

WRAP Fire Tools and Support for Smoke Management Programs, Land Managers, and Air Quality Planning in the Western U.S.

WRAP TOOLS

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DEASCO₃ project - purpose & goals

- **Assess fire's impact on elevated ozone episodes with retrospective studies in the West and Southeastern U.S., using empirical and photochemical modeling analyses**
- **Studies of fire and ozone in 2002 through 2008**
- **Outcomes**
 - Support future collaborative FLM-state ozone air quality planning
 - Develop “lessons learned”, basic analysis rules for fire-ozone episodes, and online tools for FLM-state air quality planning
 - Through the WRAP Fire Emissions Tracking System ([FETS](#)), prepare and implement planning-grade fire emissions inventories in the FETS suitable for SIP work by states and FLMs
 - Publish data and analysis results in transparent and reproducible formats

Ozone and PM Fire Impacts

Deterministic and Empirical Assessment of Smoke's Contribution to Ozone ([DEASCO3](#))

Project Period: late 2011 to mid-2013

Activities

- Analysis of complex relationship between fires and elevated Ozone
- Describe how fires contribute to ambient Ozone concentrations
- National emission inventory development for wildland and agricultural fires in 2002-08
- Photochemical grid modeling with fire emissions source apportionment

Deliverables

- Online tool for FLMs & states to access results
- Collaborative review and analysis by NPS and USFS air program staff
- Documentation and summary reports of methods and results
- Evaluation of contributions to Ozone NAAQS violations and exceptional events

Particulate Matter Deterministic & Empirical Tagging & Assessment of Impacts on Levels ([PMDETAIL](#))

Project Period: late 2012 to early 2016

Activities

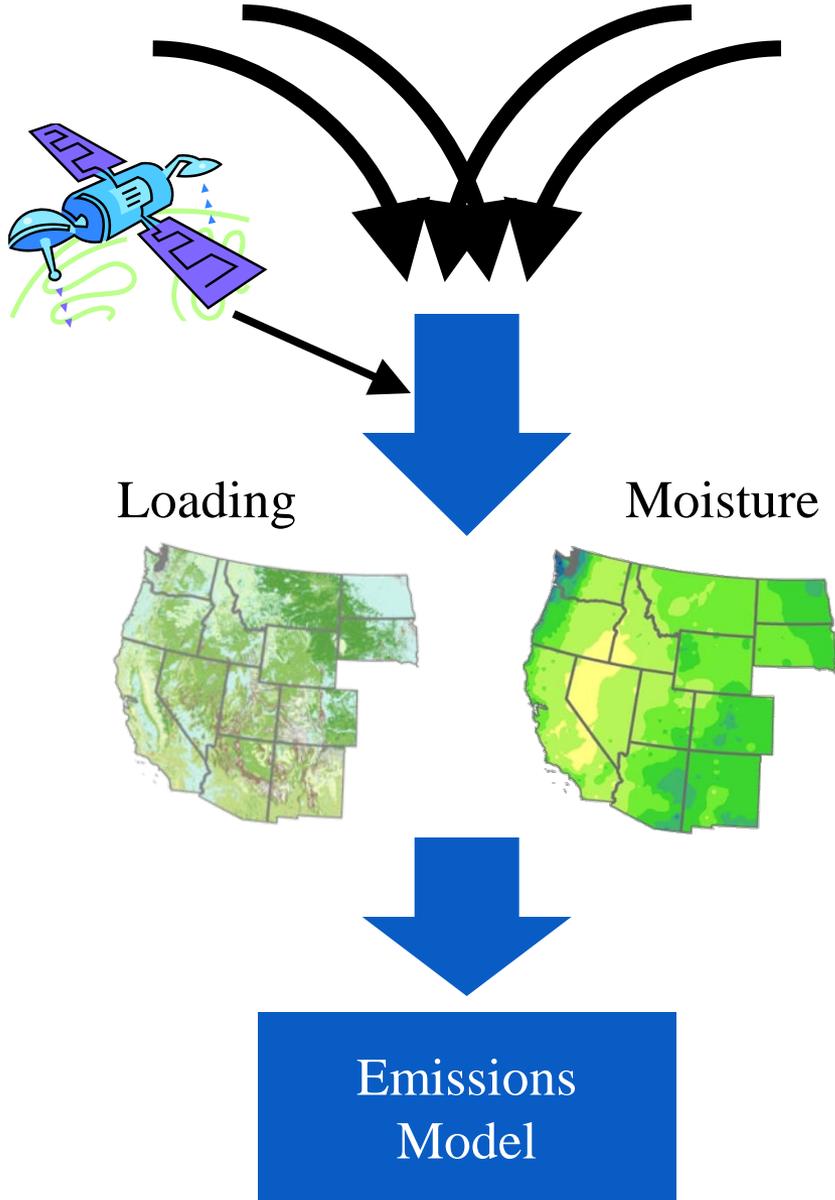
- Analysis of complex relationship between fires and elevated PM
- Describe how fires contribute to ambient PM concentrations
- National emission inventory development for wildland and agricultural fire for 2002-08-11
- Uses special additional emission inventory methods and ambient filter-based markers to track secondary organic aerosol formation and fire contributions to monitored PM
- Photochemical grid modeling with fire emissions source apportionment

