Results from 2018 Preliminary Reasonable Progress Modeling

Gail Tonnesen, University of California, Riverside

Ralph Morris, ENVIRON Corporation Int., Novato, CA

Zac Adelman, University of North Carolina

TSS Meeting, Denver, CO, June 19, 2007

Topics

- Comparison of emissions changes:
  - PRP18a, Base18b and Plan02c
- Comparison of CMAQ visibility results:
  - PRP18a versus Base18b CMAQ spatial plots for PM species.
  - visibility projections for PRP18a & Base18b.
  - PRP18a versus Plan02c CMAQ spatial plots for PM species.

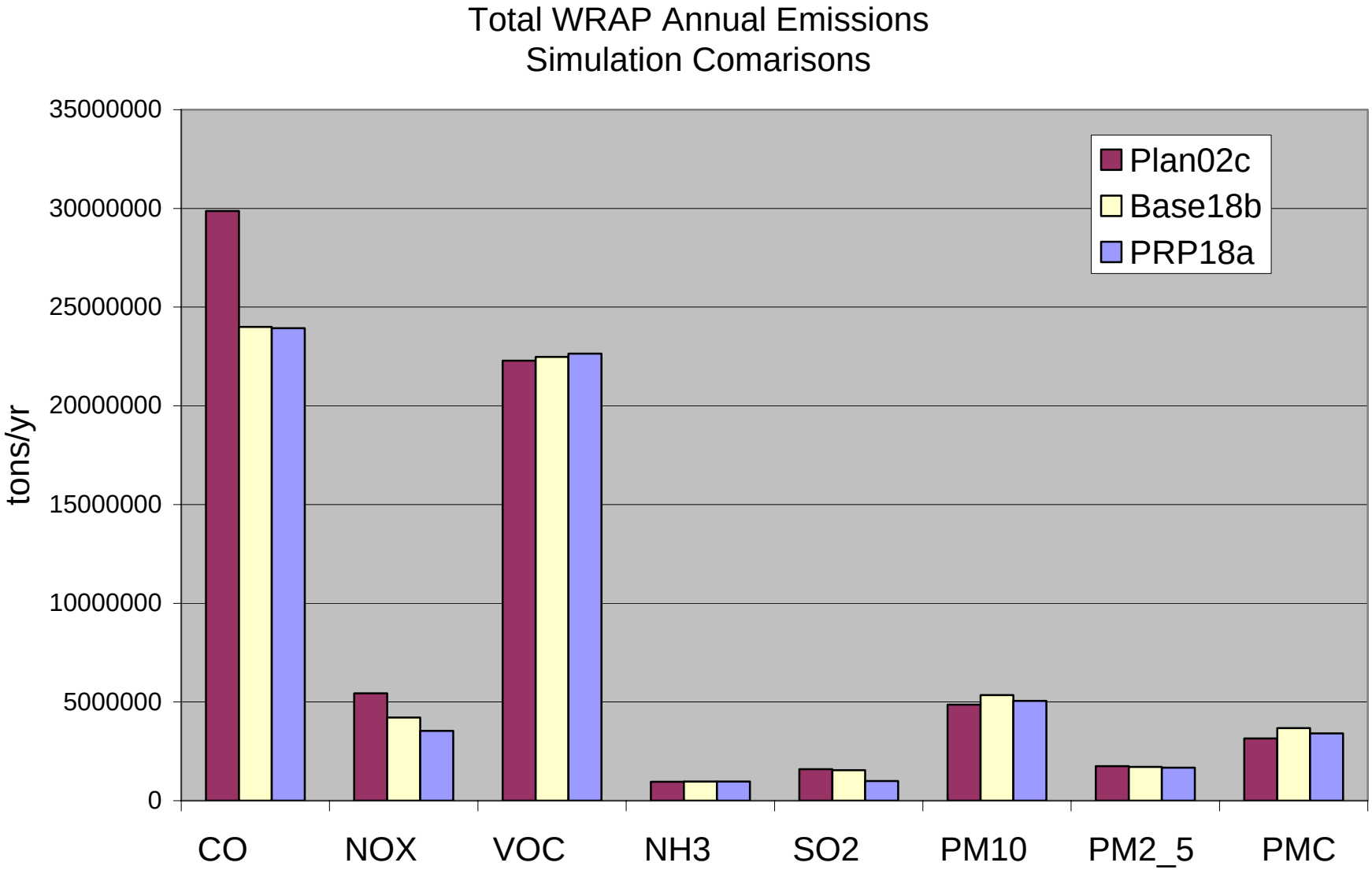
2018 Preliminary Reasonable Progress Case PRP18 version A

- Data Sources:
  - WRAP info is from the states.
  - some changes in other RPOs are error corrections and adding new data sets.

Updates in PRP18, not yet addressed in Plan02 modeling analysis

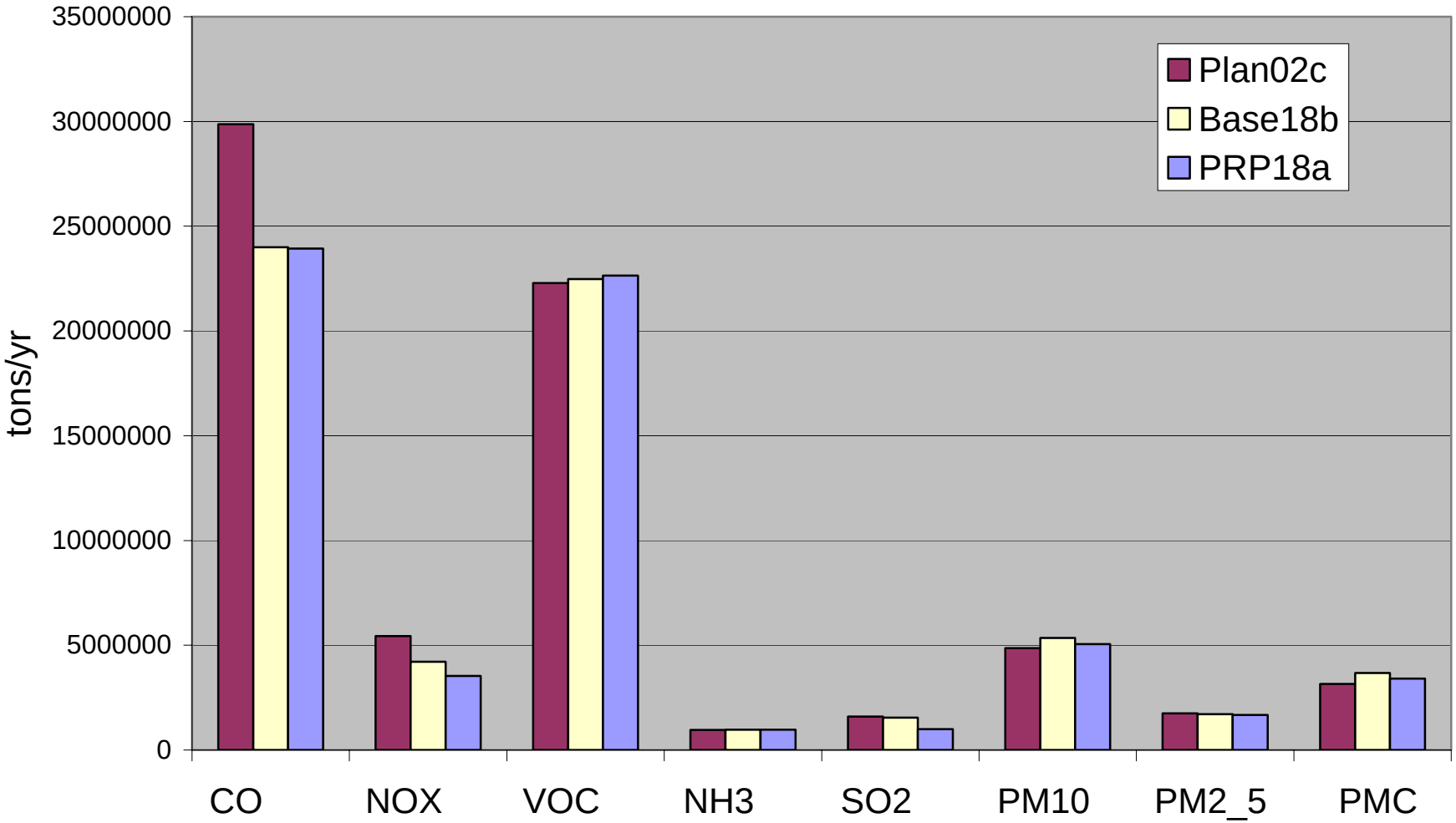
- Some errors and differences from the Plan02c case have been corrected in the PRP18 case
- Those same types of changes will need to be included in the next, final round of 2002 (Plan02d) modeling:
  - Expanded list of fugitive dust sources - moved these emissions from the area to the fugitive dust sector, this move creates a net change of zero. These changes are related to transport factors and the PM10/PM2.5 ratio.
  - Inclusion of Phase III 1999 Mexico inventories (whole nation of MX now has emissions) and update of Mexican spatial surrogates
  - Addition of Gulf of Mexico and Atlantic shipping lanes' emissions
  - Correction of Elemental Carbon and Organic Aerosol double-counting in the WRAP mobile source sector – this lowers EC, OA, and PMfine emissions in the WRAP states
  - Area source fire emissions were double-counted in the CENRAP region, lowers CENRAP emissions

