

West-wide Jumpstart Air Quality Modeling Study

Final Project Report and Modeling Results



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Funding from State of NM, BP, and National BLM Air Program

Oversight by western states, local air agencies, federal land managers, EPA regional and national offices

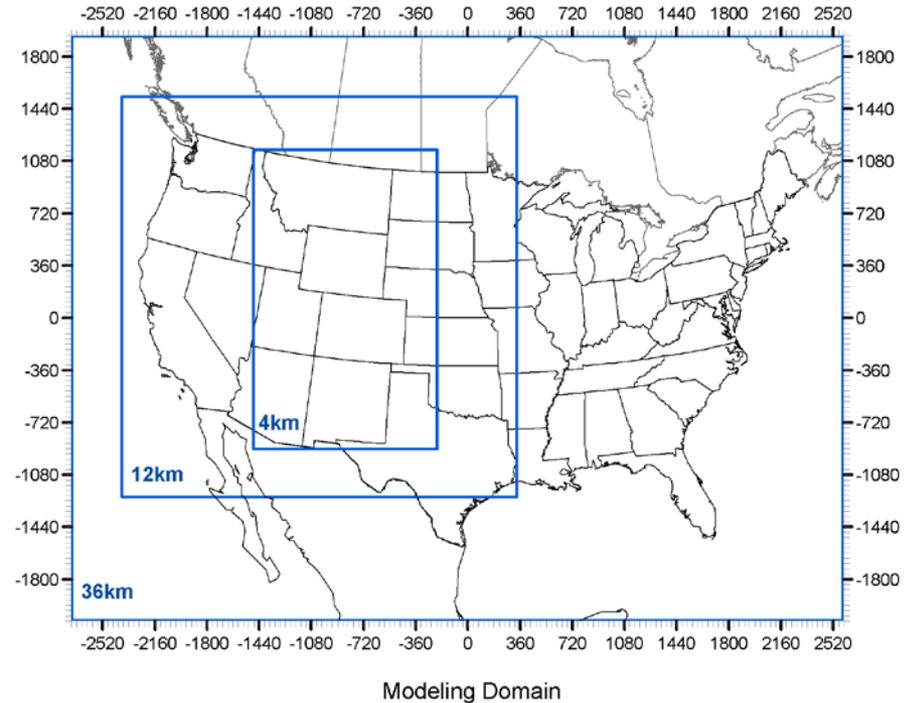


Introduction

- West-wide Jump-start Air Quality Modeling Study (WestJumpAQMS) was initiated in late 2010 to:
 - Develop the next generation of regional air quality modeling databases for ozone, PM_{2.5}, visibility and deposition planning in the western U.S.
 - Provide information on the role of interstate and international transport to ozone and PM_{2.5} under current and potential future NAAQS
 - Assess contributions of major source categories (e.g., point, O&G, mobile, et cetera) to air quality in the West
 - Provide detailed information to the community

Overview of Approach

- 2008 Modeling Database
 - 36 km CONUS
 - 12 km WESTUS
 - 4 km IMWD
- WRF meteorological; CAMx photochemical; SMOKE emissions models
- 2008 WRAP Phase III O&G emissions
- 2008 NEI emissions
- Model Evaluation
- Sensitivity Tests



- State-Specific and Source Category-Specific Ozone and PM_{2.5} Source Apportionment Modeling

WestJumpAQMS Products

- Final Report
 - 15 Electronic Appendices
 - Response-to-Comments
- Ammonia Emissions Recommendations Memo
- Modeling Protocol
 - Response-to-Comments
- WRF Application/Evaluation Report
 - Evaluation down to individual monitoring site
 - Response-to-Comments
- 16 Technical Memorandums on Emissions
 1. Point Sources
 2. Area + Non-Road
 3. On-Road Mobile
 - 4a-e. Oil and Gas (5 geographic areas)
 5. Fire (WF, Rx & Ag)
 6. Fugitive Dust
 7. Off-Shore Shipping
 8. Ammonia
 9. Biogenic
 - 11 Mexico/Canada
 12. Sea Salt and Lightning
 13. Emissions Modeling Parameters

All information on WestJumpAQMS website

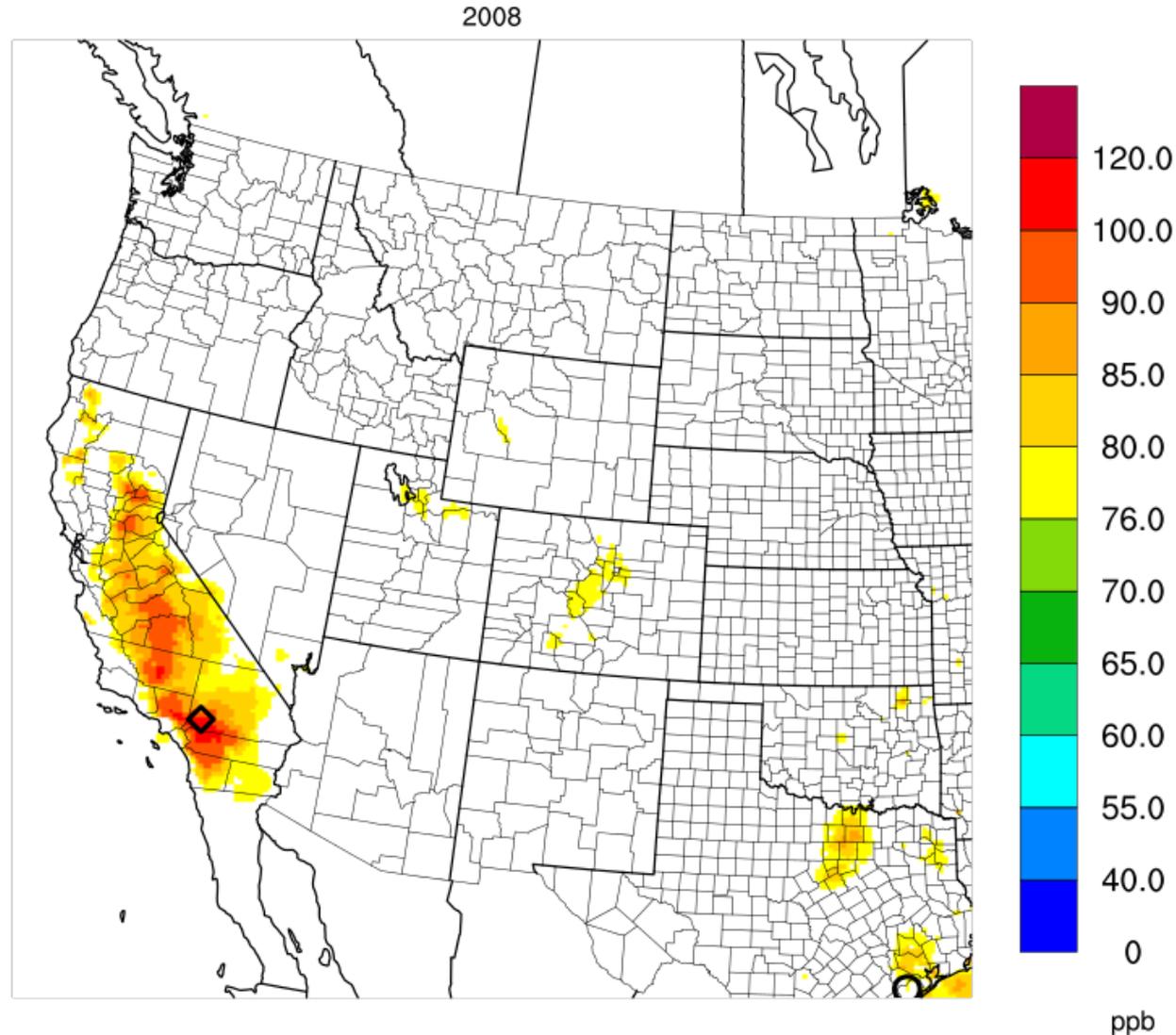
WestJumpAQMS Progress Webinars

- June 20, 2013: 2008 Database Development
- July 26, 2013: State-Specific Source Apportionment
- August 29, 2013: Source Category-Specific Source Apportionment
- [Interactive agenda from WestJumpAQMS Final Project Report meeting](#), Denver, CO – September 25, 2013
- **Presentations and all project materials at:**
<http://www.wrapair2.org/WestJumpAQMS.aspx>

Ozone, PM, Deposition, and Visibility Source Apportionment Resources from WestJumpAQMS

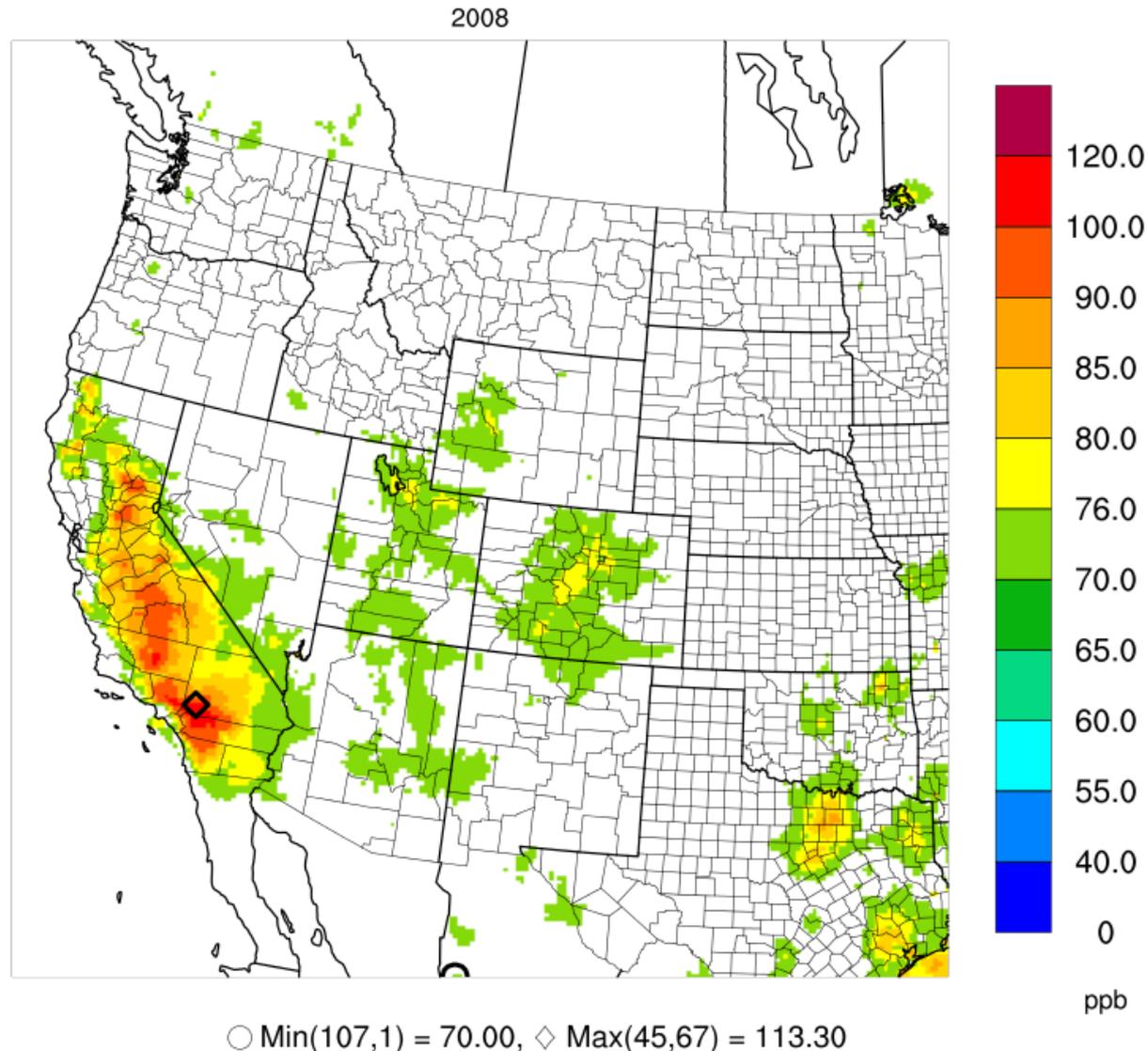
- Appendices A through I address Ozone
- Appendix J: Source Category-Specific Contributions to Annual PM_{2.5} Design Values at Monitoring Sites in the 12 km WESTUS Domain using MATS ([XLSX](#) 2MB)
- Appendix K: Source Category-Specific Contributions to Modeled Annual PM_{2.5} Concentrations ($\mu\text{g}/\text{m}^3$) at Monitoring Sites in the 12 km WESTUS Domain ([XLSX](#) 4MB)
- Appendix L: Source Category-Specific Contributions to 24-Hour PM_{2.5} Design Values at Monitoring Sites in the 12 km WESTUS Domain using MATS ([XLSX](#) 2MB)
- Appendix M: Source Category-Specific Contributions to Ten Highest Modeled 24-Hour PM_{2.5} Concentrations ($\mu\text{g}/\text{m}^3$) at Monitoring Sites in the 12 km WESTUS Domain ([XLSX](#) 10MB)
- Appendix N: Annual Sulfur and Nitrogen Wet and Dry Deposition at IMPROVE Monitors by Species ([XLSX](#) 1MB)
- Appendix O: Western State-Specific Modeled Contributions to Visibility Impairment at IMPROVE Monitoring Sites for Modeled Worst (W20) and Best (B20) 20% Days during 2008 ([ZIP](#) 46MB)

Ozone Attainment Test Software – Unmonitored Area Analysis with Design Value (2006-2010) ≥ 76 ppb

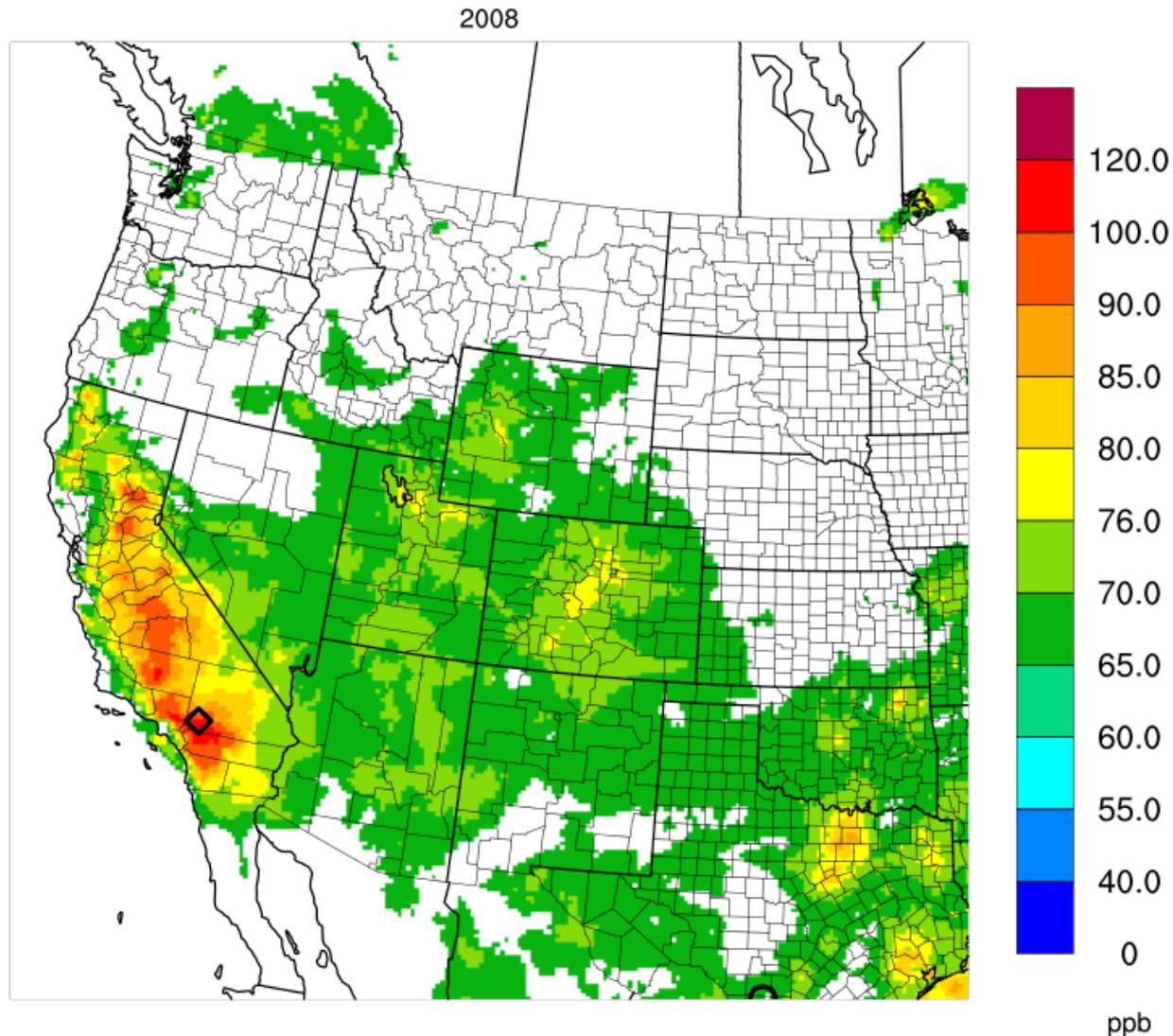


○ Min(210,3) = 76.00, ◇ Max(45,67) = 113.30

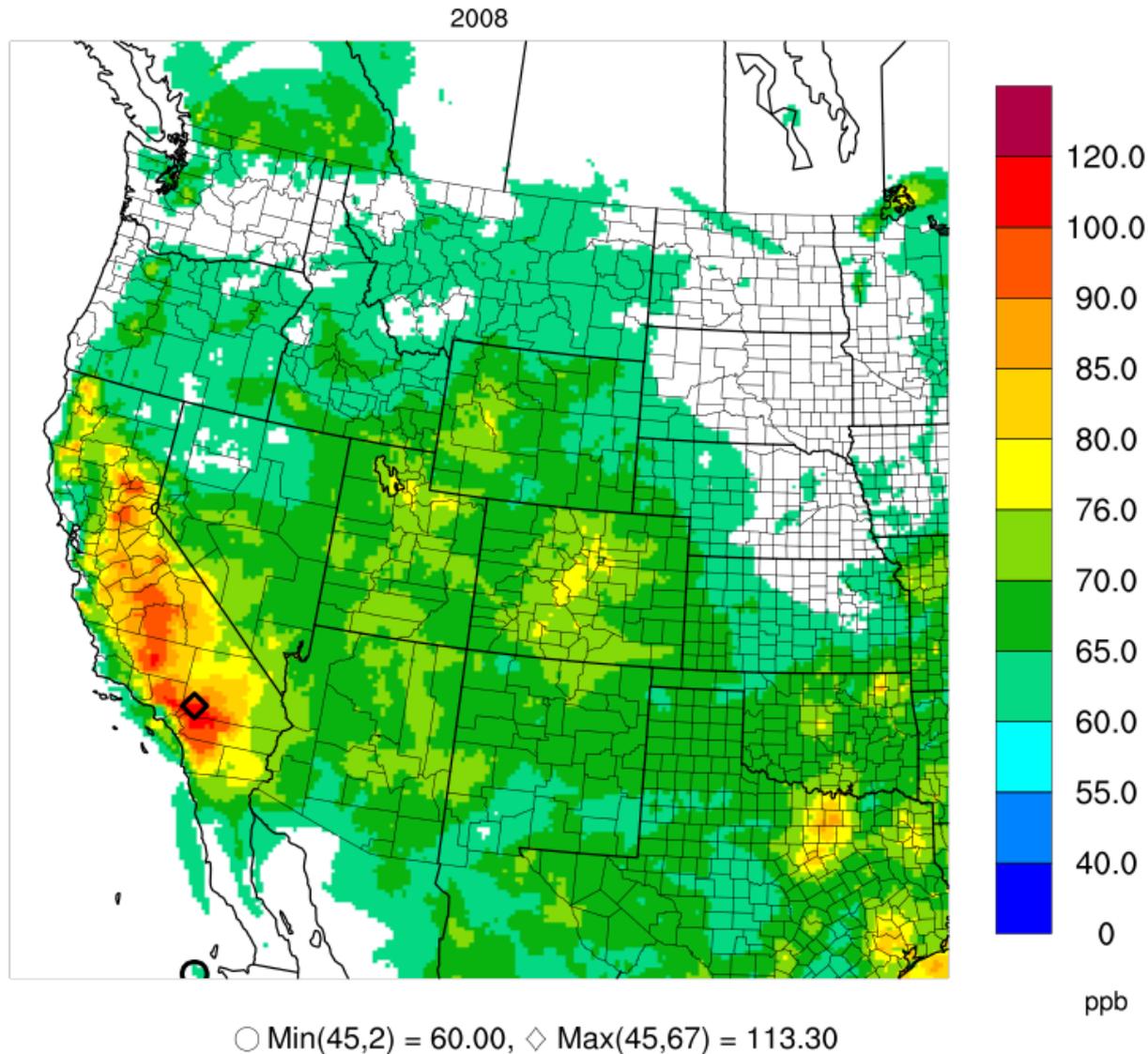
Ozone Attainment Test Software – Unmonitored Area Analysis with Design Value (2006-2010) ≥ 70 ppb



