OAQPS Photochemical Modeling Update

AAPCA Fall Business Meeting

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U.S. EPA Office of Air Quality Planning & Standards

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Overview

- 2016 Modeling Platform
  - Emissions modeling platform
  - Air quality modeling
- Regional Haze Modeling

Overview of the Emissions Platform Collaborative

- A new multi-purpose emissions modeling platform base is needed to replace the 2011 platform
  - State Implementation Plans, federal analyses
  - For the first time, EPA, states, and MJOs are engaging in collaborative emissions modeling platform development
  - The 2016 base year was selected via a collaborative process
    - Some data is 2016-specific and some taken from 2014NEIv2
    - Some applications may also use 2014 or 2015
- Future years selected due to regulatory relevance
  - 2023 is relevant for Ozone NAAQS moderate areas
  - 2028 for regional haze

Organizational Structure

- **Coordination co-leads**: Zac Adelman (LADCO) and Alison Eyth (EPA OAQPS)
  - Develop process and communication structures, help resolve issues, documentation requirements, coordinate distribution of data
- **Coordination committee**: regional, state, EPA leaders
  - Define processes, resolve issues, co-lead workgroups
  - Includes overall and WG co-leads plus MJO directors
- **Sector-specific Workgroups**: one regional/state staff and one EPA staff (where possible)
  - Focus on preparing emissions estimates for 2016 and future years and improve how the emissions sectors are modeled
  - Include participants from EPA/states/locals/regions

Workgroups in Collaborative

Workgroups cover the emission modeling sectors:

- Electric Generating Units (EGUs)
- Non-EGU Point (including aircraft)
- Nonpoint (agriculture, fugitive dust, res. wood, other)
- Oil and gas (point and nonpoint)
- Onroad (also VIN-decoding subgroup)
- Nonroad
- Rail
- Commercial Marine Vessels (CMV)
- Fires
- Biogenic
- Emissions Modeling

Wiki hosted by Intermountain West Data Warehouse has more information and notes from each workgroup

- http://views.cira.colostate.edu/wiki/wiki/9169

2016 Platform Versions & Schedule

- **Alpha**: *preliminary* version based on 2014NEIv2 for some and 2016 for other key sectors (released Spring, 2018)
  - Used for initial testing of 2016 model runs
  - Compatible versions of 2014 and 2015 were also released
- **Beta**: *improved and/or new* version of 2016 emissions for most sectors and preliminary projected emissions to 2023 and 2028 (November, 2018)
  - Use for base and future year preliminary analyses
- **V1.0**: *fully updated* 2016 emissions and complete projected emissions for 2023 and 2028 (Winter-spring, 2019)
- Schedule overlaps with 2017 NEI Development
  - States should prioritize 2016 vs 2017 as they see fit
    - 2017 NEI has regulatory requirements (AERR), 2016 is voluntary (default methods will be available for 2016)

Development of Beta Platform

- Workgroups developed base and future year emissions inventories, along with associated documentation
- States/locals have provided 2016-specific data for some sectors (e.g., EGUs, non-EGUs, onroad vehicle miles traveled [VMT] and population [VPOP], fires, oil & gas)
- States have reviewed data for many sectors
- EPA is supporting the effort by running models and tools
  - MOtor Vehicle Emissions Simulator (MOVES) for onroad and nonroad (2016, 2023, 2028)
  - Oil & Gas Tool (2016)
  - Fire emissions- Blue Sky Framework / SMARTFIRE2 (2016)

