



Intermountain West Data Warehouse (IWDW)



Western Air Quality Study (WAQS)



STUDY OVERVIEW



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National O&G Emissions Committee Call
June 13, 2019



BACKGROUND

Purpose of IWDW-WAQS:

- Multiple federal and state agencies identified need to more efficiently collect and disseminate air quality data and conduct photochemical grid modeling to assess air quality impacts from oil and gas development in the intermountain west.
- Initial Cooperating Agencies: EPA-Region 8; BLM CO/UT/WY State Offices; Forest Service (Regions 2 and 4); NPS-Intermountain Region; CDPHE; WDEQ; and UDEQ
- Initial Domain: Colorado, Wyoming, and Utah

History / Memorandum of Understanding (MOU):

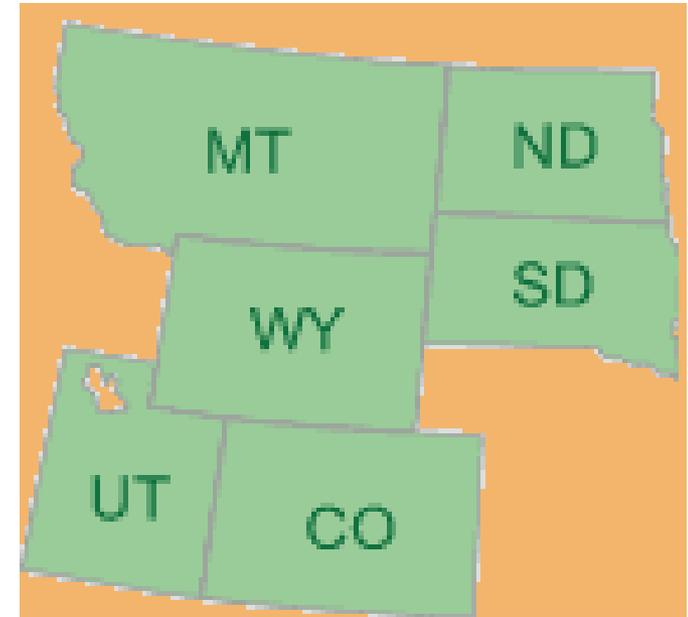
- 2008: Agencies began meeting to discuss study.
- 2011: Pilot Study called Three State Air Quality Study (3SAQS)
- 2014: Renewed MOU to extend and expand efforts (IWDW – WAQS)
 - Agencies Added: BLM New Mexico State Office; FWS; NMED; and FS - Rocky Mountain & Southwestern Regions
 - Domain Added: Northern New Mexico
- 2016: Addendum to MOU to include additional agencies and states:
 - Agencies Added: BLM Montana/Dakotas State Office and FS – Northern Region
 - Domain Added: North/South Dakota and Montana



BACKGROUND

Goals of IWDW-WAQS:

- Operate and maintain a data warehouse (IWDW) with current, representative, and complete data.
- Ensure ability to characterize air quality in intermountain west with high-quality data and analyses.
- Work under analysis protocols and data criteria that are agreed to by Cooperators.
- Effectively communicating project status and activities.
- Establish and maintain future funding to ensure sustainability of monitoring sites, air quality modeling platform, and IWDW.



Benefits of Study:

- Centralized platform to store, share, and visualize air quality data.
- Prevents duplication of efforts for NEPA, SIP/FIP, and Planning Projects.
- **Streamlines process to reduce uncertainty, time (1-2 years), and expense (\$300K to \$800K) of starting air quality analysis from scratch.**

OVERVIEW

IWDW-WAQS Structure:

- **Governing Board:** Provides oversight assistance and advice in the long-term, on-going operations of IWDW and on any budget decisions.
- **Oversight Committee:** Provides advisory and technical assistance on IWDW, monitoring and modeling activities and sub-workgroups. Communicates or elevates appropriate issues to the Governing Board.
- **Technical Committee:** Provides technical assistance and recommendations on operations and work products to ensure appropriate methodologies are implemented and work products are accurate and complete. Supports Oversight Committee and main point of contact for IWDW staff and contractors conducting modeling analyses.
- **Project Lead Agency:** Primarily convenes and facilitates Governing Board and Oversight Committee meetings. Agency changes every two years.

Work Products (As Resources Allow):

- Intent is to complete a base and future year air quality modeling platform (BC/IC, emissions, meteorology, air quality modeling) that includes monitoring data and a base case Model Performance Evaluation (MPE) for years associated with National Emissions Inventory (NEI). The NEI is developed and released by EPA every three years.

WORK PRODUCTS

Administrative Products:

- **Operation Plan:** Outlines process for streamlining the development of future IWDW-WAQS work plans or contingency plans.
- **Funding and Budget:** Cooperating Agencies have fully funded IWDW-WAQS activities, leveraged external data, and contributed significant in-kind resources since creation in 2008. Cooperators have developed methods for supplementing resources by external groups that use the IWDW-WAQS data because future funding is uncertain.
- **Communication/Outreach:** Effective communications essential for maintaining support to complete work. Flyers and presentations have been developed to communicate the Study's efforts.

