Webinar on "Technical Guidance on Tracking Visibility Progress for the Second Implementation Period of the Regional Haze Rule"

Brett Gantt and Brian Timin

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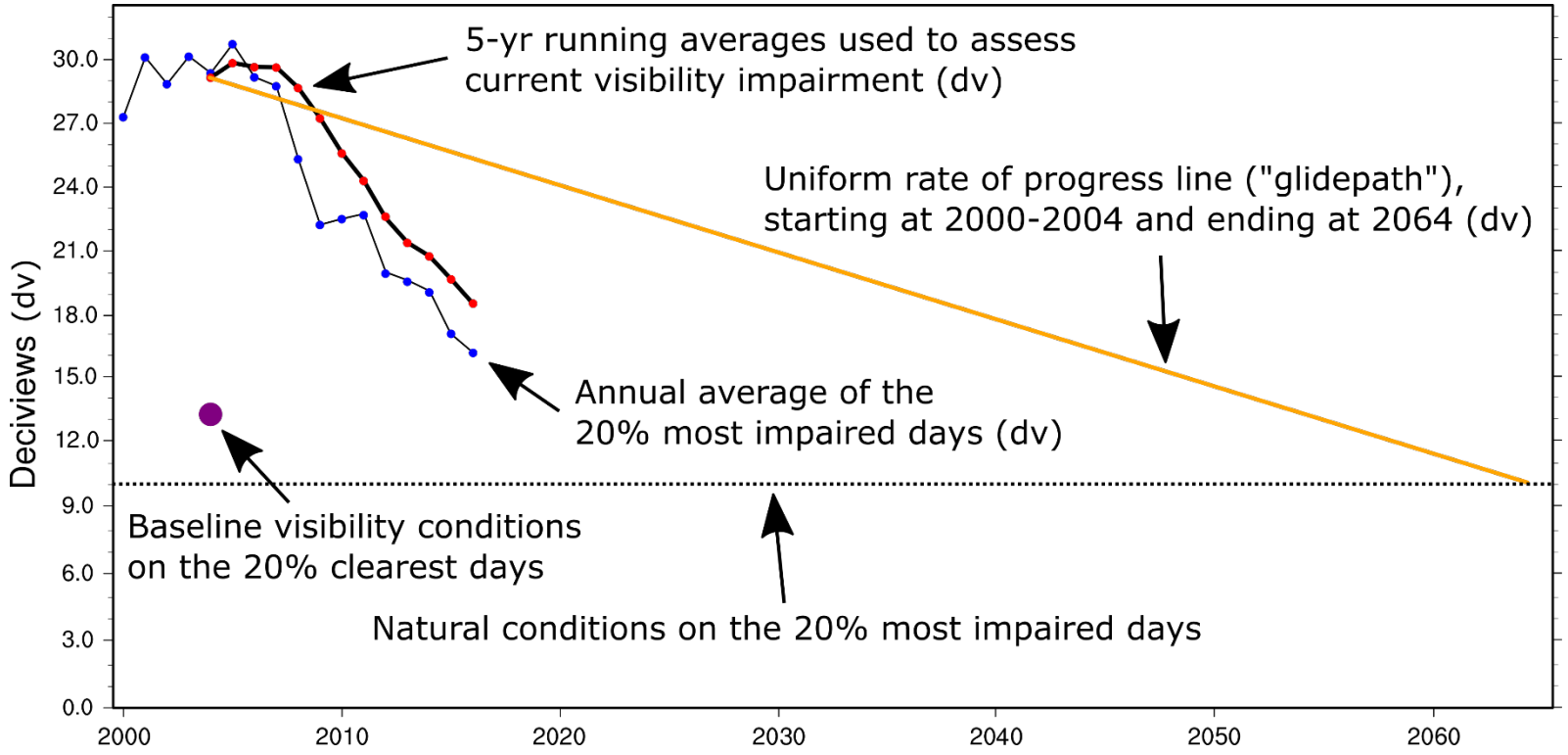
Visibility Tracking Metric and International Adjustment

- The guidance was released on December 20, 2018 and fulfills a commitment in EPA's Regional Haze Reform Roadmap
  - https://www.epa.gov/visibility/technical-guidance-tracking-visibility-progress-second-implementation-period-regional
- The 2017 Regional Haze Rule revisions require a revised approach to tracking visibility improvements over time.
  - The guidance finalizes a recommended methodology to develop baseline and current visibility conditions, and natural conditions on the most impaired and clearest days at Class I areas.
- The 2017 Regional Haze Rule also includes a provision that allows states to propose an adjustment to the uniform rate of progress (URP) glidepath to account for anthropogenic international sources (and prescribed fires).
  - The guidance describes recommended tools and methods to develop optional URP adjustments