Inventory Collaborative Next Steps

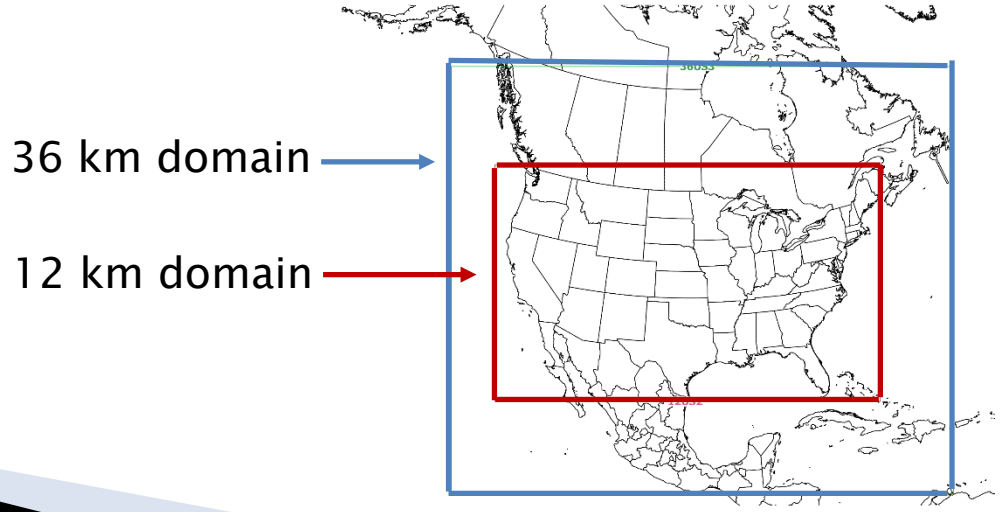
- Workgroups are working to release the beta inventories and documentation
- Model evaluation can be performed with outputs from alpha and beta versions to inform v1.0
- States may review beta inventories and related data
- Workgroups will implement updates for v1.0
- Quarterly outreach calls are being held to report out on progress
  - http://views.cira.colostate.edu/wiki/wiki/9169#National-Report-Out-Calls
  - Next call December 19th

EPA's 2019 International Emission Inventory Conference

- Biennial conference that connects offices across EPA, regional/state/local/tribal staff, researchers, consultants, and students who work on various aspects of emissions inventory development
- 2019 Theme: "Collaborative Partnerships to Advance Science and Policy"
- **July 29–August 2, 2019 in Dallas, Texas**
  - Training on Monday, July 29
  - Tuesday–Friday: plenary session, technical sessions, lightning talks
  - More info coming soon to: https://www.epa.gov/air-emissions-inventories/international-emission-inventory-conference

EPA's Air Quality Modeling of the 2016 Emissions Platform

- CMAQ and CAMx annual model runs are underway using the alpha inventory as part of a "shake out" of the platform.
  - 12 km national domain nested within a 36 km domain (see map below).
- Boundary conditions for the 36 km domain are from a 2016 Hemispheric CMAQ run.
- 2016 beta emissions will be modeled starting later this year.
- We are open to sharing our modeling data with states; but, we have not yet settled on a timeframe for this.

