

**JUNE 11, 2007  
EXCEPTIONAL EVENT  
DEMONSTRATION PACKAGE**

**FOR THE  
SPRUCE PINE  
FINE PARTICLE  
FEDERAL REFERENCE METHOD MONITOR  
(371210001-88101-1)**

**December 14, 2007**



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

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Spruce Pine FRM-PM<sub>2.5</sub> (No TEOM-PM<sub>2.5</sub> at Spruce Pine)  
 138 Highland Avenue  
 Spruce Pine, NC  
 Mitchell County  
 371210001-88101  
 6/11/07  
 60.58 µg/m<sup>3</sup>  
 Recommended Flag - E: Forest Fire

**DISCUSSION:**

The North Carolina Division of Air Quality seeks EPA concurrence of the “E” flag (Forest Fire) for the Federal Reference Method (FRM) – PM<sub>2.5</sub> monitor reading 60.58 micrograms per meter cubed (µg/m<sup>3</sup>) on 6/11/07 at the Spruce Pine monitoring station.

Lightning sparked two fires in Burke County on Friday 6/8/07 at Dobson Knob and Shortoff Mountain. On Monday, 6/11/07, the particulate matter monitor at Spruce Pine, located Northwest of the fire locations, registered an unusually high concentration. Meteorological data show the prevailing winds were to the Northwest during this period. Computer modeling of wind and smoke plume trajectories show that the Spruce Pine monitor was directly impacted by the event. Plots of Forward and Backward trajectories are provided here for graphical evidence. In addition, these trajectories were superimposed on a map of the areas of interest using GIS software and are also included here for review. The following table provides concentration data (µg/m<sup>3</sup>) for the Spruce Pine FRM PM-2.5 monitor for 6/11/07 and the periods immediately prior to and after the event. Also included in the table are concentrations data from two upwind sites which included FRM PM-2.5 as well as automated continuous TEOM PM-2.5. This comparative data shows that the PM-2.5 concentrations were nominally a factor of four lower than the value observed on 6/11/07.

Table 1 Comparative PM<sub>2.5</sub> Data, (µg/m<sup>3</sup>)

		Exceedance monitor		Upwind		Upwind	
		Spruce Pine		Marion		Hickory	
		FRM	TEOM	FRM	TEOM	FRM	TEOM
Pre Event, 6/2 - 6/8	3-day Avg	11.8	NA	12.5	11.7	8.09	13.5
	Max.	15.71	NA	17.46	15.3	12.67	18.9
	Min.	7.79	NA	7.96	9.7	9.71	10.3
<b>6/11/07</b>	<b>24 hr Avg</b>	<b>60.58</b>	<b>NA</b>	<b>28.46</b>	<b>31.3</b>	<b>25.08</b>	<b>28.8</b>
Post Event, 6/17-6/29	5-day Avg	14.76	NA	21.38	21.6	17.3	22.9
	Max.	17.75	NA	32.5	27.6	22.17	26.5
	Min.	10.08	NA	10.08	10.5	13.33	11.8

As can be seen from the table, the Pre- and Post-event (background) averages were very similar across all three sites.



# NATIONAL FORESTS IN NORTH • CAROLINA

USDA FOREST SERVICE, 160A ZILICOA STREET, ASHEVILLE, NC 28801

## NEWS • RELEASE

Contact: Terry Seyden  
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terryseyden@yahoo.com

For Immediate Release      June 10, 2007

6/10/2007

### Lightning Starts Two New Fires Near Linville Gorge

Lightning started two new fires in the Linville Gorge area of the Pisgah National Forest late Friday afternoon. The fires are on national forest land in Burke County about six miles apart from each other. As of 10:00 am Sunday, the Dobson Knob fire, three miles north of Lake James, had burned over 250 acres. The Shortoff Mountain fire has burned about 125 acres on the east side of Linville River within the Linville Gorge Wilderness.

The fires are currently burning on national forest lands and no private lands or homes are threatened. State and federal helicopters and air tankers made water and retardant drops yesterday to help slow down the fires and are available today if needed. Two dozers are also being used to construct containment lines around the perimeter of the fires. Approximately 140 firefighters are now on the scene battling the two blazes, and more crews are en route.

