

Lake States Fire Science Consortium

A JFSP KNOWLEDGE EXCHANGE CONSORTIUM



2014-2015 Webinar Series
April 16, 2015

Easy-to-Use Smoke Tools

Trent Wickman

Air Resource Management

Great Lakes National Forests - Eastern Region

Audio will start at top of the hour.

This webinar is listen only – to ask questions please use the chat box in lower right of screen.



@LSFireScience



LakeStatesFireSci.net



Burn Boss Refresher

Smoke Management

Trent Wickman

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(218) 626-4372

Who am I?

- Attended Michigan Tech
- Worked for the State of MN for 5 years as an air permit engineer
- Been with Forest Service since 2001
- 2009 - became Lake States Forest's Air Dude
- Native of NE MN and UP of MI





Region 9 Zoned Air Program

- Claire O'Dea (Southern Tier Forests): Hoosier, Mark Twain, Monongahela, Shawnee, Wayne, and Midewin National Tallgrass Prairie
- Ralph Perron (Northeastern Forests): Allegheny, Finger Lakes, Green Mountain, and White Mountain
- Trent Wickman (Lake States Forests): Chequamegon-Nicolet, Chippewa, Hiawatha, Huron-Manistee, Ottawa, and Superior

Why Do I Need to Know About Smoke?



What do I need to know about Smoke?

(Cliff Notes version)

- Your State Smoke Management Plan
 - Or Basic Smoke Management Practices if you don't have a plan
- What a Nonattainment Area is and why its bad
 - And if you burn in one
- How to figure out how polluted the air is now
- How to predict where my smoke will go (or where it went) and how thick it will be
- How to estimate how bad the smoke was?

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EPA's Air Quality Index (AQI) for PM_{2.5}

- Shorter averaging and reporting times
- Uses information from continuous monitoring instruments (some are not “official” like the FRM)
- Used for real time communication with the public
- Could trigger evacuations
- What you hear about in the news



Index Values	Levels of Health Concern	Cautionary Statements	PM _{2.5} Breakpoints (µg/m ³ , 24-hr ave)
0 – 50	Good	None	0.0 - 12.0
51 – 100	Moderate	Unusually sensitive people should consider reducing prolonged or heavy exertion outdoors.	12.1 - 35.4
101 – 150	Unhealthy for Sensitive Groups	Active children and adults, and people with lung disease, such as asthma, should reduce prolonged or heavy exertion outdoors.	35.5 - 55.4
151 – 200	Unhealthy	Active children and adults, and people with lung disease, such as asthma, should avoid prolonged or heavy exertion outdoors. Everyone else, especially children, should reduce prolonged or heavy exertion outdoors.	55.5 - 150.4
201 – 300	Very Unhealthy	Active children and adults, and people with lung disease, such as asthma, should avoid all outdoor exertion. Everyone else, especially children, should avoid prolonged or heavy exertion outdoors.	150.5 - 250.4
301 – 500	Hazardous	Everyone should avoid all physical activity outdoors	250.5 - 500



Mlair

Department of Environmental Quality



Michigan.gov

[Michigan.gov Home](#)[DEQ Home](#)[DEQ Air](#)[DEQ Air Monitoring](#)[Contact DEQ](#)[Air Quality Index](#)[Action! Days](#)[Air Quality Notification](#)[Monitoring Data](#)[Ozone Maps](#)[PM_{2.5} Maps](#)[Links](#)

Announcements

Ozone is monitored April thru September.

Previous season maps & data are available. Use the calander option to...

TIP ... Click on an AQI "dot" to view air monitor data.[\(more\)](#)

Forecast Discussions

FORECAST SUMMARY: Tuesday, February 19th, 2013 through Monday, February 25th, 2013 PM-2.5: 24-hour Fine Particulate concentra...

[\(more\)](#)

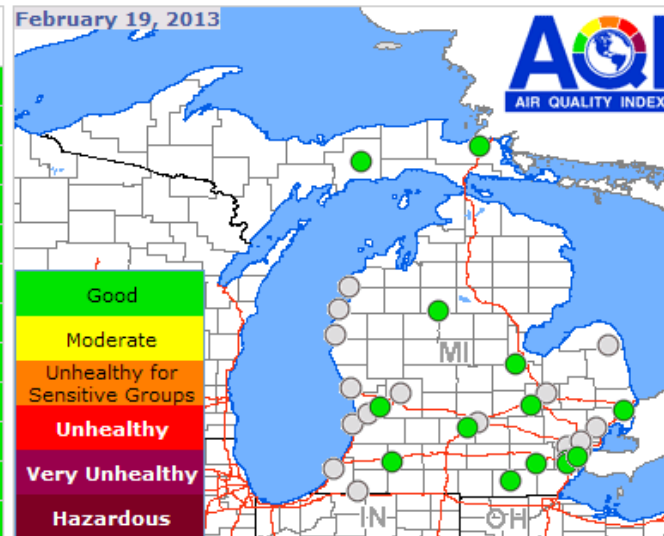
Latest AQI Information

Select Map: [Legend](#)

Location	Current AQI Value	Forecast	
		Today	Tomorrow
Ann Arbor	23 - PM _{2.5}	PM _{2.5}	PM _{2.5}
Benton Harbor	16 - PM _{2.5}	PM _{2.5}	PM _{2.5}
Detroit	33 - PM _{2.5}	PM _{2.5}	PM _{2.5}
Eastern U.P.	16 - PM _{2.5}	PM _{2.5}	PM _{2.5}
Flint	15 - PM _{2.5}	PM _{2.5}	PM _{2.5}
Grand Rapids	24 - O ₃	PM _{2.5}	PM _{2.5}
Houghton Lake	27 - O ₃	PM _{2.5}	PM _{2.5}
Kalamazoo	16 - PM _{2.5}	PM _{2.5}	PM _{2.5}
Lansing	24 - O ₃	PM _{2.5}	PM _{2.5}
Ludington	27 - O ₃	PM _{2.5}	PM _{2.5}
Saginaw	17 - PM _{2.5}	PM _{2.5}	PM _{2.5}
Traverse City	27 - O ₃	PM _{2.5}	PM _{2.5}

[AQI Breakpoints](#) [Actions To Protect Health](#)

February 19, 2013



Click on site to display hourly monitor values

[Michigan.gov Home](#)[Accessibility Policy](#)[Privacy Policy](#)[Link Policy](#)[Security Policy](#)

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In partnership with the U.S. EPA AIRNow program.

Check
it out !

Minnesota

<http://www.mn.enviroflash.info/signup.cfm>

The screenshot shows a web browser window with the URL <http://www.mn.enviroflash.info/signup.cfm>. The browser's address bar and tabs are visible at the top. The page content features the AirNow logo and the title "Air Quality Notifications". On the left, there is a sidebar with links: "EnviroFlash Home", "EnviroFlash Challenge", "EnviroFlash Fact Sheet (PDF)", "Free AIRNow iPhone & Android Apps! iPhone App | Android App", "EnviroFlash on Twitter", "AIRNow RSS Feeds", "EnviroFlash Toolkit", "About the Air Quality Index (AQI) (PDF)", "Today's National Air Quality Forecast", "Recommend to a friend", and "About EnviroFlash". The main content area has a green "Subscribe to EnviroFlash" button and a blue "Manage Your Account" button. Below these is a heading "Sign up and Start Receiving Your Air Quality Forecast Today!" followed by the instruction "Fill out the form below to get started." The "Subscriber Information" section contains input fields for "Email Address:", "Confirm Email:", "First Name:", "Last Name:", and "ZIP Code:", with asterisks indicating required fields. A link "* Receive as a text message?" is next to the email field. Below this is the "City Selection" section with a "Nearest EnviroFlash City:" label and a "Change City" link. The "Email Preferences" section is partially visible at the bottom. The Windows taskbar at the bottom shows various application icons and the system clock displaying 1:41 PM on 4/10/2015.

AirNow
EnviroFlash

Air Quality Notifications

[Subscribe to EnviroFlash](#) [Manage Your Account](#)

Sign up and Start Receiving Your Air Quality Forecast Today!

Fill out the form below to get started.

Subscriber Information

Email Address: * [Receive as a text message?](#)

Confirm Email: *

First Name:

Last Name:

ZIP Code: *

* required fields

City Selection

Nearest EnviroFlash City:

[Change City](#)

Email Preferences

[EnviroFlash Home](#)

[EnviroFlash Challenge](#)

[EnviroFlash Fact Sheet \(PDF\)](#)
Learn how EnviroFlash works!

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[EnviroFlash Toolkit](#)
Available to AIRNow partner agencies


[About the Air Quality Index \(AQI\) \(PDF\)](#)

[Today's National Air Quality Forecast](#)

[Recommend to a friend](#)

[About EnviroFlash](#)

<http://www.airnow.gov/>

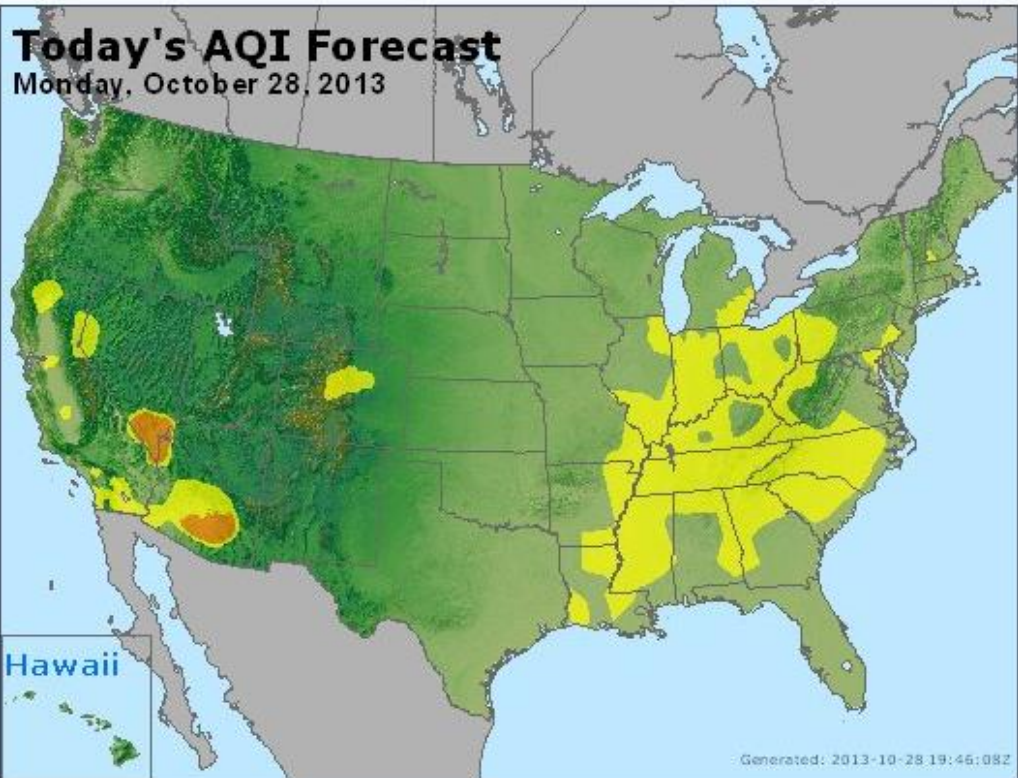


Local Air Quality Conditions
Zip Code: State: [National Summary](#)

[Forecast](#) [Current AQI](#) [More Maps](#)

Today's AQI Forecast

Monday, October 28, 2013



Hawaii

Generated: 2013-10-28 19:46:08Z

Wildfire Smoke Advisories and Forecasts

[For more information](#)

Announcements

SAVE THE DATE! February 10-12, 2014
[2014 NATIONAL AIR QUALITY CONFERENCES](#)

10/23/13: [AirNow API](#) replaces AirNow Gateway. The AirNow API suite of tools includes web services, data feeds, and other file products for software developers.

10/21/13: [Eight New Pennsylvania Schools](#) Join the School Flag Program

[more announcements](#)

Air Quality Basics

[Air Quality Index](#) | [Ozone](#) | [Particle Pollution](#) | [UV](#) | [Smoke from fires](#) | [What You Can Do](#)

Health

Learning Center

Good

Moderate


USG


Unhealthy

Very Unhealthy

Hazardous

! Action Day

 [Apps](#)

 [EnviroFlash Email](#)

What do I need to know about Smoke?