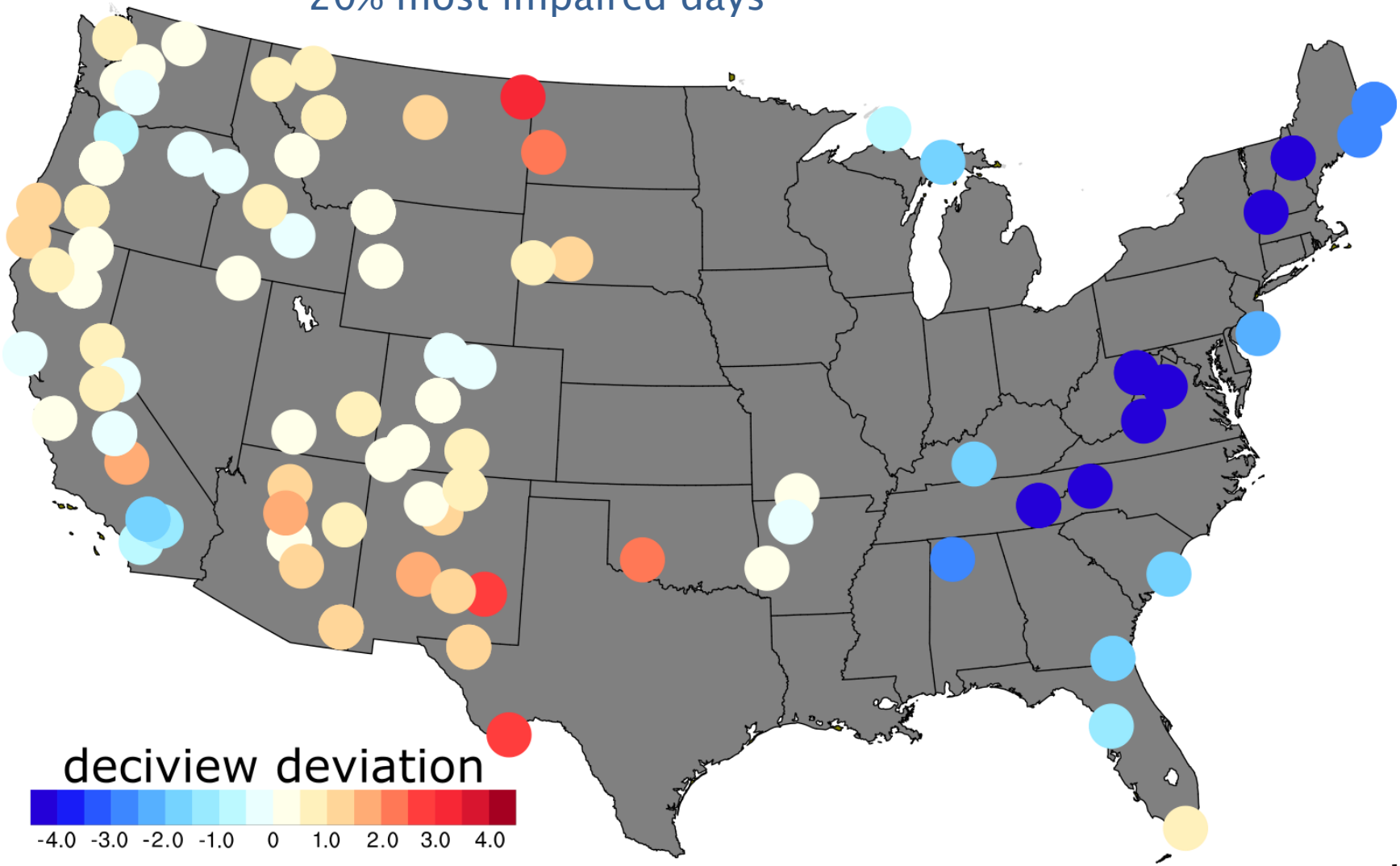


EPA Regional Haze Modeling

- EPA released initial regional haze air quality modeling for 2028 to evaluate visibility impairment for each Class I area/IMPROVE site, including source sector contribution information.
  - Presented to MJOs in July 2017
  - Documentation released in October 2017
    - https://www3.epa.gov/ttn/scram/reports/2028_Regional_Haze_Modeling-TSD.pdf
- Identified a list of modeling improvements and updates that may be needed for the next round of modeling
  - Model performance issues should be addressed before the results can be confidently used ***in some areas***.
- Continue to work collaboratively with MJOs, states, and FLMs to make improvements and update the modeling where necessary.

Projected Glidepath Status in 2028 (Preliminary modeling)

