Southern New Mexico Ozone Modeling Study

Project Summary

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

June 29, 2016

http://www.wrapair2.org/SNMOS.aspx

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

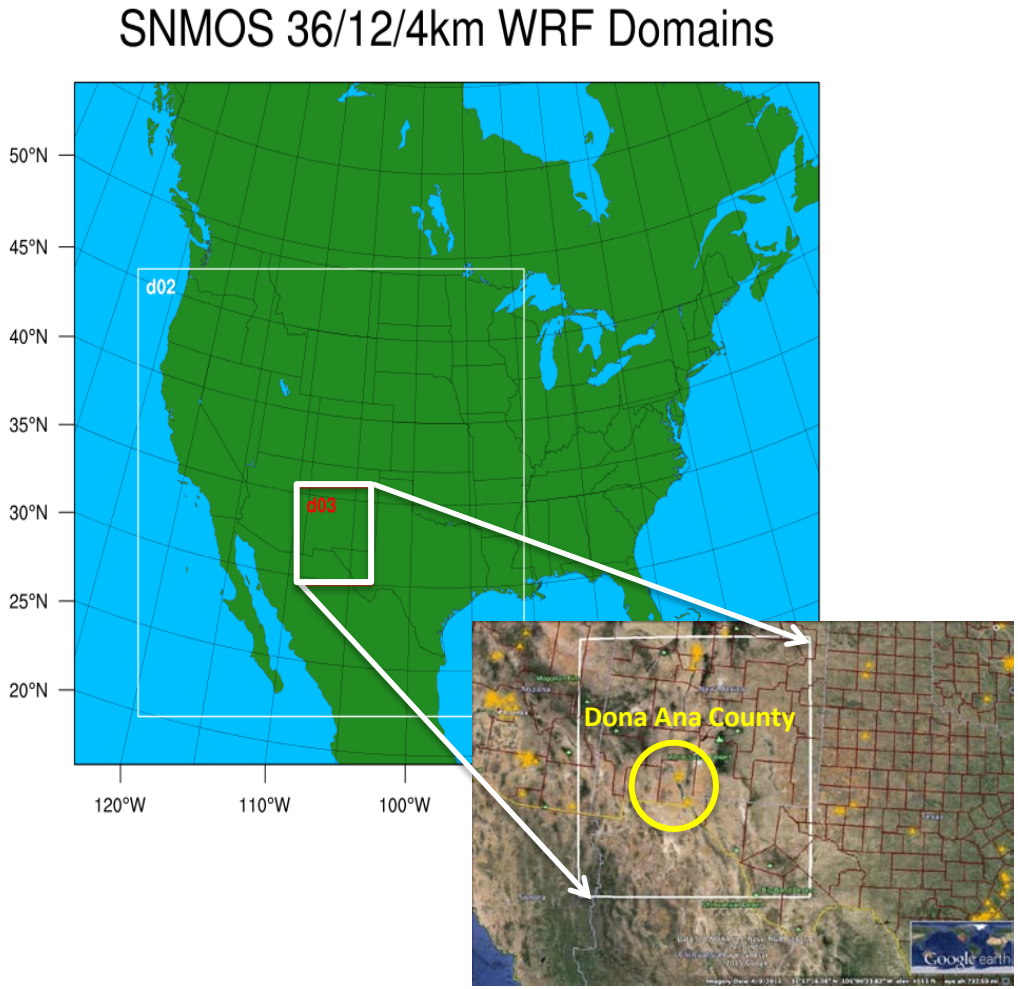
Overview of Approach

- 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)
  - **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 12/4-km CAMx simulation (5/31/2016)
  - **Task 10**: FY ozone projections with MATS (5/31/2016)
- **Active**
  - **Task 11**: FY emissions sensitivity/controls (8/15/2016)
  - **Task 12**: FY 4 km source apportionment run (9/15/2016)
- **Pending**
  - **Task 13**: Air Quality Technical Support Document (11/8/2016)

SNMOS Meteorology Modeling



- Objective
  - Simulate and evaluate WRF meteorology for modeling 2011 ozone season in Doña Ana County, New Mexico
- Tasks
  - Used WRF v3.7.1 to simulate 2011 ozone season (mid-April-August)
  - 36/12/4 km modeling domains
  - Tested WRF sensitivity to ICs/BCs, nudging, cumulus parameterization (4 runs)
  - Selected 2 best performing runs
  - Converted WRF output to CAMx inputs using WRFCAMx for 12/4 km domains

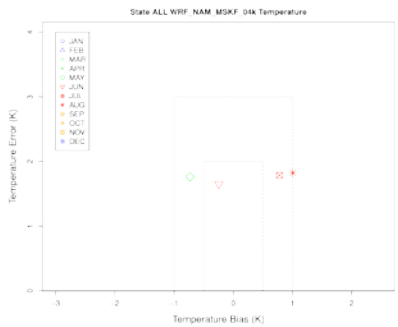
WRF Sensitivity Tests

WRFv3.7.1 (released August 2015)

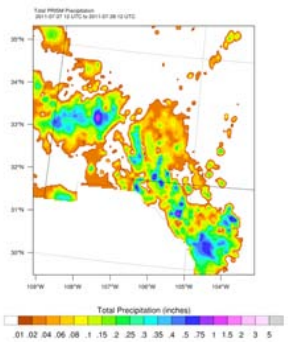
1. ***WRF_NAM_Kfmods*** – NAM ICBCs and the modified Kain-Fritsch cumulus scheme.
2. ***WRF_NAM_MSKF*** - Same as Configuration 1 with the multi-scale (grid-aware) Kain-Fritsch (MSKF) cumulus scheme.
3. ***WRF_ERA_MSKF*** - Same as Configuration 2 but using the ECMWF ERA-Interim Reanalysis as the ICBC fields.
4. ***WRF_ERA_MSKF_AN*** - Same as Configuration 3 but based on prior experiences from the San Juan Hg study. Analysis nudging was not applied in domain 2 in the San Juan Hg study. This configuration will turn off analysis nudging for domain 2.

WRF Model Performance Evaluation

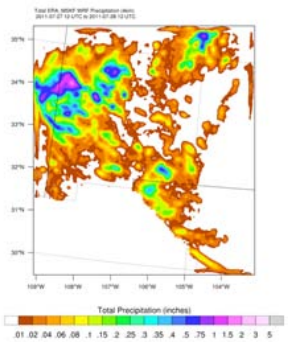
	Temperature (deg K)		Mixing Ratio (g/kg)		Wind Speed (m/s)		Wind Direction (degrees)	
	Bias	Error	Bias	Error	Bias	RMSE	Bias	Error
Benchmark: Simple	≤ ±0.5	≤ 2.0	≤ ±0.5	≤ 1.0	≤ ±0.5	≤ 2.0	≤ ±5	≤ 40
Benchmark: Complex	≤ ±1.0	≤ 3.0	≤ ±1.0	≤ 2.0	≤ ±1.0	≤ 3.0	≤ ±10	≤ 80
NAM KFmods	**0.21**	**1.77**	-0.53	1.05	**-0.30**	2.12	5.46	43.6
NAM MSKF	0.22	**1.77**	-0.46	**1.03**	-0.34	2.12	5.02	43.9
ERA MSKF	0.24	1.87	**0.14**	1.12	-0.43	**2.08**	**3.95**	**42.8**
ERA MSKF no AN	0.40	2.05	-0.39	1.18	-0.34	2.28	4.73	49.1

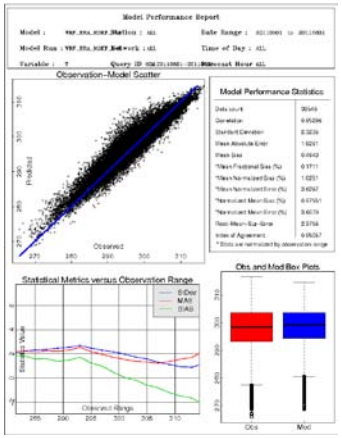


PRISM - OBS

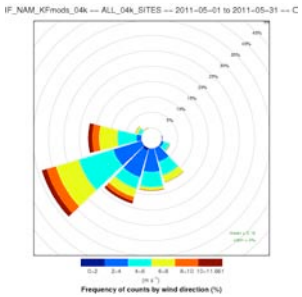


ERA_MSKF

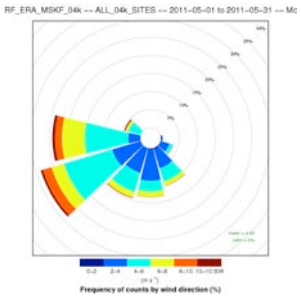


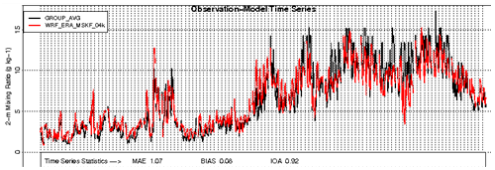


OBS



ERA-MSKF





- Evaluation focused on 12/4 km domain statistics and periods with high ozone and active monsoon
  - Evaluated domain average and site-specific statistics
- Surface winds, temperature humidity, precipitation
- Results available at http://ie-events.unc.edu/cempd/projects/data_viewer?project=SNMOS

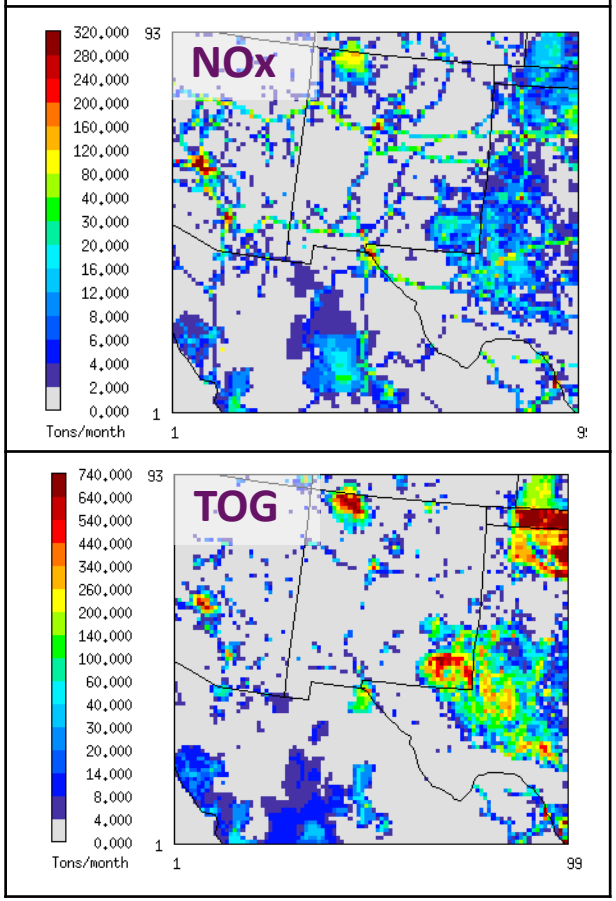
SNMOS WRF Modeling Summary

- Analysis nudging is needed in the 12 km domain
- All WRF simulations able to simulate the predominant wind direction
- ERA and NAM MSKF were the two best performing runs overall
  - KF-mods is too dry overall; MSKF has lower bias and error in mixing ratio
  - ERA is generally wetter than NAM, better mixing ratio performance but positively biased overall
  - NAM performs better with temperature
  - ERA performs better with winds
- Ran both ERA and NAM MSKF WRF runs in CAMx

