

Modeling and Other Technical Updates

Richard A. “Chet” Wayland
US EPA OAQPS/AQAD
AAPCA Spring Meeting
April 4-6, 2018

Office of Inspector General Update on Ozone Data Quality Report

<https://www.epa.gov/office-inspector-general/report-differences-processing-practices-could-decrease-reliability-ozone>



Office of Inspector General

[EPA OIG Home](#)[Reports](#)[Investigations](#)[EPA OIG Hotline](#)[News Releases and IG
Statements](#)[Project Notifications](#)[Congressional Testimony](#)[Multimedia](#)[About EPA OIG](#)

Report: Differences in Processing Practices Could Decrease the Reliability of Ozone Data Used for Assessing Air Quality to Protect Public Health

Report #18-P-0105, February 28, 2018

What Was Found

There is a risk that the state, local and tribal agencies that monitor ambient air quality are not always implementing the EPA's recommended QA practices for validating ozone data. This risk could reduce the quality of the data that the EPA uses to determine whether the air is healthy to breathe.

Report Materials

You may need a PDF reader to view files on this page. See EPA's [About PDF page](#) to learn more.

- [Report at a Glance \(PDF\)](#) (1 pg, 50 K)
- [Full Report \(PDF\)](#) (41 pp, 636 K)



EPA's Final Response to Recommendations (#1, #2)

1. Assess the risk of any data adjustments impacting the ozone data used in the EPA's NAAQS determinations.
 - Compared 2014-2016 DVs from AirNow and AQS.
 - Only found 12 monitors where AirNow DV exceeded and AQS attained
 - 8 differed by 1ppb - explained through reporting conventions (rounding /truncation)
 - 3 located in counties with other violating monitors - no impact on designations
 - 1 in Shasta County, CA AQAD working with Region 9 on data evaluation
 - **Expect assessment completion Q2, FY18**
2. Issue Guidance Clarifying Shelter Temperature
 - OAQPS will revise QA Handbook and develop technical memo to clarify that FEM specific approval criteria should be considered in addition to shelter temperature criteria
 - **Expect completion of technical memo Q2, FY18 ☑ [March 8, 2018]**
 - https://www.epa.gov/sites/production/files/2018-03/documents/clarifications_on_shelter_temperature_for_gaseous_pollutant_methods_03_2018_0.pdf

EPA's Final Response to Recommendations (#3)

3. Complete the QAPP review/approval process to verify that air monitoring agencies' QAPPs incorporate the EPA regulations and guidance for conducting data validations and adjustments
 - Posted 7/11/2017 memo on AMTIC alerting states to have QAPPs submitted/approved that conform to regulation and critical criteria. **Expected completion of reviews by Q1, FY19**
 - Completion of QAPP review/approval process to ensure QAPPs meet every 5-year timeline. **Expected Completion Q1, FY19**
 - OAQPS will revise the AMP600 Certification report to flag "N" any QAPP > 5 years old. **Expected Completion Q4, FY18**
 - (impacts CY2018 certification process due May 1, 2019)

EPA's Final Response to Recommendations (#4)

4. Verify that air monitoring agencies are implementing the EPA's recommended criteria for data validation and adjustments through technical system audits (TSA's) or other oversight mechanisms.
 - OAQPS completed a TSA Guidance Document in early 2018; posted on NACAA and AAPCA site; **corrective action is completed**
 - http://www.4cleanair.org/sites/default/files/Documents/TSAGD_Final_Draft_1-9-18_with_Appendices.pdf
 - TSA Training for *Regions* is scheduled for June 2018 at RTP
 - Looking to create a *state/local* TSA training session at the August 2018 National Monitoring Conference

EPA's Final Response to Recommendations (#5)