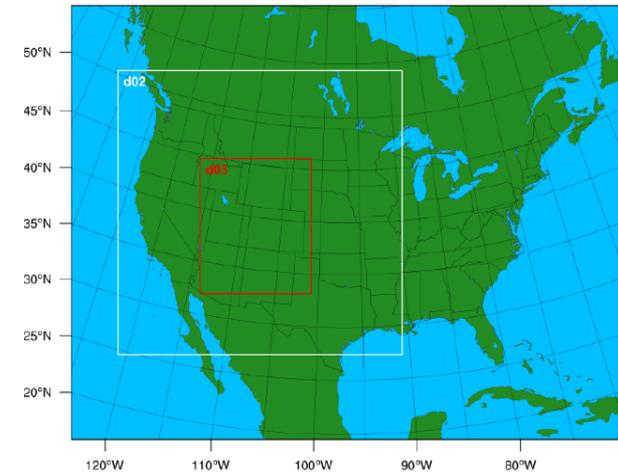
2018 – 2019 Work Plan:

- **Purpose:** Outlines next round of work tasks to be completed within the IWDW-WAQS framework.
- **Primary Goal:** Outlines work products that meet needs of all Cooperators efficiently and timely based on available resources.
- **Components:** Work tasks associated with monitoring, emissions inventory and modeling, meteorological modeling, air quality modeling, and IWDW maintenance.
- **New Approach:** Given limited resources, Cooperators are leveraging resources with WESTAR-WRAP and work products from external groups. This resulted in prioritization of tasks:
 - “Core” Tasks: Tasks that address Cooperators base needs to complete upcoming air quality projects.
 - “Optional” Tasks: Tasks that need more information to determine if technically/monetary feasible.

WORK PRODUCTS

Air Quality Products and Operations:

- **Monitoring:** Ozone and Particulate Matter Monitors
- **Modeling:** Emissions, Meteorology, Air Quality Modeling
 - **Provides:** Model Inputs for Baseline; No-Action Scenario, Baseline Model Performance Evaluation and Technical Support Documents.
 - **2008 Platform:** MOZART IC/BC; 2008/2020 Emissions; WRF/CAMx (36/12km)
 - **2011 Platform:** MOZART/Geos-Chem IC/BC; 2011/2020 Emissions; WRF/CAMx/CMAQ (36/12/4km)
 - **2014 Platform (In-Progress/Leverage with WESTAR-WRAP):** GEOS-CHEM IC/BC; 2014/2023/2028 Emissions; WRF/CAMx/CMAQ (36/12km & 4km as-needed)
- **IWDW:** Storage and dissemination of air quality data and files (monitoring, emissions, meteorology, air quality modeling). Various visualization tools to analyze monitoring and modeling data.
- **Development of Guidance Documents:**
 - National Environmental Policy Act – Intermountain West Data Warehouse Process Outline (NEPA-IWDW Process Outline)
 - Recommendations for Evaluating the Performance of the WAQS Photochemical Grid Model Platform (WAQS MPE Checklist)



NEPA-IWDW PROCESS OUTLINE

Purpose:

- Outlines process for requesting and using IWDW data in future NEPA projects.

Background:

- NEPA requires federal agencies to conduct air quality assessments for federal actions that may significantly affect environment. These assessments evaluate potential air quality and air quality related value (AQRV) impacts due to emissions from proposed action and alternatives.
- Level of analysis depends on type and location of development and magnitude of emissions created from development. The air quality assessments may include a qualitative or quantitative analysis.
- A plume dispersion model (AERMOD) and a photochemical grid model (PGM) (CAMx and CMAQ) are typically used to quantitatively assess the air quality impacts associated with development.

Components of Process Outline:

- Requesting Data for NEPA Projects: Need a sponsor and a Data Request Form.
- Types of Model Platform Components for NEPA Projects: IWDW will only support PGM products.
- Utilization of Model Platform for NEPA Projects: Outlines approaches for downloading, testing, and conducting PGM simulations using the IWDW products for a new NEPA project.
- NEPA-Specific Data Return to IWDW: After Record of Decision, specific data should be returned to IWDW to inform and share with future NEPA assessments.

WAQS MPE CHECKLIST

Purpose:

- Recommends series of model evaluation analyses for determining adequacy of PGM platforms.
- Recommends approach for summarizing and interpreting MPE results.
- Assists in identifying resources (time, funding, evaluation tools) needed to complete future MPEs.

Benefits of MPE Checklist to WAQS:

- Streamlines approach for conducting model evaluations.
- Comprehensive performance evaluation to inform users of model issues.
- Identifies potential resources (funding and computing needs) for completing evaluations that are relevant to the intermountain west.
- Outlines approach for documenting model performance and gaps for transparency and development of future platforms.

