



Photochemical Modeling of Ozone, PM_{2.5} & Visibility Impacts of Texas Existing and New Coal-Fired Power Plants in Neighboring States

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Modeling Studies by Sierra Club

- Cumulative ozone modeling studies in February 2010 using the CAMx model with modeling grid with 4-km resolution and short ozone episodes that were used in State Implementation Plan (SIP):
 - August 13 – September 1 episode for OK
 - August 13 – September 1 episode for AR
 - May 26 – July 1 episode for LA
- Significant ozone impacts (i.e. new exceedances of 8-hr AAQS) of Texas existing & new coal-fired plants have been predicted



Photochemical Modeling Methodologies

- CAMx (Comprehensive Air Quality Model with Extensions) Photochemical Model –version 5.10
- 3 CAMx runs:
 - Baseline (including existing plants)
 - Baseline without TX existing coal plants
 - Baseline adding TX new coal plants
- Modeling Inputs:
 - Model entire year of 2002 by 4 quarterly runs
 - National RPO grid with 36 km resolution
 - CENRAP 2002 database for regional haze (2007)



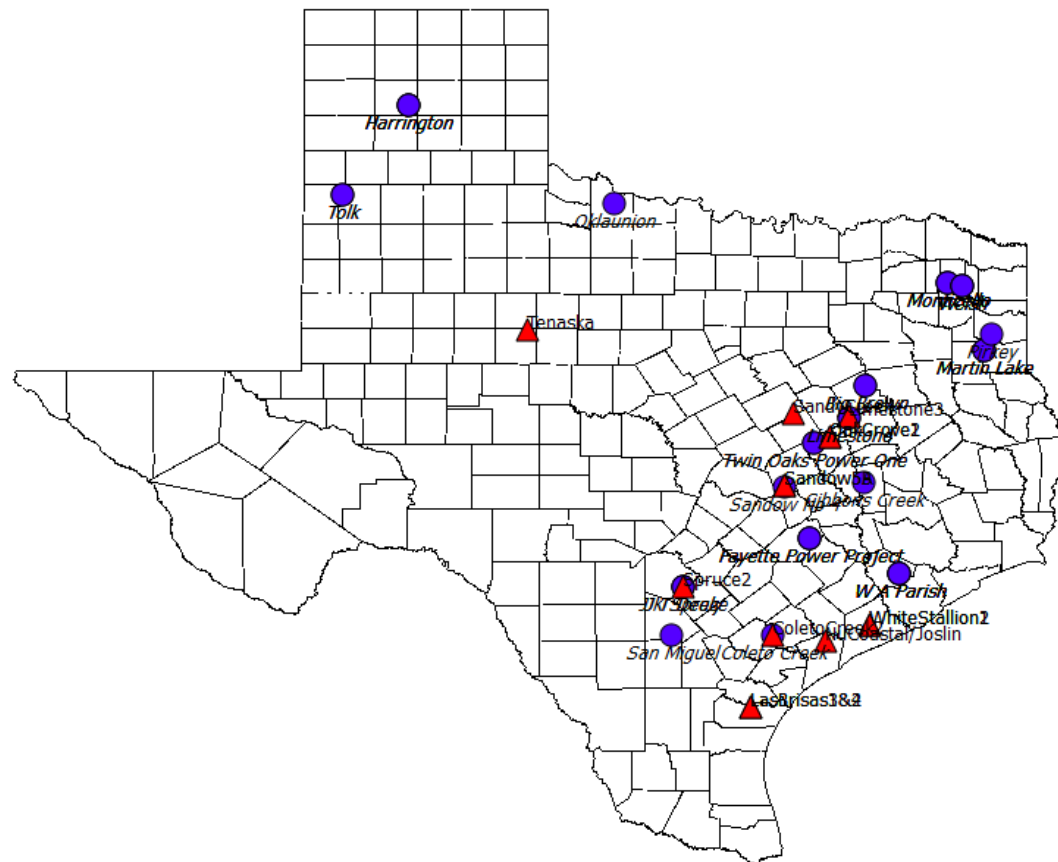
Ozone, PM2.5 & Visibility Impact Analyses

- Ozone & PM2.5:
 - Impacts on daily regional peaks
 - Maximum increases in State
 - New exceedances of NAAQS (0.075 ppm and 0.07 ppm for 8-hour ozone; 35 ug/m³ for 24-hour PM2.5; and 15 ug/m³ for annual PM2.5)
 - Impacts at monitoring stations

Visibility: Ozone & PM2.5:

- Class I areas (Caney Creek & Upper Buffalo in AR; Breton in LA; Wichita Mt in OK)
- Change in deciview (del-dv) calculated by the old and new IMPROVE equations

