U155 Ver. 6a
Quick Startup Guide
(and references)

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1. Introduction

U155 and U405A are the programs we use to perform our gridded analysis. Simply stated, they are complex programs with a lot of options to set. This guide is meant as a sort of "quick-start" guide, and is not, by any means an exhaustive description of these programs, nor a breakdown of exactly how they work. It will however, assist in getting you up and running, and give you an idea of how to switch some of the more important options.

U155 and U405A, although separate programs with separate control files, are essentially one large program, or gridded analysis suite. U155 acts more as the driver for U405A, which is run separately for different elements. The U155 control file is much simpler than the U405A control file for an element, but the 405 control file contains a majority of the options for fine-tuning the analysis.

While allowing for a wide variety of settings and variations in analysis, the U155/U405A suite is fairly easy to pick up and run with. Learning where the various switches and settings takes a little bit longer.

Additionally, the appendices at the end of this guide will help you to view your U155/U405A analyses in ESRI ArcGIS.

2. Basic Control Files and Options of Interest

a. U155.CN

Sample U155.CN file:

```
HRG1 12  0 12  0 17  0 12  8 12 10 12  0  0 14 15 16  0  0 19 20 21  0 12 24 25
THIS IS A FEBRUARY 2007 RUN OF MOS TEMP FORECASTS
         0  KSKIP --SKIP PAST THIS DATE ON OUTPUT
        19  NSKIP --NUMBER OF ERRORS TO TOLERATE ON DAY 1 BEFORE STOPPING
       800  JSTOP --NUMBER OF ERRORS TO TOLERATE BEFORE STOPPING RUN
        06  INCCYL--HOURS BETWEEN CASES
         1  NEW   --1 FOR NEW ICAO CALL LETTERS, 0 = NOT
         1  NALPH --1 FOR ALPHABETIZATION OF CALL LETTERS, 0 = NOT
         0  PXMISS--VALUE TO INSERT FOR 9997
         1  NAREA--VALUE FOR ALASKA AREA
         3  NPROJ--MAP PROJECTION
        95  ORIENT--MAP ORIENTATION
        25  XLAT--LATITUDE AT WHICH MESH LENGTH APPLIES
         5  MESHB--NOMINAL MESH SIZE TO WHICH NX AND NY APPLY
         5  MESHE--NOMINAL MESH SIZE OF TERRAIN GRID
      1073  NX--SIZE OF GRID IN X DIRECTION (ALASKA)
       689  NY--SIZE OF GRID IN Y DIRECTION (ALASKA)
   20.1920  ALAT--NORTH LATITUDE OF LOWER LEFT CORNER OF ANALYSIS GRID  (TAKEN FROM TERRAIN GRID)
  121.5540  ALON--WEST LONGITUDE OF LOWER LEFT CORNER OF ANALYSIS GRID
         5  MESHL--NOMINAL MESH LENGTH OF GRID FOR SUBSETTED AREA FOR CONTINUOUS VARIABLES
         5  MESHD--NOMINAL MESH LENGTH FOR GRID FOR DISCONTINUOUS VARIABLES
         1  NXGMIN--MINIMUM NX VALUE FOR SUBSETTING FOR GRIDPRINTING OR TDLPACKING  NO SUBSETTING FOR WITHHELD
DATA TESTS
      1073  NXGMAX--MAXIMUM NX VALUE FOR SUBSETTING FOR GRIDPRINTING OR TDLPACKING
         1  NYGMIN--MINIMUM NY VALUE FOR SUBSETTING FOR GRIDPRINTING OR TDLPACKING
       689  NYGMAX--MAXIMUM NY VALUE FOR SUBSETTING FOR GRIDPRINTING OR TDLPACKING
        08  NCEPNO--NCEP MODEL NUMBER
        08  IDD--DD FOR OUTPUT
        12  MINVEC--MINIMUM NUMBER OF HOURS TO KEEP VECTOR DATA FOR BACKUP
        00  MINMOD--MINIMUM NUMBER OF HOURS TO KEEP MODEL (GRIDDED) DATA FOR BACKUP
         1  IPRTEL--1 = OUTPUT TERRAIN PER IP22 AND KFILOG; 0 OTHERWISE
         1  ISTA--1 = DIRECTORY WILL BE READ AND STATION ANALYZED; 0 OTHERWISE
         0  ISMPL--NUMBER OF POINTS TO SAMPLE FROM THE FIRST GUESS GRID TO ANALYZE; 0 OTHERWISE
 05    DEFAULT                                                    **DATE LIST ON DEFAULT INPUT.
 99
  08031712
  99999999
 80    /com/gfs/prod/gfs.20080317/mdl_gfsmergesta.t00z            **KFILIN( ) - VECTOR FORECASTS  0 -  84 H
 80    /com/gfs/prod/gfs.20080317/mdl_gfsmergesta.t12z            **KFILIN( ) - VECTOR FORECASTS  0 -  84 H
 50 08 /com/gfs/prod/gfs.20080317/mdl_goemosgrsq.t00z             **KFILIN( ) - MODEL DATA  0 -  84 H
 99
 44    /nwprod/fix/mdl_analysisgrconst                            **KFILRA( ) - RANDOM ACCESS INPUT
 99
 31    output/arc                                                 **KFILIO - ARCHIEVED GRID OUTPUT
 99
 32    output/ascii                                               **KFILVO - GRID OUTPUT FOR GMOS_PLOT
 99
 33    output/dis                                                 **KFILOG - DISPOSIBLE GRID OUTPUT
 99
 34    output/vector                                              **KFILOV - DISPOSABLE VECTOR DATA OUTPUT
 99
 35    output/qc                                                  **KFILQC - QC VECTOR DATA OUTPUT
 99
 36    /nwprod/fix/mdl_granlsta.lst                               **KFILD(1) - STATION LIST
 37    /nwprod/fix/mdl_allsites.tbl                               **KFILD(2) - STATION DICTIONARY NOTE
DIFFERENT UNIT NOS
 99
 38    /nwprod/fix/mdl_granlstation_pairs                         **STATION PAIRS
 99
 99                                                               **KFILNI TERMINATOR
 05    DEFAULT                                                    **KFILP - VARIABLE LIST TO ANALYSIZE ON
DEFAULT INPUT
 99
 05    DEFAULT                                                    **KFILAN - INDIVIDUAL VARIABLE CONTROL
FILES ON DEFAULT INPUT
 99
 39    /nwprod/fix/mdl_mos2000id.tbl                              **KFILCP - VARIABLE CONSTANTS
 99
 40    /mdl1/save/mos/we21gw/u178/station_radii_conus
 99
222020008 000000000 000000048 000  .0000E+00     1 1 1 U405ATMPMOS^^^.CN  40 0 1        TEMPERATURE   (F)
222020008 000000000 000000060 000  .0000E+00     1 1 1 U405ATMPMOS^^^.CN  40 0 1        TEMPERATURE   (F)
   999999
```

Since U155 is the first level of the U155/U405A combo, its control file contains the more general parameters of operation, including the location of input data, output, dates, station list and dictionary, and IDs of elements to be analyzed. The control file is straightforward, and should look fairly familiar.

The long set of values located beneath the IP settings and run descriptor are grid settings, specifying grid size, projection, and other important characteristics. These settings can be left alone for the most part, but must be changed between the CONUS and Alaska (the above settings are for the CONUS).

The next group of settings is fairly standard; date, input files, varying types of output, and station list/table. The primary output to be concerned with is the archived grid output (unit 31), although random access output is also possible, and can be done by adding a pre-created (empty) random access file in the '**KFILRA( ) – RANDOM ACCESS INPUT' section, below the random access constant file (unit 42 should be available). Additionally, a random access file can be used as station data input, by listing it in this same section (I listed it above the random access constant file, with a unit number of 45). The random access file on unit number 44 is the gridded constants file, which contains fields such as the land/water mask and terrain. You'll want to leave that alone.

There are two inputs unique to U155 in the lower part of the .CN file (units 38 and 40). These are the station pairs list and variable radii input file. The station pairs list is generated in U174 (more on this in section 5), and the variable radii file is generated by U178 (see section 6). The variable radii feature will only be used if the U405A control file for the specific element indicates that variable radii should be used (more on this in the next section). Otherwise, fixed radii will be used, also as specified by the U405A element control file. In the future, this input may be moved to the U405A control file, allowing for different variable radii for different elements.