Attainment Test Software – Unmonitored Area Analysis with Design Value (2006-2010) ≥ 65 ppb



Ozone Attainment Test Software – Unmonitored Area Analysis with Design Value (2006-2010) ≥ 60 ppb

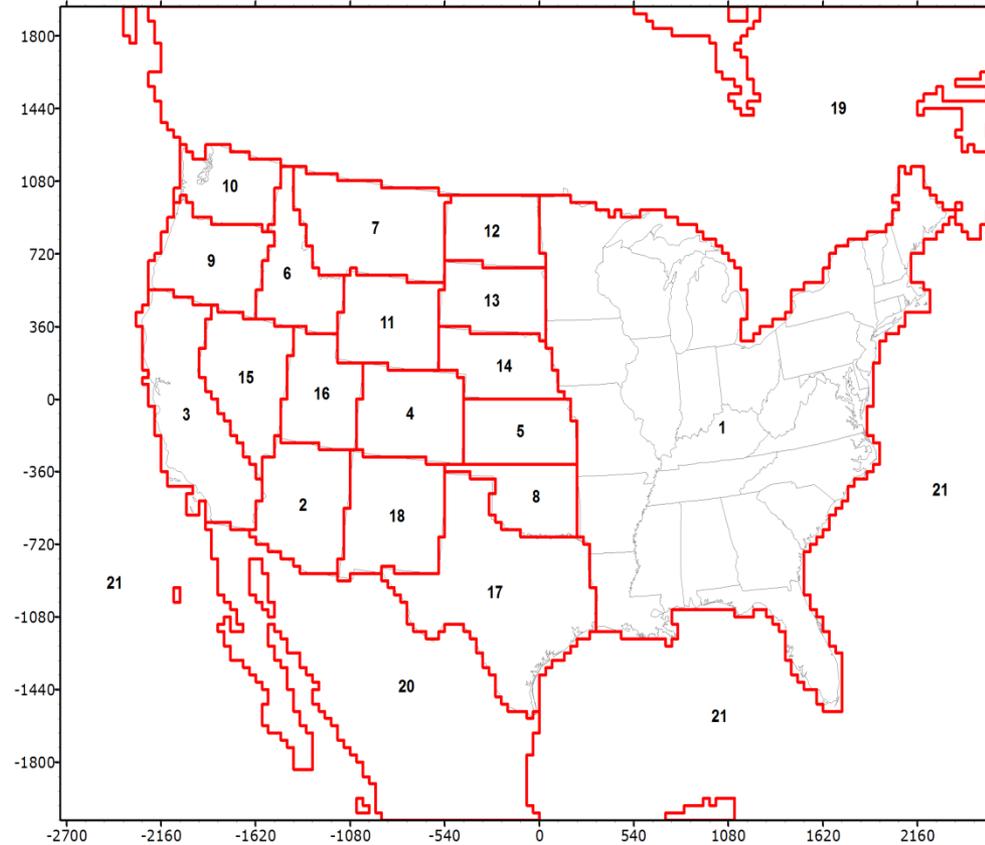


State-Specific Ozone Source Apportionment

- Purpose: To provide information on the role of ozone transport to exceedances of the current and potential future ozone NAAQS in the western U.S.
- Approach: Analyze ozone apportionment several ways:
 1. Upwind state contribution to downwind state nonattainment using Cross State Air Pollution Rule (CSAPR-type) approach
 - Use EPA method for projecting ozone Design Values (RRFs)
 2. State contributions to modeled high ozone DMAX8 ozone at monitors in 12 km WESTUS domain
 - Spatial extent of modeled state contributions to 1stmax and 4thmax DMAX8 ozone greater than current and potential future NAAQS
 - Source category analysis (Natural, Fires & Anthropogenic)
 3. Detailed Source Category-Specific Source Apportionment
 - 6 key source categories across 4 states in intermountain West
 - 2-way nesting between model domains

State-Specific Ozone Source Apportionment

- 2008 36/12 km Base
- 17 Western States
 - Plus EasternUS, Can, Mex & Off-Shore
- 5 Source Categories
 - Natural
(Biogenics+Lightning+WBDust+SeaSalt)
 - WF, Rx and Ag Fires
 - Anthropogenic
- 107 Source Groups (21 x 5 + 2)
 - 4 Extra Species for each Group
 - 428 additional species
 - Standard Model = 70 species
 - Computationally Demanding

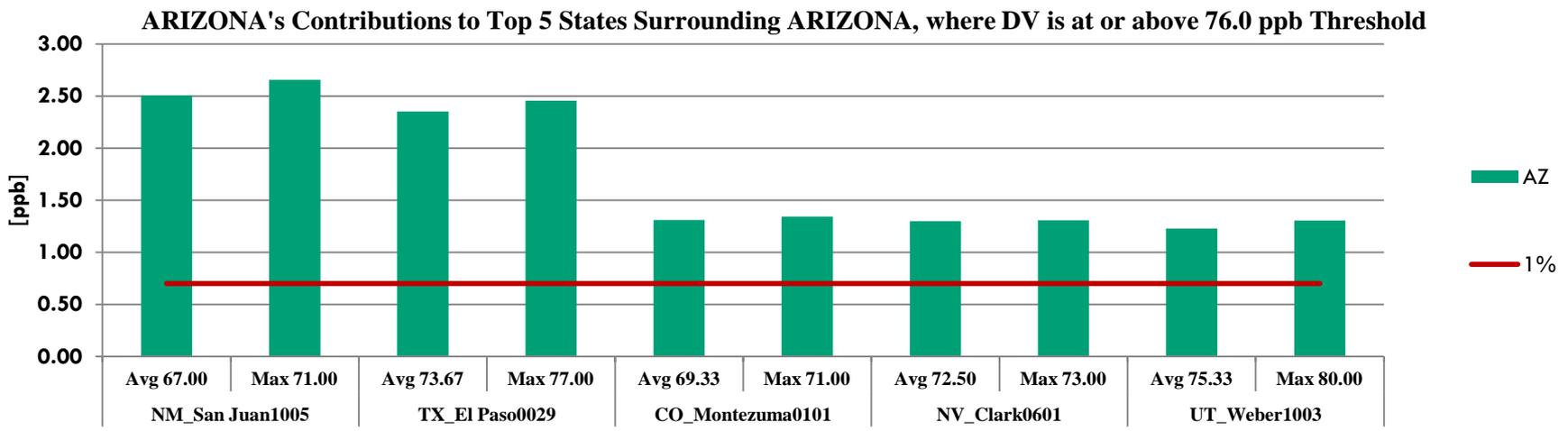


CSAPR-Type Analysis for Current (76 ppb) NAAQS

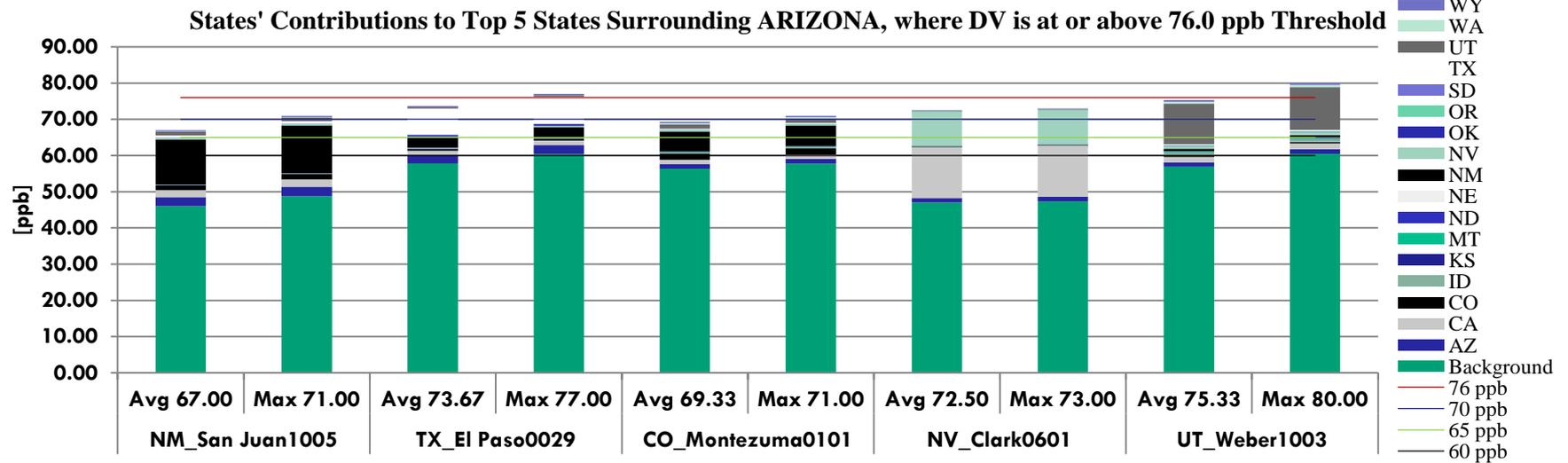
- CSAPR looked at contributions to:
 - Average Design Value = Average of DVs from 2006-2010
 - Max Design Values = Max DVs from 2006-2010
- 136 ozone monitors in 12 km WESTUS domain with Average Design Value exceeding NAAQS
 - 86 sites (63%) in California
- For 17 upwind western states examine 2008 contribution to DMAX8 ozone Design Value in downwind states
 - CSAPR used a 1% NAAQS significance threshold (≥ 0.76 ppb)
- This analysis is for 2008 and is not a regulatory analysis that would have to examine a future year

Arizona CSAPR-Type Ozone Analysis for 76 ppb NAAQS (from WestJumpAQMS Appendix A)

Arizona Ozone Contributions

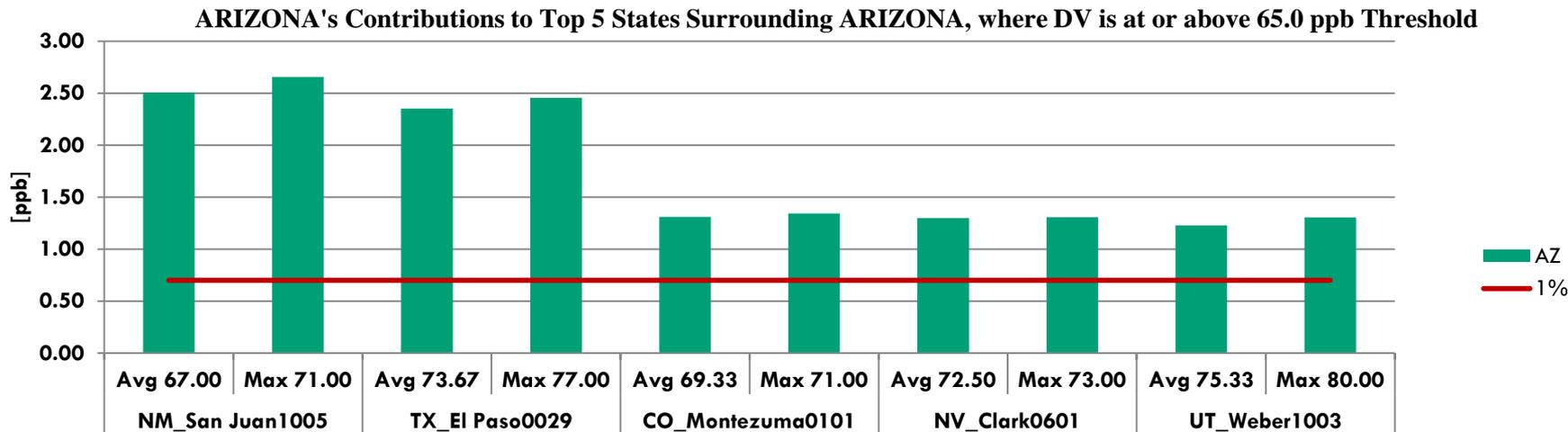


Downwind State Design Values

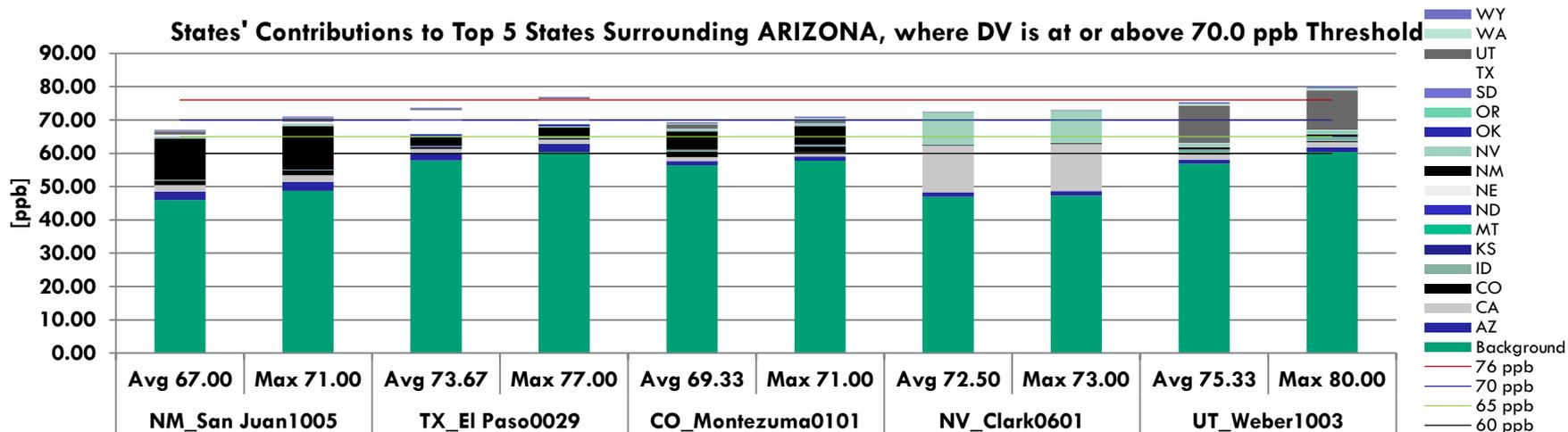


Arizona CSAPR-Type Ozone Analysis for 65 ppb NAAQS (from WestJumpAQMS Appendix A)

Arizona Ozone Contributions



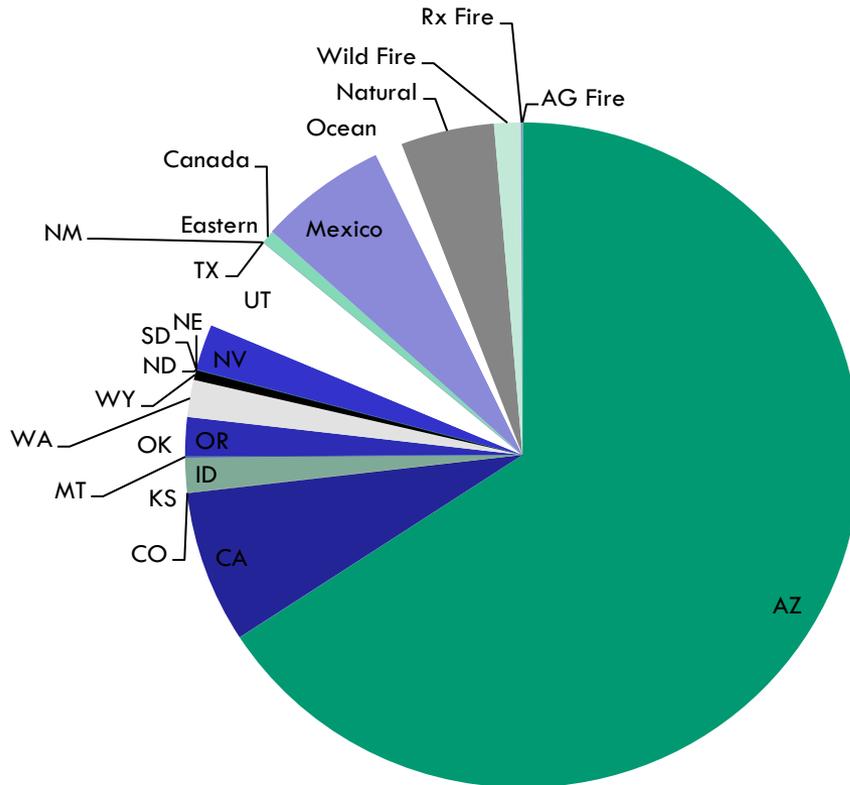
Downwind State Design Values



State Contributions to Modeled 10 Highest DMAX8 Ozone Days (from WestJumpAQMS Appendix B)

Highest Modeled DMAX8 Day @ Fairgrounds in Tucson, AZ

Contributions to MDA8 Ozone [ppb]



Site: AZ_Pima1020

Rank: 1 - 06 Aug, 2008

Total Ozone = 75.2 ppb

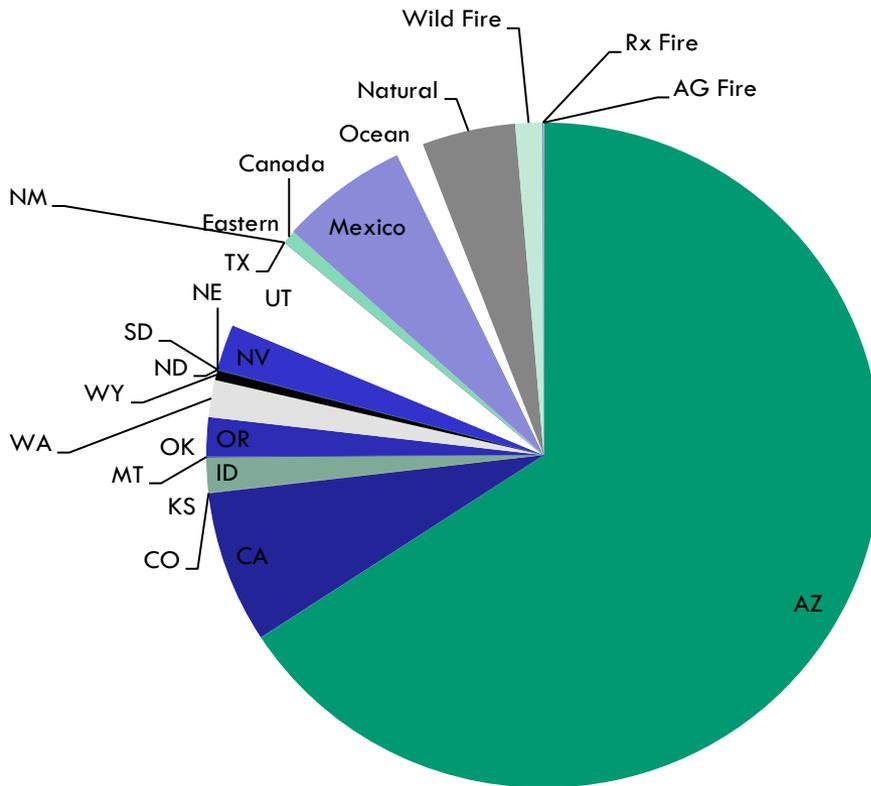
BC Ozone = 52.8 ppb (70.1%)

AZ	AZ (5.64 ppb, 7.49%)
CA	CA (0.60 ppb, 0.79%)
CO	CO (0.23 ppb, 0.31%)
KS	KS (0.10 ppb, 0.13%)
ID	ID (0.04 ppb, 0.06%)
MT	MT (0.02 ppb, 0.03%)
OK	OK (0.21 ppb, 0.28%)
OR	OR (0.02 ppb, 0.02%)
WA	WA (0.01 ppb, 0.01%)
WY	WY (0.15 ppb, 0.20%)
ND	ND (0.00 ppb, 0.01%)
SD	SD (0.04 ppb, 0.06%)
NE	NE (0.04 ppb, 0.06%)
NV	NV (0.11 ppb, 0.14%)
UT	UT (0.15 ppb, 0.20%)
TX	TX (1.49 ppb, 1.98%)
NM	NM (0.57 ppb, 0.75%)
Eastern	Eastern (0.64 ppb, 0.85%)
Canada	Canada (0.01 ppb, 0.01%)
Mexico	Mexico (3.74 ppb, 4.97%)
Ocean	Ocean (0.38 ppb, 0.51%)
Natural	Natural (7.95 ppb, 10.57%)
Wild Fire	Wild Fire (0.35 ppb, 0.47%)
Rx Fire	Rx Fire (0.01 ppb, 0.01%)
AG Fire	AG Fire (0.00 ppb, 0.01%)