Texas Existing (●) and New (▲) Coal Plants





Texas Existing Coal Plants

- 2007 database of US Energy Information Administration (EIA)
- 36 units identified in EIA database
- Total NO_x emissions of 371 tons/day
- Remove existing units (“zero-out”)



Texas New Coal Plants

- Added 14 new or proposed units
- Emissions (NO_x, VOC, CO, SO₂, PM_{2.5}, PM, H₂SO₄, NH₃) and stack parameters from TCEQ permits
- Total NO_x emissions of 153 tons/day
- NO_x speciation - 90% NO, 10% NO₂
- VOC speciation - Carbon Bond IV
- PM_{2.5} speciation – NCOAL profile



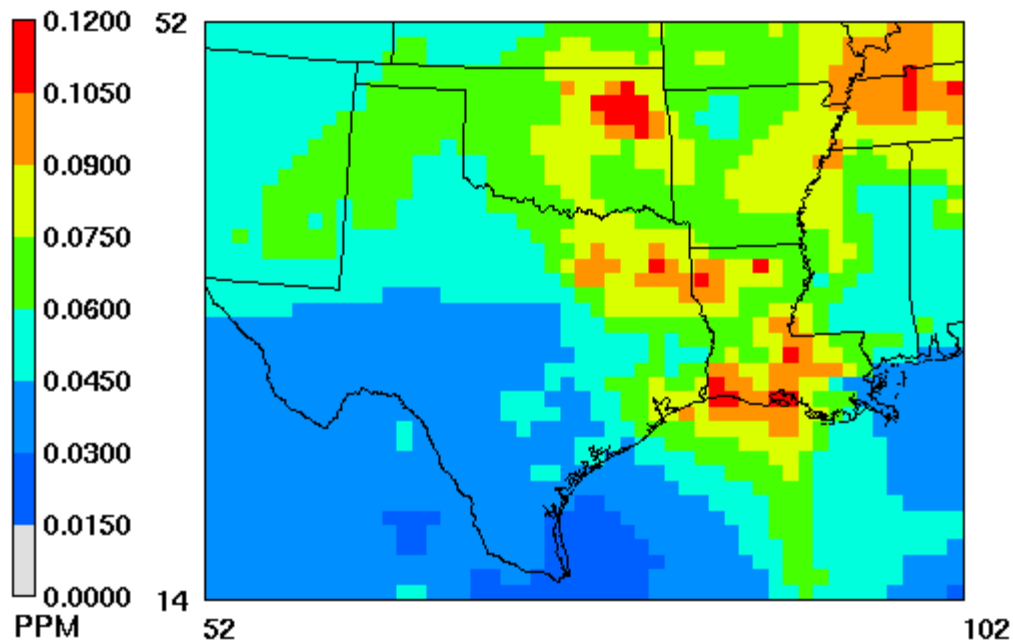
LA Ozone Impacts of TX Existing Plants

- Max impacts from 1-8 ppb at 27 monitoring sites
- 16 new exceedances of 0.075 ppm AAQS at monitors
- 9 new exceedances of 0.07 ppm AAQS at monitors
- Max increases at any location up to 10.4 ppb in northwest LA
- 94 new exceedances of 0.07 ppm AAQS in 36x36 km² areas in LA
- 95 new exceedances of 0.07 ppm AAQS in 36x36 km² areas in LA

