

Technical Memorandum

Development of MANE-VU Mobile Source Projection Inventories for SMOKE/MOBILE6 Application

**Northeast States for Coordinated Air Use Management (NESCAUM)
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I. Background

The MANE-VU Emissions Inventory workgroup chose to utilize in-house expertise to develop future year mobile source emission estimates for use in ozone, PM_{2.5}, and regional haze SIP modeling. Jung-Hun Woo, NESCAUM, and Megan Schuster, MARAMA, compiled all the information necessary to run MOBILE6 with Sparse Matrix Operator Kernel Emissions (SMOKE) based on the state submitted data. The purpose of this document is to describe how member states and NESCAUM/MARAMA prepared the mobile source activity data (i.e., non-link based VMT & Speed), MOBILE6 scenario input files, and accompanying files in SMOKE/MOBILE6 format in support of future year projection inventory development.

II. Procedure

2.1. Base year (Y2002) inventory file

The MANE-VU 2002 base year SMOKE/MOBILE6-ready mobile source files served as a starting point for projection inventory development; hence, the procedures employed for the development of these files are summarized here. E.H Pechan, a contractor for MANE-VU, compiled MANE-VU 2002 mobile source inventories. The onroad emissions inventory was compiled from data supplied by the MANE-VU state agencies in the form of onroad emissions input data or emissions inventories either directly to MANE-VU or to EPA through its CERR submittal. States provided information in one or more of the following ways: (1) an onroad emission inventory submittal to EPA, (2) MOBILE6 inputs and VMT data in National Mobile Inventory Model (NMIM) format to EPA, (3) portions of MOBILE6 inputs or full MOBILE6 input files and supporting files plus VMT to EPA, or (4) portions of MOBILE6 inputs or full MOBILE6 input files and supporting files plus VMT to MANE-VU. Different procedures were followed in developing the MANE-VU 2002 onroad emission inventory depending upon how the data were submitted. All states provided information on 2002 onroad activity in the form of vehicle miles traveled (VMT) estimates, although the level of detail of the VMT data varied by state. After integration of all these data, Pechan compiled onroad mobile source files in a SMOKE/MOBILE6 ready format.

2.2. Preparing technical guidance to create SMOKE/Mobile6 ready information

As described above, states had the ability and experience to develop their mobile source inventory data in NMIM, stand-alone MOBILE6, and emissions inventory format. They,

however, were not familiar with procedures for integrating files and converting them into a model ready format. To assist the state workgroup in the creation of an inventory in (as close as possible to) the SMOKE/MOBILE6-ready format, NESCAUM/MARAMA developed a technical guidance document

(<http://www.marama.org/visibility/Inventory%20Summary/FutureEmissionsInventory.htm>). In the document, we also explained how the state workgroup could download the year 2002 files (<ftp.marama.org>) and update them to create projection inventory files.

In the technical guidance, states were requested to supply NESCAUM and MARAMA with the data described below, under Required Data. States also had the option to supply NESCAUM and MARAMA with the information listed under Optional Data.

REQUIRED DATA:

- 1) SMOKE/IDA Activity File
 - a. Go to MARAMA FTP site (above), click on Onroad/ Final Smoke Files/ MANEVU_2002_mbinv.txt
 - b. Open the MANEVU_2002_mbinv.txt file
 - c. Delete all data that is not your state's.
 - d. Update file with new header and annual VMT by SCC for 2009
 - e. Name file: state_2009_mbinv.txt
 - f. Repeat steps 'b' through 'e' for years 2012 and 2018
- 2) MOBILE6 input scenario files
 - a. Go to MARAMA ftp site, click on MANE-VU Onroad/ Final Smoke Files/ MANEVU_2002_SMOKE_M6_InputFiles_12032004.zip /m6_2002/month/statecounty.in
 - b. Provide updated statecounty.in files for each month and year 2009, 2012 and 2018
 - c. Use same naming convention as the 2002 files – statecounty.in

OPTIONAL DATA:

- 1) If a state wants to, it can update registration data to either 2004 or 2005
 - a. Go to MARAMA FTP site - Onroad/ Final Smoke Files/MANEVU_2002_SMOKE_M6_ExternalFiles.zip
 - b. As an example, open file 0900002.reg (or any files with extension .reg)
 - c. There is a long header followed by the real data. Real data starts at the line called REG DIST. (See example file below).
 - d. States should update the registration data by vehicle class and age for 2004 or 2005.
 - e. If you update this data and change the name of the file, make sure the M6 input scenario file (required data from above) includes the correct file name for registration data (REG DIST).