State Contributions to Modeled 10 Highest DMAX8 Ozone Days (from WestJumpAQMS Appendix B)

4th Highest Modeled DMAX8 Day @ Fairgrounds in Tucson, AZ

Contributions to MDA8 Ozone [ppb]



Site: AZ_Pima1020

Rank: 4 - 08 Aug, 2008

Total Ozone = 74.1 ppb

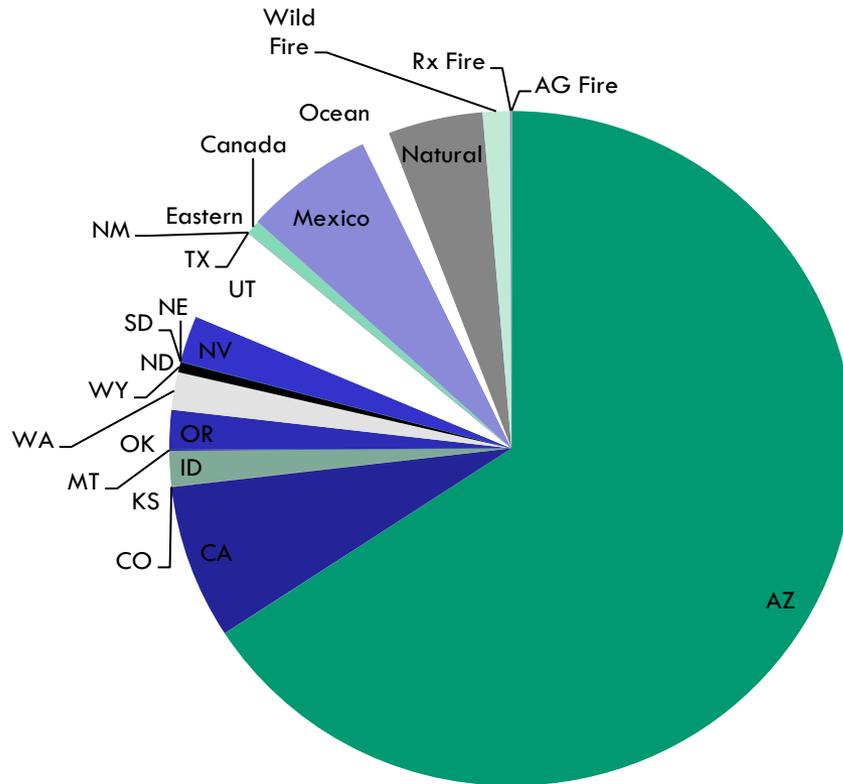
BC Ozone = 30.4 ppb (41.0%)

AZ	AZ (27.31 ppb, 36.86%)
CA	CA (1.45 ppb, 1.96%)
CO	CO (0.17 ppb, 0.24%)
KS	KS (0.07 ppb, 0.10%)
ID	ID (0.03 ppb, 0.04%)
MT	MT (0.02 ppb, 0.02%)
OK	OK (0.17 ppb, 0.23%)
OR	OR (0.01 ppb, 0.02%)
WA	WA (0.00 ppb, 0.01%)
WY	WY (0.12 ppb, 0.16%)
ND	ND (0.00 ppb, 0.00%)
SD	NE (0.03 ppb, 0.05%)
NE	NV (0.07 ppb, 0.10%)
NV	UT (0.11 ppb, 0.15%)
UT	TX (1.44 ppb, 1.94%)
TX	NM (0.58 ppb, 0.78%)
NM	Eastern (0.47 ppb, 0.64%)
Eastern	Canada (0.01 ppb, 0.01%)
Canada	Mexico (3.06 ppb, 4.12%)
Mexico	Ocean (0.52 ppb, 0.70%)
Ocean	Natural (7.80 ppb, 10.53%)
Natural	Wild Fire (0.22 ppb, 0.30%)
Wild Fire	Rx Fire (0.01 ppb, 0.01%)
Rx Fire	AG Fire (0.00 ppb, 0.00%)
AG Fire	

State Contributions to Modeled 10 Highest DMAX8 Ozone Days (from WestJumpAQMS Appendix B)

10th Highest Modeled DMAX8 Day @ Fairgrounds in Tucson, AZ

Contributions to MDA8 Ozone [ppb]



Site: AZ_Pima1020

Rank: 10 - 19 Jun, 2008

Total Ozone = 69.4 ppb

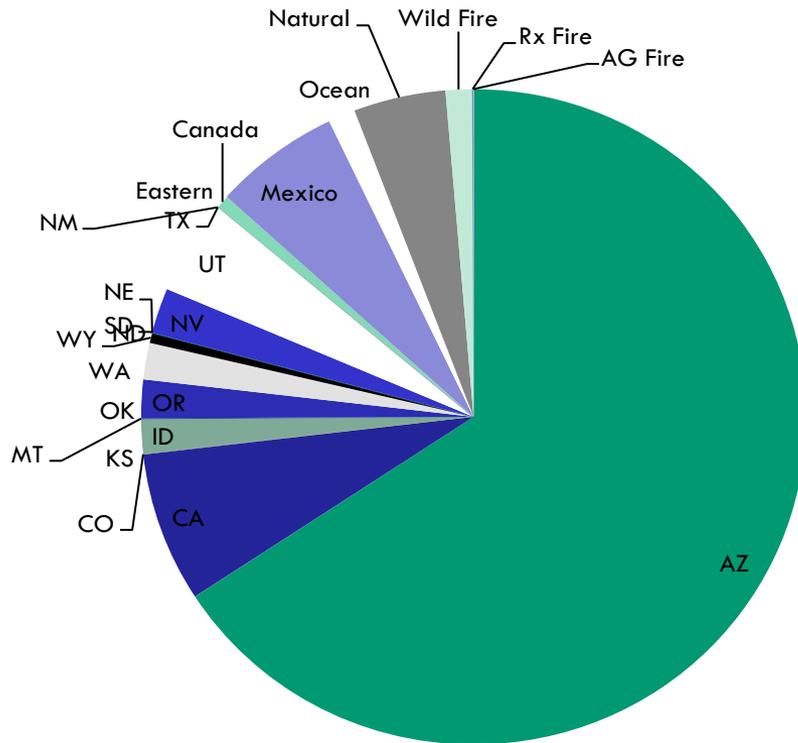
BC Ozone = 48.3 ppb (69.6%)

AZ	AZ (6.32 ppb, 9.12%)
CA	CA (10.60 ppb, 15.27%)
CO	CO (0.00 ppb, 0.00%)
KS	KS (0.00 ppb, 0.00%)
ID	ID (0.00 ppb, 0.00%)
MT	MT (0.00 ppb, 0.00%)
OK	OK (0.00 ppb, 0.00%)
OR	OR (0.03 ppb, 0.05%)
WA	WA (0.01 ppb, 0.01%)
WY	WY (0.00 ppb, 0.00%)
ND	ND (0.00 ppb, 0.00%)
SD	SD (0.00 ppb, 0.00%)
NE	NE (0.00 ppb, 0.00%)
NV	NV (0.12 ppb, 0.17%)
NV	UT (0.00 ppb, 0.00%)
UT	TX (0.10 ppb, 0.14%)
TX	NM (0.04 ppb, 0.06%)
NM	Eastern (0.01 ppb, 0.01%)
Eastern	Canada (0.00 ppb, 0.01%)
Canada	Mexico (1.46 ppb, 2.11%)
Mexico	Ocean (0.30 ppb, 0.44%)
Ocean	Natural (1.70 ppb, 2.44%)
Natural	Wild Fire (0.38 ppb, 0.5%)
Wild Fire	Rx Fire (0.01 ppb, 0.01%)
Rx Fire	AG Fire (0.00 ppb, 0.00%)
AG Fire	

State Contributions to Modeled 10 Highest DMAX8 Ozone Days (from WestJumpAQMS Appendix B)

Highest Modeled DMAX8 Day @ North Phoenix, AZ site

Contributions to MDA8 Ozone [ppb]



Site: AZ_Maricopa1004

Rank: 1 - 24 Jul, 2008

Total Ozone = 90.8 ppb

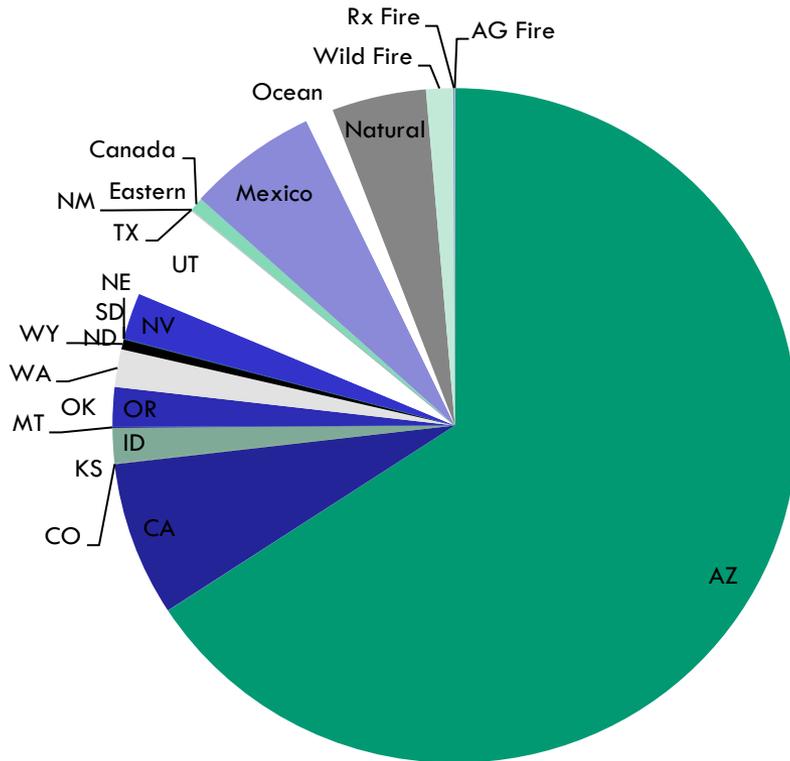
BC Ozone = 27.6 ppb (30.4%)

AZ	AZ (47.14 ppb, 51.92%)
CA	CA (0.79 ppb, 0.87%)
CO	CO (0.16 ppb, 0.18%)
KS	KS (0.01 ppb, 0.01%)
ID	ID (0.01 ppb, 0.01%)
MT	MT (0.01 ppb, 0.01%)
OK	OK (0.02 ppb, 0.02%)
OR	OR (0.02 ppb, 0.02%)
WA	WA (0.01 ppb, 0.01%)
WY	WY (0.03 ppb, 0.03%)
ND	ND (0.00 ppb, 0.00%)
SD	SD (0.01 ppb, 0.01%)
NE	NE (0.01 ppb, 0.01%)
NV	NV (0.07 ppb, 0.07%)
UT	UT (0.08 ppb, 0.09%)
TX	TX (1.75 ppb, 1.93%)
NM	NM (1.13 ppb, 1.24%)
Eastern	Eastern (0.62 ppb, 0.68%)
Canada	Canada (0.01 ppb, 0.01%)
Mexico	Mexico (2.73 ppb, 3.01%)
Ocean	Ocean (0.66 ppb, 0.73%)
Natural	Natural (7.53 ppb, 8.30%)
Wild Fire	Wild Fire (0.36 ppb, 0.3)
Rx Fire	Rx Fire (0.01 ppb, 0.01%)
AG Fire	AG Fire (0.00 ppb, 0.00%)

State Contributions to Modeled 10 Highest DMAX8 Ozone Days (from WestJumpAQMS Appendix B)

4th Highest Modeled DMAX8 Day @ North Phoenix, AZ site

Contributions to MDA8 Ozone [ppb]



Site: AZ_Maricopa1004

Rank: 4 - 09 Jul, 2008

Total Ozone = 80.2 ppb

BC Ozone = 39.6 ppb (49.4%)

■ AZ	AZ (27.00 ppb, 33.66%)
■ CA	CA (0.94 ppb, 1.18%)
■ CO	CO (0.99 ppb, 1.24%)
■ KS	KS (0.01 ppb, 0.01%)
■ ID	ID (0.21 ppb, 0.26%)
■ MT	MT (0.01 ppb, 0.01%)
■ OK	OK (0.01 ppb, 0.01%)
■ OR	OR (0.07 ppb, 0.09%)
■ WA	WA (0.01 ppb, 0.01%)
■ WY	WY (0.23 ppb, 0.29%)
■ ND	ND (0.00 ppb, 0.00%)
■ SD	SD (0.01 ppb, 0.01%)
■ NE	NE (0.01 ppb, 0.01%)
■ NV	NV (0.31 ppb, 0.39%)
■ UT	UT (1.54 ppb, 1.92%)
■ TX	TX (0.82 ppb, 1.03%)
■ NM	NM Eastern (0.01 ppb, 0.02%)
■ Eastern	Eastern (0.01 ppb, 0.01%)
■ Canada	Canada (0.00 ppb, 0.01%)
■ Mexico	Mexico (1.14 ppb, 1.42%)
■ Ocean	Ocean (0.13 ppb, 0.17%)
■ Natural	Natural (4.12 ppb, 5.14%)
■ Wild Fire	Wild Fire (0.33 ppb, 0.4)
■ Rx Fire	Rx Fire (0.01 ppb, 0.01%)
■ AG Fire	AG Fire (0.00 ppb, 0.00%)

State Contributions to Modeled 10 Highest DMAX8 Ozone Days (from WestJumpAQMS Appendix B)

10th Highest Modeled DMAX8 Day @ North Phoenix, AZ site

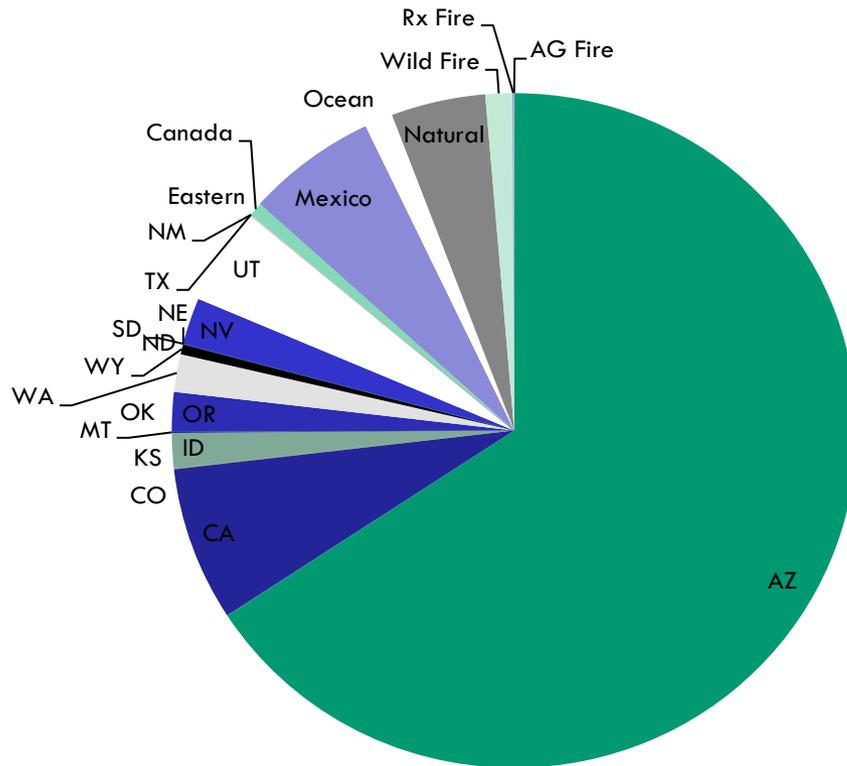
Contributions to MDA8 Ozone [ppb]

Site: AZ_Maricopa1004

Rank: 10 - 26 Aug, 2008

Total Ozone = 77.0 ppb

BC Ozone = 38.2 ppb (49.7%)

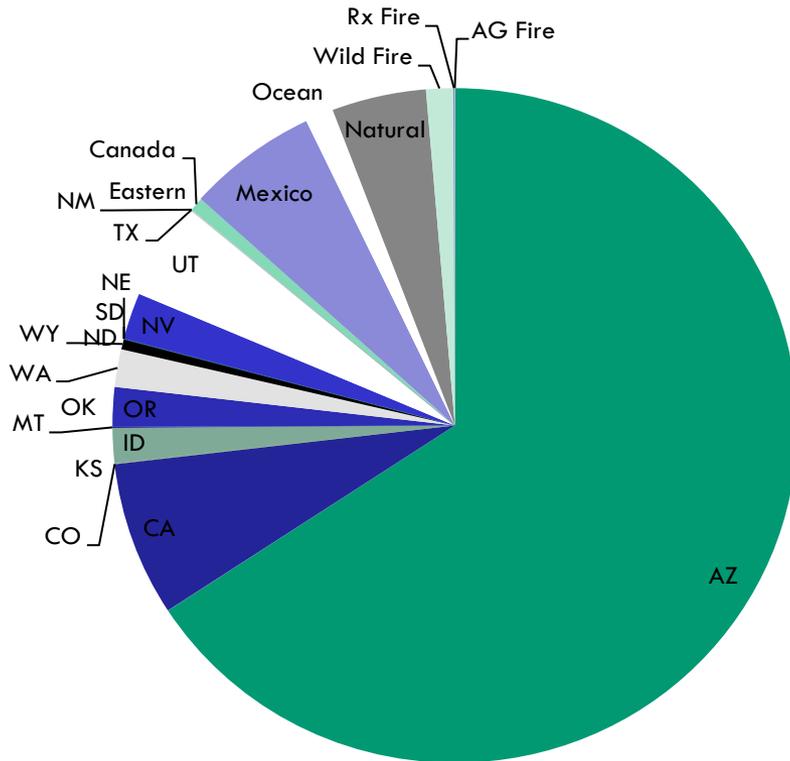


■ AZ	AZ (25.47 ppb, 33.10%)
■ CA	CA (0.37 ppb, 0.48%)
■ CO	CO (0.21 ppb, 0.28%)
■ KS	KS (0.07 ppb, 0.10%)
■ ID	ID (0.01 ppb, 0.02%)
■ MT	MT (0.01 ppb, 0.02%)
■ OK	OK (0.26 ppb, 0.33%)
■ OR	OR (0.01 ppb, 0.01%)
■ WA	WA (0.01 ppb, 0.01%)
■ WY	WY (0.15 ppb, 0.19%)
■ ND	ND (0.00 ppb, 0.01%)
■ SD	SD (0.00 ppb, 0.01%)
■ NE	NE (0.02 ppb, 0.02%)
■ NV	NV (0.08 ppb, 0.10%)
■ NV	UT (0.16 ppb, 0.21%)
■ UT	TX (3.91 ppb, 5.08%)
■ TX	NM (0.82 ppb, 1.07%)
■ NM	Eastern (0.28 ppb, 0.37%)
■ Eastern	Canada (0.03 ppb, 0.04%)
■ Canada	Mexico (1.63 ppb, 2.11%)
■ Mexico	Ocean (0.22 ppb, 0.28%)
■ Ocean	Natural (4.90 ppb, 6.36%)
■ Natural	Wild Fire (0.10 ppb, 0.1)
■ Wild Fire	Rx Fire (0.01 ppb, 0.01%)
■ Rx Fire	AG Fire (0.01 ppb, 0.01%)
■ AG Fire	

State Contributions to Modeled 10 Highest DMAX8 Ozone Days (from WestJumpAQMS Appendix B)

Highest Modeled DMAX8 Day at Queen Valley, AZ site

Contributions to MDA8 Ozone [ppb]



Site: AZ_Pinal8001

Rank: 1 - 07 Aug, 2008

Total Ozone = 82.2 ppb

BC Ozone = 29.8 ppb (36.2%)

■ AZ	AZ (36.45 ppb, 44.34%)
■ CA	CA (1.66 ppb, 2.02%)
■ CO	CO (0.14 ppb, 0.17%)
■ KS	KS (0.05 ppb, 0.06%)
■ ID	ID (0.02 ppb, 0.03%)
■ MT	MT (0.01 ppb, 0.01%)
■ OK	OK (0.12 ppb, 0.14%)
■ OR	OR (0.01 ppb, 0.01%)
■ WA	WA (0.00 ppb, 0.00%)
■ WY	WY (0.08 ppb, 0.10%)
■ ND	ND (0.00 ppb, 0.00%)
■ SD	SD (0.02 ppb, 0.03%)
■ NE	NE (0.06 ppb, 0.07%)
■ NV	NV (0.06 ppb, 0.07%)
■ UT	UT (0.08 ppb, 0.10%)
■ TX	TX (0.73 ppb, 0.89%)
■ NM	NM Eastern (0.28 ppb, 0.34%)
■ Eastern	Eastern (0.28 ppb, 0.34%)
■ Canada	Canada (0.00 ppb, 0.00%)
■ Mexico	Mexico (3.33 ppb, 4.06%)
■ Ocean	Ocean (0.53 ppb, 0.64%)
■ Natural	Natural (8.30 ppb, 10.09%)
■ Wild Fire	Wild Fire (0.19 ppb, 0.23%)
■ Rx Fire	Rx Fire (0.00 ppb, 0.01%)
■ AG Fire	AG Fire (0.00 ppb, 0.00%)

