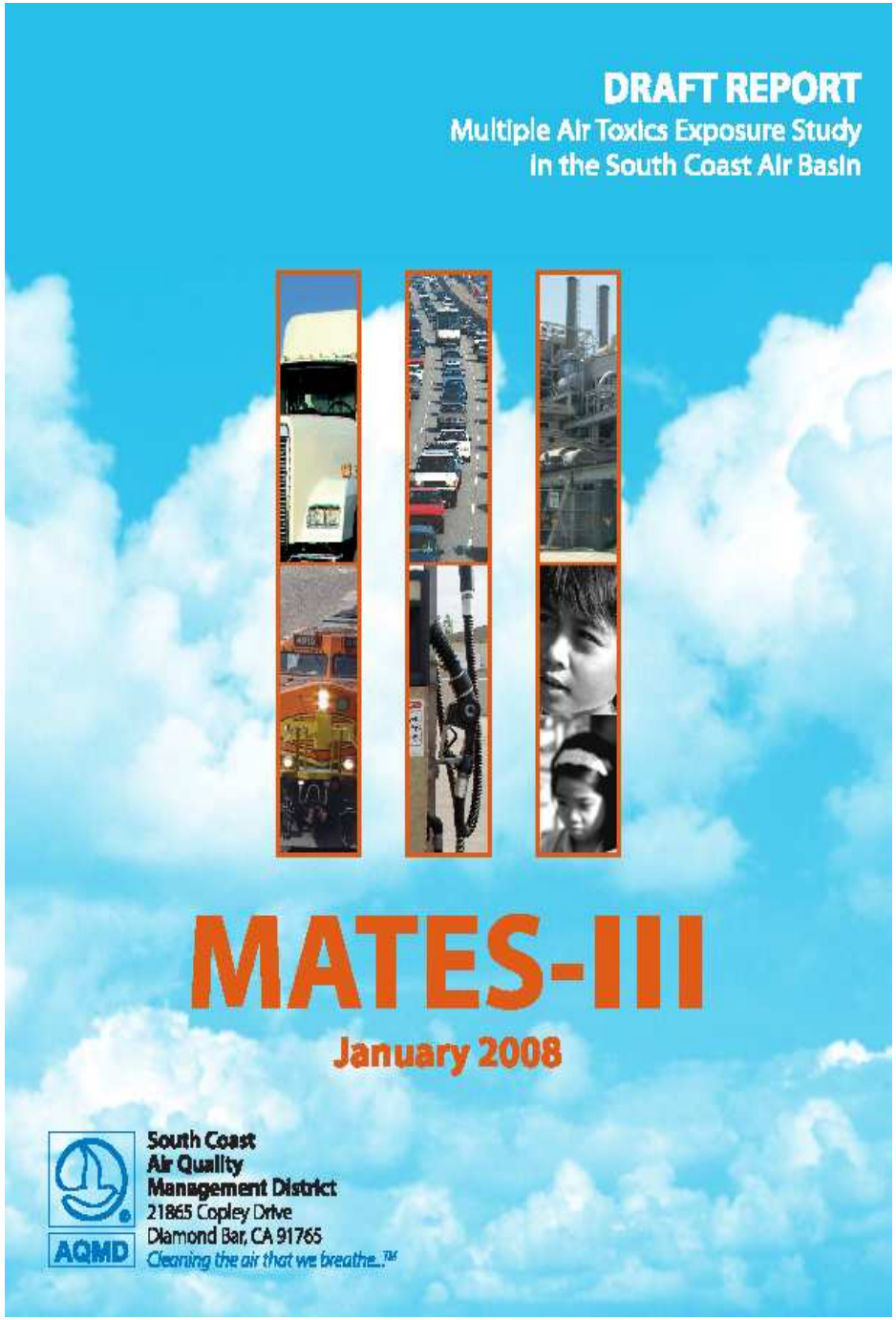
# Regional Modeling

## MATES III Technical Advisory Group

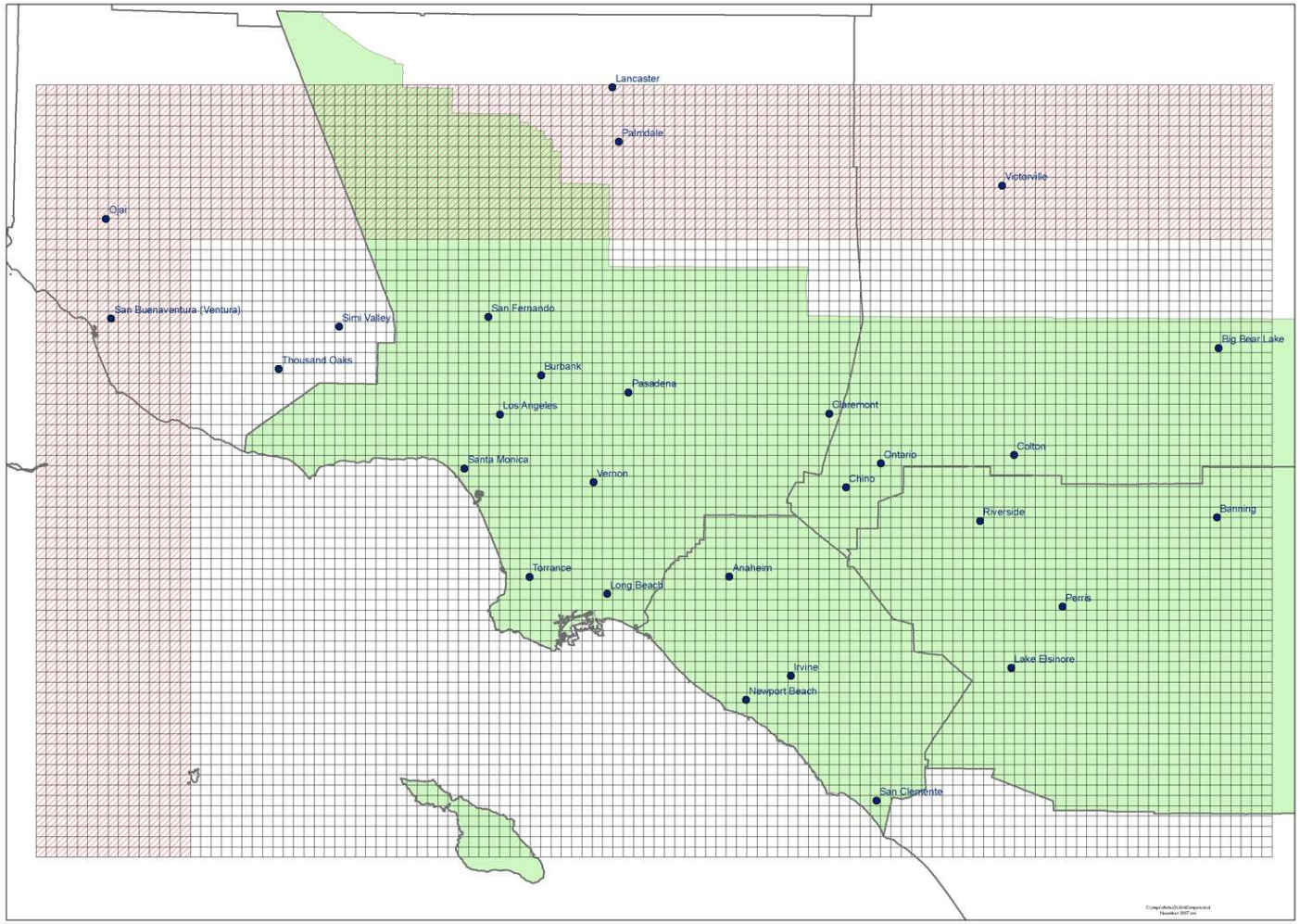
## March 13, 2008



# Changes to Analysis

- CAMx vs. UAMTOX
- AQMP inventory updated for AB2588 sources
- MM5 meteorology/ 7 layers/ offshore ship emissions split layer 1& 2 (total 150 m)
- Truck emissions distribution from AQMP (old followed gas vehicles)
- EMFAC2007 vs EMFAC7G

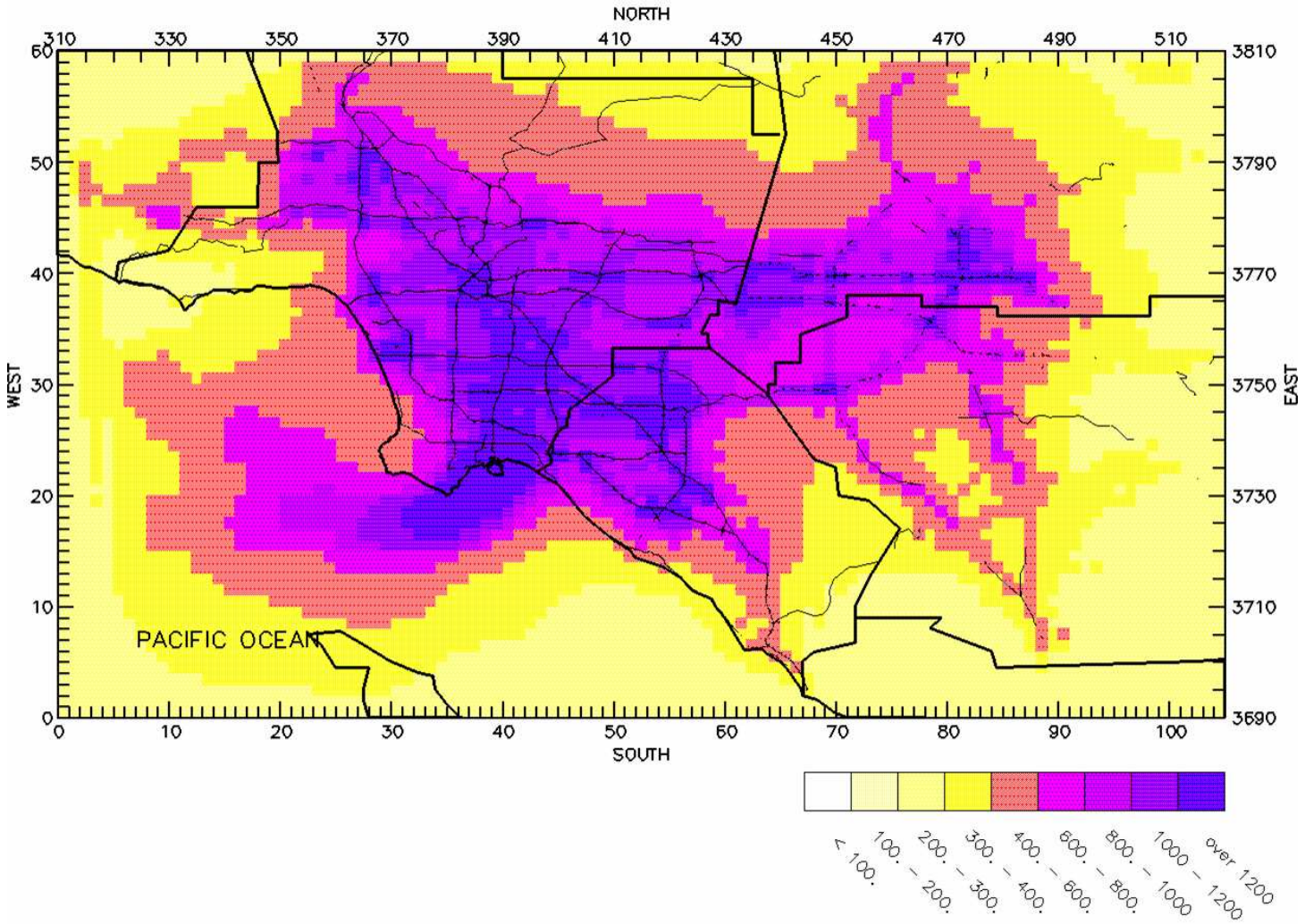
# MATES-III Modeling Domain



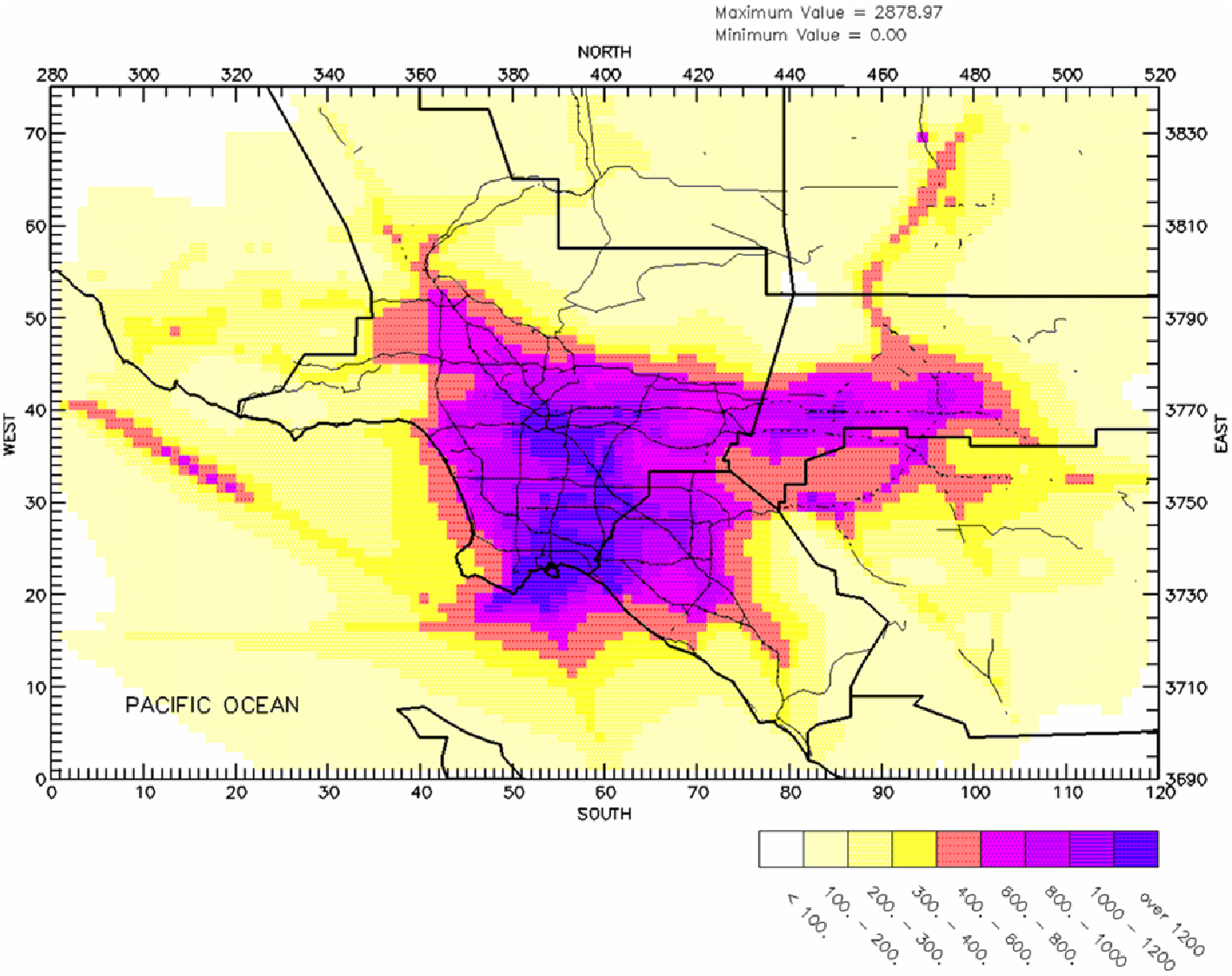
# Comparison of Key Modeling Considerations between MATES-III and MATES-II

| Parameter | MATES-III | MATES-II |
|---|---|---|
| Model Platform / Chemistry | CAMx / RTRAC | UAM/TOX |
| Meteorology Model /Layers | MM5 Prognostic / 7 layers | Diagnostic Wind Model / 5 layers |
| Vertical Diffusion | Blackadar PBL to determine grid-layer specific vertical diffusivity | Hourly grid specified mixing height |
| Boundary Conditions | Segmented Boundary: low over water & higher over land | Constant Boundary |
| On-Road Truck Emissions | CalTrans/SCAG Truck Model | Used passenger vehicle pattern |
| Shipping Emissions Stack Height | Emissions spread through layers 1 and 2 | Emissions released in layer 1 (variable size) |
| Emissions Inventory | 2007 AQMP: 2005 Projection with updated AB2588 source profiles | 1998 Projection with AB2588 Source Profiles |
| Mobile Emissions | EMFAC2007 | EMFAC7G |