The very last inputs in U155.CN (unless listed in a separate file and indicated in KFILAN) are the IDs and information for the individual elements and projections to be analyzed. One important piece of information included in this area is the U405A control file to be used for a specific element/projection (in the sample file above, both projections of temperature use the file U405ATMPMOS^^^.CN).

b. U405A^^^^^^^^^.CN

Sample U405A Control File (Temperature, U405ATMPMOS^^^.CN):

```
   4   2   4   0   0   0   4   0     40. TEMPERATURE        5   1   0   2   0   NPASS,IFSTGS,IGUESS(1-
4),IBACKN,IBACKL,GUESS,TITLE,NSMTYP,I400ADG,LAPFG,LIMIT,IVRAD
   1  1.00  1.00  1.00  1.00  0  1 +1 99 20000 20000   0 1 1   0 .25  12   1  111111   IQUALC,QUALWT(1-
4),ISETP,ILS,IBKPN,LPNO,HGTTHA,HGTTHB,IWITH,IWSEED,ITYPR,NBLEND,CSTSM,N4P,NCLIP,NSHLHL(6)
   2     0    12     0     0     0              COMBINE UP TO 5 RUNS
        1.    1.    .0    .0    .0              WEIGHTS FOR RUNS (ANALYSIS)
        1.    1.    .0    .0    .0              WEIGHTS FOR RUNS (LAPSE)
 222020000         0         0         0                          ID OF ANALYSIS (TEMPERATURE)
 202020000         0         0         0                          ID OF DATA TO ANALYZE
 212020000         0         0         0                          ID OF FIRST GUESS WHEN IGUESS = 2
         0         0         0         0                          ID OF FIRST GUESS WHEN IGUESS = 3
         0         0         0         0                          ID OF ADDITIONAL FIELD IF NEEDED
         0         0         0         0                          ID OF ADDITIONAL FIELD IF NEEDED
         0         0         0         0                          ID OF ADDITIONAL FIELD IF NEEDED
       5       5       5       5       5                          MESH LENGTHS, MSHPAS, GUESS OPTION 1
       5       5       5       5       5                          MESH LENGTHS, MSHPAS, GUESS OPTION 2
       5       5       5       5       5                          MESH LENGTHS, MSHPAS, GUESS OPTION 3
       5       5       5       5       5                          MESH LENGTHS, MSHPAS, GUESS OPTION 4
     60.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 1, MONTH 1
     35.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 2
     35.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 3
     60.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 4
     60.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 1, MONTH 2
     35.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 2
     35.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 3
     60.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 4
     60.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 1, MONTH 3
     35.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 2
     35.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 3
     60.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 4
     50.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 1, MONTH 4
     35.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 2
     35.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 3
     50.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 4
     50.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 1, MONTH 5
     35.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 2
     35.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 3
     50.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 4
     50.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 1, MONTH 6
     35.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 2
     35.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 3
     50.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 4
     50.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 1, MONTH 7
     35.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 2
     35.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 3
     50.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 4
     50.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 1, MONTH 8
     35.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 2
     35.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 3
     50.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 4
     50.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 1, MONTH 9
     35.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 2
     35.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 3
     50.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 4
     50.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 1, MONTH 10
     35.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 2
     35.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 3
     50.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 4
     60.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 1, MONTH 11
     35.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 2
     35.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 3
     60.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 4
     60.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 1, MONTH 12
     35.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 2
     35.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 3
     60.     25.     21.     18.     18.                          ERROR LIMITS, ER1, GUESS OPTION 4
       3       3       3       3       3                          TYPE OF CORRECTION, NTYPE, GUESS OPTION 1
       3       3       3       3       3                          TYPE OF CORRECTION, NTYPE, GUESS OPTION 2
       3       3       3       3       3                          TYPE OF CORRECTION, NTYPE, GUESS OPTION 3
       3       3       3       3       3                          TYPE OF CORRECTION, NTYPE, GUESS OPTION 4
      .0      .0      0.     4.0     4.0                          SMOOTHING PARAMETER, B, GUESS OPTION 1  (USE
4 TO WEIGHT ALL
      .0      .0      0.     4.0     4.0                          SMOOTHING PARAMETER, B, GUESS OPTION 2
POINTS THE SAME)
      .0      .0      0.     4.0     4.0                          SMOOTHING PARAMETER, B, GUESS OPTION 3  (USE
1 TO WEIGHT POINT
      .0      .0      0.     4.0     4.0                     four SMOOTHING PARAMETER, B, GUESS OPTION 4   AND
AVERAGE THE SAME)
    37.0    27.5    20.0    15.0    10.0                          RADIUS OF INFLUENCE, R, GUESS OPTION 1
```

```
    37.0    27.5    20.0    15.0    10.0                            RADIUS OF INFLUENCE, R, GUESS OPTION 2
    37.0    27.5    20.0    15.0    10.0                            RADIUS OF INFLUENCE, R, GUESS OPTION 3
    37.0    27.5    20.0    15.0    10.0                            RADIUS OF INFLUENCE, R, GUESS OPTION 4
       1       1       1       1       1                            TYPE OF INTERPOLATION, ITRPLQ, GUESS OPTION
1
       1       1       1       1       1                            TYPE OF INTERPOLATION, ITRPLQ, GUESS OPTION
2
       1       1       1       1       1                            TYPE OF INTERPOLATION, ITRPLQ, GUESS OPTION
3
       1       1       1       1       1                            TYPE OF INTERPOLATION, ITRPLQ, GUESS OPTION
4
      1.     .05     .05     .05     .05                            FRACTION OF R TO USE DATA OUTSIDE GRID,
GUESS OPTION 1
      .3     .05     .05     .05     .05                            FRACTION OF R TO USE DATA OUTSIDE GRID,
GUESS OPTION 2
      .3     .05     .05     .05     .05                            FRACTION OF R TO USE DATA OUTSIDE GRID,
GUESS OPTION 3
      1.     .05     .05     .05     .05                            FRACTION OF R TO USE DATA OUTSIDE GRID,
GUESS OPTION 4
       1       1       1       1       1                            TYPE OF LAND/SEA CORRECTION, GUESS OPTION 1
(LNDWAT)
       1       1       1       1       1                            TYPE OF LAND/SEA CORRECTION, GUESS OPTION 2
       1       1       1       1       1                            TYPE OF LAND/SEA CORRECTION, GUESS OPTION 3
       1       1       1       1       1                            TYPE OF LAND/SEA CORRECTION, GUESS OPTION 4
       1       1       1       1       1        ALGORITHM 1         NUMBER OF CORRECTION ALGORITHM, GUESS OPTION
1
       1       1       1       1       1        ALGORITHM 1         NUMBER OF CORRECTION ALGORITHM, GUESS OPTION
2
       1       1       1       1       1                            NUMBER OF CORRECTION ALGORITHM, GUESS OPTION
3
       1       1       1       1       1                            NUMBER OF CORRECTION ALGORITHM, GUESS OPTION
4
      1.     .75      .5     .00      0. NORMALLY USED FOR MOST    FRACTION OF ELEVATION CORRECTION TO APPLY
OPTION 1
      1.     .75      .5     .00      0.                           FRACTION OF ELEVATION CORRECTION TO APPLY
OPTION 2
      1.     .75      .5     .00      0.                           FRACTION OF ELEVATION CORRECTION TO APPLY
OPTION 3
      1.     .75      .5     .00      0.                           FRACTION OF ELEVATION CORRECTION TO APPLY
OPTION 4
       5       5       5       5       0                            NUMBER OF GRIDLENGTHS UNUSUAL LAPSE WILL
AFFECT GRIDOINT, O 1
       5       5       5       5       0                            NUMBER OF GRIDLENGTHS UNUSUAL LAPSE WILL
AFFECT GRIDOINT, O 2
       5       5       5       5       0                            NUMBER OF GRIDLENGTHS UNUSUAL LAPSE WILL
AFFECT GRIDOINT, O 3
       5       5       5       5       0                            NUMBER OF GRIDLENGTHS UNUSUAL LAPSE WILL
AFFECT GRIDOINT, O 4
      1.     .75      .5     .00      0.                           FRACTION OF ELEVATION CORRECTION OPTION 1
FOR UNUSUAL LAPSE MOD 9/21/07
      1.     .75      .5     .00      0.                           FRACTION OF ELEVATION CORRECTION OPTION 2
FOR UNUSUAL LAPSE
      1.     .75      .5     .00      0.                           FRACTION OF ELEVATION CORRECTION OPTION 3
FOR UNUSUAL LAPSE
      1.     .75      .5     .00      0.                           FRACTION OF ELEVATION CORRECTION OPTION 4
FOR UNUSUAL LAPSE
     3.5     3.5     3.5     3.5     3.5                           FACTOR TO INCREASE R( , ) FOR OCEAN WATER
POINTS
     3.5     3.5     3.5     3.5     3.5                           FACTOR TO INCREASE R( , ) FOR INLAND POINTS
       0       0       0       0       0                           NUMBER OF POINTS SAMPLED FROM THE FIRST
GUESS TO USE, GUESS OPTION 1
       0       0       0       0       0                           NUMBER OF POINTS SAMPLED FROM THE FIRST
GUESS TO USE, GUESS OPTION 2
       0       0       0       0       0                           NUMBER OF POINTS SAMPLED FROM THE FIRST
GUESS TO USE, GUESS OPTION 3
       0       0       0       0       0                           NUMBER OF POINTS SAMPLED FROM THE FIRST
GUESS TO USE, GUESS OPTION 4
     1.0     1.0     1.0     1.0     1.0                           SMULT
      .0      .0      .0      .0      .0                           SADD
      .0      .0      .0      .0      .0                           ORIGIN
      5.      5.      5.      5.      5.                           CINT
       0       0       0       0       0                           GRIDPRINTING OF UNSMOOTHED ANALYSIS, NPRT
       0       0       0       0       0                           GRIDPRINTING OF SMOOTHED ANALYSIS, JPRT
       1       1       1       1       1                           TDLPACKING OF UNSMOOTHED ANALYSIS, NPRT
       1       1       1       1       1                           TDLPACKING OF SMOOTHED ANALYSIS, JPRT
                                                                   THE PREPROCESSING SUBROUTINE 1
       0       0       0       0       0       0       0       0   PREPROCESSING CONSTANTS FOR SUBROUNTIE 1
                                                                   THE PREPROCESSING SUBROUTINE 2
       0       0       0      25       1       0       0       0   PREPROCESSING CONSTANTS FOR SUBROUNTIE 2
                                                                   THE PREPROCESSING SUBROUTINE 3
       0       0       0       0       0       0       0       0   PREPROCESSING CONSTANTS FOR SUBROUNTIE 3
                                                                   POSTROCESSING SUBROUTINE 1 FOR ARCHIVE GRID
       0       0       0       0       0       0      25       1   POSTPROCESSING CONSTANTS FOR ARCHIVE SUB 1
                                                                   POSTROCESS SUBROUTINE 2 FOR ARCHIVE GRID
       0       0       0       0       0       0       0       0   POSTPROCESSING CONSTANTS FOR ARCHIVE SUB 2
                                                                   POSTROCESS SUBROUTINE 3 FOR ARCHIVE GRID
```

```
  0       0       0       0       0       0       0       0   POSTPROCESSING CONSTANTS FOR ARCHIVE SUB 3
                                                               POSTROCESS SUBROUTINE 1 FOR DISPOSABLE GRID
  0       0       0       0       0       0       0       0   POSTPROCESSING CONSTANTS FOR DISPOSABLE  1
                                                               POSTROCESS SUBROUTINE 2 FOR DISPOSABLE GRID
  0       0       0       0       0       0       0       0   POSTPROCESSING CONSTANTS FOR DISPOSABLE  2
                                                               POSTROCESS SUBROUTINE 3 FOR DISPOSABLE GRID
  0       0       0       0       0       0       0       0   POSTPROCESSING CONSTANTS FOR DISPOSABLE  3
```