Domain Total Emissions Comparison



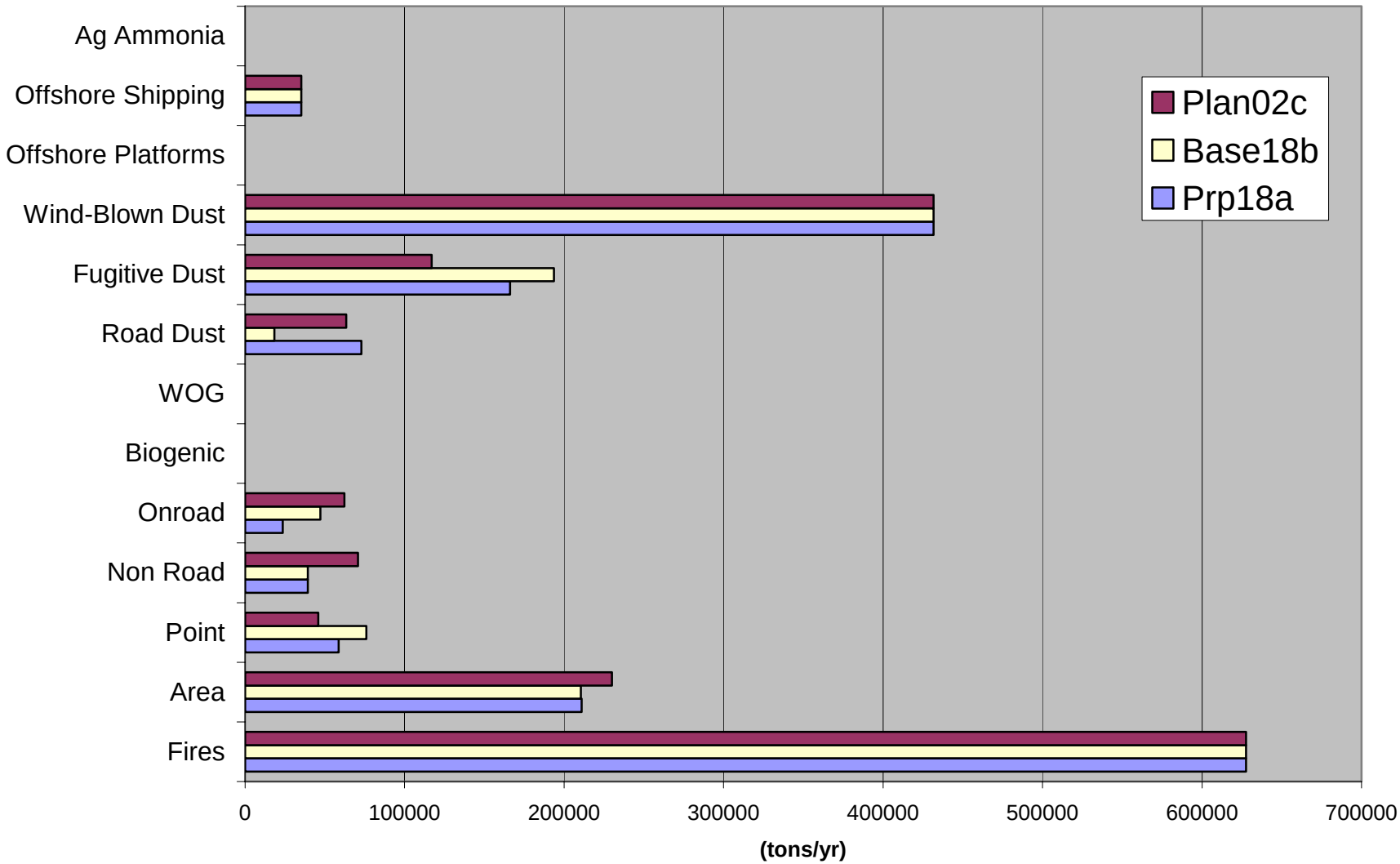
WRAP States Total Emissions Comparison

Total WRAP Annual Emissions
Simulation Comarisons

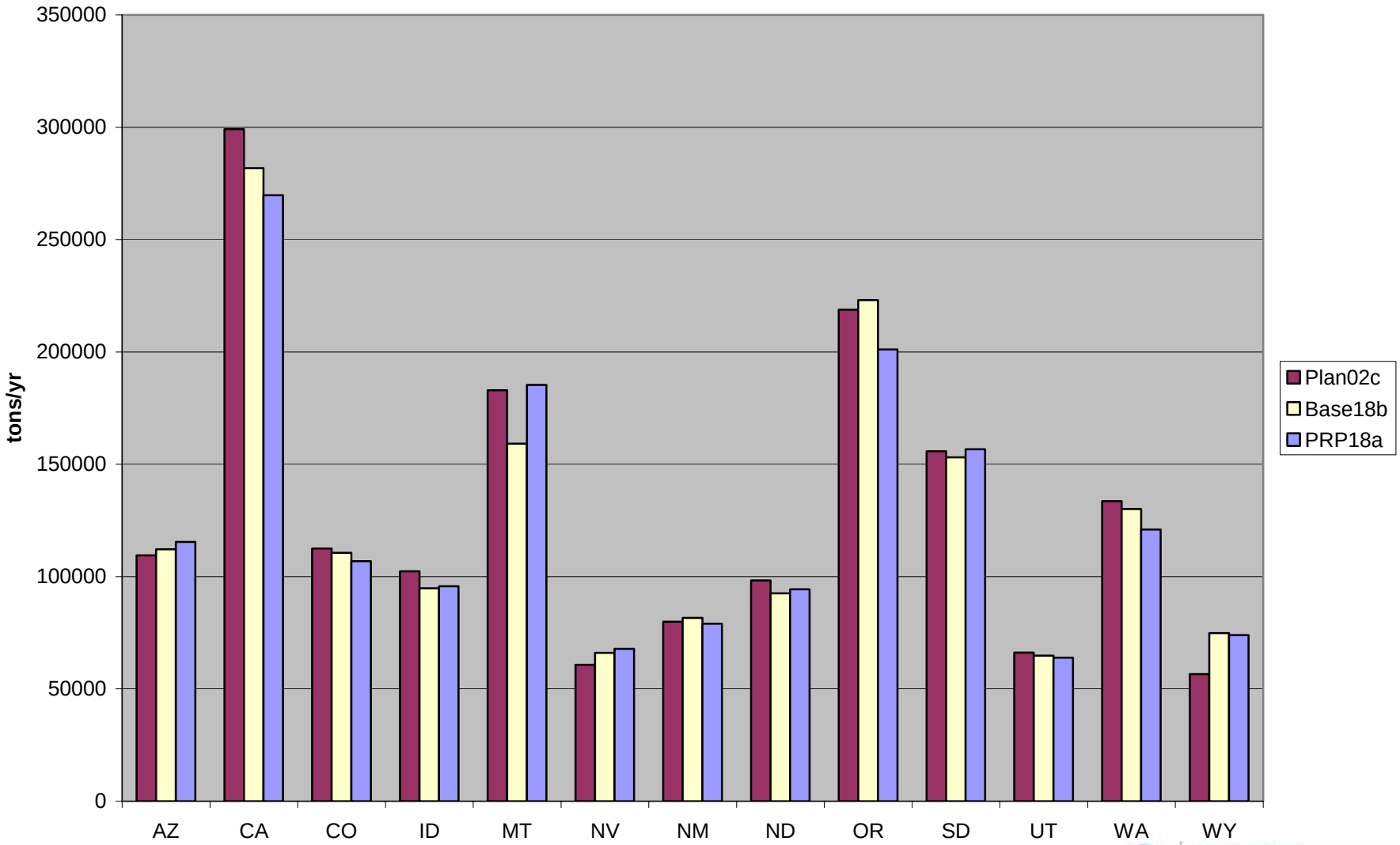


PM2.5 Emissions Comparison by Source Category

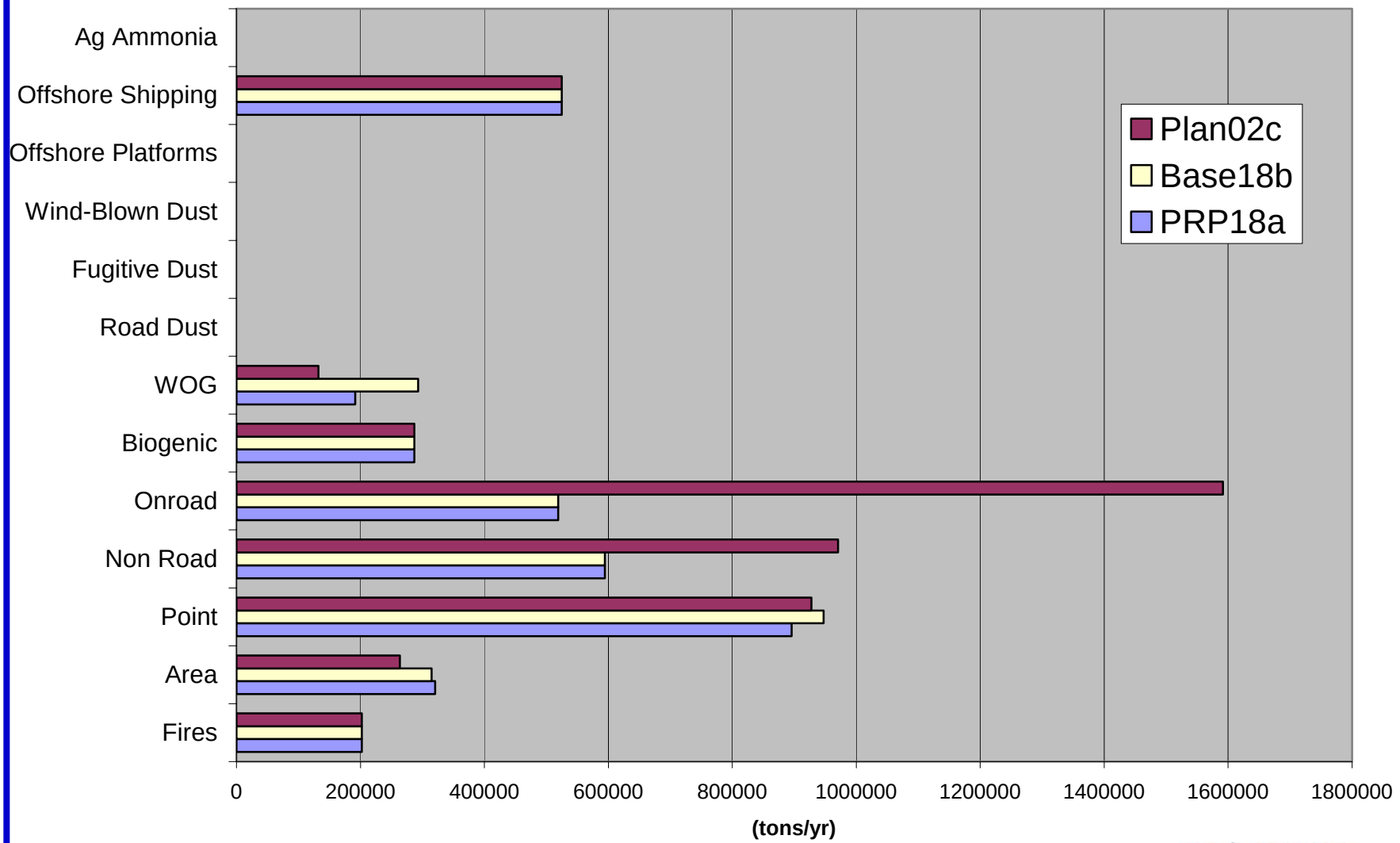
WRAP Annual Total PM2.5 Emissions



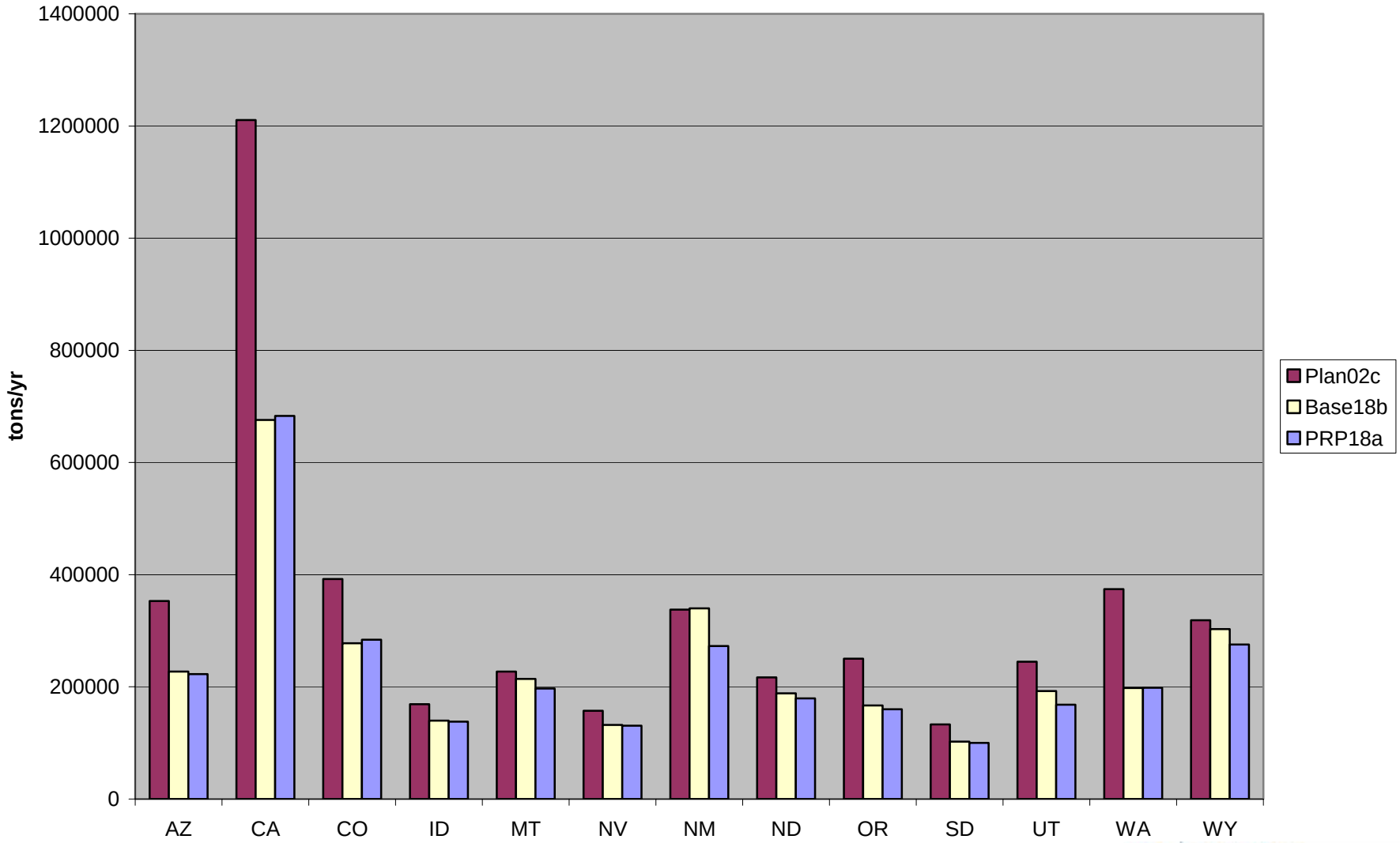
PM2.5 State Total Emissions Comparison



NOx Emissions Comparison by Source Category

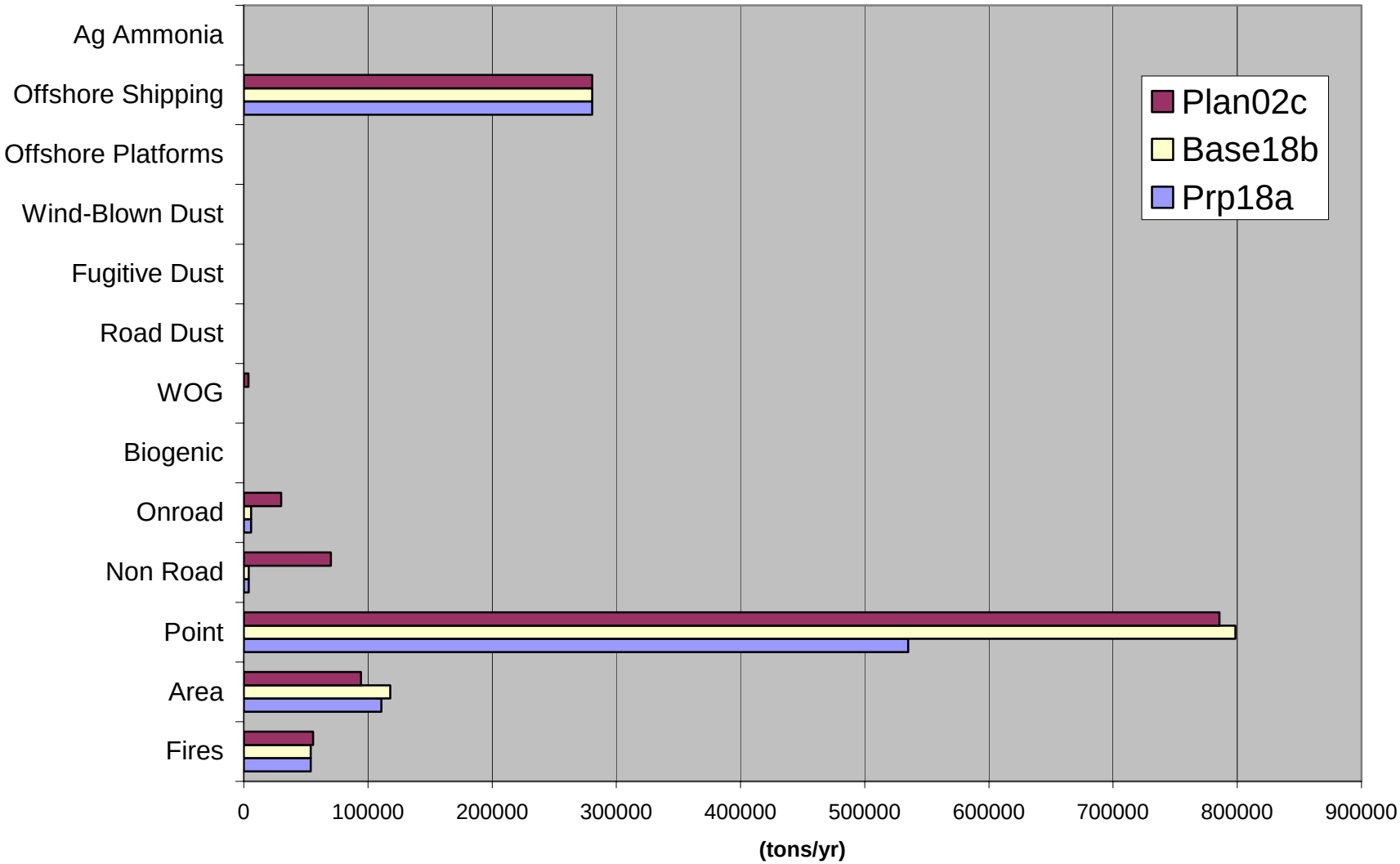


NOx State Total Emissions Comparison

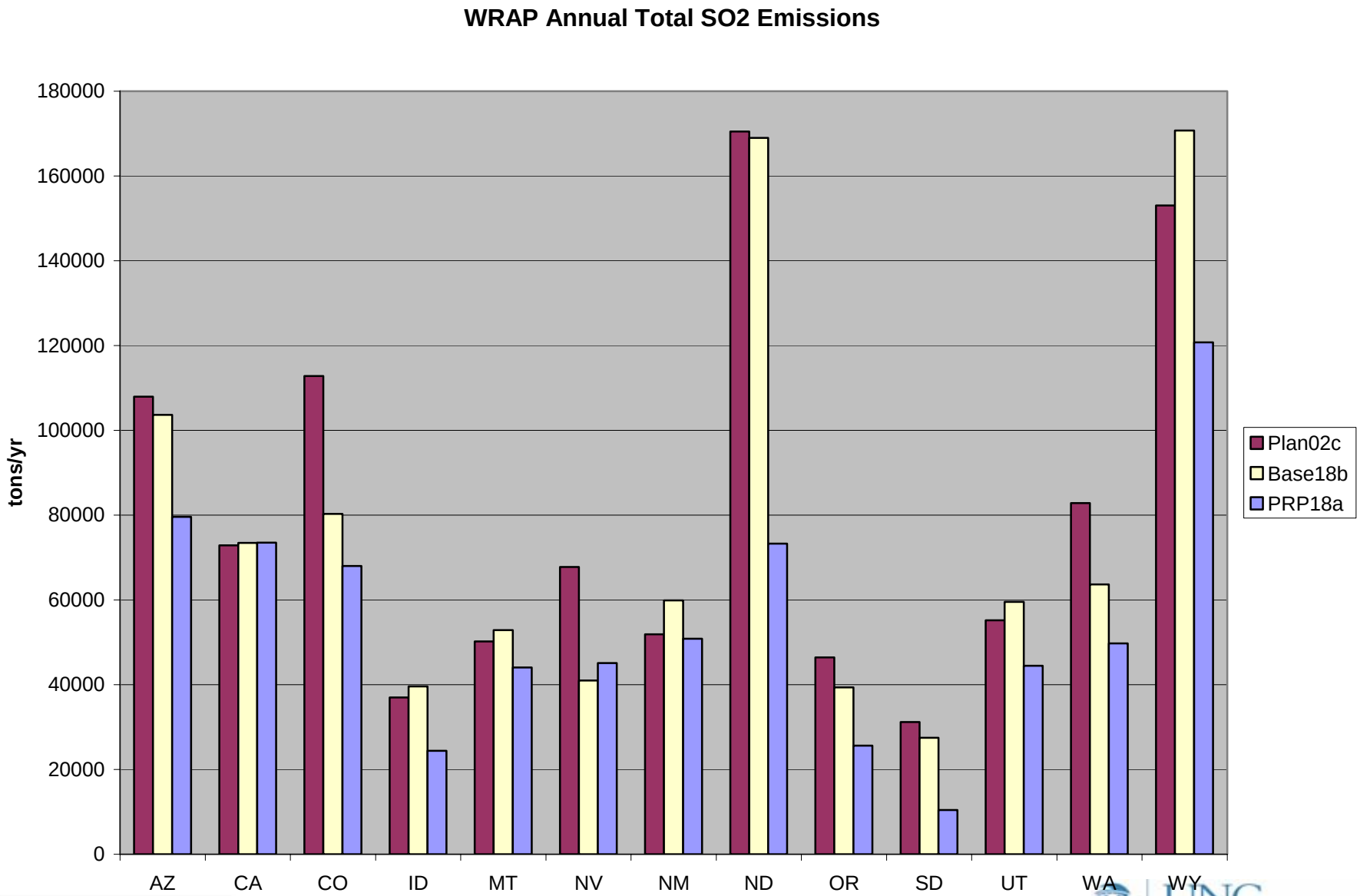


SO2 Emissions Comparison by Source Category

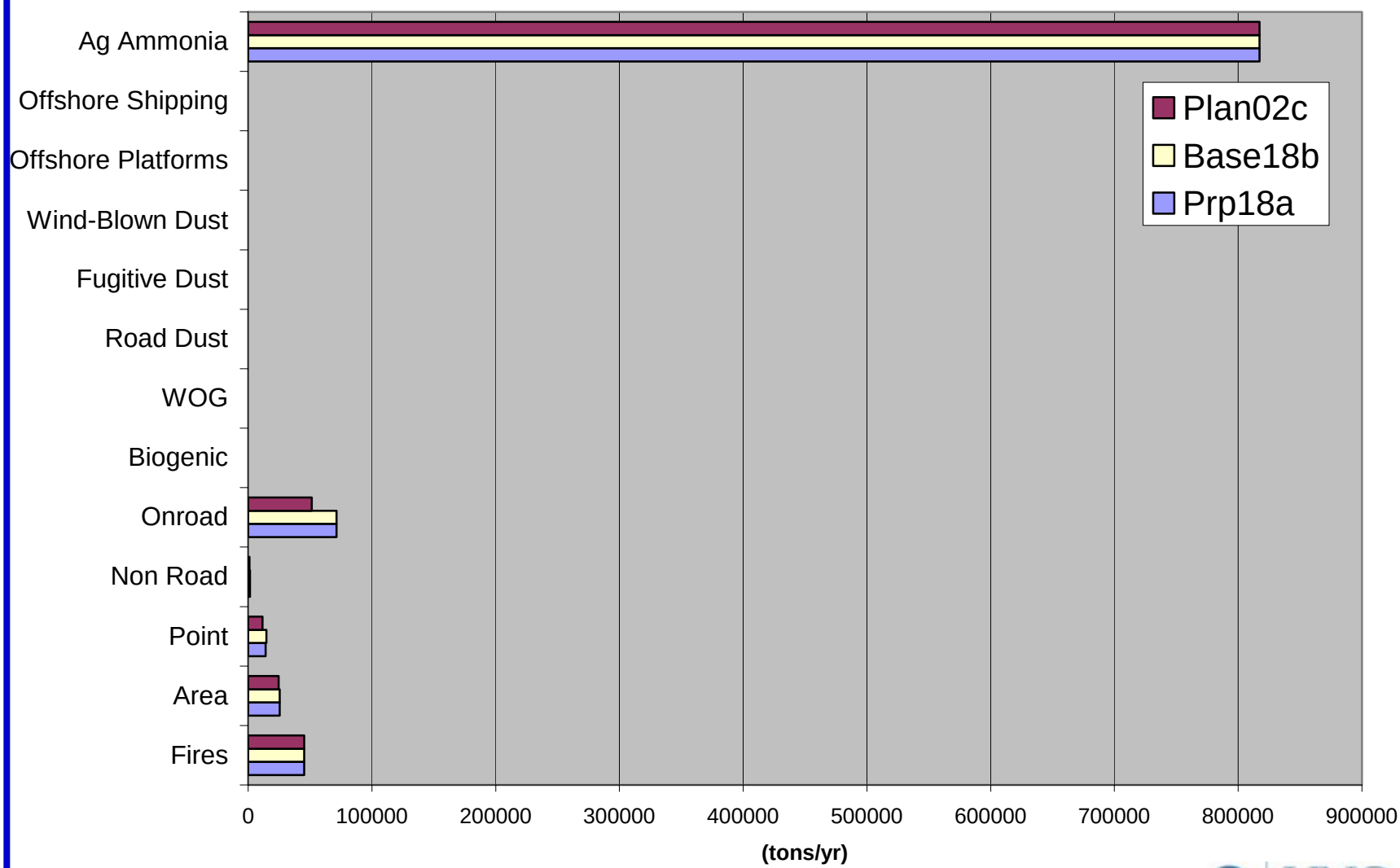
WRAP Annual Total SO2 Emissions



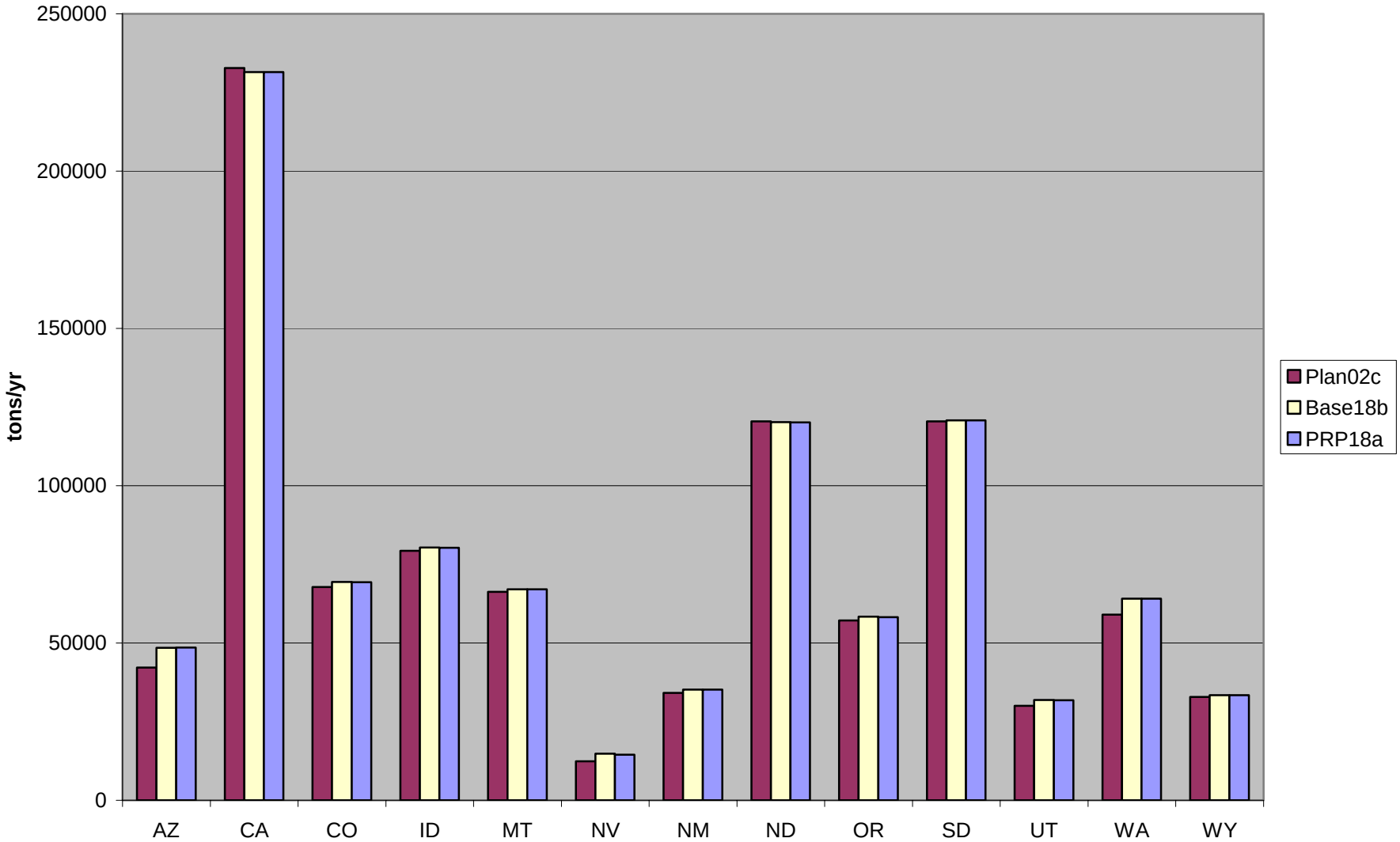
SO2 State Total Emissions Comparison



NH3 Emissions Comparison by Source Category

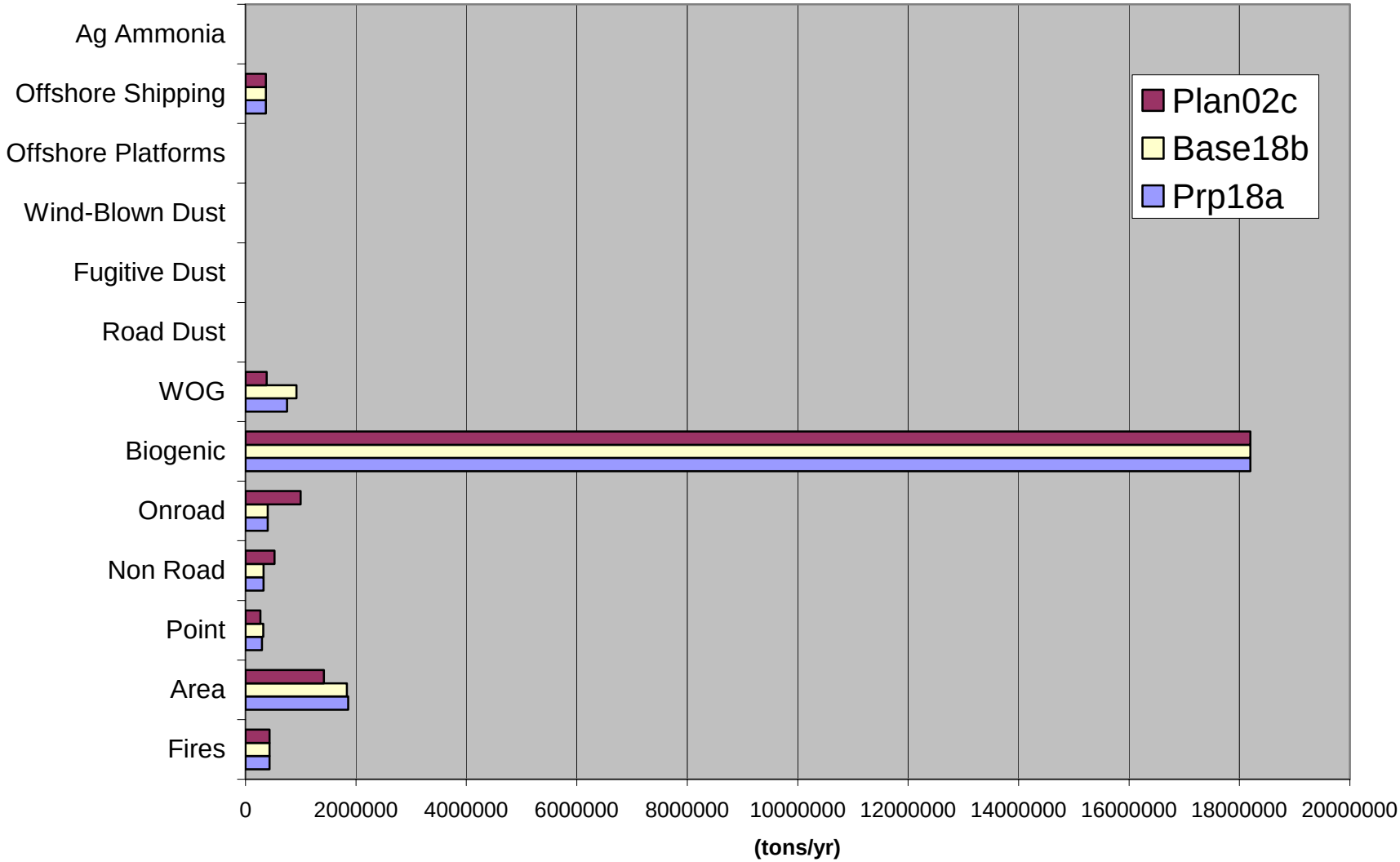


NH3 State Total Emissions Comparison



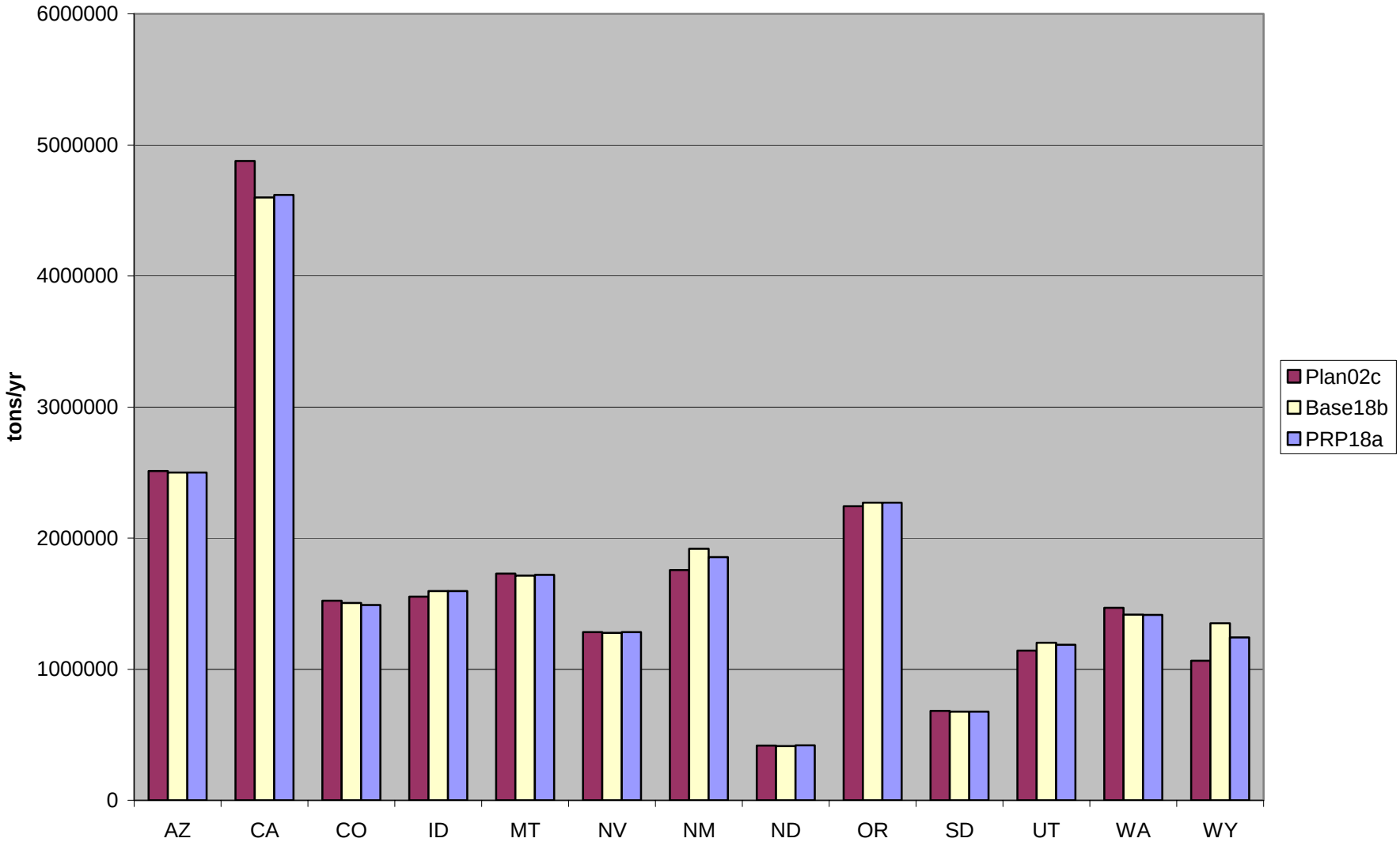
VOC Emissions Comparison by Source Category

