

Inter-RPO/FLM/EPA
Fire and Smoke Meeting
Austin, TX
Feb 9-10, 2005

VISTAS Presentation

Meeting Objectives

- Review scientific and technical approaches to develop fire emission inventories for RH and other SIPs
- Identify differences in approaches among RPOs and opportunities for collaboration
- Promote sharing of inventories for multi-RPO modeling
- Facilitate coordination with Federal Agencies (tools, policy, guidance)

Part I – Technical Approaches

- VISTAS has developed a protocol to use in CMAQ modeling for base and future year
- Want to share VISTAS approach
- Final modeling will be at end 2005 or beginning of 2006

2002 Emissions Inventory Review for Ag Burning, Prescribed Fires, Wildfires, and Land Clearing

- Activity Data
- Temporal and Spatial Quality
- QA/QC
- Fuel Assignments
- Fuel Loading
- Daily Emission Profile
- Plume Rise Approach
- EI Formats Available
- Modeling Issues

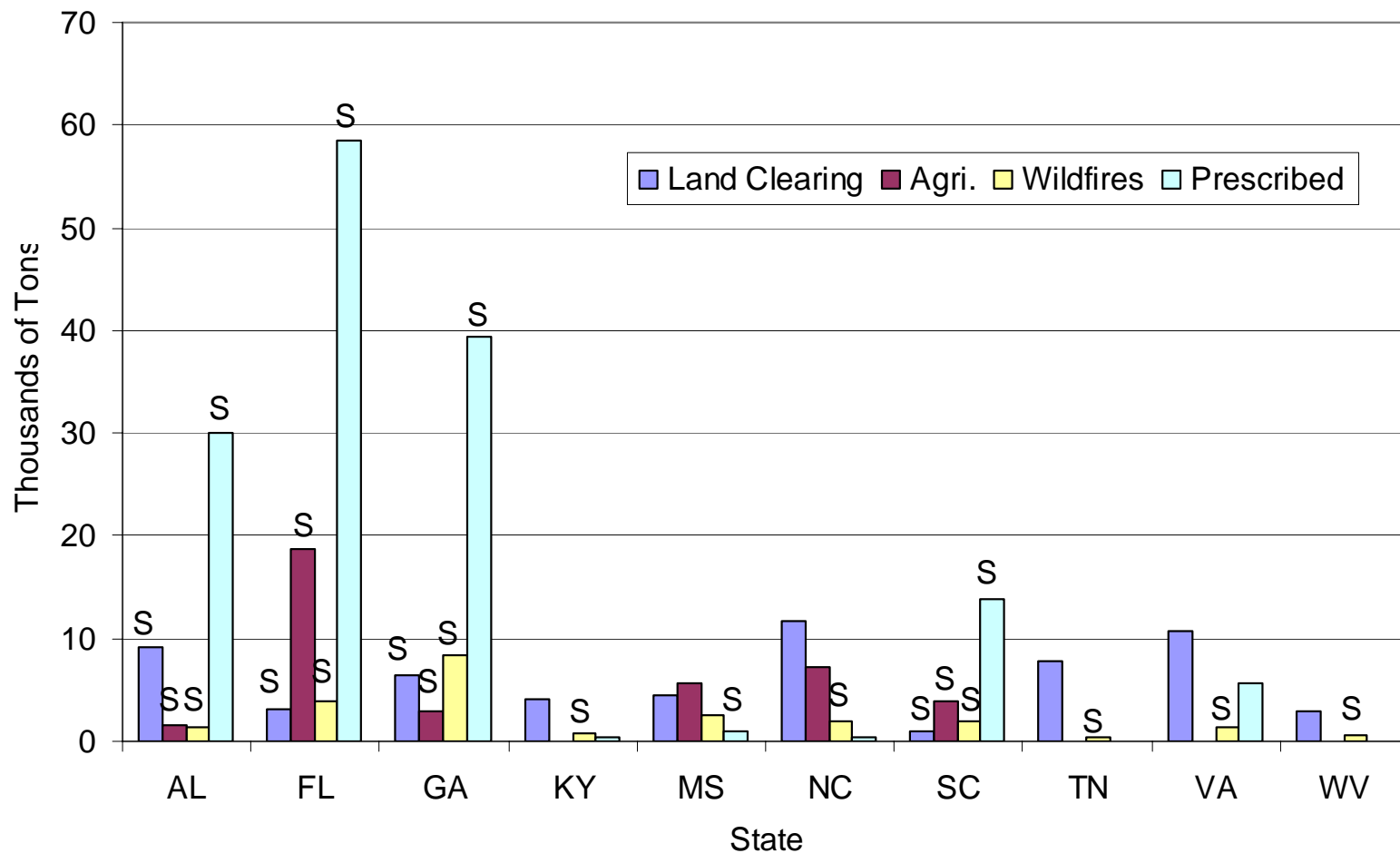
State Supplied 2002 Fire Activity Data

State	Agriculture	Prescribed/Silviculture	Land Clearing	Wildfires
AL	✓	✓	✓	✓
FL	✓	✓	✓	✓
GA	✓	✓	✓	✓
KY				✓
MS		✓		
NC				✓
SC	✓	✓	✓	✓
TN				✓
VA				✓
WV				✓

Federal Agency Supplied 2002 Fire Activity Data

Agency	Agriculture	Prescribed/ Silviculture	Land Clearing	Wildfires
USFS		✓		✓
FWS				✓
NPS				✓
BLM				✓
BIA				✓