Motivation for Changing the Tracking Metric

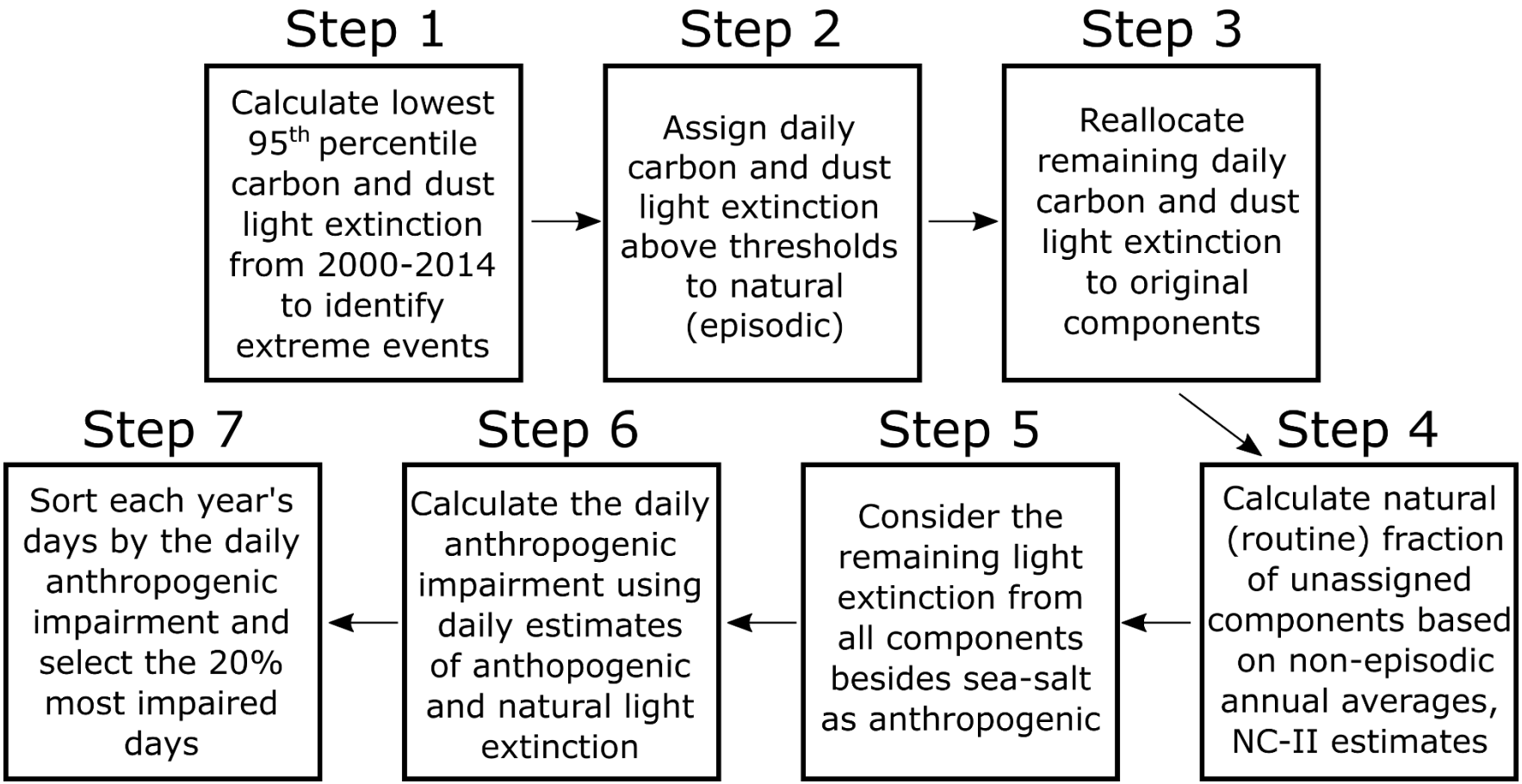
- In the 2017 Regional Haze Rule revisions, the EPA clarified that states select the 20 percent most impaired days, i.e., the days with the most impairment from *anthropogenic* sources, for the purposes of calculating baseline, current visibility conditions, and natural visibility conditions.
- In the first implementation period, the most impaired days were simply the 20% haziest days
  - In the eastern U.S., these days typically had high sulfate/nitrate extinction from anthropogenic sources
  - In the western U.S., these days occasionally had high extinction from organic carbon and coarse matter whose sources include wildfires and dust storms (sometimes from outside of the U.S.)
    - Even with a 5-year rolling average, one year with frequent impacts from wildfires or dust storms could affect the entire trend at some sites
- This guidance finalizes the recommended changes to the visibility tracking metric to focus on anthropogenic contributions

Uniform Rate of Progress Diagram



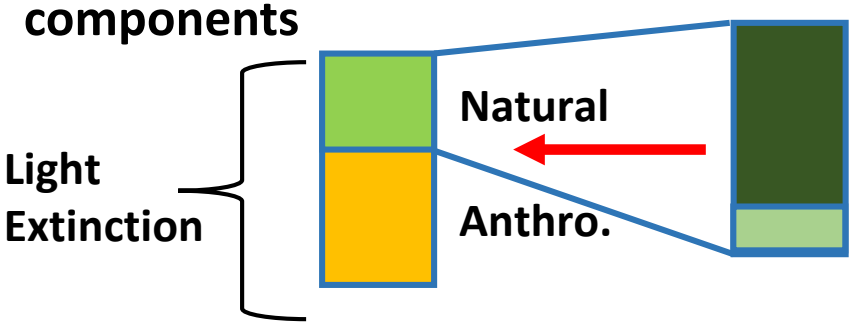
In the Regional Haze Rule, the URP framework is used to track and present visibility progress over time

Recommended Metric Flow-chart



Recommended Metric Simplified (Steps 1–2)