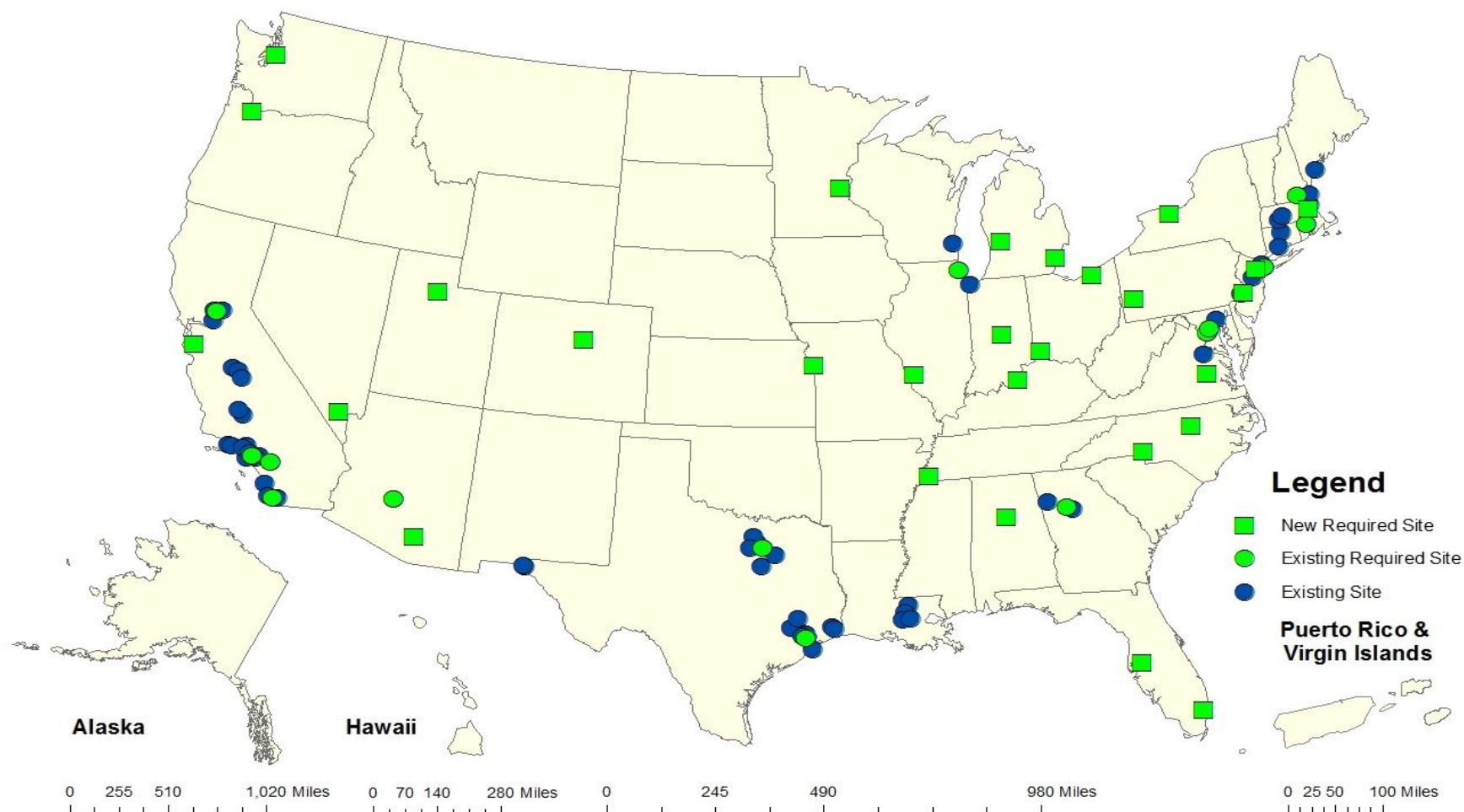
5. Develop a process to provide assurances that data reported to the Air Quality System database have met the approved zero- and span-check validation criteria prior to regional review and approval of the air monitoring agencies' annual data certification packages.
 - OAQPS did *not* commit to require the AQS reporting of zero and span checks
 - Regions will review zero and span data during TSAs
 - The AQS Team will create a QA transaction for zero and span data to facilitate voluntary reporting. **Expected completion Q4, FY18**