SNMOS Emissions Modeling

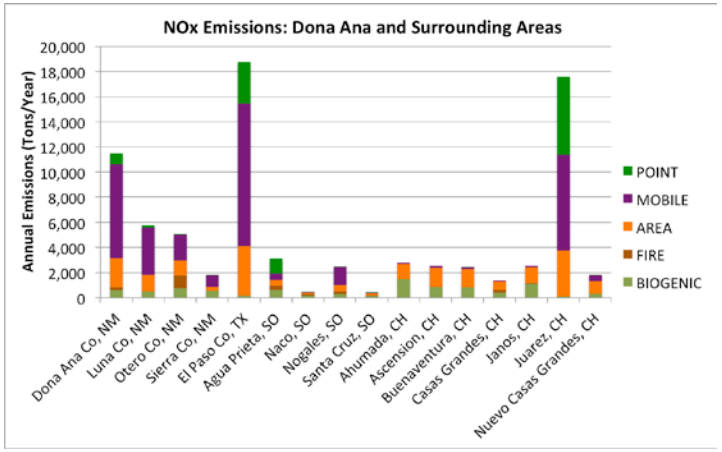
- Objective
  - Combine the U.S. EPA 2011v2 modeling platform base (2011) and projection (2025) inventories, WAQS O&G inventories, and Mexico inventories to estimate emissions for the SNMOS.
- Deliverables
  - Memo on base year air emissions modeling
  - Power Point Presentation on future year emissions modeling
- Tasks
  - Collect U.S. EPA 2011v2 base and future year inventory data for the SNMOS modeling domains
  - Use the Sparse Matrix Operator Kernel Emissions (SMOKE) model to prepare 12-km and 4-km emissions for CAMx
  - Summarize the base & future year emissions inventories and processing results

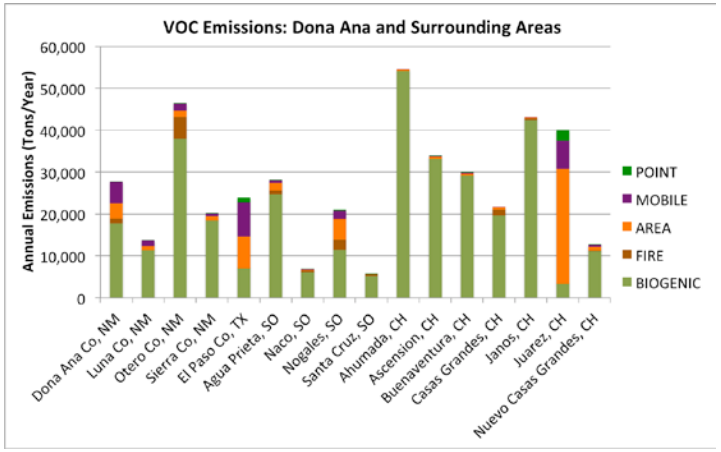
SNMOS 12-km 2011 Emissions



SNMOS Base11b Emissions Modeling Platform

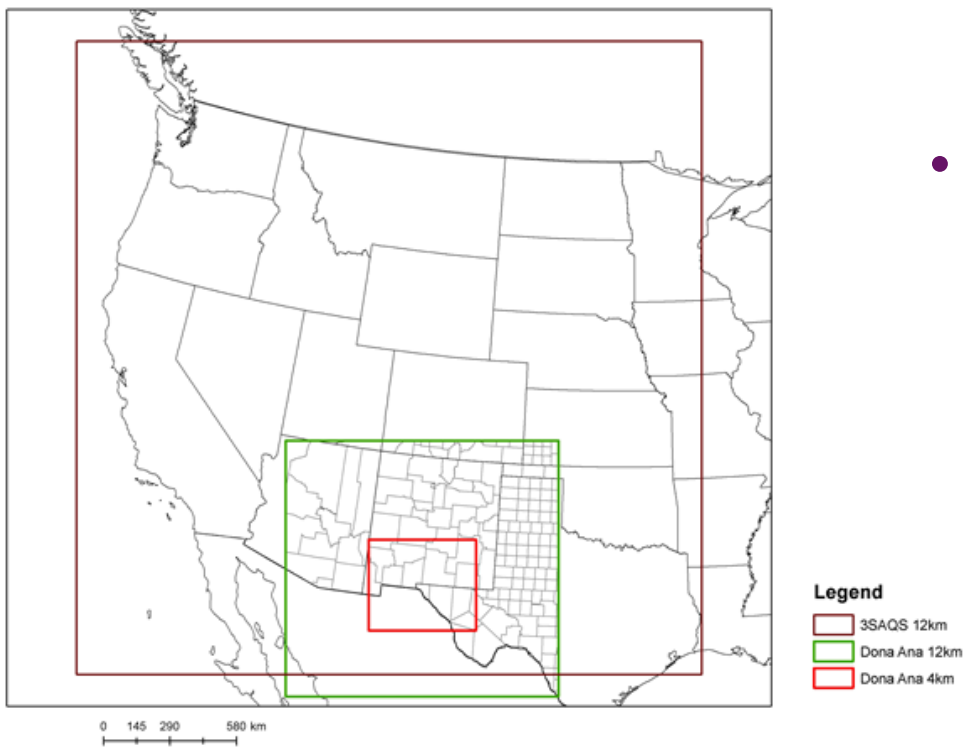
- Non-O&G
  - EPA 2011NEIv2 Platform
    - Technical Documentation* available from EPA
  - Same categories as WAQS 2011 Base11b
  - WAQS Phase 2 O&G for 2011
- Mexico
  - MNEI 2008
- Biogenic
  - MEGANv2.10 with 2011 SNMOS WRF meteorology
- Fires
  - PMDETAIL version 2 daily 2011 inventory
- Lightning
  - Daily lightning NO calculated with 2011 SNMOS WRF meteorology
- Ancillary Emissions Data
  - Same as WAQS 2011 Base11b modeling





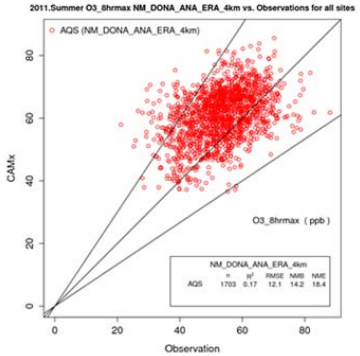
* https://www.epa.gov/air-emissions-modeling/2011-version-62-technical-support-document

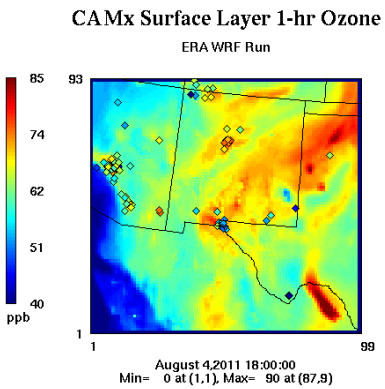
SNMOS CAMx 2011 Base Case Modeling



- Objective
  - Carry out SNMOS 2011 Base Case CAMx modeling and Model Performance Evaluation
- Tasks
  - Ran CAMx for 2011 ozone season with WRF MSKF ERA and NAM run meteorological inputs
  - Conducted a model performance evaluation for ozone and precursors and PM for both CAMx runs on 12/4 km domains
  - Selected better performing CAMx run
  - Prepared model performance evaluation report and PowerPoint http://www.wrapair2.org/SNMOS.aspx

CAMx Model Performance Evaluation





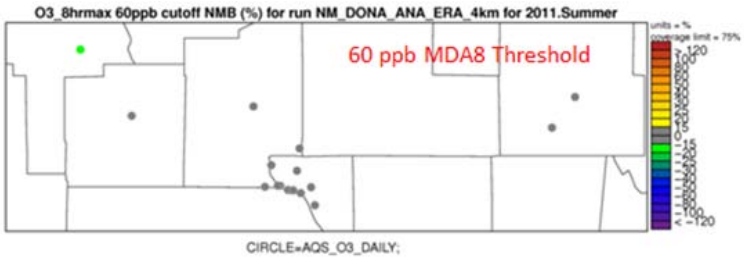
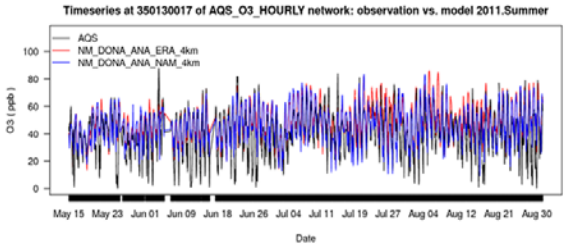


Table 4-1. 4 km domain ozone performance indicators. Red type indicates a metric that exceeds the ozone performance goal in Table 3-5.

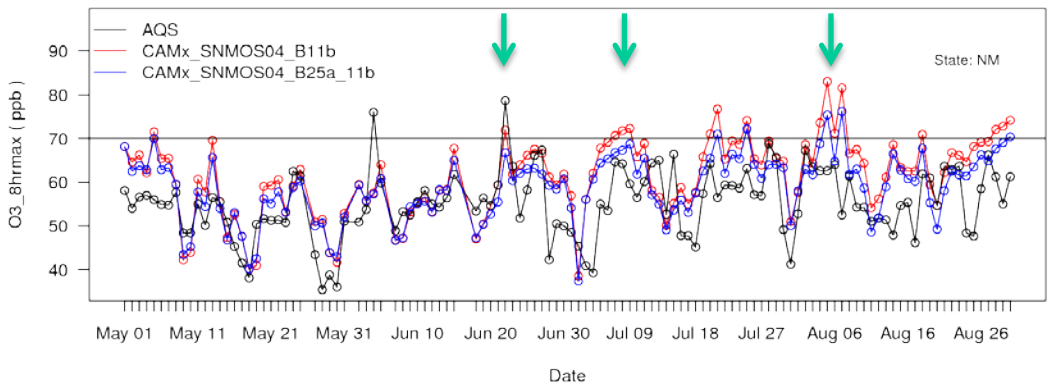
Species		Network	FB	FE	MB	ME	NMB	NME	R^2	RMSE
		Units	(%)	(%)	(ppb)	(ppb)	(%)	(%)		(ppb)
O3	CAMx with ERA WRF	AQS Hourly	24.6	32.4	9.35	12.7	23	31.2	0.34	15.8
	CAMx with NAM WRF	AQS Hourly	20.5	31.1	7.42	11.8	18.3	29.2	0.31	15
O3 > 60 ppb	CAMx with ERA WRF	AQS Hourly	-5.6	12.5	-3.23	7.97	-4.9	12	0.01	10.4
	CAMx with NAM WRF	AQS Hourly	-9.1	13.9	-5.39	8.64	-8.1	13	0.01	11.3
O3	CAMx with ERA WRF	AQS MDA8	13.8	17.7	7.56	9.83	14.2	18.4	0.17	12.1
	CAMx with NAM WRF	AQS MDA8	11.0	16.9	5.9	9.25	11.1	17.4	0.09	11.7
O3 > 60 ppb	CAMx with ERA WRF	AQS MDA8	-0.50	9.46	-0.14	6.20	-0.22	9.5	0.00	7.79
	CAMx with NAM WRF	AQS MDA8	-4.4	10.5	-2.54	6.69	-3.89	10.2	0.00	8.64

