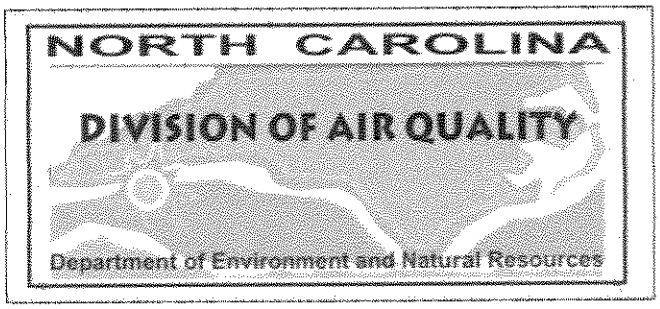


AUGUST 5, 2007
EXCEPTIONAL EVENT
DEMONSTRATION PACKAGE

FOR THE

MILLBROOK (RALEIGH, NORTH CAROLINA)
(371830014-88101-1, 371830014-88101-2)

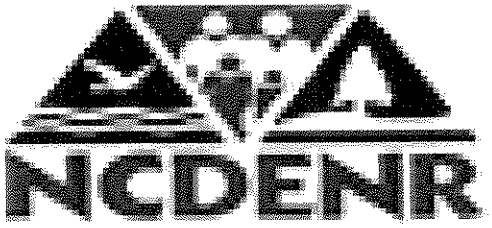
HICKORY (HICKORY, NORTH CAROLINA)
(370350004-88101-1)

AND

MENDENHALL (GREENSBORO, NORTH CAROLINA)
(370810013-88101-1, 370810013-88101-2)

FINE PARTICLE
FEDERAL REFERENCE METHOD MONITORS

December 14, 2007



A Division of the North Carolina Department
of Environment and Natural Resources
Mail Service Center 1641
Raleigh, North Carolina 27699-1641

TABLE OF CONTENTS

EXCEPTIONAL EVENT INFLUENCED DATA REPORT

SUMMARY:

This report furnishes physical, modeled, and statistical evidence that fires caused the exceedances of the daily fine particle (PM2.5) standard of 35 $\mu g/m^3$ at the Millbrook, Hickory, and Mendenhall monitoring stations on 8/5/07. The North Carolina Division of Air Quality seeks EPA concurrence of the "E" flag (Forest Fire) for the Federal Reference Method (FRM) – PM2.5 monitor readings of 37.08 $\mu g/m^3$, 37.5$\mu g/m^3$, and 42.25 $\mu g/m^3$ on 8/5/07 at the Millbrook, Hickory, and Mendenhall monitoring stations, respectively.

Site/Monitor	Millbrook	Hickory	Mendenhall
Street Address	3801 Spring Forest Rd.	1st Avenue	205 Willoughby Blvd.
City	Raleigh	Hickory	Greensboro
County	Wake	Catawba	Guilford
State	NC	NC	NC
Site ID	371830014-88101	370350004-88101	370810013-88101
Exceedance date	8/5/07	8/5/07	8/5/07
Exceedance value	37.08 $\mu g/m^3$	37.5 $\mu g/m^3$	42.25 $\mu g/m^3$
Recommended Flag	E: Forest Fire	E: Forest Fire	E: Forest Fire

DISCUSSION:

The smoke from a large concentration of wildland fires in Idaho, Montana, and Canada (Saskatchewan, Manitoba, and Northwest Territory) impacted the Millbrook, Hickory, and Mendenhall FRM-PM2.5 monitors on 8/5/07. The various fires, shown plotted on maps developed by the USDA (U.S. Dept. of Agriculture), started around 7/21/07 and continued past 8/27/07. The smoke had arrived over Maryland and Virginia by 8/1/07 and eventually spread over the entire Eastern US by 8/5/07. There is good corroboration between satellite imagery, NOAA smoke reports, and HYSPLIT trajectories. Trajectories were overlaid onto maps showing locations of the fires and monitors with GIS software. Surface winds at the Millbrook, Hickory, and Mendenhall monitoring stations on 8/5/07 were predominantly Northwesterly. Both forward and backward trajectories and satellite imagery are included for graphical evidence. Tables 1, 2, and 3 (next page) provide brief comparative overviews of the FRM-PM2.5 readings at Millbrook, Hickory, and Mendenhall prior to and after the event.

Table 1 Comparative PM2.5 ($\mu g\ m^{-3}$)

		Milbrook FRM ($\mu g\ m^{-3}$)	**Millbrook TEOM** ($\mu g\ m^{-3}$)	**William Owen TEOM** ($\mu g\ m^{-3}$)
Pre Event, 8/1-8/3	3-day Avg.	19.4	21.6	18.7
	Max	24.4	25.9	22.9
	Min	14.3	16.8	13.1
8/5/07 (Exceedance)	24 hr Avg	**37.1**	**39.1**	**26.3**
Post Event, 8/10-8/12	3-day Avg	16.8	19.6	17.2
	Max.	22.8	24.0	22.1
	Min.	10.7	11.3	10.7

Table 2 Comparative PM2.5 ($\mu g\ m^{-3}$)

		Hickory FRM ($\mu g\ m^{-3}$)
Pre Event, 7/31-8/4	5-day Avg(FRM).	25.93
	Max	27.73
	Min	20.92
8/5/07 (Exceedance)	24 hr Avg (FRM).	**37.5**
Post Event, 8/6-8/10	5-day Avg(FRM).	24.31
	Max.	32.83
	Min.	18.29

Table 3 Comparative PM2.5 ($\mu g\ m^{-3}$)

		Mendenhall FRM ($\mu g\ m^{-3}$)
Pre Event, 7/31-8/4	5-day Avg(FRM).	22.55
	Max	34.67
	Min	14.08
8/5/07 (Exceedance)	24 hr Avg (FRM).	**42.25**
Post Event, 8/7-8/10	5-day Avg(FRM).	24.24
	Max.	29.04
	Min.	19.67

PM 2.5 FRM Concentrations ug/m3

Site_ID1	370630015	370630001	371350007	371830014	371830014	371830014	370650004	371830015	370370004	370370004
Site_ID2	517	503	507	509	510	515	513	511	501	502
Region	RRO	RRO	RRO	RRO	RRO	RRO	RRO	RRO	RRO	RRO
Site	DA	DH	HR	ML	ML	ML	SR	ST	UP	UP
07/31/2007				19.29						
08/01/2007		26.13	25.37	24.37			19.04		22.21	
08/02/2007				19.50	20.58					
08/03/2007				14.29						
08/04/2007		28.37	27.87	25.46	25.38		18.96		25.83	
08/05/2007				37.08						
08/06/2007				35.42						
08/07/2007		32.25	33.79	34.45			33.29		32.25	
08/08/2007				34.21	31.4					
08/09/2007				30.17						
08/10/2007		22.47	22.50	22.75	23.21		22.21		21.17	
08/11/2007				16.96						
08/12/2007				10.71						
08/13/2007		20.59	17.50	21.34			24.29		16.62	
08/14/2007				18.96						
08/15/2007				29.87						
08/16/2007		24.83	26.25	25.29	26.08		24.46		24.37	
08/17/2007				25.04						
08/18/2007				17.67						
08/19/2007		25.62	26.42	26.00			19.12		25.50	
08/20/2007				17.76						
08/21/2007				15.46						
08/22/2007		19.08	15.71	16.67	16.96		19.92		15.71	
08/23/2007				21.25						
08/24/2007				19.67						
08/25/2007		16.71	17.38	17.17			17.71		15.71	
08/26/2007				11.46						
08/27/2007				18.04						
08/28/2007		20.21	20.62	18.58	18.88		14.38		19.04	
08/29/2007				17.25						
08/30/2007				18.50						
08/31/2007		26.67	27.33	24.83			24.33		24.96	
Average		23.90	23.70	22.05	22.10		21.61		22.12	

Millbrook 8/5/07

PM 2.5 FRM Concentrations ug/m3

Site_ID1	370710016	370710016	370350004	370350006	370250004	370350005	371590021
Site_ID2	305	306	307	311	301	309	313
Region	MRO	MRO	MRO	MRO	MRO	MRO	MRO
Site	GM	GM 7/3	HC	HU	KA	RS	UR
08/01/2007	31.72		26.21				25.33
08/02/2007			27.38	25.93			
08/03/2007			27.73				
08/04/2007	22.85		27.42				29.50
08/05/2007			37.50				
08/06/2007			32.83				
08/07/2007	31.30		27.96				32.08
08/08/2007			23.00	24.31			
08/09/2007			18.29				
08/10/2007	20.00		19.50				19.71
08/11/2007			27.79				
08/12/2007			23.50	Hickory			
08/13/2007	21.72		21.83				
08/14/2007			22.92				
08/15/2007			20.79				
08/16/2007	28.03		30.75				29.17
08/17/2007			29.04				
08/18/2007			20.08				
08/19/2007	24.85		28.67				25.25
08/20/2007			20.54				
08/21/2007			16.21				
08/22/2007	15.98		14.83				16.00
08/23/2007			20.58				
08/24/2007			13.00				
08/25/2007	15.65		16.62				17.79
08/26/2007			13.29				
08/27/2007			22.62				
08/28/2007	24.39		24.17				25.25
08/29/2007			19.54				
08/30/2007			26.46				
Average	23.65		23.37				24.45

I

PM 2.5 FRM Concentrations ug/m3

Site_ID1	370570003	371890003	370570004	370010002	370570002	370810013	370810013	370330001
Site_ID2	415	411	417	401	409	413	414	403
Region	WSRO	WSRO	WSRO	WSRO	WSRO	WSRO	WSRO	WSRO
Site	AL	BN	FL	HD	LX	MH	MH	UC
07/30/2007						19.63		
07/31/2007						14.08		
08/01/2007		19.88		21.04	23.88	20.83		
08/02/2007								
08/03/2007						23.54		
08/04/2007		29.21		33.90	35.83	34.67	36.53	36.17
08/05/2007						42.25		
08/06/2007								
08/07/2007		22.21		35.44	32.92	29.04		
08/08/2007						25.79		
08/09/2007						20.13		
08/10/2007				24.85	19.21	19.67	20.37	20.96
08/11/2007						26.58		
08/12/2007						18.58		
08/13/2007				17.22	21.79	16.83		
08/14/2007						16.17		
08/15/2007						18.17		
08/16/2007				27.39	30.87	27.21	27.60	25.87
08/17/2007		24.79				24.29		
08/18/2007		15.08				15.58		
08/19/2007		26.58		25.27	28.92	26.17		
08/20/2007		24.17				18.33		
08/21/2007						16.62		
08/22/2007		13.04		14.04	15.54	11.17	11.69	11.89
08/23/2007						22.12		22.50
08/24/2007						18.29		
08/25/2007		16.13		18.09	19.83	18.92		
08/26/2007						16.00		
08/27/2007						19.37		
08/28/2007		19.88		24.32	24.21	24.88	25.60	21.96
08/29/2007						24.96		
08/30/2007						25.21		
08/31/2007		27.96		31.87	30.29	28.58		
Average		21.72		24.86	25.75	22.05	24.36	23.22

22.55

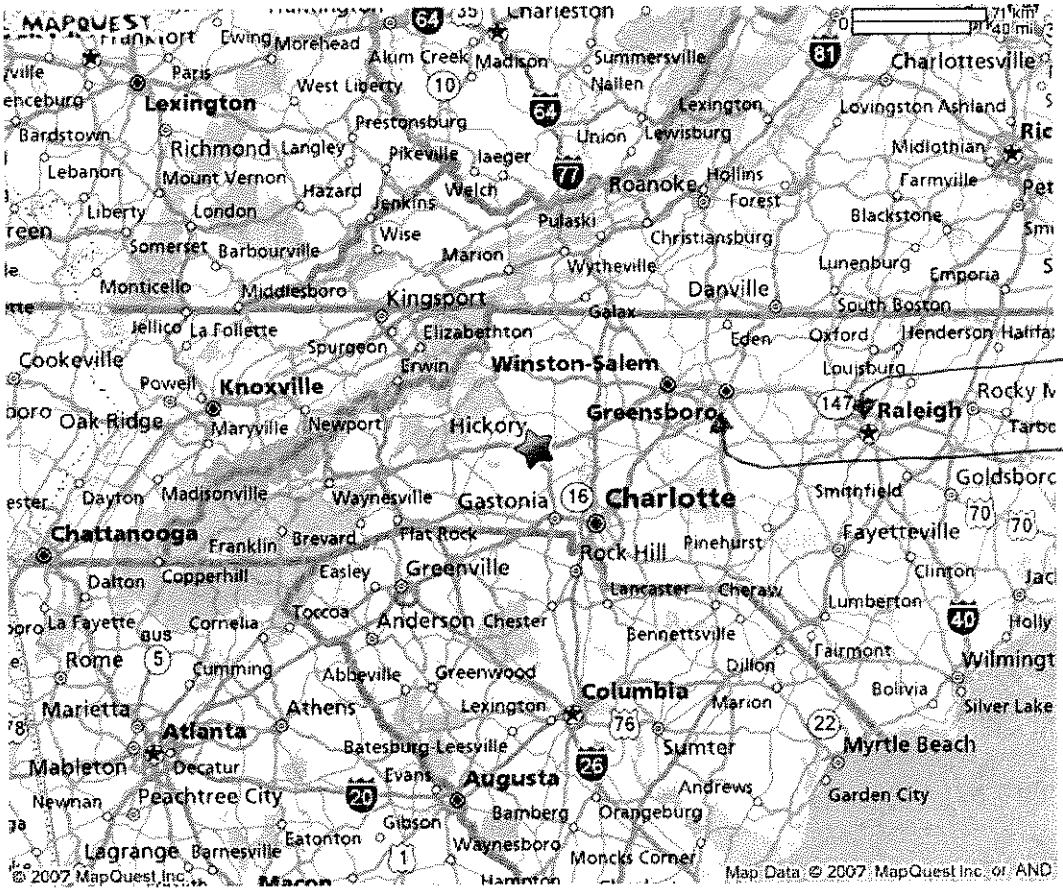
Mendenhall

24.24

MAPQUEST

Hickory NC
US

Notes:
Only text visible within note field will print.



6

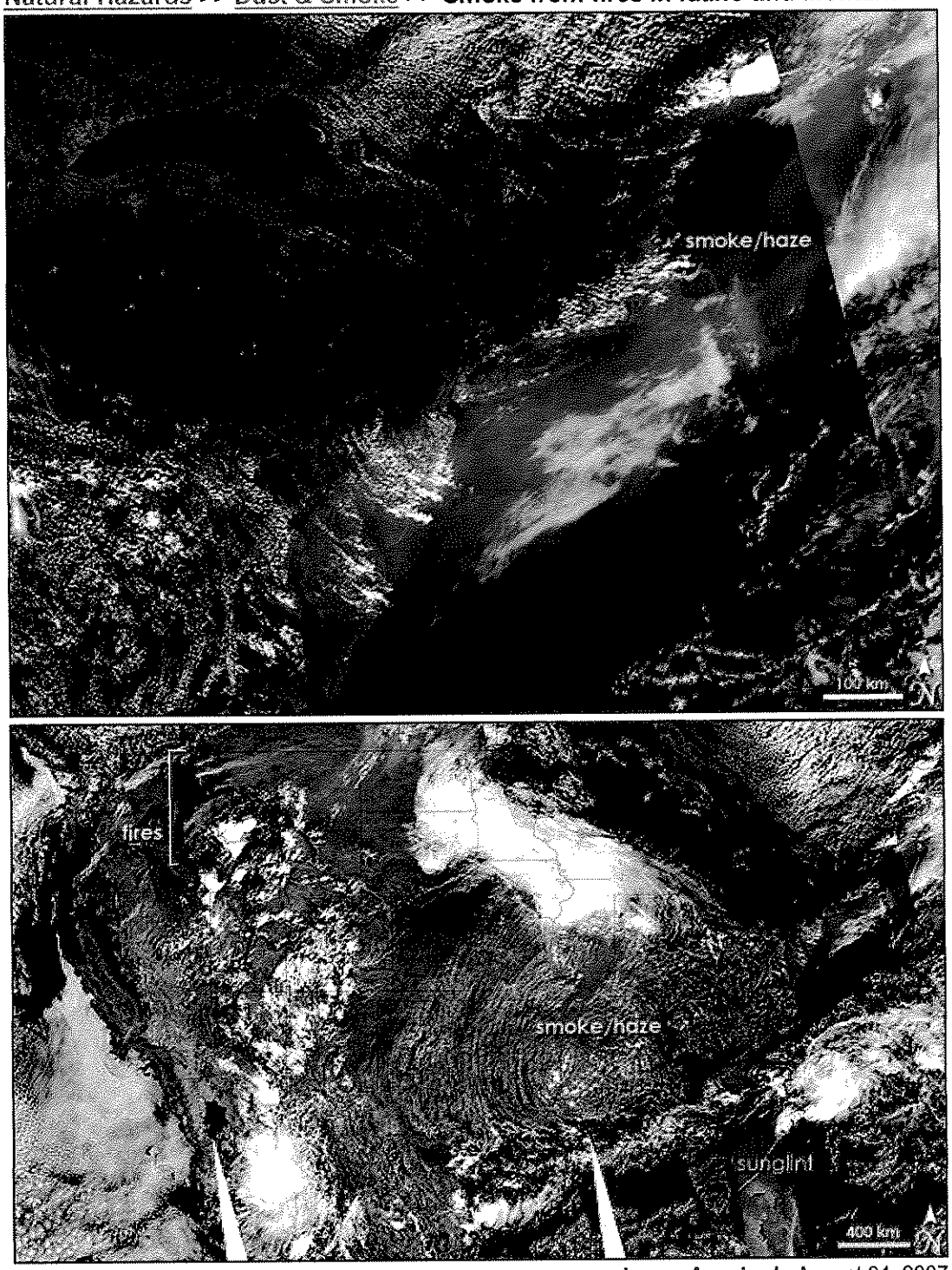


Image Acquired: August 04, 2007

Smoke from fires in Idaho and Montana

Large Images:

Eastern United States (250 meters/pixel) (4.64 MB JPG)
United States mosaic (4 km/pixel) (431 kB JPG)

Some things are so large that the perspective from space is necessary to appreciate them. One of those things is the long-distance impact that pollutants like smoke or dust can have on air quality. On August 4, 2007, for example, fires raging in Montana and Idaho polluted the air over much of the United States. The Moderate Resolution Imaging Spectroradiometer (MODIS) onboard NASA's Aqua satellite captured this image of the smoke and fires on the afternoon of August 4. The lower image is a mosaic of four separate flyovers (separated by faint diagonal lines), while the top image is a close-up view of the smoke and haze along the northeastern seaboard.

Strong winds on August 4 created uncontrollable firestorms that forced the evacuation of at least two communities in Montana, reported the *Missoulian.* Fires in Montana and Idaho are marked with red dots in the lower image and are more clearly visible in the large image. In addition to fueling the flames, the winds blew dense plumes of smoke northeast. The thickest plumes rise from the fires in northwestern Montana. By the time the smoke reached eastern Montana, the plumes were no longer distinct. The air was clouded with a soupy, gray haze that curves north into Canada. High-level winds pushed the smoke south over the western Great Lakes, and into the central and southern United States. From the bank of clouds over Illinois to the Gulf of Mexico, the air was white-gray with haze.

From the central United States, the plume of pollution snaked over the Mid-Atlantic States and the Chesapeake Bay to the Atlantic Ocean, where it turned north and flowed along the coast. Some additional haze may line the coast south of Cape Hatteras, but reflected sunlight has turned the ocean's surface into a mirror, effectively masking the presence of any haze.

The top image provides a closer view of the haze over the Atlantic Ocean from the Delmarva Peninsula

Where in the World

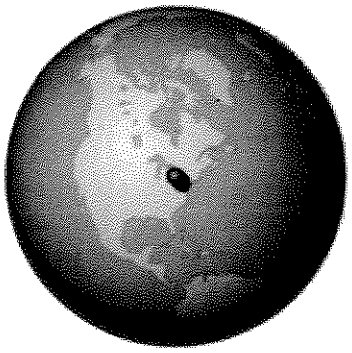


Image Posted

August 06, 2007

Satellite & Sensor

Aqua- MODIS

Other Images for this Event

Posted: Aug 17, 2007

Dust & Smoke Latest Events

Dust over the Persian Gulf
Haze off the U.S. East Coast
Dust Plume off Mauritania
Dust over the Caspian Sea
Dust over the Gulf of Oman and Arabian Sea
Bodele Depression Dust Storm

along the eastern shore of the Chesapeake Bay, to the Gulf of Maine, north of Cape Cod. By this point, smoke from the western wildfires is probably only one component of the haze. High temperatures and stagnant air also amplified the impact of urban pollution, creating Code Orange air quality conditions, which are unhealthy for sensitive groups such as active children or adults or individuals with respiratory ailments. The jetstream—the fast-moving, high-level winds that steer weather systems—is defined by the stark boundary between the hazy air over the Mid-Atlantic and the clear air over New England. Jetstream winds are clearly blocking the smoke from traveling north.

Further reading

U.S. Air Quality, the Smog Blog produced by the Joint Center for Earth Systems Technology, a NASA and University of Maryland, Baltimore County partnership.

Smoke from Agricultural and Forest Fires from the U.S. government AIRNow Web site.

Air Quality Index—a Guide to Air Quality and your Health from the U.S. government AIRNow Web site.

NASA image courtesy the MODIS Rapid Response Team at NASA GSFC, which provides daily images of the United States in a clickable map.

Recommend this Image to a Friend

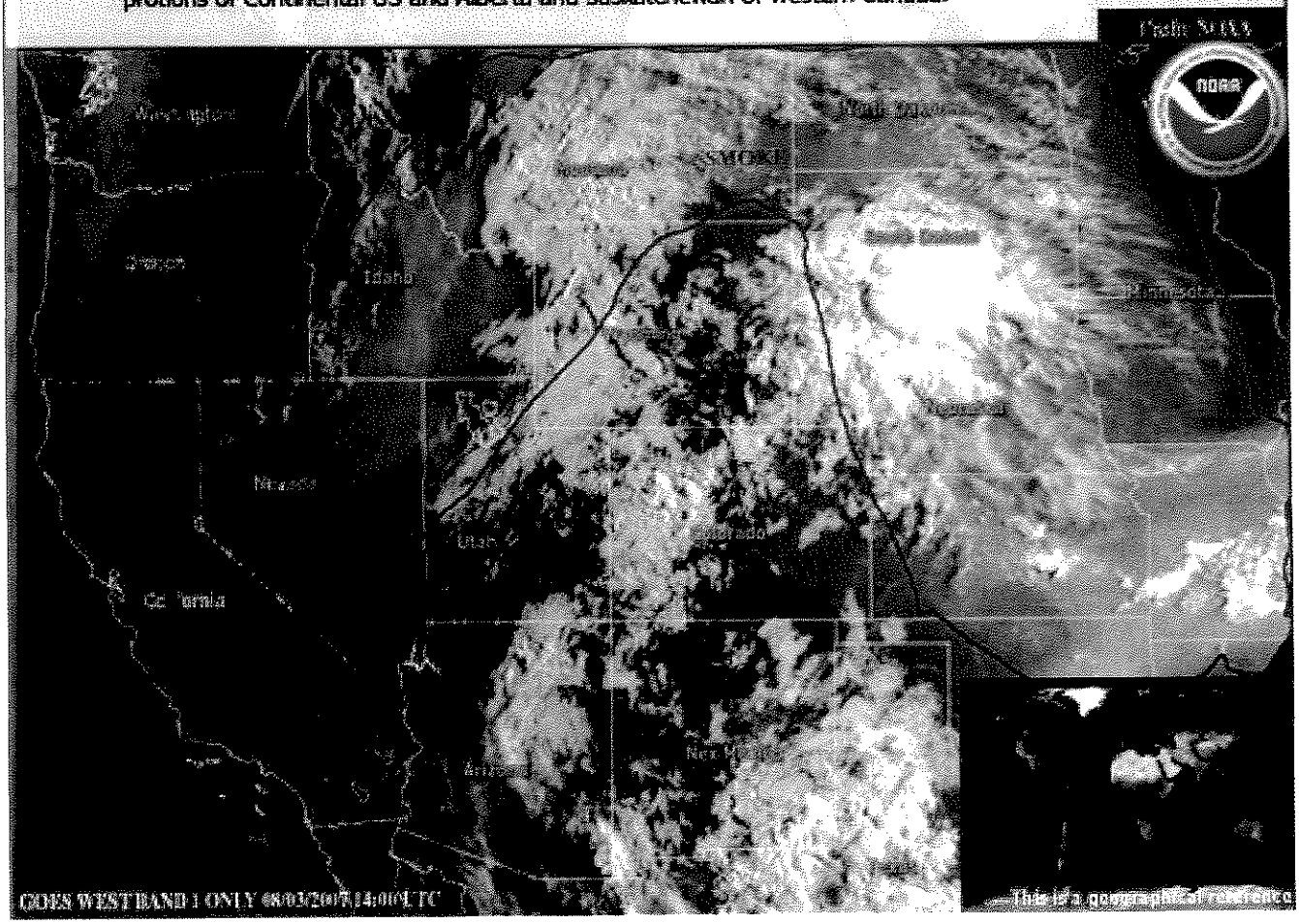
Dust & Smoke: Topic Home | Archive | Related Links

Natural Hazards Home | Section FAQ

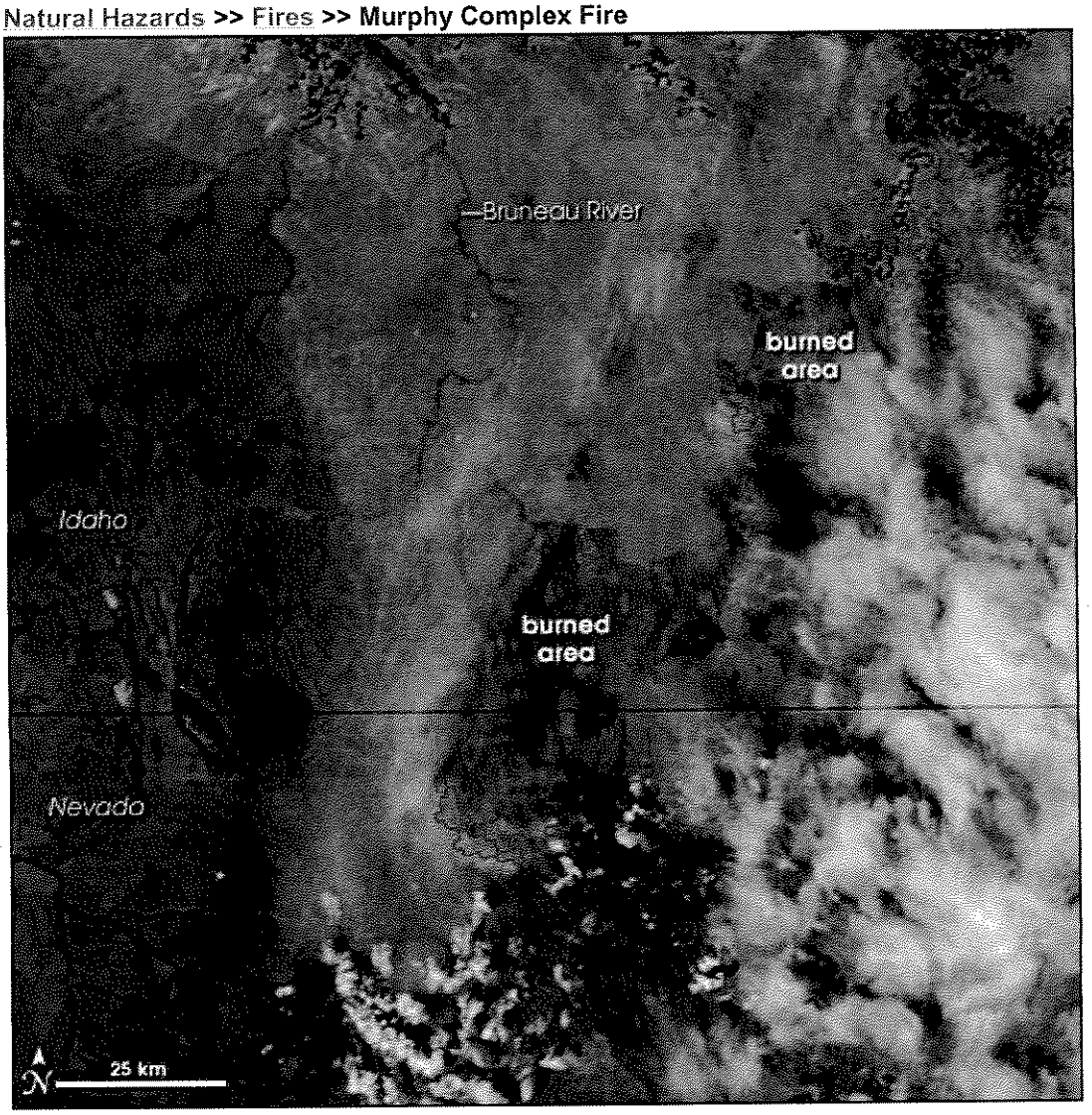
Subscribe to Natural Hazards
About the Earth Observatory & Natural Hazards
Contact Us

Program Manager: David Herring
Responsible NASA official: Michael King

This morning's GOES WEST imagery showed a large area of moderately dense smoke from the massive fires in northern Idaho, western Montana, and southern British Columbia of Canada has covered most protions of Continental US and Alberta and Saskatchewan of western Canada.