PAMS Program Update

PAMS Network Design

- Major changes to the PAMS requirements were finalized in October 2015 as part of the ozone NAAQS review
- Replaced existing 20 year-old multi-site, enhanced ozone network design with an updated 2-part network design
 - Requiring PAMS measurements to be collocated with existing NCore sites in areas with population of 1 million or more irrespective of Ozone NAAQS attainment status
 - Results in a stable network of approximately 40 required sites with improved spatial distribution and less redundancy
 - Includes a waiver for historically low ozone areas
 - Includes an option to make PAMS measurements at an alternative location (e.g., an existing PAMS site) which may cross CBSA or even state boundaries
- Require states with moderate or above ozone non-attainment areas and states in the Ozone Transport Region to develop and implement an Enhanced Monitoring Plan (EMP)
- Provides support for flexible approaches for collecting data to understand ozone issues in new and existing high ozone areas

New and Existing PAMS Sites



Equipment Purchases

- EPA is holding 2 million/yr off the top to assist with equipment purchases in FY 17-20
 - FY 17: \$2 million was given out to early implementors who were able to purchase their own equipment
 - FY 18: we are focusing on autoGC purchases since they have a longer startup/learning curve
 - We are putting in an order to purchase 13 Markes/Agilent autoGC's per agency requests
 - CAS is not yet on GSA so we won't be purchasing those systems in FY18
 - FY 19/20 is intended to fund “late” implementors and refresh older existing equipment

QA and other Implementation Issues

- EPA is working to develop a number of QA and other implementation guidance documents to assist states with implementation of the new PAMS requirements
 - Updated TAD
 - Generic QAPP
 - SOPs for the autoGCs, ceilometer, and true NO₂
 - EMP Guidance
- EPA is also working with data acquisition vendors (Envidas/Dr DAS and Agilaire) to setup protocols to collect autoGC and mixing height data

Enhanced Monitoring Guidance

- EPA is working on developing guidance for states in developing EMPs, and for Regions in reviewing and approving EMPs
 - Core concepts include
 - Plans should seek to supplement the required site network and collect data to understand local ozone issues
 - Plans should be coordinated with neighbor states/monitoring agencies where appropriate (e.g., OTR and Lake Michigan Shoreline)
 - The amount of additional monitoring identified in the plans should reflect the degree of the O₃ problem and available funding
 - EPA plans to support voluntary EMPs for states without moderate or above O₃ NA areas where appropriate
 - Upwind/downwind states (e.g., Illinois)
 - Other historically high O₃ areas (e.g., Louisiana)

2015 Ozone NAAQS Transport

Context and Timing for 2015 Ozone NAAQS Transport SIPs

- State are required to submit SIPs that address CAA section 110(a)(2)(D)(i)(I), also called the “Good Neighbor” provision, within 3 years of the promulgation of a new or revised NAAQS.
- These “transport SIPs” are required to contain adequate provisions prohibiting and source or other type of emissions activity within the state from emitting any air pollutants in amounts which will contribute significantly to nonattainment or interfere with maintenance in any other state.
- On October 1, 2015 EPA promulgated the 70 ppb ozone NAAQS and, thus, transport SIPs for this NAAQS are due by October 1, 2018.

Update on EPA's Analyses of Ozone Transport for the 2015 NAAQS

- In January 2017 EPA issued a Notice of Availability (NODA) which released a preliminary set of projected ozone design values and contributions for a 2023 analytic year for possible use by states in developing 2015 NAAQS transport SIPs
- In fall 2017 EPA completed updated air quality modeling for 2023 that reflects many of the comments received from the NODA. The 2023 ozone design values based on the updated modeling were provided to the states in a memo from EPA dated October 27, 2017. The updated 2023 ozone contributions were provided to states in a memo from EPA on March 27, 2018.
- As part of the March 2018 memo EPA also identified certain ideas and approaches that are intended to provide potential flexibilities that states may consider as they develop Good Neighbor SIPs.
- EPA is working to set up a call with states in mid-April to get feed-back on these potential flexibilities.

Development of 2016 Modeling Platform

Background and Motivation

- For the past five years or so, EPA and states in the OTC/MARAMA, SESARM, LADCO, and WRAP have been using various versions of a 2011-based platform for to support numerous air quality management-related analyses.
- The base year and projected emissions and ambient air quality data that comprise the key parts of the 2011 platform are becoming increasingly “outdated” in view of the more recent data and improved methodologies that are now available.
- The development of the 2016 modeling platform represents a collaboration effort involving OAQPS, ORD, OAP, OTAQ, and the MJOs and states.
- The new platform is intended to support policy development, air quality management and regulatory analyses including future state attainment demonstrations for ozone and PM_{2.5}, regional haze SIPs, and 110 transport actions.

