2006 MAG Biogenics Study

Air Quality Technical Advisory Committee

October 26, 2006

MARICOPA ASSOCIATION of GOVERNMENTS

2006 MAG Biogenics Study

- Importance – Biogenic source emissions are background emissions in estimating ozone concentrations
- Purpose – To develop the state-of-art new biogenics model and update plant emission factors
- Major Contractor - ENVIRON International, Inc., and Subcontractor - Dr. Alex Guenther (the National Center for Atmospheric Research)
- Project Term – July 11, 2005 - September 11, 2006

2006 MAG Biogenics Study

- July 13, 2005 Kickoff meeting
- February 6, 2006 Initial draft report
- June 11 - 23, 2006 Field study
- June 27, 2006 Preliminary report on field study
- August 1, 2006 Draft version of MEGAN
- August 11, 2006 MAG staff training for MEGAN
- September 11, 2006 Final report and final version of MEGAN

Field Study Results

Table 1. Percent contribution of individual plant species to total woody plant cover in Maricopa County wildlands

Plant Species	Plant Cover Contribution	VOC Emission Rate ($g\ g^{-1}\ h^{-1}$)
Creosote bush (larrea tridentata)	29.4%	2
Triangle leaf bursage (ambrosia deltroides)	8.2%	4.1
Yellow paloverde (parkinsonia microphylla)	7.6%	0.05
Brittlebush (encelia farinosa)	3.9%	37
Jojoba (simmondsia chinensis)	3.7%	30
Catclaw acacia (acacia greggii)	2.9%	0
Honey mesquite (prosopis glandulosa)	2.2%	0.11
Sonoran scrub oak (quercus turbinella)	1.5%	26

MEGAN

- Model of Emissions of Gases and Aerosols from Nature
- Driving Variable Preprocessor, Main Program, and Post-processors (Visual Basic and FORTRAN)
- EPA version of MEGAN (FORTRAN)
- Driving Variable Preprocessor extracts some meteorological input data from the database
- Post-processors convert the MEGAN ASCII output to the CAMx or CMAQ compatible binary format

MEGAN

- Emission Rate ($\mu g\ m^{-2}\ h^{-1}$) = $\varepsilon \times \gamma \times \rho$

  ε : emission factor ($mg\ m^{-2}\ h^{-1}$)