2002 VISTAS PM2.5 Emissions from Fire Sources

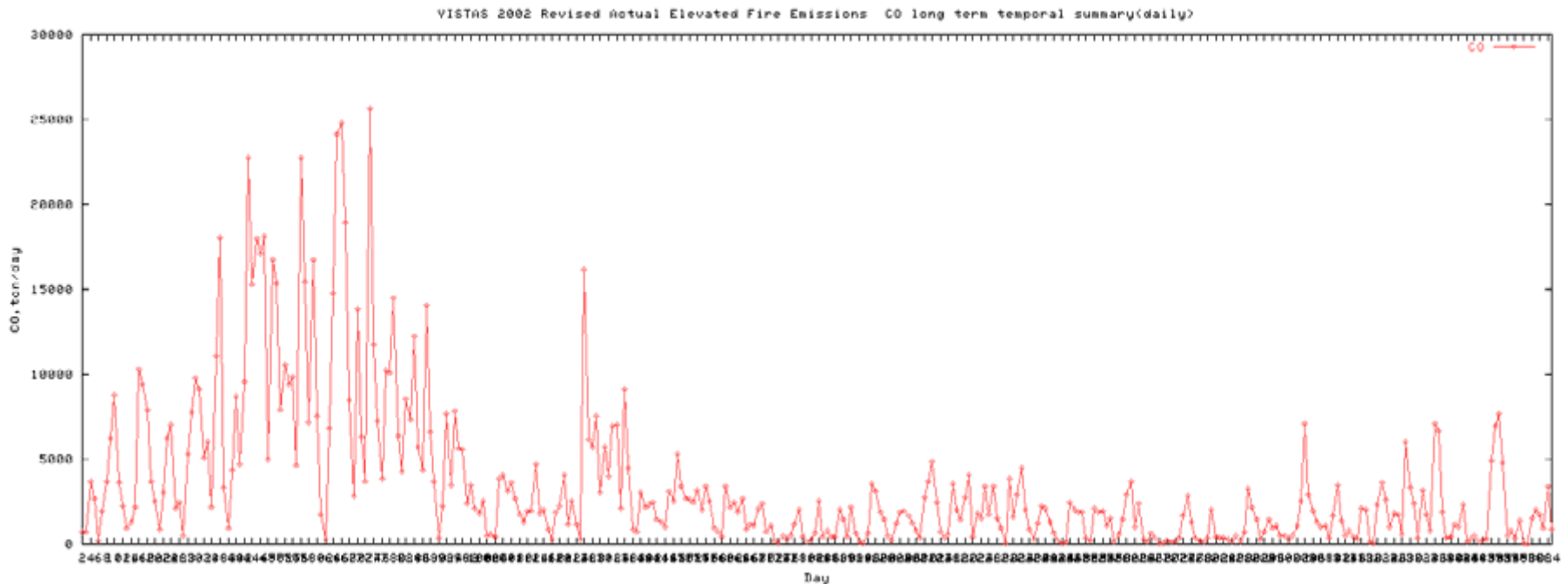


Temporal and spatial quality

- Issues:
 - No centralized guidelines/requirements
 - For fires recorded as acres burned per county on monthly basis, it is hard to track as “point source” because there’s no lat/lon data or date of incident
- Options:
 - Use satellite imagery or GIS to improve temporal/spatial distribution

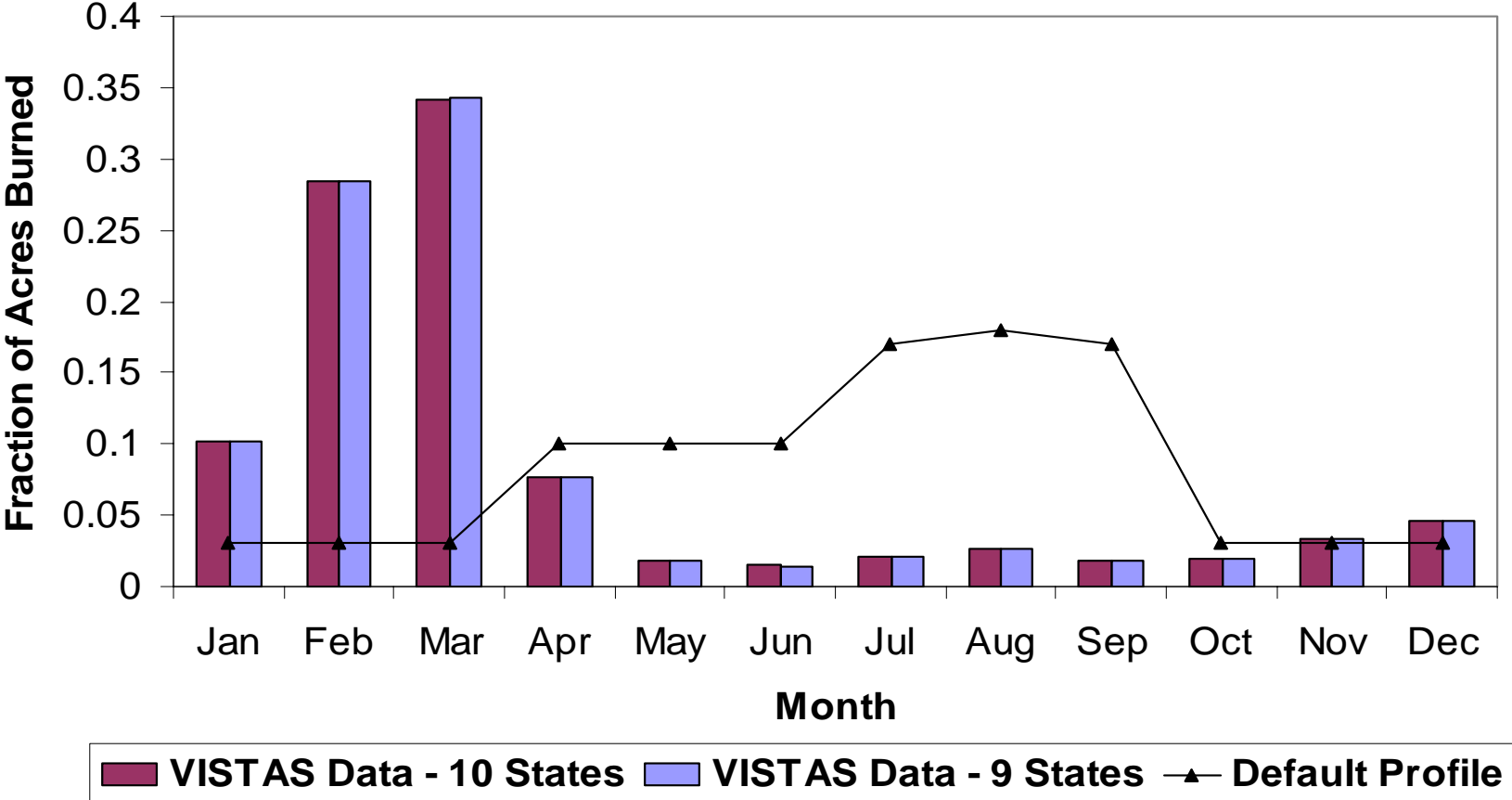
Elevated Fire Emissions

(Annual Temporal Plot of CO Emissions in VISTAS 12km)



Most Emissions from VISTAS Fires Occur in Spring

Comparison of VISTAS Rx Fire to Previously Used Temporal Profile

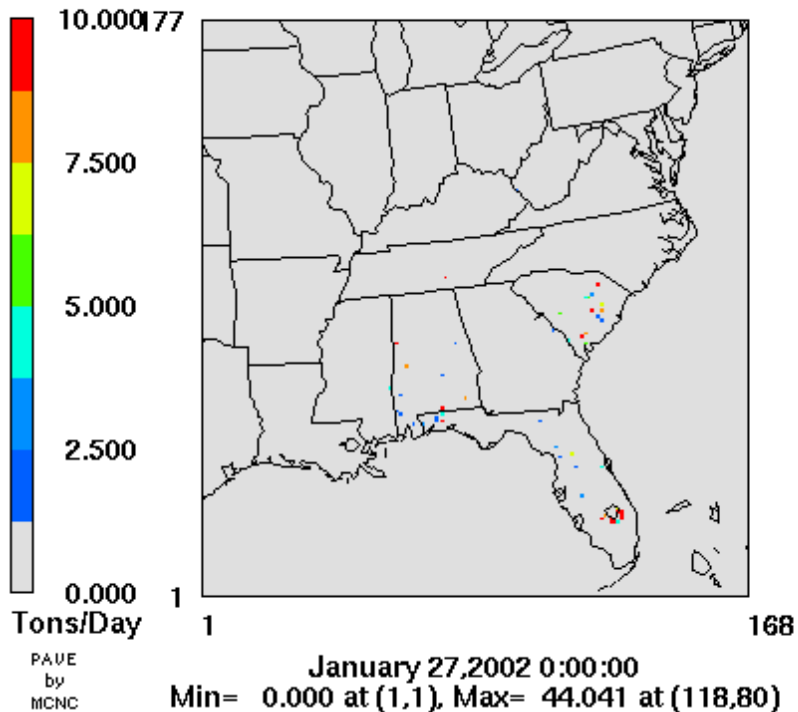


Elevated Fire Emissions

(Daily Spatial Plots of CO Emissions)