# MATES-II Model Estimated Risk From All Emission Sources



# MATES-III Model Estimated Risk From All Emission Sources



# Risk Summary

| Region | Population | Average Risk (Per Million) |
|---|---|---|
| Los Angeles | 9305726 | 912 |
| Orange | 2579794 | 724 |
| Riverside | 1249554 | 410 |
| San Bernardino | 1269919 | 631 |
| SCAB | 14404993 | 810 |

# Risk Comparison

| | MATES-III | MATES-II | Percentage Change |
|---|---|---|---|
| Population Weighted Risk | 810 | 981 | -17.2 |
| Grid with Maximum Risk (40,23) | 2878 | 4910 | -41.4 |

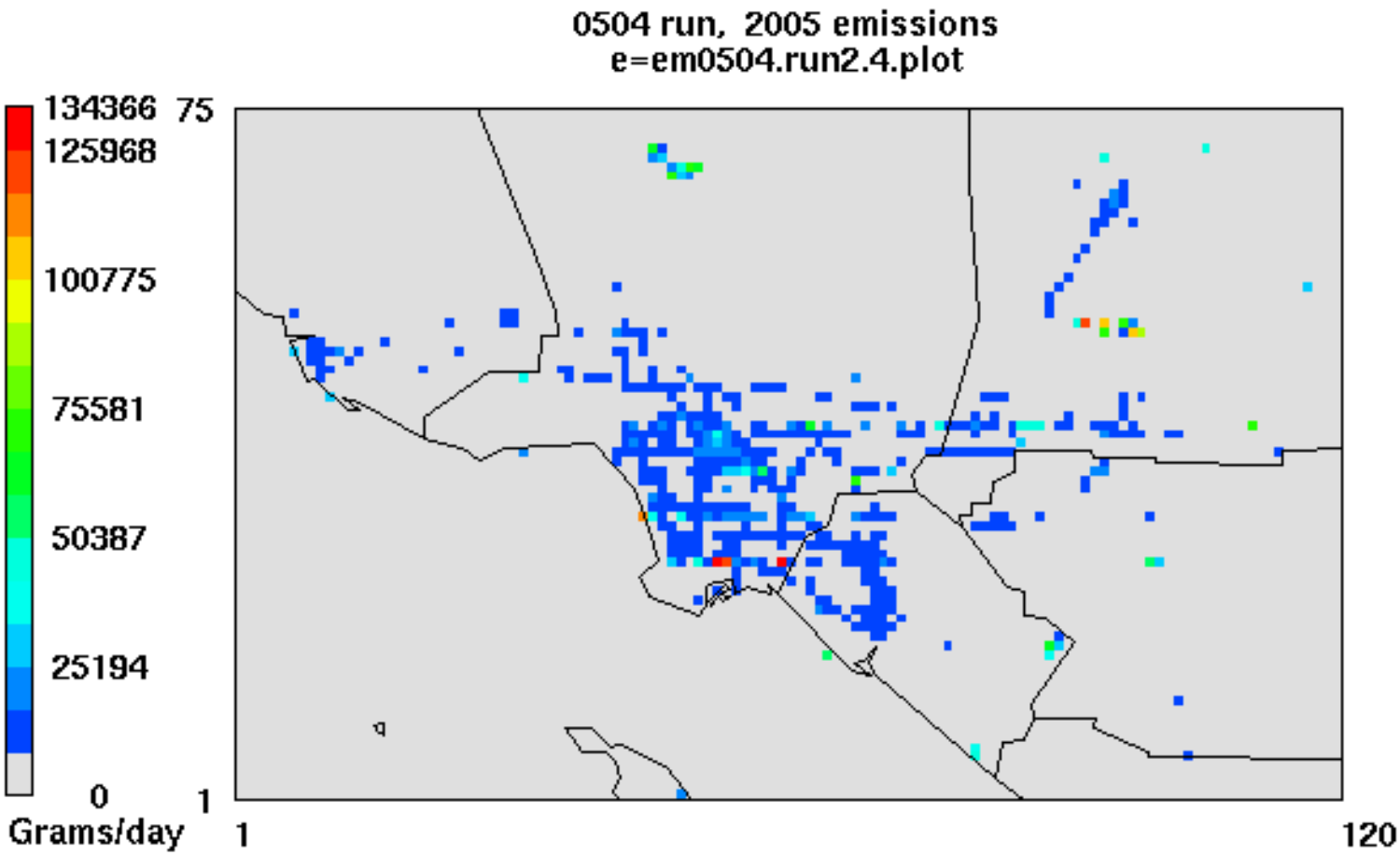
# MATES-III Diesel/EC Modeling Emissions (TPD)

| Compound | MATES –III | | | | MATES-II | |
|---|---|---|---|---|---|---|
| | 2005 | | 1998 (Back-cast) | | 1998 | |
| | PM2.5 | TSP | PM2.5 | TSP | PM2.5 | TSP |
| Total Diesel | 26.06 | 28.33 | 27.37 | 29.75 | N/A | 23.56 |
| EC | 15.17 | 20 | 15.46 | 20.71 | N/A | 25.87 |
| DPM | | | | | | |
| On-road | 9.52 | 10.35 | 10.81 | 11.75 | N/A | 11.95 |
| Off-road | 11.02 | 11.97 | 12.29 | 13.36 | N/A | 8.08 |
| Ships | 4.15 | 4.51 | 2.7 | 2.93 | N/A | 2.59 |
| Trains | 0.86 | 0.94 | 0.79 | 0.86 | N/A | 0.53 |
| Stationary | 0.51 | 0.55 | 0.78 | 0.85 | N/A | 0.41 |

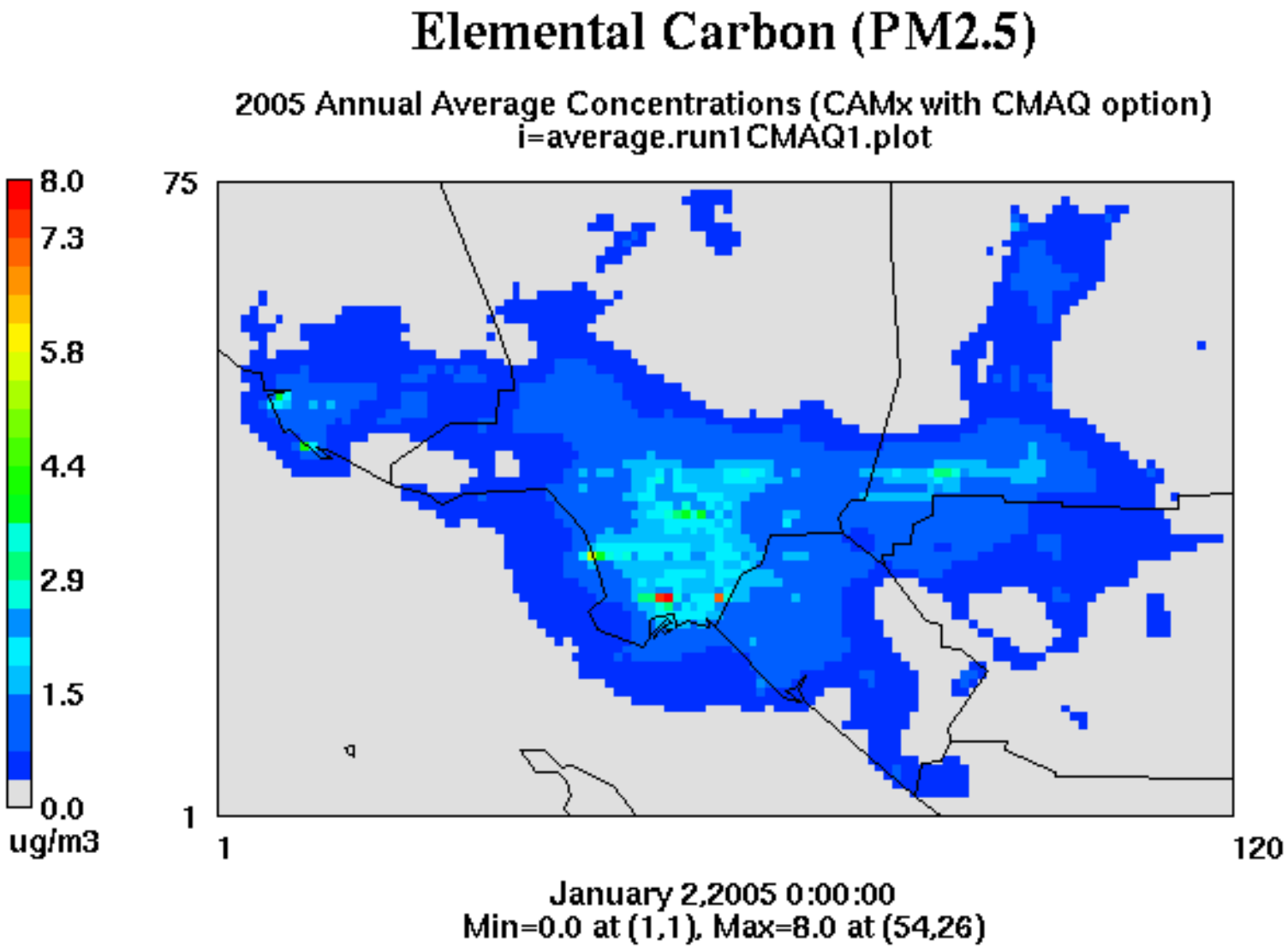
# Simulation Performance Statistics for PM2.5 Elemental Carbon

| Station | Measured ($\mu g/m^3$) | Predicted ($\mu g/m^3$) | Mean Bias ($\mu g/m^3$) | Mean Absolute Error ($\mu g/m^3$) |
|---|---|---|---|---|
| Anaheim | 1.41 | 1.47 | 0.06 | 0.59 |
| Burbank | 2.04 | 1.08 | -0.93 | 1.07 |
| Compton | 1.74 | 2.00 | 0.33 | 0.74 |
| Fontana | 2.16 | 1.53 | -0.58 | 0.99 |
| North Long Beach | 1.39 | 2.00 | 0.77 | 0.99 |
| Los Angeles | 1.93 | 2.12 | 0.25 | 0.83 |
| Rubidoux | 1.69 | 0.99 | -0.67 | 0.84 |
| Wilmington | 2.04 | 2.47 | 0.52 | 1.01 |

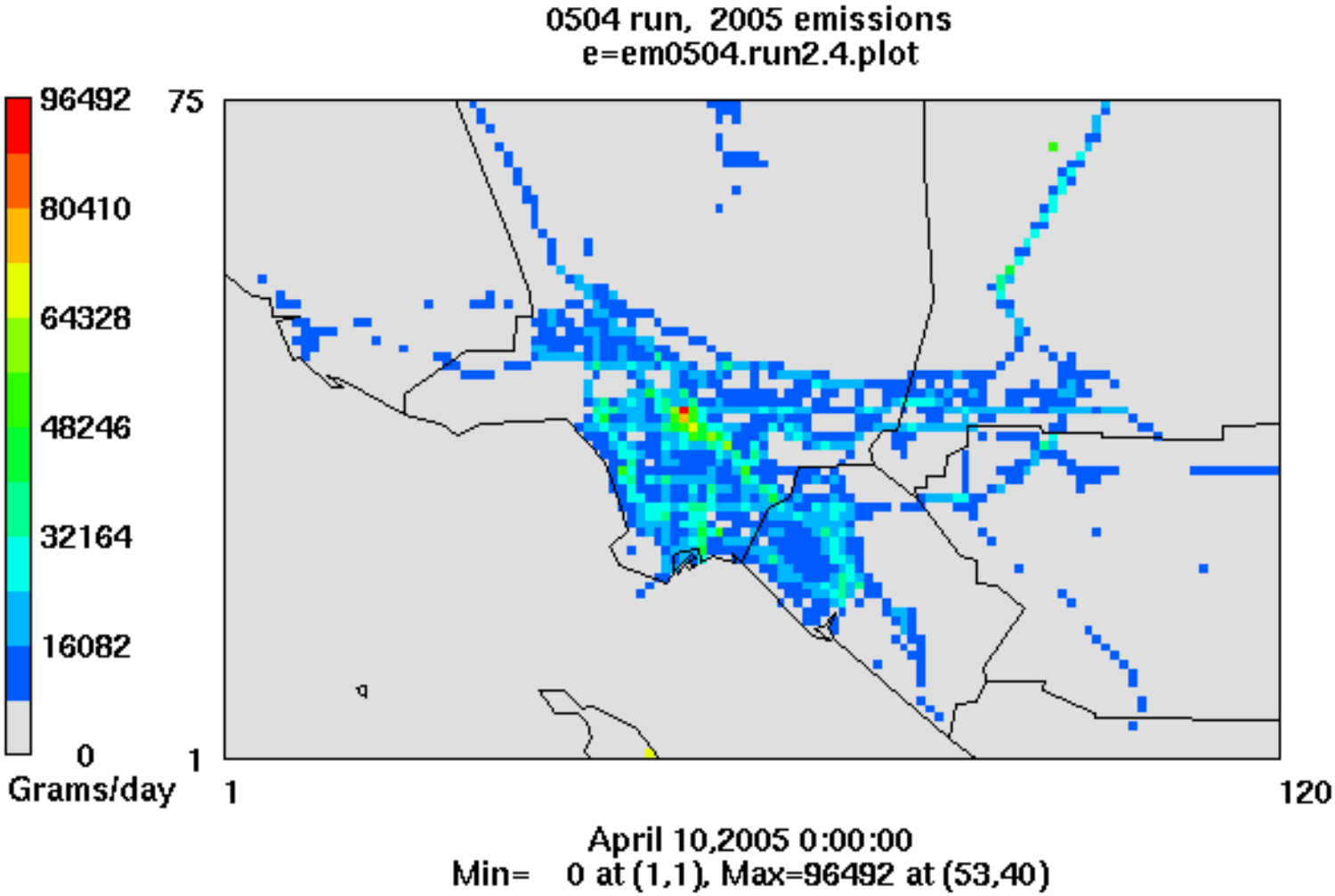
# Elemental Carbon Emissions (PM2.5)