2028 Deviation from *Unadjusted* Glidepath
20% most impaired days

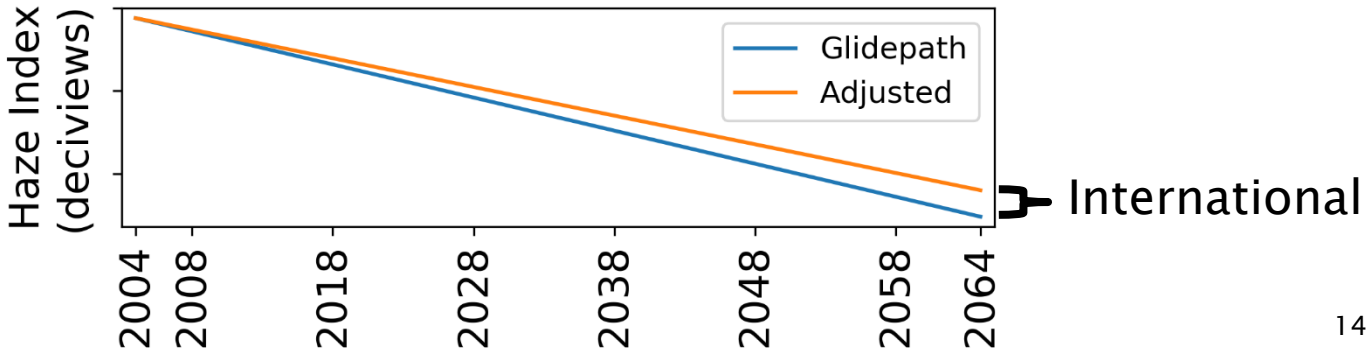


Regional Haze "Roadmap"

- Memo from the Administrator (9/12/18)
  - https://www.epa.gov/sites/production/files/2018-09/documents/regional_haze_reform_roadmap_memo_09-11-2018.pdf
- Implementation tools
  - Fall 2018
    - Final recommendations on methods to calculate most impaired days
    - Methods to account for international impacts on regional haze
  - Spring 2019
    - As necessary, updated natural visibility conditions estimates
  - Spring/Summer 2019
    - Updated 2028 visibility modeling platform including estimates of international source contributions

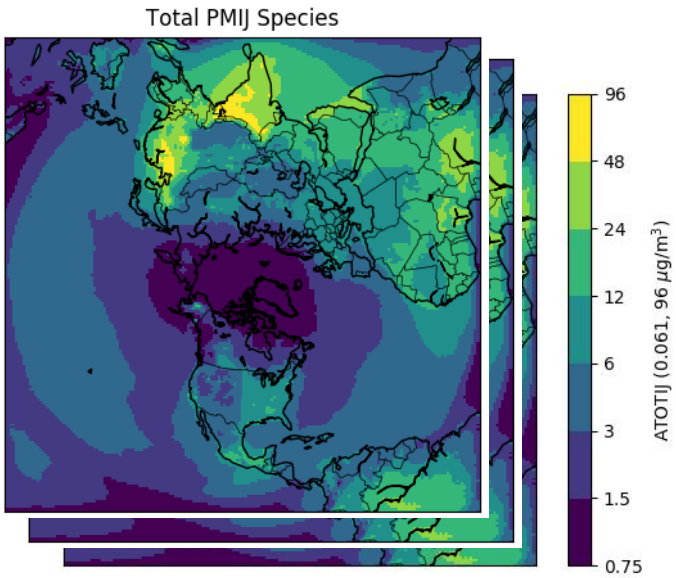
International Adjustment

- Current analysis uses the EPA draft recommended natural conditions to calculate the glidepath (i.e., "unadjusted glidepath").
  - 2017 RHR allows states to adjust the endpoint of the glidepath upwards to account for international impacts (and prescribed fires).
    - 51.308(f)(1)(vi)(B): *As part of its implementation plan submission, the State may propose (1) an adjustment to the uniform rate of progress for a mandatory Class I Federal area to account for impacts from anthropogenic sources outside the United States and/or (2) an adjustment…. to account for impacts from wildland prescribed fires….*
  - Modeled estimates of international transport (and prescribed fires) can be used to adjust the endpoint and glidepath.