LA Baseline 8-hr Ozone on July 11

base Ozone

CAMx 5.1 –Mech4 CF base
b=camx.base.2002192.maxo3

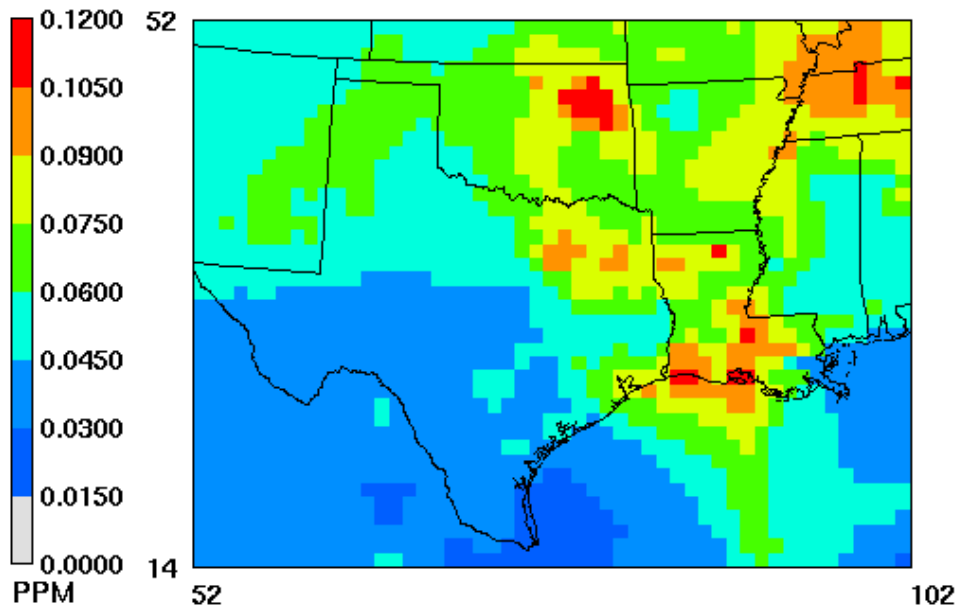


July 11, 2002 0:00:00
Min=0.0258 at (76,15), Max=0.1292 at (79,47)

LA Ozone Without TX Existing Plants on July 11

zeroTX Ozone

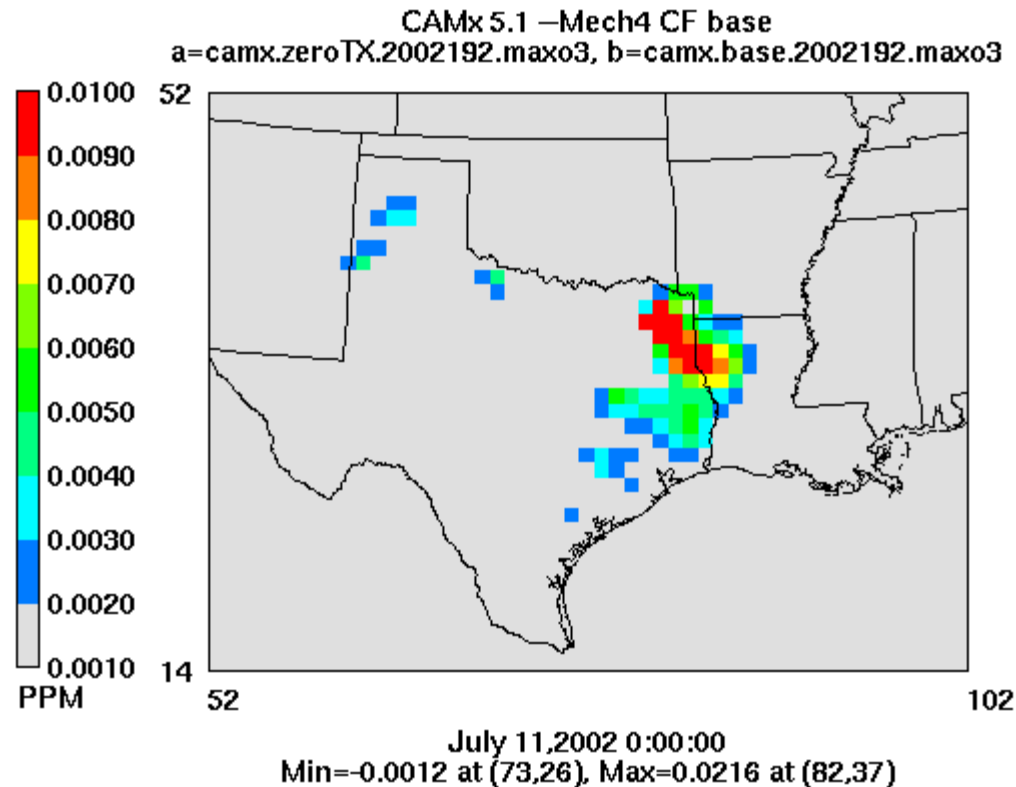
CAMx 5.1 –Mech4 CF base
a=camx.zeroTX.2002192.maxo3



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LA Ozone Impacts of TX Existing Plants on 7/11

