



IWDW

Intermountain West Data Warehouse

Overview and Structure of the CIRA Air Data Management System (ADMS): IWDW and sister websites

NACAA Emissions & Modeling Committee Meeting



February 1, 2022
Tom Moore, WESTAR-WRAP



- CIRA ADMS and websites – From the bottom up
 - Hardware framework
 - Networking framework
 - Software architecture
 - Web and application ecosystem
 - Project Manager / Lead Developer – Shawn McClure
 - 970.491.8455 / Shawn.McClure@colostate.edu
- IWDW website
 - Website traffic summary
 - Maintenance and operations
 - Data import and management
 - Website development
 - Modeling platform data requests
 - Website and tool development

SuperMicro dual 6-core CPU file servers (current quantity: 4)

Front view



1 or 2 bays reserved for in-chassis data transfers

Back view



Redundant power supplies

Redundant network ports

Hardware features:

- 36 drive bays
- Dual power supplies
- Dual Ethernet ports
- Rack-mounted

Storage Capacity:

VIKING:	250 Terabytes
VALKYR:	400 Terabytes
VISIGOTH:	400 Terabytes
	<hr/>
	1.05 Petabytes

Tower chassis production servers (current quantity: 8-10)

Web

Web

Database

Database

Backup

Backup

Backup



Web servers:

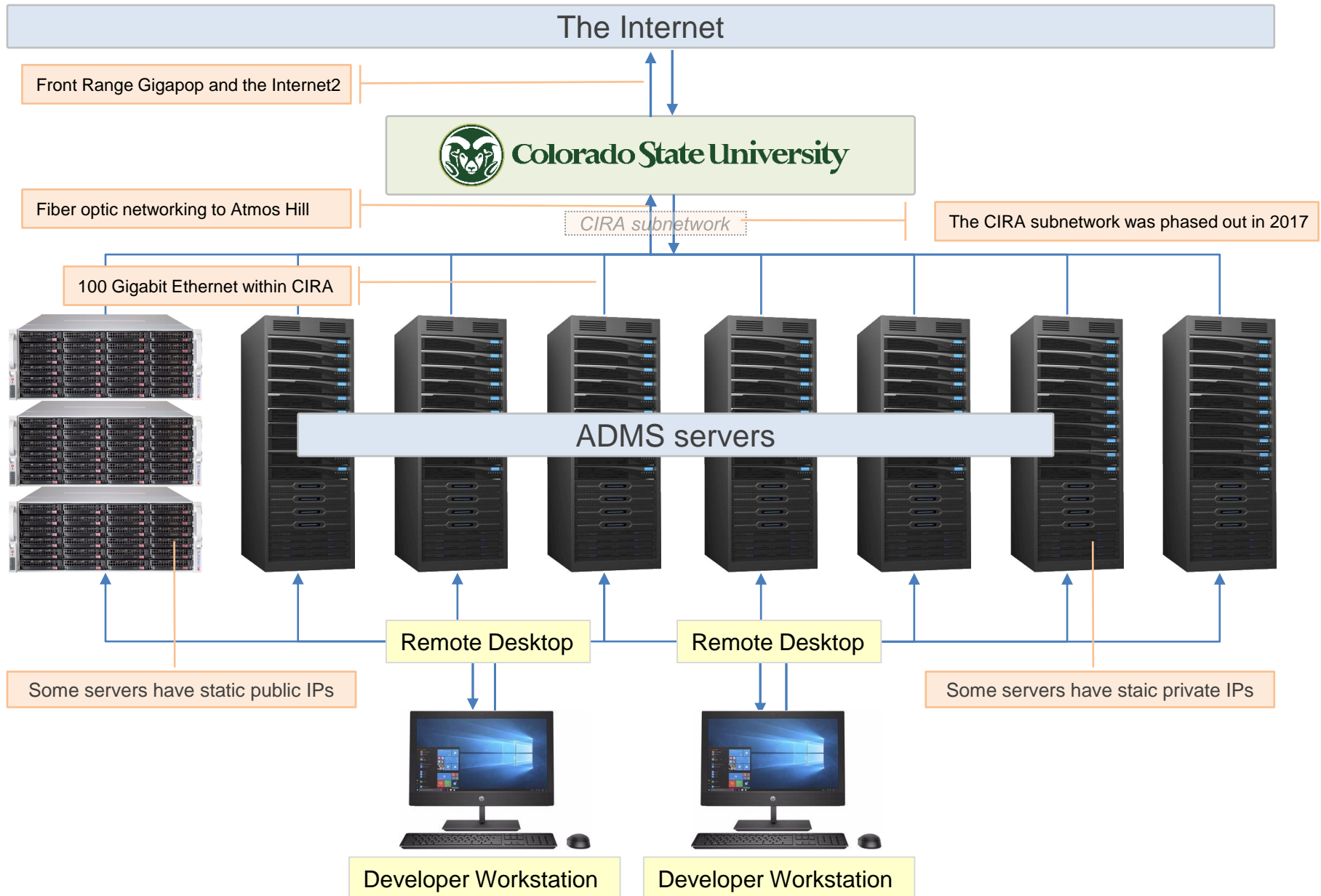
- Production IWDW website
- Local web services
- FTP/SFTP data distribution
- Support websites (GIS, images)

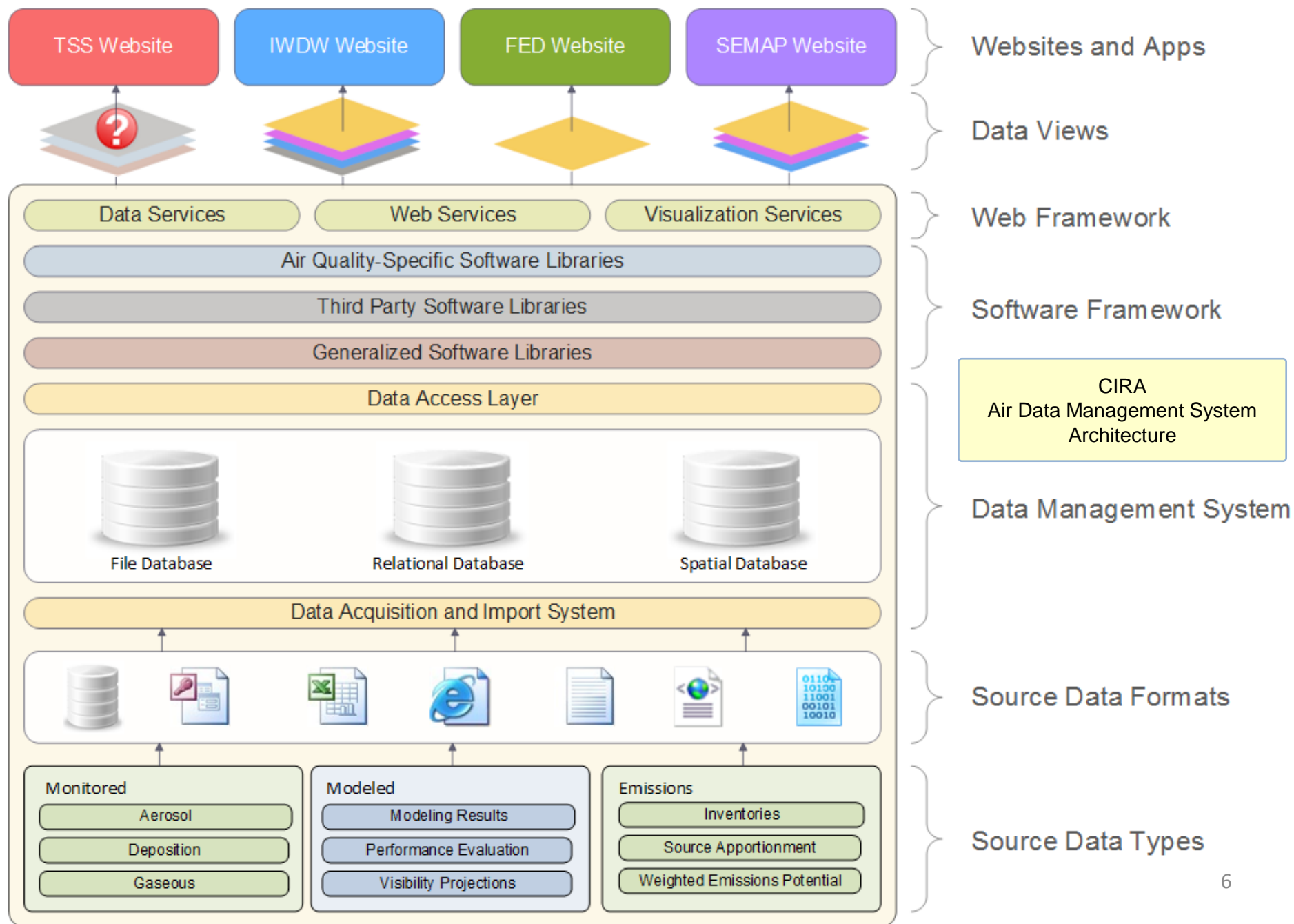
Database servers:

