Southern New Mexico Ozone Modeling Study

Summary of Results: Tasks 7 and 8

Ramboll-Environ (RE)
University of North Carolina (UNC-IE)

April 30, 2016

WESTAR
Western Regional Air Partnership
RAMBOLL ENVIRON
UNC Institute for the Environment

SNMOS Background and Objectives

- The southern Doña Ana County region has the highest ozone levels of any area in New Mexico
  - The southern Doña Ana County area is within 95% of the federal standard for ozone
  - The New Mexico Air Quality Control Act requires the New Mexico Environment Department to develop a plan for reducing ozone levels in areas that are within 95% of the ozone standard
- The first step towards developing the plan is to understand the causes of high ozone in Doña Ana County
- SNMOS objectives:
  - Study the factors contributing to high ozone in Doña Ana County
  - Investigate future emissions scenarios that will produce attainment of the ozone standard

Overview of Approach

- SNMOS builds off of the Western Air Quality Study (WAQS)
  - WAQS 2011 modeling platform: WRF/SMOKE/CAMx
  - Adjustments to the meteorology and modeling domains to optimize for southern New Mexico
- Modeling 2011 New Mexico ozone season: May 1 – August 31
- Modeling Plan
  - Prepare base year emission inventories
  - Run WRF/SMOKE/CAMx for 2011 base year
    - Evaluate 2011 base year model against observations, refine model if needed
  - Prepare future year emission inventories for 2025
  - Run SMOKE/CAMx for future year
    - Modeled Attainment Test
    - Emissions sensitivity/control runs
    - Source apportionment to diagnose causes of high ozone in Doña Ana County
  - Reporting

SNMOS Tasks

- **Completed**
  - **Task 1**: 2011 WRF 36/12/4 km with 4 km focus on Dona Ana/El Paso/Juarez and Work Plan (11/30/15)
  - **Task 2**: 2011 update Permian Basin O&G (11/30/15)
  - **Task 3**: 2011 update of Juarez and nearby Mexico EI, 2020 Mexico emissions update (11/30/15)
  - **Task 4**: SMOKE current 2011 NEI for 4 km domain (2/29/16)
  - **Task 5**: Gridded 2011 biogenic, fires, wind-blown dust, lightning emissions for 4 km domain (2/29/16)
  - **Task 6**: Develop 2011 4 km CAMx database and perform base case (2/29/16)
- **This Deliverable Period (April 30, 2016)**
  - **Task 7**: 2011 MPE and sensitivity modeling for Dona Ana County
  - **Task 8**: SMOKE current FY US EI and FY Mexico emissions update
- **Pending**
  - **Task 9**: FY 4 km CAMx simulation
  - **Task 10**: FY ozone projections (MATS)
  - **Task 11**: FY emissions sensitivity/controls
  - **Task 12**: FY 4 km source apportionment run
  - **Task 13**: Air Quality Technical Support Document (AQTSD)

Southern New Mexico Ozone Modeling Study

Task 7: 2011 Model Performance Evaluation

Ramboll-Environ (RE)
University of North Carolina (UNC-IE)

April 30, 2016

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Task 7 Objectives and Deliverables

- Objective
  - Carry out SNMOS 2011 Base Case CAMx modeling (**Completed 3/25/2016**)
- Deliverables
  - Base case modeling and model performance evaluation report. (**Completed 4/17/2016**)
- Tasks
  - Gather any aerometric data for the Doña Ana region from NMED that are not readily available from the EPA AQS or other Federal air quality monitoring systems.
  - Conduct a model performance evaluation for ozone, NO2, CO, and VOCs (if available).
  - Conduct short-time period emissions and/or other CAMx sensitivity modeling simulations to address any performance issues in the base year MPE as needed.
  - Rerun CAMx 2011 12/4 km base case with revised configuration and update MPE (if needed)
  - Prepare model performance evaluation report and PowerPoint

CAMx Air Quality Modeling

- CAMx configured as in WAQS 2011b study
  - Modeling ozone, PM, N and S deposition
  - CAMx v6.20*
  - CB6r2 chemical mechanism, EBI solver
  - Zhang dry deposition scheme
  - WRF meteorology
    - WRFCAMx v4.4* with CMAQ-like Kv
- CAMx run for April–October, 2011

* Model updated since the WAQS and most recent model version available used in SNMOS

CAMx Modeling Domains and Boundary Conditions

- 3SAQS 36 km grid 3D output fields used as BCs for the Dona Ana 12 km grid
- 12/4 km grids run in 2-way nested mode

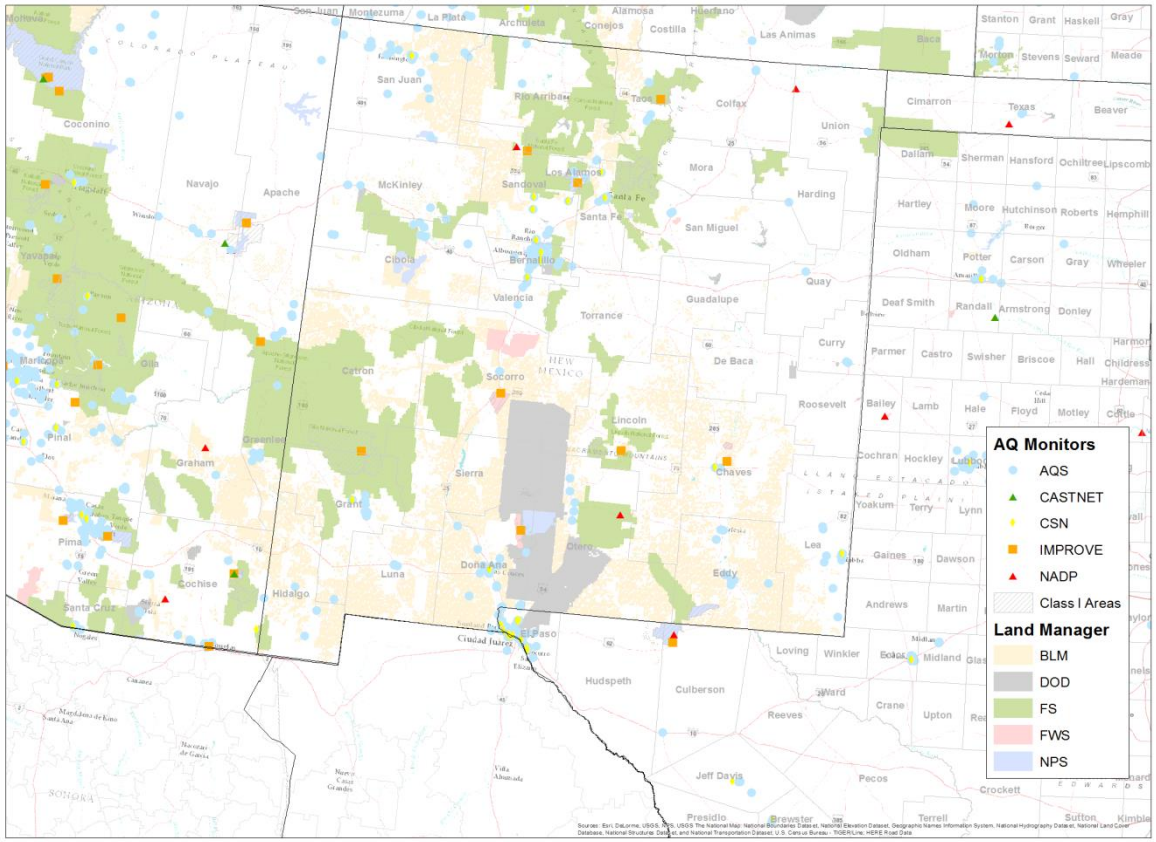
CAMx Sensitivity to WRF Meteorological Model Inputs

- UNC-IE made a series of WRF runs to optimize performance over Southern New Mexico and surrounding region
- The two best-performing WRF runs were chosen
  - Runs differ only in the choice of analysis used for model initialization and nudging.
  - North American Model (NAM) and interim ECMWF Reanalysis (ERA-Interim) (ERA)
- RE ran CAMx twice; only difference in CAMx runs was met inputs
  - First CAMx run used meteorology inputs from WRF run that used NAM analysis. Second CAMx run made with WRF ERA run inputs
- Compared CAMx run model performance for ozone for both runs
  - Selected better performing CAMx run as the base year run

CAMx Model Performance Evaluation

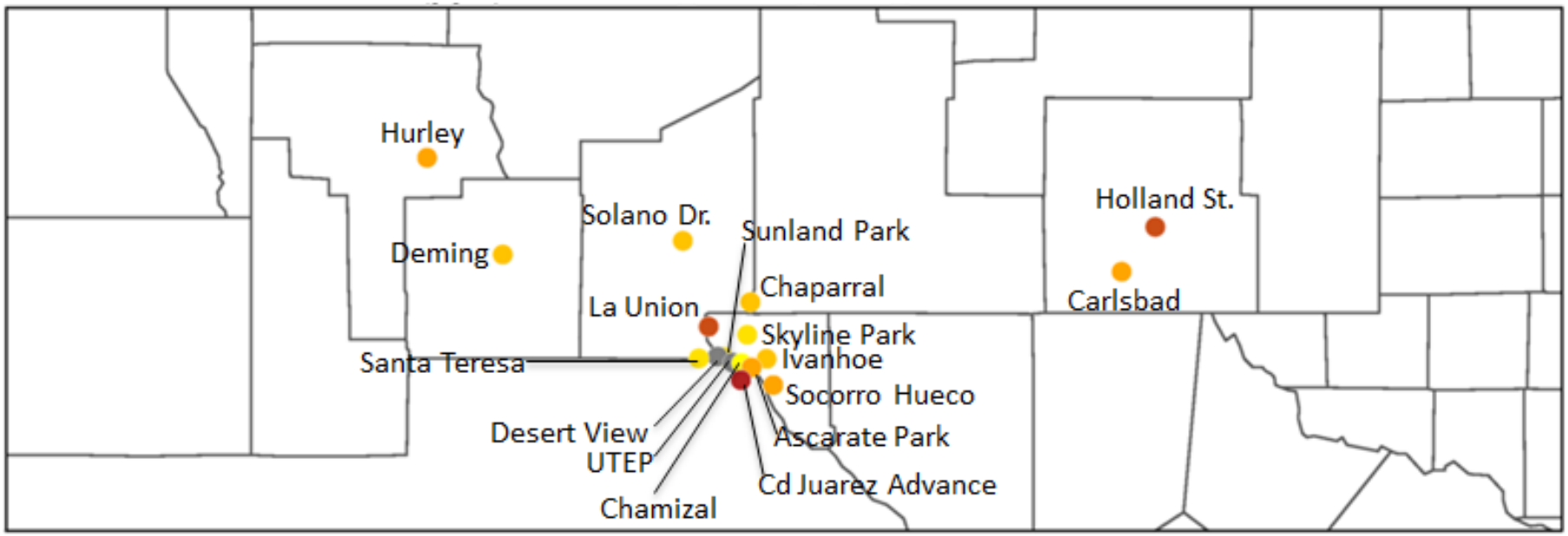
- Evaluated model on 12/4 km grid
  - Compared ozone, CO, NO_2, total $PM_{2.5}$ mass and speciated $PM_{2.5}$ concentrations against observed values, paired in time and space
  - Procedures followed EPA's 2014 modeling guidance[1] and WAQS 2011b modeling
- Performance statistics (bias, error, etc.) and spatial plots using AMET
  - Compared model performance with results of other modeling efforts (Simon et al., 2012)

Monitoring Data for Model Evaluation



- Evaluated the model at AQS sites within the 12/4 km model domain
  - CASTNET/AQS sites
- In 4 km domain, only AQS sites available
- Used AMET for statistical evaluation, plotting

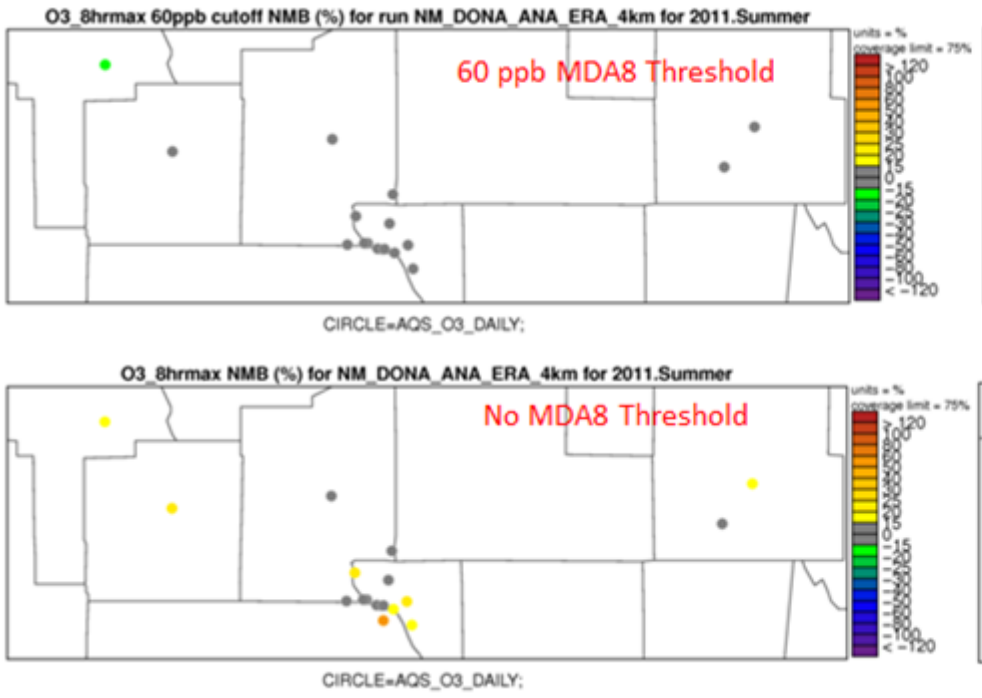
Monitoring Sites in 4 km Grid



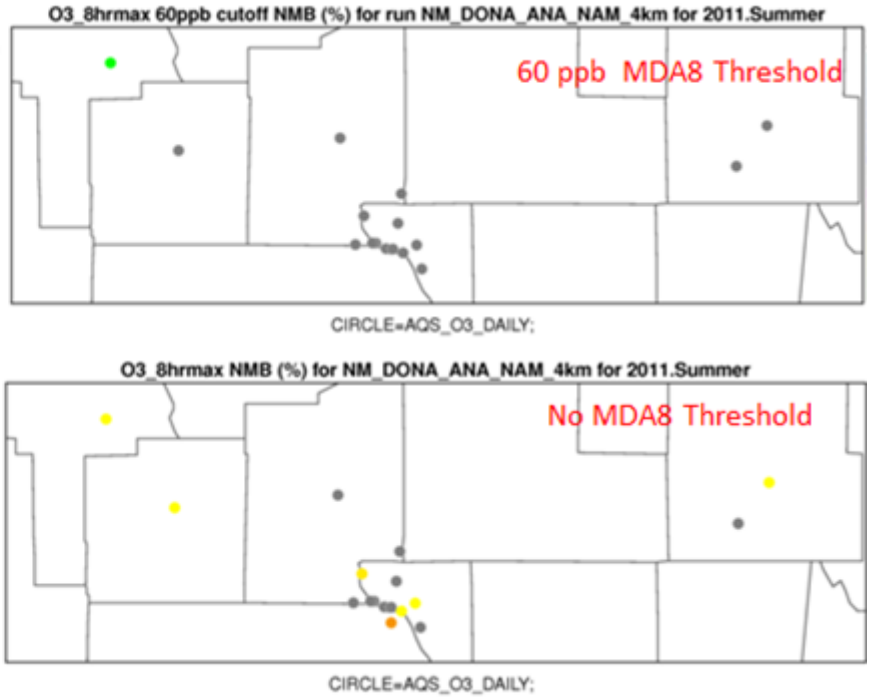
- Good coverage in southeastern Dona Ana and El Paso areas
  - Ciudad Juarez Advance has uncertain data quality
  - Removed this site from MPE statistical metric averages

CAMx NMB for 8-hr Ozone

CAMx ERA



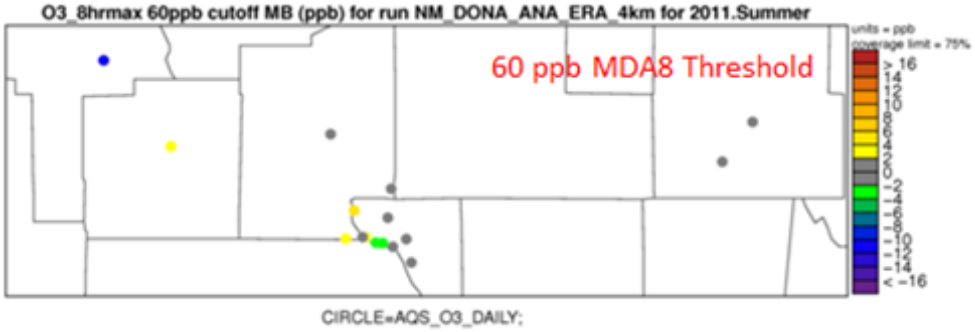
CAMx NAM

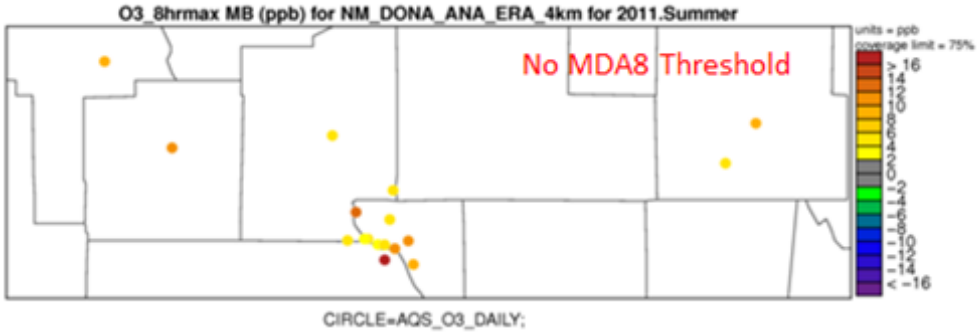


- With 60 ppb threshold, both runs are within the ±15% benchmark for all sites except Hurley
  - Similar performance without the 60 ppb threshold, but high bias appears more pronounced in El Paso than in NM, except for La Union

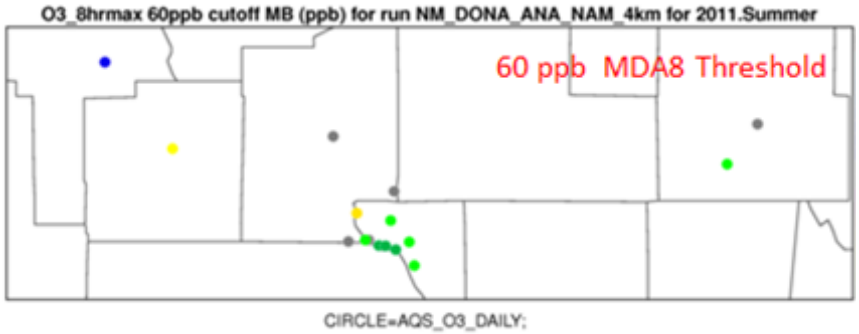
CAMx MB for 8-hr Ozone

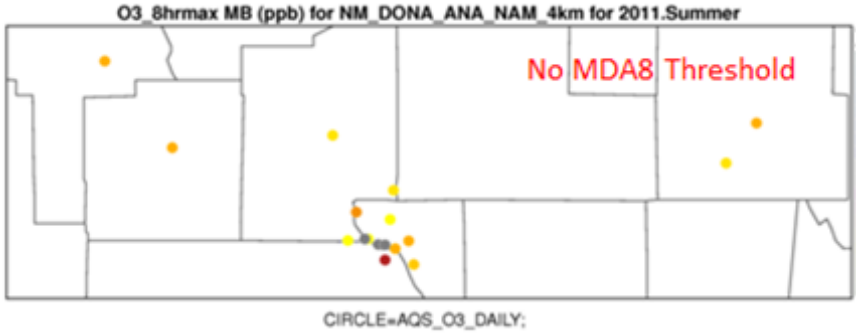
CAMx ERA





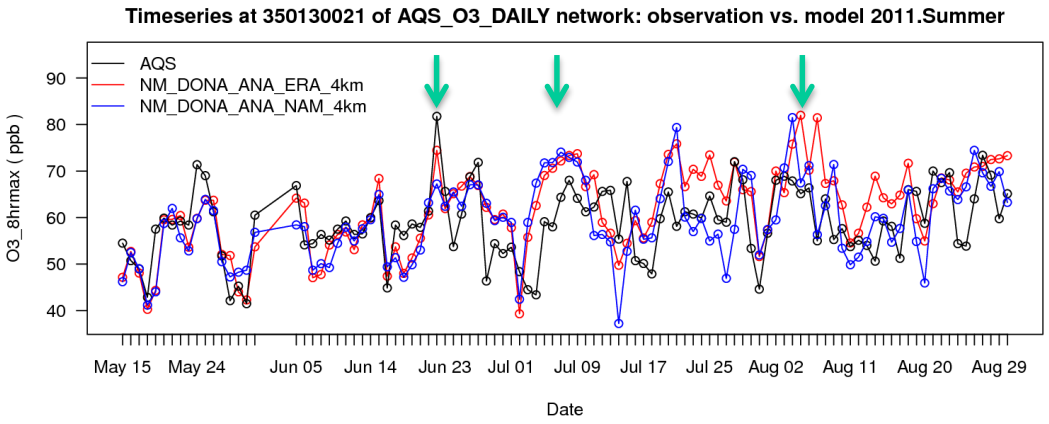
CAMx NAM

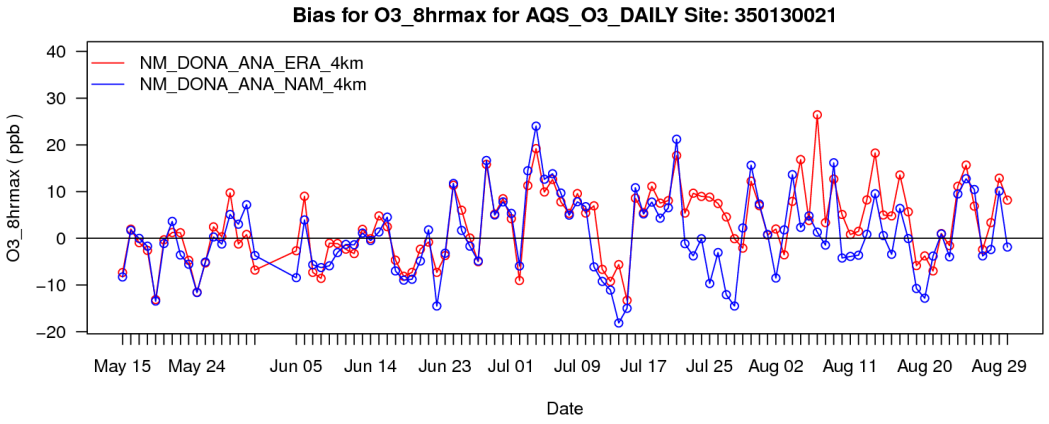




- CAMx ERA has smaller |MB| than CAMx NAM when 60 ppb threshold is used
  - NAM low bias has larger magnitude
  - Without 60 ppb threshold, CAMx NAM has smaller |MB| at sites near the Mexico-U.S. border