08/03/2007 14:00 UTC

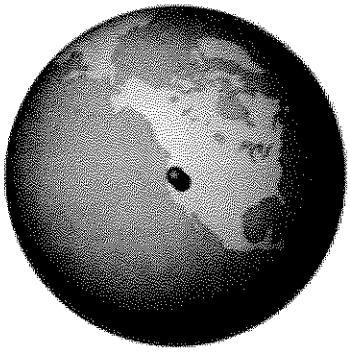


Click here to view high-resolution version (1.58MB)
Image Acquired: July 22, 2007

Murphy Complex Fire

When two large, previously separate wildfires (Rowland and Elk Mountain) near the Idaho-Nevada state line merged over the July 21 weekend, fire management officials renamed the incident as the Murphy Complex Fire. According to the morning report from the National Interagency Fire Center on July 23, 2007, the blaze had consumed more than 560,000 acres and was 15 percent contained. This image of the Murphy Complex Fire was captured by

Where in the World



the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Aqua satellite on July 22. Places where the sensor detected actively burning fire are outlined in red. The dry grassland and sagebrush terrain appears olive-tan, while the sprawling burned area appears deep brown.

The large image provided above has a spatial resolution (level of detail) of 250 meters per pixel. The MODIS Rapid Response Team provides twice-daily images of the western United States in additional resolutions. Images of the separate fires were previously published in the Fires in Idaho and Eastern Oregon event.

NASA image courtesy the MODIS Rapid Response Team, Goddard Space Flight Center

Recommend this Image to a Friend

Fires: Topic Home | Archive | Related Links

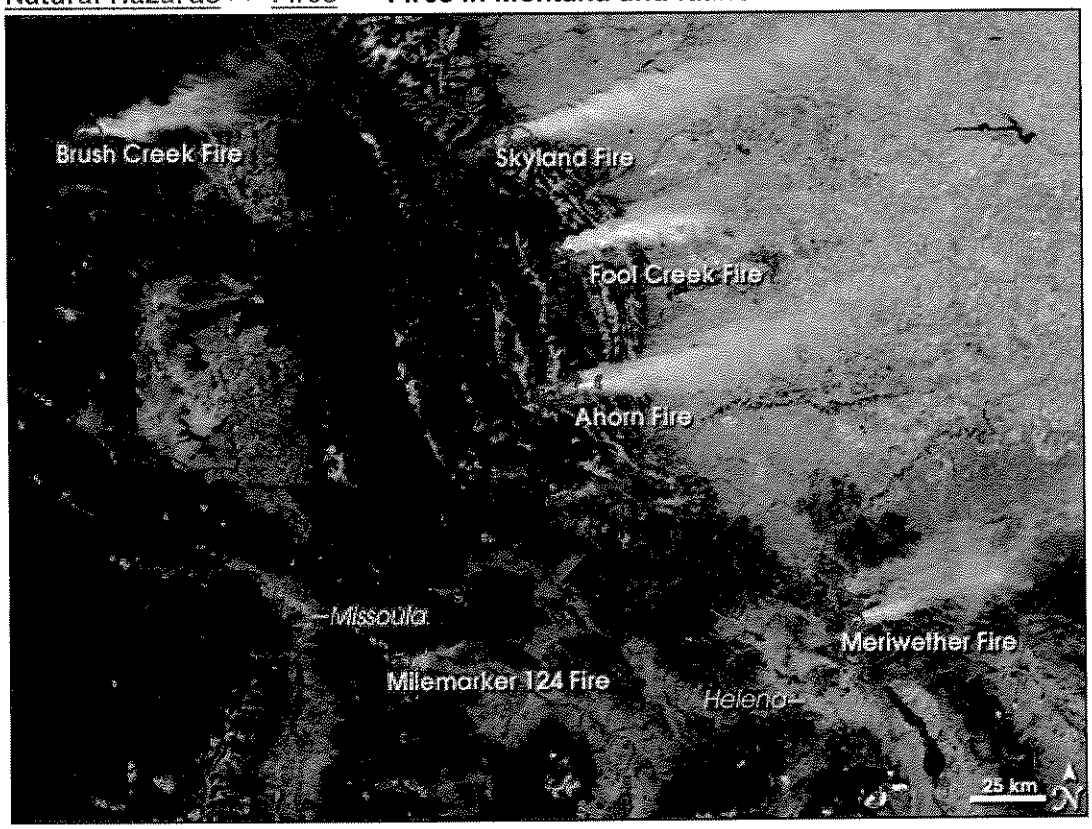
Natural Hazards Home | Section FAQ

Subscribe to Natural Hazards
About the Earth Observatory & Natural Hazards
Contact Us
Program Manager: David Herring
Responsible NASA official: Michael King
Privacy Policy and Important Notices

Image Posted
July 23, 2007

Satellite & Sensor
Aqua- MODIS

Fires Latest Events
Bushfires in Northern Australia
Fires in the Amazon
Fire on Alaska's North Slope
Fires in Southeast Africa
Fires on Sumatra
Bushfires in Northern Territory, Australia



Click here to view high-resolution version (865.38KB)
Image Acquired: July 31, 2007

Fires in Montana and Idaho

In the northern Rocky Mountains of Idaho and Montana, dozens of large, dangerous wildfires burned tens of thousands of acres in late July and early August 2007. Several communities in Montana were under evacuation on August 1, according to the daily report from the National Interagency Fire Center. Like much of the United States (with the notable exception of the southern Great Plains), the Northern Rockies of Montana and Idaho were experiencing moderate to severe drought in late July according to the weekly report from the U.S. Drought Monitor.

This image of Montana (with a little bit of Idaho included in the lower-left corner) was captured by the Moderate Resolution Imaging Spectroradiometer

Where in the World

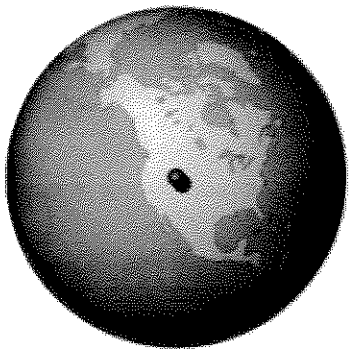


Image Posted

August 01, 2007

Satellite & Sensor

Aqua- MODIS

(MODIS) on NASA's Aqua satellite on July 31, 2007. Locations where the sensor detected actively burning fires are outlined in red. A westerly wind appeared to have been blowing at the time of the image (2:30 p.m. Mountain Daylight Time), and plumes of smoke spread from the mountains over the state's eastern plains. As of August 1, the Meriwether (20,745 acres) and Ahorn (36,311 acres) were the largest fires in the scene, but the Skyland Fire had grown most rapidly in the previous 24 hours; it grew by an estimated 7,505 acres to a total of 16,055 acres.

NASA's Terra and Aqua satellites both collect fire detection data over the United States at least twice a day, once in daylight and once at night. Through a partnership between NASA's Goddard Space Flight Center's MODIS Rapid Response Team, the University of Maryland, and the Remote Sensing Application Center of the USDA Forest Service, the satellite observations are relayed over the Internet to the Forest Service, which maps them. The Forest Service and its partners use the MODIS fire maps to help them make strategic decisions about where firefighting resources are needed at a national level.

The large image provided above has a spatial resolution (level of detail) of 250 meters per pixel. The MODIS Rapid Response Team provides twice-daily images of the region in additional resolutions.

NASA image courtesy the MODIS Rapid Response Team, Goddard Space Flight Center

Recommend this Image to a Friend

Fires: Topic Home | Archive | Related Links

Natural Hazards Home | Section FAQ

Subscribe to Natural Hazards
About the Earth Observatory & Natural Hazards
Contact Us
Program Manager: David Herring
Responsible NASA official: Michael King

Other Images for this Event
Posted: Sep 13, 2007
Posted: Sep 04, 2007
Posted: Aug 14, 2007
Posted: Aug 12, 2007
Posted: Aug 06, 2007
Posted: Aug 02, 2007

Fires Latest Events
Bushfires in Northern Australia
Fires in the Amazon
Fire on Alaska's North Slope
Fires in Southeast Africa
Fires on Sumatra
Bushfires in Northern Territory, Australia

Canadian Wildland Fire Information System

Maps and Reports > Hotspots

CFS CANADIAN FOREST SERVICE
Forest Fire in Canada

- CWFIS Home
- Introduction
- Background
- Maps and Reports
  - Interactive Map
  - Current Conditions
  - Fire Danger
  - Weather
  - Fire Weather
  - Fire Behavior
  - Fire M3 Hotspots
  - Regional Images
- Weekly Fire Statistics
- Historical Analysis
  - Fire Weather Normals
  - Fire Behavior Normals
  - Large Fire Database
- Fire Research
- Forest Fire Facts & Questions
- Publications
- Fire Links

CWFIS Web Site Survey

Maps and Reports

Fire M3 Hotspots for 25 July, 2007

Select Map or Report: Daily Hotspot Report | Day: 25 | Month: July | Year: 2007

Retrieve Document

<< Previous Day Next Day >>

Ecozone	Hotspots / Points chauds		Cloud / Nuage	
	Daily / quotidiens	Year-to-date / cumulés pour l'année	km²	%
1	0	0	-	-
2	0	0	-	-
3	0	1	-	-
4	6	1549	-	-
5a	93	3666	-	-
5b	0	533	-	-
6a	24	3064	-	-
6b	2	3308	-	-
7	0	35	-	-
8	1	6	-	-
9	1	2443	-	-
10	0	80	-	-
11	0	160	-	-
12	3	423	-	-
13	0	5	-	-
14	3	163	-	-
15	3	190	-	-
Total	136	15626	-	-

View Ecozone Map

Maps and Reports

Fire M3 Hotspots for 02 August, 2007

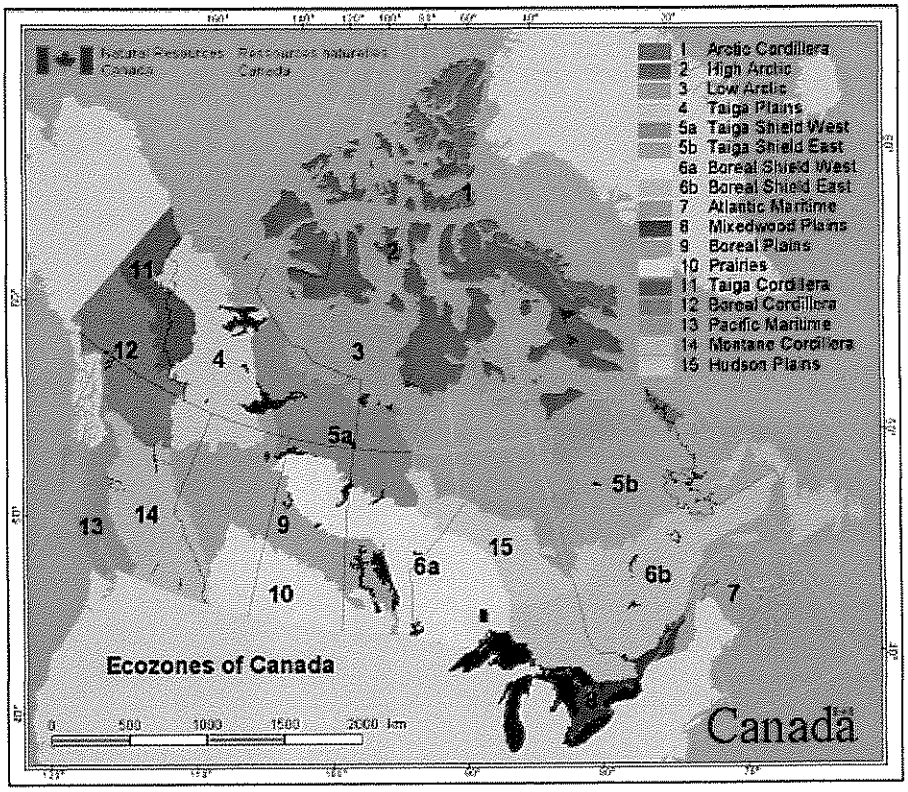
Select Map or Report	Day	Month	Year
Daily Hotspot Report	02	August	2007

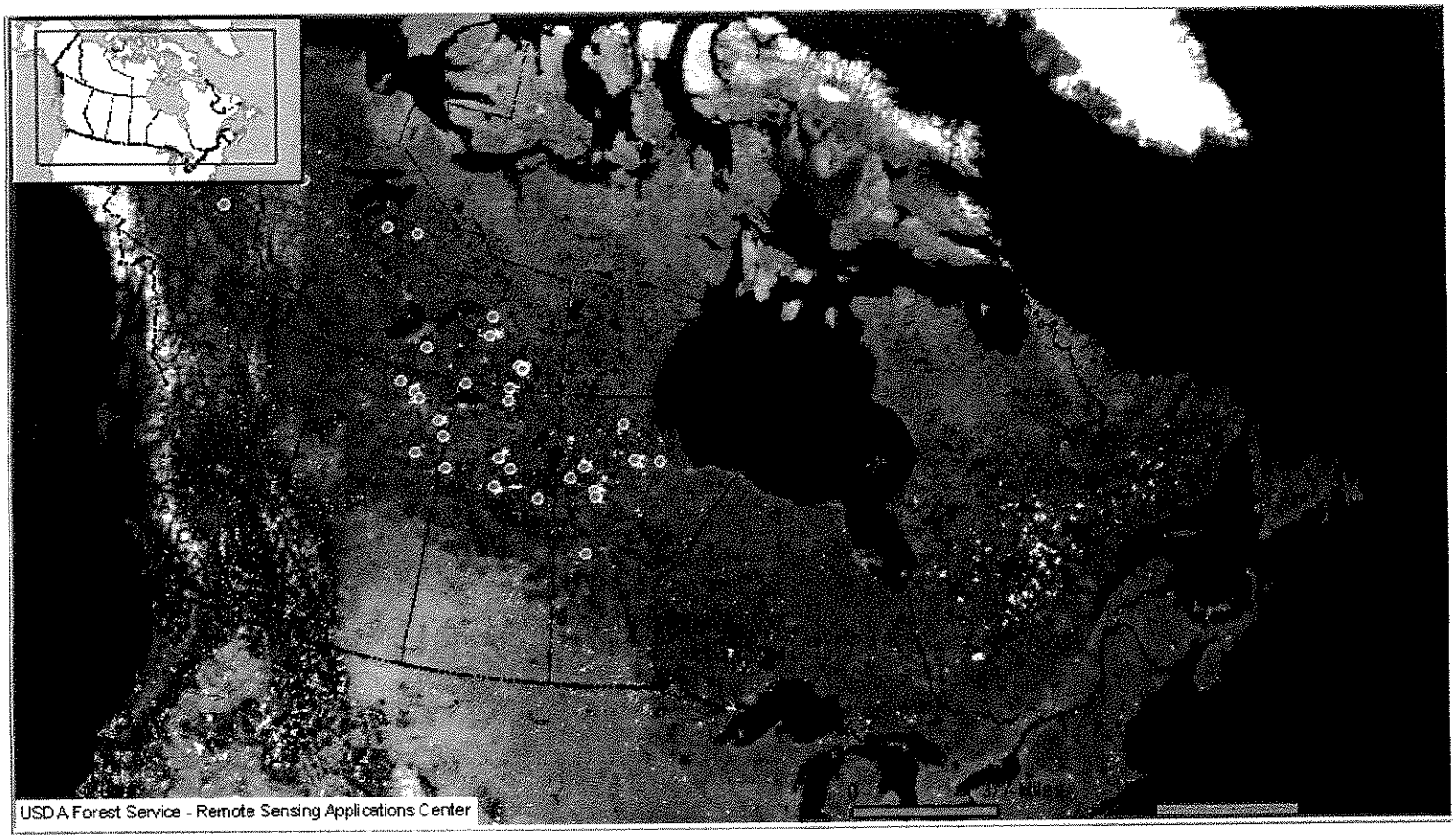
Retrieve Document

<< Previous Day Next Day >>

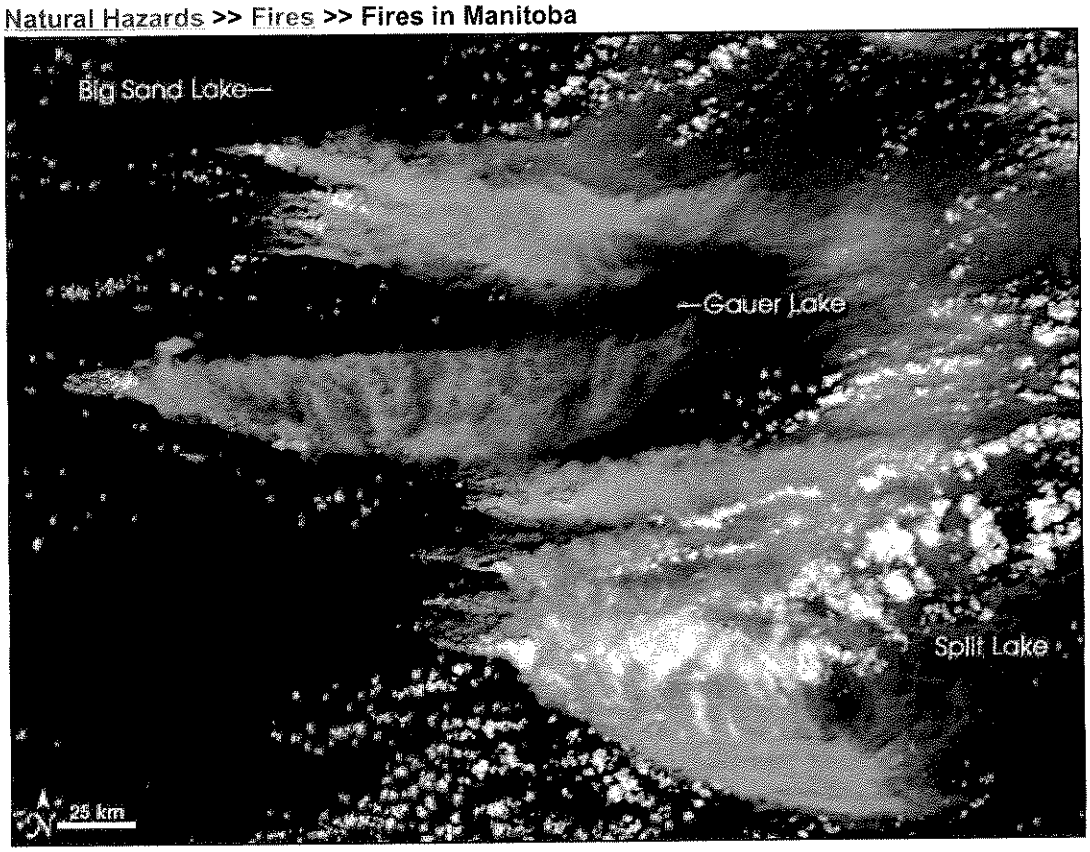
Ecozone	Hotspots / Points chauds		Cloud / Nuage	
	Daily / quotidiens	Year-to-date / cumulés pour l'année	km²	%
1	0	0	-	-
2	0	0	-	-
3	0	1	-	-
4	4	1783	-	-
5a	30	3730	-	-
5b	0	535	-	-
6a	1	3151	-	-
6b	0	3318	-	-
7	0	36	-	-
8	0	7	-	-
9	2	2485	-	-
10	0	80	-	-
11	0	178	-	-
12	5	440	-	-
13	0	5	-	-
14	29	414	-	-
15	0	195	-	-
Total	71	16358	-	-

View Ecozone Map


1 Arctic Cordillera
2 High Arctic
3 Low Arctic
4 Taiga Plains
5a Taiga Shield West
5b Taiga Shield East
6a Boreal Shield West
6b Boreal Shield East
7 Atlantic Maritime
8 Mixedwood Plains
9 Boreal Plains
10 Prairies
11 Taiga Cordillera
12 Boreal Cordillera
13 Pacific Maritime
14 Montane Cordillera
15 Hudson Plains
Ecozones of Canada
0 500 1000 1500 2000 km
Canada



8/1/07



Click here to view high-resolution version (3MB)
Image Acquired: July 23, 2007

Fires in Manitoba

In Manitoba, Canada, north of Lake Winnipeg, several massive fires were burning on July 23, 2007, when the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Terra satellite captured this photo-like image. Places where the sensor detected actively burning fires are outlined in red. Thick plumes of smoke spread east from the forest fires. In previous days, smoke from fires degraded the air quality enough that people in communities near Southern Indian Lake (hidden by smoke to the west of Gauer Lake) had to evacuate.

The large image provided above has a spatial resolution (level of detail) of 250 meters per pixel and shows a slightly wider area, including part of

Where in the World

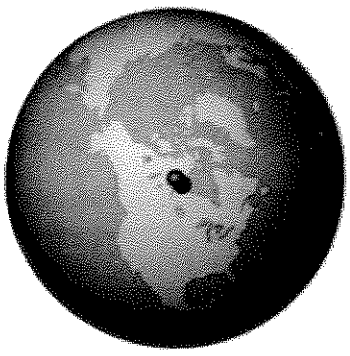
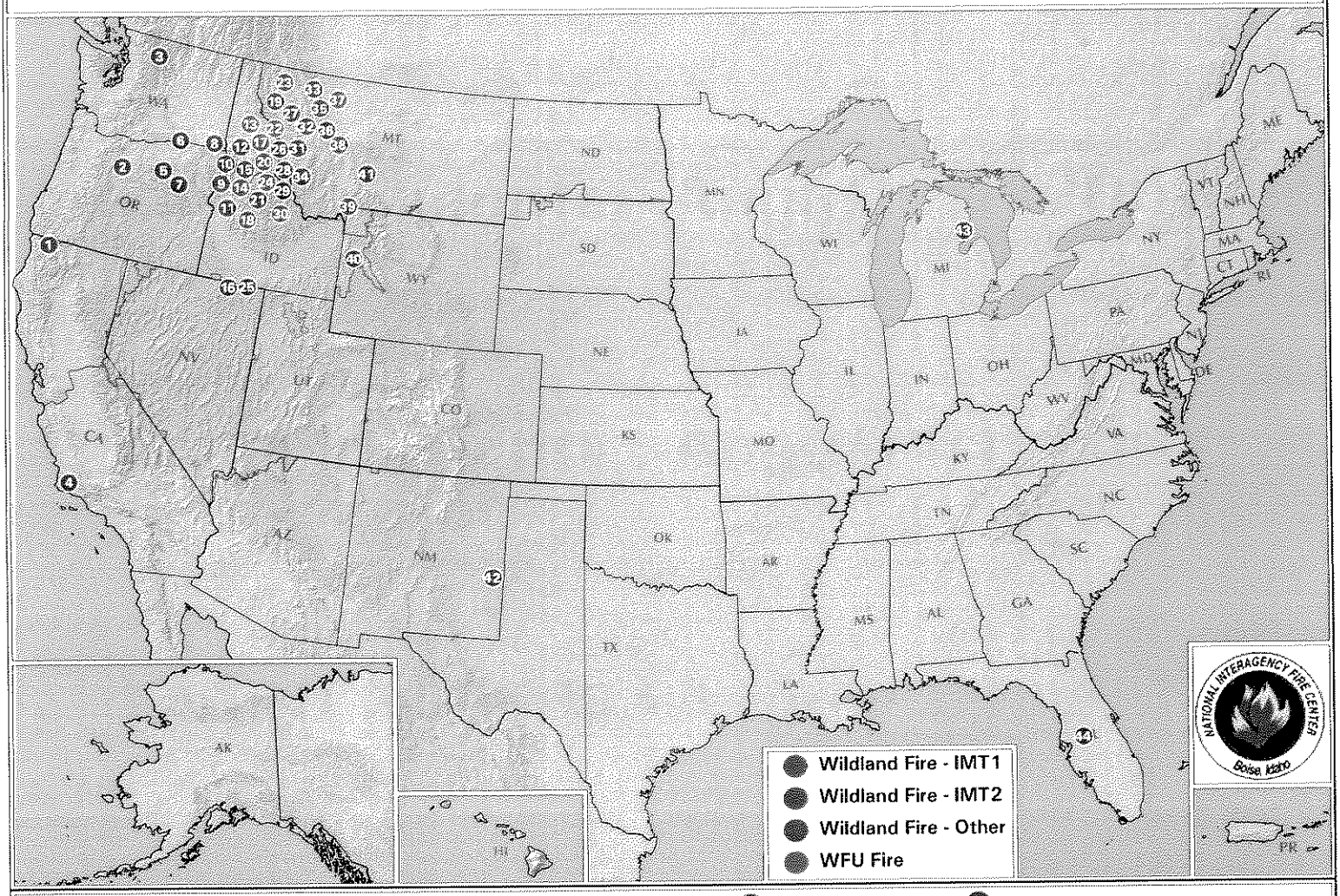