base Ozone - zeroTX Ozone





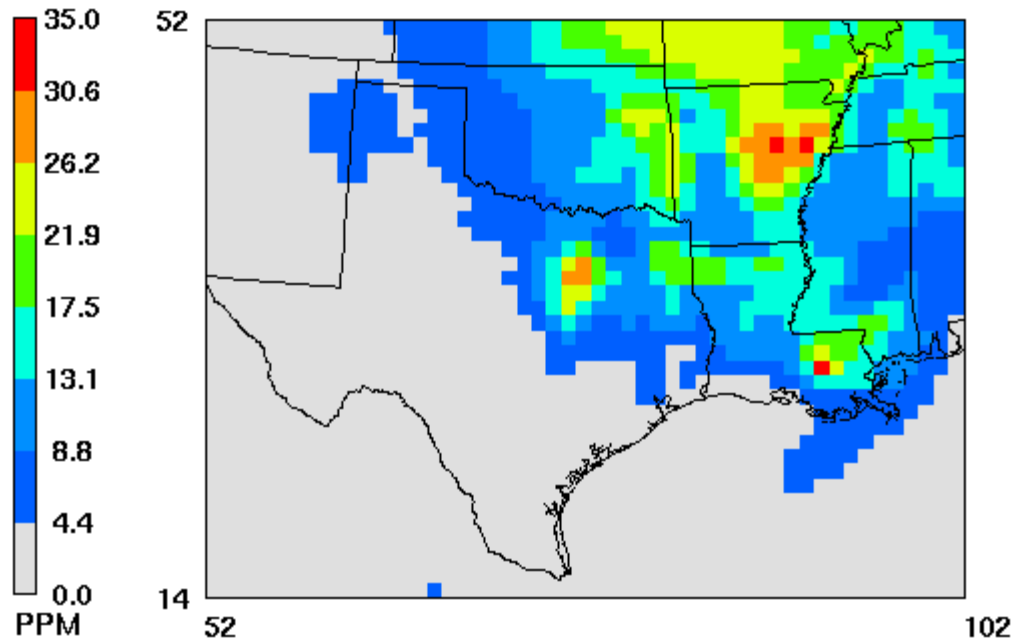
LA PM_{2.5} Impacts of TX Existing Plants

- Max impacts from 2-10 ug/m³ at 18 monitoring sites
- 3 new exceedances of 24-hr AAQS at monitors
- Max increase at any location up to 11 ug/m³ in northwest LA
- 12 new exceedances of 24-hr NAAQS in 36x36 km² areas in LA

LA Baseline 24-hr PM2.5 on July 13, 2002

base PM2.5 (ug/m3)

CAMx 5.1 –Mech4 CF base
b=camx.base.2002194.maxpm

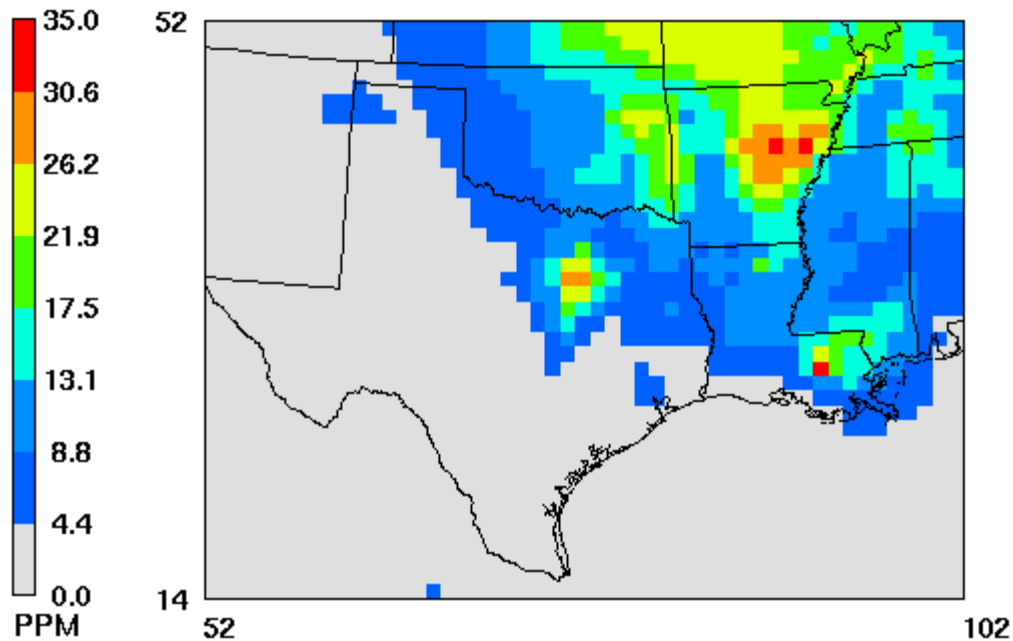


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Min= 0.3 at (52,14), Max=34.2 at (93,29)

LA PM2.5 With TX Existing Plants on July 13

zeroTX PM2.5 (ug/m3)