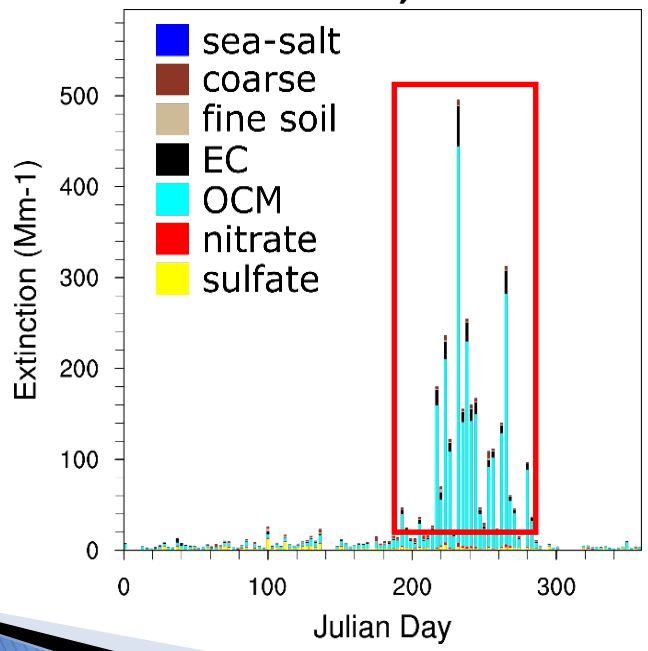
- **Split each day of IMPROVE data into natural and anthropogenic extinction components**

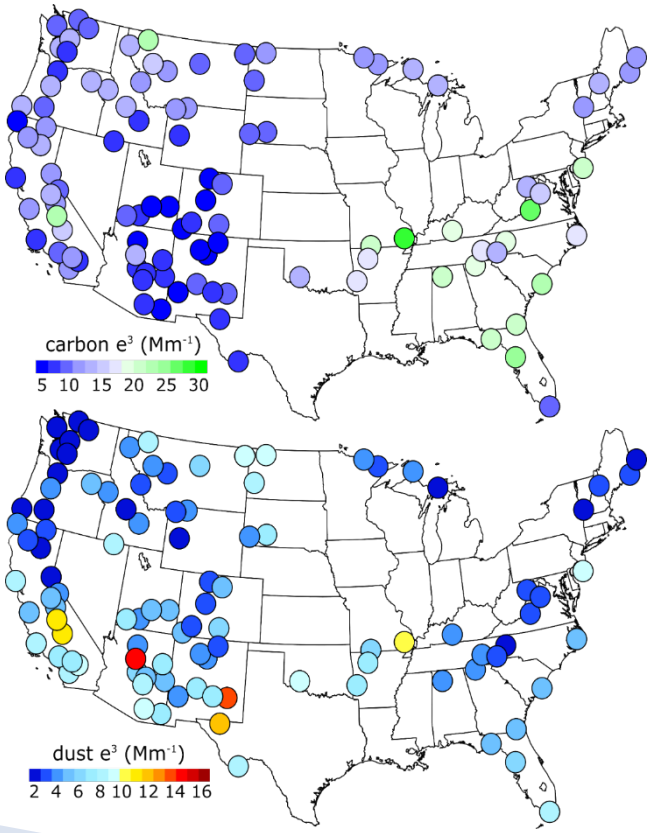


Episodic = site-specific daily dust and carbon > site's lowest annual 95th percentile values between 2000-2014

Routine = all sea-salt; daily fraction of avg. NC-II dust, carbon, sulfate, and nitrate in proportion to the non-episodic portion of measured values

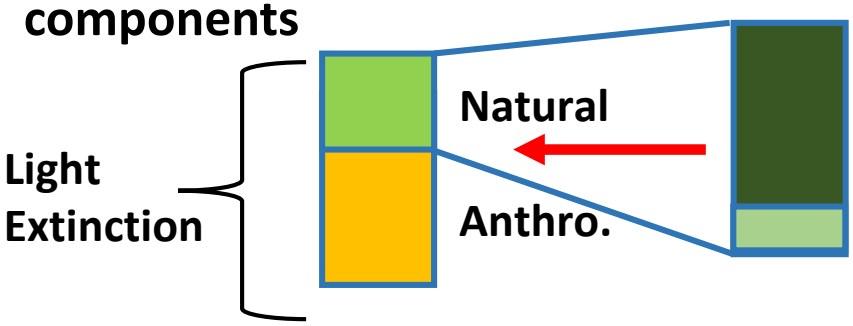
Sawtooth NF, ID in 2012





Recommended Metric Simplified (Steps 3–4)

- **Split each day of IMPROVE data into natural and anthropogenic extinction components**