(Cliff Notes version)

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All Models Are Wrong

**Some
Models
Are
Useful**



How to predict where my smoke will go (or where it went) and how thick it will be

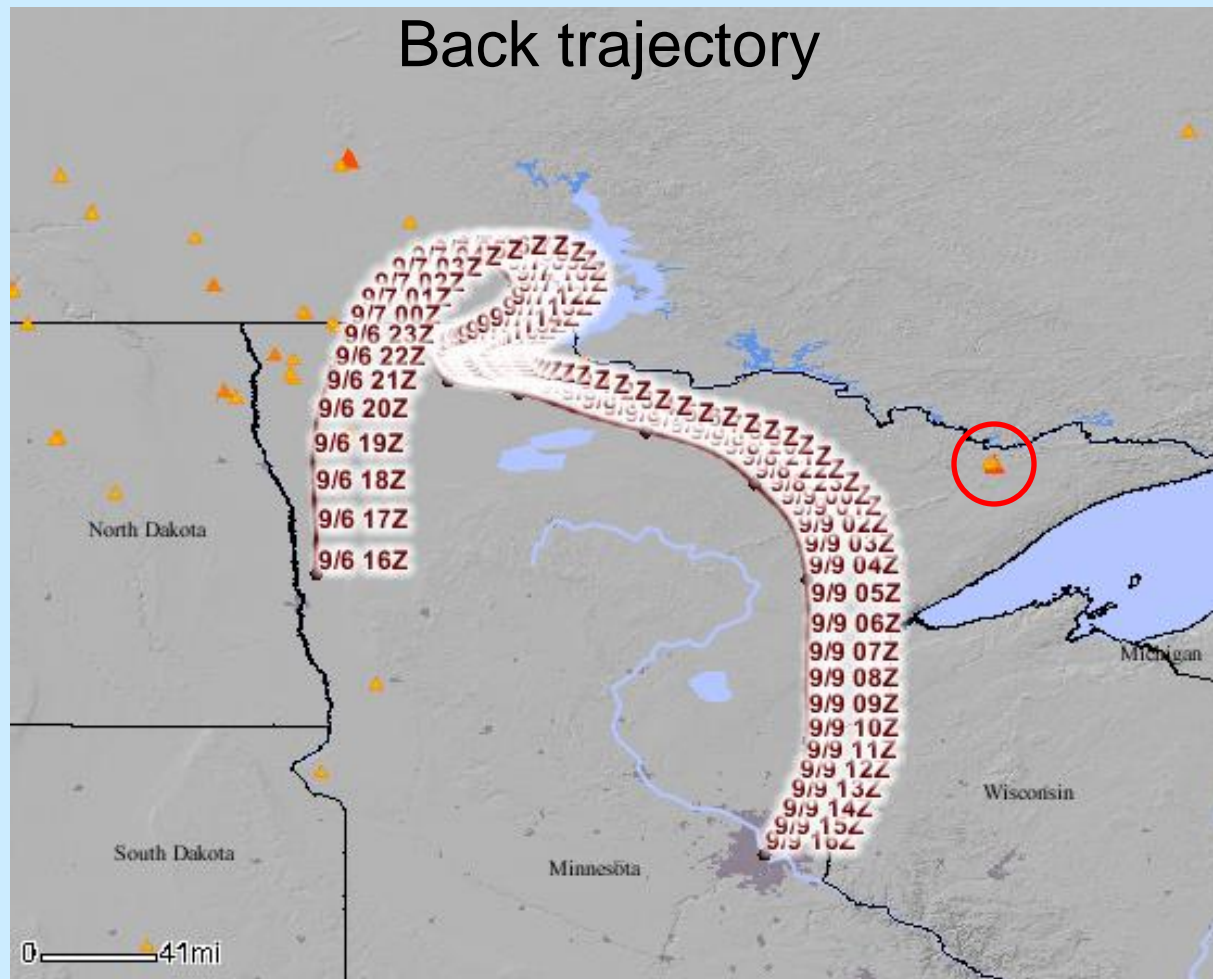
- Where my smoke will go (or where it went)
 - Trajectory Modeling
 - Hysplit
- How to predict how thick it will be
 - Dispersion Modeling
 - Screening
 - Smoke Screen
 - Refined
 - VSmoke-Web
 - Bluesky



Trajectory Models

- Model that uses archived and/or predicted meteorological info to calculate where air came from (back trajectory) or traveled to (forward trajectory) based on a starting location, height and time.

Smoke in Minneapolis: Sept 9, 2011





What it does NOT do

- HYSPLIT trajectory model does NOT produce concentration estimates of smoke.
- ...meaning it does NOT tell you how MUCH smoke is in the air
- ...it just tells you WHERE the smoke is going or where it has been



Key Inputs

- Where – Location of fire (smoke)
 - X,Y not as important as height AGL (plume rise)
- When – when will smoke be generated at a significant height?
- Try to bracket possible combinations of conditions (perform multiple runs)

Chicago Smoke Sept 13, 2011

Logged in as

[Log out](#) | [Edit A](#)[Documentation](#) | [Operational Status](#)

Options Tool Options

Trajectory Parameters

Start Hour

22Z

Hours

72hr Backward

Height (m agl)

100 m

Trajectory cluster

☐ Create trajectory clusters

Label

(Only appears when map scale is less than 22 mi)

- ☒ Hour
☐ Height (m agl)
☐ Pressure (mb)
☐ None

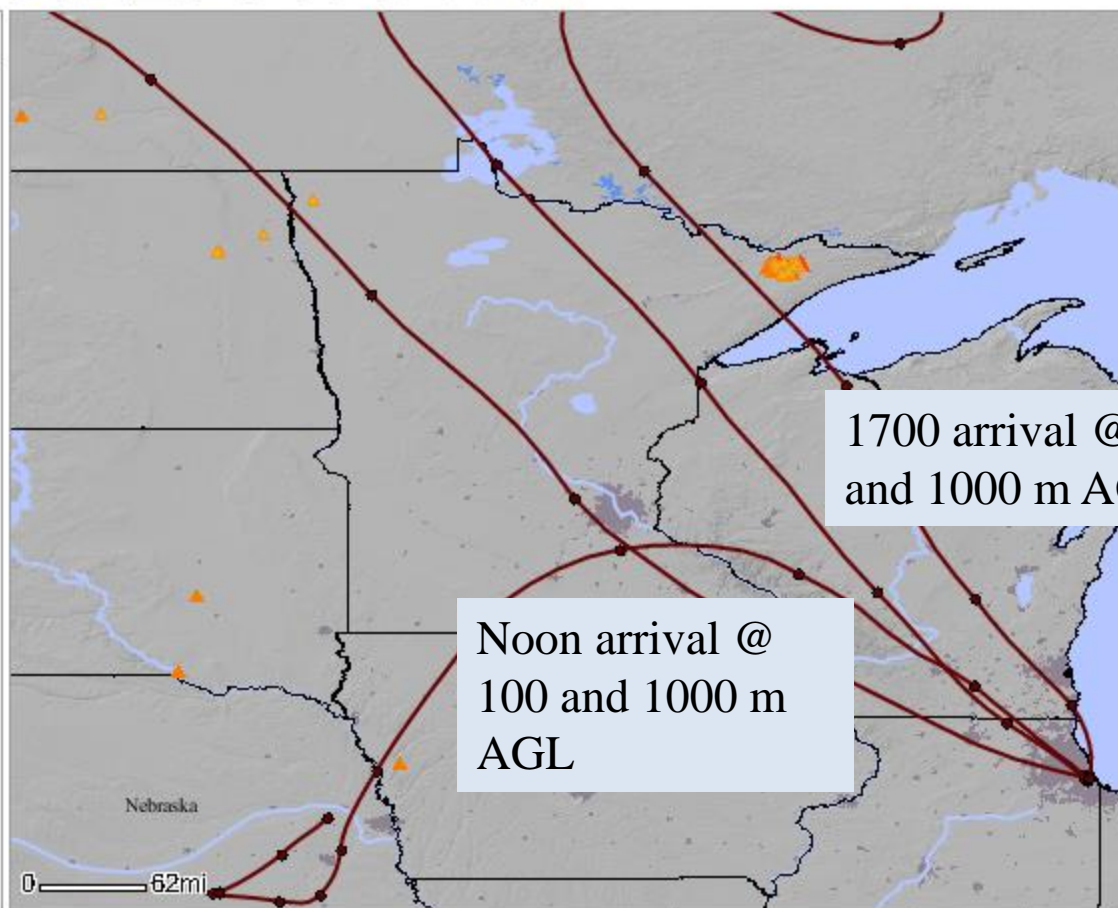
Source:

[NOAA HYSPLIT model](#)

NAM/NDAS models (40km)

Most Recent: 30 Dec 2011 00Z

Model vertical velocity



Legend

Legend

Today's Fire Location

- ▲ 100 acres or less
- ▲ 100 - 500 acres
- ▲ 500 - 5000 acres
- ▲ more than 5000 acres

Today's Fire Perimeter

Total Fire Perimeters

Today's HMS fire dete

Today's ICS-209 repo

1700 arrival @ 100
and 1000 m AGLNoon arrival @
100 and 1000 m
AGL[Additional legend information](#)

Apply Changes



Key Issues

- Accuracy – model uses gridded meteorological data. Some are 12 x 12 km cells
- Not useful for near-field impacts (use spot forecasts of surface and transport wind directions)
- A useful tool when used correctly by someone who understands its limitations



Websites for Tools

Trajectories - HYSPLIT

- 1) EPA AirNow-Tech - <http://airnowtech.org/>
- 2) NWS Spot Weather Forecast Page
- 3) <http://ready.arl.noaa.gov/HYSPLIT.php>



Example: HYSPLIT through AirNow-Tech



About

AirNow-Tech is a password-protected website for air quality data management analysis, and decision support. AirNow-Tech is primarily used by the federal, State, Tribal, and local air quality organizations that provide data and forecasts to the AirNow system, as well as researchers and other air data users. It allows users to:

- Access monitoring site data, information, and polling status
- Analyze current and past air quality events and episodes
- Submit and analyze air quality forecasts
- Configure EnviroFlash email services for public dissemination of air quality forecasts
- View meteorological and air quality data
- Generate data reports
- Create GIS-based maps with air quality and meteorological conditions
- Sign up for the AirNow Notifier listserve

[Register for an AirNow-Tech Account](#)

[A comprehensive list of EPA air pollution data sources](#)

[Register with AirNow API for an automatic feed of AirNow air quality data](#)

News and Events

Polling Summary

Color Legend

Green	Current	Yellow	2 to 6 hrs old
Red	over 6 hrs old	Gray	Unknown status

April 15, 2015 06:52 (ET)

(All times are in ET)

Agency	Ozone	PM _{2.5}	PM ₁₀
AB1	04/15 05:00	04/15 05:00	04/15 05:00
AIR			
AK1	04/15 05:00	04/15 05:00	04/15 05:00
AL1	04/15 05:00	04/15 05:00	10/28 13:00
AL2	04/15 05:00	04/15 05:00	04/15 05:00
AL3			
AL4	04/15 05:00	04/15 05:00	
AR1	04/15 05:00	04/15 05:00	
AZ1	04/15 05:00	04/15 05:00	04/15 05:00
AZ2	04/15 05:00	04/15 05:00	04/15 05:00
AZ3	04/15 05:00	04/15 05:00	04/15 05:00
AZ4	04/15 05:00		04/15 05:00
BC1	04/15 05:00	04/15 05:00	04/15 05:00
BC2	04/15 05:00	04/15 05:00	04/15 05:00



[Log In](#)

[Agencies](#) [Sites](#) [Navigator](#) [Data](#) [Forecasts](#) [Polling](#) [Notifier](#) [Tools](#) [Resources](#)