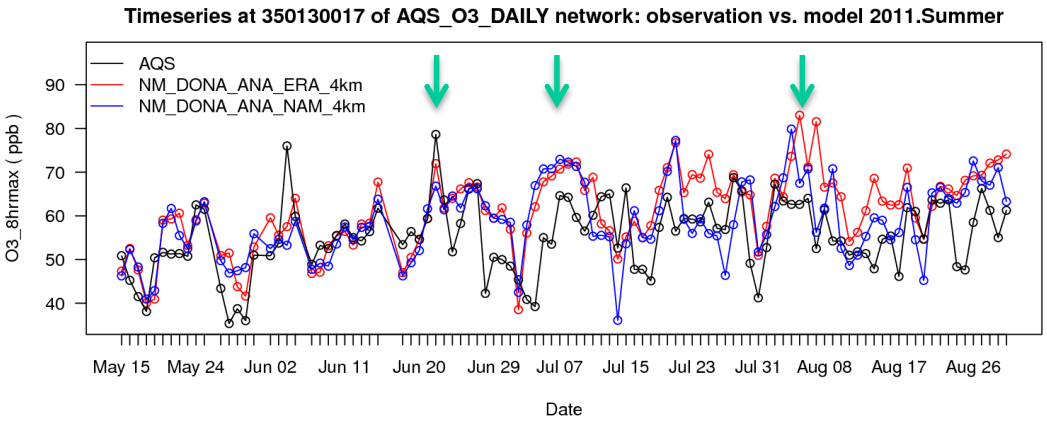
Desert View MDA8 Ozone Time Series

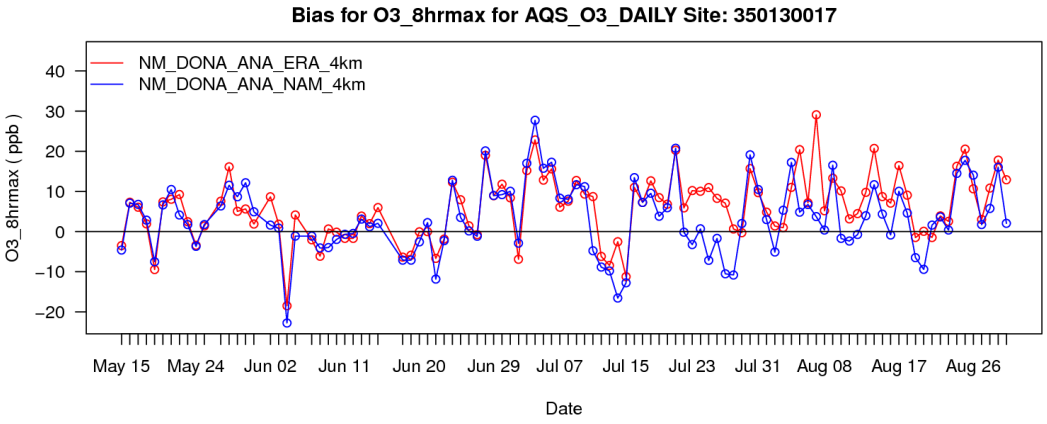




- Overall high bias
  - Some extended periods of overestimated ozone: July 5-9, August 4-9
- On high observed MDA8 days, model underestimates ozone
  - May 24, June 22

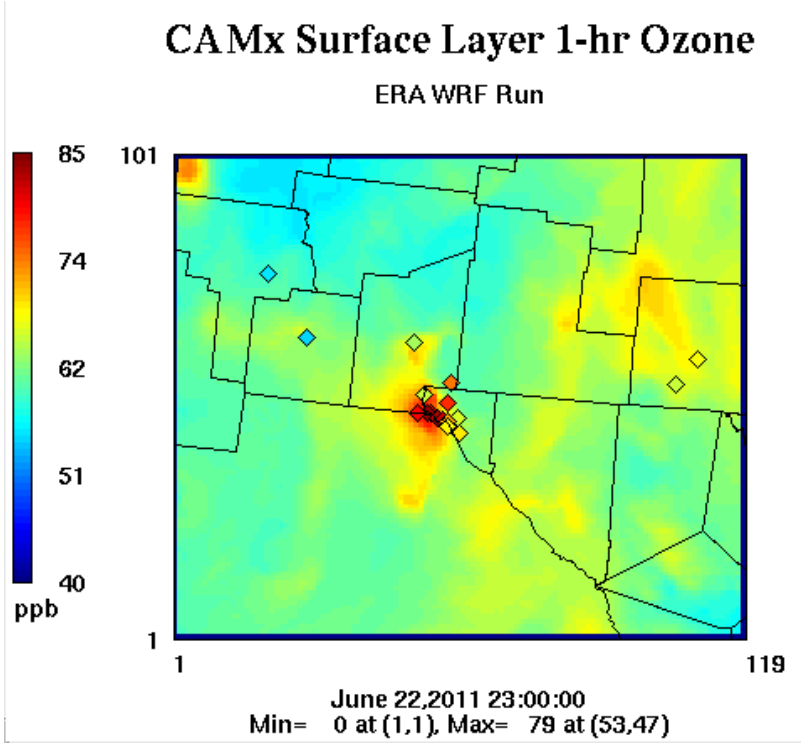
Sunland Park MDA8 Ozone Time Series

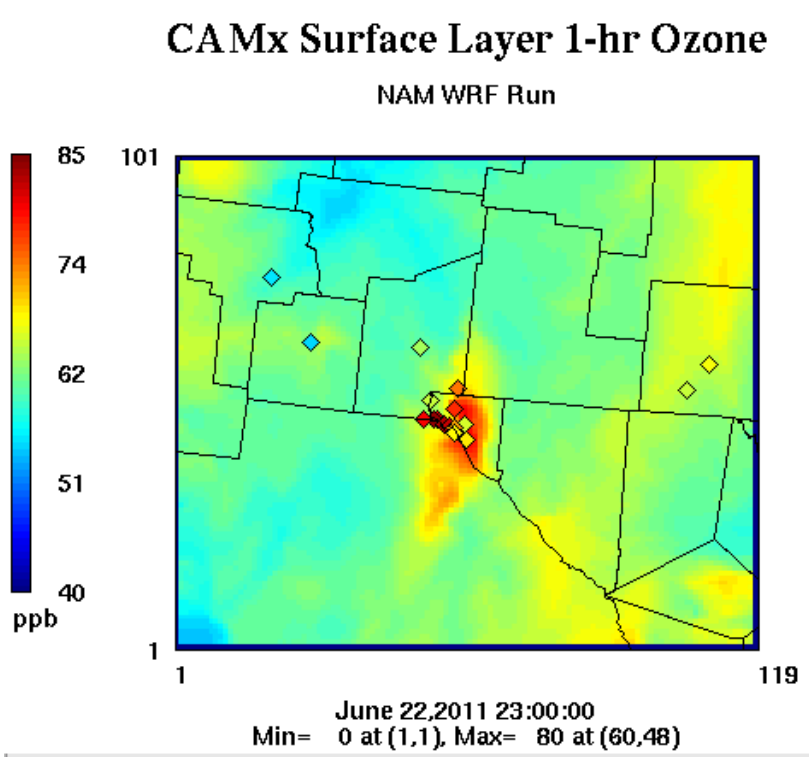




- Overall high bias
  - Some extended periods of overestimated ozone: July 5-9, August 4-9
- On high observed MDA8 days, model underestimates ozone
  - June 22

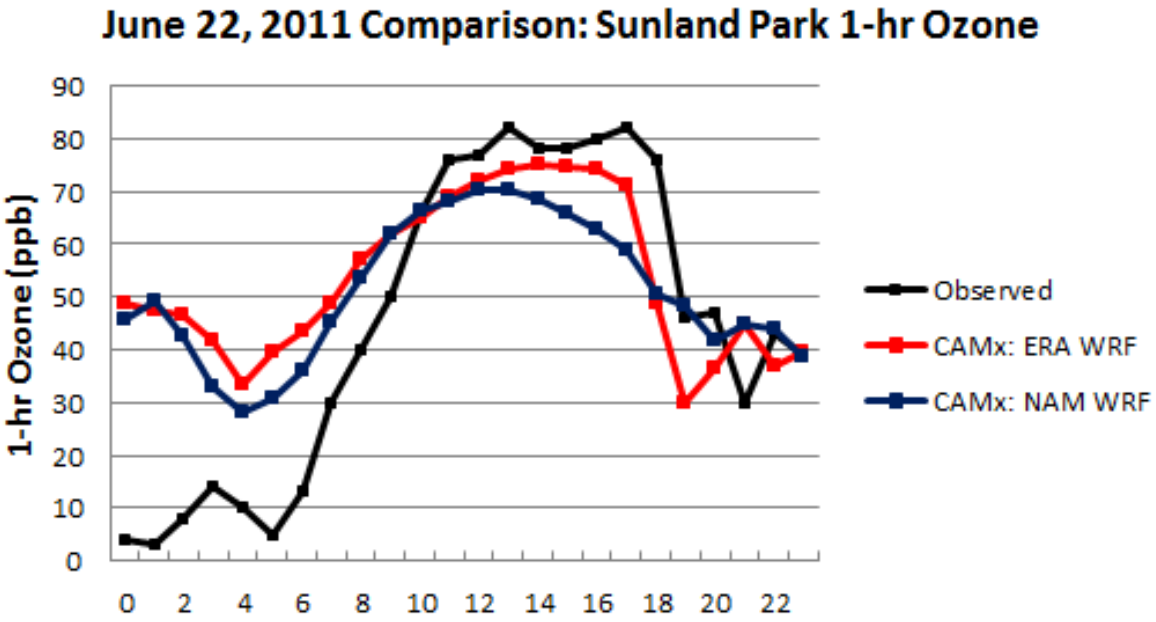
Sunland Park: June 22, 2011





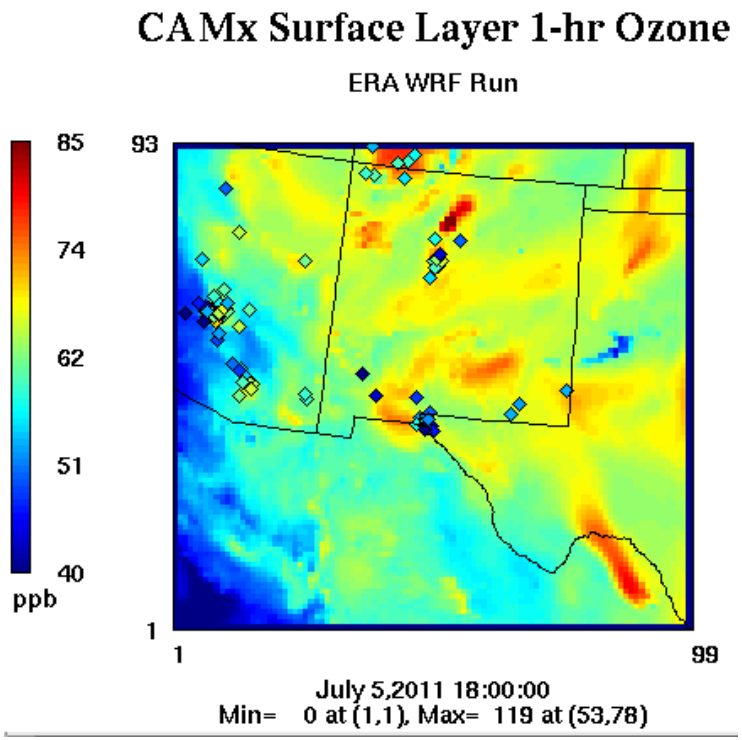
- Model simulates regional background well and captures presence of high ozone at Doña Ana County and El Paso monitors
- CAMx NAM places plume too far east
- Both runs underestimate timing and intensity of peak ozone

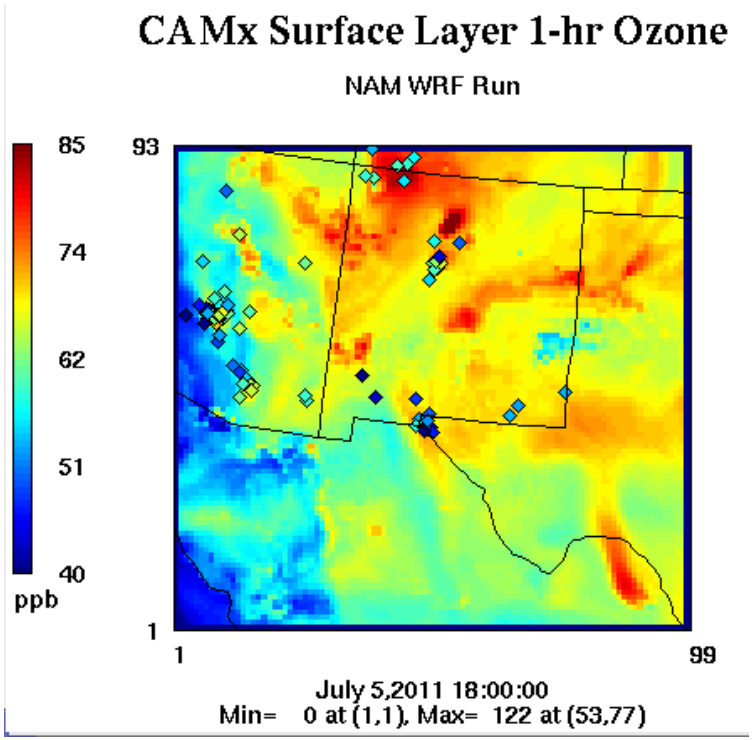
Sunland Park: June 22, 2011



- CAMx NAM places plume too far east
- Both models underestimate timing and intensity of peak ozone, but see enhanced ozone on this day

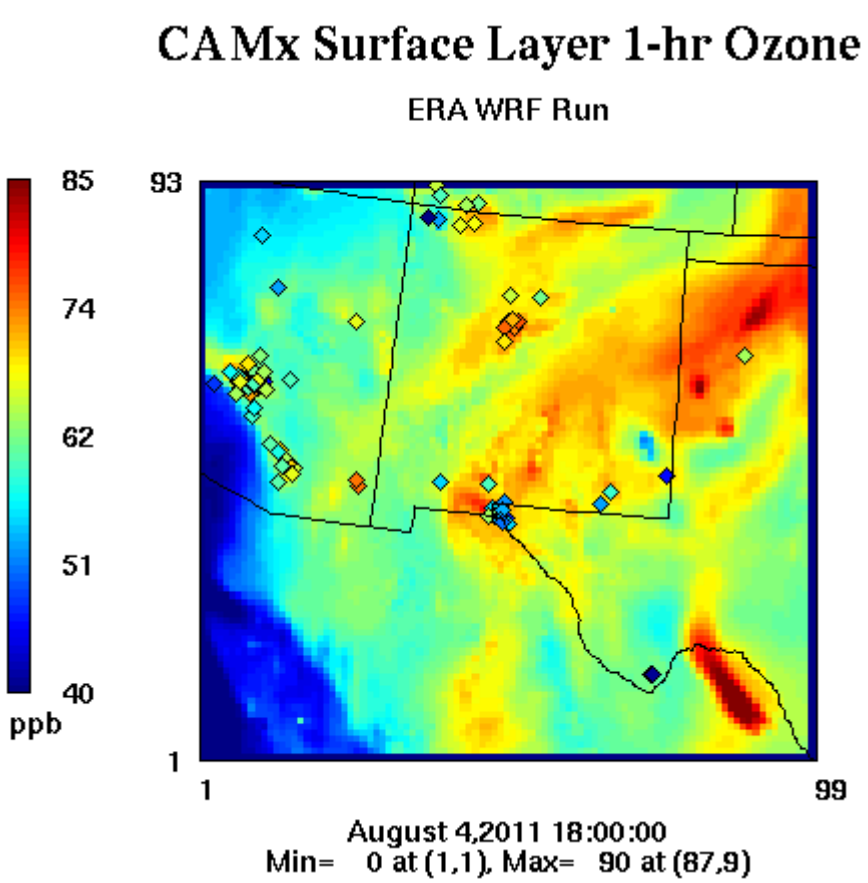
July 5, 2011: 1-hour Ozone

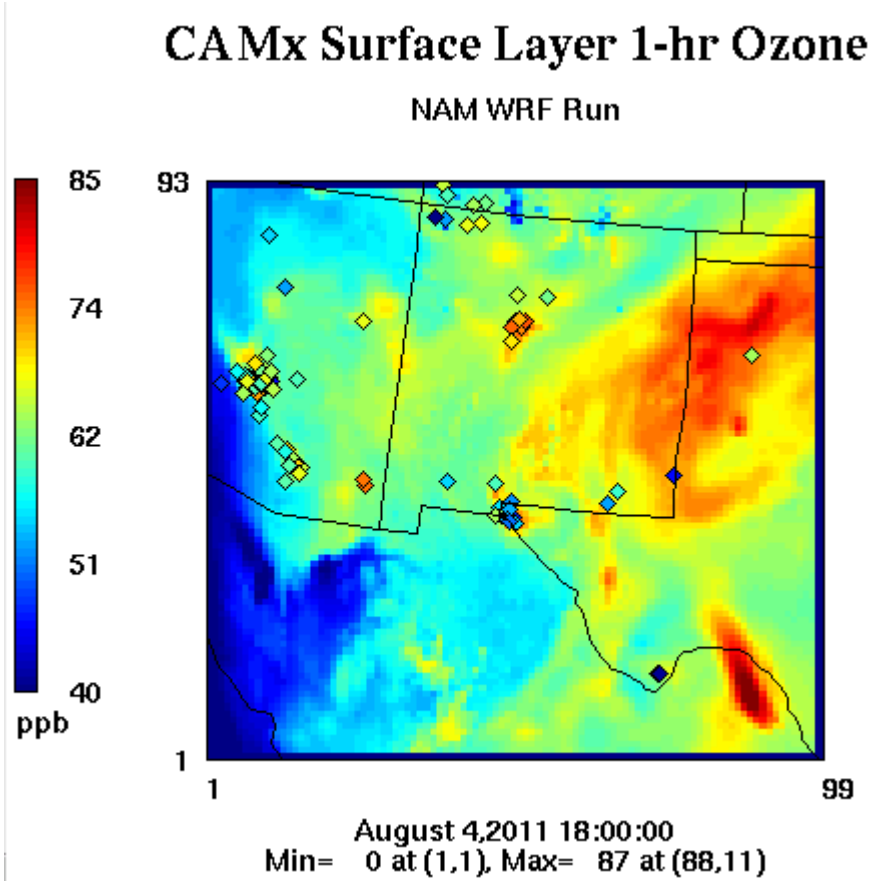




- For CAMx NAM run, 5 of the 10 highest modeled MDA8 days at Sunland Park occur during the July 5-9 episode
- Both runs overestimate ozone across NM and eastern AZ

August 4, 2011: 1-hour Ozone





- Broad regions of overestimated ozone across NM and North Texas in both runs

EPA MATS Projections of Future Year Design Values

$$DVF_{monitor\ i} = DVB_{monitor\ i} \times RRF_{monitor\ i}$$

$$RRF_{monitor\ i} = \frac{\sum_{days}(MDA8\ ozone)_{future\ year}}{\sum_{days}(MDA8\ ozone)_{base\ year}}$$

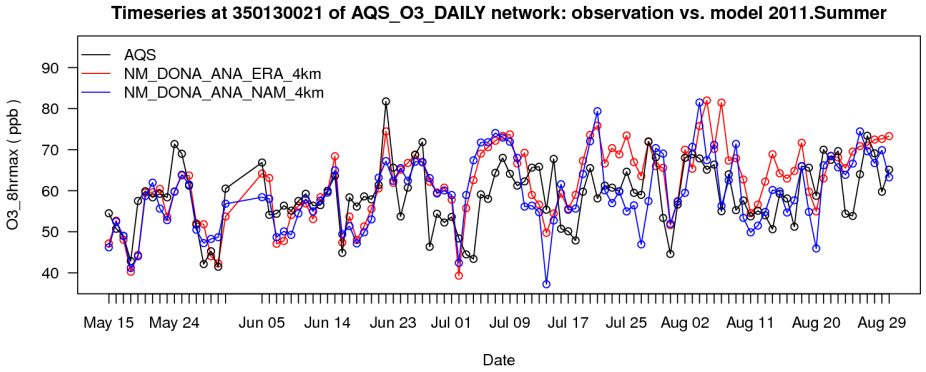
- Procedure
  - Fractional changes in MDA8 ozone between the base and future year are calculated for all monitors. These ratios are called relative response factors (RRF)
  - RRF are based on the **highest 10 modeled days** in the simulated period at each monitoring site

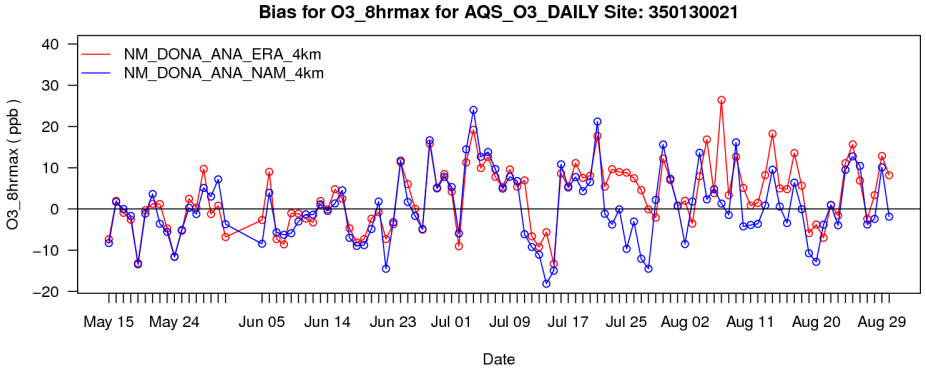
Desert View: Days with 10 Highest Modeled MDA8 Ozone