Estimating Anthropogenic International Contribution

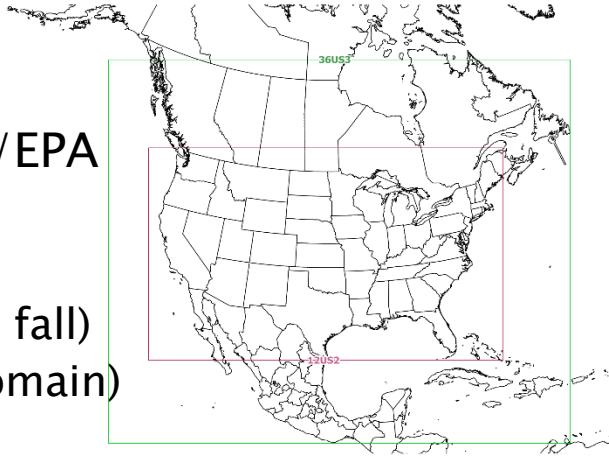
- Simulations with and without international or U.S. anthropogenic emissions
  - Calculate contributions by subtraction from base run
- 2016 base year emissions and meteorology
  - Hemispheric/global models
    - CMAQ v5.2.1and v5.3
    - GEOS-Chem v11-01c and v12.0.0
  - Provide boundary conditions for regional model platforms



$$\text{International}_i = \begin{cases} \Delta C_1 \\ \vdots \\ \Delta C_n \end{cases}$$

Updated EPA Regional Haze Modeling

- Updated modeling over the next year
  - New 2016 based modeling platform with emissions projections to 2028, including sector-based source apportionment
  - Model Improvements
    - New 2016 and 2028 emissions from the State/EPA platform collaborative
    - Regional model improvements
      - Updates to CAMx (also new version of CMAQ this fall)
      - Larger regional domain (including 36km outer domain)
    - Hemispheric CMAQ and/or GEOS-Chem
      - Updated boundary conditions
      - Estimate of international anthropogenic contributions
- Also will examine "natural conditions" with possible adjustments to draft recommended values



Next Steps

- Continue outreach to MJOs and prioritize list of technical issues
- As appropriate, modeling improvements will be developed and implemented in EPA's 2016 modeling platform.
- EPA will then conduct updated photochemical modeling with the 2016 modeling platform (including hemispheric/global modeling)
  - Results for regional haze will be discussed with the MJOs and their member states.

Appendix

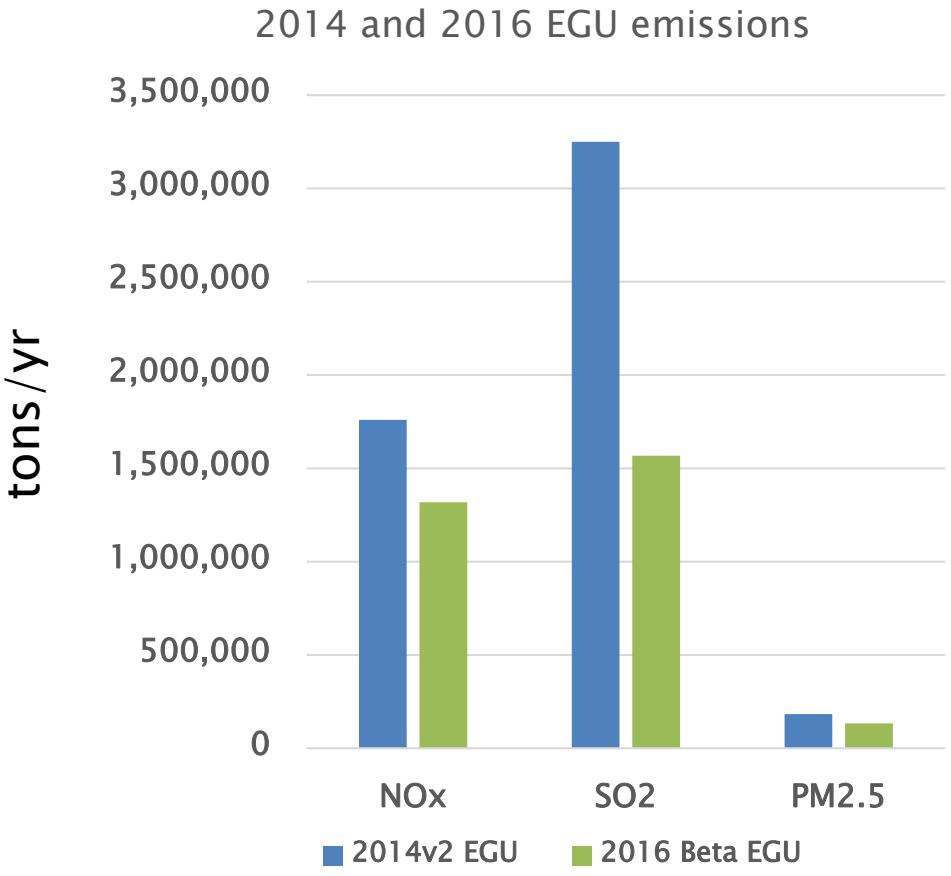
Overview of Beta Emissions (1)