Deliverables

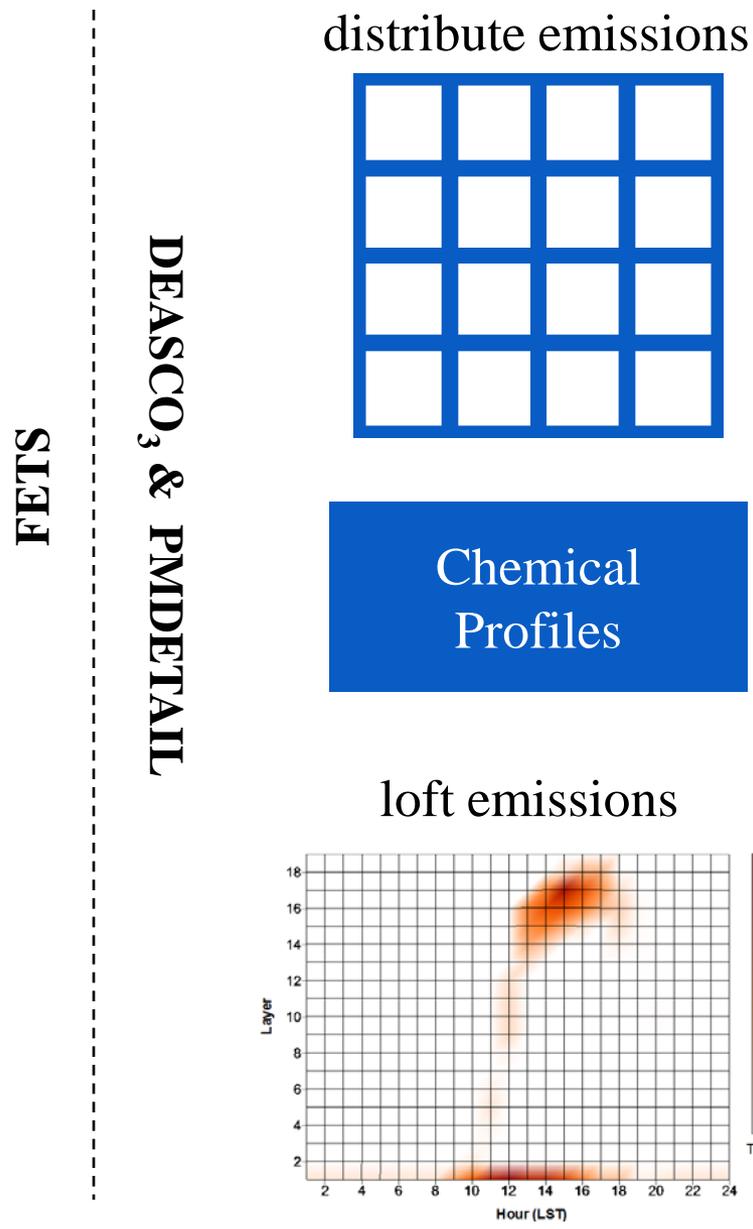
- Online tool for FLMs and states to access results
- Collaborative review and analysis by NPS and USFS air program staff
- Carnegie-Mellon and Colorado State Universities' experts on air quality monitoring and modeling added to team
- Documentation and summary reports of methods / results
- Evaluation of contributions to PM NAAQS violations and exceptional events

Track activity and emissions

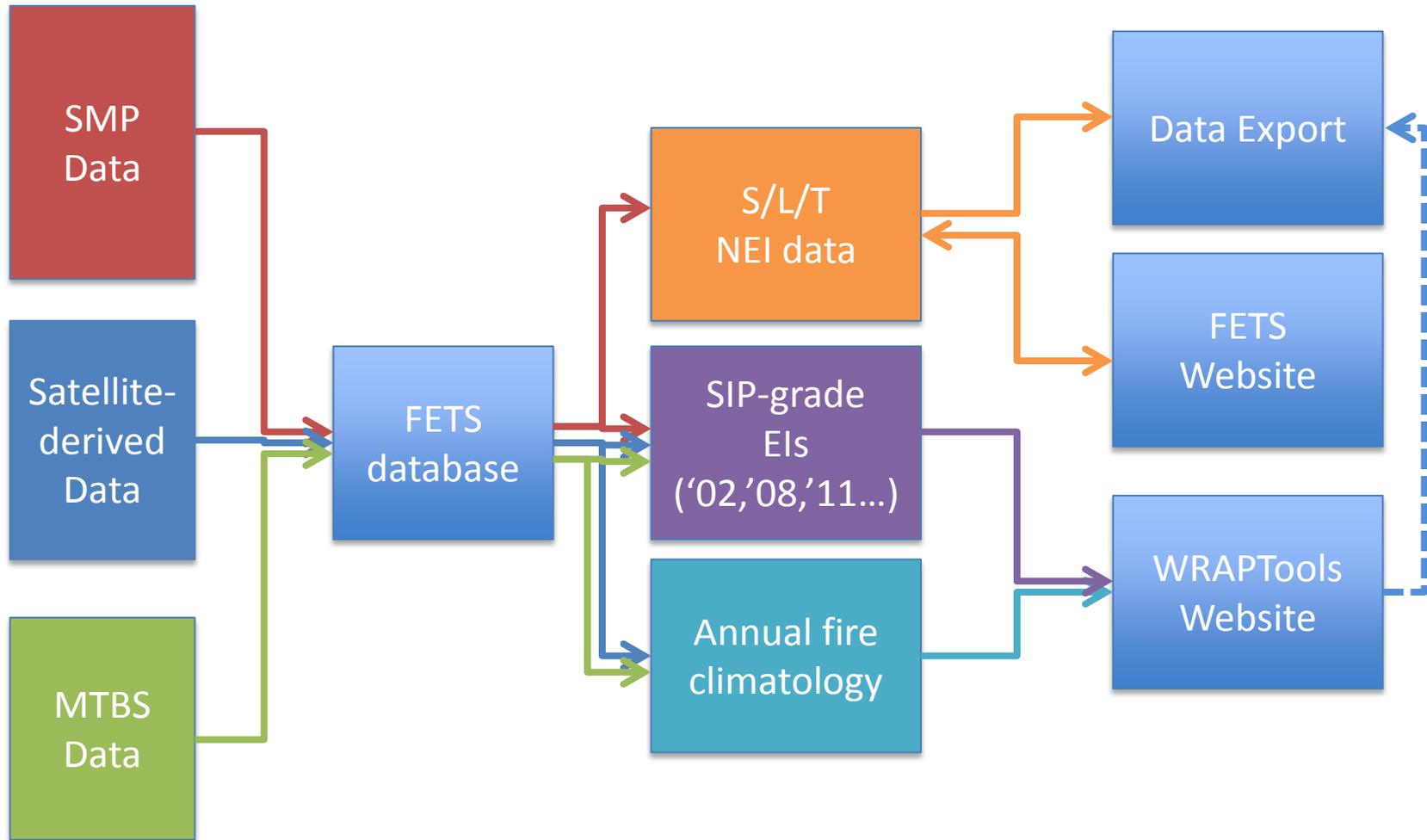
Fire Activity Data (acres/day)