Please log in to use AirNow-Tech

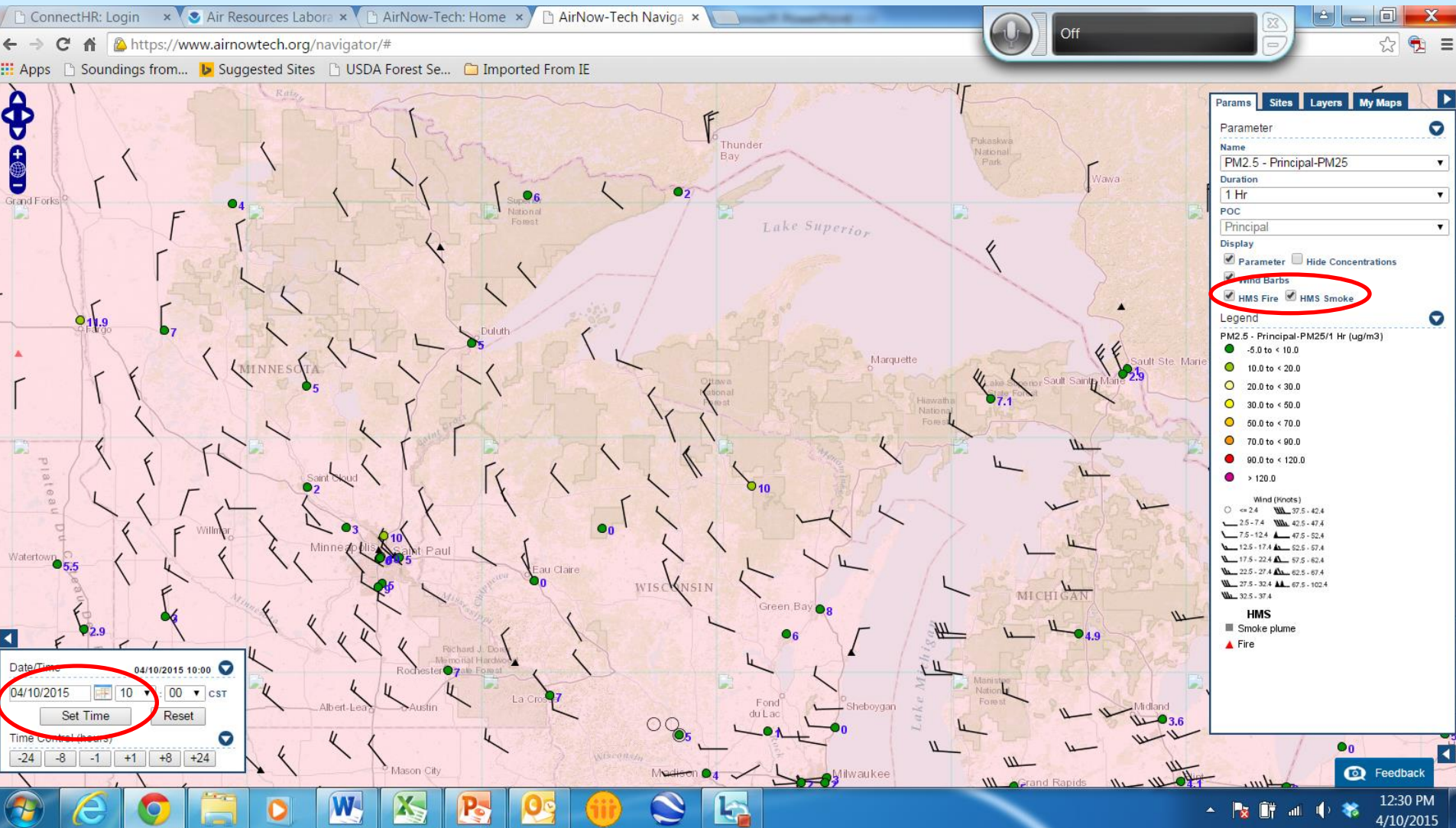
Username:

Password:

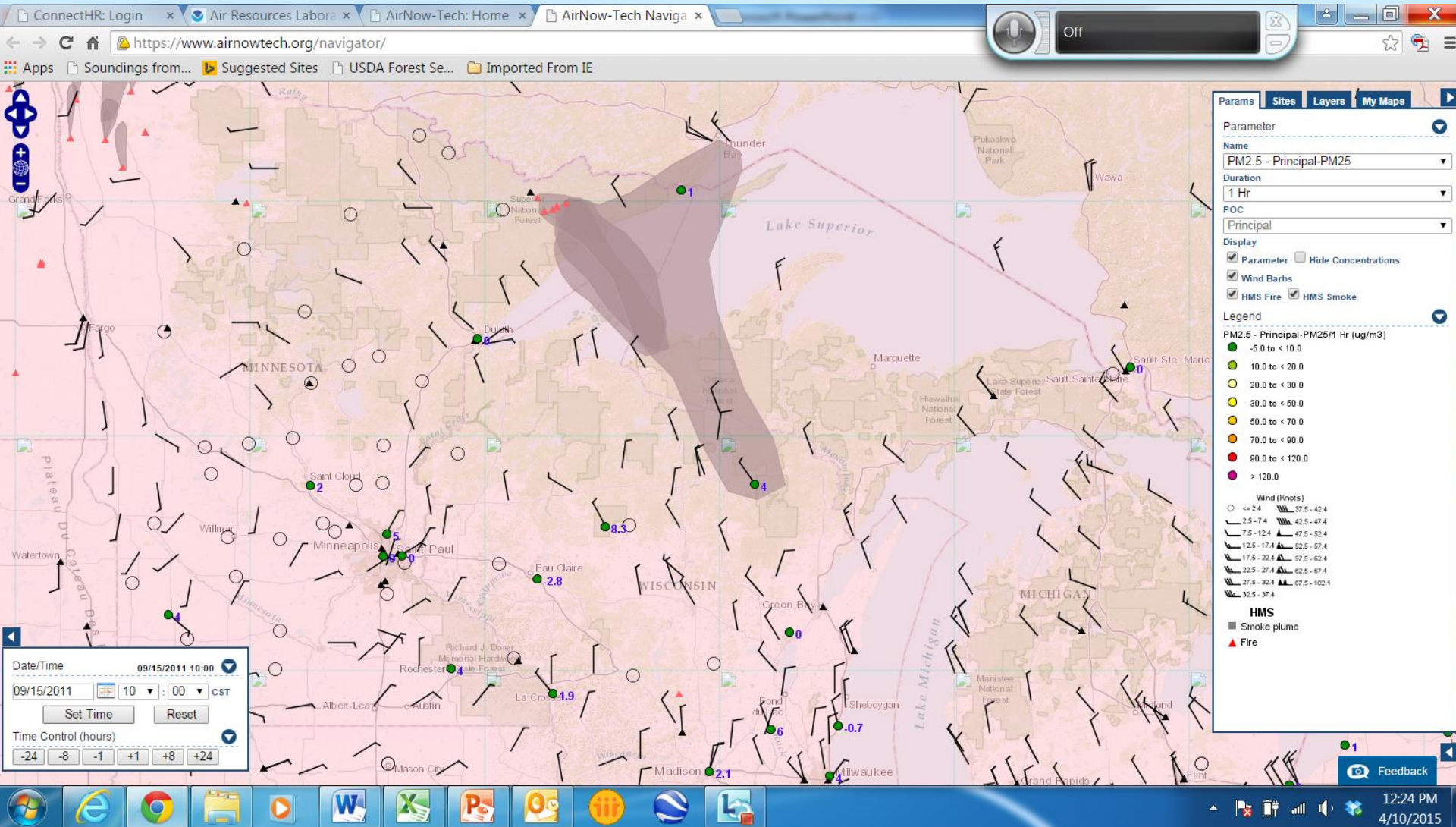
[Forgot your password?](#)

[Request an AirNow-Tech Account](#)