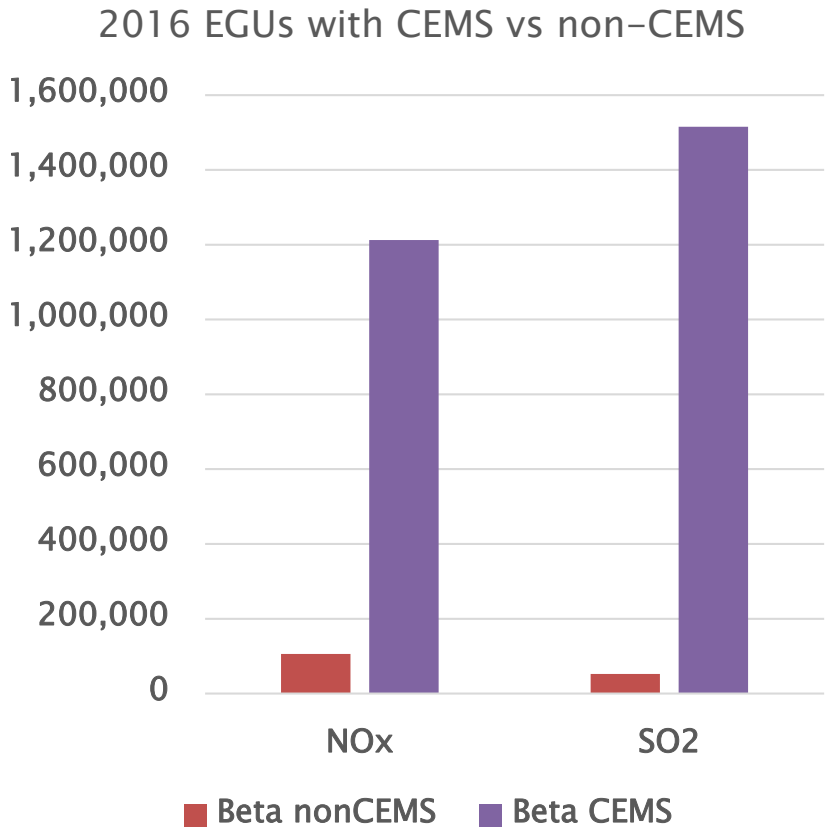
- **EGUs**: 2016 point submittals and national data sets; Integrated Planning Model (IPM) and ERTAC EGU outputs for 2023/2028
- **Non-EGU point**: 2016 point submittals
  - Incorporate growth, consent decrees and key regulations for 2023/2028, project airports
- **Nonpoint**: Start with 2014NEIv2; adjust paved road dust, livestock, and some others to 2016; project to 2023, 2028
- **Nonpoint oil and gas**: oil and gas tool output for 2016 plus new spatial surrogates and temporal profiles; simple projections to 2023/2028
- **Onroad**: State/local 2016 activity with 2016 emission factors, new on-roadway spatial surrogates

Overview of Beta Emissions (2)

- **Nonroad**: MOVES2014b outputs for all years – ***these are expected to be more than 20% lower than 2014NEIv2***
- **Rail**: New 2016 inventory, including new commuter rail
- **Commercial Marine vessels**: 2014NEIv2 adjustments to 2016 and projection to 2023/2028
- **Biogenics**: BEIS 3.61 and MEGANv3 run with 2016 meteorology
- **Fires**: 2016 wild and prescribed fires based on updated inputs, agricultural fires by point and day, non-US fires
- **Canada**: New 2015 emissions expected, plus projection to 2025
- **Mexico**: 2008 projected to 2016, 2023, 2028 plus MOVES-Mexico for each of the years