Determine source impact / contribution

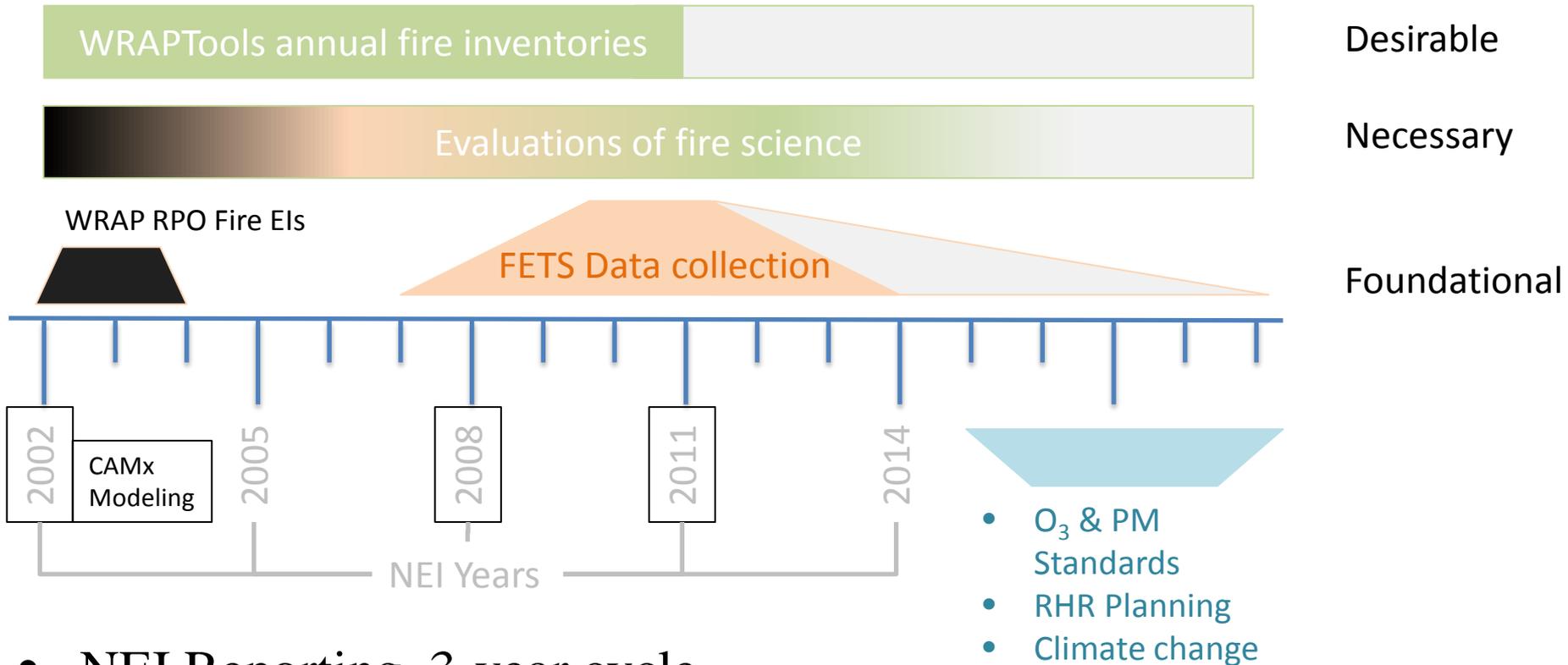


Data Flow in the WRAP Fire Tools System



User-supplied data maintain their identity throughout the system

Past, Present, and Future



- NEI Reporting, 3-year cycle
- Long-term fire trends
- Evolution of fire science
- Continued support of SMPs, relevance of analysis tools

- Accounting for gas-particle partitioning of POA will reduce the contribution of primary PM emissions from fires and will reduce the predicted near fire (≤ 25 km) PM levels.
- The major contribution of fires to ambient PM will be SOA.
- Oxidation of levoglucosan creates biases greater than 2x in existing model estimates of the contribution of fires to ambient PM levels.
- CAMx and PMCAMx treating the fire PM emissions as semi-volatile and reactive can simulate accurately the fire impacts on regional PM levels.