The U405A control file is considerably longer and more complicated than U155.CN. This is because it contains a majority of the options for the actual analysis of the data. While this guide will not go over all options available in the U405A control file in detail, it is worthwhile to examine several important options.

The best way to discuss this file will be to run from top to bottom, looking at common and important options. We'll start with the first line:

```
4   2   4   0   0   0   4   0     40. TEMPERATURE        5   1   0   2   0
```

The first options we'll look at are NPASS, IGUESS, GUESS, TITLE, NSMTYP and IVRAD. These are the first, third, ninth, tenth, eleventh, and fifteenth values, respectively.

- NPASS is the number of passes to use for the analysis. This will almost always be 4.
- IGUESS is the option number to use for the first guess field. 1 = First guess field is a constant (see GUESS), 2 = primary first guess grid, 3 = secondary first guess grid, 4 = the average of all data values to be used in the analysis. Technically, there are four values for IGUESS (which are the third through sixth values in the top line) – the first of these specifies the first priority, and then the second specifies the second priority, etc. So if your IGUESS values are 2, 3, 1, and 4, U405A would first look for a primary first guess grid, and if it couldn't find that, it would look for a secondary, and if it couldn't find that, it would use the constant specified by GUESS (Since it should always be able to find this, it wouldn't move on to the last option).
- GUESS is the actual value to be used for a constant first guess field. Obviously this will change by element.
- TITLE is a 16-word title for the analysis.

- NSMTYP is the type of smoothing to be used in the analysis. See the full write-up for all possible settings for this option, but the example uses NSMTYP = 5, which is a special terrain-following smoother (which is fairly standard). For normal 5-point smoothing, set NSMTYP = 1. To turn smoothing off, set NSMTYP = 0.
- IVRAD is the basic on/off switch for variable radii for a specific element. If this is set to 0, fixed radii (as specified later in the .CN file) will be used. To use variable radii (specified in an ASCII file generated by U178 and designated in the U155.CN file), set this value to 1. In this case, it is set to 0.

The next set of options we'll look at is in the second line:

```
1  1.00  1.00  1.00  1.00  0  1 +1 99 20000 20000   0 1 1   0 .25  12   1
111111
```

The main options of interest to us here are IQUALC, IBKPN, CSTSM, and N4P (the first, eighth, sixteenth, and seventeenth options).

- IQUALC indicates which part of the 'FLAG' field in the station dictionary turns this element on and off (0 = Off, 1 = On). This is always counted starting with the second column from the right of the flag field (the far-right value is the land/water indicator), and moves to the left (i.e. IQUALC = 1 means the second column from the right, IQUALC = 2 means the third column from the right, etc.).
- IBKPN is a flag that specifies what is considered an unusual lapse rate in the analysis (more on what this does later). +1 = lapse rates that increase with height are unusual (this is true for temperature and dew point, for example), +2 = the same as +1, but lapse rates aren't applied downward, -1 = negative lapse rates are considered unusual (this would be the case for snow and wind speed), -2 = same as -1, but not applied downward, 0 = unusual lapse rates are not used, 99 = lapse rates (usual or unusual) are not computed or used.

- CSTSM controls the coastal smoother. This is the fraction of smoothing to apply when the current gridpoint is ocean water, but not all gridpoints used in the smoothing are water points. This will work with NSMTYP = 5, 6, or 7. Default value is .25.
- N4P is the number of gridpoints surrounding a point that will be checked for a point of the same type. The example uses 12, which is pretty standard, but this value can be set to 4, 12, 16, or 36.

The next three lines of the .CN file control cycle averaging. This is fairly straightforward, and will be discussed in greater detail in section 3.

The next section allows the user to control the MOS2000 ID of the gridded analysis variable (output) and specify the ID of the data to be analyzed (input), as well as any first guess fields. If you are running from a pre-made control file for a standard element, you won't need to change anything here. If you are running a custom analysis, you'll need to change these values. Further, if there is no established ID for either the gridded analysis or the data to be analyzed, you'll want to use a dummy mos2000id.tbl until the proper IDs are approved and implemented.

The main body of the 405A control file contains several sets of options which have different settings for each first guess option and each pass. It is typical for values to be the same for any given pass, across guess numbers, although there are a few exceptions. Most of these options can be either briefly described or skipped altogether, for the purpose of this guide.

The mesh lengths section in general can be left alone. After those is a series of error limits for each possible first guess option for each month. As with the IDs, if you are running a pre-made control file for an element we already grid (like temperature, for example), you likely won't need to adjust these at all. However, if you are creating a new analysis, you will want to think about appropriate error limits for your element. Typically the error limits reduce with each

pass. Also, some caution should be used, as setting the limits too strictly will cause many stations to be removed from the analysis. Correction type can be left alone as well.

The next parameter of note is the smoothing parameter, B. This can range from 1 to 4, but by default, this is set to 4.0 for each guess option for passes 4 and 5 (even though pass five is generally not used). This can also be set to 0 to effectively stop smoothing (though it is better to turn it off at NSMTYP).

After the smoothing parameter are the settings for fixed radius of influence. These are listed by pass (columns) and by guess option (rows), and measured in grid lengths. The default values are 37.0 for the first pass, 27.5 for the second pass, 20.0 for the third pass, 15.0 for the fourth pass, and 10.0 for the (unused) fifth pass. If you set IVRAD to 1 and provided a variable radius file in U155.CN, these values will not be used.

Type of interpolation, fraction of R, and type of land/sea correction can be left as is. Correction algorithm affects the way that the elevation correction (lapse rates) are used, and will be discussed more in section 4, along with the options for the fraction of elevation correction to apply for usual and unusual lapse rates.

