IMPROVE's roles in tracking changes in visibility and determining causal mechanisms for impairment for Class I areas*
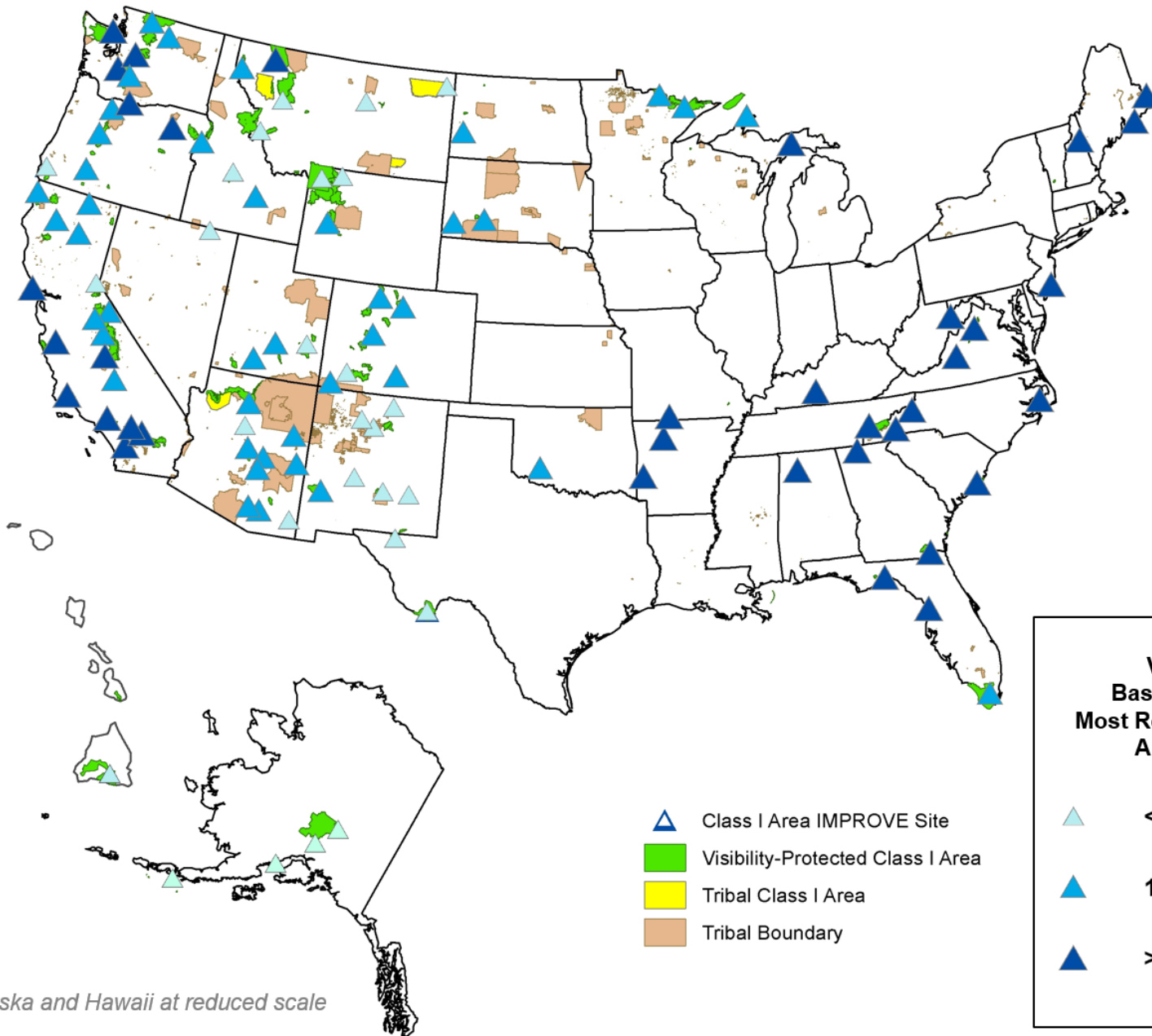
Regional Haze / Data Analysis session
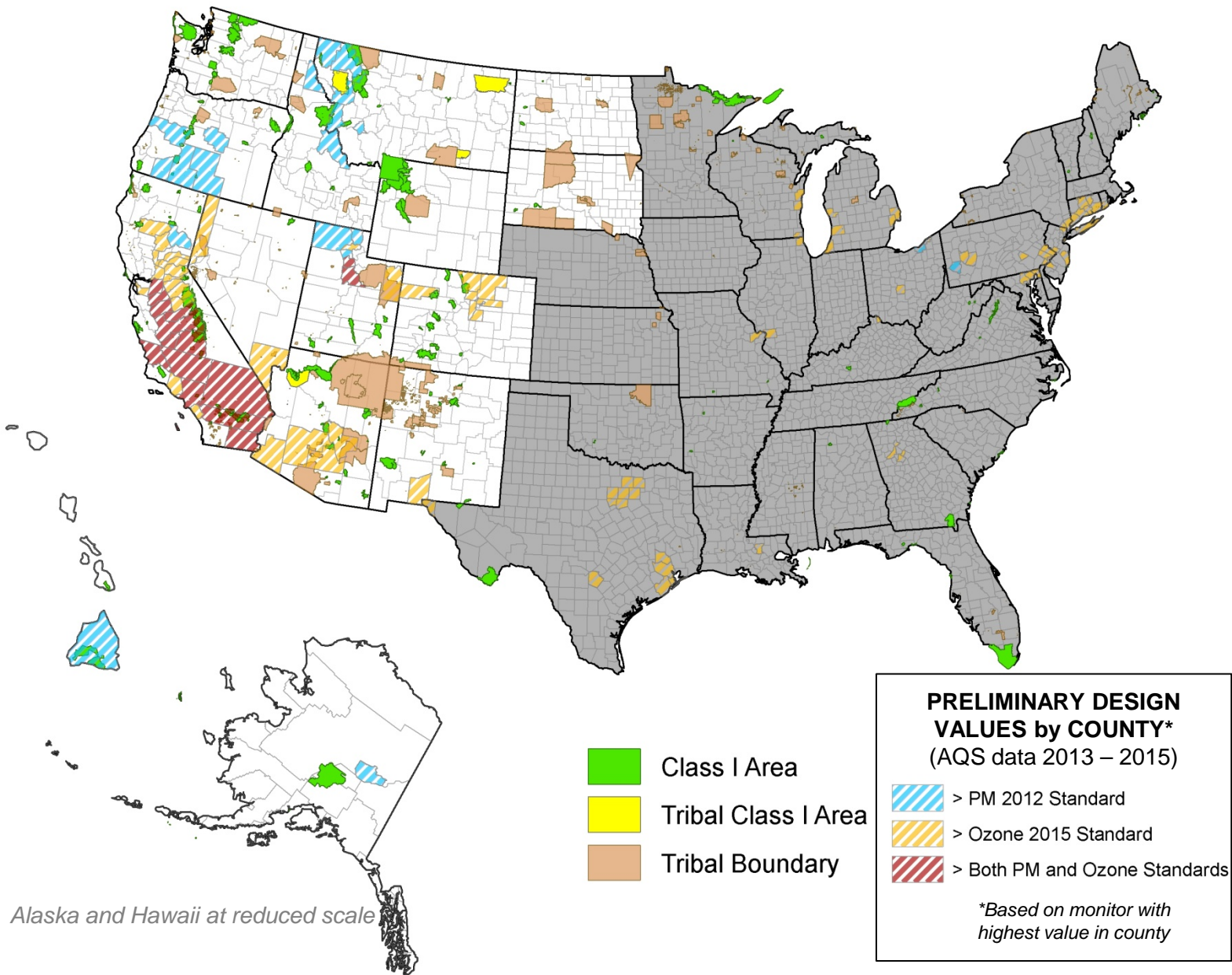
IMPROVE Meeting