# CAMx Simulated

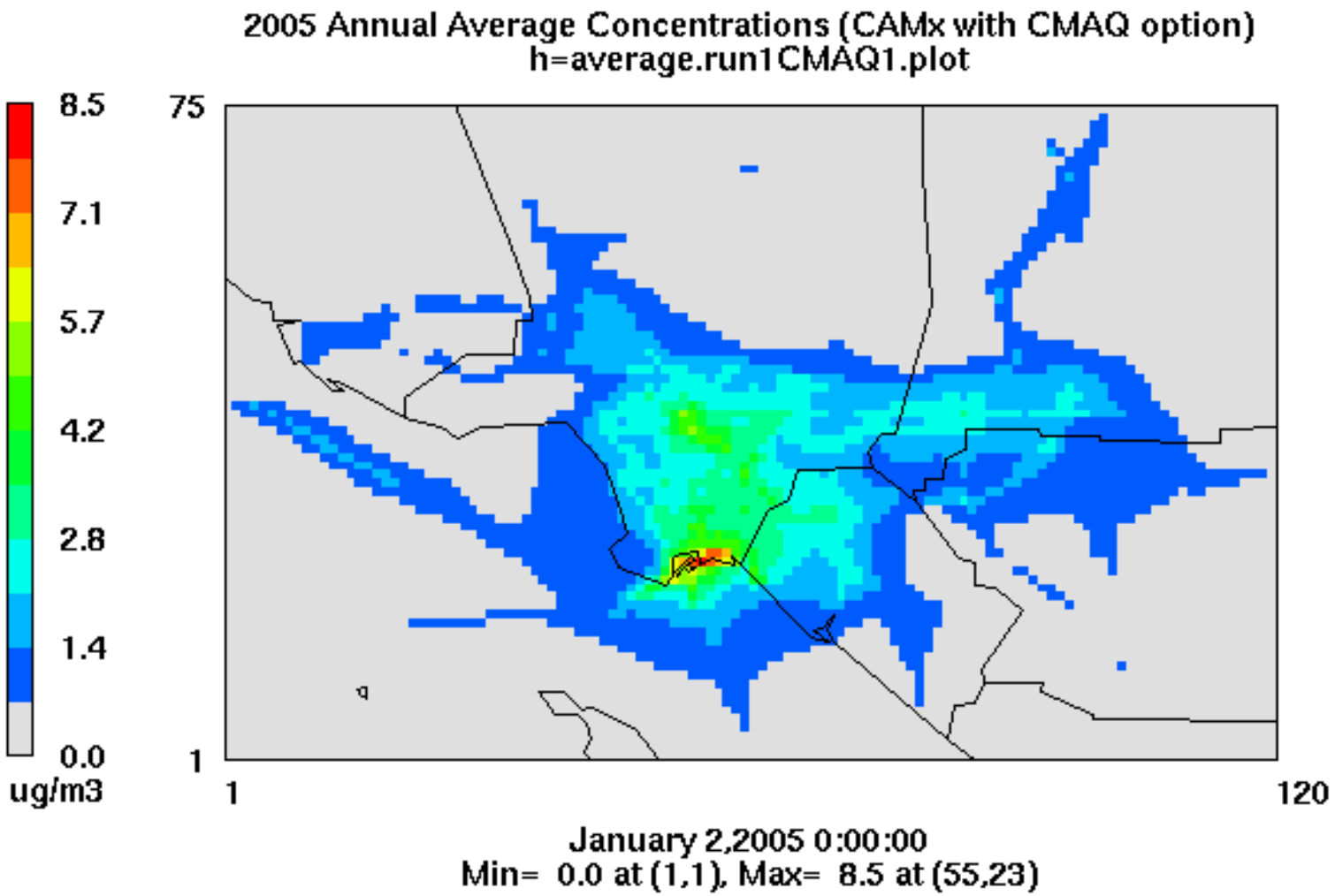


# Diesel Emissions (PM2.5)

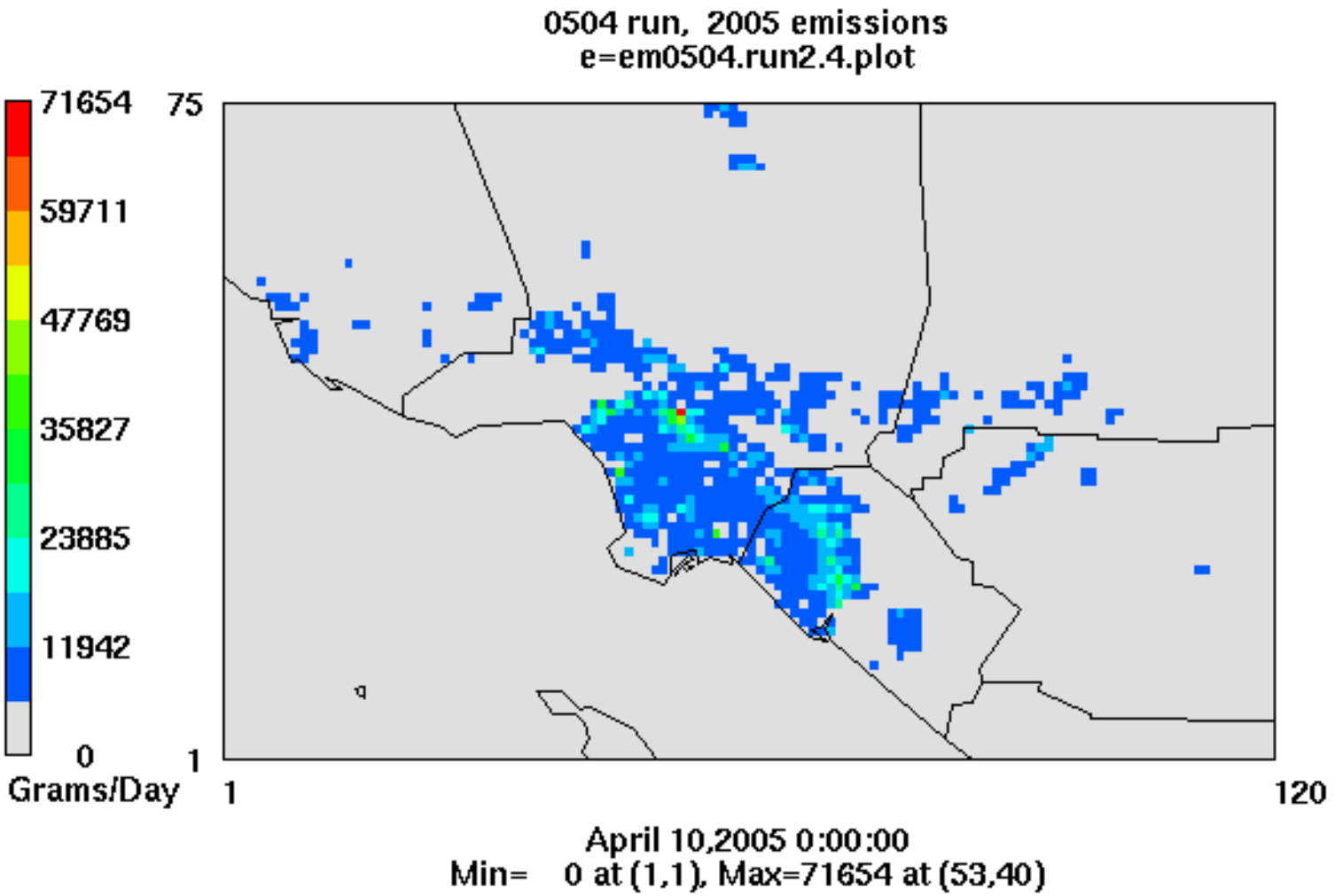


# CAMx Simulated

## Diesel (PM2.5)

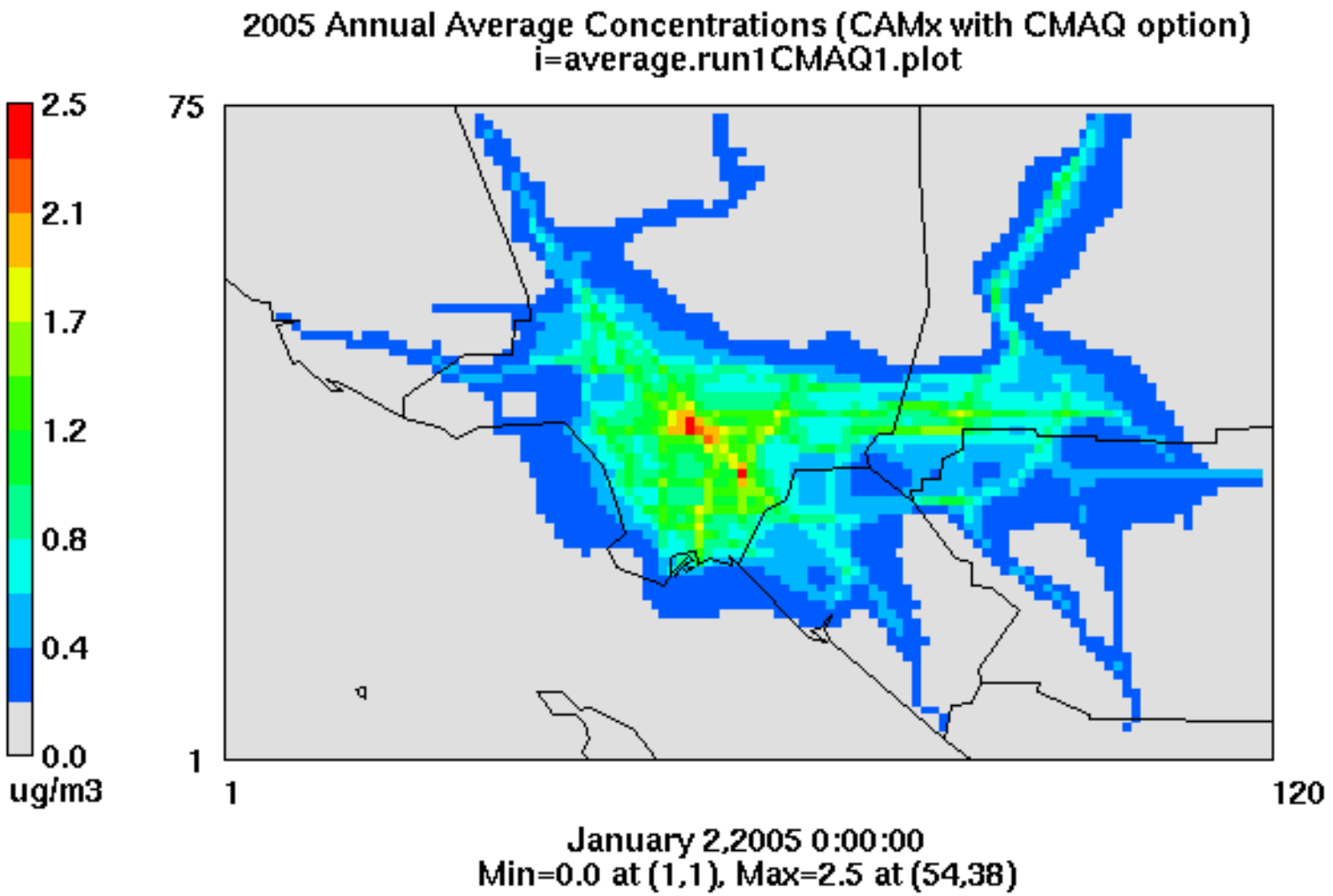