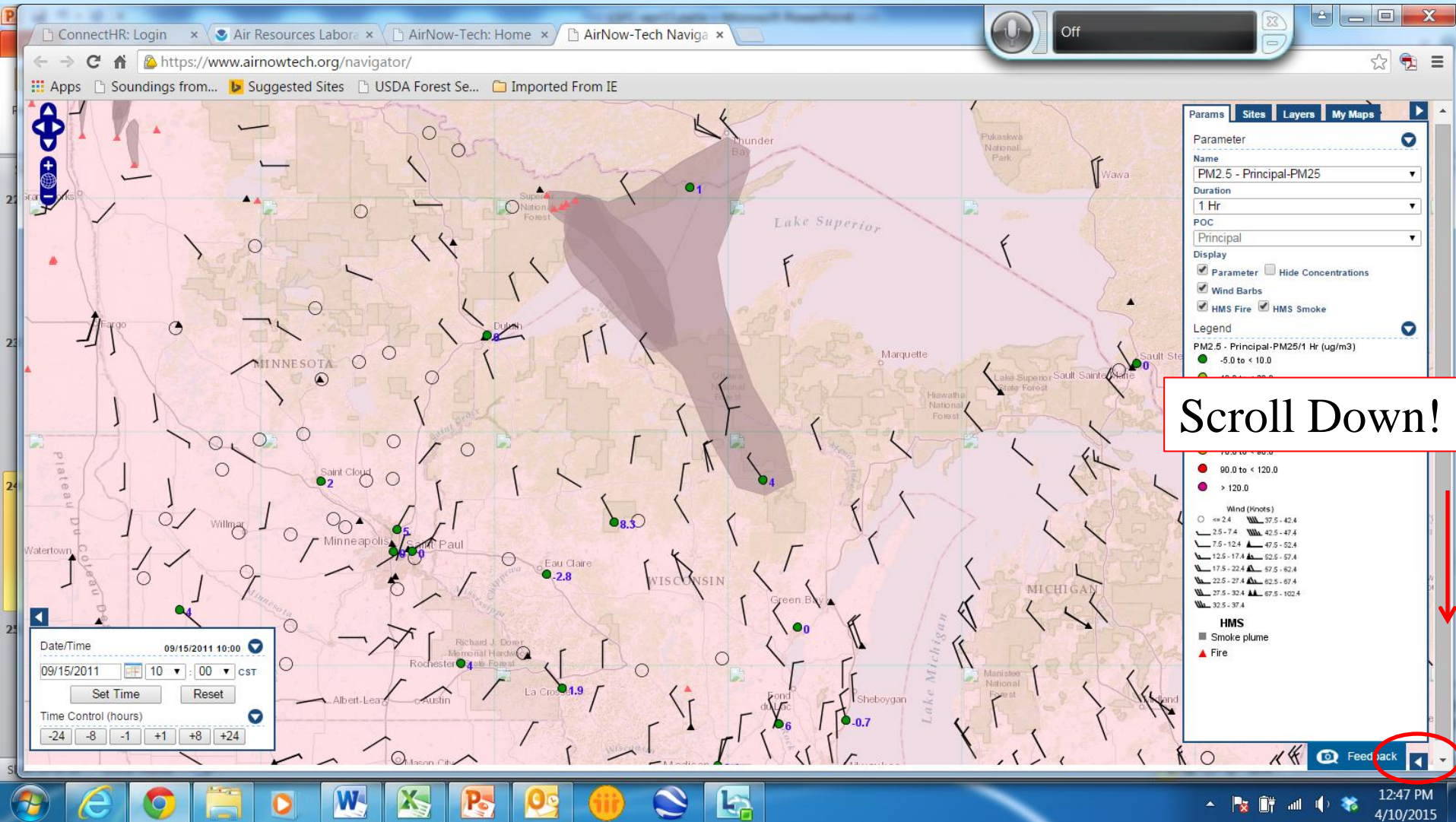
Turn on Fire and Smoke Detects



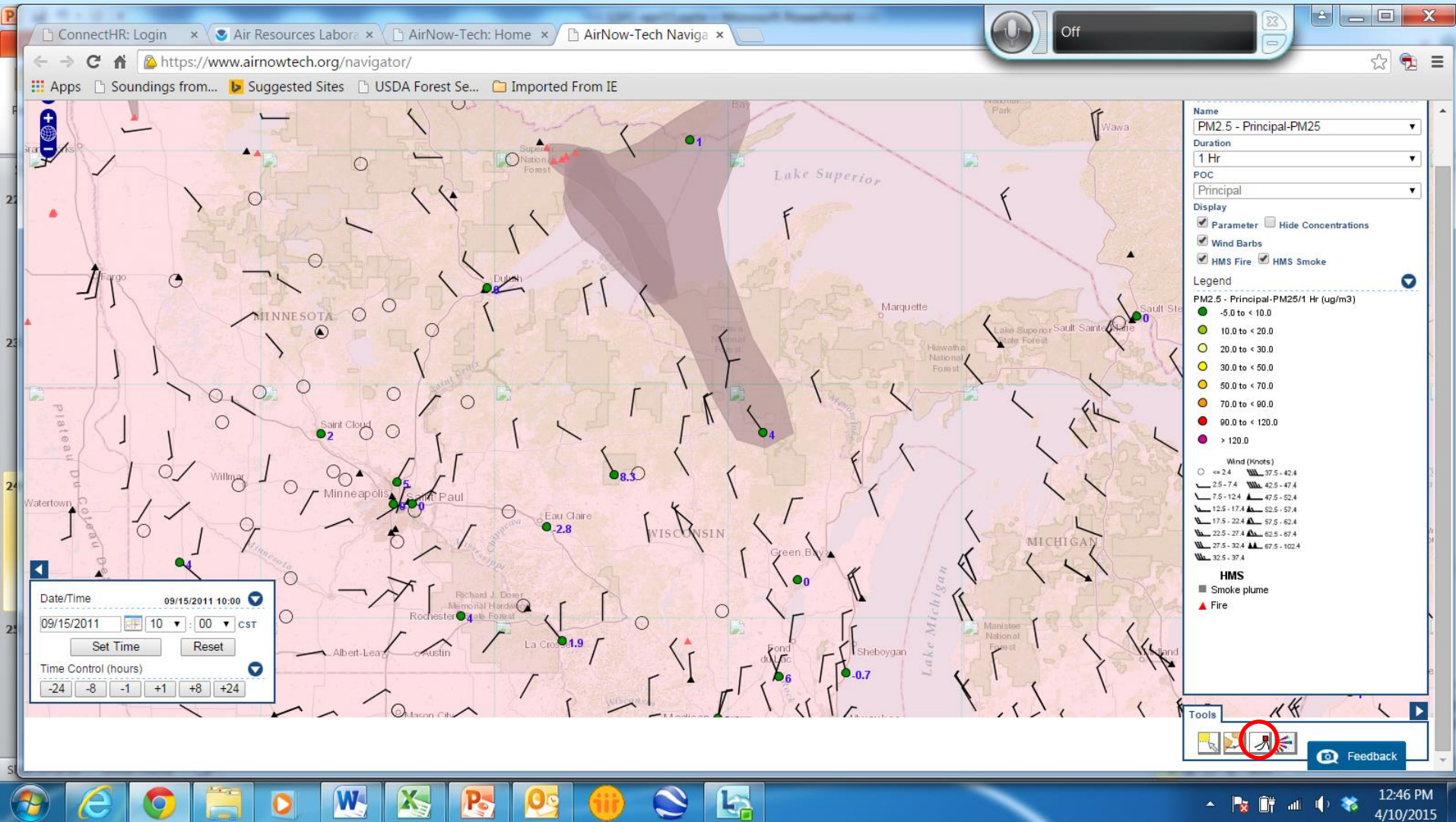
9-15-11 Pagami Fire



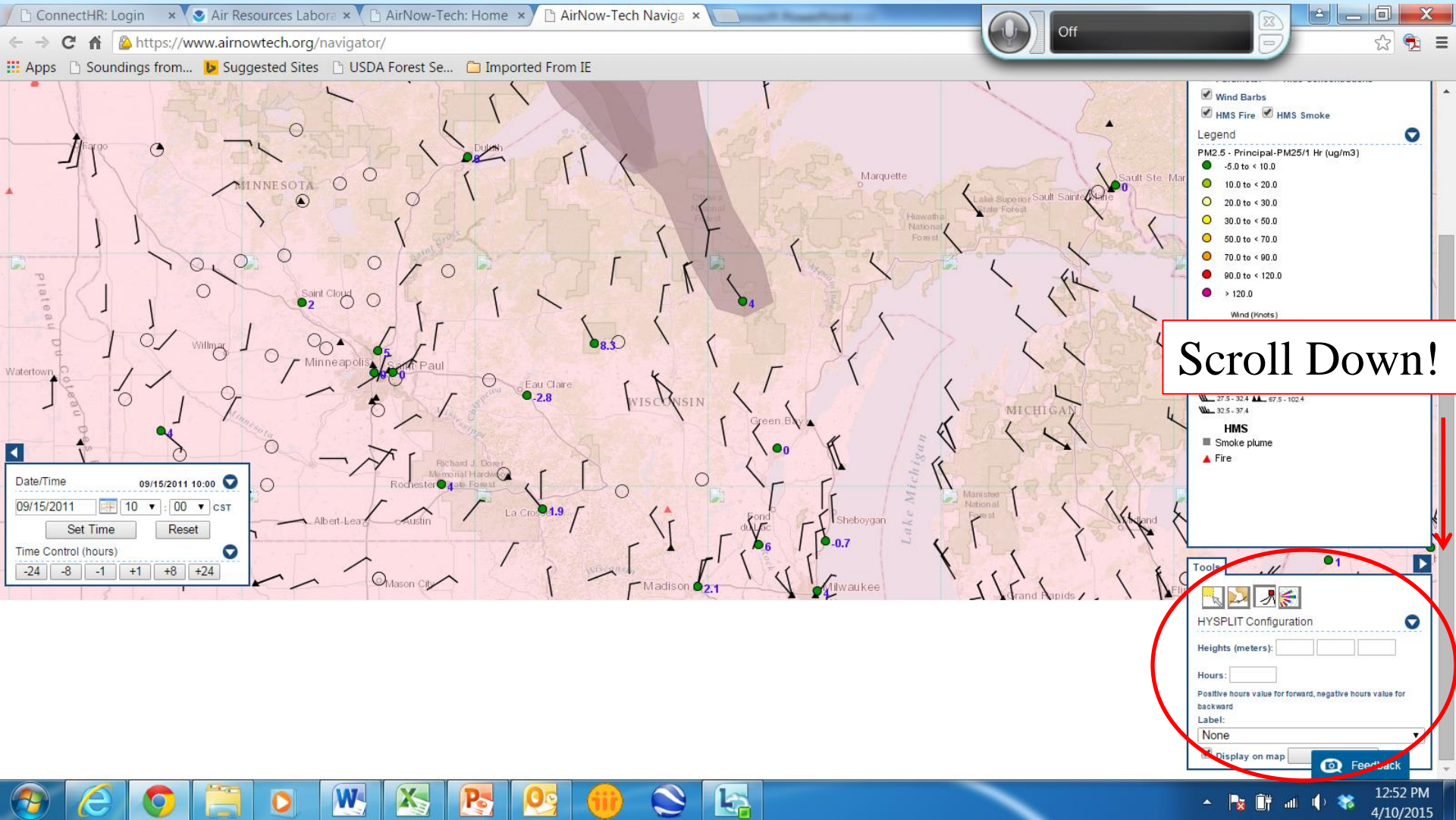
Setup Trajectory



Setup Trajectory



Setup Trajectory



Setup Trajectory

The screenshot displays the AirNow-Tech Navigator web application interface. The main map shows the Great Lakes region with various trajectory points marked by colored circles and numbers. A red box highlights the HYSPLIT Configuration panel in the bottom right corner, which includes fields for Heights (meters), Time (hours), and a checkbox for Display on map. A red arrow points from the text box to the Time field.

For back trajectories use a negative #

HYSPLIT Configuration

- Heights (meters): 100 1000 3000
- Time: 24
- Positive hours value for forward, negative hours value for backward
- Label: Hour
- Display on map: ☐
- Feedback:

Setup Trajectory

The screenshot displays the AirNow-Tech Navigator web application. The browser address bar shows the URL <https://www.airnowtech.org/navigator/>. The application interface includes a map of the Great Lakes region with various locations marked. A red arrow points to a location on the map, indicating where to click to start a trajectory. A text box labeled "Pan and zoom" is positioned near the top left of the map. Another text box labeled "Click where you want trajectory to start" is positioned near the red arrow. A third text box labeled "Scroll Up!" is positioned near the right side of the map, with a red arrow pointing upwards. The right side of the application features a sidebar with a "Params" tab, a "Sites" tab, a "Layers" tab, and a "My Maps" tab. The "Params" tab is active, showing a "Parameter" dropdown set to "PM2.5 - Principal-PM25", a "Duration" dropdown set to "1 Hr", and a "POC" dropdown set to "Principal". The "Display" section has checkboxes for "Parameter", "Hide Concentrations", "Wind Barbs", "HMS Fire", and "HMS Smoke". The "Legend" section shows a color-coded scale for PM2.5 concentrations in $\mu\text{g}/\text{m}^3$. The bottom of the application features a "Date/Time" section with a date/time picker set to 09/15/2011 10:00 CST, and a "Time Control (hours)" section with a range from -24 to +24. The Windows taskbar at the bottom shows various application icons and the system clock indicating 1:00 PM on 4/10/2015.

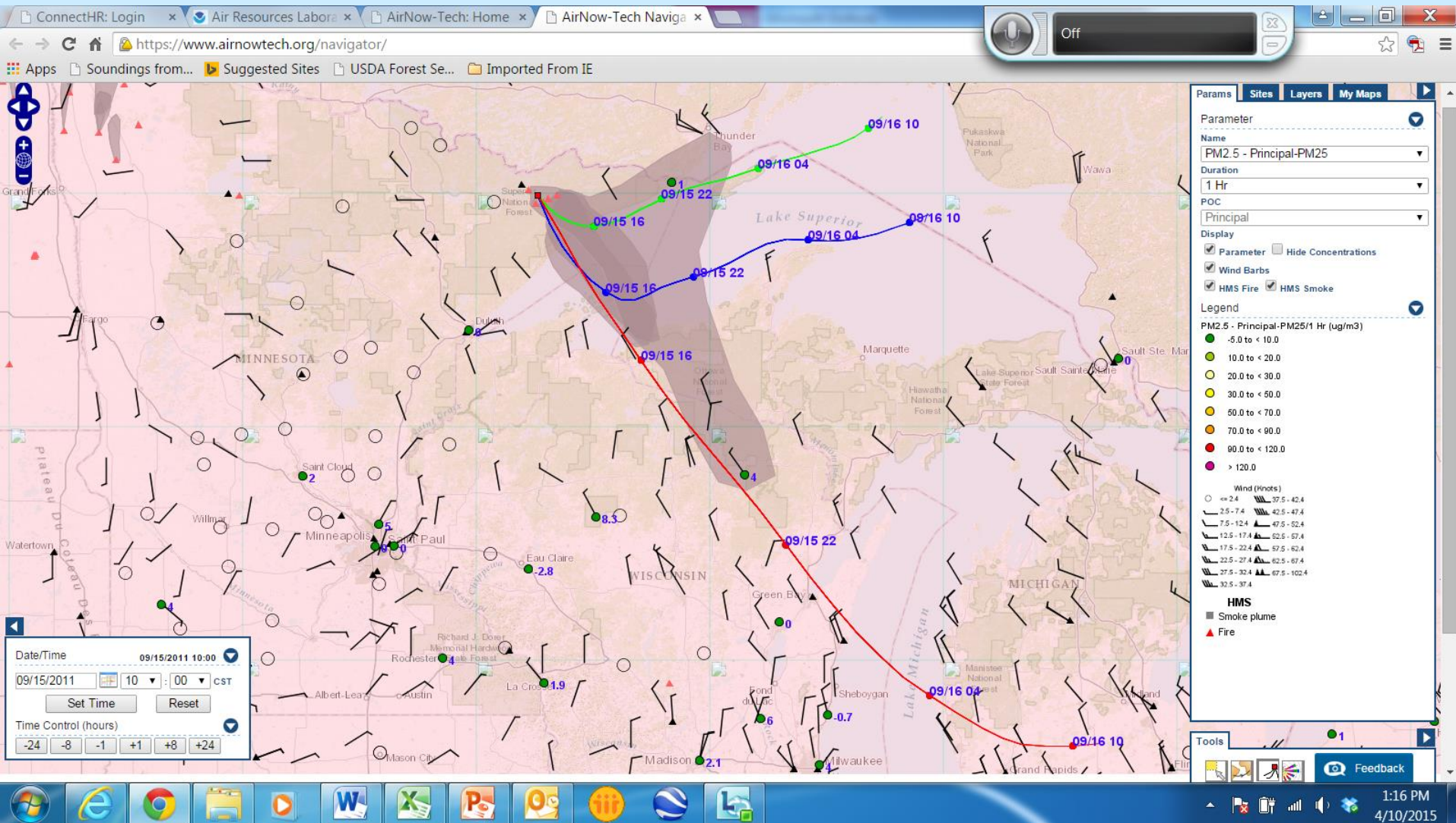
Pan and zoom

Click where you want trajectory to start

Scroll Up!