The hot, dry weather the last two months in western North Carolina has created unusually high fire danger conditions for this late in the season. "The extended drought and a buildup of dead pines killed by southern pine beetle outbreaks have combined to cause these fires to burn much hotter and spread faster than what we normally see", said U.S. Forest spokesman Terry Seyden.

-more-

At this time the Forest Service does not have an estimate of when these two fires will be contained. Long range weather forecasts call for continued hot, dry conditions which will make it more difficult to bring these fires under control. "What we really need is an extended period of heavy, soaking rains, but unfortunately that's not in the forecast," Seyden added.

To ensure public safety, trails in the southern part of Linville Gorge Wilderness area will be closed until further notice. The public can check for updated fire information at the National Forests in North Carolina website <http://www.cs.unca.edu/nfsnc>.

###

CITIZEN-TIMES\_com Linville Gorge blaze claims 900 acres.txt  
CITIZEN-TIMES.com: Linville Gorge blaze claims 900 acresCITIZEN-TIMES.com  
Linville Gorge blaze claims 900 acres

By Mike McWilliams (828-232-5953)  
MMCWILLIAMS@CITIZEN-TIMES.COM  
[Tuesday] June 12, 2007 12:15 am

LINVILLE GORGE - Two fires burning across the Linville Gorge area of Pisgah National Forest have consumed more than 900 acres, a U.S. Forest Service official said Monday.

U.S. Forest Service spokesman Terry Seyden said the Dobson Knob fire, three miles north of Lake James, has burned about 540 acres. As of 6 p.m. Monday, the second fire, on Shortoff Mountain, had burned about 700 acres, according to a Forest Service news release.

"Both fires continued to burn actively overnight," Seyden said Monday. "We've got more than 150 personnel working on the fires, and we're watching the weather closely."

Lightning sparked the two fires Friday [June 8, 2007] on National Forest land in Burke County. Dense smoke from the fires Monday afternoon hampered visibility and caused traffic congestion on U.S. 221 north of Woodlawn in McDowell County.

The hot, dry weather the last two months in western North Carolina has created unusually high fire danger conditions for this late in the season, Seyden said. Seyden said the U.S. Forest Service has been working with state and local firefighters to battle the blazes. So far, private homes are not in harm's way, Seyden said.

On the Shortoff Mountain blaze, Seyden said crews would likely start back-burning in the next day or two to establish a perimeter line. Back-burning includes setting fires ahead of the active fire line to eliminate trees, bushes and other fuels for the main fire.

"We could easily be dealing with these fires for another week or two," Seyden said. "We're going to secure the lines, and we have aerial support, but long, sustained rains are what it's going to take to make sure these fires are out." Staff writer Andre A. Rodriguez contributed to this report.