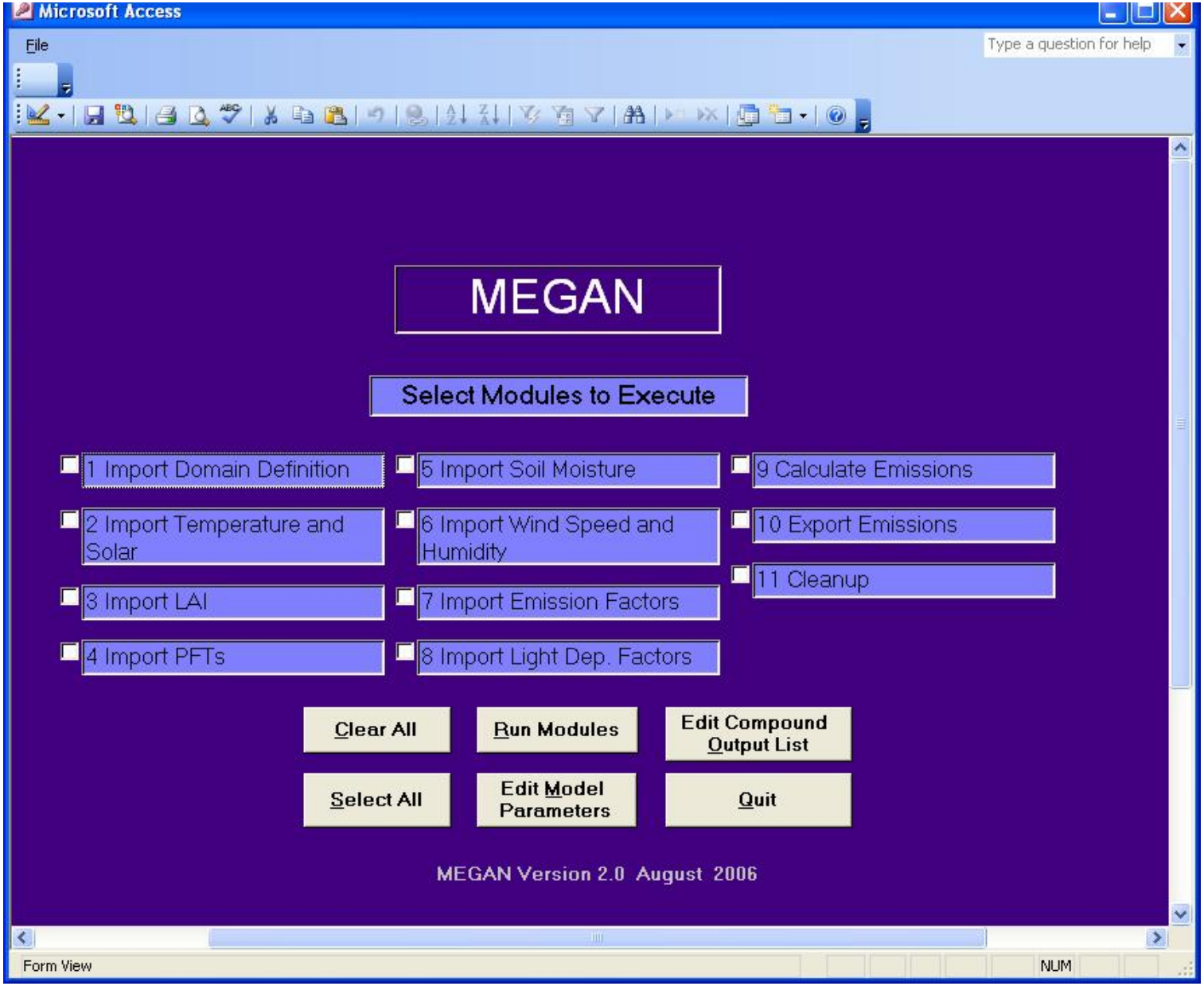
  γ : emission activity correction factor

  ρ : chemical loss and production factor within canopy.

- Inputs :
  - modeling domain definition, gridded temperature and solar radiation, humidity, soil moisture, etc.

- Output:
  - gridded hourly emission rates for the 134 species of VOC, CO, NO, Aerosols