Image Posted
July 24, 2007

Satellite & Sensor
Aqua- MODIS

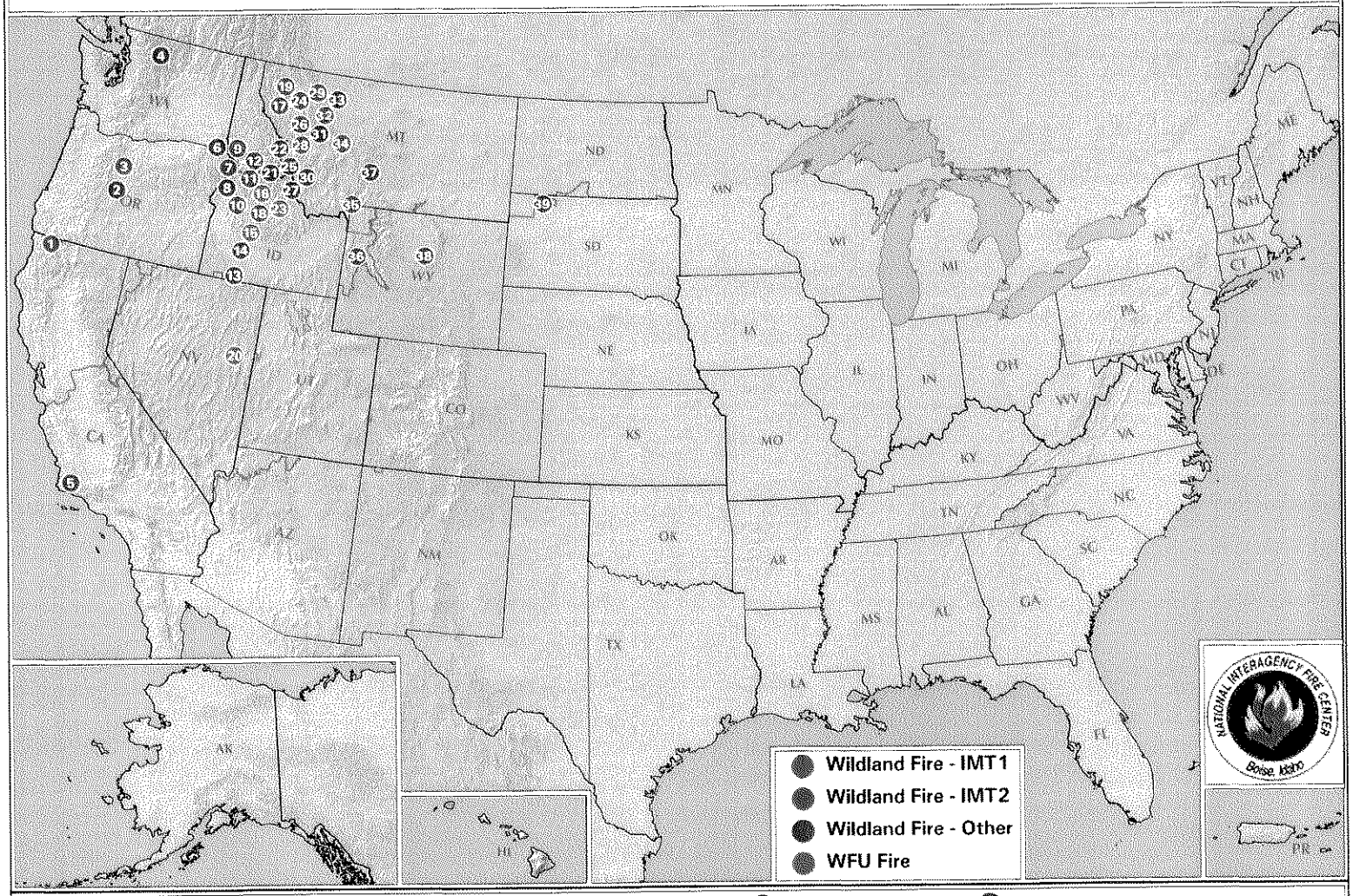
Other Images for this

Large Incidents - August 01, 2007



1. ELK COMPLEX
2. WSA LIGHTNING COMPLEX
3. TOLO
4. ZACA
5. MONUMENT COMPLEX
6. LES BLAIR
7. CHINA DIGGINS
8. CHIMNEY COMPLEX
9. EAST ZONE COMPLEX
10. BATTLE CREEK COMPLEX
11. CASCADE COMPLEX
12. RATTLESNAKE
13. LIZARD
14. RAINES
15. CONCORD
16. MURPHY COMPLEX
17. DOG
18. TRAPPER RIDGE WFU
19. CHIPPY CREEK
20. POE CABIN
21. MIDDLE FORK COMPLEX
22. CHAIN
23. BRUSH CREEK
24. KRASSEL COMPLEX
25. CEDAR SOUTH
26. BRIDGE
27. GARCEAU
28. ROMBO MOUNTAIN
29. VAN HORN
30. RED BLUFF
31. SAWMILL COMPLEX
32. MILE MARKER 124
33. SKYLAND
34. PATTENGAIL CREEK
35. AHORN
36. CONGER CREEK
37. FOOL CREEK
38. MERIWETHER
39. OWL
40. GRANITE CREEK
41. PORCUPINE
42. PETERSON
43. GALION
44. WEEEPING WILLOW

Large Incidents - August 03, 2007



1. ELK COMPLEX
2. WOODSIDE RANCH
3. WSA LIGHTNING COMPLEX
4. TOLO
5. ZACA
6. CHIMNEY COMPLEX
7. BATTLE CREEK COMPLEX
8. HORTON
9. POE CABIN
10. CASCADE COMPLEX
11. EAST ZONE COMPLEX
12. RATTLESNAKE
13. MURPHY COMPLEX
14. COLD
15. TRAPPER RIDGE WFU
16. KRASSEL COMPLEX
17. CHIPPY CREEK
18. MIDDLE FORK COMPLEX
19. BRUSH CREEK
20. TELEGRAPH WFU
21. RAINES
22. BRIDGE
23. SHOWER BATH
24. GARCEAU
25. ROMBO MOUNTAIN
26. MILE MARKER 124
27. VAN HORN
28. SAWMILL COMPLEX
29. SKYLAND
30. PATTENGAIL CREEK
31. CONGER CREEK
32. AHORN
33. FOOL CREEK
34. MERIWETHER
35. OWL
36. GRANITE CREEK
37. PORCUPINE
38. BUFFALO SPRINGS
39. HAY CREEK

Hawaii

Definitions of Map Terms

Large Incident:	A wildfire of 100 acres or more occuring in timber, or a wildfire of 300 acres or more occuring in grass/sage.
Wildland Fire:	Any nonstructure fire, other than prescribed fire, that occurs in the wildland.
Wildland Fire - IMT1:	Wildland fire; Type 1 Incident Management Team Assigned.
Wildland Fire - IMT2:	Wildland fire; Type 2 Incident Management Team Assigned.
Wildland Fire - Other:	Wildland fire; Other Incident Management Team Assigned besides Type 1 or Type 2 team (e.g. [illegible]

WFU Fire:	Wildland Fire Use. A naturally ignited wildland fire that is managed to accomplish specific prestated resource management objectives in predefined geographic areas outlined in Fire Management Plans.

Information based on data provided by the National Interagency Fire Center and is subject to change

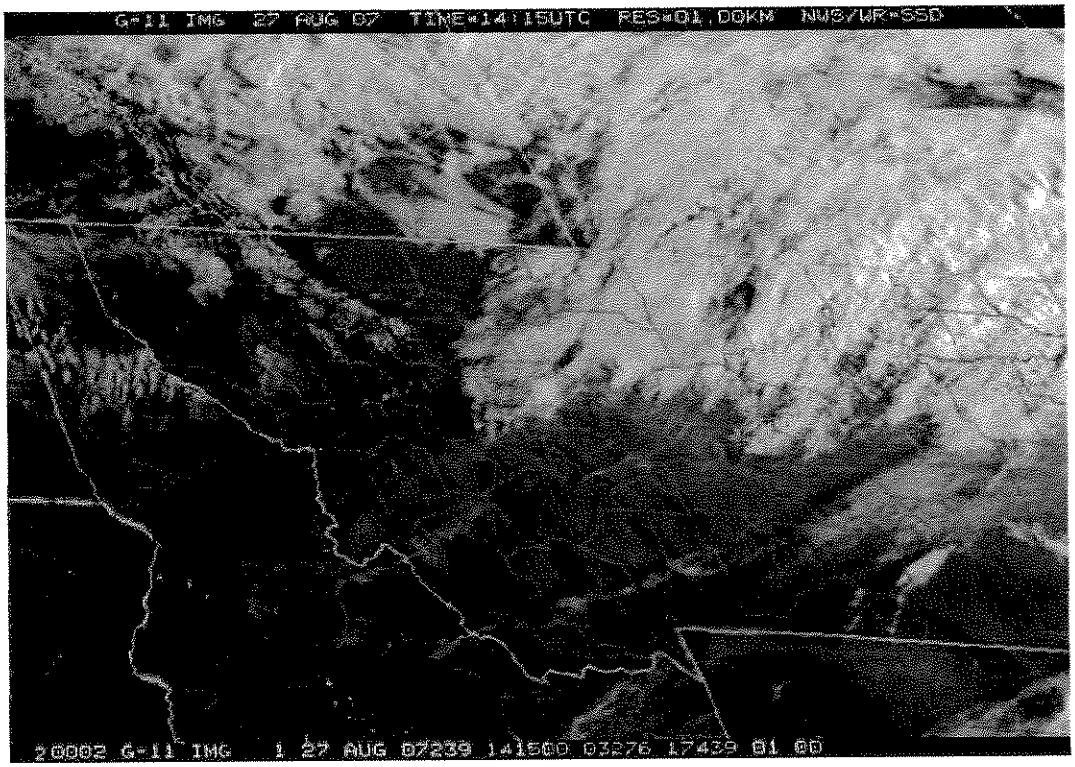
Montana DEQ Forest Fire Smoke Advisory
August 27, 2007
10:00 AM Monday

FORECAST:

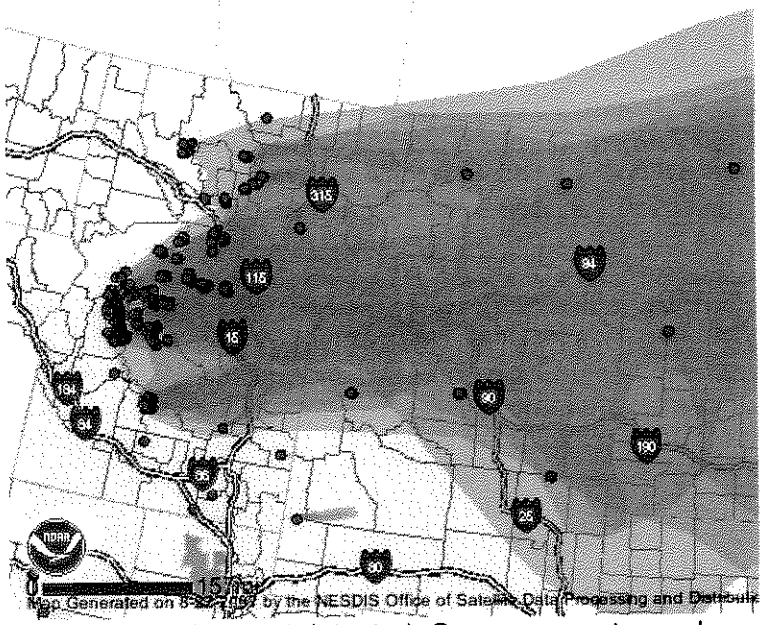
The fires in Idaho and Montana were active yesterday but most of the smoke is staying aloft right now and is headed steadily east. Moderate conditions are still present in some western Montana communities from local fires but only the southwestern corner of the state is receiving new smoke this morning. Many of the fires in the Krassel complex west of Salmon, Idaho remained active through the night and smoke from those fires is just overhead in the Wisdom, Butte, Bozeman, and Dillon areas.

The flow aloft is from the west today as a shallow, cool air mass from Canada has pushed into the northern half of the state producing northerly surface winds east of the divide. We will be transitioning into a weak ridge for the next day and stagnant conditions are not expected. Later this morning, the smoke aloft will start to mix down to the surface and smoke will be noticeable under the thicker parts of the plume of smoke aloft. Hazy skies will be evident across the southern half of the state. Direct plume impacts from local fires could be a problem this afternoon and evening. Residents near active fires or experiencing noticeable smoke levels should use the VISIBILITY GUIDELINES to determine smoke levels in their area and guide their activity decisions.

A morning satellite photo centered on Great Falls is illustrated below:



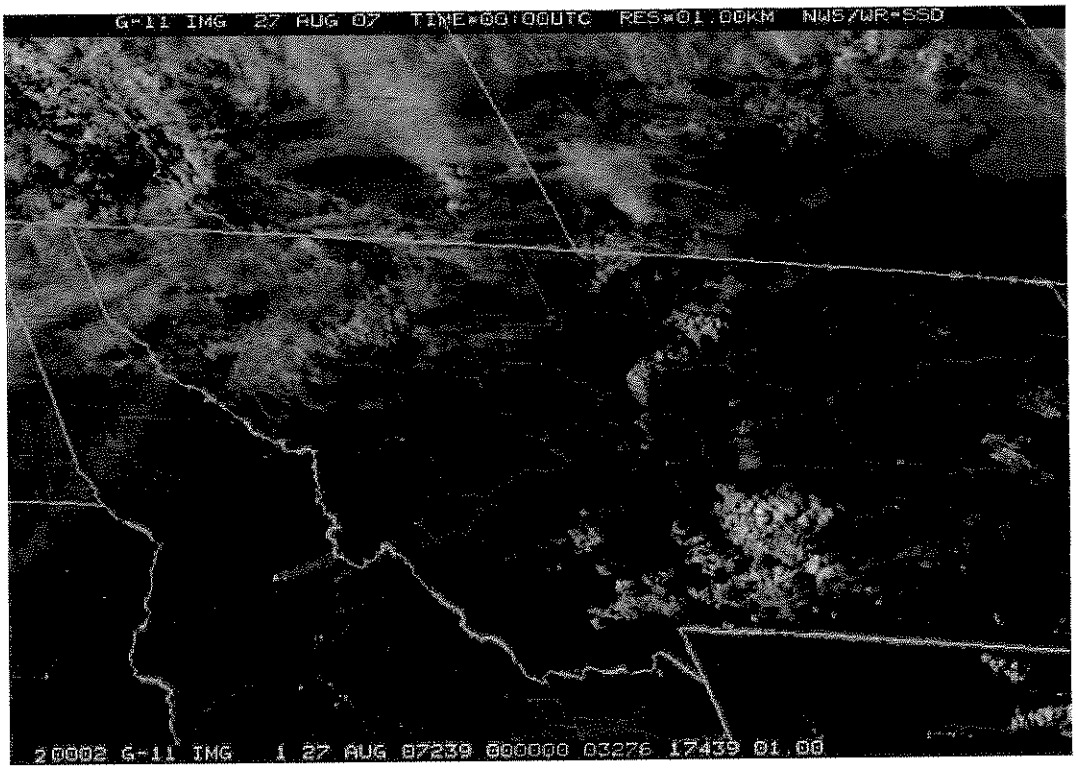
This morning's analysis from NOAA's satellite services division shows the active fires in Montana and the smoke plumes combining and spreading downwind (the analyzed smoke is based on yesterday's satellite coverage, the fire detects are based on last nights satellite coverage).



Red indicates hot spot detected. Grey represents smoke seen by satellite. Fire size is exaggerated for visibility at this scale

To identify individual fires on graphic above go here:
http://activefiremaps.fs.fed.us/lg_fire2.php

This satellite photo taken at 6:00 PM last night shows the smoke plumes from the fires in Idaho moving across into southwestern Montana.



This morning's smoke report is below, comparing particulate levels where we have information to MDEQ's Forest Fire health advisory levels.

Montana DEQ Forest Fire Smoke Advisory
August 27, 2007

10:00 AM Monday

DISCUSSION:

The smoke from recent fire activity is mostly aloft but moderate smoke levels are currently impacting Whitefish, Kalispell, and Missoula. There is a lot of smoke in the southwest corner of the state as some of the fires continued to be active throughout the night and still have plumes visible downwind this morning. Surface conditions are OK now but are expected to get worse occasionally later this morning and in the afternoon. The advisories in the table below represent conditions between midnight and 8 AM and may change substantially through the day. Residents downwind of the active fires and experiencing impacts from residual smoke will need to pay close attention to conditions in their area and use the visibility guidelines to determine current conditions.

John Coefield
Meteorologist
Montana Department of Environmental Quality

Locations and severity of forest fire smoke reports since midnight of the date above at reporting stations.

Real time particulate information is currently available in most of the larger urban areas from several different sources including: DEQ run PM-10 BAMS and PM2.5 BAMS, CS&KT run PM-10 TEOMS, NWS ASOS visibility monitors, and USFS remote access Nephelometers and BAMS.

Updated 10 AM August 27, 2007

These advisories represent conditions between midnight and 8 AM and may change substantially through the day

HAZARDOUS	
VERY UNHEALTHY	
UNHEALTHY	
UNHEALTHY FOR SENSITIVE GROUPS	
MODERATE	WhitefishT24 Kalispell T24 Missoula T24

T1(x)	One-hour TEOM or BAM value (number of values)
T8(x)	Eight-hour average TEOM or BAM value(number of values)
T24	24 hour average TEOM or BAM value
Vis(x)	Visibility value(number of hours)
Vis(am/pm)	Visibility value from twice/day reporting stations
(est)	estimate

Local impacts in areas immediately adjacent to active fires are expected to exceed some or all of the advisory levels. DEQ recommends the use of local visibility guidelines to evaluate possible health risks and make informed activity decisions.

Thursday, July 26, 2007

DESCRIPTIVE TEXT NARRATIVE FOR SMOKE/DUST OBSERVED IN SATELLITE IMAGERY
THROUGH 1630Z July 26, 2007

Northwest US:
Moderately dense smoke from fires across the area is currently concentrated in northeastern Oregon, southwestern Washington, and Central Idaho where is is moving into western Montana.

Montana:
A large fire in Lewis and Clark county near Cascade county is producing dense smoke that is slowly dispersing outward in all directions of the fire.

Arkansas:
A fire in Clark County is producing a small area of locally dense smoke traveling north.

Saskatchewan/Manitoba:
Fires in the northern portions of these provinces continue to produce locally dense smoke plumes moving toward the east. The complete extent of the smoke is not known due to to cloud cover in the area.

Smoke can be seen streaming across Manitoba north of Lake Winnipeg, where it crosses into Ontario and Quebec along with the southern Hudson Bay.

A continued area of dense residual smoke and haze continues to cover northern Nova Scotia and areas to the west.

Unless otherwise indicated:

- Areas of smoke are analyzed using GOES-EAST and GOES-WEST Visible satellite imagery.
- Only a general description of areas of smoke or significant smoke plumes will be analyzed.
- A quantitative assessment of the density/amount of particulate or the vertical distribution is not included.
- Widespread cloudiness may prevent the detection of smoke even from significant fires.

27

Saturday, July 28, 2007

DESCRIPTIVE TEXT NARRATIVE FOR SMOKE/DUST OBSERVED IN SATELLITE IMAGERY
THROUGH 0215 July 29, 2007

Northern Rockies/High Plains:
Numerous fires have exploded this evening over the northern Rockies and are producing dense to very dense smoke. This smoke has merged with residual smoke from last evening and earlier in the day to create a broad area of smoke that covers most of northern and central Idaho, Montana, southern Alberta, southern Saskatchewan and into southwest Manitoba. The fires that are producing the thickest smoke are along the Idaho/Oregon border near Hell's Canyon and in Idaho, Valley and Boise counties in Idaho and in eastern Flathead and Lewis and Clark counties in Montana. The plumes were all moving to the east-northeast. Additional fires are seen in southeast British Columbia about 75 km north of the Idaho border. These fires were also producing thick smoke that was moving to the northeast.

California:
A fire complex in western Siskiyou county in northern California intensified this evening and began producing more moderate to dense smoke. The smoke was fanning out in 2 directions â€" one area moving north into Douglas county Oregon and the remainder moving east into central Siskiyou.

The long running blaze in central Santa Barbara county is also producing moderate to thick smoke that is moving in 2 different directions. The higher elevation smoke is moving to the north into Kings county while the lower level smoke is spreading south to the eastern Channel Islands.

Kansas/Oklahoma:
A tremendous number of mainly small, short duration fires was seen across south central Kansas and north central Oklahoma. An area of light smoke associated with these fires was seen over the region with a gradual drift to the north or northwest.

Northwest Minnesota/Lake Superior:
A cluster of fires mainly in Roseau county in northwest Minnesota has produced an area of moderate smoke that is drifting to the northeast into southeast Manitoba and southwest Ontario.

Residual smoke from previous days fires was seen over eastern Lake Superior and adjoining Ontario. The smoke was mainly light.

Northwest Canada:
A few fires were observed over the northern Yukon and western Northwest Territory west of Great Bear Lake. They were producing light to moderate smoke that was drifting to the west but did not reach the Alaska border. Extensive clouds were seen over Alaska.

Ruminski

Unless otherwise indicated:

- Areas of smoke are analyzed using GOES-EAST and GOES-WEST Visible satellite imagery.
- Only a general description of areas of smoke or significant smoke plumes will be analyzed.
- A quantitative assessment of the density/amount of particulate or the vertical distribution is not included.

28

Monday, July 30, 2007

DESCRIPTIVE TEXT NARRATIVE FOR SMOKE/DUST OBSERVED IN SATELLITE IMAGERY
THROUGH 1630 July 30, 2007

Northern Rockies/High Plains:
A huge area of very dense smoke from numerous fires over northern and central Idaho and western Montana is seen covering much of Montana, the southern half of Saskatchewan and Manitoba and north central Wyoming. Moderately dense smoke also extends further south across central Wyoming and into northeast Colorado and is seen over northeast North Dakota into northwest Minnesota. Mainly light to moderate smoke remains with the fires in central Idaho.

Additional fires in southeast British Columbia are producing narrow plumes of light to moderate smoke that is spreading to the east across the Continental Divide and into southern Alberta.

California:
Moderately dense smoke from the fire complex in western Siskiyou county in northern California has settled into the valleys around the fire complex this morning.

The long running blaze in central Santa Barbara county has produced a plume of mainly light to locally moderate smoke that extends north across the entire Sierra Nevada range across Lake Tahoe and reached the California/Oregon border. The smoke is also spreading to the southeast of the fire and is banked to the west of the Sierra Madre and San Gabriel mountains and off the coast.

Mid Atlantic Coast and the Ohio Valley:
Residual smoke from previous days has settled into this region and mixed with haze. This area of light smoke stretches from Long Island westward across New Jersey and Pennsylvania then bends back to the southwest across southeast Ohio, much of Kentucky and into central Tennessee.

Northwest Canada:
A few fires were observed over the northern Yukon and western Northwest Territory west of Great Bear Lake. They were producing moderate to dense smoke that is now drifting to the east and reaching the western shore of the lake.

Ruminski

Unless otherwise indicated:

- Areas of smoke are analyzed using GOES-EAST and GOES-WEST Visible satellite imagery.
- Only a general description of areas of smoke or significant smoke plumes will be analyzed.
- A quantitative assessment of the density/amount of particulate or the vertical distribution is not included.
- Widespread cloudiness may prevent the detection of smoke even from significant fires.

Tuesday, July 31, 2007

DESCRIPTIVE TEXT NARRATIVE FOR SMOKE/DUST OBSERVED IN SATELLITE IMAGERY
THROUGH 0215 UTC August 1, 2007

Oregon/Montana/Idaho:
Large wildfires in northeast Oregon (Hells Canyon National Recreational Park), in central Idaho and western Montana are producing a large area of moderately dense to very dense smoke that is moving west across parts of central Idaho and western/central Montana. Light to moderately dense residual smoke (with a few dense pockets) from these fires continues to move west across parts of southern Canada, the northern/central Rockies, the northern/central Plains, the Upper/Middle Mississippi Valley, the Great Lakes region and the Ohio Valley.

British Columbia/Alberta:
Wildfires burning in southeast British Columbia are producing moderately dense to dense plumes of smoke moving west into southern Alberta.

California:
A wildfire in the Sierra Madre Mountains in Santa Barbara county is emitting an area of moderately dense to dense smoke south into the Pacific Ocean. Light to moderately dense smoke is also fanning north NE across the county. A narrow line of residual smoke from this fire stretches from northern to southern California in the central section of the state (San Joaquin Valley).

A fire in northern California in the Siskiyou mountains (Siskiyou county) is producing an area of moderately dense to dense smoke that stretches south into Humboldt, Del Norte and Trinity counties. Residual light smoke from this fire can be seen in extreme southwest Oregon and a small area in the Pacific Ocean west of the wildfire.

Washington:
A fire in Chelan county (North Cascades National Park) is producing an area of moderately dense smoke extending southeast along the Okanogan county border.

Mid Atlantic/Tennessee and Ohio Valley/Upper and Lower Mississippi Valley:
A mix of light smoke and haze spreads across most of Maryland, Virginia, West Virginia, Kentucky, Tennessee and parts of southern Indiana and Illinois and southeast Missouri, northeast Arkansas and northern North Carolina. Source of smoke cannot be confirmed, but thinking is that its from the wildfires in the western U.S.

Northwest Territories:
Cloud cover limits smoke detection but an area of moderate smoke or smoke mixed with haze can be seen moving from southeast of Great Bear Lake toward Great Slave Lake. Presumably this smoke is a residual from previous days fires in western Northwest Territories and east central Alaska.

J Kibler

Unless otherwise indicated:

30

Wednesday, August 1, 2007

DESCRIPTIVE TEXT NARRATIVE FOR SMOKE/DUST OBSERVED IN SATELLITE IMAGERY
THROUGH 0130 UTC August 2, 2007

Idaho, Montana, Alberta, Wyoming, North and South Dakota, Nebraska, Minnesota, Wisconsin, and Ontario:
The large, persistent and numerous fires primarily in central Idaho and western Montana are producing a very large swath of smoke that extends from the fires toward the east. The smoke currently covers much of Idaho, most of Montana, the southwestern corner of Alberta, the northeastern corner of Wyoming, southern North Dakota, all of South Dakota, the north-central part of Nebraska, central and southern Minnesota, northwestern Wisconsin, Lake Superior, and areas of Ontario near Lake Superior. The smoke is densest near the fires but also has moderate to dense bands scattered throughout the entire length of the plume. Smoke is moving primarily eastward.

Northern Minnesota:
A fire in northern Lake of the Wood County is producing a light to moderate smoke plume that extends southeastward paralleling the U.S./Canadian border (but the smoke is currently on the U.S. side of the border).

Midwest, mid-Atlantic, western New England, southeastern Ontario and southeastern Quebec:
An area of light smoke mixed with haze covers most of Michigan, Indiana and Ohio and possibly northern Kentucky, and extends eastward into West Virginia, Virginia and southern Maryland, and also extends northward in a swath that covers western and northern New York and neighboring parts of Ontario as well as northern Vermont, northern New Hampshire and northern Maine and neighboring parts of Quebec, including Montreal. The smoke is believed to be a residual from previous days fires in Idaho and Montana.

Mississippi, Louisiana, Arkansas, Missouri,
A quasi-stationary area of light smoke mixed with haze covers northern Mississippi, northeastern Louisiana, most of Arkansas, and southeastern Missouri. This smoke is also thought to be a residual from previous days fires in Idaho and Montana.

California:
The persistent fire in Santa Barbara County is producing a moderate to dense smoke plume that extends both northward (into San Luis Obispo) as well as southward to the ocean. A fire in western Siskiyou County is producing a smoke plume that extends southward; the plume is mostly light, but moderate or dense smoke occurs near the fire. A related area of light smoke just off the coast of northern California was produced by smoke originally from the Siskiyou County fire.