2.3. States data submittal and compiling future inventory

As states submitted their projected mobile source files as listed above, NESCAUM started to integrate Y2018 files and convert them into regional (i.e., MANE-VU) files. The following subsections summarize the compilation process for activity input, scenario input files, external files and other SMOKE related files.

1) Activity input data (VMT/Speed)

- All member states submitted VMT and speed data. There were minor issues in data formatting but nothing major.
- DE and MA re-submitted VMT files in October, 2005 (MA also changed 2002 VMT)
- Merged update 2002 MBINV file, ptpro/ptref, scenario input files for CT and NJ

2) Scenario input files

- VT used the same input file for all the counties. So, only 36 input files (i.e., 12 months * 3 future years) were provided. VT set 050001 as a reference county (MCREF).
- VT uses January as reference month for August processing. VT has confirmed that it wants to change reference month for Apr-Sep as July instead of January.
- ME submitted all monthly data in a file. NESCAUM split it by month.
- MA submitted only three input files (Avg Summer day, Typ Ozone day, Avg Winter day), which were submitted to Pechan to develop base year input files. NESCAUM created *.in files by copying MANE-VU 2002 base-year *.in files, then changing years into 2009/2012/2018 and the link to the new external files (LEV2CERT.D, LEV2EVAP.D, LEV2EXH.D).
- CT submitted *.IN files on 9/22/2005. The "> I/M DESC" file path had been removed.
- RI scenario input files have 044yyc.IN name convention that is supposed to be 044ccc.IN (yy stands for 2 digit year and ccc stands for 3 digit county FIPS). They are renamed and populated for 12 months.
- Some states (MD) put "REBUILT EFFECTS" after the "SCENARIO RECORD" line. They were moved ahead of it.
- PA put "ANTI-Tamp" records in external files that need to be in Scenario input files. NESCAUM wrote a FORTRAN code (pa_input_4_override.f) and a C-shell script (cp_antitamp_4_pa.csh) to put those records in scenario input files.
- NJ had 2012 year tag in 2009 scenario input files. NESCAUM changed them back to 2009.
- For 2002 scenario input files update (10/27/2006), CT put 0.07 Rebuild effect, NJ did not have any. NESCAUM put 0.1 to NJ 2002 input files.
- Putting future year rebuild effect is a modeling decision that needs to be a constant throughout the region. NESCAUM didn't correct that in file compilation. Modelers put 10% for the base year (2002) and 90% for the future years (2009/2012/2018). NYSDEC put 0.9 into year 2009 files and NESCAUM put 0.9 into year 2018 files before SMOKE/MOBILE6 processing.

3) External files

- VT used some of NY state external files (e.g. NYLEV2.D, NYL2EXH.D, NYL2EVAP.D, and NYL2CERT.D).
- RI didn't provide any future-specific external files. 2002 MANE-VU M6 external files were used.

- MA and ME used the same named files which have identical contents to each other: LEV2CERT.D, LEV2EVAP.D, and LEV2EXH.D
- DE, PA, and NJ submitted the same named files which have identical contents to each other: NLEVNE.D
- DC file produce warnings (but not errors) from SMOKE/MOBILE6 test run
 “User Supplied HC IM240 Cutpoint of 0.500 for year 1 and Vehicle Type 1 is Too Low and has been Reset to 0.80 g/mi.” Consulted with DC and confirmed that it’s okay to use it as is.

4) Other SMOKE related files

- MCREF/MVREF
 Update MANEVU_2002_mcref.txt for Maine because Penobscot county (23019) was not found from MAINE_pointerfile.xls. Tammy Gould @ Maine confirmed that Penobscot (019) has to be added where Piscataquis (021) is. Corrected this problem on both MANEVU_2018_mcref.txt and MAINE_pointerfile.xls. MANEVU_2018_mvref.txt is updated by deleting non-ref counties in ME.
- MTPRO/MTREF
 Added CT and NJ temporal profile/x-ref to 2018 MANEVU files.

III. Sample model run

Even though NESCAUM had not run SMOKE/MOBILE6 for any of the complete projection years, we ran one day for each year for the following purposes: 1) to test compatibility of compiled data with the SMOKE/MOBILE6 system, and 2) to examine trends in submitted projection data. As seen in the Figure 1 and Figure 2, VMT increases 10~20% compared to the base year (i.e., year 2002) for most states whereas speed remains the same except for NY and PA.

