CAMx2CMAQ

User's Guide

Version 1.0

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1.0 INTRODUCTION

The CAMx2CMAQ converter is a suite of Fortran programs that convert the emissions and initial and boundary condition (IC/BC) inputs for the Comprehensive Air-quality Model with extensions (CAMx; http://www.camx.com/) to the required format for the Community Multiscale Air Quality (CMAQ) model (http://www.cmascenter.org/cmaq/). CAMx uses the Urban Airshed Model (UAM)-compatible format whereas CMAQ uses the hybrid Network Common Data Form-Input/Output Applications Programming Interface (netCDF-I/O API) file format. The CAMx User's Guide (http://www.camx.com/files/camxusersguide_v6-10.pdf) contains specifications of the CAMx input format. The CMAQ I/O API data structure is available in the CMAQ Operational Guidance Document (http://www.airqualitymodeling.org/cmaqwiki/).

This program does not handle meteorology inputs. CMAQ requires extra meteorology input parameters (e.g., planetary boundary layer) from those available in CAMx meteorological inputs. It is necessary that CMAQ meteorology inputs be prepared separately using the Meteorology-Chemistry Interface Processor (MCIP) distributed with CMAQ.

1.1 Program Structure

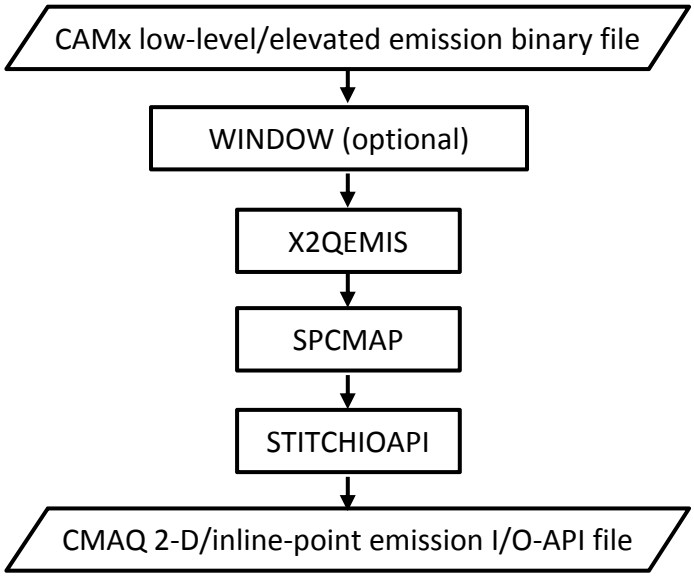
The CAMx2CMAQ converter consists of the following programs:

WINDOW	Modify the size and/or resolution of the CAMx low-level emission input grid
X2QEMIS	Convert the CAMx low-level/elevated emission input file to the CMAQ 2-D/inline-point emission input file
ICBC2IOAPI	Convert the CAMx IC/BC input file to the CMAQ ICON/BCON input file
SPCMAP	Map the CAMx model species to the CMAQ model species
STITCHIOAPI	Stitch multiple I/O API files to a single file for a user-specified time period

The WINDOW program is needed only if a user wants to change the horizontal grid of the CAMx 2-D emissions (e.g., to exclude the buffer cells or change the grid resolution). The X2QEMIS program reformats the CAMx emissions data for CMAQ. Model species mapping between CAMx and CMAQ is performed by SPCMAP. The STITCHIOAPI program performs time adjustments such as time-zone shifting and the required number of hours in the daily files.

For converting the IC/BC inputs, the ICBC2IOAPI, SPCMAP, and STITCHIOAPI programs are applied sequentially. Figure 1-1 shows the flow charts of the emissions and IC/BC conversion process.

(a) Emission conversion



(b) IC/BC conversion

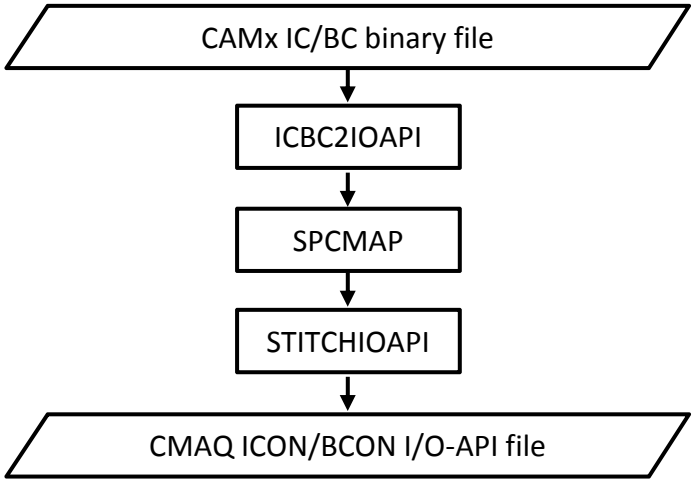


Figure 1-1. Flow charts of the emissions and IC/BC conversion process.

1.2 Compiling CAMx2CMAQ

A single “Makefile” script developed for a Linux platform is provided in the source code directory. The Makefile will compile each of the source codes and generate executable programs. The netCDF and I/O API libraries are required during compilation. The user needs to set these library paths in the Makefile prior to compilation.

2.0 EMISSION CONVERSION

This section describes how to convert the CAMx emission data to the CMAQ input format. Sample run scripts for the emission conversion are provided in the software package and are presented in Appendix A. Detailed descriptions of the script variables are given below.