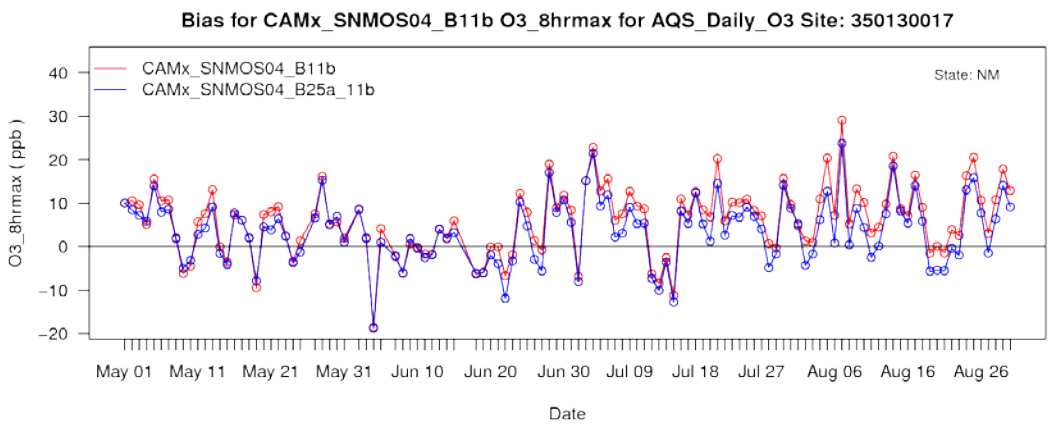


- Evaluated model on 12/4 km grid
  - Compared modeled concentrations against observed values, paired in time and space
  - Ozone, CO, NO_2, total $PM_{2.5}$ mass and speciated $PM_{2.5}$
- Performance statistics (bias, error, etc.) and spatial plots using AMET
  - Compared model performance with results of other modeling efforts (Simon et al., 2012)

Overview of CAMx 2011 MPE Results

Sunland Park MDA8 Ozone Time Series





- Model performance acceptable, but overall high bias for ozone
  - Model performs well in May-June, but has high bias in July-August
- On highest observed MDA8 days, model underestimates ozone
- CAMx run with ERA WRF performed better than CAMx run with NAM WRF when MDA8 ozone > 60 ppb
  - Selected CAMx run with ERA WRF as 2011 Base Case
- At Doña Ana monitors, 10 highest modeled days do not correspond to 10 highest observed days

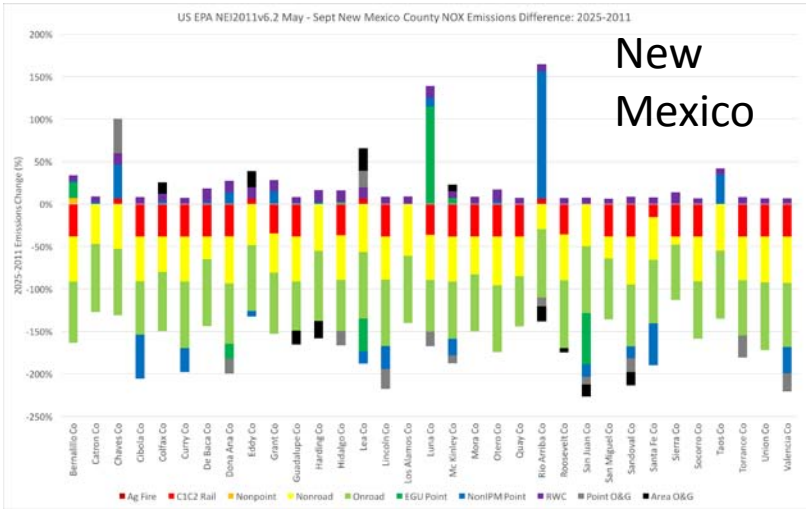
SNMOS Ozone Modeling Uncertainties

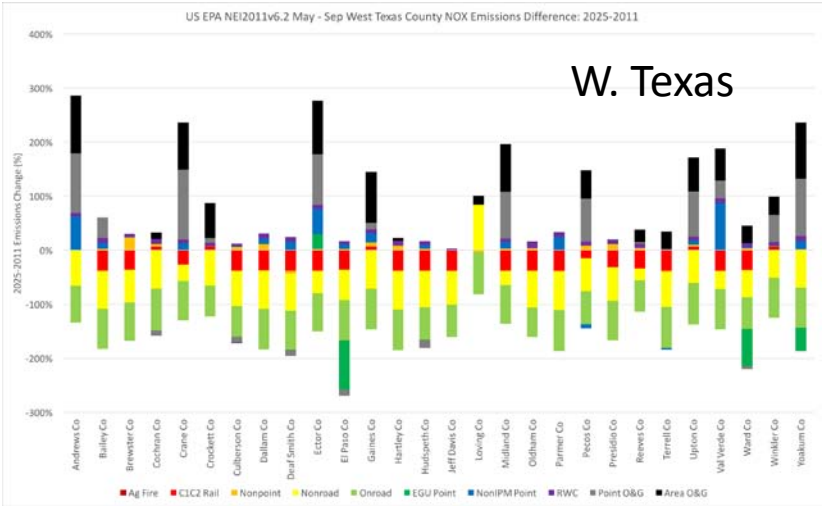
- Meteorological model performance
  - May contribute to high bias for ozone
- Simulation of fire emissions and fire plumes in CAMx
  - Possible CAMx overestimating ozone from fires on some occasions
- Emissions from Mexico
- On-road mobile source emissions
- Biogenic emissions

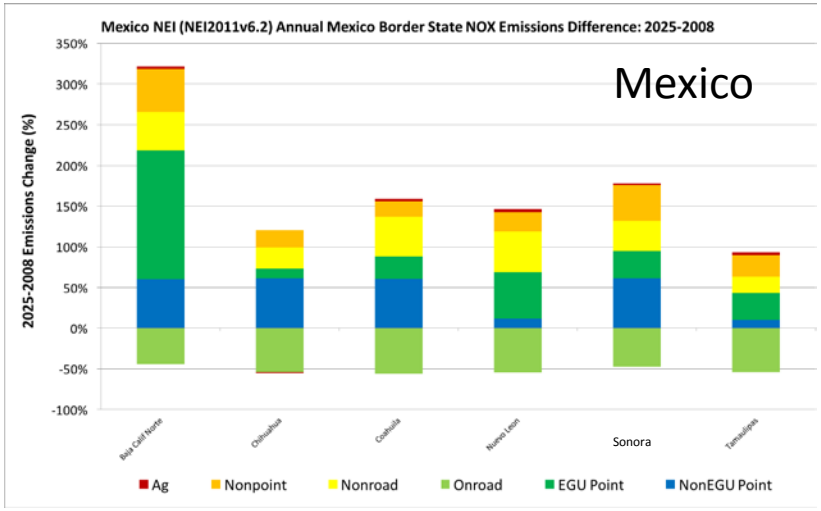
SNMOS 2025 Emissions Modeling

- Non-O&G
  - EPA 2011NEIv2 Platform
  - 2025 projection year
  - Same categories as 2011 base (including O&G)
  - WAQS Phase 2 O&G for 2011 and 2020
- Mexico
  - 2025 projections off of the MNEI 2008
- Biogenic, Fires, Lightning, Ancillary Data
  - Same as SNMOS 2011 Base11b modeling

Percent Difference ([2025-2011]/2011)



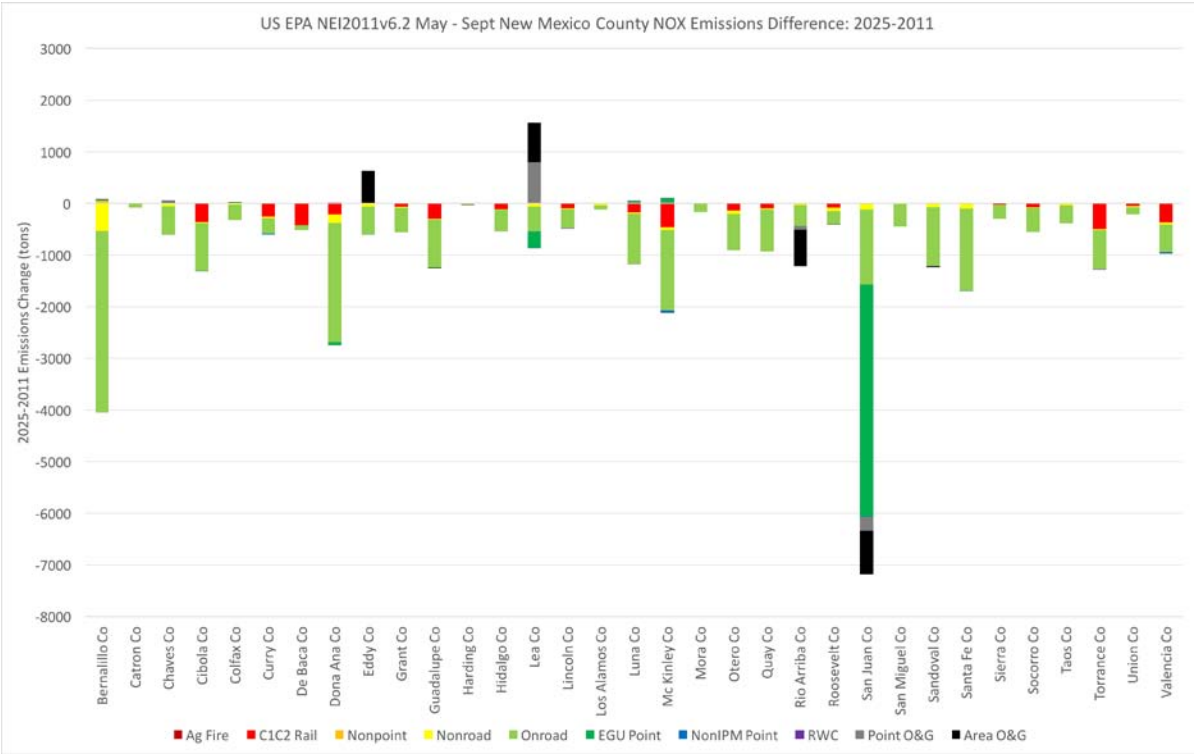




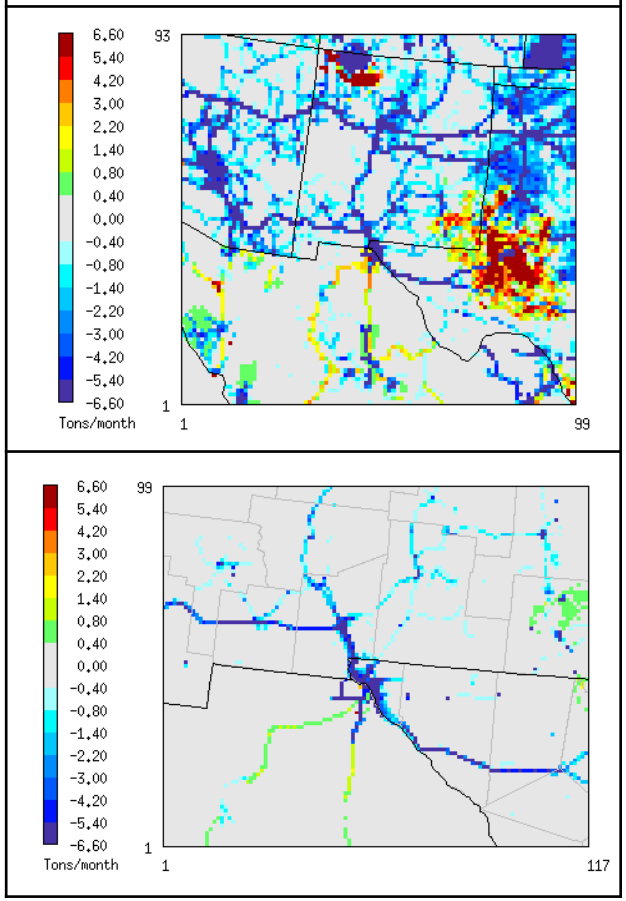
SNMOS 2025 Emissions Modeling

New Mexico 2011 and 2025 NOx Emissions Differences

Absolute Difference (2025-2011)