British Columbia:
Fires in southeastern British Columbia are producing light to moderate smoke that extends northward. In most cases the smoke that can be seen in satellite imagery remains within about 75 km of the fires and the smoke does not extend outside British Columbia.

Oregon:
A fire in western Jefferson County is producing a moderate smoke plume that extends northeastward. A fire in Deschutes County is producing a light to moderate plume that extends southward.

Washington:
In Grant County a fire is producing a small light to moderate plume that extends slightly in all direcitions from the fire.

Thursday, August 2, 2007

DESCRIPTIVE TEXT NARRATIVE FOR SMOKE/DUST OBSERVED IN SATELLITE IMAGERY
THROUGH 1630 UTC August 2, 2007

British Columbia, Alberta, Idaho, Montana, North Dakota, South Dakota, Nebraska, Minnesota, Iowa, Wisconsin, Michigan:
Smoke from the numerous, persistent, Idaho/western Montana fires is dense to very dense in central Idaho and western Montana, and then moderate to dense in a swath from British Columbia to Michigan. The swath covers the southeastern corner of British Columbia, southern Alberta, central Idaho and all of Montana, the northeastern corner of Wyoming, most of the Dakotas (except for northeastern N. Dakota) and Nebraska (except for extreme southern Nebraska), southern Minnesota, most of Iowa, central and southern Wisconsin and the Upper Peninsula of Michigan.

Ohio, Indiana, Illinois, Kentucky, Missouri, Arkansas:
A mix of haze and light smoke covers much of Ohio, Indiana, central and western Kentucky, southern Illinois, most of Missouri and northern Arkansas. The smoke is a residual from previous days fires in Idaho/Montana. The area is quasi-stationary but might drift slightly eastward as the afternoon progresses.

Southeastern Quebec:
Just north of the border between New York and Canada there is a small area of light smoke, another residual from previous days Idaho/Montana fires. The smoke is moving toward the northeast.

California:
The persistent fire in Santa Barbara County is producing light to moderate smoke that is moving southward and westward but does not appear to quite reach the ocean.

Oregon:
A fire in western Jefferson County is producing a moderate narrow smoke plume that extends northeastward.

Unless otherwise indicated:

- Areas of smoke are analyzed using GOES-EAST and GOES-WEST Visible satellite imagery.
- Only a general description of areas of smoke or significant smoke plumes will be analyzed.
- A quantitative assessment of the density/amount of particulate or the vertical distribution is not included.
- Widespread cloudiness may prevent the detection of smoke even from significant fires.

Friday, August 3, 2007

DESCRIPTIVE TEXT NARRATIVE FOR SMOKE/DUST OBSERVED IN SATELLITE IMAGERY
THROUGH 0400 UTC August 4, 2007

Western U.S and southern Canada:
In addition to the persistent fires in Idaho/western Montana, increased fires in northern Oregon as well as fires in southeastern British Columbia are contributing to the dense to very dense smoke that covers northern Oregon, most of Idaho, most of Montana, western Wyoming, extreme southern Alberta and extreme southern Saskatchewan. Light to moderate smoke extends further into Alberta and Saskatchewan and also covers extreme southeastern British Columbia and most of eastern Nevada and western Utah. The smoke is moving toward the northeast over most of this area, but turns more easterly as it reaches eastern Montana and Saskatchewan.

California:
The large fire in Santa Barbara County is producing very dense smoke that extends in all directions from the fire but primarily is moving north northeastward. The smoke just barely crosses the Nevada border into Esmeralda County, Nevada. Areas of light smoke now detached from this fire have been moving northward into central California from time to time today but dissipate before they reach northern California. In addition, a fire in western Siskiyou County is producing mostly light to moderate smoke that extends eastward and then turns southward.

Central and Eastern U.S.
A very large area of light to moderate smoke mixed with haze covers much of the central and eastern U.S. The smoke is from the past several days of persistent fires in Idaho and western Montana. The smoke/haze covers North Dakota, South Dakota, southwestern Minnesota, Nebraska, western and southern Iowa, Kansas, Missouri, Oklahoma, Arkansas, eastern Texas, eastern Louisiana, Mississippi, Alabama, northern Georgia, Tennessee, Kentucky, Illinois (except extreme northern Illinois), Indiana (except extreme northern Indiana), Ohio, West Virginia, Virginia, western North Carolina, northwestern South Carolina, Maryland, New Jersey, New York, and all of New England. Smoke in the eastern U.S. is moving slowly eastward while smoke in the Central Plains is moving southeastward.

Michigan:
A vigorous fire in Luce County, Michigan is producing a large smoke plume that extends eastward (or more accurately east southeastward). The smoke is dense near the fire, becomes moderate as it reaches Lake Huron, and then light as it extends farther covering much of northern Lake Huron. Earlier today the smoke went slightly into Ontario, but it no longer seems to do so. In the past few hours it has begun to move more southerly and is likely to soon begin to affect Cheboygan and Emmet Counties.

Minnesota, Ontario and Manitoba:
Several fires in Minnesota (and one in Ontario) all near the Minnesota/Ontario/Manitoba border are producing dense smoke. The smoke is moving northward or northeastward. The area of the smoke seems small (barely extending into Canada) but cloud cover might be hindering satellite observation of the smoke. In addition, a fire in Manitoba (near 53.4N 96.4W) is producing a small, light smoke plume that extends toward the east.

Unless otherwise indicated:

- Areas of smoke are analyzed using GOES-EAST and GOES-WEST Visible satellite imagery.
- Only a general description of areas of smoke or significant smoke plumes will be analyzed.

33

Saturday, August 4, 2007

DESCRIPTIVE TEXT NARRATIVE FOR SMOKE/DUST OBSERVED IN SATELLITE IMAGERY
THROUGH 1700 UTC August 4, 2007

Western U.S and Southern Canada:
Persistent fires in northwestern United States and southeastern British Columbia are contributing to the dense and very dense smoke from northern Oregon/northern Idaho across Montana to southern Saskatchewan and Manitoba. The area of smoke becomes thinner and turns southward over the Northern Plains and the Upper Mississippi Valley. Risidual smoke from the large fires in Santa Barbara County in California extends northward to central California and western Nevada.

Central and Eastern United States:
The very large area of smoke and haze from the fires in the Northwest and British Columbia covers much of the central U.S.
, the Southeast and the Middle Atlantic. During the morning hours the most dense smoke and haze stretched from the Mid-Atlantic to southern New England. A plume of dense smoke from the fire in N Luce County in Michigan is drifting northward over eastern Lake Superior.

Brown

Unless otherwise indicated:

- Areas of smoke are analyzed using GOES-EAST and GOES-WEST Visible satellite imagery.
- Only a general description of areas of smoke or significant smoke plumes will be analyzed.
- A quantitative assessment of the density/amount of particulate or the vertical distribution is not included.
- Widespread cloudiness may prevent the detection of smoke even from significant fires.

Saturday, August 4, 2007

DESCRIPTIVE TEXT NARRATIVE FOR SMOKE/DUST OBSERVED IN SATELLITE IMAGERY
THROUGH 0200 UTC August 5, 2007

Saskatchewan/Alberta/Northwest Territories:
Several fires north of eastern Lake Athabasca are producing thin to moderately dense plumes of smoke that are moving southerly. A fire south of western Lake Athabasca is producing a thin to moderately dense plume of southerly smoke. A fire norther of Great Slave Lake is producing a southerly thin to moderately dense plume of smoke.

Southern British Columbia/Idaho/Montana/Wyoming/Nevada/Utah/
Dakotas/Nebraska/Alberta/Saskatchewan/Manitoba:
The massive fires in southern British Columbia of Canada, Idaho and Valley counties of central Idaho, and Flathead and Missoula counties of western Montana are producing locally very very dense plumes of smoke that are mainly moving northeasterly. The denst portion of the smoke has now covered the eastern half of central Idaho and western half of Montana. The residual smoke from this morning's burning has formed a large area with moderately dense smoke which has covered the areas mentioned above.

Oregon:
A large fire in northeastern corner of Grant county in Oregon is producing a locally very dense plume of smoke that is moving northeasterly across Washingotn, oregon, and Idaho three states intersection into western Idaho. A large fire in southeastern corner of Union county is producing a locally very dense plume of smoke that is moving northeasterly into western Idaho and merge with the smoke form Grant county fire. A fire in western Jefferson county is producing a moderately dense plume of smoke that is moving easterly to eastern Jefferson county.

California:
The fire in Siskiyou county is still producing a moderately dense plume of smoke that is swirling around. The fire in Santa Barbara county is producing a locally very dense plume of smoke that is movng northeasterly and almost reached the California-Nevada border in Inyo county of eastern California.

Michigan:
The fire in northern Luce county of Upper Michigan is producing a locally very dense plume of smoke that is fanning to the north across eastern Lake Superior into southern Ontario of Canada. A fire in Delta county is producing a moderately dense plume of smoke that is fanning to the north across the counties north of Delta county into Lake Superior. A fire along Crawford-Otsego coutny boundary is producing a thin to moderately dense plume of smoke that is movint northeasterly across Otsego county into northwestern Montmorency county.

New Jersey:
A fire in the three-county(Pheladelphia, Camden, and Atlantic) intersection is producing a moderately dense to dense plume of smoke that is moving easterly into the Atlantic.

Arkansas:
A fire in eastern Hempstead and a fire in western Nevada are producing thin plumes of smoke that are moving northerly into central Clark county.

Mexico:
A large area of thin smoke in southwestern Gulf of Mexico is moving to southern Mexico.

Zhong

35

Sunday, August 5, 2007

DESCRIPTIVE TEXT NARRATIVE FOR SMOKE/DUST OBSERVED IN SATELLITE IMAGERY
THROUGH 0200 UTC August 6, 2007

British Columbia/Alberta/Saskatchewan/Ontario/Quebec/Idaho/Montana/
Dakotas/Minnesota/eastern half United States/Gulf of Mexico:
The big fires in southeastern British Coumbia, Idaho and Valley counties
of Idaho, and Flathead and Lake counties of Montana are still buring
and it cannot tell if these fires are still producing smoke due to
thick weather clouds. However, a large belt area of moderately dense to
locally dense smoke has covered the areas including: northern Idaho,
all the Montana, southeastern British Columbia, southern Alberta,
southern Saskatchewan, all of North Dakota, northern South Dakota,
all of Minnesota, southern Ontario, and southern Quebec. Furthermore,
a large area of thin to moderately dense smoke has covered all of the
eastern half United States and the most portion of east Gulf of mexico.

California:
The large fires in Santa Barbara are producing locally very dense plumes
of smoke that are moving northeasterly across western Santa Barbara,
northwestern Los Angeles, Kern, northwestern San Bernardino, and the
Nevada-California border in Inyo county of eastern California into
southern Nye county of southern Nevada.

Michigan:
The big fire in northern Luce county of Upper Michigan is producing a
locally very dense plume of smoke that is moving northerly then easterly
across Lake Superior into southern Ontario and is merging with the smoke
from the Northwest US and southeastern British Columbia fires.

Louisiana:
A fire in western Vermilich county of southern Louisiana is producing
a moderately dense plume of smoke that is moving easterly into central
St. Mary county.

Northwest Territories:
A fire north of Great Slave Lake is producing a moderately dense plume
of smoke that is moving easterly.

Zhong

Unless otherwise indicated:

- Areas of smoke are analyzed using GOES-EAST and GOES-WEST Visible satellite imagery.
- Only a general description of areas of smoke or significant smoke plumes will be analyzed.
- A quantitative assessment of the density/amount of particulate or the vertical distribution is not included.
- Widespread cloudiness may prevent the detection of smoke even from significant fires.

Climate Services » Private NC CRONOS Database » Hickory Airport, NC (KHKY)

Station: KHKY - Hickory Airport **Date of first observation:** January 1, 1998

Station type: ASOS - Standard what is this?

City, State: Hickory, NC **County:** Burke County

Latitude: 35.74115° **Longitude:** -81.38955°

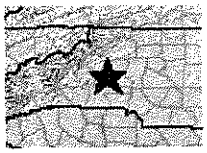
Elevation: 1189 feet above sea level

You may select another station if you wish:
Hickory, NC (KHKY - ASOS)

Climate division: NC01 - Southern Mountains

River basin: Santee

Supported by: NOAA National Weather Service



[need help?]
[list of all stations] [map]

show/hide list of nearby stations

Station Details

Current conditions at KHKY as of Monday, October 8th, 2007 @ 1:53 PM EDT (33 mins ago)

Temperature:	87.1 °F (30.6 °C)		
Dew point:	59 °F (15 °C)	**Relative humidity:**	39%
Heat Index:	87.4 °F (30.8 °C)		
Wind:	Calm		
Pressure:	1015.9 mb (30 inHg)	**Visibility:**	10 statute miles
Weather:	not available		
Cloud Levels:	Clear		

Current Conditions

Hourly | Daily | Monthly | Threshold | Summary | Metadata

» Hickory Airport, NC (KHKY) » Hourly Data Retrieval

Hourly observations are the actual observed weather conditions recorded at least once every hour.

37

Station details

Station: KHKY - Hickory Airport **Date of first observation:** January 1, 1998
Station type: ASOS - Standard
City, State: Hickory, NC **County:** Burke County
Latitude: 35.7411464° **Longitude:** -81.3895489°
Elevation: 1189 feet above sea level
Climate division: NC01 - Southern Mountains
River basin: Santee
Supported by: NOAA National Weather Service

This page is created dynamically and should not be bookmarked. Instead, bookmark the page preceeding this.

Retrieving hourly data from Hickory Airport for 2007-08-04 *thru* 2007-08-05 (2 days)

47 observations for this period of record (97.9% data available; 1 missing records)

Date/Time of ob (Eastern Standard Time)	Wind Speed at 10m (mph)	Wind Direction at 10m
08/04/2007 00:53 H	0	Calm or Variable
08/04/2007 01:53 H	3.5	North Northwest (340°)
08/04/2007 02:53 H	0	Calm or Variable
08/04/2007 03:53 H	4.6	Northwest (310°)
08/04/2007 04:53 H	0	Calm or Variable
08/04/2007 05:53 H	3.5	West Southwest (250°)
08/04/2007 06:53 H	3.5	West Northwest (300°)
08/04/2007 07:53 H	4.6	West (280°)
08/04/2007 08:53 H	0	Calm or Variable
08/04/2007 09:53 H	4.6	Calm or Variable
08/04/2007 10:53 H	6.9	East (80°)
08/04/2007 11:53 H	5.8	Northeast (40°)
08/04/2007 12:53 H	8.1	Northeast (40°)
08/04/2007 13:53 H	6.9	East Northeast (70°)
08/04/2007 14:53 H	5.8	Calm or Variable
08/04/2007 15:53 H	3.5	Calm or Variable
08/04/2007 16:53 missing		
08/04/2007 17:53 H	5.8	North Northeast (30°)
08/04/2007 18:53 H	9.2	West Southwest (240°)
08/04/2007 19:53 H	4.6	Northeast (50°)
08/04/2007 20:53 H	0	Calm or Variable
08/04/2007 21:53 H	0	Calm or Variable
08/04/2007 22:53 H	0	Calm or Variable
08/04/2007 23:53 H	4.6	West Northwest (300°)

08/05/2007 00:53 H	0	Calm or Variable
08/05/2007 01:53 H	4.6	West Northwest (290°)
08/05/2007 02:53 H	4.6	West Northwest (300°)
08/05/2007 03:53 H	3.5	North Northwest (340°)
08/05/2007 04:53 H	0	Calm or Variable
08/05/2007 05:53 H	4.6	Northwest (310°)
08/05/2007 06:53 H	4.6	Northwest (320°)
08/05/2007 07:53 H	3.5	West Northwest (290°)
08/05/2007 08:53 H	3.5	Calm or Variable
08/05/2007 09:53 H	4.6	West Southwest (250°)
08/05/2007 10:53 H	3.5	Southwest (230°)
08/05/2007 11:53 H	3.5	Calm or Variable
08/05/2007 12:53 H	3.5	Calm or Variable
08/05/2007 13:53 H	6.9	North Northwest (340°)
08/05/2007 14:53 H	5.8	North (350°)
08/05/2007 15:53 H	10.4	North (350°)
08/05/2007 16:53 H	3.5	North (350°)
08/05/2007 17:53 H	4.6	North (360°)
08/05/2007 18:53 H	3.5	North (360°)
08/05/2007 19:53 H	0	Calm or Variable
08/05/2007 20:53 H	0	Calm or Variable
08/05/2007 21:53 H	0	Calm or Variable
08/05/2007 22:53 H	0	Calm or Variable
08/05/2007 23:53 H	0	Calm or Variable
Sum	164.2	
Average $1/n \sum a_i$	5	
Mean *(max+min)/2*	7	
High	10.4	
Low	3.5	

Quality Control flags that may appear above

*	0	Not yet quality checked
U	0	Updated manually by a human
T	0	Updated by algorithm
R	0	Possible range failure
B	0	Possible buddy check failure
N	0	Data point differs from NCDC data set
E	0	Extracted/Augmented from NCDC Surface Airways Data
A	0	Augmented from old AgNet files

M	0	Recovered from the Bulletin Board System from 1978-1992
P	0	Precipitation Estimate from RADAR

NC CRONOS Database version 2.6.0 beta
Query script last modified Sep 07, 2007 12:07:28

Home

State Climate Office of North Carolina

Quick Links: Data Request Form | Get Data | FAQs | Search | Contact Us |

- Climate Observations
- Aspects of NC Climate
- Monitoring
- Education
- Outlook
- Research
- Related Resources
- About Our Office

Climate Services » Private NC CRONOS Database » Reedy Creek Field Laboratory, NC (REED)

Station: REED - Reedy Creek Field Laboratory **Date of first observation:** October 14, 1998

Station type: ECONET - Tower what is this? Maintenance Logs

City, State: Raleigh, NC **County:** Wake County

Latitude: 35.80712° **Longitude:** -78.74412°

Elevation: 420 feet above sea level

Climate division: NC04 - Central Piedmont

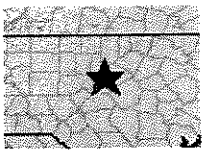
River basin: Neuse

Supported by: NC Agricultural Research Service

show/hide list of nearby stations

You may select another station if you wish:

Raleigh, NC (REED - ECONET) (Milbrook)



[need help?]
[list of all stations] [map]

Current conditions at REED as of Friday, October 26th, 2007 @ 9:00 AM EDT (1 hr, 36 mins ago)

Temperature: 61.8 °F (16.6 °C)

Dew point: calculated at 60.9 °F (16.1 °C) **Relative humidity:** 97%

Wind: East (92°) at 2 mph

Pressure: 1001 mb (29.56 inHg) station pressure

Hourly | Daily | Monthly | Threshold | Summary | Metadata

» Reedy Creek Field Laboratory, NC (REED) » Hourly Data Retrieval

Station: REED - Reedy Creek Field Laboratory **Date of first observation:** October 14, 1998

Station Details

Station type: ECONET - Tower

City, State: Raleigh, NC **County:** Wake County

Latitude: 35.80712° **Longitude:** -78.74412°

Elevation: 420 feet above sea level

Climate division: NC04 - Central Piedmont

River basin: Neuse

Supported by: NC Agricultural Research Service

This page is created dynamically and should not be bookmarked. Instead, bookmark the page preceeding this.

Retrieving hourly data from Reedy Creek Field Laboratory for 2007-08-04 *thru* 2007-08-05 (2 days)

48 observations for this period of record (100% data available)

Date/Time of ob (Eastern Standard Time)	Wind Speed at 10m (mph)	Wind Direction at 10m	Wind Direction Standard Deviation at 10m (degrees)
08/04/2007 01:00 H	3	Northwest (324°)	30.2
08/04/2007 02:00 H	4	West Southwest (254°)	31.7
08/04/2007 03:00 H	5.7	West Southwest (254°)	24.2
08/04/2007 04:00 H	4	West Southwest (252°)	29.1
08/04/2007 05:00 H	0.6	West Southwest (249°)	30.8
08/04/2007 06:00 H	2.5	Northwest (323°)	27.5
08/04/2007 07:00 H	5.1	North Northwest (340°)	31.4
08/04/2007 08:00 H	6.2	Northwest (315°)	15.5
08/04/2007 09:00 H	5.1	North Northwest (332°)	18.8
08/04/2007 10:00 H	4.8	West (270°)	32.3
08/04/2007 11:00 H	2.8	North Northwest (342°)	47.5
08/04/2007 12:00 H	6.9	North Northwest (345°)	59
08/04/2007 13:00 H	5.2	Northwest (315°)	60.6
08/04/2007 14:00 H	1.1	East Northeast (73°)	54.1
08/04/2007 15:00 H	1.7	North Northwest (345°)	48.6
08/04/2007 16:00 H	4.6	Northwest (311°)	53.2
08/04/2007 17:00 H	1.5	Northwest (304°)	27.7
08/04/2007 18:00 H	2.8	West Southwest (237°)	30.5
08/04/2007 19:00 H	1.6	West Southwest (244°)	18.9

08/04/2007 20:00 H	1.4	West Southwest (257°)	19.3
08/04/2007 21:00 H	2.9	West Northwest (285°)	17.8
08/04/2007 22:00 H	3.4	West Northwest (302°)	15.4
08/04/2007 23:00 H	0	Northwest (311°)	13.4
08/04/2007 23:59 H	2.2	Southwest (226°)	38
08/05/2007 01:00 H	1.9	Southeast (142°)	43
08/05/2007 02:00 H	3	West Southwest (256°)	33.5
08/05/2007 03:00 H	2.3	West Northwest (300°)	48
08/05/2007 04:00 H	0.5	North Northwest (343°)	52.9
08/05/2007 05:00 H	1.9	South Southwest (197°)	39.1
08/05/2007 06:00 H	1.3	West Southwest (245°)	33.4
08/05/2007 07:00 H	1.1	West Southwest (243°)	32.2
08/05/2007 08:00 H	2.6	Northwest (318°)	32.1
08/05/2007 09:00 H	4.5	Northwest (321°)	19.3
08/05/2007 10:00 H	2.7	West (268°)	46.6
08/05/2007 11:00 H	4.5	North Northwest (337°)	49.2
08/05/2007 12:00 H	2.7	West (260°)	27.9
08/05/2007 13:00 H	4.6	West Northwest (297°)	59.4
08/05/2007 14:00 H	4.8	South Southeast (156°)	74.8
08/05/2007 15:00 H	0.8	North Northwest (331°)	71.4
08/05/2007 16:00 H	4.3	Northwest (307°)	62.7
08/05/2007 17:00 H	3.8	Northwest (310°)	23.6
08/05/2007 18:00 H	1	West Northwest (302°)	13.5
08/05/2007 19:00 H	3	North (350°)	41.4
08/05/2007 20:00 H	0.7	Northeast (45°)	42.9
08/05/2007 21:00 H	2.5	East Southeast (110°)	95.8
08/05/2007 22:00 H	1.6	South (187°)	65.2
08/05/2007 23:00 H	2.6	South (185°)	15.3
08/05/2007 23:59 H	2.4	South Southwest (193°)	61.9
Sum	140.2		1860.6
Average $1/n \sum a_i$	3		38.8
Mean *(max+min)/2*	3.7		54.6
High	6.9		95.8
Low	0.5		13.4

Quality Control flags that may appear above

State Climate Office of North Carolina

Climate Services » Private NC CRONOS Database » Greensboro Airport, NC (KGSO)

Station: KGSO - Greensboro Airport **Date of first observation:** July 1, 1948

Station type: ASOS - Standard what is this?

City, State: Greensboro, NC **County:** Guilford County

Latitude: 36.09775° **Longitude:** -79.9373°

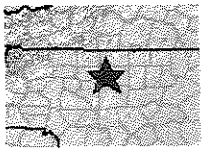
Station Details

Elevation: 926 feet above sea level

You may select another station if you wish:

Greensboro, NC (KGSO - ASOS) Greensboro Mendenhall

Climate division: NC03 - Northern Piedmont



[need help?]
[list of all stations] [map]

River basin: Cape Fear

Supported by: NOAA National Weather Service

show/hide list of nearby stations

Current Conditions

Current conditions at KGSO as of Friday, October 26th, 2007 @ 1:54 PM EDT (15 mins ago)

Temperature:	59 °F (15 °C)		
Dew point:	57 °F (13.9 °C)	**Relative humidity:**	93%
Wind:	Northeast (40°) at 13 mph		
Pressure:	1020.3 mb (30.13 inHg)	**Visibility:**	10 statute miles
Weather:	Light rain		
Cloud Levels:	Overcast at 500 ft.		

Hourly | Daily | Monthly | Threshold | Summary | Metadata

» Greensboro Airport, NC (KGSO) » Hourly Data Retrieval

Hourly observations are the actual observed weather conditions recorded at least once every hour.

STATION DATA

Station: KGSO - Greensboro Airport **Date of first observation:** July 1, 1948
Station type: ASOS - Standard
City, State: Greensboro, NC **County:** Guilford County
Latitude: 36.0977469° **Longitude:** -79.9372975°
Elevation: 926 feet above sea level
Climate division: NC03 - Northern Piedmont
River basin: Cape Fear
Supported by: NOAA National Weather Service

This page is created dynamically and should not be bookmarked. Instead, bookmark the page preceeding this.