Santa Fe, NM

Nov. 1, 2016

* terms selected from IMPROVE home page

Percent Change in
Visual Range (V.R.)
Baseline (2000 – 2004) vs.
Most Recent Years (2010 – 2014)
ALL SAMPLED DAYS

△ Class I Area IMPROVE Site

■ Visibility-Protected Class I Area

■ Tribal Class I Area

■ Tribal Boundary

△ < 10% improvement
(current V.R. 68-149 miles)

▲ 10-20% improvement
(current V.R. 53-165 miles)

▲ > 20% improvement
(current V.R 36-108 miles)

Alaska and Hawaii at reduced scale

2

**PRELIMINARY DESIGN
VALUES by COUNTY***
(AQS data 2013 – 2015)

> PM 2012 Standard
> Ozone 2015 Standard
> Both PM and Ozone Standards

*Based on monitor with
highest value in county*

Class I Area

Tribal Class I Area

Tribal Boundary

Alaska and Hawaii at reduced scale

Metrics - Tracking Progress to (the beautiful / dreaded) Natural Conditions (to be achieved)

- Unchanged for more than 30 years until 2016
- Visibility Impairment – Relative Contribution
  - Any <u>humanly perceptible change</u> in visibility (light extinction, visual range, contrast, coloration) from that which would have existed under natural conditions.
  - *So, not the impairment a visitor is actually experiencing*
- Natural background to be divided into 2 parts:
  - Routine – background natural haze levels that occur on most days of the year. The values are more consistent from year to year and result from a mix of natural sources including vegetation, long range transported smoke, "typical" wind blown dust, etc.
  - Episodic – Relatively infrequent natural haze events that add to the routine levels. Episodes generally differ in size, number and time of occurrence from year to year, e.g. smoke and dust events

B_{ext}
(Light
Extinction)

Anthropogenic

Natural Episodic

Natural Routine
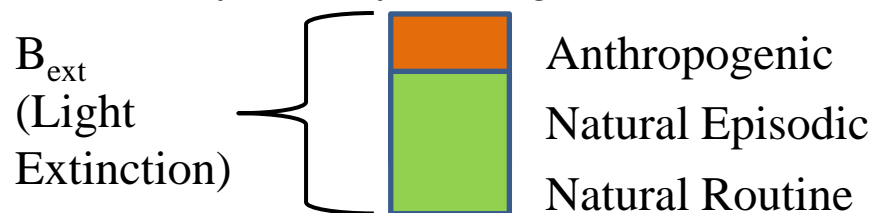
Most Impaired Days mostly eliminate summer days (wildfire, dust) Shift to fall-winter days (nitrate and sulfate)
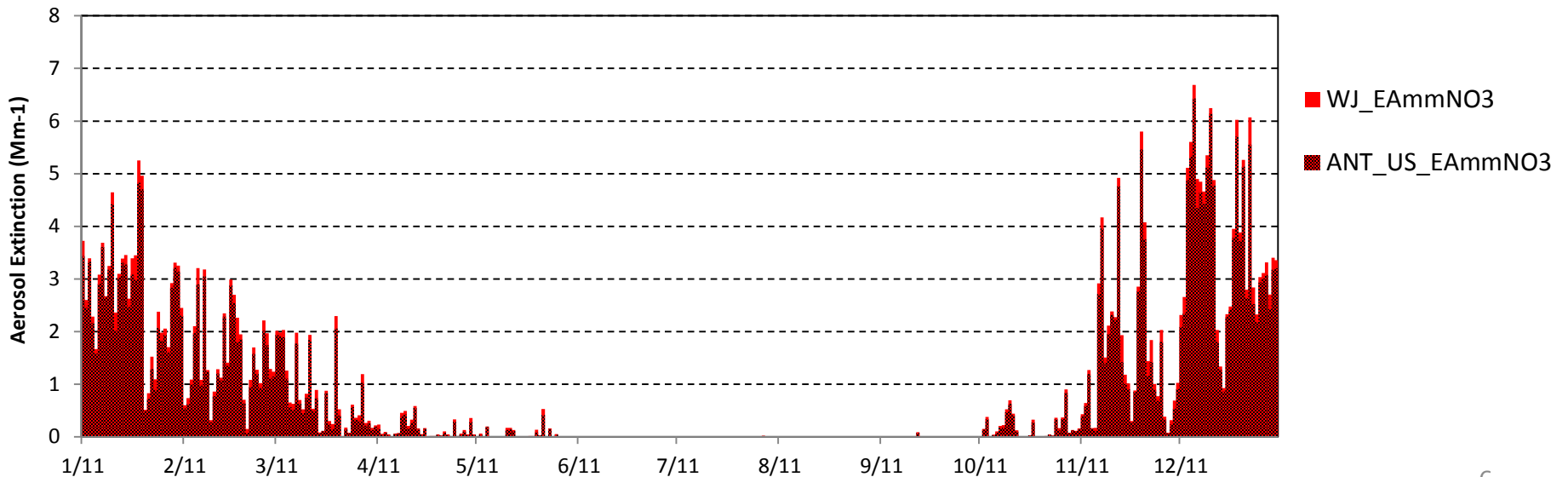

