



PM2.5 Public Reporting and Wildfires in EPA's AirNow Program

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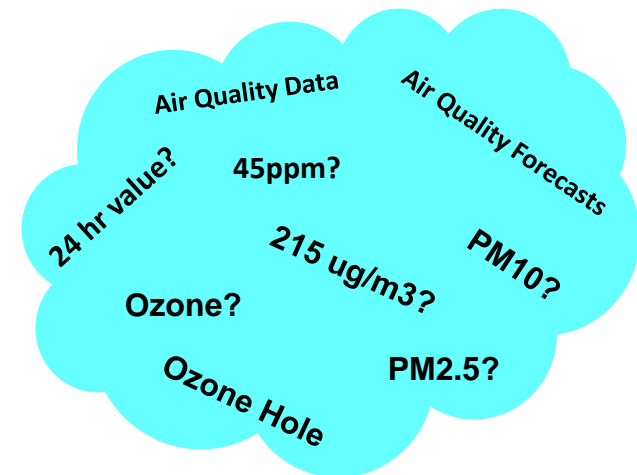
- **Communicating PM levels**
- **The EPA Nowcast**
- **Wildfire Page on AirNow website**
- **Fire analysis tools in AirNow-Tech**
 - Global HYSPLIT and fires

Communicating PM levels

Air quality can be difficult to understand...

- **U.S. Air Quality Index is based on complicated daily or 8-hr averages**
 - ✓ *What do these averages really mean?*
 - ✓ *Nowcast???*
- **Why isn't there a monitor close to me?**
- **Varying levels of education in communities**
- **Distrust of data/information**
 - ✓ Unclear messaging
 - ✓ Data reporting inconsistent
 - ✓ Hard to get or find

Air Quality Index (AQI) Values	Levels of Health Concern	Colors
<i>When the AQI is in this range:</i>	<i>...air quality conditions are:</i>	<i>...as symbolized by this color:</i>
0 to 50	Good	Green
51 to 100	Moderate	Yellow
101 to 150	Unhealthy for Sensitive Groups	Orange
151 to 200	Unhealthy	Red
201 to 300	Very Unhealthy	Purple
301 to 500	Hazardous	Maroon



A BIG Challenge: How do we communicate or report 24-hr PM levels?

- **EPA is tied to the Air Quality Index (AQI) to communicate the health effects of air quality**
 - The AQI is based on daily air quality summaries, specifically daily maximums or daily averages for criteria pollutants
- **Averaging times for AQI pollutants are rooted in the exposure studies used to set the National Ambient Air Quality Standards**
 - Until enough health evidence exists to have EPA consider setting a sub-daily AQI for PM, we are bound to a 24-hr average AQI
 - We can't report hourly concentrations directly **AS** the corresponding AQI ☹️
- **Problem is that real-time reporting requires shorter-term data to caution people in time for them to reduce their 24-hour exposure!**