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**July 05, 2007**

**Fire Information  
828-443-1668**

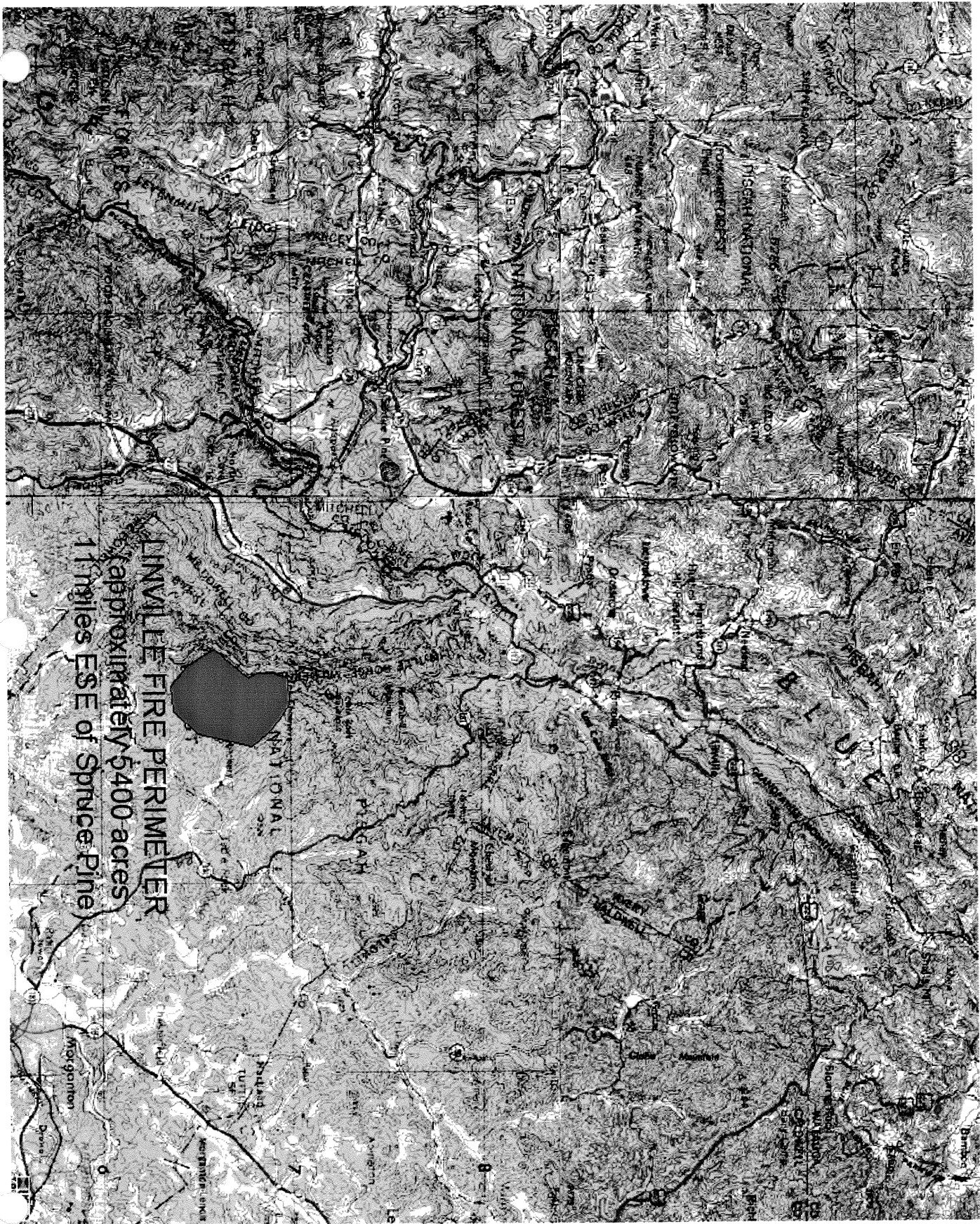
# **Fire Update**

**National Forest in NC  
Pisgah National Forest  
Grandfather Ranger District  
Linville Complex**

- ❖ The Linville Complex is located on the Pisgah National Forest, Grandfather Ranger District. Three wildfires, each started by lightning on June 8, 2007, comprise the complex. Total complex acreage is currently at 5,400 with 100% containment. There are 130 personnel assigned to the complex. This includes 4 hand crews, 2 helicopter, 4 engines and 2 dozers. Air support from the North Carolina Division of Forest Resources is available if needed.
- ❖ The Linville Complex consists of:
  - Shortoff Mountain Fire – 4,517 acres in Linville Gorge Wilderness (contained)
  - Dobson Knob Fire – 816 acres (contained)
  - Cold Mountain Fire – 67 acres west (fire is out)
- ❖ **The trails north of and to include the Table Rock picnic area have been reopened. Mountain to the Sea Trail south of the Table Rock picnic area to include the Chimneys remains closed to the public.**
- ❖ **The western side off Forest Road 105, including Wiseman's View, is entirely open, as well as the north end of Linville Gorge. The only section closed is from Forest Road 99 on the eastern side of the Linville River to Shortoff Mountain, between the river and Forest Road 118.**
- ❖ Firefighters will continue to patrol and mop-up any hot spots and fell any snags that may pose a threat to firefighter and public safety on the Shortoff Mountain and Dobson Knob Fires. While the fires are now 100% contained they are not totally out. Until we receive a significant amount of rain fall ground fires will continue to burn and resurface in patches of unburned areas.
- ❖ The Cold Mountain Fire is considered out.
- ❖ Rehabilitation work will continue to include the public trails.
- ❖ **The threat of new fires continues to exist and the public is reminded that over the holiday weekend fireworks are not allowed on the Pisgah National Forest. The public should also be careful with campfires if they are camping on the Forest, and ensure their fire is never left unattended and is completely out when they leave their campsite.**