2.1 Input/Output Files

INP_FILE	Input CAMx emissions file name (low-level or elevated-source emissions)
OUT_FILE	Output CMAQ emissions file name (2-D or inline-point emissions)
STK_FILE	Output CMAQ stack group file name (required only if converting inline-point emissions)

In general, the stack parameters do not vary during a modeling episode. Note that the CMAQ stack group file does not allow time-variant stack parameters. The program will check for such time-variant parameters (e.g., fire plume height) in the input data.

2.2 Input Time Zone

TIME_ZONE	Time zone of input CAMx data (e.g., 8 for PST). If this variable is omitted then the time zone that is specified in the CAMx file header will be used: This will work ONLY with the new CAMx v6 binary file header.

CAMx supports the option to perform model simulations in a user specified time zones. Often the inputs are prepared and CAMx is run using Local Standard Time (LST). In contrast, CMAQ is always run using UTC. The CAMx to CMAQ converter program has the capability to convert from any time zone to UTC for CMAQ. CAMx version 6.0 and later uses updated binary file headers that include time zone for the input data. If the TIME_ZONE variable is not set, the program will read the information from the CAMx input file header. With older headers used in previous versions of CAMx, the user must specify the input time zone in the script, which is also recommended if the user is not certain whether the input file uses the new header.

2.3 Map Projection Parameters

GDTYP3D	Integer number for type of coordinate system: 1 – Lat-long 2 – Lambert conformal conic 5 – UTM
P_ALP3D	Map projection specification parameter, PROJ_ALPHA
P_BET3D	Map projection specification parameter, PROJ_BETA
P_GAM3D	Map projection specification parameter, PROJ_GAMMA
XCENT3D	Longitude for the center of the coordinate system
YCENT3D	Latitude for the center of the coordinate system

The above variables specify the map projection for the CMAQ I/O API file. Details of these variables can be found in the I/O API User Manual (http://www.cmascenter.org/ioapi/documentation/3.1/html/GRIDS.html). CAMx versions 6.0 and later have file headers that include the map projection parameters. If the above variables are not set in the script then the information will be read from the CAMx input file header. Users must specify the map projection parameters in the script when converting versions of CAMx files prior to version 6.0.

2.4 Horizontal Grid Modification

CONVERT_DOMAIN_GRID	Yes or No flag [Y or N] to resize domain and/or convert grid resolution. ONLY for 2-D emission files
BEG_COL_INDEX	Input grid column containing western edge of output grid [integer]
END_COL_INDEX	Input grid column containing eastern edge of output grid [integer]
BEG_ROW_INDEX	Input grid row containing southern edge of output grid [integer]
END_ROW_INDEX	Input grid row containing northern edge of output grid [integer]
MESH_FACTOR	Cell size ratio of output grid to input grid [real]; e.g., 0.33333 if converting 36-km to 12-km

The program has the ability to window out a smaller modeling domain from the CAMx domain and also to change the grid cell size. CAMx uses the internal boundary (i.e., the modeling grid includes the boundary/buffer cells) while CMAQ typically uses the external boundary (i.e., boundary cells are not included in the modeling grid). Therefore, in order to have a consistent modeling grid between CAMx and CMAQ the CAMx boundary cells need to be removed.

Additionally, grid cells can be aggregated to make a coarser grid or disaggregated to a finer grid cell size. For a finer grid resolution, emissions will be uniform on all finer grid cells that originate from the same CAMx grid cell. The MESH_FACTOR variable sets the cell size ratio. No adjustment is made to the cell size when the MESH_FACTOR is set to 1.0.

This process applies to 2-D emission data.

2.5 Species Mapping

MAP_TABLE_FILE	Species mapping table file name

The species mapping table describes how the CAMx model species are mapped to the CMAQ model species. The structure of the mapping table is as follows:

- A comment line begins with # (number sign)
- Labels begin with . (period). The mapping lines begin and end with the labels ".START" and ".END"
- Each output model species is defined with a mapping equation that consists of three lines. The equation can be represented as
  *output_species = 1st_input_species * 1st_coeff + 2nd_input_species * 2nd_coeff + ...*
  The format, which is repeated for each output species, is:

Line	Format	Description
1	A16 A16 I16	Output species name Output species units Number of input species used in the mapping (maximum of 15 input species)
2	A16 A16	1st input species in the mapping 2nd input species in the mapping ...
3	F16 F16	1st coefficient in the mapping 2nd coefficient in the mapping …

The mapping table for converting emission species from the CAMx CB6 CF mechanism to the CMAQ CB05 AE5 mechanism is provided in the software package and presented in Appendix B.

In the case where CAMx emissions data do not include all species needed to define a required CMAQ emission species (e.g., PMC), one can create a substitute mapping for the species by assigning a zero coefficient (e.g., PMC = 0.0 x FPRM). It is strongly recommended that users examine the messages from the SPCMAP processor and verify that the mappings are applied as intended.

2.6 Temporal Conversion

INFILE01	1st CMAQ I/O-API input file name
INFILE02	2nd CMAQ I/O-API input file name
OUTFILE	Time-stitched output CMAQ I/O-API file name
OUT_STDATE	Start date for output file [YYYYJJJ]
OUT_STTIME	Start time for output file [HHMMSS]
OUT_DELTAT	Time step duration for output file [HHMMSS]
OUT_NUMREC	Number of records (e.g., hours) for output file [integer]

CMAQ is always run using time zone UTC. The daily CMAQ inputs typically cover midnight to midnight in UTC. If daily CAMx inputs are prepared using a local time zone other than UTC, the starting and ending times of the converted CMAQ data will not coincide with the UTC midnight. In addition, CMAQ daily emissions require 25 hours of emissions data while CAMx requires 24 hours for the same input period. This is because CMAQ uses instantaneous emission rates (at 0:00, 1:00, 2:00, etc.) while CAMx uses average emission rates (0:00-1:00, 1:00-2:00, etc.) for each input data timespan.

