Technical Updates on Transport & 2016 Modeling Platform

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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

National Stakeholder Outreach on 2015 Ozone NAAQS Transport SIPs

- In a March 27, 2018 memo EPA provided air quality modeling results relevant for 2015 NAAQS transport SIPs including projected 2023 ozone concentrations and contributions for monitoring sites nationwide

- The March memo also includes a list of potential alternative approaches to evaluate interstate transport that stakeholders had previously indicated as being useful in developing good neighbor SIPs

- Potential alternative approaches were identified for each step in the 4-step CSAPR framework
  - Step 1 – Identify downwind air quality problems in an appropriate analytic year
  - Step 2 – Identify upwind states that contribute to downwind air quality problems that warrant further review and analysis
  - Step 3 – Perform a multi-factor analysis to identify the amount of emissions that significantly contribute to nonattainment or interfere with maintenance downwind
  - Step 4 – Adopt enforceable control measures to achieve the emissions reductions identified in Step 3.

National Stakeholder Outreach on 2015 Ozone NAAQS Transport SIPs

- EPA held conference calls with states on April 12 and 19 to get feedback on the potential alternative approaches for each of the components of the 4-step process

- Stakeholders can provide additional feedback to EPA through the first week of May via email to Norm Possiel and Elizabeth (Beth) Palma (lastname.firstname@epa.gov)

- EPA will summarize the feedback we received from states and discuss this at a follow-on call to be scheduled for the latter part of May.

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 PM2.5, regional haze SIPs, and 110 transport actions.

National Emissions Inventory versus a Modeling Platform

NEI

- Comprehensive annual emissions inventory developed every 3 years
- Criteria pollutants (required by regulation) and HAPS (voluntary) submitted by states & supplemented by EPA
- Combination of measurements and estimates
- Mobile, nonroad, oil & gas utilize EI development tools
- Data used for various regulatory requirements and to feed modeling platform development
- Submitted via Emissions Inventory System
- Publicly available

Modeling Platform

- Base year and future year emissions inventories for all source sectors adjusted temporally, spatially and chemically
- 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 factor 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

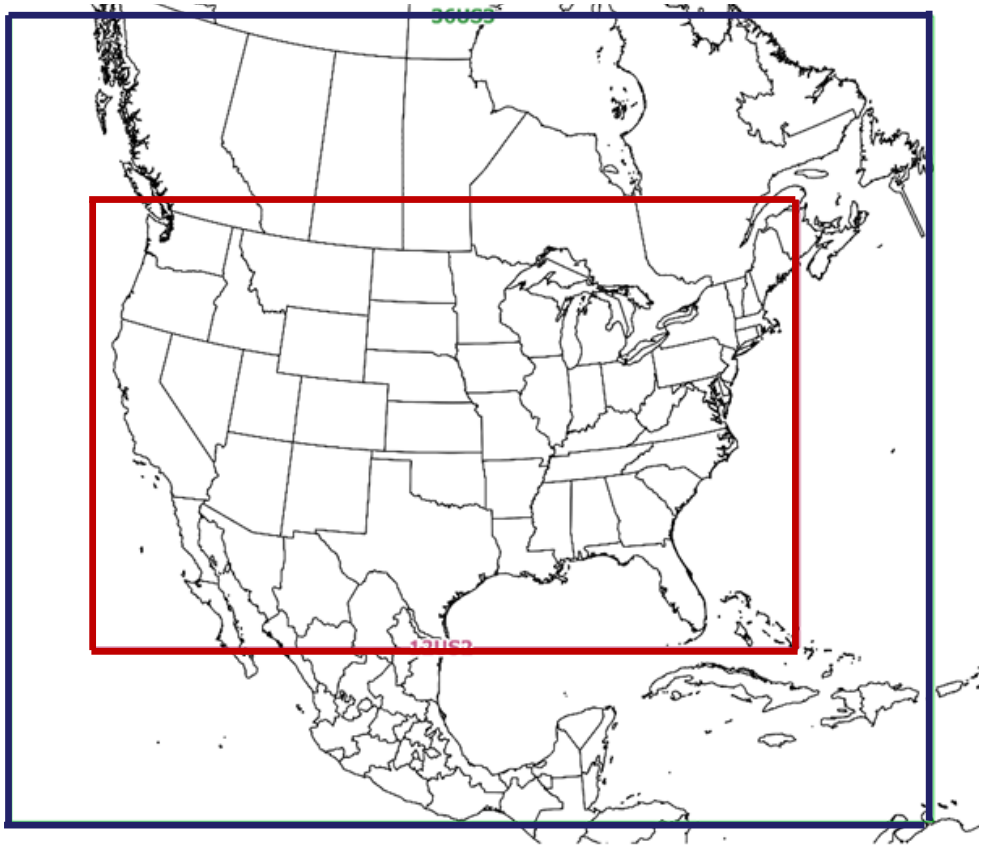
- Evaluation is on-going for ozone, PM, and precursor pollutants using sondes, satellite data, and global surface measurements