State Contributions to Modeled 10 Highest DMAX8 Ozone Days (from WestJumpAQMS Appendix B)

4th Highest Modeled DMAX8 Day at Queen Valley, AZ

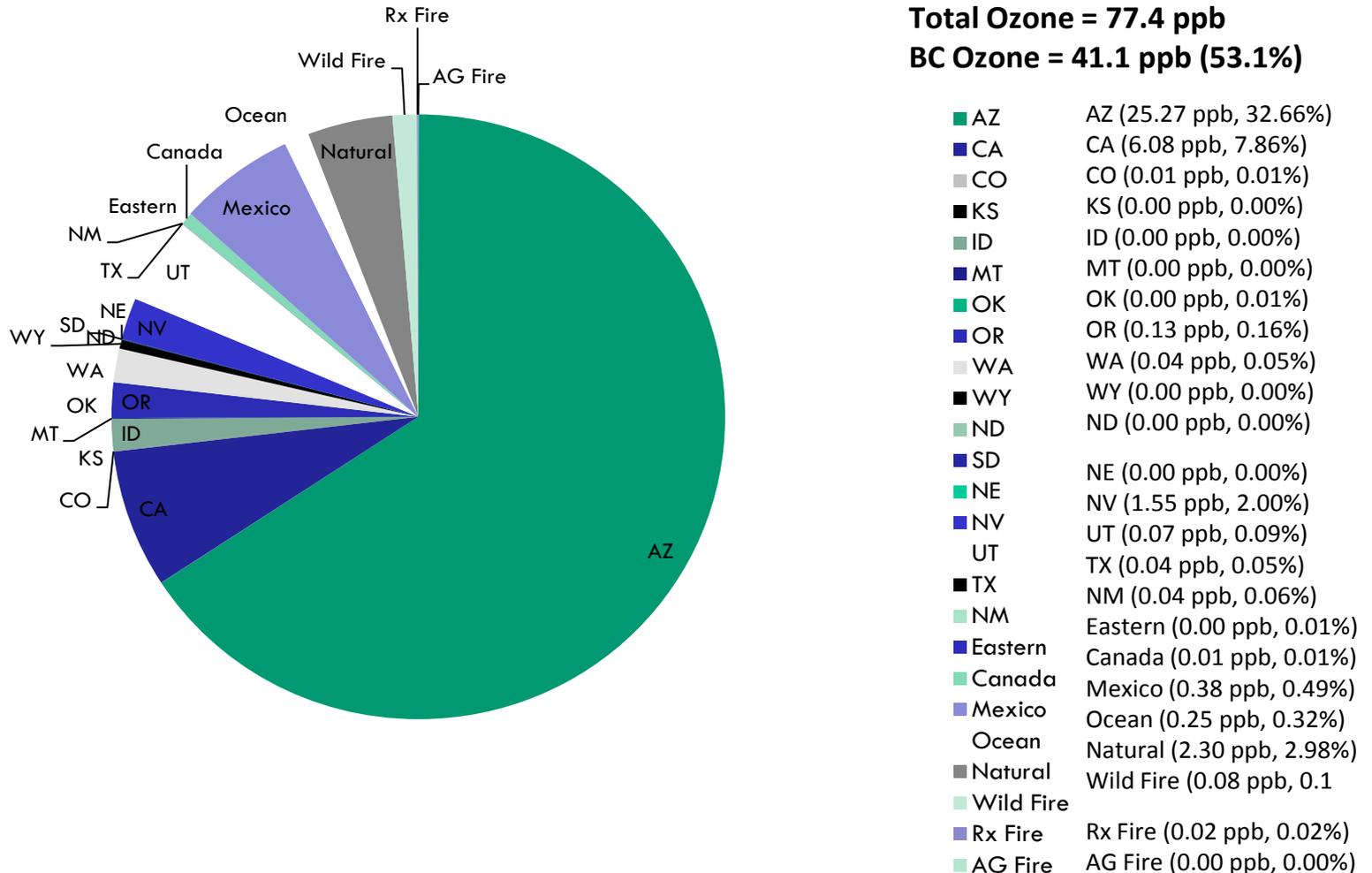
Contributions to MDA8 Ozone [ppb]

Site: AZ_Pinal8001

Rank: 4 - 04 Sep, 2008

Total Ozone = 77.4 ppb

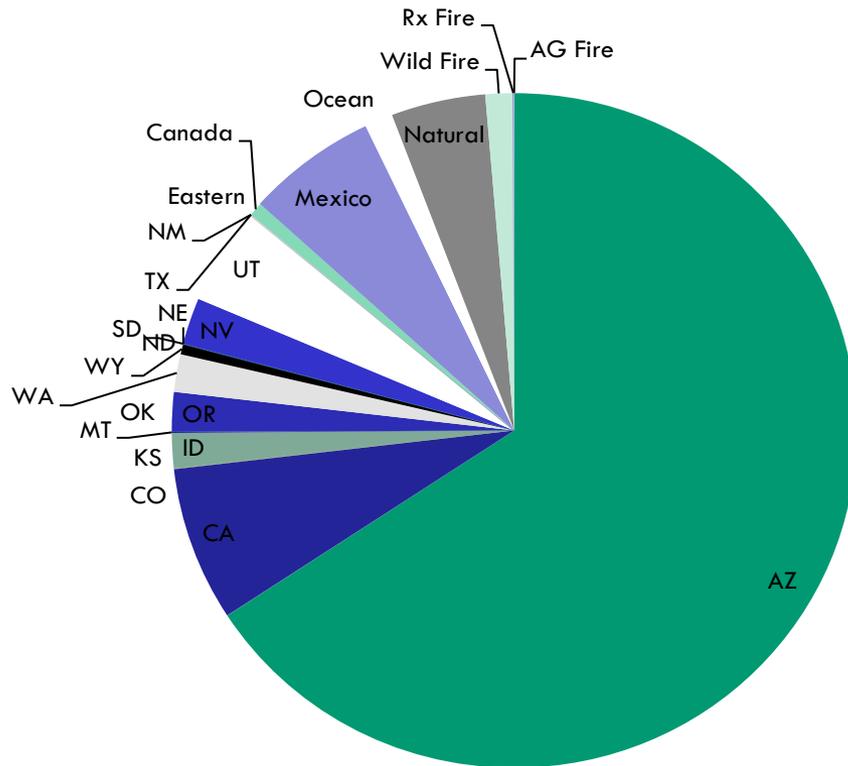
BC Ozone = 41.1 ppb (53.1%)



State Contributions to Modeled 10 Highest DMAX8 Ozone Days (from WestJumpAQMS Appendix B)

10th Highest Modeled DMAX8 Day at Queen Valley, AZ

Contributions to MDA8 Ozone [ppb]



Site: AZ_Pinal8001

Rank: 10 - 18 Jul, 2008

Total Ozone = 74.2 ppb

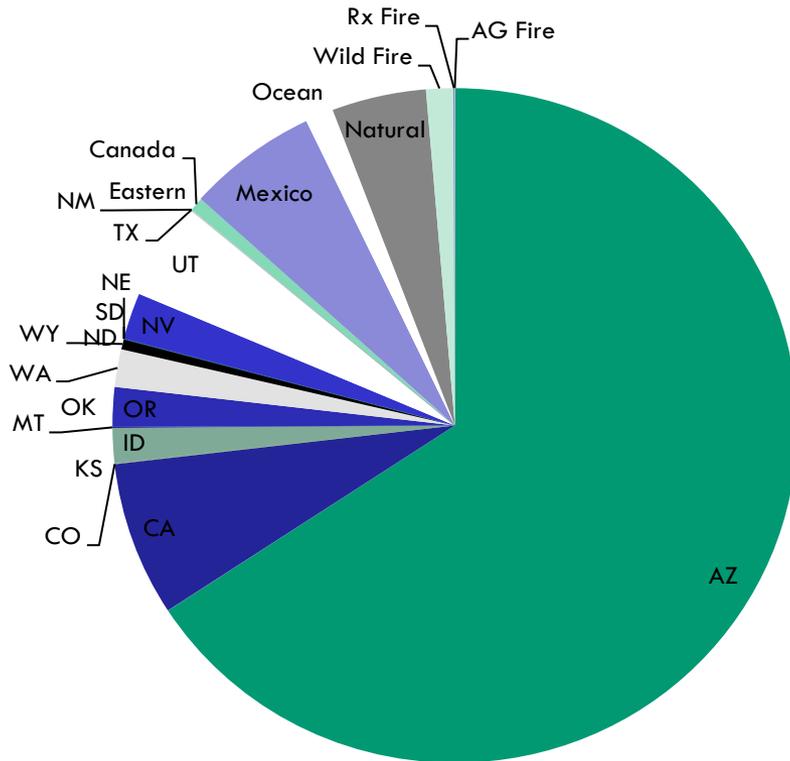
BC Ozone = 26.4 ppb (35.6%)

AZ	AZ (25.20 ppb, 33.99%)
CA	CA (11.26 ppb, 15.19%)
CO	CO (0.04 ppb, 0.05%)
KS	KS (0.00 ppb, 0.00%)
ID	ID (0.02 ppb, 0.03%)
MT	MT (0.00 ppb, 0.00%)
OK	OK (0.00 ppb, 0.00%)
OR	OR (0.09 ppb, 0.11%)
WA	WA (0.04 ppb, 0.06%)
WY	WY (0.01 ppb, 0.01%)
ND	ND (0.00 ppb, 0.00%)
SD	SD (0.00 ppb, 0.00%)
NE	NE (0.00 ppb, 0.00%)
NV	NV (0.58 ppb, 0.79%)
NV	UT (0.12 ppb, 0.16%)
UT	TX (0.05 ppb, 0.07%)
TX	NM (0.11 ppb, 0.14%)
NM	Eastern (0.02 ppb, 0.03%)
Eastern	Canada (0.00 ppb, 0.00%)
Canada	Mexico (3.16 ppb, 4.26%)
Mexico	Ocean (0.64 ppb, 0.86%)
Ocean	Natural (4.90 ppb, 6.61%)
Natural	Wild Fire (1.43 ppb, 1.9)
Wild Fire	Rx Fire (0.01 ppb, 0.02%)
Rx Fire	AG Fire (0.01 ppb, 0.02%)
AG Fire	

State Contributions to Modeled 10 Highest DMAX8 Ozone Days (from WestJumpAQMS Appendix B)

Highest Modeled DMAX8 Day @ Yuma Supersite, AZ

Contributions to MDA8 Ozone [ppb]



Site: AZ_Yuma8011

Rank: 1 - 17 Jul, 2008

Total Ozone = 75.6 ppb

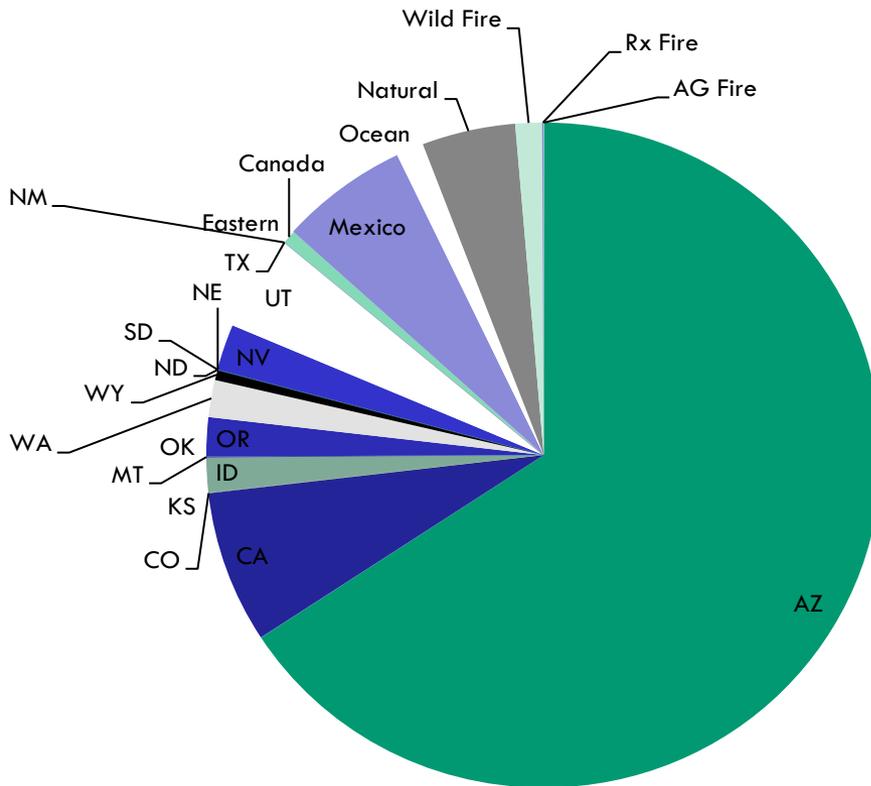
BC Ozone = 31.9 ppb (42.1%)

■ AZ	AZ (3.57 ppb, 4.72%)
■ CA	CA (26.42 ppb, 34.95%)
■ CO	CO (0.05 ppb, 0.06%)
■ KS	KS (0.00 ppb, 0.00%)
■ ID	ID (0.03 ppb, 0.04%)
■ MT	MT (0.00 ppb, 0.00%)
■ OK	OK (0.00 ppb, 0.00%)
■ OR	OR (0.12 ppb, 0.16%)
■ WA	WA (0.06 ppb, 0.08%)
■ WY	WY (0.01 ppb, 0.02%)
■ ND	ND (0.00 ppb, 0.00%)
■ SD	SD (0.00 ppb, 0.00%)
■ NE	NE (0.00 ppb, 0.00%)
■ NV	NV (0.77 ppb, 1.01%)
■ UT	UT (0.15 ppb, 0.19%)
■ TX	TX (0.04 ppb, 0.06%)
■ NM	NM (0.13 ppb, 0.18%)
■ Eastern	Eastern (0.00 ppb, 0.01%)
■ Canada	Canada (0.00 ppb, 0.00%)
■ Mexico	Mexico (5.34 ppb, 7.07%)
■ Ocean	Ocean (0.86 ppb, 1.14%)
■ Natural	Natural (3.99 ppb, 5.27%)
■ Wild Fire	Wild Fire (2.11 ppb, 2.7%)
■ Rx Fire	Rx Fire (0.01 ppb, 0.01%)
■ AG Fire	AG Fire (0.05 ppb, 0.07%)

State Contributions to Modeled 10 Highest DMAX8 Ozone Days (from WestJumpAQMS Appendix B)

4th Highest Modeled DMAX8 Day @ Yuma Supersite, AZ

Contributions to MDA8 Ozone [ppb]



Site: AZ_Yuma8011

Rank: 4 - 06 Sep, 2008

Total Ozone = 69.2 ppb

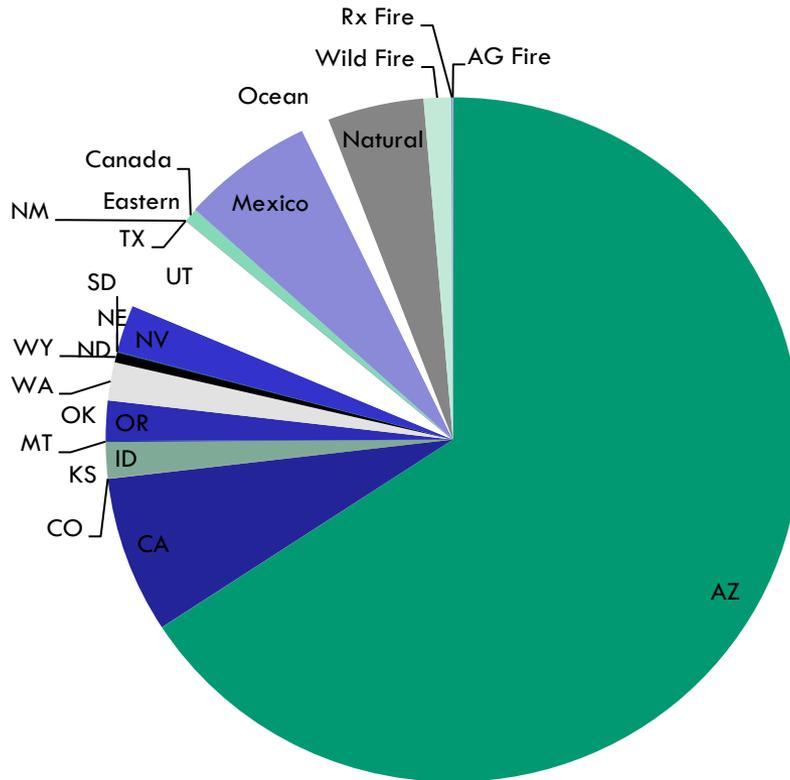
BC Ozone = 35.2 ppb (50.9%)

AZ	AZ (5.59 ppb, 8.08%)
CA	CA (24.20 ppb, 34.96%)
CO	CO (0.01 ppb, 0.01%)
KS	KS (0.00 ppb, 0.00%)
ID	ID (0.00 ppb, 0.00%)
MT	MT (0.00 ppb, 0.00%)
OK	OK (0.00 ppb, 0.00%)
OR	OR (0.14 ppb, 0.20%)
WA	WA (0.06 ppb, 0.09%)
WY	WY (0.00 ppb, 0.00%)
ND	ND (0.00 ppb, 0.00%)
SD	NE (0.00 ppb, 0.00%)
NE	NV (0.68 ppb, 0.98%)
NV	UT (0.01 ppb, 0.02%)
UT	TX (0.02 ppb, 0.03%)
TX	NM (0.03 ppb, 0.04%)
NM	Eastern (0.00 ppb, 0.00%)
Eastern	Canada (0.02 ppb, 0.03%)
Canada	Mexico (0.58 ppb, 0.84%)
Mexico	Ocean (0.30 ppb, 0.43%)
Ocean	Natural (2.05 ppb, 2.96%)
Natural	Wild Fire (0.31 ppb, 0.4)
Wild Fire	Rx Fire (0.01 ppb, 0.02%)
Rx Fire	AG Fire (0.00 ppb, 0.01%)
AG Fire	

State Contributions to Modeled 10 Highest DMAX8 Ozone Days (from WestJumpAQMS Appendix B)

10th Highest Modeled DMAX8 Day @ Yuma Supersite, AZ

Contributions to MDA8 Ozone [ppb]



Site: AZ_Yuma8011

Rank: 10 - 16 Jul, 2008

Total Ozone = 66.0 ppb

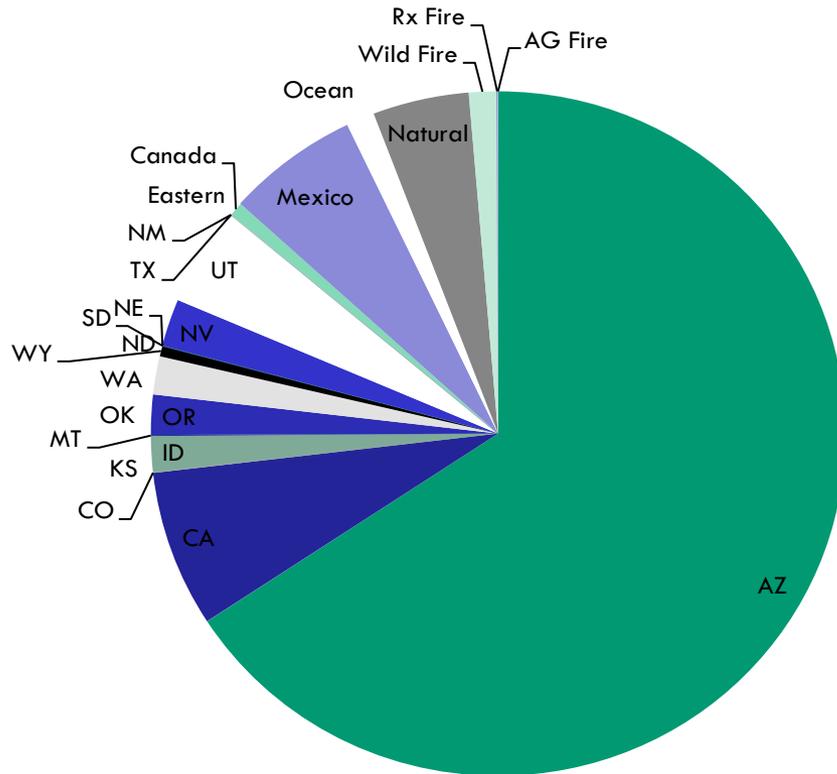
BC Ozone = 28.6 ppb (43.4%)