NM_DONA_ANA_ERA_4km				
Rank	Date	Obs_Average	Model_Average	Bias_Average
1	8/5/2011	65.13	81.97	16.84
2	8/7/2011	55.00	81.43	26.43
3	7/21/2011	58.13	75.84	17.71
4	8/4/2011	67.88	75.79	7.91
5	6/22/2011	81.75	74.45	-7.30
6	7/9/2011	64.13	73.71	9.58
7	7/20/2011	65.50	73.57	8.07
8	7/25/2011	64.63	73.44	8.82
9	7/8/2011	68.00	73.34	5.34
10	8/30/2011	65.13	73.31	8.18

NM_DONA_ANA_NAM_4km				
Rank	Date	Obs_Average	Model_Average	Bias_Average
1	8/4/2011	67.88	81.49	13.62
2	7/21/2011	58.13	79.34	21.22
3	8/26/2011	64.00	74.45	10.45
4	7/7/2011	64.38	74.05	9.67
5	7/8/2011	68.00	72.93	4.93
6	7/20/2011	65.50	72.03	6.53
7	7/9/2011	64.13	71.94	7.81
8	7/6/2011	58.00	71.82	13.82
9	7/5/2011	59.13	71.76	12.64
10	8/9/2011	55.25	71.40	16.15

Average Bias on 10 highest modeled MDA8 days	
NAM	11.68
ERA	10.16





Summary of Performance on 10 Highest MDA8 Days: Doña Ana County Monitors

Average Bias in MDA8 on 10 Highest Modeled MDA8 days (ppb)		
Monitor	CAMx: NAM WRF	CAMx: ERA WRF
Desert View	11.7	10.2
Sunland Park	14.6	13.9
La Union	18.3	19.4
Chapparal	16.4	15.9
Santa Teresa	12.4	11.3
Solano	12.1	11.0

Average Observed Value on 10 Highest Modeled Days (ppb)		
Monitor	CAMx: NAM WRF	CAMx: ERA WRF
Desert View	62.4	65.5
Sunland Park	58.4	61.3
La Union	56.0	57.0
Chapparal	56.2	59.6
Santa Teresa	61.5	63.8
Solano	58.9	61.7

- Both runs overestimate ozone on 10 highest modeled days
  - ERA run has slightly lower bias overall
  - Observed values are higher on the 10 highest modeled days using the ERA CAMx run
  - Observed values are slightly closer to the actual monitored DVs using the ERA run
- Modeled high ozone days do not correspond well with observed high ozone days
- RRF will not reflect conditions that produce high observed ozone in Doña Ana County

Ozone MPE Summary

- Model performance is acceptable based on comparison with EPA statistical benchmarks
  - In both CAMx runs, model has overall high bias, but underestimates MDA8 ozone on days when observed MDA8 > 60 ppb
- CAMx ERA run performs slightly better than CAMx NAM run when MDA8 > 60 ppb
- For both CAMx runs, 10 highest MDA8 days that will form RRF have significant regional ozone overestimates
  - Most of the 10 highest modeled days did not have high observed ozone
  - CAMx ERA run had slightly lower bias on these days than CAMx NAM run
- Unlikely that using default MATS RRF method will give useful results for developing emissions control strategies
  - Local controls will not reduce Dona Ana County ozone if RRF based on days when model is greatly overestimating the regional background
- Propose alternate method for future year DV projections

Alternate DV Projection Method

- Use an ozone model performance criterion in selecting days for making RRFs and DVF projections
  - Use only modeled days in which the observed and modeled MDA8 ozone are within a specified % bias of one another.
- Resulting RRFs are based on more days with observed high ozone and better model performance
  - Days with high modeled ozone when the model performed poorly would not be used in the RRF
- Use RRFs to determine whether the CAMx NAM or CAMx ERA run should be used as the 2011 base case in the SNMOS

DV Projection Method Example: Desert View

Default MATS Method

		MDA8 (ppb)		Bias	
Rank	Date	Observed	Modeled	(ppb)	(%)
1	8/5/2011	65.125	81.966	16.841	25.86%
2	8/7/2011	55	81.433	26.433	48.06%
3	7/21/2011	58.125	75.839	17.714	30.48%
4	8/4/2011	67.875	75.785	7.91	11.65%
5	6/22/2011	81.75	74.447	-7.303	-8.93%
6	7/9/2011	64.125	73.708	9.583	14.94%
7	7/20/2011	65.5	73.573	8.073	12.33%
8	7/25/2011	64.625	73.442	8.817	13.64%
9	7/8/2011	68	73.339	5.339	7.85%
10	8/30/2011	65.125	73.307	8.182	12.56%

Top 10 observed MDA8 days

Top 10 modeled MDA8 days

Alternate Method

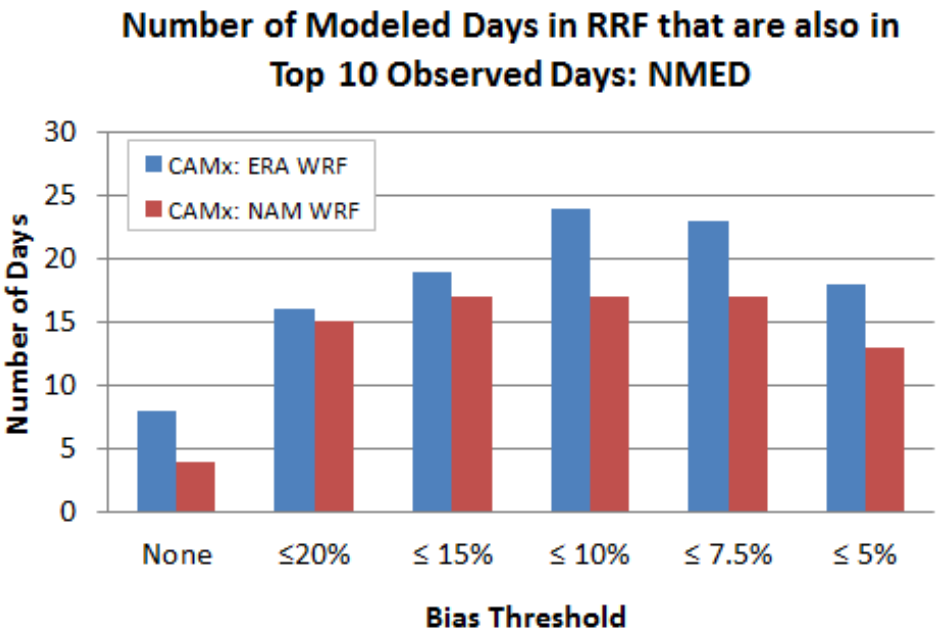
		MDA8 (ppb)		Bias	
Rank	Date	Observed	Modeled	(ppb)	(%)
1	6/22/2011	81.75	74.447	-7.303	-8.93%
2	7/8/2011	68	73.339	5.339	7.85%
3	8/28/2011	69.125	72.483	3.358	4.86%
4	7/28/2011	72	71.9	-0.1	-0.14%
5	8/18/2011	66	71.665	5.665	8.58%
6	8/27/2011	73.375	70.966	-2.409	-3.28%
7	8/6/2011	66.375	70.191	3.816	5.75%
8	8/2/2011	68	69.984	1.984	2.92%
9	6/26/2011	68.75	68.794	0.044	0.06%
10	8/22/2011	67.5	68.517	1.017	1.51%

Top 10 observed MDA8 days

Top 10 modeled MDA8 days

- Choose top 10 modeled MDA8 days with bias < ±10%
  - The 10 days to be used in the RRF now include 4 of the 10 highest observed days at Desert View
- Model performance is reasonably good on all days that would go into the RRF.
- Observed and modeled MDA8 values are now closer to the observed base year DV than would be the case using the default MATS method
- More confidence that alternate method RRF days reflect conditions that cause high ozone in Doña Ana County

Selection of Bias Threshold and CAMx Run



- Threshold of bias < ±10% produces RRF with highest number of observed high ozone days
- CAMx ERA run has closer correspondence between 10 highest modeled and observed MDA8 ozone days at the Doña Ana County monitors
- CAMx ERA run is better suited for making future year ozone projections and for emissions control strategy development
- Given this and better MPE stats when MDA8>60 ppb, selected CAMx ERA run for SNMOS

MPE for Ozone Precursors and PM for CAMx ERA Run

- $PM_{2.5}$ underestimated across New Mexico and the surrounding region
  - Underestimate of total $PM_{2.5}$ consistent with underestimates of component species including NH_4, NO_3, and SO_4
  - Reasons unclear, but focus of SNMOS is ozone so did not attempt to diagnose cause(s)
- Performance for NO_2 and CO and PM roughly comparable to that of other similar studies in the western U.S. such as the WAQS
- Conclude that CAMx ERA run performance for PM and ozone precursors NO_2 and CO is adequate for the SNMOS and model is functioning properly

Task 7 Summary

- CAMx SNMOS 2011 model performance for ozone is acceptable based on comparison with EPA statistical benchmarks
- Selected CAMx ERA run to be SNMOS 2011 base year run
  - Performs better than CAMx NAM run when MDA8 > 60 ppb and in producing RRFs in which modeled high ozone corresponds to observed high ozone
- 10 highest modeled MDA8 days that would be used in future year projections using default MATS method have significant regional overestimates of ozone for all Doña Ana County monitors
  - Most of the 10 highest modeled days did not have high observed ozone
  - RRFs will not reflect conditions that produce high observed ozone in Doña Ana County
  - Default MATS RRF method unlikely to give useful results for developing emissions control strategies
- Proposed alternate method for future year DV projections ozone model that uses a performance criterion in selecting days for making RRFs and DVF projections
  - Increases confidence that RRF days reflect conditions that cause high ozone in Doña Ana County

Southern New Mexico Ozone Modeling Study

Task 8: Prepare Future Year Emissions with SMOKE

University of North Carolina (UNC-IE)
Ramboll-Environ (RE)

April 30, 2016

Task 8 Objectives and Deliverables

- Objective
  - Combine the U.S. EPA 2011v2 modeling platform 2025 projection inventory, WAQS future year O&G inventories, and future year Mexico inventories to estimate future year emissions for the Southern New Mexico Ozone Study.
- Deliverables
  - Power Point Presentation on future year emissions modeling (**Completed 4/30/2016**)
- Tasks
  - Collect U.S. EPA 2011v2 future year inventory data for the SNMOS modeling domains (**Completed 3/15/2016**)
  - Use the Sparse Matrix Operator Kernel Emissions (SMOKE) model to prepare 12-km and 4-km emissions for CAMx (**Completed 4/12/2016**)
  - Summarize the future year emissions inventories and processing results (**Completed 4/30/2016**)
  - Prepare a Power Point presentation on future year emissions modeling (**Completed 4/30/2016**)

Emissions Projection Conventions

Base Year → Future Year

- Projections = growth + controls
- Do not decouple a base and future year inventory pair
- Natural emissions categories are held constant
- Anthropogenic emissions categories may be projected
- Typically no changes to spatial allocation, temporal patterns, or speciation

Future Year Emissions Data for SNMOS Base11b Platform

- Non-O&G
  - EPA 2011NEIv2 Platform
  - 2025 projection year
    - Technical Documentation* available from EPA
  - Same categories as 2011 base (including O&G)
- O&G
  - WAQS 2020 projections off of 2011 Phase 2
  - Permian Basin 2025 projections from the NEI2011v2
- Mexico
  - 2025 projections off of the MNEI 2008
  - See Task 3 Powerpoint slides for details

* https://www.epa.gov/air-emissions-modeling/2011-version-62-technical-support-document

Future Year Emissions Data for SNMOS Base11b Platform

- Biogenic
  - MEGANv2.10 with 2011 SNMOS WRF meteorology
- Fires
  - PMDETAIL version 2 daily 2011 inventory
- Lightning
  - Daily lightning NO calculated with 2011 SNMOS WRF meteorology
- Ancillary Emissions Data
  - Same as SNMOS 2011 Base11b modeling

Emissions Processing for SNMOS 2025 Emissions

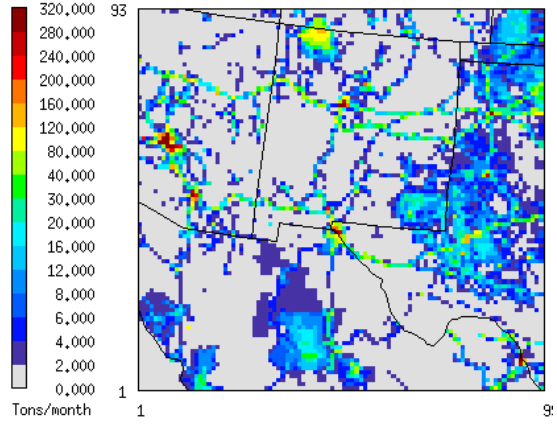
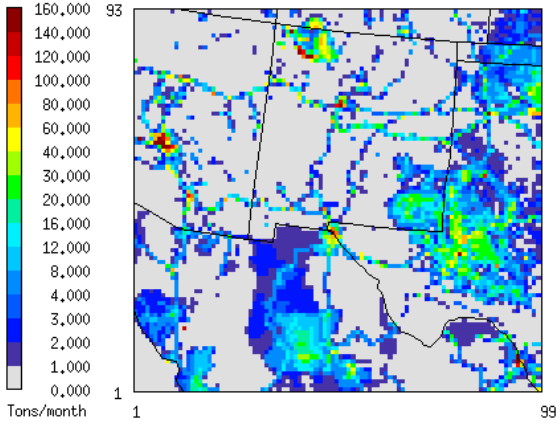
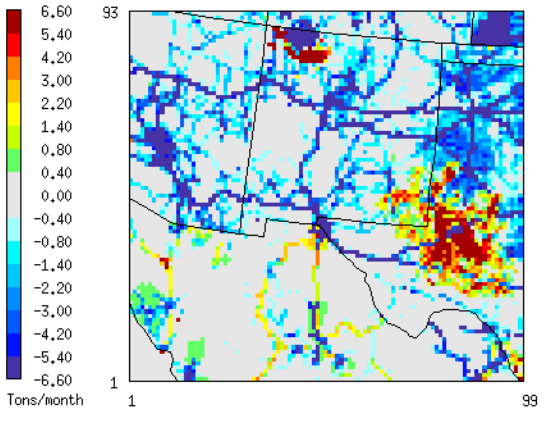
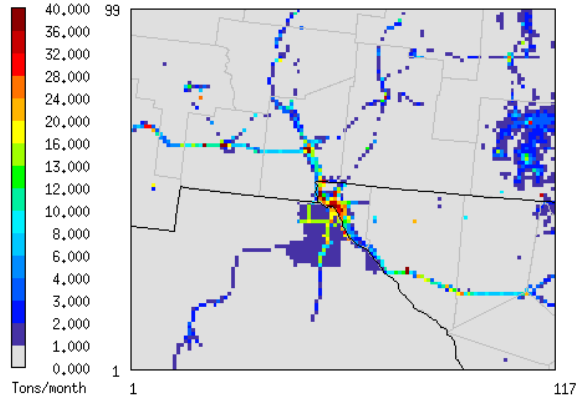
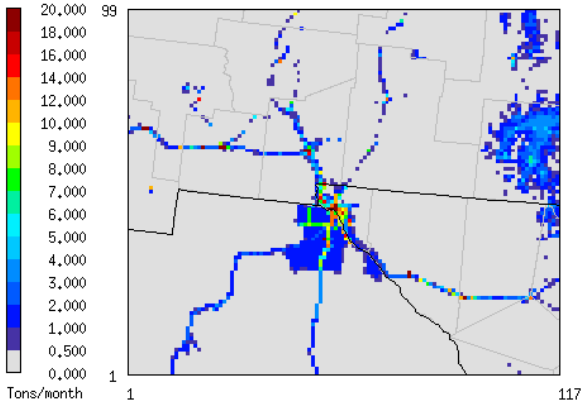
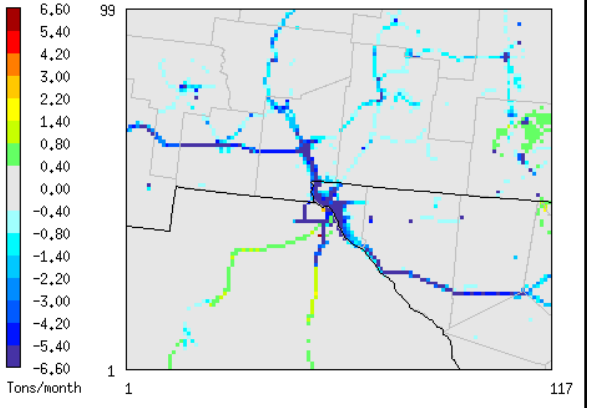
- Same SMOKE configuration as Base11b
  - See Task 4 emissions modeling memo for details
- Simulation ID: SNMOS Base25a_11b
- Processing Period: April 15 – August 31, 2011
- Domains: SNMOS 12-km and 4-km

SNMOS 2025 Emissions Results

- US emissions totals charts are for May – Sep
- Mexico emissions totals charts are annual
- Emissions tileplot examples of 12 and 4-km domains
- Summary Charts
  - By NM and TX county; by Mexico border state
  - Total percent change by county
  - Stacked bar plots comparing 2011 and 2025
  - Absolute difference stacked bar plots
  - Percent difference stacked bar plots show the percent change for each inventory sector
    - Note that the sum of the individual sector changes does not add up to the total change

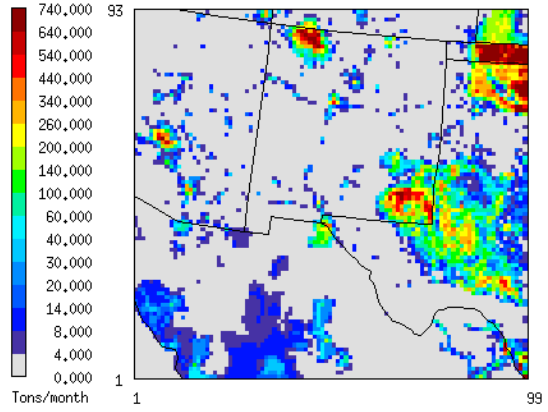
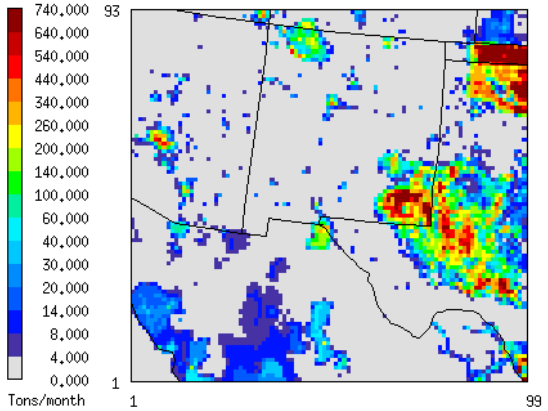
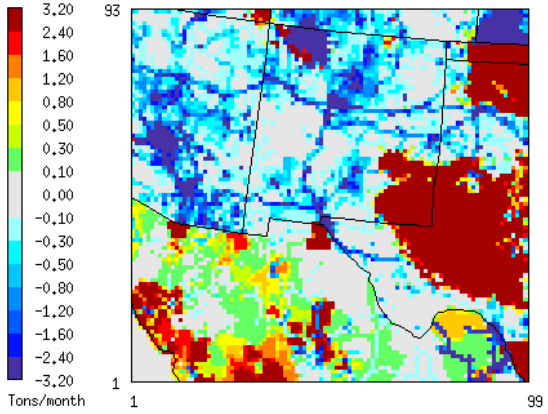
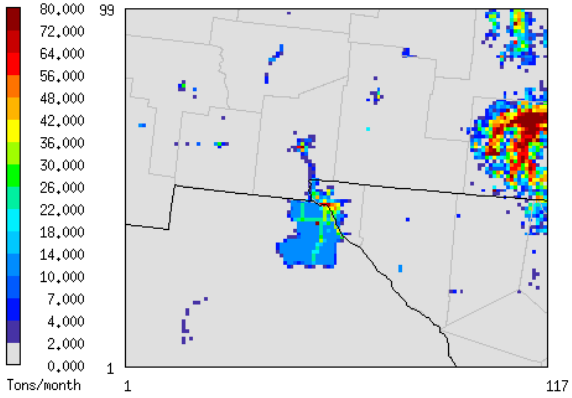
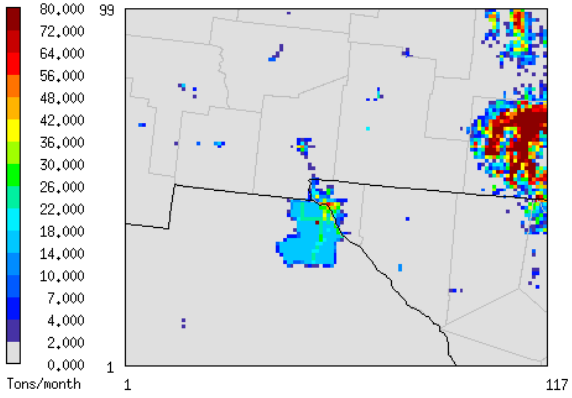
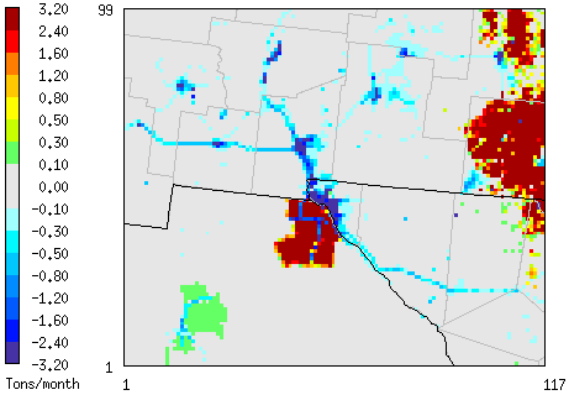
SNMOS 2025 Emissions Results