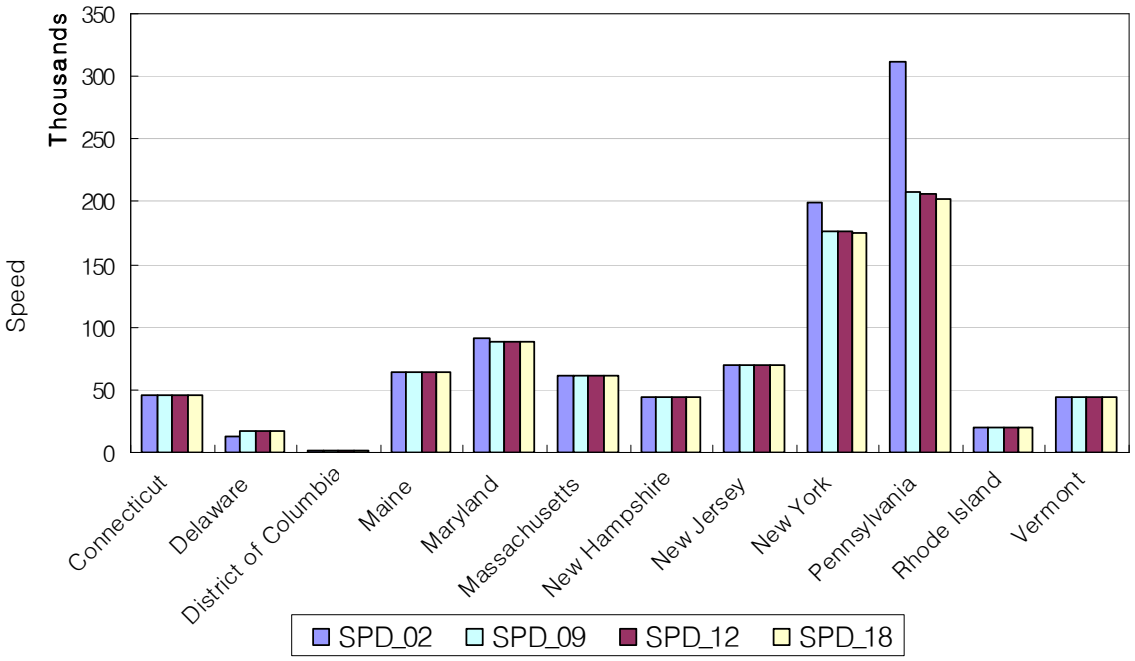
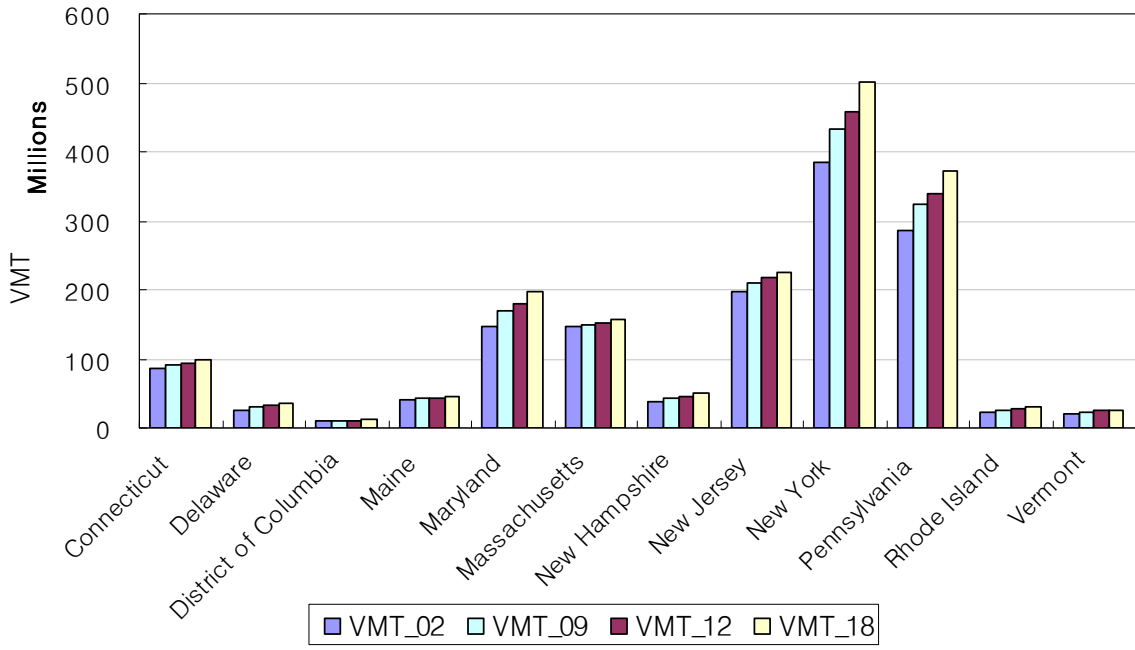