■ AZ	AZ (3.75 ppb, 5.68%)
■ CA	CA (18.63 ppb, 28.22%)
■ CO	CO (0.08 ppb, 0.12%)
■ KS	KS (0.00 ppb, 0.00%)
■ ID	ID (0.05 ppb, 0.08%)
■ MT	MT (0.00 ppb, 0.00%)
■ OK	OK (0.00 ppb, 0.00%)
■ OR	OR (0.17 ppb, 0.25%)
■ WA	WA (0.08 ppb, 0.12%)
■ WY	WY (0.02 ppb, 0.03%)
■ ND	ND (0.00 ppb, 0.00%)
■ SD	NE (0.00 ppb, 0.01%)
■ NE	NV (1.21 ppb, 1.84%)
■ NV	UT (0.26 ppb, 0.39%)
■ NV	UT (0.26 ppb, 0.39%)
■ UT	TX (0.06 ppb, 0.09%)
■ TX	NM (0.22 ppb, 0.34%)
■ NM	Eastern (0.01 ppb, 0.01%)
■ Eastern	Canada (0.00 ppb, 0.01%)
■ Canada	Mexico (4.75 ppb, 7.20%)
■ Mexico	Ocean (0.94 ppb, 1.42%)
■ Ocean	Natural (4.47 ppb, 6.77%)
■ Natural	Wild Fire (2.62 ppb, 3.9%)
■ Wild Fire	
■ Rx Fire	Rx Fire (0.00 ppb, 0.01%)
■ AG Fire	AG Fire (0.02 ppb, 0.04%)

State Contributions to Modeled 10 Highest DMAX8 Ozone Days (from WestJumpAQMS Appendix B)

Highest Modeled DMAX8 Day @ Flagstaff Middle School, AZ

Contributions to MDA8 Ozone [ppb]



Site: AZ_Coconino1008

Rank: 1 - 10 Jul, 2008

Total Ozone = 75.3 ppb

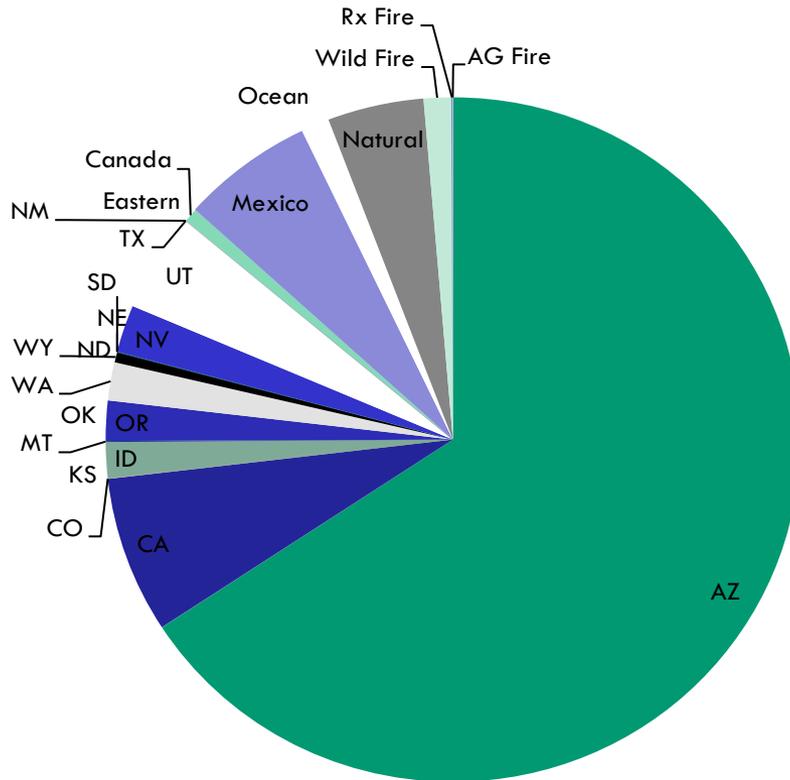
BC Ozone = 56.3 ppb (74.8%)

AZ	AZ (6.42 ppb, 8.52%)
CA	CA (0.49 ppb, 0.65%)
CO	CO (2.72 ppb, 3.61%)
KS	KS (0.06 ppb, 0.07%)
ID	ID (0.41 ppb, 0.55%)
MT	MT (0.04 ppb, 0.05%)
OK	OK (0.01 ppb, 0.01%)
OR	OR (0.12 ppb, 0.16%)
WA	WA (0.02 ppb, 0.03%)
WY	WY (1.08 ppb, 1.43%)
ND	ND (0.00 ppb, 0.00%)
SD	NE (0.15 ppb, 0.20%)
NE	NV (0.18 ppb, 0.23%)
NV	UT (1.10 ppb, 1.47%)
UT	TX (0.18 ppb, 0.24%)
TX	NM (2.83 ppb, 3.76%)
NM	Eastern (0.00 ppb, 0.00%)
Eastern	Canada (0.00 ppb, 0.00%)
Canada	Mexico (0.22 ppb, 0.29%)
Mexico	Ocean (0.04 ppb, 0.06%)
Ocean	Natural (2.64 ppb, 3.51%)
Natural	Wild Fire (0.26 ppb, 0.3)
Wild Fire	Rx Fire (0.00 ppb, 0.01%)
Rx Fire	AG Fire (0.00 ppb, 0.00%)
AG Fire	

State Contributions to Modeled 10 Highest DMAX8 Ozone Days (from WestJumpAQMS Appendix B)

4th Highest Modeled DMAX8 Day @ Flagstaff Middle School, AZ

Contributions to MDA8 Ozone [ppb]



Site: AZ_Coconino1008

Rank: 4 - 02 May, 2008

Total Ozone = 68.3 ppb

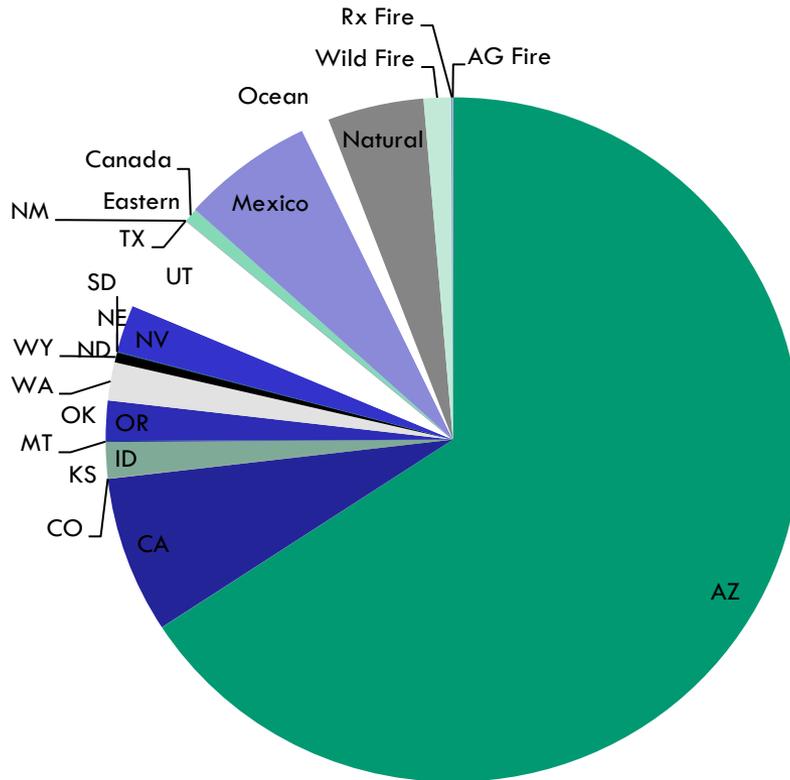
BC Ozone = 65.3 ppb (95.6%)

■ AZ	AZ (0.34 ppb, 0.50%)
■ CA	CA (0.05 ppb, 0.08%)
■ CO	CO (0.00 ppb, 0.00%)
■ KS	KS (0.00 ppb, 0.00%)
■ ID	ID (0.26 ppb, 0.39%)
■ MT	MT (0.03 ppb, 0.05%)
■ OK	OK (0.00 ppb, 0.00%)
■ OR	OR (0.48 ppb, 0.71%)
■ WA	WA (0.57 ppb, 0.84%)
■ WY	WY (0.00 ppb, 0.01%)
■ ND	ND (0.00 ppb, 0.00%)
■ SD	NE (0.00 ppb, 0.00%)
■ NE	NV (0.09 ppb, 0.13%)
■ NV	UT (0.31 ppb, 0.46%)
■ UT	TX (0.00 ppb, 0.00%)
■ TX	NM (0.00 ppb, 0.00%)
■ NM	Eastern (0.00 ppb, 0.00%)
■ Eastern	Canada (0.15 ppb, 0.22%)
■ Canada	Mexico (0.00 ppb, 0.00%)
■ Mexico	Ocean (0.11 ppb, 0.16%)
■ Ocean	Natural (0.56 ppb, 0.82%)
■ Natural	Wild Fire (0.01 ppb, 0.0)
■ Wild Fire	
■ Rx Fire	Rx Fire (0.01 ppb, 0.01%)
■ AG Fire	AG Fire (0.00 ppb, 0.00%)

State Contributions to Modeled 10 Highest DMAX8 Ozone Days (from WestJumpAQMS Appendix B)

10th Highest Modeled DMAX8 Day @ Flagstaff Middle School, AZ

Contributions to MDA8 Ozone [ppb]



Site: AZ_Coconino1008

Rank: 10 - 19 Apr, 2008

Total Ozone = 66.5 ppb

BC Ozone = 55.6 ppb (83.6%)

■ AZ	AZ (7.17 ppb, 10.79%)
■ CA	CA (0.81 ppb, 1.21%)
■ CO	CO (0.00 ppb, 0.00%)
■ KS	KS (0.00 ppb, 0.00%)
■ ID	ID (0.18 ppb, 0.28%)
■ MT	MT (0.01 ppb, 0.01%)
■ OK	OK (0.00 ppb, 0.00%)
■ OR	OR (0.21 ppb, 0.31%)
■ WA	WA (0.20 ppb, 0.30%)
■ WY	WY (0.06 ppb, 0.08%)
■ ND	ND (0.00 ppb, 0.00%)
■ SD	NE (0.00 ppb, 0.00%)
■ NE	NV (0.24 ppb, 0.37%)
■ NV	UT (0.51 ppb, 0.76%)
■ UT	TX (0.00 ppb, 0.00%)
■ TX	NM (0.00 ppb, 0.00%)
■ NM	Eastern (0.00 ppb, 0.00%)
■ Eastern	Canada (0.07 ppb, 0.11%)
■ Canada	Mexico (0.67 ppb, 1.01%)
■ Mexico	Ocean (0.14 ppb, 0.22%)
■ Ocean	Natural (0.49 ppb, 0.73%)
■ Natural	Wild Fire (0.14 ppb, 0.22%)
■ Wild Fire	Rx Fire (0.01 ppb, 0.01%)
■ Rx Fire	AG Fire (0.00 ppb, 0.00%)
■ AG Fire	

Spatial Distribution of State Ozone Contributions

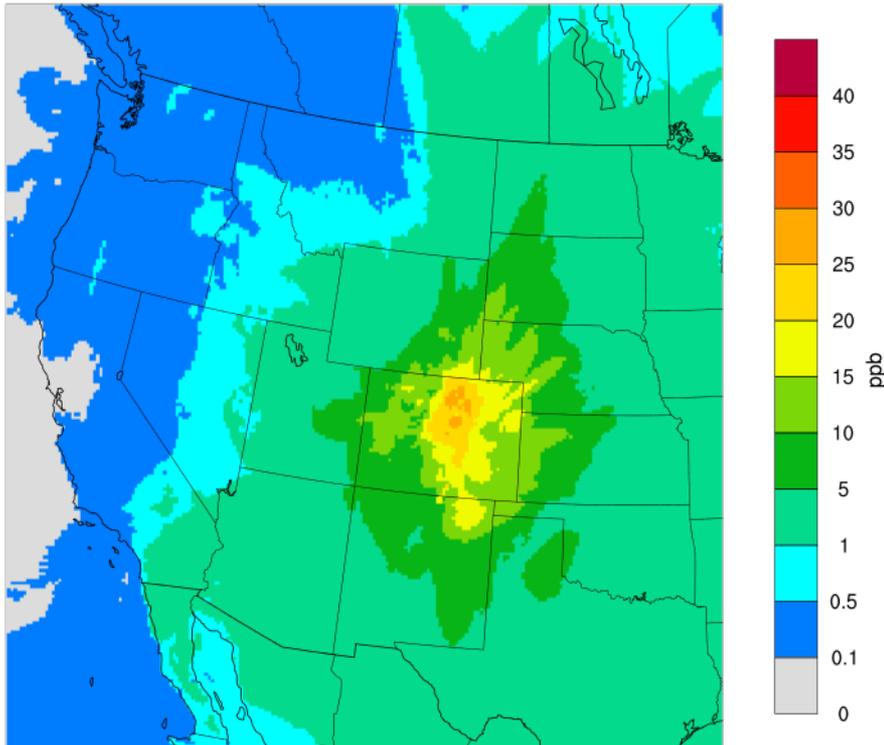
- Spatial distribution of state's ozone contribution to DMAX8 ozone concentrations greater than or equal to:
 - 76 ppb (current NAAQS)
 - 70 ppb; 65 ppb and 60 ppb (potential future NAAQS)
 - 0 ppb (highest contribution in year)
- Two types of metrics:
 1. Maximum modeled contribution to Highest and 4th Highest DMAX8 ozone (from WestJumpAQMS Appendix C)
 2. Attainment Test Unmonitored Areas projection contribution to 8-hour ozone design value
- Examples for Colorado next:
 - Maximum contribution to highest DMAX8 ever and design value
 - Maximum contribution to 4th high DMAX8 for 76 and 65 ppb

2008 Colorado 8-Hour Ozone Contribution

Highest Modeled Contribution

(actual 2008 emissions)

Contrib. to CAMx Daily Max 8-Hour Ozone \geq 0 ppb
CO Anthropogenic Max Contribution



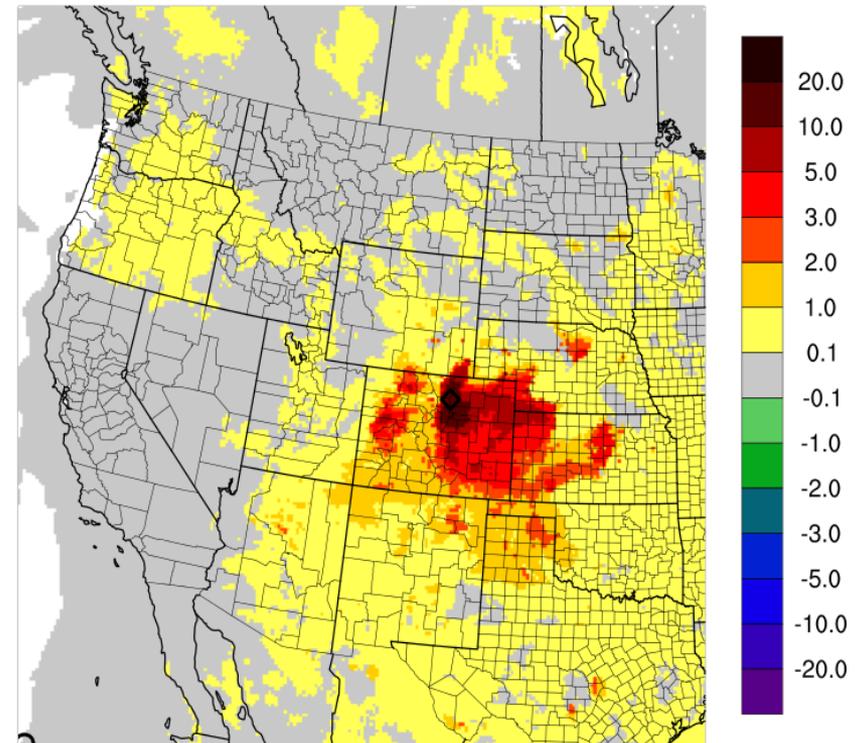
Max(144,110) = 29.18

Attainment Test Design Value Contribution

(EPA and states have used both a 3-year average or an average of three 3-year averages)

CO

2008



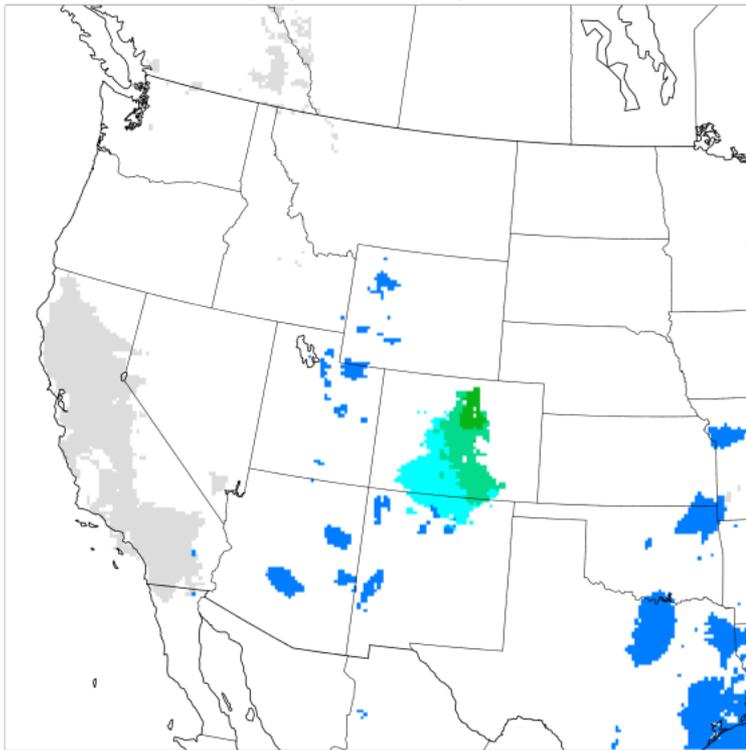
○ Min(3,1) = 0.00, ◇ Max(142,107) = 17.60

Colorado Max Contribution to 4th High DMAX8 Ozone

DMAX8 Ozone ≥ 76 ppb

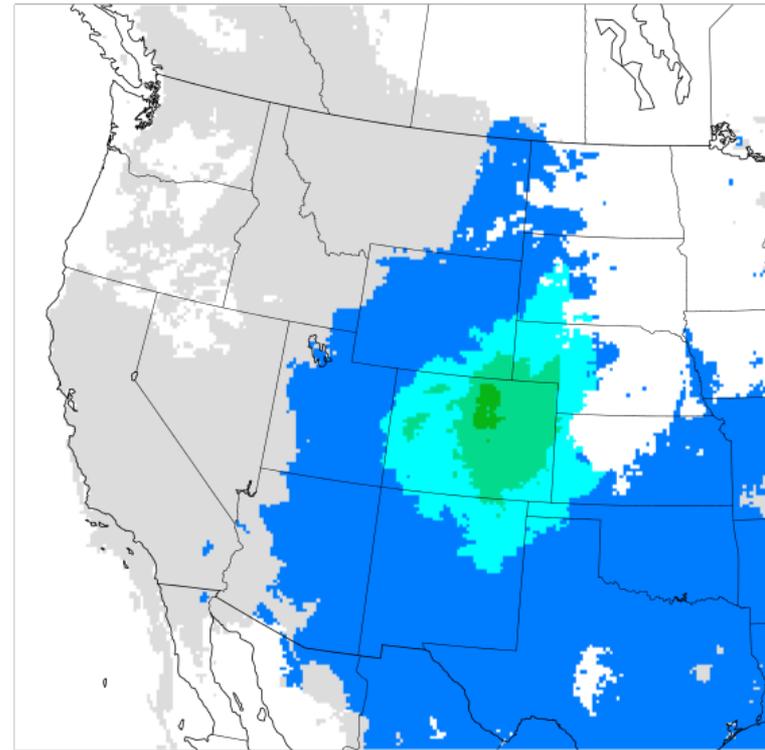
DMAX8 Ozone ≥ 65 ppb

Contrib. to CAMx Daily Max 8-Hour Ozone ≥ 76 ppb
CO Anthropogenic 4th Highest Contribution



Max(142,109) = 24.25

Contrib. to CAMx Daily Max 8-Hour Ozone ≥ 65 ppb
CO Anthropogenic 4th Highest Contribution