WRAP Annual Total VOC Emissions

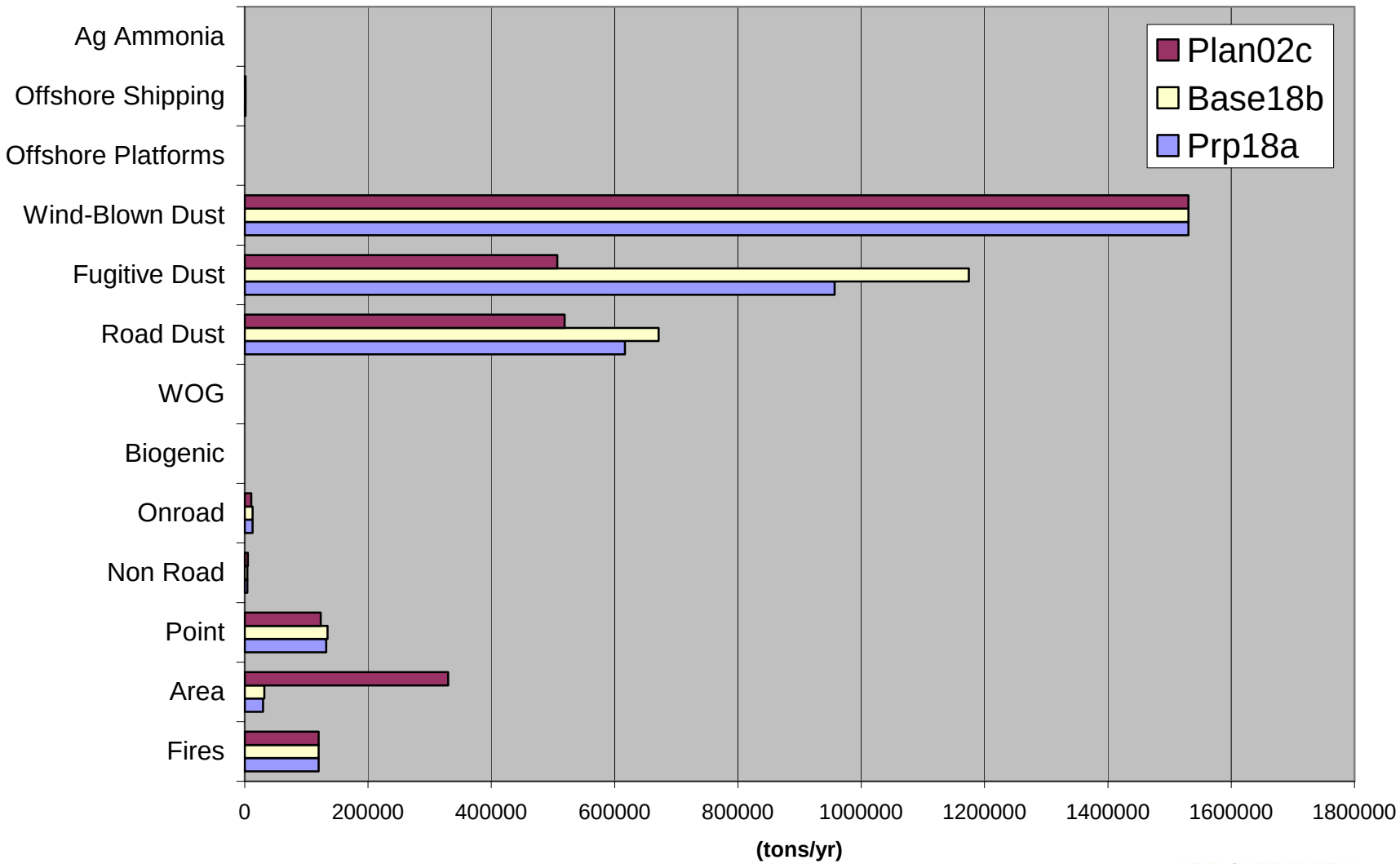


VOC State Total Emissions Comparison

WRAP Annual Total VOC Emissions

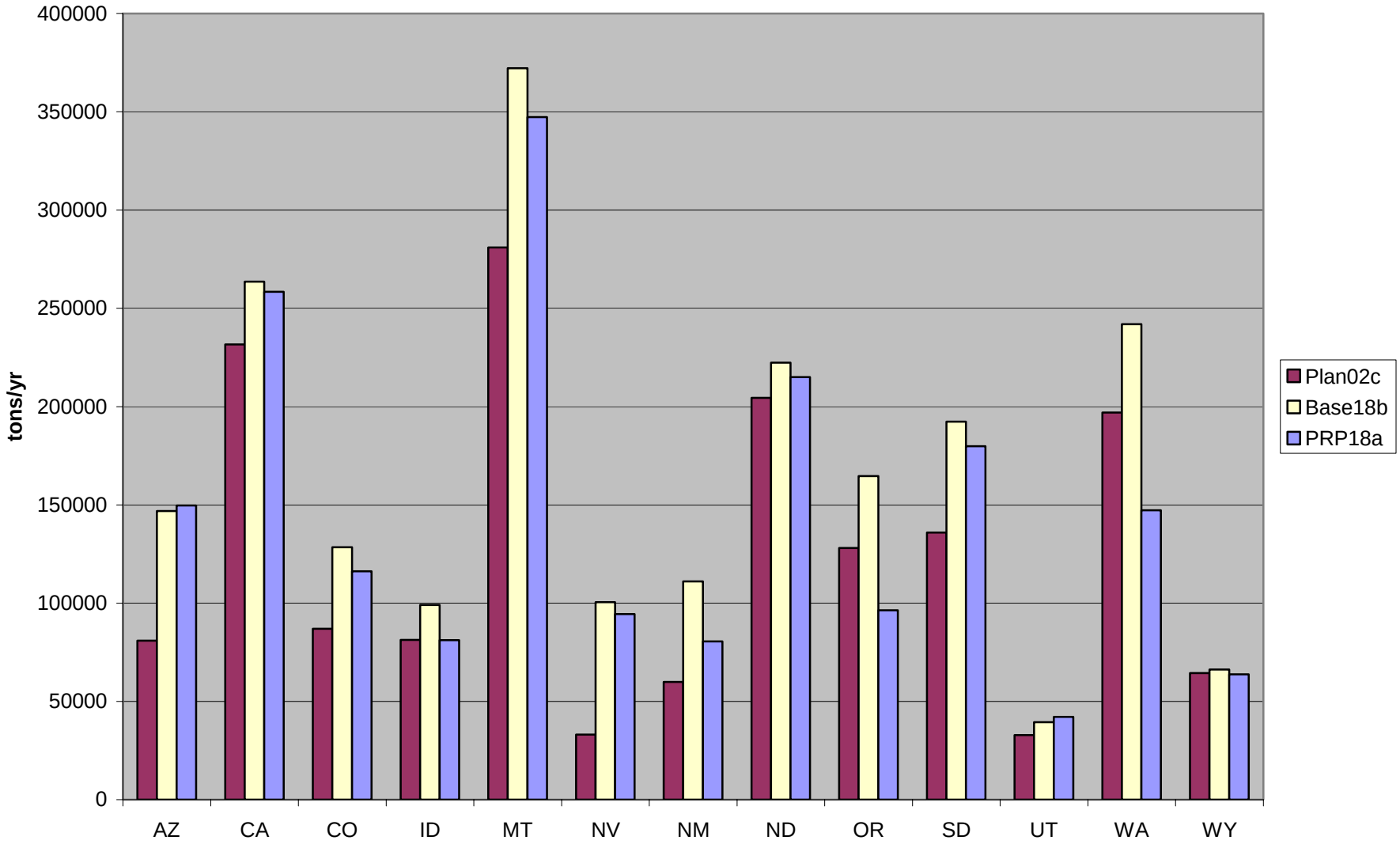


PCM Emissions Comparison by Source Category



PMC State Total Emissions Comparison

WRAP Annual Total PMC Emissions

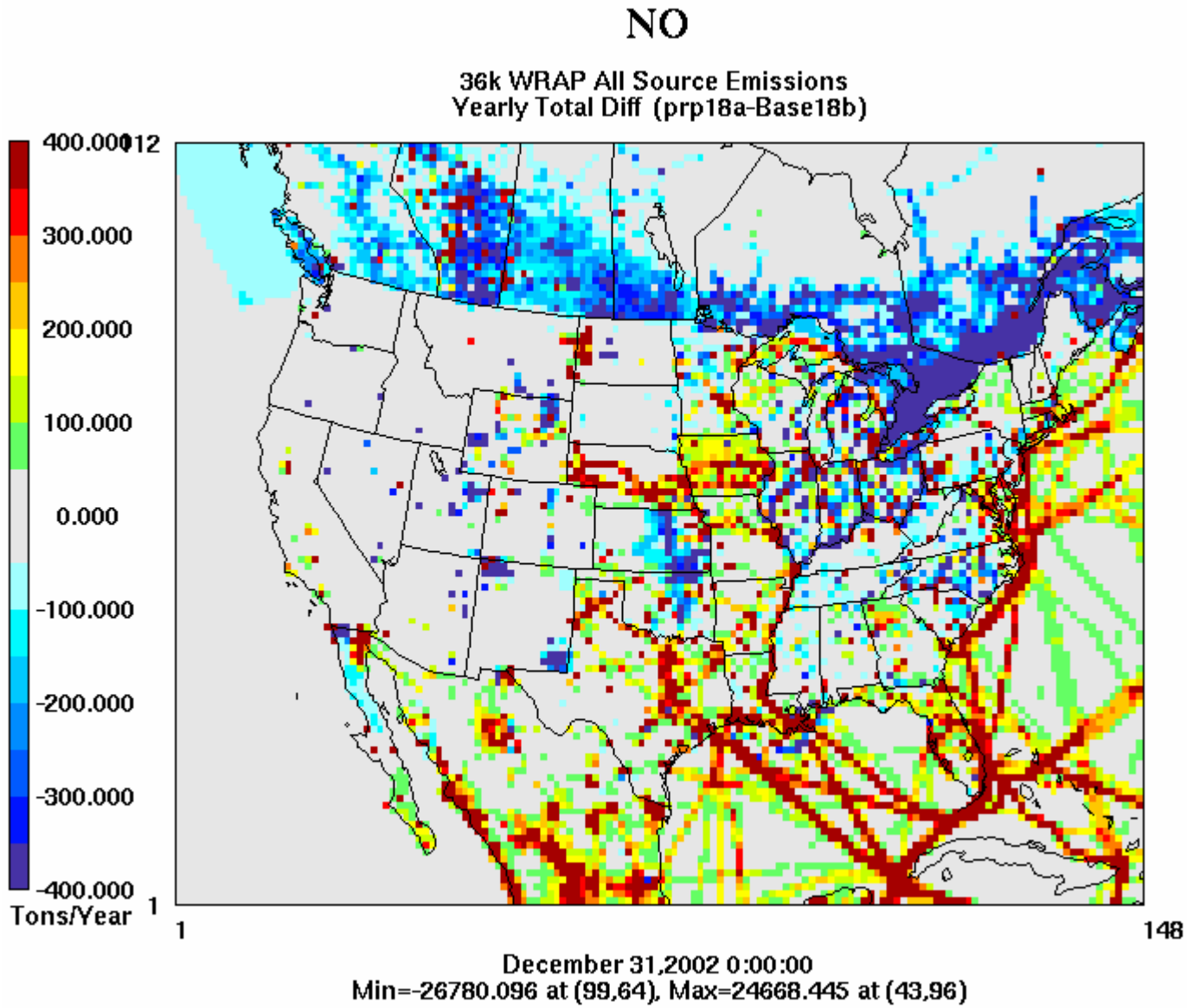


Emissions Comparison

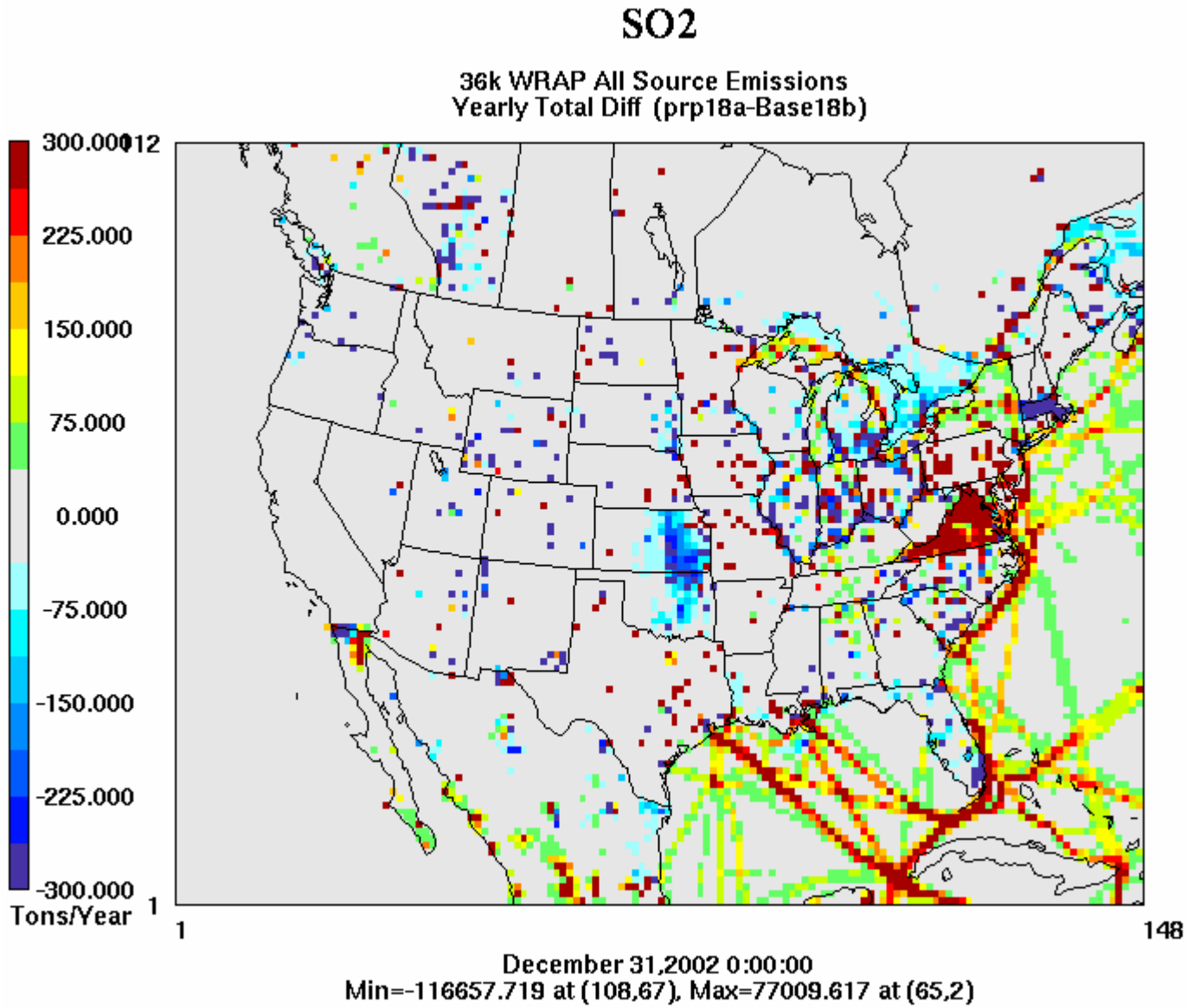
- PAVE QA plots comparing PRP18a vs. Base18b:
  - red colors showed increased emissions in PRP18a
  - blue colors showed reduced emissions in PRP18a
- Additional emissions QA and visibility modeling plots available at RMC website:

www.cert.ucr.edu/aqm/308

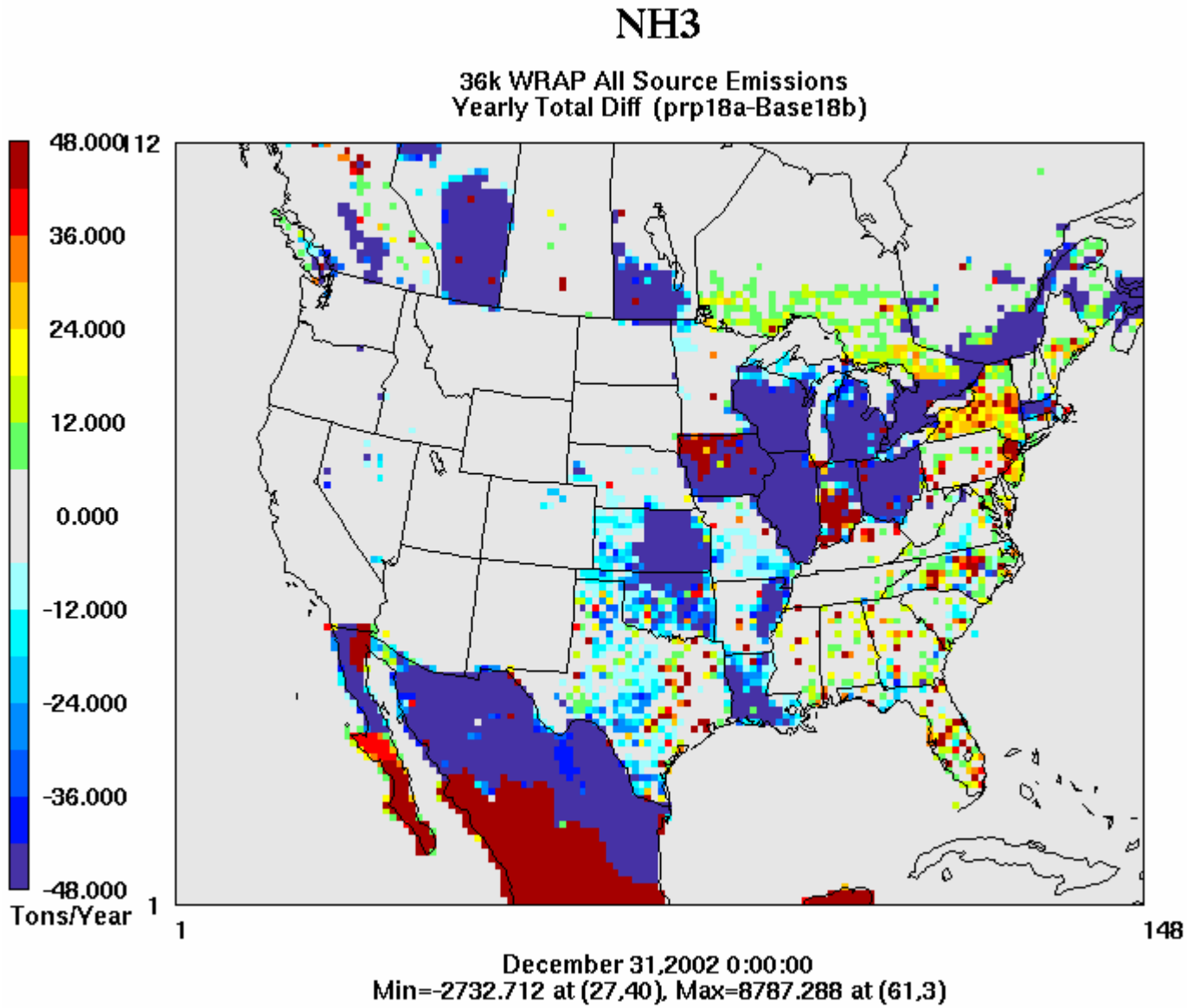
NO Annual emissions difference PRP18a - Base18b