May Total Anthropogenic NOx Emissions: 2011, 2025, and 2025-2011

	2011	2025	2025-2011
12km			
4km			

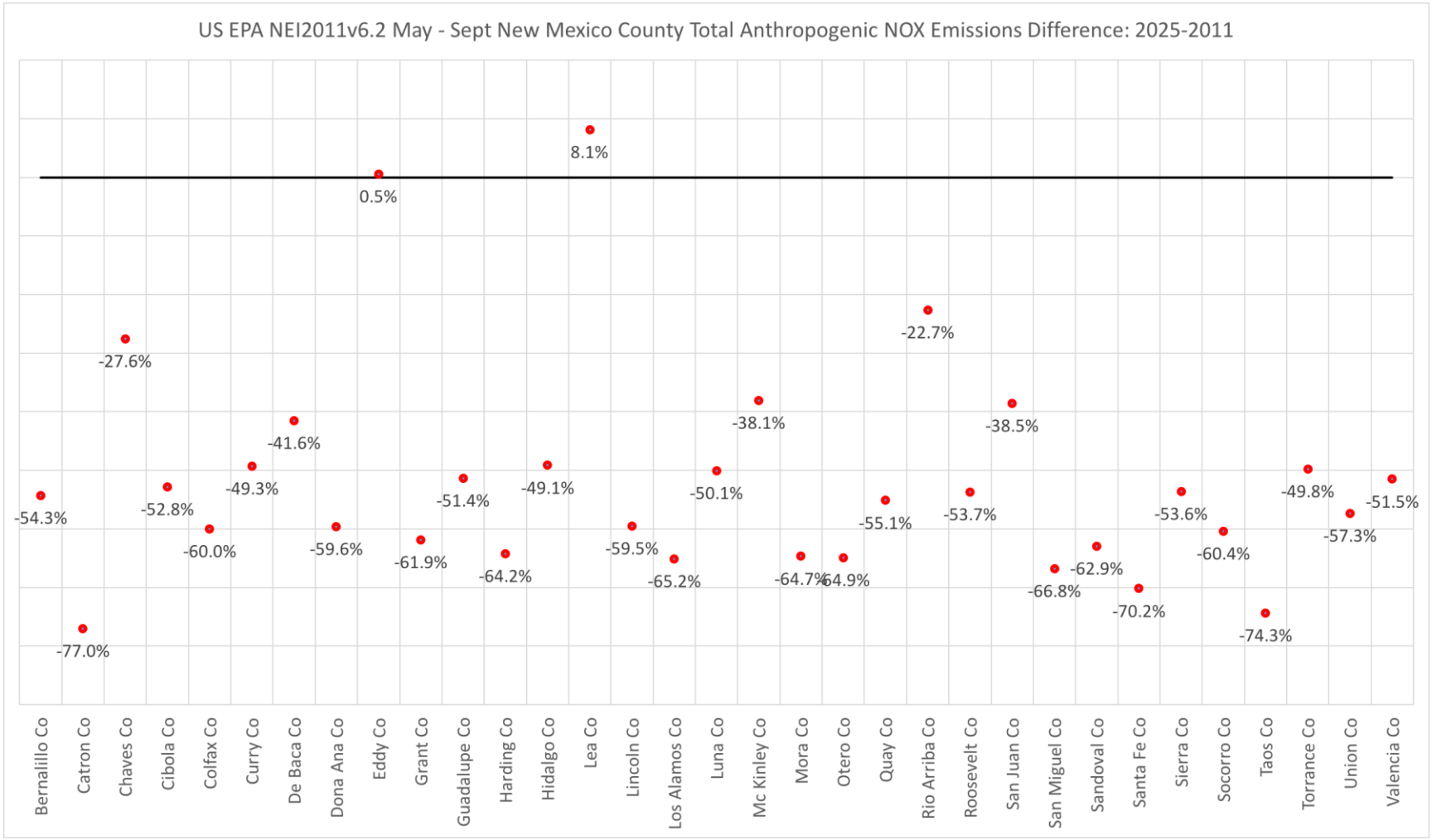
SNMOS 2025 Emissions Results

May Total Anthropogenic TOG Emissions: 2011, 2025, and 2025-2011

	2011	2025	2025-2011
12km			
4km			

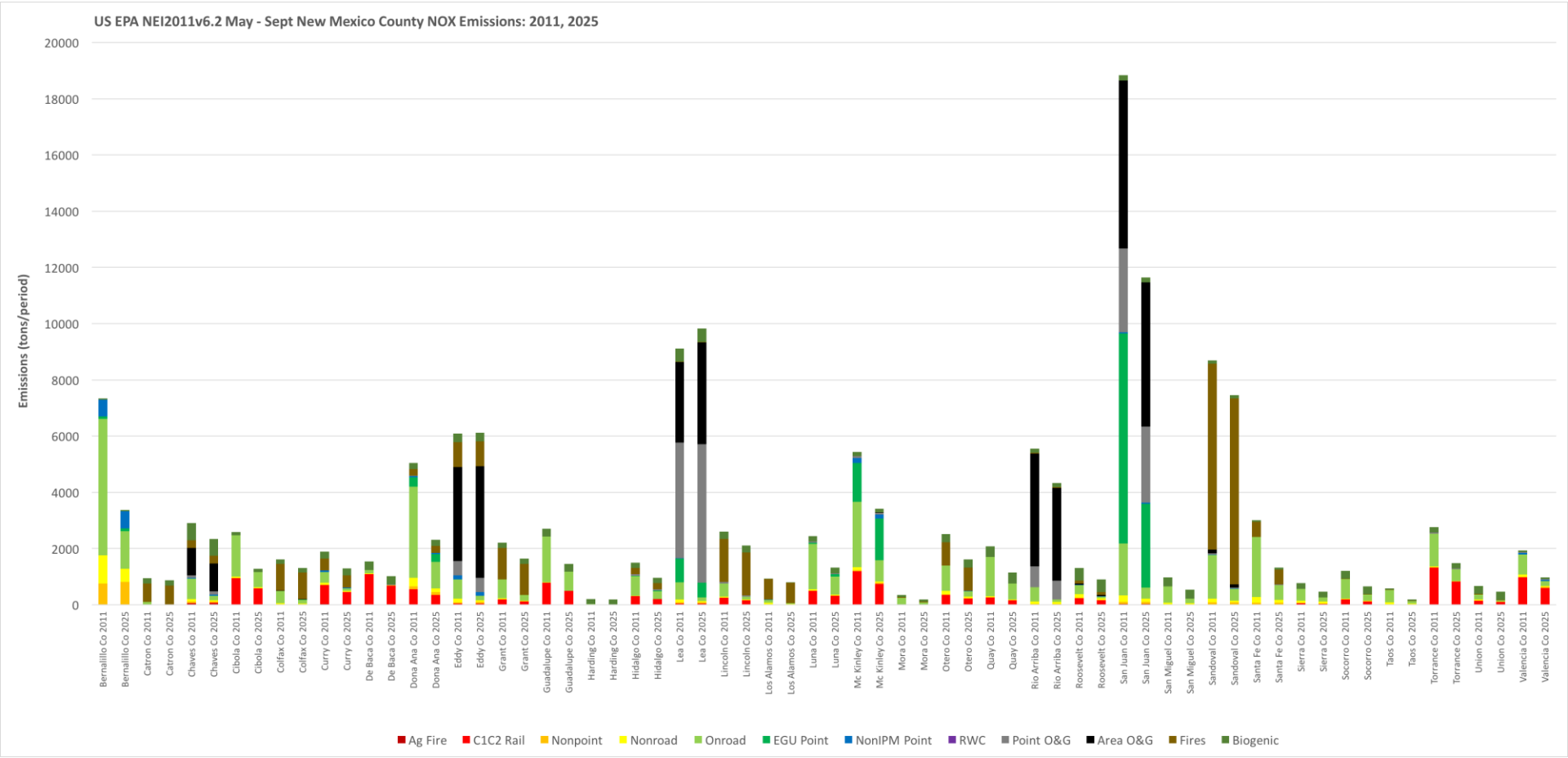
SNMOS 2025 Emissions Results

New Mexico Total Anthropogenic NOx Emissions Change: 2025-2011



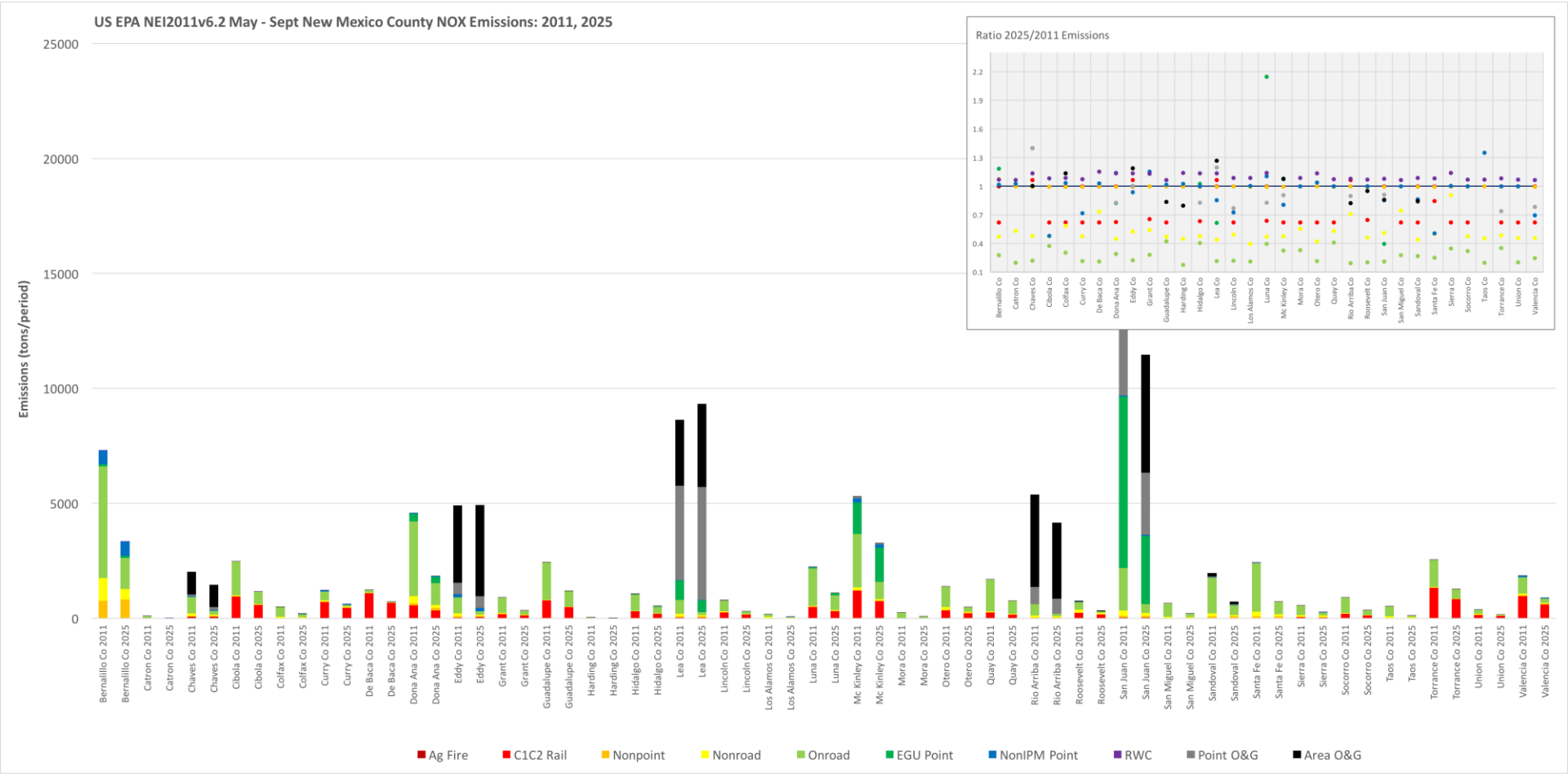
SNMOS 2025 Emissions Results

New Mexico 2011 and 2025 NOx Emissions: All Surface Sources



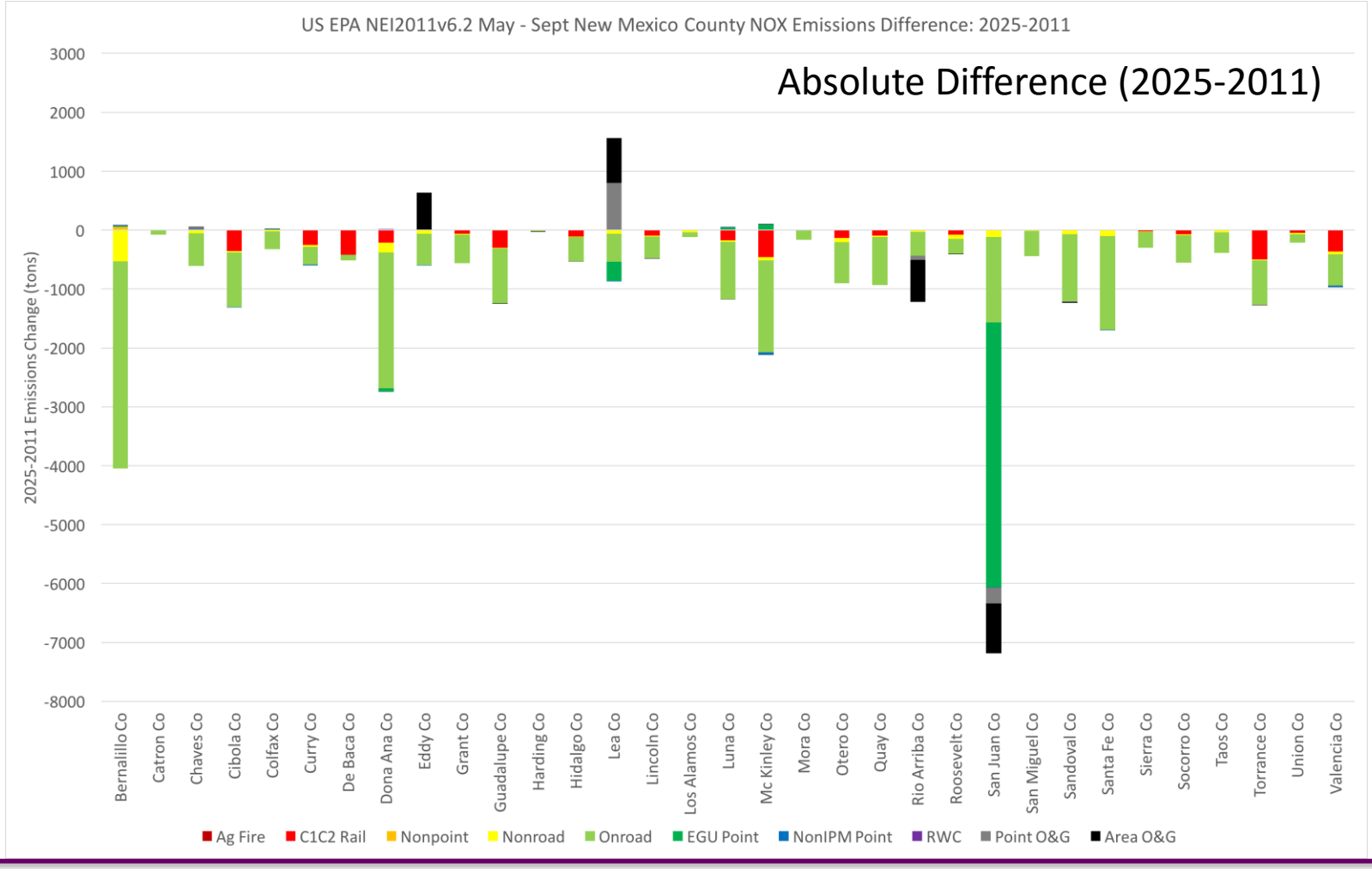
SNMOS 2025 Emissions Results

New Mexico 2011 and 2025 NOx Emissions: No Natural Sources



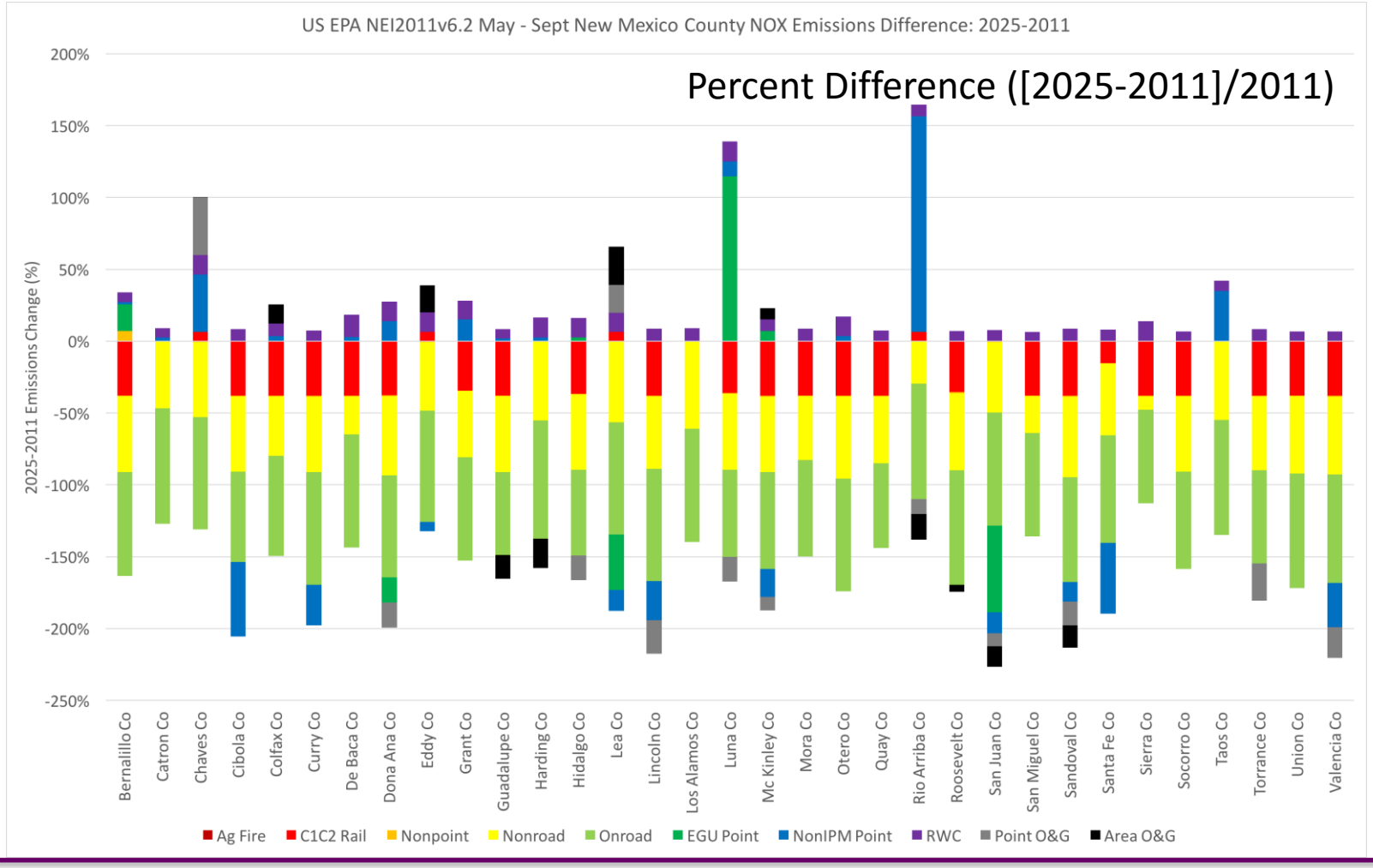
SNMOS 2025 Emissions Results

New Mexico 2011 and 2025 NOx Emissions Differences



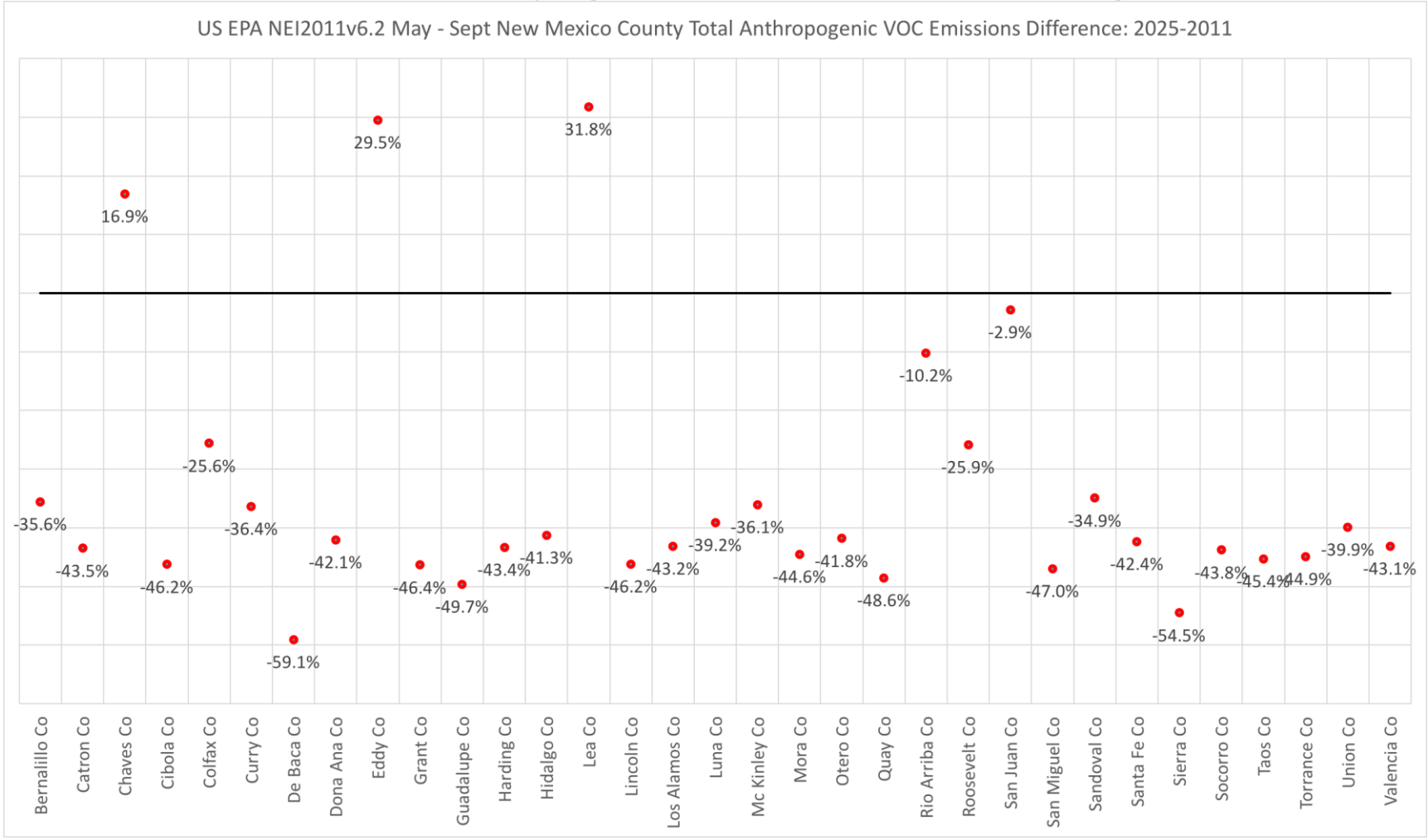
SNMOS 2025 Emissions Results

New Mexico 2011 and 2025 NOx Emissions Differences



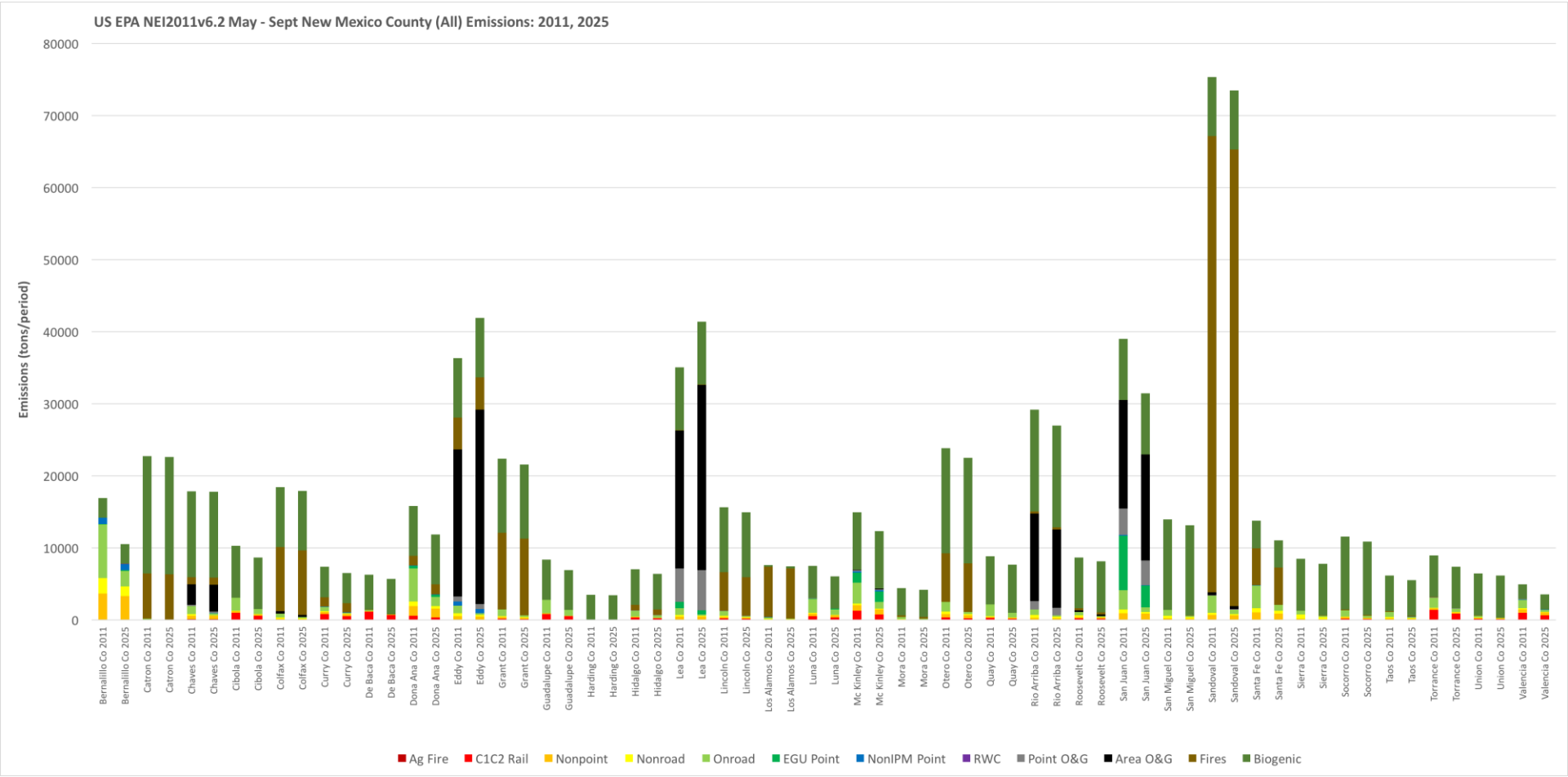
SNMOS 2025 Emissions Results

New Mexico Total Anthropogenic VOC Emissions Change: 2025-2011