Max(142,109) = 24.25

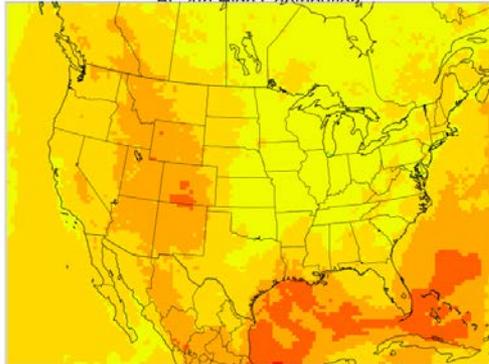
“Other Sources” Max Contrib. 4th High DMAX8 Ozone

Boundary Conditions

Natural

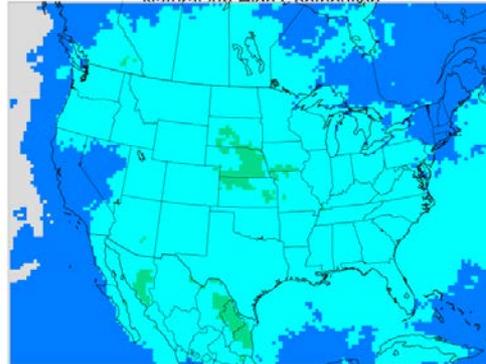
Anthropogenic

Contrib. to CAMx Daily Max 8-Hour Ozone \geq 0 ppb
BC 4th High Contribution



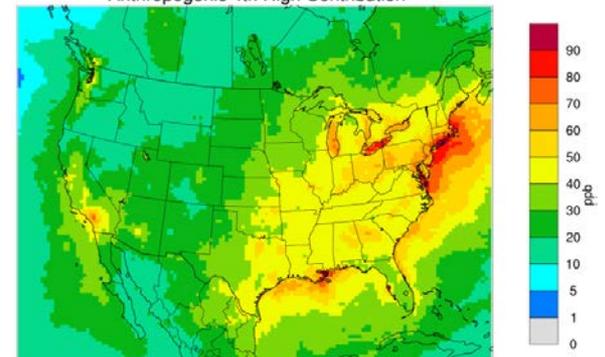
Max(82,2) = 80.37

Contrib. to CAMx Daily Max 8-Hour Ozone \geq 0 ppb
Natural 4th High Contribution



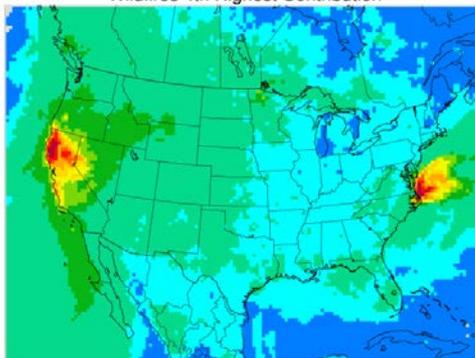
Max(70,11) = 12.84

Contrib. to CAMx Daily Max 8-Hour Ozone \geq 0 ppb
Anthropogenic 4th High Contribution



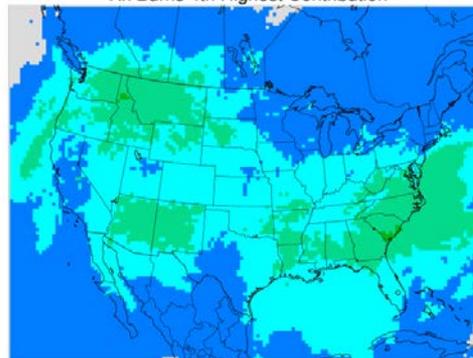
Max(133,70) = 110.89

Contrib. to CAMx Daily Max 8-Hour Ozone \geq 0 ppb
Wildfires 4th Highest Contribution



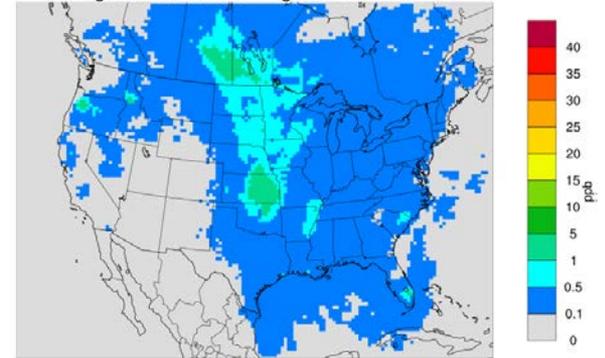
Max(129,53) = 60.13

Contrib. to CAMx Daily Max 8-Hour Ozone \geq 0 ppb
Rx Burns 4th Highest Contribution



Max(116,41) = 6.16

Contrib. to CAMx Daily Max 8-Hour Ozone \geq 0 ppb
Agricultural Burns 4th Highest Contribution



Max(79,51) = 3.15

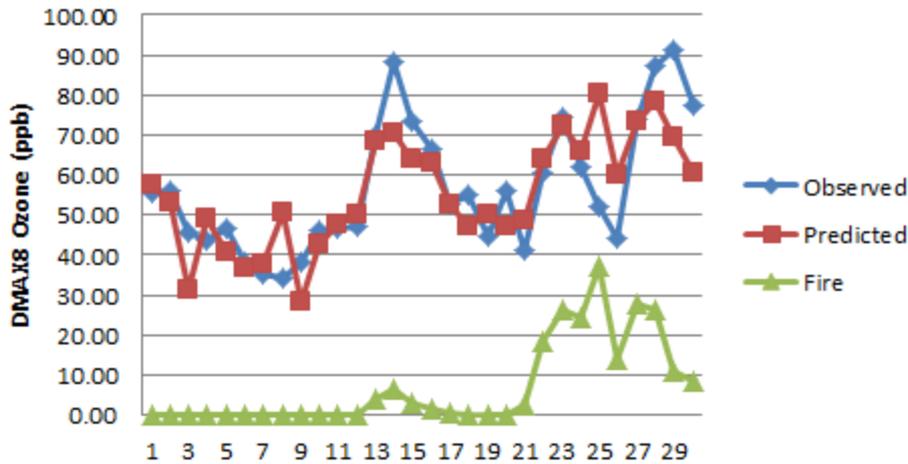
Wildfire

Prescribed Fire

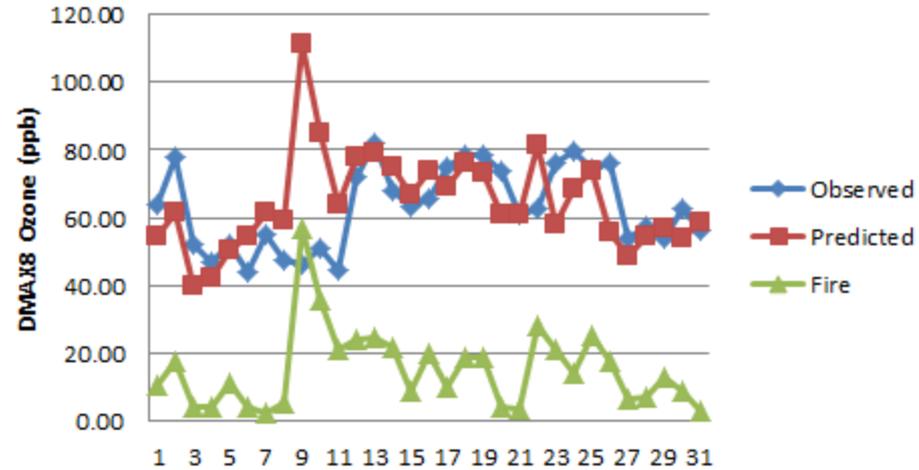
Agricultural Fire

Northern California Wildfires June-July 2008

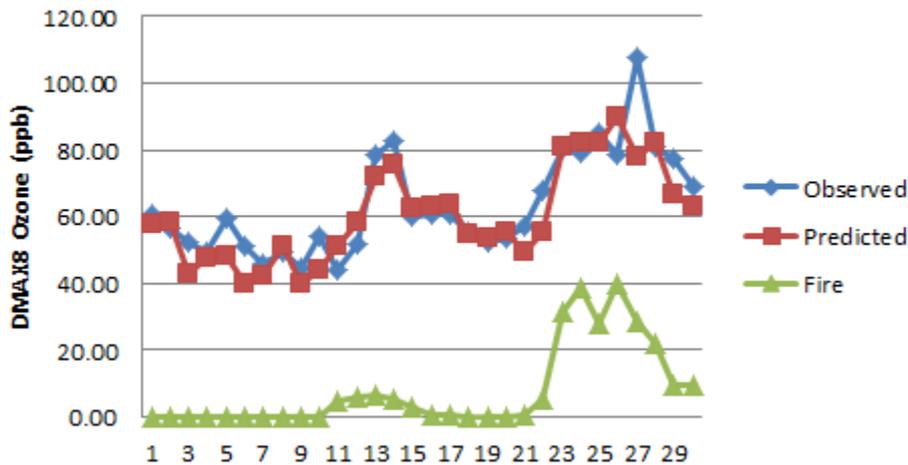
June Base08c DMAX8 Ozone Shasta 0007



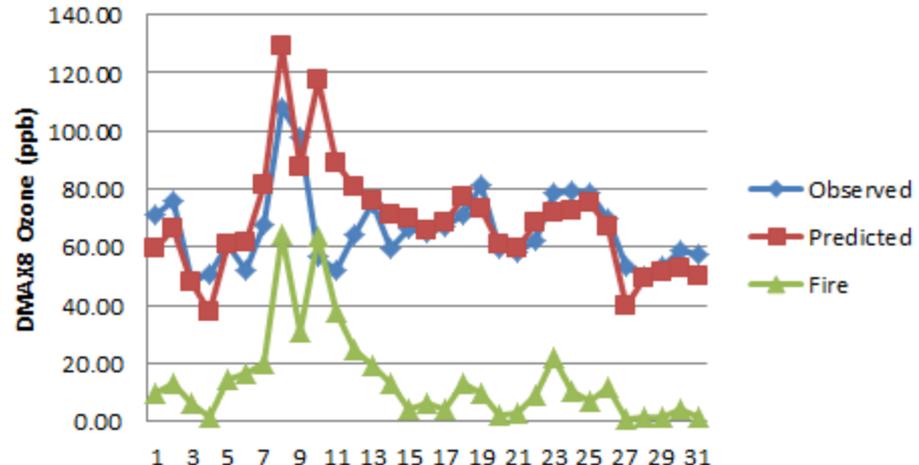
July Base08c DMAX8 Ozone Shasta 0007



June Base08c DMAX8 Ozone Butte 0007

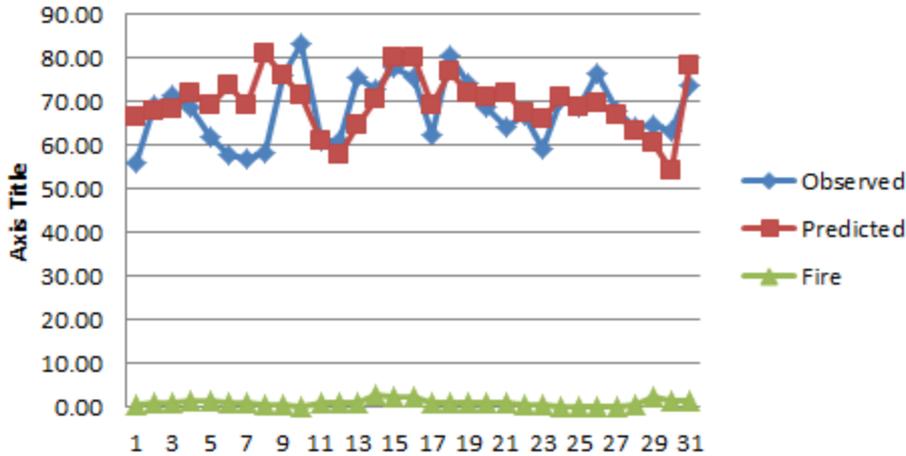


July Base08c DMAX8 Ozone Butte 0007

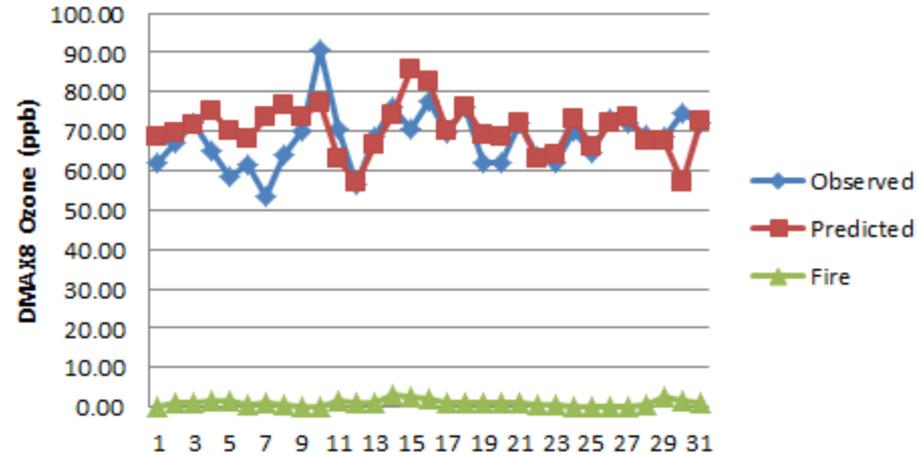


Denver Ozone Monitors July 2008

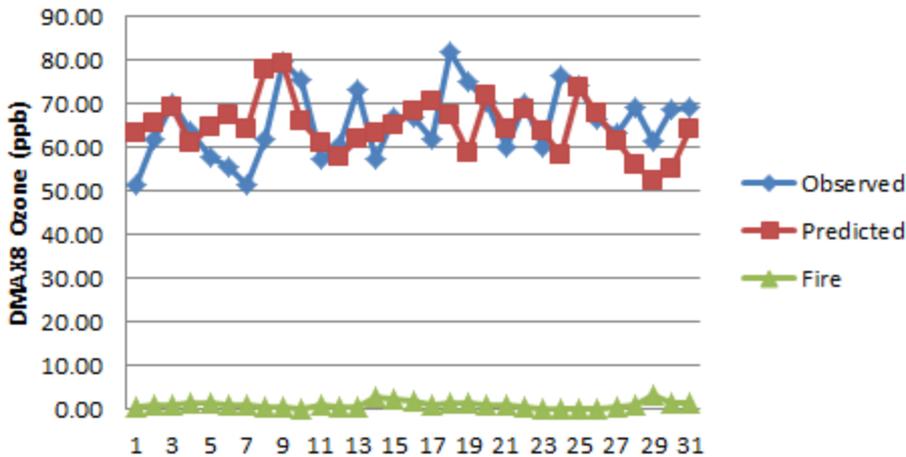
Jul DMAX8 Ozone Rocky Flats No



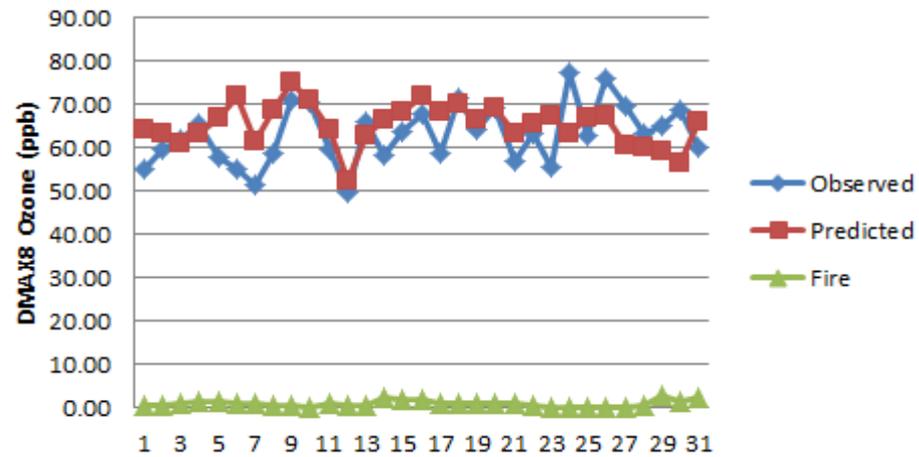
Jul Base08c DMAX8 Ozone Chatfield



Jul Base08c DMAX8 Fort Collins West



Jul Base08c DMAX8 Greeley



Pilot Study - Detailed Source Category-Specific Ozone Source Apportionment

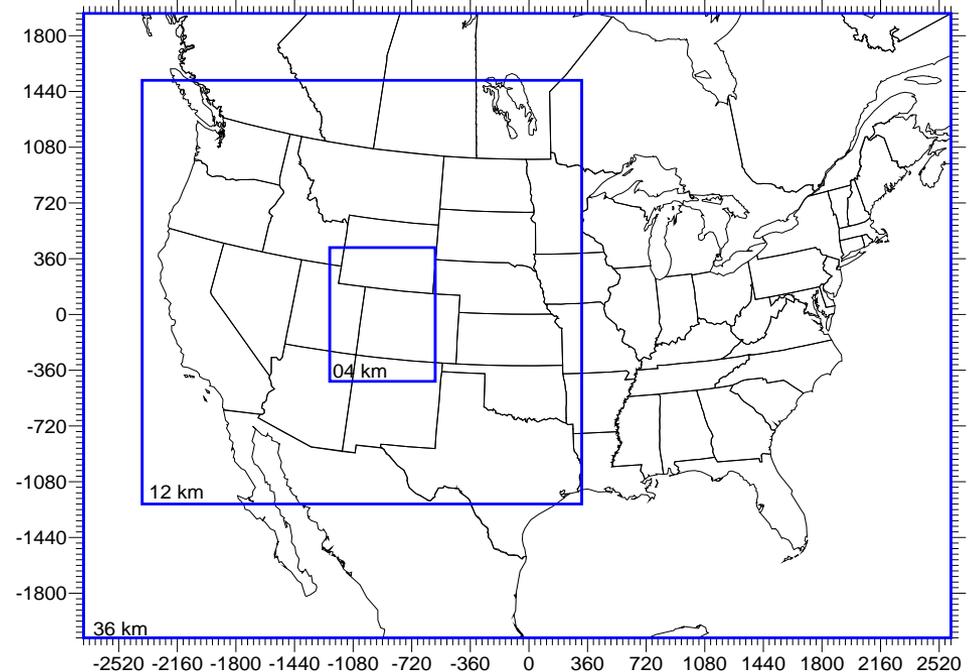
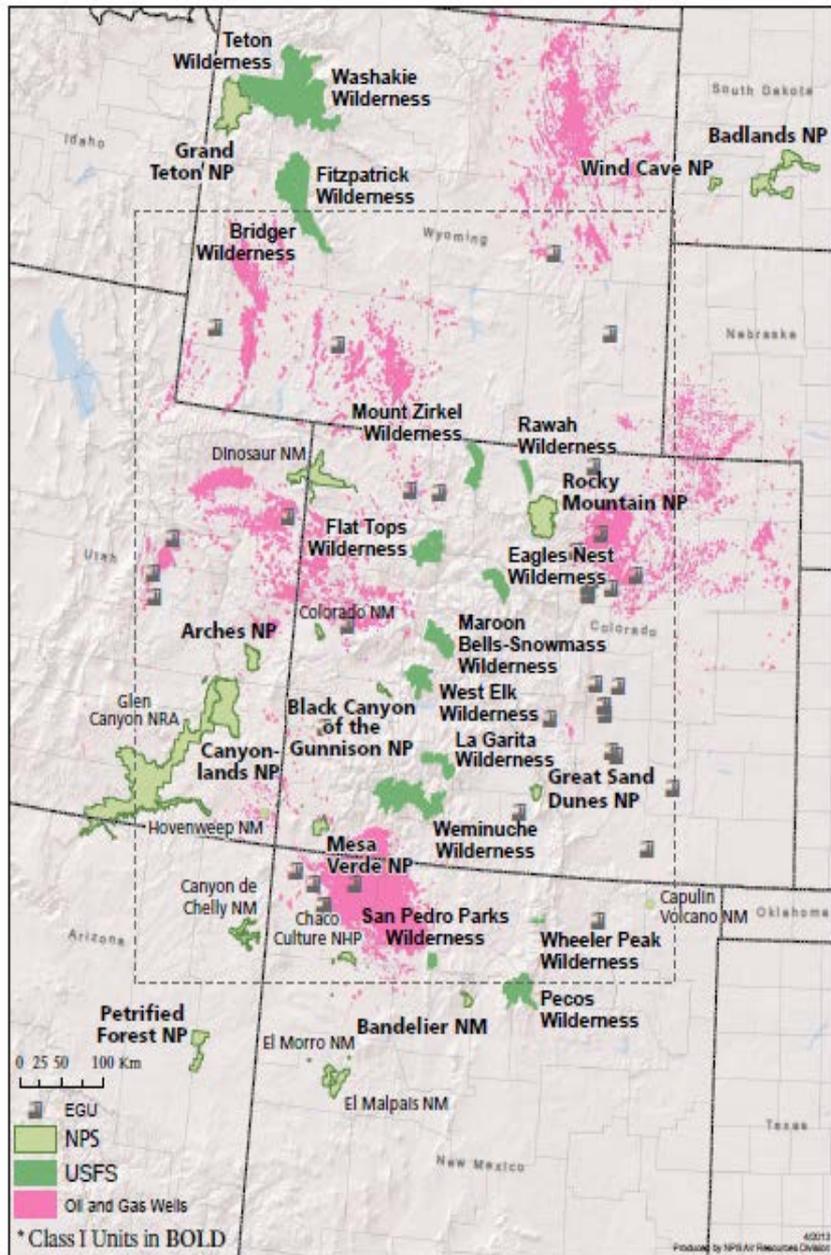
- **Six Source Categories:**
 - Natural (Biogenic, Lightning, Sea Salt & WBD)
 - Fires (WF, Rx, & Ag)
 - Upstream Oil and Gas (O&G)
 - Point Sources (EGU & Non-EGU)
 - Mobile Sources (on-road, non-road & CMV)
 - Remainder (Area/Non-Point)
- **Ozone Apportionment**
 - May-Aug 2008
 - 36/12/4 km Domains
 - 4 States (CO, NM, UT & WY)