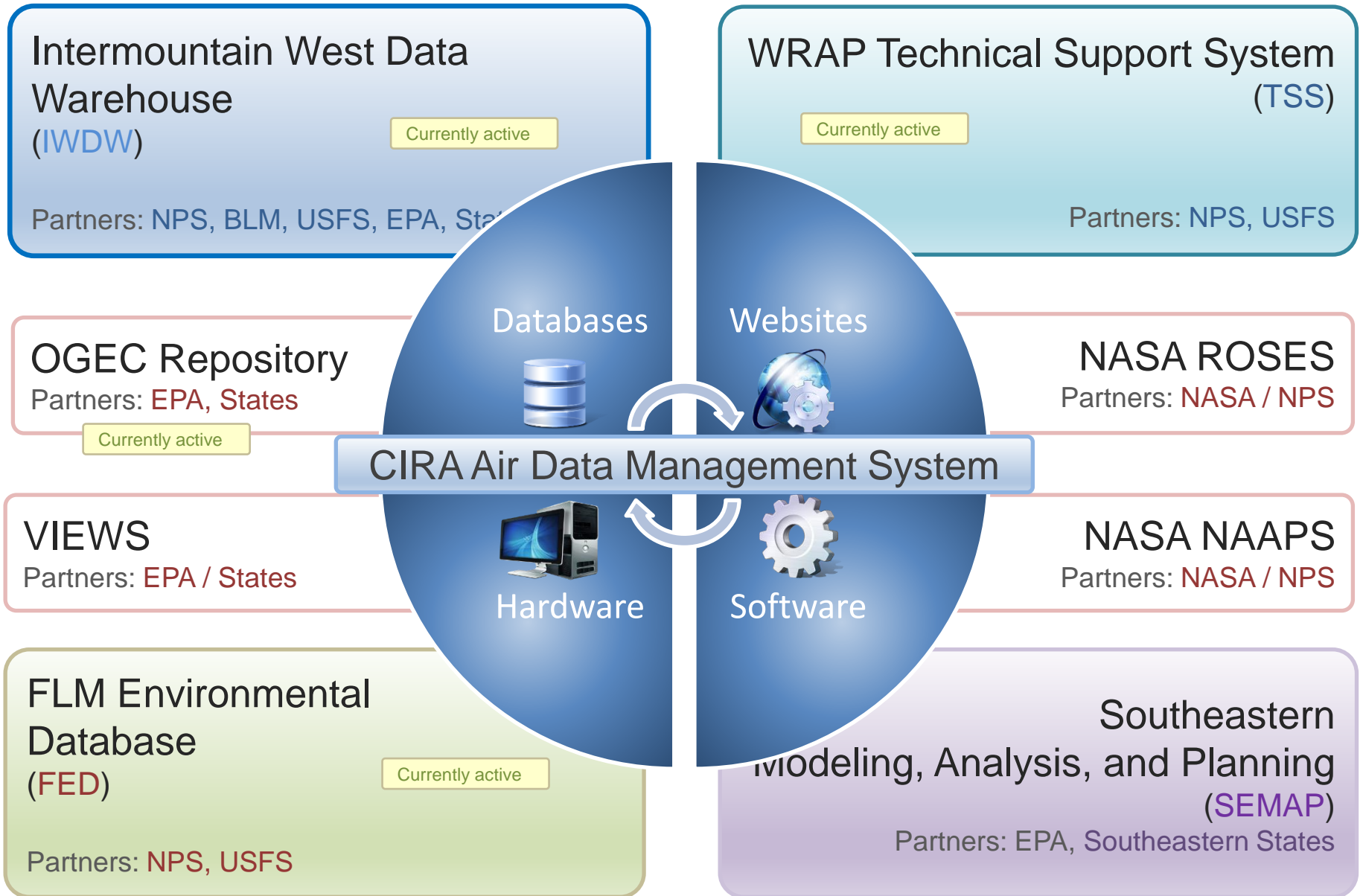
- Monitoring, modeled, emissions
- Import and staging databases
- User membership and auth.
- Spatial databases

Backup servers:

- Automatic backups
- Development and testing
- Auxiliary data storage
- Data copy and transfer









A Unique Collaboration

The IWDW-AQS project is supported by multiple federal and state agencies with project management assistance provided by [WESTAR-WRAP](#) and information technology development performed by [CSU-CIRA](#).

[more](#) →

ALL MODELING EMISSIONS MONITORING



Modeling Platforms

Request entire modeling platforms in bulk or select individual platform components...



Emissions Review

View charts of annual emissions totals from a variety of different modeling scenarios...



MPE Results

View charts and graphs of a variety of key model performance evaluation metrics...

• UPDATES

A new draft [Emissions Review Tool](#) and a small portion of the WAQS 2014 v2 state- and county-level annual emissions totals are now available for preliminary review.

December 16, 2019

WAQS 2014 v2 emissions data has been received, and an updated [Emissions Review Tool](#) will be available soon with the new data.

November 15, 2019

A new 36-bay 4U rack-mount file server with a 500TB storage capacity arrived at CIRA and will be used to store the WAQS 2014 platform and other modeling data for the IWDW.

November 04, 2019

The [National Emissions Inventory Collaborative](#) released portions of its 2016 v1 platform which are being transferred and cataloged for release from the IWDW.

October 01, 2019

• EVENTS

[IWDW Technical Steering Committee meeting](#)

Purpose: To review the ongoing operation, recent activities, and future goals of the IWDW-AQS project.

December 18, 2019

[Institute for Tribal Environmental Professionals \(ITEMP\) webinar \(*.pptx, 11 MB\)](#)

A webinar featuring an overview of the CIRA ADMS and several IWDW tools

December 04, 2019

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

Purpose: To review the progress and status of



Rocky Mountain National Park

- ALL
- MONITORING
- MODELING
- EMISSIONS
- DOCUMENTATION



WRAP Storyboard

A storyboard presentation about



Class I Area List

A table of WRAP Class I Areas



RHR Planning Steps

A user's guide to technical tools

NOTICE

The TSS website is operational for Round 2 Regional Haze analysis results for the WESTAR-WRAP region. Minor changes and updates will need to continue to be made to tool formats and documentation links as needed. Those changes will be noted on the TSS so users can easily identify them.

UPDATES

Updated tools: The suite of [Modeled Data Analysis - Express Tools](#) for quickly analyzing a variety of modeling data has been updated.