The STITCHIOAPI program stitches multiple I/O API files (typically 2) and produces a single I/O API file that covers the required input period (typically midnight to midnight in UTC) with the required number of data records (typically 25 hourly records for daily emission data). A sample run script for generating a CMAQ daily emission data file is provided in the software package and presented in Appendix C.

A typical CAMx to CMAQ emissions conversion application will extract a sub-grid (WINDOW), convert file formats (X2QEMIS), and redefine model species (SPCMAP) for each CAMx emissions file. This is followed by the final step of time period adjustment and stitching hours from multiple episode day files (STITCHIOAPI).

3.0 IC/BC CONVERSION

This section describes how to convert the CAMx IC/BC inputs to the CMAQ ICON/BCON inputs. Sample run scripts for the IC/BC conversion are provided in the software package and presented in Appendix A. Detailed descriptions of the variables in the script are given below.

3.1 Input/Output Files

INP_FILE	Input CAMx IC or BC file name
OUT_FILE	Output CMAQ ICON or BCON file name

CMAQ ICON/BCON files require variables that are not available in CAMx IC/BC files. These are the aerosol number and surface area concentrations for each aerosol size distribution mode and obtained from the pre-defined profile data included in the CMAQ distribution package (Table 3-1). Since the CMAQ profile data are only available for six specific sigma levels, the ICBC2IOAPI program interpolates this data for the output layers. The profile data is embedded in the program, thus no user input is needed.

Table 3-1. CMAQ's default profile data for number and surface area concentrations

	Layer Top Sigma Value					
Variable	**0.98**	**0.93**	**0.84**	**0.6**	**0.3**	**0**
NUMATKN	1.478E+09	1.470E+09	9.774E+08	9.655E+08	1.920E+08	9.584E+07
NUMACC	3.706E+08	3.412E+08	2.161E+08	1.693E+08	2.957E+07	1.416E+07
NUMCOR	2.350E+04	1.626E+04	6.338E+03	1.162E+03	2.025E+02	2.000E+02
SRFATKN	8.153E-07	8.112E-07	5.393E-07	5.327E-07	1.059E-07	5.288E-08
SRFACC	1.491E-05	1.373E-05	8.694E-06	6.815E-06	1.190E-06	5.697E-07
SRFCOR	2.640E-07	2.100E-07	1.160E-07	3.860E-08	8.530E-09	8.490E-09

3.2 Input Time Zone

See Section 2.2.

3.3 Coordinate/Grid System

GRID_FILE	3-D I/O API file name for output coordinate/grid systems.

The above file provides the map projection and horizontal/vertical grid structure information for the CMAQ I/O API file. Only the following variables are taken from this file:

- GDNAM3D - Grid name
- GDTYP3D - Horizontal coordinate system type
- P_ALP3D - Map projection specification parameter, PROJ_ALPHA
- P_BET3D - Map projection specification parameter, PROJ_BETA
- P_GAM3D - Map projection specification parameter, PROJ_GAMMA
- XORIG3D - X coordinate of the grid origin
- YORIG3D - Y coordinate of the grid origin
- XCENT3D - Longitude for the center of the coordinate system
- YCENT3D - Latitude for the center of the coordinate system
- XCELL3D - Cell dimension parallel to the X coordinate axis
- YCELL3D - Cell dimension parallel to the Y coordinate axis
- VGTYP3D - Vertical coordinate system type
- VGLVS3D - Vertical coordinate value array
- VGTOP3D - Model top value for the sigma coordinate system types

Details of these variables can be found in the I/O API User Manual (http://www.cmascenter.org/ioapi/documentation/3.1/html/GRIDS.html). This file could be GRIDCRO3D, METCRO3D, or any 3-D I/O API file that can provide correct coordinate/grid parameters for the CMAQ ICON/BCON file. Typically, this is provided by MCIP. Otherwise, an I/O API tool, "M3FAKE" can be used to make one (http://www.cmascenter.org/ioapi/documentation/3.1/html/M3FAKE.html).

Grid dimensions (number of columns/rows/layers) will be taken from the input CAMx file while GRID_FILE must have enough layers to provide sufficient information for VGLVS3D. Note that a CMAQ vertical grid requires the model top layer extended to the pressure level of 50 millibars while CAMx allows a lower model top layer. If CAMx uses a vertical grid with a lower model top than CMAQ, the conversion will result in an inconsistency in the top layer thickness between CAMx and CMAQ.

3.4 Species Mapping

See Section 2.5.

The mapping table for converting IC/BC species from the CAMx CB6 CF mechanism to the CMAQ CB05 AE5 mechanism is provided in the software package and presented in Appendix B. It is strongly recommended that users examine the screen output from the SPCMAP processor and verify that the mappings are applied as intended.

3.5 Temporal Conversion

See Section 2.6.

Similar to emissions data, each time step of CAMx BC has concentrations averaged for the time step period while CMAQ BCON uses instantaneous concentrations at the time step. There is no

single right way to map the 24 hourly average BCs back to the 25 instantaneous ones. Instead of using interpolation which tends to smooth out peak concentrations, STITCHIOAPI assigns each average concentration to the mid-point of the time step period. CMAQ requires additional data before and after the converted BCON file to cover the entire period. That is, 26 hourly data records from 23:30 UTC of the previous day to 0:30 UTC of the next day.

A sample run script for generating a daily BCON file is provided in the software package and presented in Appendix C.