**LINVILLE FIRE PERIMETER**  
(approximately 5400 acres  
11 miles ESE of Spruce Pine)

LEGEND  
● Spruce Pine

2

## "Atypical" Analysis for 11 June 2007 Spruce Pine Exceedance

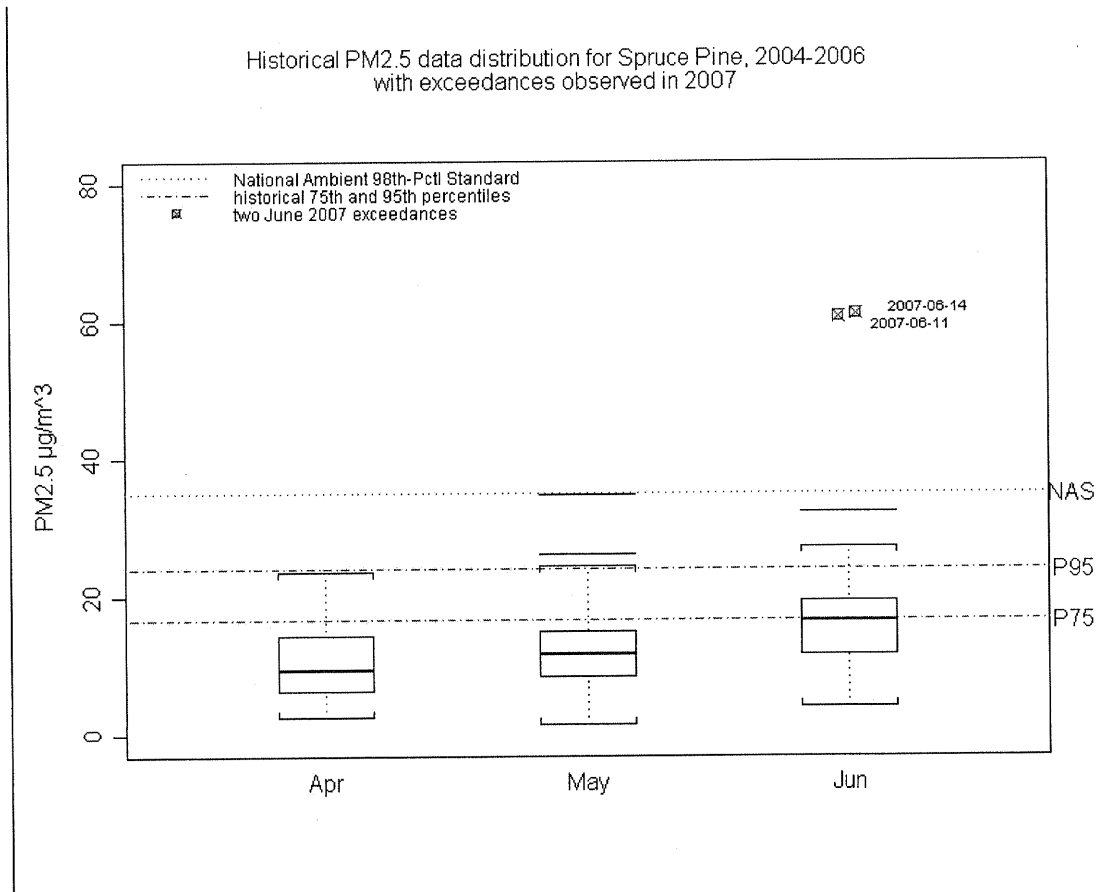


Figure 3.1 - shows "normal historical fluctuations" of PM<sub>2.5</sub> data for the Spruce Pine monitoring station during the second calendar quarter in the form of boxplots for the individual *monthly* distributions with reference lines showing the historical levels of the 75th and 95th percentile levels as well as the level of the National Ambient 98th-percentile Standard (16.7 µg/m<sup>3</sup>, 24.1 µg/m<sup>3</sup>, and 35.0 µg/m<sup>3</sup>, 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 historical 95th percentile level for this event is 24.1 µg/m<sup>3</sup>. The 11 June 2007 exceedance exceeds the historical 95th percentile level by 152 percent.

