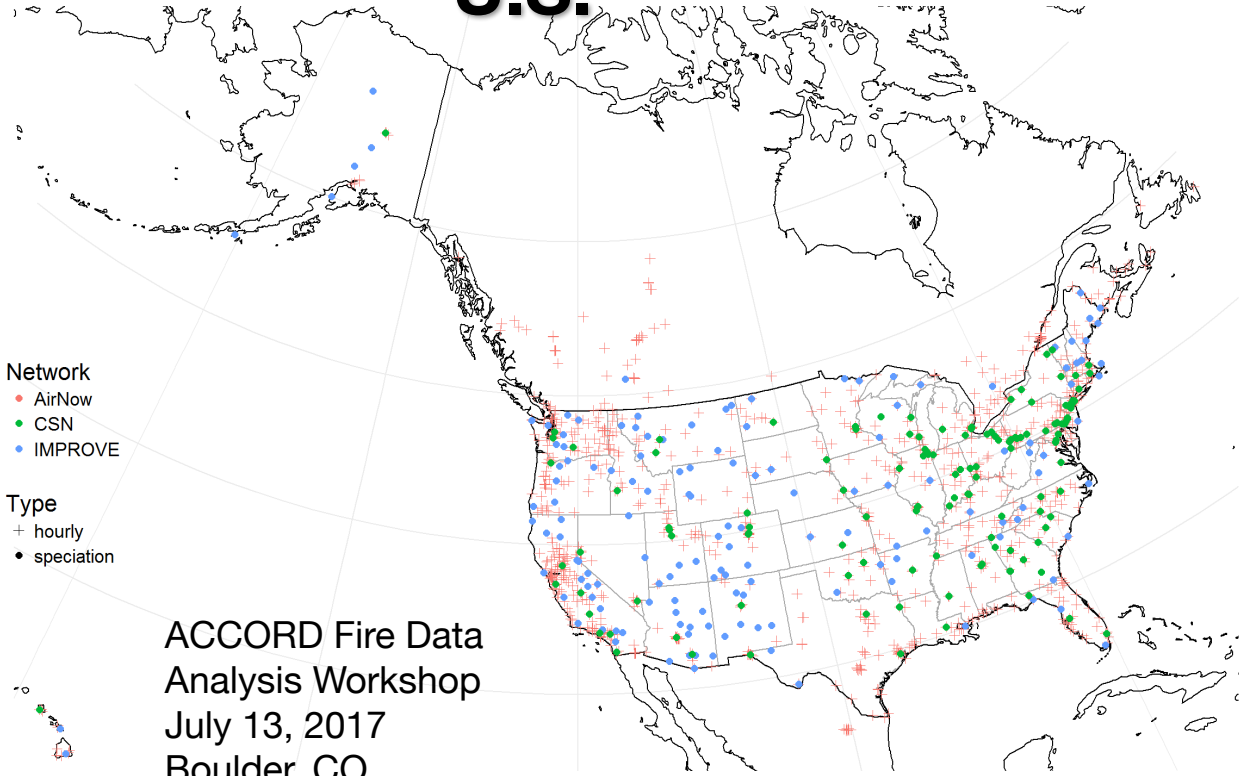
Monitoring Networks in the U.S.



ACCORD Fire Data Analysis Workshop
July 13, 2017
Boulder, CO

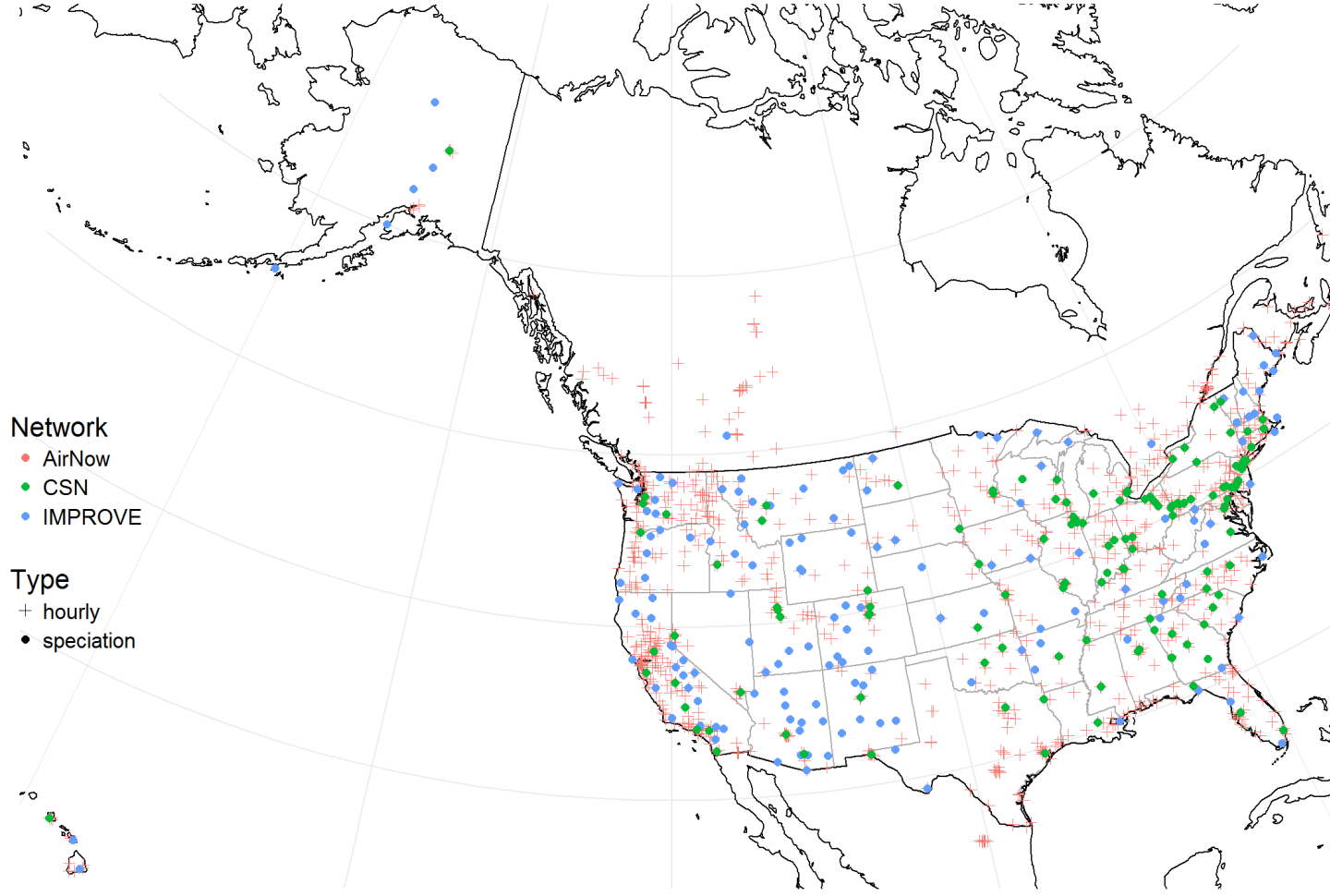
Sean Raffuse – Air Quality Research Center