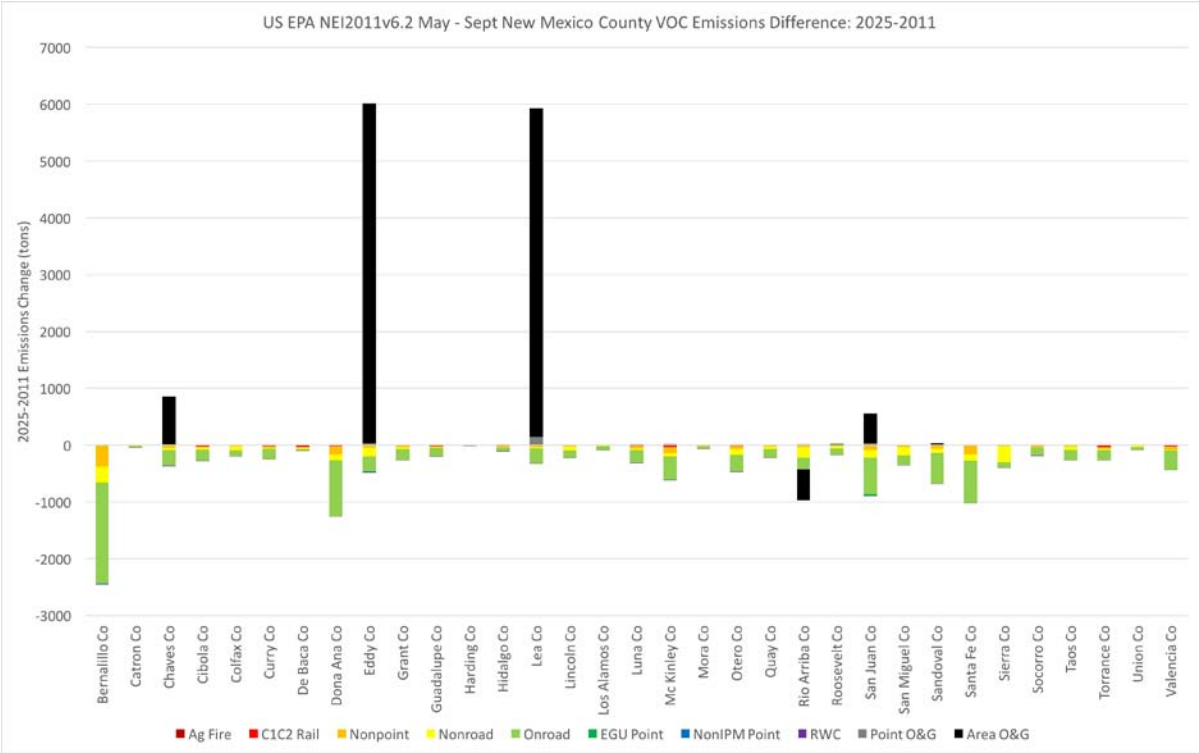
2025-2011 NOx Emissions



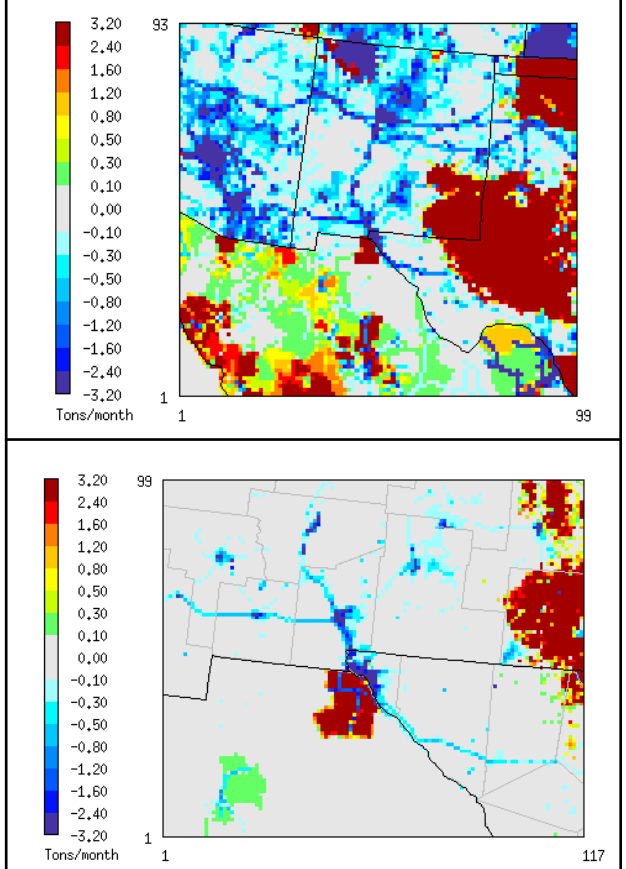
SNMOS 2025 Emissions Modeling

New Mexico 2011 and 2025 VOC Emissions Differences

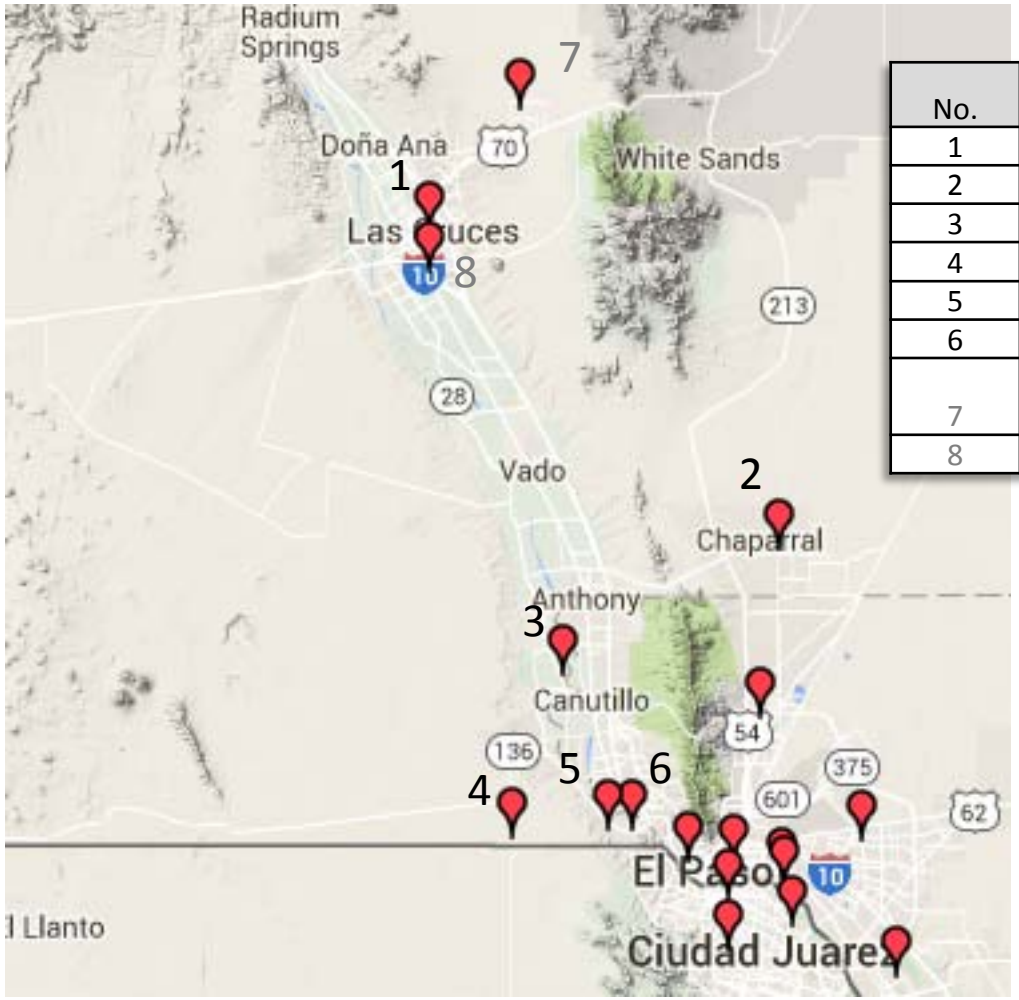
Absolute Difference (2025-2011)



2025-2011 VOC Emissions



SNMOS Future Year CAMx Modeling



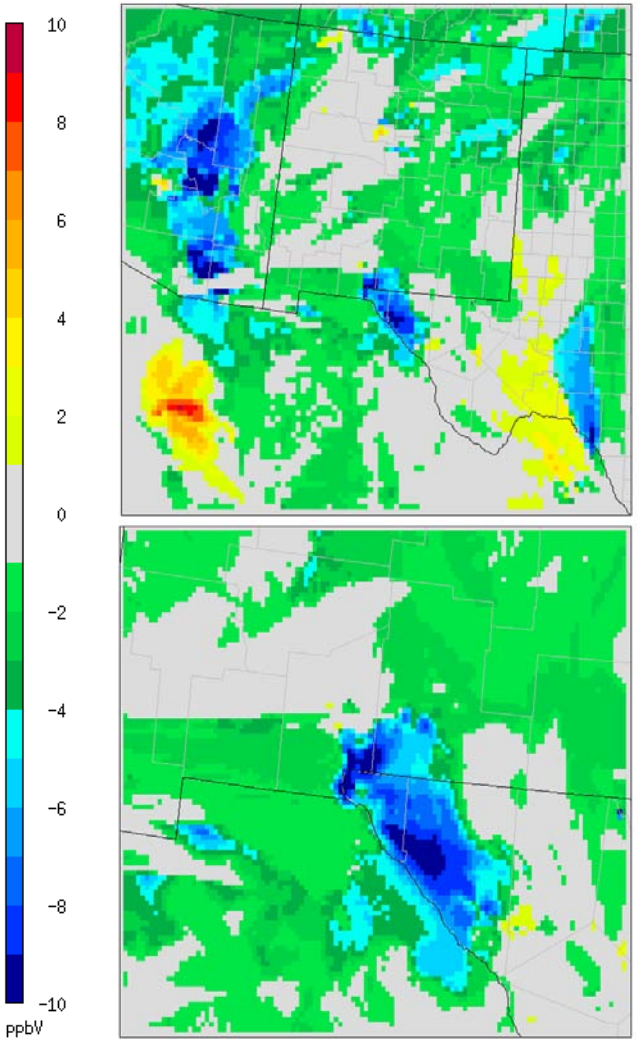
No.	Site ID	Start Year	End Year	Name
1	350130023	2005	present	750 N. SOLANO DRIVE
2	350130020	1996	present	CHAPARRAL
3	350130008	1990	present	LA UNION
4	350130022	1996	present	SANTA TERESA
5	350130021	1996	present	DESERT VIEW
6	350130017	1988	present	SUNLAND PARK
7	350130019	1995	2002	LAS CRUCES WELL STATION #41;HOLMAN ROAD
8	350131012	1990	2004	HOLIDAY INN