SO2 Annual emissions difference PRP18a - Base18b

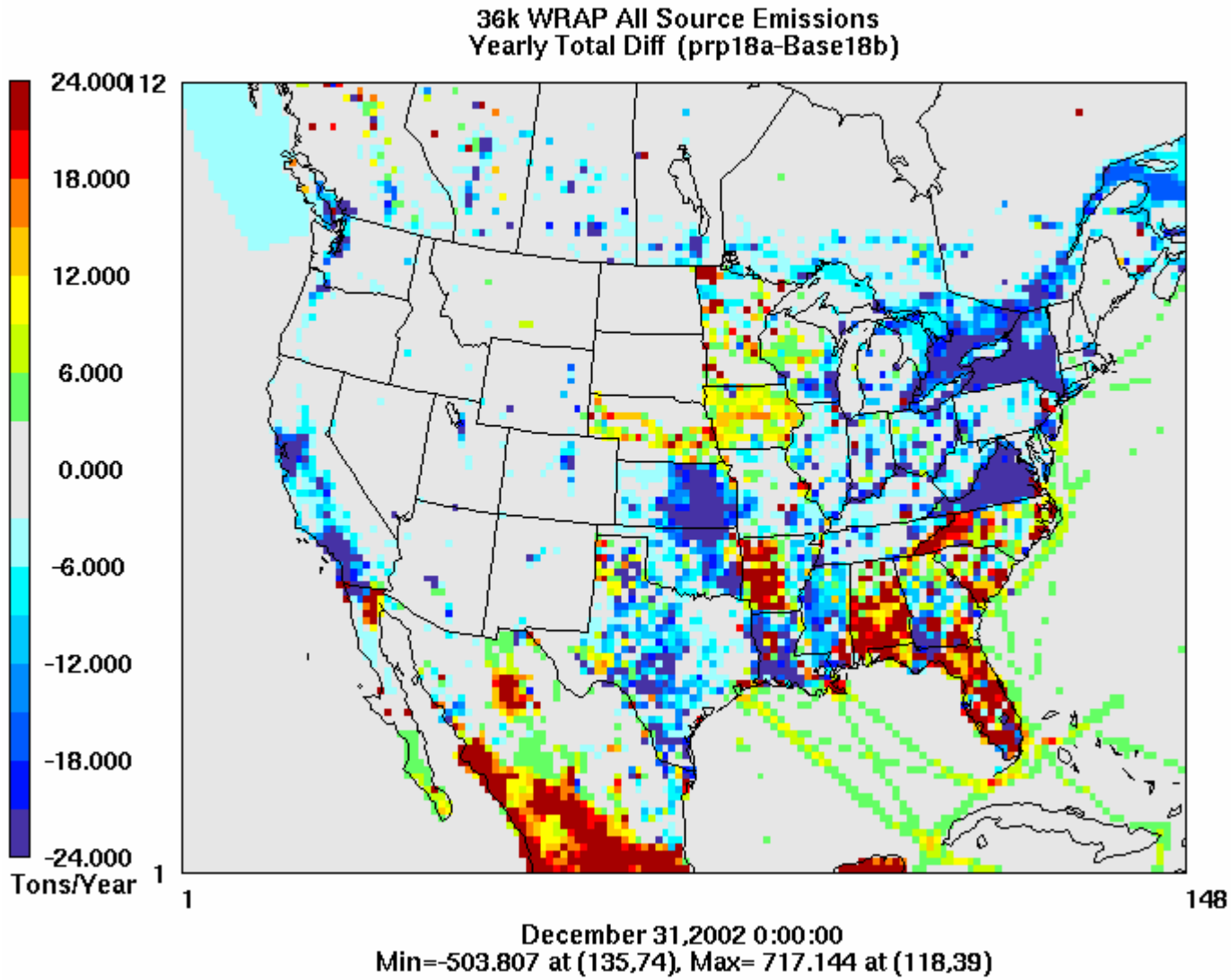


NH3 Annual emissions difference PRP18a - Base18b

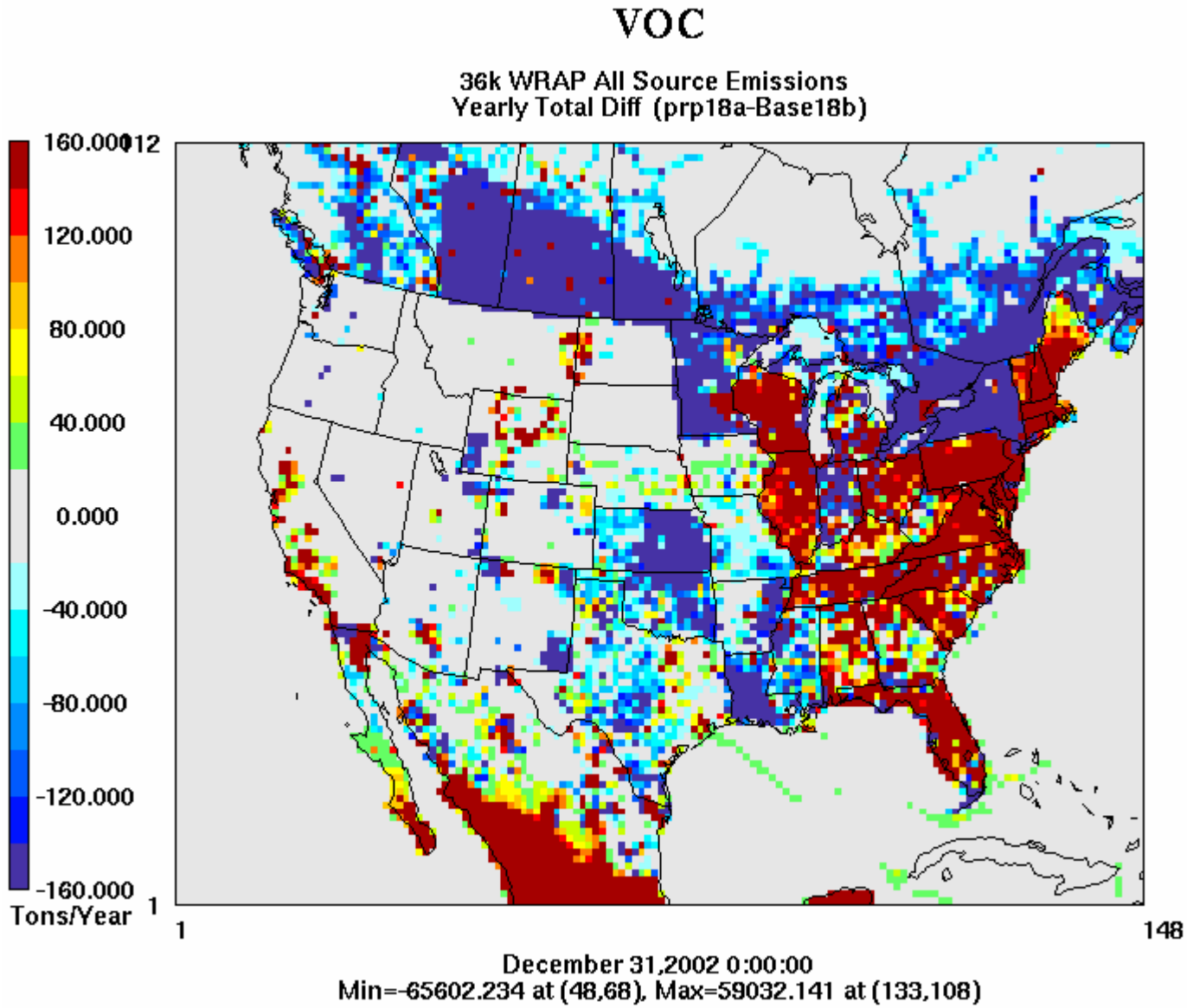


EC Annual emissions difference PRP18a - Base18b

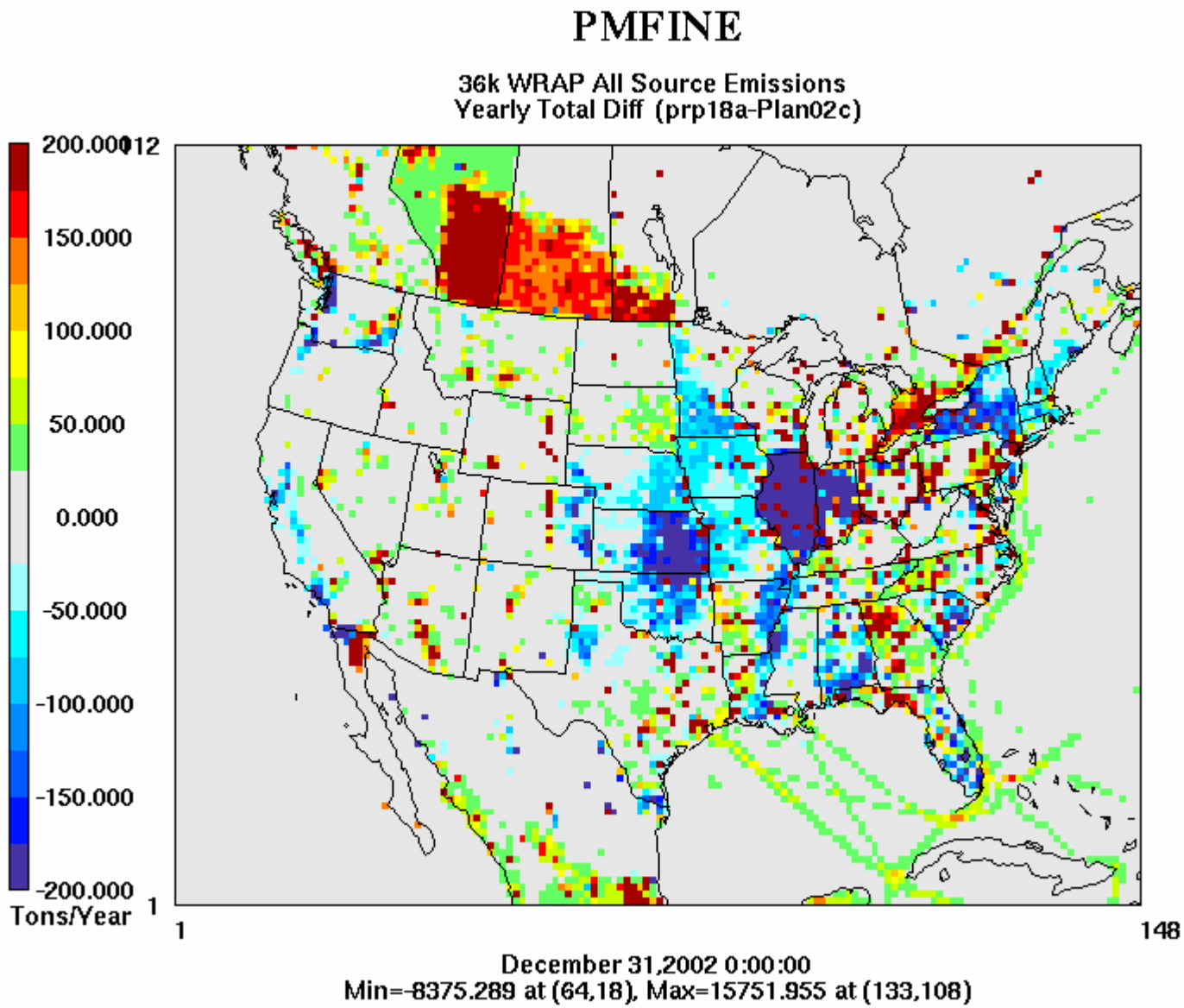
PEC



VOC Annual emissions difference PRP18a - Base18b



PMFINE Annual emissions difference PRP18a - Base18b

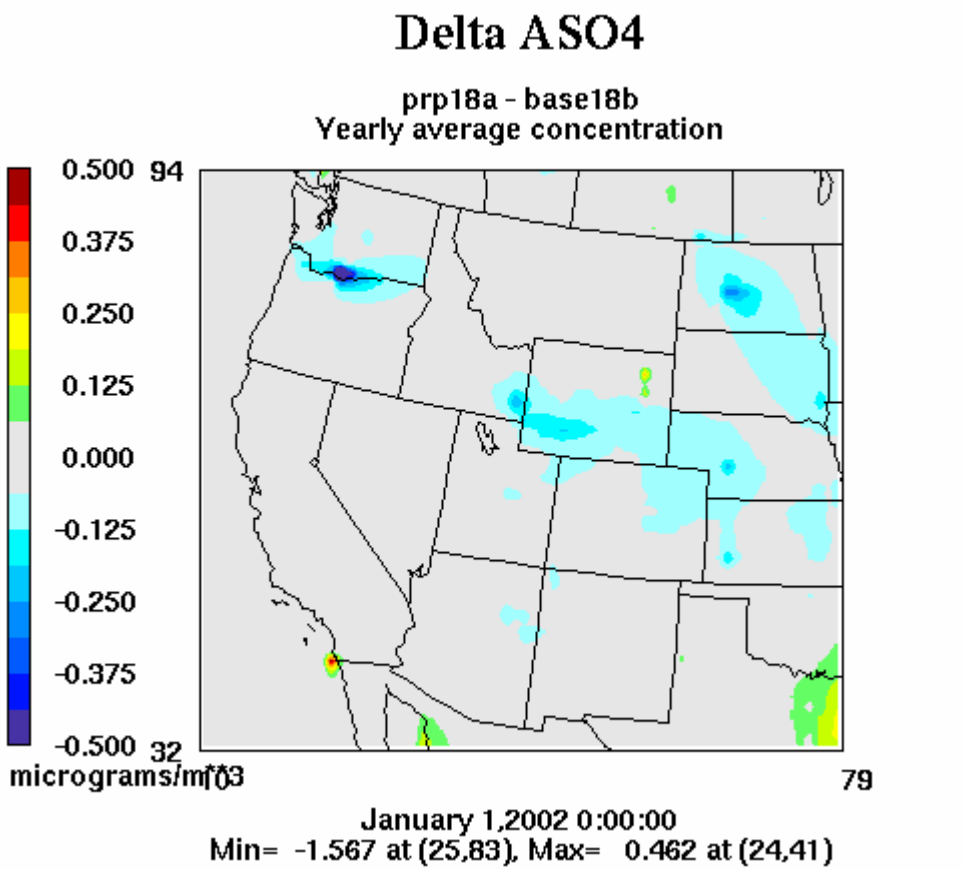


PRP18a vs. Base18b
CMAQ Results Comparison

- PAVE plots comparing:
  - Plots show change in conc, PRP18a minus Base18b.
  - Blue colors show area with lower mass in PRP18a.
  - Annual average change shown here, monthly average changes are available on webpage.

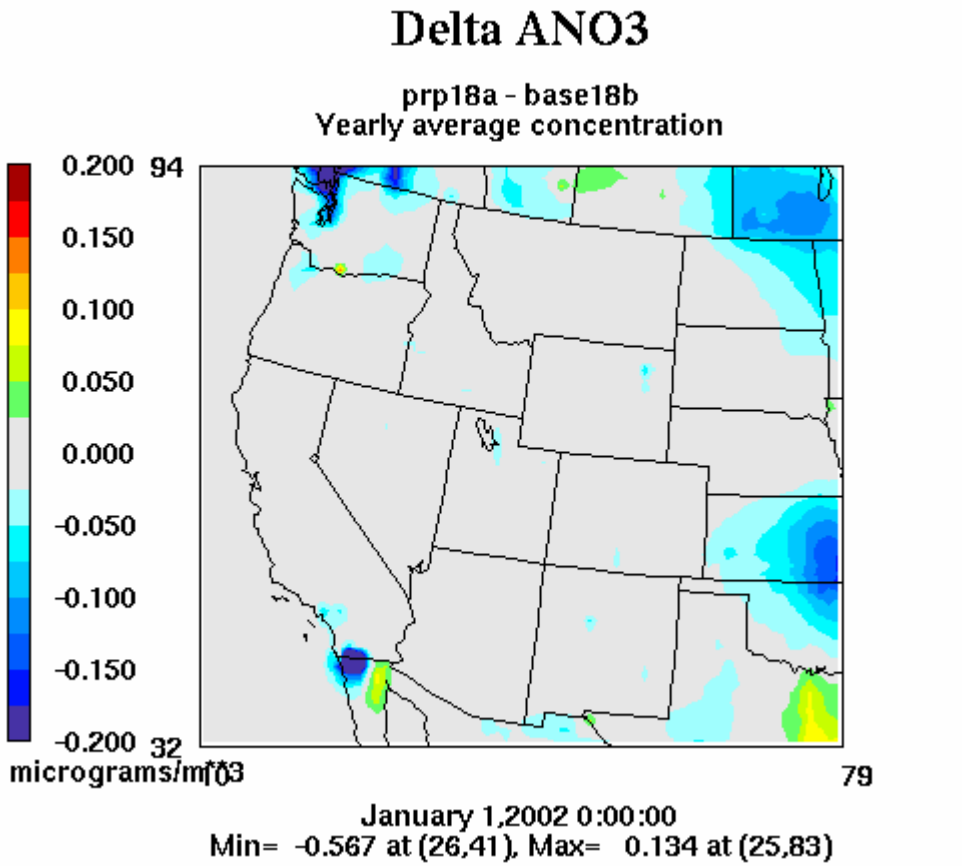
CMAQ Difference Plots PRP18a minus Base18b

Sulfate Annual Average change



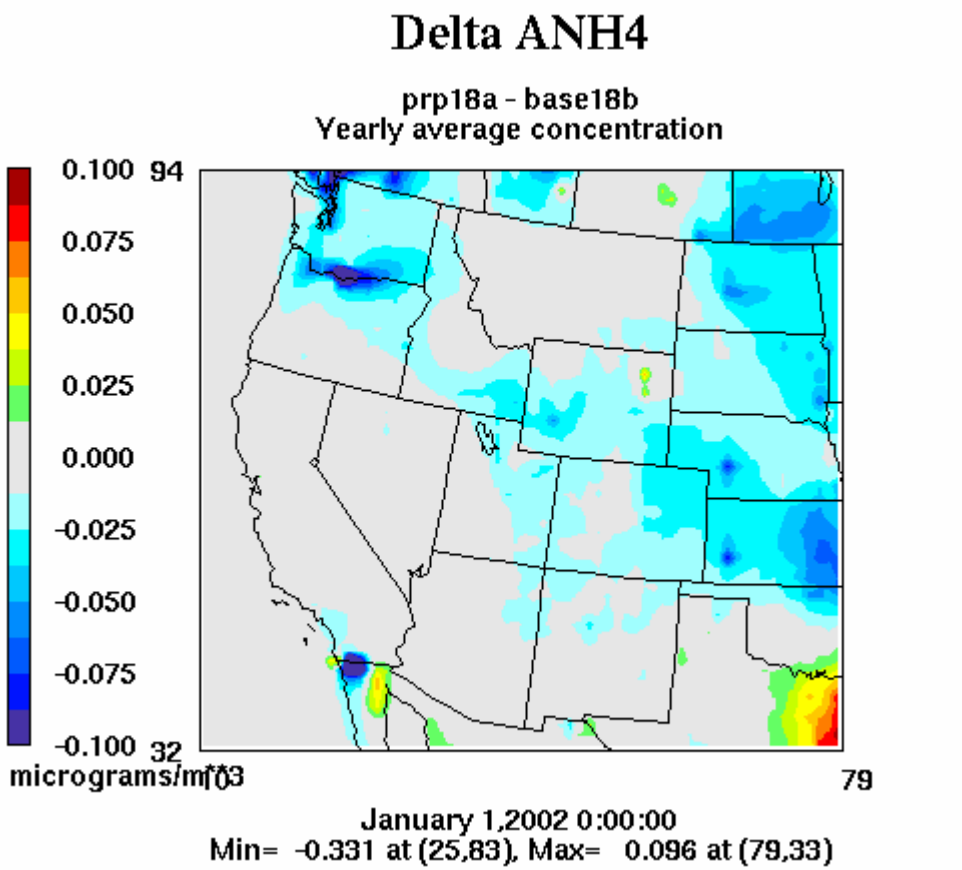
CMAQ Difference Plots PRP18a minus Base18b

Nitrate Annual Average change



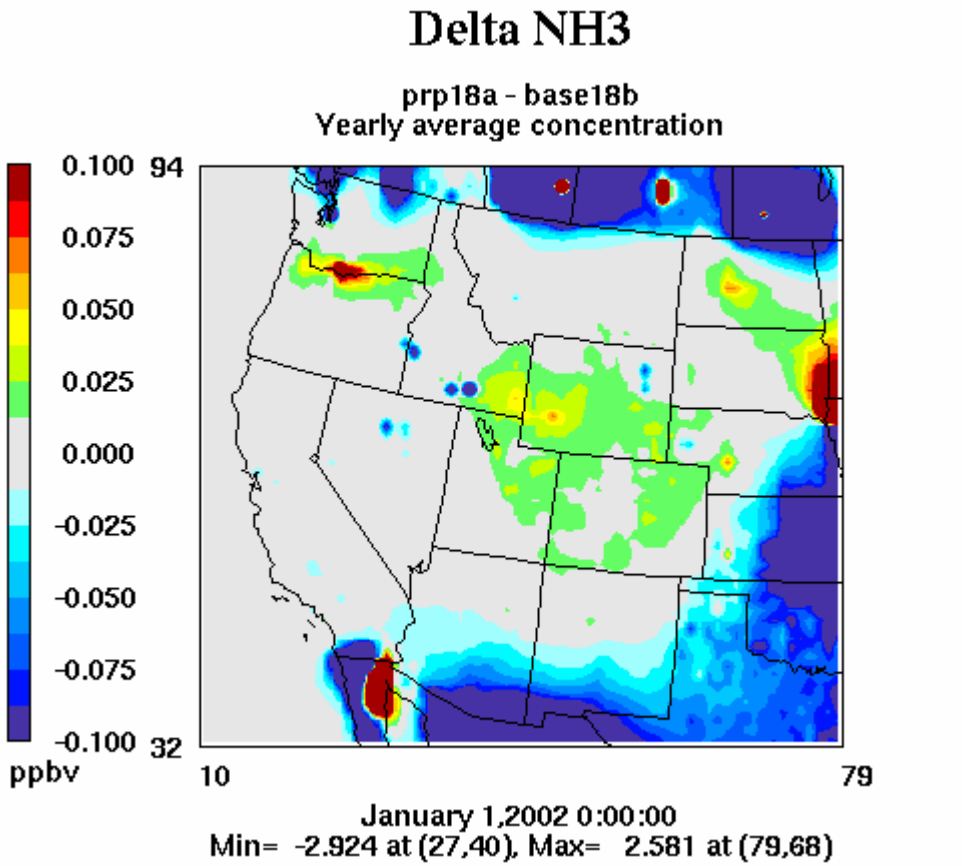
CMAQ Difference Plots PRP18a minus Base18b

Ammonium Annual Average change



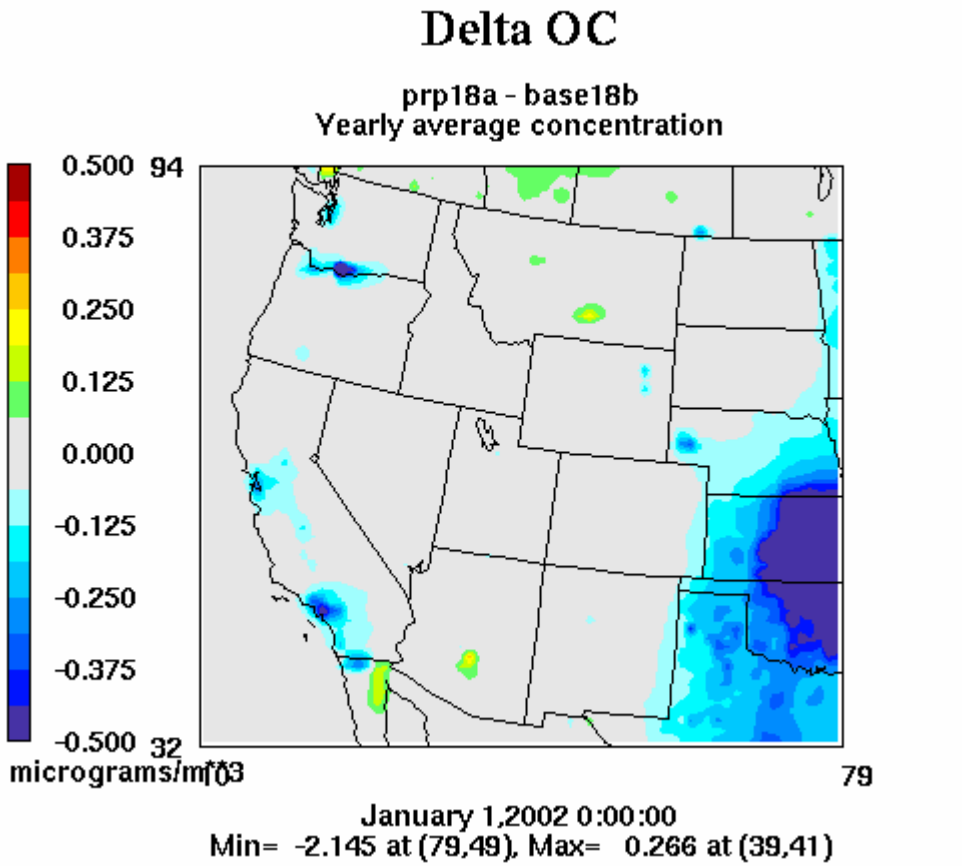
CMAQ Difference Plots PRP18a minus Base18b

NH3 Annual Average change



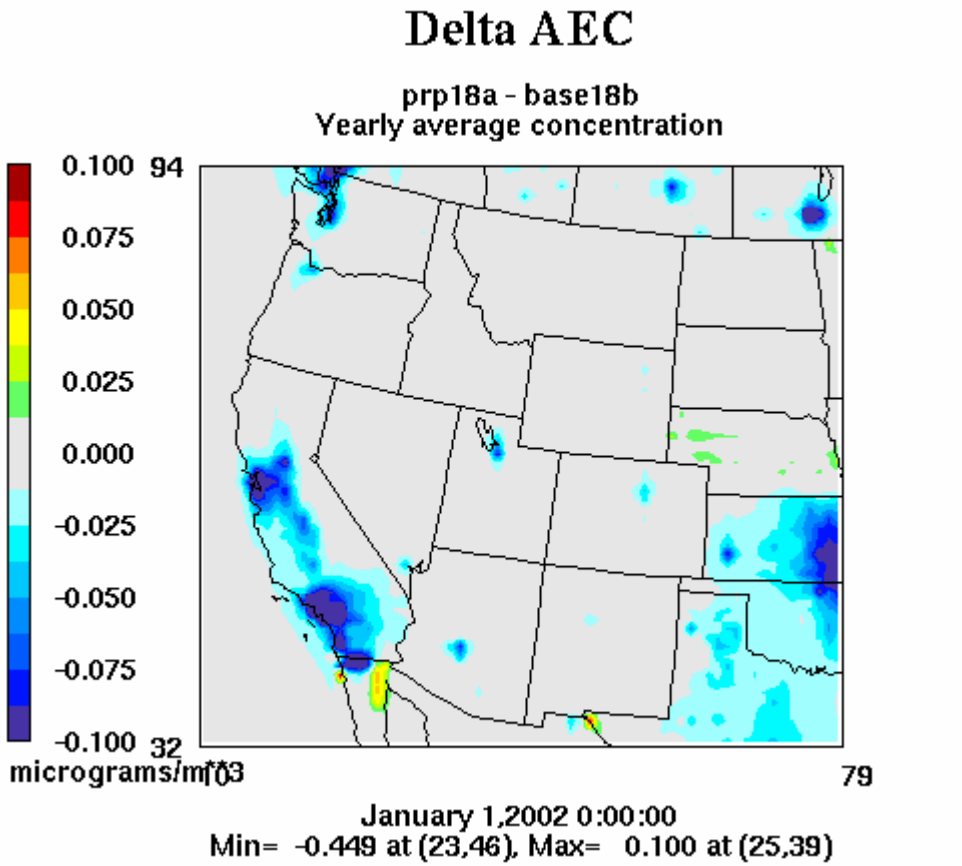
CMAQ Difference Plots PRP18a minus Base18b