UCDAVIS

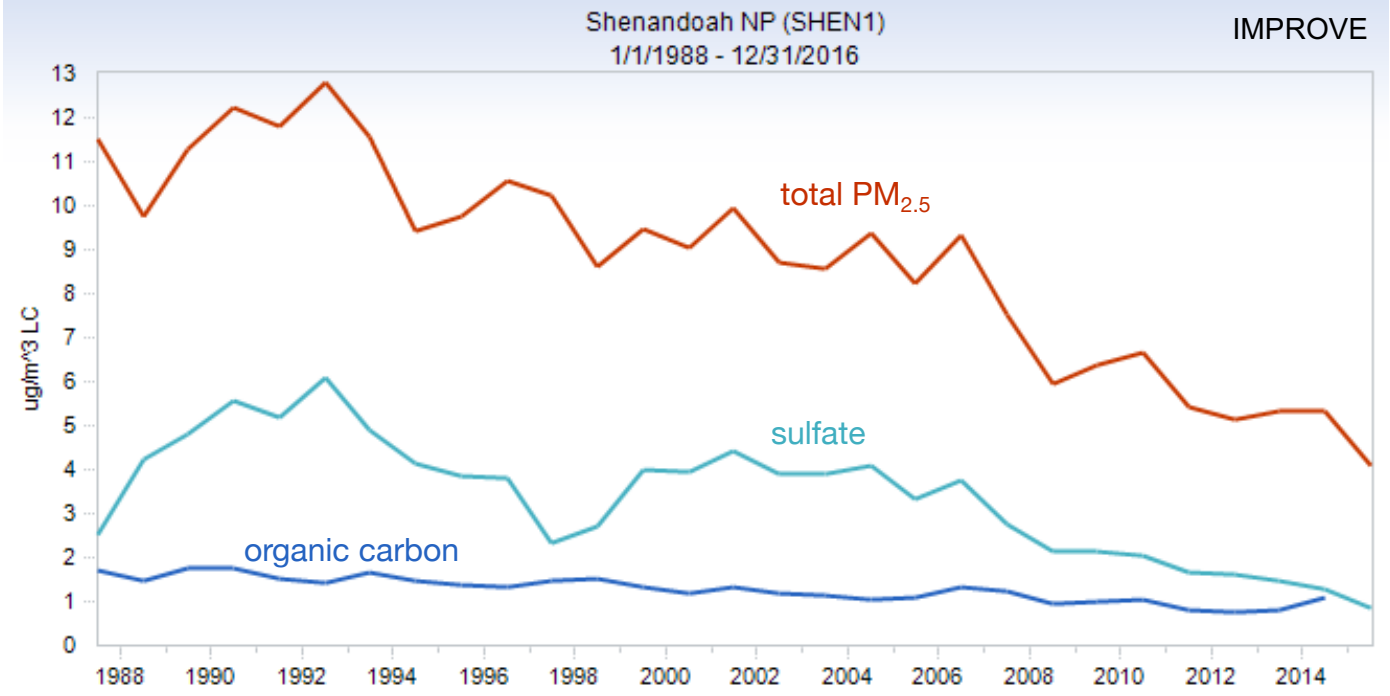
Routine Monitoring

- There are many nationwide air quality monitoring networks established for research and regulatory purposes
- Several of those are valuable for biomass burning tracking and analysis
- I will focus on three
    - Hourly PM mass via AirNow (briefly)
    - 24-hr speciated PM from CSN
    - 24-hr speciated PM IMPROVE
- Advantages
- Disadvantages
- A few examples
- Preview of the breakout session