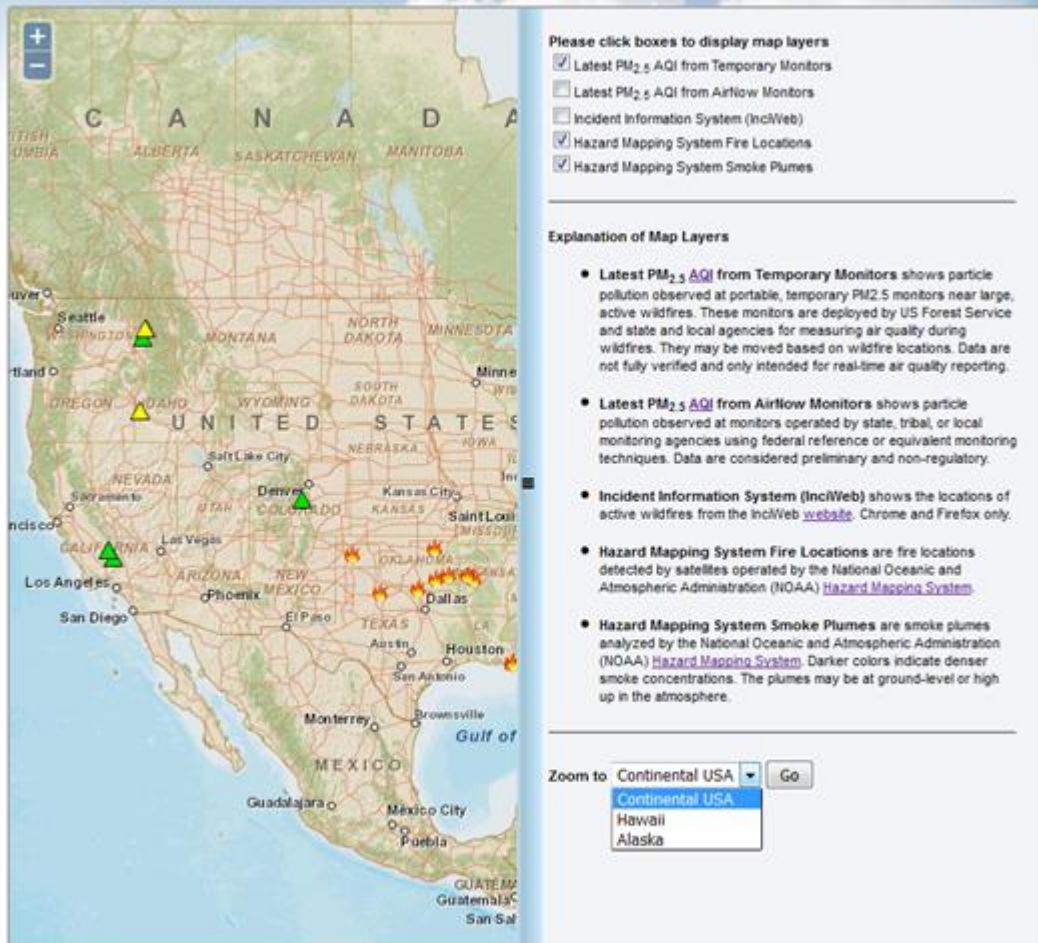
- **With a 24-hour index; people really need a way to take action to reduce their exposures to protect their health**
 - Need a current valuation of air quality conditions (not waiting 24-hrs to know the actual AQI).
 - Reducing exposures during high PM conditions for a few hours will help reduce a person's overall 24-hour exposure
- **Reporting current conditions of any pollutant with an AQI averaging time over an hour (e.g., ozone and CO with 8 hr AQI), always requires some sort of Nowcast or estimation**
 - Done for 15+ yrs for ozone , but easier to “report” due to a “shorter” averaging time
 - Original PM_{2.5} “NowCast” method was developed in 2003 when continuous PM monitoring was just implemented in the U.S.
 - Designed so “current conditions” represented the 24-hour PM_{2.5} standard as closely as possible.
 - EPA and our partners had little experience reporting PM_{2.5} values to the public at the time
 - This method was slow to respond when air quality changes rapidly

- **EPA developed a new NowCast to approximate the 24-hour AQI in any given hour**
 - EPA analyzed millions of data points in developing the new NowCast method
- **The Nowcast responds more quickly to rapidly changing air quality conditions, such as those we see during fire**
 - Represents a shorter average (target 3-hour) when air quality is changing rapidly
 - 3-hour average chosen to smooth out effects of hourly spikes in continuous monitoring technology and to account for any potential missing data
- **The Nowcast reflects a longer-term average when air quality is stable**
 - 12-hr running average
- **Reporting PM with the NowCast means current conditions (maps, AQI values) will align more closely with what people are seeing/experiencing**
 - *Remember the trust factor...*
- **We believe this will increase individual action to reduce exposure**
 - Makes alerts more timely

- **The new method is a weighted average of the previous 12 hours**
 - *Note: Background slides at the end of presentation have details on the formula and the handling of missing data*
- **If air quality is less variable, then the hours are weighted more evenly (approaching a 12-hour average)**
- **If air quality is more variable, then recent hours are weighted more heavily (approaching an average of the most recent 3-hours)**
- **PM10 uses the nowcast and the same methodology will be applied to ozone this year!**
 - Ozone nowcast improves AQI prediction and consistency



Fires: Current Conditions



Please click boxes to display map layers

- Latest PM_{2.5} AQI from Temporary Monitors
- Latest PM_{2.5} AQI from Airflow Monitors
- Incident Information System (InciWeb)
- Hazard Mapping System Fire Locations
- Hazard Mapping System Smoke Plumes