Components of Checklist (in order of completion):

- Assessment of boundary conditions
- Evaluation of meteorological modeling results
- **Assessment of emissions inventory and modeling results**
- Evaluation of photochemical grid modeling results
- Summarizing and interpreting results of platform

PROGRESSION OF IWDW-WAQQS MPE EFFORTS

Model Platform	2008 [36/12 km]	2011 [36/12/4 km] & 2014 [36/12/4 km (as-needed)]
AQ PGM Platform (Focus)	CAMx: 12 km	CAMx and CMAQ
IC/BC Evaluation	No	Yes
Emissions/Meteorology/PGM Evaluation	Yes	Yes
Pollutants Evaluated	O3, NOx, Speciated PM, AQRVs	O3, NOx, Speciated VOCs and PM, CH4, NH3, AQRVs
Results Averaging Approach	Hourly, Monthly, Seasonal Average Across; Domain, Network, State	Hourly, Monthly, Seasonal, Diurnal Average Across; Domain, Network, State, Individual Sites
Statistical Evaluation	Yes	Yes
Diagnostic Evaluation	No	BC (GEOS-Chem vs MOZART), WRF Winter Configuration, Emissions Adjustments
Dynamic Evaluation	No	Yes (Limited: 2008 and 2011)
Report	Protocols, PGM MPE Report	Protocols, Emissions (2011 and 2008 comparisons), WRF, PGM
Distribution/Review of Results	Upon Request/Summarized in Report	Online Access /Summarized in Report
IWDW Visualization	No	Yes

MPE CHECKLIST: EMISSIONS

Purpose:

- Given that emission inventories (EIs) are compiled from multiple datasets, review EIs using Quality assurance (QA) checks to identify data problems (errors in emissions amounts, codes, facility names, stack heights, or latitude/longitude locations).

Recommended Quality Assurance Checks:

- **Checking data codes:** Ensure inventory codes are valid
- **Point versus nonpoint reconciliation:** Ensure sources are identified properly, are not double-counted across point and nonpoint, and do not have missing pollutant emission rates, temporal allocations or spatial components.
- **Rankings and percent differences techniques:** Rank emissions and calculate percent differences (with previous emissions estimates). Large or unexpected differences can be investigated further to ensure that differences have reasonable explanation.
- **Comparisons among emissions inventories and regions:** Use spatial plots and county and states totals to compare previous emissions, proposed emissions, region-by-region emissions, and the computed difference to reveal unexpected changes or patterns that could signal an error.

Additional Analyses:

- Evaluate VOC speciation by source category to determine if the emissions accurately represent the reactivity of the VOC mixture.

IWDW VISUALIZATION TOOLS



Intermountain West Data Warehouse

Search Logout Account

MODELING EMISSIONS MONITORING WIKI DOCS NEWS HELP



A Powerful Data Resource

The Intermountain West Data Warehouse (IWDW) provides easy online access to monitored air quality data, gridded modeling products, emissions data, and an integrated suite of tools to help assess air quality on Federal lands.

[more](#)

UPDATES

The SMOKEv4.5 processing scripts and emissions inputs used for the [WAQS 2014 Shakeout v.1 Modeling Platform](#) were released for download.

March 28, 2019

The U.S. EPA 2016 Emissions Modeling Platform (beta) was released for download.

March 01, 2019

The Base 2014 Unmerged emissions data for the [WAQS 2014 Shakeout v.1 Modeling Platform](#) were released for download.

January 25, 2019

The [website](#) was updated with a responsive web design framework, a new home page, and some navigational changes.

December 28, 2018

EVENTS

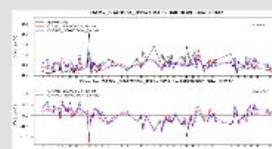
[RTOWG / IWDW-WAQS 2014v1 Shakeout Modeling Platform – Results Meeting](#)

Purpose: To review the progress and status of the WAQS 2014 v.1 Shakeout Modeling Platform effort

April 05, 2019

[IWDW-WAOS Governing Board Meeting](#)

ALL MODELING EMISSIONS MONITORING



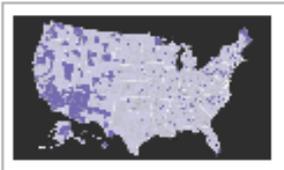
IWDW VISUALIZATION TOOLS

Emissions Data



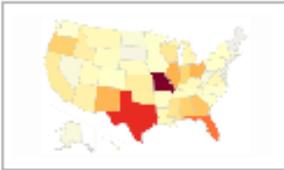
Emissions Review Tool

View charts and graphs of annual emissions totals for States, Counties, and Source Classification Codes (SCCs) from several different 3SAQS modeling scenarios.



Emissions Review Map

View spatial display of annual emissions totals for States, Counties, and Source Classification Codes (SCCs) from several different WAQS modeling scenarios.



Emissions Inventory Browser

View charts, maps, and data tables of emissions inventory data for States, Counties, Tribes, and the entire U.S. using an interactive dashboard of selection and filtering controls.