OC Annual Average change



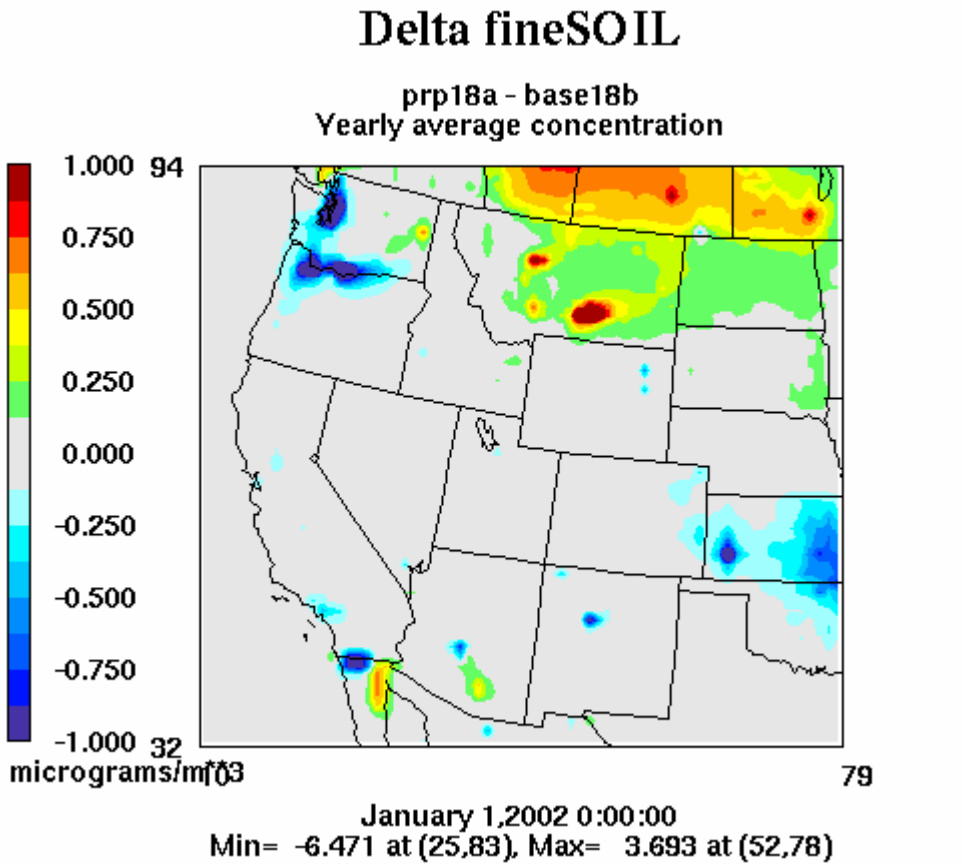
CMAQ Difference Plots PRP18a minus Base18b

EC Annual Average change



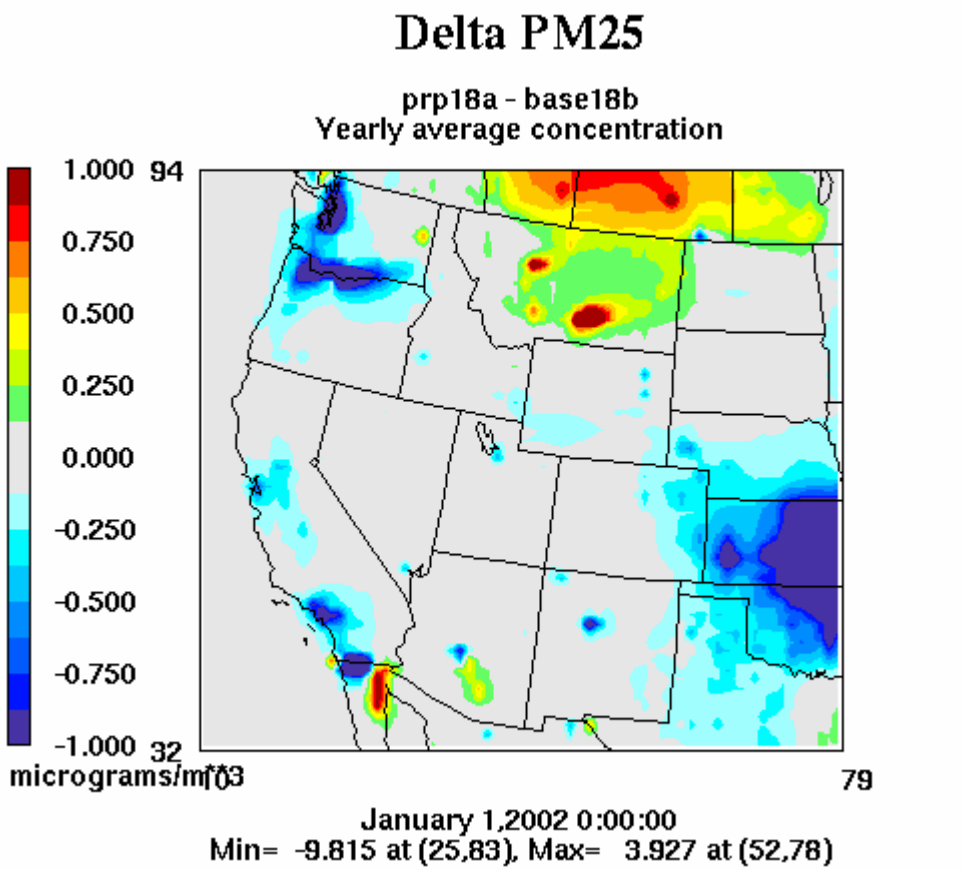
CMAQ Difference Plots PRP18a minus Base18b

Soil Annual Average change



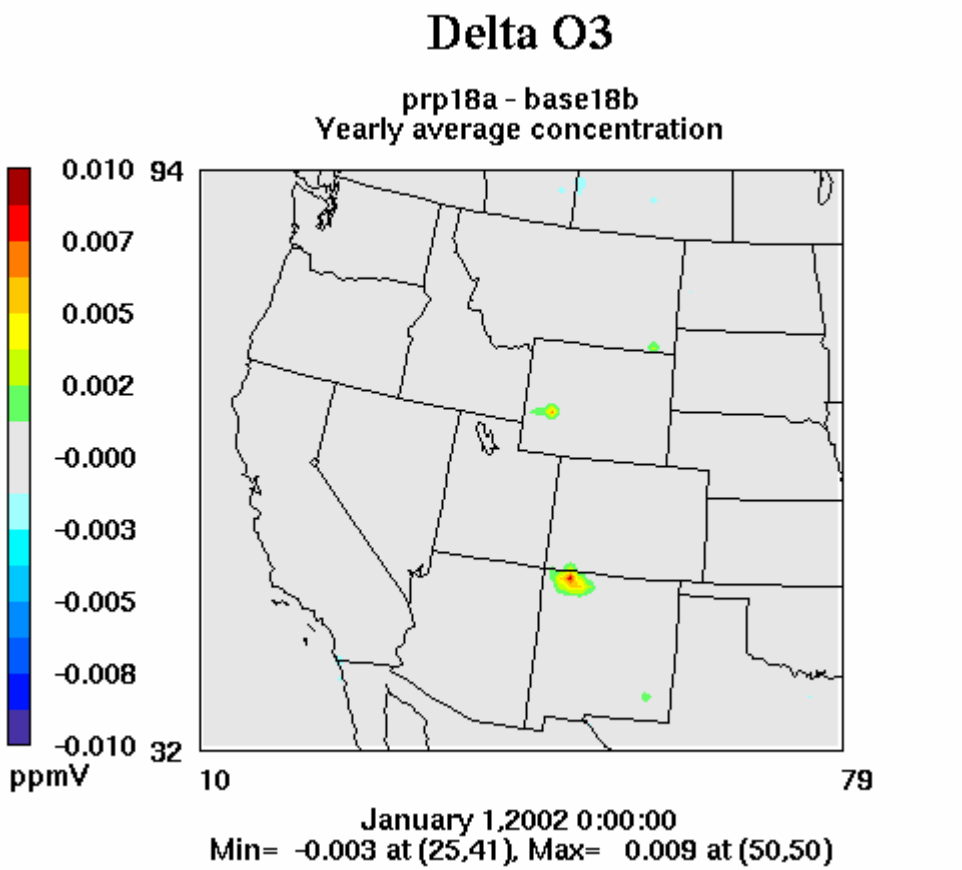
CMAQ Difference Plots PRP18a minus Base18b

PMFINE Annual Average change



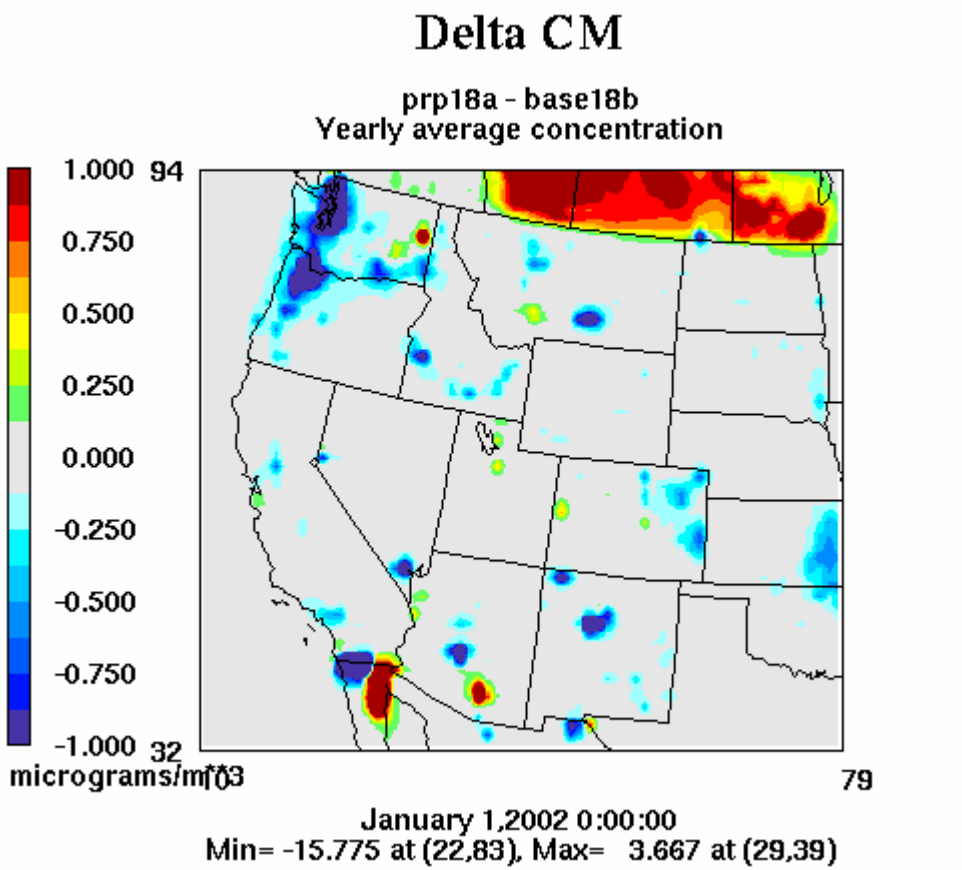
CMAQ Difference Plots PRP18a minus Base18b

Ozone Annual Average change



CMAQ Difference Plots PRP18a minus Base18b

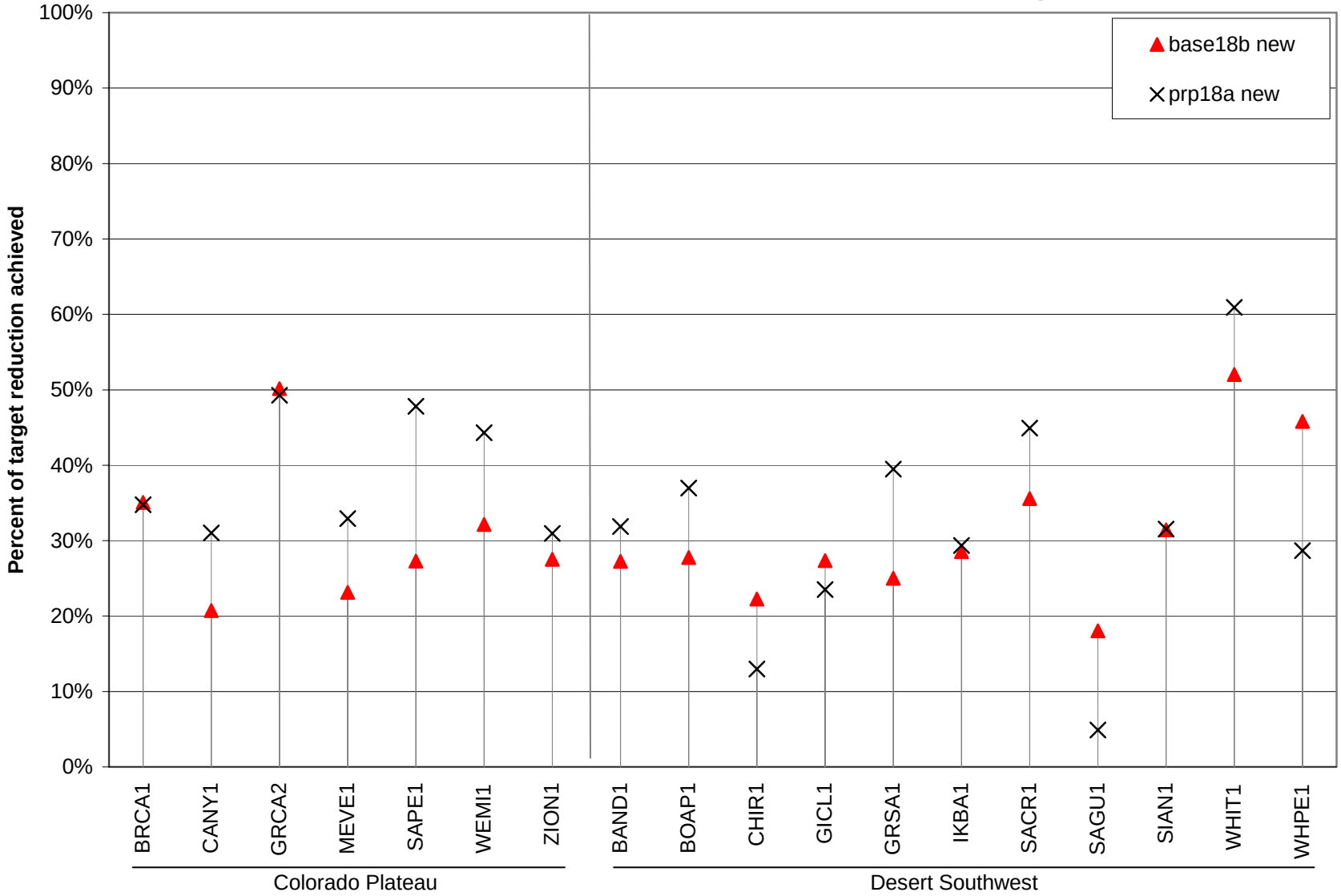
Coarse Matter Annual Average change



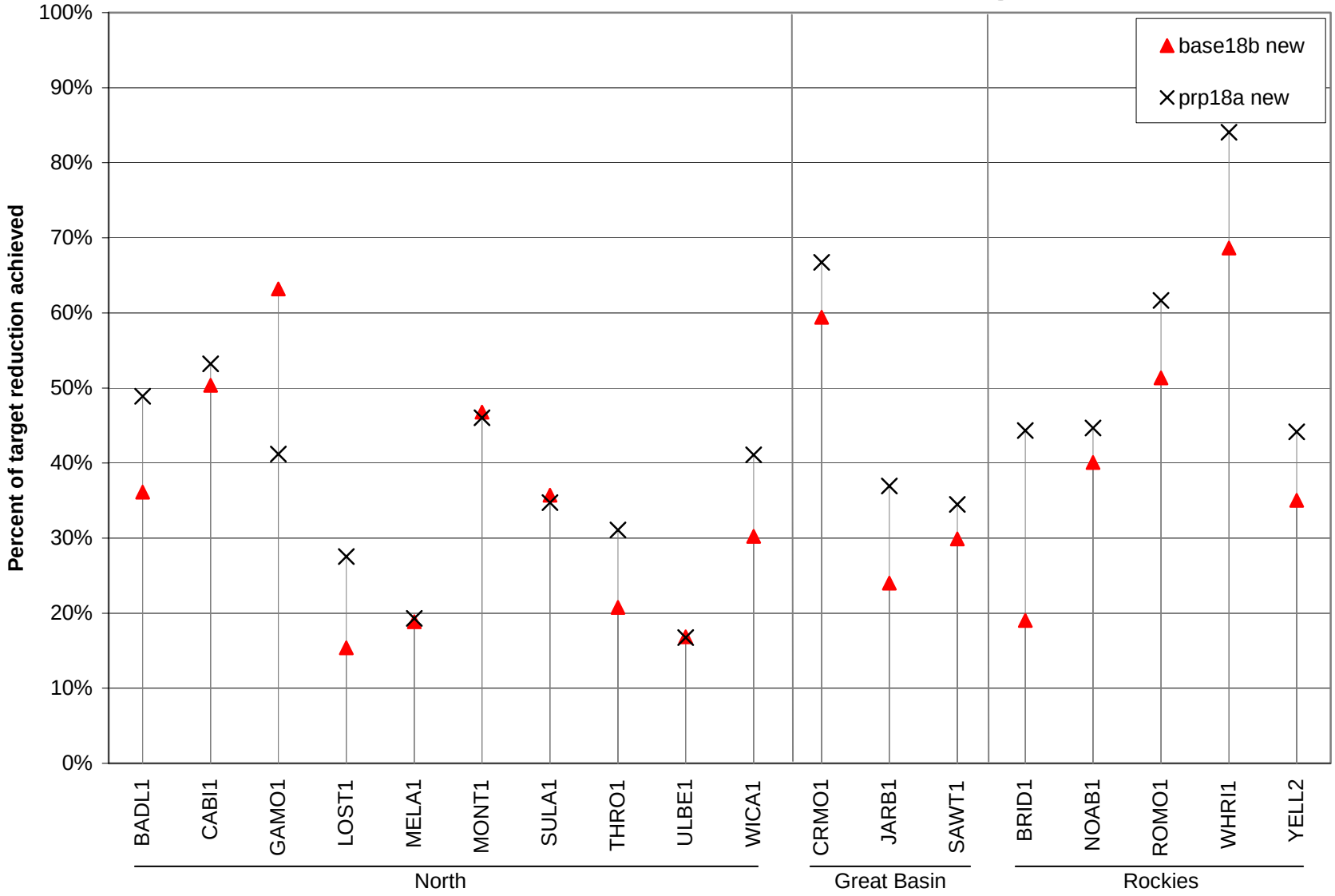
Visibility Projections

- Visibility projections calculated using **new** IMPROVE equation for two cases:
  - PRP18a & Base18b (previously used old equation)
  - dot plots show % deciviews of progress goal achieved.

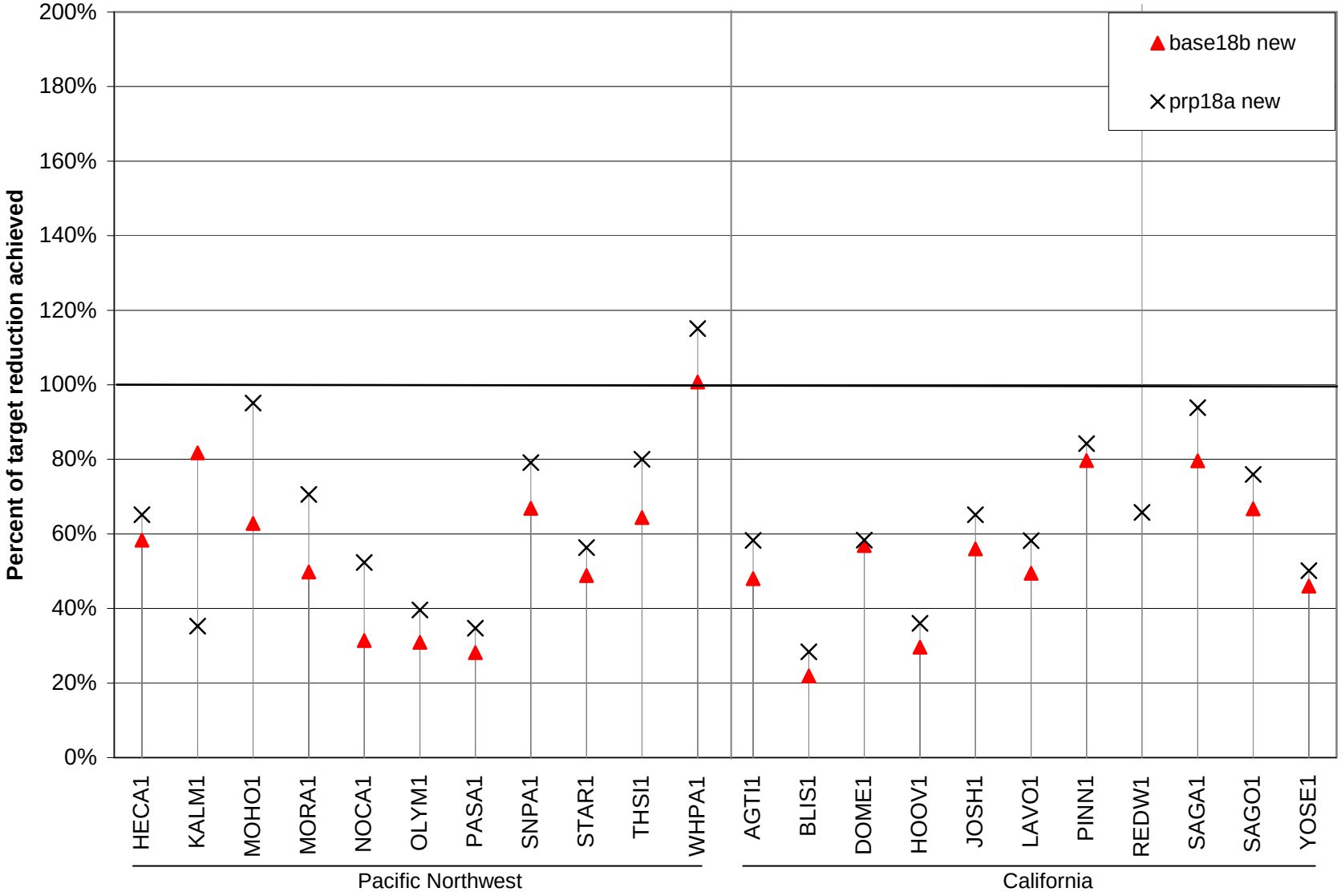
EPA Specific Day method: Predictions for Colorado Plateau and Desert Southwest sites (% dcv goal)



EPA Specific Day method: Predictions for North, Great Basin and Rockies sites (% dcv goal)



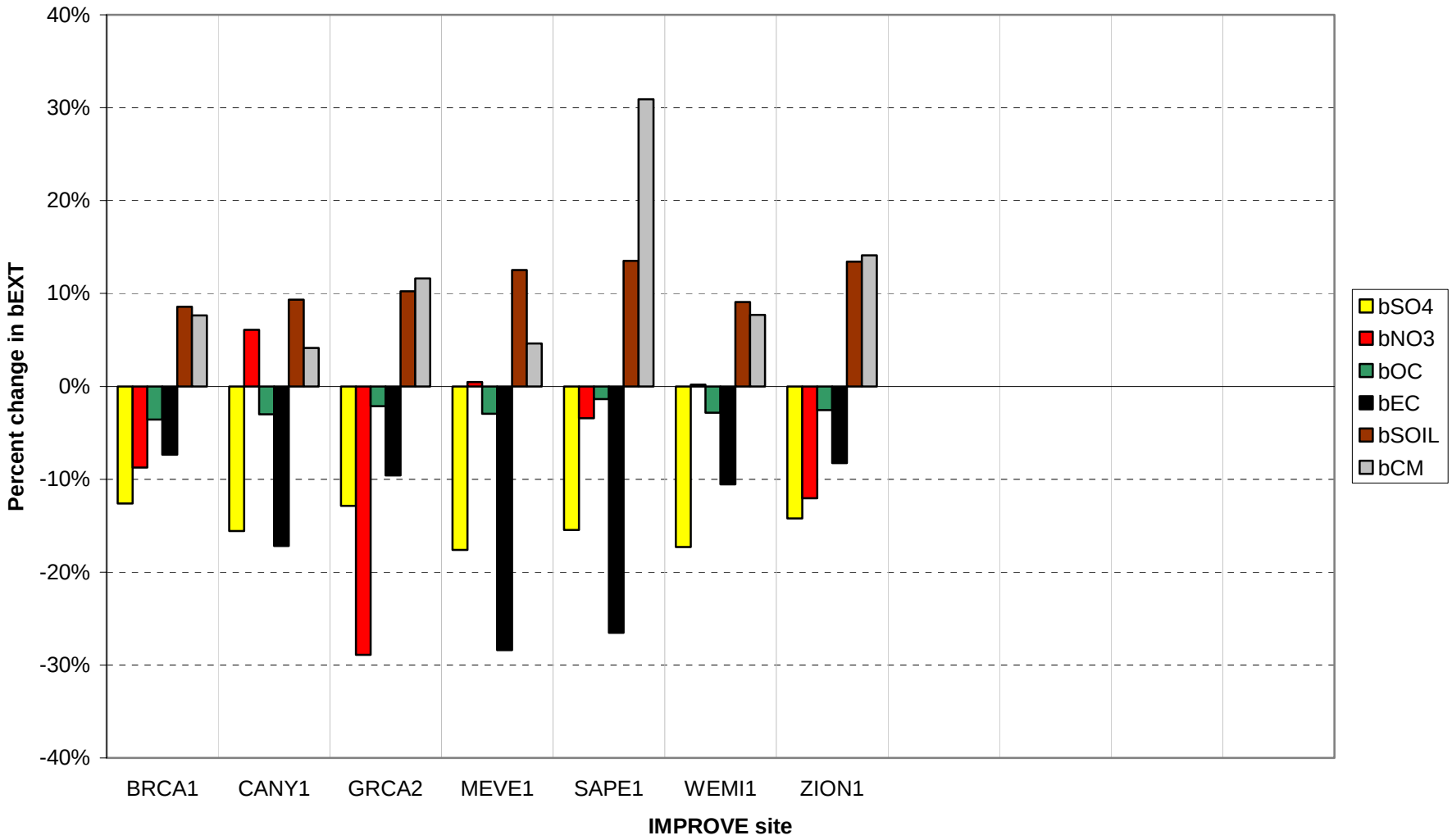
EPA Specific Day method: Predictions for Pacific Northwest and California sites (% dcv goal)