Parameter
Name
PM2.5 - Principal-PM25
Duration
1 Hr
POC
Principal
Display
☒ Parameter ☐ Hide Concentrations
☒ Wind Barbs
☒ HMS Fire ☒ HMS Smoke
Legend
PM2.5 - Principal-PM25/1 Hr ($\mu\text{g}/\text{m}^3$)
-5.0 to < 10.0
10.0 to < 20.0
20.0 to < 30.0
30.0 to < 50.0
50.0 to < 70.0
70.0 to < 90.0
90.0 to < 120.0
> 120.0
Wind (Knots)
0 - 2.4
2.5 - 7.4
7.5 - 12.4
12.5 - 17.4
17.5 - 22.4
22.5 - 27.4
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1122.5 - 1127.4
1127.5 - 1132.4
1132.5 - 1137.4
1137.5 - 1142.4
1142.5 - 1147.4
1147.5 - 1152.4
1152.5 - 1157.4
1157.5 - 1162.4
1162.5 - 1167.4
1167.5 - 1172.4
1172.5 - 1177.4
1177.5 - 1182.4
1182.5 - 1187.4
1187.5 - 1192.4
1192.5 - 1197.4
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Results



How to predict where my smoke will go (or where it went) and how thick it will be

- Where my smoke will go (or where it went)
 - Trajectory Modeling
 - Hysplit
- How to predict how thick it will be
 - Dispersion Modeling
 - Screening
 - Smoke Screen
 - Refined
 - VSmoke-Web
 - Bluesky

Black Area



Fuel Loading

Largest Error



Fuel Consumption

Second Largest Error



Emission Factor

Smallest Error



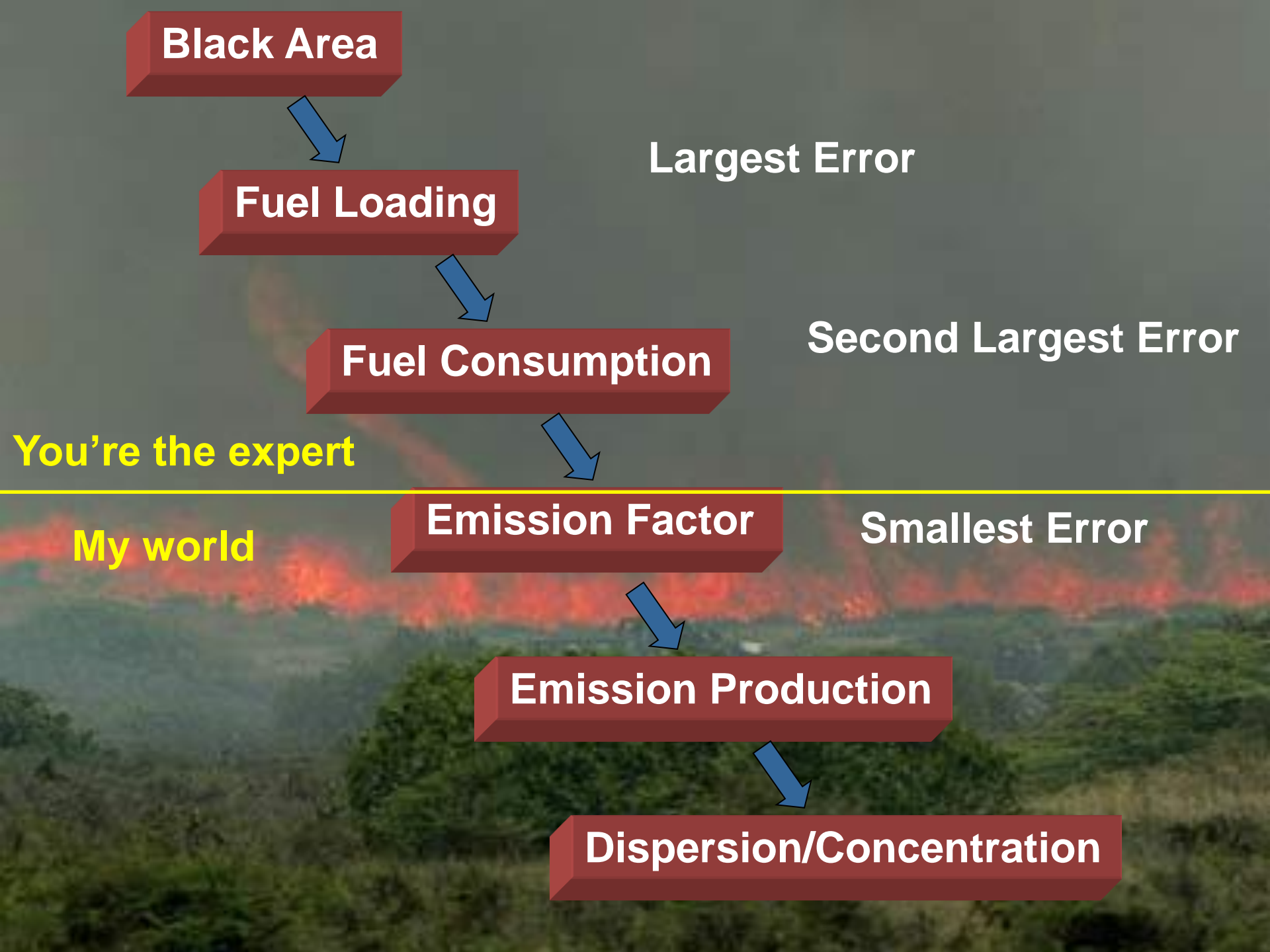
Emission Production



Dispersion/Concentration

You're the expert

My world



Screening Modeling

ConnectHR: Login x SHRMC Simple Smo... AirNow-Tech: Home x AirNow-Tech Naviga x

shrmc.ggy.uga.edu/maps/screen.html

Apps Soundings from... Suggested Sites USDA Forest Se... Imported From IE

Maps

FCAMMS SHRMC Smoke Screening

Simple Smoke Screening

Or click on map

Pan and zoom

Fire & Fuel Info

Lat:
Lon:
Acres:

Fuels
Grass

Ignition Method
Backing/Spot

Wind Direction
N +/- 30

Update Map

After generating a grid
save the data for display
in Google Earth
Get KML data

Nice option

About

The Southern Smoke Management Guide made use of a simple graphical smoke screening system. This system relied upon a simple protractor to use with paper

Screening Modeling

ConnectHR: Login x SHRMC Simple Smol x AirNow-Tech: Home x AirNow-Tech Naviga x

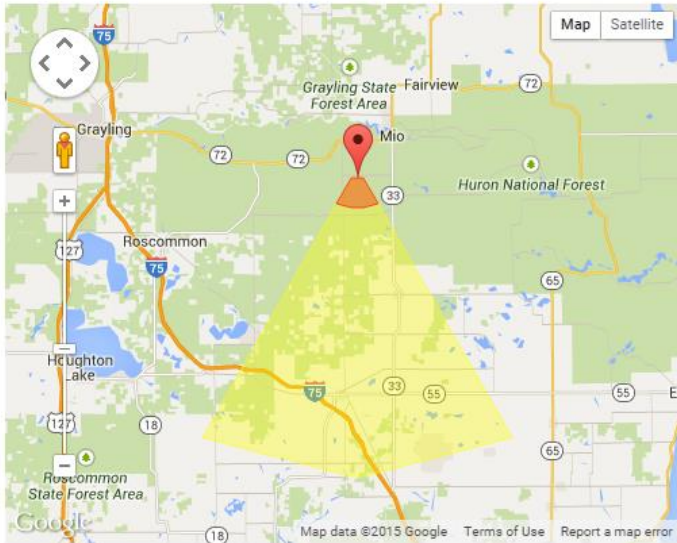
shrmc.ggy.uga.edu/maps/screen.html

Apps Soundings from... Suggested Sites USDA Forest Se... Imported From IE

Maps

FCAMMS SHRMC Smoke Screening

Simple Smoke Screening



The map displays a geographical area with a yellow shaded region representing the smoke screening area. The map includes labels for Grayling, Mio, Roscommon, Huron National Forest, and Grayling State Fairview Forest Area. A red pin is located at Mio. The map data is from 2015 Google.

Fire & Fuel Info

Lat: 44.5904671813
Lon: -84.2005920410
Acres: 1000

Fuels: Slash

Ignition Method: Backing/Spot

Wind Direction: N +/- 30

Update Map

After generating a grid save the data for display in Google Earth
Get KML data

About

The [Southern Smoke Management Guide](#) made use of a simple graphical smoke screening system. This system relied upon a simple protractor to use with paper

Refined Modeling

- Vsmoke-Web

ConnectHR: Home x USDA FS Paycheck8 x SHRMC VSmoke-We x AirNow-Tech: Home x AirNow-Tech Naviga x

shrmc.ggy.uga.edu/maps/vsmoke.html

Apps Soundings from... Suggested Sites USDA Forest Se... Imported From IE

VSmoke-Web

FCAMMS SHRMC Smoke VSmoke

Estimating Prescribed Fire Smoke Impacts

Map Satellite

United States

Mexico

Map data ©2015 Google, INEGI, Inav/Geosistemas SRL Terms of Use

Fire & Weather Info

1. Location
Lat:
Lon:
2. Fire Size
Acres:
Duration: hours
Ignition Method:
3. Fuel Load
Fuel Type:
Tons/Acre:
4. Fuel Consumption
Fuel Moisture Scenario:
% consumed:
5. Emissions
PM 2.5 Emission Factor: lbs/ton

More inputs

About

VSmoke-Web is a web-based implementation of VSmoke (Lavdas, 1996) and is designed to assist with planning prescribed burns in the Southern United States.

4:18 PM 4/10/2015

Refined Modeling

- VSmoke-Web

The screenshot shows the VSmoke-Web interface in a web browser. The browser's address bar shows the URL `shrmc.ggy.uga.edu/maps/vsmoke.html`. The page has a navigation bar with tabs for 'ConnectHR: Home', 'USDA FS Paycheck8', 'SHRMC VSmoke-We', 'AirNow-Tech: Home', and 'AirNow-Tech Naviga'. The main content area is divided into two columns. The left column contains an 'About' section and an 'AQI' section. The 'About' section describes VSmoke-Web as a web-based implementation of VSmoke (Lavdas, 1996) designed to assist with planning prescribed burns. The 'AQI' section contains a table with five rows: 'Good', 'Moderate', 'Unhealthy for Sensitive Groups', 'Unhealthy', and 'Very Unhealthy'. Each row provides AQI ranges, PM 2.5 concentration ranges, and a description of the health effects. The right column contains a '5. Emissions' section with input fields for 'PM 2.5 Emission Factor' (27 lbs/ton), 'Particulate Emission Rate' (1.19 grams/sec), and 'Heat Release Rate' (1.77 MW). Below this is a '6. Weather' section with input fields for 'Mixing Height' (2000 ft), 'Transport Wind' (10 mph), and a dropdown for 'Stability Class' (Moderately Unstable). A red oval highlights the input fields in the '5. Emissions' and '6. Weather' sections. A red box with the text 'More inputs' is positioned to the right of the oval. The bottom of the screen shows a Windows taskbar with various application icons and a system clock indicating 4:19 PM on 4/10/2015.

About

VSmoke-Web is a web-based implementation of VSmoke (Lavdas, 1996) and is designed to assist with planning prescribed burns in the Southern United States. VSmoke is a simple gaussian smoke dispersion model that calculates isopleths of surface smoke concentration. Output from the model represents *peak hourly concentrations of PM2.5* or visibility (under development). Contour values and their colors correspond to the PM 2.5 thresholds for the Air Quality Index (AQI) and reflect potential health impacts ranging from moderate to hazardous (Visit [AirNow for more AQI info](#)). Burn location can be set by clicking on the map or by entering the Latitude and Longitude. Note that the Latitude and Longitude should be entered in decimal degrees (30.38,-84.37) or degrees+decimal minutes (30 22.80, -84 22.20 - note the space between degree and minute values).