Key Components of a Modeling Platform

- Base year and future year emissions inventories for all source sectors
- Measured air quality data for model evaluation and projecting design values to future years
- Meteorology
- Boundary conditions obtained from large-scale globe or hemispheric modeling
- Air quality models (typically the latest public release versions of CMAQ and CAMx)

Rationale for Choosing 2016

- Several factors are considered when selecting a modeling platform base year.
 - Availability of emissions data and other key components of the platform that are year-specific and high quality.
 - Air quality measurements and meteorological conditions representative of high concentrations that approximate the magnitude of design values.
 - Ample observed data to evaluate model performance; avoiding anomalous events - when possible.
- MJOs recommended to EPA that 2016 would be the most appropriate year for an updated modeling platform based largely on their analysis of nationwide air quality concentrations and meteorology in several recent years including 2014, 2015, and 2016.

Process for Developing 2016 Base Year and 2023/2028 Future Year Emissions

- Ongoing collaborative effort between EPA and MJOs/states to develop three public versions
 - Alpha version (2016 only) based largely on the methods and data in the 2014 NEIv2 has been completed and release to MJOs/states
 - Includes 2016-specific data for point, onroad, nonroad, fires and biogenics
 - Oil and gas sources projected to 2016 using state-level factors based on historic production
 - Beta version (improved methods and data for certain sectors for 2016 and draft 2023/2028 data) targeted for release in summer/fall 2018
 - Version 1.0 (“final” 2016, 2023, and 2028 inventories) targeted for release in winter 2019

2016 Meteorology Development and Evaluation

- 2016 Meteorological data have been prepared using the Weather Research Forecast (WRF) model version 3.8
- EPA's WRF modeling uses a lightning data assimilation method developed by ORD that significantly improves the prediction of precipitation
- The 2016 WRF outputs have been made available to the states directly or via the MJOs.
- An MJO-led workgroup on meteorological modeling and evaluation of 2016 has been discussed, but has not met yet. EPA will be participating in this workgroup if/when it starts

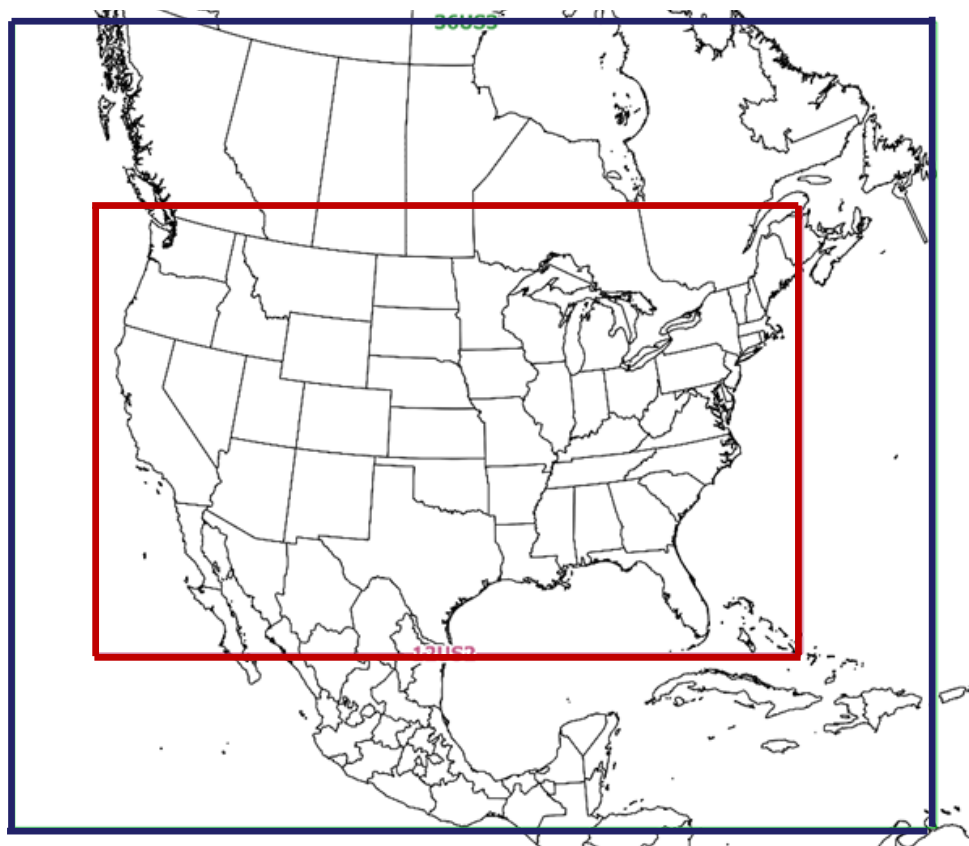
2016 Global/Hemispheric Modeling for Boundary Conditions