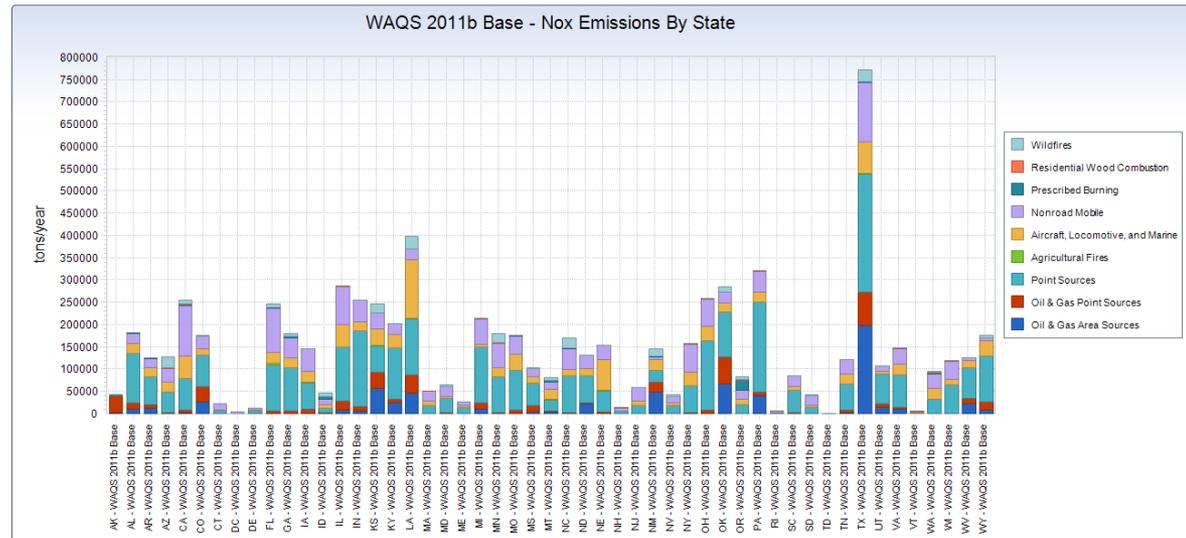
VISUALIZATION TOOLS: EMISSIONS

Purpose:

Breakdown of emissions by state, county, & source category for Base and Future years.

Features:

- Pie and bar charts and maps of emissions for specified parameter, source categories, and SCC codes at state or county levels
- Chart data downloadable



Scenario:

Parameter:

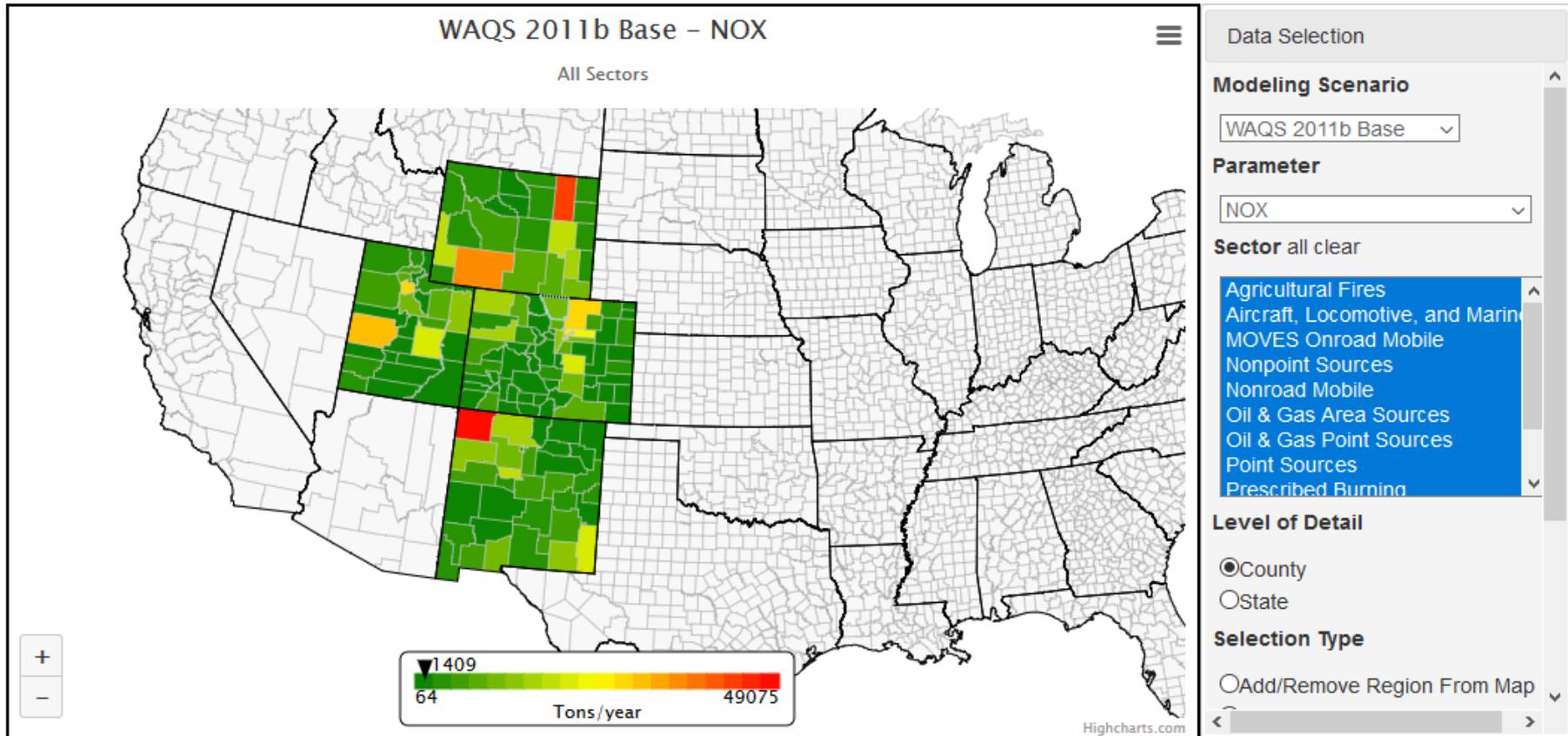
Source Category:

