

Processing a Model-Ready Emissions Inventory for Primary PM

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Importance of This Emissions Inventory

- ❖ No previous model-ready primary PM Emissions Inventory for Texas because fine PM standards have not been violated in Texas
- ❖ Up to 40% of ambient fine PM comes from primary emissions
- ❖ A major focus of TEXAQs II will be to look at heterogeneous chemistry
 - ❖ An Emissions inventory will be necessary for accurate modeling

PM Emissions Inventories: What is Supplied by the NEI vs. What is Required for Photochemical Modeling

NEI

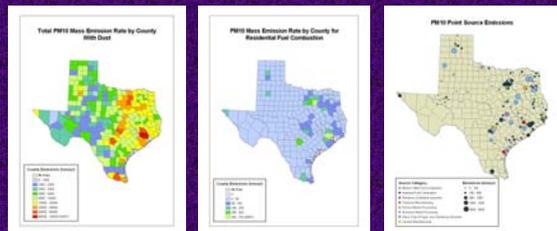
- Spatial Resolution:** County-wide
- Temporal Resolution:** annual
- Composition:** No information included
- Size Fraction:** PM₁₀ and PM_{2.5}

CAMx

- Spatial Resolution:** 36, 12, and 4km grid cells
- Temporal Resolution:** hourly
- Composition:** OC, EC, SO₄, NO₃, NH₄, water, Na, Cl, and crustal
- Size Fraction:** CMU scheme has 4 size bins

PM Emissions Data in the NEI

- ❖ We have created an atlas of NEI data which displays PM emission rates by county and source type
- ❖ Examples of the maps compiled are shown below
- ❖ The entire atlas may be accessed from the TEXAQs II website:
<http://www.utexas.edu/research/ceer/texaqsII/>

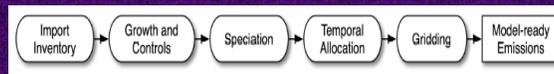


How Did We Create a Model-Ready Primary PM Emissions Inventory?

- ❖ Started with Central Regional Air Planning Association (CENRAP) EI
 - ❖ Countywide averages
 - ❖ Annual averages (except point sources with CEMS)
 - ❖ PM₁₀, PM_{2.5}, and PMC
- ❖ Developed for regional haze planning
- ❖ CENRAP EI incorporates 2002 data from:
 - ❖ NEI
 - ❖ State agencies
 - ❖ Local agencies
- ❖ CENRAP performed extensive QA/QC on data
- ❖ Missing from the CENRAP EI
 - ❖ Processing for a fine spatial/temporal resolution
 - ❖ Composition data
 - ❖ Size distribution data

SMOKE

- ❖ Sparse Matrix Operator Kernel Emissions (SMOKE) modeling system was used to process the data



- ❖ Environ provided default chemical profiles, temporal profiles, and gridding surrogates

Major Changes We Made to the CENRAP EI and Default Profiles

- ❖ **Magnitude of emissions:**
 - ❖ NEI predictions of fugitive dust emissions are up to an order of magnitude greater than measured ambient values
 - ❖ All dust values were multiplied by 0.1 to account for this overestimation
- ❖ **Temporal Profiles:**
 - ❖ We used the monthly profiles for Texas fire data that were compiled by Ann Dennis (2000)
 - Agricultural field burning (Corn, Wheat, Grass/hay, and sugar)
 - Prescribed rangeland burns
- ❖ **Spatial Profiles:**
 - ❖ The EPA (used by CENRAP) and The TCEQ use different projections
 - ❖ We mostly created our own surrogates (using EPA MIMS Spatial Allocator) in the TCEQ projection
 - ❖ Where MIMS did not include proper inputs, we regridded the CENRAP surrogates
- ❖ **Chemical Speciation Profiles:**
 - ❖ We created our own profiles for:
 - Cooking (from Schauer et al, 1999)
 - Gasoline Vehicles (from Cadle et al, 1999)
 - Diesel Vehicles (from Lowenthal et al, 1994)
 - ❖ The default fugitive dust chemical profile is not accurate for TX, but we do not have sufficient data to create our own

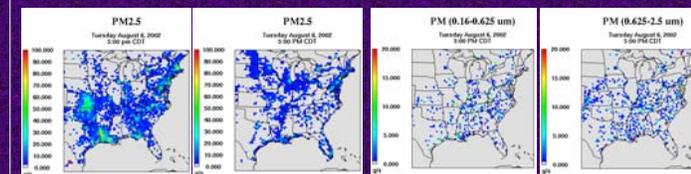
Allocation to CMU Size Bins

- ❖ We are unaware of any other primary PM EIs that have done this
- ❖ 4 size bins
 - ❖ 0.039063 – 0.15625 μm
 - ❖ 0.15625 – 0.625 μm
 - ❖ 0.625 – 2.5 μm
 - ❖ 2.5 – 10 μm
- ❖ There is very little available source data for creating size profiles
- ❖ Most articles with size distribution data, used different instruments for different portions of the size range
- ❖ Size bins in the literature are different from CMU size bins
- ❖ Profiles have significant uncertainty

What Size Profiles Did We Create?

- ❖ We created size profiles for 4 source categories
 - ❖ Diesel vehicle emissions (from Morawska et al, 1998)
 - ❖ Commercial cooking emissions (from Kleeman et al, 1999)
 - ❖ Wood smoke emissions (from Kleeman et al, 1999)
 - ❖ Fugitive dust emissions (from Kinsey et al, 2004)
- ❖ All other sources assigned one of these size profiles
 - ❖ Engine/boiler combustion sources → diesel profile
 - ❖ Condensation sources → cooking profile
 - ❖ Open/uncontrolled combustion sources → wood smoke profile
 - ❖ Mechanically generated PM → fugitive dust profile
- ❖ Using 4 profiles for all sources is a very large source of uncertainty

Sample Results – 36km Domain



Total Fine PM Emissions from Area Sources Total Fine PM Emissions from Non-Road Mobile Sources Size Resolved PM Emissions from Point Sources

Please Let Us Know If You Would Like To Use This Inventory