CAMx 5.1 –Mech4 CF base
a=camx.zeroTX.2002194.maxpm

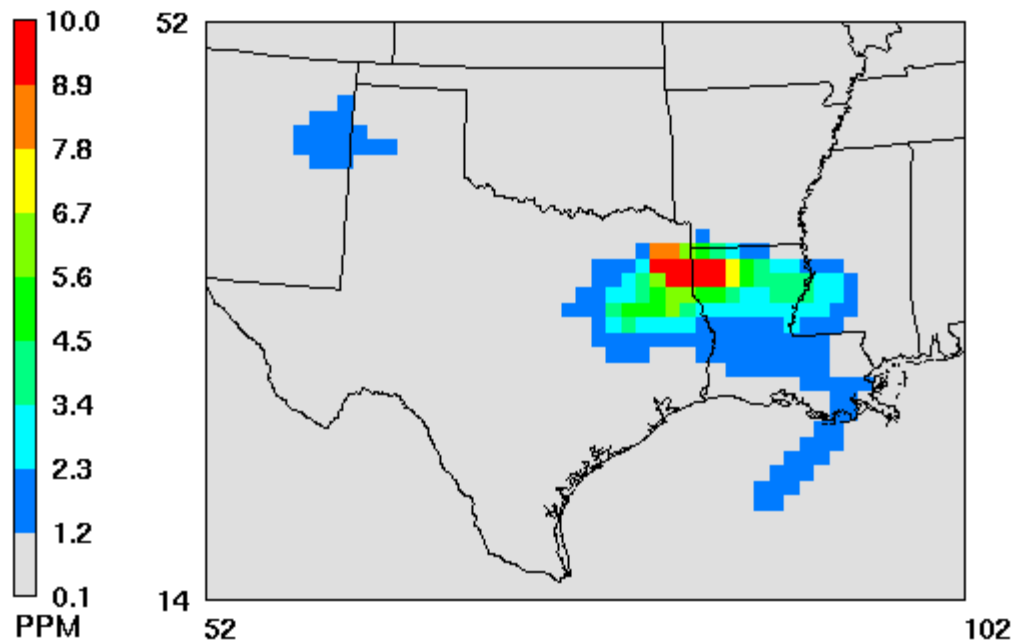


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Min= 0.3 at (52,14), Max=32.7 at (93,29)

LA PM2.5 Impacts of TX Existing Plants on 7/13

base PM2.5 - zeroTX PM2.5 (ug/m3)

CAMx 5.1 -Mech4 CF base
a=camx.zeroTX.2002194.maxpm, b=camx.base.2002194.maxpm



July 13,2002 0:00:00
Min=-0.2 at (62,34), Max=11.6 at (83,36)



Visibility Impacts of TX Existing Plants at Breton

- 0 day with del-dv > 0.5 deciview by both the old and new IMPROVE equations
- Max change 0.289 deciview by the old IMPROVE equation



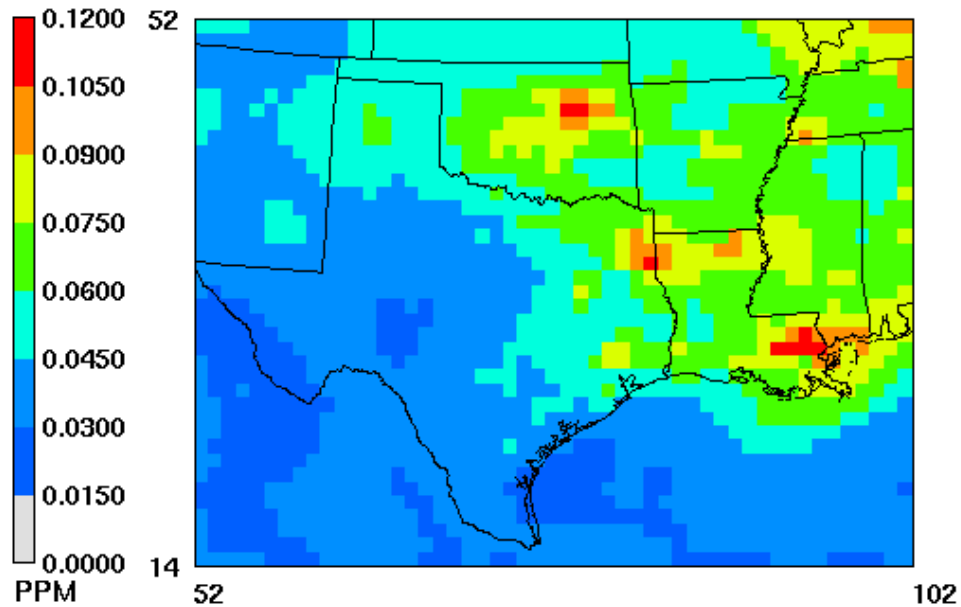
LA Ozone Impacts of TX New Plants

- Max impacts from 0.3-1.3 ppb at 27 monitoring sites
- 4 new exceedances of 0.075 ppm AAQS at monitors
- 2 new exceedances of 0.07 ppm AAQS at monitors
- Max increases at any location up to 1.9 ppb in northwest LA
- 9 new exceedances of 0.07 ppm AAQS in 36x36 km² areas in LA
- 16 new exceedances of 0.07 ppm AAQS in 36x36 km² areas in LA