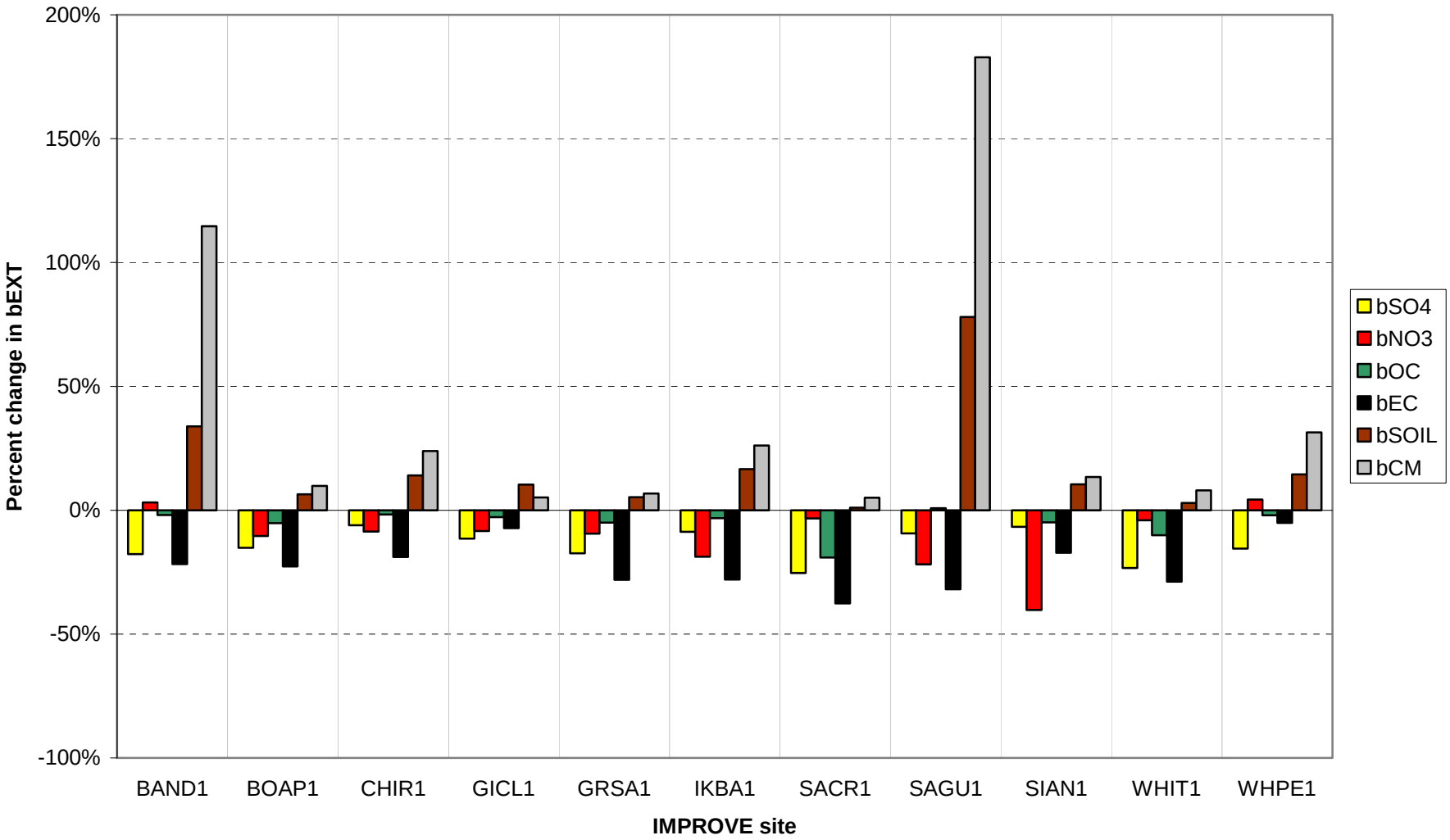
Bar Plots of change in visibility

- Available for all sites show PM component changes in bext:
  - PRP18a vs Plan02c
  - Base18b vs Plan02c
  - PRP18a vs Base18b
- These plots show change weighted by RRF.

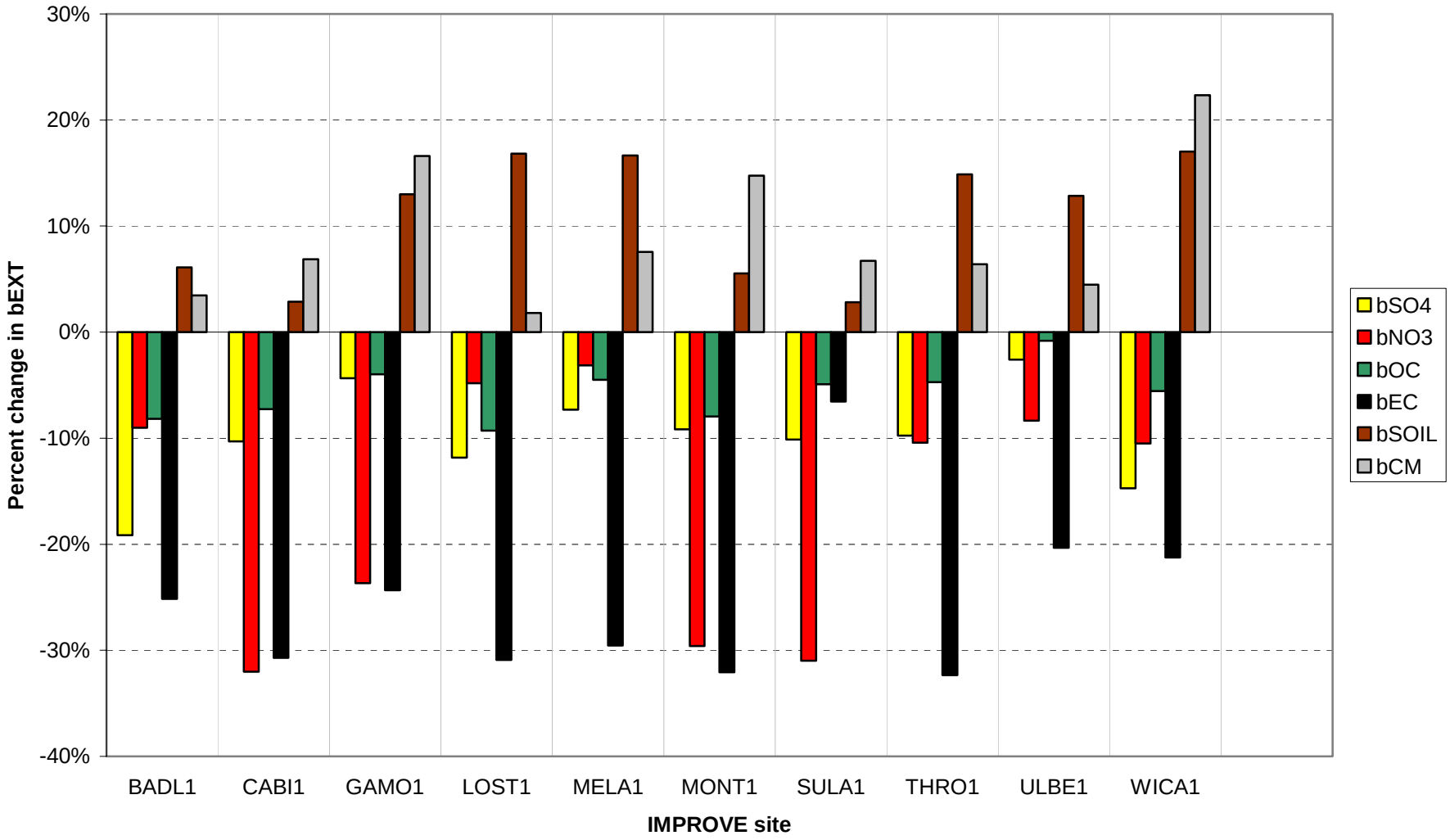
Percent change in extinction components from 2002 baseline to 2018 projected at Colorado Plateau sites using prp18a/plan02c RRFs



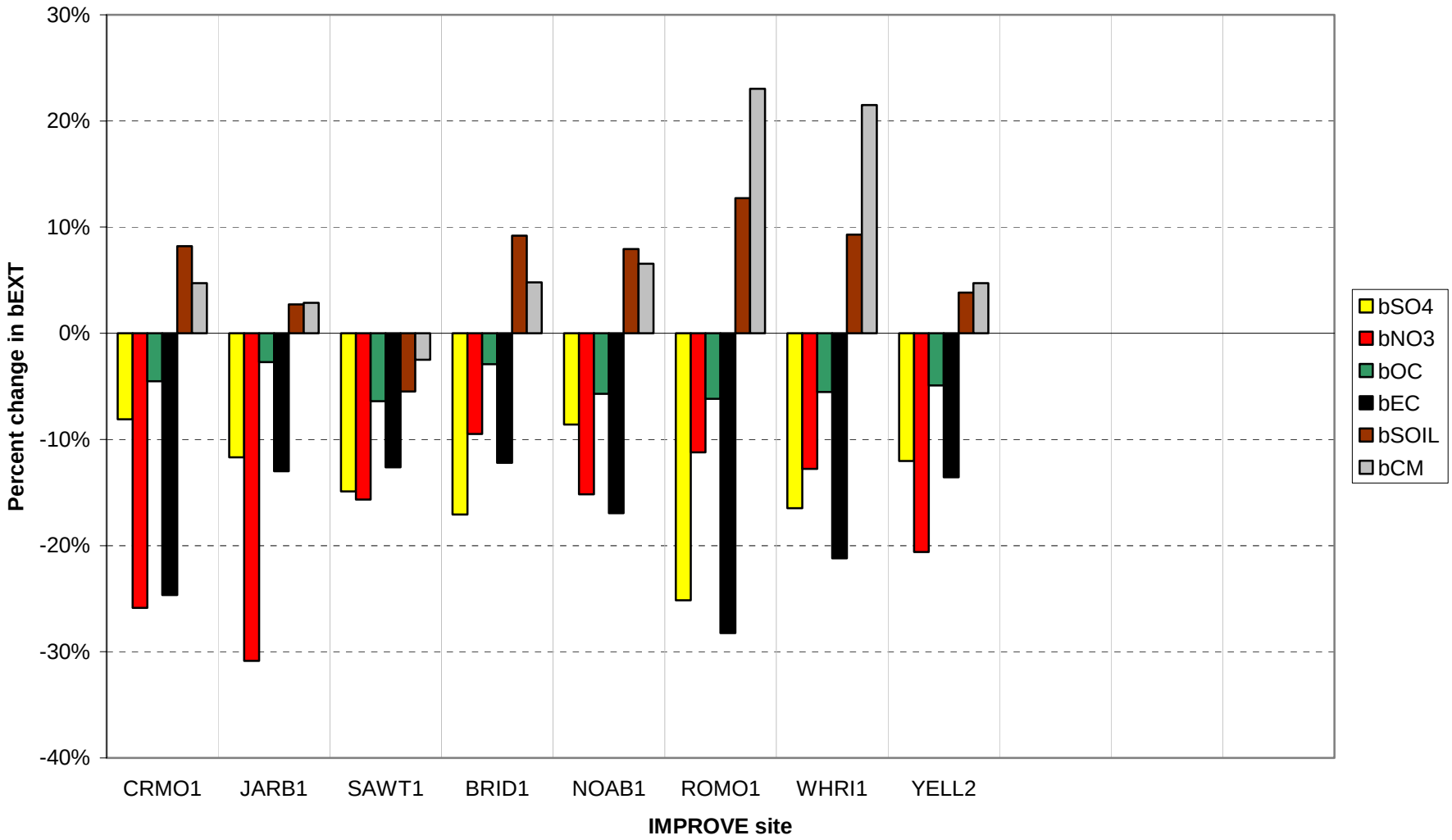
Percent change in extinction components from 2002 baseline to 2018 projected at Desert Southwest sites using prp18a/plan02c RRFs



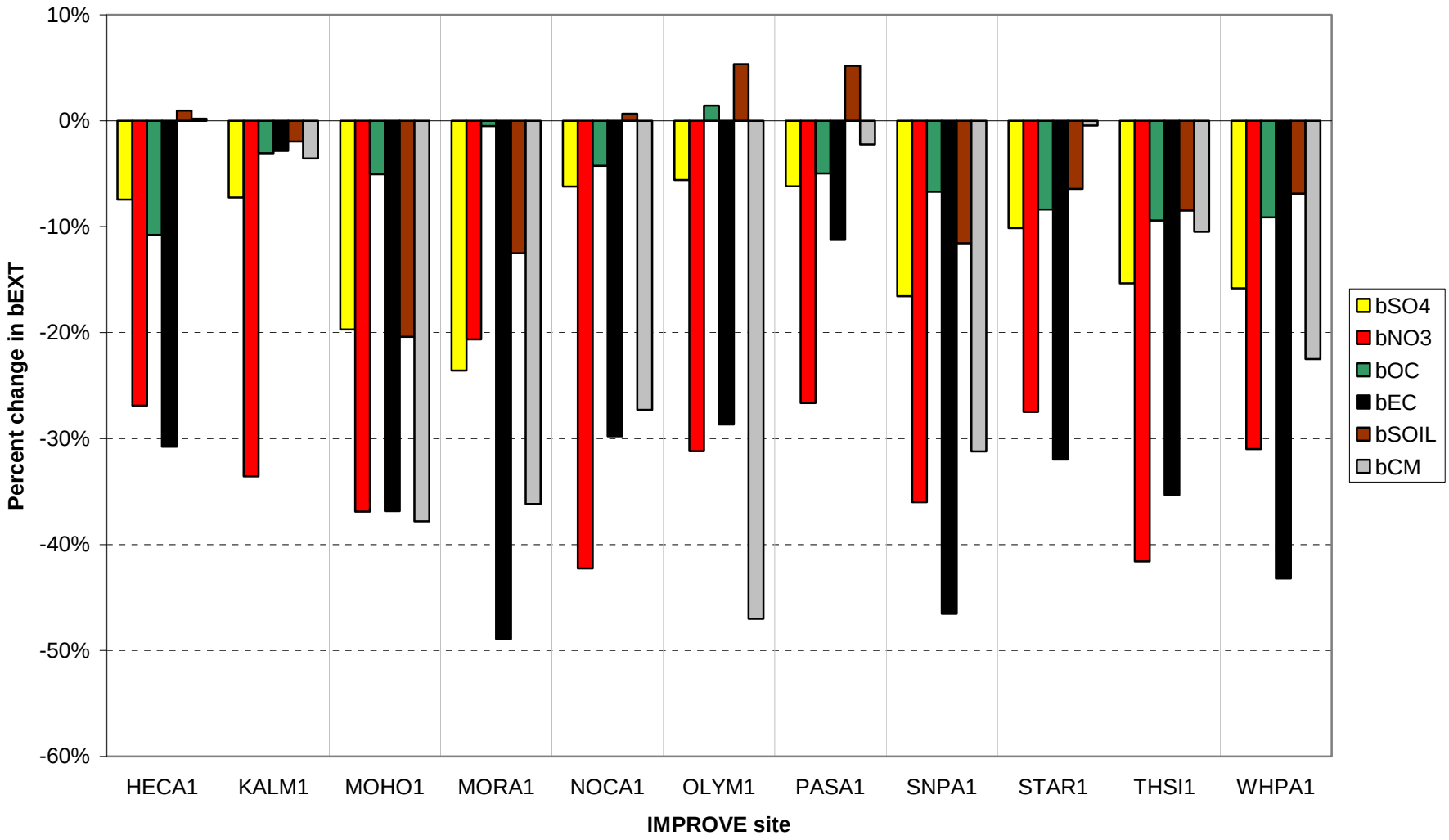
Percent change in extinction components from 2002 baseline to 2018 projected at Northern sites using prp18a/plan02c RRFs



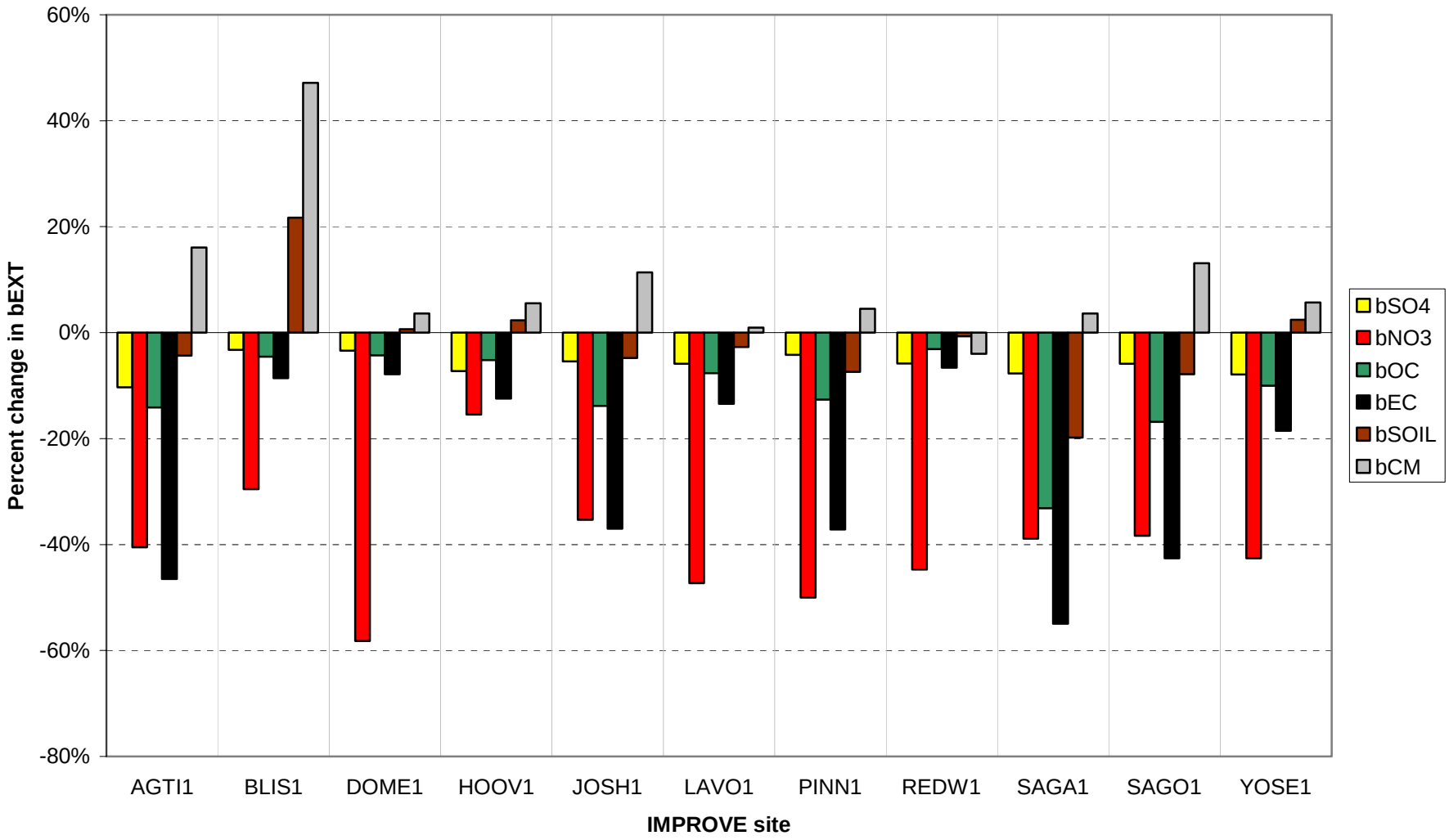
Percent change in extinction components from 2002 baseline to 2018 projected at Great Basin & Rockies sites using prp18a/plan02c RRFs



Percent change in extinction components from 2002 baseline to 2018 projected at Pacific Northwest sites using prp18a/plan02c RRFs



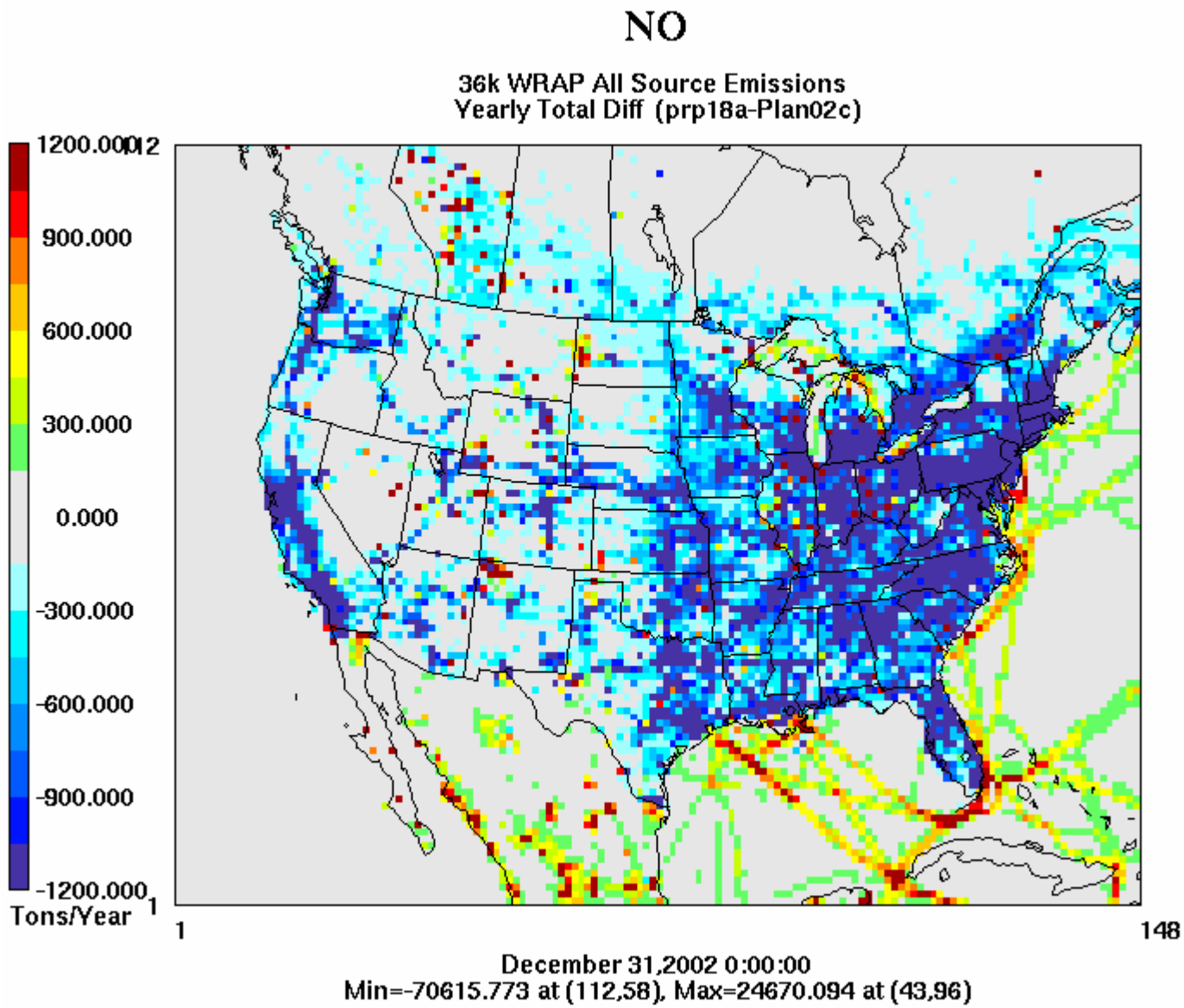
Percent change in extinction components from 2002 baseline to 2018 projected at California sites using prp18a/plan02c RRFs