ENVIRONMENTAL SERVICES



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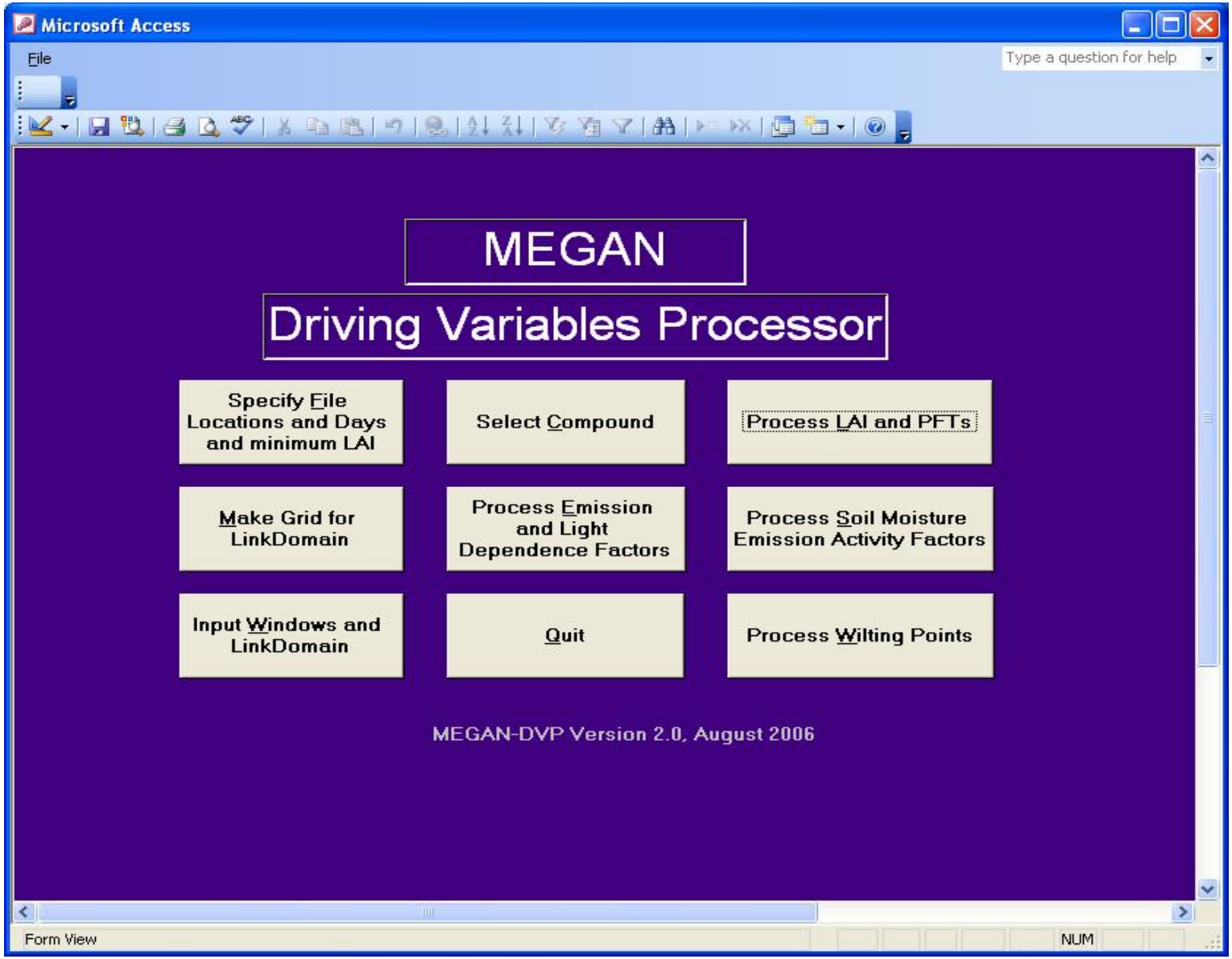
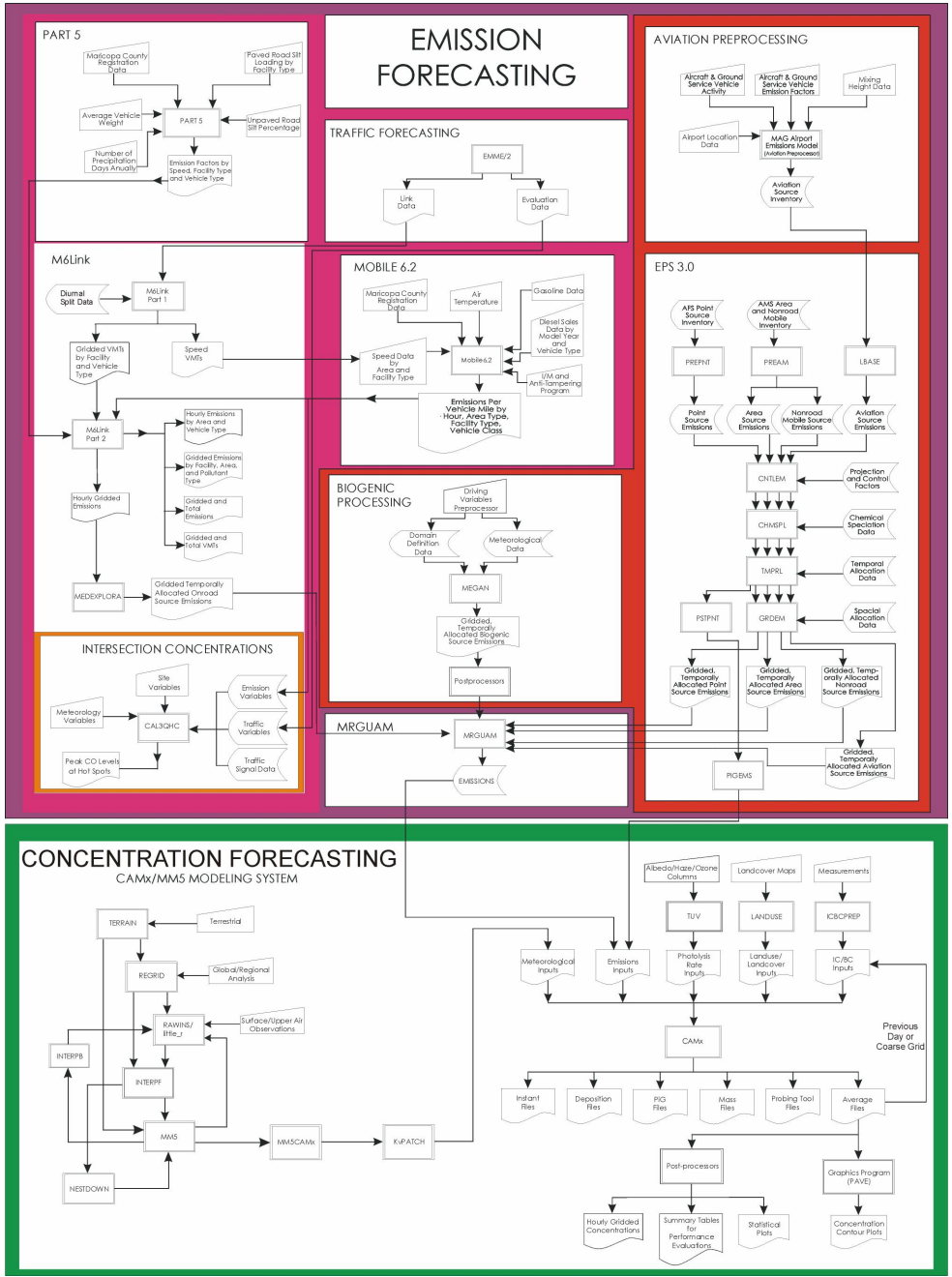