# Diesel Emissions From Off-road Sources (PM2.5)



# CAMx Simulated

## On-Road Diesel



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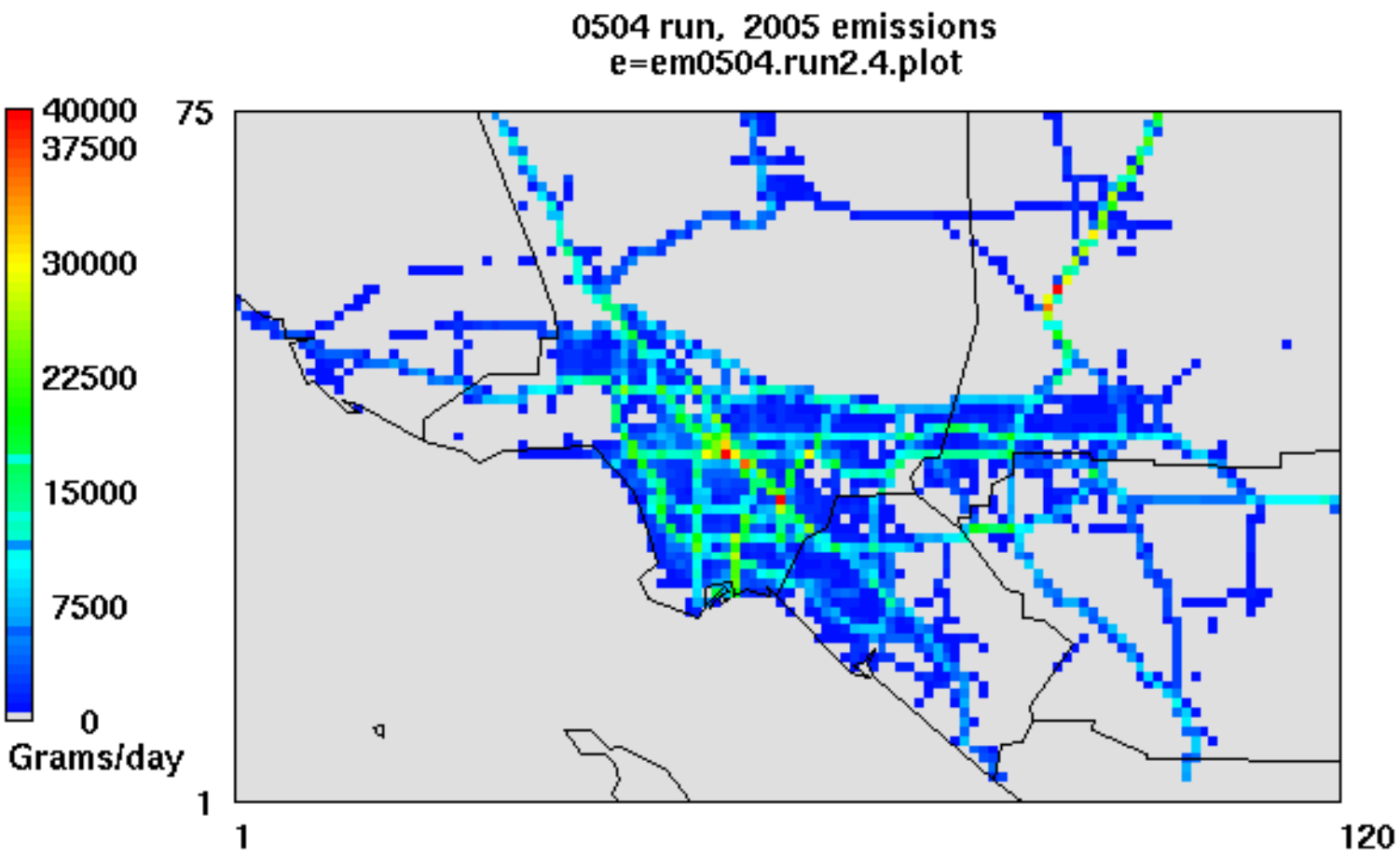
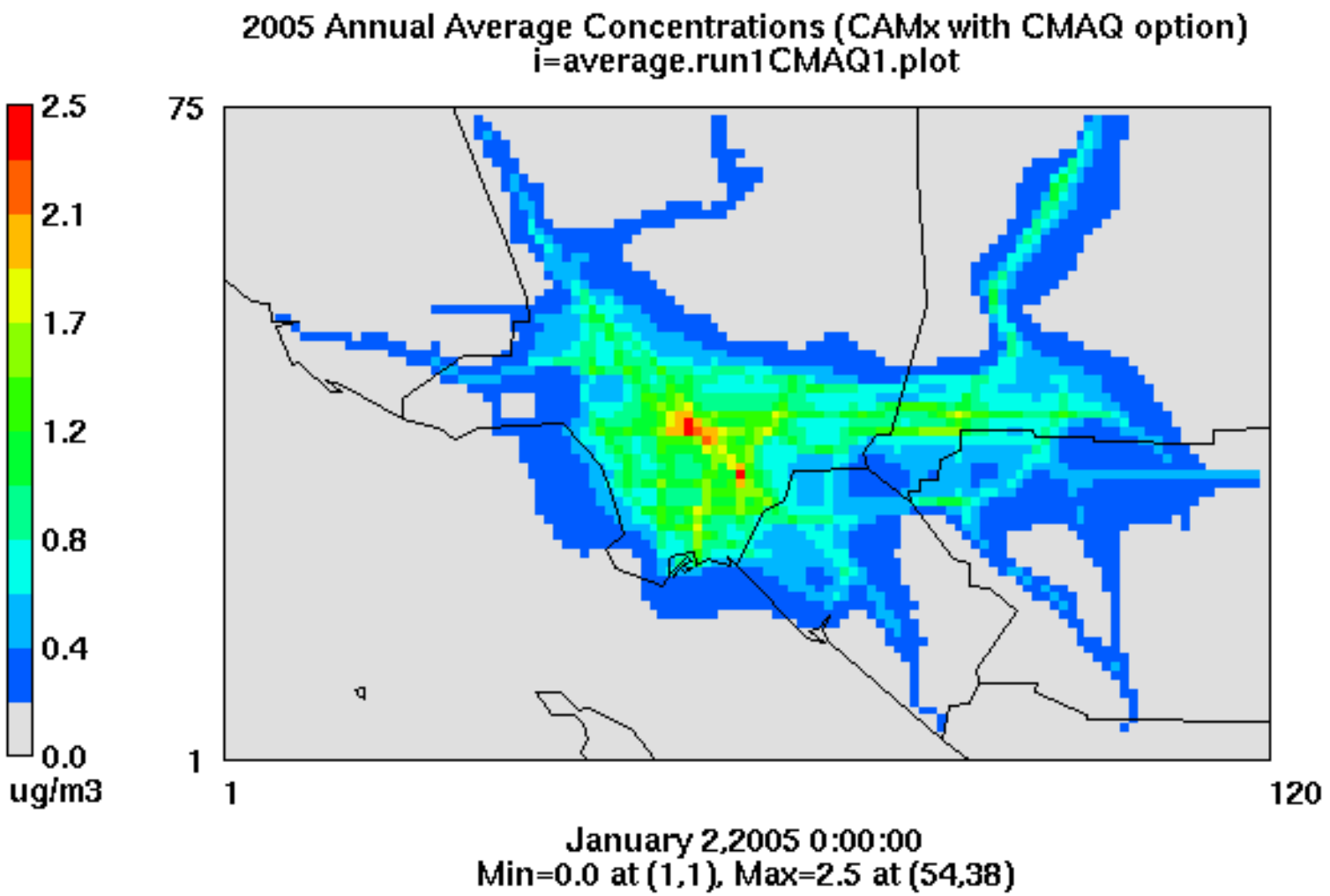
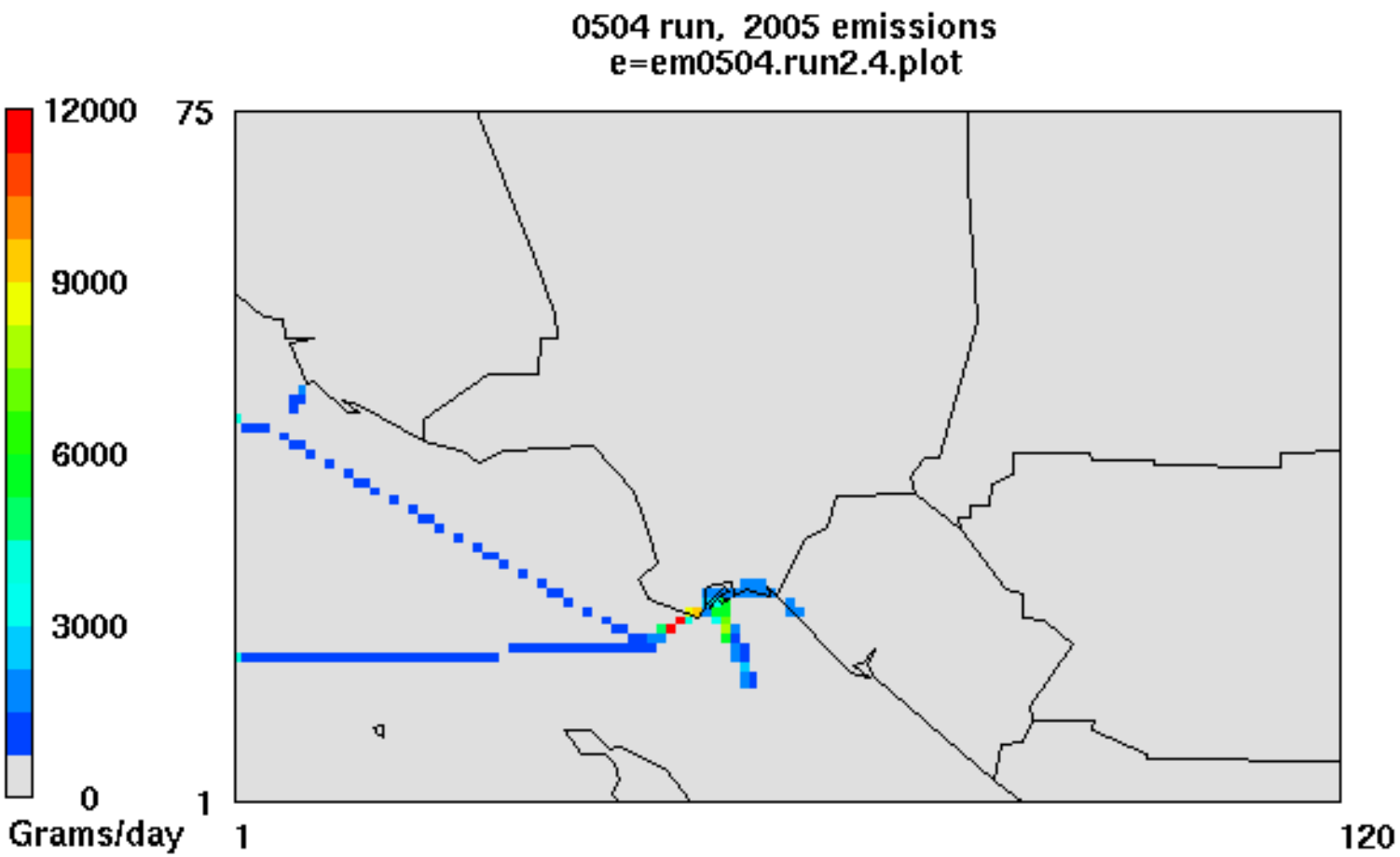