- Through a joint effort between EPA/OAQPS and ORD we have developed an initial “test set” of boundary conditions from Harvard’s GEOS-Chem model and EPA/s Hemispheric CMAQ model
- Evaluation is on-going for ozone, PM, and precursor pollutants using sondes, satellite data, and global surface measurements.
- New global/hemispheric modeling is planned with updates to emissions and model configuration informed in part by collaboration with academia and NASA/NOAA.

Air Quality Model Runs and Evaluation

- Annual 2016 test runs with CAMx v6.40 and CMAQ v5.2 are being performed for a 12 km modeling domain covering the lower 48 states that is nested within a large 36 km domain that includes all of Mexico and most of Canada, as shown on the next slide
- These test model runs use a set of 2016 emissions based largely on v1 of the 2014 NEI as an initial “shake-out” of the components of the platform
- New global/hemispheric modeling is planned with updates to emissions and model configuration informed in part by collaboration with academia and NASA/NOAA.
- Currently, we are conducting an operational model evaluation using EPA’s Atmospheric Model Evaluation Tool (AMET) with 2016 measured data for ozone, PM, VOC, and NO_x and nitrogen and sulfur wet deposition.
 - This evaluation includes a comparison of 2016 model performance to the findings from modeling for 2011 and 2014 in order for us to identify and investigate model performance issues in collaboration with EPA/ORD
- We have prepared a tracking table that identifies the current status of each component of the platform and the various model runs and evaluation to facilitate informing the MJOs/states

Boundaries of 36 km Domain (green) and 12 km Domain (red)



Next Steps

- Continue effort to develop the beta and v1 2016 base and future year emissions inventories
- Complete evaluation of the initial 2016 global/hemispheric and national scale air quality model runs
- Identify and investigate model performance issues to improve model performance
- Update tracking table as the development of the 2016 platform continues to evolve
- Continue coordination and collaboration with partner organizations

EPA's Initial 2028 Regional Haze Air Quality Modeling

EPA Regional Haze Modeling

- In order to help inform the regional haze SIP development process in a timely fashion (for RH SIPS due in 2021), EPA conducted initial air quality modeling for 2028 to evaluate visibility impairment for each Class I area/IMPROVE site and provide 2028 source sector contribution information.
- EPA recommends using these initial results only as a first step in the process of developing technically sound regional haze modeling for the 2nd implementation period.
 - EPA intends to work collaboratively with MJOs, states, and FLMs to make necessary improvements and ultimately update this modeling.
- Initial modeling summary presentation on July 20th MJO workgroup call
- Released more detailed results and documentation (including a transmittal memo) on October 19, 2017
 - 2028 regional haze modeling transmittal memo and summary results:
https://www3.epa.gov/ttn/scram/reports/2028_Regional_Haze_Modeling-Transmittal_Memo.pdf
 - 2028 regional haze Modeling technical support document:
https://www3.epa.gov/ttn/scram/reports/2028_Regional_Haze_Modeling-TSD.pdf

EPA Regional Haze Modeling Platform

- EPA's regional haze modeling was based on:
 - CAMx v6.32
 - 12km national modeling domain
 - 2011 base year emissions, meteorology and boundary conditions
 - Boundary conditions derived from a 2011 GEOS-Chem global model run
 - 2028 future year emissions
 - Emissions modeling TSD: <https://www.epa.gov/air-emissions-modeling/updates-2011-and-2028-emissions-version-63-technical-support-document>
 - 2028 CAMx source apportionment (PSAT) modeling to quantify the contributions from major source sectors, nationwide (i.e., not state-by-state)
 - 19 source tags