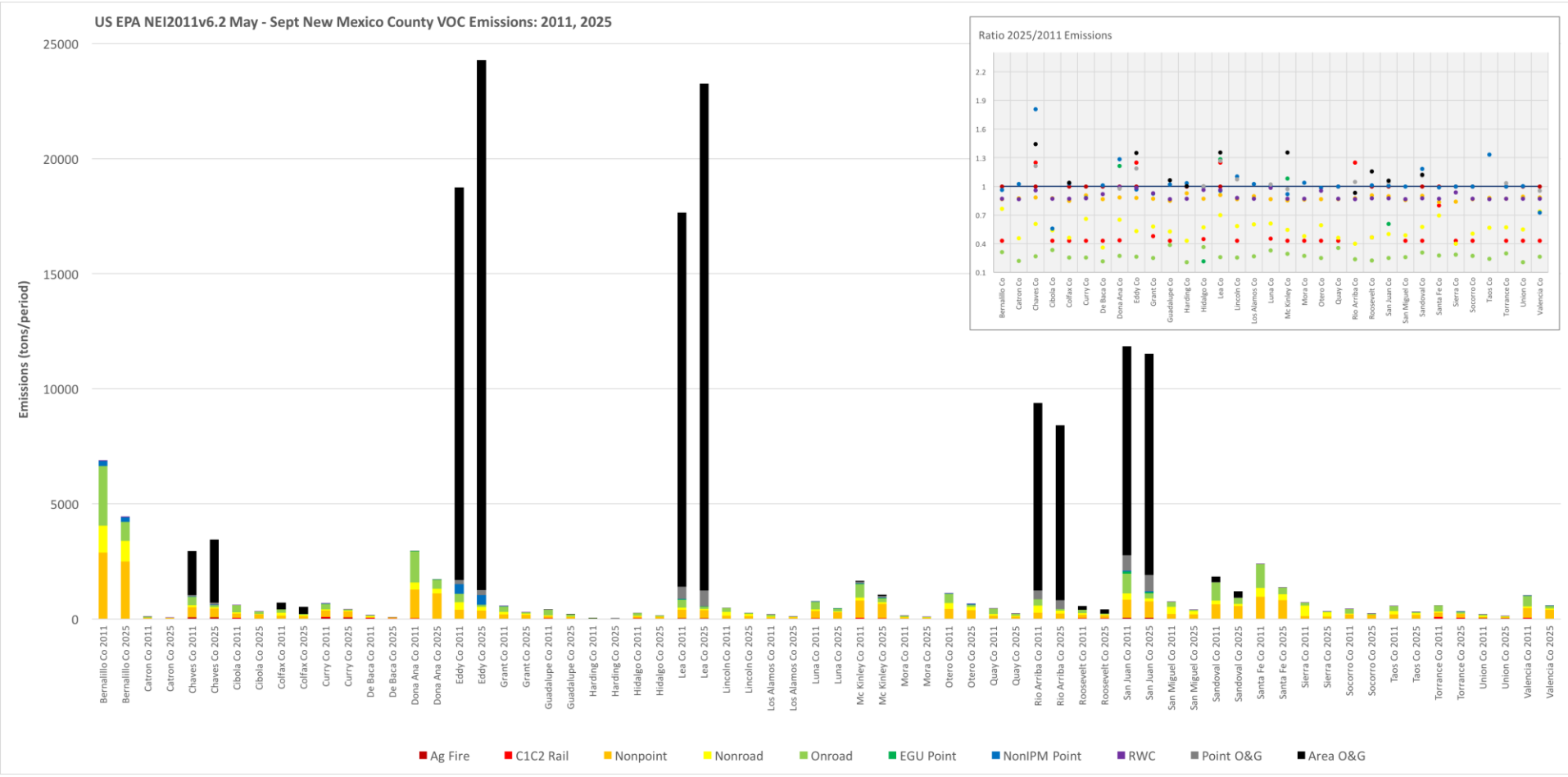
SNMOS 2025 Emissions Results

New Mexico 2011 and 2025 VOC Emissions: All Surface Sources



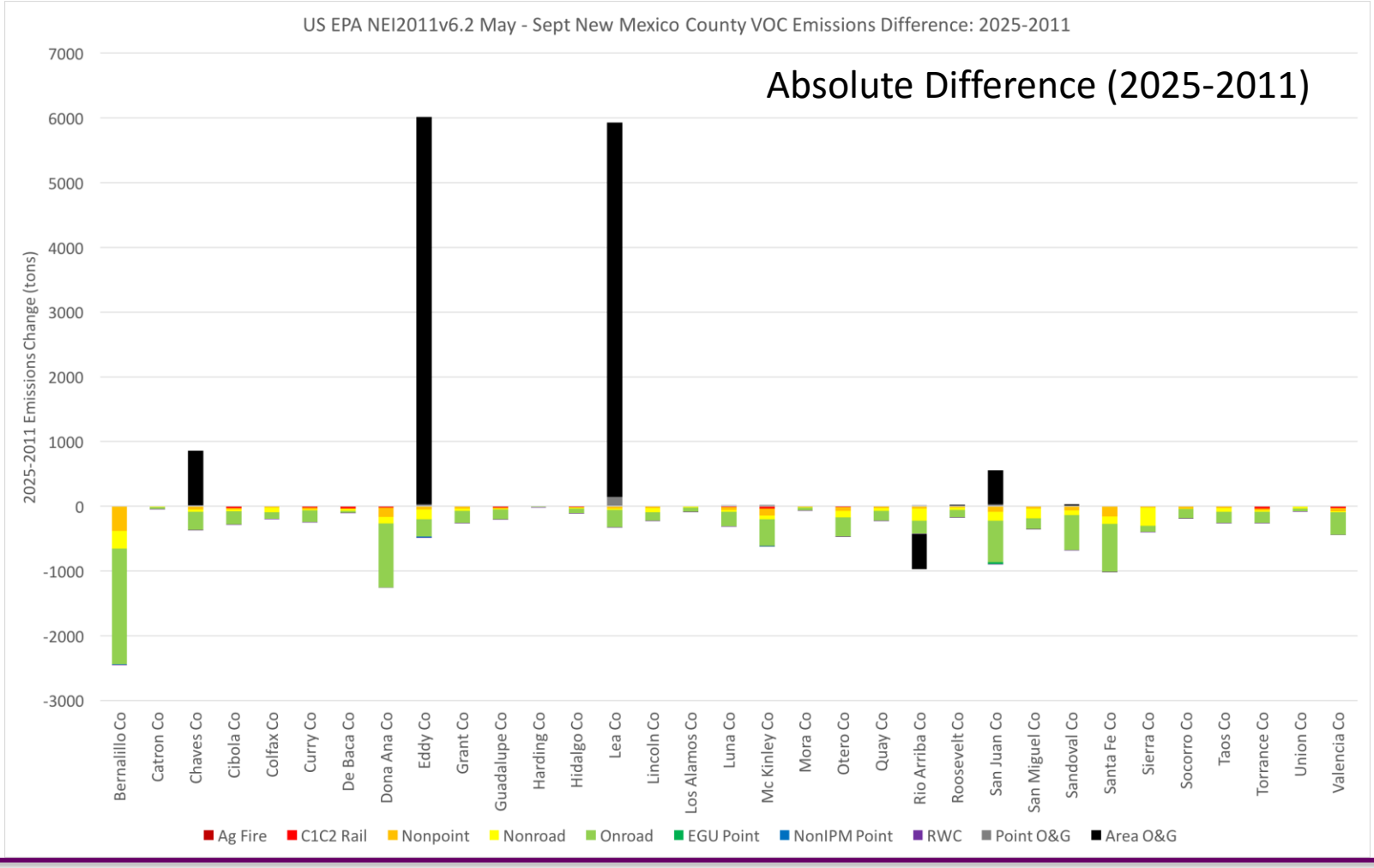
SNMOS 2025 Emissions Results

New Mexico 2011 and 2025 VOC Emissions: No Natural Sources



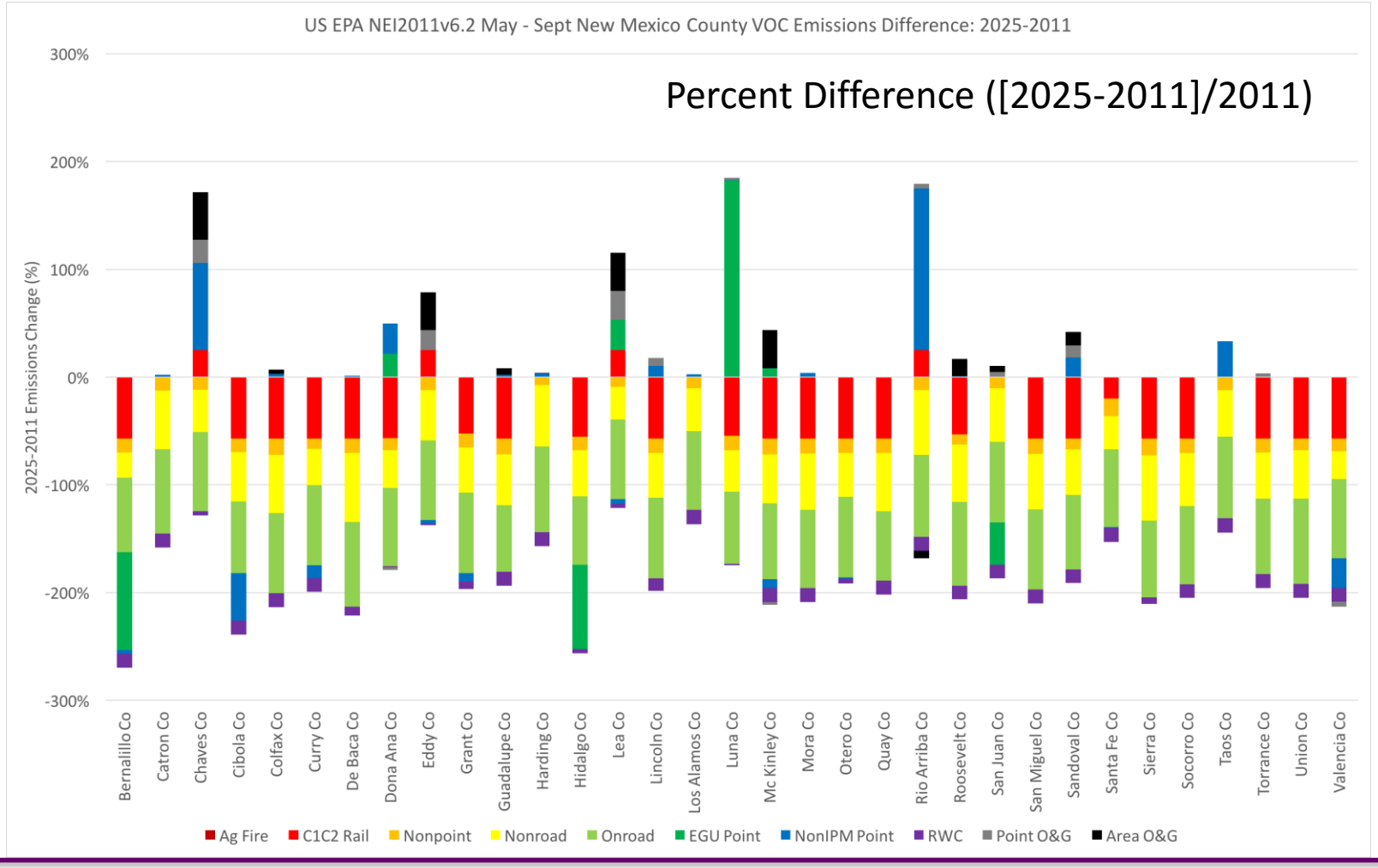
SNMOS 2025 Emissions Results

New Mexico 2011 and 2025 VOC Emissions Differences



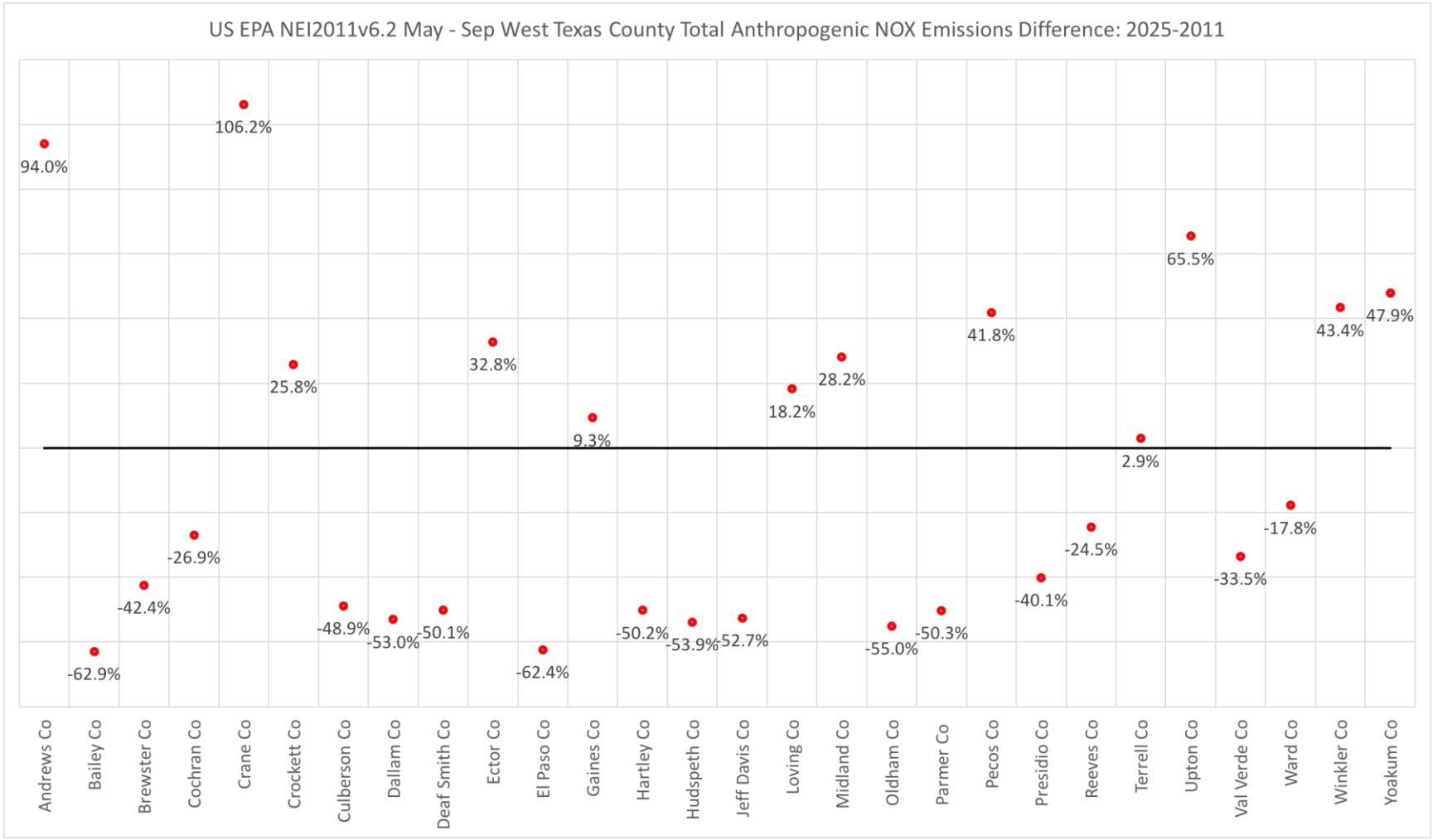
SNMOS 2025 Emissions Results

New Mexico 2011 and 2025 VOC Emissions Differences



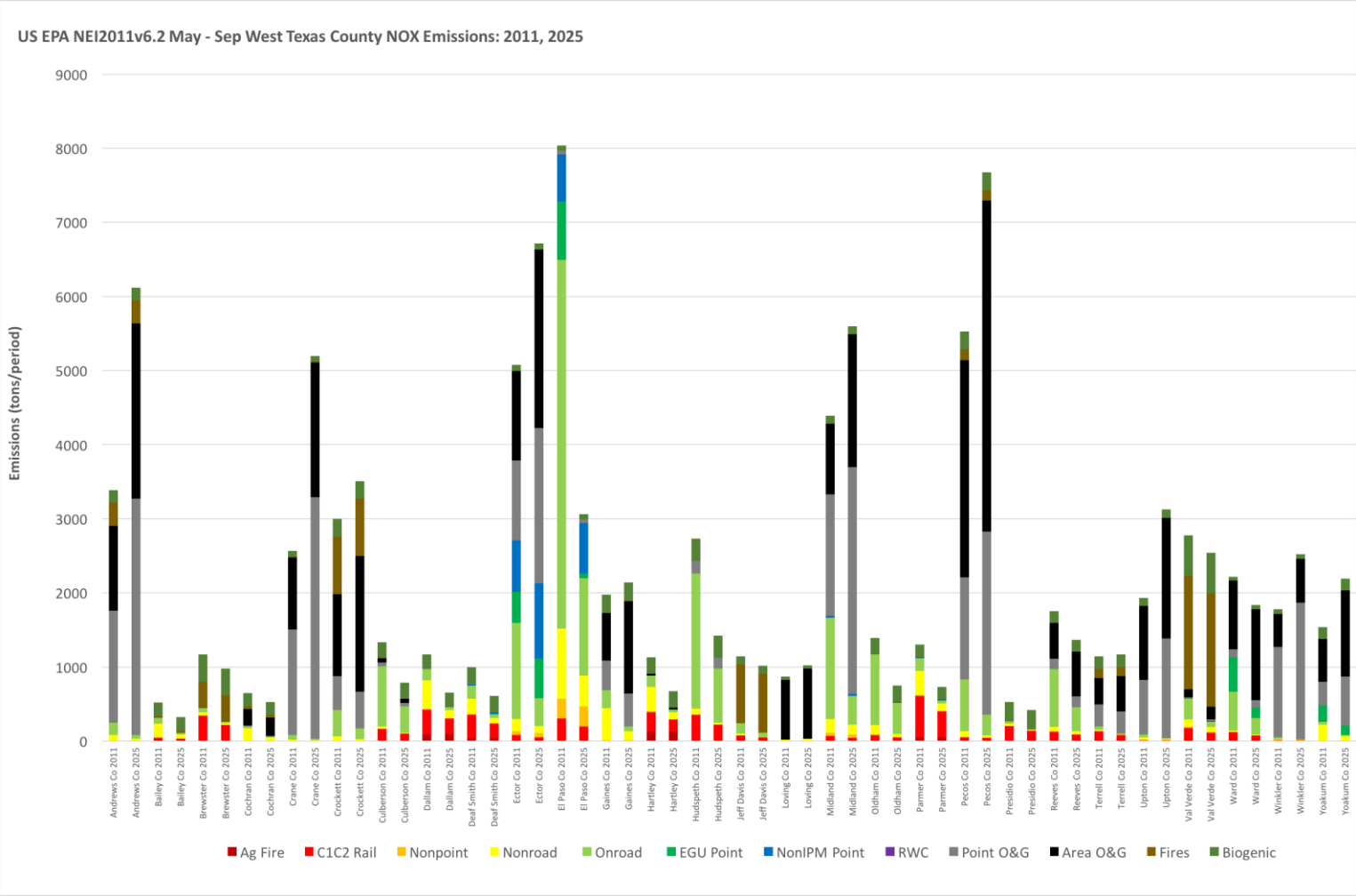
SNMOS 2025 Emissions Results

West Texas Total Anthropogenic NOx Emissions Change: 2025-2011



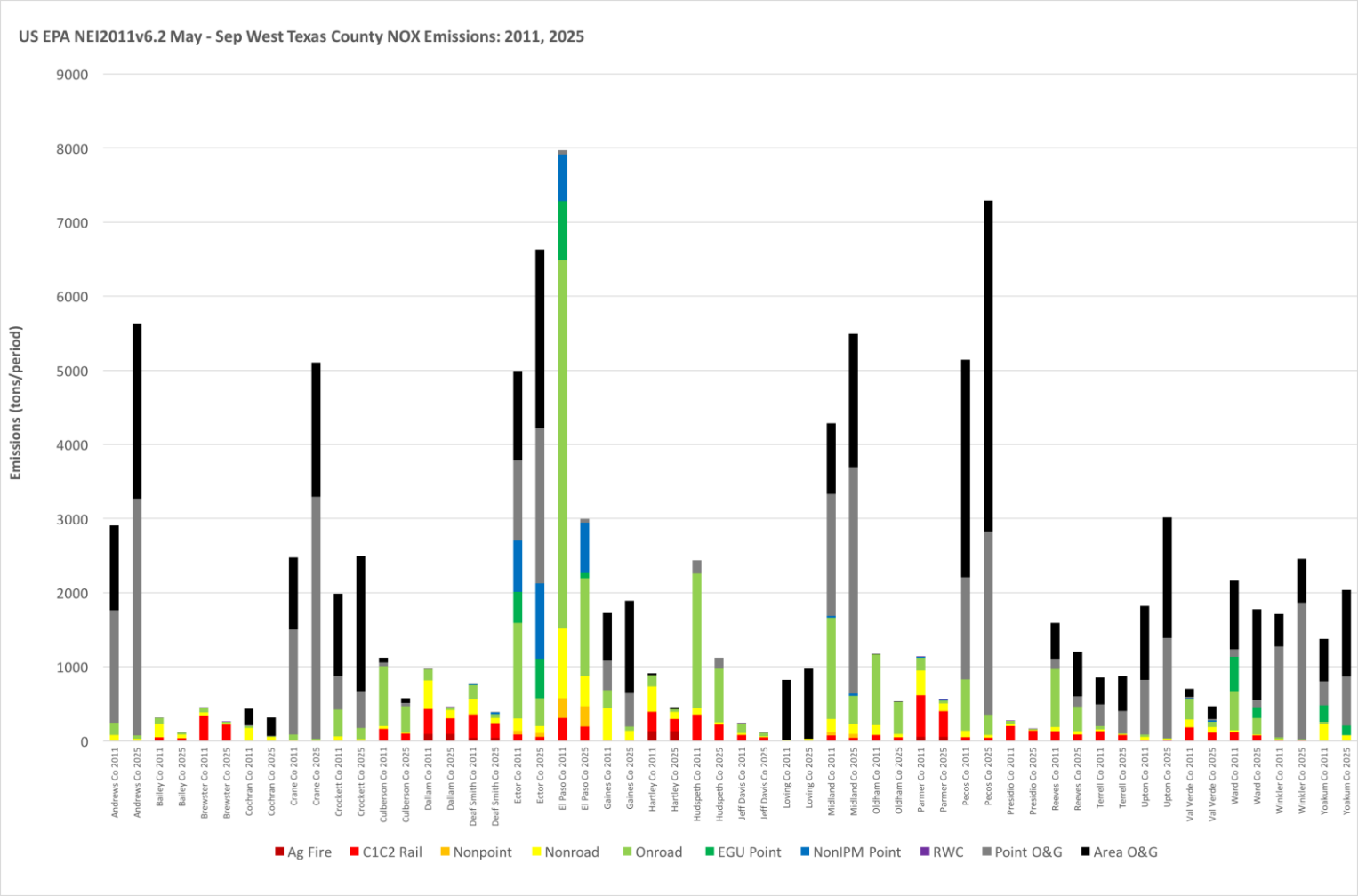
SNMOS 2025 Emissions Results

West Texas 2011 and 2025 NOx Emissions: All Surface Sources



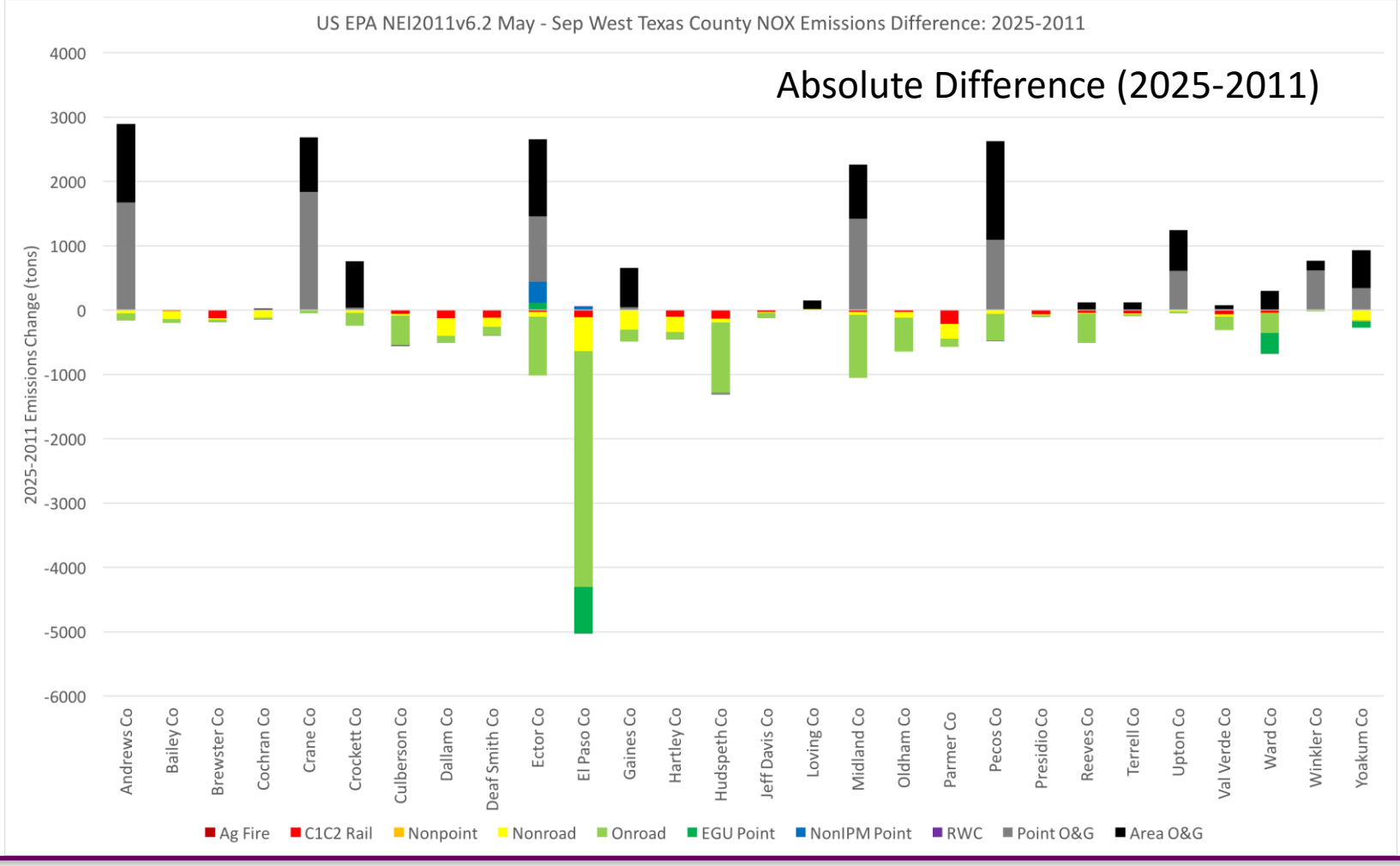
SNMOS 2025 Emissions Results

West Texas 2011 and 2025 NOx Emissions: No Natural Sources



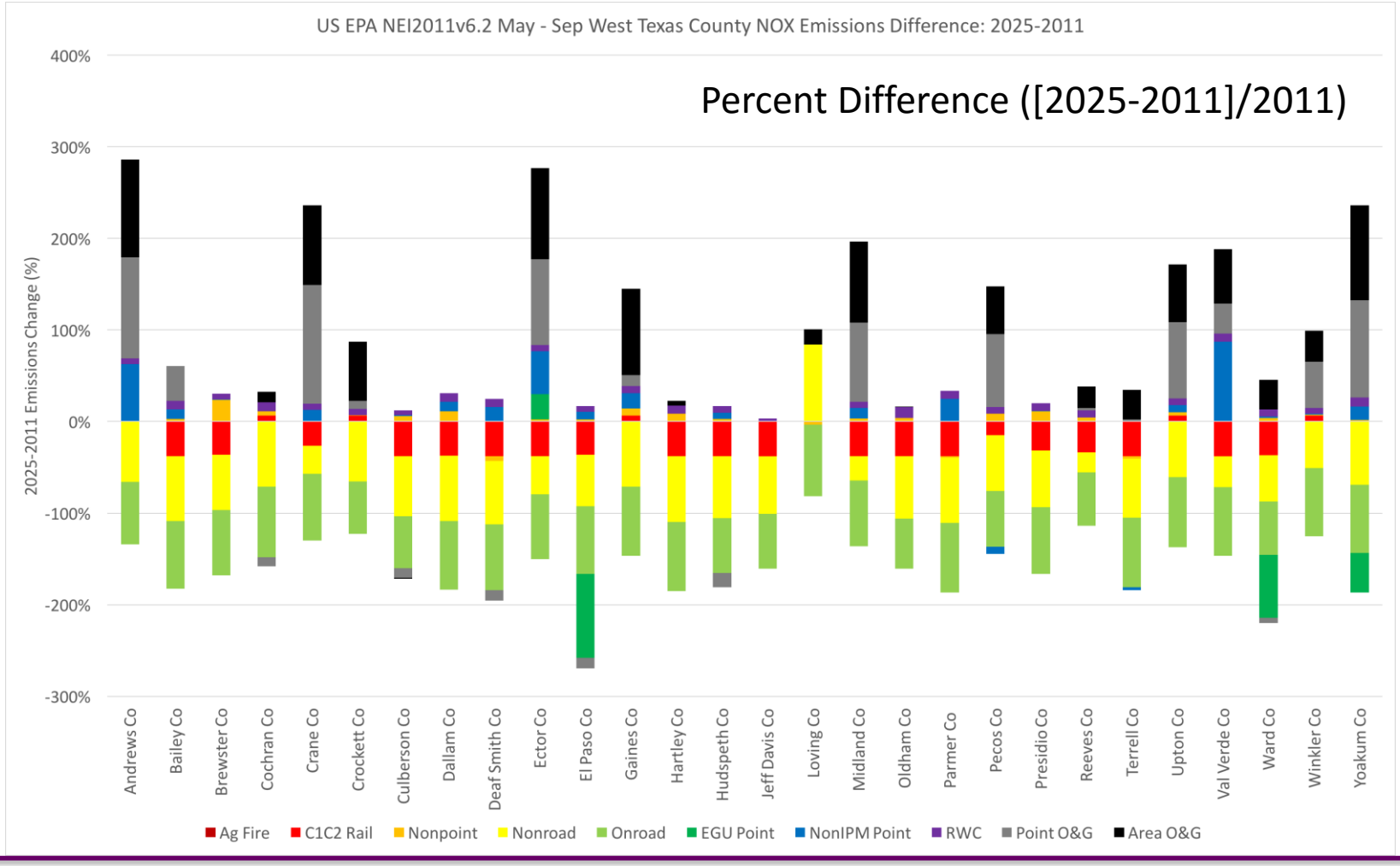
SNMOS 2025 Emissions Results

West Texas 2011 and 2025 NOx Emissions Differences