# CAMx Simulated

## On-Road Diesel



# Diesel Emissions from Ships (PM2.5)



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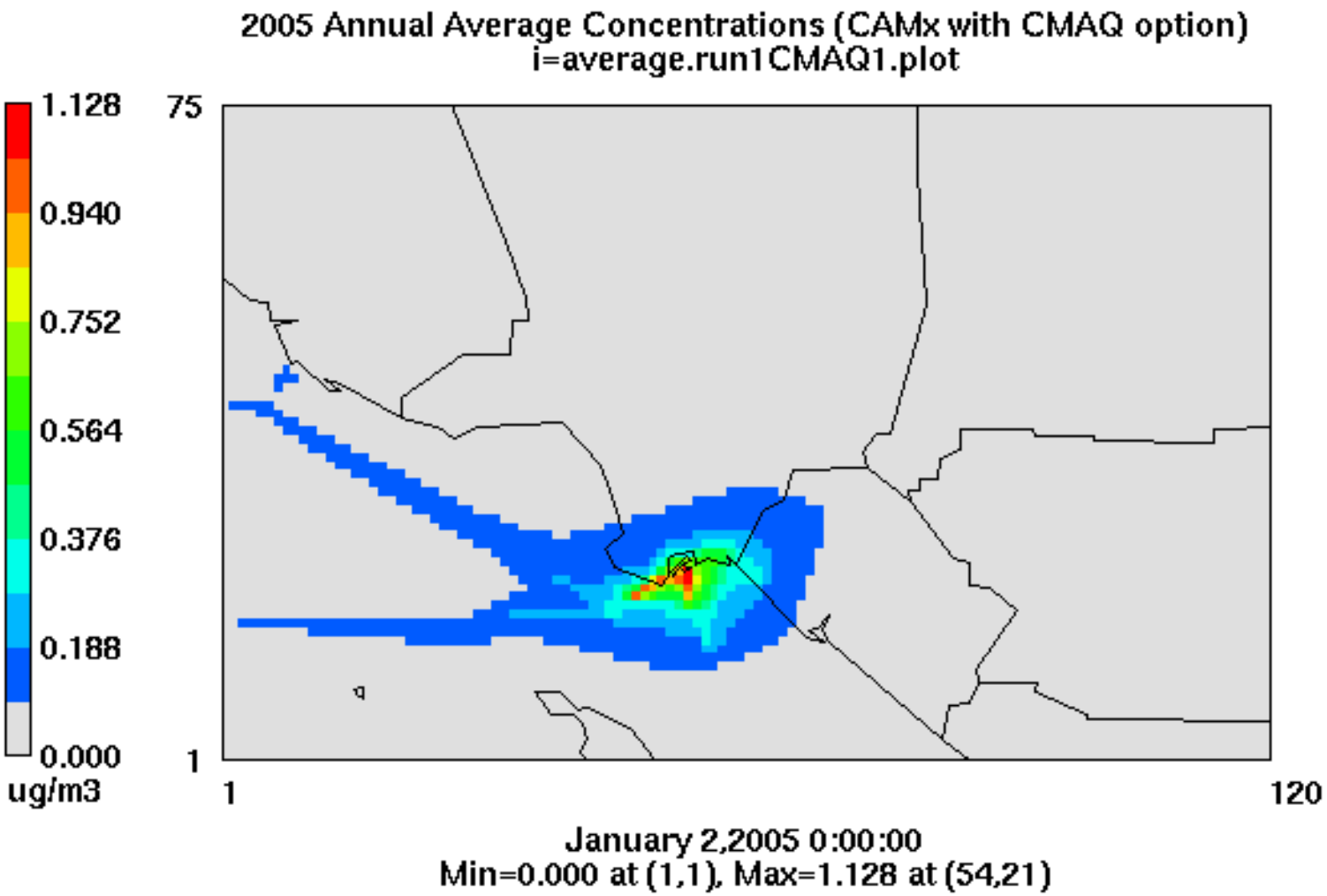
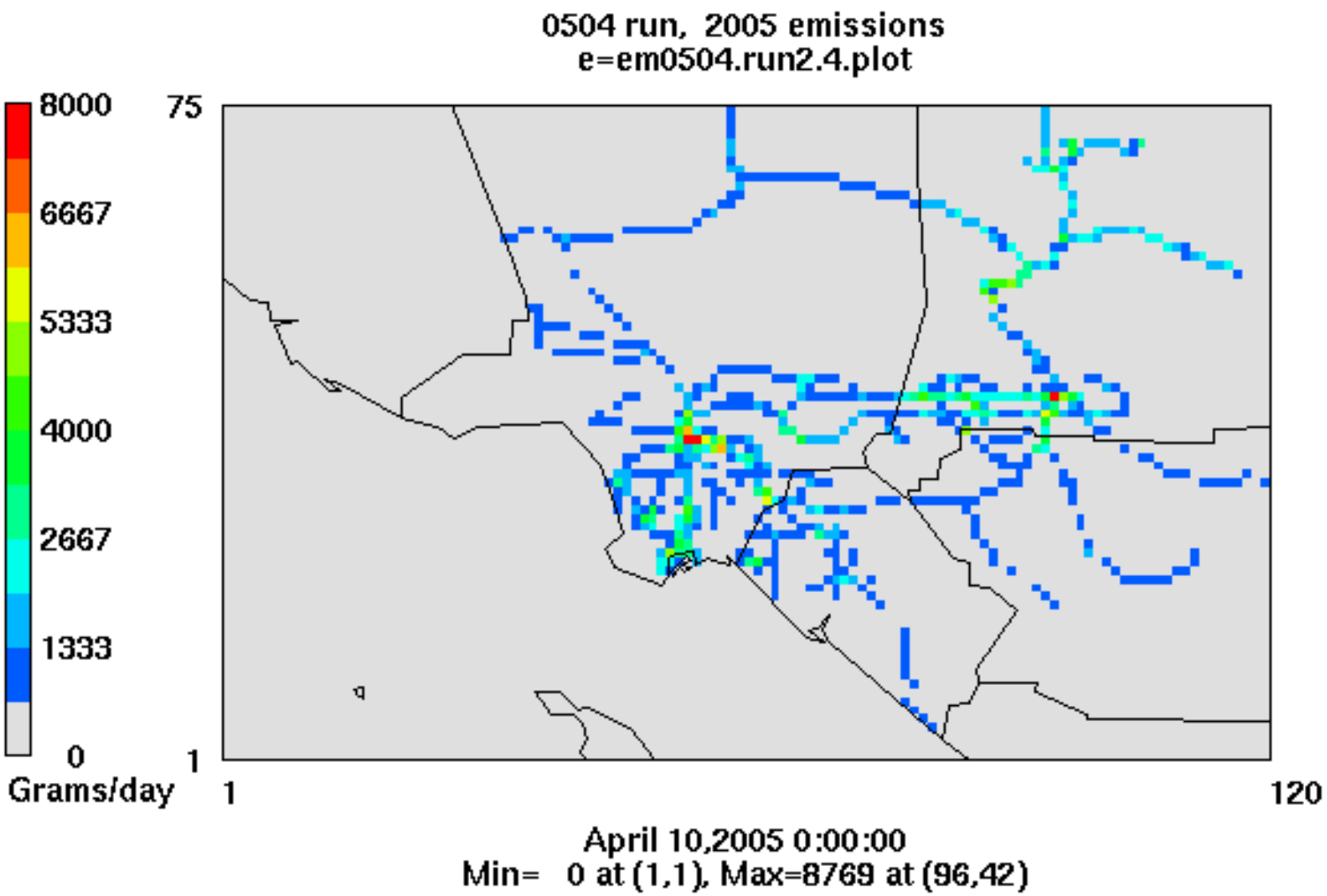
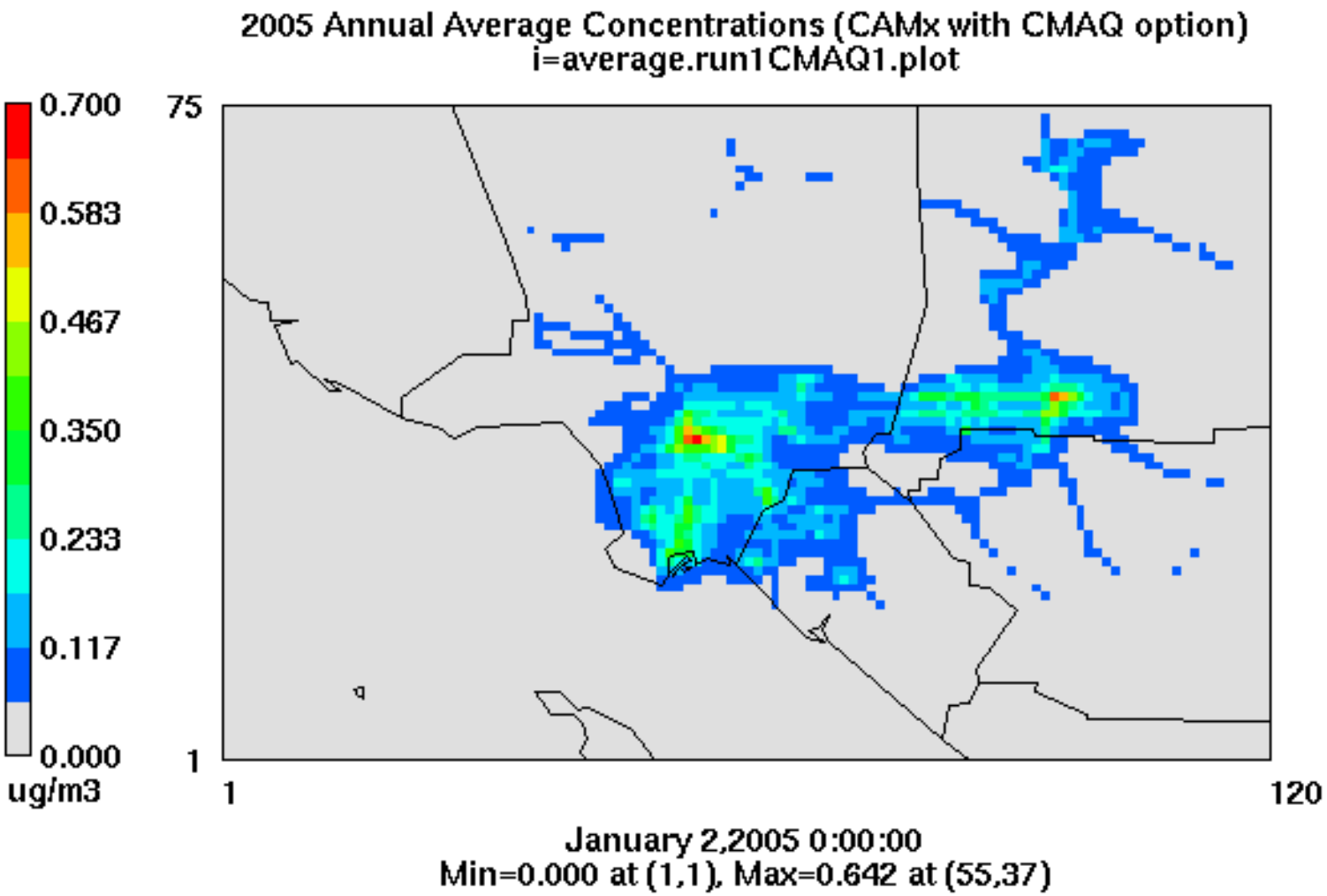


# Diesel Emissions from Trains (PM2.5)



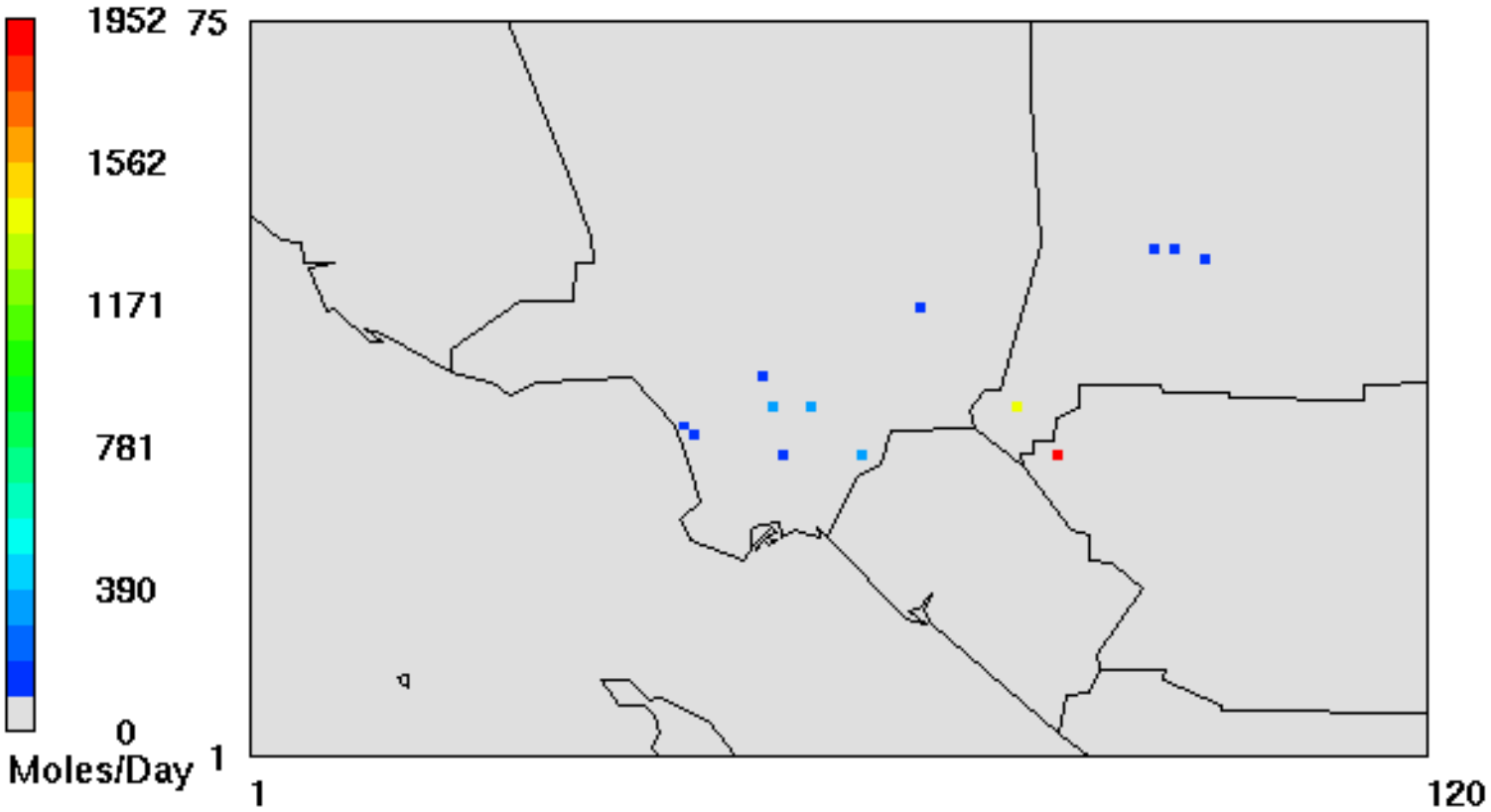
# CAMx Simulated

## Diesel from Trains



# 1,3Butadiene Emissions

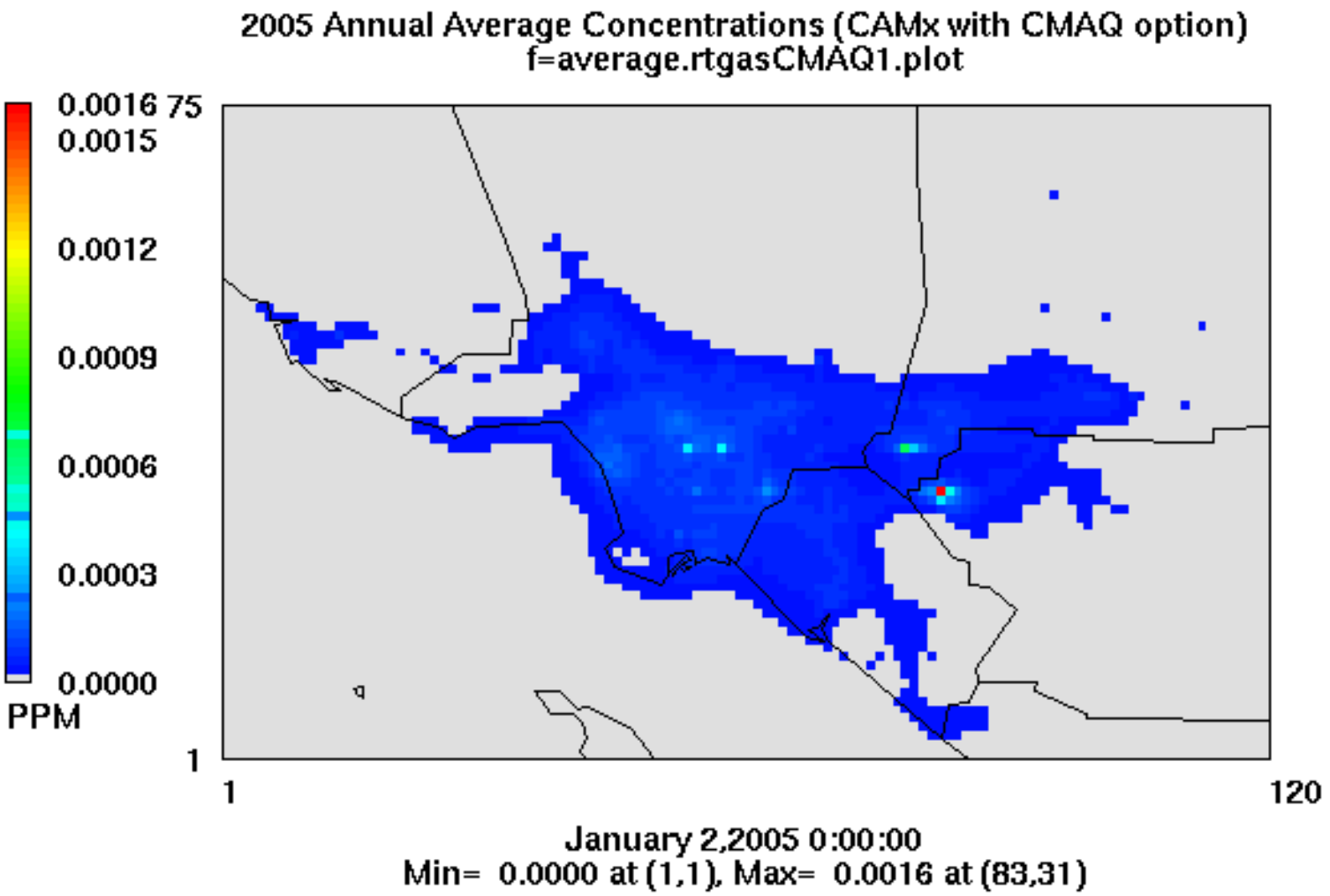
MATES3 1/weekday 2005 ** ALL EMISSIONS
d=em0501.rtgas01.4.plot