Pilot Study - Ozone Source Category-Specific Source Apportionment

← 4 km Detailed Source Apportionment Domain

36/12/4 km Two-Way Grid Nesting

(Results in Appendix I on WestJumpAQMS webpage)



CAMx Modeling Domain

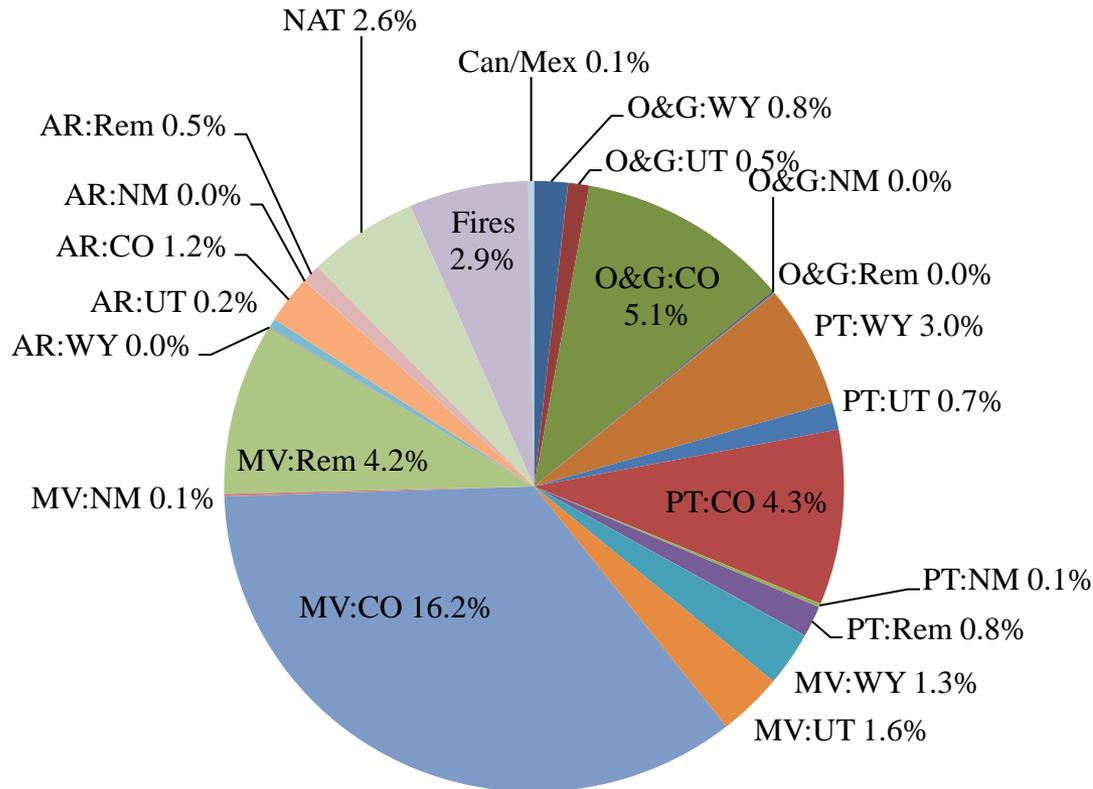
36 km : 148 x 112 (-2736, -2088) to (2592, 1944)
 12 km* : 227 x 230 (-2388, -1236) to (336, 1524)
 04 km* : 164 x 218 (-1228, -436) to (-572, 436)

* includes buffer cells

Detailed Pilot Study: 2008 4th Highest Modeled Contribution to Ozone (from WestJumpAQMS Appendix I)

Example: Colorado_JeffersonCounty0006

Rank (4) 07/15/08; Model = 75.0 ppb; Obs = 77.8 ppb; Bias = -3.5%; BC = 40.4 ppb (53.9%)



Summary of WestJumpAQMS 2008 Modeling Results for Arizona

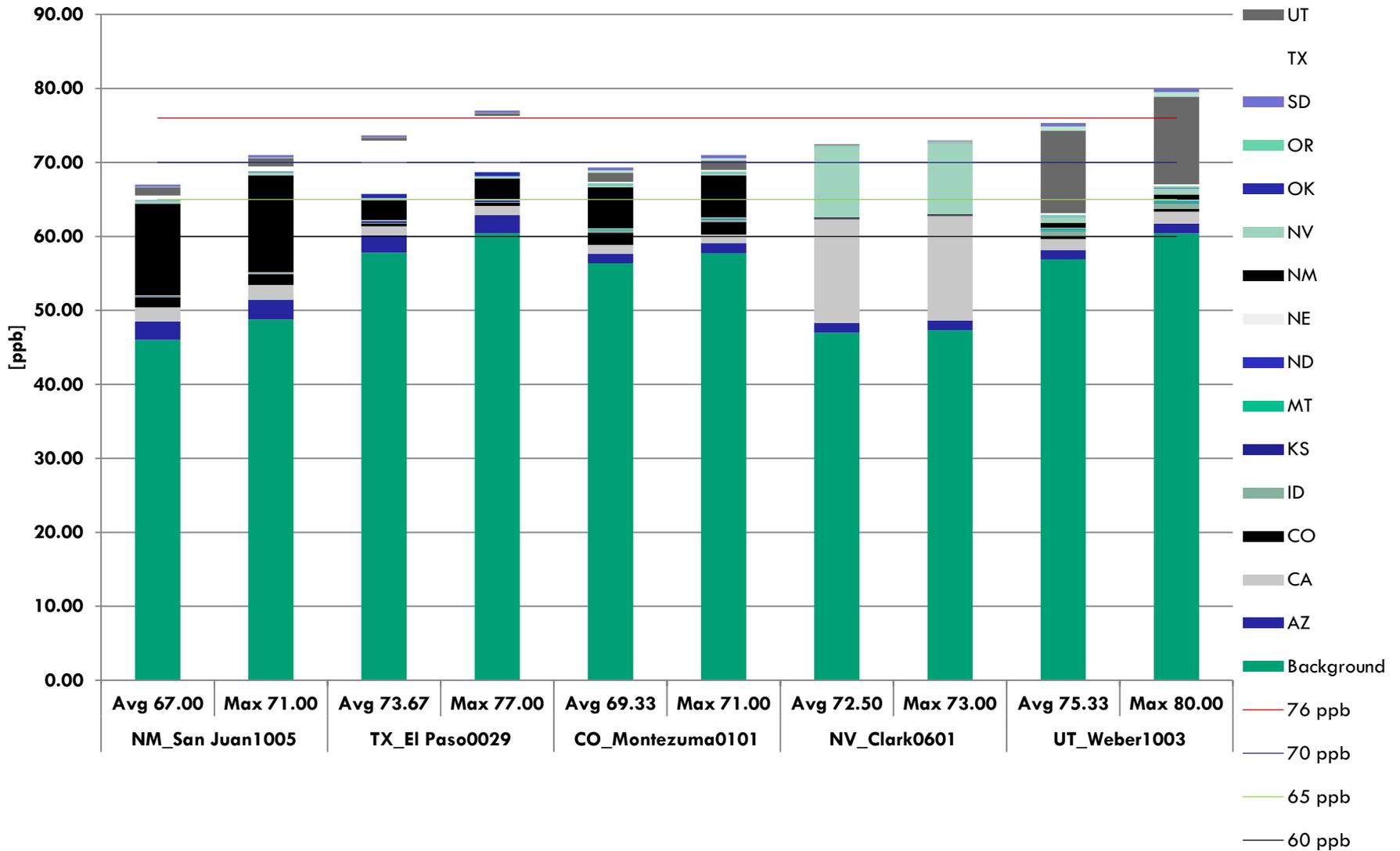
- Shown earlier
 - Examples of Upwind Ozone Contribution to highest, 4th highest, and 10th highest modeled days at 5 monitor sites across AZ with relatively high ppb concentrations (shown earlier, from Appendix B)
- Next
 - Arizona's Ozone Contribution to Downwind States (from Appendix A)
 - Maps of Arizona's anthropogenic contributions on the highest and 4th highest modeled days at 70 and 65 ppb (from Appendix C)

Arizona's Ozone Contribution to Downwind States

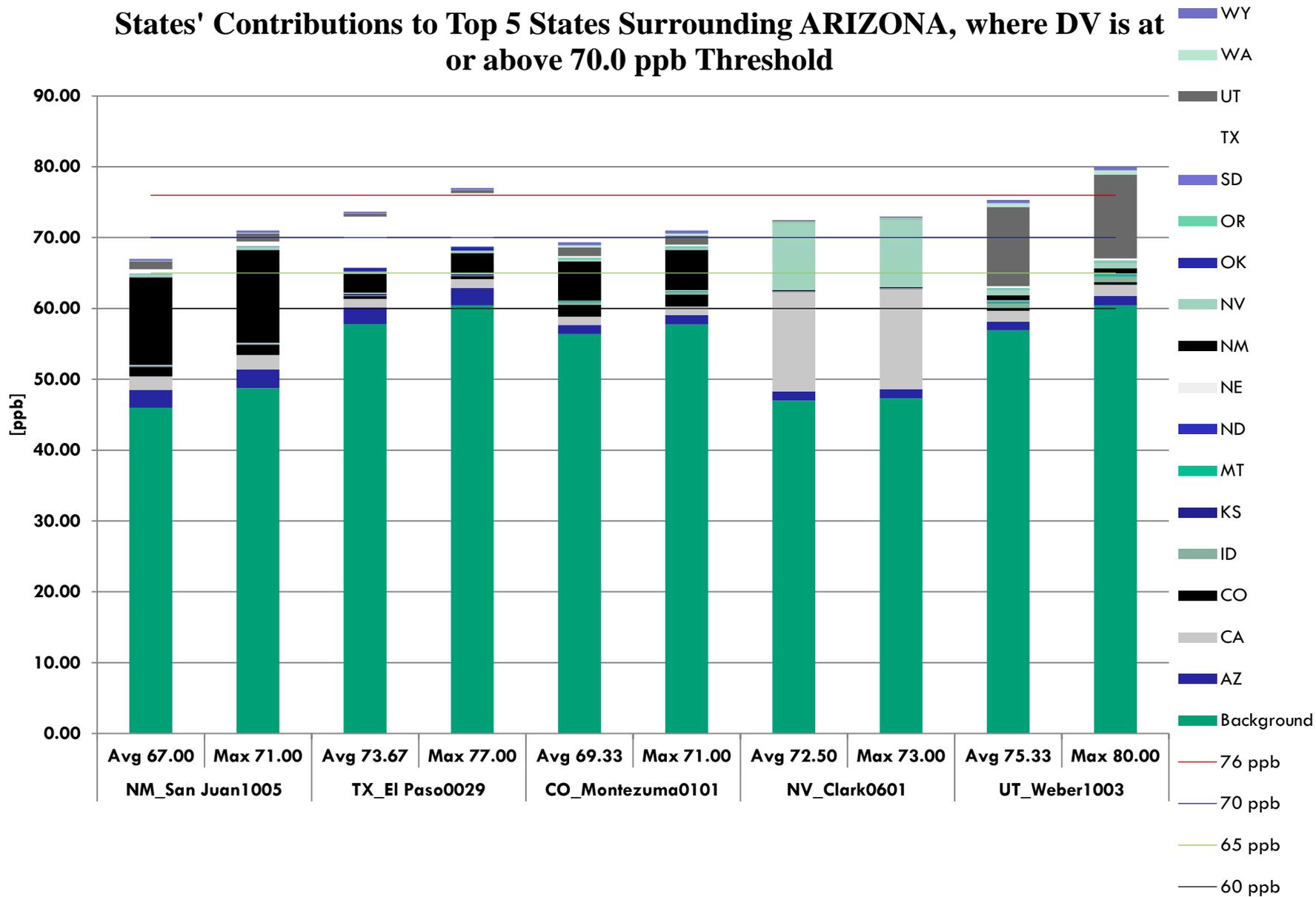
(from WestJumpAQMS Appendix A)

- A significant modeled contribution for this analysis is 1% of the current or potential new levels of the Ozone standard, such as contributions ≥ 0.76 , 0.70, 0.65, and 0.60 ppb
- At the current Ozone NAAQS level of 75 ppb, Arizona significantly contributes to modeled downwind nonattainment in surrounding States
- If the Ozone NAAQS were lowered below 70 ppb or lower, then Arizona would start to be a significant contributor to modeled downwind exceedances in surrounding States
- This analysis is for 2008 and is not a regulatory analysis that would have to examine a future year. A future year analysis, as is done for CSPAR, would be required in a Transport SIP.

States' Contributions to Top 5 States Surrounding ARIZONA, where DV is at or above 76.0 ppb Threshold



States' Contributions to Top 5 States Surrounding ARIZONA, where DV is at or above 70.0 ppb Threshold

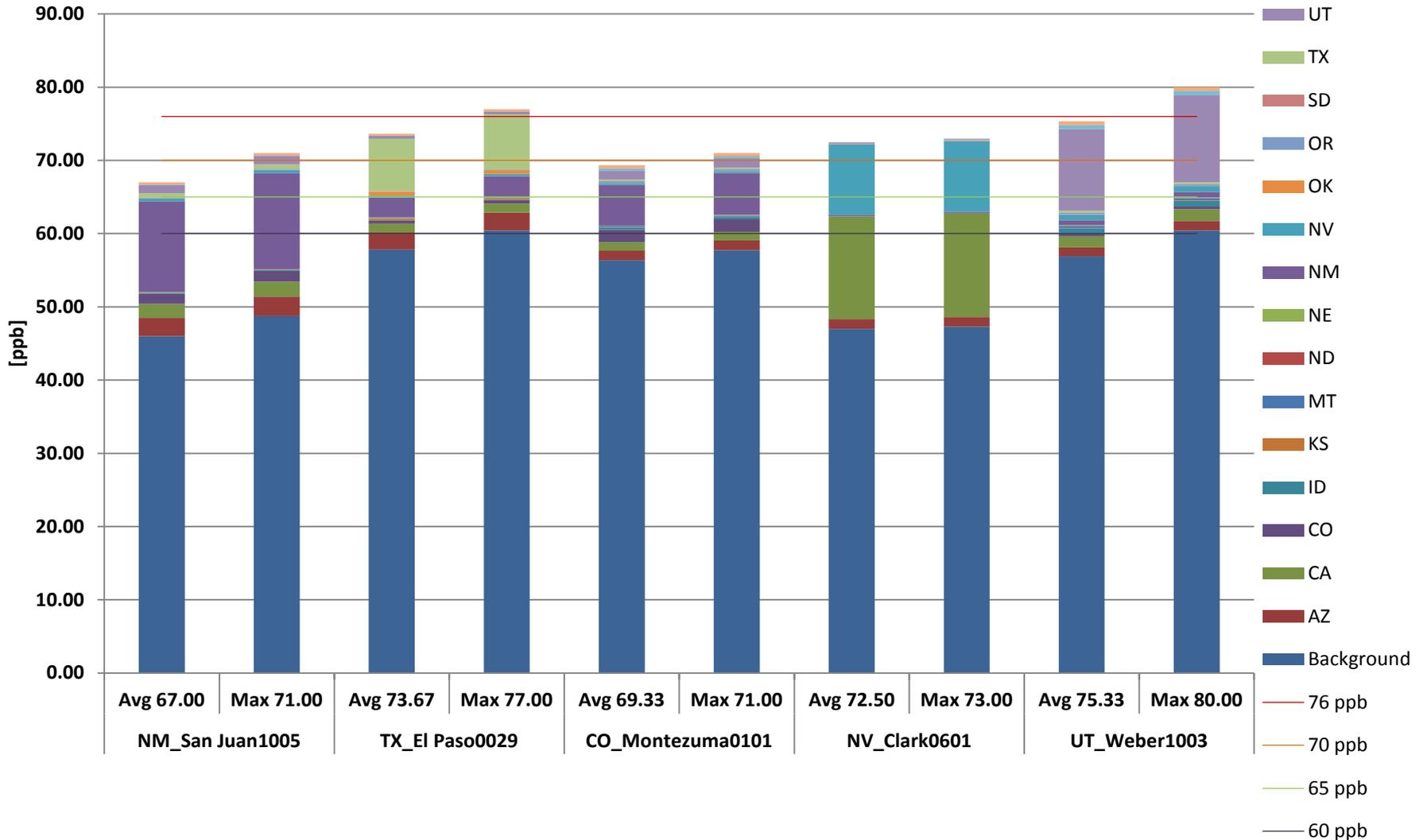


Arizona's Ozone Contribution to Downwind States, cont.

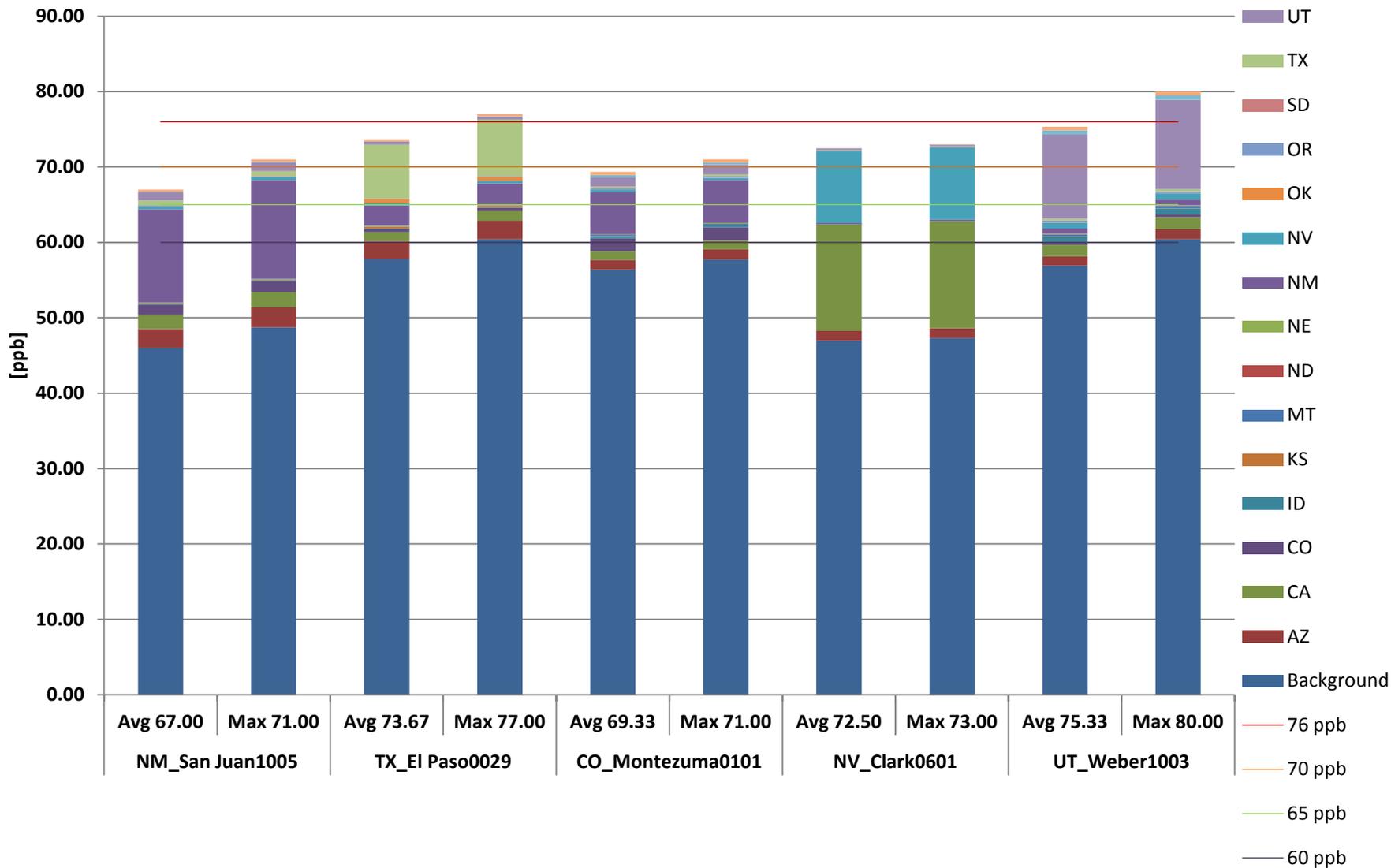
(from WestJumpAQMS Appendix A)

- If the Ozone NAAQS were kept at 75 ppb then Arizona would start to be a significant contributor (> 0.76 ppb) to modeled downwind exceedances in Nevada, Utah, Colorado, New Mexico, and Texas
- If the Ozone NAAQS were lowered to 70 ppb then Arizona would continue to be a significant contributor (> 0.70 ppb) to modeled downwind exceedances in those same states
- This analysis is for 2008 and is not a regulatory analysis that would have to examine a future year. A future year analysis, as is done for CSPAR, would be required in a Transport SIP.