Characterization of the Emissions Sectors

Emissions Summary Category	Emissions Sectors (PSAT tags)	Notes
US Anthropogenic	On-road mobile, Non-road mobile, EGUs, NonEGU point, Oil and Gas, Nonpoint (area), Commercial marine (onshore), Prescribed fires, Ag fires, Rail, Residential Wood	Most certain contributors to US anthropogenic visibility.
International	Anthropogenic Canada and Mexico	Only from emissions within the 12km domain
Natural	Biogenic, Wildfires (domainwide), Sea salt	Most certain contributors to natural visibility
"Mixed"	Boundary conditions, Fugitive dust, Offshore (commercial marine and platforms), Secondary organics	Each of these sectors are particularly uncertain regarding the contribution from natural vs. international vs. US anthropogenic. Need further review to improve our understanding of the contributions.

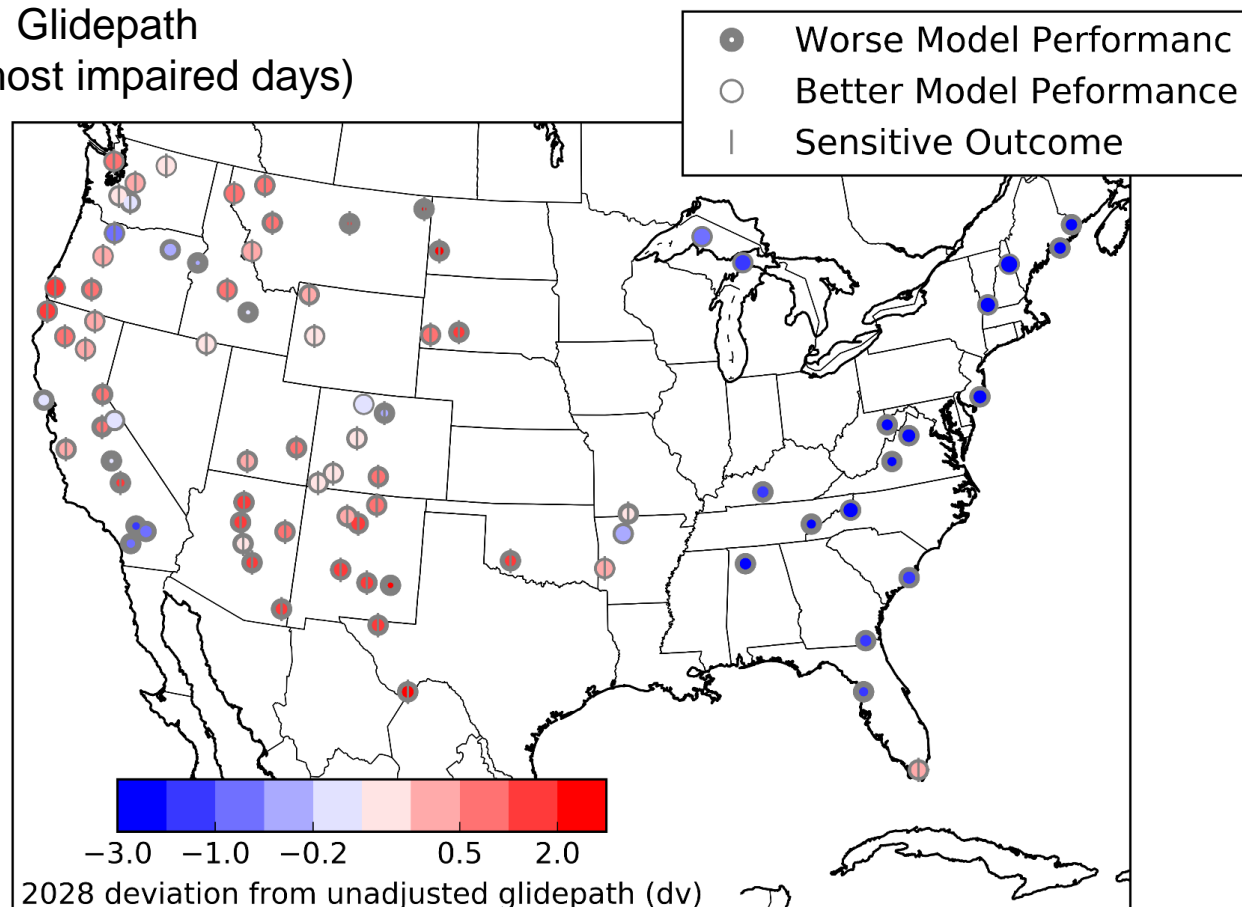
Unadjusted Glidepath and Natural Conditions