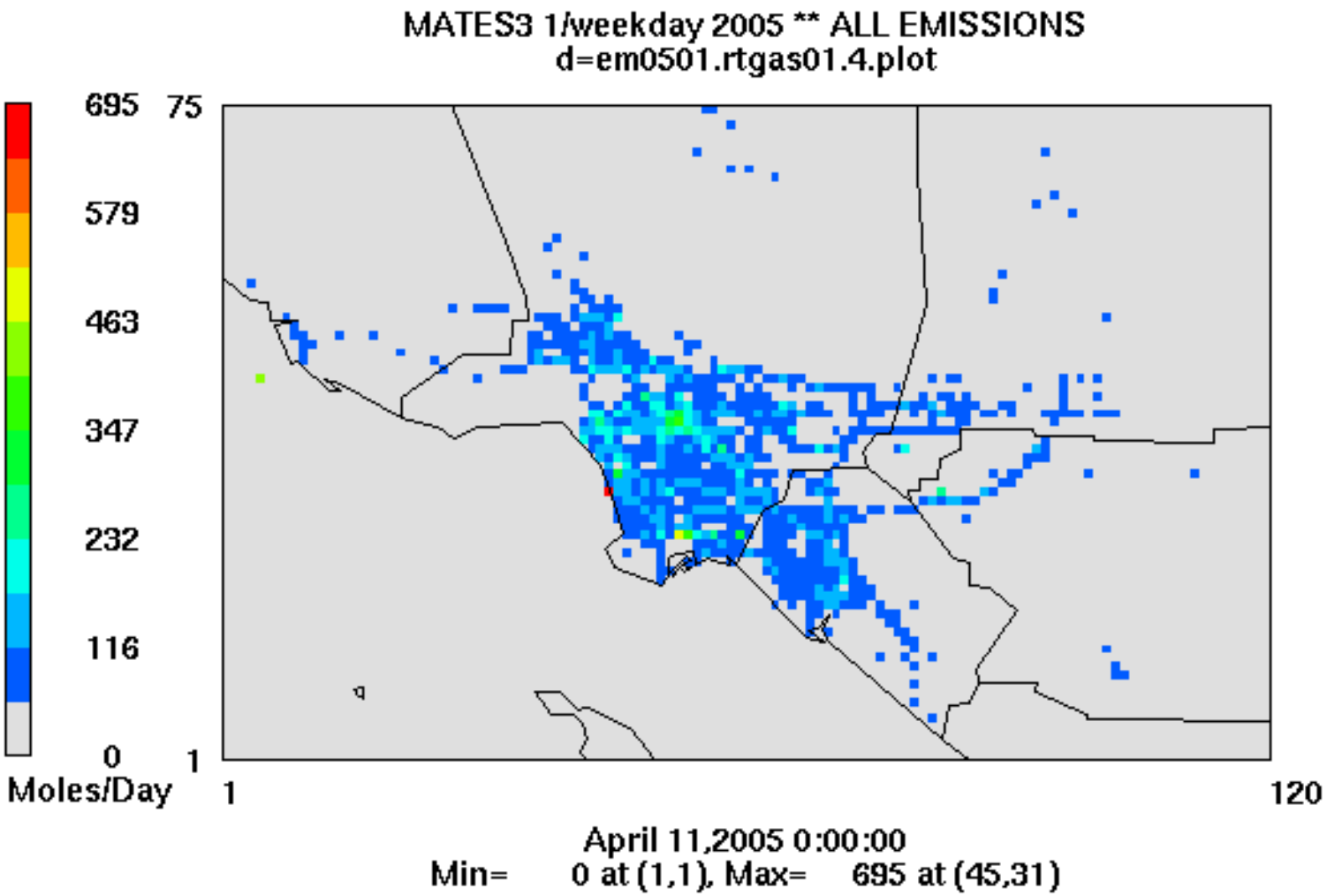

April 11,2005 0:00:00
Min= 0 at (1,1), Max= 1952 at (83,31)