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APPENDIX A

Sample Run Scripts for the CAMx2CMAQ Conversion

Appendix A. Sample Run Scripts for the CAMx2CMAQ Conversion

run.camx2cmaq.2d_emiss.sample.job

```
#!/bin/csh -f

#
#   This script converts CAMx binary emission files to CMAQ I/O-API emission files.
#

#
#   INP_FILE : Input CAMx emissions file (low-level or elevated-source emissions)
#   OUT_FILE : Output CMAQ emissions file (2-D or in-line point-source emissions)
#   STK_FILE : Output CMAQ stack group file (ONLY for in-line point-source emissions)
#
set INP_FILE  = IN/camx_cb6p_ei_lo.20060603.tx.bl06_06jun.reg2f.tx_12km
set OUT_FILE  = OUT/cmaq.2d_emis.cb05_ae5.tx.bl06_06jun.reg2f.tx_12km.gmt.20060603
set STK_FILE  =

#
#   TIME_ZONE  : Time zone for CAMx data (e.g., 8 for PST)
#                If omitted, time zone set in the CAMx file header will be used
#                (Note that this will work ONLY with the new CAMx v6 binary file header)
#
set TIME_ZONE   = 6

#
#   Map Projection Parameters for CMAQ header:
#       +-----------------------------------------------------------+
#       |          | Lat-Lon | Lambert Conformal Conic | UTM          |
#       +----------+---------+-------------------------+--------------+
#       | GDTYP3D | 1        | 2                       | 5            |
#       | P_ALP3D | unused   | 1st true latitude       | UTM zone     |
#       | P_BET3D | unused   | 2nd true latitude       | unused       |
#       | P_GAM3D | unused   | central meridian        | unused       |
#       | XCENT3D | unused   | center longitude        | UTM X offset |
#       | YCENT3D | unused   | center latitude         | UTM Y offset |
#       +---------+----------+-------------------------+--------------+
#       If omitted, those set in the CAMx file header will be used
#       (Note that this will work ONLY with the new CAMx v6 binary file header)
#
set GDTYP3D  =  2
set P_ALP3D  =  33.0
set P_BET3D  =  45.0
set P_GAM3D  = -97.0
set XCENT3D  = -97.0
set YCENT3D  =  40.0

#
#   CONVERT_DOMAIN_GRID : Resize domain and/or convert grid resolution [Y or N] (ONLY for 2-D
emissions)
#       - BEG_COL_INDEX : Input grid column containing western edge of output grid [integer]
#       - END_COL_INDEX : Input grid column containing eastern edge of output grid [integer]
#       - BEG_ROW_INDEX : Input grid row containing southern edge of output grid [integer]
#       - END_ROW_INDEX : Input grid row containing northern edge of output grid [integer]
#       - MESH_FACTOR   : Cell size ratio of output grid to input grid [real] (e.g., 0.33333 if
converting 36-km to 12-km)
#
set CONVERT_DOMAIN_GRID  = Y
set BEG_COL_INDEX  = 2
set END_COL_INDEX  = 148
set BEG_ROW_INDEX  = 2
set END_ROW_INDEX  = 109
set MESH_FACTOR    = 1.0

#
#   Species Mapping : Chemistry mechanism / aerosol scheme conversion
```

```
#       - MAP_TABLE_FILE : Species mapping table file
#
set MAP_TABLE_FILE  = Species_Mapping_Tables/MAPTBL.CAMx-CB6-CF_to_CMAQ-CB05-AE5.EMIS

#########################################################################
#
#   DO NOT MODIFY LINES BELOW
#
#########################################################################

set TMPFILE = OUT/tmp.bin
rm -f $TMPFILE

if ( $CONVERT_DOMAIN_GRID == "Y" ) then

./src/window_v2 << EOF
input file name    :$INP_FILE
output file name   :$TMPFILE
begin cell index   : $BEG_COL_INDEX $BEG_ROW_INDEX
ending cell index  : $END_COL_INDEX $END_ROW_INDEX
meshing factor     : $MESH_FACTOR
buffer?(0=NO,1=YES):0
Redefine domain?   :0
domain def         :
EOF

else

cp -v $INP_FILE $TMPFILE

endif # CONVERT_DOMAIN_GRID


setenv CMAQ_EMISS   OUT/tmp_emis.bin
setenv CMAQ_STKGRP  $STK_FILE
rm -f $CMAQ_EMISS $CMAQ_STKGRP

./src/x2qemis << EOF
Input CAMx filename|$TMPFILE
Input Time Zone    |$TIME_ZONE
Map Proj Parameters|$GDTYP3D, $P_ALP3D, $P_BET3D, $P_GAM3D, $XCENT3D, $YCENT3D
EOF


setenv INFILE   $CMAQ_EMISS
setenv OUTFILE  $OUT_FILE
setenv MAPTBL   $MAP_TABLE_FILE
rm -f $OUTFILE

./src/spcmap
```