Figure 1. VMT (upper) and Speed (lower) for one day (August 1) of year 2002, 2009, 2012, and 2018

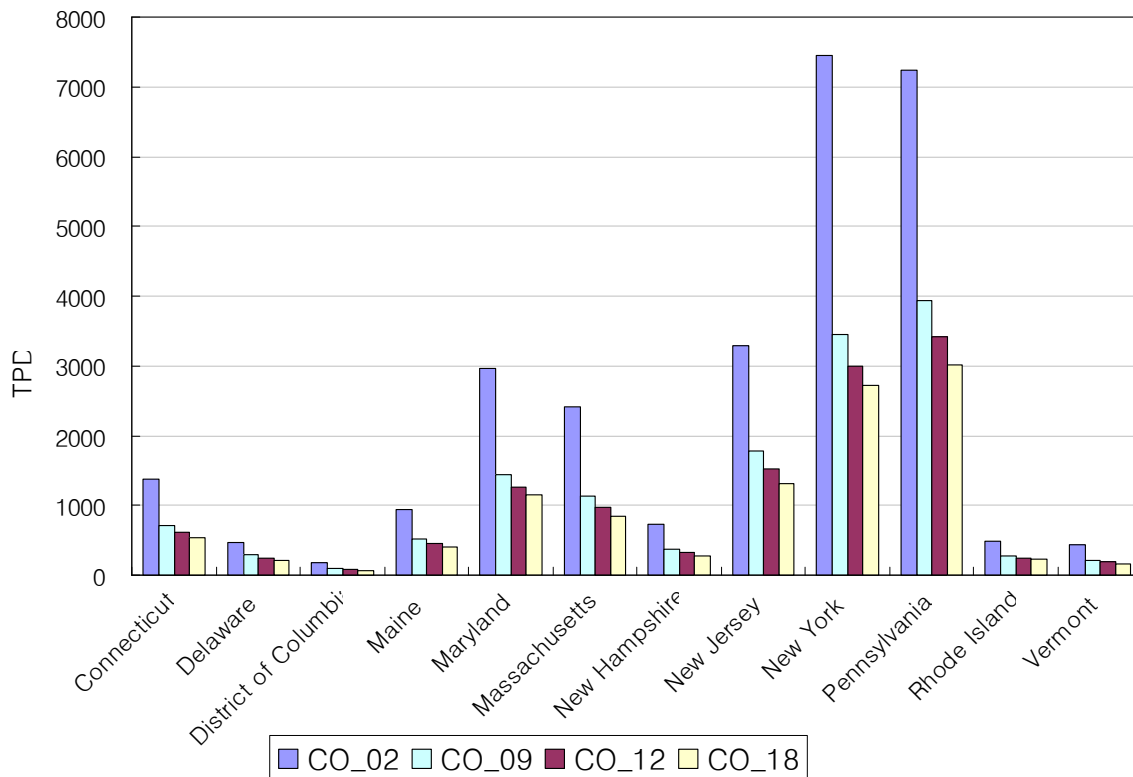
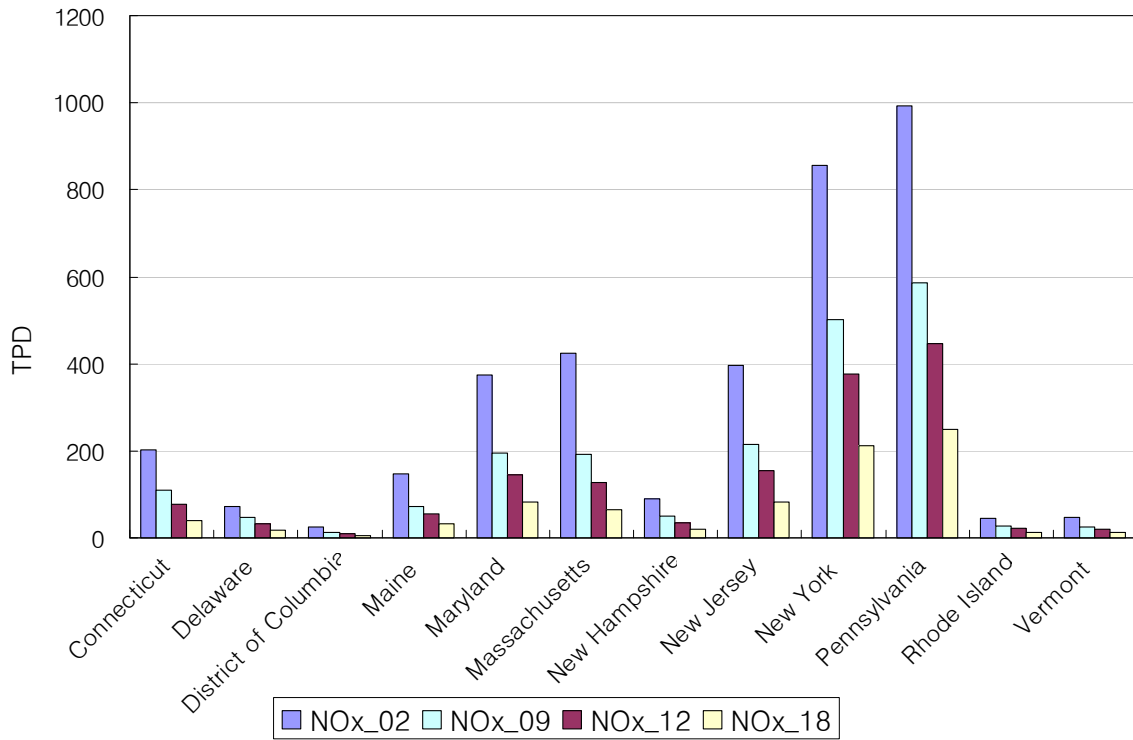