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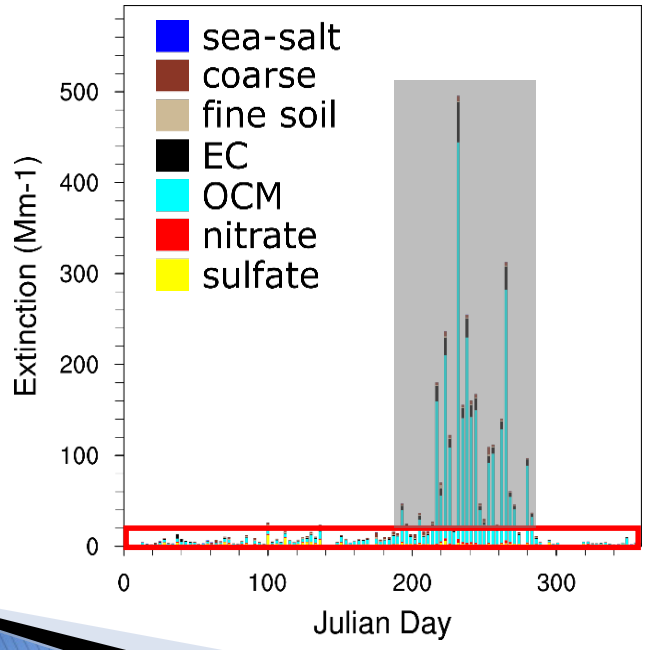
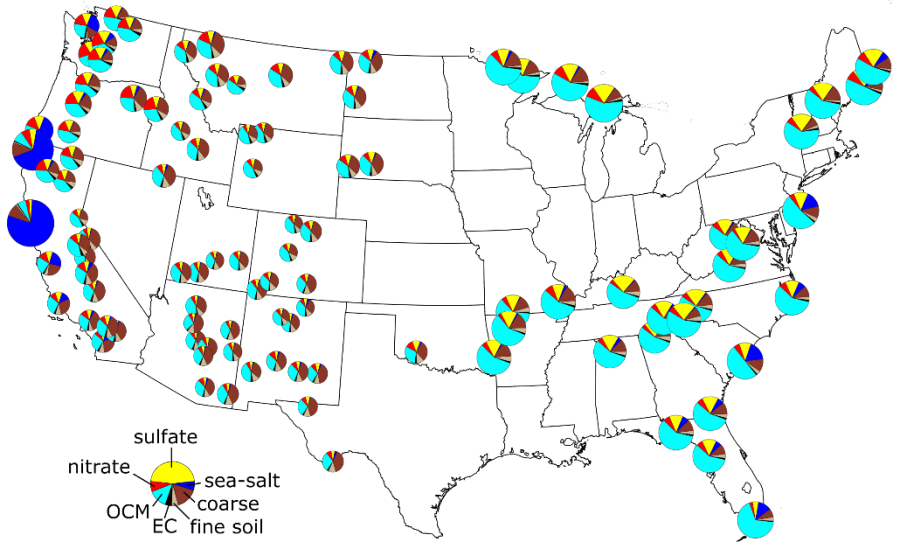


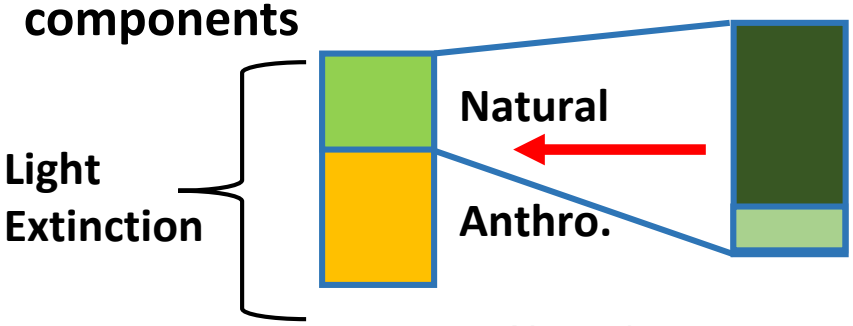
NC-II average conditions



$$\text{natural(routine)} = \frac{\text{daily extinction} \times \text{NC-II estimate}}{\text{non-episodic annual average}}$$

Recommended Metric Simplified (Step 5)

- **Split each day of IMPROVE data into natural and anthropogenic extinction components**



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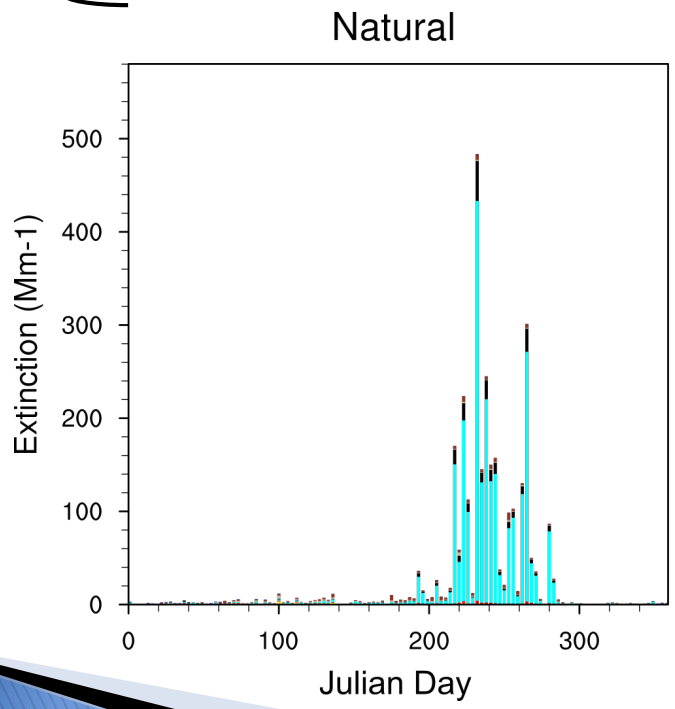
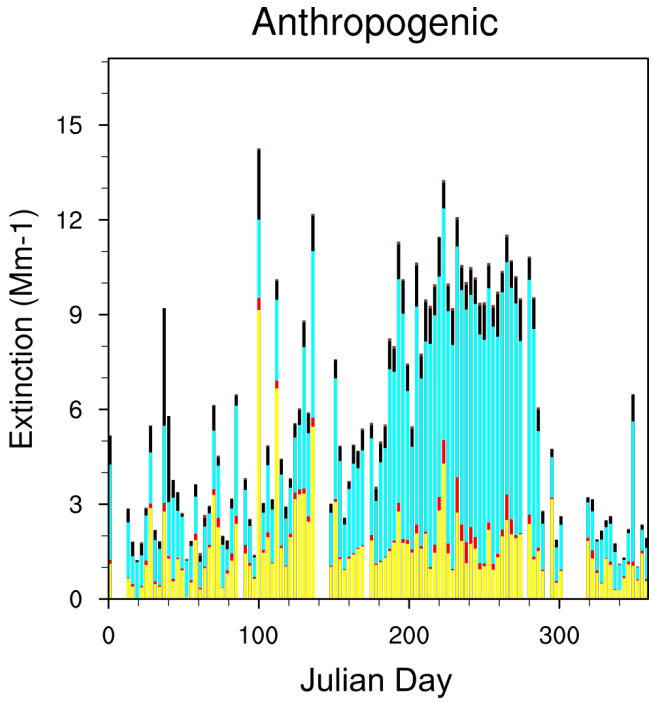
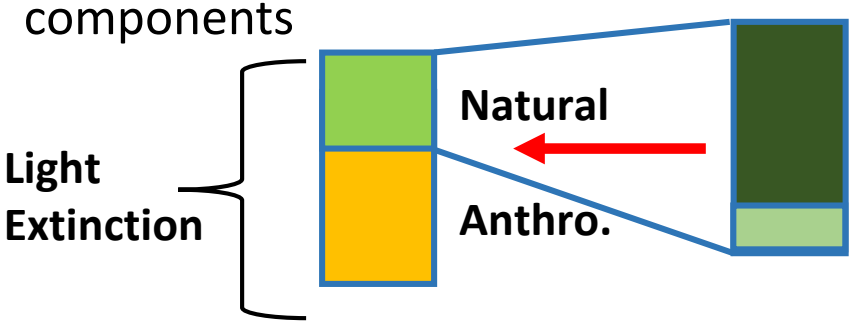