The main remaining option of interest in the .CN file is the final section – options for post processing. If you want to run post processing on your data, you will have to specify that here. The first thing you will want to do is give the name of the post processing routine you intend to use. For an example, we'll use a routine called POST. So, you would enter post on the left side of the CN file, opposite the text "POSTPROCESSING SUBROUTINE 1 FOR ARCHIVE GRID":

```
POST                                                    POSTROCESSING SUBROUTINE 1 FOR ARCHIVE GRID
```

Then you enter the specific parameters for post processing on the line below. If, for example, you were running a probability and didn't want any values below zero, or above one, the following line of values would look like this:

```
0       0       1       1       1       0       0       0   POSTPROCESSING CONSTANTS FOR ARCHIVE SUB 1
```

The first zero specifies zero as a minimum threshold, and the second sets and values below that minimum to zero. Likewise, the first one sets one as a maximum threshold, and the second one sets anything above that maximum threshold to one. The final one is a smoothing factor. This subroutine is a little difficult to use, as there is very little documentation available.

That sums up the majority of the options of interest in the U405A control file. The following sections will speak a little more in detail about some of these options.

3. Cycle Averaging

Cycle averaging is a feature of U155/U405A that attempts to maintain consistency between forecasts by averaging the MOS values between different cycles in the gridded analysis. Currently all operationally produced elements (outside of wind speed, gusts, and direction) are averaged.

The cycle averaging controls are located in the U405A control file for an element, near the top. They look like this:

```
2     0    12     0     0     0              COMBINE UP TO 5 RUNS
     1.    1.    .0    .0    .0              WEIGHTS FOR RUNS (ANALYSIS)
     1.    1.    .0    .0    .0              WEIGHTS FOR RUNS (LAPSE)
```

The top line controls the number of cycles (and which cycles) to combine in the average, and the bottom two lines determine how to combine these cycles. In the top line of the example above, two cycles are being averaged (as indicated by the two in the left column). These cycles are the current cycle (the zero in the second column from the left), and the previous cycle, which occurred 12 hours prior (the 12 in the third column from the left). If GMOS were to run every 6 hours (which is possible in the near future), the 12 would be changed to a 6 to include only the previous cycle. Since no other cycles are currently being averaged, the remaining top row values are all zero. The next two rows indicate the weights to be given to the analysis values for each cycle (second row), and to the lapse rates for each cycle (bottom row). Since the current averaging scheme weights all cycles the same for both lapse rates and analysis, the weights given to the current and previous cycle are exactly one. These values could be changed to put more or less weight on each cycle.

To turn off the cycle averaging (that is, use only the current cycle's values), you would take out any previous cycles and reduce the appropriate weights to 0. Then this section to look like:

```
1      0    0     0     0     0                COMBINE UP TO 5 RUNS
      1.    .0    .0    .0    .0               WEIGHTS FOR RUNS (ANALYSIS)
      1.    .0    .0    .0    .0               WEIGHTS FOR RUNS (LAPSE)
```

If you happen to be gridding a constant (where there are no cycles to average), it is best to turn the cycle averaging off, as a precaution.

4. Elevation Correction

a. Unusual Lapse Rates

Unusual lapse rates (as well as the general operation of lapse rates and elevation correction) are controlled by IBKPN as discussed in the U405A control file section: +1 = lapse rates that increase with height are unusual (this is true for temperature and dew point, for example), +2 = the same as +1, but lapse rates aren't applied downward, -1 = negative lapse rates are considered unusual (this would be the case for snow and wind speed), -2 = same as -1, but not applied downward, 0 = unusual lapse rates are not used, 99 = lapse rates (usual or unusual) are not computed or used.

This especially comes into play if you choose to use a different fraction of elevation correction for unusual lapse rates, or if you plan to limit the number of grid lengths an unusual lapse rate can affect a gridpoint. Both of these settings are located in the main body of the U405 control file, and are clearly labeled.

b. Correction Algorithm

The correction algorithm determines the exact method of elevation correction to be used. This setting is found (as mentioned in section 2b) in the U405A control file. To change the algorithm number, simply change this value to the number of the algorithm you want. Currently there are two different algorithms coded into the software.

The default (and standard) algorithm is algorithm number 1. Algorithm number 2 uses a distance-weighted scheme to apply the lapse rates (this means that nearer stations receive a heavier weight than those far away).

A third algorithm was written, but is not part of the current software (it will most likely be included in future versions). This algorithm applies the lapse rates as usual as long as the

elevation difference between a given point and the site whose lapse rate it is using is below a given threshold. Above that threshold (defaulted to 750 meters), the applied correction is reduced. This algorithm can be added into the routine corbc5.f, located in the u405alib directory of the u155 folder.

To do this, you will need to go to the section in corbc5.f where the algorithms are defined. You can do this by searching for instances of the variable IALGOR. This section is located (as of the writing of this) at approximately line 1,032 of the code. Insert the following code:

```
            ELSEIF(IALGOR.EQ.3)THEN
C
               IF(ELEDIF.LE.750.)THEN
                  BBPLUS=BB+WHT*(P(IX,JY)-BB-XLAPSE(K)*ELEDIF)
C                    THIS IS THE SAME AS ALGORITHM WHEN ELEDIF LE 750.
               ELSE
                  ELL=(ELEDIF-750.)**.8
                  BBPLUS=BB+WHT*(P(IX,JY)-BB-XLAPSE(K)*(ELEDIF-ELL))
               ENDIF
```

Obviously, once this code is added, you will need to rebuild your u405a library, and recompile your executable for u155. You will need to do this each time you fine tune the settings for this algorithm, as well.

The fine tuning is done by adjusting the minimum elevation distance to which the modified lapse rate will be applied, and by adjusting the power that is applied to the modified rate (the minimum elevation difference is reflected by all values in the above code equal to 750, which are in bold, and the power is the .8, in italics). The smaller the minimum difference, the more often the adjusted correction will be applied, and the higher the power, the lower the applied correction.

c. Correction Fractions

The U405A control file contains two sets of elevation correction fractions that may be adjusted – a standard set, and a set for unusual lapse rates. As with most of the settings in this section, the fractions are set for each pass and guess number. It is standard to have the fractions begin at a full correction (1.0) on the first pass and reduce until hitting zero on the 4th pass. For example, a common setting would be (1.0, 0.75, 0.5, 0).

For most of the pre-existing control files for common elements, these can be left alone. For a unique analysis, however, it is worthwhile to experiment with these values, especially depending on the number and location of stations. For example, it might be useful to set the fractions to (1.0, 0.25, 0, 0) to apply the full correction over a broad area, and then tweak values in a more concentrated space.

5. Station Pairs/U174

a. General Information

An additional way to control the elevation correction is by controlling the stations that are used to calculate the lapse rates. This list is created by the program U174 and the resulting output file is then an input in the U155.CN file.

A working version of U174 can be found in: /mdl1/save/mos/we21gw/Quck155/U174.

b. U174.CN

```
GWAG 12  0  0 04 26  0  0  0  0  0  0  0  0 15  0  0  0  0  0  0  0 12  0  0
THIS IS AN MAY 2004 TEST OF U174
       800  JSTOP --NUMBER OF ERRORS TO TOLERATE BEFORE STOPPING RUN
         1  NEW   --1 FOR NEW ICAO CALL LETTERS, 0 = NOT
         1  NALPH --1 FOR ALPHABETIZATION OF CALL LETTERS, 0 = NOT
         3  NPROJ--MAP PROJECTION
        95  ORIENT--MAP ORIENTATION
        25  XLAT--LATITUDE AT WHICH MESH LENGTH APPLIES
         5  MESHB--NOMINAL MESH SIZE TO WHICH NX AND NY APPLY
      1073  NX--SIZE OF GRID IN X DIRECTION (US) (CHANGED FROM 63)
       689  NY--SIZE OF GRID IN Y DIRECTION (US) (CHANGED FROM 43)
   20.1920  ALAT--NORTH LATITUDE OF LOWER LEFT CORNER OF ANALYSIS GRID
  121.5540  ALON--WEST LONGITUDE OF LOWER LEFT CORNER OF ANALYSIS GRID
       100  DEMIN--MINIMUM ELEVATION DIFFERENCE IN M ACCEPTED AS A PAIR
     20000  DEMAX--MAXIMUM ELEVATION DIFFERENCE IN M ACCEPTED AS A PAIR
        30  XDIST--MAXIMUM DISTANCE IN GRID UNITS ACCEPTED AS A PAIR
        30  ODIST--MAXIMUM DISTANCE IN GRID UNITS OUTSIDE GRID A STATION IS USED
         1         1         1         1  QUALWT--QUALITY WEIGHTS FOR 4 LEVELS
 35    station_pairs_optn_txt                                          **STATION PAIRS
 99                                                                    **OUTPUT FILE TERMINATOR
 36    station_pairs                                                   **STATION PAIRS
 99                                                                    **OUTPUT FILE TERMINATOR
 37    mdl_allsites.tbl                                                **KFILD(1) - STATION LIST
 37    mdl_allsites.tbl                                                **KFILD(2) - STATION DICTIONARY
 99

   37.0000  ALATL--NORTH LATITUDE OF LOWER LEFT CORNER OF ANALYSIS GRID BISHOP
  119.0000  ALONL--WEST LONGITUDE OF LOWER LEFT CORNER OF ANALYSIS GRID

    6.9870  ALATL--NORTH LATITUDE OF LOWER LEFT CORNER OF ANALYSIS GRID (AVIATION)
  147.0640  ALONL--WEST LONGITUDE OF LOWER LEFT CORNER OF ANALYSIS GRID
****************CHANGED INPUT STATION FILE 5/12/05 0341 PM.

 37    ncdc_snownrml.list                                        **KFILD(1) - STATION LIST
 37    all_snow.tbl                                              **KFILD(2) - STATION DICTIONARY

NOTE:  CHANGED TO USE LAMBERT ON 5/24/05
```