Figure 2. NOx (upper) and CO (lower) emissions for one day (August 1) of year 2002, 2009, 2012, and 2018

Despite VMT increases, NO_x and CO emissions decrease dramatically due to future year control programs. Emissions decrease a bit more slowly after 2009 given fewer anticipated controls during post-2009 years.

NO_x reductions seen from Figure 2 can be verified in the spatial (by county) NO_x emission maps that were calculated using SMOKE/MOBILE6 for August 1 of each year. As region wide emissions decreased across years, emissions from high emission areas (e.g., urban centers) decreased as well.

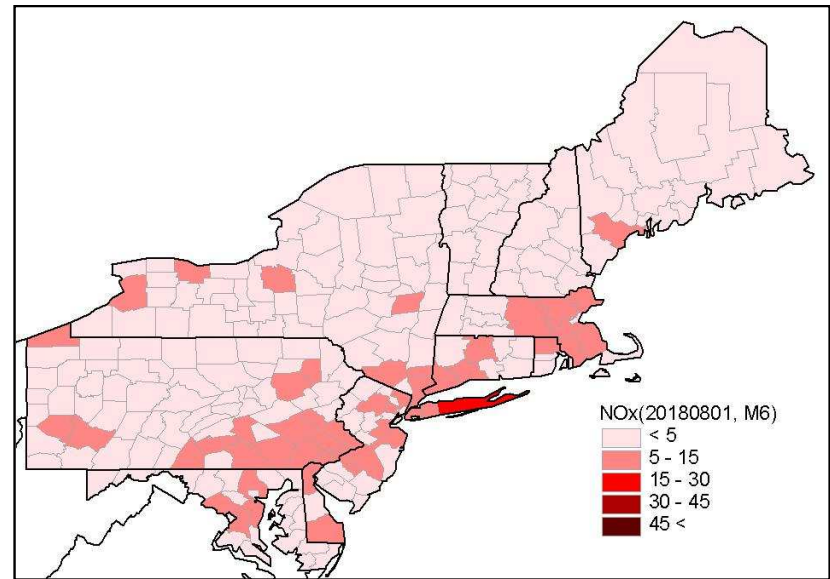
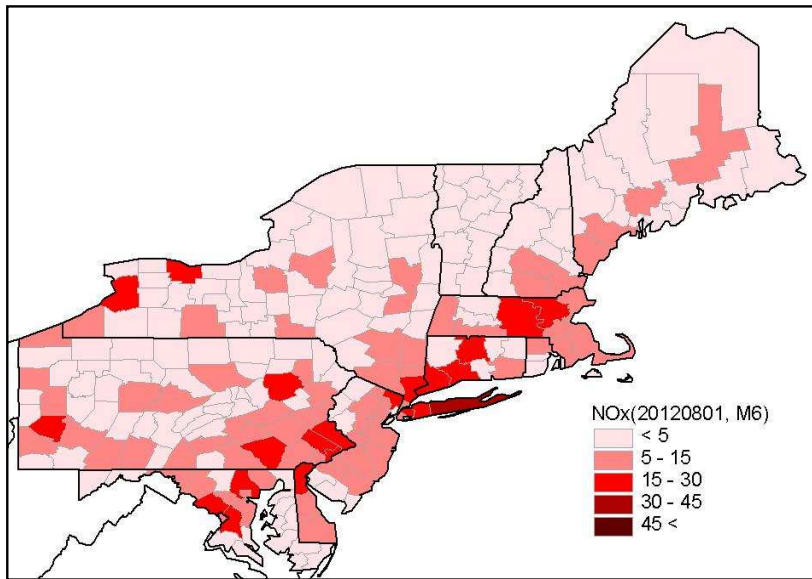
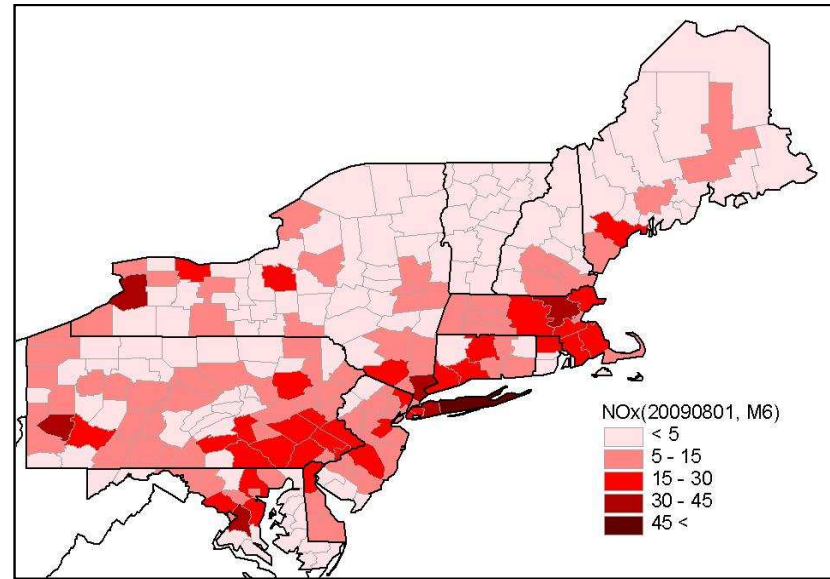
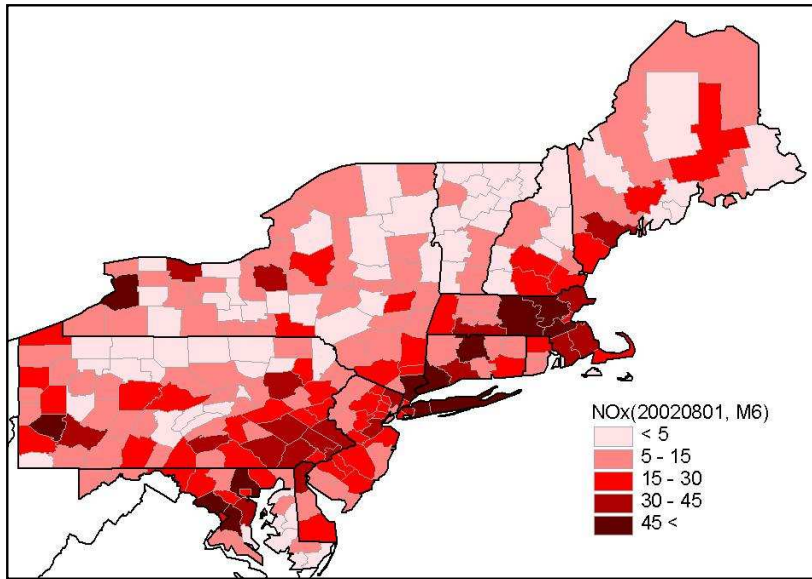


Figure 3. Spatial distribution of emissions from SMOKE/MOBILE6 (August 1, NOx)