Retrieving hourly data from Greensboro Airport for 2007-08-04 *thru* 2007-08-05 (2 days)
48 observations for this period of record (100% data available)

Date/Time of ob (Eastern Standard Time)	Wind Speed at 10m (mph)	Wind Direction at 10m	Wind Gusts at 10m (mph)
08/04/2007 00:54 H	5.8	Southwest (220°)	*
08/04/2007 01:54 H	6.9	South Southwest (200°)	*
08/04/2007 02:54 H	6.9	Southwest (230°)	*
08/04/2007 03:54 H	5.8	Southwest (220°)	*
08/04/2007 04:54 H	3.5	Southwest (220°)	*
08/04/2007 05:54 H	5.8	West Southwest (240°)	*
08/04/2007 06:54 H	5.8	West (260°)	*
08/04/2007 07:54 H	5.8	West (270°)	*
08/04/2007 08:54 H	4.6	West Northwest (290°)	*
08/04/2007 09:54 H	5.8	Calm or Variable	*
08/04/2007 10:54 H	6.9	Calm or Variable	*
08/04/2007 11:54 H	5.8	North Northeast (20°)	*
08/04/2007 12:54 H	6.9	Calm or Variable	*
08/04/2007 13:54 H	6.9	Calm or Variable	*
08/04/2007 14:54 H	5.8	North (350°)	*
08/04/2007 15:54 H	8.1	North (360°)	*
08/04/2007 16:54 H	3.5	Calm or Variable	*
08/04/2007 17:54 H	3.5	North (10°)	*
08/04/2007 18:54 H	0	Calm or Variable	*
08/04/2007 19:54 H	0	Calm or Variable	*
08/04/2007 20:54 H	3.5	West Northwest (290°)	*
08/04/2007 21:54 H	0	Calm or Variable	*
08/04/2007 22:54 H	0	Calm or Variable	*
08/04/2007 23:54 H	0	Calm or Variable	*

45

08/05/2007 00:54 H	0	Calm or Variable	*
08/05/2007 01:54 H	4.6	Northwest (310°)	*
08/05/2007 02:54 H	0	Calm or Variable	*
08/05/2007 03:54 H	0	Calm or Variable	*
08/05/2007 04:54 H	0	Calm or Variable	*
08/05/2007 05:54 H	3.5	South Southwest (210°)	*
08/05/2007 06:54 H	0	Calm or Variable	*
08/05/2007 07:54 H	0	Calm or Variable	*
08/05/2007 08:54 H	3.5	South (180°)	*
08/05/2007 09:54 H	6.9	West Southwest (250°)	*
08/05/2007 10:54 H	5.8	West Southwest (240°)	*
08/05/2007 11:54 H	9.2	West (270°)	*
08/05/2007 12:54 H	9.2	West Southwest (250°)	*
08/05/2007 13:54 H	6.9	Southwest (220°)	*
08/05/2007 14:54 H	6.9	West (270°)	*
08/05/2007 15:54 H	6.9	North Northwest (340°)	*
08/05/2007 16:54 H	10.4	West Northwest (300°)	*
08/05/2007 17:54 H	4.6	Northwest (320°)	*
08/05/2007 18:54 H	5.8	Northwest (310°)	*
08/05/2007 19:54 H	3.5	East (80°)	*
08/05/2007 20:54 H	0	Calm or Variable	*
08/05/2007 21:54 H	0	Calm or Variable	*
08/05/2007 22:54 H	0	Calm or Variable	*
08/05/2007 23:54 H	0	Calm or Variable	*
Sum	195.3		
Average $1/n \sum a_i$	5.9		
Mean *(max+min)/2*	7		
High	10.4		
Low	3.5		

Quality Control flags that may appear above

*	48	Not yet quality checked
U	0	Updated manually by a human
T	0	Updated by algorithm
R	0	Possible range failure
B	0	Possible buddy check failure
N	0	Data point differs from NCDC data set
E	0	Extracted/Augmented from NCDC Surface Airways Data
A	0	Augmented from old AgNet files
M	0	Recovered from the Bulletin Board System from 1978-1992

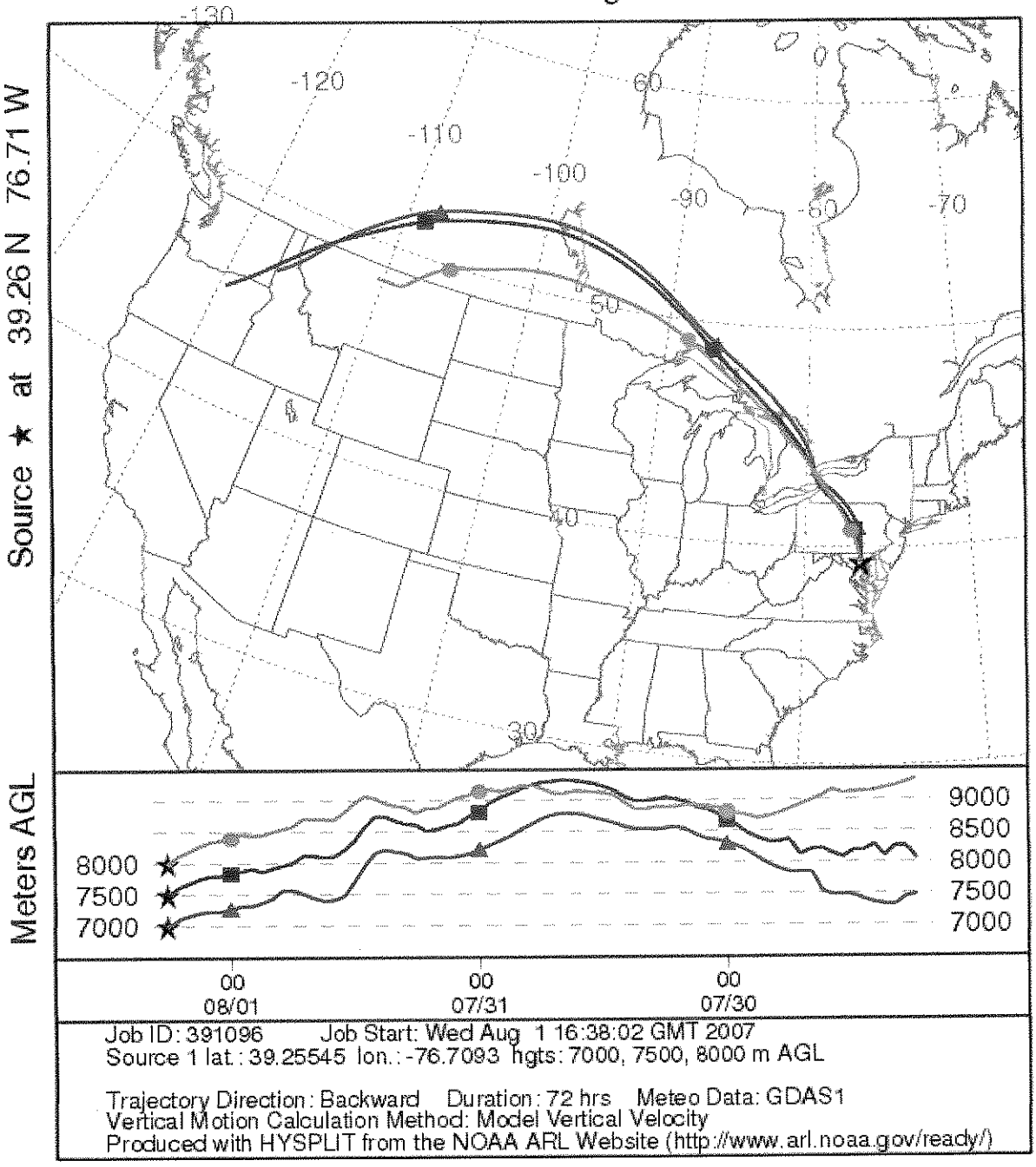
FIRES OVER 5000 ACRES ON 7/24/05

INAME	INUM	LATDD	LONDD	AREA
MIDDLE FORK COMPLEX	ID-BOF-000642	44.3490	-115.4940	5300
FOOL CREEK	MT-LCF-000009	47.9230	-112.9880	6214
CASCADE COMPLEX	ID-BOF-000635	44.5350	-115.9770	8200
AHORN	MT-LCF-000013	47.5300	-113.0470	8792
TRAPPER RIDGE WFU	ID-BOF-000575	44.0230	-115.3530	10884
KRASSEL WFU COMPLEX	ID-PAF-007078	45.4050	-114.8750	11700
RATTLESNAKE	ID-NPF-000017	45.4310	-115.6560	14000
JUNIPER RESERVOIR	OR-VAD-096	43.8200	-118.1500	29000
POE CABIN	ID-CMS-043014	45.6940	-116.4780	35000
EAST ZONE COMPLEX	ID-PAF-007071	45.2500	-115.6830	37700
BATTLE CREEK COMPLEX	OR-WWF-376	45.6180	-116.8010	47992
CHIMNEY COMPLEX	ID-CMS-43013	46.0470	-116.9170	51000

NOAA HYSPLIT MODEL

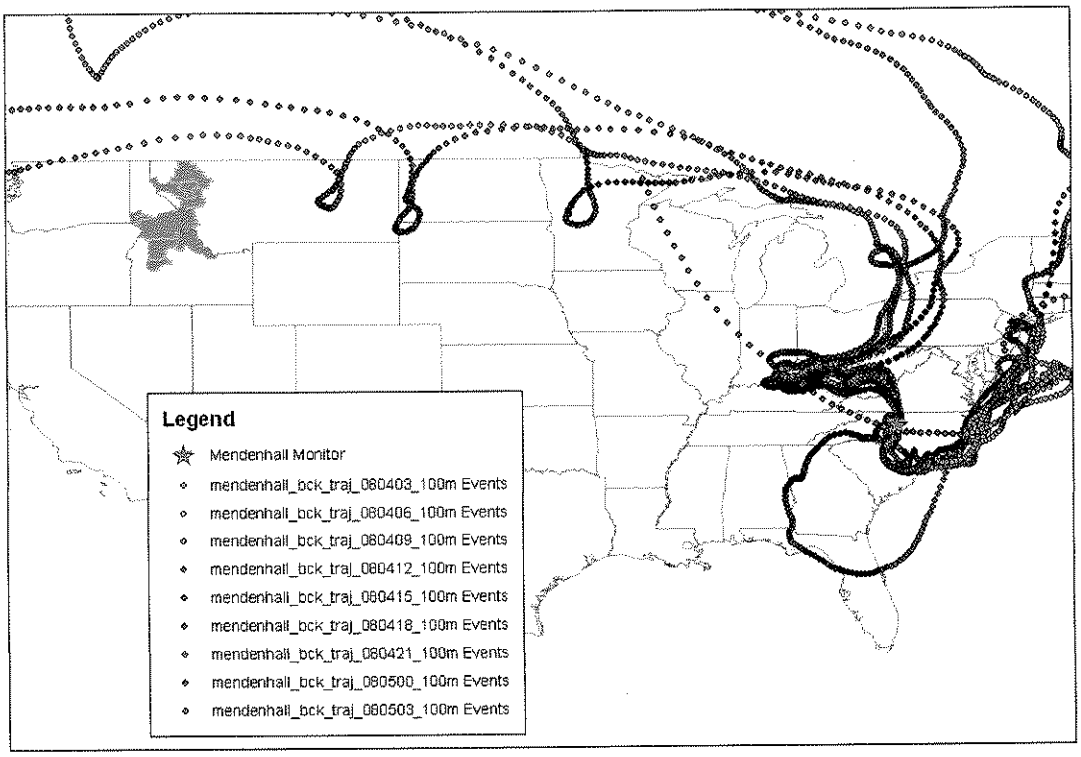
Backward trajectories ending at 06 UTC 01 Aug 07

GDAS Meteorological Data



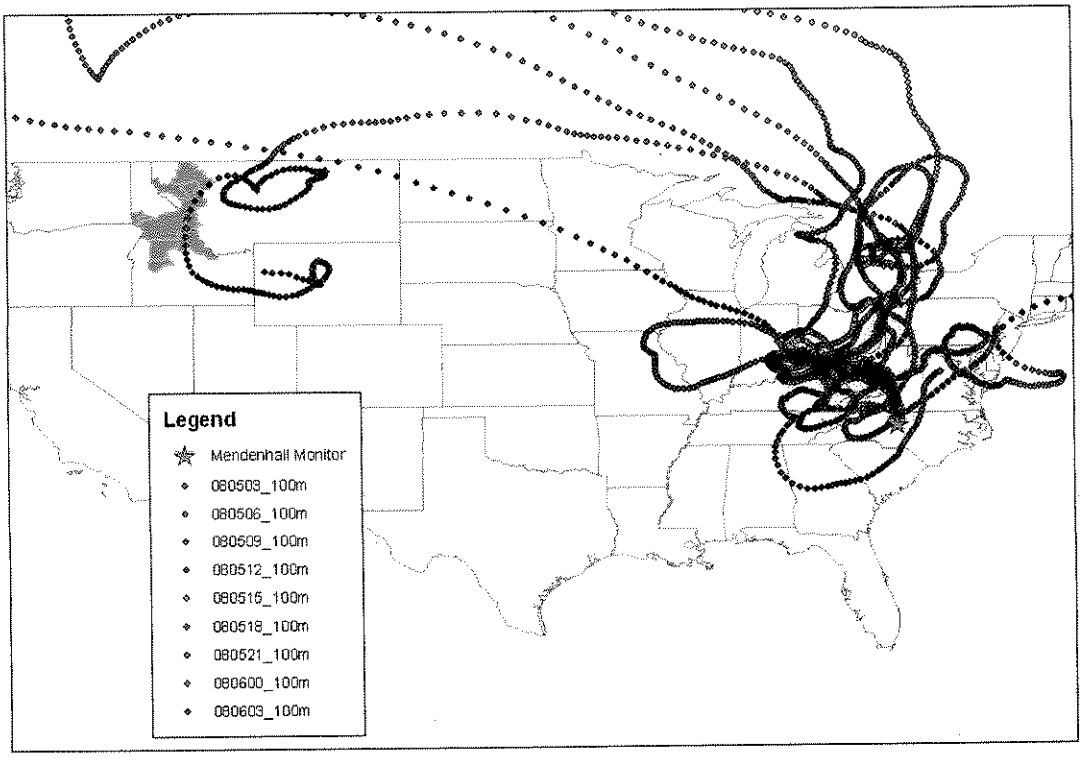
HYSPLIT Back Trajectories at Mendenhall at various times at 100m 8/4/07 to 8/5/07

Fires were located in Idaho, Montana, and the Canadian provinces of Saskatchewan, Manitoba, and Northwest Territory. Legend indicates date/time(zulu)/trajectory level (MMDDHH_LEVEL)



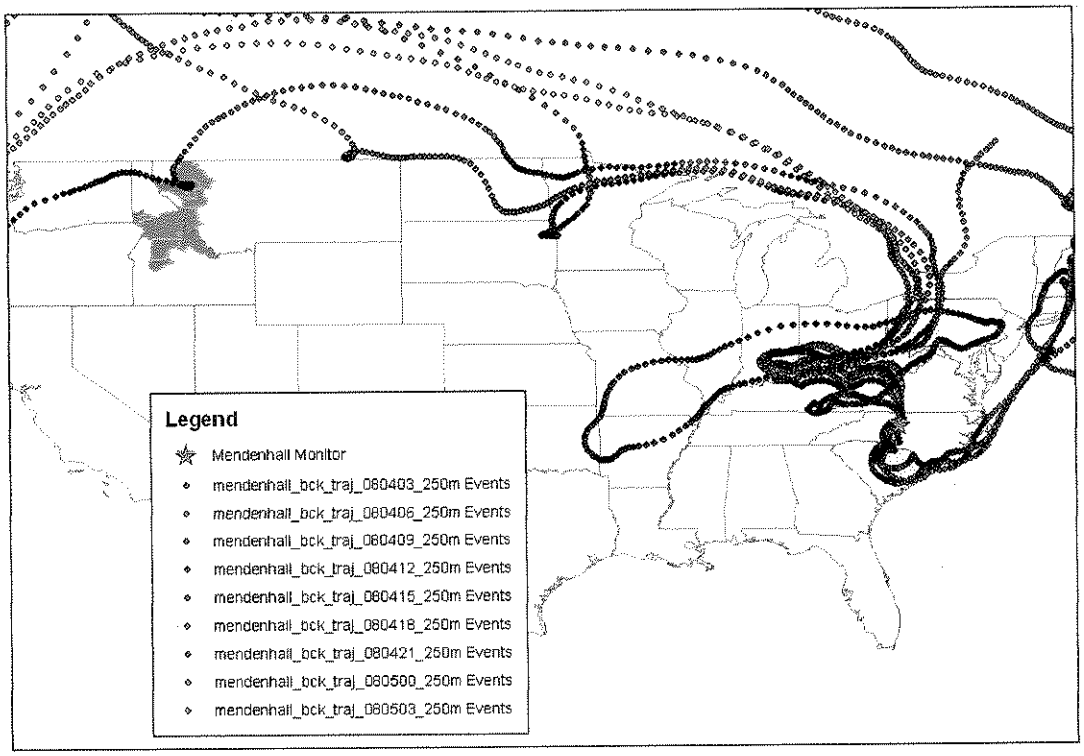
Back Trajectories at Mendenhall at 100m (Cont'd)

Fires were located in Idaho, Montana, and the Canadian provinces of Saskatchewan, Manitoba, and Northwest Territory. Legend indicates date/time(zulu)/trajectory level (MMDDHH_LEVEL)



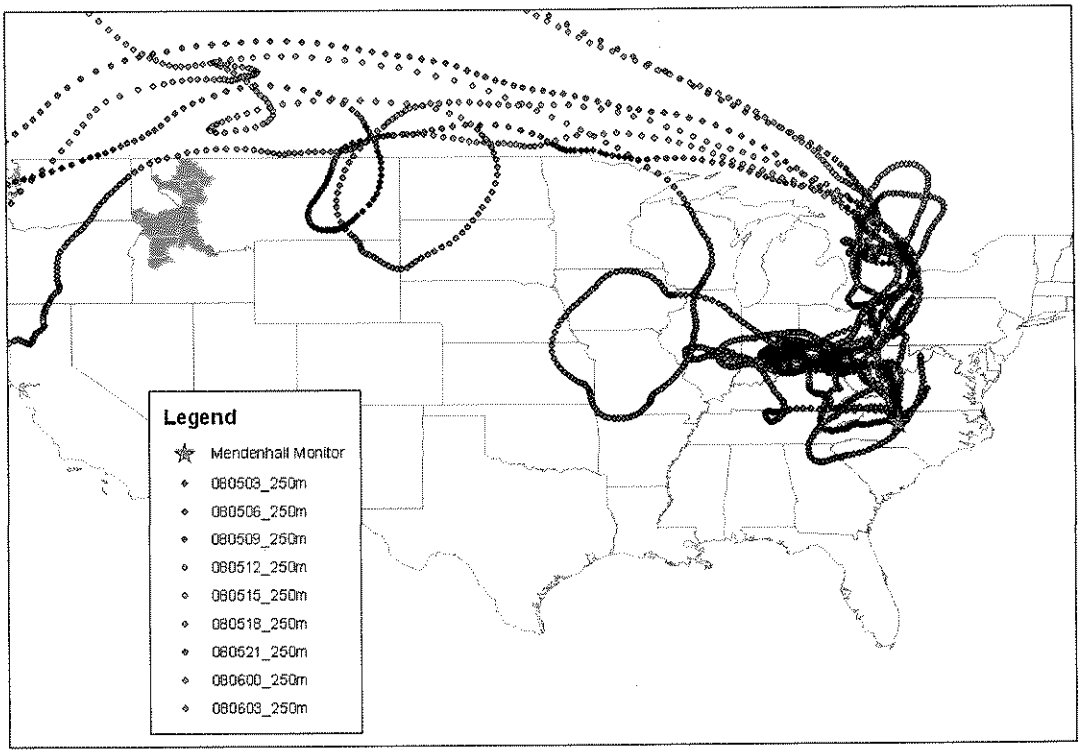
HYSPLIT Back Trajectories at Mendenhall at 250 m at various times on 8/4/07 and 8/5/07

Fires were located in Idaho, Montana, and the Canadian provinces of Saskatchewan, Manitoba, and Northwest Territory. Legend indicates date/time(zulu)/trajectory level (MMDDHH_LEVEL)



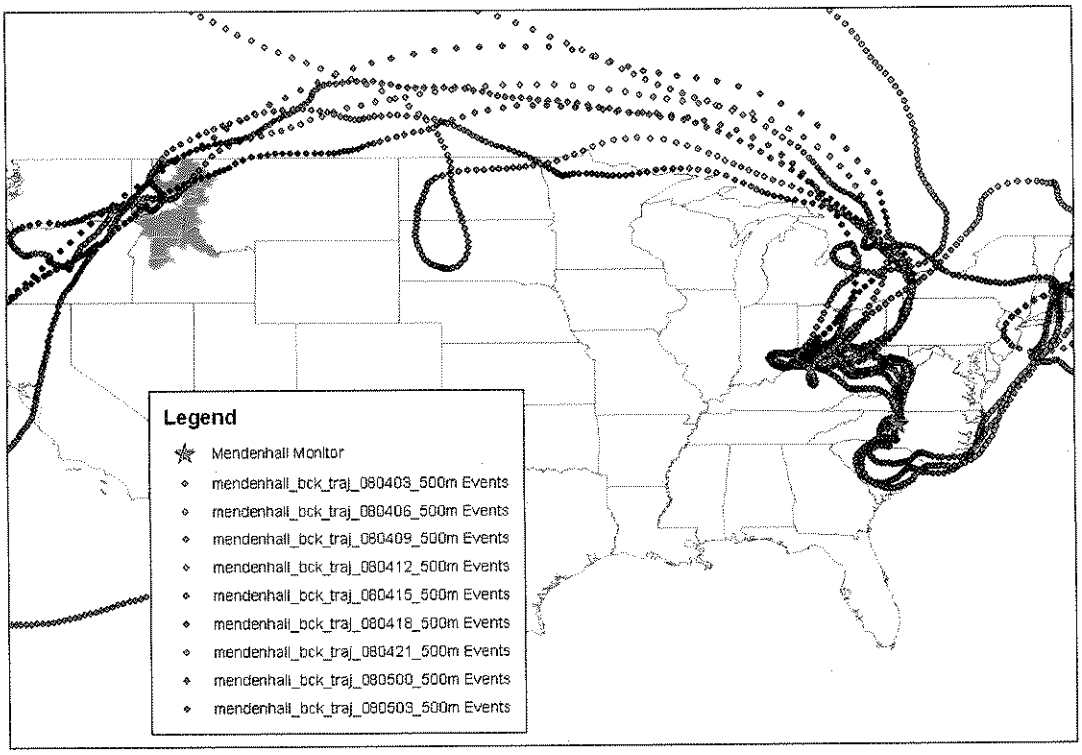
HYSPLIT Back Trajectories at Mendenhall at 250 m (Cont'd)

Fires were located in Idaho, Montana, and the Canadian provinces of Saskatchewan, Manitoba, and Northwest Territory. Legend indicates date/time(zulu)/trajectory level (MMDDHH_LEVEL)



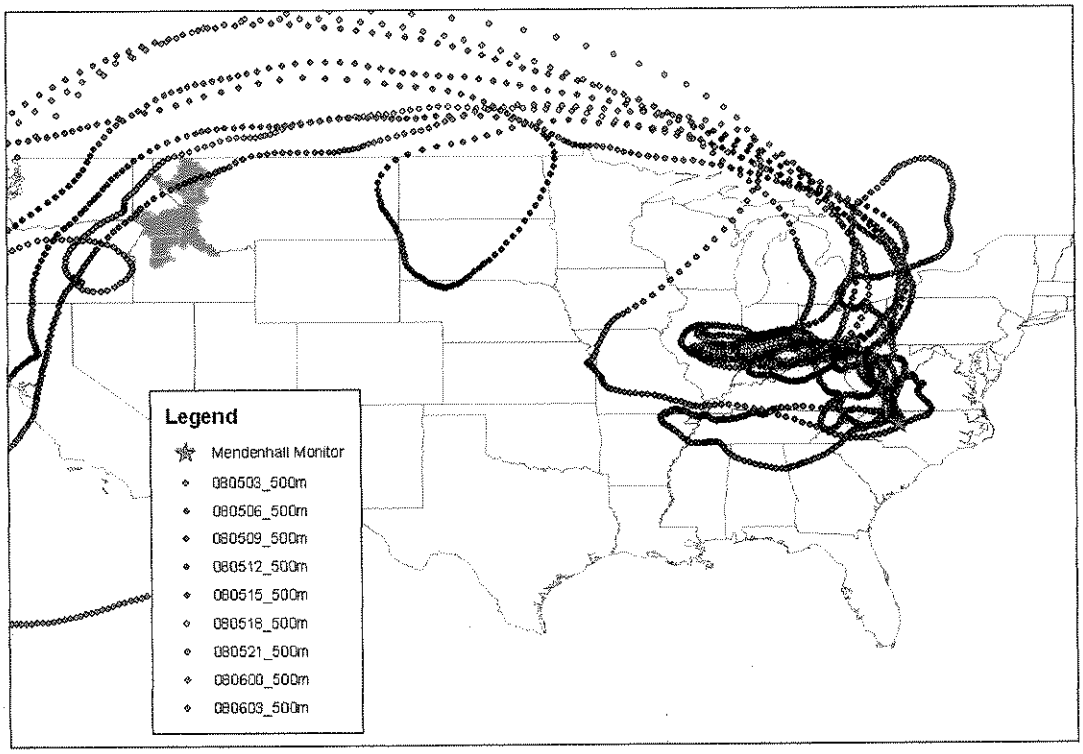
HYSPLIT Back Trajectories at Mendenhall at 500 m at various times on 8/4/07 and 8/5/07

Fires were located in Idaho, Montana, and the Canadian provinces of Saskatchewan, Manitoba, and Northwest Territory. Legend indicates date/time(zulu)/trajectory level (MMDDHH_LEVEL)



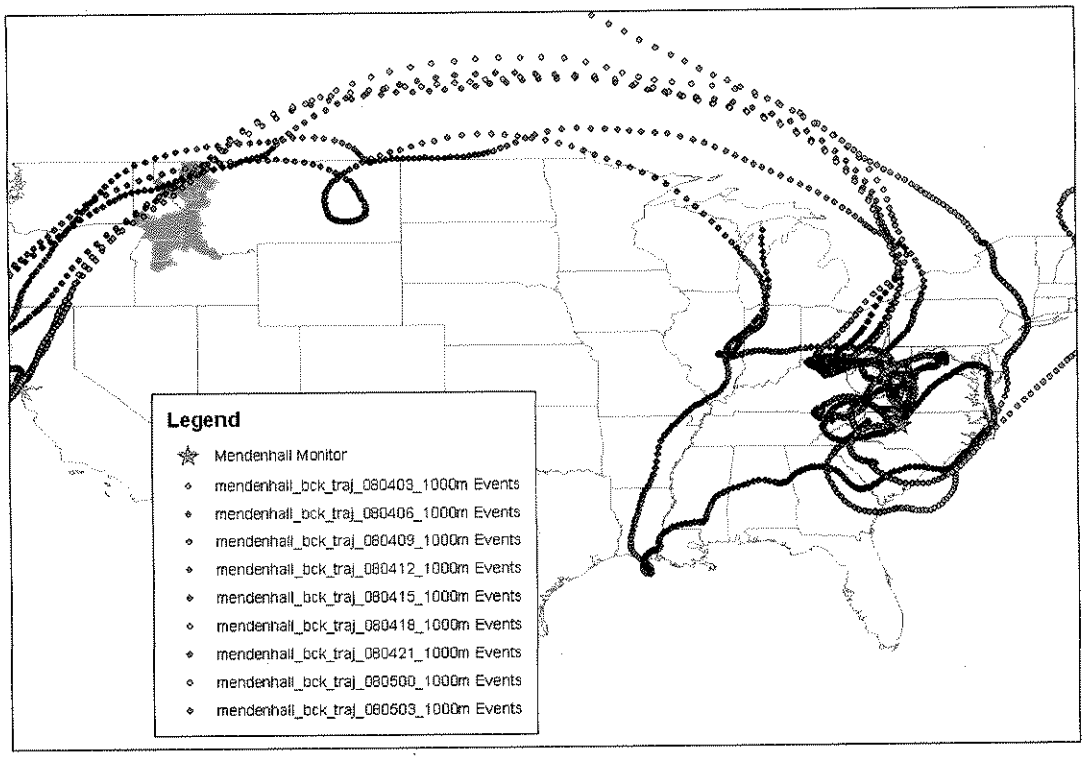
HYSPLIT Back Trajectories at Mendenhall at 500 m (Cont'd)

Fires were located in Idaho, Montana, and the Canadian provinces of Saskatchewan, Manitoba, and Northwest Territory. Legend indicates date/time(zulu)/trajectory level (MMDDHH_LEVEL)