run.camx2cmaq.inline_pt.sample.job

```
#!/bin/csh -f

#
#   This script converts CAMx binary emission files to CMAQ I/O-API emission files.
#

#
#   INP_FILE : Input CAMx emissions file (low-level or elevated-source emissions)
#   OUT_FILE : Output CMAQ emissions file (2-D or in-line point-source emissions)
#   STK_FILE : Output CMAQ stack group file (ONLY for in-line point-source emissions)
#
set INP_FILE  = IN/camx_cb6p_ei_el.20060603.tx.bc06_06jun.reg2f
set OUT_FILE  = OUT/cmaq.inline_pt.cb05_ae5.tx.bc06_06jun.reg2f.gmt.20060603
set STK_FILE  = OUT/cmaq.stack_groups.tx.bc06_06jun.reg2f.gmt.20060603

#
#   TIME_ZONE  : Time zone for CAMx data (e.g., 8 for PST)
#                If omitted, time zone set in the CAMx file header will be used
#                (Note that this will work ONLY with the new CAMx v6 binary file header)
#
set TIME_ZONE   = 6

#
#   Map Projection Parameters for CMAQ header:
#       +---------------------------------------------------------+
#       |          | Lat-Lon | Lambert Conformal Conic | UTM          |
#       +---------+---------+-------------------------+--------------+
#       | GDTYP3D | 1       | 2                       | 5            |
#       | P_ALP3D | unused  | 1st true latitude       | UTM zone     |
#       | P_BET3D | unused  | 2nd true latitude       | unused       |
#       | P_GAM3D | unused  | central meridian        | unused       |
#       | XCENT3D | unused  | center longitude        | UTM X offset |
#       | YCENT3D | unused  | center latitude         | UTM Y offset |
#       +---------+---------+-------------------------+--------------+
#       If omitted, those set in the CAMx file header will be used
#       (Note that this will work ONLY with the new CAMx v6 binary file header)
#
set GDTYP3D  =  2
set P_ALP3D  =  33.0
set P_BET3D  =  45.0
set P_GAM3D  = -97.0
set XCENT3D  = -97.0
set YCENT3D  =  40.0

#
#   CONVERT_DOMAIN_GRID : Resize domain and/or convert grid resolution [Y or N] (ONLY for 2-D
emissions)
#       - BEG_COL_INDEX : Input grid column containing western edge of output grid [integer]
#       - END_COL_INDEX : Input grid column containing eastern edge of output grid [integer]
#       - BEG_ROW_INDEX : Input grid row containing southern edge of output grid [integer]
#       - END_ROW_INDEX : Input grid row containing northern edge of output grid [integer]
#       - MESH_FACTOR   : Cell size ratio of output grid to input grid [real] (e.g., 0.33333 if
converting 36-km to 12-km)
#
set CONVERT_DOMAIN_GRID  = N
set BEG_COL_INDEX  =
set END_COL_INDEX  =
set BEG_ROW_INDEX  =
set END_ROW_INDEX  =
set MESH_FACTOR    =

#
#   Species Mapping : Chemistry mechanism / aerosol scheme conversion
#       - MAP_TABLE_FILE : Species mapping table file
#
set MAP_TABLE_FILE  = Species_Mapping_Tables/MAPTBL.CAMx-CB6-CF_to_CMAQ-CB05-AE5.EMIS
```

```
#############################################################################
#
#   DO NOT MODIFY LINES BELOW
#
#############################################################################

set TMPFILE = OUT/tmp.bin
rm -f $TMPFILE

if ( $CONVERT_DOMAIN_GRID == "Y" ) then

./src/window_v2 << EOF
input file name    :$INP_FILE
output file name   :$TMPFILE
begin cell index   : $BEG_COL_INDEX $BEG_ROW_INDEX
ending cell index  : $END_COL_INDEX $END_ROW_INDEX
meshing factor     : $MESH_FACTOR
buffer?(0=NO,1=YES):0
Redefine domain?   :0
domain def         :
EOF

else

cp -v $INP_FILE $TMPFILE

endif # CONVERT_DOMAIN_GRID


setenv CMAQ_EMISS   OUT/tmp_emis.bin
setenv CMAQ_STKGRP  $STK_FILE
rm -f $CMAQ_EMISS $CMAQ_STKGRP

./src/x2qemis << EOF
Input CAMx filename|$TMPFILE
Input Time Zone    |$TIME_ZONE
Map Proj Parameters|$GDTYP3D, $P_ALP3D, $P_BET3D, $P_GAM3D, $XCENT3D, $YCENT3D
EOF


setenv INFILE   $CMAQ_EMISS
setenv OUTFILE  $OUT_FILE
setenv MAPTBL   $MAP_TABLE_FILE
rm -f $OUTFILE

./src/spcmap
```

run.camx2cmaq.icon.sample.job

```
#!/bin/csh -f

#
#   This script converts CAMx binary IC/BC files to CMAQ I/O-API ICON/BCON files.
#

#
#   INP_FILE : Input CAMx IC or BC file
#   OUT_FILE : Output CMAQ ICON or BCON file
#
set INP_FILE  = IN/camx_cb6_ic.20060524.geoschem.rpo_36km
set OUT_FILE  = OUT/cmaq.ICON.cb05_ae5.geoschem.rpo_36km.gmt.20060524

#
#   TIME_ZONE : Time zone for CAMx data (e.g., 8 for PST)
#               If omitted, time zone set in the CAMx file header will be used
#               (Note that this will work ONLY with the new CAMx v6 binary file header)
#
set TIME_ZONE  = 6

#
#   GRID_FILE : 3-D I/O API file name for output coordinate/grid systems.
#               This could be GRIDCRO3D, METCRO3D, or any 3-D I/O API file
#               that can provide correct coordinate/grid parameters for
#               OUTFILE. Typically, this is provided by MCIP. Otherwise,
#               an I/O API tool, M3FAKE can be used to make one:
#               https://www.cmascenter.org/ioapi/documentation/3.1/html/M3FAKE.html
#               Only the following parameters are taken from this file:
#                      GDNAM3D, GDTYP3D, P_ALP3D, P_BET3D, P_GAM3D,
#                      XORIG3D, YORIG3D, XCENT3D, YCENT3D, XCELL3D,
#                      YCELL3D, VGTYP3D, VGLVS3D, VGTOP3D.
#               Grid dimensions (number of columns/rows/layers) will be
#               taken from INFILE while GRID_FILE must have enough number
#               of layers to provide sufficient information for VGLVS3D.
#
set GRID_FILE  = mcip_v4.1/METCRO3D_tceq_camx2cmaq_36km.20060525

#
#   Species Mapping : Chemistry mechanism / aerosol scheme conversion
#       - MAP_TABLE_FILE : Species mapping table file
#
set MAP_TABLE_FILE  = Species_Mapping_Tables/MAPTBL.CAMx-CB6-CF_to_CMAQ-CB05-AE5.ICBC

###########################################################################
#
#   DO NOT MODIFY LINES BELOW
#
###########################################################################

setenv INFILE      $INP_FILE
setenv OUTFILE     OUT/tmp.bin
setenv GRIDCRO3D   $GRID_FILE
setenv TZONE       $TIME_ZONE
rm -f $OUTFILE

./src/icbc2ioapi

setenv INFILE   $OUTFILE
setenv OUTFILE  $OUT_FILE
setenv MAPTBL   $MAP_TABLE_FILE
rm -f $OUTFILE

./src/spcmap
```