April 22, 2021

Updated tools: The suite of [Emissions Data Analysis - Express Tools](#) for quickly analyzing annual emissions data has been updated.

February 03, 2021

Updated tools: The suite of [Ambient Data Analysis - Express Tools](#) for quickly analyzing IMPROVE monitoring data has been updated.

January 20, 2021

COVID-19 Update: Although development and operations are now being conducted according to the relevant social-distancing guidelines, work continues unabated on the TSS database and website with no significant impacts to progress.

April 13, 2020



Canyonlands National Park

All AQRV Data Metadata Visualization ← Click a button to filter the grid



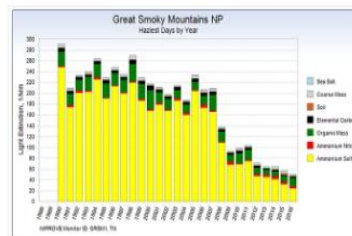
Visibility Tools

A set of charting tools for analyzing haze trends and composition from the IMPROVE aerosol network



Query Wizard

An advanced query and selection tool for filtering and downloading raw data from the database



AQRV Tools

A set of charting tools for analyzing haze, ozone, and deposition impacts in Federal Class 1 Areas

- ▶ AQRV Summaries
- ▶ Dataset Index and Search
- ▶ Dataset Explorer
- ▶ Database Query Wizard
- ▶ Monitoring Site Browser
- ▶ Webcams and Photographs
- ▶ Web Services and Tools
- ▶ Air Quality Glossary

UPDATES

01/10/22: The **July 2021** EPA Chemical Speciation Network (CSN) data from AQS was imported into the database.

12/30/21: The **Dec 2020** IMPROVE Aerosol dataset update from UCD was imported into the FED database.

12/15/21: The **June 2021** EPA Chemical Speciation Network (CSN) data from AQS was imported into the database.

12/10/21: The **Nov 2020** IMPROVE Aerosol dataset update from UCD was imported into the FED database.

12/10/21: The **2018-2021** EPA Nitrogen Dioxide (NO₂) (42602) - Hourly data from AQS was imported into the database.

12/08/21: The **2018-2021** EPA Carbon Monoxide (CO) (42101) - Hourly data from AQS was imported into the database.

12/06/21: The **2018-2021** EPA Sulfur Dioxide (SO₂) (42401) - Hourly data from AQS was imported into the database.

12/02/21: The **2018-2021** EPA PM10 Mass (81102) - Hourly data from AQS was imported into the database.

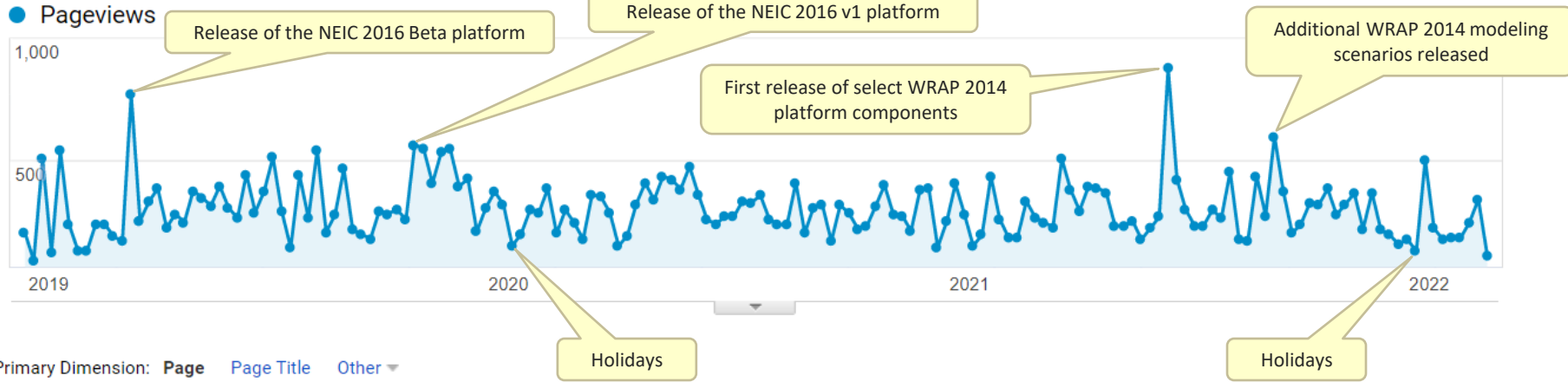
IWDW Website Traffic Summary – Past 3 Years (Weekly View)



Explorer Navigation Summary

Pageviews VS. [Select a metric](#)

Day Week Month



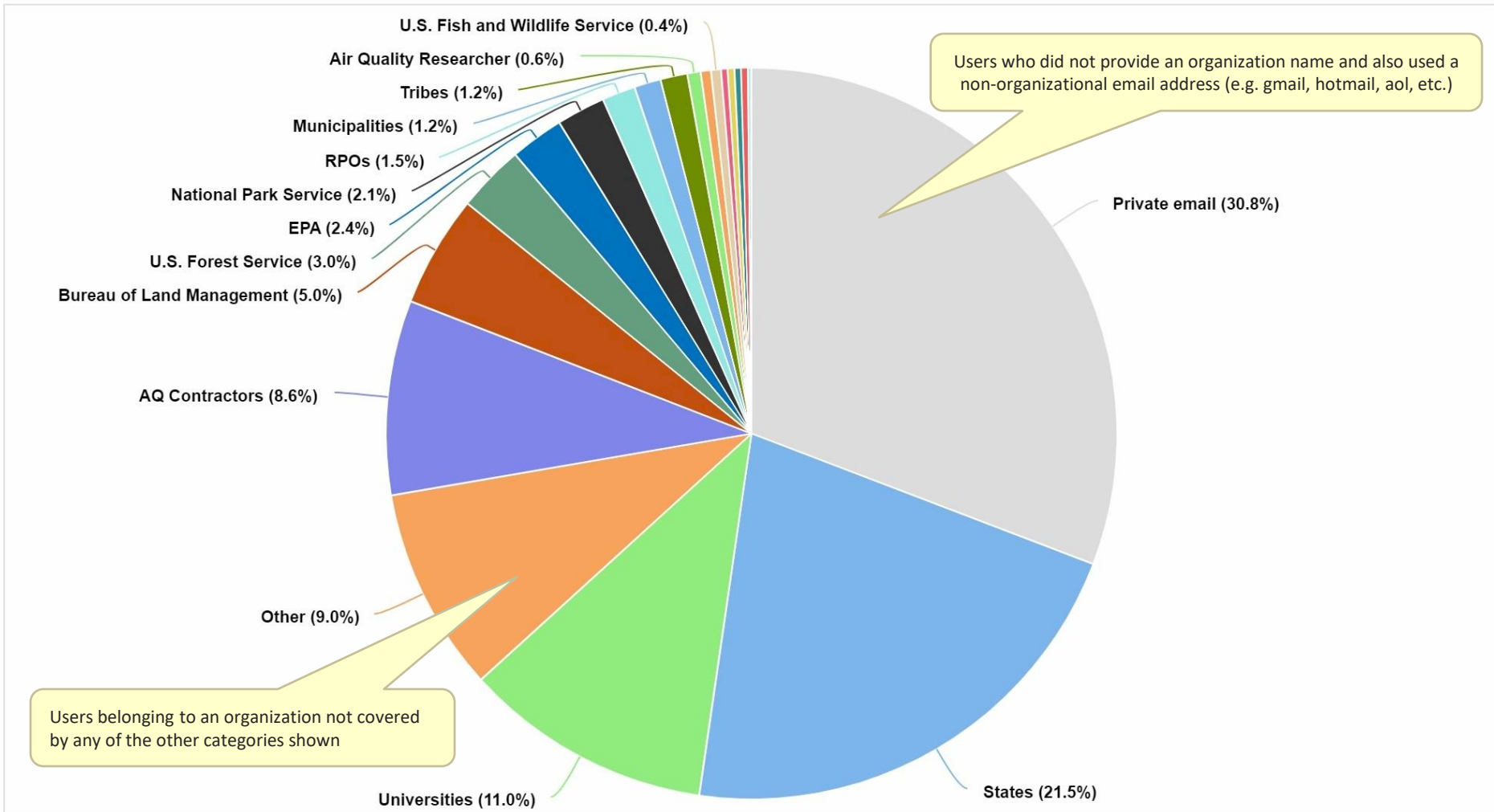
Primary Dimension: [Page](#) [Page Title](#) [Other](#)