2014 and 2016 Point Source Emissions

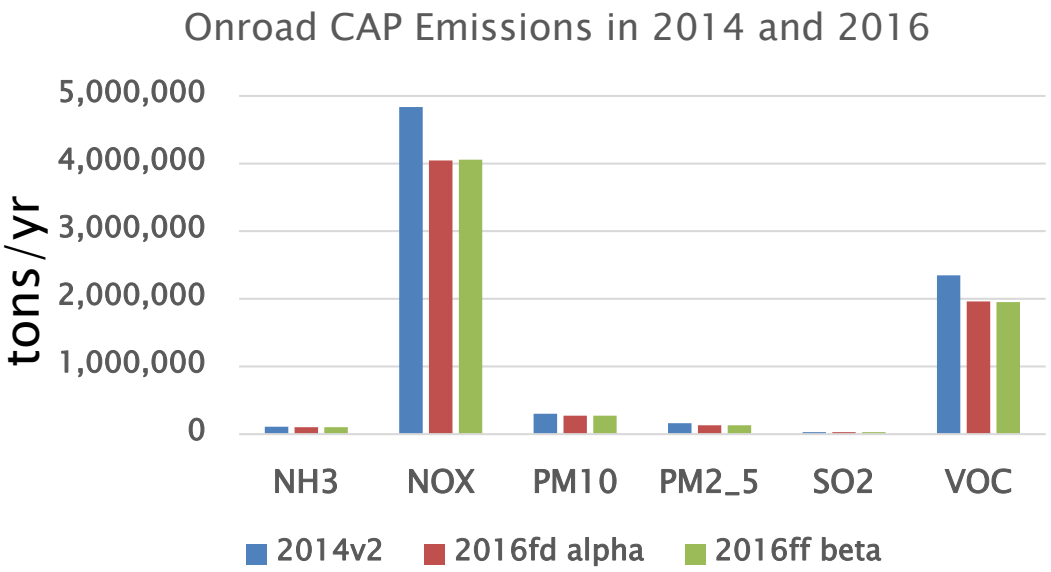




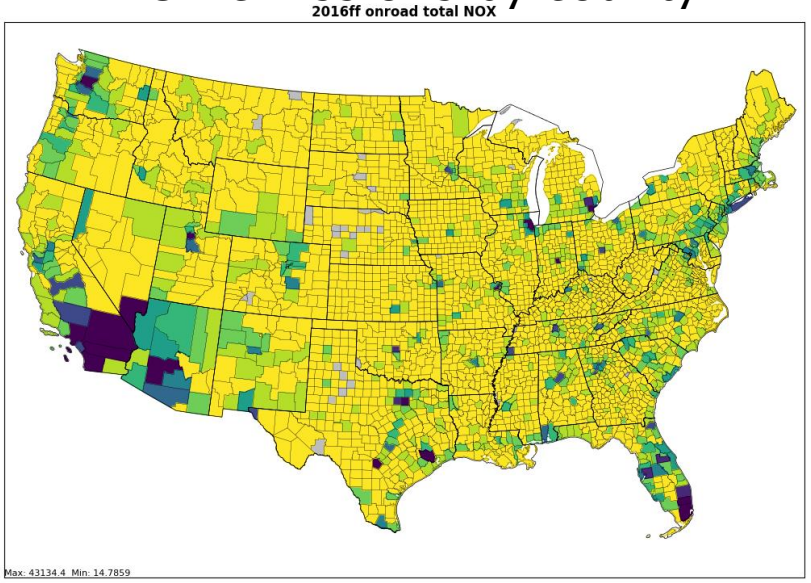
There was a substantial drop in NOx and SO2 from 2014 to 2016
A large fraction of NOx and SO2 emissions are based on CEMS data

2016 beta Onroad Emissions Totals

Onroad emissions are predicted to go down from ‘14 to ‘16



NOx emissions by county



Gridded Combination Truck VMT