Summarize data

- Obs, mod PM2.5
- Fire contr.
- Est. OA
- Monitor locs
- Fire activity

Apply Filter Selection Criteria

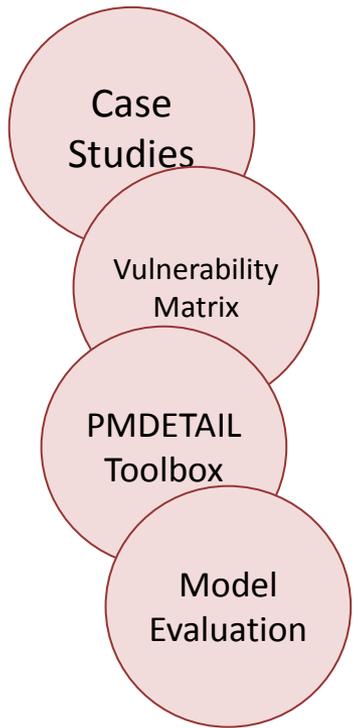
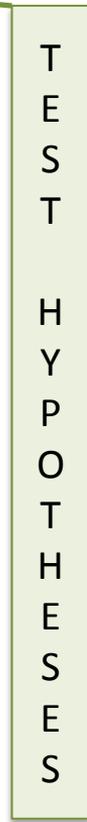
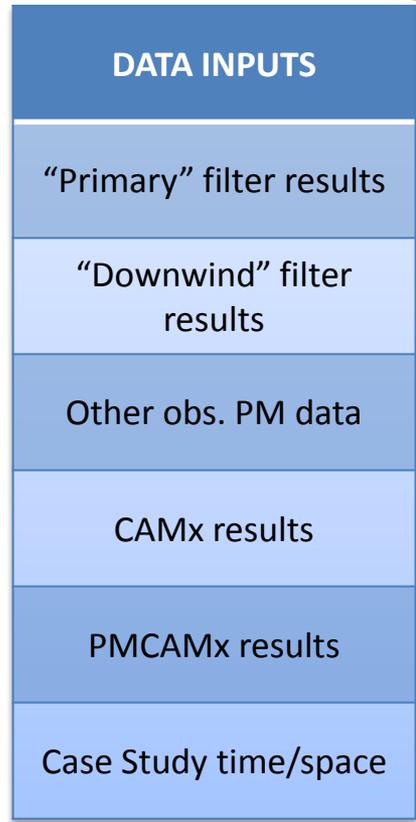
- Obs/mod PM levels
- Proximate burning
- Fire types
- HYSPLIT analysis

Analyze Filters

Identify Case Studies

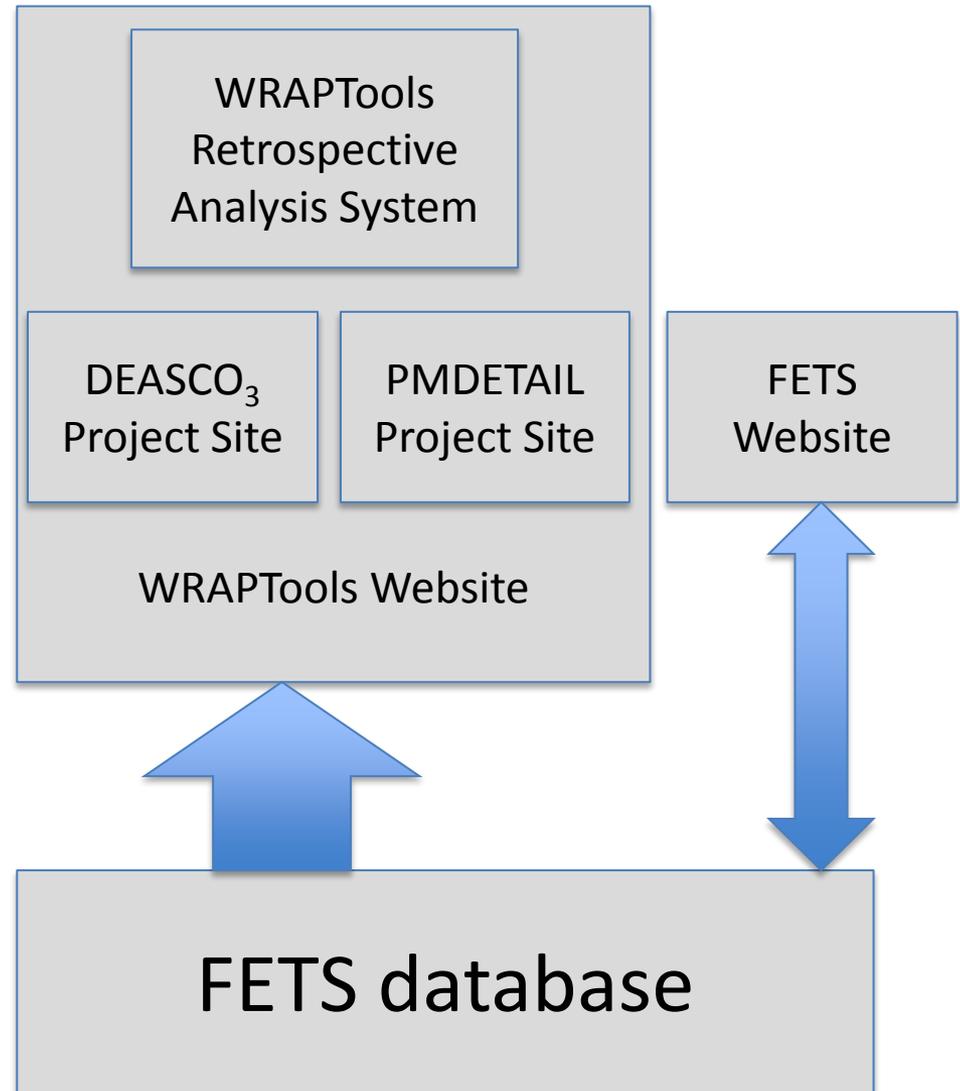
- Anecdotal
- Burn patterns
- Filter selection results