Many Locations



Long time history



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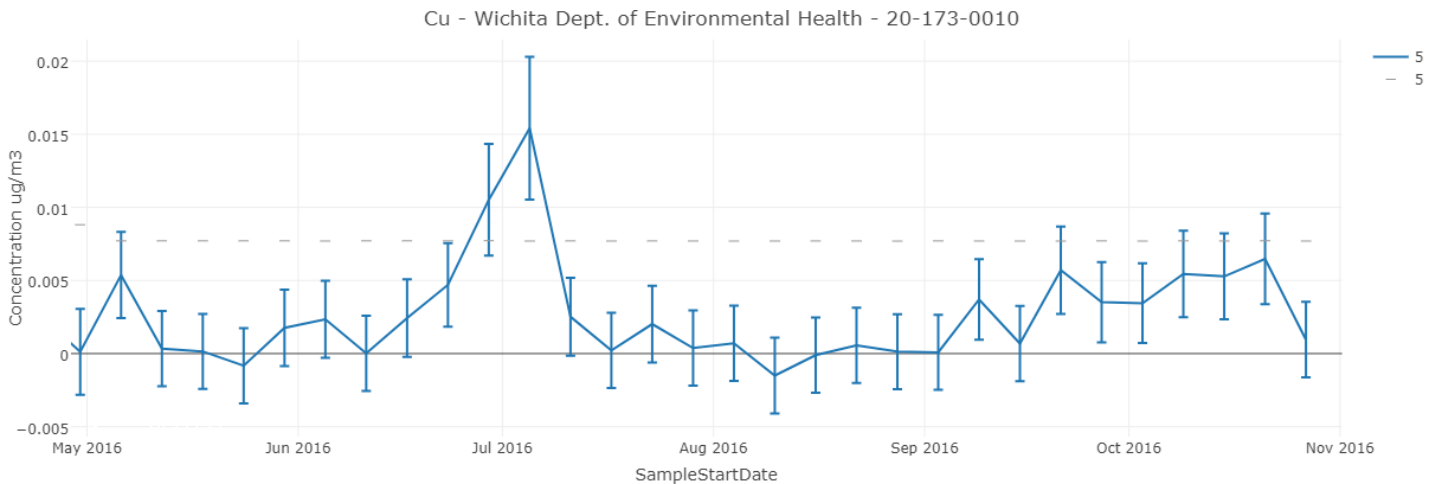
Consistent and validated

Posting type	Advisory
Subject	Over-reporting of sodium in salt-rich samples
Module/Species	A/ Na
Sites	Entire network
Period	Before 1/1/2011
Recommendation	Treat pre-2011 Na data as qualitative.
Submitter	W.H. White, whwhite@ucdavis.edu