- 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 NOx 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.

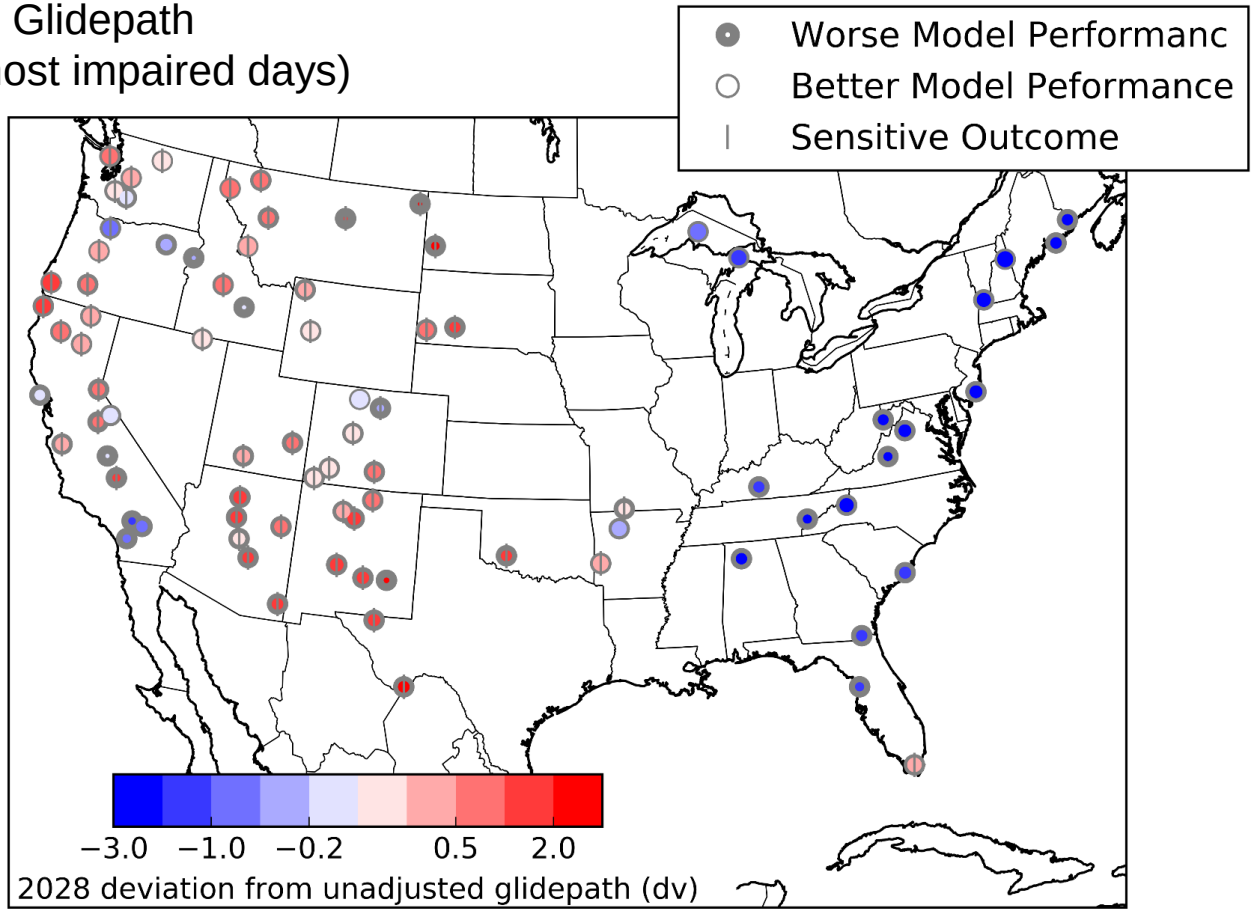
Unadjusted Glidepath and Natural Conditions