CMU PMCAMx modeling



WRAP Fire Tools Landscape

- Fire Emissions Tracking System
 - Gathering daily WF and S/L/T data
 - QA/QC and reporting tools for activity, emissions, NEI
 - Starting point for ozone and PM projects
- DEASCO₃ – Smoke Impact on ozone
 - JFSP-funded project, complete 9/2013
 - CONUS monitoring, all fire emissions types, empirical analysis, photochemical modeling
 - DSS for Ozone impacts
 - Temporal analysis, area impacts
- PMDETAIL – Smoke Impact on PM
 - JFSP-funded project, complete 9/2015
 - CONUS monitoring, all fire emissions types with VBS, empirical data and filter marker lab analyses, photochemical modeling
 - DSS for PM impacts
 - Temporal analysis, vulnerability matrix



WRAPTools Toolbar Approach



What questions do we need to address to perform retrospective case study analyses?

What data are available to us?

How do we organize results to accommodate differing analysis types?

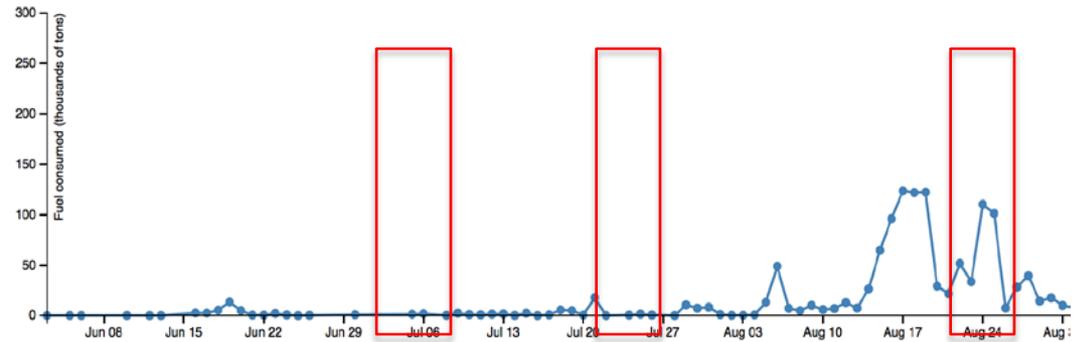
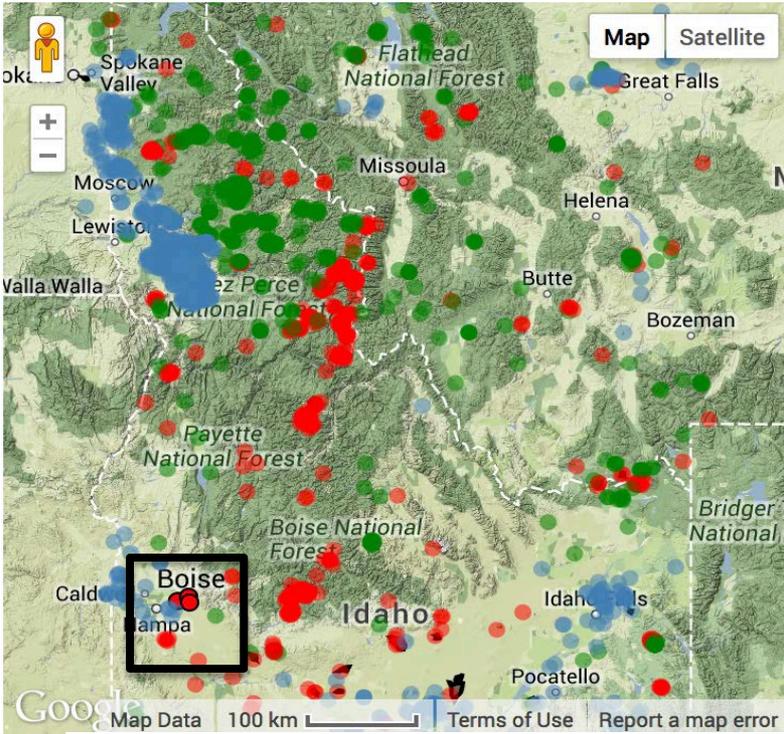
- Start with basic criteria from user: time, space
- Build a set of modular tools that produce analysis results
- Build a one-page “workspace” and plug in tool results, commentary.