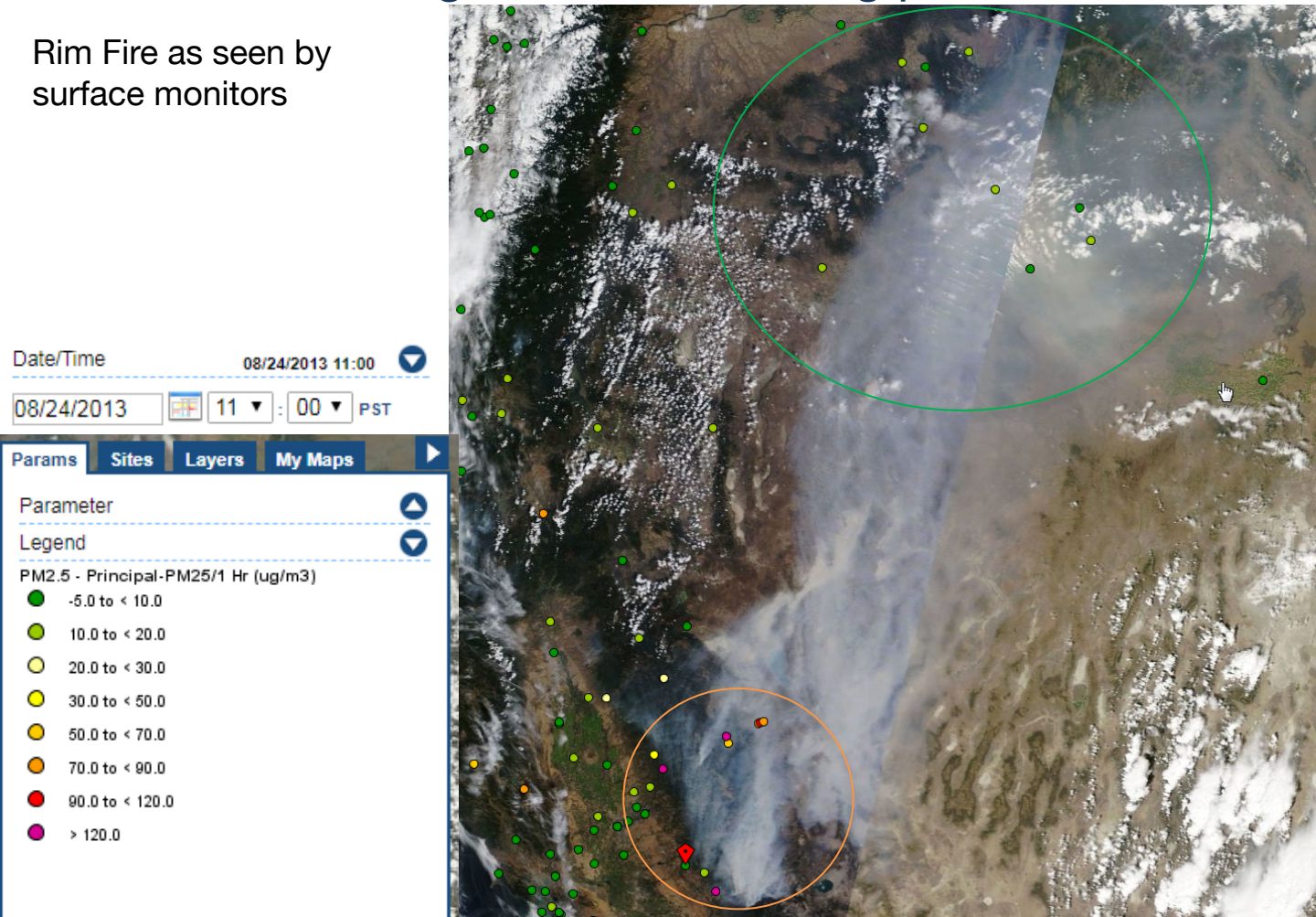
Supporting information

Elemental concentrations in samples analyzed with the legacy PIXE and XRF systems were reported with a semi-empirical correction for the expected attenuation of X-rays within the deposit. Attenuation generally increases as the fluorescing element's atomic number decreases and is strongest for Na, the lightest element reported. Samples collected since the beginning of 2011 have been analyzed with Epsilon 5 XRF systems manufactured by PANalytical. Results are now taken directly from the new systems' integrated software, with no adjustment made for deposit thickness.



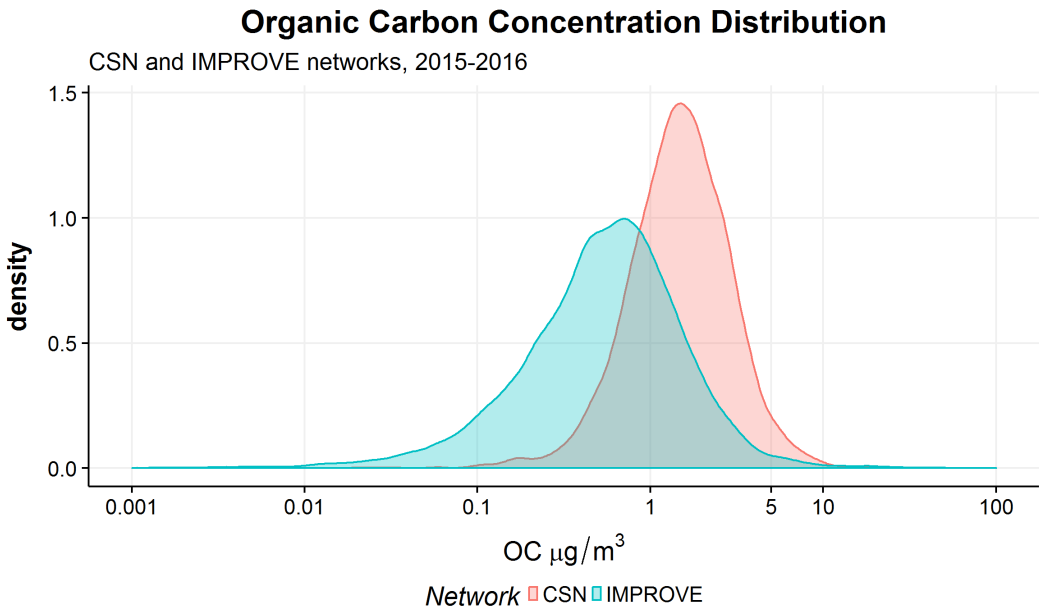
Located at the height of the breathing public

Rim Fire as seen by surface monitors



The networks put data in context

- CSN is urban and IMPROVE mostly rural
- IMPROVE OC rarely > 5 µg/m^3
- Usually indicates smoke impact



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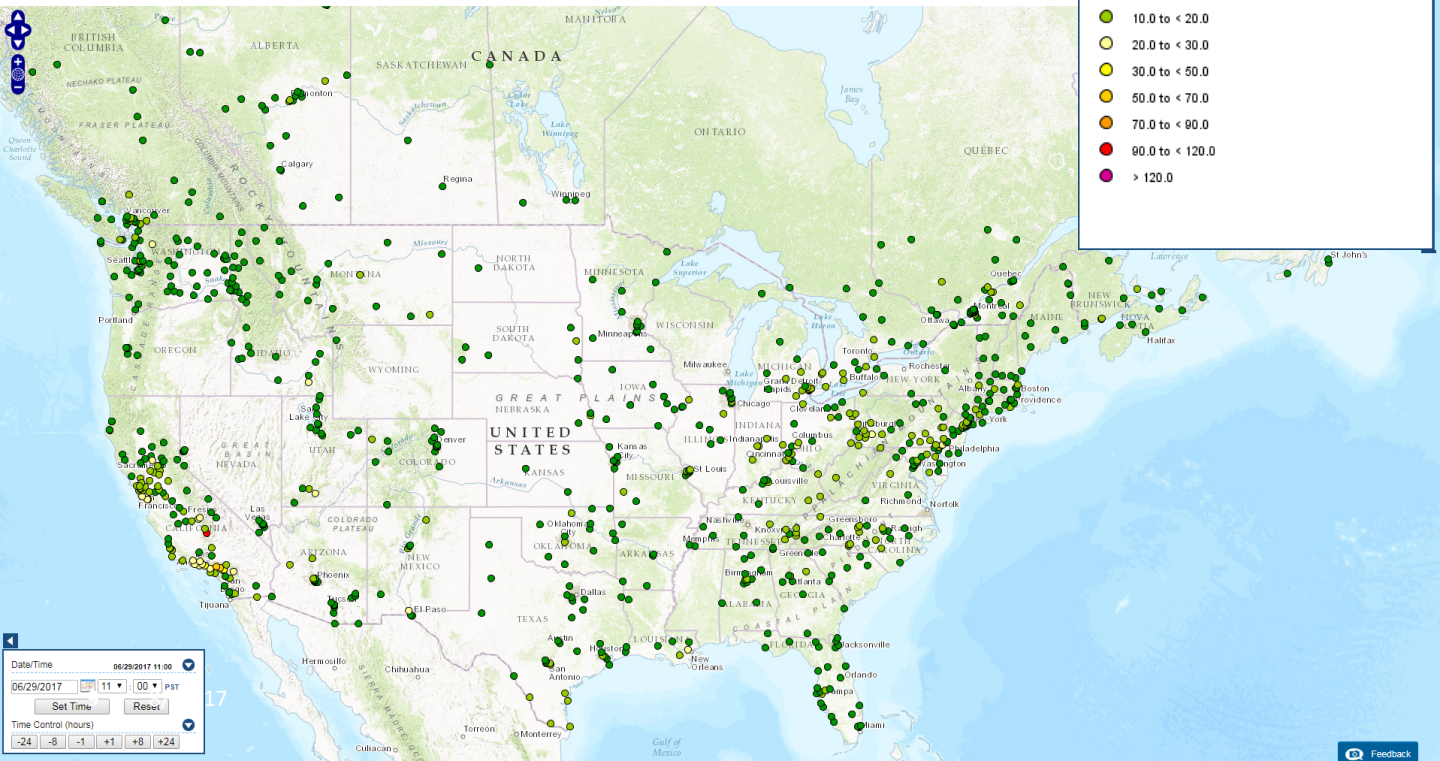
Disadvantages