U174.CN is fairly short, and only has a few important items to change. In the top section of values, you'll want to examine DEMIN and XDIST. By default, DEMIN is set to 100, and XDIST is set to 30. Especially in the case of having fewer stations, you may want to increase XDIST to offer more pairs to calculate lapse rates from.

The remaining parameters to change are the output file names and input station list and dictionary. U174 creates two types of output files – one ASCII (unit 35, station_pairs_optn_txt) and binary (unit 36, station_pairs). The ASCII file is optional, but the binary file is necessary to

input into U155. For station list and dictionary, it is acceptable (and may be easier) to simply list the station dictionary twice, as is done in the sample file.

Once you've changed the appropriate settings, U174 is ready to run.

6. Variable Radii/U178

a. General Info

A newer innovation to U155 is the ability to set different radii of influence for each station used in the analysis. This makes a lot of sense, due to the large variation in station density over the map. The program that sets the list of radii for each station is U178. Much like U174, U178 is a fairly simple program to run.

You can find a copy of U178 (not yet evaluated by the library team) in /mdl1/save/mos/we21gw/Quick155/U178.

The output of U178 is an ASCII format file, listing each station used and the appropriate radii for that station, and some extra information, as shown below:

```
082944      50.00    37.00    27.00    20.50    15.00    10.00    0.   129.   FERNANDINA BEACH  FL
```

The far left value is the station ID, the next value is the radius of influence for pass 1, next is pass 2, and so on, all the way to pass 6. The next two values are the lowest (first) and highest (second) elevation values within the maximum (first pass) radius for each station. Last is the station name and state.

Now that we've looked at the output, let's take a look at the control file.

b. U178.CN

```
GWAG 12  0  0 14 15  0  0  0  0  0  0  0  0 16  0  0  0  0  0  0  0  0  0  0
THIS IS A MAY 2008 CONUS RUN.
         1  NEW   --1 FOR NEW ICAO CALL LETTERS, 0 = NOT
         1  NALPH --1 FOR ALPHABETIZATION OF CALL LETTERS, 0 = NOT
         3  NPROJ--MAP PROJECTION
        95  ORIENT--MAP ORIENTATION
        25  XLAT--LATITUDE AT WHICH MESH LENGTH APPLIES
         5  MESHB--NOMINAL MESH SIZE TO WHICH NX AND NY APPLY
      1073  NX--SIZE OF GRID IN X DIRECTION (Alaska = 1321)
       689  NY--SIZE OF GRID IN Y DIRECTION (Alaska = 721)
   20.1920  ALAT--NORTH LATITUDE OF LOWER LEFT CORNER OF ANALYSIS GRID  (TAKEN FROM TERRAIN GRID)
  121.5540  ALON--WEST LONGITUDE OF LOWER LEFT CORNER OF ANALYSIS GRID
        30  MAXSTA--MAXIMUM NUMBER OF STATIONS TO COLLECT PER GRIDPOINT
        50  XDIST--MAXIMUM DISTANCE IN GRID UNITS TO SEARCH FOR STATION (50 X 3.5 FOR OCEAN)
        1.       .74       .54       .41       .30       .20  --RFACT( ) FOR 6 PASSES
 35    snow_radii_m30x50                                          **STATION PAIRS (OUTPUT)
 99                                                               **OUTPUT FILE TERMINATOR
 44    /nwprod/fix/mdl_analysisgrconst                            **KFILRA( ) - RANDOM ACCESS INPUT
 99                                                               **KFILRA( ) - RANDOM ACCESS TERMINATOR
 99                                                               **OVERRIDE FILE TERMINATOR
 36    /mdl1/noscrub/mos/we21gw/rf_155/ncdc_snownrml.list         **KFILD(1) - STATION LIST
 37    /mdl1/noscrub/mos/we21gw/rf_155/all_snow.tbl               **KFILD(2) - STATION DICTIONARY NOTE
DIFFERENT UNIT NOS
 99
```

There are 2 primary values to be concerned with in this control file, and 2 optional changes. The primary values to examine are MAXSTA and XDIST. MAXSTA, as described in the file, controls the maximum number of stations a gridpoint will look for. Generally, as this value is increased, the radii for the stations will increase. XDIST is the farthest distance U178 will search from a gridpoint to look for up to MAXSTA stations. This provides a cap on the maximum possible radius.

The optional changes in U178 are RFACT and the override file. RFACT determines the radii for each pass as a fraction of the maximum radius found. The defaults are currently 1.0 for the first pass, .74 for the second, .54 for the third, .41 for the fourth, .30 for the fifth, and .20 for the sixth (most of our analyses only use 4 passes, but this allows for up to 6). In general, these settings are fine. The override file (not included in the sample .CN file), allows you to set a specific first pass radius for any stations you choose. The remaining radii will be determined by RFACT, and the set values will be written with the other standard radii in the final ASCII output file. Here's a sample from an Alaska override file:

```
 1          ONLY ONE RADIUS WILL BE READ AND USED.
46001     190.00   148.00   108.00   82.00   60.00   40.00   0.  11794.   GULF OF ALASKA   AK
46035     360.00   148.00   108.00   82.00   60.00   40.00   0.   5021.   BERING SEA       AK
46060      20.00   148.00   108.00   82.00   60.00   40.00   0.  18994.   WEST ORCA BAY    AK
46061      50.00   148.00   108.00   82.00   60.00   40.00   0.  18994.   SEAL ROCKS       AK
46066     135.00   148.00   108.00   82.00   60.00   40.00   0.   7199.   SOUTH ALEUTIANS  AK
46072     535.00   148.00   108.00   82.00   60.00   40.00   0.   5762.   CENTRAL ALEUTIANS AK
46080     140.00   148.00   108.00   82.00   60.00   40.00   0.  18994.   NORTHWEST GULF   AK
46081      30.00   148.00   108.00   82.00   60.00   40.00   0.  18994.   W PR WILLIAM SOUN AK
46082      75.00   148.00   108.00   82.00   60.00   40.00   0.  18994.   CAPE SUCKLING    AK    MOD 10/20/07
```

The top line of the override file specifies how many of the radii to insert in the final output – in this case, only the first radius will be used (even if others are specified, as above). The main lines for the rest of the file follow the same pattern as the output file. It appears that there is the allowance for additional comments after the state field.

The remaining entries to the .CN file are standard – output filename, station list, and station dictionary. Depending on the size of your station list, and your settings for MAXSTA and XDIST, U178 can take some time to run. Once it has finished, the ASCII output is ready for U155.

7. Post Processed Elements

a. General Info/Elements

For the most part, elements output from U155 are ready to plot. However, some elements (such as wind direction) aren't calculated in U155. Additionally, to exactly replicate some of the operational elements we produce, some post processing is required.