Elevated Ozone due to Fire: Idaho - 2008 Case Study

Jun 1 – Sep 30, 2008, O₃ > 70ppb

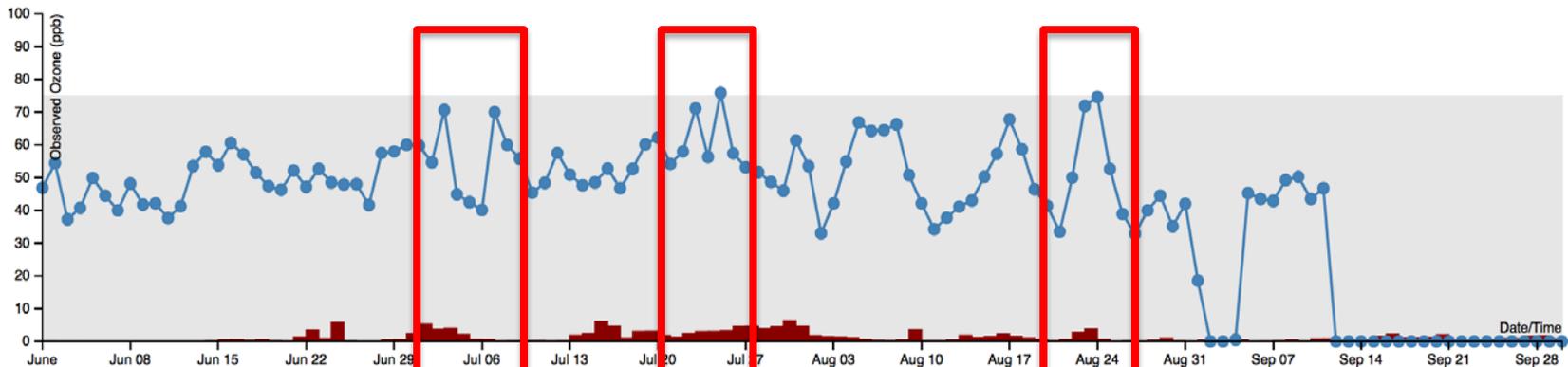
Fire contr. ≥ 1ppb, model error ≤ 25%

- 3 periods of elevated O₃
- Each period shows fire contribution > 3ppb
- Only late August period has nearby fire activity
- Earlier contr. from long-range transport (NorCal complexes)

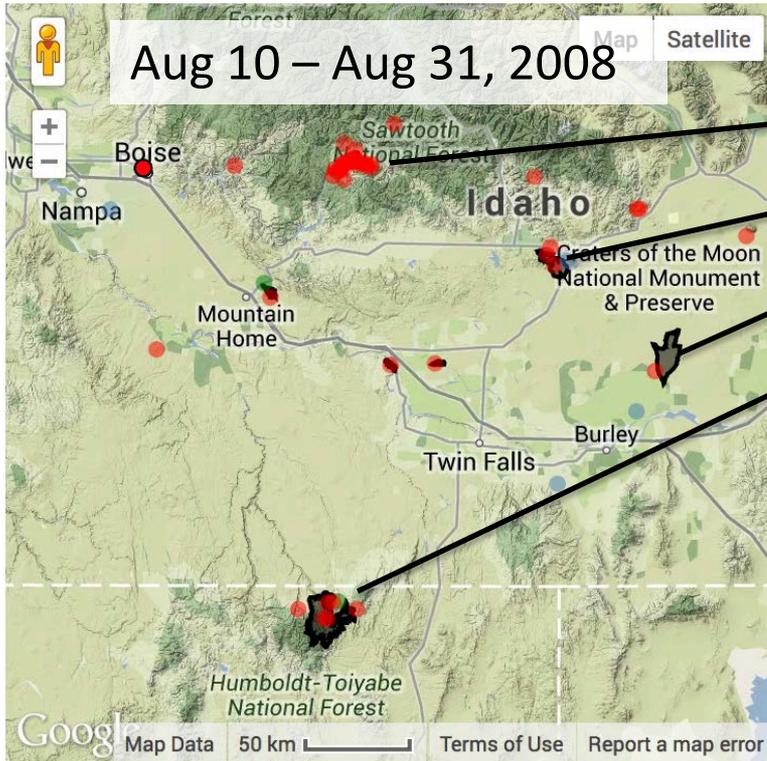


Observed Ozone paired with modeled max 8-hour fire contribution 06/01/2008 to 09/30/2008