- Low time resolution
  - Hourly for $PM_{2.5}$ mass
  - 24-hr average (every 3rd day) for speciated PM
- Networks are relatively sparse
  - Even large plumes can slip between the cracks
- Limited specie and modest detection limits
  - Compared to research instruments
- Can be difficult to acquire and understand

Hourly $PM_{2.5}$ from AirNow



About AirNow

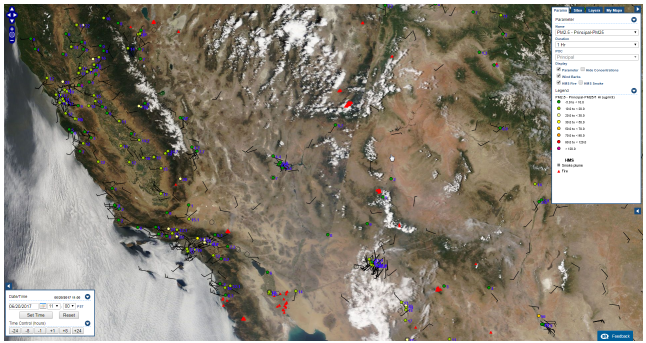
- The national repository of *real time* air quality data and forecasts for the United States.
- Purpose: support the U.S. EPA's Air Quality Index Program (AQI) and real-time reporting and forecasting by state, local, tribal and international governments.
- Data are collected using U.S. EPA federal reference or equivalent monitoring techniques or techniques approved by state, local or tribal monitoring agencies.
- Data are displayed after the end of each hour.
- Data in AirNow are *not fully verified and validated*. For the final validated version, visit the EPA Air Quality System (AQS).

Source: https://www.airnow.gov/index.cfm?action=ani.airnowUS#whatairnow

AirNow

- A convenient and quick way to assess biomass burning events, transport, and extent.
- Excellent tools for analysis at www.airnowtech.org
- Requires a login that takes a day to turn around (see at breakout session)

Navigator provides
- Hourly data
- Fires
- Satellite imagery
- Met data
- Trajectory mapping



IMPROVE

Interagency Monitoring of Protected Visual Environments

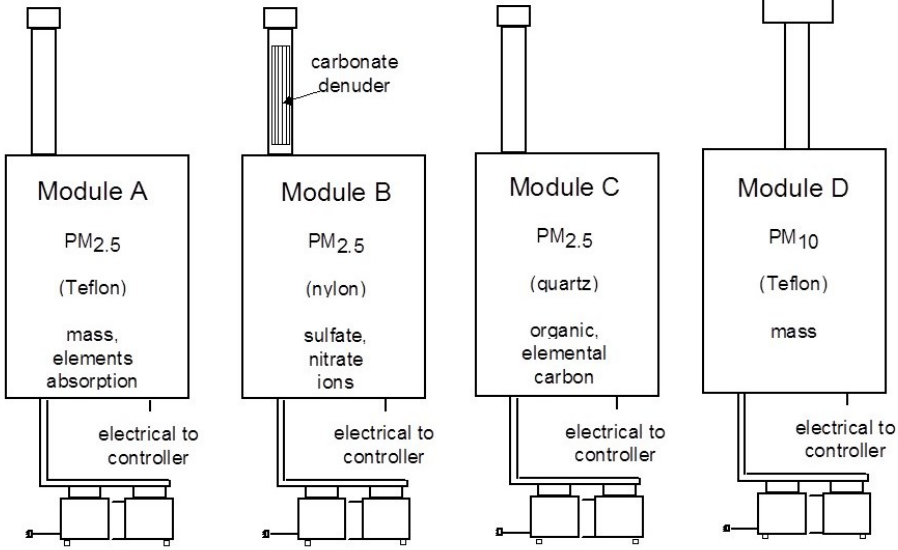
- Cooperative effort started in 1988 with ~30 sites
- Expanded in 2000 to ~165 sites
- Many sponsors
  - U.S. National Park Service
  - U.S. Forest Service
  - U.S. Fish & Wildlife Service
  - U.S. Environmental Protection Agency
  - Various State Governments & Tribes
  - Environment Canada
  - South Korea Ministry of Environment