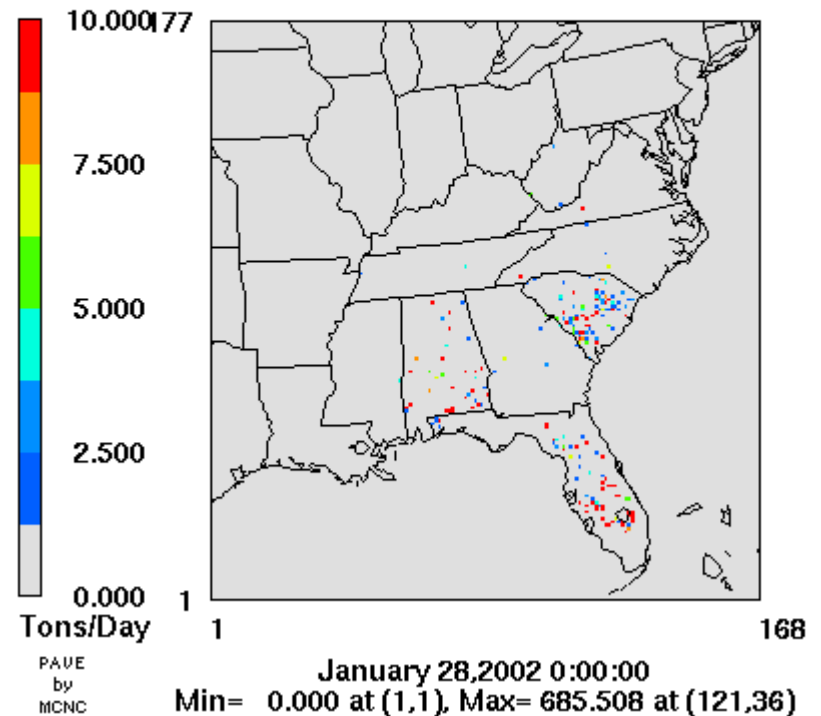
CO

VISTAS 2022 Revised Actual Elevated Fire Sources
12K Grid Vertical Total



CO

VISTAS 2022 Revised Actual Elevated Fire Sources
12K Grid Vertical Total

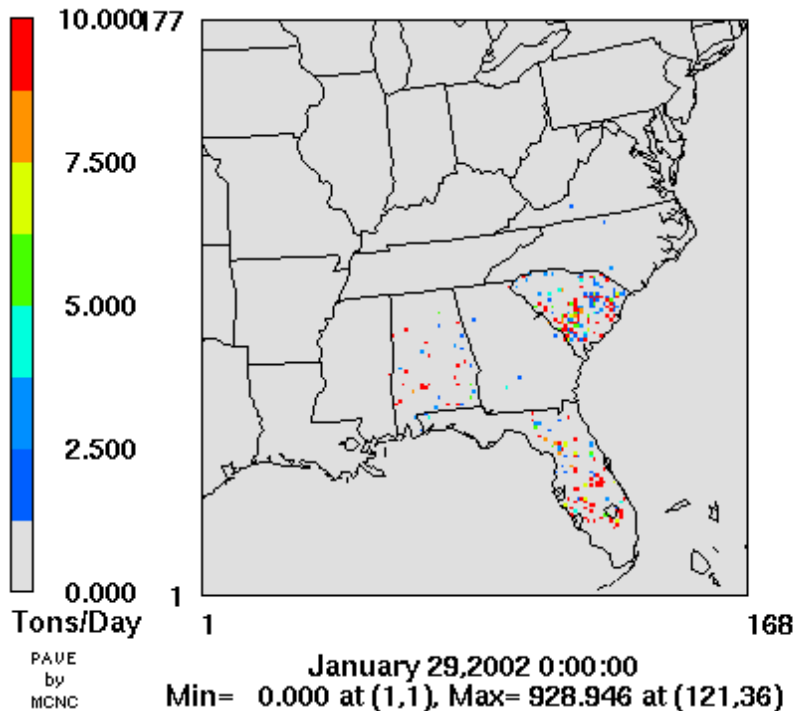


Elevated Fire Emissions

(Daily Spatial Plots of CO Emissions)