State:

County:

SCC:

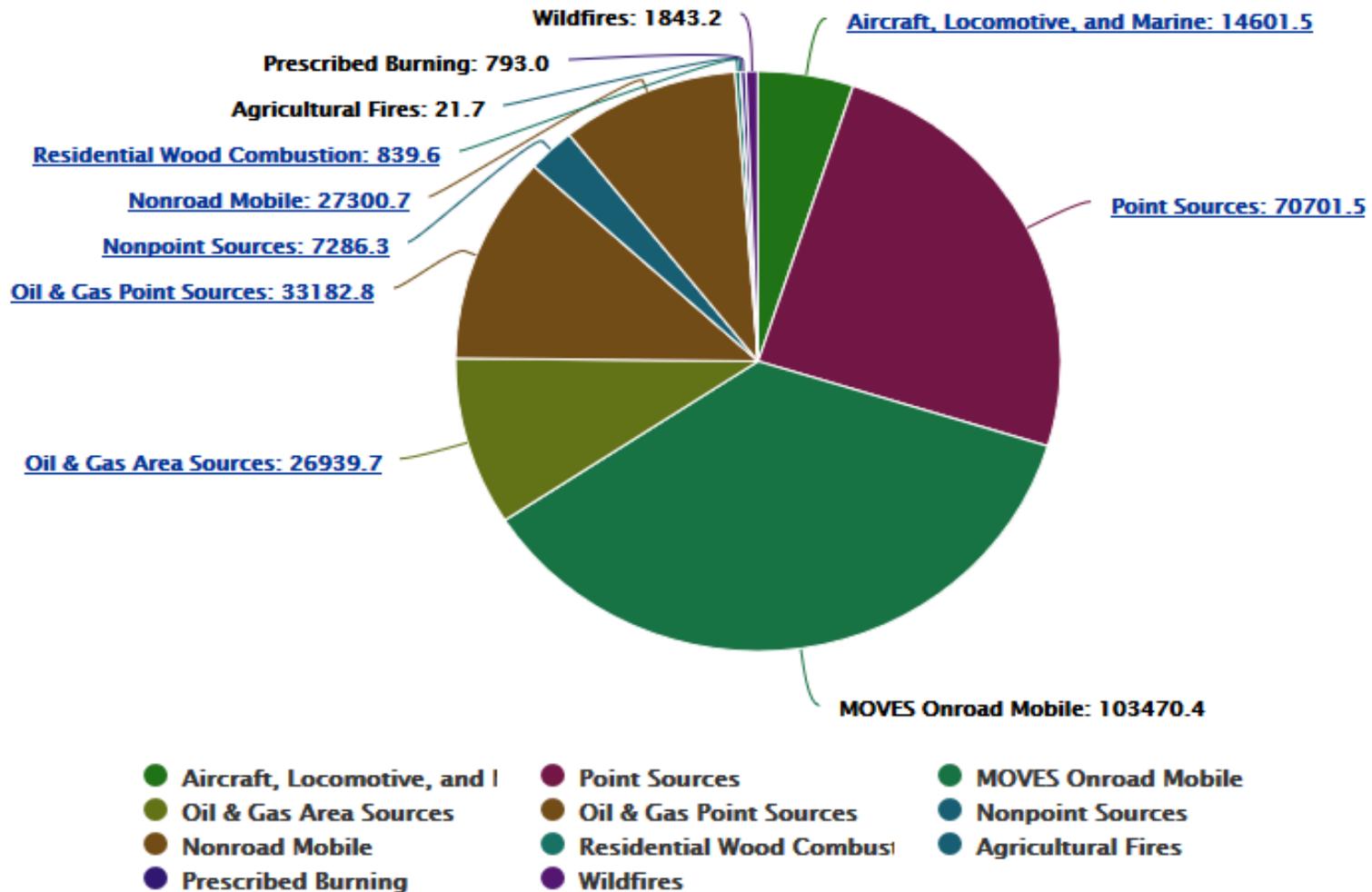
VISUALIZATION TOOLS: EMISSIONS



County Breakdown by Sector

VISUALIZATION TOOLS: EMISSIONS

WAQS 2011b Base – Colorado Nox Emissions By Sector



IWDW VISUALIZATION TOOLS

Monitoring Data



Haze Analysis [↗](#)

Scenic vistas are diminished by haze that causes discoloration, loss of texture, and diminished visual range, and some of the pollutants that form haze have been linked to serious health effects and environmental damage. These reports summarize haze in protected Class I areas.