Active in 2011 Inactive in 2011

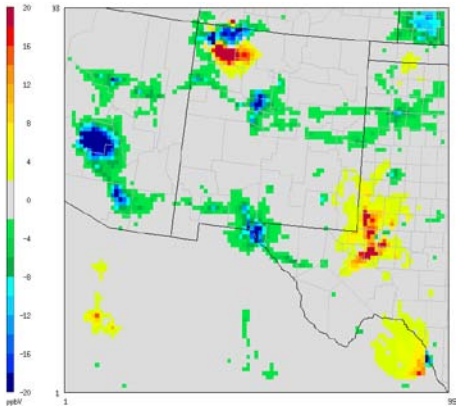
- CAMx configured as in SNMOS Base11b
- Predicted ozone concentrations decrease in 2025 relative to 2011
- Reductions in on-road mobile NOx emissions appear to be driving the ozone reductions

CAMx June Air Quality and Emissions: 2025-2011

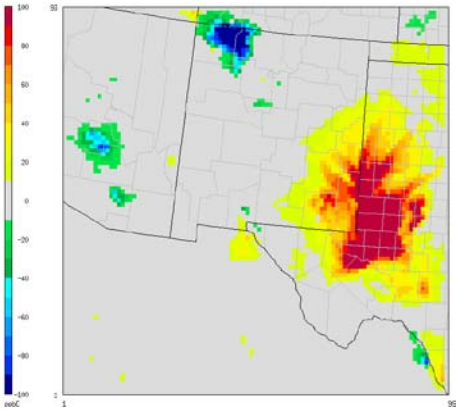
Diff Monthly Max O3



Diff Monthly Max NOx

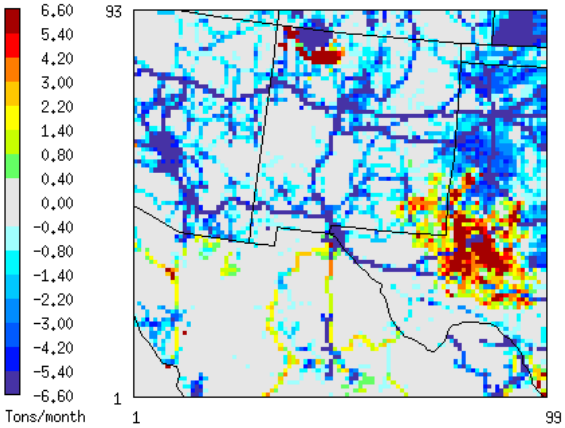


Diff Monthly Max VOC

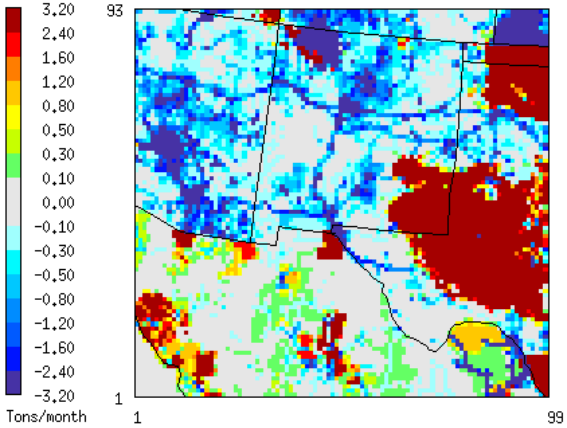


Emissions

Diff Monthly Max NOx

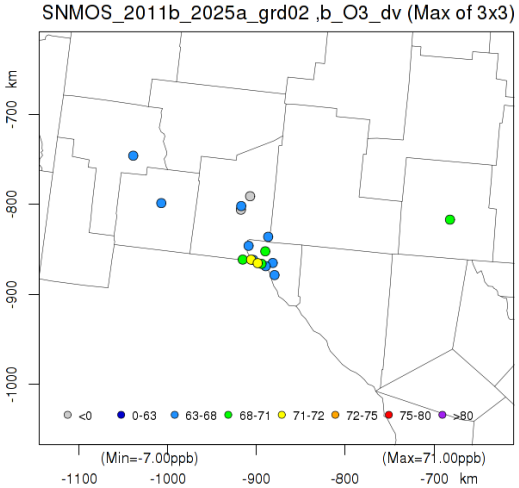


Diff Monthly Max TOG

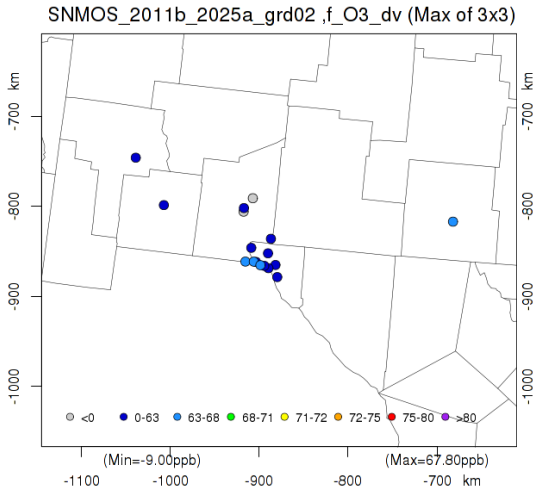


SNMOS Attainment Testing

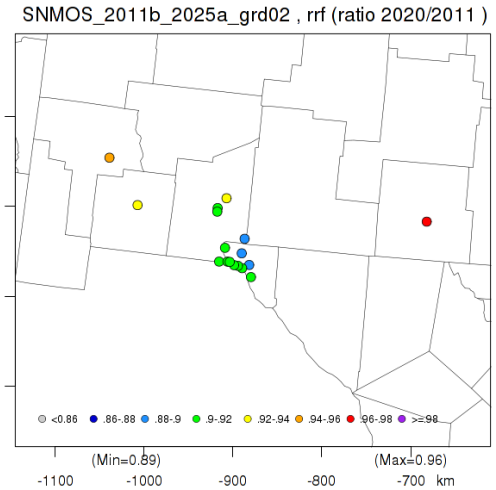
DVC (2011)

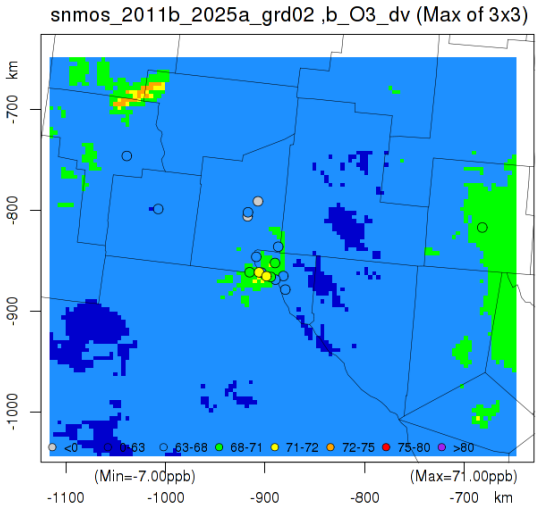


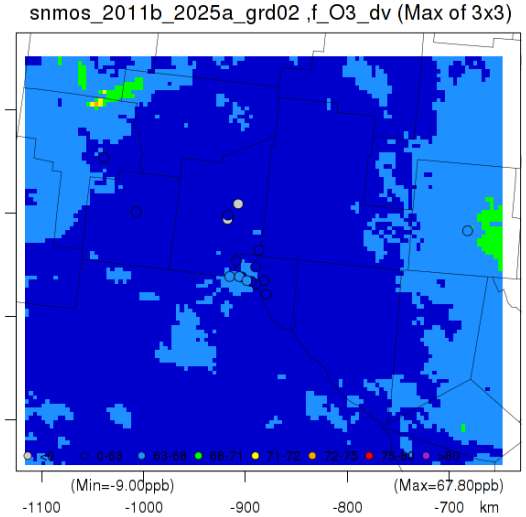
DVF (2025)



RRF (2025/2011)





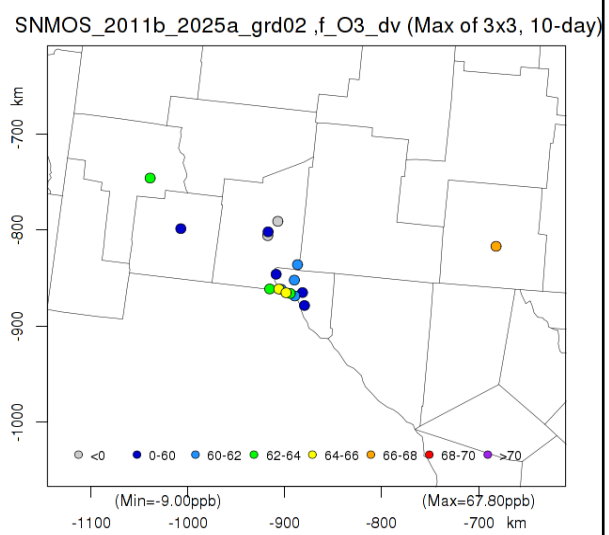
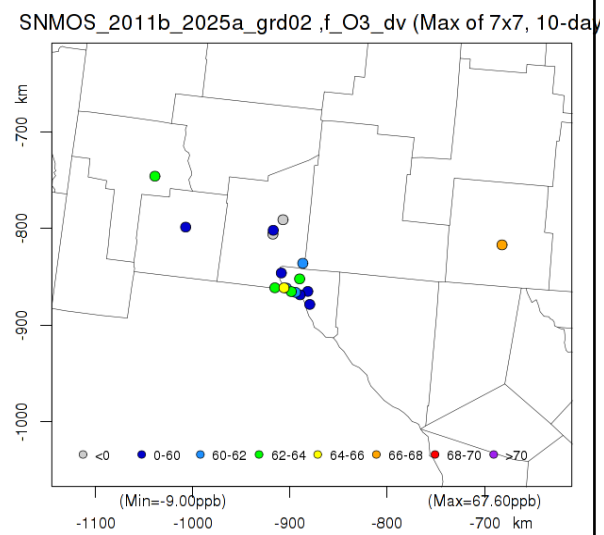
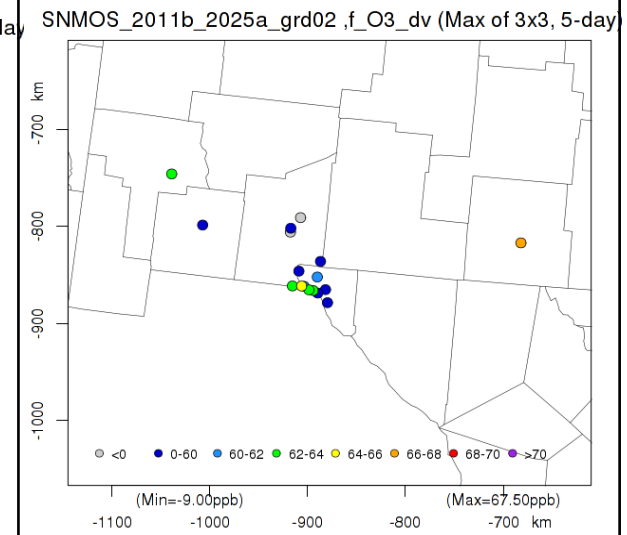
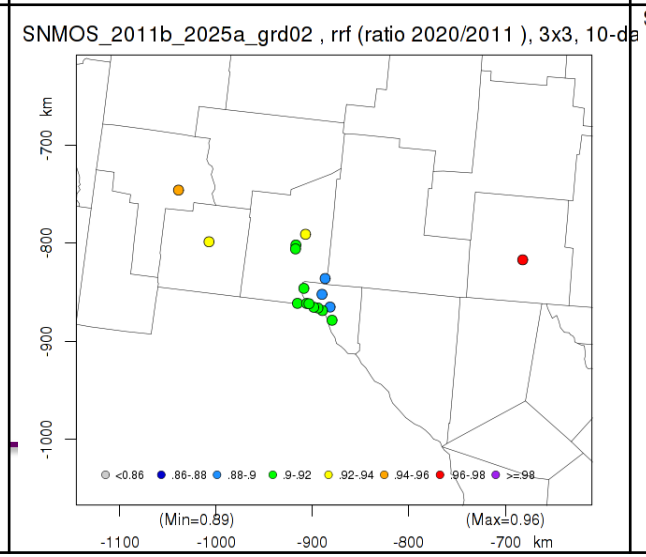
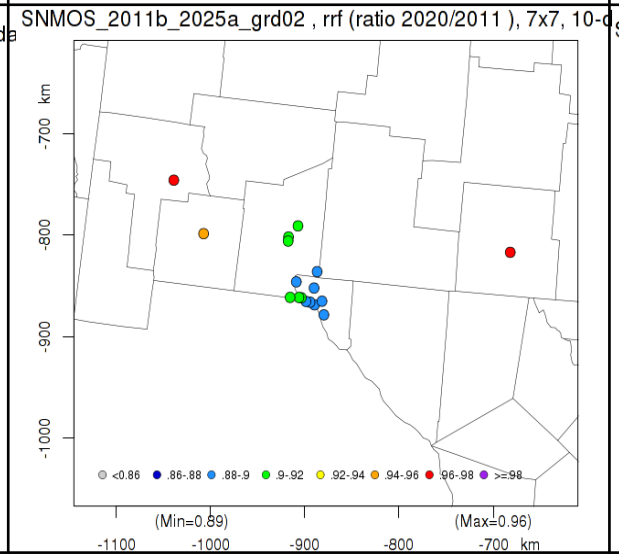
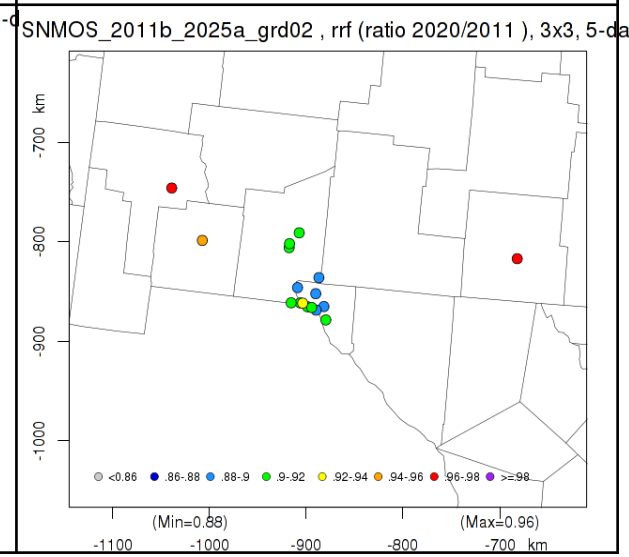