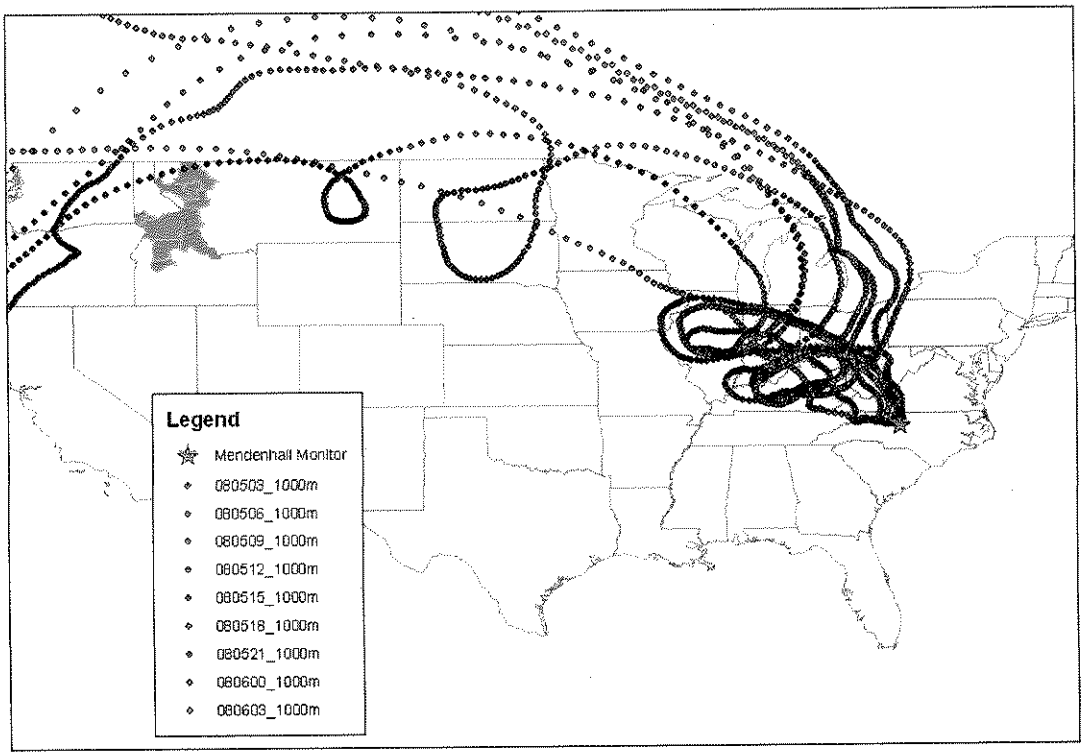
HYSPLIT Back Trajectories at Mendenhall at 1000 m at various times on 8/4/07 and 8/5/07

Fires were located in Idaho, Montana, and the Canadian provinces of Saskatchewan, Manitoba, and Northwest Territory. Legend indicates date/time(zulu)/trajectory level (MMDDHH_LEVEL)



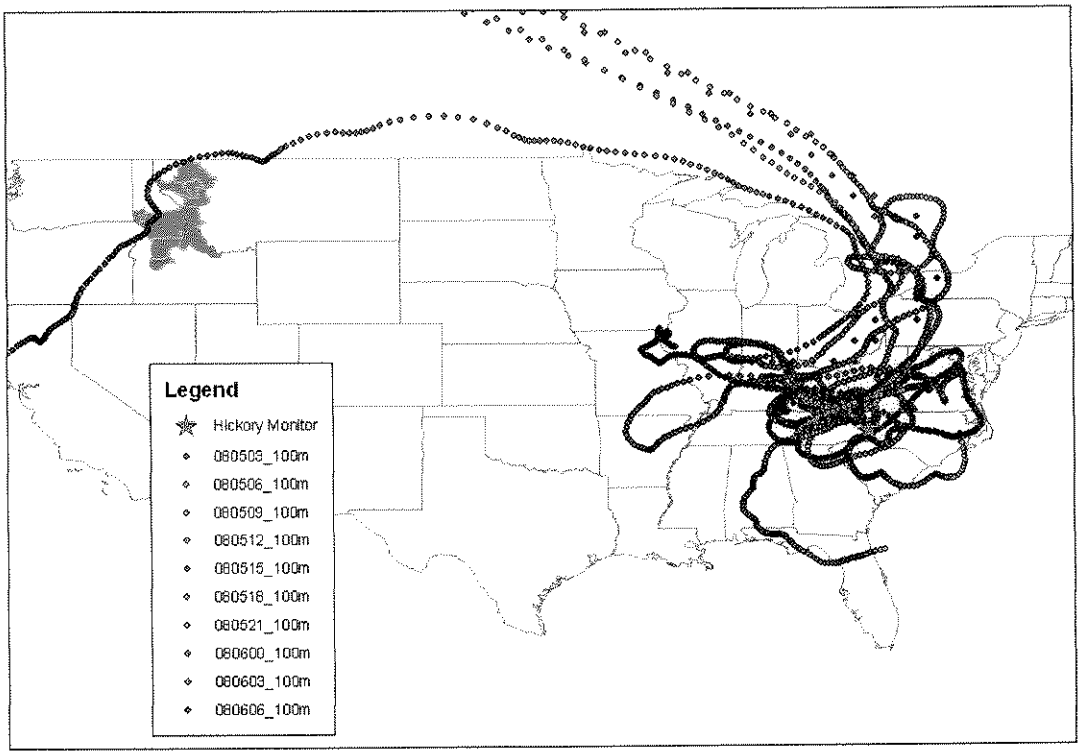
HYSPLIT Back Trajectories at Mendenhall at 1000 m (Cont'd)

Fires were located in Idaho, Montana, and the Canadian provinces of Saskatchewan, Manitoba, and Northwest Territory. Legend indicates date/time(zulu)/trajectory level (MMDDHH_LEVEL)



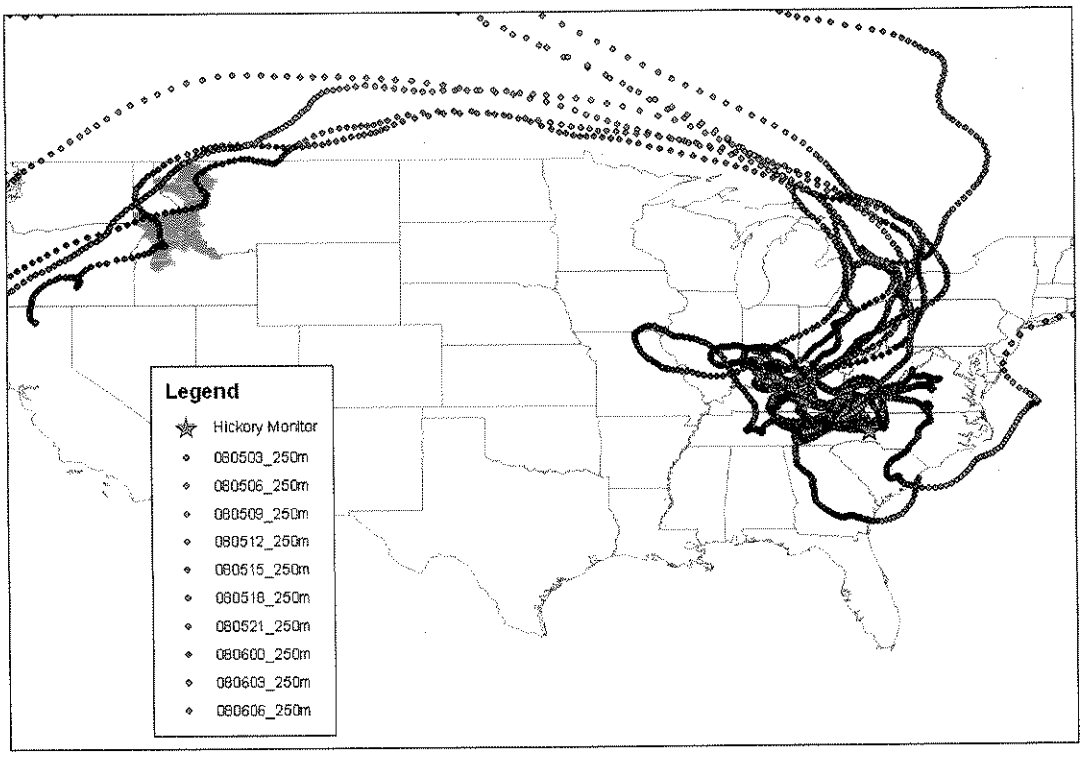
HYSPLIT Back Trajectories at Hickory at various times at 100m
8/5/07

Fires were located in Idaho, Montana, and the Canadian provinces of Saskatchewan, Manitoba, and Northwest Territory. Legend indicates date/time(zulu)/trajectory level (MMDDHH_LEVEL)



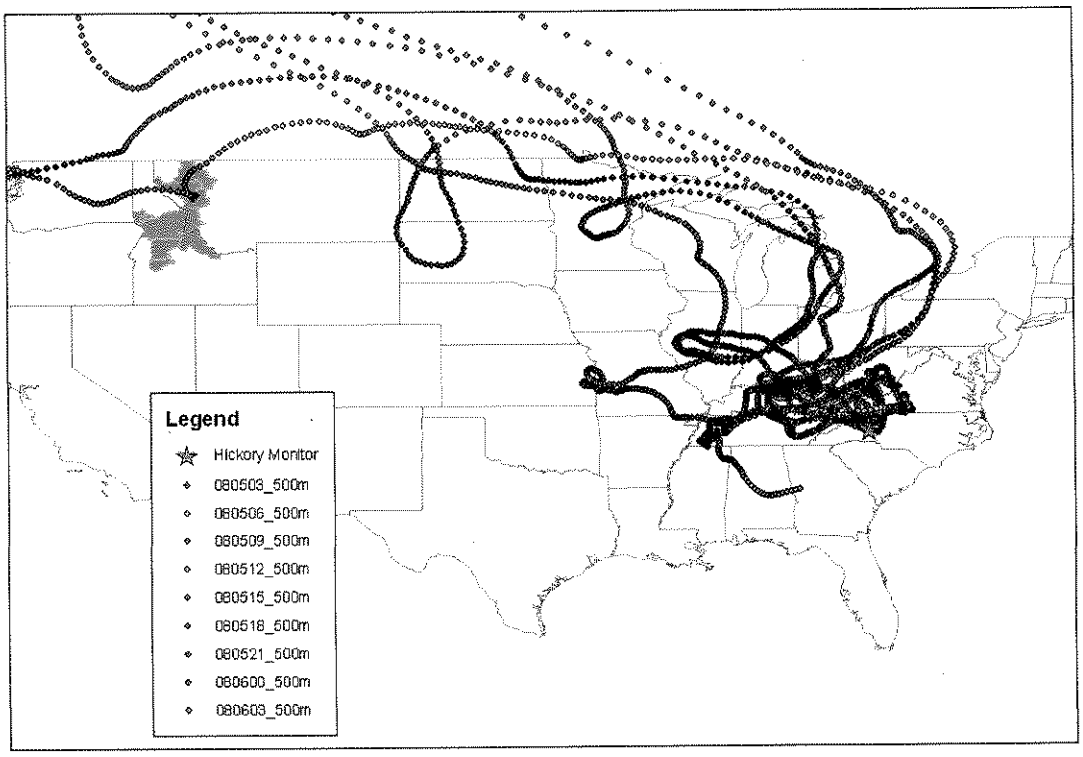
HYSPLIT Back Trajectories at Hickory at 250m at various times on 8/5/07

Fires were located in Idaho, Montana, and the Canadian provinces of Saskatchewan, Manitoba, and Northwest Territory. Legend indicates date/time(zulu)/trajectory level (MMDDHH_LEVEL)



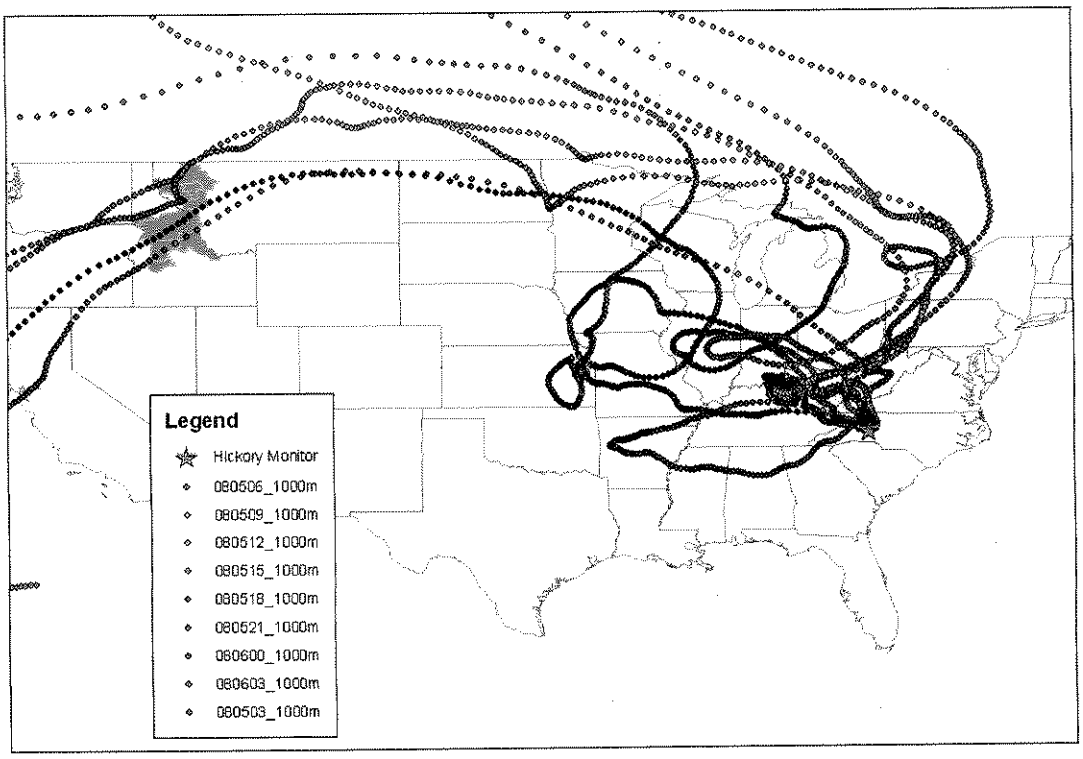
HYSPLIT Back Trajectories at Hickory at 500 m at various times on 8/5/07

Fires were located in Idaho, Montana, and the Canadian provinces of Saskatchewan, Manitoba, and Northwest Territory. Legend indicates date/time(zulu)/trajectory level (MMDDHH_LEVEL)



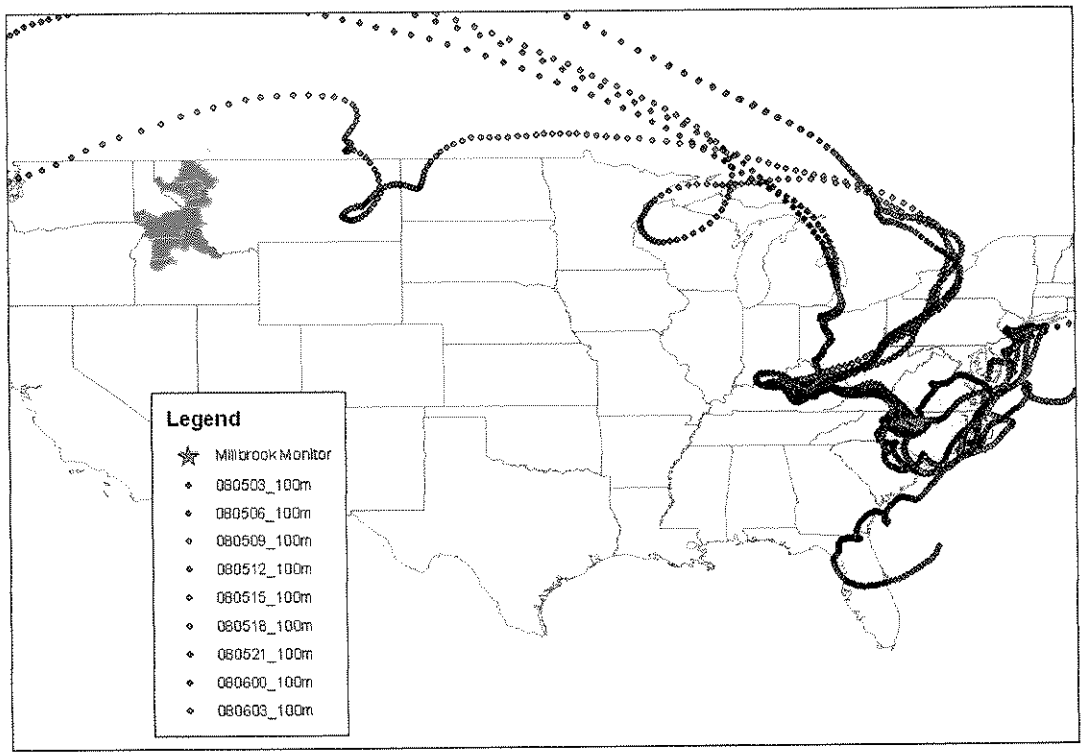
HYSPLIT Back Trajectories at Hickory at 1000 m at various times on 8/5/07

Fires were located in Idaho, Montana, and the Canadian provinces of Saskatchewan, Manitoba, and Northwest Territory. Legend indicates date/time(zulu)/trajectory level (MMDDHH_LEVEL)



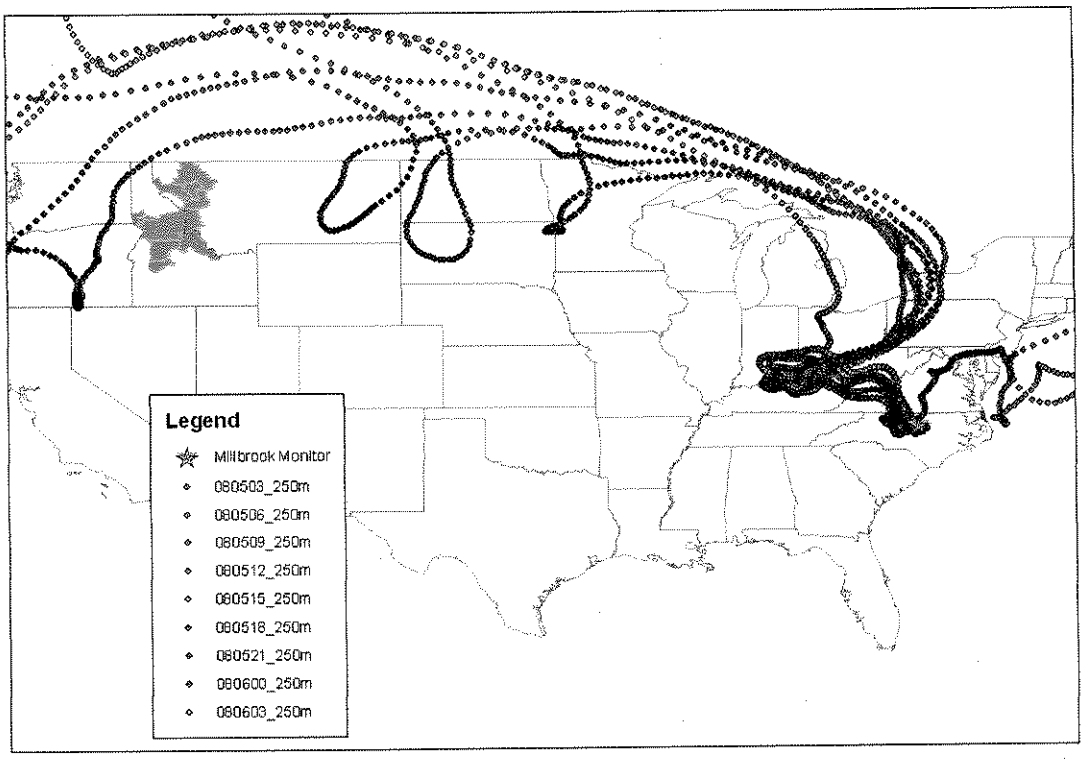
HYSPLIT Back Trajectories at Milbrook at various times at 100m
8/5/07

Fires were located in Idaho, Montana, and the Canadian provinces of Saskatchewan, Manitoba, and Northwest Territory. Legend indicates date/time(zulu)/trajectory level (MMDDHH_LEVEL)



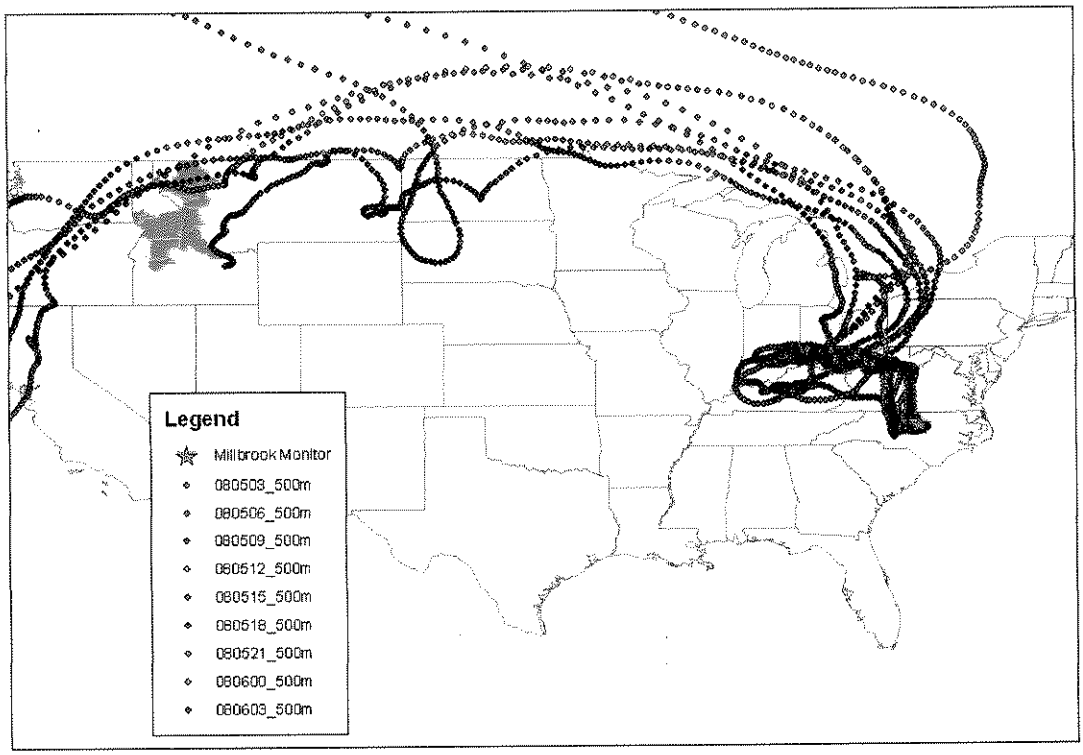
HYSPLIT Back Trajectories at Millbrook at various times at 250m 8/5/07

Fires were located in Idaho, Montana, and the Canadian provinces of Saskatchewan, Manitoba, and Northwest Territory. Legend indicates date/time(zulu)/trajectory level (MMDDHH_LEVEL)



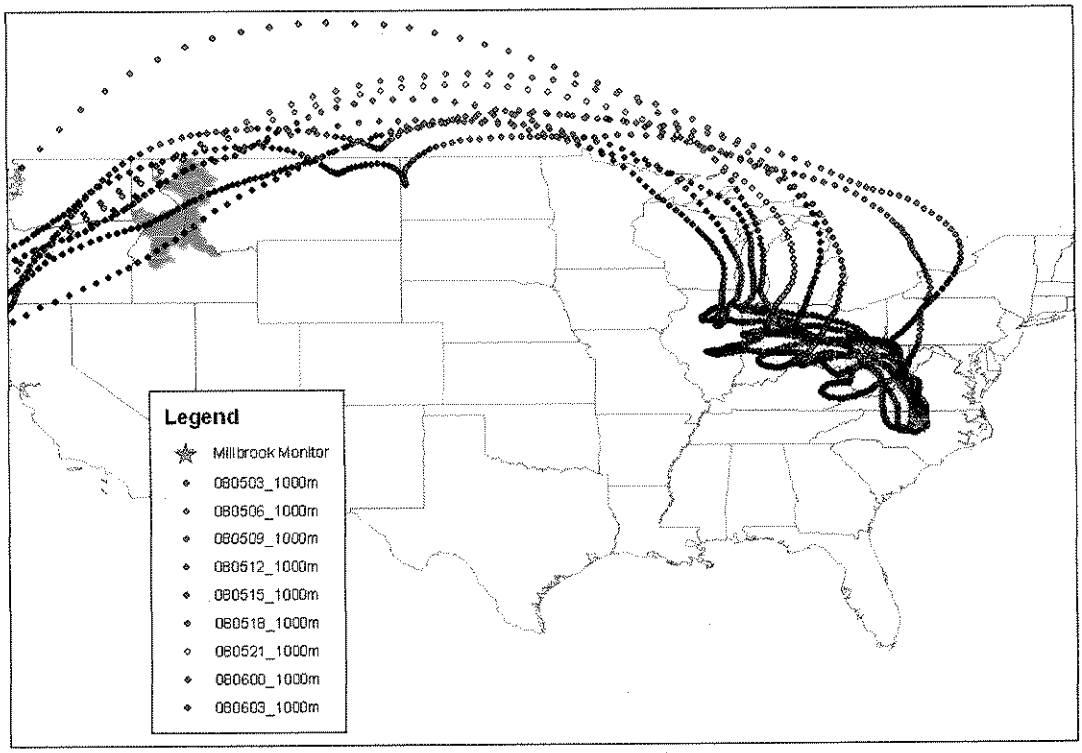
HYSPLIT Back Trajectories at Millbrook at various times at 500m 8/5/07

Fires were located in Idaho, Montana, and the Canadian provinces of Saskatchewan, Manitoba, and Northwest Territory. Legend indicates date/time(zulu)/trajectory level (MMDDHH_LEVEL)



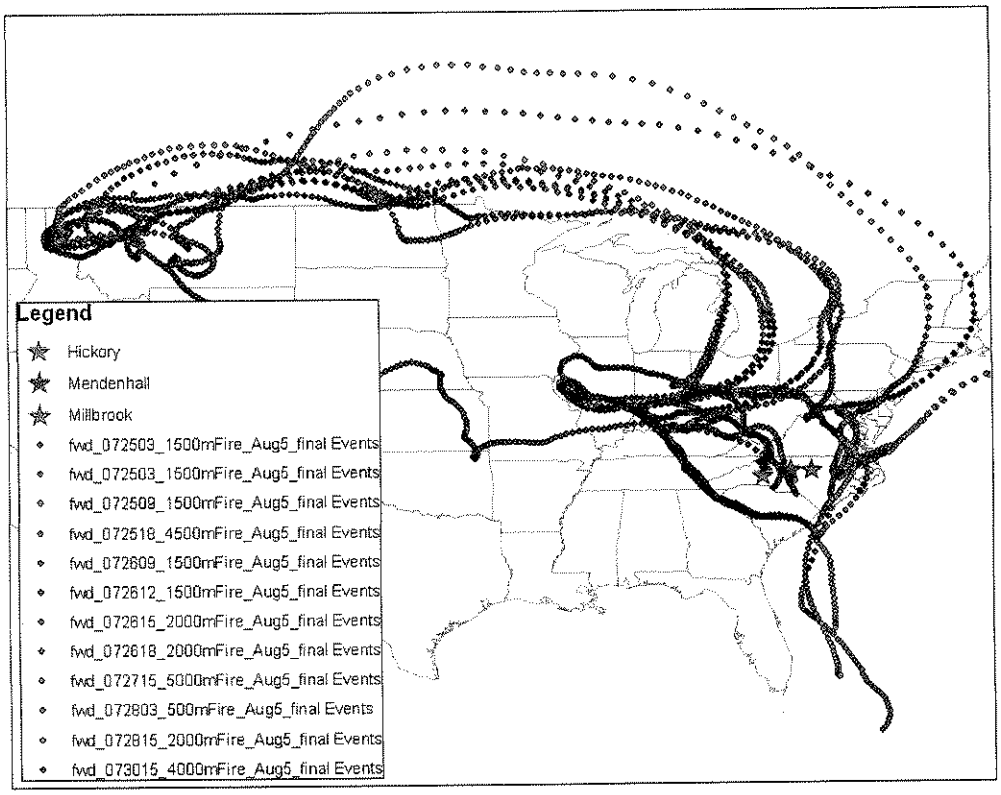
HYSPLIT Back Trajectories at Millbrook at various times at 1000m 8/5/07