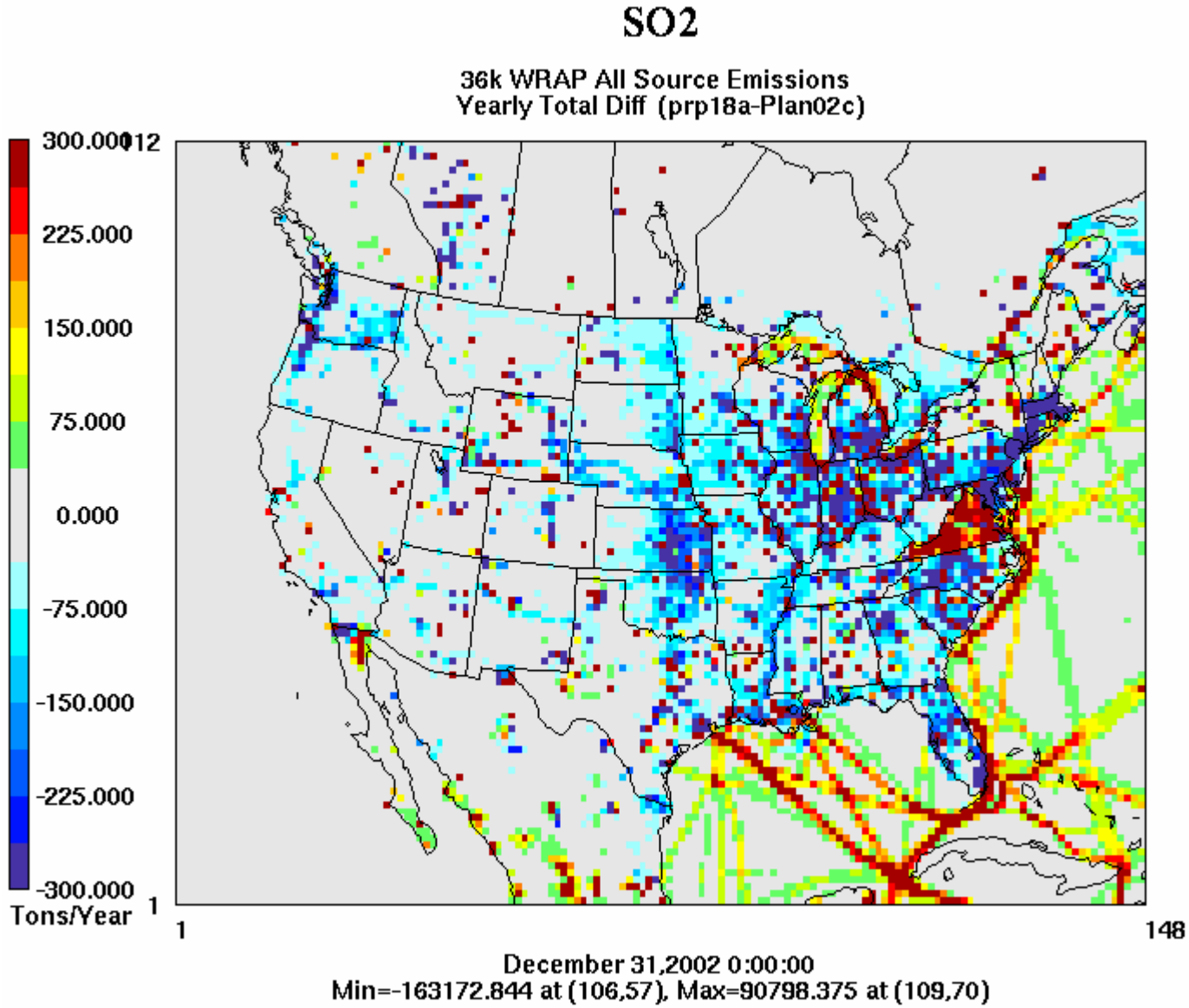
PRP18a vs. Plan02c
Emissions Comparison

- PAVE QA plots comparing PRP18a vs. Plan02c:
  - red colors showed increased emissions in PRP18a
  - blue colors showed reduced emissions in PRP18a

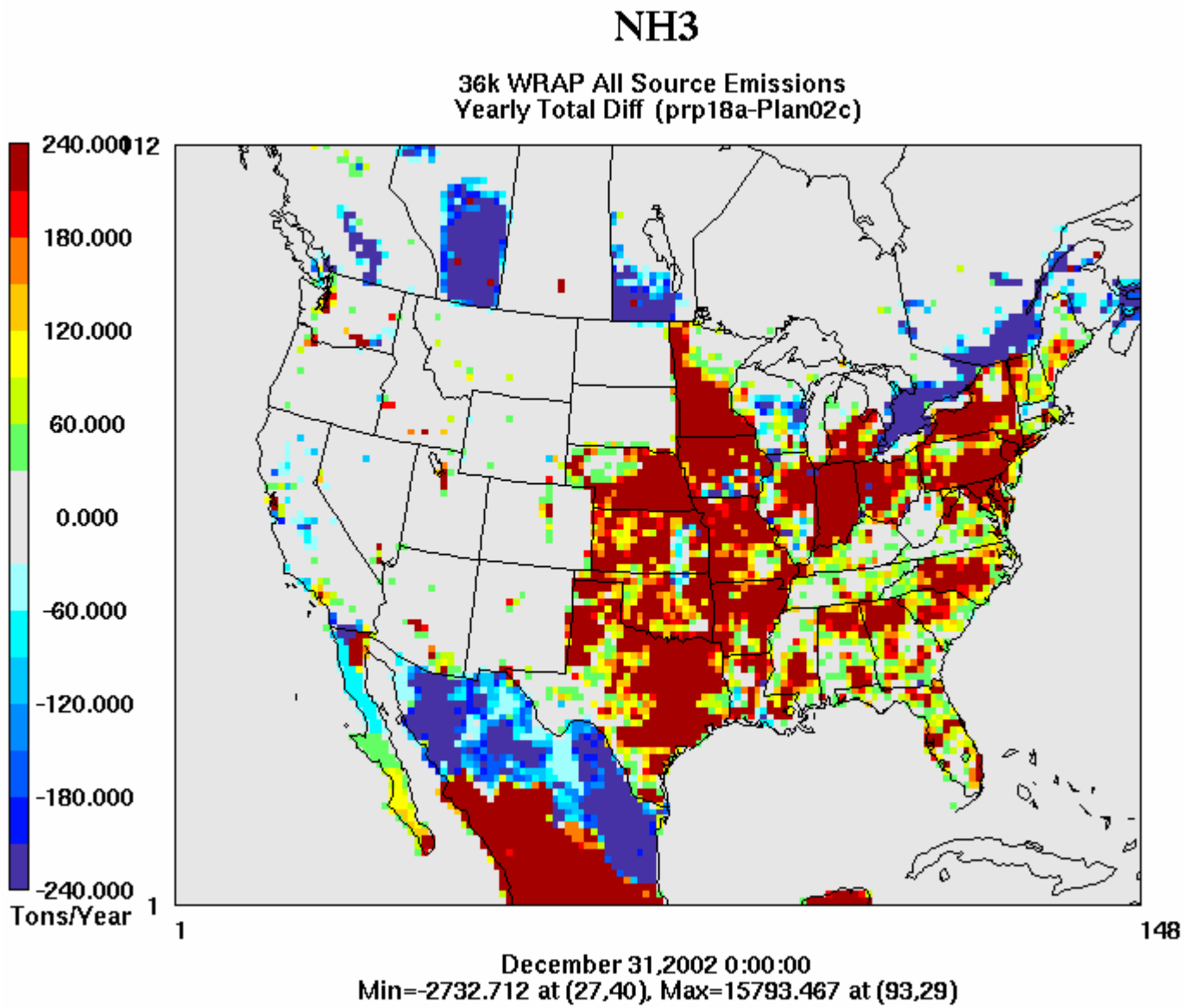
NO Annual emissions difference PRP18a – Plann02c



SO2 Annual emissions difference PRP18a – Plann02c

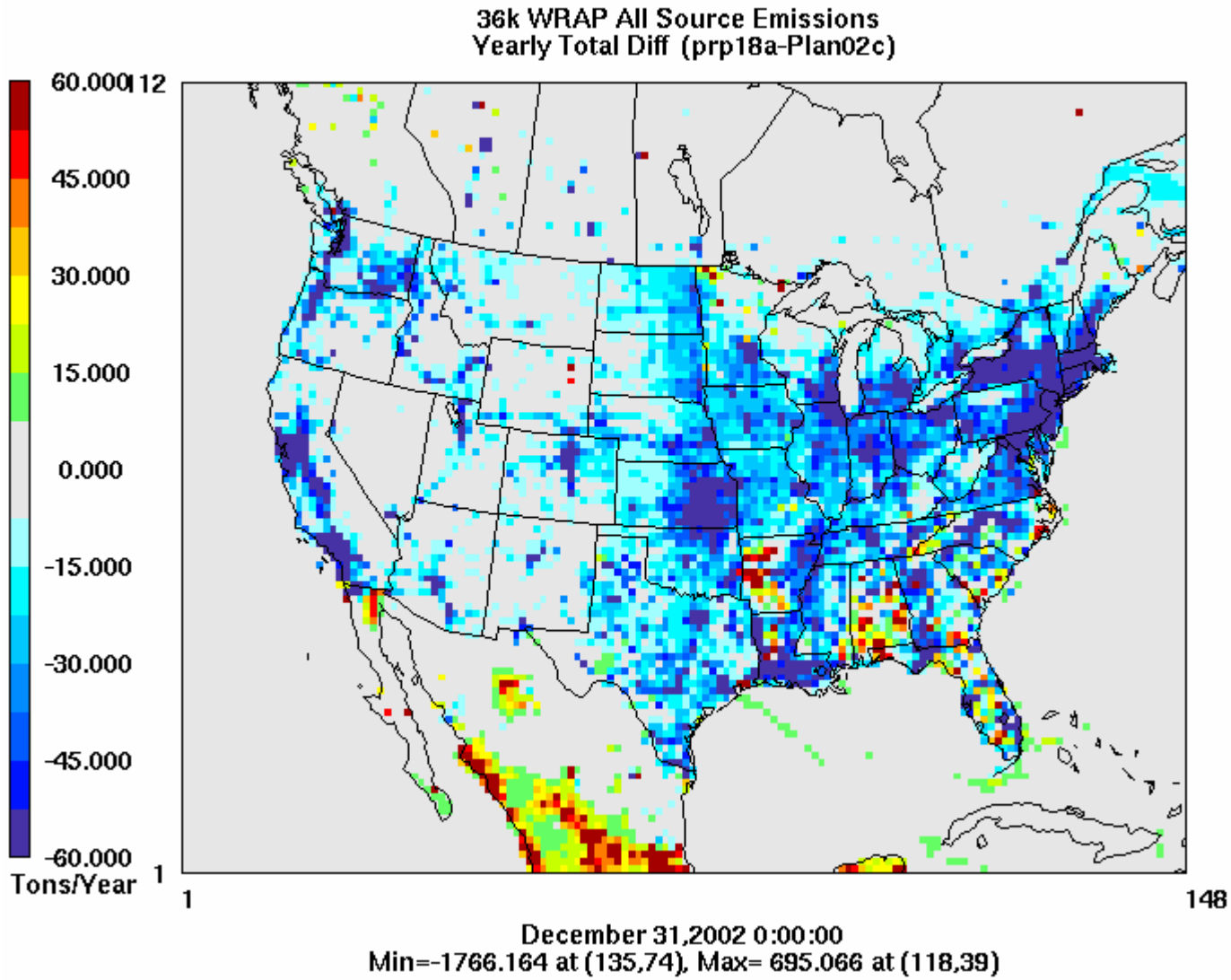


NH3 Annual emissions difference PRP18a – Plann02c

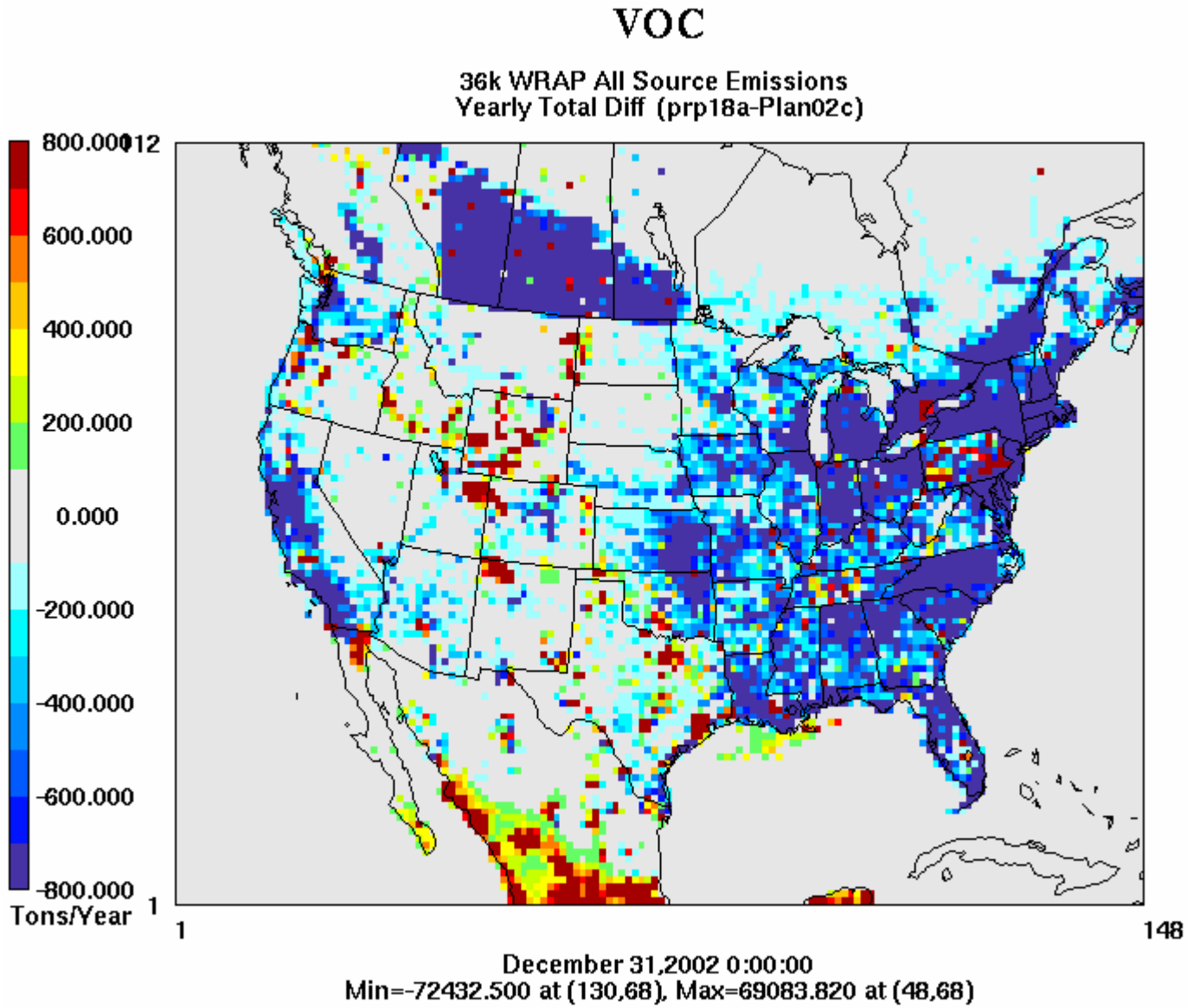


EC Annual emissions difference PRP18a – Plann02c

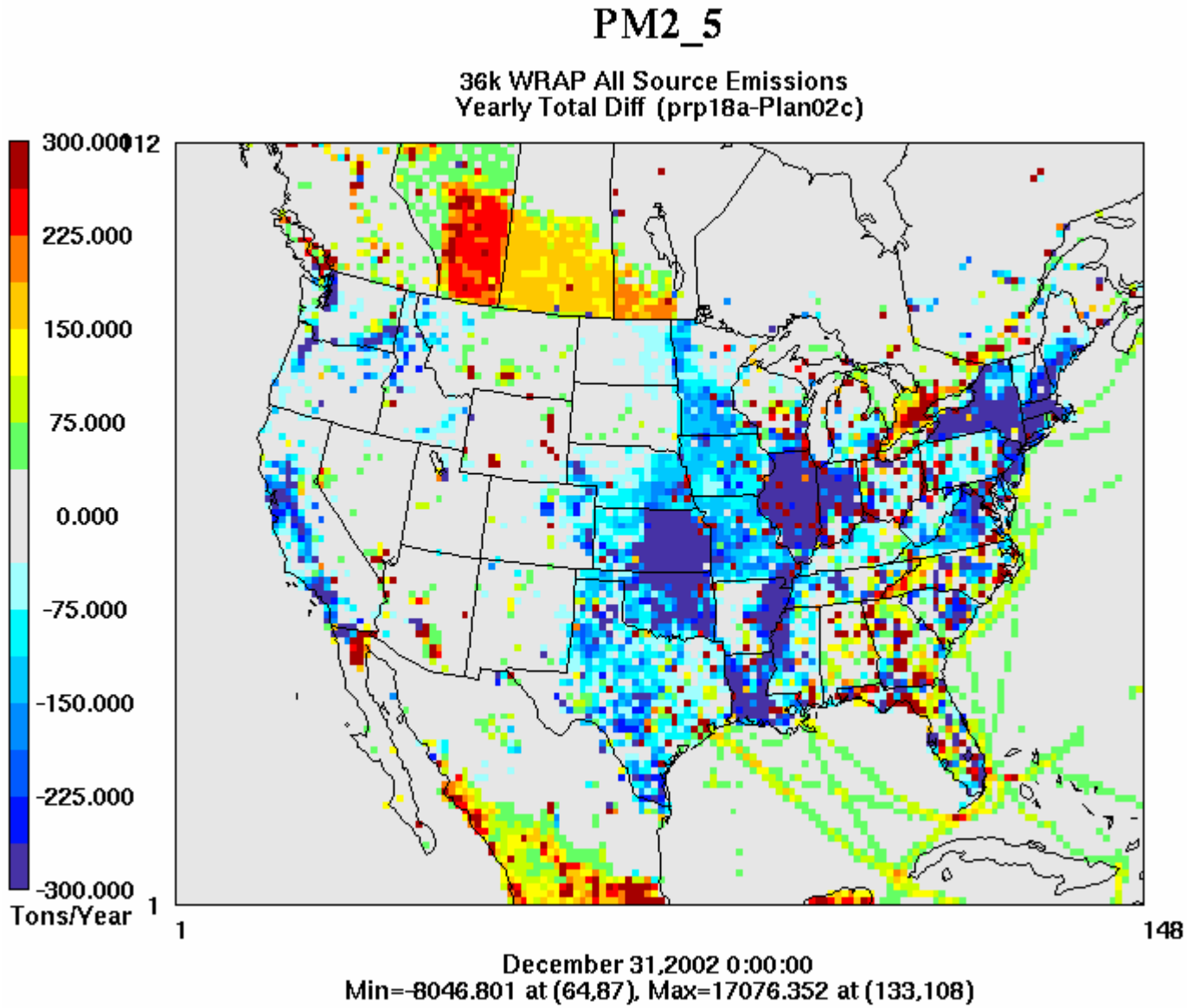
PEC



VOC Annual emissions difference PRP18a – Plann02c



PMFINE Annual emissions difference PRP18a – Plann02c

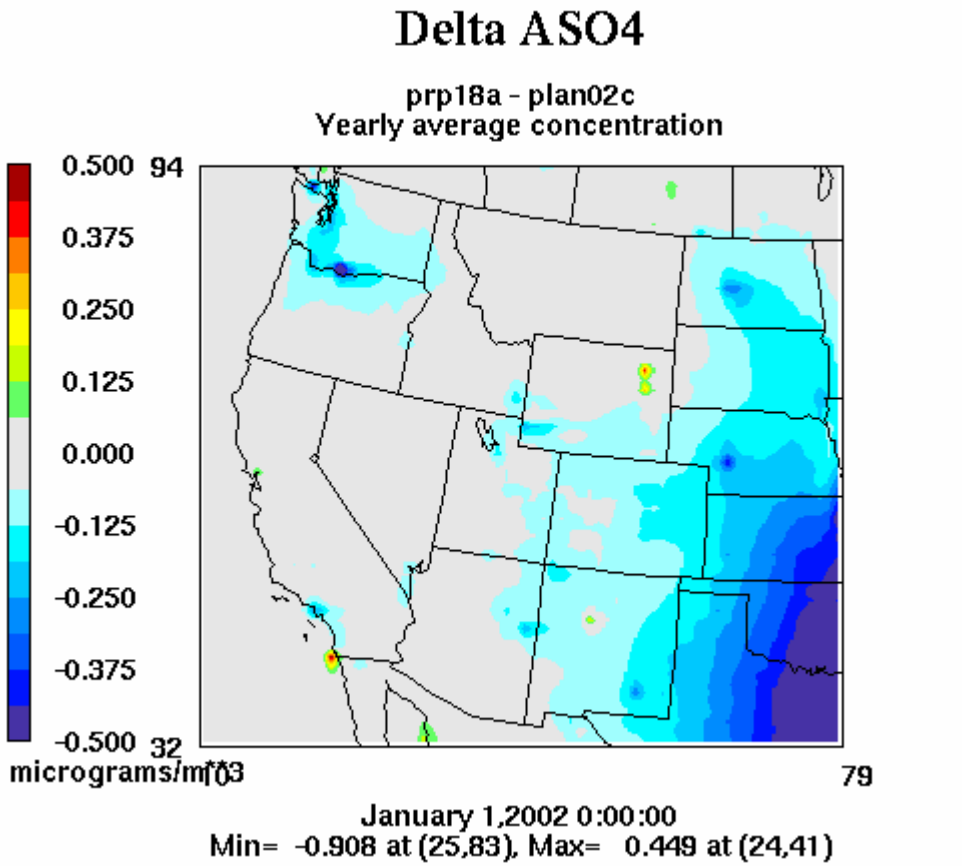


CMAQ Results Comparison

- PAVE plots comparing PRP18a vs. Plan02:
  - Plots show change in conc as PRP18a minus Plan02c
  - Blue colors show area with lower mass in PRP18a.
  - Annual average change shown here, monthly average changes are available on webpage.
  - coarse material is not being used