LA Baseline 8-hr Ozone on July 23, 2002

base Ozone

CAMx 5.1 –Mech4 CF newTX
a=camx.base.2002204.maxo3

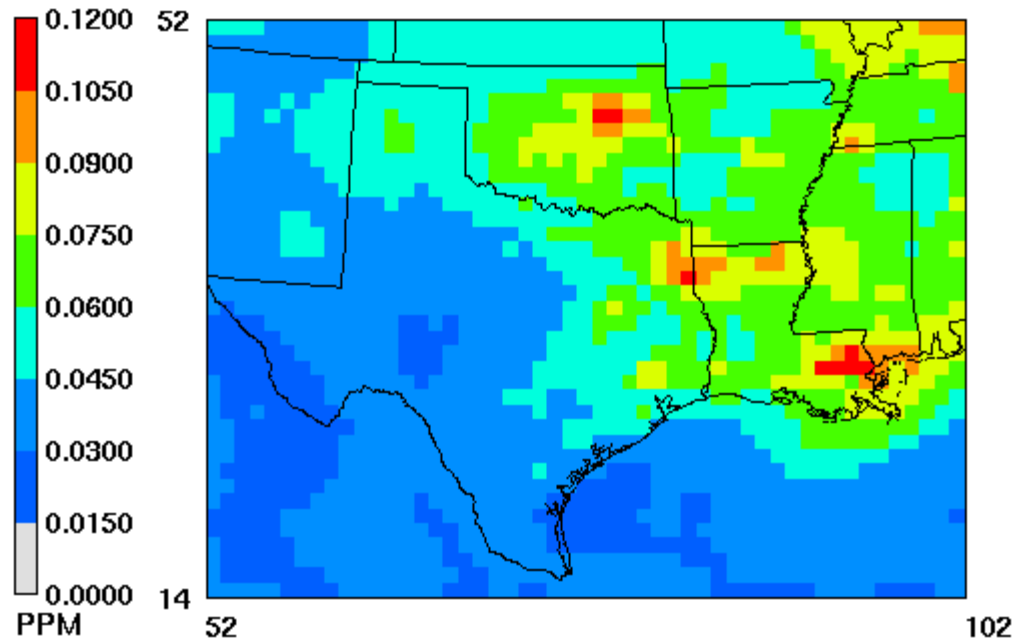


July 23,2002 0:00:00
Min=0.0238 at (54,29), Max=0.1206 at (79,46)

LA Ozone With TX New Plants on July 23

newTX Ozone

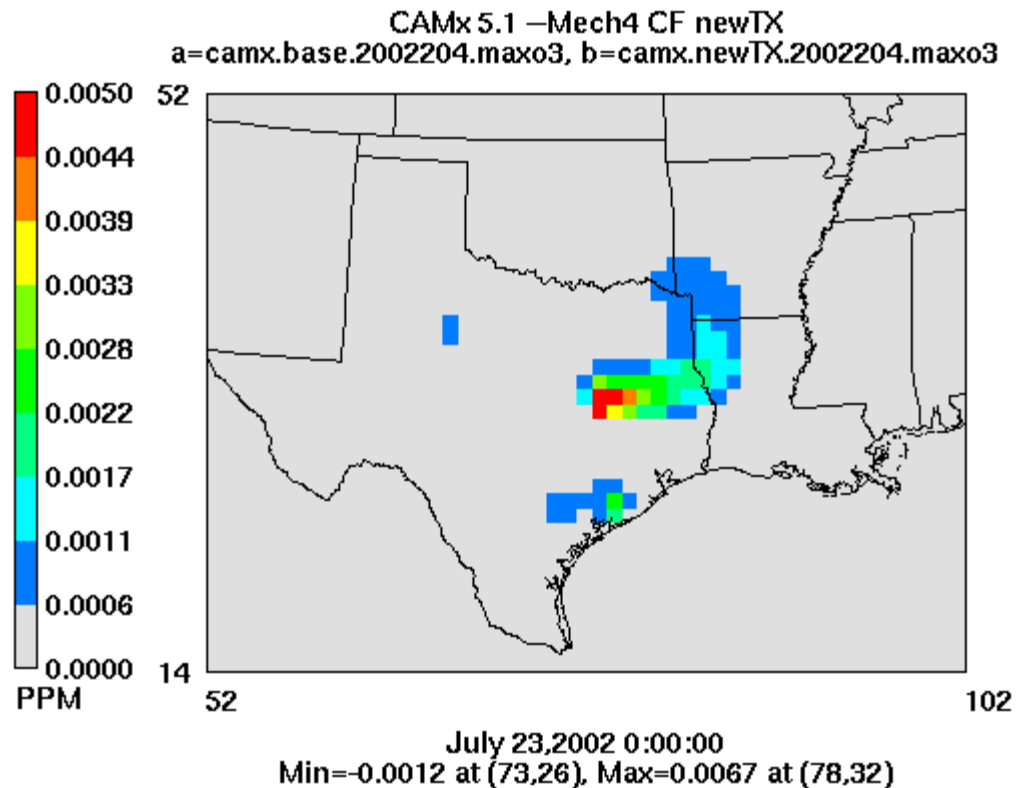
CAMx 5.1 –Mech4 CF newTX
b=camx.newTX.2002204.maxo3