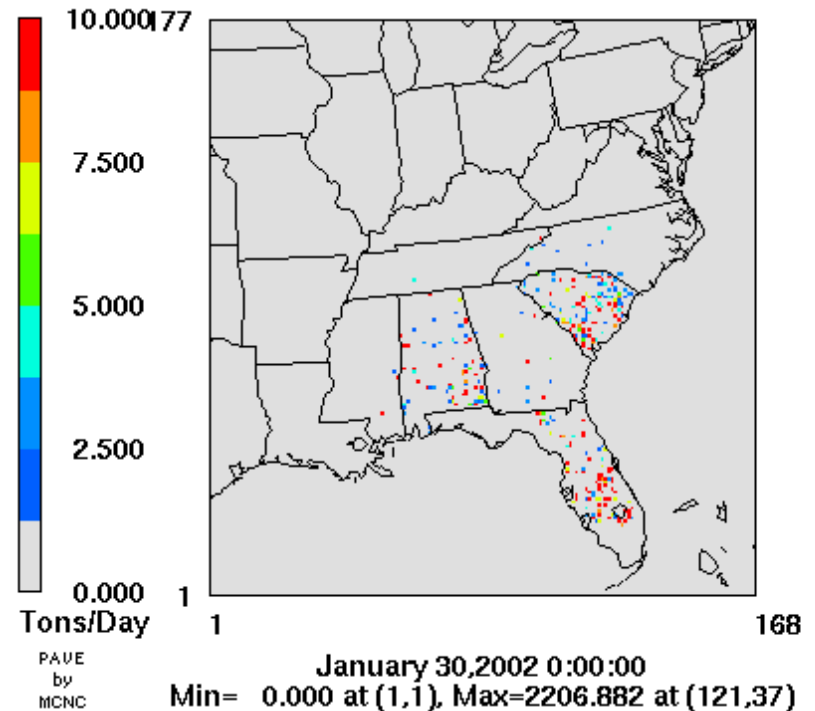
CO

VISTAS 2022 Revised Actual Elevated Fire Sources
12K Grid Vertical Total



CO

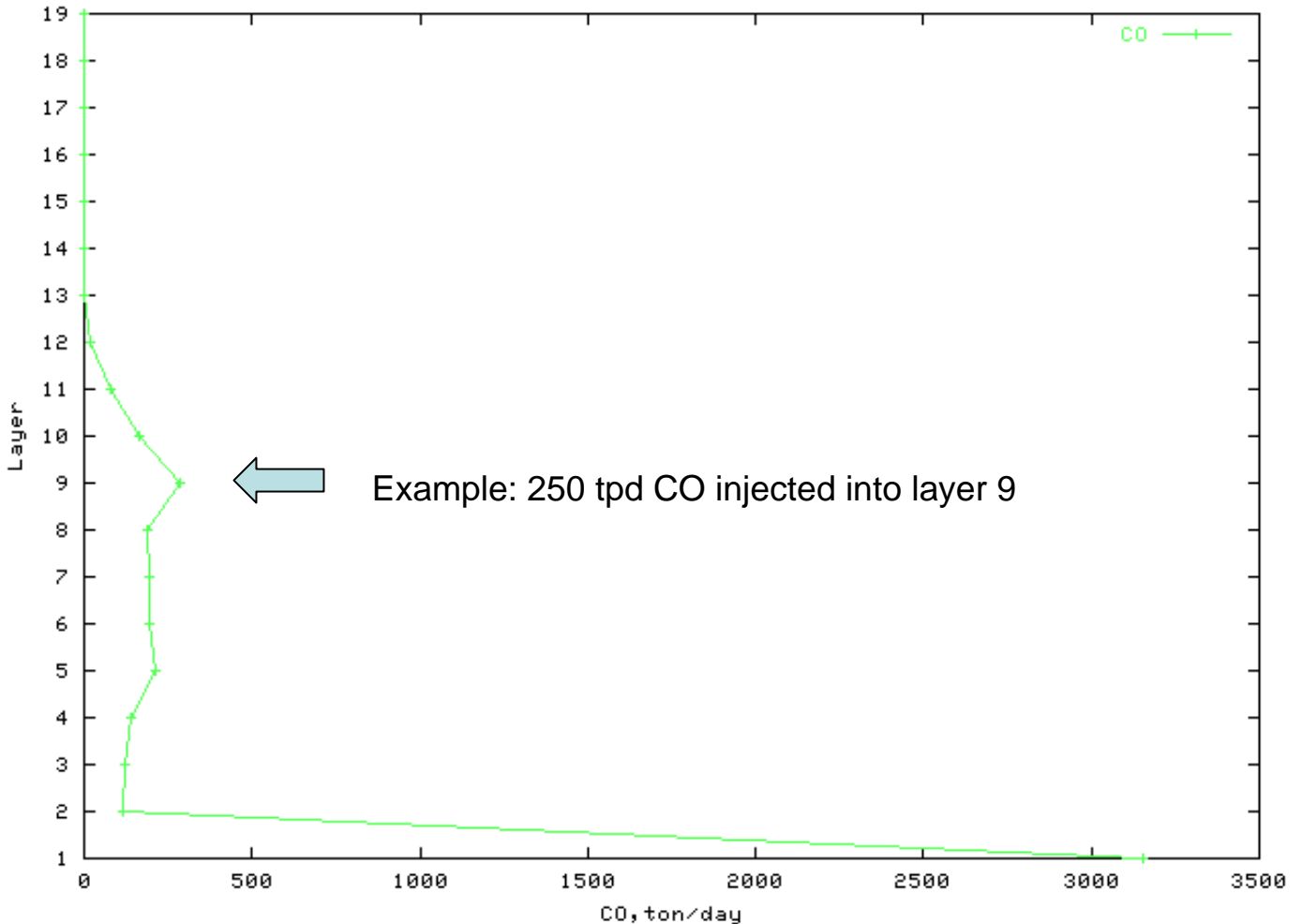
VISTAS 2022 Revised Actual Elevated Fire Sources
12K Grid Vertical Total



Elevated Fire Emissions

(Daily Vertical Layer Plots of CO Emissions)

VISTAS 2002 Revised Actual Elevated Fire Emissions CO vertical distribution



Indicates
layer in which
emissions are
injected

Example: 250 tpd CO injected into layer 9

QA/QC

- All emission data sets reviewed for proper format and content
 - Ensured appropriate structure for conversion
 - Verified all categories represented when expected
 - Reviewed for outlying data points
 - Removed double counting of incidents
- In cases where errors found, verified original data source and corrected or revised with appropriate value

QA/QC (cont.)

- Emission tables and charts developed for State-to-State comparisons
- County-level maps plotted to highlight “hot spots” and empty cells

Fuels Hierarchy

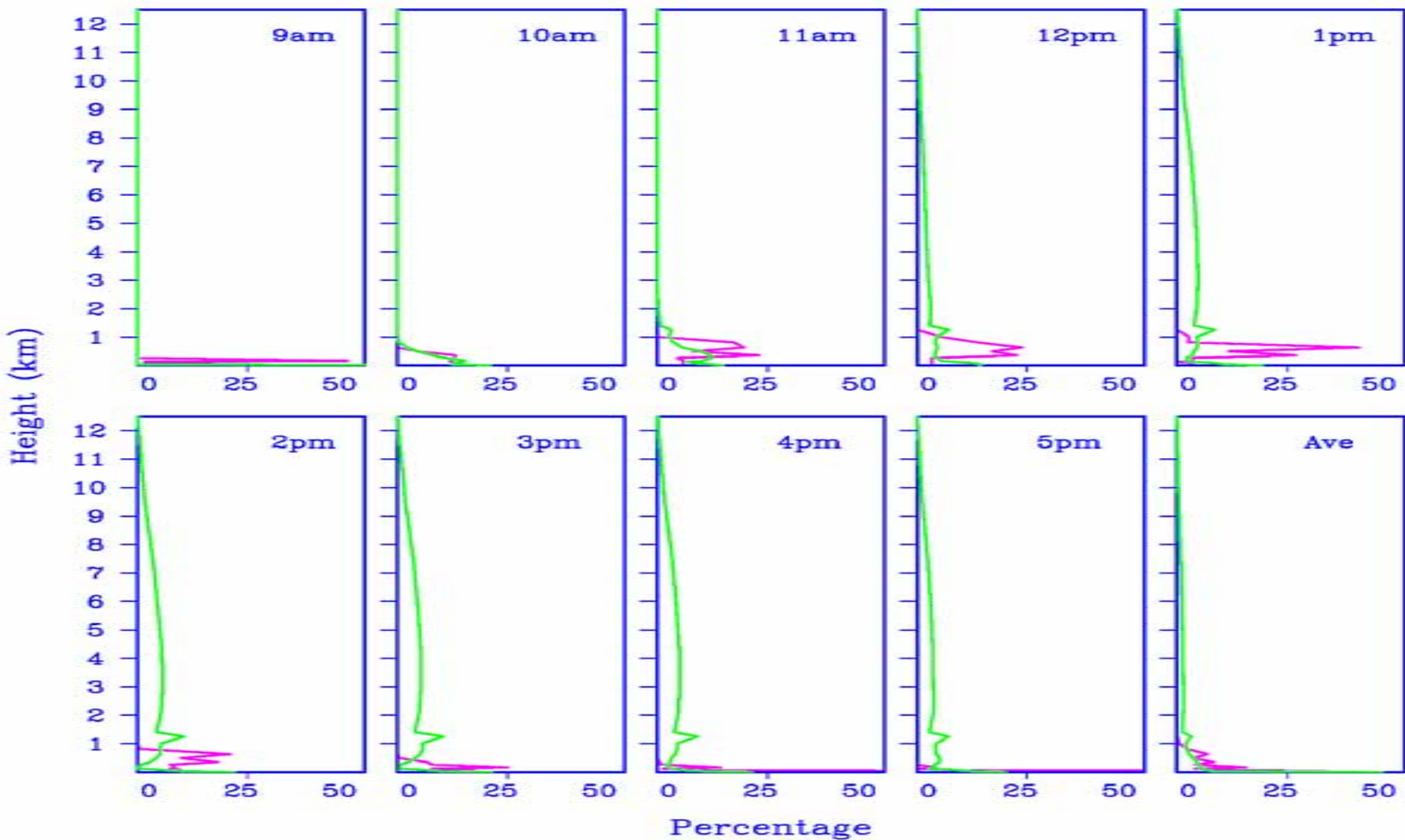
- State-supplied data
 - if provided, these values were always used
- Federal agency-supplied data
 - if provided, values were used. If federal record is redundant of state fire record, state data used.
- National Fire Danger Rating System (NFDRS) Model
 - The default values for the NFDRS fuel models were provided by Bruce Bayle, USFS Region 8
- Material burned type
 - a NFDRS value was assigned if the material burned could be easily matched to a NFDRS fuel model
- State specific defaults calculated
 - where no material burned type was provided
- AP-42 values
 - for fires other than wildfires or prescribed burns