Explanation of Map Layers

- **Latest PM_{2.5} AQI from Temporary Monitors** shows particle pollution observed at portable, temporary PM_{2.5} monitors near large, active wildfires. These monitors are deployed by US Forest Service and state and local agencies for measuring air quality during wildfires. They may be moved based on wildfire locations. Data are not fully verified and only intended for real-time air quality reporting.
- **Latest PM_{2.5} AQI from Airflow Monitors** shows particle pollution observed at monitors operated by state, tribal, or local monitoring agencies using federal reference or equivalent monitoring techniques. Data are considered preliminary and non-regulatory.
- **Incident Information System (InciWeb)** shows the locations of active wildfires from the InciWeb [website](#). Chrome and Firefox only.
- **Hazard Mapping System Fire Locations** are fire locations detected by satellites operated by the National Oceanic and Atmospheric Administration (NOAA) [Hazard Mapping System](#).
- **Hazard Mapping System Smoke Plumes** are smoke plumes analyzed by the National Oceanic and Atmospheric Administration (NOAA) [Hazard Mapping System](#). Darker colors indicate denser smoke concentrations. The plumes may be at ground-level or high up in the atmosphere.

Zoom to: Continental USA

- Continental USA
- Hawaii
- Alaska

- **Live in 2014**
 - Flexible, adaptable system
 - Mobile data input and display
 - Rapid product creation
- **Can display PM_{2.5} data from temporary monitors sited by USFS and state/local agencies**
- **Can also show fire locations and smoke plumes**

Smoke Advisories and Forecasts

[Fires and Your Health](#)

[Fires: Current Conditions](#)

Advisories and Forecasts

United States

Alaska

[Alaska DEC Wildfire Information](#)

Arizona

[Arizona Wildfire Information](#)

California

[Butte County Air Quality Management District](#)

[Northern Sierra Air Management District](#)

[Shasta County Air Quality Management District](#)

[Shasta County \(Redding\) Air Quality Webcam](#)

[South Coast Air Quality Management District](#)

[Ventura County Air Pollution Control District](#)

Colorado

[Colorado Wildfire Smoke Health Advisories](#)

Idaho

[Idaho Department of Environmental Quality](#)

[Current Wildfire Smoke Information](#)

[Check for Advisories due to Wildfire Smoke](#) Current Wildfire Smoke Information

[Idaho Smoke Information Blog](#)

Montana

[Wildfire Smoke Update](#)

Health

and fine particles produced when wood and other organic materials burn. The biggest health concern is microscopic particles that can get into your eyes and respiratory system, where they can cause health problems such as bronchitis. Fine particles also can aggravate chronic heart and lung diseases - especially if you have them with these conditions.

Even if you are not from short-term exposures to smoke. Still, it's a good idea to avoid breathing smoke if you can when wildfires are present.



Photo by NASA

Use common sense. If it looks smoky outside, it's probably not a good time to mow the lawn or go for a run. And it's probably not a good time for your children to play outdoors.

Pay attention to local air quality reports. Stay alert to smoke-related news coverage or health warnings.

Visit [AirNow](#) to find out the Air Quality Index in your area. As smoke gets worse, the amount of particles in the air changes - and so do the steps you should take to protect yourself. AirNow recommends precautions you can take to protect your health when air pollution gets bad.

If you are advised to stay indoors, take steps to keep indoor air as clean as possible. When smoke levels are high, try to avoid using anything that burns, such as wood fireplaces, gas logs, gas stoves - and even candles! Don't vacuum. That stirs up particles already inside your home. And don't smoke. That puts even more pollution

into

the air. Make sure you follow your doctor's directions about asthma management plan. Call your doctor if your

asthma symptoms worsen. If you have a fresh air intake closed and the filter clean to prevent it from having an air conditioner, staying inside with the windows closed. In these cases, seek alternative shelter.

For an adult, or if you have children, talk with your doctor about what to do. When smoke is heavy for a prolonged period of time, you may not be able to see them.

[Current Conditions.](#)

[- Data](#)

Health Resources

- [How Smoke from Fires Can Affect Your Health](#) - Learn steps you can take to protect your health.
- [Particle Pollution and Your Health](#) - Find out if you are at risk from exposure to particle pollution, and what health effects can be caused by particles. (PDF, 2 pp, 280KB, [about PDF](#)).