IMPROVE Measured Aerosol Extinction (MEVE1)
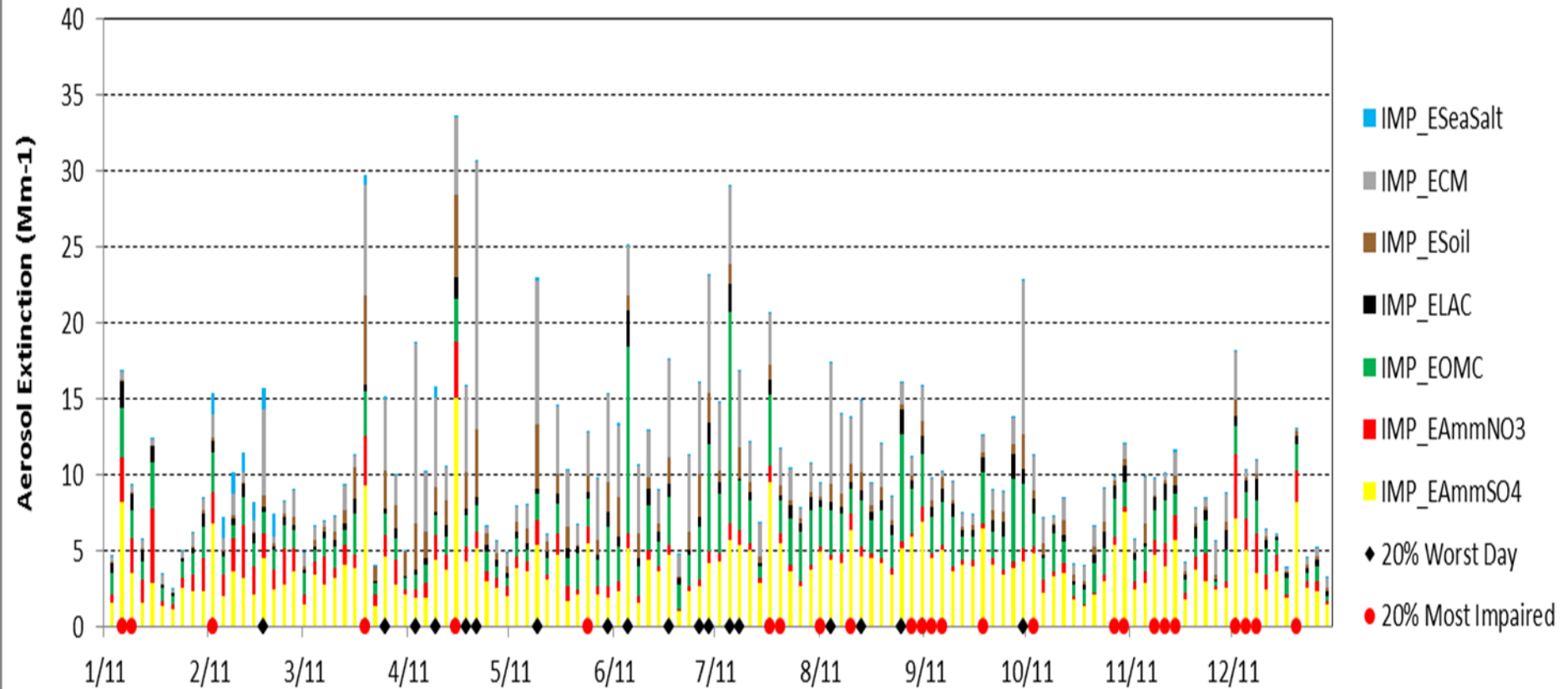
Black Diamonds indicate 20% Worst Visibility Days
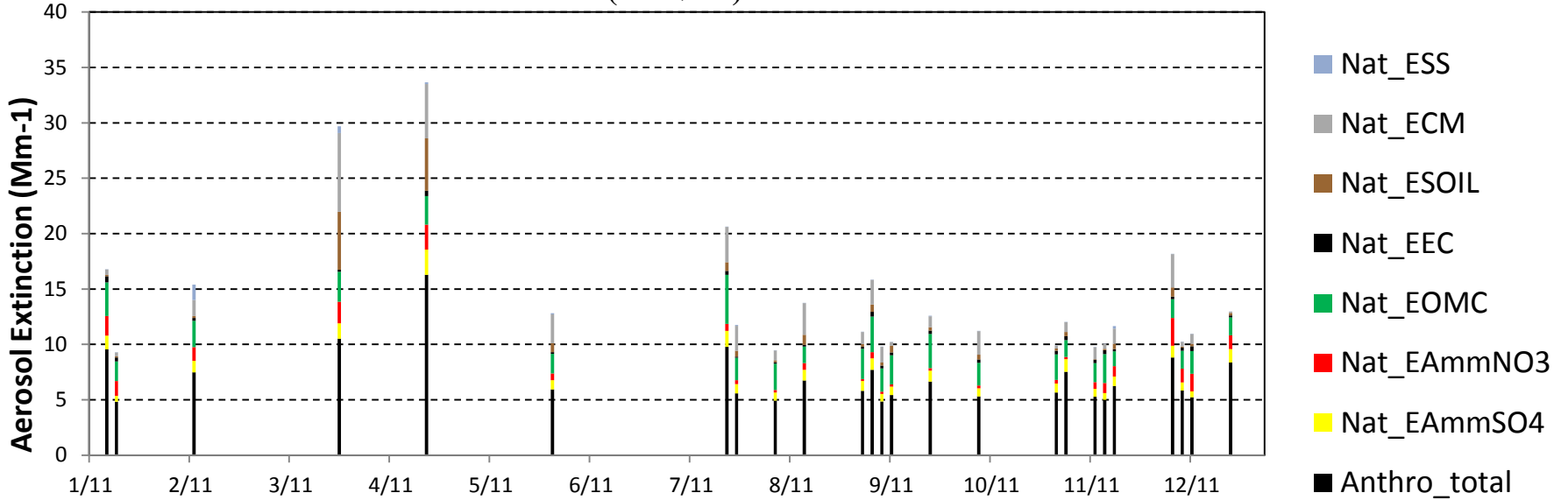Red Diamonds indicate 20% Most Impaired Days