Recommended Metric Simplified (Step 6)

- Split each day of IMPROVE data into natural and anthropogenic extinction components



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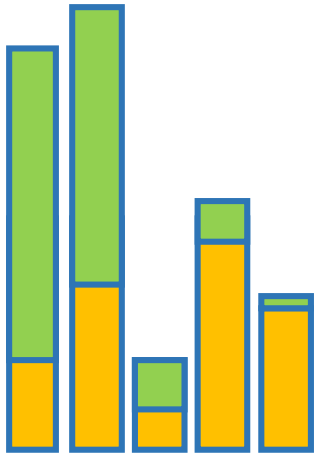
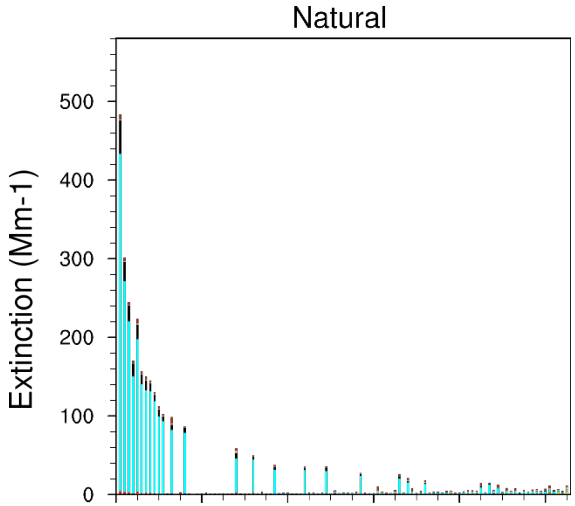
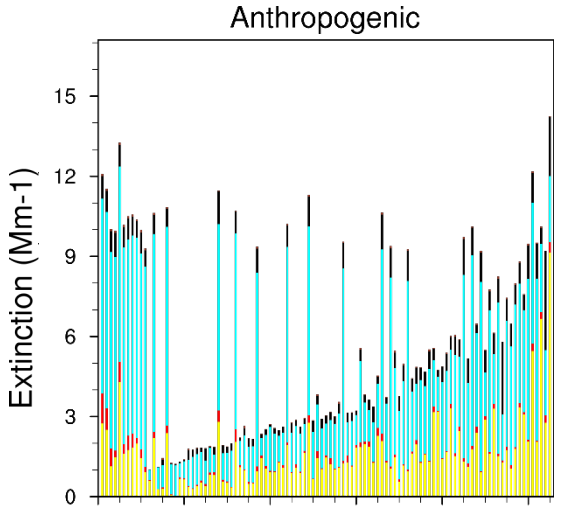
- **Sort days by $dv_{Total} - dv_{Nat}$ (proportional to Anthro/Nat extinction) to identify the "most impaired" days:**

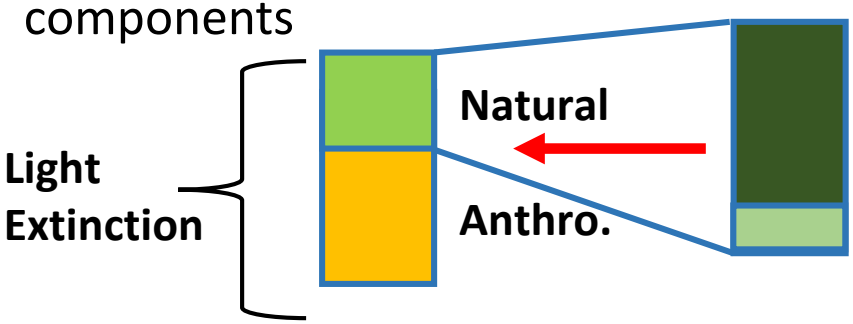






Recommended Metric Simplified (Step 7)

- Split each day of IMPROVE data into natural and anthropogenic extinction components



