcards are missing from the custom output filename. In order to not overwrite files, the following must be used somewhere in the output filename if the -f command line option is used:*

YYYY 4-digit year

MM 2-digit month

DD 2-digit day

HH 2-digit hour

NNN 3-digit time interval

The following appear to be missing:"

When using the -o and -f command line options, the user can specify where the date/time and time interval values can be specified within the output filenames which make sense to their operations. This message will appear if any of those are missing and will indicate to the user which one(s) are missing.

- o) *"While attempting to combine files, there was a problem accessing the first two GRIB filenames.
Therefore cannot combine GRIB files into one as desired.*

Or:

- p) *There was a problem while attempting to combine the GRIB files into one.
If number of GRIB files below equals to 1, won't be done.
For DEBUG purposes, GRIB warn = (a debug variable) and number of GRIB files = (number of GRIB files)"*

These two messages indicate a problem when producing the file of combined GRIB messages. The first indicates a file access problem. For some reason, the program could not retrieve the first two GRIB filenames that should normally have been produced. The second indicates only one GRIB message found and therefore, no need to combine them into the specified filename. Check to make sure the NetCDF file was correctly created with the number of data sets expected during the time frame specified. Support personnel may have to troubleshoot further.

- q) *"The -q option was specified but a basis time was not. Using the -q option indicates this is an estimate product that requires a basis time to correct determine the GRIB reference, period, and valid times. This is commonly used for QPE for NPVU. Please revise your command line options accordingly and rerun the program.*

Exiting..."

When using the -q option, nc2grib requires that the basis time also is specified on the command line.

- r) *"WARNING: If the NetCDF was generated by MPE/Daily QC and is QPE, you need to specify two place holders with %% vs one for forecast grids. This is because the NetCDF MPE/DQC QPE file contains two products valid 24 hours from basis time, a 6-hour QPE and a 24-hour QPE.*

Please check to ensure you formatted your output string accordingly."

Please refer to section 7, output files for a discussion on using basis time within the site-specified output filename for QPE from MPE DailyQC NetCDF file.

- s) *"WARNING: Basis time option was found but the formatted time interval and/or hours from basis time is missing from the input format string. These should have the format of %%0d or %%d in the input format string. This should be included so as not overwrite files.*

A default date/time will be used instead."

If you intended on a custom date/time, please check the pattern for the missing time interval/hours past basis time pattern in your command line and try again.