Here is a list of the IDs used in our operational post-processing for GFS gridded MOS elements. It has been reduced to show only one projection for each ID:

```
222030008 000000000 000000006 000  .0000E+00     0 0 0    CORR TMP
222034008 000000000 000000006 000  .0000E+00     0 0 0    CORR TMP (K)
223030008 000000000 000000006 000  .0000E+00     0 0 0    CORR DP
223034008 000000000 000000006 000  .0000E+00     0 0 0    CORR DP (K)
222124008 000000000 000000030 000  .0000E+00     0 0 0    MAX (K)
222129008 000000000 000000024 000  .0000E+00     0 0 0    MAX (K) SHIFT6
222224008 000000000 000000042 000  .0000E+00     0 0 0    MIN (K)
222229008 000000000 000000036 000  .0000E+00     0 0 0    MIN (K) SHIFT6
223075008 000000000 000000006 000  .0000E+00     0 0 0    RH COMP FROM T&TD
223250108 000000000 000000012 000  .9500E-02     0 0 0    6-HR POP CONSTRAINED
223254108 000000000 000000012 000  .9500E-02     0 0 0    6-HR POP CONST %
223350108 000000000 000000018 000  .9500E-02     0 0 0    12-HR POP CONS/CONST
223354108 000000000 000000018 000  .9500E-02     0 0 0    12-HR POP CONS/CONST %
223274008 000000000 000000012 000  .0000E+00     0 0 0    6-HR PCP AMT (KG/SQM)
223380008 000000000 000000018 000  .0000E+00     0 0 0    CALC 12-HR PCP AMT
223384008 000000000 000000018 000  .0000E+00     0 0 0    CALC 12-HR PCP AMT (KG/SQM)
224250008 000000000 000000006 000  .0000E+00     0 0 0    WIND DIRECTION
224370008 000000000 000000006 000  .0000E+00     0 0 0    WIND SPEED (CK CALM)
224374008 000000000 000000006 000  .0000E+00     0 0 0    WIND SPEED (MPS)
227124108 000000000 000000009 000  .9500E+00     0 0 0    03HTSTM (%)
227234108 000000000 000000012 000  .9500E+00     0 0 0    06HTSTM (%)
227334108 000000000 000000018 000  .9500E+00     0 0 0    12HTSTM (%)
224390008 000000000 000000006 000  .0000E+00     0 0 0    MAX WIND SPEED (CONS.WSPD)
224394008 000000000 000000006 000  .0000E+00     0 0 0    MAX WIND SPEED (MPS)
228399008 000000000 000000006 000  .0000E+00     0 0 0    OPQ SKY COVER (%)
228474008 000000000 000000030 000  .0000E+00     0 0 0    SNW AMT(M)
228479008 000000000 000000024 000  .0000E+00     0 0 0    SNW AMT(M)-SHIFT6
```

For the full list for all projections, see /nwprod/fix/mdl_gfsgrpost.00z and mdl_gfsgrpost.12z (there are also files for Alaska post processing, mdl_gfsgrpost_ak.00z and mdl_gfsgrpost_ak.12z).

If you need it, you can find a version of the post processor in /mdl1/save/mos/we21gw/Quick155/postproc. This version works with TDLPack sequential files. The next subsection will detail how to run it.

When doing post-processing, the order in which post processing is done is important. For example, when post-processing the wind speed in meters per second from the u and v

components, you must first process wind direction, then ck calm wind speed, and then the wind speed in meters per second. These all have to be separate post-processor runs.

b. Running the Post-Processor

The setup for this post processor takes a little bit of work, but is fairly simple. First, you'll want to edit the control file for the cycle you are working with. These are the mdl_gfsgrpost.(*t00z or t12z*) files, and they simply contain a list of the elements to be processed in that run, and a terminator. For example, here is a sample mdl_gfsgrpost.t00z for wind direction processing:

```
224250008 000000000 000000012 000  .0000E+00     0 0 0    WIND DIRECTION
   999999
```

Then you'll want to edit postproc.sh, the script that drives the entire process. Here is a sample of the script:

```
#!/bin/sh
# @ job_type=serial
# @ environment=COPY_ALL
# @ error=u155.out
# @ output=u155.out
# @ class=1
# @ group=mdl
# @ wall_clock_limit=03:00:00
# @ Feature="batch_node"
# @ account_no=MDL-T2O
# @ resources=ConsumableCPUs(1) ConsumableMemory(4000 MB)
# @ queue
#

set -x
##########  stuff that shouldn't need changing  #############
export XLFRTEOPTS="unit_vars=yes"
export FIXmdl=/nwprod/fix
export PARMmdl=/nwprod/parm
#export EXECmdl=/nwprod/exec
export EXECmdl=mdl_gridpost.fd
export EXECutil=/nwprod/util/exec
export cyc=00
export cycle=t${cyc}z
#######################################################

#cp /com/date/$cycle ncepdate
#PDY=`cut -c 7-14 ncepdate`
PDY=20070921
echo DATE'  '${PDY}${cyc}0000WASHINGTON >ncepdate
COMIN=/com/gfs/prod/gfs.$PDY
export PDY COMIN DCOM
export DAT="$PDY$cyc"



#######################################################################
#
# PROGRAM GRIDPOST - PERFORMS POST-PROCESSING OF THE GRIDDED MOS
#                    FORECASTS.
#
```

```
#######################################################################
echo MDLLOG: `date` - begin job GRIDPOST - POST PROCESS MOS FORECASTS
export pgm=mdl_gridpost
export XLFUNIT_10="ncepdate"
export XLFUNIT_26="$FIXmdl/mdl_granlsta.lst"
export XLFUNIT_27="$FIXmdl/mdl_allsites.tbl"
export XLFUNIT_28="mdl_gfsgrpost.$cycle"
export XLFUNIT_29="$FIXmdl/mdl_mos2000id.tbl"
export XLFUNIT_60="/mdl1/save/mos/we21gw/dru155/RUN/u155_20070921.savg"
export XLFUNIT_61="u155_savg_070921.ppdstep1"
$EXECmdl/mdl_gridpost < mdl_gridpost.cn >> $pgmout 2>errfile
export err=$?;
echo MDLLOG: `date` -  GRIDPOST ended
```

The first thing you'll want to check is that the line:

export cyc=00

Reflects your current cycle. In the next section, make sure to set the correct date, and then in the main block of the script, make sure to set your station list (XLFUNIT=26), dictionary (XLFUNIT=27), mos2000id table (if necessary, XLFUNIT=29), input file (XLFUNIT=60), and output file (XLFUNIT=61).

Once you've set the appropriate parameters, you can llsubmit the script to run your postprocessing job. The final output will be in TDLPack sequential format.

8. Grid Point Diagnostics

a. CORBC5

U155/U405A has built in grid point diagnostics that you can use to evaluate how an individual grid point is being affected by surrounding stations, or which stations are influencing a point, or even which points a station influences. Enabling the diagnostics simply requires uncommenting a small block of code in the subroutine CORBC5. This is located in the u405alib as corbc5.f

The block of code that prints diagnostics looks like this:

```
CCC      IF(IX.EQ.73.AND.JY.EQ.254)THEN
C           FOR PRINTING, WHT IS UNDEFINED WHEN IBKPN = 99.
CCC      IF(CCALL(K).EQ.'PAAK    '.AND.SEALND(IXE,JYE).EQ.9)THEN
CCC            WRITE(KFILDO,2284)P(IX,JY),CORR(IX,JY),COUNT(IX,JY),
CCC     1              WT,WHT,BB,BBPLUS,NCOUNT(IX,JY),IX,JY,LP,
CCC     2              SEALND(IXE,JYE),CCALL(K),ELEDIF,XLAPSE(K)
CCC 2284       FORMAT(' AT 2284--P(IX,JY),CORR(IX,JY),COUNT(IX,JY),',
CCC     1             'WT,WHT,BB,BBPLUS,NCOUNT(IX,JY),IX,JY,LP,',
CCC     2             'SEALND(IXE,JYE),CCALL(K),ELEDIF,XLAPSE(K)'
CCC     2              ,/,7F10.3,4I5,F5.1,2X,A8,2F10.3)
CCC      ENDIF
C
```

You can locate this code quickly by searching the file for the number of the FORMAT statement (2284). Simply remove the comments from this block of code (and make a few small adjustments) to enable the diagnostics.

The first adjustment you will need to make is to choose which IF statement you want to use. If you use the top one (`IF(IX.EQ.73.AND.JY.EQ.254)THEN`), you will be evaluating all of the stations that influence a given grid point. If you use the second, (`IF(CCALL(K).EQ.'PAAK '.AND.SEALND(IXE,JYE).EQ.9)THEN`), you will be evaluating all of the grid points influenced by a given station. Whichever you choose, leave the other IF statement commented out (since there is only one ENDIF for this block of code).

If you choose the first IF statement (evaluating all of the stations influencing a grid point), you will need to give the X and Y numbers of the grid point in question (for example, to look at grid point (101, 227), you would enter '`IF (IX .EQ. 101 .AND. JY .EQ. 227) THEN`'). This will create a line of output in the fort.12 file for each station that influences that particular grid point, at each pass. That is the only change you will need to make for this diagnostic.