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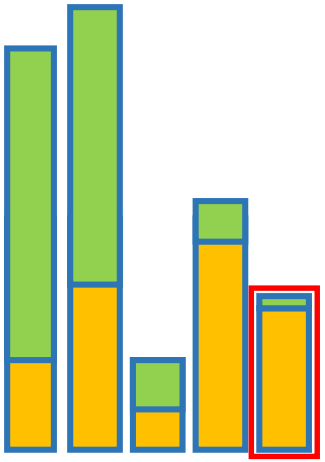
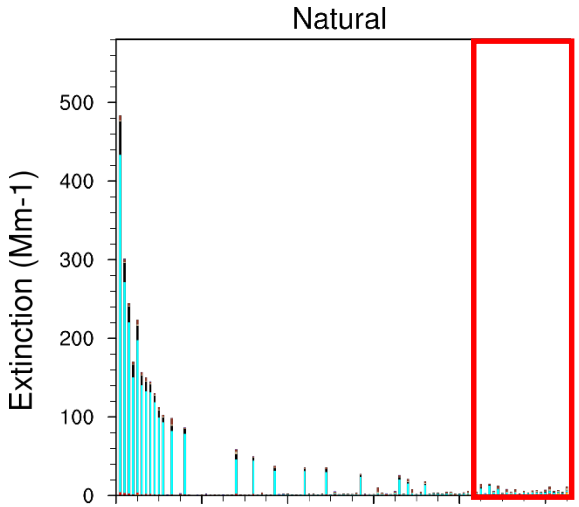
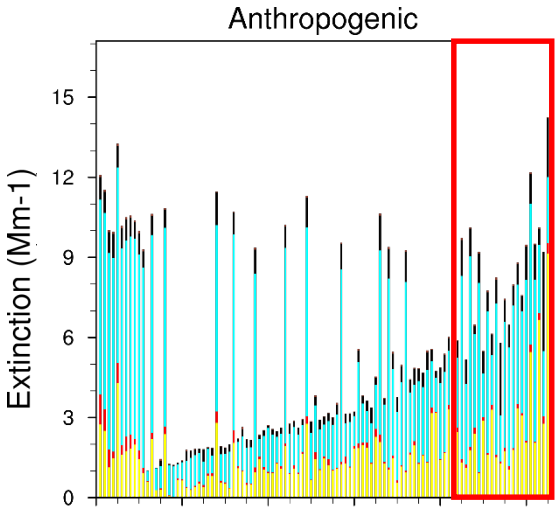
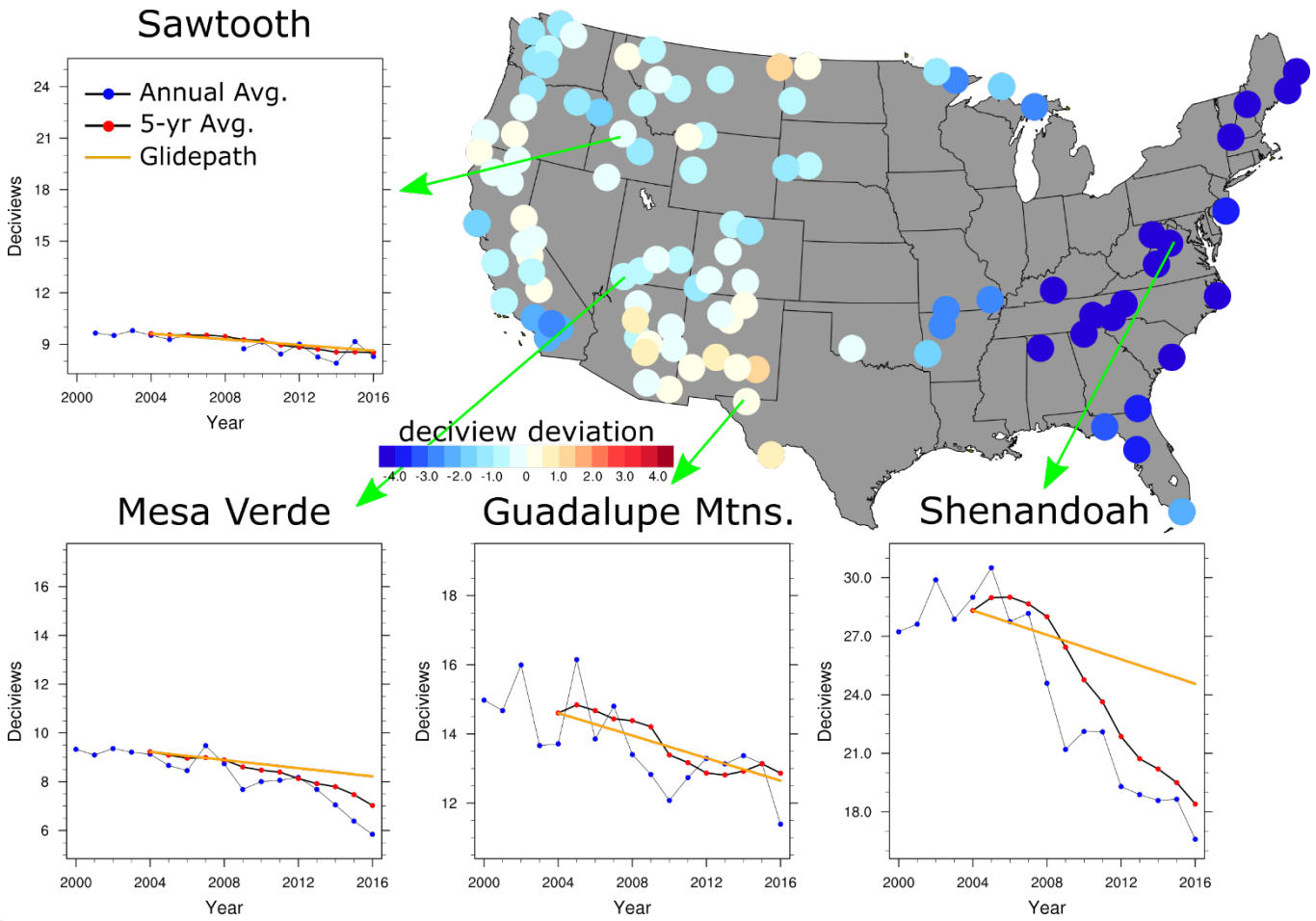