Educational Resources

- [CDC Wildfire Fact Sheet](#) - Information on emergency preparedness and response.
- [California Air Resources Board SMP Public Outreach Protocol - Tools and Materials](#)
- [EXIT AIRNOW](#)
- [Wildfire Guide for Health Officials](#)
- [EXIT AIRNOW](#)
- FOR KIDS- Follow [Smoky Bear's advice](#) when wildfires are in your area!

SEARCH

[CDC A-Z INDEX](#)

Language:

Be ready for a wildfire and prepare your family. If you see a wildfire, evacuate safely during a wildfire.



[Image](#) of the Be Ready: Wildfires

Share it on social media or print it out to post in your home.

<http://www.bt.cdc.gov/disasters/wildfires/>

Current Advisories

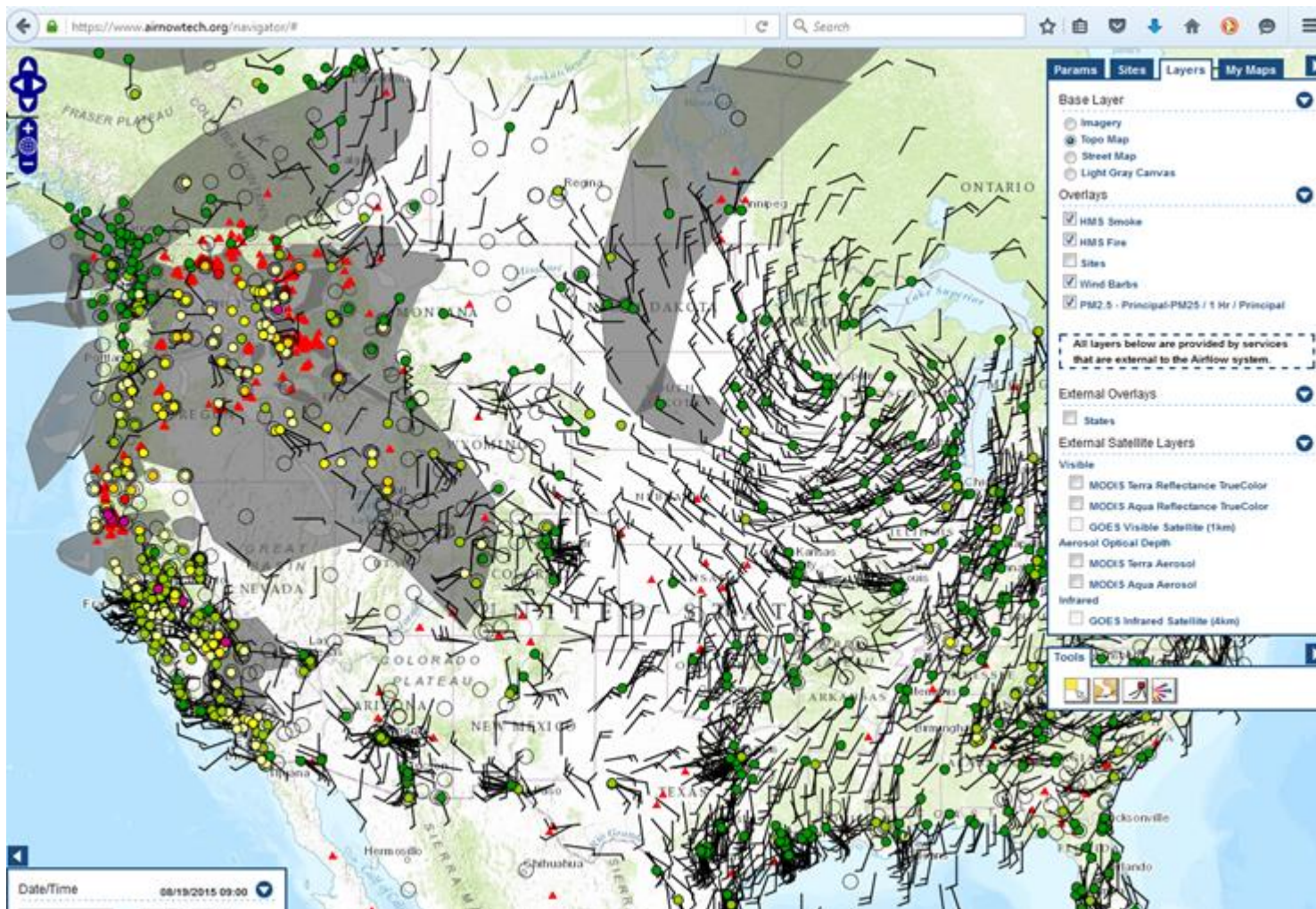
Fires and Health

Before, During, and After a Wildfire

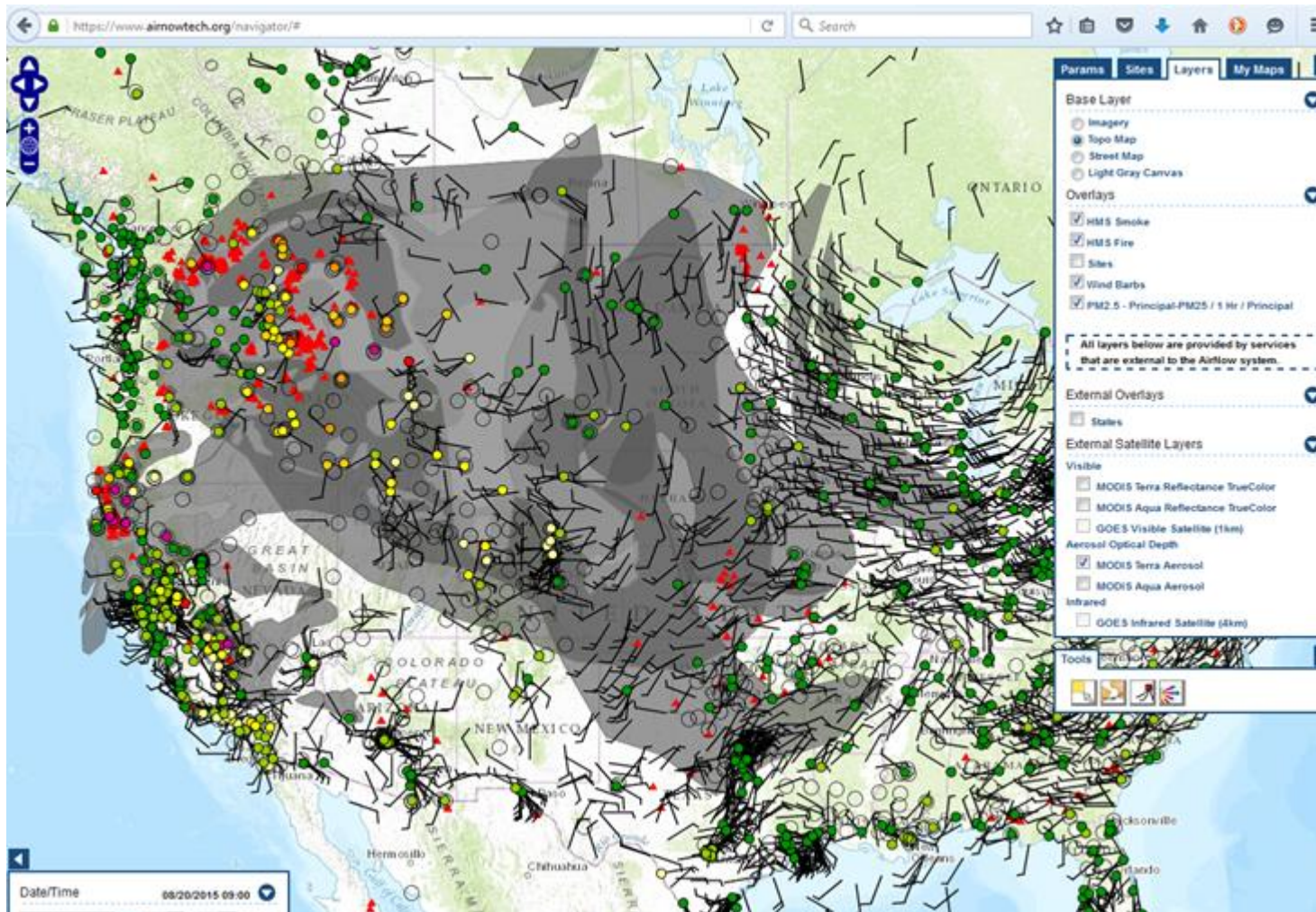
More Fire Tools

- [NOAA Smoke Forecast Tool](#) - Maps of surface and vertical smoke can be found under "Additional Air Quality Forecast Guidance."
- [NOAA's Fire Weather Outlook](#) - This tool maps fire watches and warnings.
- [GEOMAC Wildland Fire Support](#) - Access maps of current fire locations using this tool from the Geospatial Multi-Agency Coordination Group (GEOMAC).
- [MODIS Active Fire Mapping](#) - This site from the USDA Forest Service Remote Sensing Applications Center (RSAC) maps active fires.