Fire Plume Rise Algorithm

- Based on data generated from the Southern High-Resolution Modeling Consortium Coupled Prescribed Fire–Air Chemistry Modeling Framework [SHRMC-4S]
 - Daysmoke module of Framework
 - Dr. Gary Achtemeier & Staff
 - USDA Forest Service, Athens, GA
 - Presentation made to VISTAS on Sept. 1

Daysmoke as a Smoke Injector for CMAQ

- Plume time scale
 - plume changes during course of burn
- Vertical distribution
 - how high smoke goes,
 - which levels emissions are distributed,
 - how much smoke distributed at each level and when



Normalized vertical distribution of smoke particles estimated using Daysmoke (red) and Briggs scheme (green). (Average over all fires in FL on 3/6/2002)

Implementation of Profile

- “Average” profile developed based on single sounding in Florida during 2002 fire season
- Category 1 or 2 fires (<100 acres)
 - No change to plume rise calculation
- Category 3 fires “capped” at Daysmoke upper bound
 - Moved from 3,528 to 1,029 m (layer 16 to 11)
- Category 4 and 5 plumes reduced by same percentage from Briggs estimated height
 - Cat 4 from 5,095 to 1,488 m (layer 16 to 13)
 - Cat 5 from 6,351 to 1,854 m (layer 17 to 14)

EI Formats (Fires)

- Annual 2002 NIF 3.0 files
 - Includes agricultural, prescribed, land clearing and wildfire data
- Modeling files generated using more specific raw data
 - Includes acres, dates, and locations of fire activity
 - Generated elevated fire file for sources with appropriate data elements
 - Non-elevated sources retained in county-level area source file

Modeling Issues

- If fires did not meet requirement of elevated development (e.g., lat/lon, date)
 - Aggregated into area source file for low level modeling
 - Centroid and temporal profiles assigned
- Elevated fires converted to day specific inputs and processed as point sources

Modeling Issues (cont.)

- Township/Range/District Data
 - T/R/S data or models not readily available for VISTAS domain
 - Project sponsored to develop T/R/S centroids for AL/FL for purposes of spatially distributing fire activity provided on T/R/S level
 - Resulted in greatly improved fire siting

Part II – Typical Year, Baseline and 2018 Projection

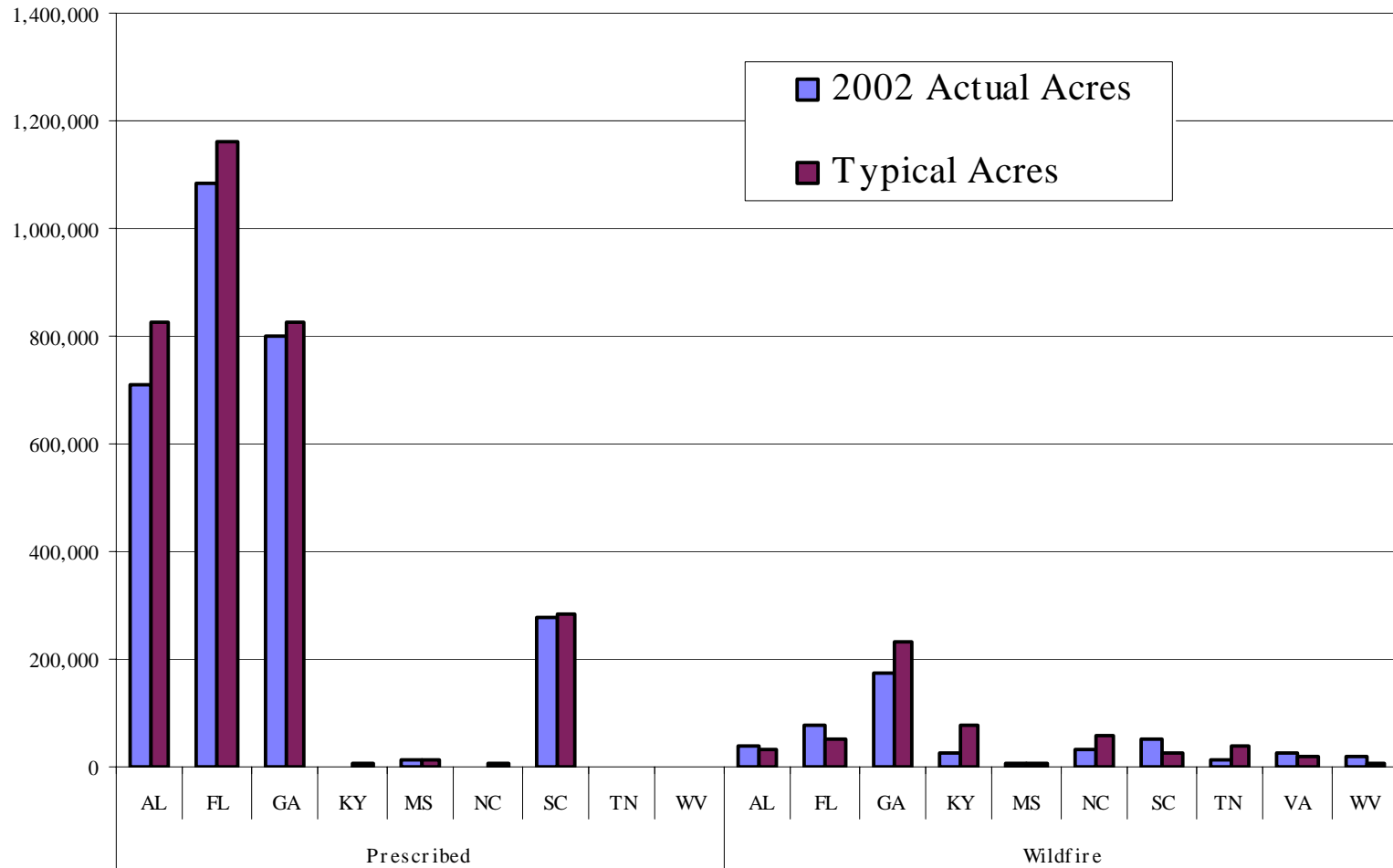
VISTAS Fire Emissions

- 2018 fire emissions based on “typical year” fire acreage
 - Acreage estimates collected from States and federal agencies for recent time periods representative of “typical” conditions or readily available
 - “Typical” based on a minimum of five years of data where possible
 - State or county level of aggregation for each fire type
- These data were then used to “normalize” the actual 2002 base year inventory to “typical” conditions
 - Wildfire acreage: 7 VISTAS States
 - Prescribed fire acreage: 6 VISTAS States
 - Average of State data used for non-reporting areas
 - North and South State tiers

VISTAS “Typical” Fire Emissions

- High/Low 5% dropped in normalization
- Only change in acres burned / emissions
- Spatial and temporal distribution retained
 - Prevented artificial change in haze/visibility attributed to unknown fire (particularly wildfire) activity