- **Select the 20% most impaired days**

2012–2016 Glidepath Deviation (20% most impaired days)



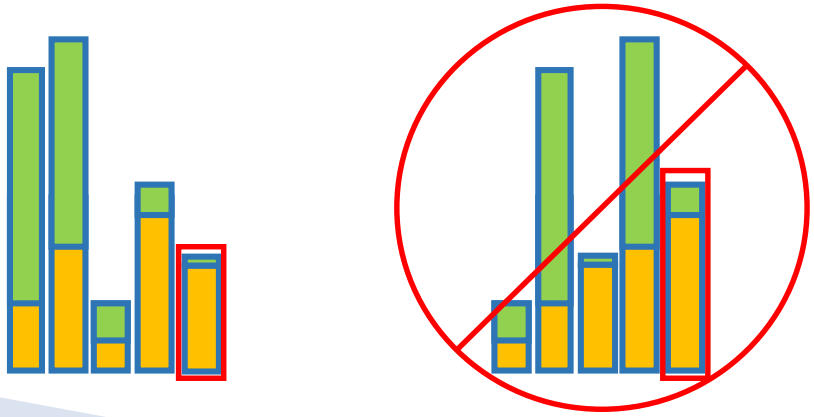
Major Comments to 2016 Draft Guidance

- **The extreme episodic event threshold is too high/low**
  - Some commenters identified sites where they claimed the threshold value was too low because it was closer to the peak of the distribution than the tail
  - Other commenters identified sites where the threshold allowed smaller wildfires to be considered partially anthropogenic
  - We retained the threshold recommended in the draft guidance because:
    - This threshold seems to be acceptable for most IMPROVE sites
    - The guidance makes it clear that states can choose a different threshold if they explain why another method is more appropriate for their individual Class I areas

Major Comments to 2016 Draft Guidance

- **Sorting of days should use the anthropogenic extinction rather than the recommended delta-deciview approach**
  - We retained the sorting method recommended in the draft guidance because:
    - We found that sorting by anthropogenic extinction was much more sensitive to the anthropogenic/natural split and inadvertently included more wildfire/dust storms in the selected days
    - Sorting by the delta-deciview approach selects the days where cuts in anthropogenic emissions can have the largest visibility impact

Recommended Approach **Anthropogenic Extinction**



Recommended Metric Summary

- Compared to the metric used in the first implementation period:
  - In the eastern U.S.: little difference between metrics
  - In the western U.S.: many sites that were above the URP in 2012-2016 are now at or below the URP with the recommended metric
    - Days selected as the 20% most impaired tend to have:
      - Lower extinction
      - Wider distribution across seasons
      - Higher fractions of sulfate and nitrate, much lower organic carbon
- States can easily download data using the recommended EPA methodology by going to the following website: http://views.cira.colostate.edu/fed/QueryWizard/Default.aspx and choosing the "IMPROVE aerosol, RHR III" dataset