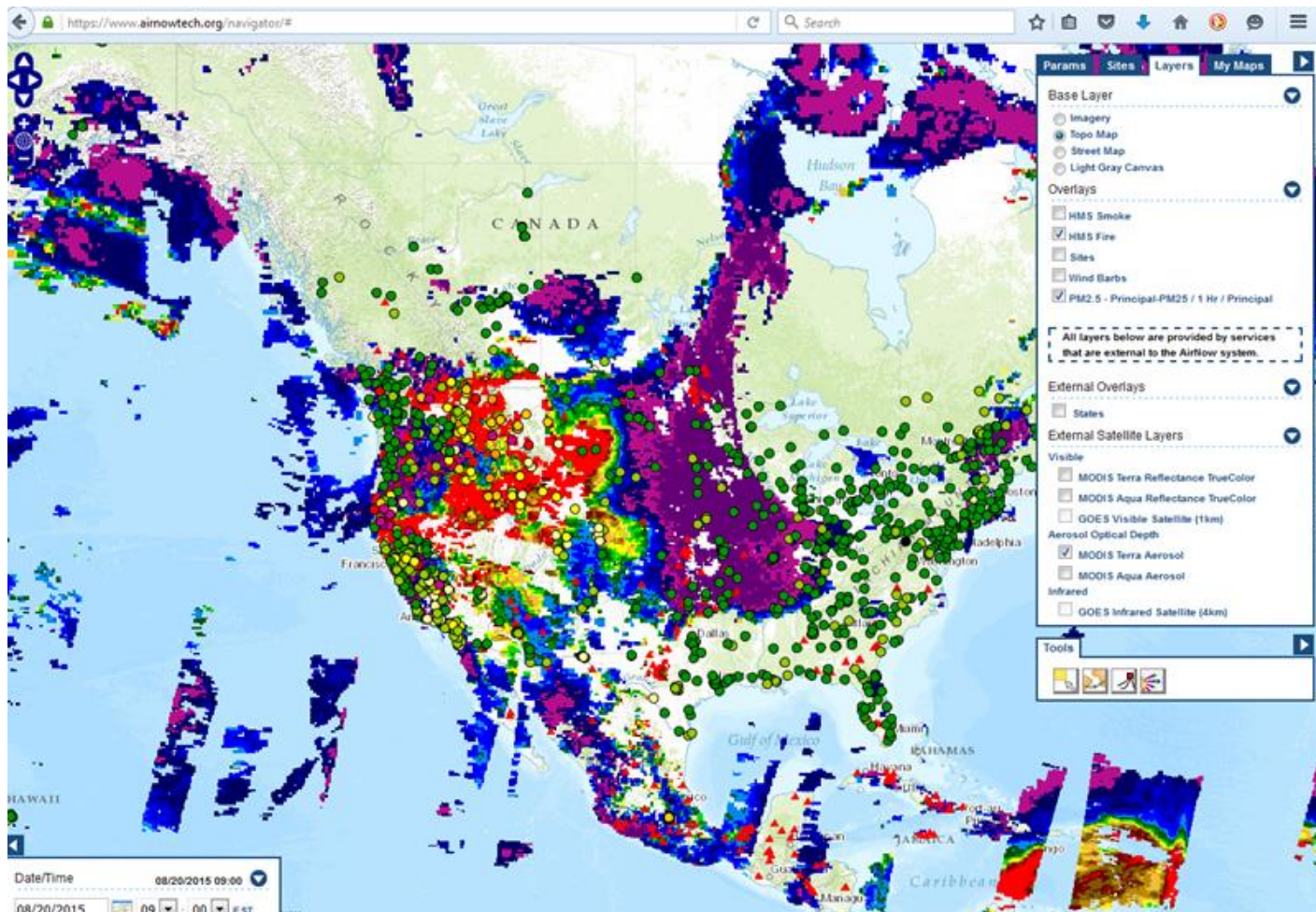
Fire and Smoke with More Data Overlays



Fire and Smoke with More Data Overlays

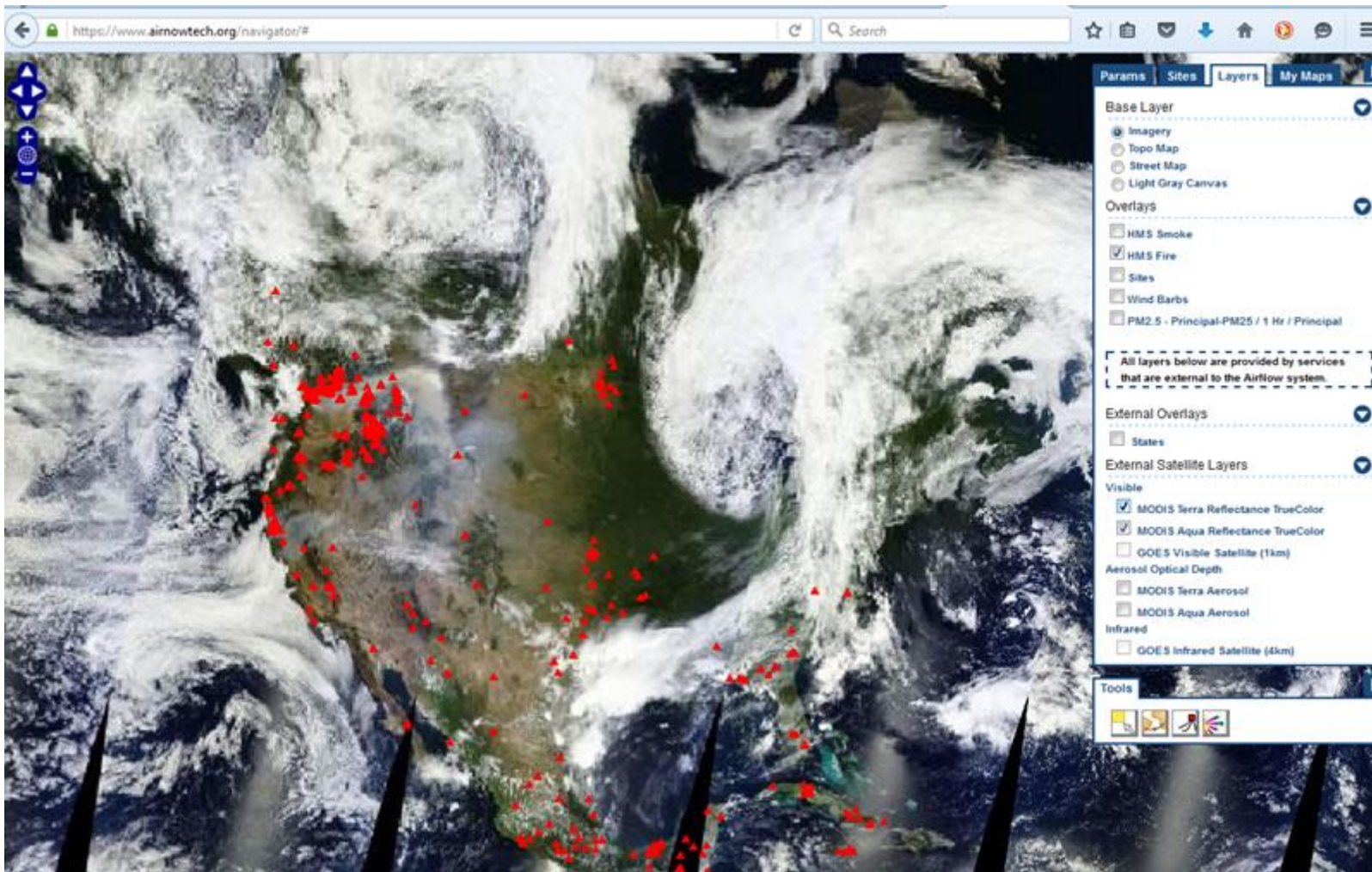


Fire and Smoke with More Data Overlays



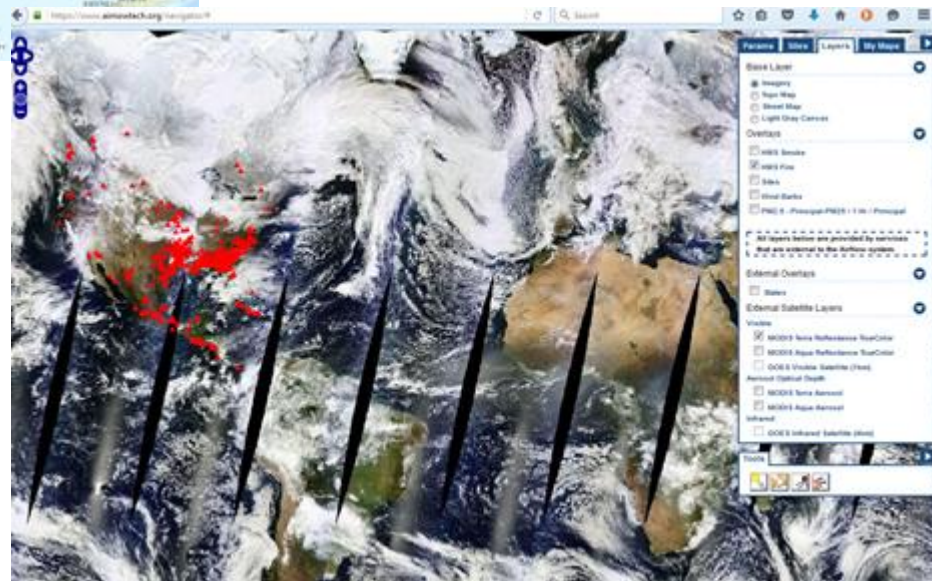
AirNow-Tech Fire Features

Fire and Smoke with More Data Overlays





- **Global HYPSLIT Trajectories**
- **Global fire detects coming...**
- **Global smoke plume not available**
 - Use visible satellite as a surrogate



Thanks!

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Background: EPA Nowcast Formula

1. Compute the concentration range (max-min) over the last 12 hours. This tells us how much the air has changed, but relative to what? We need to scale it.

Example 12-hour period
 50 80 75 **90** 82 53 64 74 21 **10** 16 13
 Range = 90-10 = 80 ug/m³

2. Divide the range by the maximum concentration in the 12-hour period

Scaled rate of change is 80/90.