Prescribed and Wildfires Acres Burned (Actual vs. Typical)



Part III – Mexican and Canadian Fire Activity

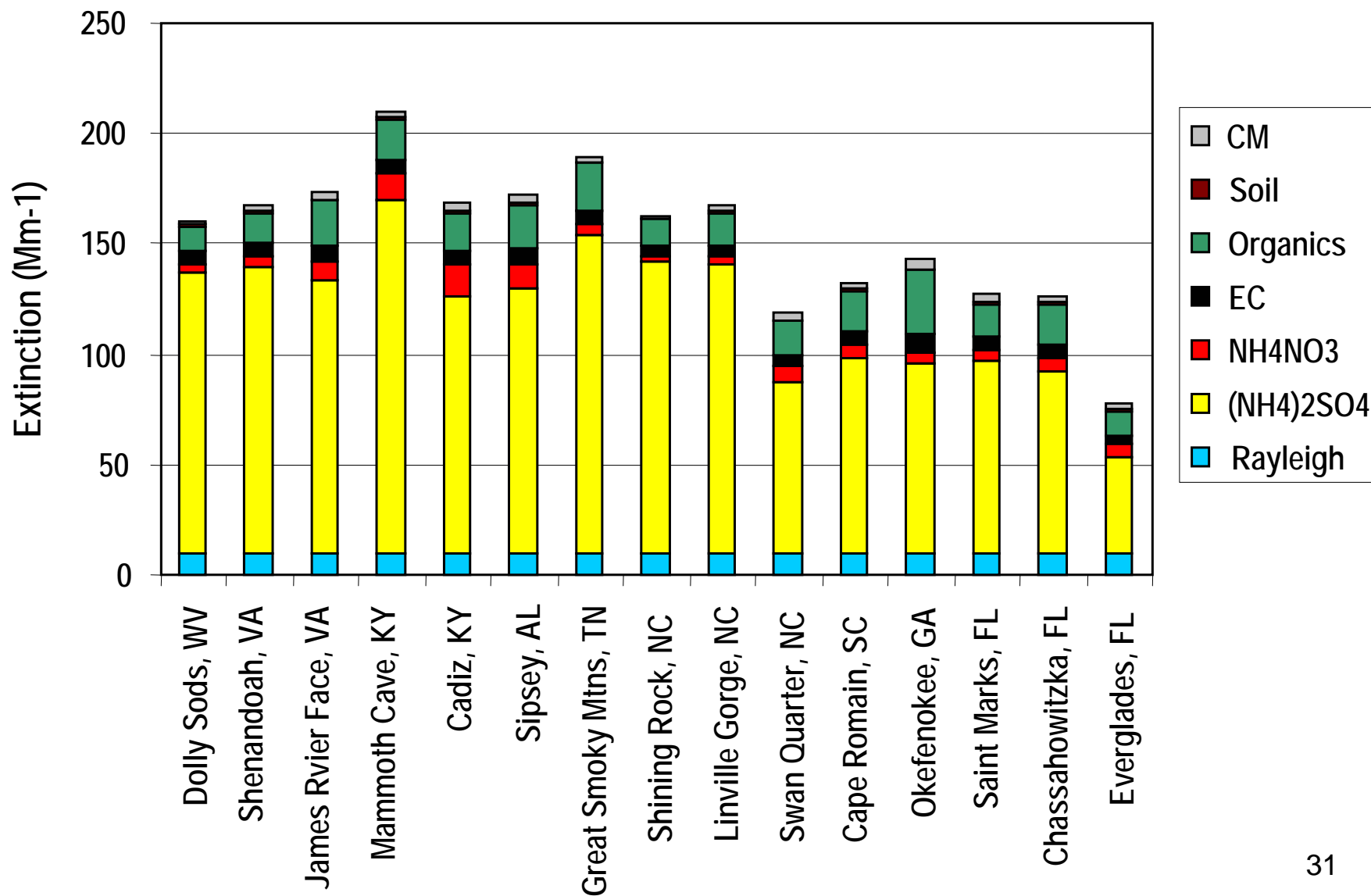
Canadian/Mexican Emissions

- Modeled as low level only; no elevated fire
- Data Sources
 - Canadian Criteria Air Contaminants (CAC)
 - Big Bend National Park Regional Aerosol and Visibility Observational (BRAVO)

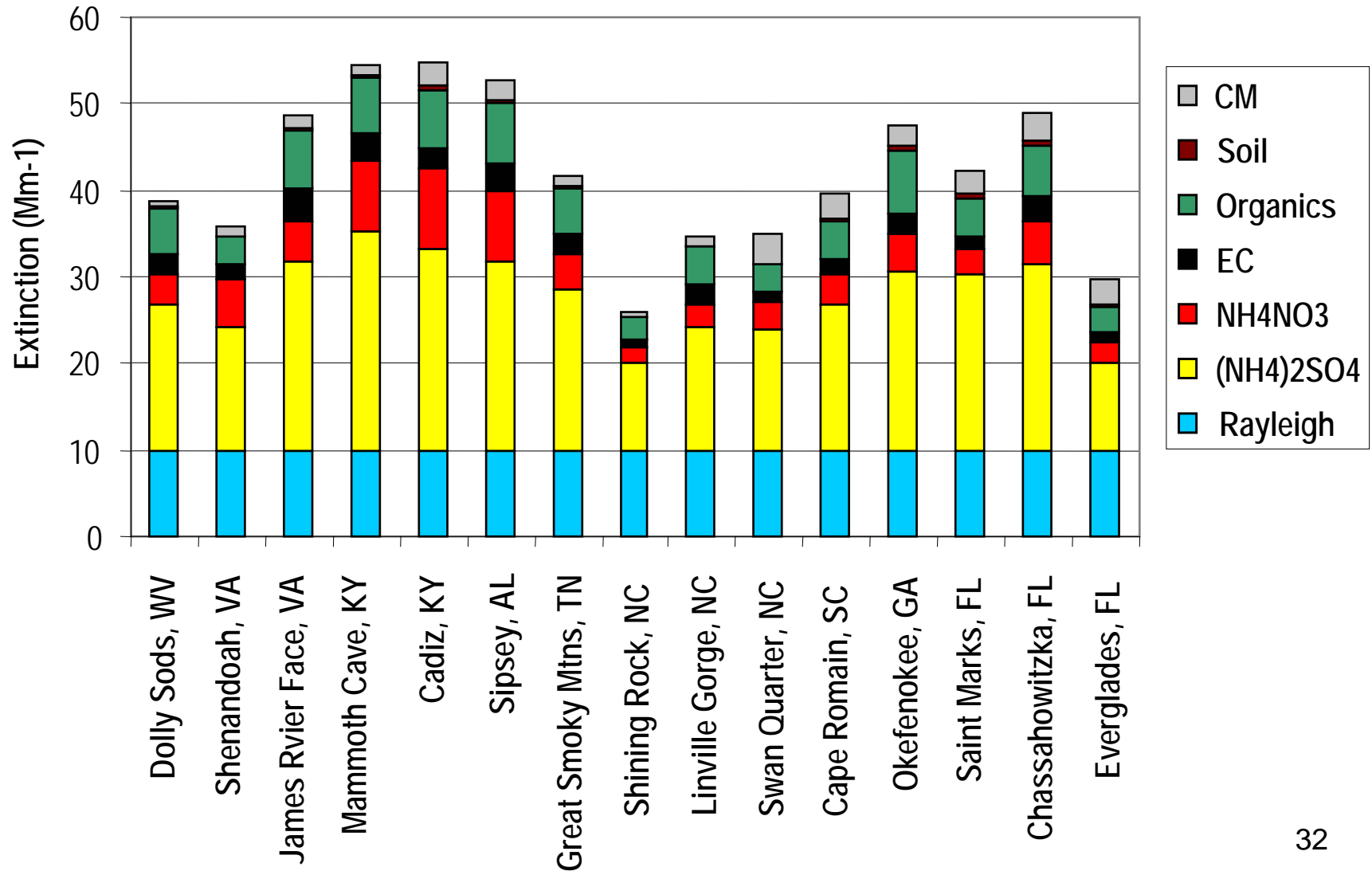
Part IV -- Preliminary Model Results and Haze Attribution