Fires were located in Idaho, Montana, and the Canadian provinces of Saskatchewan, Manitoba, and Northwest Territory. Legend indicates date/time(zulu)/trajectory level (MMDDHH_LEVEL)



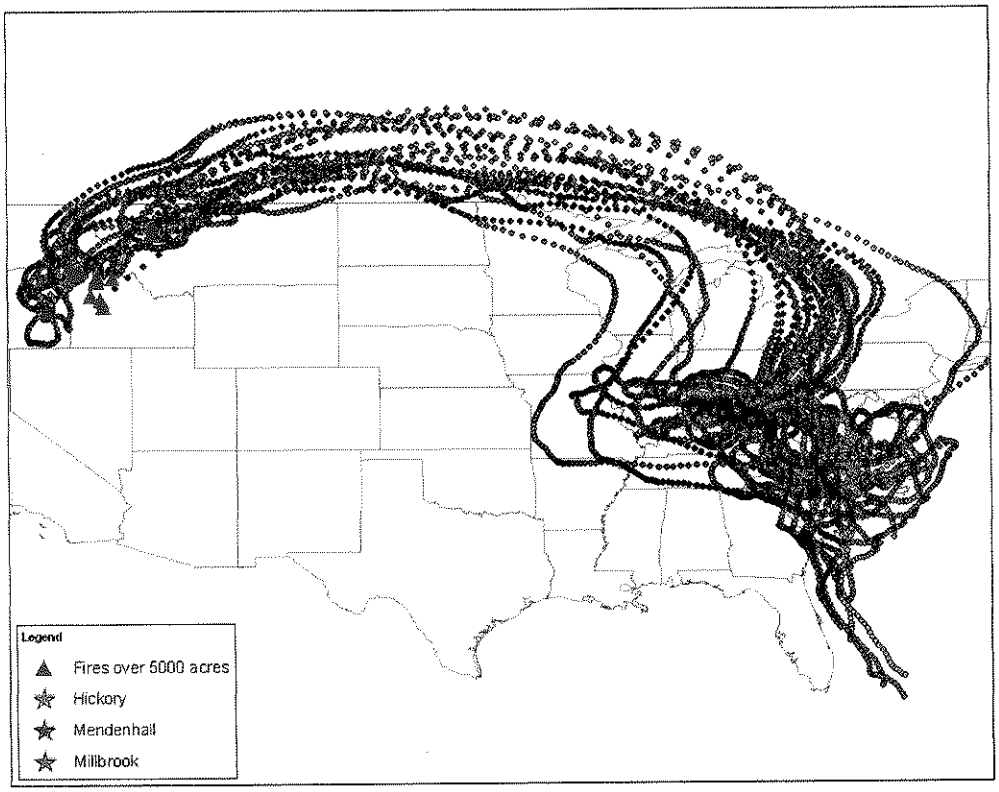
HYSPLIT Forward Trajectories from the fires to Hickory, Milbrook, and Mendenhall at various heights ending on 8/5/07

Fires were located in Idaho, Montana, and the Canadian provinces of Saskatchewan, Manitoba, and Northwest Territory. Legend indicates date/time(zulu)/trajectory level (MMDDHH_LEVEL)



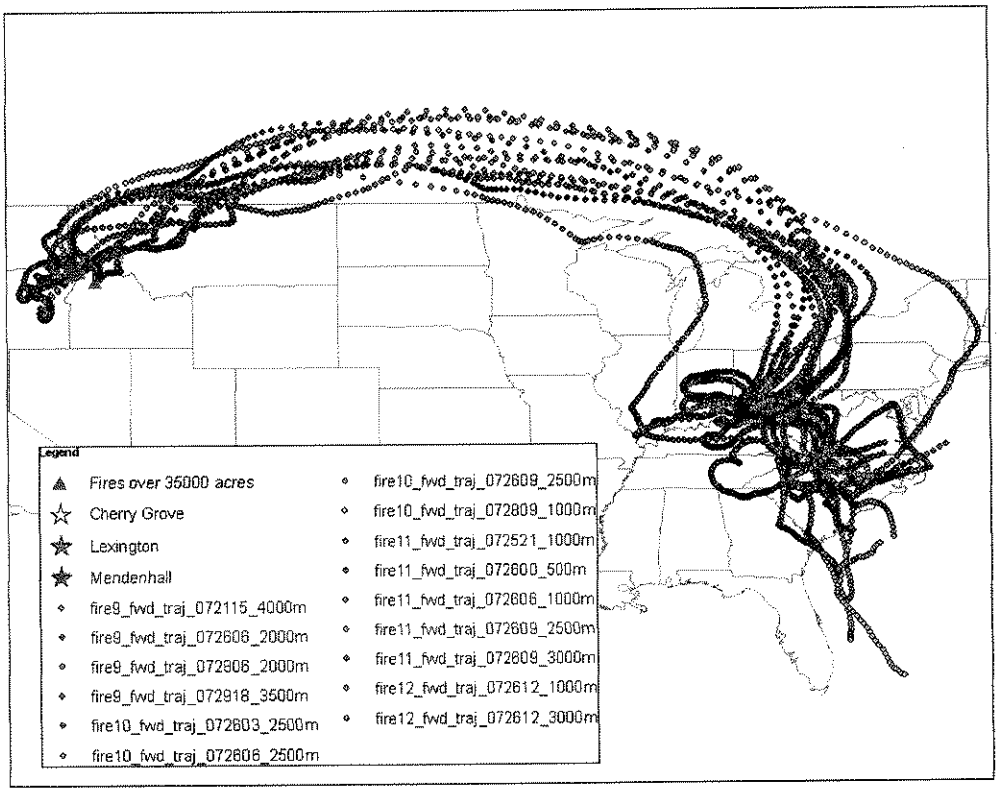
HYSPLIT Forward Trajectories from the fires to Hickory, Milbrook, and Mendenhall on 8/4/07. Heights vary from 1500 to 5000m.

Fires were located in Idaho, Montana, and the Canadian provinces of Saskatchewan, Manitoba, and Northwest Territory. Legend indicates date/time(zulu)/trajectory level (MMDDHH_LEVEL)



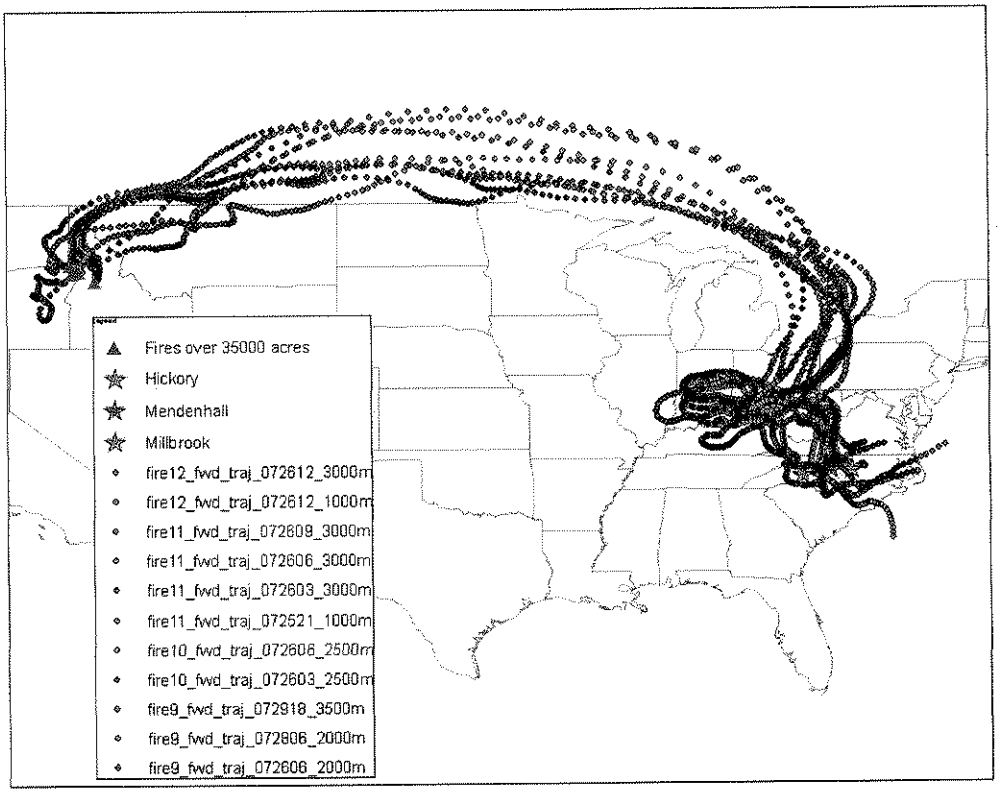
HYSPLIT Forward Trajectories from the fires to Mendenhall, Cherry Grove, and Lexington at various heights ending on 8/4/07

Fires were located in Idaho, Montana, and the Canadian provinces of Saskatchewan, Manitoba, and Northwest Territory. Legend indicates date/time(zulu)/trajectory level (MMDDHH_LEVEL)



HYSPLIT Forward Trajectories from the fires to Hickory, Milbrook, and Mendenhall at various heights ending on 8/4/07

Fires were located in Idaho, Montana, and the Canadian provinces of Saskatchewan, Manitoba, and Northwest Territory. Legend indicates date/time(zulu)/trajectory level (MMDDHH_LEVEL)



"Atypical" Analysis for Millbrook 5 August 2007 Exceedance

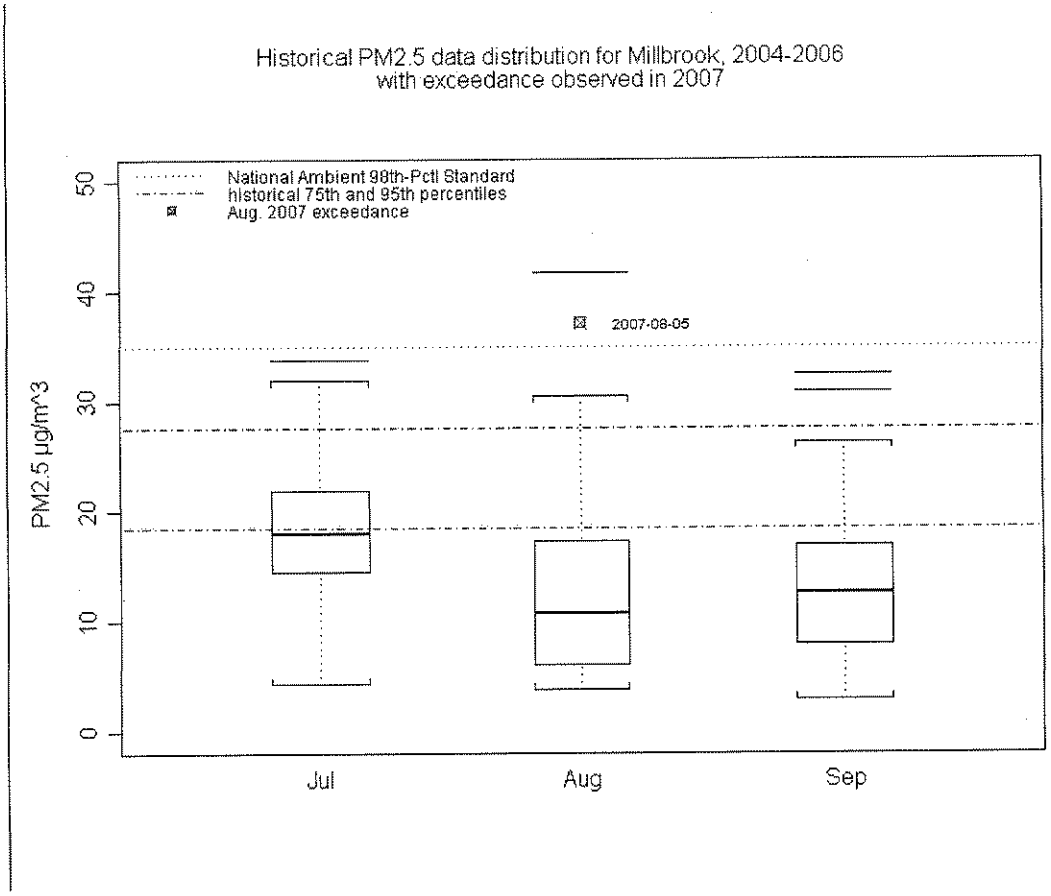


Figure 3.1 - shows "normal historical fluctuations" of PM2.5 data for the Millbrook monitoring station during the third calendar quarter in the form of boxplots for the individual *monthly* distributions with reference lines showing the historical levels of the 75th and 95th percentile levels as well as the level of the National Ambient 98th-percentile Standard (18.5 µg/m^3, 27.6 µg/m^3, and 35.0 µg/m^3, respectively) .

EPA has discussed the possible use of the historical 75th and 95th percentiles as objective thresholds for favorable concurrence decisions {[Federal Register: March 10, 2006 (Volume 71, Number 47)] The Treatment of Data Influenced by Exceptional Events: Proposed Rules, p. 12592}. The historical 95th percentile level for this event is 27.6 µg/m^3. The 5 Aug. 2007 exceedance exceeds the historical 95th percentile level by 18 percent.

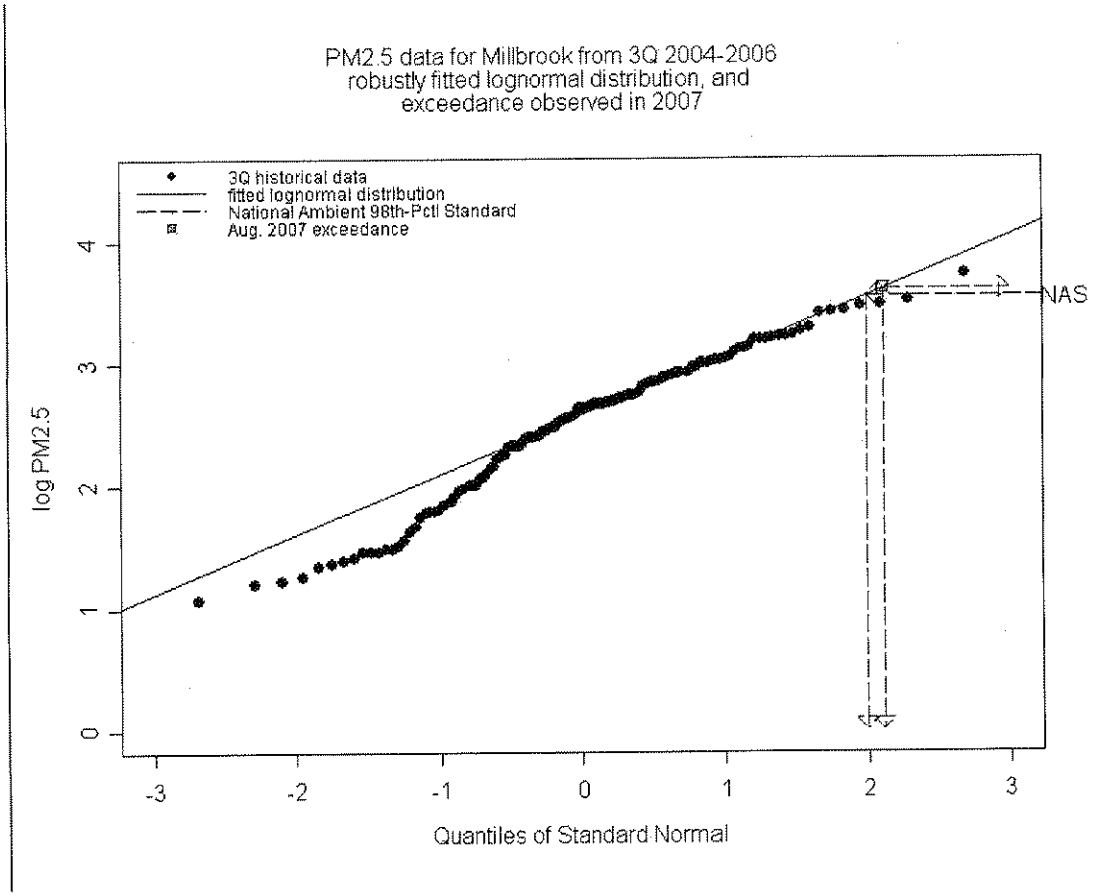


Figure 3.2 - shows "normal historical fluctuations" of PM2.5 data for the Millbrook monitoring station during the third calendar quarter in the form of a lognormal distribution quantile plot.

Particulate pollution data are often well approximated by lognormal distributions. This graph shows the natural logarithms of the historical data (in log-μg/m^3 units) sorted from smallest concentration to largest concentration, plotted against the corresponding quantiles of a standard normal distribution. An *exact* lognormal distribution closely matching these data is shown as a diagonal straight line in the graph. The level of the National Ambient 98th-percentile Standard (y=3.56), the 5 Aug. 2007 exceedance (y=3.61) is shown as a point on the lognormal distribution line, illustrating that expected probability of exceeding the level of the National Ambient 98th-percentile Standard in the absence of exceptional events is about 2.3 percent (1.99 standard deviations greater than the lognormal mean value), and the expected probability of "unexceptional data" exceeding the level observed on 5 Aug. 2007 is less than 1.75 percent (more than 2.11 standard deviations greater than the lognormal mean value). The estimated parameters of the lognormal approximation are:

- median PM2.5 = 13.24
- mean PM2.5 = 14.91
- 98th pctl PM2.5 = 36.03

"But For" Test: There would have been no exceedance or violation "but for" the event at Millbrook on 8/5/07.

Executive summary

To demonstrate that the wildfires in Idaho and Canada caused an exceedance of the daily fine particle standard of 35 micrograms per cubic meter at the Millbrook monitor on August 5, 2007, we need to find a way to either estimate (1) what the fine particle concentration value would have been on August 5, 2007, if the wildfires had not been present or (2) how many fine particles the wildfires contributed to the fine particle concentration measured at the Millbrook monitor on August 5, 2007. Either approach should be sufficient to demonstrate that the wildfires caused this exceedance. There are several possible ways to approach either question. For the impact of these wildfires at Millbrook on August 5, 2007, we opted to develop a model using meteorological measurements to estimate what the fine particle concentration value would have been on August 5, 2007 at Millbrook if the wildfires had not occurred. A more detailed description of the model is provided below. We also compared measured fine particle concentration values measured at Millbrook with those measured at a nearby site (William Owen in Fayetteville, North Carolina) that did not appear to be impacted by smoke from the wildfires in Idaho and Canada.

The model developed explains one third of the observed variation in the fine particle concentrations in the dataset. As a result there is a large amount of uncertainty in the estimation of the fine particle concentration at Millbrook on August 5, 2007, using this model. However, we can use the value calculated by the model and the uncertainty calculated by the model for that value to calculate the maximum value that we would expect to see at Millbrook on August 5, 2007, with a certain probability. **If we calculate the maximum expected value using a 99 percent probability and it is less than 35 micrograms per cubic meter, then there is at most a 1 percent probability that a value above the standard would have occurred at Millbrook on August 5, 2007, if smoke from wildfires in Idaho and Canada had not been transported into the area.**

Using the developed model and calculating the maximum expected value using a 99 percent probability indicates that there is a 1 percent probability that a value exceeding 36.17 micrograms per cubic meter would have occurred at Millbrook on 8/5/2007. Calculating the maximum expected value using a 95 percent probability indicates that there is a 5 percent probability that a value exceeding 31.90 would have occurred at Millbrook on 8/5/2007. Thus, without the wildfires, the developed model indicates there is less than 5 percent but more than 1 percent probability that the National Ambient Air Quality Standard would have been exceeded on that day. Correlation of the Millbrook data with the William Owen data indicates similar results.

As a result, we believe that the value of 37.08 micrograms per cubic meter, which exceeded the daily fine particle standard, would not have occurred at Millbrook if smoke from wildfires in Idaho and Canada had not been transported to North Carolina beginning on August 4, 2007, and lasting at least through August 8, 2007, in the Raleigh area.

Model Description

Data Description

For each day in the 3rd quarter of 2004, 2005, 2006 and 2007 on which there was a valid PM2.5 concentration the following met data was acquired to model the PM2.5 concentrations:

- AT daily mean ambient temperature at the PM2.5 monitoring station
- RH daily mean relative humidity at the PM2.5 monitoring station
- SR daily mean solar radiation at the collocated met tower
- WS daily mean (scalar) wind speed the collocated met tower
- PR daily total precipitation at the collocated met tower
- PR.lag1 previous-day daily total precipitation at the collocated met tower
- WS24 daily arith mean wind speed at KRDU, the NOAA automated met station at Raleigh-Durham International Airport, NC.
- VWD24 daily vector average wind direction at KRDU
- WG24 daily mean wind gust speeds at KRDU
- RN24 daily total precipitation at KRDU
- RN24.lag1 previous-day daily total precipitation at KRDU

Linear Models

I omitted from the model WG24 and RN24.lag1, because they had missing values on the exceedance day, which prevents any model that uses these variables from making a prediction.

Because PR and RN24 are essentially measurements of the same variable, but at different locations, I ran one model using PR and PR.lag1 a second model using RN24. (There were many more unusable samples in the RN24 model, because of missing values.)

Method of analysis

1. Define a covariate for the exceptional event, setting its value at +1 on the the day of the event and 0 on all other dates. PM.e1 is the covariate for 08/05/2007 (actual concentration 37.1).
2. Define the response variable PM2.5 as follows:

   Response Variable "PM2.5" = actual PM2.5 concentration, if there is not an exceptional event

   = 0.0 on the day of the exceptional event
3. Fit linear model as defined below. The coefficient associated with PM.e1 provides an estimate of the expected concentration that would have occurred if there had

not been an exceptional event around 5 Aug 2007. (The coefficient value is to be subtracted from the surrogate 0.0 value, so it is actually the *negative* of the estimated concentration.)

Results

Model using precipitation data from the site

Call: aov(formula = PM2.5 ~ AT + RH + SR + PR + PR.lag1 + WS24 + VWD24 + PM.e1, data = MLtest005.df, na.action = na.exclude)

Residuals:				
Min	1Q	Median	3Q	Max
-22.43	-3.657	-0.2414	3.391	19.68

Coefficients:				
	Value	Std. Error	t value	Pr(>|t|)
(Intercept)	4.7573	105.0343	0.0453	0.9639
AT	0.9419	0.1741	5.4107	0.0000
RH	-0.0188	0.1372	-0.1370	0.8912
SR	0.0137	0.0069	1.9802	0.0492
PR	0.0038	0.0845	0.0451	0.9641
PR.lag1	-0.2347	0.0819	-2.8664	0.0046
WS24	-0.5368	0.1770	-3.0329	0.0028
VWD24	0.0041	0.0051	0.8068	0.4208
PM.e3	-21.7078	6.1619	-3.5229	0.0005

Residual standard error: 6.096 on 182 degrees of freedom

Multiple R-Squared: 0.3305

F-statistic: 11.23 on 8 and 182 degrees of freedom, the p-value is 7.155e-013

8 observations deleted due to missing values

Model using precipitation data from the airport

Call: aov(formula = PM2.5 ~ AT + RH + SR + RN24 + WS24 + VWD24 + PM.e1, data = MLtest005.df, na.action = na.exclude)

Residuals:				
Min	1Q	Median	3Q	Max
-20.68	-4.397	0.08041	3.483	15.87

Coefficients:				
	Value	Std. Error	t value	Pr(>|t|)
(Intercept)	46.5654	180.5504	0.2579	0.7973

AT	1.0241	0.3516	2.9130	0.0049
RH	-0.0831	0.2366	-0.3513	0.7265
SR	0.0085	0.0123	0.6928	0.4909
RN24	0.8908	1.4742	0.6043	0.5478
WS24	-0.4271	0.3039	-1.4056	0.1646
VWD24	0.0174	0.0090	1.9399	0.0567
PM.e3	-19.9842	6.6956	-2.9847	0.0040
Residual standard error: 6.486 on 65 degrees of freedom				
Multiple R-Squared: 0.3256				
F-statistic: 4.484 on 7 and 65 degrees of freedom, the p-value is 0.0004013				
126 observations deleted due to missing values				

Discussion

The linear model explains about one-third of the observed variation in PM2.5 concentrations in the dataset, and there is accordingly a large amount of uncertainty in the estimation of the concentration that was affected by the exceptional event. Let's report the estimates using the assumptions that commonly justify regression analysis and analysis of variance. The expected values are as shown in the Coefficients tables for the site precipitation model, 2.347* Std. Error defines a 99-percent upper bound, and in the Coefficients tables for the airport precipitation model, 2.385* Std. Error defines a 99-percent upper bound under the observed uncertainty.

This means that "but for the exceptional event" we have concentrations as shown in Table 5. The column labeled "expectation" is the model's estimate of what concentration would have most likely been observed were the exceptional event not present. The column labeled "95% probability upper limit" takes the standard error into account and shows a threshold that there is less than 5 percent probability of exceeding. The column labeled "99% probability upper limit" takes the standard error into account and shows a threshold that there is less than 1 percent probability of exceeding. With this exceptional event, the expected concentration was between 20 and 22 $\mu g/m^3$ on 5 Aug 2007 and the 99-percent upper probability limits were between 36.0 and 36.2 $\mu g/m^3$ for both models -- exceeding the NAS threshold and only 1.5 $\mu g/m^3$ less than the observed concentration.