3. Compute the weight factor by subtracting the scaled rate of change from 1. The weight factor must be between .5 and 1. The minimum limit approximates a 3-hour average. If the weight factor is less than .5 then set it equal to .5.

Weight factor is $1 - 80/90 = .11 \rightarrow$ less than .5, so use .5

4. Multiply each hourly concentration by the weight factor raised to the power of how many hours ago the concentration was measured (for the current hour, the factor is raised to the zero power)

$13*(.5)^0 + 16*(.5)^1 + 10*(.5)^2 + 21*(.5)^3 + 74*(.5)^4 + \dots$

5. Compute the NowCast by summing these products and dividing by the sum of the weight factors raised to the power of how many hours ago the concentration was measured.

$\frac{13*(.5)^0 + 16*(.5)^1 + 10*(.5)^2 + 21*(.5)^3 + 74*(.5)^4 + \dots}{(.5)^0 + (.5)^1 + (.5)^2 + (.5)^3 + (.5)^4 + \dots}$
 = 17.4 ug/m³

How is missing data handled?

- To compute a valid NowCast, you must have at least two of the most recent 3 hours

- If you are missing a single hour, there will be no interruption in the reported NowCast
- If you are missing two of three hours, there will be at least one missing NowCast value

I = data
X = NO data

Hourly data	I	I	I	X	I	I	I	I	I
NowCast			I	I	I	I	I	I	I

Hourly data	I	I	I	X	X	I	I	I	I
NowCast			I	I	X	X	I	I	I

Hourly data	I	I	I	X	I	X	I	I	I
NowCast			I	I	I	X	I	I	I

- The weighting of the values does not change

- That is, each hourly concentration is multiplied by the weight factor raised to the power of how many hours ago the concentration was measured
- The example to the right shows the calculation if we were missing the next to last value in the 12-hour period

Example 12-hour period
50 80 75 90 82 53 64 74 21 10 ~~16~~ 13

$$\frac{13*(.5)^0 + \cancel{16*(.5)^1} + 10*(.5)^2 + 21*(.5)^3 + 74*(.5)^4 + \dots}{(.5)^0 + \cancel{(.5)^1} + (.5)^2 + (.5)^3 + (.5)^4 + \dots}$$