- Importance of fires vs SO₂
 - SO₂ is driving factor for extinction and poor visibility
 - EC contribution is low compared to anthropogenic SO₂
- Fires don't dominate 20% worst days

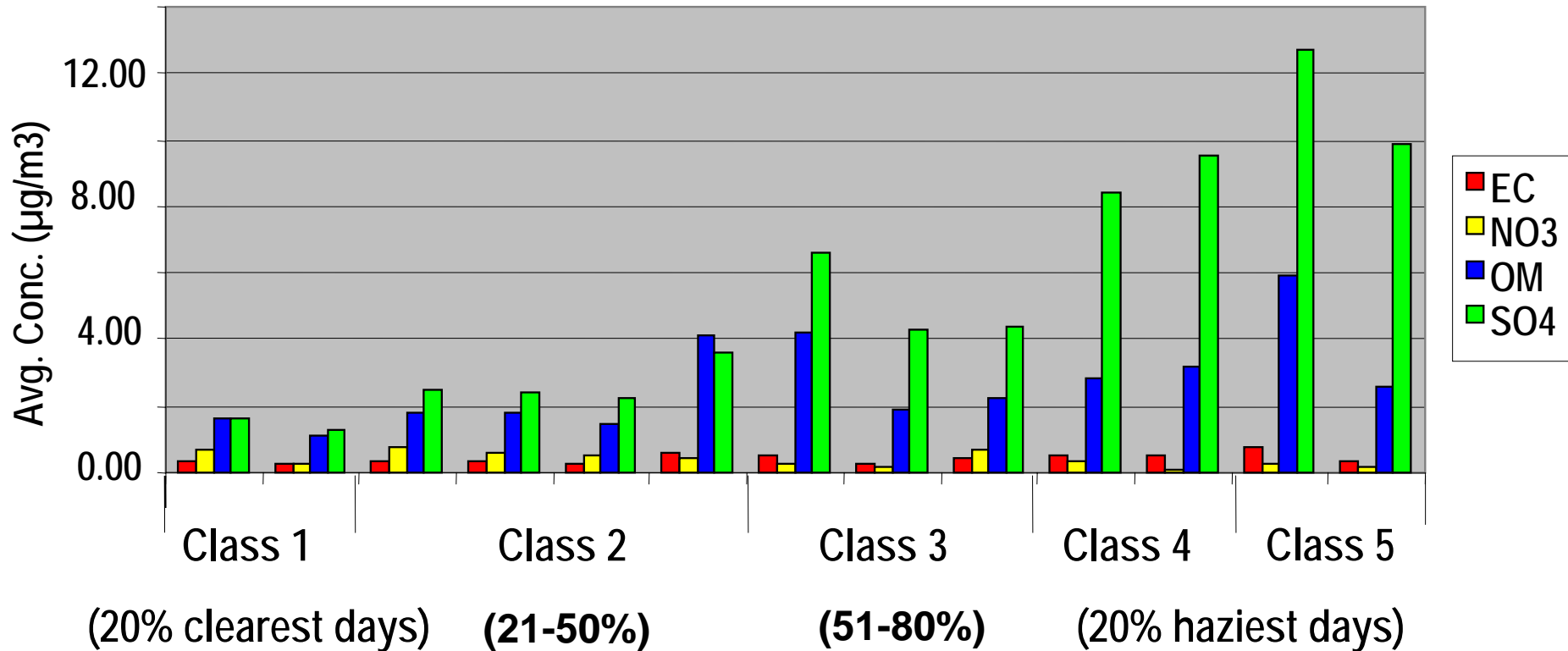
Light Extinction on 20% Poorest Visibility Days - IMPROVE 2000 - 2002



Light Extinction on 20% Best Visibility Days - IMPROVE 2000 - 2002



Average PM2.5 Components for Key Visibility Bins - Great Smoky Mtns., TN



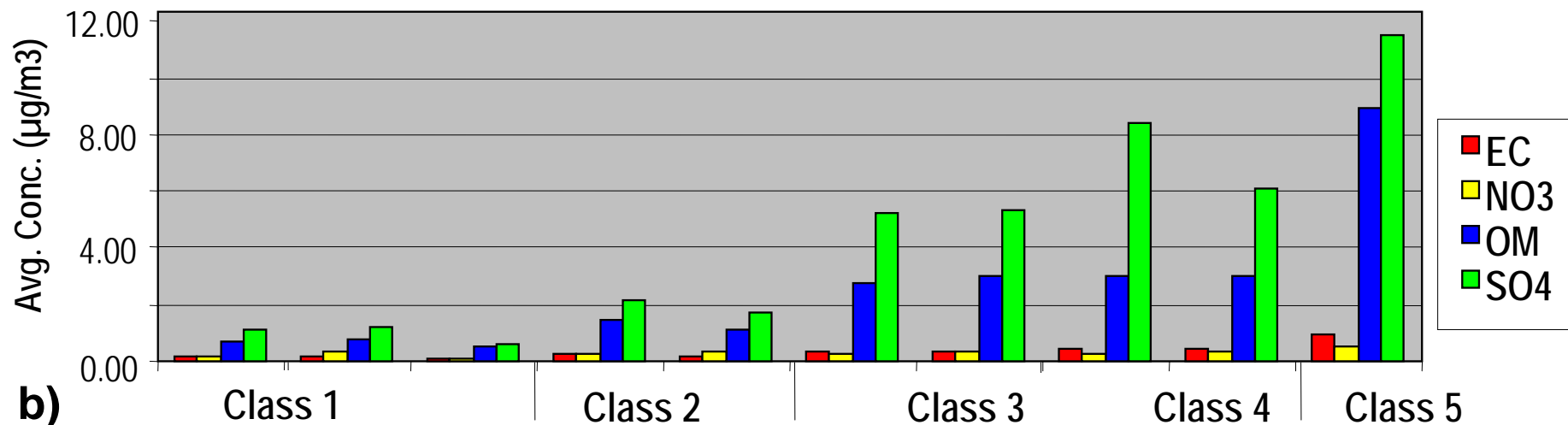
(Days ranked in bins and classes from clearest to haziest days)