# CAMx Simulated

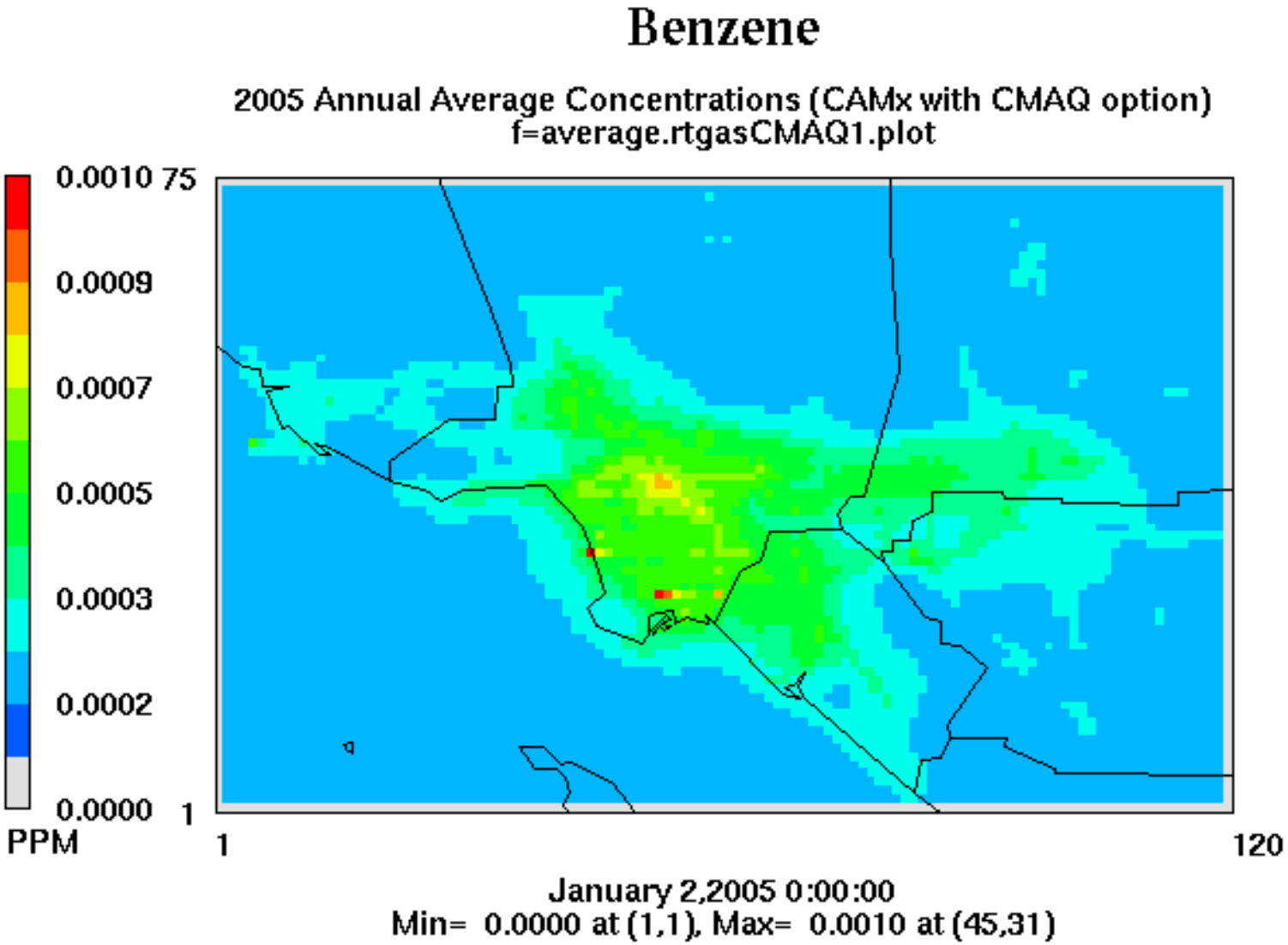
## 1,3Butadiene



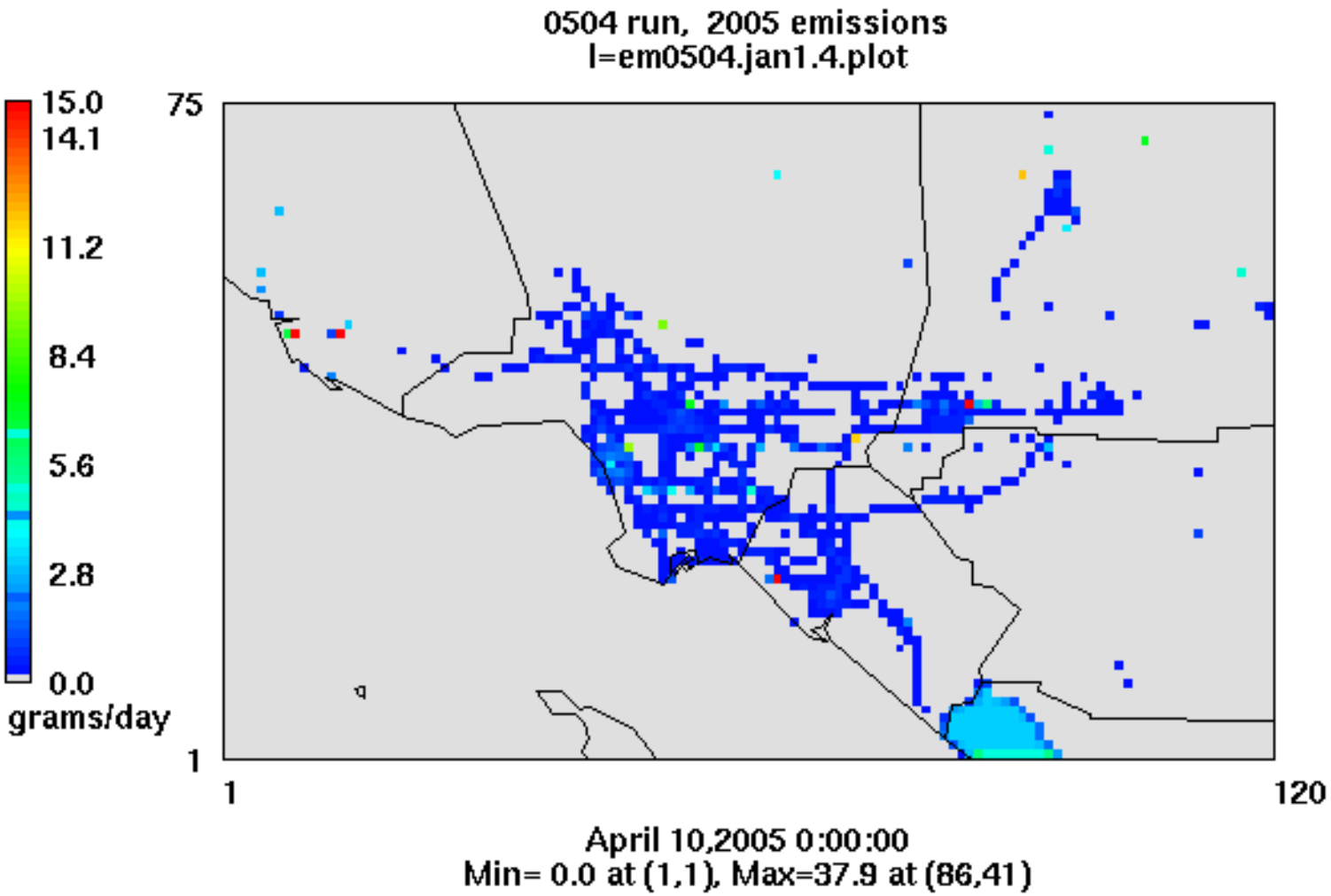
# Benzene Emissions



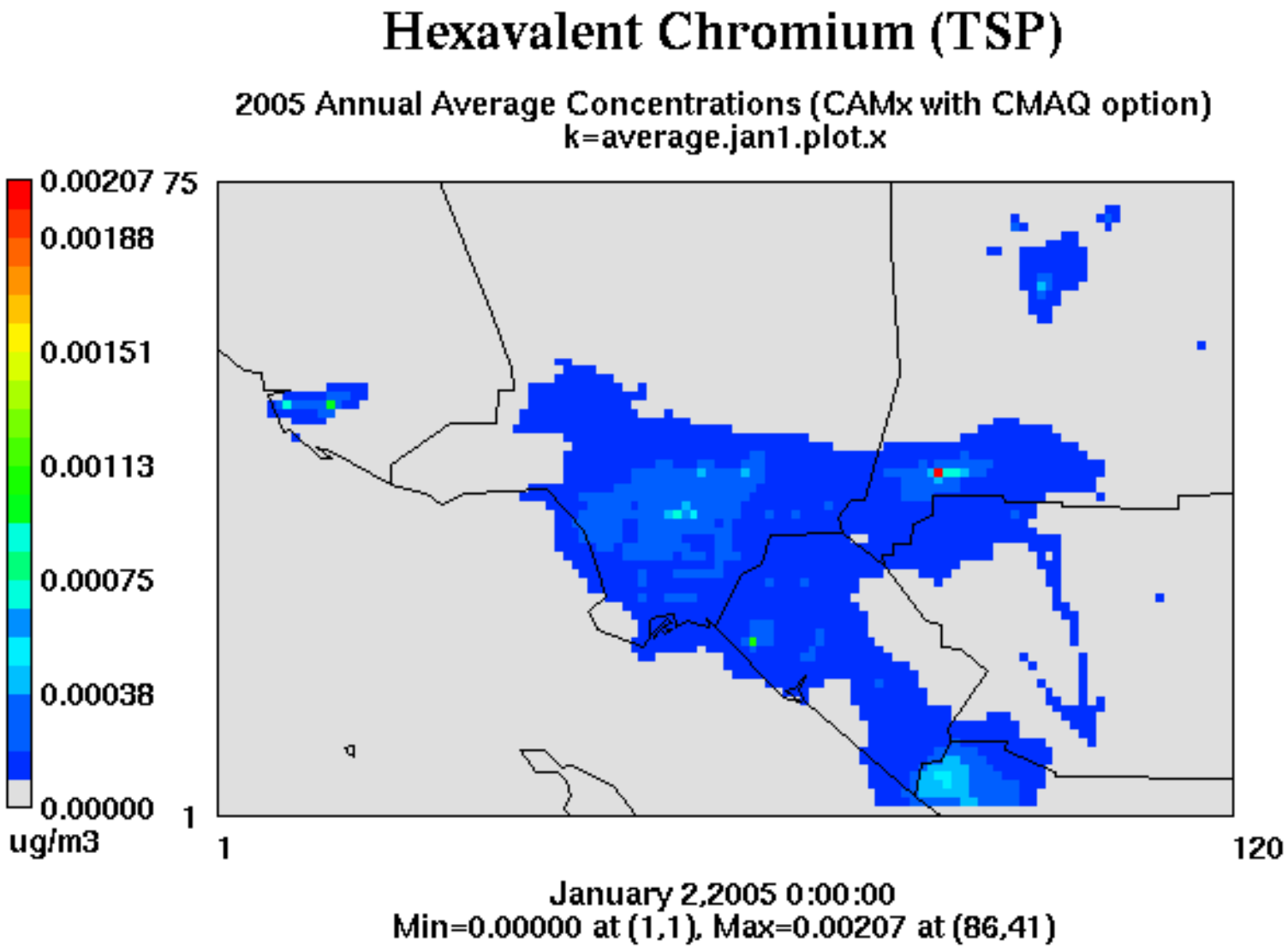
# CAMx Simulated



# Hexavalent Chromium Emissions (PM2.5)



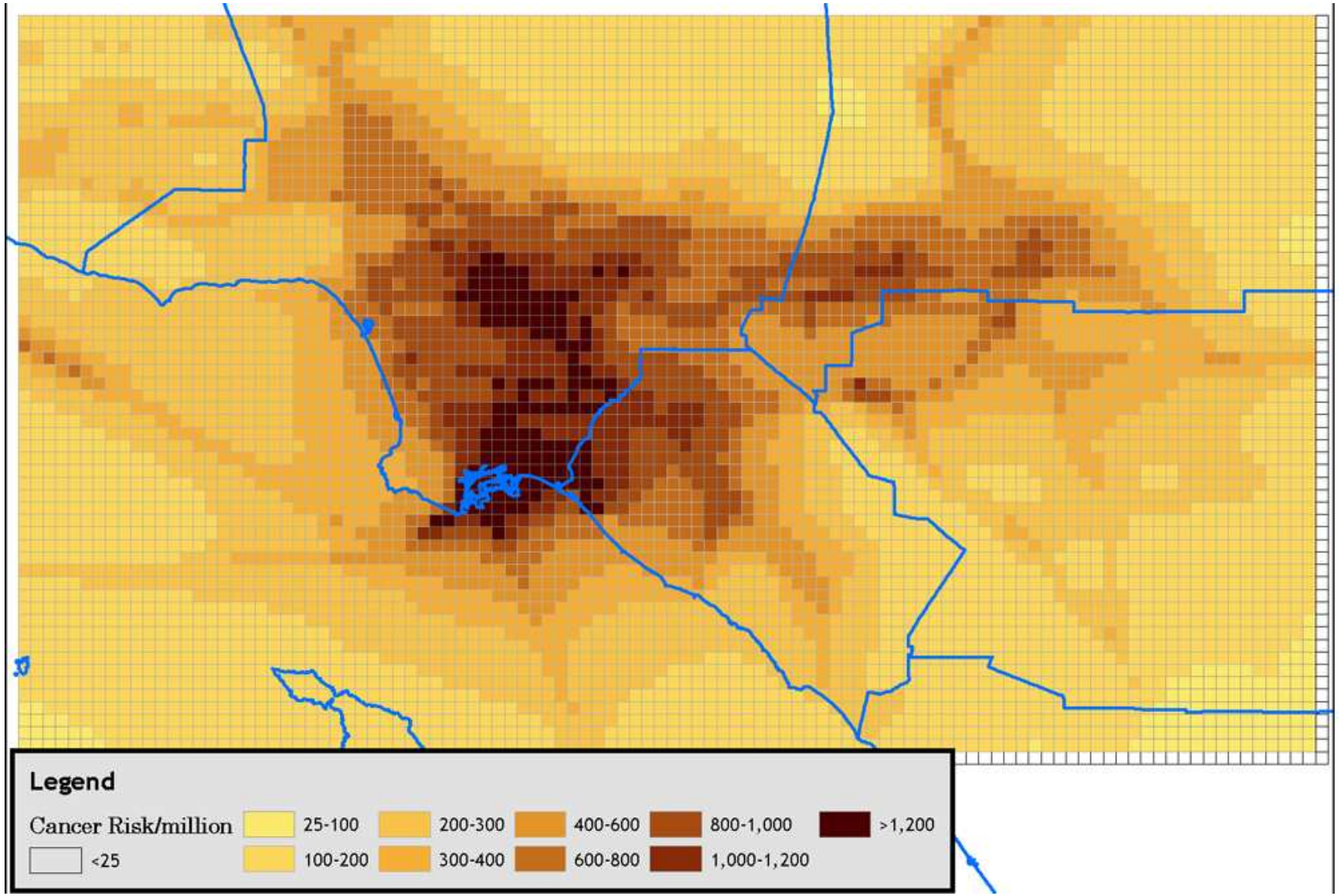
# CAMx Simulated



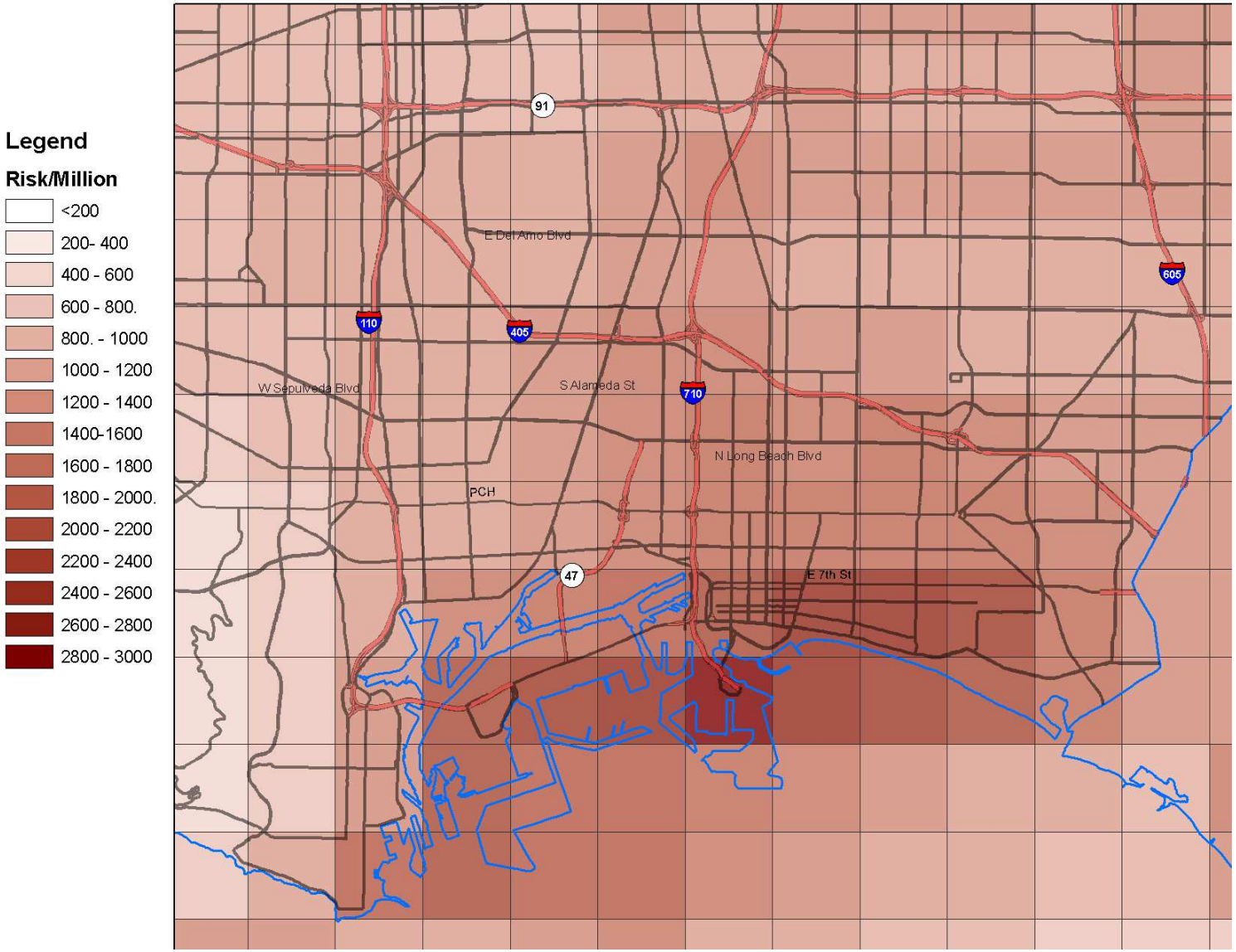
# Risk from Individual Toxic Compounds

| Toxic Compound | Basinwide Risk (per million) | Percent Contribution |
|---|---|---|
| Diesel | 681.62 | 84.1 |
| Benzene | 43.46 | 5.4 |
| 1,3 Butadiene | 27.7 | 3.4 |
| Primary Formaldehyde | 11.37 | 1.4 |
| Secondary Formaldehyde | 11.16 | 1.4 |
| Hexavalent Chromium 6 | 8.26 | 1.0 |
| Arsenic | 7.97 | 1.0 |
| p-Dichlorobenzene | 5.02 | 0.6 |
| Secondary Acetaldehyde | 4.02 | 0.5 |
| Perchloroethylene | 3.67 | 0.5 |
| Cadmium | 2.4 | 0.3 |
| Primary Acetaldehyde | 1.69 | 0.2 |
| Methylene Chloride | 0.99 | 0.1 |
| Nickel | 0.9 | 0.1 |
| Trichloroethylene | 0.33 | < 0.1 |
| Lead | 0.09 | < .01 |