Visibility Summary [↗](#)

Scenic vistas are diminished by haze that causes discoloration, loss of texture, and diminished visual range, and some of the pollutants that form haze have been linked to serious health effects and environmental damage. These reports summarize haze in protected Class I areas.



Ozone Summary [↗](#)

Elevated ozone concentrations adversely affect sensitive vegetation and ecosystems, including forests, parks, wildlife refuges, and wilderness areas. This graphical report summarizes ozone trends as measured by the EPA ozone monitoring network.



Wet Deposition Summary [↗](#)

Deposition of sulfur and nitrogen compounds contributes to the acidification and eutrophication of sensitive terrestrial and aquatic ecosystems. This graphical report summarizes trends in wet deposition data from the NADP National Trends Network (NTN).



Dry Deposition Summary [↗](#)

About half of the acidity in the atmosphere falls back to earth through dry deposition. This graphical report summarizes the sulfur and nitrogen composition of dry deposition data from the EPA's Clean Air Status and Trends Network (CASTNet).

VISUALIZATION TOOLS: MONITORING DATA

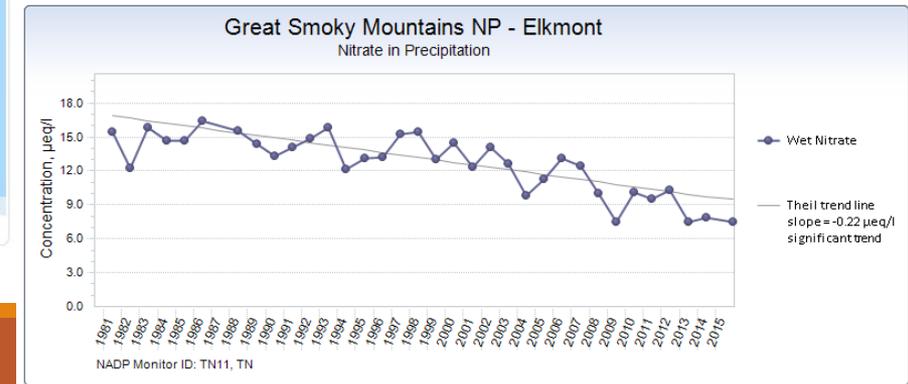
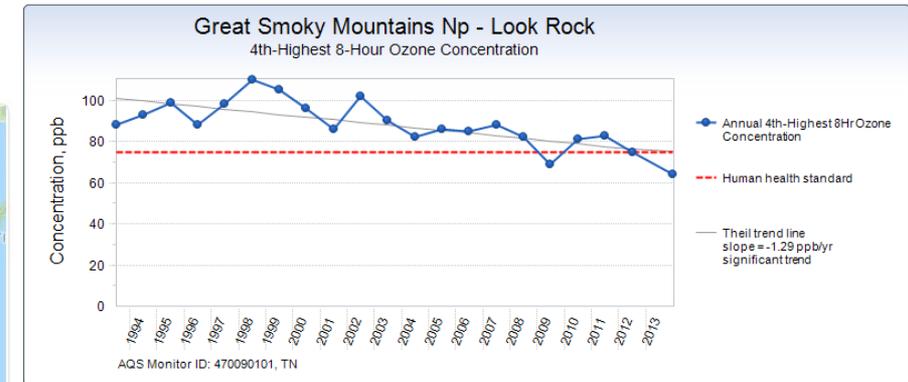
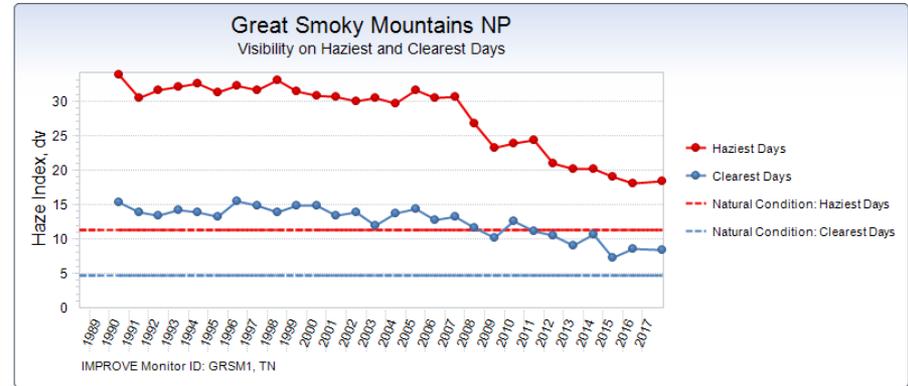
Purpose:

Present visual summaries of monitoring data using AQS, CASTNET, IMPROVE networks.