If you choose the second IF statement (evaluating all of the grid points influenced by a specific station), you will first want to remove the '`.AND. SEALND (IXE,JYE) .EQ. 9`' from the end of the statement. This will allow you to evaluate all stations around the grid point (or all grid points around the station). You will then also want to set the name of the station you are examining. For example, to look at all the grid points KDCA influences, you would enter, '`IF (CCALL(K) .EQ. 'KDCA  ') THEN`'.

As a warning, if you choose to look at every grid point a given station influences, it will produce an EXTREMELY LARGE amount of output. This is because you will potentially be looking at every grid point within the first pass radius, then every grid point within the second pass, and so on. For the default fixed radius value of 37 grid lengths, this means the first pass alone could produce over 159,000 lines of output.

b. Output

The diagnostic output appears in the fort.12 file, in the section where information about each individual pass for an element is. The output looks like this:

```
AT 2284--
P(IX,JY),CORR(IX,JY),COUNT(IX,JY),WT,WHT,BB,BBPLUS,NCOUNT(IX,JY),IX,JY,LP,SEA
LND(IXE,JYE),CCALL(K),ELEDIF,XLAPSE(K)
    59.355   726.999    56.248     0.999     1.000    59.355    59.289  113
71  380    1  9.0  KLVK        -9.006    -0.007
```

Where the top line is the rundown of all the variables, and the bottom line contains the actual values (listed in the same order). Here's a quick breakdown of what these values are:

- P(IX,JY) – Field holding first guess and analysis.
- CORR(IX,JY) – Correction for grid point IX, JY (IX=1,NX) (JY=1,NY).
- COUNT(IX,JY) – Sum of weights for grid point IX, JY when a type 3 correction is being made (IX=1,NX) (JY=1,NY).
- WT – Weight for corrections.
- WHT – WT modified by ELCORR (the fraction of the elevation correction for each pass and guess option) OR ELCORU (ELCORR for unusual lapse rates).
- BB - Interpolated value from Subroutine INTR.
- BBPLUS - BB, augmented by elevation correction.
- NCOUNT(IX,JY) – Count of stations correcting grid point IX, JY (IX=1,NX). (JY=1,NY), not counting wind corrections.
- IX, JY – X and Y location of the grid point.
- LP – Pass number.
- SEALND(IXE,JYE) – The land/sea mask (J=1,NXE*NYE) at nominal mesh length MESHE. 0 = Ocean water grid points, 3 = Inland water grid points, 9 = Land grid points.
- CCALL(K) – Station call letters (K=1,NSTA).
- ELEDIF – Grid point elevation minus station elevation in meters.
- XLAPSE(K) – Calculated lapse rate in units of the variable being analyzed per meter (K=1,KSTA).

Once the diagnostics have been printed, they can be reformatted (with a little effort) to several useful formats. This can include formats compatible with Excel or GIS, for example.

APPENDIX I: GIS Dumping Program

In order to view your U155/U405A output in ESRI ArcGIS, you will first need to convert it from TDLPack to ASCII format. This is done with the GIS dumping utility.

There are two variations of the utility – one for sequential U155 output, and one for random access. You can find both versions in /mdl1/save/mos/we21gw/Quick155/gisdump. That folder contains /sequential and /raccess directories for the appropriate version of the utility. For simplicity, we will go over the sequential version (it is more commonly used, and the random access version works very similarly).

The utility is run through gisseqdump.sh. The script looks like this:

```
#!/bin/sh

#
#   Run gisseqdump.sh
#
#   unit 20 is the input data set to be inventoried
#
#   unit 55 is the output dataset for the clean inventory
#
#   GIS.txt in the output data to be used for GIS post processing

echo `date` - begin job indptdlp
set -xs
export XLFRTEOPTS="unit_vars=yes"

#input filename
FNAMEIN=/mdl1/save/mos/we21gw/dru155/RUN/u155_071211avg.lw080129

#output inventory file
FNAMEOUT=output.ibm

export FNAMEIN FNAMEOUT
export XLFUNIT_20="$FNAMEIN"
export XLFUNIT_55="$FNAMEOUT"
./gisseqdump.x << EOF
1073                    !number of columns
689                     !number of rows
-2765754.737            !X11 corner
-266343.91800001        !Y11 corner
5079.407                !cell Size
9999                    !no data value
WS_avg_071211_new.txt                                                   !output GIS filename
224360008               !word1
0                       !word2
126                     !word3
0                       !word4
2007121100              !date
EOF

echo `date` - end job indptdlp
```

The modifications to the script are fairly straight-forward (and well labeled), but I'll give a quick run-down of what usually needs to be changed:

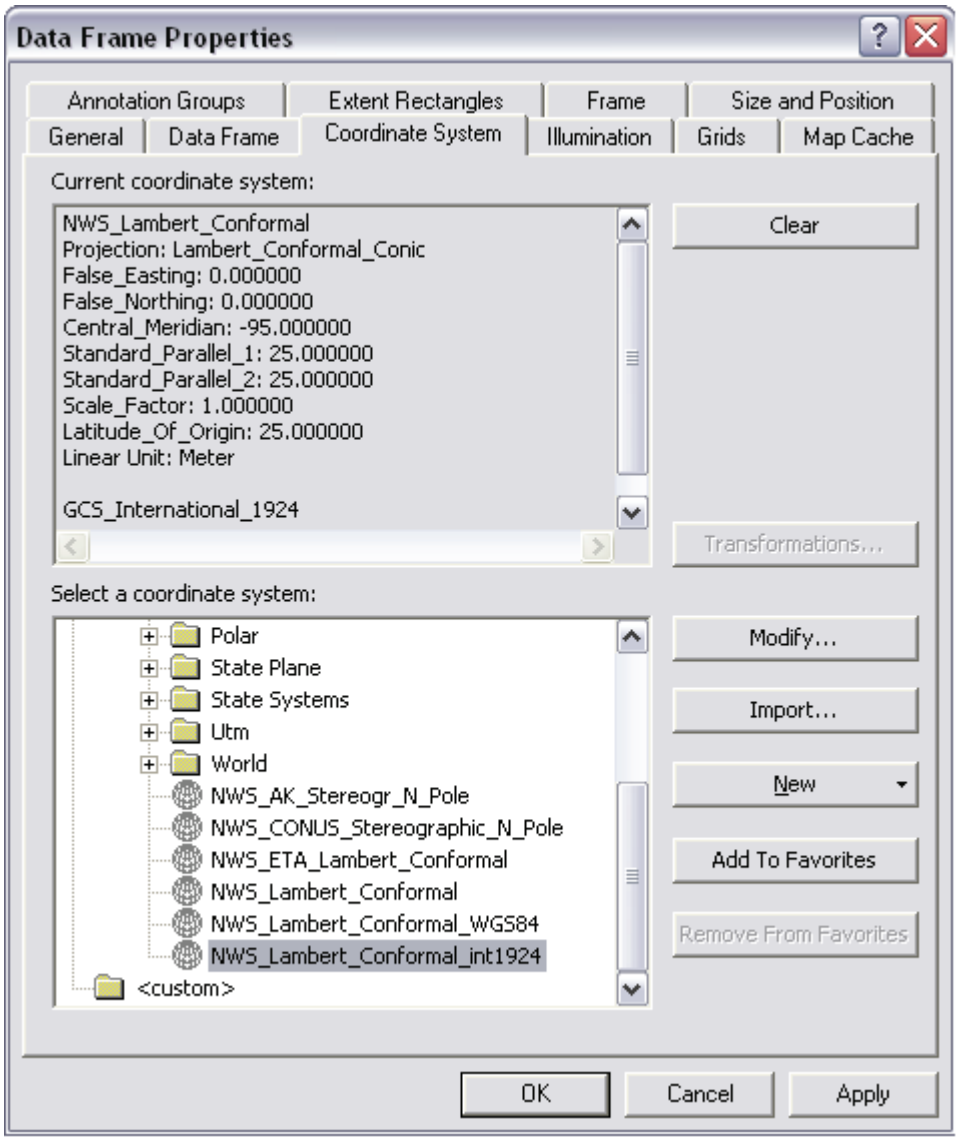
- FNAMEIN – The path and name of the U155 sequential output file.
- FNAMEOUT – The name of the script output file (this is where all available IDs and dates in the sequential file are listed).
- Cell Size – Usually this field won't need any changes, but some input files (especially from the operational job stream) have this value as 5079.406 instead of 5079.407. If this is the case, you will get an error stating so, and you'll just need to change this value appropriately.
- Output GIS filename – This is the name of the ASCII output file. For ease importing into GIS, it's usually good to give this file a .txt extension.
- Word1 – Word4 – These are the 4 words of the MOS2000 ID. They should be the same as what you set in your U155.CN file.
- Date – Make sure the date matches the date you set at the top of the U155.CN file.