July 23,2002 0:00:00
Min=0.0238 at (54,29), Max=0.1206 at (79,46)

LA Ozone Impacts of TX New Plants on July 23

newTX Ozone - base Ozone





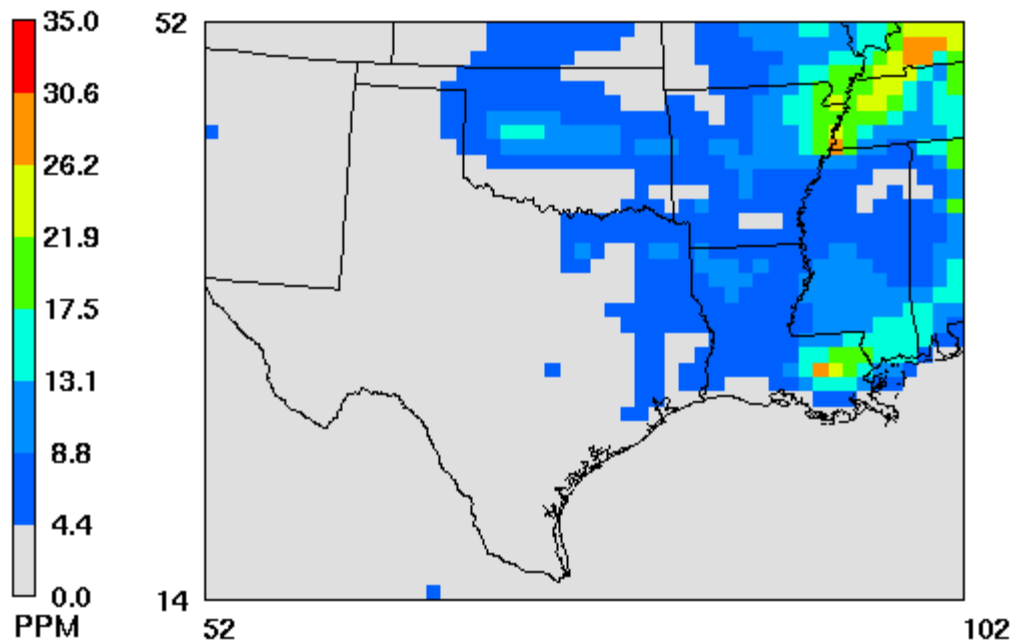
LA PM_{2.5} Impacts of TX New Plants

- Max impacts from 1-4 ug/m³ at 11 monitoring sites
- 2 new exceedances of 24-hr AAQS at monitors
- Max increase at any location up to 4.6 ug/m³ in northwest LA
- 7 new exceedances of 24-hr NAAQS in 36x36 km² areas in LA

LA Baseline 24-hr PM2.5 on July 24, 2002

base PM2.5 (ug/m3)