- The analysis uses an “unadjusted” glidepath based on the draft EPA recommended 20% most impaired days metric and natural conditions.
- 2028 visibility projected using modeled (CAMx) 2011 base case and 2028 future case
 - 2028 PM concentrations, light extinction, and deciview values calculated using Software for Modeled Attainment Test (SMAT)
 - Beta version of SMAT available at: <https://www.epa.gov/scram/photochemical-modeling-tools>
- Visibility at most Eastern Class I areas is projected to be below the 2028 glidepath, with large percentages of the projected light extinction from US anthropogenic sources.
- Visibility at many western Class I areas is projected to be above the 2028 glidepath, with relatively small percentages of the model projected light extinction from US anthropogenic sources.
 - However, there are large uncertainties associated with many aspects of the analysis which causes the position relative to the 2028 point on the glidepath to be uncertain.
- Because of the uncertainties, EPA recommends using caution when considering whether and how these results can help guide the next steps in SIP preparation.
 - Consult with your EPA Regional Office to discuss options

Deviation from 2028 Unadjusted Glidepath

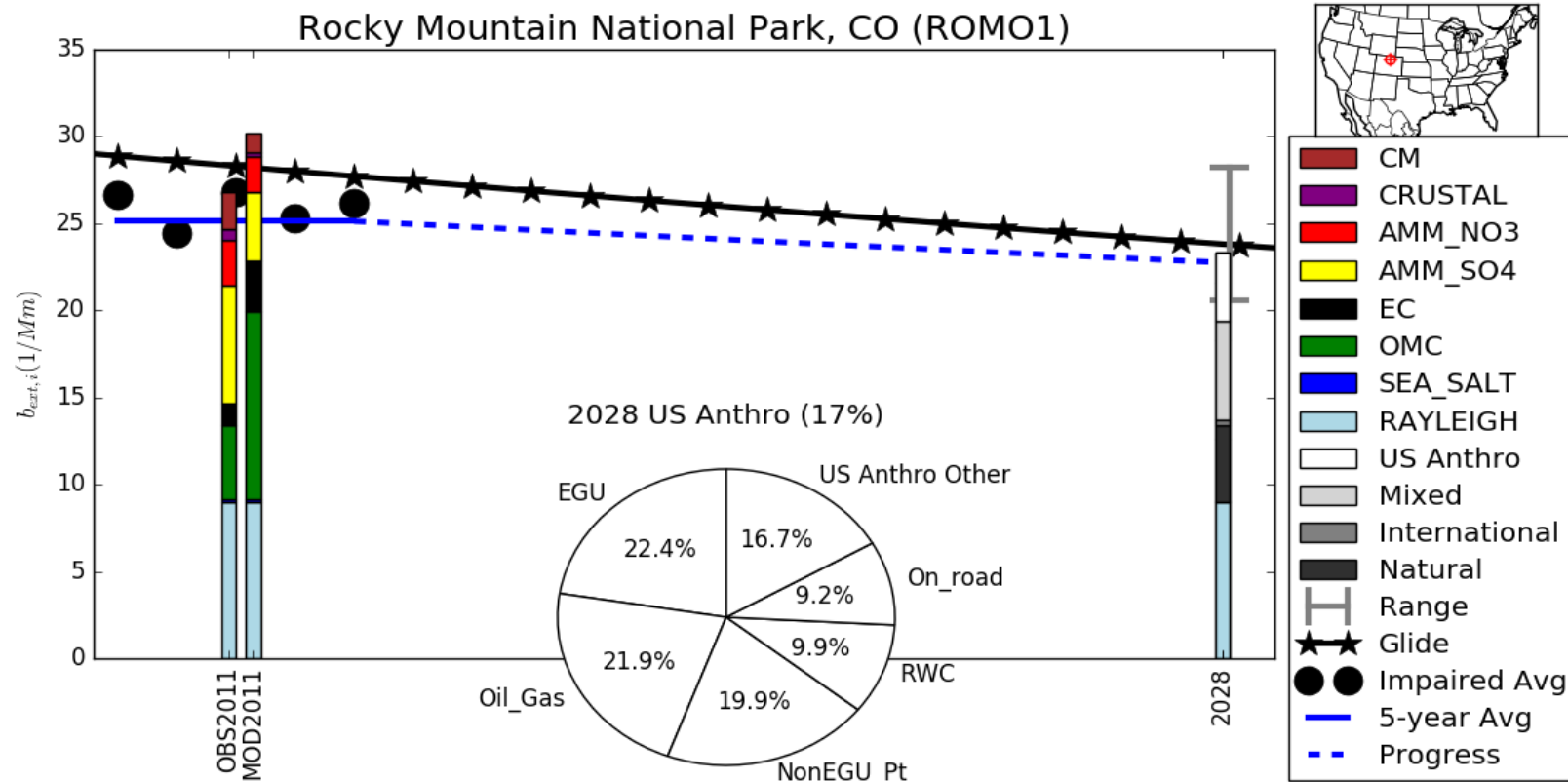
EPA Draft Recommended Metric: 2028 Deviation from
Glidepath
(20% most impaired days)