IMPROVE

- Established to monitor visibility in “Class I areas” as defined by the Clean Air Act and the Regional Haze Rule
- Primarily rural locations
- 24-hour samples, every three days
- $PM_{2.5}$ and PM_{10} mass
- $PM_{2.5}$
  - ions
  - OC/EC
  - elements
- Designed for clean air
  - High flow rate
  - Small filter
  - Better detection limits

IMPROVE Samplers

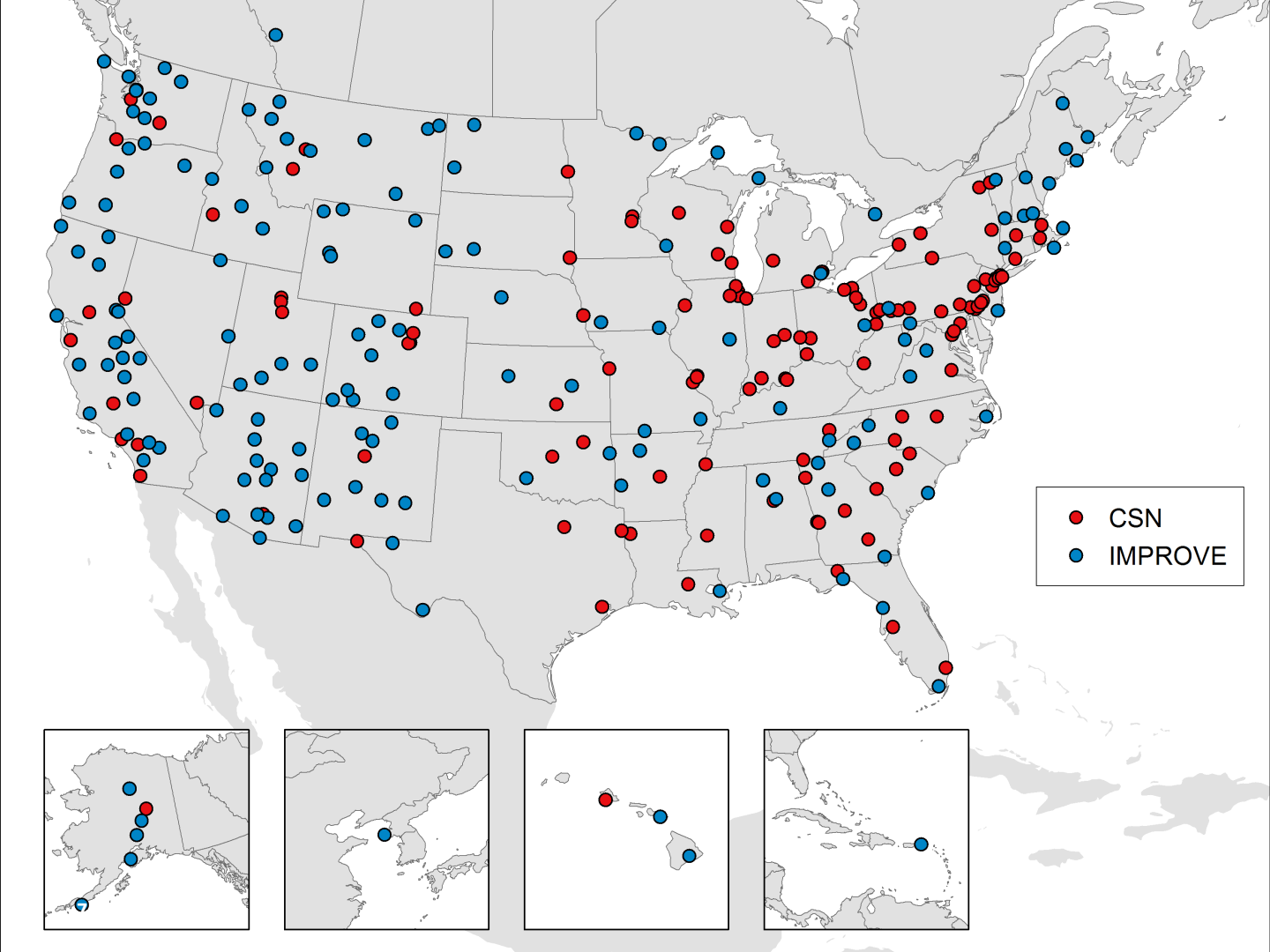
- 4 modules to collect different aerosol components
- Designed for clean environments
  - High flow rate
  - Small filter
- Better detection limits, particularly for trace elements



Chemical Speciation Network (CSN)

- Established by EPA in 2000 for routine speciation monitoring of $PM_{2.5}$ predominantly in urban areas.
- Purpose: to provide long-term chemical composition data of $PM_{2.5}$ in the U.S. for
    - evaluation of long-term trends
    - identification and quantification of sources and their impacts
    - assess effectiveness of emission reduction strategies
- 24-hour samples, every three (or six) days.
- $PM_{2.5}$
    - ions
    - OC/EC
    - elements

	IMPROVE	CSN
Number of Sites	159	139
Sample Duration	24 hours	24 hours
Sampling Frequency	Every 3rd day	Every 3rd or 6th day
Locations	National Parks, Monuments, and Forests	Urban Areas
Objective	Visibility	Human exposure/health
$PM_{2.5}$ Mass	Y	N after 2015
PM_{10} Mass	Y	N
Ions (IC)	Anions only	Anions and cations
Elements (XRF)	Y	Y
Carbon (TOR/TOT)	Y	Y