Features:

- Data aggregation and analysis
- Map-based selection of monitoring sites
- High-level interpretations of the data

IMPROVE Aerosol, Regional Haze Rule II (New Equation), with substituted data



IWDW VISUALIZATION TOOLS

Modeling Data

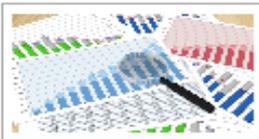
Bulk Modeling Data



Request Modeling Platform Data

Submit a formal request for bulk modeling data by selecting entire modeling platforms or individual platform components and providing a description of your intended application of the data. The Data Warehouse team will review your request and provide instructions for obtaining your data.

Modeling Data Tools



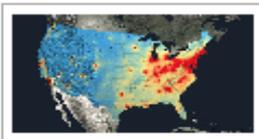
Model Performance Evaluation Plots

View a wide variety of scatter plots, soccer plots, bar charts, and maps demonstrating model performance for several modeling scenarios in the Three-State Air Quality Study (3SAQS).



Model-To-Observation Comparison Tool

View a wide variety of scatter plots, soccer plots, bar charts, and maps demonstrating model performance for several modeling scenarios in the Three-State Air Quality Study (3SAQS).



Model Data Maps

View interactive maps and animations of gridded air quality modeling results for the Intermountain West region.



Source Apportionment Tools and Resources

View a wide variety of scatter plots, soccer plots, bar charts, and maps demonstrating model performance for several modeling scenarios in the Three-State Air Quality Study (3SAQS).

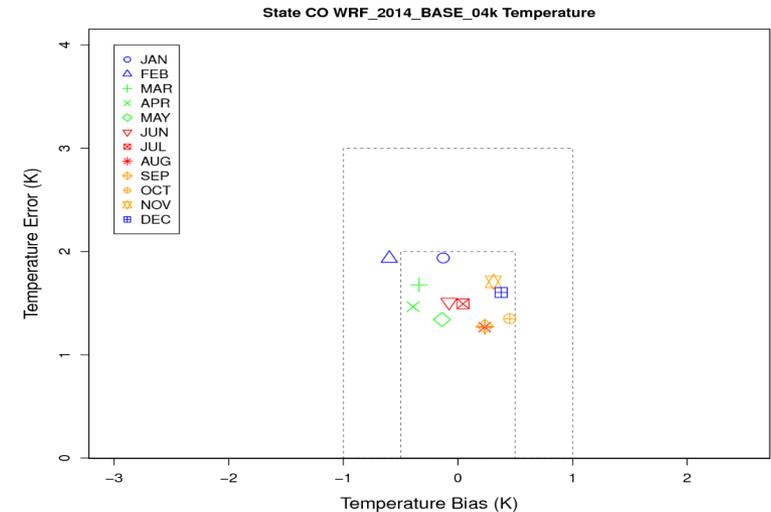
VISUALIZATION TOOLS: PGM MPE

Purpose:

Provide analyses of modeled and observed parameters leveraging PAVE and AMET.

Features:

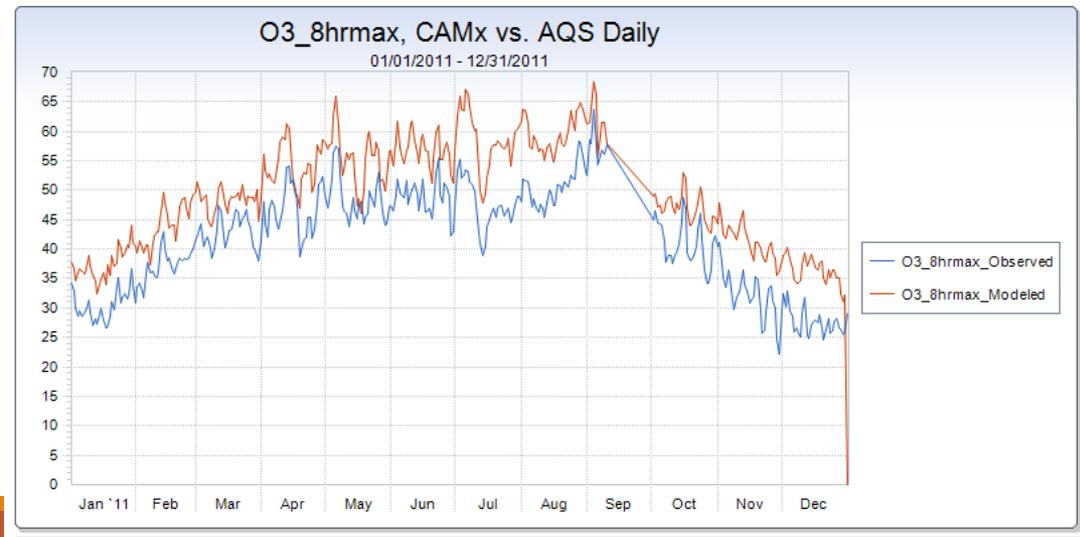
- Chart data visible in browser
- Mouse over to get specific values
- Displays and images downloadable
- Image directories open for browsing



Comparison Type: By Network
Modeling Scenario: WAQS - 2011b - CAMx - 12K
Start Date: 01/01/2011
End Date: 12/31/2011