Microsoft Access
File
Type a question for help
MEGAN
Driving Variables Processor
Specify File Locations and Days and minimum LAI
Select Compound
Process LAI and PFTs
Make Grid for LinkDomain
Process Emission and Light Dependence Factors
Process Soil Moisture Emission Activity Factors
Input Windows and LinkDomain
Quit
Process Wilting Points
MEGAN-DVP Version 2.0, August 2006
Form View
NUM

MAG Air Quality Modeling Chain



ENVIRONMENTAL SERVICES

Table 2. Temperature Sensitivity to MEGAN VOC Emissions for 8 Hour Ozone Modeling Domain

	Domain Average Temperature (°F)	Domain Total VOC (Metric tons/day)
5/31/2002	86	452
6/1/2002	85	407
6/2/2002	81	332
6/3/2002	79	287
6/4/2002	79	304
6/5/2002	82	375
6/6/2002	86	452
6/7/2002	86	435

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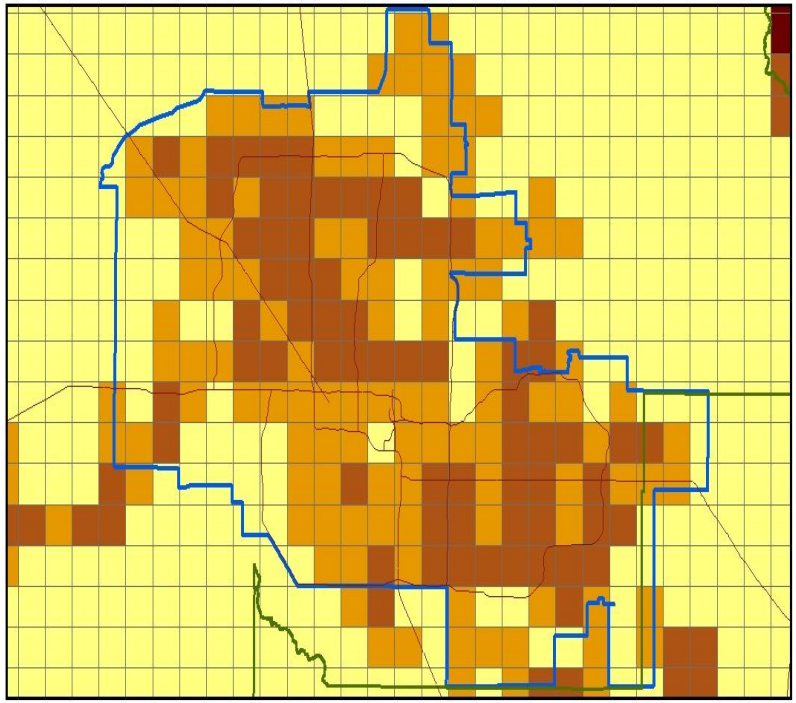
Urban VOC Emission Comparison