DVC	DVF	RRF	Site Name
64.7	58.3	0.9026	LA UNION
66.7	61.3	0.9195	SUNLAND PARK
-7	-9	0.9239	LAS CRUCES WELL STATION #41;HOLMAN ROAD
67.7	60.8	0.8985	CHAPARRAL
71	65.1	0.9183	DESERT VIEW
70.3	63.8	0.9086	SANTA TERESA
64.3	58.7	0.9136	750 N.SOLANO DRIVE
-7	-9	0.9198	HOLIDAY INN
70.3	67.8	0.9646	HOLLAND ST;SE OF WATER TANK;CARLSBAD;NM
65	62	0.955	CHINO BLVD NR HURLEY PARK; HURLEY;NM
63	58.6	0.9311	310 AIRPORT ROAD; DEMING; NM 88030
65	58.4	0.8996	10834 IVANHOE; IVANHOE FIRE STATION
71	65.2	0.9186	RIM RD. NEAR HAWTHORNE NEXT TO UT POLICE
69	62.7	0.9098	800 S. SAN MARCIAL STREET
66.3	60.1	0.9069	650 R.E. THOMASON LOOP
66	59.8	0.9071	201 S. NEVAREZ RD.
69.3	61.7	0.8917	5050 A YVETTE DRIVE

MATS Sensitivity Configurations

- Use the 4-km domain to test how different MATS configurations change the DVF and RRF results
- Spatial Matrix Experiment (7x7)
  - Maximum concentration from a matrix of modeled grid cells surrounding a monitor is used in the DVF calculation
  - Current EPA guidance is a 3x3 matrix (9 cells)
  - Experiment uses a 7x7 matrix (49 cells, previous EPA guidance)
- Temporal Averaging Experiment (5 days)
  - DVFs and RRFs calculated from top X modeled MDA8 ozone days
  - Current EPA guidance is top 10 days
  - Experiment uses top 5 days

SNMOS MATS 4-km Domain Sensitivity Results

	Base (3x3 10-days)	7x7 10-days	3x3 5-days
DVF			
RRF			

Note the scales are adjusted to highlight the changes between the runs

SNMOS MATS 4-km Domain

Sensitivity Results

Future Design Values

Site ID	DVC	DVF (Base)	DVF (7x7)	DVF (5 days)	% Diff (Base – 7x7)	% Diff (Base – 5 days)	Site Name
350130008	64.7	58.3	57.9	57.7	-0.69%	-1.03%	LA UNION
350130017	66.7	61.3	60	61.5	-2.12%	0.33%	SUNLAND PARK
350130020	67.7	60.8	60.8	59.8	0.00%	-1.64%	CHAPARRAL
350130021	71	65.1	64	64.5	-1.69%	-0.92%	DESERT VIEW
350130022	70.3	63.8	63.4	63.9	-0.63%	0.16%	SANTA TERESA
350130023	64.3	58.7	58.1	59	-1.02%	0.51%	750 N.SOLANO DRIVE

Relative Response Factors

Site ID	DVC	RRF (Base)	RRF (7x7)	RRF (5 days)	% Diff (Base – 7x7)	% Diff (Base – 5 days)	Site Name
350130008	64.7	0.9026	0.8959	0.8929	-0.74%	-1.07%	LA UNION
350130017	66.7	0.9195	0.9001	0.9228	-2.11%	0.36%	SUNLAND PARK
350130020	67.7	0.8985	0.8983	0.8838	-0.02%	-1.64%	CHAPARRAL
350130021	71	0.9183	0.9027	0.9087	-1.70%	-1.05%	DESERT VIEW
350130022	70.3	0.9086	0.9032	0.9099	-0.59%	0.14%	SANTA TERESA
350130023	64.3	0.9136	0.9039	0.9176	-1.06%	0.44%	750 N.SOLANO DRIVE

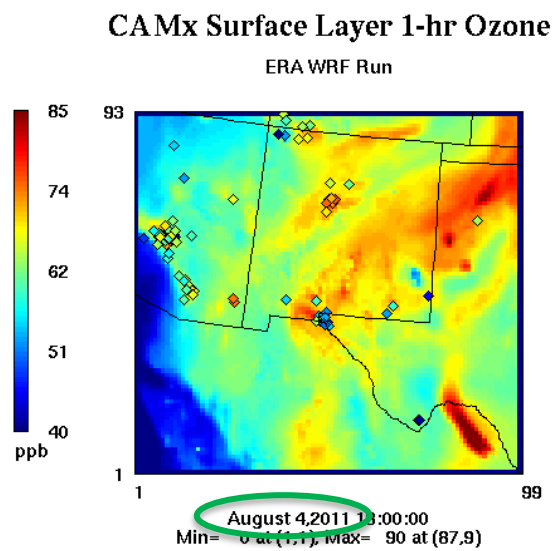
Alternative Days for MATS: Desert View

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%

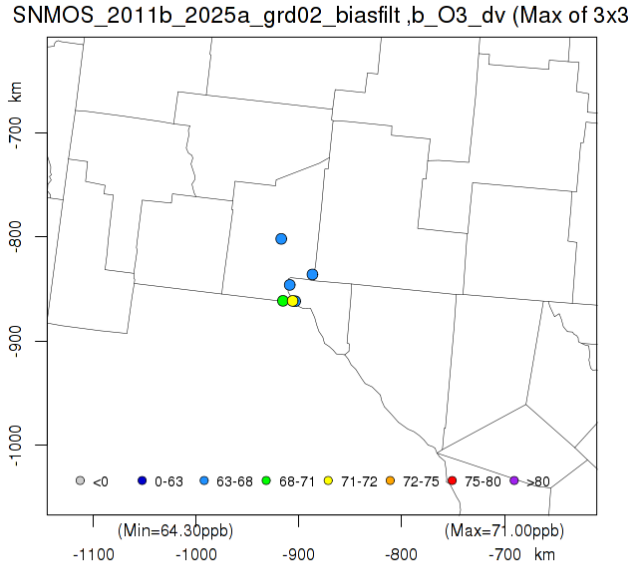
Top 10 observed MDA8 days

Top 10 modeled MDA8 days

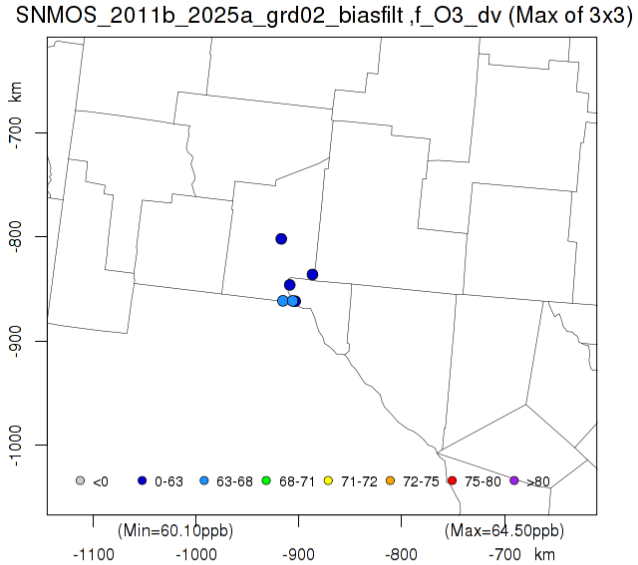
- Choose top 10 modeled MDA8 days with bias < ±10% for sensitivity analysis
  - The 10 days to be used in the RRF with ≤±10% MPE filter now include 4 of the 10 highest observed days at Desert View
- Model performance is reasonably good on all days that would go into the RRF