Secondary dimension Sort Type: [Default](#)

advanced

Page	Pageviews	Pageviews (compared to site average)
	38,155 % of Total: 100.00% (38,155)	38,155 % of Total: 100.00% (38,155)
1. /iwdw/	8,339	23,853.73%
2. /iwdw/RequestData/Default.aspx	1,942	5,478.38%
3. /iwdw/docs/WAQS_and_WRAP_Regional_Haze_spec_sheets.aspx	1,057	2,936.23%
4. /iwdw/Auth/Login.aspx?ReturnUrl=/iwdw/RequestData/Default.aspx	963	2,666.21%
5. /iwdw/Maps/ModelDataMap.aspx	954	2,640.36%
6. /iwdw/Auth/Login.aspx	934	2,582.91%

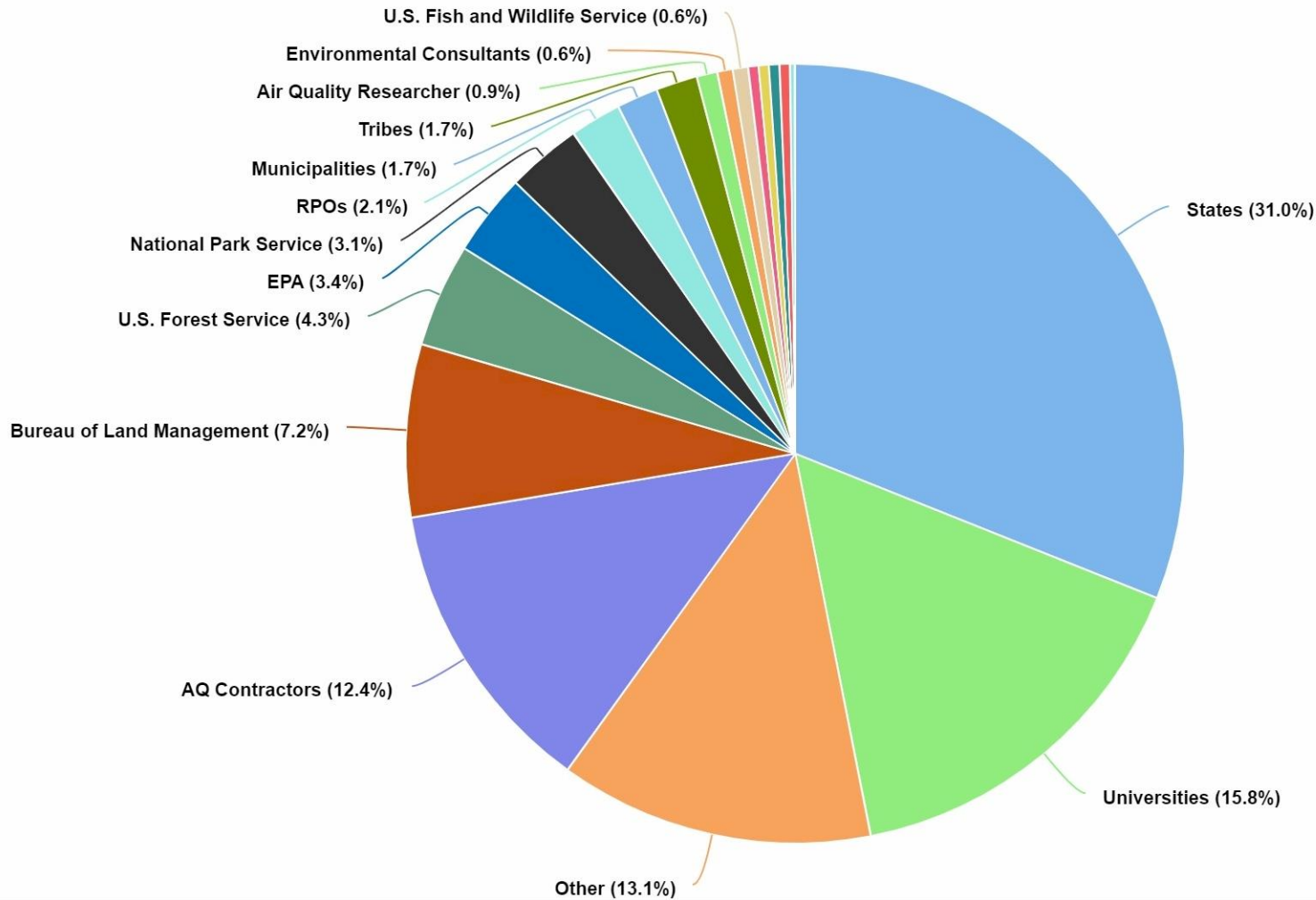
Website Traffic Composition Intermountain West Data Warehouse



- Private email
- States
- Universities
- Other
- AQ Contractors
- Bureau of Land Management
- U.S. Forest Service
- EPA
- National Park Service
- RPOs
- Municipalities
- Tribes
- Air Quality Researcher
- Environmental Consultants
- U.S. Fish and Wildlife Service
- AQ Districts
- Counties
- Other Federal Agencies
- Stakeholders
- Environmental Organizations