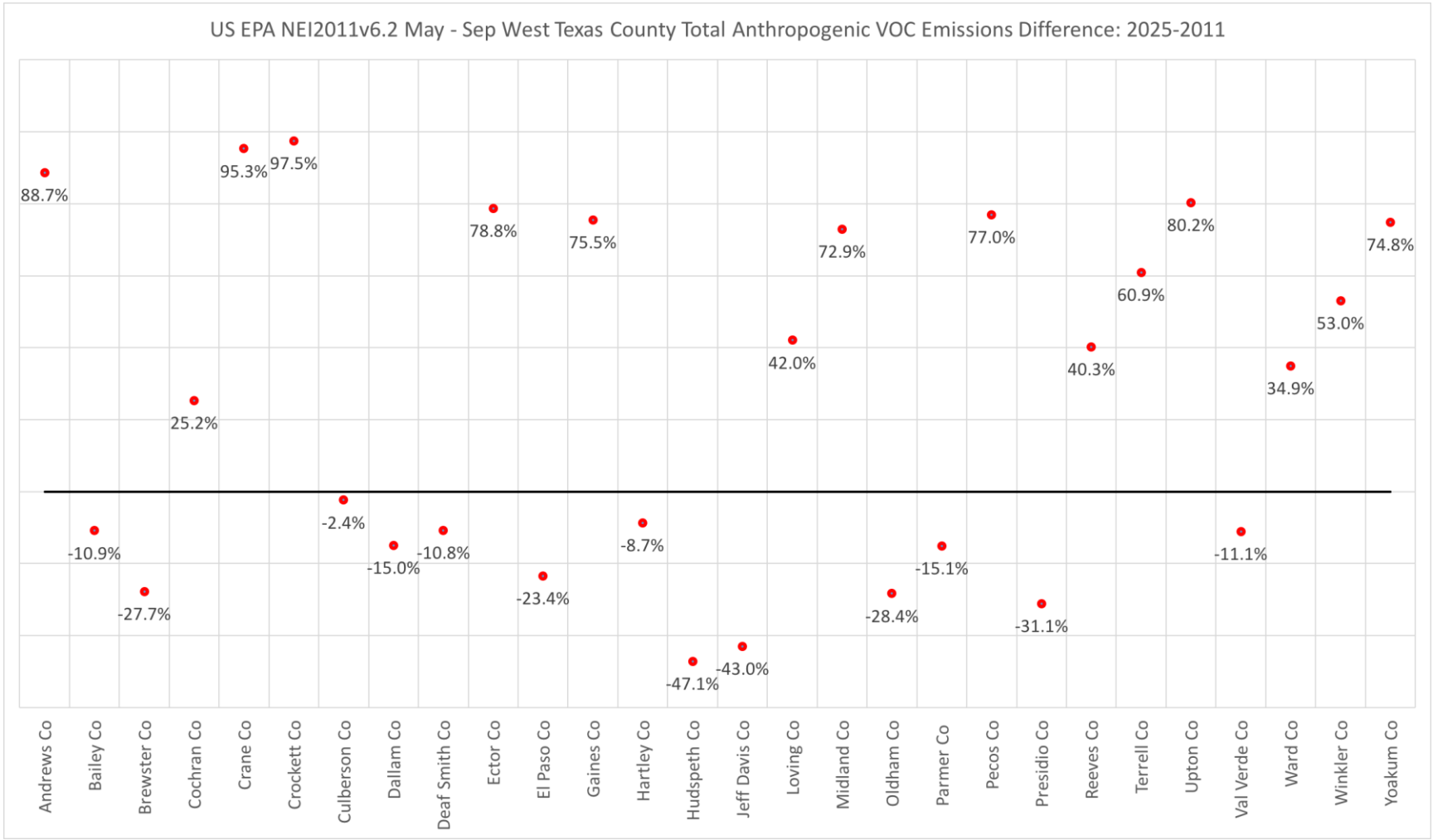
SNMOS 2025 Emissions Results

West Texas 2011 and 2025 NOx Emissions Differences



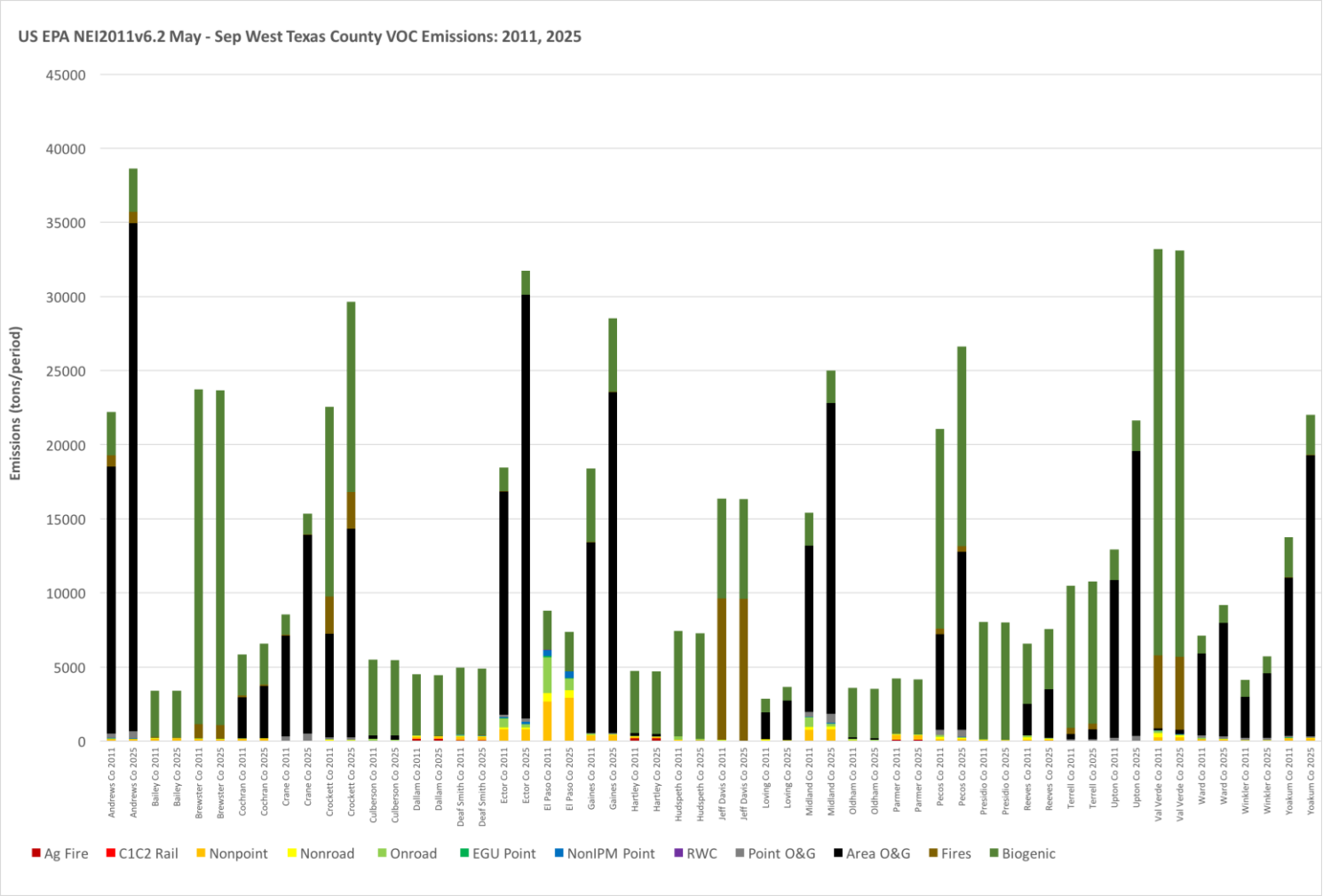
SNMOS 2025 Emissions Results

West Texas Total Anthropogenic VOC Emissions Change: 2025-2011



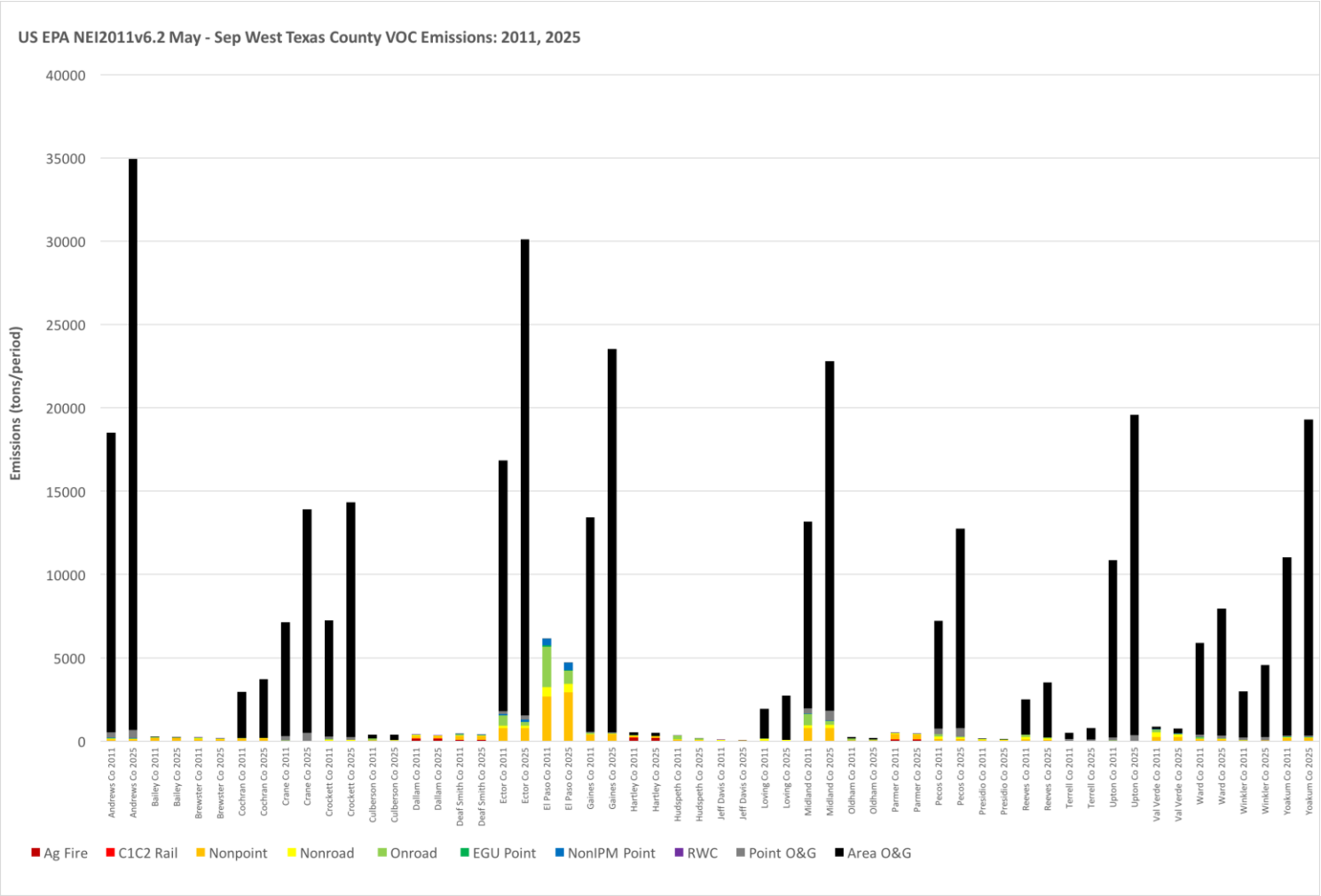
SNMOS 2025 Emissions Results

West Texas 2011 and 2025 VOC Emissions: All Surface Sources



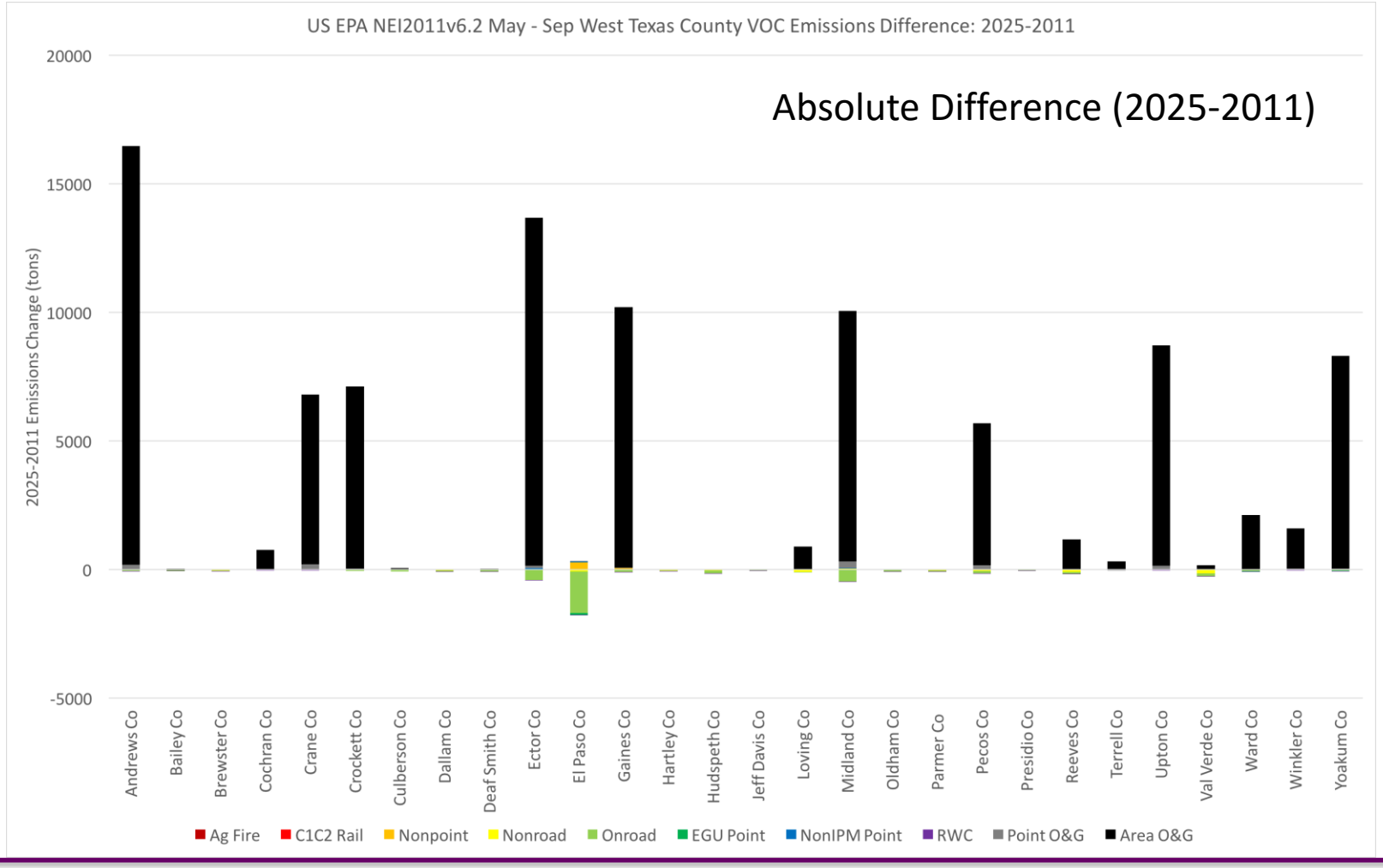
SNMOS 2025 Emissions Results

West Texas 2011 and 2025 VOC Emissions: No Natural Sources



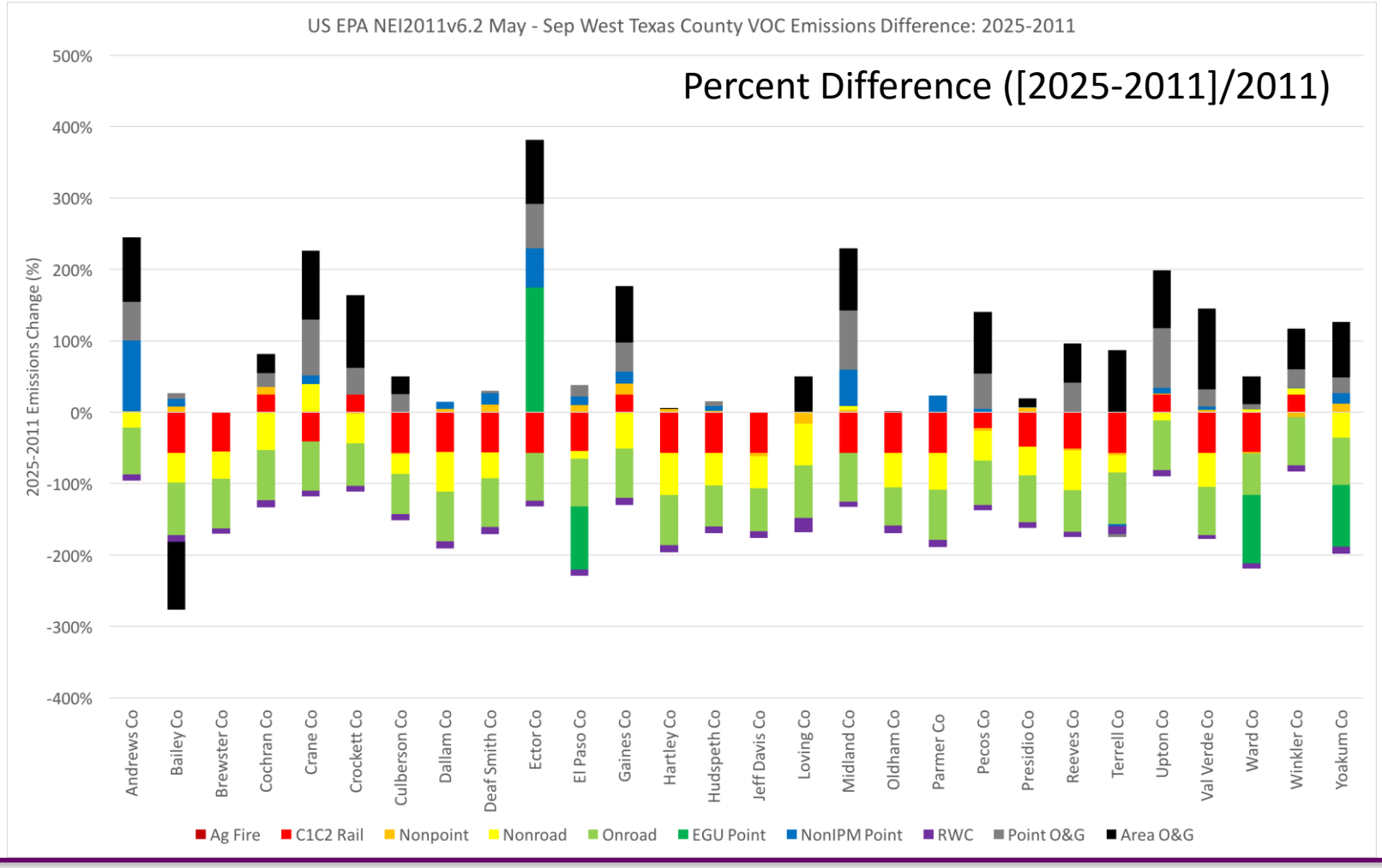
SNMOS 2025 Emissions Results

West Texas 2011 and 2025 VOC Emissions Differences



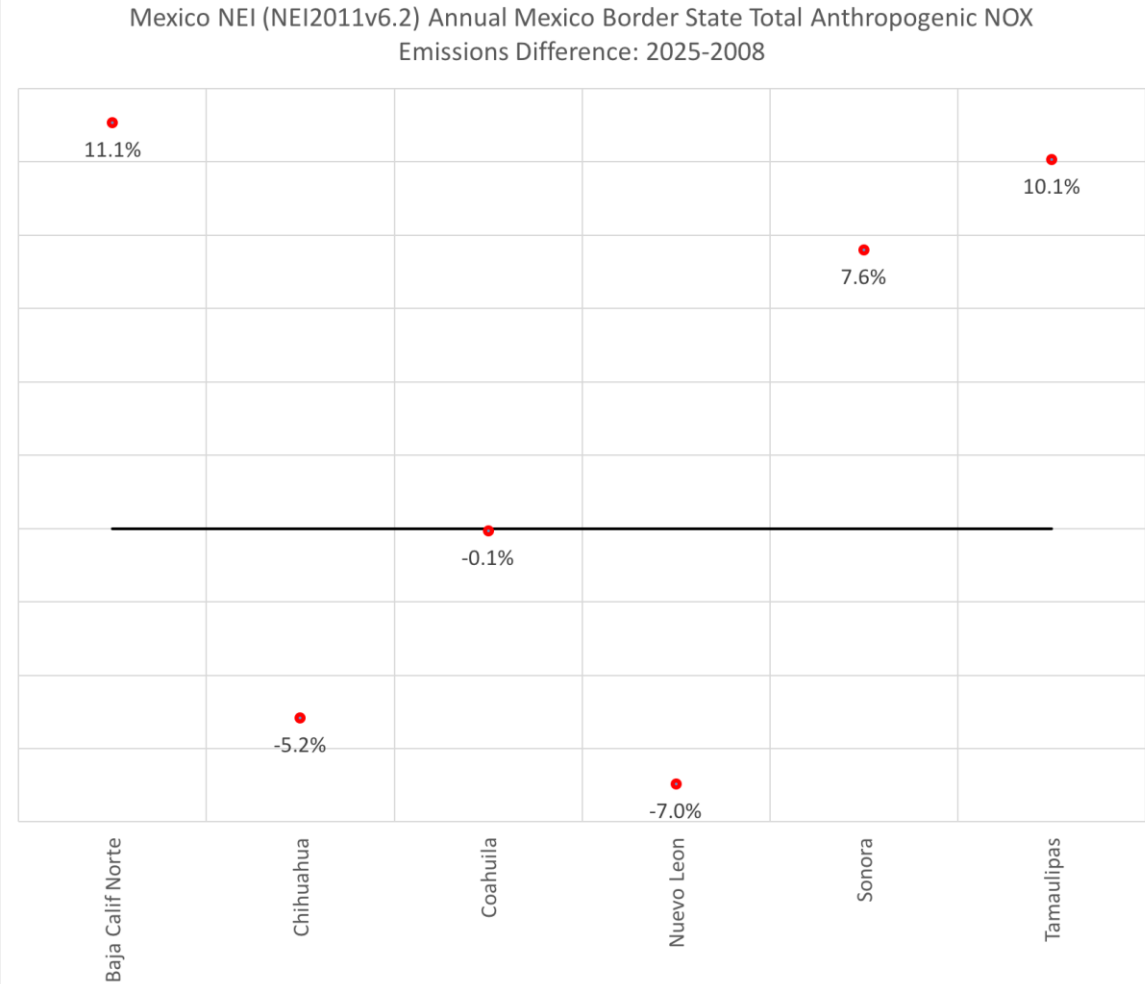
SNMOS 2025 Emissions Results

West Texas 2011 and 2025 VOC Emissions Differences



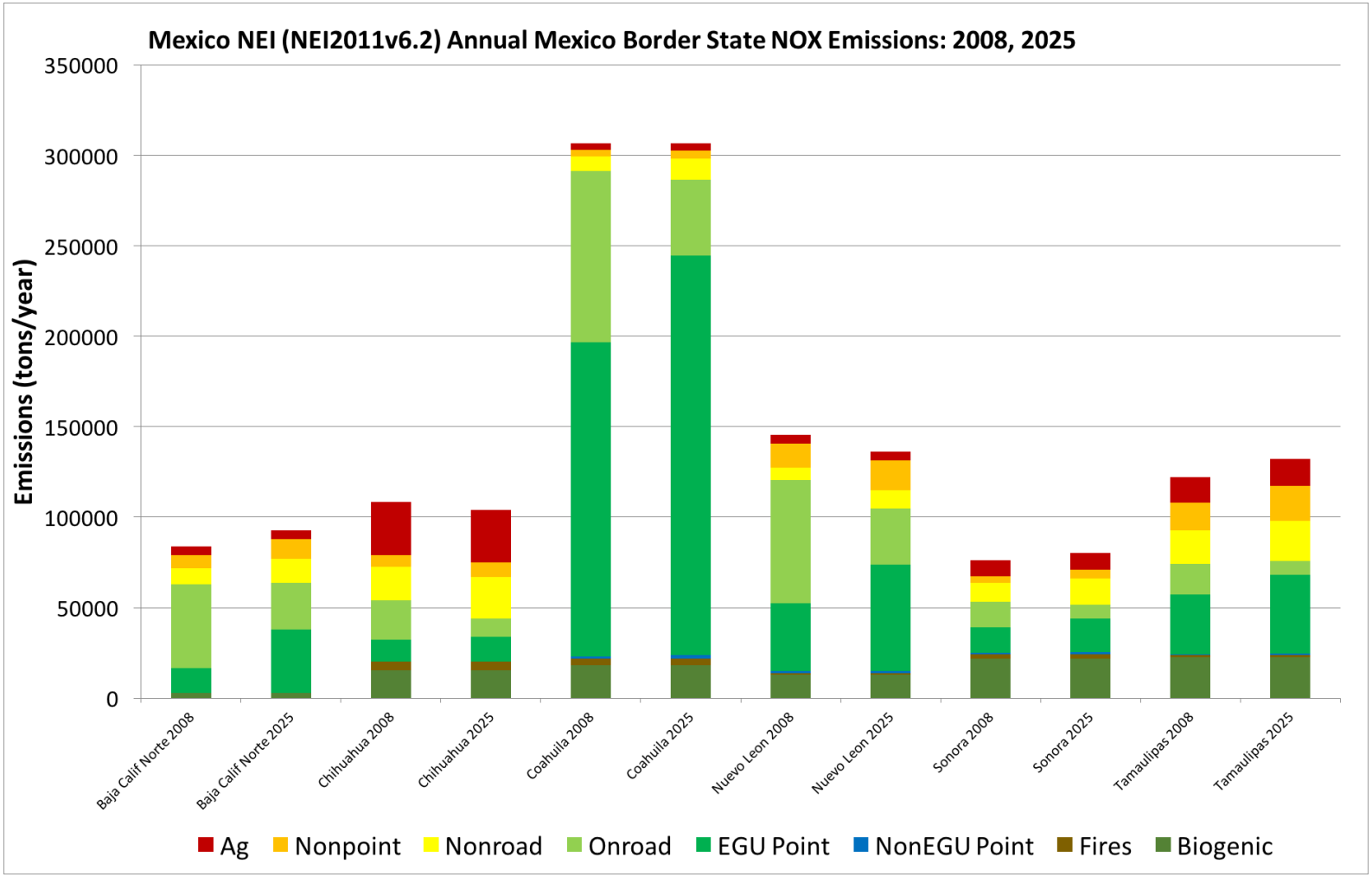
SNMOS 2025 Emissions Results

Northern Mexico Total Anthropogenic NOx Emissions Change: 2025-2011



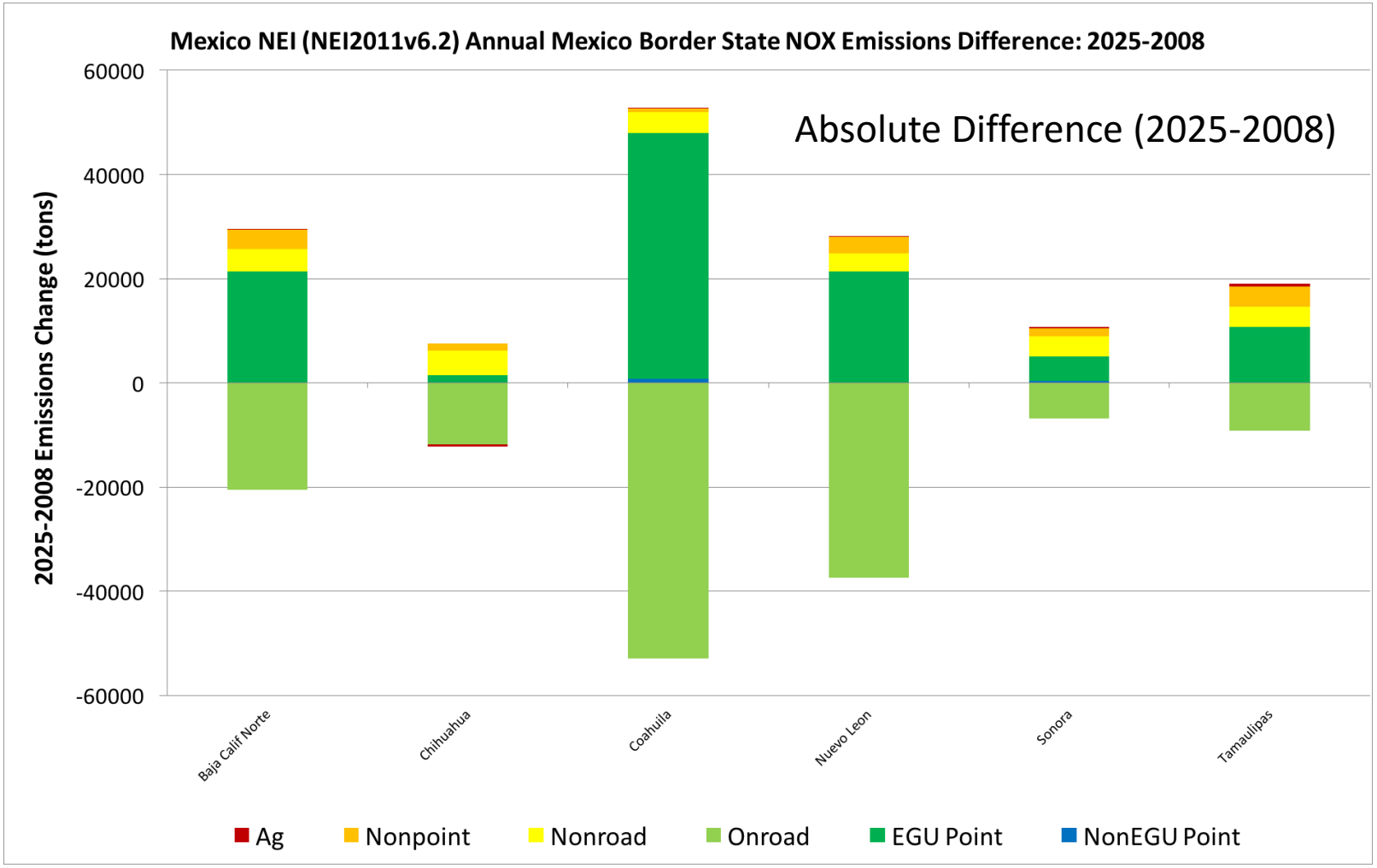
SNMOS 2025 Emissions Results

Northern Mexico 2008 and 2025 NOx Emissions: All Surface Sources