CSN
IMPROVE

Biomass burning relevant parameters

$PM_{2.5}$ mass

Organic carbon, and pyrolized carbon

Total carbon

Potassium

K is for Kansas in the Springtime

0.6 ug/m^3 of potassium at the Tallgrass site April 12, 2016

Annual burning of the Flint Hills rangeland to improve cattle feed

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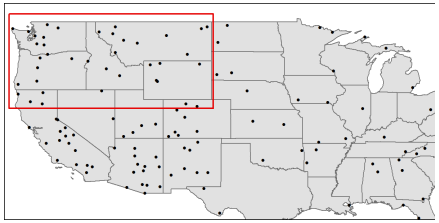
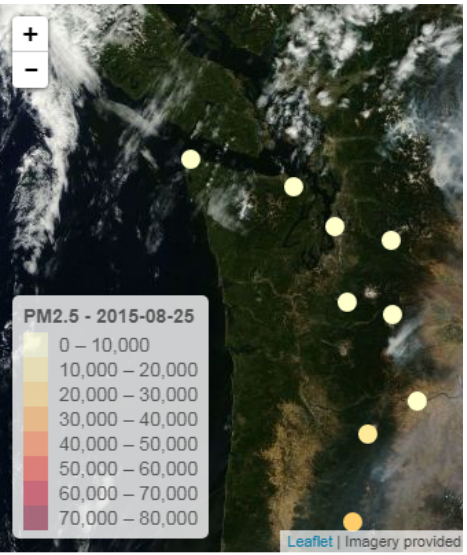
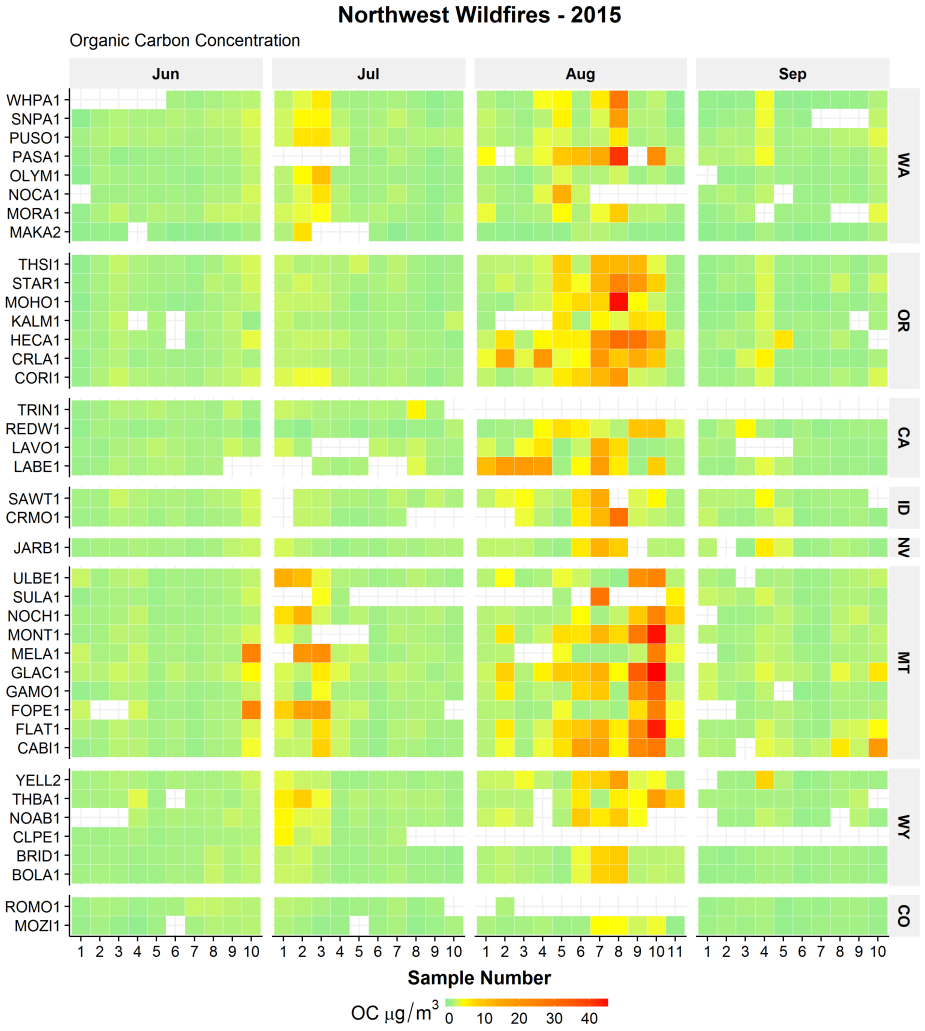
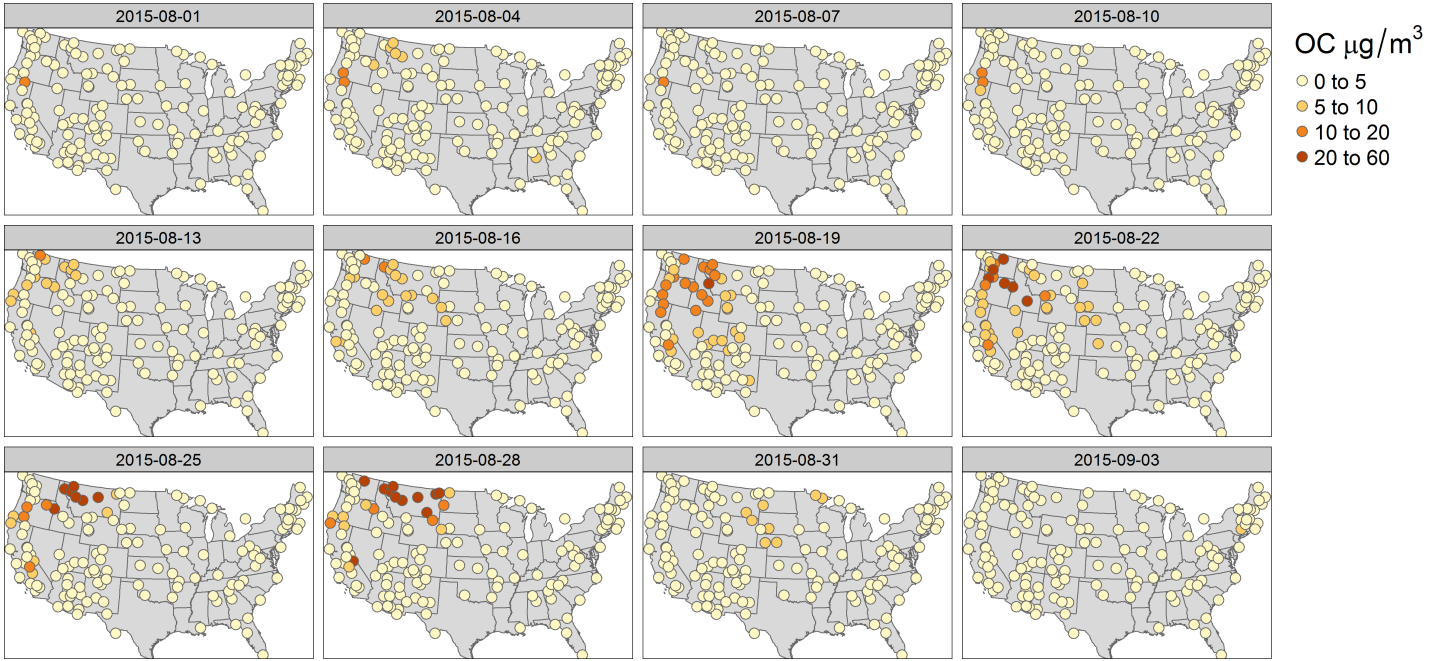
Northwest Wildfires - 2015