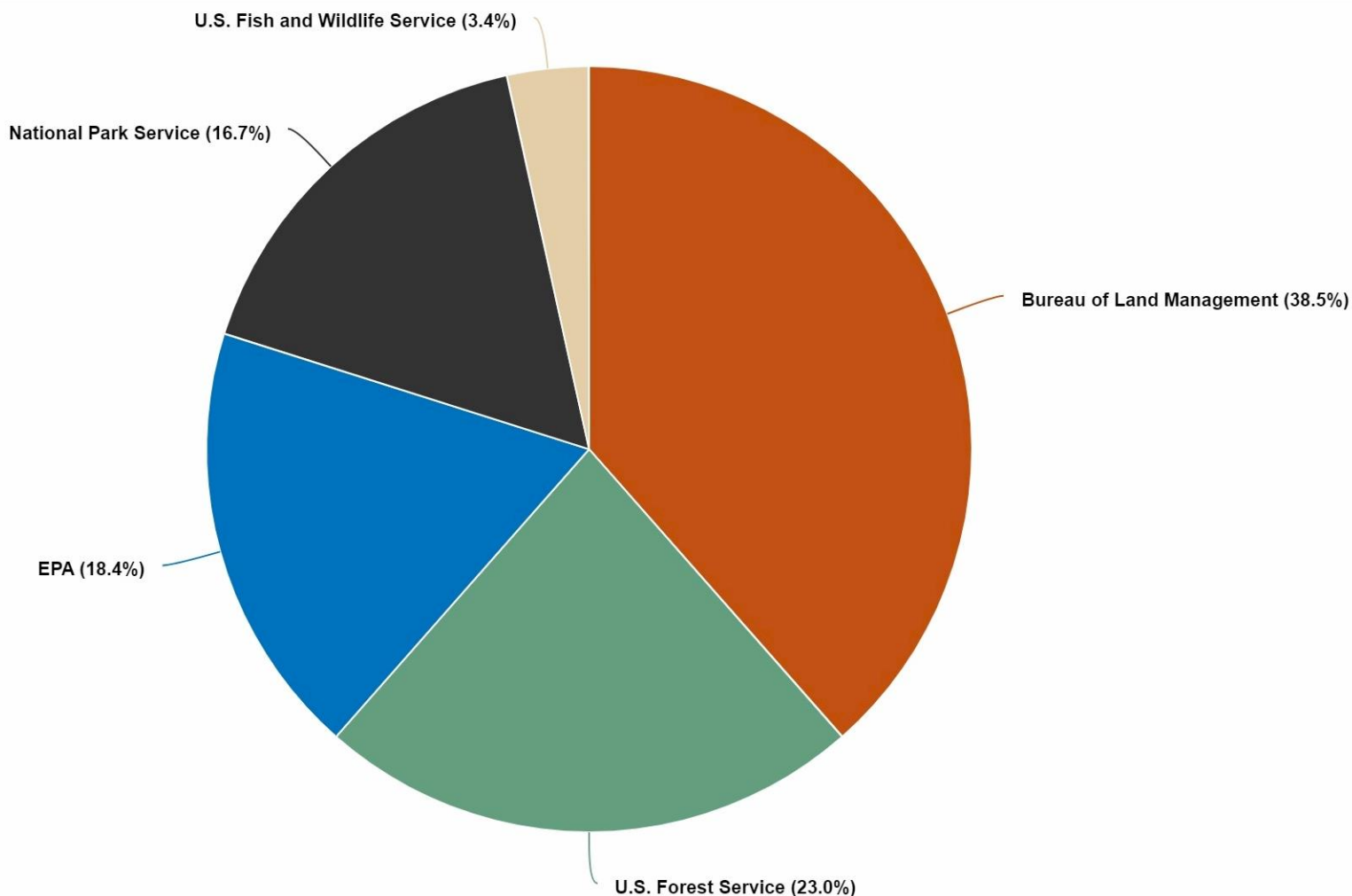
Website Traffic Composition
Intermountain West Data Warehouse



- Private email
- States
- Universities
- Other
- AQ Contractors
- Bureau of Land Management
- U.S. Forest Service
- EPA
- National Park Service
- RPOs
- Municipalities
- Tribes
- Air Quality Researcher
- Environmental Consultants
- U.S. Fish and Wildlife Service
- AQ Districts
- Counties
- Other Federal Agencies
- Stakeholders
- Environmental Organizations

Website Traffic Composition

Intermountain West Data Warehouse



- Private email
- States
- Universities
- Other
- AQ Contractors
- Bureau of Land Management
- U.S. Forest Service
- EPA
- National Park Service
- RPOs
- Municipalities
- Tribes
- Air Quality Researcher
- Environmental Consultants
- U.S. Fish and Wildlife Service
- AQ Districts
- Counties
- Other Federal Agencies
- Stakeholders
- Environmental Organizations

- Acquired and organized various USEPA and NEIC modeling platforms
 - NEIC 2016 Beta
 - NEIC 2016 v1
 - USEPA 2016 Regional Haze
- Acquired and organized the WRAP-WAQS 2014 Regional Haze modeling platform
 - 2014 v1 base case
 - 2014 v2 base case
 - 2014-based Regional Haze Baseline and Projection scenarios
 - 2014-based Regional Haze Projection sensitivity and source apportionment scenarios
- Access to modeling platforms' files and data
 - manifests for new platforms
 - IWDW data request form for platform file exploration
 - serviced over 100 end user and contractor data requests / year
 - Dozens of hard disks shipped

EPA Disk 3: Lacie Porsche Design 8TB; SN: NL32CB68

Folder PATH listing
Volume serial number is 4F39-DD3B
Space used: ~7.15 TB

```
H:.\
├── asml
│   └── romo
│       ├── 2016platform
│       │   ├── camx_v7.0beta2
│       │   │   ├── 2016fg_camx7b2_dms_16j
│       │   │   │   └── 36us3
│       │   │   │       └── post12
│       │   │   │           ├── dailyavg
│       │   │   │           ├── dailysum
│       │   │   │           ├── monthlyavg
│       │   │   │           ├── monthlysum
│       │   │   │           └── o3
│       │   ├── camx_v7.0beta3
│       │   │   ├── 2028fg_camx7b3_dms_psat_all_16j_allmrgu
│       │   │   │   └── 36us3
│       │   │   │       ├── pm_tag12
│       │   │   │       │   ├── dv
│       │   │   │       │   └── mv
│       │   │   │       ├── pm_tag36
│       │   │   │       │   ├── dv
│       │   │   │       │   └── mv
│       │   ├── camx_v7.0beta4p2ts
│       │   │   ├── 2028fg_camx7b4p2ts_all_16j_tag_all_icbctag
│       │   │   │   └── 36us3
│       │   │   │       ├── pm_tag36
│       │   │   │       │   ├── dv
│       │   │   │       │   └── mv
│       └── regionalhaze
│           ├── smoke_out
│           │   └── 2028fg_secsa_16j
│           │       └── 36us3
│           │           └── camx_v7
│       └── work
│           └── romo
│               └── 2016platform
│                   ├── camx_v7.0beta4p2ts
│                   │   ├── 2028fg_camx7b4p2ts_all_16j_tag_all_icbctag
│                   │   │   └── 36us3
│                   │   │       └── pm_tag36
```

EPA Disk 2: Buffalo 2TB; SN: 95518210222482

Folder PATH listing
Volume serial number is 2576-03D5
Space used: ~1.6 TB

```
.
├── home
│   ├── hnf
│   ├── $RECYCLE.BIN
│   ├── S-1-5-21-1339303556-449845944-1601390327-256940
│   ├── System\Volume\Information
│   │   └── EfaSIDat
│   ├── T2
│   └── work
│       └── romo
│           ├── 2016platform
│           │   ├── camx_v6.50
│           │   │   ├── 2016ff_cb6camx_2way_16j
│           │   │   │   └── 36us3
│           │   │   │       └── wrfcamx
│           │   │   ├── o3col_rates
│           │   │   │   ├── ozcol
│           │   │   │   └── rates
│           ├── regionalhaze
│           │   ├── icbc
│           │   │   └── out
│           │   │       ├── 0611
│           │   │       └── bk
│           │   ├── taggeddbc
│           │   │   └── saicbc_v1.0-28jun19
│           │   │       └── tagged
│           ├── users
│           │   └── kpc
│           │       └── camx
│           │           ├── osat
│           │           └── src
│           │               └── v7.00beta6
│           │                   ├── CAMx
│           │                   ├── CF_AERO
│           │                   ├── CMC
│           │                   ├── CMU_AERO
│           │                   ├── DDM
│           │                   ├── Dummy_MPI
│           │                   ├── Dummy_NCF
│           │                   ├── HG
│           │                   ├── Includes
│           │                   ├── inputs
│           │                   ├── IO_bin
│           │                   └── IO_NCF
```

Modeling Platform Data Request Form



Notes ^
October 18, 2018

The Intermountain West Data Warehouse – Western Air Quality Study (IWDW-WAQS) is in the process of developing an updated air quality modeling platform for 2014. The WAQS 2014 modeling platform components, as described below, will be reviewed and approved by the IWDW-WAQS Cooperating Agencies. Components are being developed for use in regional air quality modeling studies by the cooperating agencies and for external users accepting the terms of the Agreement and authorized by the Cooperators.