run.camx2cmaq.bcon.sample.job

```
#!/bin/csh -f

#
#   This script converts CAMx binary IC/BC files to CMAQ I/O-API ICON/BCON files.
#

#
#   INP_FILE : Input CAMx IC or BC file
#   OUT_FILE : Output CMAQ ICON or BCON file
#
set INP_FILE  = IN/camx_cb6_bc.20060525.geoschem.rpo_36km
set OUT_FILE  = OUT/cmaq.BCON.cb05_ae5.geoschem.rpo_36km.gmt.20060525

#
#   TIME_ZONE : Time zone for CAMx data (e.g., 8 for PST)
#               If omitted, time zone set in the CAMx file header will be used
#               (Note that this will work ONLY with the new CAMx v6 binary file header)
#
set TIME_ZONE  = 6

#
#   GRID_FILE : 3-D I/O API file name for output coordinate/grid systems.
#               This could be GRIDCRO3D, METCRO3D, or any 3-D I/O API file
#               that can provide correct coordinate/grid parameters for
#               OUTFILE. Typically, this is provided by MCIP. Otherwise,
#               an I/O API tool, M3FAKE can be used to make one:
#               https://www.cmascenter.org/ioapi/documentation/3.1/html/M3FAKE.html
#               Only the following parameters are taken from this file:
#                      GDNAM3D, GDTYP3D, P_ALP3D, P_BET3D, P_GAM3D,
#                      XORIG3D, YORIG3D, XCENT3D, YCENT3D, XCELL3D,
#                      YCELL3D, VGTYP3D, VGLVS3D, VGTOP3D.
#               Grid dimensions (number of columns/rows/layers) will be
#               taken from INFILE while GRID_FILE must have enough number
#               of layers to provide sufficient information for VGLVS3D.
#
set GRID_FILE  = mcip_v4.1/METCRO3D_tceq_camx2cmaq_36km.20060525

#
#   Species Mapping : Chemistry mechanism / aerosol scheme conversion
#       - MAP_TABLE_FILE : Species mapping table file
#
set MAP_TABLE_FILE  = Species_Mapping_Tables/MAPTBL.CAMx-CB6-CF_to_CMAQ-CB05-AE5.ICBC

###########################################################################
#
#   DO NOT MODIFY LINES BELOW
#
###########################################################################

setenv INFILE      $INP_FILE
setenv OUTFILE     OUT/tmp.bin
setenv GRIDCRO3D   $GRID_FILE
setenv TZONE       $TIME_ZONE
rm -f $OUTFILE

./src/icbc2ioapi

setenv INFILE   $OUTFILE
setenv OUTFILE  $OUT_FILE
setenv MAPTBL   $MAP_TABLE_FILE
rm -f $OUTFILE

./src/spcmap
```