Table 5. Millbrook Exceptional Event Concentration Statistics

Date	Model	actual	expectation	95%-probability upper limit	99%-probability upper limit
08/05/2007	site precip.	37.1	21.71	31.90	36.17
08/05/2007	KRDU precip.	37.1	19.98	31.16	35.96

"Atypical" Analysis for Hickory 5 August 2007 Exceedance

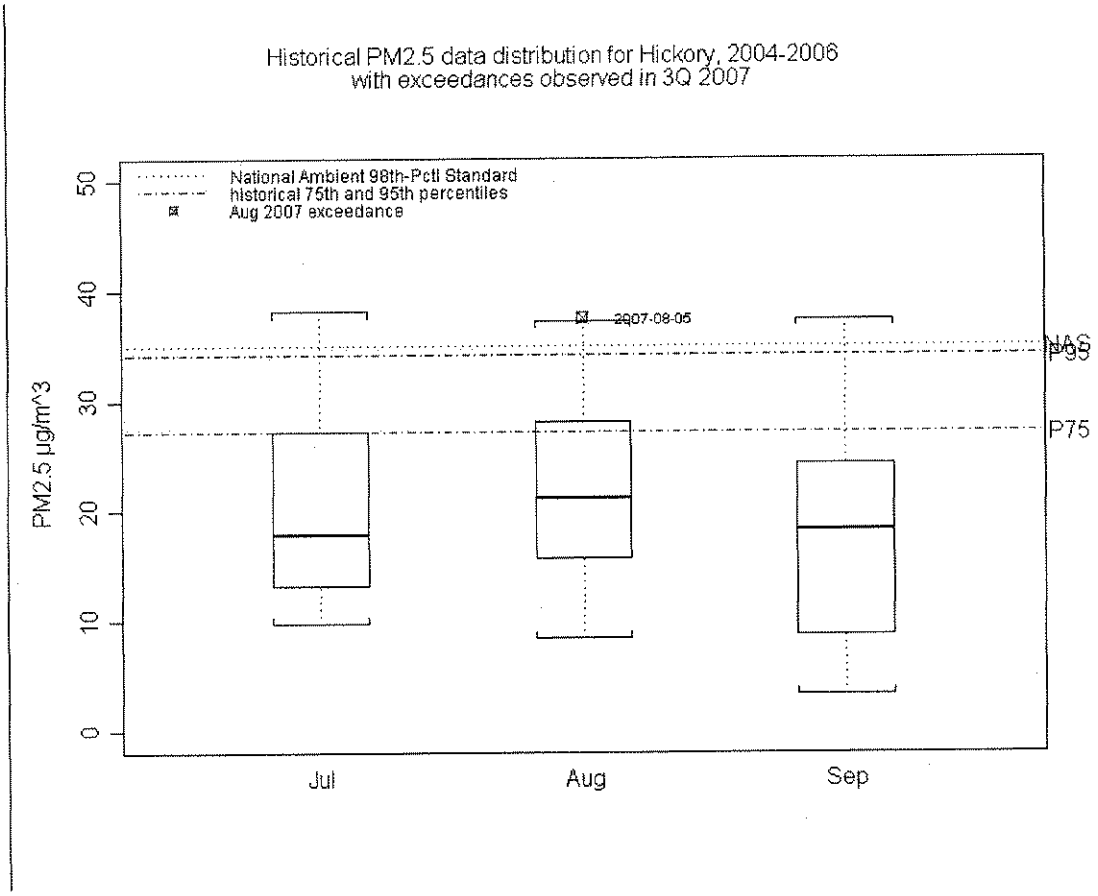


Figure 3.1 - shows "normal historical fluctuations" of PM2.5 data for the Hickory monitoring station during the third calendar quarter in the form of boxplots for the individual *monthly* distributions with reference lines showing the historical levels of the 75th and 95th percentile levels as well as the level of the National Ambient 98th-percentile Standard (27.2 µg/m^3, 34.2 µg/m^3, and 35.0 µg/m^3, respectively) .

EPA has discussed the possible use of the historical 75th and 95th percentiles as objective thresholds for favorable concurrence decisions { [Federal Register: March 10, 2006 (Volume 71, Number 47)] The Treatment of Data Influenced by Exceptional Events: Proposed Rules, p. 12592} The historical 95th percentile level for this event is 34.2 µg/m^3. The 5 Aug 2007 exceedance exceeds the historical 95th percentile level by 10 percent.

"Atypical" Analysis for Hickory 5 August 2007 Exceedance (Cont'd)

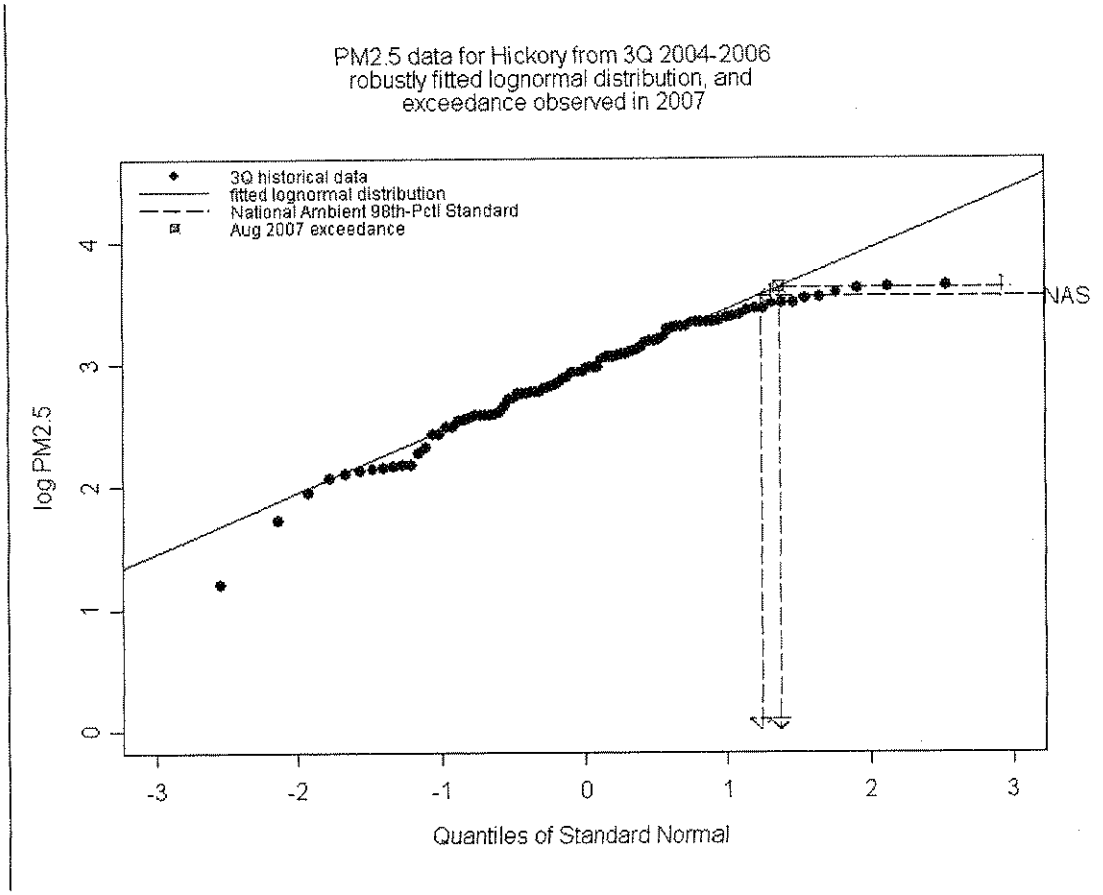


Figure 3.2 - shows "normal historical fluctuations" of PM2.5 data for the Hickory monitoring station during the third calendar quarter in the form of a lognormal distribution quantile plot.

Particulate pollution data are often well approximated by lognormal distributions. This graph shows the natural logarithms of the historical data (in log-$\mu g/m^3$ units) sorted from smallest concentration to largest concentration, plotted against the corresponding quantiles of a standard normal distribution. An *exact* lognormal distribution closely matching these data is shown as a diagonal straight line in the graph. The level of the National Ambient 98th-percentile Standard (y=3.56) and the 5 Aug 2007 exceedance (y=3.66) are shown as points on the lognormal distribution line, illustrating that expected probability of exceeding the level of the National Ambient 98th-percentile Standard in the absence of exceptional events is about 11 percent (1.24 standard deviations greater than the lognormal mean value), and the expected probability of "unexceptional data" exceeding the level observed on 5 Aug 2007 is about 8.4 percent (1.38 standard deviations greater than the lognormal mean value). The estimated parameters of the lognormal approximation are:

- median PM2.5 = 19.0
- mean PM2.5 = 21.4
- 98th pctl PM2.5 = 52.4

"But For" Test: There would have been no exceedance or violation "but for" the event at Hickory on 8/5/07.

Executive summary

To demonstrate that the wildfires in Idaho and Canada caused an exceedance of the daily fine particle standard of 35 micrograms per cubic meter at the Hickory monitor on August 5, 2007, we need to find a way to either estimate (1) what the fine particle concentration value would have been on August 5, 2007, if the wildfires had not been present or (2) how many fine particles the wildfires contributed to the fine particle concentration measured at the Hickory monitor on August 5, 2007. Either approach should be sufficient to demonstrate that the wildfires caused this exceedance. There are several possible ways to approach either question. For the impact of these wildfires at Hickory on August 5, 2007, we opted to develop a model using meteorological measurements to estimate what the fine particle concentration value would have been on August 5, 2007 at Hickory if the wildfires had not occurred. A more detailed description of the model is provided below.

The model developed explains less than half of the observed variation in the fine particle concentrations in the dataset. As a result there is a large amount of uncertainty in the estimation of the fine particle concentration at Hickory on August 5, 2007. However, we can use the value calculated by the model and the uncertainty calculated by the model for that value to calculate the maximum value that we would expect to see at Hickory on August 5, 2007, with a certain probability. **If we calculate the maximum expected value using a 99 percent probability and it is less than 35 micrograms per cubic meter, then there is at most a 1 percent probability that a value above the standard would have occurred at Hickory on August 5, 2007, if there had not been wildfires in the area.**

Using the developed model and calculating the maximum expected value using a 99 percent probability indicates that there is a 1 percent probability that a value exceeding 37.45 micrograms per cubic meter and a 5 percent probability that a value exceeding 32.53 micrograms per cubic meter would have occurred at Hickory on 8/5/2007. Thus, without the wildfires, there is greater than a 1 percent and less than a 5 percent probability that the National Ambient Air Quality Standard would have been exceeded on that day. As a result, we believe that the value of 37.5 micrograms per cubic meter, which exceeded the daily fine particle standard, would not have occurred at Hickory if there had not been wildfires in Idaho and Canada during July and August that caused smoke to envelop North Carolina on August 5, 2007.

Data Description

For each day in the 3rd quarter of 2004, 2005, 2006 and 2007 on which there was a valid PM2.5 concentration the following met data was acquired to model the PM2.5 concentrations:

- AT daily mean ambient temperature at the PM2.5 monitoring station
- RH daily mean relative humidity at the PM2.5 monitoring station
- WS24 daily arith mean wind speed at KHKY, the NOAA automated met station at Hickory municipal airport, NC.
- VWD24 daily vector average wind direction at KHKY
- WG24 daily mean wind gust speeds at KHKY
- RN24 daily total precipitation at KHKY
- RN24.lag1 previous-day daily total precipitation at KHKY

Linear Models

I omitted from the model WG24 and RN24, because they had missing values on the exceedance day, which prevents any model that uses these variables from making a prediction.

Method of analysis

1. Define a covariate for the exceptional event, setting its value at +1 on the the day of the event and 0 on all other dates. PM.e1 is the covariate for 08/05/2007 (actual concentration 37.5).
2. Define the response variable PM2.5 as follows:

   Response Variable "PM2.5" = actual PM2.5 concentration, if there is not an exceptional event

   = 0.0 on the day of the exceptional event

3. Fit linear model as defined below. The coefficient associated with PM.e1 provides an estimate of the expected concentration that would have occurred if there had not been an exceptional event around 5 Aug 2007. (The coefficient value is to be subtracted from the surrogate 0.0 value, so it is actually the *negative* of the estimated concentration.)

Results

Call: aov(formula = PM2.5 ~ AT + RH + RN24.lag1 + WS24 + VWD24 + PM.e1, data = HCtest007.df, na.action = na.exclude)

Residuals:				
Min	1Q	Median	3Q	Max
-12.54	-4.759	-0.7689	3.78	14.97

Coefficients:

	Value	Std. Error	t value	Pr(>|t|)
(Intercept)	-203.6394	245.3542	-0.8300	0.4094
AT	0.7047	0.2429	2.9010	0.0050
RH	0.2858	0.3320	0.8609	0.3923
RN24.lag1	-3.0400	1.5318	-1.9845	0.0512
WS24	-0.9154	0.5347	-1.7120	0.0914
VWD24	-0.0115	0.0061	-1.8904	0.0629
PM.e1	-21.0518	6.8839	-3.0581	0.0032
Residual standard error: 6.705 on 69 degrees of freedom				
Multiple R-Squared: 0.3224				
F-statistic: 5.472 on 6 and 69 degrees of freedom, the p-value is 0.0001116				
102 observations deleted due to missing values				

Discussion

The linear model explains about one-third of the observed variation in PM2.5 concentrations in the dataset, and there is accordingly a large amount of uncertainty in the estimation of the concentration that was affected by the exceptional event.
Let's report the estimates using the assumptions that commonly justify regression analysis and analysis of variance. The expected values are as shown in the Coefficients tables, 2.382×Std. Error defines a 99-percent upper bound under the observed uncertainty.
This means that "but for the exceptional event" we have concentrations as shown in Table 5. The column labeled "expectation" is the model's estimate of what concentration would have most likely been observed were the exceptional event not present. The column labeled "95% probability upper limit" takes the standard error into account and shows a threshold that there is less than 5 percent probability of exceeding. The column labeled "99% probability upper limit" takes the standard error into account and shows a threshold that there is less than 1 percent probability of exceeding. With this exceptional event, the expected concentration was 21.1 $\mu g/m^3$ on 5 Aug 2007 and the 99-percent upper probability limit was 37.45 $\mu g/m^3$ -- exceeding the NAS threshold and approximately equal to the observed concentration.

Table 5. Hickory Exceptional Event Concentration Statistics

Date	actual	expectation	95%-probability upper limit	99%-probability upper limit
008/05/2007	37.5	21.05	32.53	37.45

"Atypical" Analysis for Mendenhall 5 August 2007 Exceedance

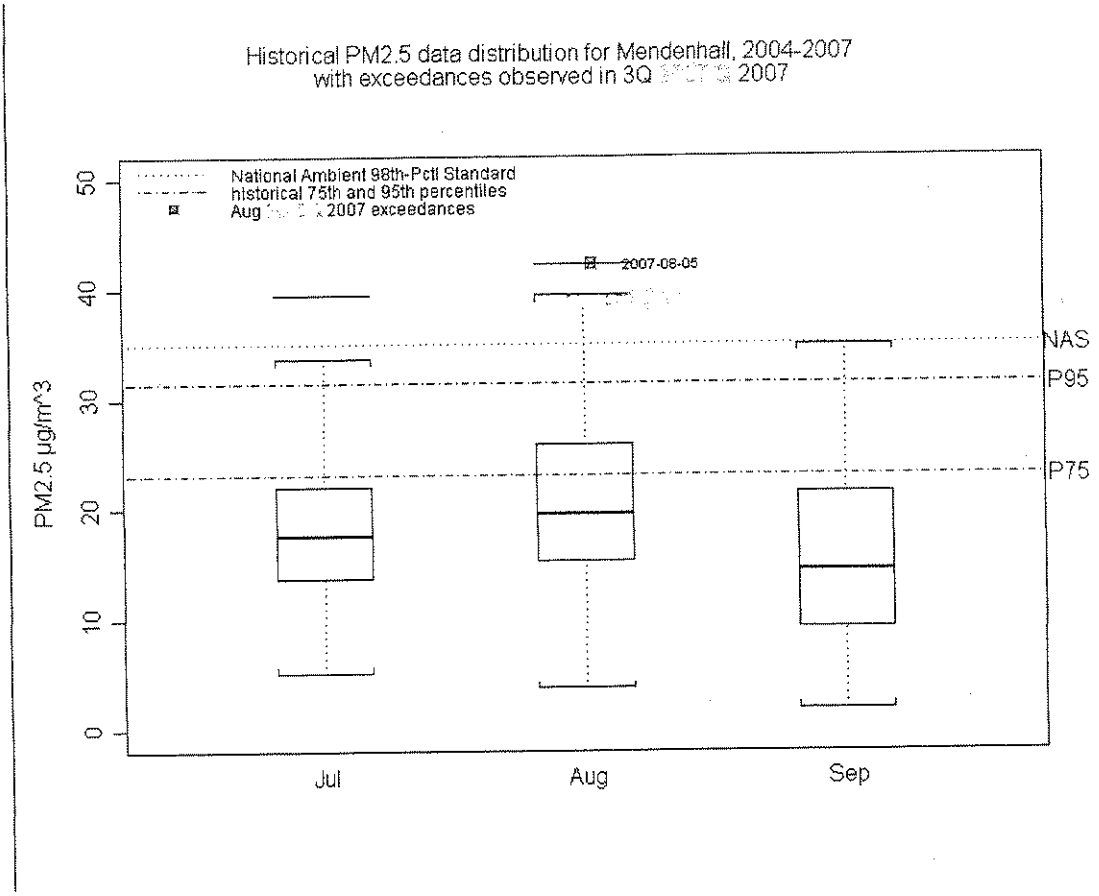


Figure 3.1 - shows "normal historical fluctuations" of PM2.5 data for the Mendenhall monitoring station during the third calendar quarter in the form of boxplots for the individual *monthly* distributions with reference lines showing the historical levels of the 75th and 95th percentile levels as well as the level of the National Ambient 98th-percentile Standard (23.1 µg/m^3, 31.34 µg/m^3, and 35.00 µg/m^3, respectively).

EPA has discussed the possible use of the historical 75th and 95th percentiles as objective thresholds for favorable concurrence decisions { [Federal Register: March 10, 2006 (Volume 71, Number 47)] The Treatment of Data Influenced by Exceptional Events: Proposed Rules, p. 12592} The historical 95th percentile level for this event is 31.3 µg/m^3. The 07 Aug 2005 exceedance exceeds the historical 95th percentile level by 35 percent.

"Atypical" Analysis for Mendenhall 5 August 2007 Exceedance (Cont'd)

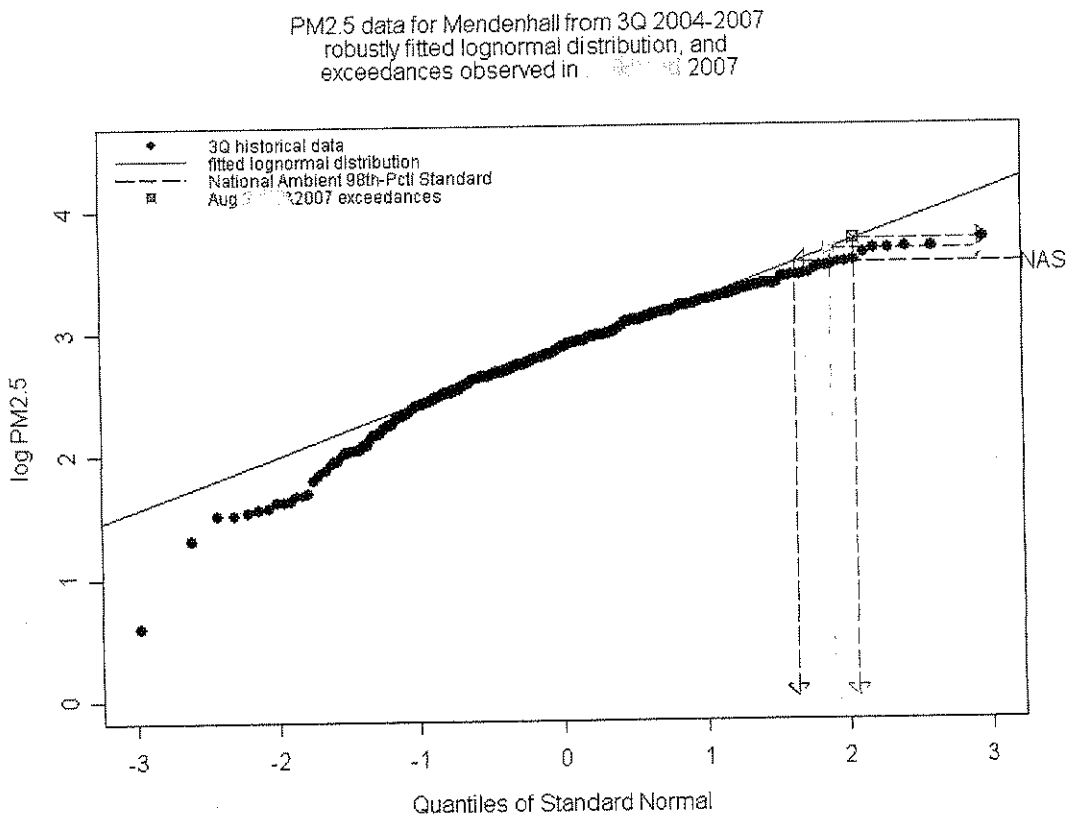


Figure 3.2 - shows "normal historical fluctuations" of PM2.5 data for the Mendenhall monitoring station during the third calendar quarter in the form of a lognormal distribution quantile plot.

Particulate pollution data are often well approximated by lognormal distributions. This graph shows the natural logarithms of the historical data (in log-$\mu g/m^3$ units) sorted from smallest concentration to largest concentration, plotted against the corresponding quantiles of a standard normal distribution. An *exact* lognormal distribution closely matching these data is shown as a diagonal straight line in the graph. The level of the National Ambient 98th-percentile Standard (y=3.56) and the 5 Aug 2007 exceedance (y=3.74) are shown as points on the lognormal distribution line, illustrating that expected probability of exceeding the level of the National Ambient 98th-percentile Standard in the absence of exceptional events is about 5.1 percent (1.63 standard deviations greater than the lognormal mean value), and the expected probability of "unexceptional data" exceeding the level observed on 5 Aug 2007 is about 2 percent (2.07 standard deviations greater than the lognormal mean value). The estimated parameters of the lognormal approximation are:

- median PM2.5 = 17.3
- mean PM2.5 = 19.0
- 98th pctl PM2.5 = 41.9

"But For" Test: There would have been no exceedance or violation "but for" the event at Mendenhall on 8/5/07.

Executive summary

To demonstrate that the wildfires in Idaho and Canada caused an exceedance of the daily fine particle standard of 35 micrograms per cubic meter at the Mendenhall monitor on August 5, 2007, we need to find a way to either estimate (1) what the fine particle concentration value would have been on August 5, 2007, if the wildfires had not been present or (2) how many fine particles the wildfires contributed to the fine particle concentration measured at the Mendenhall monitor on August 5, 2007. Either approach should be sufficient to demonstrate that the wildfires caused this exceedance. There are several possible ways to approach either question. For the impact of these wildfires at Mendenhall on August 5, 2007, we opted to develop a model using meteorological measurements to estimate what the fine particle concentration value would have been on August 5, 2007 at Mendenhall if the wildfires had not occurred. A more detailed description of the model is provided below.

The model developed explains less than half of the observed variation in the fine particle concentrations in the dataset. As a result there is a large amount of uncertainty in the estimation of the fine particle concentration at Mendenhall on August 5, 2007. However, we can use the value calculated by the model and the uncertainty calculated by the model for that value to calculate the maximum value that we would expect to see at Mendenhall on August 5, 2007, with a certain probability. **If we calculate the maximum expected value using a 99 percent probability and it is less than 35 micrograms per cubic meter, then there is at most a 1 percent probability that a value above the standard would have occurred at Mendenhall on August 5, 2007, if there had not been wildfires in the area.**

Using the developed model and calculating the maximum expected value using a 99 percent probability indicates that there is a 1 percent probability that a value exceeding 37.45 micrograms per cubic meter and a 5 percent probability that a value exceeding 34.74 would have occurred at Mendenhall on 8/5/2007. Thus, without the wildfires, there is more than 1 percent and less than a 5 percent probability that the National Ambient Air Quality Standard would have been exceeded on that day. As a result, we believe that the value of 37.5 micrograms per cubic meter, which exceeded the daily fine particle standard, would not have occurred at Mendenhall if there had not been a wildfires in Idaho and Canada around the day of August 5, 2007.

Data Description

For each day in the 3rd quarter of 2004, 2005, 2006 and 2007 on which there was a valid PM2.5 concentration the following met data was acquired to model the PM2.5 concentrations:

- AT daily mean ambient temperature at the PM2.5 monitoring station
- RH daily mean relative humidity at the PM2.5 monitoring station
- SR daily mean solar radiation at the collocated met tower
- WS daily mean (scalar) wind speed the collocated met tower
- PR daily total precipitation at the collocated met tower
- PR.lag1 previous-day daily total precipitation at the collocated met tower
- WS24 daily arith mean wind speed at KGSO, the NOAA automated met station at Greensboro (Triad International Airport?), NC.
- VWD24 daily vector average wind direction at KGSO
- WG24 daily mean wind gust speeds at KGSO
- RN24 daily total precipitation at KGSO
- RN24.lag1 previous-day daily total precipitation at KGSO

Linear Models

I omitted from the model WG24, RN24, and RN24.lag1 because they had missing values on the exceedance days, which prevents any model that uses these variables from making a prediction.

Method of analysis

1. Define a covariate for each exceptional event, setting its value at +1 on the the days of the event and 0 on all other dates. PM.e1 is the covariate for 08/07/2007 (actual concentration 40.2).
2. Define the response variable PM2.5 as follows:

   Response Variable "PM2.5" = actual PM2.5 concentration, if there is not an exceptional event

   = 0.0 on the days of the exceptional events

3. Fit linear model as defined below. The coefficient associated with PM.e1 provides an estimate of the expected concentrations that would have occurred if there had not been an exceptional event around 12 Aug 2005. (The coefficient value is to be subtracted from the surrogate 0.0 value, so it is actually the *negative* of the estimated concentration.)

Results

Call: aov(formula = PM2.5 ~ AT + RH + PR + PR.lag1 + SR + WS + WS24 + VWD24 + PM.e1, data = MHtest006.df, na.action = na.exclude)

Residuals:				
Min	1Q	Median	3Q	Max
-15.48	-4.403	-0.8046	3.137	20.85

Coefficients:				
	Value	Std. Error	t value	Pr(>|t|)
(Intercept)	-112.5344	127.9179	-0.8797	0.3799
AT	0.6967	0.1566	4.4489	0.0000
RH	0.1598	0.1684	0.9487	0.3437
PR	-0.0727	0.0477	-1.5234	0.1290
PR.lag1	-0.1030	0.0418	-2.4624	0.0145
SR	-0.0100	0.0079	-1.2632	0.2078
WS	1.2496	1.3524	0.9239	0.3565
WS24	-0.9413	0.2965	-3.1752	0.0017
VWD24	-0.0027	0.0042	-0.6312	0.5285
PM.e1	-23.7771	6.6410	-3.5804	0.0004
Residual standard error: 6.547 on 237 degrees of freedom				
Multiple R-Squared: 0.2478				
F-statistic: 7.808 on 10 and 237 degrees of freedom, the p-value is 8.254e-011				
57 observations deleted due to missing values				

Discussion

The linear model explains about one-fourth of the observed variation in PM2.5 concentrations in the dataset, and there is accordingly a large amount of uncertainty in the estimation of the two concentrations that were affected by exceptional events.
Let's report the estimates using the assumptions that commonly justify regression analysis and analysis of variance. The expected values are as shown in the Coefficients tables, 2.342× Std. Error defines a 99-percent upper bound under the observed uncertainty. This means that "but for the exceptional event" we have concentrations as shown in Table 5. The column labeled "expectation" is the model's estimate of what concentration would have most likely been observed were the exceptional event not present. The column labeled "95% probability upper limit" takes the standard error into account and shows a threshold that there is less than 5 percent probability of exceeding. The column labeled "99% probability upper limit" takes the standard error into account and shows a threshold that there is less than 1 percent probability of exceeding. With this exceptional event, the expected concentration was 23.77 $\mu g/m^3$ on 5 Aug 2007 and the 99-percent upper probability limit was 39.33 $\mu g/m^3$ -- exceeding the NAS threshold and about 2.9 $\mu g/m^3$ less than the observed concentration.

Table 5. Mendenhall Exceptional Event Concentration Statistics

Date	actual	expectation	95%-probability upper limit	99%-probability upper limit
08/05/2007	42.2	23.77	34.74	39.33