The 2014 WAQS modeling platform is based on EPA's 2014 NEIv2 with updates for emissions sectors affecting regional AQ modeling, particulate matter impact ozone modeling, and PM emissions that may impact modeling for Regional Haze Planning. Base 2014 modeling uses WRF meteorological data, precipitation cover/snow depth data and versions of WRFCAMx and CAMx with specialized dynamical and chemical parameterizations for areas covered by the modeling platform.

Modeling Software ^

Name	Description	Notes	Source	Status
WRF v3.6.1	WAQS 2014 WRF modeling software	NCAR/UCAR WRF.		Pending
WRF v3.8	EPA 2014 WRF modeling software	NCAR/UCAR WRF.		Pending
<input type="checkbox"/> SMOKEv4.5	Processing scripts and emissions inputs used in WRAP emissions processing	CMAS SMOKE. SMOKE processing scripts and input package. Includes all WRAP v1 and updated NEIv2 inventories and SMOKE-ready inputs.		Available
CAMx v6.4				Pending
CMAQ v5.2				Pending

Shows the status of the component

Emissions Data ^

Name	Description	Notes	Source	Status	Size	Files	Available
<input type="checkbox"/> Base 2014 Inputs	2014 NEIv2 modeling platform inputs	Includes modeling platform inputs and scripts from EPA	EPA	Available	49Gb	97	12/5/2018
<input type="checkbox"/> Base 2014 Inputs	Updates to 2014 NEIv2 for WRAP modeling	Updates ready for WRAP 2014			6.7Mb	22	12/28/2019
<input type="checkbox"/> Base 2014 Unmerged	Unmerged emissions (12km and 36km)	Includes anthropogenic sectors (processed by SMOKE) and modeled natural emissions (generated by Ramboll). Natural sources added on 3/15/2019.	WAQS	Available	559Gb	82	1/25/2019
<input type="checkbox"/> Base 2014 Merged	Model ready merged emissions	12km model ready emissions. Includes 36km sector inputs for 12km boundaries.	WRAP	Available	844Gb	396	3/1/2019

Shows the estimated size of the component

Shows the total number of files

Meteorology Data ^

Name	Description	Notes	Source	Status	Size	Files	Available
<input type="checkbox"/> Meteorology v2014 - WRF	2014 WRF meteorology	4km, 12km, and 36km	WAQS	Available	3.2Tb	163	11/16/2018
<input type="checkbox"/> Meteorology v2014 CAMx	2014 meteorology prepared for CAMx with WRFCAMx	4km, 12km, and 36km WRFCAMx. Includes CMAQ kv files.	WAQS	Available	838Gb	2406	11/16/2018
<input type="checkbox"/> Meteorology v2014 CMAQ	2011 WRF meteorology prepared for CMAQ with MCIP	4km, 12km, and 36km MCIP files	WAQS	Available	2.1Tb	2392	11/16/2018
<input type="checkbox"/> Meteorology v2014 - WRF	2014 WRF meteorology	EPA's 12km ConUS WRF simulation. Model ready BGM inputs to be added at a later date.	EPA	Available	2.0Tb	153	11/16/2018

Shows the expected availability date

Purpose:

To facilitate the browsing, selection, and download of entire modeling platforms or individual modeling platform components, and to illustrate the expected roadmap for creating and distributing modeling platforms and individual platform scenarios. Platform components can be accessed and downloaded via SFTP, HTTP, and Globus, and extremely large-volume data requests can be delivered on physical hard drives via regular mail service.

Emissions Inventory Browser more help...

Modeling platform: Get status

clear

WAQS 2014 Shakeout v2 | NEIC 2028f | NEIC 2028f | NEIC 2023f | NEIC 2023f

Pollutants (109 shown, 1 selected)

all clear show by code

nitrogen dioxide (SP1vcz2)
Nitrous Acid (HONO)
Non toxics VOC (NONHAPVOC)
Noncarbon organic matter (POA - POC) (PNCOM)
Oxides of Nitrogen (NOX)
Paraffinic group (R1-C)
Particle bound water (PH2O)
Dichloroethane, 1,1-dichloroethane (DCE1)

Sectors (23 shown, 23 selected)

all clear show by code

Agricultural fires with point resolution (plagfire)
Airports (airports)
Biogenic (beis)
Commercial Marine Vessel, Category 1, 2 (cmv_c1c2)
Commercial Marine Vessel, Category 3 (cmv_c3)
EGU units (ptegu)
Locomotives (rail)

States

all clear Region: WRAP

Alaska
Arizona
California
Colorado
Hawaii
Idaho
Montana

Counties

all clear

< Select one State to see Counties... >

SCCs

all clear

< Select one County to see SCCs... >

Actions

Select a modeling platform

Select pollutants

Select source categories

Select states

Select counties

Select SCCs

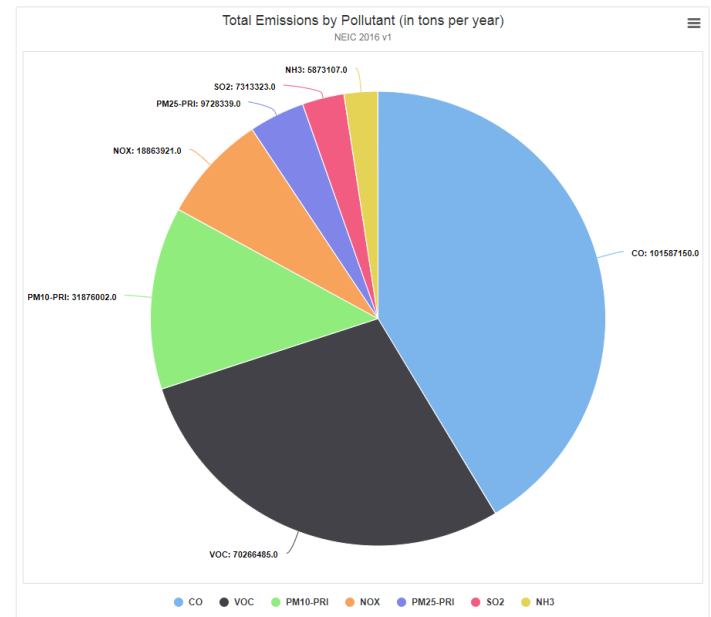
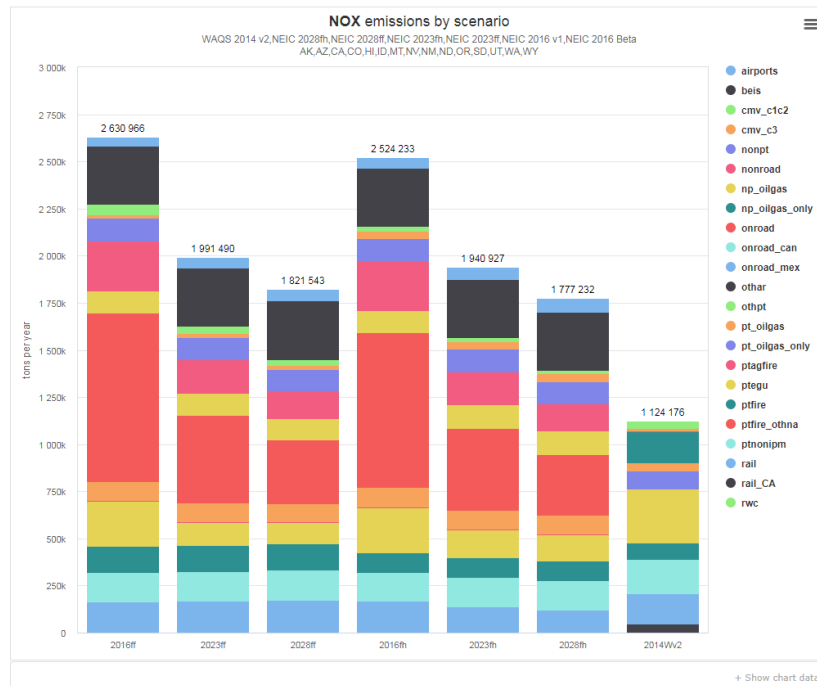
Clear all selections | Clear all lists