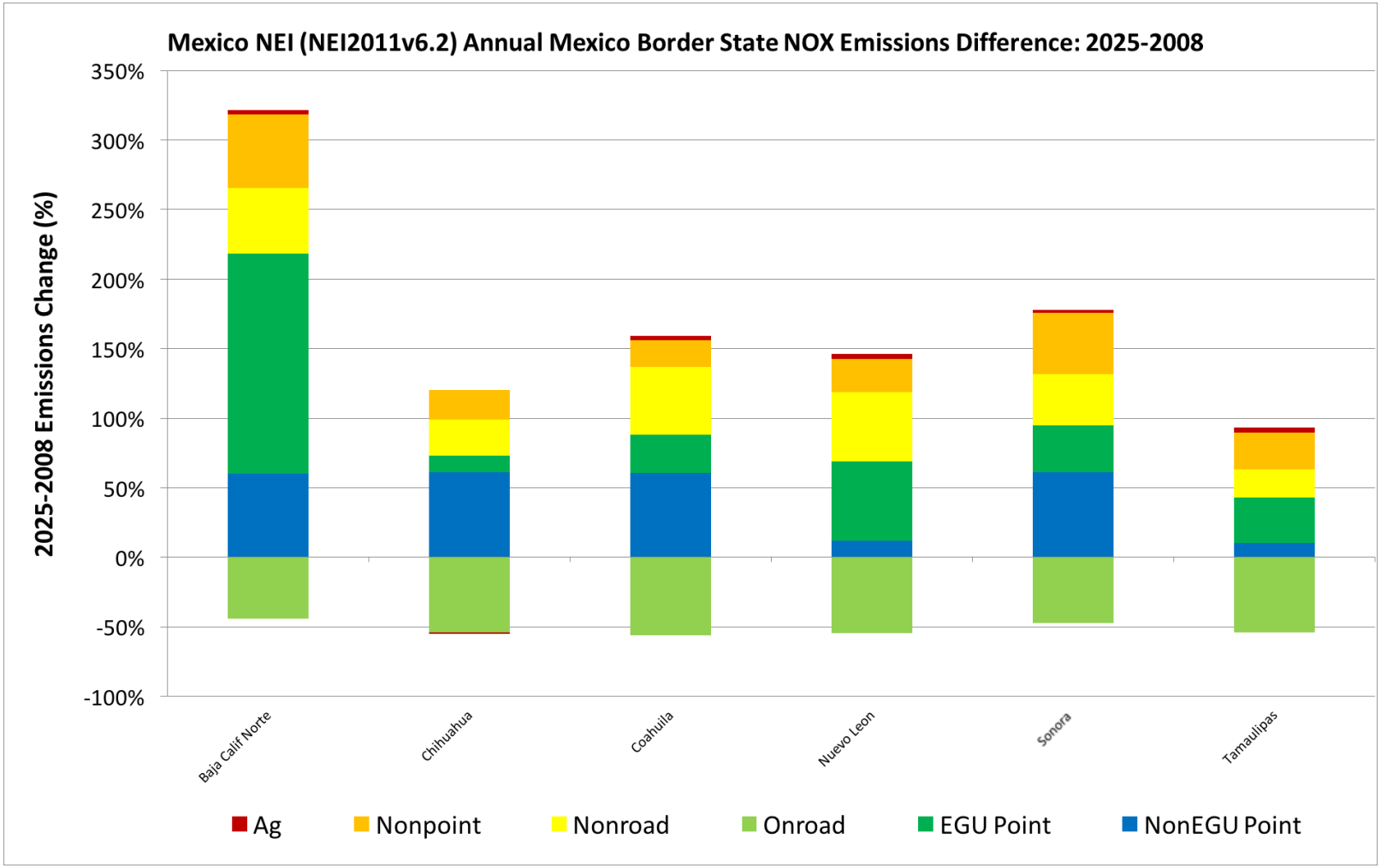
SNMOS 2025 Emissions Results

Northern Mexico 2008 and 2025 NOx Emissions Differences



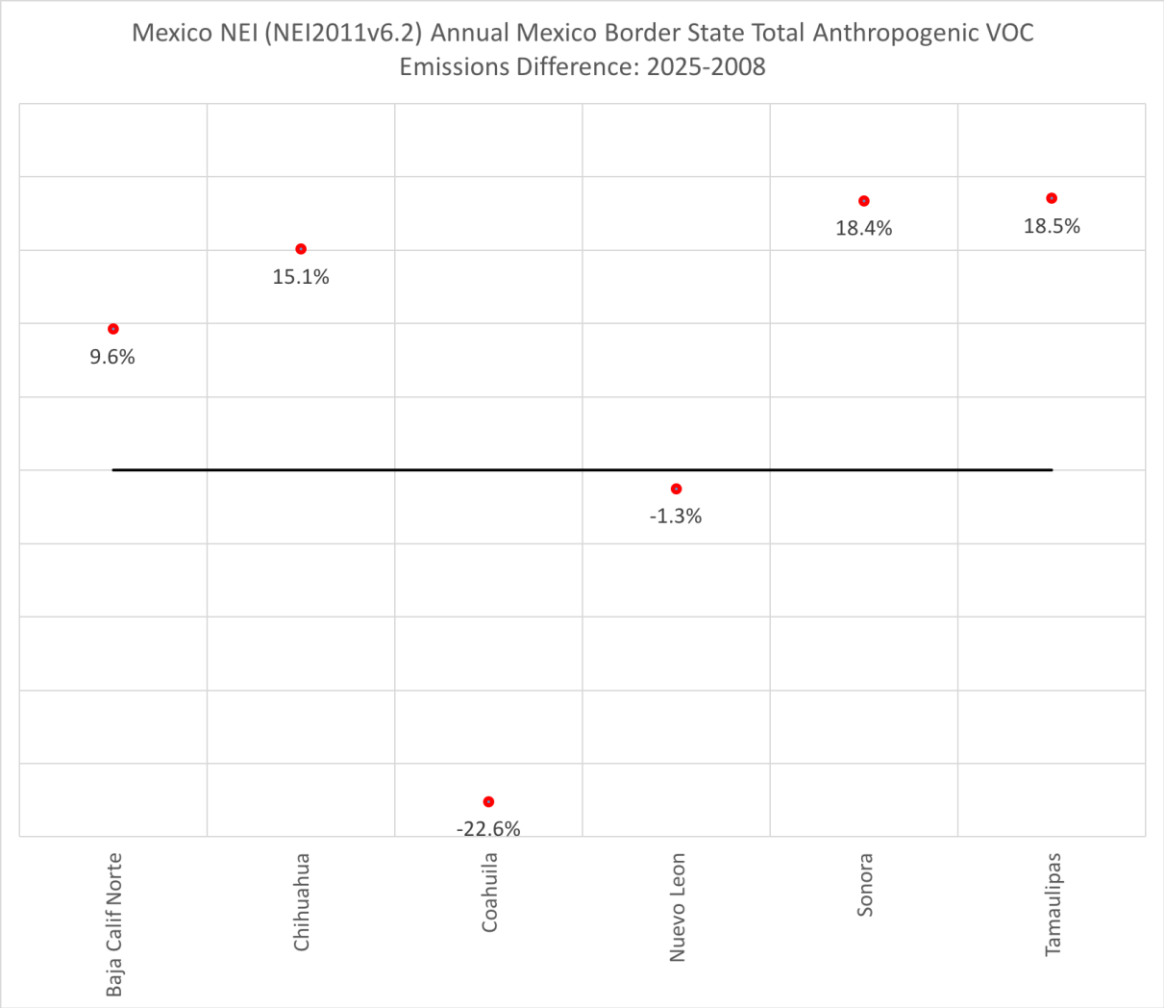
SNMOS 2025 Emissions Results

Northern Mexico 2008 and 2025 NOx Emissions Differences



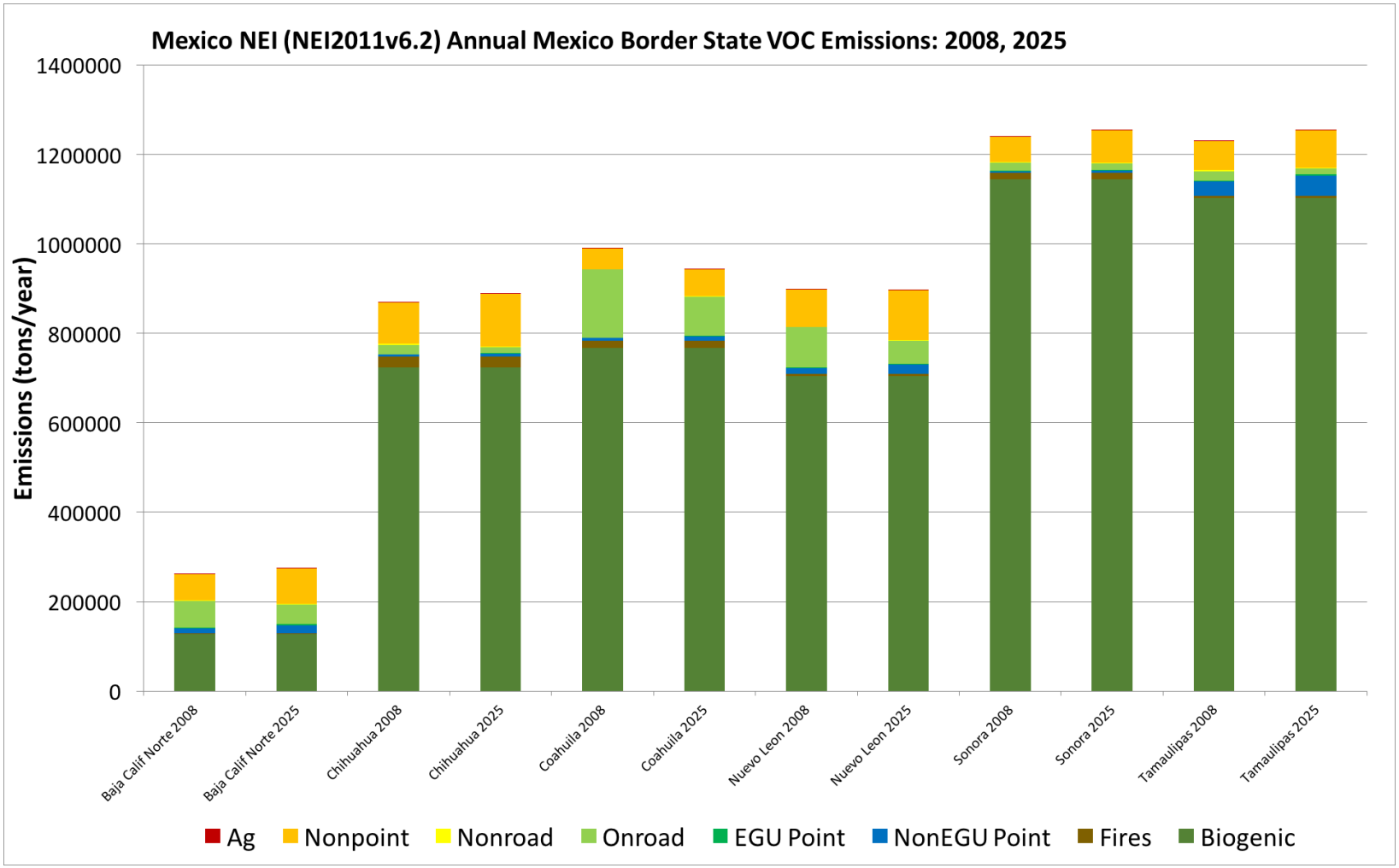
SNMOS 2025 Emissions Results

Northern Mexico Total Anthropogenic VOC Emissions Change: 2025-2011



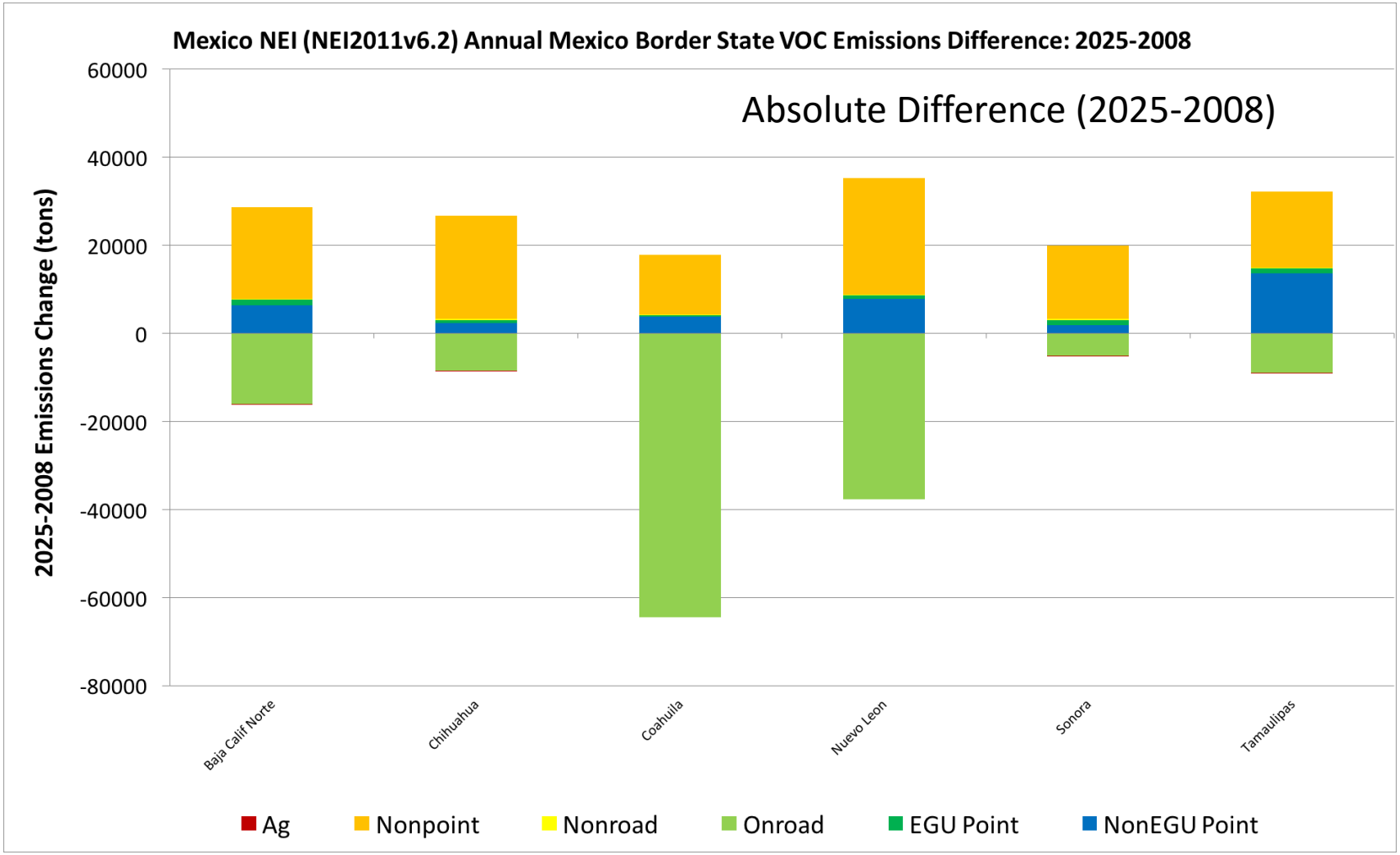
SNMOS 2025 Emissions Results

Northern Mexico 2008 and 2025 VOC Emissions: All Surface Sources



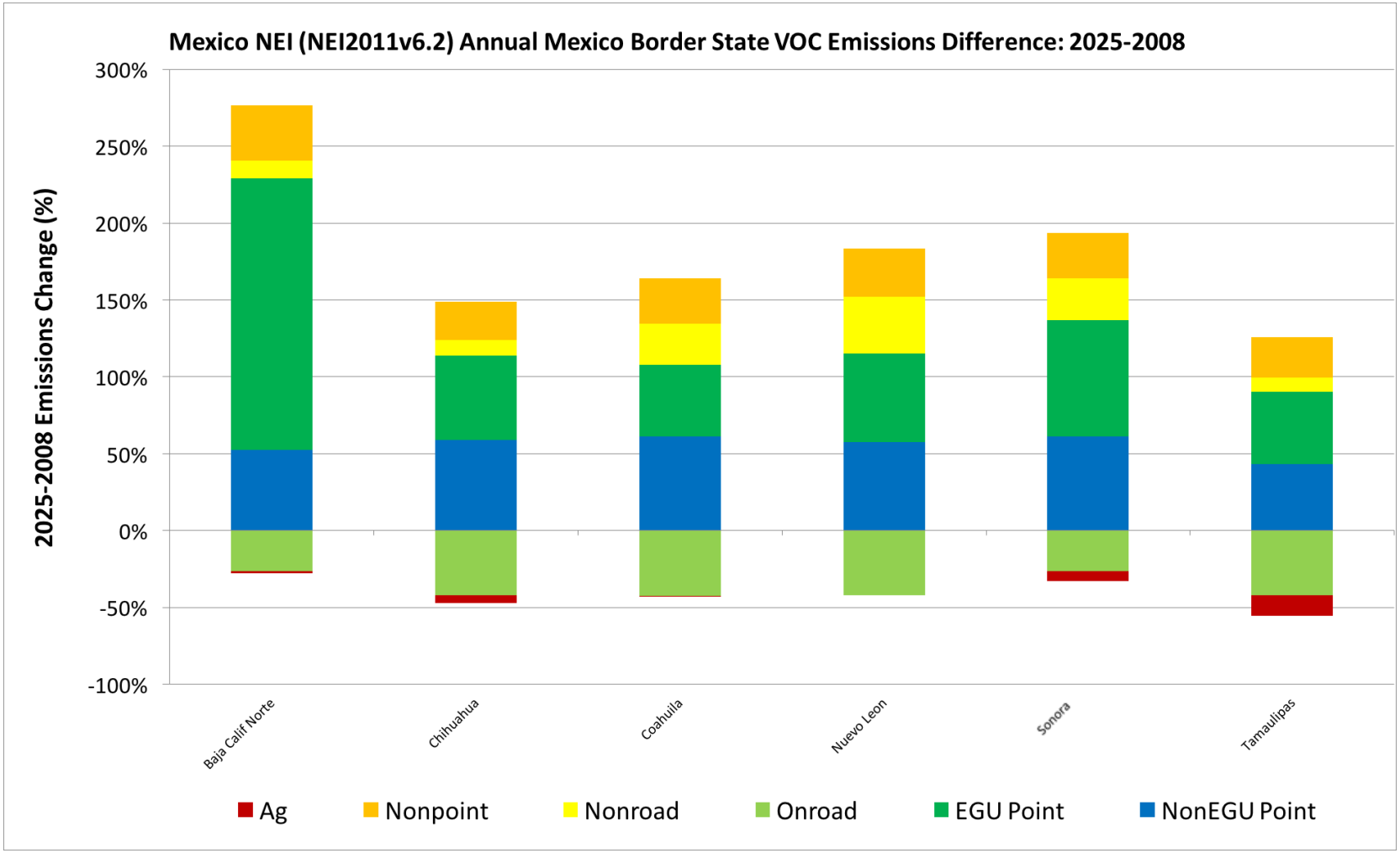
SNMOS 2025 Emissions Results

Northern Mexico 2008 and 2025 VOC Emissions Differences



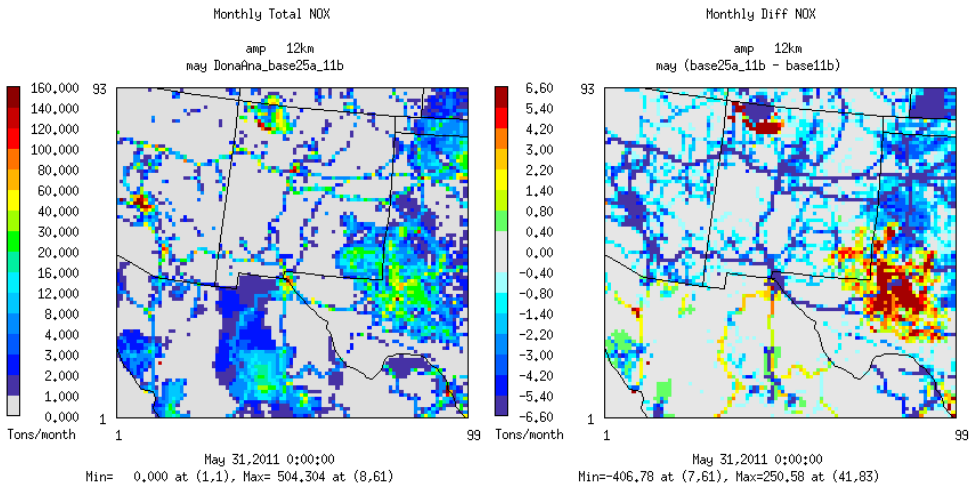
SNMOS 2025 Emissions Results

Northern Mexico 2008 and 2025 VOC Emissions Differences



Additional SNMOS Emissions Plots

- http://ie-events.unc.edu/cempd/projects/data_viewer?project=SNMOS
- Results > View the results from a single simulation
- EMIS > SMOKE > DonaAna_base25a_11b
- Plot Types
  - 2d Tile Plots
  - Timeseries