AQI

Levels of Health Concern	AQI Value	Hourly PM 2.5 Conc.	Meaning
Good	0 to 50	0 to 18	Air quality is considered satisfactory, and air pollution poses little or no risk.
Moderate	51 to 100	39 to 88	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.
Unhealthy for Sensitive Groups	101 to 150	89 to 138	Members of sensitive groups may experience health effects. The general public is not likely to be affected.
Unhealthy	151 to 200	139 to 351	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.
Very Unhealthy	201 to 300	352 to 526	Health alert: everyone may experience more serious health effects.

5. Emissions

PM 2.5 Emission Factor: 27 lbs/ton

Particulate Emission Rate: 1.19 grams/sec

Heat Release Rate: 1.77 MW

6. Weather

Mixing Height: 2000 ft

Transport Wind: 10 mph

N

Stability Class: Moderately Unstable

7. Update Map

Run Model

8. Misc Options

Background PM 2.5: 5 ug/m3

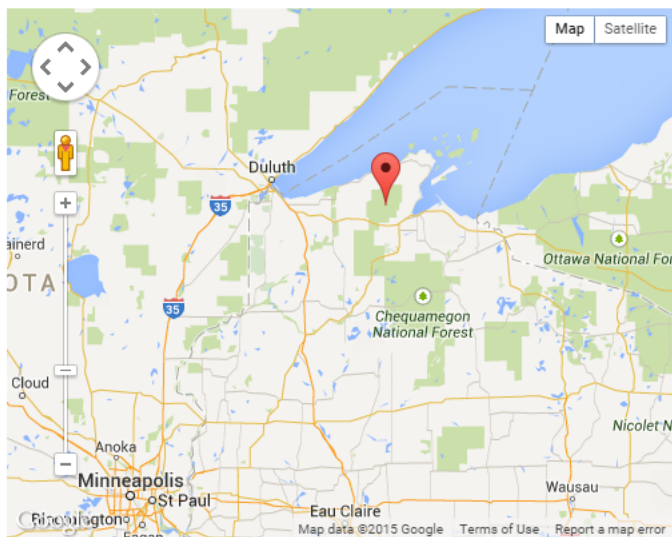
Plume Rise Fraction: -0.50

9. HYSPLIT Info

Total Emissions: ug

More inputs

Estimating Prescribed Fire Smoke Impacts



About

VSmoke-Web is a web-based implementation of VSmoke (Lavdas, 1996) and is designed to assist with planning prescribed burns in the Southern United States. VSmoke is a simple gaussian smoke dispersion model that calculates isopleths of surface smoke concentration. Output from the model represents peak hourly concentrations of PM_{2.5} or visibility (under development). Contour values and their colors correspond to the PM 2.5 thresholds for the Air Quality Index (AQI) and reflect potential health impacts ranging from moderate to hazardous (Visit AirNow for more AQI info). Burn location can be set by clicking on the map or by entering the Latitude and Longitude. Note that the Latitude and Longitude should be entered in decimal degrees (30.38, -84.37) or degrees+decimal minutes (30 22.80, -84 22.20 - note the space between degree and minute values).

Fire & Weather Info

- Location**
 Lat:
 Lon:
- Fire Size**
 Acres:
 Duration: hours
 Ignition Method:
- Fuel Load**
 Fuel Type:
 Tons/Acre:
- Fuel Consumption**
 Fuel Moisture Scenario:
 % consumed:
- Emissions**
 PM 2.5 Emission Factor: lbs/ton
 Particulate Emission Rate: grams/sec
 Heat Release Rate: MW
- Weather**
 Mixing Height: ft
 Transport Wind: mph

Imported From IE



VSmoke-Web is a web-based implementation of VSmoke (Lavdas, 1996) and is designed to assist with planning prescribed burns in the Southern United States. VSmoke is a simple gaussian smoke dispersion model that calculates isopleths of surface smoke concentration. Output from the model represents peak hourly concentrations of PM_{2.5} or visibility (under development). Contour values and their colors correspond to the PM 2.5 thresholds for the Air Quality Index (AQI) and reflect potential health impacts ranging from moderate to hazardous (Visit AirNow for more AQI info). Burn location can be set by clicking on the map or by entering the Latitude and Longitude. Note that the Latitude and Longitude should be entered in decimal degrees (30.38, -84.37) or degrees+decimal minutes (30 22.80, -84 22.20 - note the space between degree and minute values).

of h rn	AQI Value	Hourly PM 2.5 Conc.	Meaning
0 to 50	0 to 50	0 to 35	Air quality is considered satisfactory, and air pollution poses little or no risk.
51 to 100	51 to 100	39 to 88	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.
101 to 150	101 to 150	89 to 138	Members of sensitive groups may experience health effects. The general public is not likely to be affected.

Tons/Acre:

- Fuel Consumption**
 Fuel Moisture Scenario:
 % consumed:
- Emissions**
 PM 2.5 Emission Factor: lbs/ton
 Particulate Emission Rate: grams/sec
 Heat Release Rate: MW
- Weather**
 Mixing Height: ft
 Transport Wind: mph
 Stability Class:
- Update Map**
- Model Options**
 Background PM 2.5: ug/m3
 Plume Rise Fraction:
- HYSPLOT Info**
 Total Emissions: ug

Refined Modeling

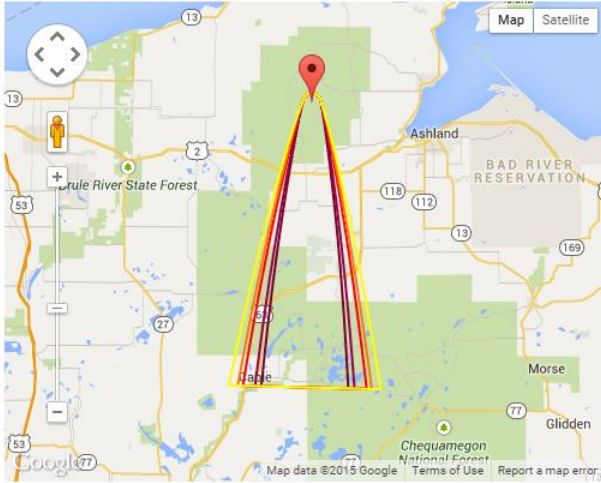
https://usdafs.conne... USDA FS Paycheck8... SHRM VSmoke-We...
shrmc.ggy.uga.edu/maps/vsmoke.html

Apps Soundings from... Suggested Sites USDA Forest Se... Imported From IE

VSmoke-Web

FCAMMS SHRM Smoke VSmoke

Estimating Prescribed Fire Smoke Impacts



Download KML File

About

Fire & Weather Info

- 1. Location**
Lat: 46.6418939589
Lon: -91.164550781
- 2. Fire Size**
Acres: 2500
Duration: 5 hours
Ignition Method: Backing/Spot
- 3. Fuel Load**
Fuel Type: Shrub - Mod
Tons/Acre: 8
- 4. Fuel Consumption**
Fuel Moisture Scenario: Dry
% consumed: 70
- 5. Emissions**
PM 2.5 Emission Factor: 27 lbs/ton

VSmoke-Web is a web-based implementation of VSmoke (Lawson, 1996) and is...

4:29 PM 4/10/2015

Refined Modeling

https://usdafs.conne... x USDA FS Paycheck8 x SHRMC VSmoke-We x

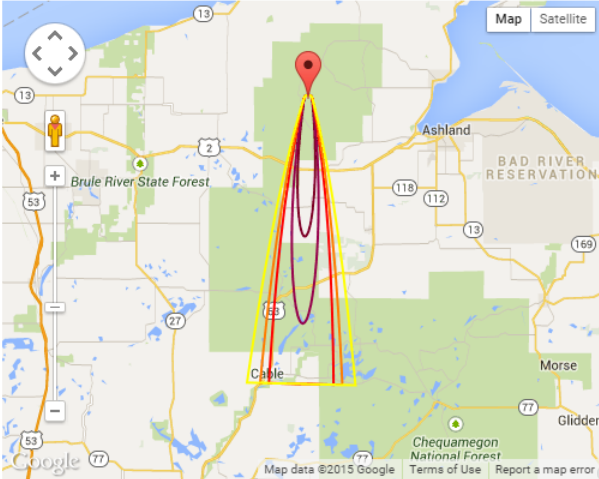
shrmc.ggy.uga.edu/maps/vsmoke.html

Apps Soundings from... Suggested Sites USDA Forest Se... Imported From IE

VSmoke-Web

FCAMMS SHRMC Smoke VSmoke

Estimating Prescribed Fire Smoke Impacts



Map Satellite

Download KML File

About

Fire & Weather Info

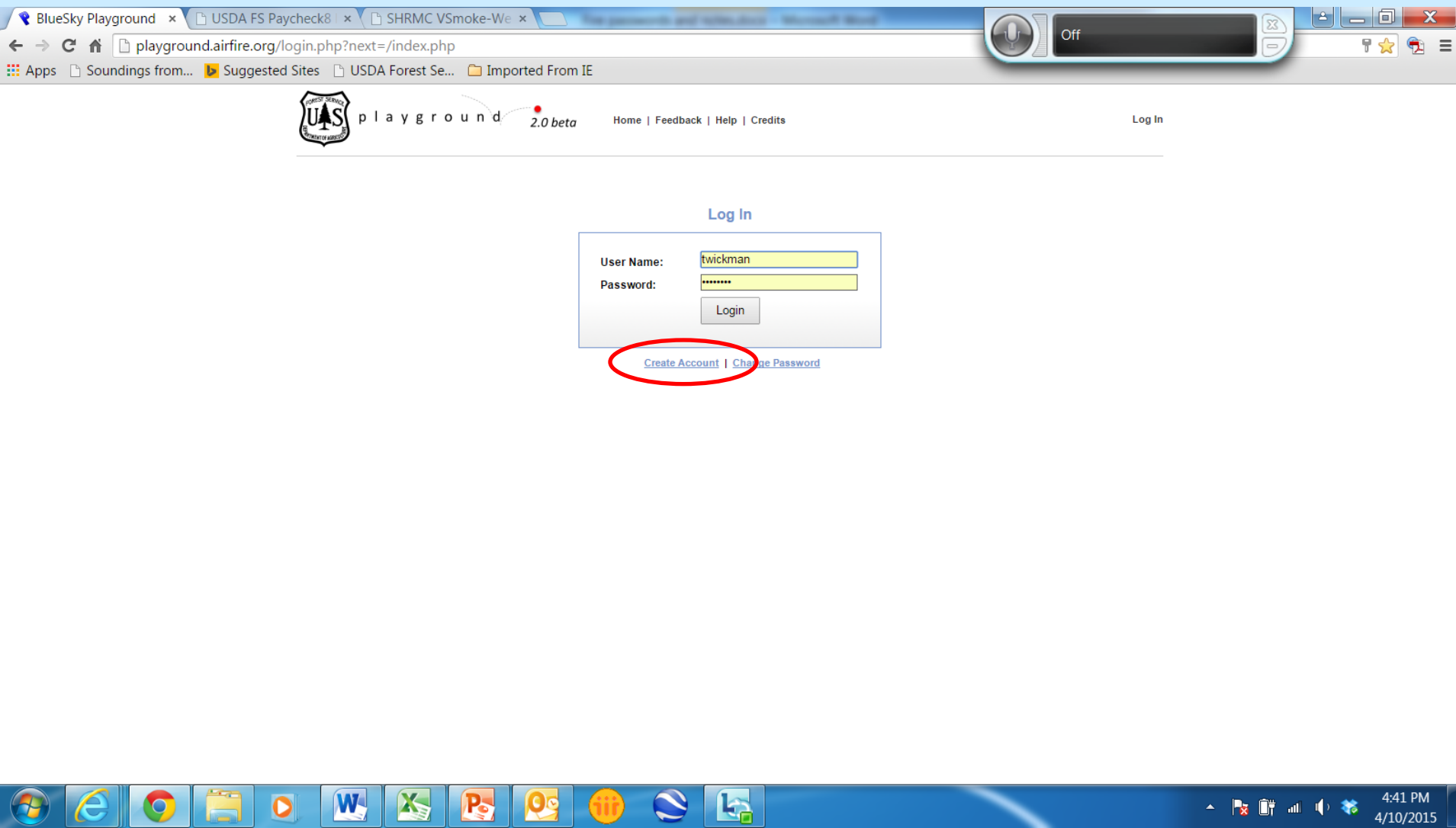
- 1. Location**
Lat: 46.6418939589
Lon: -91.2002563476
- 2. Fire Size**
Acres: 500
Duration: 5 hours
Ignition Method: Backing/Spot
- 3. Fuel Load**
Fuel Type: Shrub - Mod
Tons/Acre: 8
- 4. Fuel Consumption**
Fuel Moisture Scenario: Damp
% consumed: 50
- 5. Emissions**
PM 2.5 Emission Factor: 27 lbs/ton

VSmoke-Web is a web-based implementation of VSmoke (I yardas, 1996) and is...