Network/Dataset: AQS - Daily
Parameter: O3_1hrmax, O3_8hrmax, PM25_TOT - Mass, PM2.5 (Fine), W126

2014 | WRF | plots
20140101-20141231
Choose an image (12 available):
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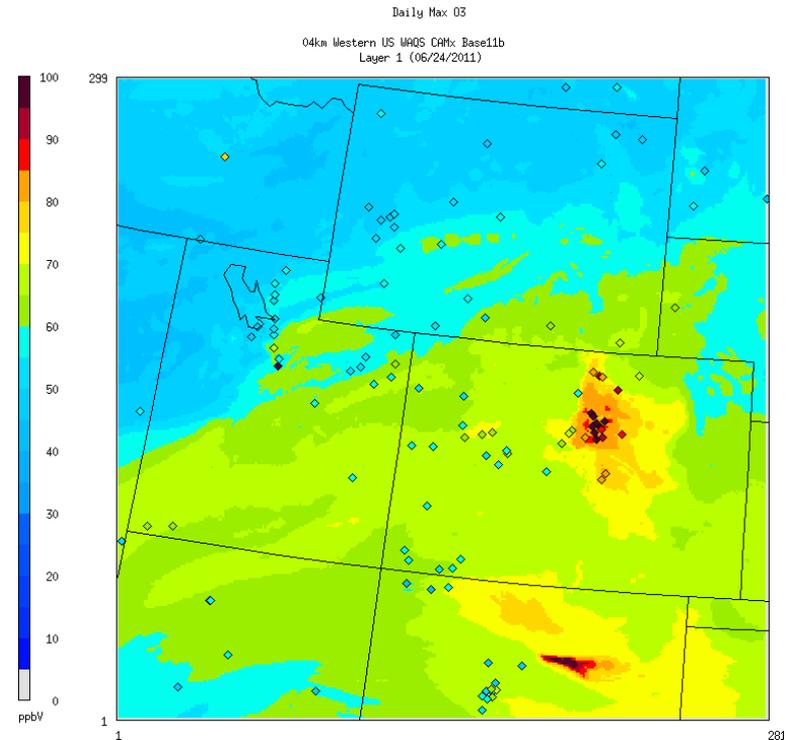
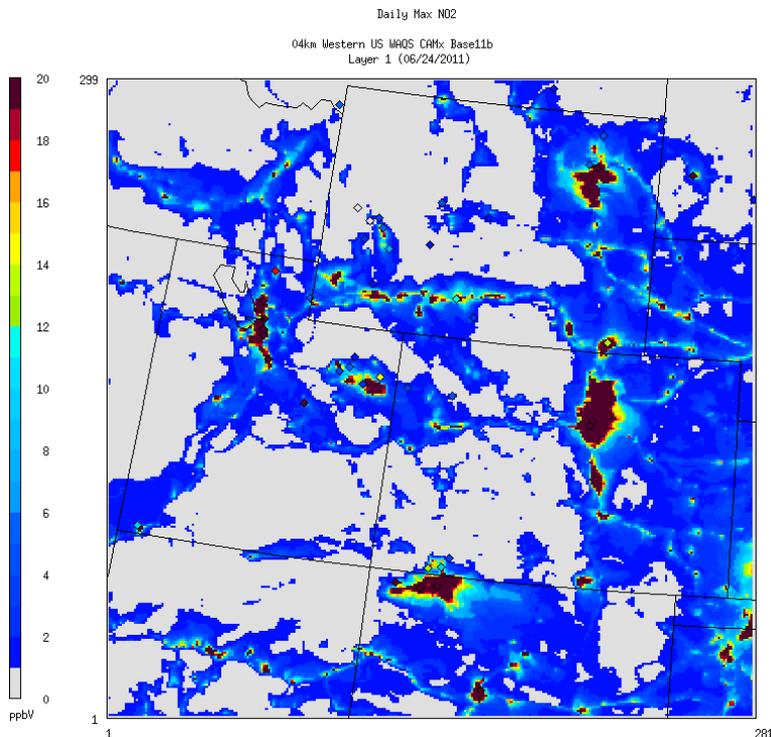
VISUALIZATION TOOLS: PGM MPE

Purpose:

Provide interactive display of gridded data and grid cell time series.

Features:

- Rendering performed in browser
- User specified coloring
- All configuration embedded in URL for quick reference



NEXT STEPS & FUTURE NEEDS

Next Steps:

- 2014 PGM Platform: Developing and anticipated release will be late 2019.
- Development of methods for extracting and nesting model domains.
- Continue development of model post-processing capabilities and tools in the IWDW.

Future Needs/Wish List:

- Continuous funding mechanism to support IWDW-WAQS efforts.
- Resources for sensitivity studies that focus on issues related to oil and gas emissions and model improvements that address performance issues in the intermountain west.
- Visualization Tools:
 - In-house MPE plot browser that displays plots model-to-model comparisons.
 - Vertical profile visualization tools.
 - Tools that allow for real-time analysis.

Website: <http://views.cira.colostate.edu/tsdw/>