Ada County, ID - 16_001_0019

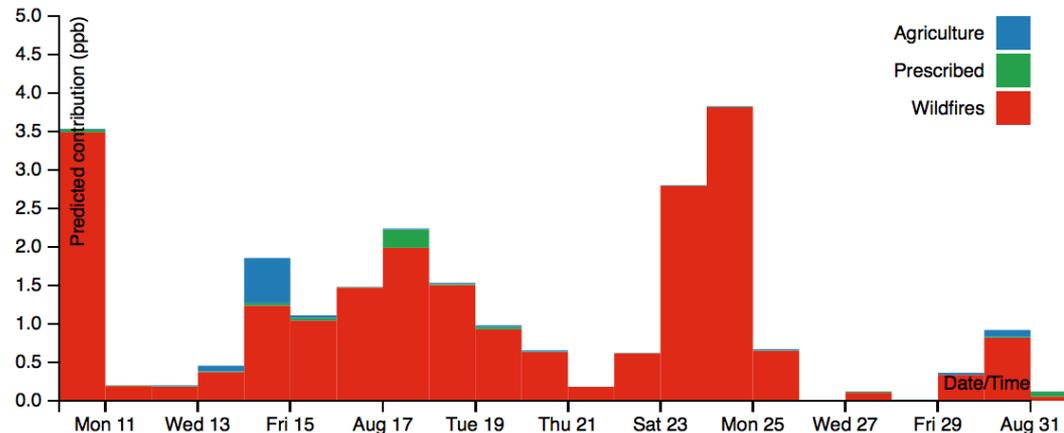


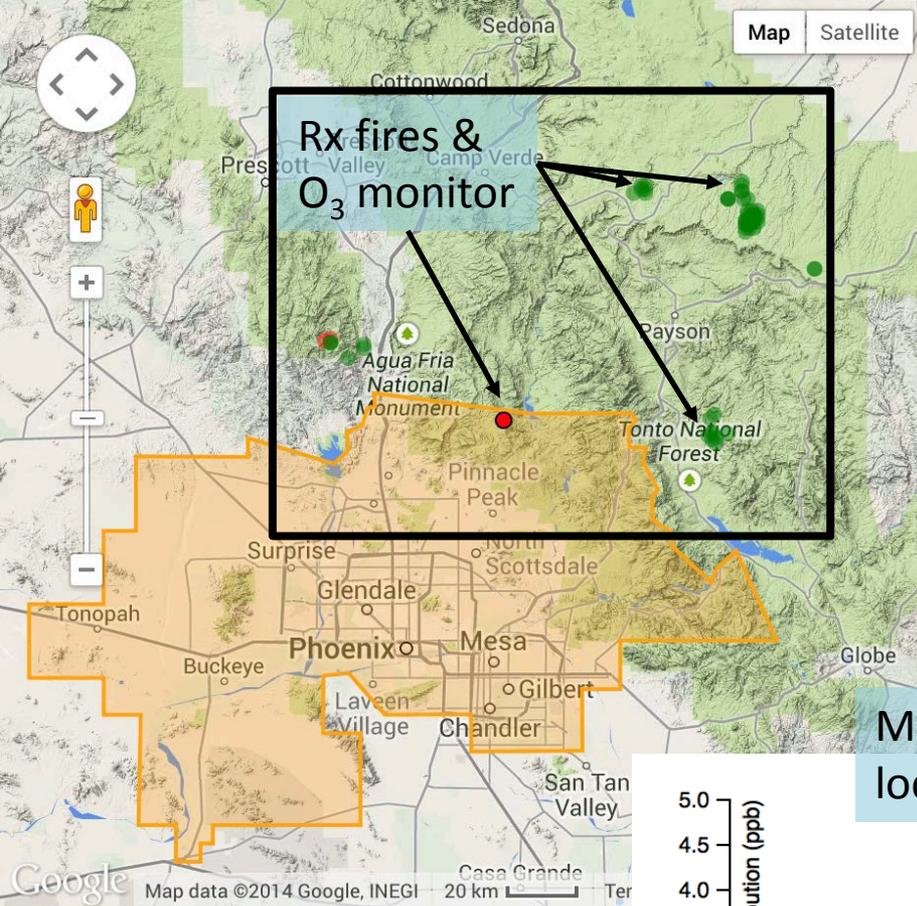
Elevated Ozone due to Fire: Idaho - 2008 Case Study



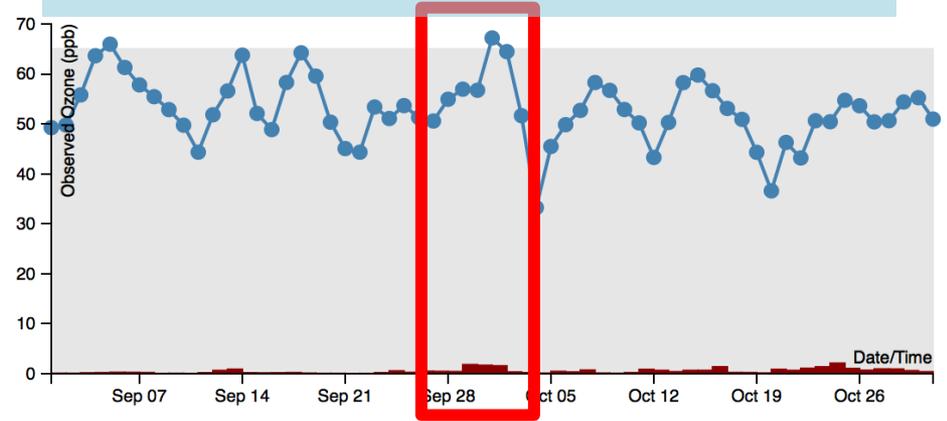
South Barker
Nature
North Minidoka
East Slide Rock Ridge

**Modeled max 8-hour fire contribution by fire type, 08/10/2008 to 08/31/2008
Ada County, ID - 16_001_0019**

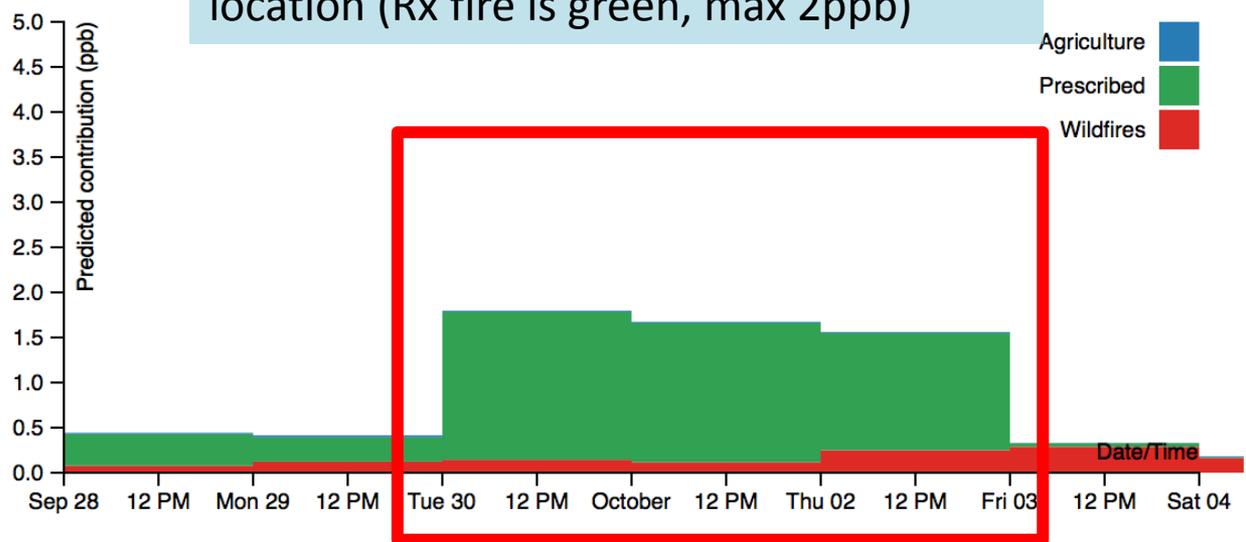




Observed O₃ (monitor on map) and modeled fire contribution



Model Source Apportionment at monitor location (Rx fire is green, max 2ppb)