Windows Taskbar: 4:35 PM 4/10/2015

Refined Modeling

- Bluesky



Refined Modeling

The screenshot shows a web browser window with the URL `playground.airfire.org/home.php`. The browser's address bar and tabs are visible at the top. The website's header includes the UAS logo, the text "playground 2.0 beta", and navigation links: "Home | My Emissions | My Dispersions | Feedback | Help | Credits". It also shows the user is logged in as "twickman" with a "Log Out" link.

The main content area is titled "Home" and contains a welcome message: "Welcome to BlueSky Playground!". Below this, it states: "Use BlueSky Playground to model your fires, estimate pollutant emissions, and predict downwind smoke concentrations."

Two bullet points provide instructions:

- To get started, create one or more *emissions scenarios* to model your fires. You simply specify the size, type, and location of the fires; then you can choose to accept defaults, or you can modify specific details about fuel loading, moisture, etc. After creating an emissions scenario, you can choose to create a dispersion scenario.
- Creating a *dispersion scenario* allows you to choose associated fires, meteorological data, and the date of the fire(s) to generate a map of the predicted hourly $PM_{2.5}$ concentrations.

Below the instructions, the link "Create New Emissions Scenario" is circled in red. Underneath it, the text "Model your fire's emissions." is displayed.

Two additional links are provided:

- [View My Emissions Scenarios](#)
View and edit your saved emissions scenarios, or create dispersion scenarios.
- [View My Dispersion Scenarios](#)
View and edit your saved dispersion scenarios.

The Windows taskbar at the bottom shows various application icons, including Internet Explorer, Google Chrome, and Microsoft Word, along with the system clock indicating 4:45 PM on 4/10/2015.

Refined Modeling

Only time you can name this run. Make up a good name!

BlueSky Playground x USDA FS Paycheck8 x SHRMV Smoke-We x

playground.airfire.org/scenarios.php?scenarioType=emissions&action=newEmissions

Apps Soundings from... Suggested Sites USDA Forest Se... Imported From IE

UAS playground 2.0 beta Home | My Emissions | My Dispersions | Feedback | Help | Credits Logged in as twickman | Log Out

Home » My Emissions

New Emissions

Name
LSFC

Emissions type
☒ Broadcast
☐ Piles
☐ Wildfire

Latitude
46.2256808263

Longitude
-86.655273433

Size (acres)
500

Go

Cancel

Map showing the location of the new emission source (LSFC) in the Hiawatha National Forest, near Marquette, Michigan. The map includes labels for Ottawa National Forest, Lake Superior, and Green Bay, WI.



Refined Modeling

Work this way



playground

2.0 beta

Home | My Emissions | My Dispersions | Feedback | Help | Credits

Logged in as twickman | Log Out

Home » My Emissions » LSFC (Broadcast)

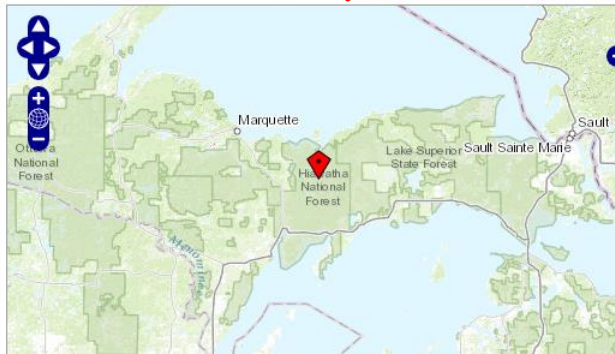
Size and Location Fuels Moisture Consumption Timing Emissions Notes

Daily Size (growth) in acres

Day 1
500

Total Size: 500 acres

[Add a Day](#)

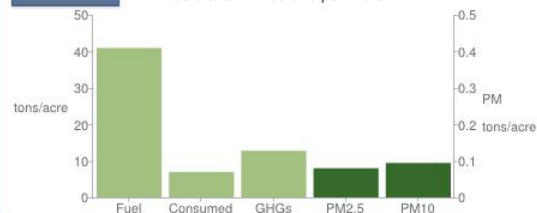


Latitude
46.225680826
Longitude
-86.655273433

Discard Changes Apply

View Totals

Fuels and Emissions per Acre



Diurnal Profile of % Total Consumption Day 1



Refined Modeling

BlueSky Playground x USDA FS Paycheck8 x SHRMC VSmoke-We x

playground.airfire.org/step.php?EmissionsScenarioID=15528483983411&page=fuels

Apps Soundings from... Suggested Sites USDA Forest Se... Imported From IE

UAS playground 2.0 beta Home | My Emissions | My Dispersions | Feedback | Help | Credits Logged in as twickman | Log Out

Default

Home » My Emissions » LSFC (Broadcast)

Size and Location Fuels Moisture Consumption Timing Emissions Notes

Use Fuels From

- ☐ FCCS Fuelbed #110 From Map
- ☒ FCCS Fuelbeds
- ☐ LANDFIRE Fuel Loading Models
- ☐ Custom Fuel Loading

Fuel Loading Results

	1-hr	10-hr	100-hr	1,000-hr	10,000-hr
	0.4 tons/acre	0.5 tons/acre	1 tons/acre	1 tons/acre	5 tons/acre

FCCS Fuelbed

110 American beech - Yellow birch - Sugar maple forest

95 Willow - mountain alder shrubland
97 Cottongrass grassland
98 Marsh Labrador tea - lingonberry tundra shrubland
99 Bluejoint reedgrass grassland
100 Altai fescue grassland
101 White spruce forest
103 White spruce - paper birch forest
105 Paper birch - quaking aspen - white spruce forest
107 Pitch pine / Scrub oak forest
109 Eastern white pine - Northern red oak - Red maple forest
110 American beech - Yellow birch - Sugar maple forest
112 Virginia pine - Pitch pine - Shortleaf pine forest
115 Rhododendron - Blueberry - Mountain laurel shrubland
123 White oak - Northern red oak - Black oak - Hickory forest
125 Oak - Hickory - Pine - Eastern hemlock forest
129 Green Ash - American Elm Forest
131 Bluestem - Indian grass - Switchgrass grassland
133 Tall fescue - Foxtail - Purple bluestem grassland
135 Eastern redcedar - Oak / Bluestem savanna
138 Red pine - White pine forest

Fuel Loading Results (Continued)

	19.14 tons/acre	0.15 tons/acre	0.1 tons/acre	0.01 tons/acre	1.5 tons/acre
Canopy	19.14 tons/acre	0.15 tons/acre	0.1 tons/acre	0.01 tons/acre	1.5 tons/acre
Shrubs					
Grasses					
Litter					
Rotten					
Total Above Ground	20.90 tons/acre				
Total Fuel Loading	40.92 tons/acre				

Discard Changes **Apply**

Diurnal Profile of % Total Consumption Day 1

percent of total consumption

hour (local time)

Flaming Smoldering and Residual

Fuel Consumed GHGs PM2.5 PM10

Digital Photo Series

- <http://depts.washington.edu/nwfire/dps/>

The screenshot shows a web browser window with the address bar displaying <http://depts.washington.edu/nwfire/dps/>. The browser's menu bar includes File, Edit, View, Favorites, Tools, and Help. Below the menu bar is a toolbar with icons for home, RSS, email, printing, and various search engines. The website's navigation bar features links for Digital Photo Series Home, Site search, Site browser, and Custom site builder.

The main content area has a light blue background with the title "Digital Photo Series" in large, dark blue font. Below the title is a map of the United States with colored regions and numerous small circular markers indicating photo sites. To the left of the main map are two smaller inset maps of Alaska and Hawaii. Below the map, the text reads: "USDA - Forest Service", "Pacific Northwest Research Station", "FERA Pacific Wildland Fire Sciences Laboratory", "Fire and Environmental Research Applications Team", and "400 N 34th Street, Suite 201 • Seattle, WA 98103 • 206.732.7800".

On the right side of the main content area, there is a text box with a welcome message: "Welcome to the Digital Photo Series (DPS), a web-based project to provide the **Natural Fuels Photo Series** data in electronic form. Here you'll find data from all 17 volumes published to date with 47 photo series containing a total of 470 sites in database form to enable searching, downloading, and eventually side-by-side comparisons and customized site generation. The DPS diverges from the published volumes both in content and presentation. In many cases we've added more information than was published (e.g., land owner and Bailey's ecoregion), in others, data have been rearranged and terminology (e.g., field names, table headings) altered to standardize among the sites." Below this text is a paragraph of instructions: "Use the tabs above to navigate between the [site search](#) page, where you can specify geographic and ecological criteria to locate sites of interest, the [site browser](#) page, where you can explore the photo series using an expandable navigation tree with all 323 sites organized by volume, the [custom site builder](#) page, where you can combine data tables to create your own sites, or read through our [help](#) interface."

At the bottom of the page is a row of logos, including the USDA Forest Service logo, the NFWF logo, and several state fire department logos.

Refined Modeling

BlueSky Playground x ConnectHR: Login x SHRM VSmoke-We x playground.airfire.org/step.php?EmissionsScenarioID=15528483983411&page=timing

Apps Soundings from... Suggested Sites USDA Forest Se... Imported From IE

UAS playground 2.0 beta Home | My Emissions | My Dispersions | Feedback | Help | Credits Logged in as twickman | Log Out

Home » My Emissions » LSFC (Broadcast)

Size and Location Fuels Moisture Consumption Timing Emissions Notes

Click the 'Add a Section' link to add multiple sections (or phases) for one day. The acreage of all added sections will be deducted from Section 1 for that day.

Timing Inputs

Day 1 (Total acres: 500)

Section	Acres	Start Ignition
1	500	10 AM

[Add a Section](#)

Discard Changes Apply

View Totals Fuels and Emissions per Acre

Category	Value (tons/acre)
Fuel	42
Consumed	8
GHGs	13
PM2.5	0.1
PM10	0.1

Diurnal Profile of % Total Consumption Day 1

Hour (local time)	Flaming (%)	Smoldering and Residual (%)
10	0	0
12	6.5	2.5
16	0	5.5
18	0	2.0
20	0	0

Can break burn into chunks (all burned on the same day) all with the same fuels info entered previously



Refined Modeling

BlueSky Playground x ConnectHR: Login x SHRMC VSmoke-We x

playground.airfire.org/step.php?EmissionsScenarioID=15528483983411&page=emissions

Apps Soundings from... Suggested Sites USDA Forest Se... Imported From IE

UAS playground 2.0 beta Home | My Emissions | My Dispersions | Feedback | Help | Credits Logged in as twickman | Log Out

Home » My Emissions » LSFC (Broadcast)

Size and Location Fuels Moisture Consumption Timing Emissions Results

Emissions Model
● FEPS

Emissions Results

PM _{2.5}	39.96	tons	CH ₄	22.75	tons
PM ₁₀	47.15	tons	NO _x	6.07	tons
CO	466.02	tons	VOCs	109.87	tons
CO ₂	5346.71	tons	NH ₃	7.64	tons
GHGs	6381.42	tons CO ₂ e	SO ₂	3.41	tons
			Heat	609.31	BTU/m ²

Discard Changes Apply

View Totals Fuels and Emissions per Acre

Diurnal Profile of % Total Consumption Day 1

Flaming Smoldering and Residual

5:26 PM 4/10/2015

Handy for NEPA

Refined Modeling

BlueSky Playground x ConnectHR: Login x SHRMC VSmoke-We x

playground.airfire.org/step.php?EmissionsScenarioID=15528483983411&page=notes

Apps Soundings from... Suggested Sites USDA Forest Se... Imported From IE

UAS playground 2.0 beta Home | My Emissions | My Dispersions | Feedback | Help | Credits Logged in as twickman | Log Out

Home » My Emissions » LSFC (Broadcast)

Size and Location Fuels Moisture Consumption Timing Emissions Notes

Edit Emissions Info

Name
LSFC

Notes

Last Modified: 04/10/2015, 03:22:44 PM

Discard Changes Apply **Create Dispersion**

View Totals Fuels and Emissions per Acre

tons/acre

Fuel	Consumed	GHGs	PM2.5	PM10
42	7	13	8	10

PM tons/acre

Diurnal Profile of % Total Consumption Day 1

percent of total consumption

hour (local time)

Flaming Smoldering and Residual

5:27 PM 4/10/2015

Refined Modeling

BlueSky Playground x ConnectHR: Login x SHRMC VSmoke-We x

playground.airfire.org/scenarios.php?scenarioType=emissions&action=newDispersion&EmissionsScenarioID=15528483983411

Apps Soundings from... Suggested Sites USDA Forest Se... Imported From IE

UAS playground 2.0 beta Home | My Emissions | My Dispersions | Feedback | Help | Credits Logged in as twickman | Log Out

Home » My Emissions

New Dispersion

1 or more Data Sources have been disabled due to selected Emissions being located outside of their domain.