SNMOS Alternative MATS 4-km Domain Results

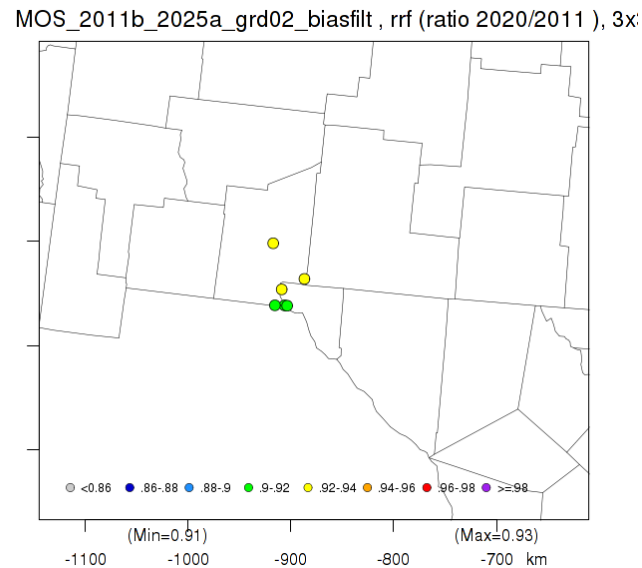
DVC (2011)



DVF (2025)



RRF (2025/2011)



Site ID	DVC	DVF (Base)	DVF (Bias < 10%)	RRF (Base)	RRF (Bias < 10%)	Site Name
350130008	64.7	58.3	60.2	0.9026	0.9306	LA UNION
350130017	66.7	61.3	60.9	0.9195	0.9136	SUNLAND PARK
350130020	67.7	60.8	62.9	0.8985	0.9293	CHAPARRAL
350130021	71	65.1	64.5	0.9183	0.9092	DESERT VIEW
350130022	70.3	63.8	64.3	0.9086	0.9158	SANTA TERESA
350130023	64.3	58.7	59.5	0.9136	0.9263	750 N.SOLANO DRIVE

SNMOS Attainment Testing Summary

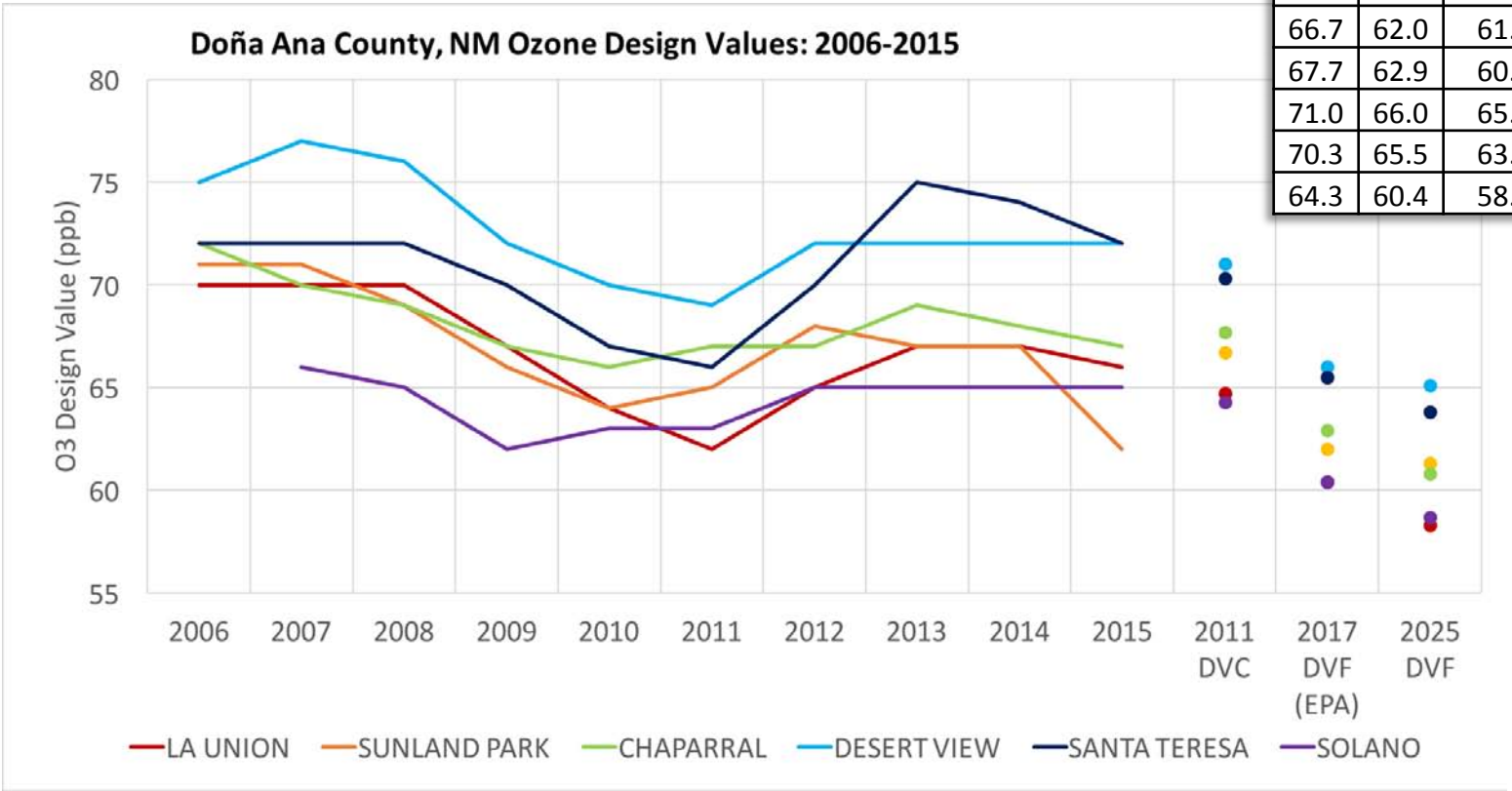
- MATS projects DVFs for all active Doña County monitors to be below the 2015 8-hr standard (70 ppb).
- Unmonitored area analysis shows that all but a few cells in the 4-km domain (northern Grant Co.) will be in attainment in 2025.
- MATS configuration sensitivities produced little impact on the DVF predictions
- The O_3 bias filtering changed the DVF predictions by up to a few percent, but did not impact future year attainment status

Doña Ana County Design Value Trends

- Historical (2006-2015) 3-year ozone DVs
- Current (DVC) and Future (DVF) 5-year DVs

Dona Aña County DVFs

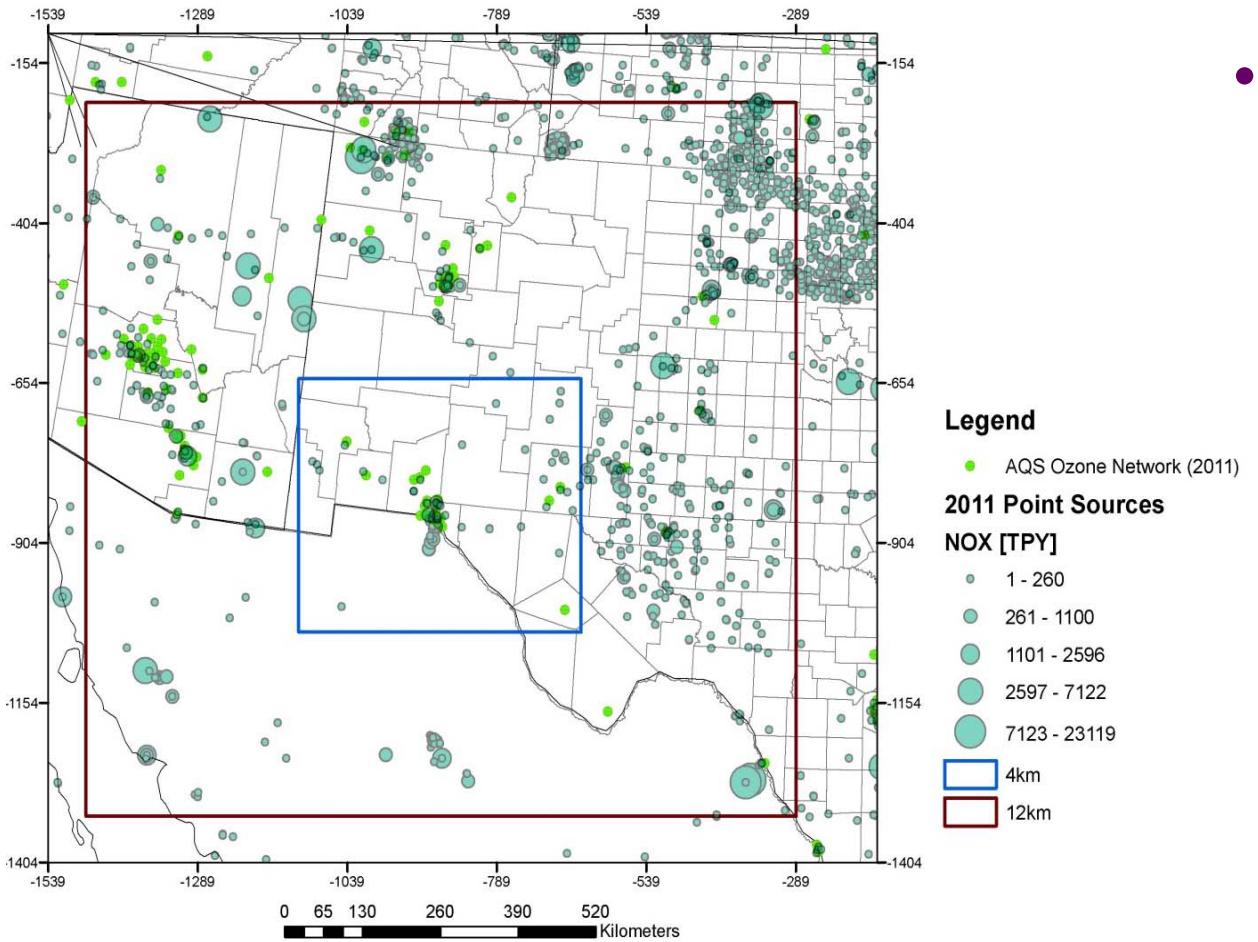
2011	2017 (EPA)	2025 (SNMOS)	Site Name
64.7	60.4	58.3	LA UNION
66.7	62.0	61.3	SUNLAND PARK
67.7	62.9	60.8	CHAPARRAL
71.0	66.0	65.1	DESERT VIEW
70.3	65.5	63.8	SANTA TERESA
64.3	60.4	58.7	SOLANO



SNMOS Next Steps

- **Task 11: Future year emissions sensitivity/control modeling**
  - Conduct future year CAMX 12/4 km emissions sensitivities to evaluate the impacts of emissions reductions on ozone concentrations using the 2011 and/or 2025 CAMx modeling database.
- **Task 12: CAMx Ozone Source Apportionment modeling**
  - Perform future year CAMx 12/4-km ozone source apportionment modeling of source region and source category contributions to ozone concentrations and ozone design values at ozone monitoring in Doña Ana county and elsewhere
- **Task 13: Technical Support Document**
  - Document all SNMOS tasks, analyses and deliverables

Task 11 & 12 Sensitivity/Source Apportionment



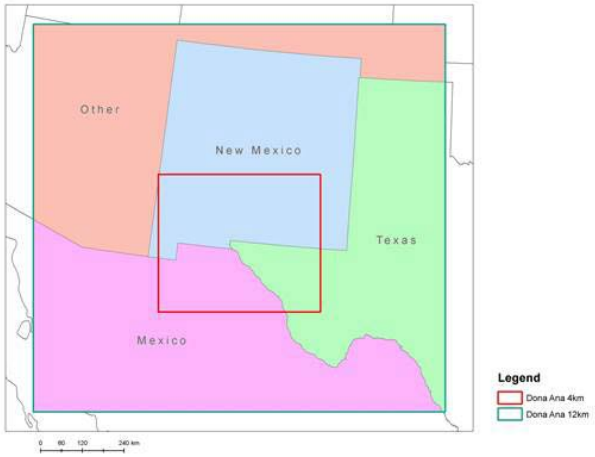
- Task 11&12 Sens/SA modeling will perform CAMx simulations on the 12/4 km domain using two-way grid nesting