Rx Fire Contribution to Elevated O₃ in Arizona

- 10/1/2008
- 2ppb modeled contribution
- Relevant to lowered standard

Area Impacts Analysis Tool – O₃

Number of days where planned fire caused an exceedance of 70ppb -- weight: 10

Number of days where planned fire caused an exceedance of 65ppb -- weight: 0

Number of days where planned fire caused an exceedance of 65ppb NAA ONLY -- weight: 2

Number of days where planned fire caused an exceedance of 70ppb NAA ONLY -- weight: 2

Number of 70+ ppb days where planned fire contributed > 1 ppb -- weight: 1.5

Number of 65+ ppb days where planned fire contributed > 1ppb -- weight: 1.25

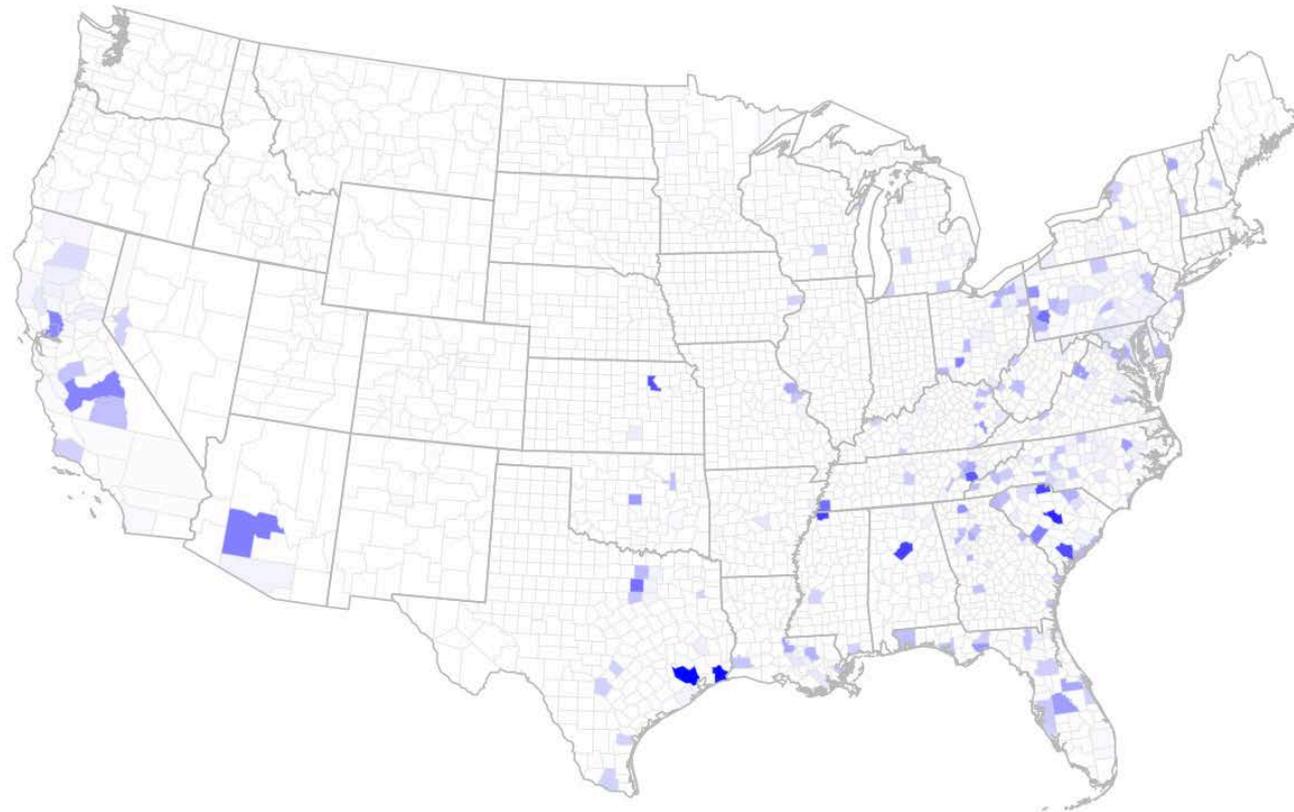
Tons consumed from planned fires near NAA during the ozone season -- weight: 1

Tons consumed from planned fires near NAA during the ozone shoulder season -- weight: 1

Average tons consumed prior to exceedance -- weight: 1

Number of 65+ days -- weight: 0.01

Number of 70+ days -- weight: 0.01



Area Impacts Analysis Tools - PM

Source
12km grid

From
2008-07-24

To
2008-08-05

Tons consumed in the 100km buffer -- weight:
1

Tons consumed in the 50km buffer -- weight:
1

Tons consumed in the 25km buffer -- weight:
1

Tons consumed during the previous day in the
200km buffer -- weight: 1

Tons consumed during the previous day in the
150km buffer -- weight: 1

Tons consumed during the previous day in the
100km buffer -- weight: 1

O₃/PM_{2.5} 50%

Fire percentage threshold 0%

Distance from NAA
All sites