Modeled Total AmmSO4 Extinction and Anthropogenic US Extinction (MEVE1)
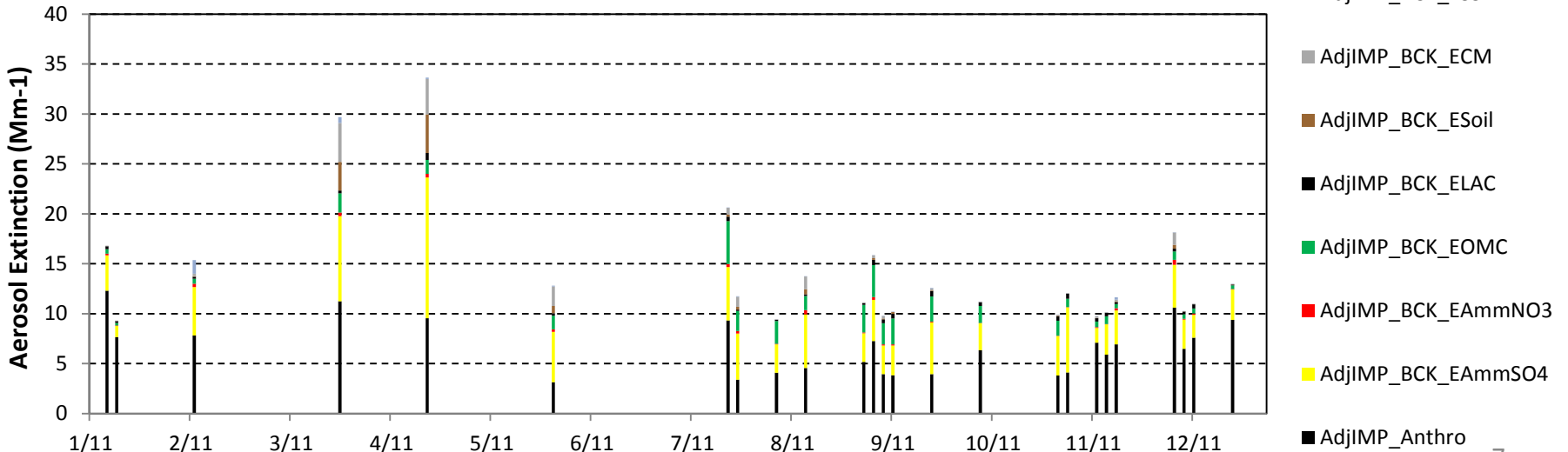