Once you've made the appropriate changes, you can run the script (you don't need to run this through load leveler). The output ASCII file can be moved to your Windows computer and is ready to be imported to GIS through the MOS2000 to Raster tool (see next Appendix section).

APPENDIX II: ArcGIS Tool - MOS2000 to Raster

Once you have transferred your ASCII file (see previous appendix) to your Windows PC, you're ready to import it into ArcGIS, using the MOS2000 to Raster tool. This is actually a combination of two other ArcGIS tools – ASCII to Raster, and Raster Flip.

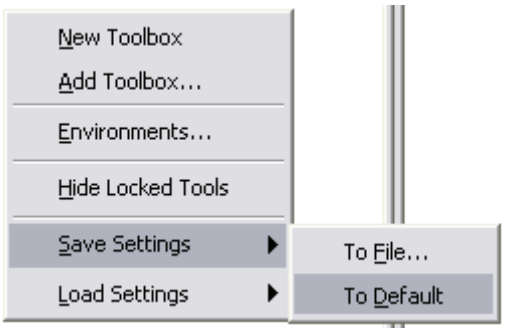
To start off, open ArcMap, and start a new project. In order for the map to display properly, you will want to set the layer's projection to NWS Lambert Conformal, based on the International 1924 datum. You can do this by opening the Layer Properties (right-click on Layer, go to properties), clicking on the 'Coordinate System' tab, expanding 'Predefined', then 'Projected Coordinate Systems', and then selecting 'NWS_Lambert_Conformal_int1924'.



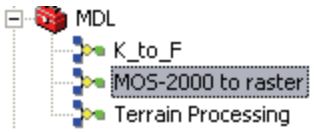
Now that the appropriate coordinate system is set, you're ready to import the raster, assuming you have the MOS2000 to Raster tool (in the MDL or SMB GIS toolbox) added to GIS. If not, you'll need to add it, but it's a simple procedure:

- Click the toolbox icon ( ) to open the toolbox.
- Right click on the white space below the toolboxes to open a menu, and select "Add Toolbox".

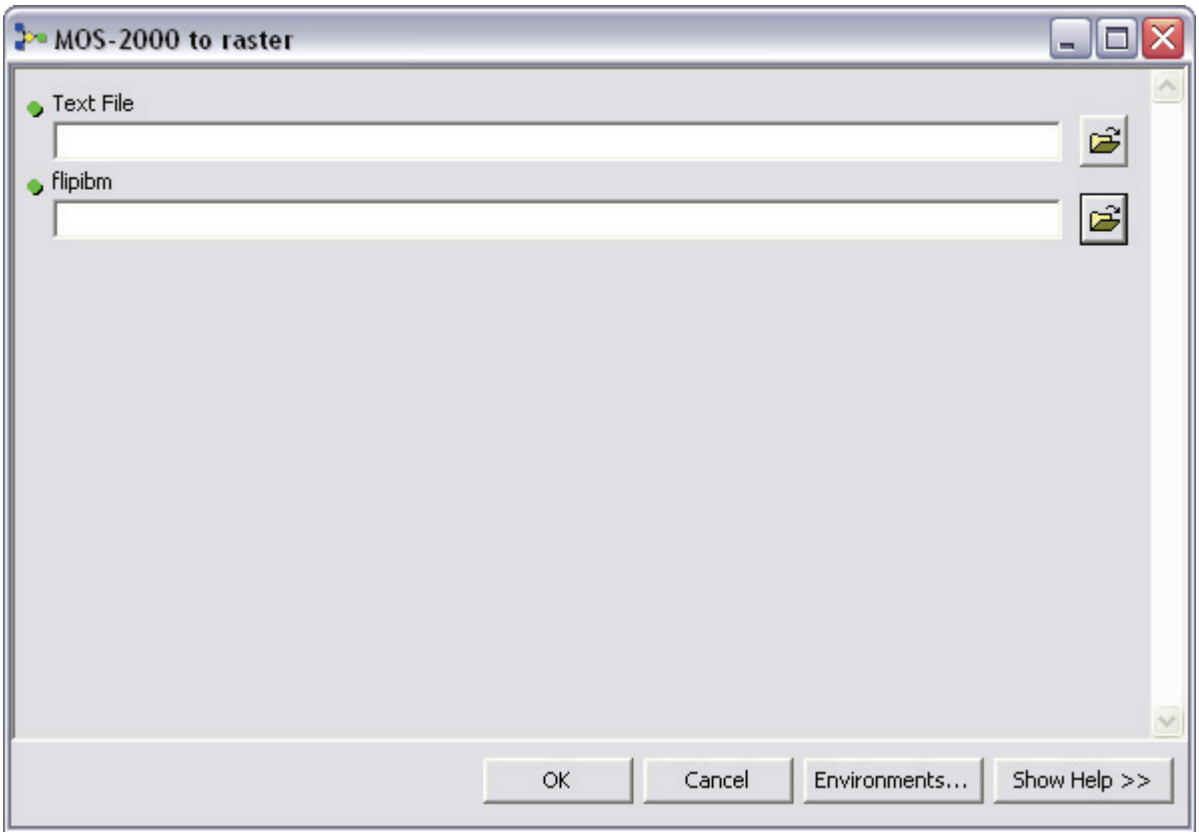
- Navigate to S:\OST2_D\MDL\MDL-Prjts\GIS_Data, and select the MDL toolbox. This will add the toolbox to your GIS.
- To make sure the toolbox loads in the future, right click on the white space in the toolbox again, and select "Save Settings > To Default".



Now, in the tools panel, expand the MDL (or SMB, if you have it) toolbox, and double-click on 'MOS2000 to Raster' to run it.



This will open the MOS2000 to Raster window, which is very simple, and looks like this:



All that is left to do is browse to the location of your ASCII file, and select it (the ASCII file goes in the 'Text File' box). The tool will pause for a while (this could be on the order of a few minutes) while it checks the file, and suggests an output path and name. Change these to your liking (GIS limits raster filenames to 13 characters, but you don't need an extension), and click OK to run. The tool will then process for a few seconds to a few minutes, and you will have your MOS2000 raster image!

Upon first import, GIS will apply a simple black and white stretched scale, a sample of which is pictured on the next page. You can adjust the color scale by right-clicking on the raster, and selecting 'Properties', and then going to the 'Symbology' tab.

APPENDIX III – Useful IDs

Commonly used MOS2000 IDs in U155 (in the appropriate format):

```
222120008 000000000 000000030 000  .0000E+00     1 1 1 U405AMAXMOS^^^.CN  40 0        MAX TEMPERATURE (F)
222220008 000000000 000000042 000  .0000E+00     1 1 1 U405AMINMOS^^^.CN  40 0        MIN TEMPERATURE (F)
222020008 000000000 000000042 000  .0000E+00     1 1 1 U405ATMPMOS^^^.CN  40 0        TEMPERATURE   (F)
223020008 000000000 000000168 000  .0000E+00     1 1 1 U405ADEWMOS^^^.CN  40 0        DEW POINT    (F)
222120008 000000000 000000174 000  .0000E+00     1 1 1 U405AMAXMOS^^^.CN  40 0        MAX TEMP (F)
222220008 000000000 000000162 000  .0000E+00     1 1 1 U405AMINMOS^^^.CN  40 0        MIN TEMPERATURE   (F)
223330108 000000000 000000168 000  .9500E-02     1 1 1 U405APOPMOS^^^.CN  40 0        12-H POP
228470008 000000000 000000066 000  .0000E+00     1 1 1 U405ASNOMOS^^^.CN  60 0        12-H SNOW
224385008 000000000 000000060 000  .0000E+00     1 1 1 U405AWNDMOSG^^.CN  40 0        WIND GUSTS   (KT)
224360008 000000000 000000060 000  .0000E+00     1 1 1 U405AWNDMOSS^^.CN  40 0        WIND SPEED   (KT)
224060008 000000000 000000060 000  .0000E+00     1 1 1 U405AWNDMOSC^^.CN  40 0        U-WIND       (KT)
224160008 000000000 000000060 000  .0000E+00     1 1 1 U405AWNDMOSC^^.CN  40 0        V-WIND       (KT)
228395008 000000000 000000060 000  .0000E+00     1 1 1 U405ASKYMOS^^^.CN  40 0        SKY
223271008 000000000 000000048 000  .0000E+00     1 1 1 U405AQ06MOS1^^.CN  60 1        6-H QPF
223270008 000000000 000000048 000  .0000E+00     1 1 1 U405AQ06MOS^^^.CN  60 0        6-H QPF
```