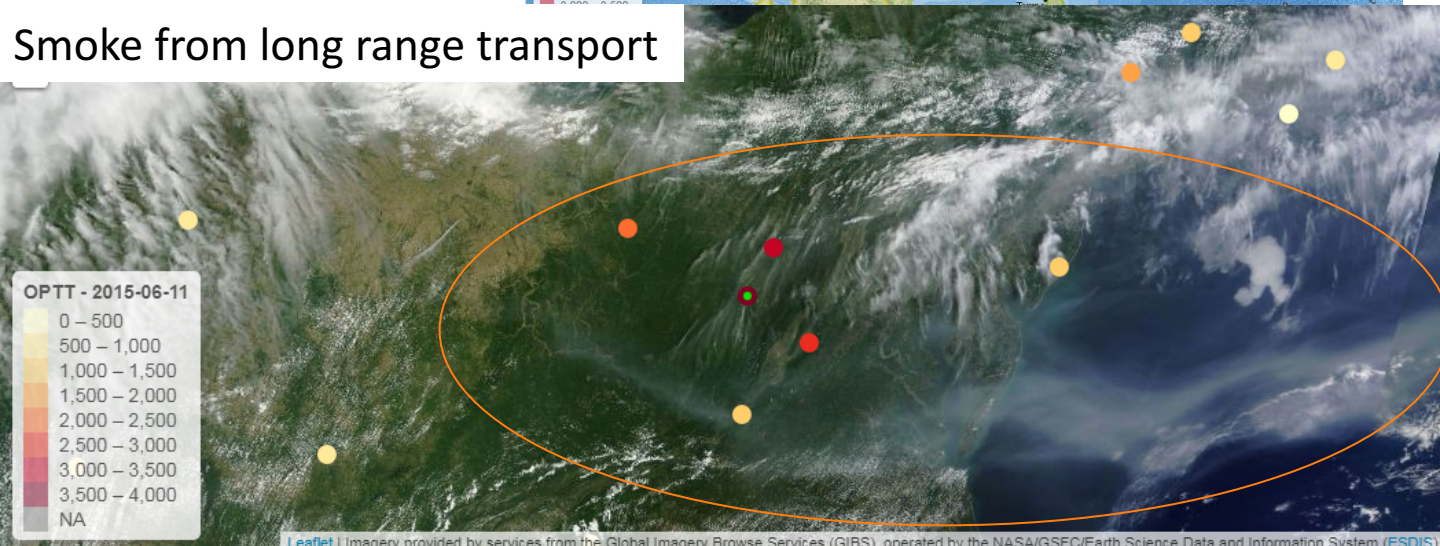
Northwest Wildfires - August



Northeast Transport

Hot spot of elevated “pyrolized carbon” in Ohio/Virginia

Smoke from long range transport



How to get the data

Final, official data from all three networks are available in the EPA's Air Quality System (AQS)

Easiest access at Air Data: https://www.epa.gov/outdoor-air-quality-data

Another option, is the Federal Land Manager Environmental Database

http://views.cira.colostate.edu/fed/DataWizard/

AirNow preliminary data can be accessed with a login at

www.airnowtech.org/data or https://docs.airnowapi.org/

About the breakout

How to discover, explore, acquire, and analyze routine data

Pick your event

Explore real-time data

Downloading speciated data

Understanding the parameters in CSN and IMPROVE

Thank you!

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