- 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

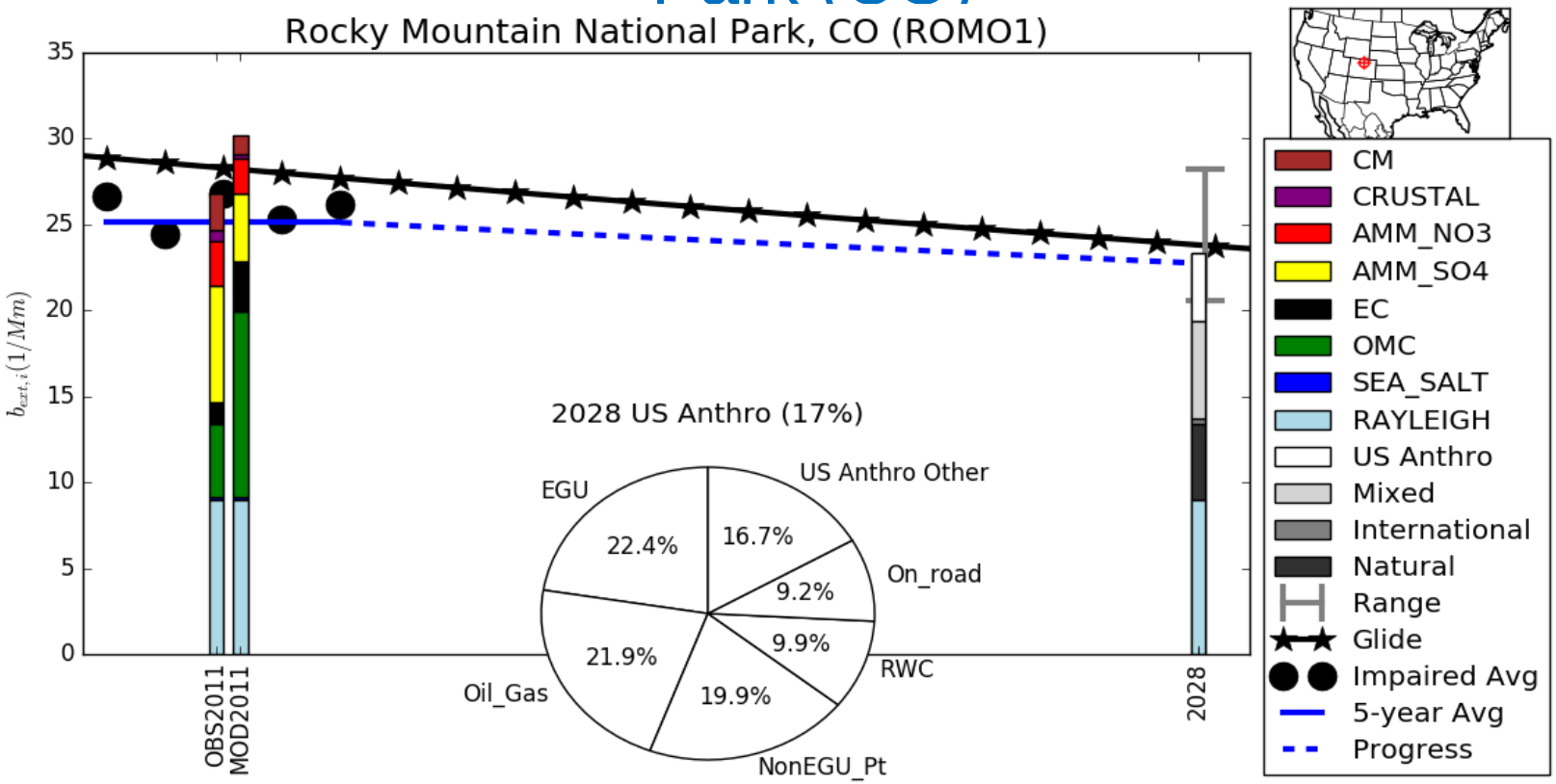
EPA Draft Recommended Metric: 2028 Deviation from Glidepath
(20% most impaired days)

- 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 NOx- *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*
  - SO_2 deposition- *examine sensitivity to dry deposition velocity*
- Model setup
  - Expand the domain- s*ome 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