International Adjustment

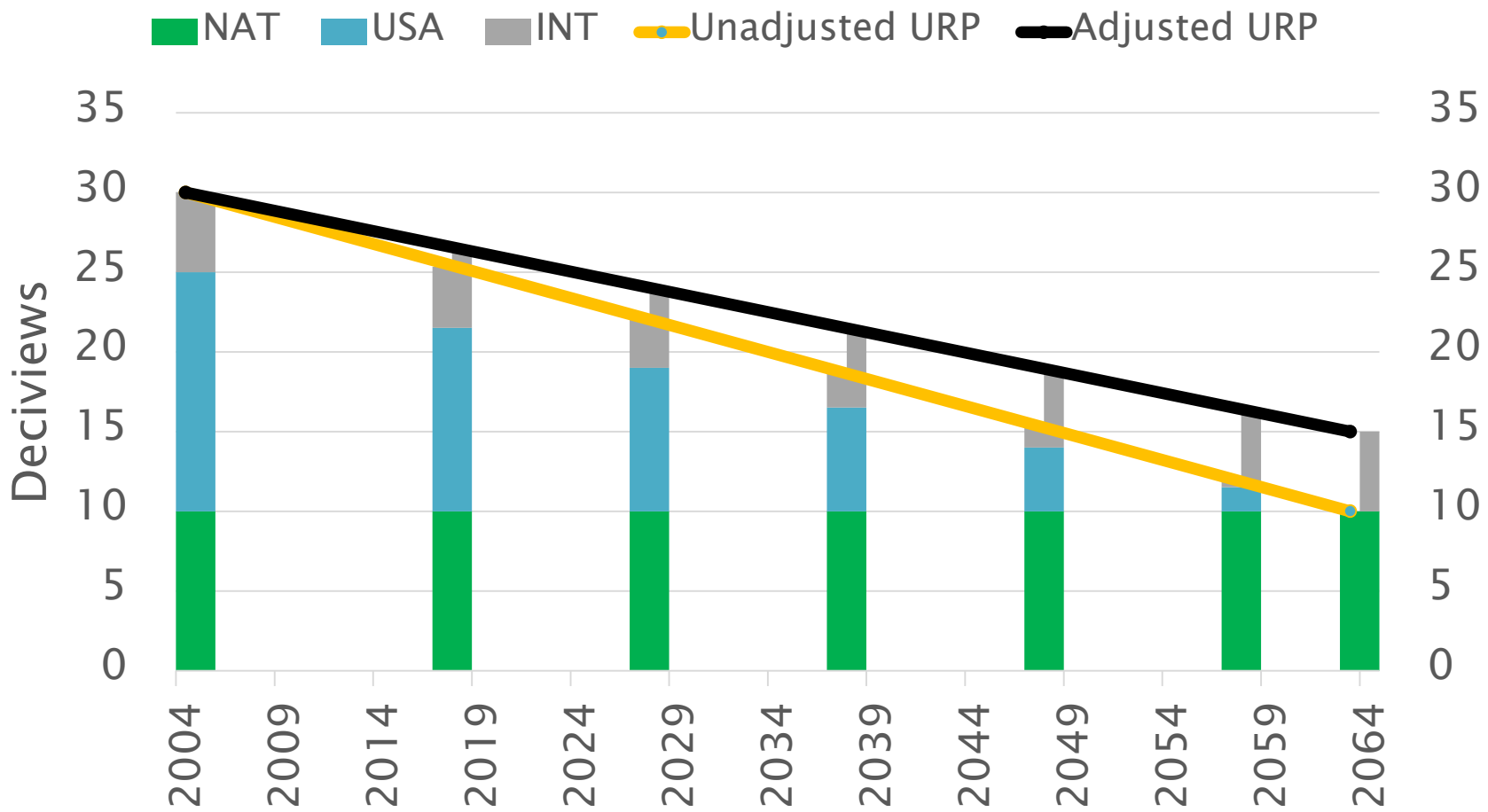
International Adjustment

- The 2017 RHR allows states to adjust the *endpoint* of the URP glidepath upwards to account for international **anthropogenic** 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....*
- This guidance provides technical information, and recommendations on procedures and considerations for making URP adjustments

International Adjustment Guidance Contents

- Background on rule language
- Year selection for quantifying international visibility impacts
- Modeling to estimate anthropogenic international visibility impacts
  - Recommended types of models
  - Modeling techniques
  - Additional considerations

Adjusting the URP Glidepath

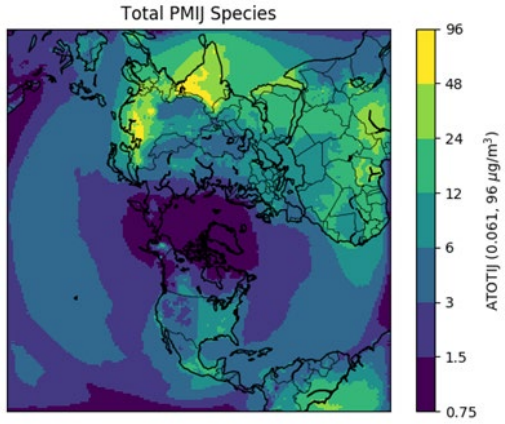


What Year To Model?

- Year selection for quantifying international visibility impacts
  - International emissions and trends, especially outside North America, are uncertain
    - Recommend modeling "recent" year or if high quality projected emissions are available, 2028
      - "Recent year" may depend on available data
        - Most common recent modeling for 2011, 2014, and 2016
      - 2028 international emissions trends may be uncertain, especially for some source sectors and regions
    - Recommend "iterative" process of updating the international emissions and adjustment in each subsequent regional haze implementation period

Modeling International Adjustment

- Tools to estimate impacts
  - Photochemical models
    - Global/hemispheric models
    - Regional models
  - Quantification of international impacts
    - Zero-out modeling
      - Simulations with and without international anthropogenic emissions
    - Source apportionment models
      - Tracking international anthropogenic impacts



Other Modeling Issues

- Consistency between global and regional models
  - Aim for consistency between global/hemispheric and regional model emissions, chemical species, and meteorology inputs
- Model performance evaluation of regional and global/hemispheric models
  - Important to evaluate both regional and global/hemispheric models
- Post-processing model results and calculating visibility impacts
  - Calculate PM concentration impacts on the observed 20% most impaired days at Class I areas
  - Convert concentration to extinction and then calculate delta deciviews
    - $\Delta dv = 10 \ln\left(bext_{\text{natural conditions}} + bext_{\text{international anthropogenic}}\right) / bext_{\text{natural conditions}}$
- Defining "international" vs. US emissions
  - Aircraft
  - Off-shore shipping
- Upcoming EPA regional haze modeling will help inform further details on the modeling and adjustment process

Updated EPA Regional Haze Modeling Summer 2019

- New 2016 based modeling platform with emissions projections to 2028, including sector-based source apportionment
  - 2028 projected deciviews and glidepath estimates
  - Estimate of international anthropogenic contributions
  - Model Improvements
    - New 2016 and 2028 emissions from the State/EPA platform collaborative
    - Regional model improvements
      - Updates to CAMx
      - Larger regional domain (including 36km outer domain)
    - Updated boundary conditions
      - Hemispheric CMAQ and/or GEOS-Chem
  - EPA will continue to work collaboratively with MJOs, states, and FLMs to make further emissions and modeling improvements

Contacts

gantt.brett@epa.gov
timin.brian@epa.gov