MAGBEIS2



MAGBEIS2 Biogenic Source VOC Emissions
June 3 (Monday), 2002

Urban Area Total = 39.0 Metric Tons/Day

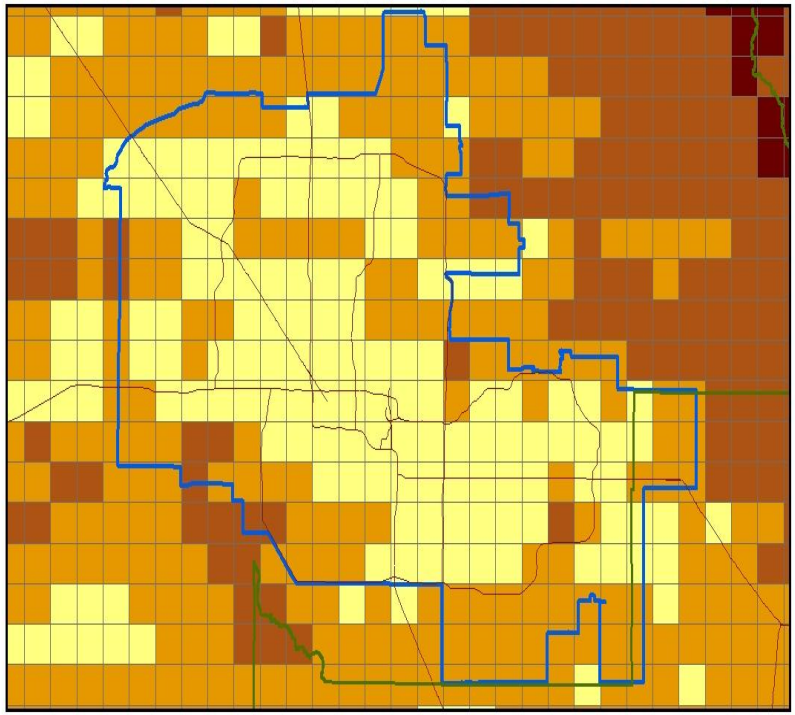
Legend

- Major Highways
- 8-Hour O3 Modeling Domain
- Maricopa County
- Urban Area

VOC (kg/day)

- 24 - 100
- 101 - 200
- 201 - 650
- 658 - 995

MEGAN



MEGAN Biogenic Source VOC Emissions
June 3 (Monday), 2002

Urban Area Total = 27.8 Metric Tons/Day

Legend

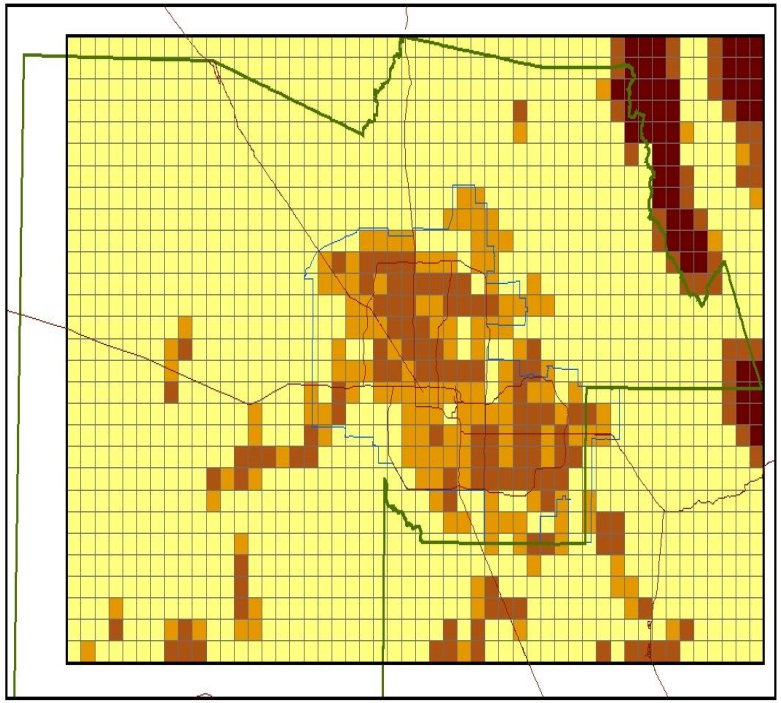
- Major Highways
- 8-Hour O3 Modeling Domain
- Maricopa County
- Urban Area