Legend: WJ_EAmmSO4, ANT_US_EAmmSO4
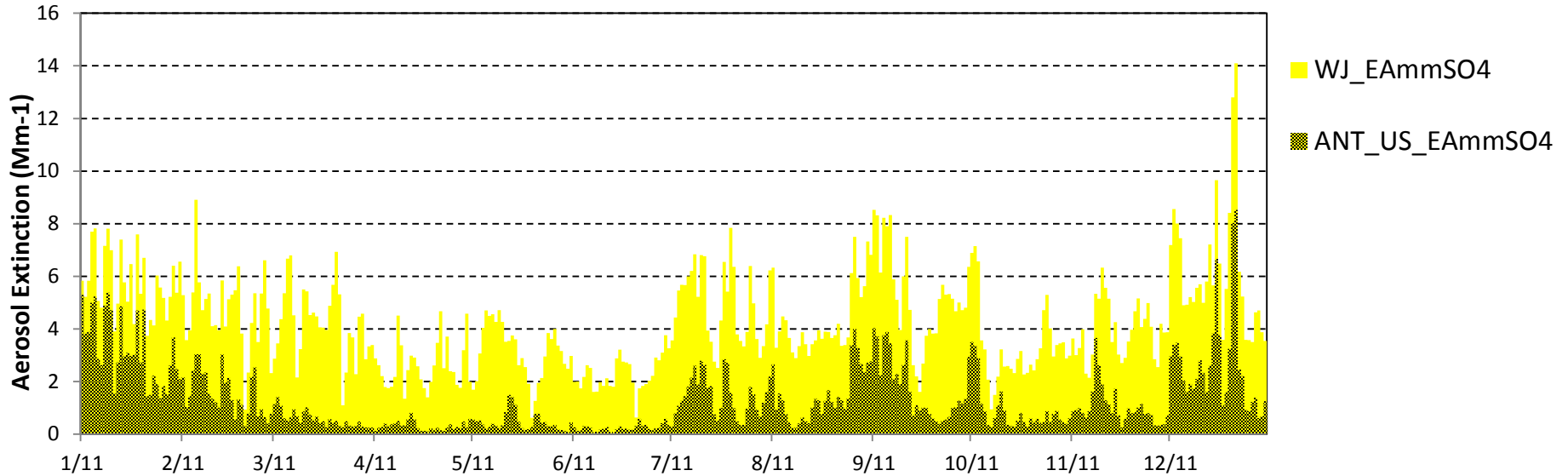
Modeled Total AmmNO3 Extinction and Anthropogenic US Extinction (MEVE1)

Legend: WJ_EAmmNO3, ANT_US_EAmmNO3

EPA's Natural vs. Anthropogenic Aerosol Extinction on 20% most impaired days (MEVE1)

Legend:
- Nat_ESS
- Nat_ECM
- Nat_ESOIL
- Nat_EEC
- Nat_EOMC
- Nat_EAmmNO3
- Nat_EAmmSO4
- Anthro_total

Apportioned Controllable vs. Uncontrollable Aerosol Extinction on 20% most impaired day (MEVE1)

Legend:
- AdjIMP_BCK_ESS
- AdjIMP_BCK_ECM
- AdjIMP_BCK_ESoil
- AdjIMP_BCK_ELAC
- AdjIMP_BCK_EOMC
- AdjIMP_BCK_EAmmNO3
- AdjIMP_BCK_EAmmSO4
- AdjIMP_Anthro