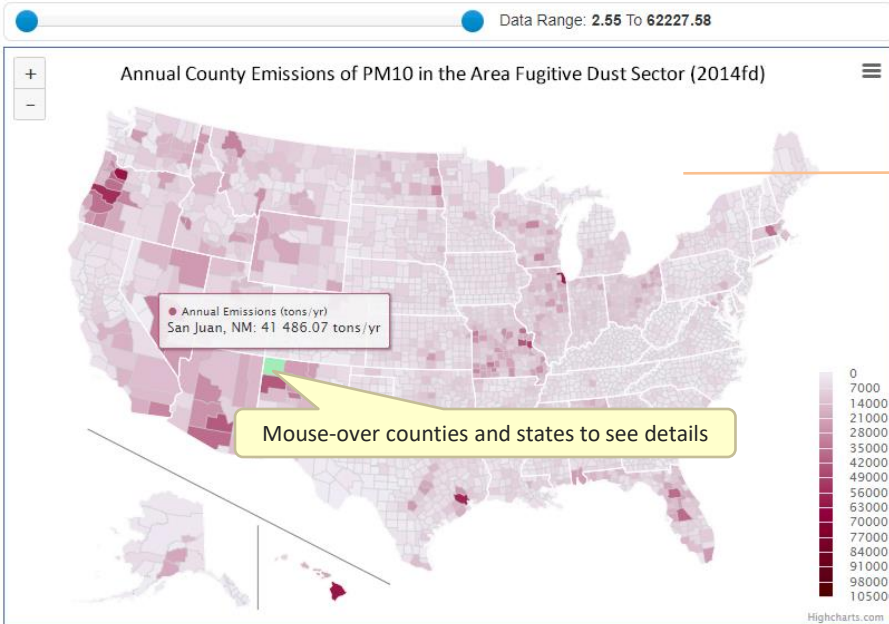
Purpose:
Provides a detailed summary of annual emissions totals by state, county, and source category via a variety of interactive maps and charts. The emissions inventory data used for ten different modeling scenarios is available, and emissions totals from multiple scenarios can be selected and visualized at the same time with multiple side-by-side charts or multiple side-by-side stacked bars on the same chart.

Pollutant/Sector Emissions Summary by State

By Scenario | By State

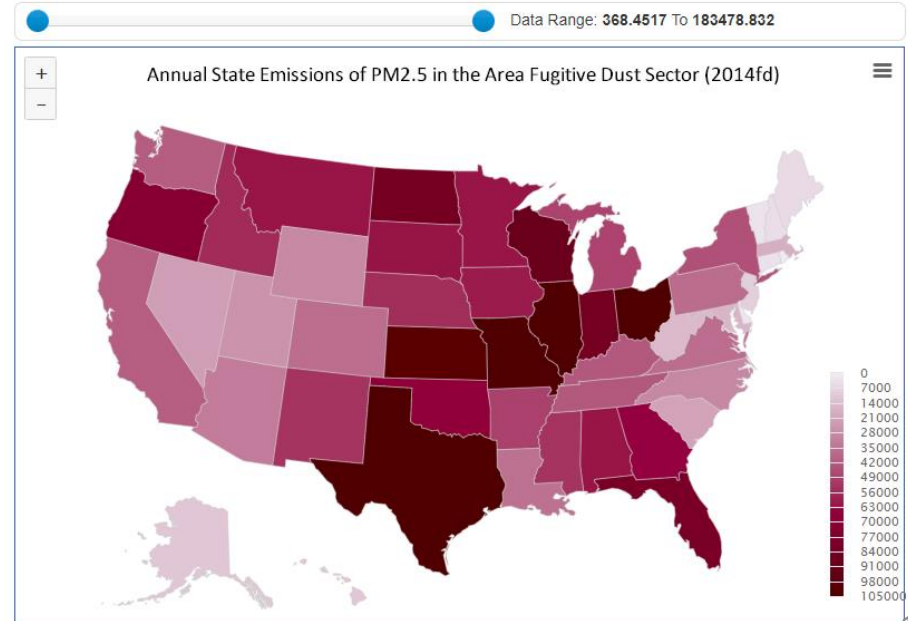
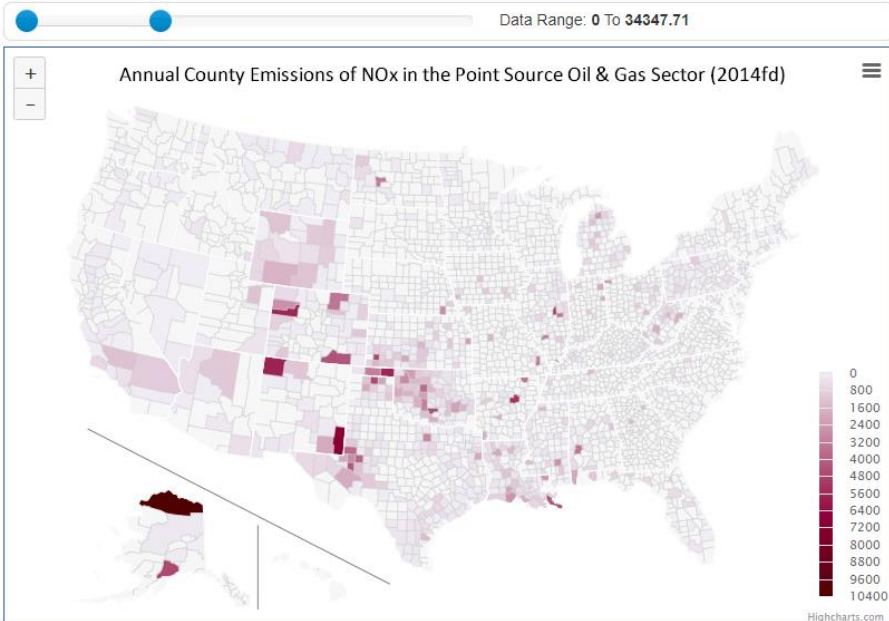
Scenario Emissions by Sector





Purpose:

To display state- and county-level annual emissions totals for the selected states, pollutants, and source sectors. You can mouse-over individual states and counties to display more detail, and you can use the “Data Range” slider bars to specify a range of total emissions in tons per year in order to filter out large numbers of low and/or high values and thus change the visual contrast and separation of the map colors.





Model-To-Observation Comparison Tool

Make selections from the lists below to view a wide variety of time-series charts, scatter plots, bar charts, maps, and other graphics that will help you visualize and evaluate the performance of the atmospheric models that were applied to each modeling scenario hosted by the warehouse.