Task 11: Sensitivity Tests

- Discussed several options with NMED during June 3 conference call:
  - Zero out Mexico emissions, 2025 ozone levels if on-road emissions reductions are smaller than projected, effects of fires on ozone projections, and shutdown of El Paso Electric Rio Grande EGU in Sunland, NM
- 2011 Zero-Out Mexico Anthropogenic Emissions:
  - What would current year ozone DVs be in the absence of Mexico anthropogenic emissions (§179B "But For")
- Double 2025 On-Road Mobile NOx, VOC and CO Emissions
  - On-road emissions are projected to be reduced ~70% between 2011 and 2025; this test would evaluate a reduction of ~45%
- Also considered shutting down El Paso Electric Rio Grande EGU but already shut down in 2025 emissions

Task 12: Source Apportionment

- 2011 and 2025 CAMx 12/4 km ozone source apportionment Simulation:
  - Source Regions (4):
    - New Mexico
    - Texas
    - Mexico
    - Arizona+
  - Initial Concentrations
  - Boundary Conditions
  - Source Categories (8):
    - Natural (Biogenic + LNOx)
    - On-Road Mobile
    - Non-Road Mobile
    - Oil and Gas
    - EGU Point
    - Non-EGU Point
    - Fires (WF, RX, Ag)
    - Remainder Anthropogenic



- Results in 34 total Source Groups (34 = 4 x 8 + 2)
  - Contribution of Mexico to 2011 and 2025 ozone
  - 2025 ozone DV projections without presence of fires
  - Changes in ozone between 2011 to 2025 by region and source type
  - Ranking of sources that contribute to 2025 ozone levels

Schedule for Completion of SNMOS

- **Task 11**: Emissions Sensitivity/Controls
  - 2011: Zero out Mexico anthropogenic emissions
  - 2025: Double on-road mobile emissions
  - Complete by: August 15, 2016
- **Task 12**: Source Apportionment
  - 4 source regions x 8 source categories + IC + BC (34 source groups)
  - 2011 and 2025 emissions
  - Complete by September 15, 2016
- **Task 13**: Air Quality Technical Support Document
  - Document results of entire study
  - Draft and Final AQTSD
  - Complete by November 18, 2016

Supplementary Materials

Monitored and 4-km CAMx Results

All Days & Bias < 10% Days

La Union (350130008)										
Top 10 Modeled All Days						Top 10 Modeled Bias < 10%				
Date	OBS	MOD	BIAS	BIAS%		Date	OBS	MOD	BIAS	BIAS%
8/7/11	48.625	81.375	32.75	67.4%		7/28/11	64.125	69.632	5.507	8.6%
8/2/11	56.625	77.582	20.957	37.0%		7/29/11	63.125	66.559	3.434	5.4%
7/23/11	53.625	77.476	23.851	44.5%		8/21/11	62.75	65.541	2.791	4.4%
7/25/11	58.125	77.133	19.008	32.7%		8/3/11	63	65.424	2.424	3.8%
8/5/11	57.625	77.072	19.447	33.7%		5/25/11	63.125	62.988	-0.137	-0.2%
7/21/11	51.125	77.006	25.881	50.6%		8/19/11	60.5	60.691	0.191	0.3%
8/4/11	61.625	76.634	15.009	24.4%		5/24/11	64.25	60.359	-3.891	-6.1%
7/8/11	58.125	73.261	15.136	26.0%		7/12/11	56.125	59.498	3.373	6.0%
6/22/11	64.25	73.198	8.948	13.9%		8/20/11	53.25	58.442	5.192	9.8%
6/27/11	60.25	72.934	12.684	21.1%		7/13/11	56	58.193	2.193	3.9%

Top 10 AQS Observed Values

Top 10 CAMx Modeled Values

Monitored and 4-km CAMx Results

All Days & Bias < 10% Days

Sunland Park (350130017)										
Top 10 Modeled All Days						Top 10 Modeled Bias < 10%				
Date	OBS	MOD	BIAS	BIAS%		Date	OBS	MOD	BIAS	BIAS%
8/5/11	62.625	82.991	20.366	32.52%		6/22/11	78.625	71.948	-6.677	-8.5%
8/7/11	52.5	81.552	29.052	55.34%		7/7/11	64.625	70.682	6.057	9.4%
7/21/11	56.5	76.743	20.243	35.83%		7/28/11	68.75	69.405	0.655	1.0%
8/30/11	61.25	74.138	12.888	21.04%		8/27/11	66.25	69.264	3.014	4.5%
7/25/11	63.125	74.081	10.956	17.36%		8/2/11	67.25	68.618	1.368	2.0%
8/4/11	62.625	73.615	10.99	17.55%		6/15/11	61.75	67.711	5.961	9.7%
8/29/11	55	72.777	17.777	32.32%		6/26/11	66.125	67.56	1.435	2.2%
7/9/11	59.625	72.326	12.701	21.30%		8/22/11	62.875	66.755	3.88	6.2%
8/28/11	61.25	72.06	10.81	17.65%		6/27/11	67.375	66.606	-0.769	-1.1%
6/22/11	78.625	71.948	-6.677	-8.49%		8/8/11	61.375	66.551	5.176	8.4%

Top 10 AQS Observed Values

Top 10 CAMx Modeled Values

Monitored and 4-km CAMx Results

All Days & Bias < 10% Days

Chaparral (350130020)										
Top 10 Modeled All Days						Top 10 Modeled Bias < 10%				
Date	OBS	MOD	BIAS	BIAS%		Date	OBS	MOD	BIAS	BIAS%
8/5/11	65.375	83.78	18.405	28.15%		8/6/11	65.25	70.362	5.112	7.83%
8/29/11	60.125	82.178	22.053	36.68%		6/15/11	66.25	68.555	2.305	3.48%
7/26/11	58.625	78.527	19.902	33.95%		7/28/11	65.625	68.281	2.656	4.05%
7/27/11	59.625	76.422	16.797	28.17%		6/23/11	65.75	66.707	0.957	1.46%
7/22/11	60	73.237	13.237	22.06%		8/9/11	60.375	66.055	5.68	9.41%
8/4/11	55.5	73.229	17.729	31.94%		8/19/11	64.75	64.163	-0.587	-0.91%
7/25/11	62.125	72.712	10.587	17.04%		5/26/11	61.5	63.952	2.452	3.99%
7/21/11	60	72.685	12.685	21.14%		6/4/11	69.75	63.424	-6.326	-9.07%
8/7/11	56.5	71.638	15.138	26.79%		8/20/11	57.375	63.064	5.689	9.92%
8/16/11	58.125	70.604	12.479	21.47%		6/5/11	60	62.947	2.947	4.91%

Top 10 AQS Observed Values

Top 10 CAMx Modeled Values

Monitored and 4-km CAMx Results

All Days & Bias < 10% Days

Desert View (350130021)										
Top 10 Modeled All Days						Top 10 Modeled Bias < 10%				
Date	OBS	MOD	BIAS	BIAS%		Date	OBS	MOD	BIAS	BIAS%
8/5/11	65.125	81.966	16.841	25.86%		6/22/11	81.75	74.447	-7.303	-8.93%
8/7/11	55	81.433	26.433	48.06%		7/8/11	68	73.339	5.339	7.85%
7/21/11	58.125	75.839	17.714	30.48%		8/28/11	69.125	72.483	3.358	4.86%
8/4/11	67.875	75.785	7.91	11.65%		7/28/11	72	71.9	-0.1	-0.14%
6/22/11	81.75	74.447	-7.303	-8.93%		8/18/11	66	71.665	5.665	8.58%
7/9/11	64.125	73.708	9.583	14.94%		8/27/11	73.375	70.966	-2.409	-3.28%
7/20/11	65.5	73.573	8.073	12.33%		8/6/11	66.375	70.191	3.816	5.75%
7/25/11	64.625	73.442	8.817	13.64%		8/2/11	68	69.984	1.984	2.92%
7/8/11	68	73.339	5.339	7.85%		6/26/11	68.75	68.794	0.044	0.06%
8/30/11	65.125	73.307	8.182	12.56%		8/22/11	67.5	68.517	1.017	1.51%

Top 10 AQS Observed Values

Top 10 CAMx Modeled Values

Monitored and 4-km CAMx Results

All Days & Bias < 10% Days

Santa Teresa (350130022)										
Top 10 Modeled All Days						Top 10 Modeled Bias < 10%				
Date	OBS	MOD	BIAS	BIAS%		Date	OBS	MOD	BIAS	BIAS%
8/4/11	68.5	78.864	10.364	15.13%		6/22/11	78.75	74.149	-4.601	-5.84%
8/7/11	53.5	78.37	24.87	46.49%		8/27/11	67.25	72.43	5.18	7.70%
8/5/11	59.875	76.028	16.153	26.98%		8/22/11	67.5	71.049	3.549	5.26%
7/7/11	67.375	74.74	7.365	10.93%		8/23/11	68.714	70.653	1.939	2.82%
7/8/11	64.375	74.173	9.798	15.22%		8/18/11	67.625	69.91	2.285	3.38%
6/22/11	78.75	74.149	-4.601	-5.84%		8/6/11	62.875	68.582	5.707	9.08%
7/9/11	62.375	73.862	11.487	18.42%		6/26/11	67.375	67.785	0.41	0.61%
7/28/11	63.75	73.67	9.92	15.56%		7/29/11	65.125	67.534	2.409	3.70%
7/25/11	59	73.514	14.514	24.60%		7/10/11	62.625	66.005	3.38	5.40%
8/26/11	60.875	73.512	12.637	20.76%		8/3/11	64.375	65.809	1.434	2.23%

Top 10 AQS Observed Values

Top 10 CAMx Modeled Values

Monitored and 4-km CAMx Results

All Days & Bias < 10% Days

Solano (350130023)										
Top 10 Modeled All Days						Top 10 Modeled Bias < 10%				
Date	OBS	MOD	BIAS	BIAS%		Date	OBS	MOD	BIAS	BIAS%
8/7/11	59.5	77.351	17.851	30.00%		8/6/11	68.25	73.424	5.174	7.58%
7/25/11	63.625	75.242	11.617	18.26%		8/5/11	66.125	72.546	6.421	9.71%
8/28/11	58.125	74.105	15.98	27.49%		8/27/11	67	69.407	2.407	3.59%
8/6/11	68.25	73.424	5.174	7.58%		7/27/11	62.5	66.834	4.334	6.93%
8/4/11	57.75	72.789	15.039	26.04%		6/15/11	62.875	66.382	3.507	5.58%
8/5/11	66.125	72.546	6.421	9.71%		6/27/11	60.375	66.217	5.842	9.68%
7/21/11	59.5	71.996	12.496	21.00%		6/22/11	65.25	64.681	-0.569	-0.87%
7/23/11	58	69.951	11.951	20.61%		7/28/11	60.875	63.757	2.882	4.73%
7/7/11	59.125	69.758	10.633	17.98%		7/29/11	59.625	62.978	3.353	5.62%
8/27/11	67	69.407	2.407	3.59%		8/8/11	58.875	62.745	3.87	6.57%

Top 10 AQS Observed Values

Top 10 CAMx Modeled Values