ENVIRON

APPENDIX B

Sample Mapping Tables for the CAMx2CMAQ Conversion

Appendix B. Sample Mapping Tables for the CAMx2CMAQ Conversion

MAPTBL.CAMx-CB6-CF_to_CMAQ-CB05-AE5.EMIS

```
#   SPECIES MAPPING TABLE FOR SPCMAP
#
#   SOURCE: CAMx-CB6-CF
#   TARGET: CMAQ-CB05-AE5 (EMIS)
#
.START
AACD            moles/s         1
AACD
1.0
ALD2            moles/s         1
ALD2
1.0
ALDX            moles/s         1
ALDX
1.0
BENZENE         moles/s         1
BENZ
1.0
CAT1            moles/s         1
CAT1
1.0
CO              moles/s         1
CO
1.0
CRES            moles/s         1
CRES
1.0
CRON            moles/s         1
CRON
1.0
ETH             moles/s         1
ETH
1.0
ETHA            moles/s         1
ETHA
1.0
ETOH            moles/s         1
ETOH
1.0
FACD            moles/s         1
FACD
1.0
FORM            moles/s         1
FORM
1.0
H2O2            moles/s         1
H2O2
1.0
HNO3            moles/s         1
HNO3
1.0
HONO            moles/s         1
HONO
1.0
IOLE            moles/s         1
IOLE
1.0
ISOP            moles/s         1
ISOP
1.0
ISPD            moles/s         1
ISPD
1.0
```

```
MEOH            moles/s         1
MEOH
1.0
MEPX            moles/s         1
MEPX
1.0
MGLY            moles/s         1
MGLY
1.0
N2O5            moles/s         1
N2O5
1.0
NO              moles/s         1
NO
1.0
NO2             moles/s         1
NO2
1.0
NO3             moles/s         1
NO3
1.0
NTR             moles/s         4
NTR             INTR            NTR1            NTR2
1.0             1.0             1.0             1.0
O3              moles/s         1
O3
1.0
OLE             moles/s         1
OLE
1.0
OPAN            moles/s         1
OPAN
1.0
OPEN            moles/s         1
OPEN
1.0
PACD            moles/s         1
PACD
1.0
PAN             moles/s         1
PAN
1.0
PANX            moles/s         1
PANX
1.0
PAR             moles/s         6
PAR             ACET            BENZ            ETHY            KET             PRPA
1.0             3.0             1.0             1.0             1.0             1.5
PNA             moles/s         1
PNA
1.0
ROOH            moles/s         1
ROOH
1.0
SO2             moles/s         1
SO2
1.0
SULF            moles/s         1
SULF
1.0
TERP            moles/s         1
TERP
1.0
TOL
1.0
XYL             moles/s         1
XYL
```

```
1.0
NH3             moles/s         1
NH3
1.0
HCL             moles/s         1
HCL
1.0
SESQ            moles/s         1
SQT
1.0
SV_TOL1         moles/s         1
CG1
0.5
SV_XYL1         moles/s         1
CG1
0.5
SV_TOL2         moles/s         1
CG2
0.5
SV_XYL2         moles/s         1
CG2
0.5
SV_ISO2         moles/s         1
CG3
1.0
SV_ISO1         moles/s         1
CG4
1.0
SV_TRP1         moles/s         1
CG5
1.0
SV_TRP2         moles/s         1
CG6
1.0
SV_SQT          moles/s         1
CG7
1.0
NR              moles/s         4
NR              BENZ            ETHY            PRPA
1.0             5.0             1.0             1.5
CL2             moles/s         1
CL2
1.0
CH4             moles/s         2
CH4             ECH4
1.0             1.0
HGNRVA          moles/s         1
HG0
1.0
HGIIGAS         moles/s         1
HG2
1.0
PSO4            g/s             1
PSO4
1.0
PNO3            g/s             1
PNO3
1.0
POC             g/s             1
POA
1.0
PEC             g/s             1
PEC
1.0
PMFINE          g/s             2
FPRM            FCRS
1.0             1.0
```

```
PMC             g/s             2
CPRM            CCRS
1.0             1.0
PHGI            g/s             1
HGP
1.0
.END
```

MAPTBL.CAMx-CB6-CF_to_CMAQ-CB05-AE5.ICBC

```
#   SPECIES MAPPING TABLE FOR SPCMAP
#
#   SOURCE: CAMx-CB6-CF
#   TARGET: CMAQ-CB05-AE5 (ICBC)
#
.START
AACD            ppmV            1
AACD
1.0
ALD2            ppmV            1
ALD2
1.0
ALDX            ppmV            1
ALDX
1.0
BENZENE         ppmV            1
BENZ
1.0
CAT1            ppmV            1
CAT1
1.0
CO              ppmV            1
CO
1.0
CRES            ppmV            1
CRES
1.0
CRON            ppmV            1
CRON
1.0
ETH             ppmV            1
ETH
1.0
ETHA            ppmV            1
ETHA
1.0
ETOH            ppmV            1
ETOH
1.0
FACD            ppmV            1
FACD
1.0
FORM            ppmV            1
FORM
1.0
H2O2            ppmV            1
H2O2
1.0
HNO3            ppmV            1
HNO3
1.0
HONO            ppmV            1
HONO
1.0
IOLE            ppmV            1
IOLE
1.0
ISOP            ppmV            1
ISOP
1.0
ISPD            ppmV            1
ISPD
1.0
MEOH            ppmV            1
MEOH
1.0
MEPX            ppmV            1
```

```
MEPX
1.0
MGLY            ppmV            1
MGLY
1.0
N2O5            ppmV            1
N2O5
1.0
NO              ppmV            1
NO
1.0
NO2             ppmV            1
NO2
1.0
NO3             ppmV            1
NO3
1.0
NTR             ppmV            4
NTR             INTR            NTR1            NTR2
1.0             1.0             1.0             1.0
O3              ppmV            1
O3
1.0
OLE             ppmV            1
OLE
1.0
OPAN            ppmV            1
OPAN
1.0
OPEN            ppmV            1
OPEN
1.0
PACD            ppmV            1
PACD
1.0
PAN             ppmV            1
PAN
1.0
PANX            ppmV            1
PANX
1.0
PAR             ppmV            6
PAR             ACET            BENZ            ETHY            KET             PRPA
1.0             3.0             1.0             1.0             1.0             1.5
PNA             ppmV            1
PNA
1.0
ROOH            ppmV            1
ROOH
1.0
SO2             ppmV            1
SO2
1.0
SULF            ppmV            1
SULF
1.0
TERP            ppmV            1
TERP
1.0
TOL             ppmV            1
TOL
1.0
XYL             ppmV            1
XYL
1.0
NH3             ppmV            1
NH3
1.0
HCL             ppmV            1
```

```
HCL
1.0
SESQ            ppmV            1
SQT
1.0
SV_TOL1         ppmV            1
CG1
0.5
SV_XYL1         ppmV            1
CG1
0.5
SV_TOL2         ppmV            1
CG2
0.5
SV_XYL2         ppmV            1
CG2
0.5
SV_ISO2         ppmV            1
CG3
1.0
SV_ISO1         ppmV            1
CG4
1.0
SV_TRP1         ppmV            1
CG5
1.0
SV_TRP2         ppmV            1
CG6
1.0
SV_SQT          ppmV            1
CG7
1.0
NR              ppmV            4
NR              BENZ            ETHY            PRPA
1.0             5.0             1.0             1.5
CL2             ppmV            1
CL2
1.0
CH4             ppmV            2
CH4             ECH4
1.0             1.0
HG              ppmV            1
HG0
1.0
HGIIGAS         ppmV            1
HG2
1.0
ASO4J           micrograms/m**3 1
PSO4
1.0
ANO3J           micrograms/m**3 1
PNO3
1.0
ANH4J           micrograms/m**3 1
PNH4
1.0
AORGPAJ         micrograms/m**3 1
POA
1.0
AECJ            micrograms/m**3 1
PEC
1.0
ATOL1J          micrograms/m**3 1
SOA1
0.5
AXYL1J          micrograms/m**3 1
SOA1
0.5
ATOL2J          micrograms/m**3 1
```

```
SOA2
0.5
AXYL2J          micrograms/m**3 1
SOA2
0.5
AISO2J          micrograms/m**3 1
SOA3
1.0
AISO1J          micrograms/m**3 1
SOA4
1.0
ATRP1J          micrograms/m**3 1
SOA5
1.0
ATRP2J          micrograms/m**3 1
SOA6
1.0
ASQTJ           micrograms/m**3 1
SOA7
1.0
AOLGAJ          micrograms/m**3 1
SOPA
1.0
AOLGBJ          micrograms/m**3 1
SOPB
1.0
ANAJ            micrograms/m**3 1
NA
1.0
ACLJ            micrograms/m**3 1
PCL
1.0
A25J            micrograms/m**3 2
FPRM            FCRS
1.0             1.0
ACORS           micrograms/m**3 1
CPRM
1.0
ASOIL           micrograms/m**3 1
CCRS
1.0
APHGJ           micrograms/m**3 1
HGP
1.0
NUMATKN         #/m**3          1
NUMATKN
1.0
NUMACC          #/m**3          1
NUMACC
1.0
NUMCOR          #/m**3          1
NUMCOR
1.0
SRFATKN         m**2/m**3       1
SRFATKN
1.0
SRFACC          m**2/m**3       1
SRFACC
1.0
SRFCOR          m**2/m**3       1
SRFCOR
1.0
.END
```