Source apportionment model results for Worst vs. Most Impaired quintiles

WAQS 2011 Extinction 20%W vs EPA 20% most impaired (MEVE1)
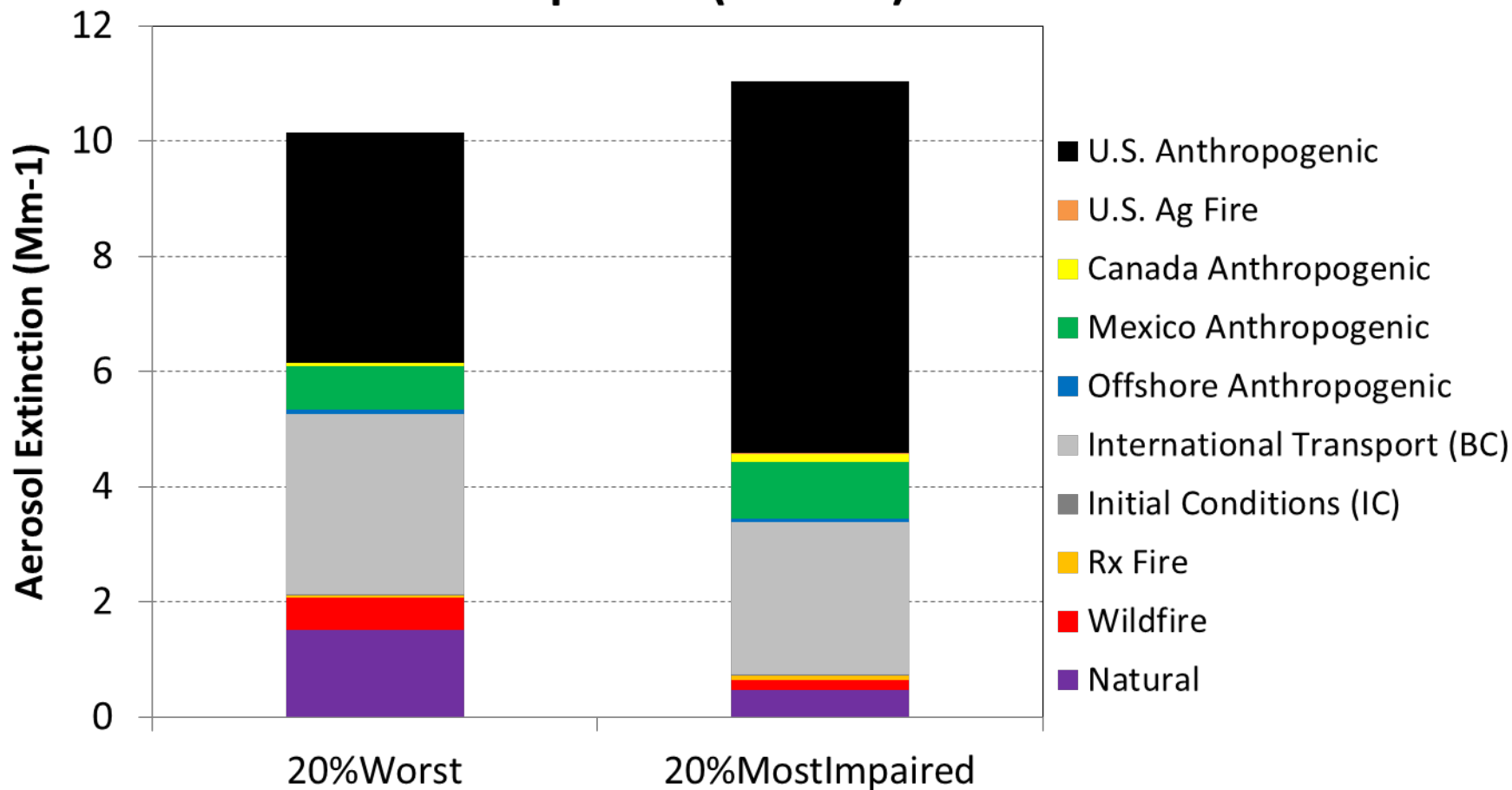
The IMPROVE program*:

- establishes current visibility and aerosol conditions in mandatory Class I areas;
- **identifies chemical species and emission sources responsible for existing man-made visibility impairment**;
- **documents long-term trends in visibility**; and
- provides regional haze monitoring representing all visibility-protected federal Class I areas, where practical.

* elements are from IMPROVE Program page, bold text for presentation

IMPROVE Reports since RHR

- [Spatial and Seasonal Patterns and Temporal Variability of Haze and its Constituents in the United States Report V: June 2011](#)

- [Spatial and Seasonal Patterns and Temporal Variability of Haze and its Constituents in the United States Report IV: November 2006](#)

- [Spatial and Seasonal Patterns and Temporal Variability of Haze and its Constituents in the United States Report III: May 2000](#)

Conclusions

- For regional haze planning, some needs are to:
  - Understand new metric in terms of (actual) source contributions as the IMPROVE data allows
    - Explaining it to stakeholders and the public
    - EPA's RHR guidance promised/es analysis help from IMPROVE
  - Determine if IMPROVE speciated monitoring trace at 110 sites is identifying any sources that states would not otherwise consider
  - Establish the 10ish-year future of the RH tracking network relative to new "improved" RHR
    - Technology
    - Network coverage and representativeness
  - Next IMPROVE report…
    - Pertinent for RH planning?