VOC (kg/day)

- 16 - 100
- 101 - 200
- 201 - 650
- 651 - 1633

VOC Emission Comparison

MAGBEIS2



MAGBEIS2 Biogenic Source VOC Emissions
June 3 (Monday), 2002

8-Hour Ozone Modeling Area Total = 177 Metric Tons/Day

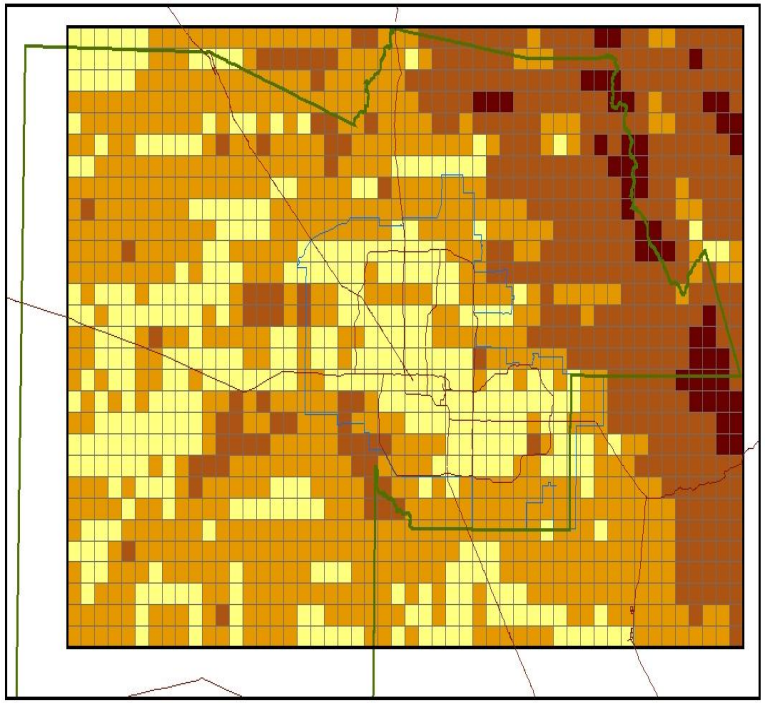
Legend

- Major Highways
- 8-Hour O3 Modeling Domain
- Maricopa County
- Urban Area

VOC (kg/day)

- 24 - 100
- 101 - 200
- 201 - 650
- 658 - 995

MEGAN



MEGAN Biogenic Source VOC Emissions
June 3 (Monday), 2002

8-Hour Ozone Modeling Area Total = 287 Metric Tons/Day

Legend

- Major Highways
- 8-Hour O3 Modeling Domain
- Maricopa County
- Urban Area

VOC (kg/day)

- 16 - 100
- 101 - 200
- 201 - 650
- 651 - 1633

Summary

- MEGAN estimates higher VOC emissions for the 8-hour ozone modeling domain than MAGBEIS2
- MEGAN estimates lower VOC emissions in the urban area than MAGBEIS2
- MEGAN estimates slightly lower NOx emissions than MAGBEIS2
- Temperature is the most sensitive parameter in estimating MEGAN biogenic emissions
- More information on MEGAN
  - http://acd.ucar.edu/~guenther/MEGAN2/

For more information

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