- The color in the middle of the circle represents the deviation from the 2028 unadjusted glidepath.
- The gray shading represents model performance; the wider the gray outer circle, the worse the model performance.
- The vertical line represents an estimate of uncertainty, indicating whether the site may potentially flip from above the glidepath to below or vice versa.



Note that results could also differ if the glidepath endpoint is adjusted to account for international anthropogenic and prescribed fire impacts

Example “Summary Plot”-Rocky Mountain National Park (CO)



2011 IMPROVE observations, 2011 CAMx model predictions, 2028 modeled projection, and 2028 sector contributions at Rocky Mountain National Park (CO).

This figure reflects EPA's initial 2028 regional haze modeling that contains a number of uncertainties such that the results should be used with caution.

Potential Model Platform Updates and Improvements

- Emissions
 - Windblown dust- *add emissions*
 - Lightning NO_x- *add emissions*
 - Ammonia- *examine magnitude and spatial allocation in remote areas*
 - Commercial marine (offshore)- *accounting for ECA (regional and global models)*
 - Sea salt- *new CAMx pre-preprocessor*
- Model chemistry and deposition
 - Dimethyl sulfide (DMS) ocean chemistry- *add to chemical mechanism*
 - ISORROPIA 2- *update from ISORROPIA*
 - Ammonia deposition- *recommended update in CAMx to reduce dry deposition*
 - SO₂ deposition- *examine sensitivity to dry deposition velocity*
- Model setup
 - Expand the domain- *some Class I areas are too close to the edge of 12km domain*
 - Updated boundary conditions (from global model)- *new global modeling*
 - Additional vertical resolution- *no layer collapsing*

Working with MJOs/States/FLMs AND Next Steps

- Coordinate with MJOs, FLMs, and states, in an effort to improve inputs to the base case and 2028 regional haze modeling platform(s).
 - Improvements to emissions, chemistry, and model setup (previous slide)
 - Estimation of “natural conditions” and possible adjustments to draft recommended values
 - Adjustments to glidepath endpoint to account for international anthropogenic and prescribed fire impacts
 - Potential updates to regional haze projection methodology in the photochemical SIP modeling guidance
- Opportunities for engagement and more detailed discussions
 - Subsequent monthly MJO calls/special calls by region
 - 2016 emissions modeling platform State/EPA workgroups
 - Other FLM calls/workgroups
- EPA will continue to work on updates to modeling platform to address issues seen in 2011 based projections
 - Focus on new 2016 modeling platform