Name:

Meteorology Data Source (HYSPLIT)

- ☐ CA/NV 2-km WRF (1/1/09 - present)
- ☒ National 12-km (9/1/2012 - present)
- ☐ Pacific Northwest 4-km WRF (9/1/2011 - present)

Simple Dispersion/Meteorology

- ☐ VSMOKE

Emissions Scenarios Selected

LSFC

Northwest 4-km
CA/NV 2-km
National 12-km

Cancel Next

Only time you can name this run. Make up a good name!

Windows taskbar: 5:32 PM 4/10/2015

Refined Modeling

BlueSky Playground x ConnectHR: Login x SHRM VSmoke-We x

playground.airfire.org/scenarios.php?scenarioType=emissions&action=newDispersion&EmissionsScenarioID=15528483983411

Apps Soundings from... Suggested Sites USDA Forest Se... Imported From IE

UAS playground 2.0 beta Home | My Emissions | My Dispersions | Feedback | Help | Credits Logged in as twickman | Log Out

Home » My Emissions

New Dispersion

National 12-km (9/1/2012 - present)

Settings

Start Date (UTC)
Please select a date...

Apr 2015

Su Mo Tu We Th Fr Sa

1 2 3 4

5 6 7 8 9 10 11

12 13 14 15 16 17 18

19 20 21 22 23 24 25

26 27 28 29 30

View Today's Date Close

displayed in the dispersion results, regardless of how long the fire itself lasts.

Back Go

Broadcast	10/23/2014 12:14:07 PM	01/26/2015 01:39:57 PM	GD
Broadcast	09/12/2014 06:11:40 AM	09/12/2014 06:15:24 AM	GD
Broadcast	09/09/2014 07:41:13 AM	09/09/2014 07:41:29 AM	GD
Broadcast	09/06/2014 10:35:00 AM	09/06/2014 10:35:15 AM	GD
Broadcast	08/26/2014 01:14:24 PM	08/26/2014 01:14:38 PM	GD
Broadcast	08/09/2014 09:48:10 AM	08/09/2014 09:48:29 AM	GD
Broadcast	05/22/2014 04:36:08 AM	05/22/2014 04:36:59 AM	GD
Broadcast	05/15/2014 02:03:47 PM	05/15/2014 02:07:11 PM	GD
Broadcast	01/30/2014 12:04:17 PM	01/30/2014 12:27:09 PM	GD
Broadcast	01/27/2014 01:27:02 PM	05/22/2014 04:56:42 AM	GD

Can go out 2 days

5:33 PM 4/10/2015

Refined Modeling

BlueSky Playground x ConnectHR: Login x SHRM VSmoke-We x

playground.airfire.org/scenarios.php?scenarioType=dispersion&DispersionScenarioName=LSFC&DispersionScenarioID=155285084d9366

Apps Soundings from... Suggested Sites USDA Forest Se... Imported From IE

UAS playground 2.0 beta Home | My Emissions | My Dispersions | Feedback | Help | Credits Logged in as twickman | Log Out

Home » My Dispersions

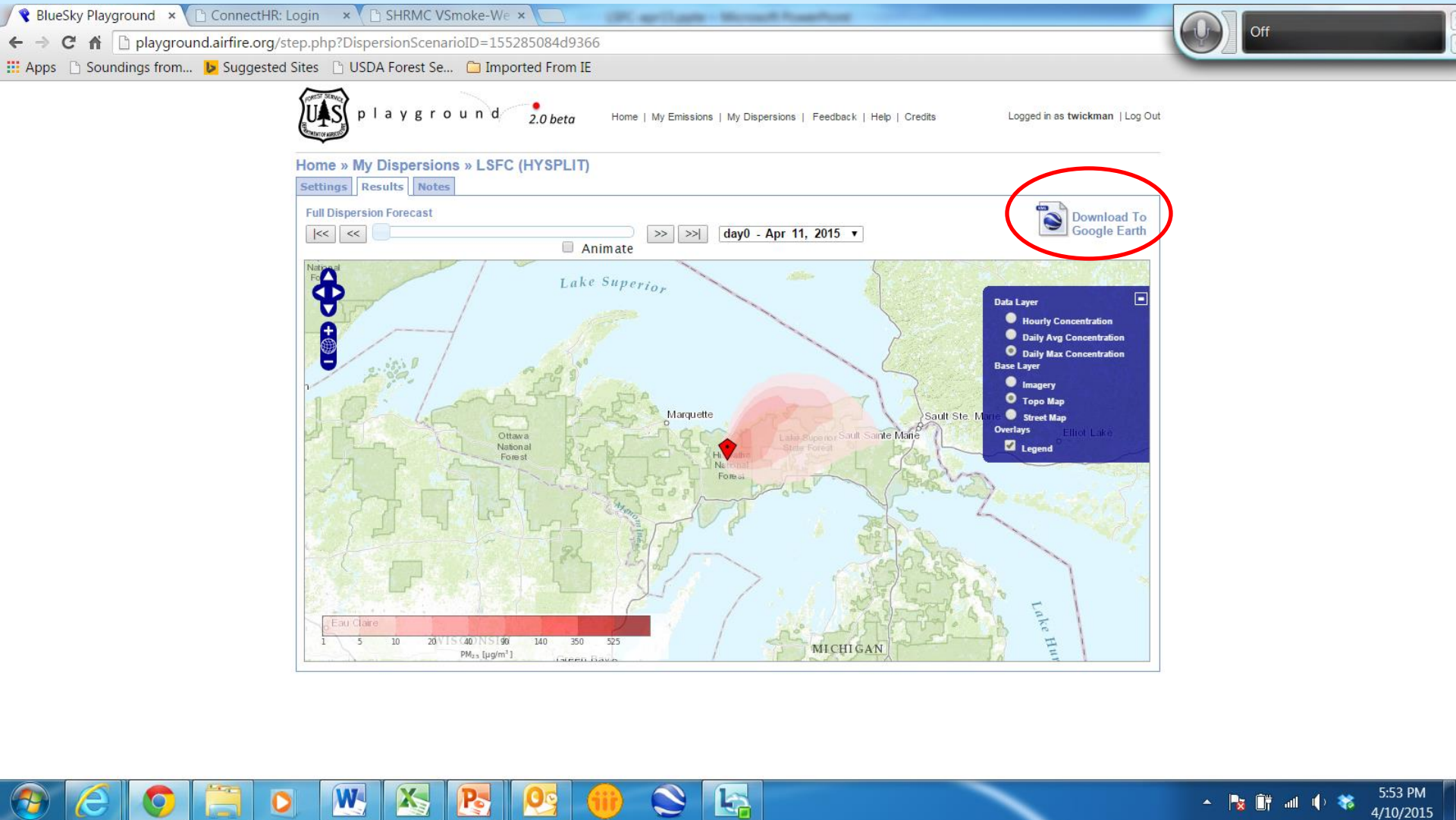
Copy Delete

Name	Dispersion Model	Date Created	Date Last Modified	
(Running...) LSFC	HYSPLIT - NAM-12km	04/10/2015 03:36:52 PM	04/10/2015 03:36:52 PM	⚙️
Kory blueskky	HYSPLIT - NAM-12km	02/25/2015 12:08:31 PM	02/25/2015 12:08:31 PM	✓
H-M Kory	VSMOKE	02/25/2015 11:39:44 AM	02/25/2015 11:48:54 AM	✓
mitawan	VSMOKE	01/27/2015 11:38:55 AM	01/28/2015 01:50:01 PM	✓
	VSMOKE	01/27/2015 10:25:18 AM	01/27/2015 10:25:20 AM	✓
NSS-Slim	VSMOKE	01/26/2015 01:43:05 PM	01/27/2015 10:24:07 AM	✓
RX410	HYSPLIT - NAM-12km	01/22/2015 07:19:43 AM	01/22/2015 07:19:43 AM	✓
claire-hy	HYSPLIT - NAM-12km	11/07/2014 09:14:35 AM	11/07/2014 09:14:35 AM	✓
Claire	VSMOKE	11/07/2014 09:03:30 AM	11/07/2014 09:03:33 AM	✓
ny	VSMOKE	11/06/2014 08:56:01 AM	11/06/2014 08:56:03 AM	✓
My Dispersion	VSMOKE	10/24/2014 08:55:45 AM	10/24/2014 09:16:17 AM	✓
hysplit	HYSPLIT - NAM-12km	10/24/2014 08:22:50 AM	10/24/2014 08:22:53 AM	⚠️
My Dispersion	VSMOKE	10/24/2014 08:14:53 AM	10/24/2014 09:30:35 AM	⚠️
MI	HYSPLIT - NAM-12km	09/12/2014 06:18:11 AM	09/12/2014 06:18:14 AM	✓
H-M	HYSPLIT - NAM-12km	09/09/2014 07:47:03 AM	09/09/2014 07:47:06 AM	✓
My Dispersion2	VSMOKE	09/06/2014 10:40:47 AM	09/06/2014 10:40:50 AM	✓
My Dispersion	HYSPLIT - NAM-12km	09/06/2014 10:38:22 AM	09/06/2014 10:38:24 AM	✓
My Dispersion	VSMOKE	08/26/2014 01:15:32 PM	08/26/2014 01:15:34 PM	✓
nw sands sat 2 day	HYSPLIT - NAM-12km	05/23/2014 05:32:21 PM	05/23/2014 05:32:23 PM	✓
nw sands sat	HYSPLIT - NAM-12km	05/23/2014 05:26:37 PM	05/23/2014 05:26:39 PM	✓

WAIT – go
for a walk,
get a cup of
coffee ...



Refined Modeling





Websites for Tools

Dispersion Modeling

1) Screening model:

<http://shrmc.ggy.uga.edu/maps/screen.html>

2) VSmoke web:

<http://shrmc.ggy.uga.edu/maps/vsmoke.html>

3) BlueSky Playground:

<http://playground.airfire.org/login.php?next=/index.php>



Smoke Management Program Tips

- Establish and maintain relationships with key state air quality folks
- Implement an ongoing program to educate the public in likely impacted areas,
 - To gain their support for your burning program
 - So at-risk folks will remove themselves from dangerous situations
- Take existing air quality into account (AQI)
- Know your SMP/state regs/procedures
- Always follow Basic Smoke Management Practices

Fire Science Consortia



<http://www.oakfirescience.com/>

Oak Woodlands & Forests Fire Consortium

- A JESP Knowledge Exchange Consortium

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Welcome to the Oak Woodlands & Forests Fire Consortium.

Our mission is to provide fire science information to resource managers, landowners, and the public about the use, application, and effects of fire. Within these pages you should expect to find information on "everything fire".

Search



Climate Change Tipping Points

Arkansas Forestry
Commission Statewide
Current Fire Information

Timber Quality and
Prescribed Fire workshop
presentations now online!

Workshops and seminars



Workshop
Don't miss
Webinars



Questions?

Feel free to contact me with additional questions:
Trent Wickman (twickman@fs.fed.us)

Lake States Fire Science Consortium

A JFSP KNOWLEDGE EXCHANGE CONSORTIUM



2015-2016 Webinar Series

Starts October 15, 2015

Webinar TBD



@LSFireScience



LakeStatesFireSci.net