ENVIRON

APPENDIX C

Sample Run Scripts for the STITCHIOAPI Processor

Appendix C. Sample Run Scripts for the STITCHIOAPI Processor

run.camx2cmaq.stitch_em.sample.job

```
#!/bin/csh -f

#
#  STITCHIOAPI stitches and cuts multiple consecutive I/O API files together.
#

#
#  Environmental variables for user inputs:
#
#  INFILE01  : 1st CMAQ I/O-API input file
#  INFILEnn  : nn-th CMAQ I/O-API input file (1<nn<100; optional)
#  OUTFILE   : Time-stitched output CMAQ I/O-API file
#  OUT_STDATE : Start date for output file [YYYYJJJ]
#  OUT_STTIME : Start time for output file [HHMMSS]
#  OUT_DELTAT : Time step duration for output file [HHMMSS]
#  OUT_NUMREC : Number of records (e.g., hours) for output file [integer]
#
#  NOTE1 - Input files must be ordered sequentially while gap or
#      overlap between them is allowed. If an output time step
#      is not available in the input files, output data for the
#      time step will be interpolated.
#
#  NOTE2 - Consistency in the coordinate/grid system between input
#      files will be checked while it's simply assumed that all
#      the inputs have the same set of variables.
#

setenv INFILE01 OUT/cmaq.2d_emis.cb05_ae5.tx.bl06_06jun.reg2f.tx_12km.gmt.20060602
setenv INFILE02 OUT/cmaq.2d_emis.cb05_ae5.tx.bl06_06jun.reg2f.tx_12km.gmt.20060603
setenv OUTFILE  OUT/cmaq.2d_emis.cb05_ae5.tx.bl06_06jun.reg2f.tx_12km.gmt_stitched.20060603

setenv OUT_STDATE 2006154
setenv OUT_STTIME 0
setenv OUT_DELTAT 10000
setenv OUT_NUMREC 25

rm -f $OUTFILE

./src/stitchioapi
```

run.camx2cmaq.stitch_bc.sample.job

```
#!/bin/csh -f

#
#   STITCHIOAPI stitches and cuts multiple consecutive I/O API files together.
#

#
#   Environmental variables for user inputs:
#
#   INFILE01   : 1st CMAQ I/O-API input file
#   INFILEnn   : nn-th CMAQ I/O-API input file (1<nn<100; optional)
#   OUTFILE    : Time-stitched output CMAQ I/O-API file
#   OUT_STDATE : Start date for output file [YYYYJJJ]
#   OUT_STTIME : Start time for output file [HHMMSS]
#   OUT_DELTAT : Time step duration for output file [HHMMSS]
#   OUT_NUMREC : Number of records (e.g., hours) for output file [integer]
#
#   NOTE1 - Input files must be ordered sequentially while gap or
#           overlap between them is allowed. If an output time step
#           is not available in the input files, output data for the
#           time step will be interpolated.
#
#   NOTE2 - Consistency in the coordinate/grid system between input
#           files will be checked while it's simply assumed that all
#           the inputs have the same set of variables.
#
#   NOTE for BCON - Converted BCON has hourly data at 0:30, 1:30, etc.
#                   Therefore, additional data need to be added before
#                   and after the day, i.e., 23:30 of the previous day
#                   and 0:30 of the next day.
#

setenv INFILE01  OUT/cmaq.BCON.cb05_ae5.geoschem.rpo_36km.gmt.20060524
setenv INFILE02  OUT/cmaq.BCON.cb05_ae5.geoschem.rpo_36km.gmt.20060525
setenv OUTFILE   OUT/cmaq.BCON.cb05_ae5.geoschem.rpo_36km.gmt_stitched.20060525

setenv OUT_STDATE  2006144
setenv OUT_STTIME  233000
setenv OUT_DELTAT  10000
setenv OUT_NUMREC  26

rm -f $OUTFILE

./src/stitchioapi
```