Average PM2.5 Components for Key Visibility Bins -

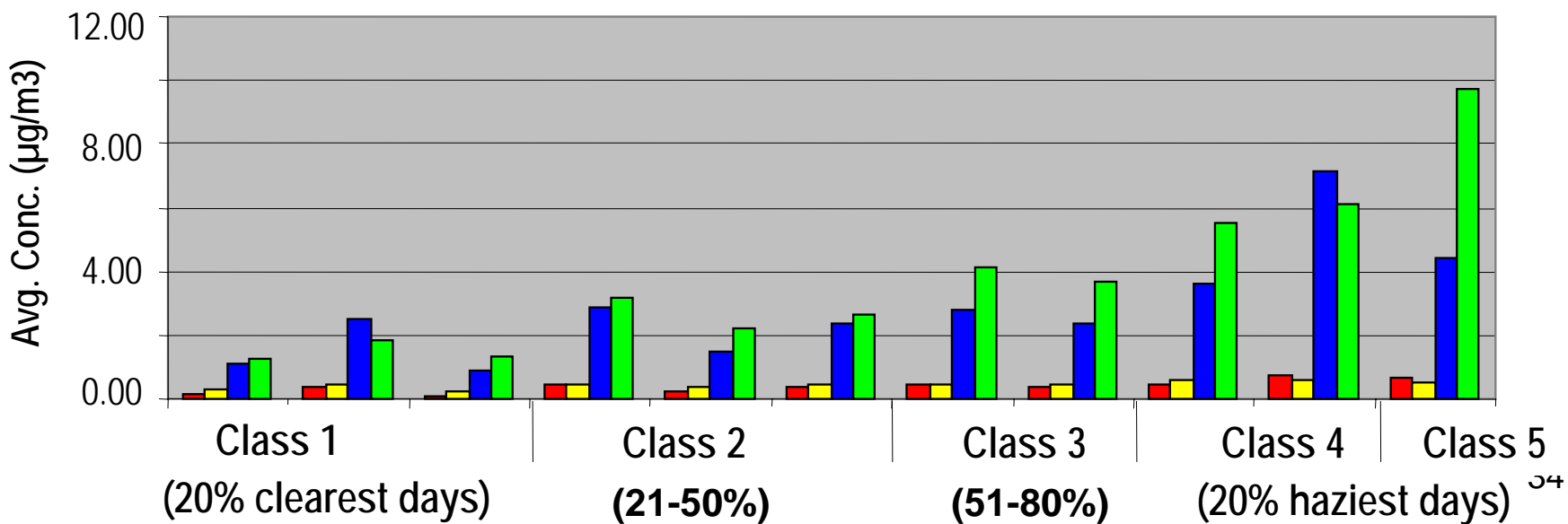
a) Shining Rock, NC

b) Cape Romain, SC

a)

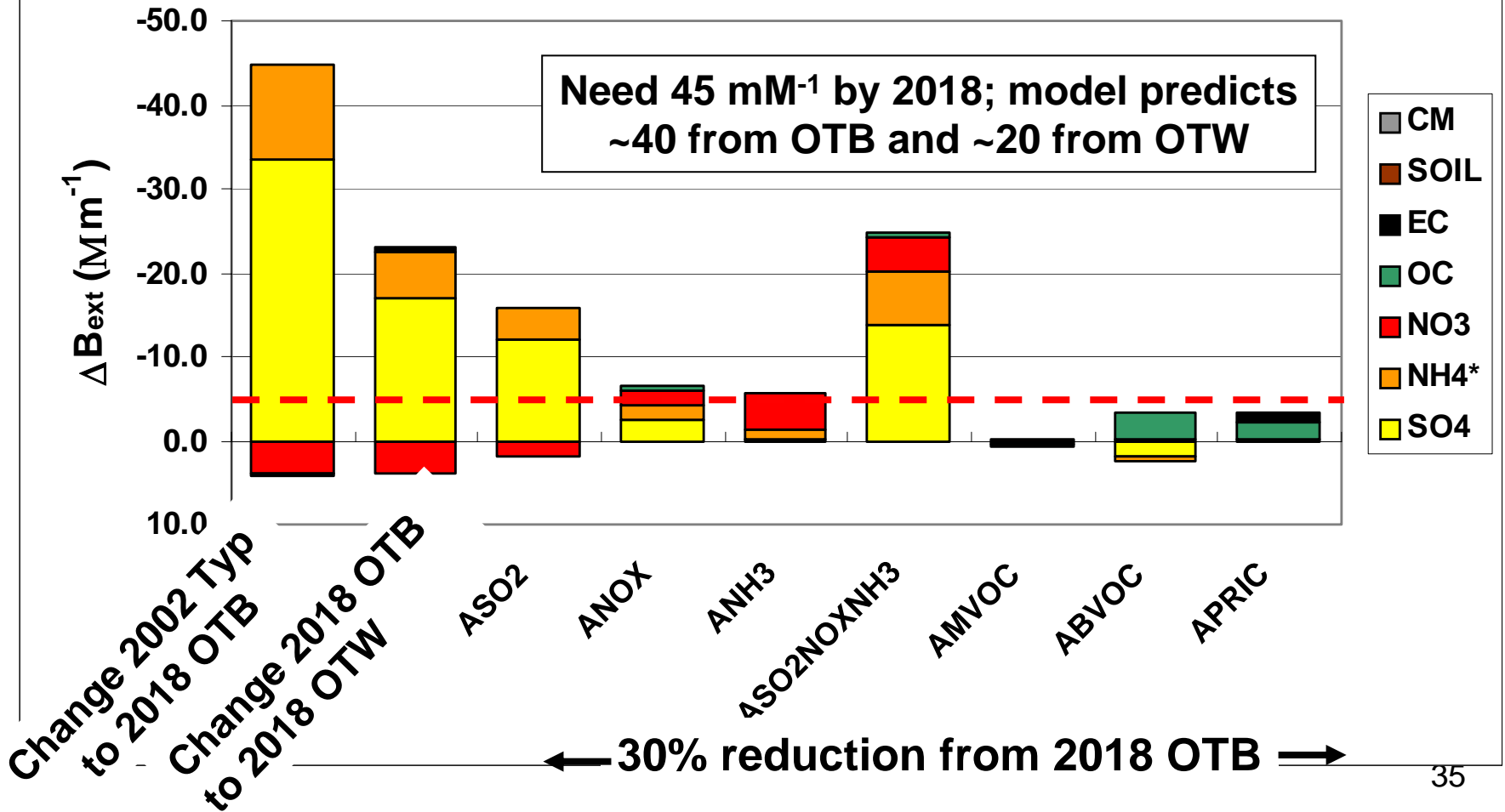


b)



Okefenokee (GA) – 4 days

Weighted B_{ext} Response at Site to Reductions in OTB Emissions: Worst 20%



Part V – Federal Guidance

Federal Guidance Needed

- Existing Policies – Don't have Smoke Mgt Plans in SE?
- Fire Tracking
- Smoke Management Programs Required – Need to coordinate with FS on planned prescribed burning plan for future years (2018); VISTAS will model 2018 with and without prescribed assumptions and based on the results could make recommendations
- VISTAS might not benefit in the short term, but hope to shed some light based on modeling results on accelerated schedule
- EPA requirements?
- Voluntary Smoke Management Programs – who has jurisdiction? State Dept of Ag/Forestry?
- Goals & Caps
- Land Clearing Burns/Open Burns

Policy Issues and Needs

- Legislative Deadlines – End of 2005
- RPO Schedules for Control Options
- Criteria for Implementation
- State/Tribe Role
- Solutions