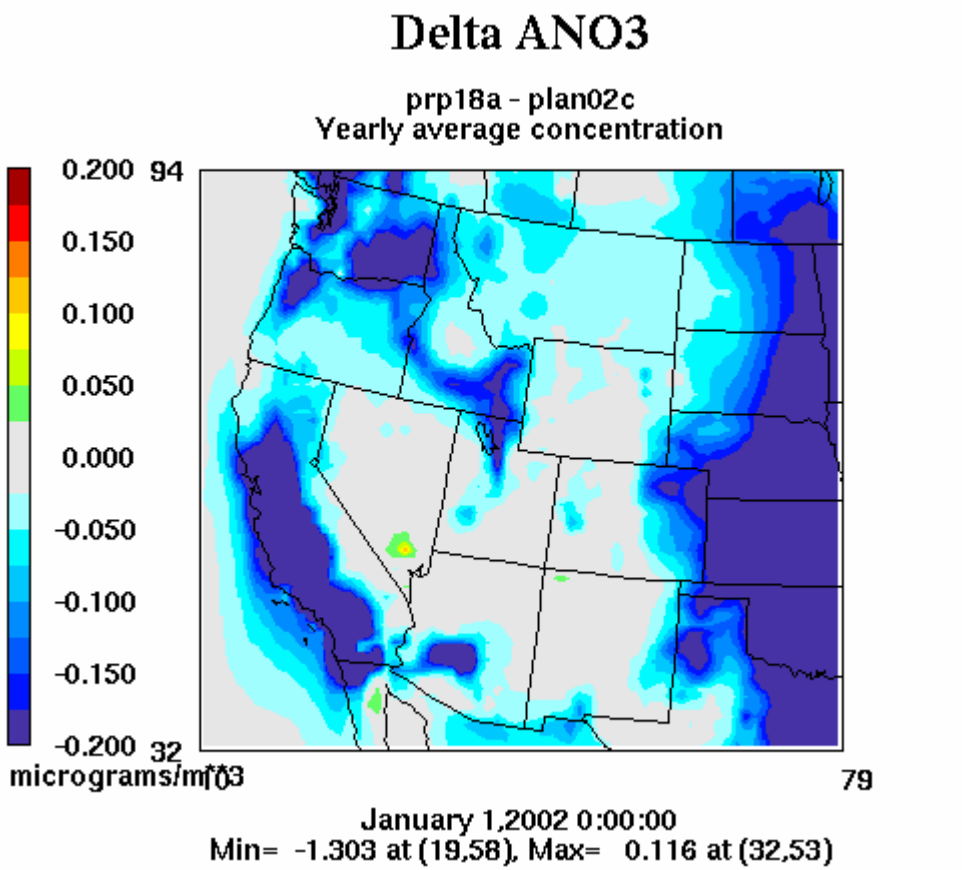
CMAQ Difference Plots PRP18a minus Plan02c

Sulfate Annual Average change



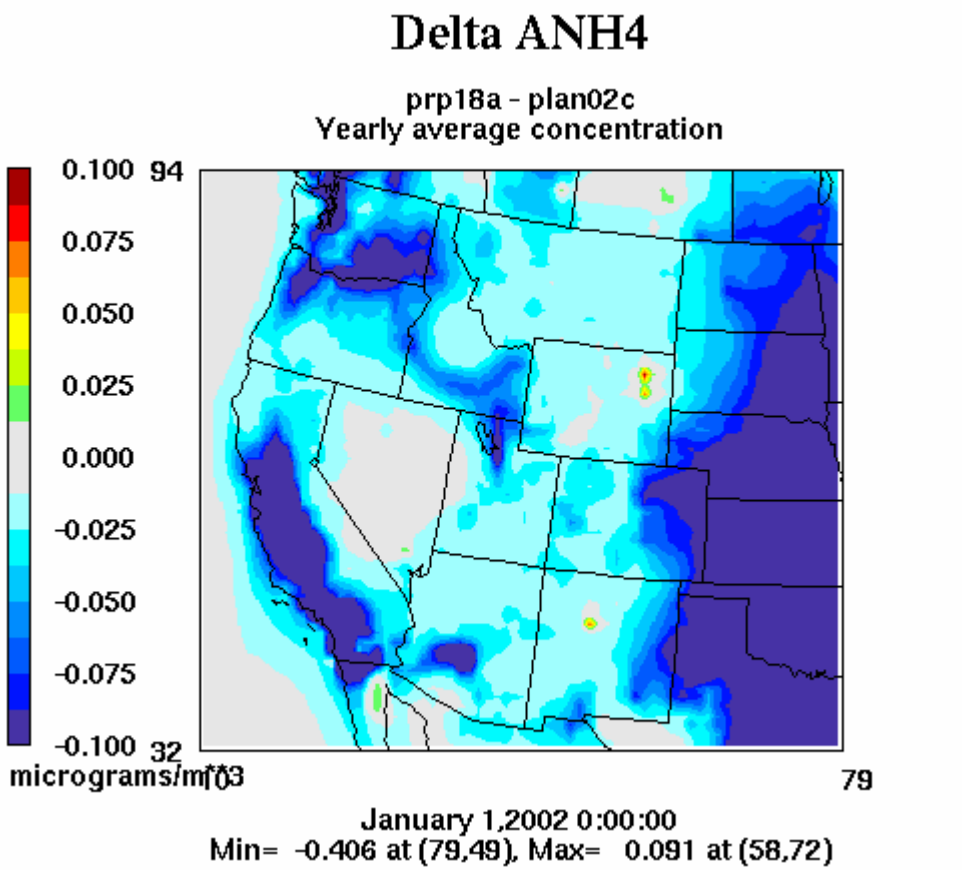
CMAQ Difference Plots PRP18a minus Plan02c

Nitrate Annual Average change



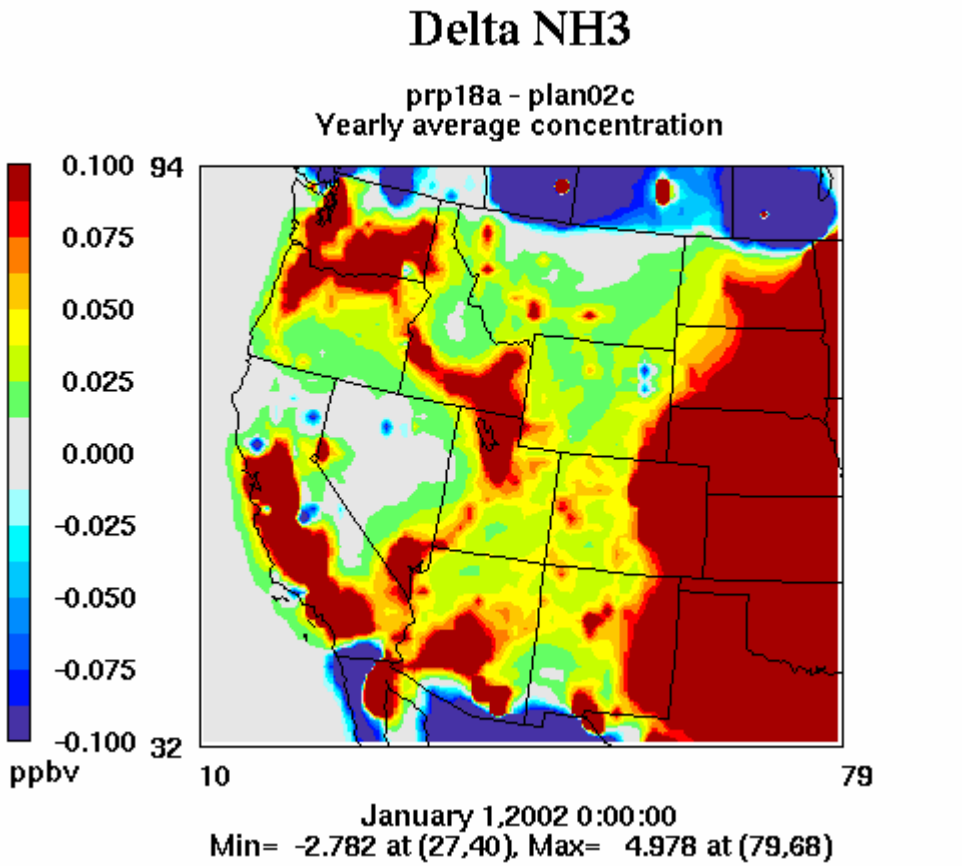
CMAQ Difference Plots PRP18a minus Plan02c

Ammonium Annual Average change



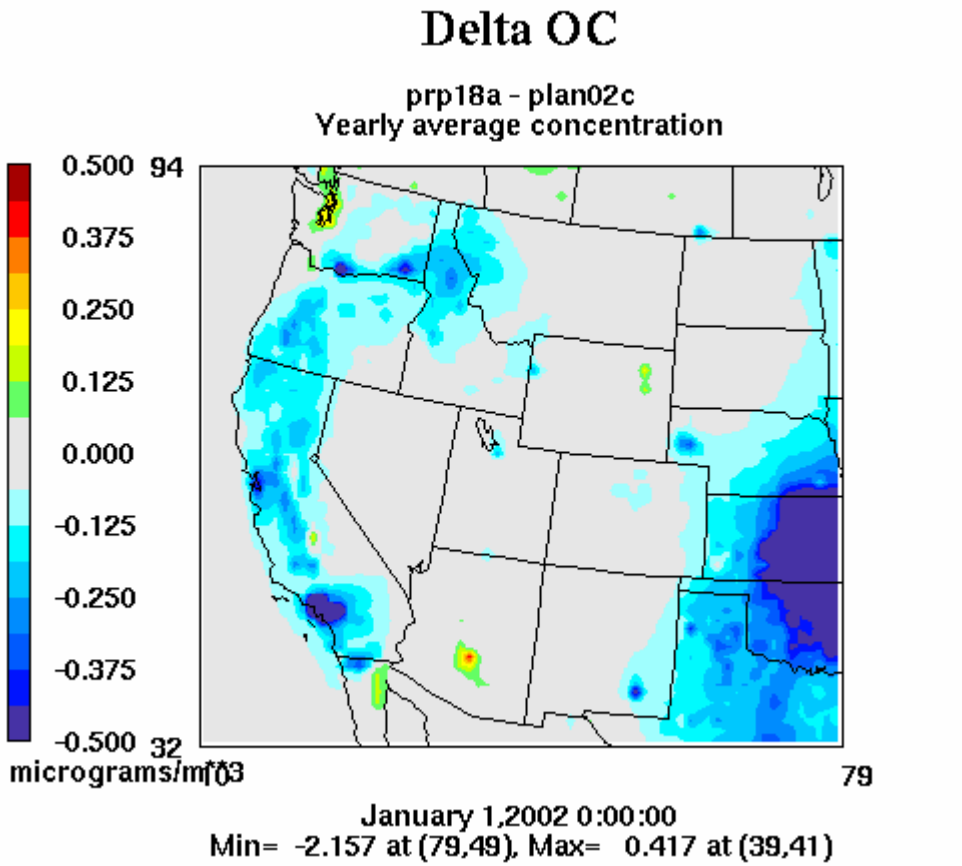
CMAQ Difference Plots PRP18a minus Plan02c

NH3 Annual Average change



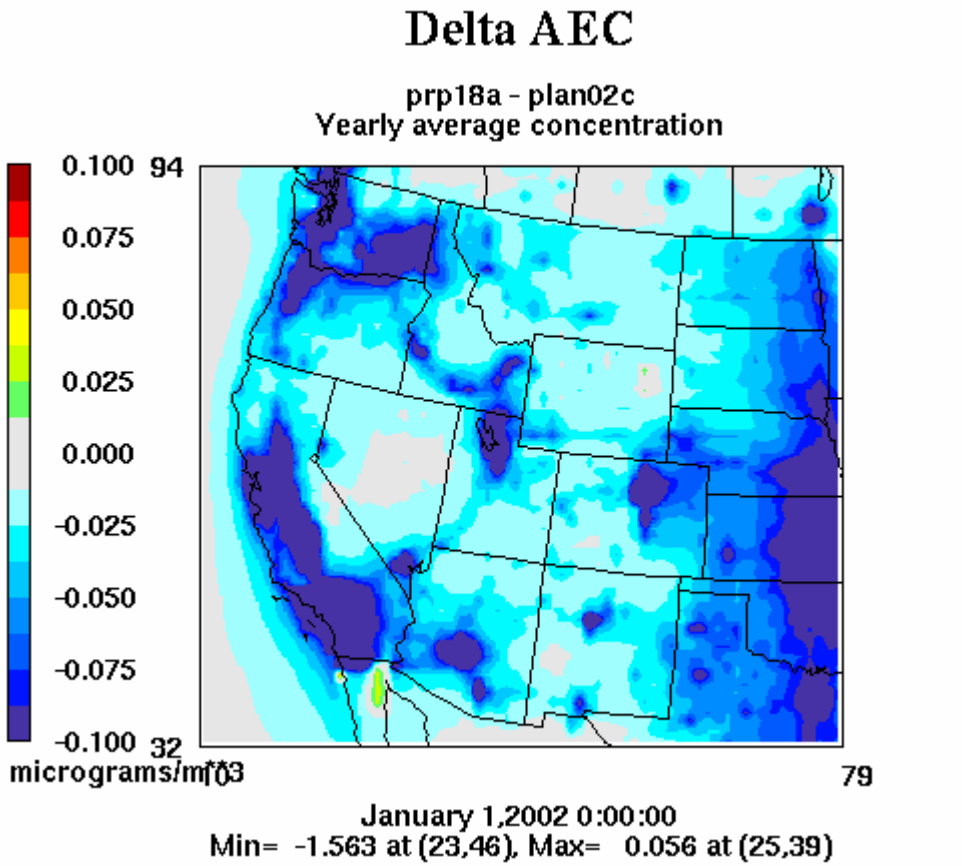
CMAQ Difference Plots PRP18a minus Plan02c

OC Annual Average change



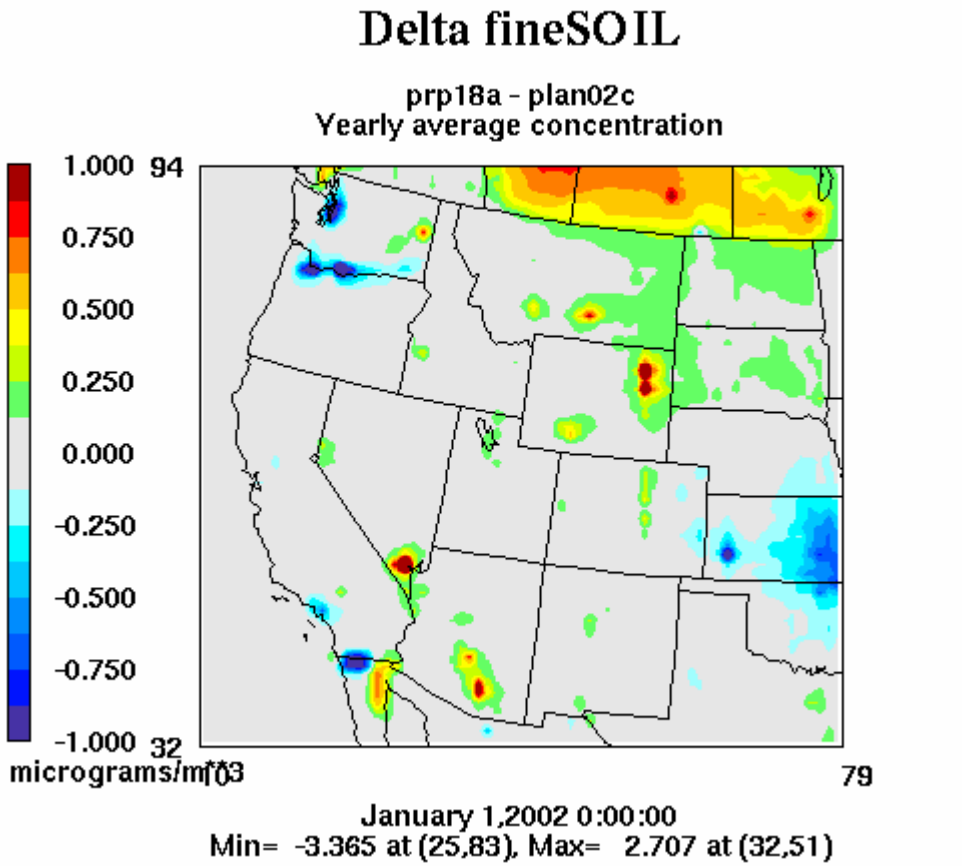
CMAQ Difference Plots PRP18a minus Plan02c

EC Annual Average change



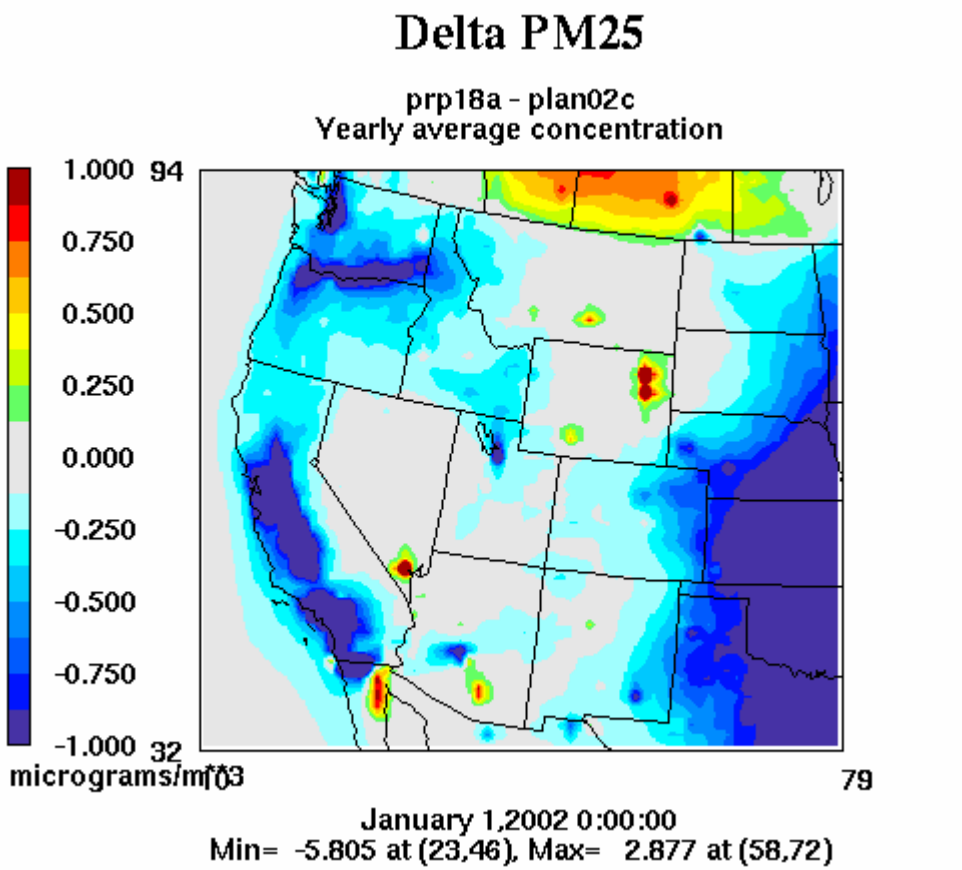
CMAQ Difference Plots PRP18a minus Plan02c

Soil Annual Average change



CMAQ Difference Plots PRP18a minus Plan02c

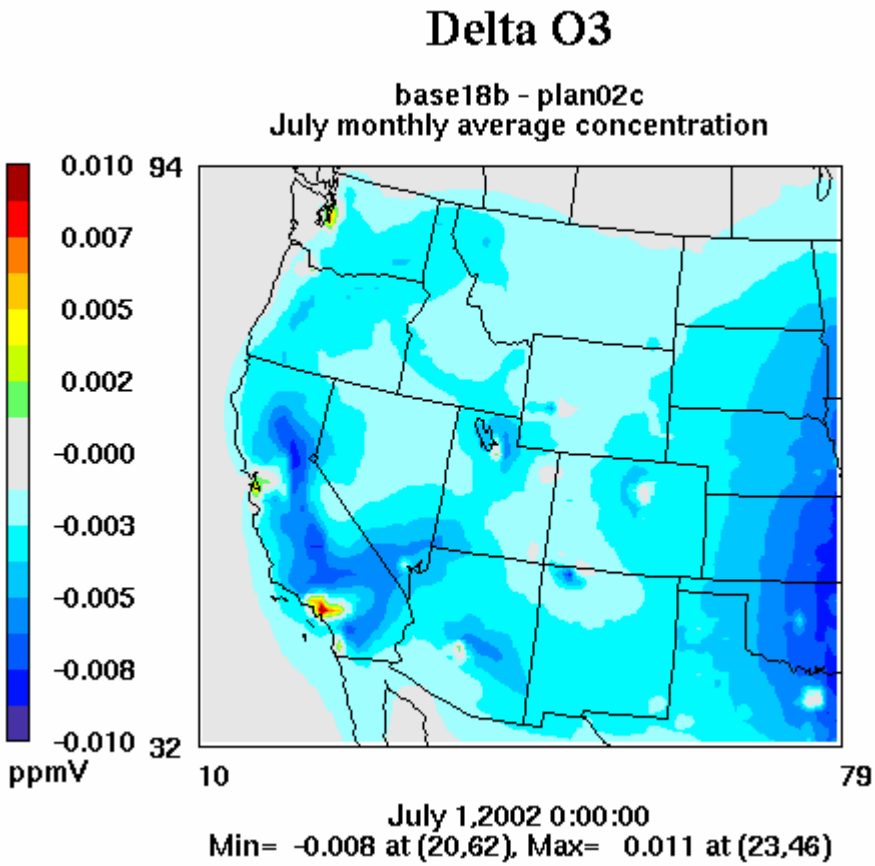
Total $PM_{2.5}$ Annual Average change



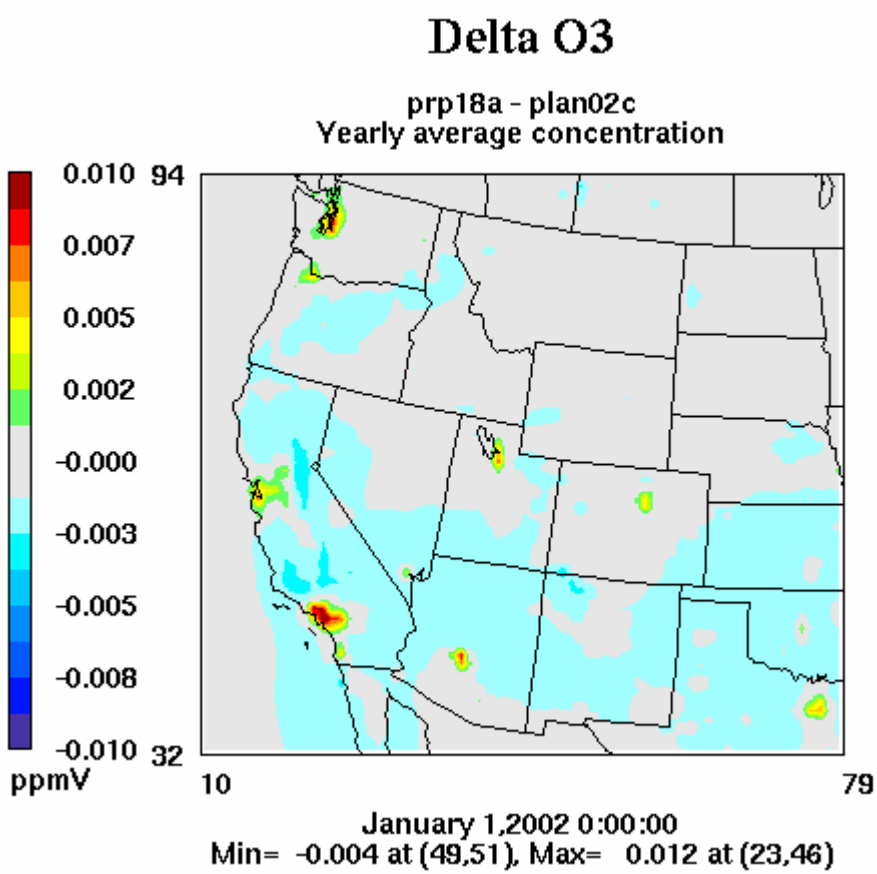
CMAQ Difference Plots PRP18a minus Plan02c

Ozone change

July Average



Annual Average



Conclusions

- PRP18a shows improvement in achieving visibility goals compared to Base18b at most sites: reductions in SOx NOx emissions.
- Some sites have worse visibility in PRP18a than in Base18b because of dust projections.
- Most IMPROVE sites are at less than 60% of visibility goal in PRP18a.

Next Steps

- Planned revisions to PRP18a:
  - Final RP19 early 2008.
  - fix all known emissions projection errors.
- Final Plan02d run correcting same errors.
- Optional model studies during 2007:
  - Sensitivity simulations with emissions reductions?
  - Do a new "model floor" simulation with all anthropogenic emissions zeroed out?