CAMx 5.1 –Mech4 CF newTX
a=camx.base.2002205.maxpm

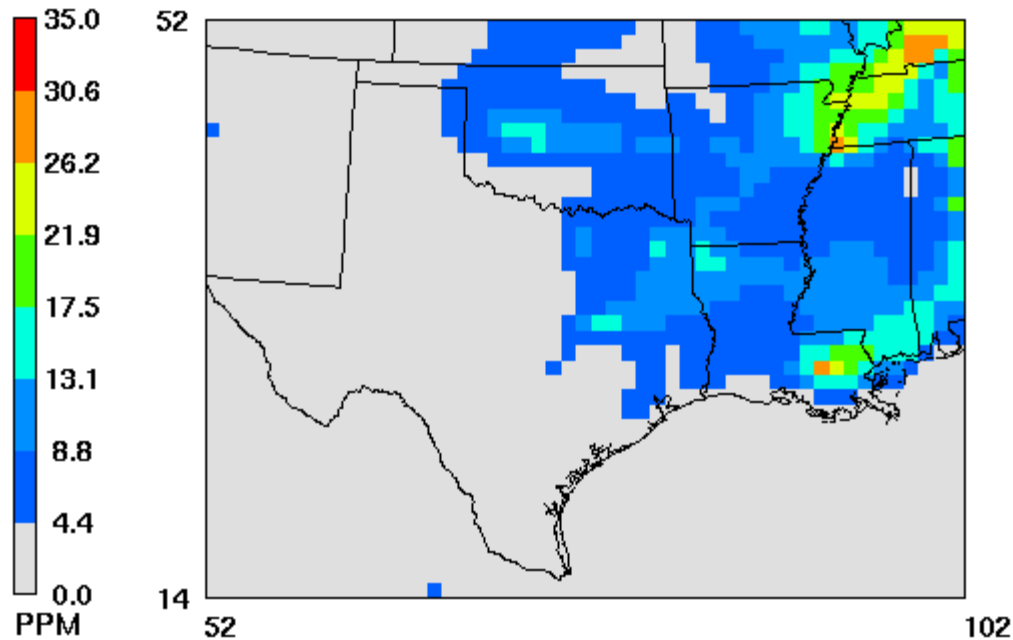


July 24, 2002 0:00:00
Min= 0.2 at (76,18), Max=29.7 at (100,51)

LA PM2.5 With TX New Plants on July 24

newTX PM2.5 (ug/m3)

CAMx 5.1 –Mech4 CF newTX
b=camx.newTX.2002205.maxpm



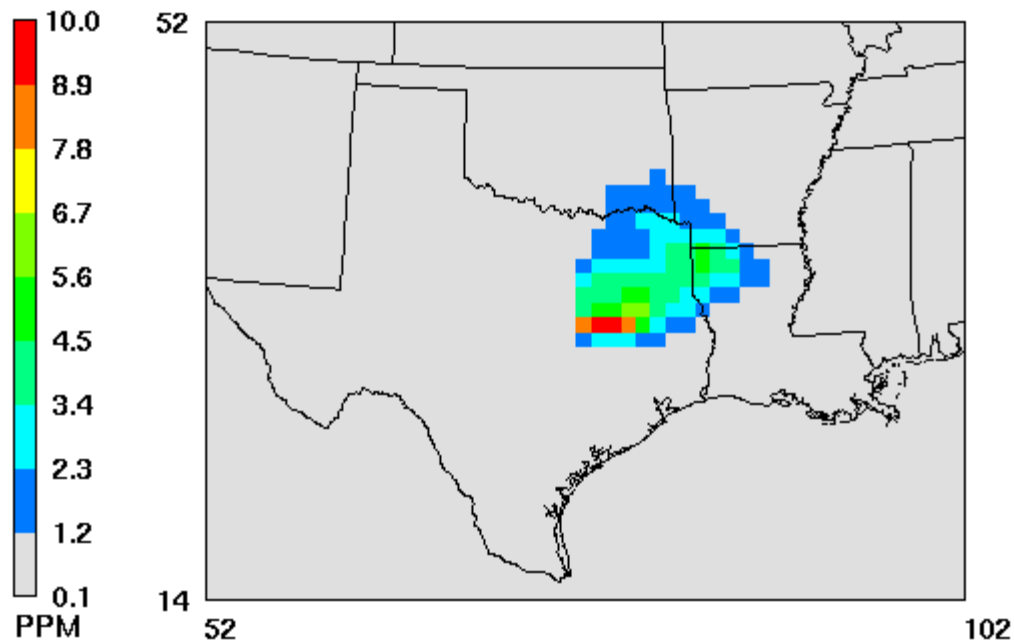
July 24, 2002 0:00:00
Min= 0.2 at (76,18), Max=29.9 at (100,51)

LA PM2.5 Impacts of TX New Plants on July 24

newTX PM2.5 - base PM2.5 (ug/m3)

CAMx 5.1 - Mech4 CF newTX

a=camx.base.2002205.maxpm, b=camx.newTX.2002205.maxpm



July 24, 2002 0:00:00

Min=-0.1 at (66,37), Max=10.1 at (79,32)



Visibility Impacts of TX New Plants at Breton

- 0 day with del-dv > 0.5 deciview by the old and new IMPROVE equations
- Max change 0.367 deciview by the old IMPROVE equation



Conclusions

- TX existing and new coal plants cause large increases of ozone and PM_{2.5} in neighboring States
- TX plants exacerbate existing violations of 8-hr ozone NAAQS (0.075 and 0.07 ppm) and 24-hr PM_{2.5} NAAQS
- TX plants cause large numbers of new exceedances of 8-hr ozone NAAQS (0.075 and 0.07 ppm) and 24-hr PM_{2.5} NAAQS (35 ug/m³)
- TX plants cause significant visibility impacts at Class I areas (Upper Buffalo and Wichita Mountains).