  - Ex. 12-km May 2025 total anthropogenic NOx Emissions (L) and 2025-2011 diff (R).



Next Steps

Tasks to be Completed by May 31, 2016

- **Task 1**: 2011 WRF 36/12/4 km with 4 km focus on Dona Ana/El Paso/Juarez and Work Plan (Completed)
- **Task 2**: 2011 update Permian Basin O&G (Completed)
- **Task 3**: 2011 update of Juarez and nearby Mexico EI, 2020 Mexico emissions update (Completed)
- **Task 4**: SMOKE current 2011 NEI for 4 km domain (2/29/16)
- **Task 5**: Gridded 2011 biogenic, fires, wind-blown dust, lightning emissions for 4 km domain (2/29/16)
- **Task 6**: Develop 2011 4 km CAMx database and perform base case (2/29/16)
- **Task 7**: 2011 MPE and sensitivity modeling for Dona Ana County (4/30/16)
- **Task 8**: SMOKE current FY US EI and FY Mexico emissions update (4/30/16)
- **Task 9**: FY 4 km CAMx simulation (5/31/16)
- **Task 10**: FY ozone projections (MATS) (5/31/16)
- **Task 11**: FY emissions sensitivity/controls (8/15/16)
- **Task 12**: FY 4 km source apportionment run (9/15/16)
- **Task 13**: Air Quality Technical Support Document (11/18/16)