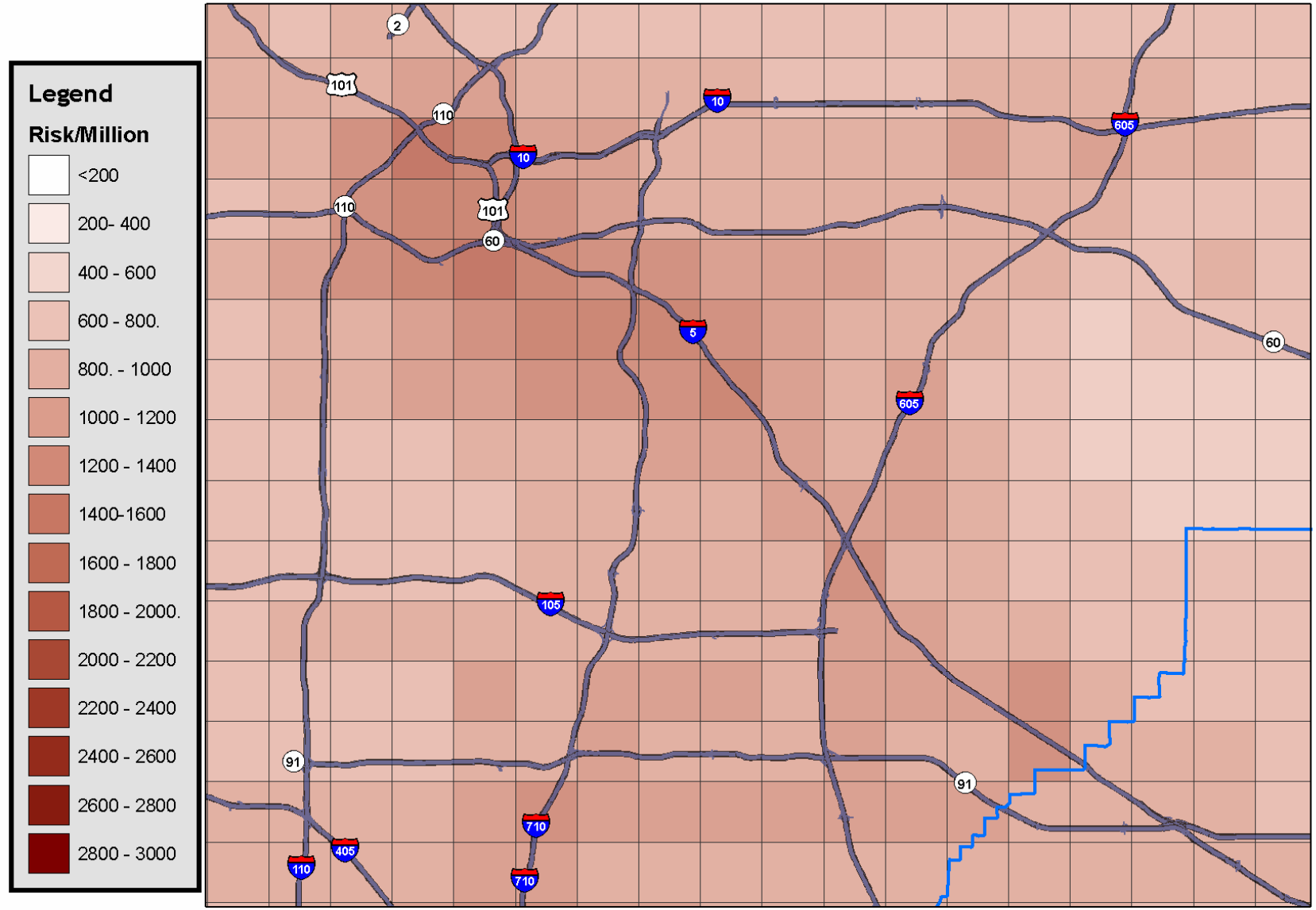
# MATES-III CAMx Simulated Risk



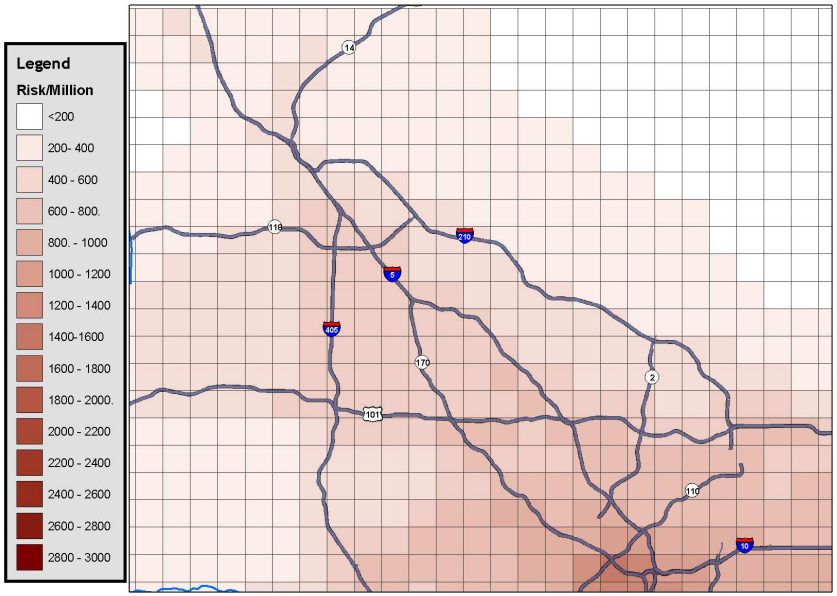
# Port Area

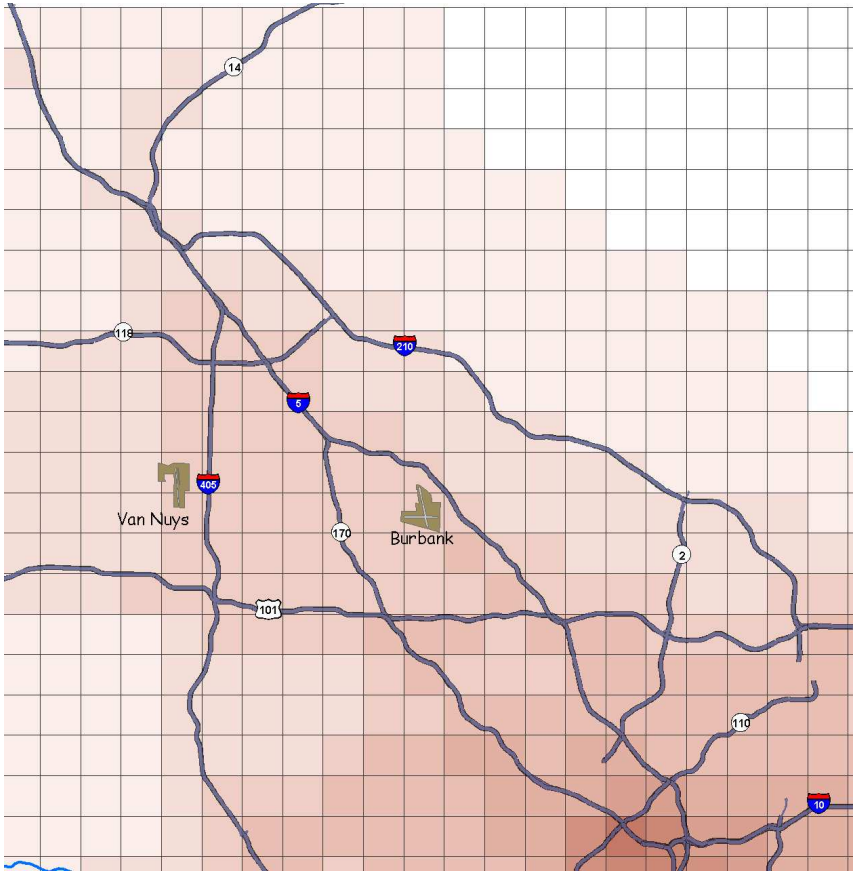

Legend
Risk/Million
<200
200- 400
400 - 600
600 - 800.
800. - 1000
1000 - 1200
1200 - 1400
1400-1600
1600 - 1800
1800 - 2000.
2000 - 2200
2200 - 2400
2400 - 2600
2600 - 2800
2800 - 3000
91
E Del Amo Blvd
110
405
605
W Sepulveda Blvd
S Alameda St
710
N Long Beach Blvd
PCH
47
E 7th St

# Downtown LA

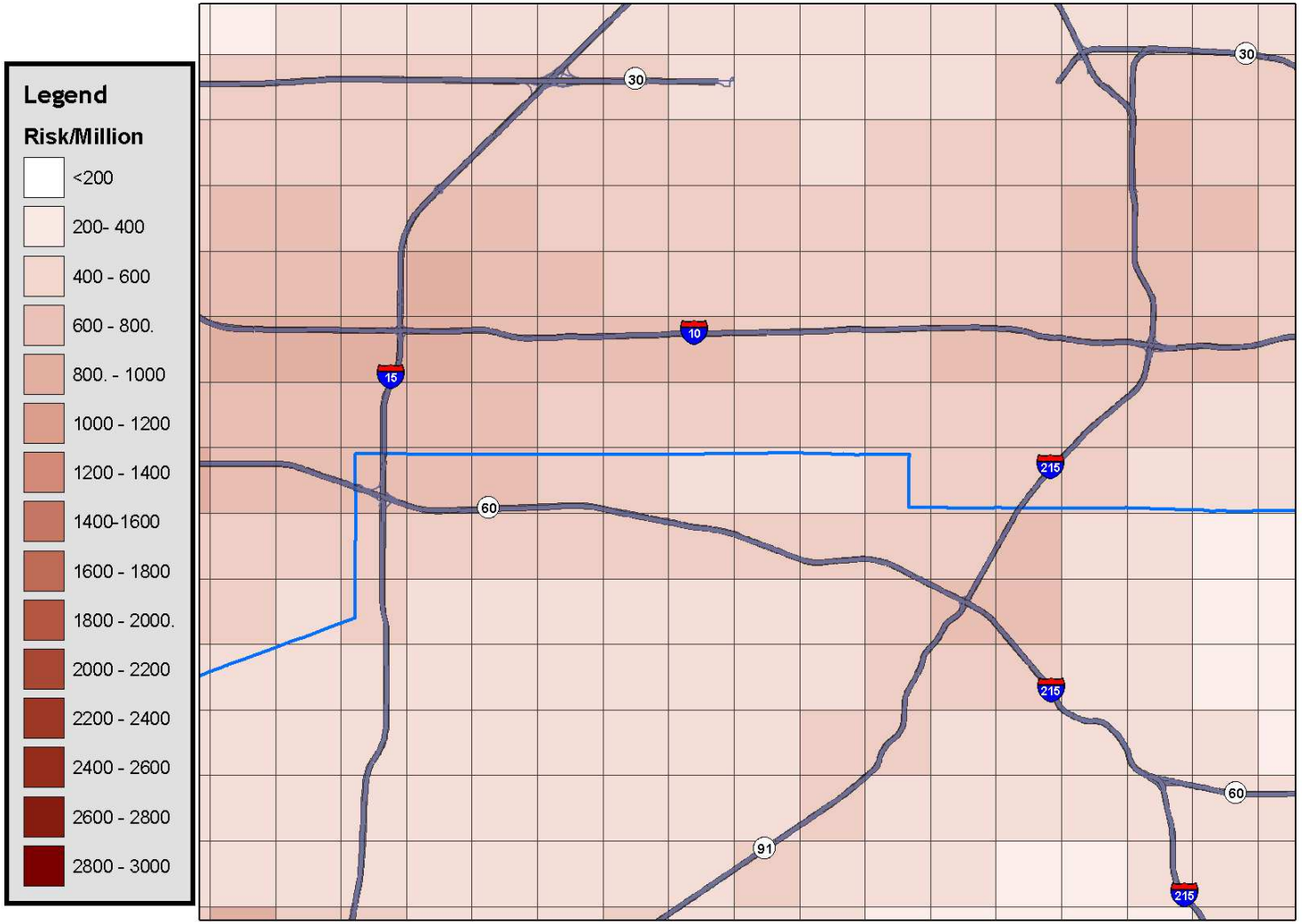

Legend
Risk/Million
<200
200- 400
400 - 600
600 - 800.
800. - 1000
1000 - 1200
1200 - 1400
1400-1600
1600 - 1800
1800 - 2000.
2000 - 2200
2200 - 2400
2400 - 2600
2600 - 2800
2800 - 3000
2
101
110
10
605
60
5
105
91
405
710

# San Fernando Valley

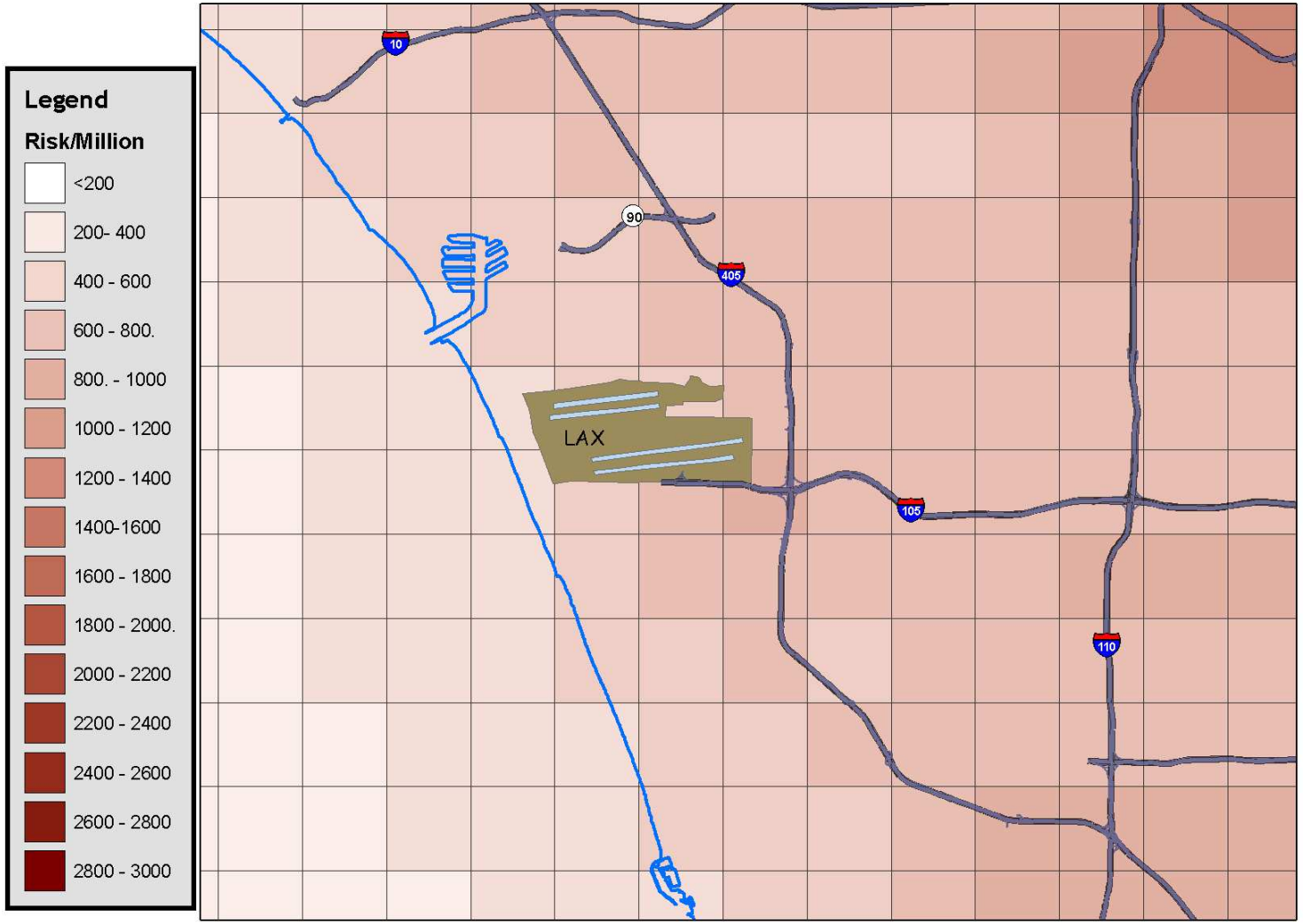


# Mira Loma / Colton



# West LA / LAX


Legend
Risk/Million
<200
200- 400
400 - 600
600 - 800.
800. - 1000
1000 - 1200
1200 - 1400
1400-1600
1600 - 1800
1800 - 2000.
2000 - 2200
2200 - 2400
2400 - 2600
2600 - 2800
2800 - 3000
10
90
405
LAX
105
110

# Network Averaged Modeled Risk to Measured Risk at the Eight –MATES III Sites

| Location | Benzene | Butadiene | Other | Diesel | Total |
|---|---|---|---|---|---|
| Anaheim | 14 | 13 | 42 | 813 | 882 |
| Burbank | 14 | 11 | 38 | 582 | 645 |
| Compton | 16 | 24 | 60 | 873 | 973 |
| Fontana | 12 | 8 | 76 | 585 | 681 |
| Long Beach | 17 | 16 | 51 | 1158 | 1242 |
| Los Angeles | 20 | 21 | 60 | 1167 | 1268 |
| Rubidoux | 11 | 8 | 37 | 489 | 545 |
| Wilmington | 18 | 12 | 71 | 1314 | 1415 |
| Average Modeled | 15 | 14 | 54 | 873 | 956 |
| Average Measured (EC2.5 * 1.72 for Diesel) | 17 | 16 | 80 | 946 | 1059 |
| Average Measured (CMB) | 17 | 16 | 80 | 1004 - 1120 | 1117 - 1233 |

# MATES III Station Modeled Risk to Measured Risk

| Location | Measured | Simulated |
|---|---|---|
| Anaheim | 877 | 882 |
| Burbank | 1304 | 645 |
| Compton | 1145 | 973 |
| Fontana | 1406 | 681 |
| Long Beach | 933 | 1242 |
| Los Angeles | 1289 | 1268 |
| Rubidoux | 1145 | 545 |
| Wilmington | 1264 | 1415 |

# MATES-III vs. MATES-II

- Risk improves 17 %
- Diesel emissions ~ 4 % higher
- Weather consideration – no major difference in dispersion potential
- Model estimation of ventilation coefficient varies by location
- Impact of split emissions (2-layers) varied
- Recreating 1998-1999 meteorology using MM5 for subsequent simulation

# CAMx Simulated MATES-III and MATES-III Risk Using 1998-1999 Back-cast Emissions

| Compound | CAMx Simulated with Back-casted 1998-99 Emissions* | MATES-III 2005 CAMx Simulation | Delta Risk Reduction | Percentage of Total Risk Reduction |
|---|---|---|---|---|
| Diesel | 720.5 | 681.2 | 39.3 | 36.2 |
| Benzene | 65.2 | 43.4 | 21.8 | 20.1 |
| 1,3Butadiene | 48.9 | 27.7 | 21.2 | 19.5 |
| Chrome-6 | 20.2 | 8.3 | 11.9 | 11 |
| Formaldehyde | 28.1 | 22.5 | 5.6 | 5.2 |
| Perchloroethylene | 7 | 3.7 | 3.3 | 3 |
| Arsenic | 10.9 | 8 | 2.9 | 2.7 |
| Acetaldehyde | 6.7 | 5.7 | 1 | 0.9 |
| Cadmium | 3.2 | 2.4 | 0.8 | 0.7 |
| Methylene Chloride | 1.6 | 1 | 0.6 | 0.6 |
| Nickel | 1.4 | 0.9 | 0.5 | 0.5 |
| Trichloroethylene | 0.5 | 0.3 | 0.2 | 0.2 |
| Lead | 0.1 | 0.1 | 0 | 0 |
| p-Dichlorobenzene | 4.7 | 5.2 | -0.5 | -0.5 |
| All | 919 | 810.4 | 108.6 | 100 |

# Observations/Ongoing Analyses

- Risk reduction from MATES-II levels consistent with emissions reductions
- Regional modeling doesn’t always capture the risk at the monitoring site
- Evaluate impacts of wind fields & transport
- Evaluate MATES-II vs backcast with MM5 generated meteorology