Comparison Type
By Network ▼

Modeling Scenario
WAQS - 2011b - CAMx - 12K ▼

Start Date
01/01/2011 

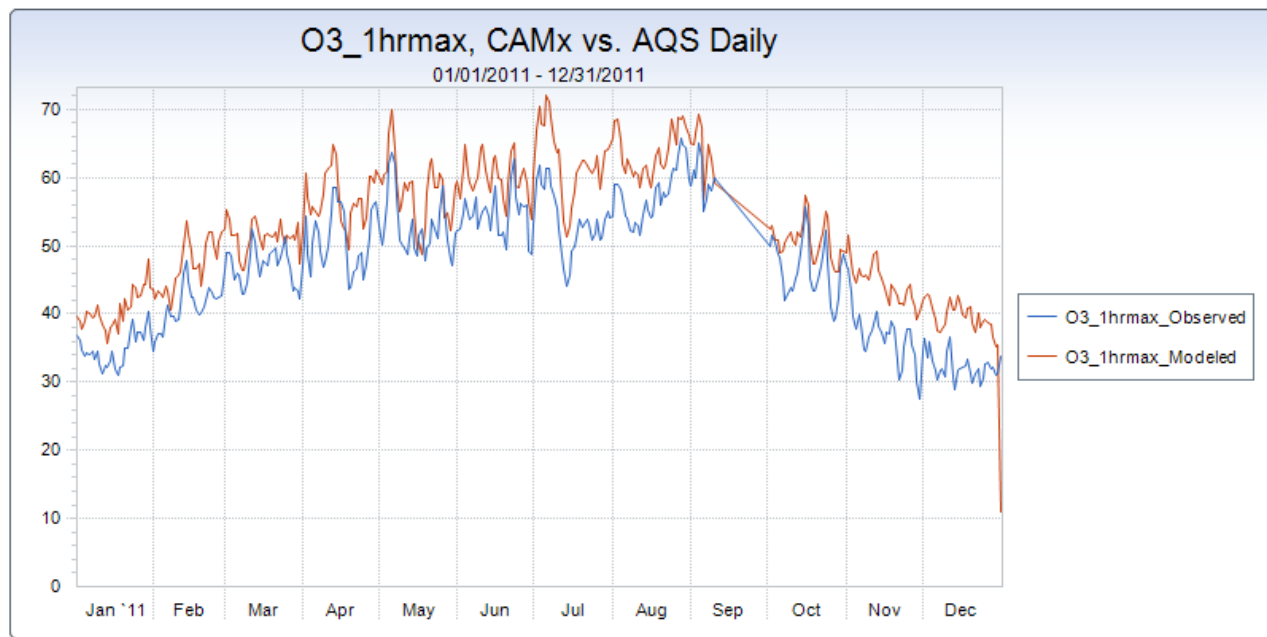
End Date
12/31/2011 

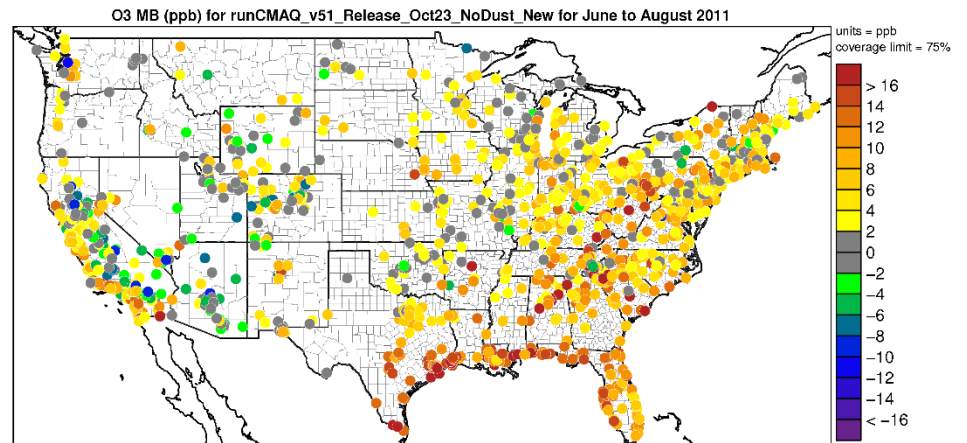
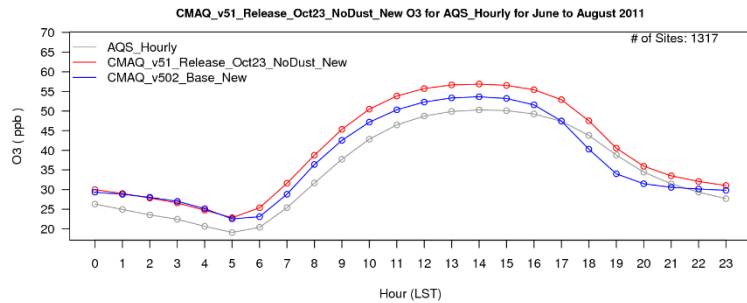
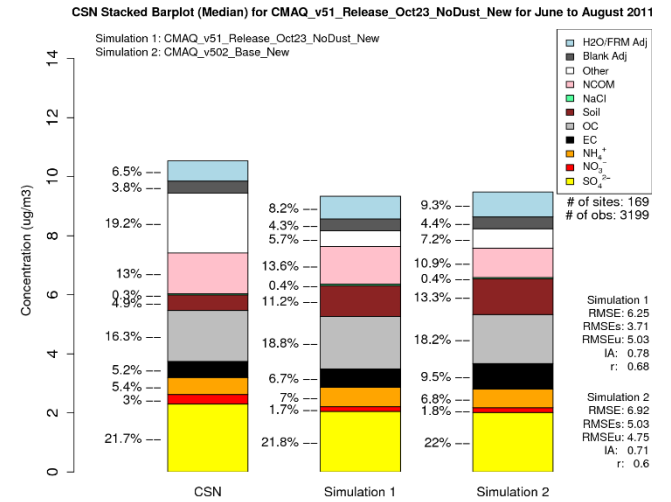
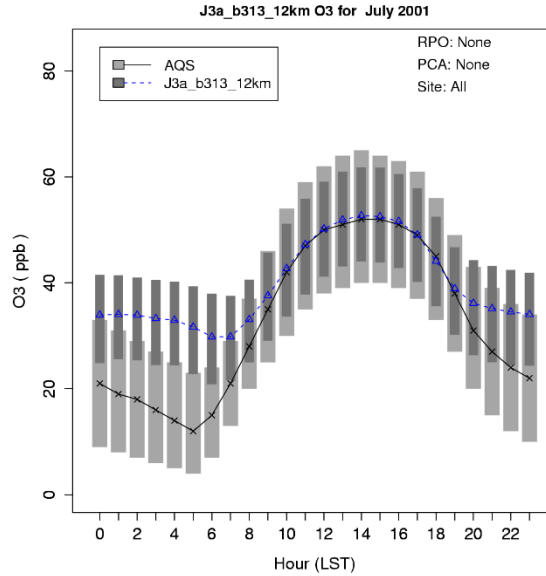
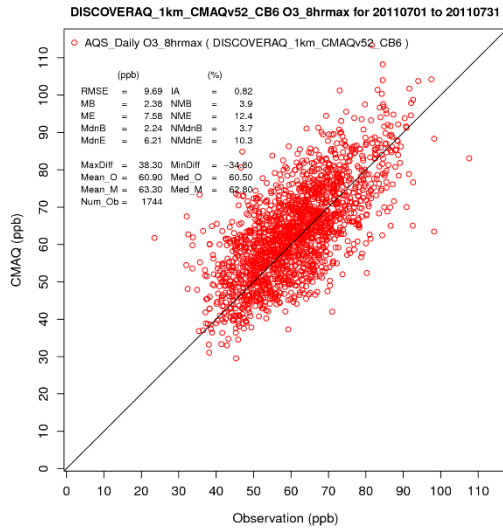
Network/Dataset
AQS - Daily ▲
AQS - Hourly
CASTNET - Daily
CASTNET - Hourly
CASTNET - Other
CDPHE - Other
CSN - Other ▼

Parameter
O3_1hrmax ▲
O3_8hrmax
PM25_TOT - Mass, PM2.5 (Fine)
W126 ▼

Will add model-to-model comparisons and new chart types...

chart options





CIRCLE=AQS_Hourly;

Streamlined image browsing and multiple images at once...

Overview and Structure of the CIRA Air Data Management System (ADMS): IWDW and sister websites



IWDW

Intermountain West Data Warehouse

Thank you.

Tom Moore, WESTAR-WRAP

970.988.4055

tmoore@westar.org