States' Contributions to Top 5 States Surrounding ARIZONA, where DV is at or above 65.0 ppb Threshold



States' Contributions to Top 5 States Surrounding ARIZONA, where DV is at or above 60.0 ppb Threshold



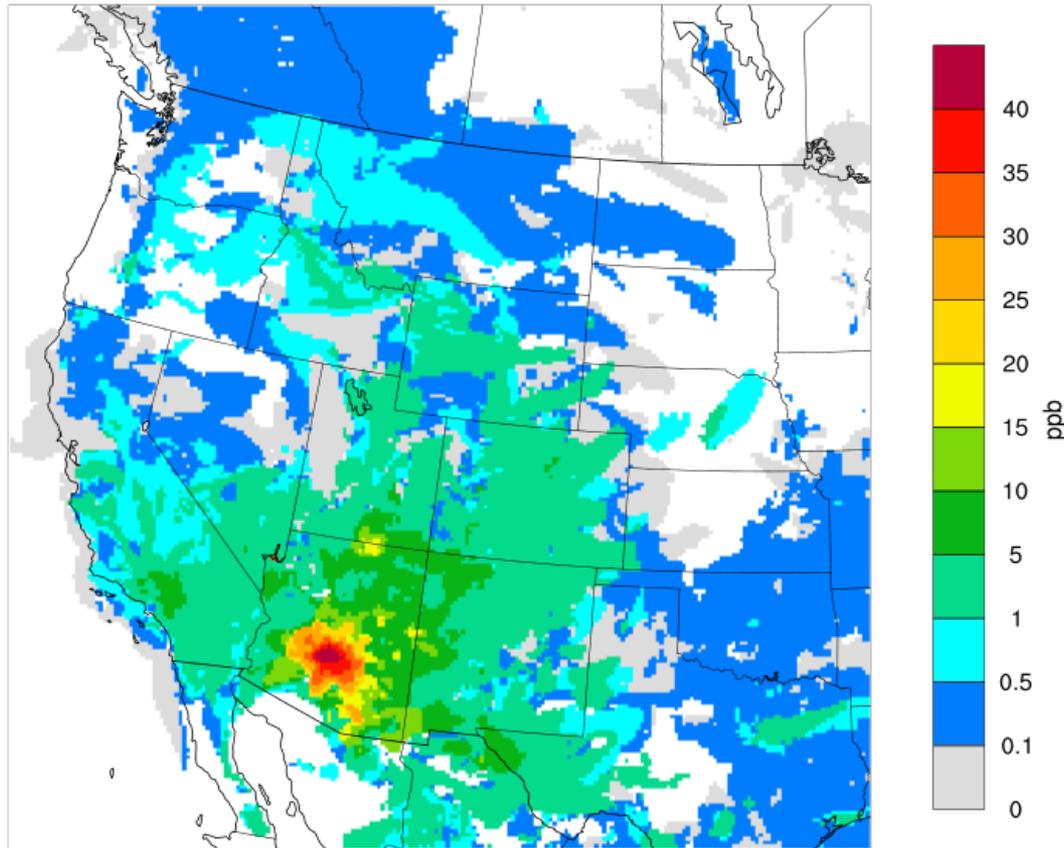
Arizona's Ozone Contribution to Downwind States, cont.

(from WestJumpAQMS Appendix A)

- If the Ozone NAAQS were lowered to 65 ppb then Arizona would start to be a significant contributor (> 0.65 ppb) to modeled downwind exceedances in Nevada, Utah, Colorado, New Mexico, and Texas
- If the Ozone NAAQS were lowered to 60 ppb then Arizona would continue to be a significant contributor (> 0.60 ppb) to modeled downwind exceedances in those same states
- This analysis is for 2008 and is not a regulatory analysis that would have to examine a future year. A future year analysis, as is done for CSPAR, would be required in a Transport SIP.

Spatial Distribution of the Maximum Modeled 2008 Anthropogenic contribution at a 70 ppb level for the Ozone NAAQS (from WestJumpAQMS Appendix C)

Contrib. to CAMx Daily Max 8-Hour Ozone \geq 70 ppb
AZ Anthropogenic Max Contribution

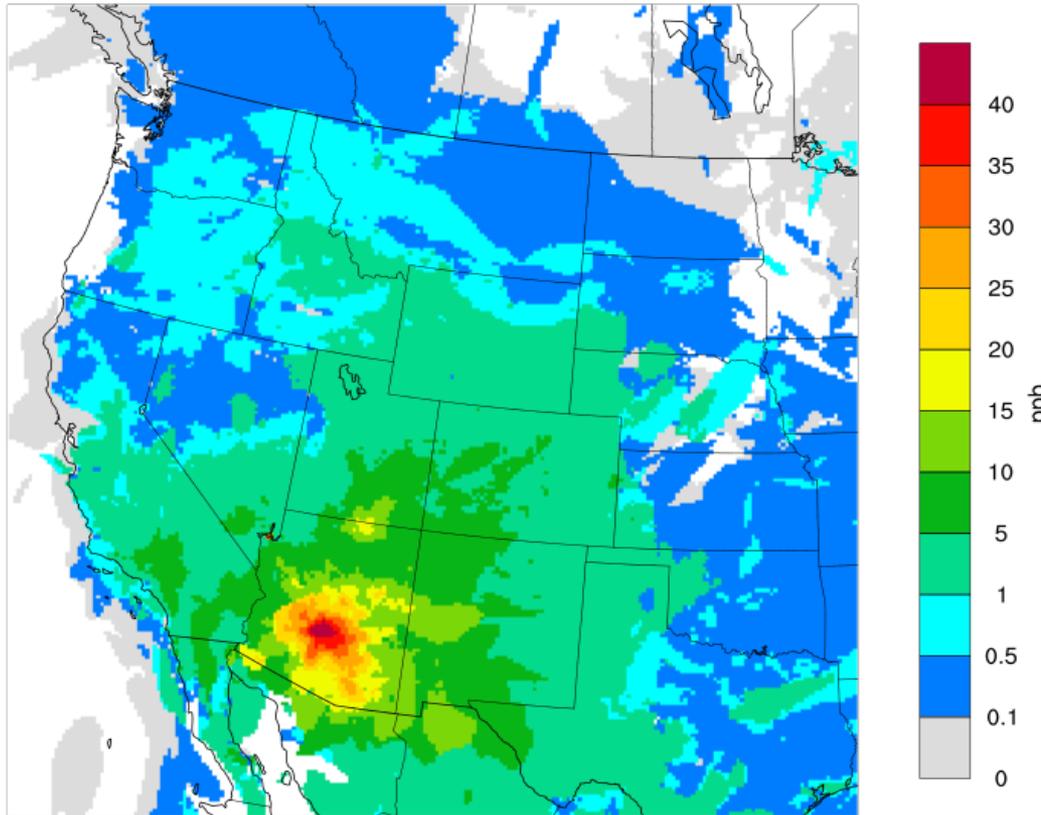


Max(83,53) = 49.38

- If the Ozone NAAQS is lowered to 70 ppb then Arizona would have a significant modeled maximum interstate contribution (> 0.70 ppb) across much of Southwest and Intermountain regions.

Spatial Distribution of the Maximum Modeled 2008 Anthropogenic contribution at a 65 ppb level for the Ozone NAAQS (from WestJumpAQMS Appendix C)

Contrib. to CAMx Daily Max 8-Hour Ozone \geq 65 ppb
AZ Anthropogenic Max Contribution

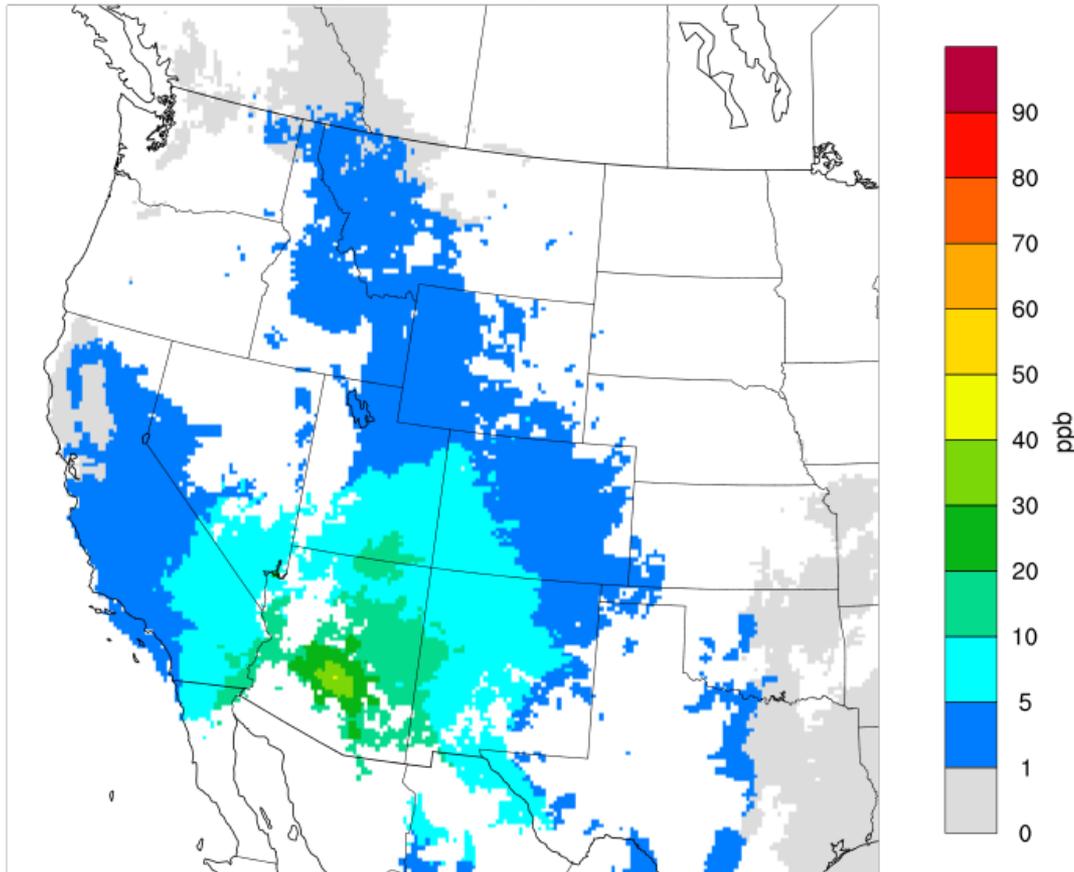


Max(83,53) = 49.38

- If the Ozone NAAQS is lowered to 65 ppb then Arizona would have a more significant modeled maximum interstate contribution (> 0.65 ppb) across all of the Southwest and Intermountain regions, and well into the Northwest. The Plains states are affected.

Spatial Distribution of the 4th Highest Modeled 2008 Anthropogenic contribution at a 70 ppb level for the Ozone NAAQS (from WestJumpAQMS Appendix C)

Contrib. to CAMx Daily Max 8-Hour Ozone \geq 70 ppb
AZ Anthropogenic 4th Highest Contribution

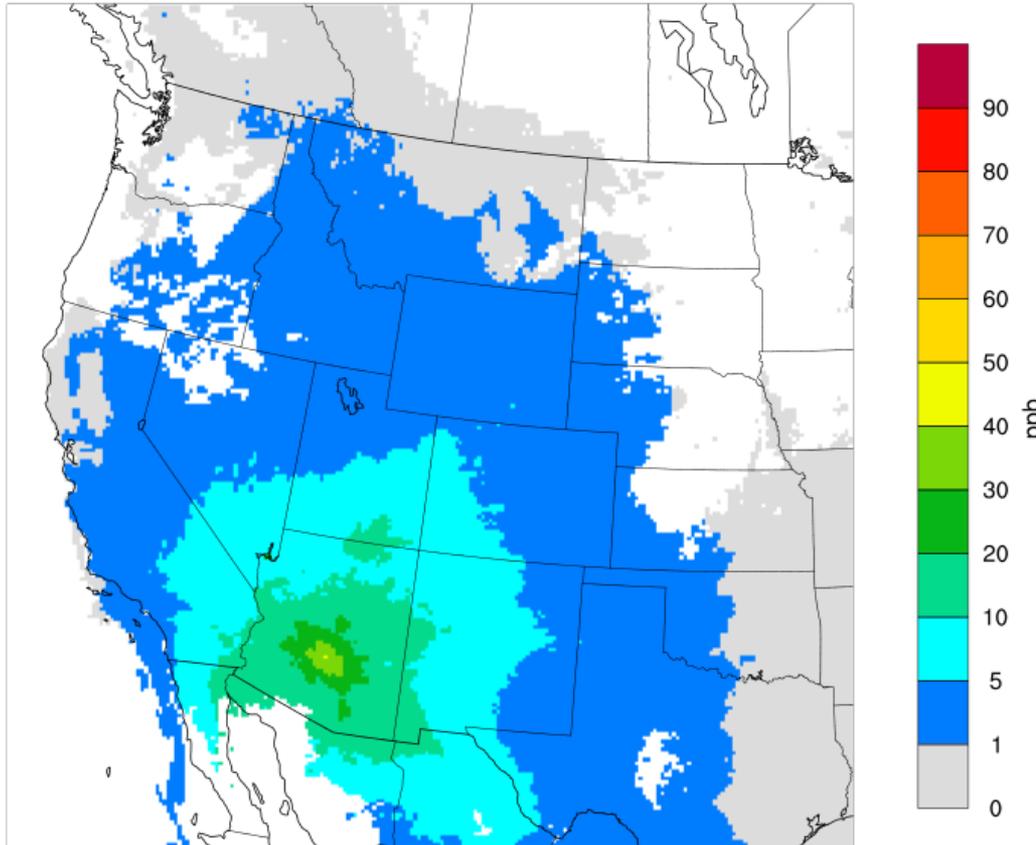


Max(86,53) = 40.05

- If the Ozone NAAQS is lowered to 70 ppb then Arizona would have a significant modeled 4th highest interstate contribution (> 0.70 ppb) across much of Southwest and Intermountain regions.

Spatial Distribution of the 4th Highest Modeled 2008 Anthropogenic contribution at a 65 ppb level for the Ozone NAAQS (from WestJumpAQMS Appendix C)

Contrib. to CAMx Daily Max 8-Hour Ozone \geq 65 ppb
AZ Anthropogenic 4th Highest Contribution

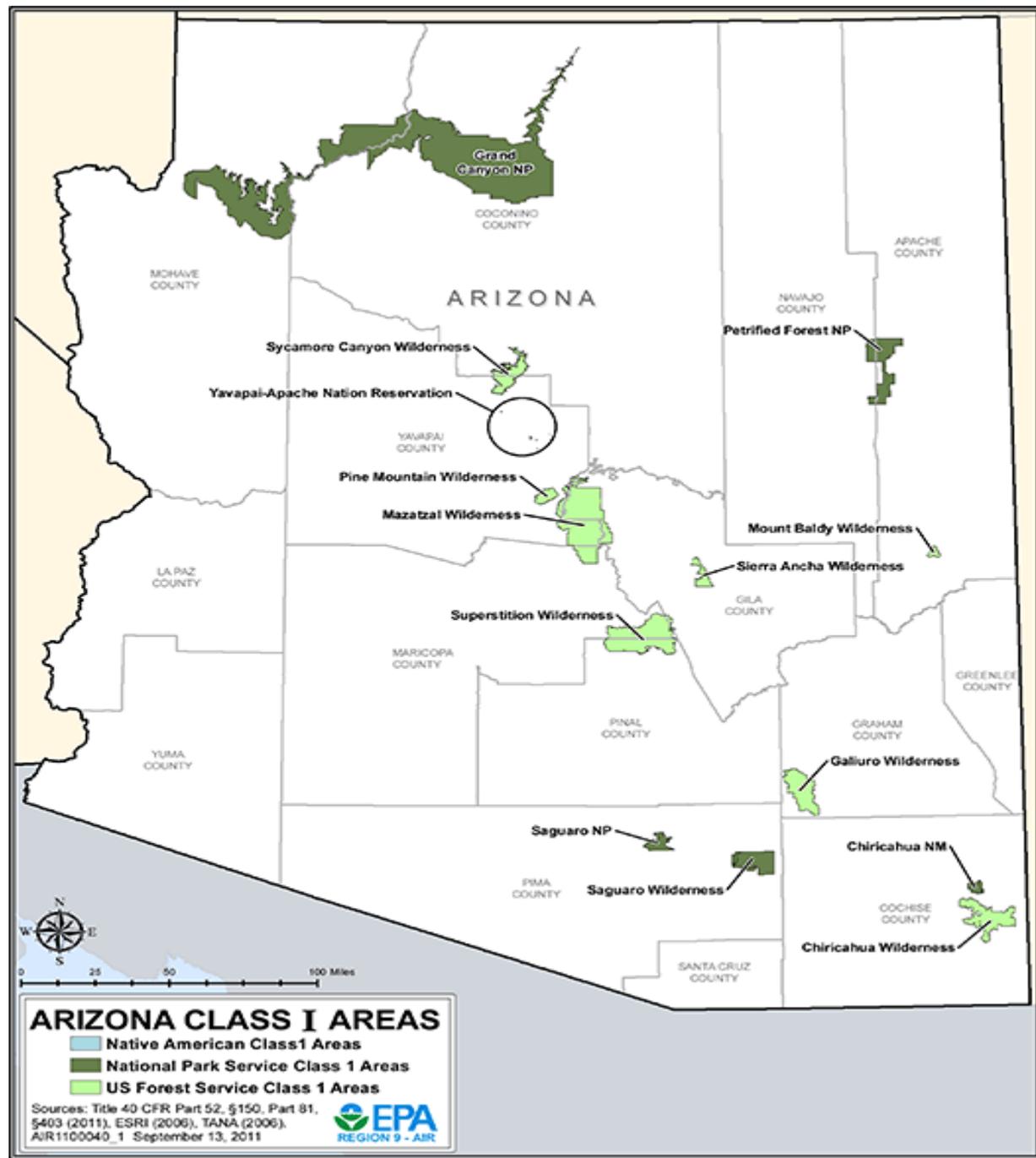


Max(86,53) = 40.05

- If the Ozone NAAQS is lowered to 65 ppb then Arizona would have a more significant modeled 4th highest interstate contribution (> 0.65 ppb) across all of the Southwest and Intermountain regions, and well into the Plains states.

Next regional haze full control SIP due July 2018

WestJumpAQMS modeling is the starting point for 2011 base year, 2018 progress check, and 2028 projection modeling.



WestJumpAQMS Benefited From

- WRAP Regional Modeling Center (2002 Platform)
- Four Corners Air Quality Task Force (2005 Platform)
- Continental Divide-Creston EIS (2005/2006 Platform)
 - NEPA O&G EIS using PGM for far-field AQ/AQRV
- Denver Ozone SIP Modeling and Follow-On
- 2008 National Emissions Inventory (2008 NEIv2.0)
 - Cornerstone to 2008 emissions
- WRAP Phase III O&G Emissions Study
 - Projected to 2008 plus add Permian Basin
- WESTAR-funded MEGAN Biogenic Emissions Enhancement Study
- DEASCO₃ 2008 Fire Emissions

Benefited from WestJumpAQMS

- Colorado Air Resource Management Study (CARMMS)
 - 2008 4 km Modeling Platform
- Deterministic & Empirical Assessment of Smoke's Contribution to Ozone (DEASCO₃)
 - 2008 36/12 km Modeling Platform
- PMDETAIL -- Smoke contributions to PM
- Three-State Data Warehouse (3SDW) and Three-State Air Quality Study (3SAQS)
 - 2008 36/12/4 km Modeling Platform; Test database for 3SDW
- Additional Follow-On Studies
 - NPS, BLM, etc.

Thanks –

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