## "Atypical" Analysis for 11 June 2007 Spruce Pine Exceedance (Cont'd)

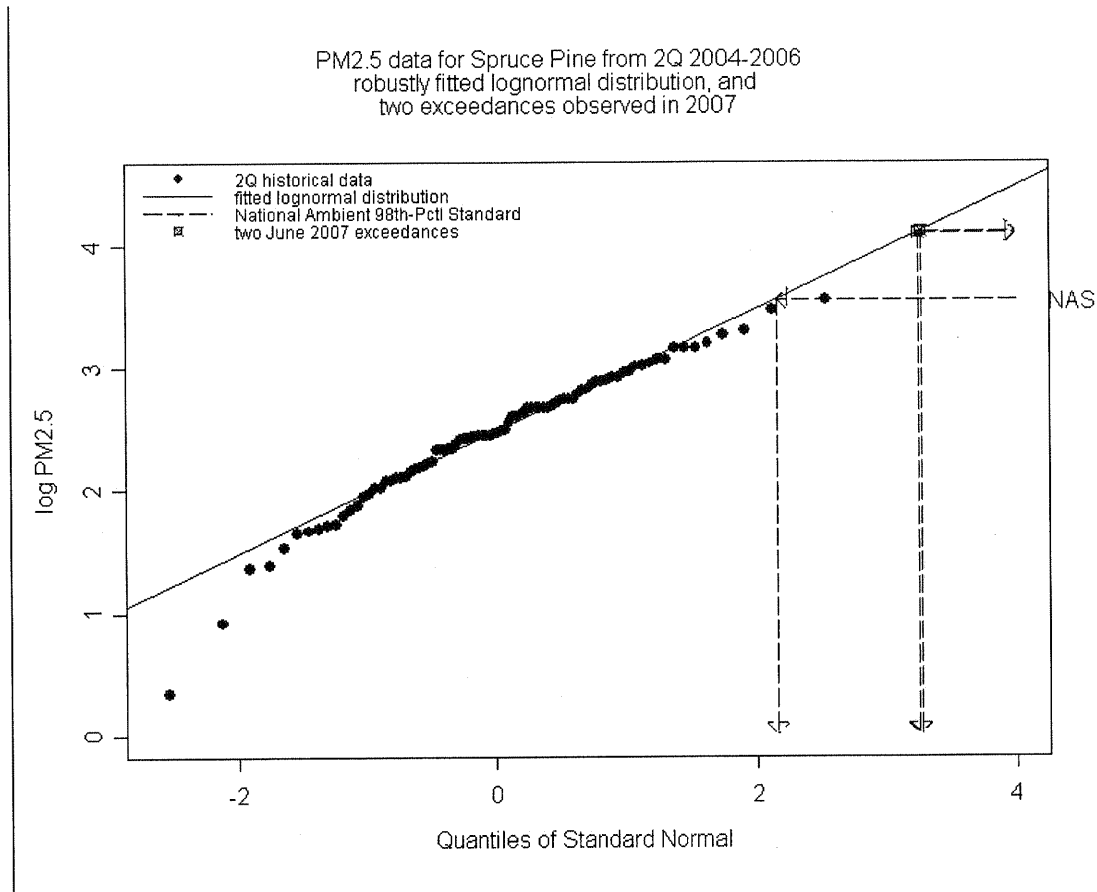


Figure 3.2 - shows "normal historical fluctuations" of PM2.5 data for the Spruce Pine monitoring station during the second calendar quarter in the form of a lognormal distribution quantile plot. Particulate pollution data are often well approximated by lognormal distributions. This graph shows the natural logarithms of the historical data (in  $\log\text{-}\mu\text{g}/\text{m}^3$  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 11 June 2007 exceedance ( $y=4.10$ ) 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 1.55 percent (2.16 standard deviations greater than the lognormal mean value), and the expected probability of "unexceptional data" exceeding either of the level observed on 11 June 2007 is less than 0.6 percent (more than 3.25 standard deviations greater than the lognormal mean value).

The estimated parameters of the lognormal approximation are:

- median PM2.5 = 11.92
- mean PM2.5 = 13.50
- 98th pctl PM2.5 = 33.23

#### IV. “But For” Test: There would have been no exceedance or violation “but for” the event

-Executive summary-

To demonstrate that the wildfires at Dobson Knob and Shortoff Mountain caused an exceedance of the daily fine particle standard of 35 micrograms per cubic meter at the Spruce Pine monitor on June 11, 2007, we need to find a way to either estimate (1) what the fine particle concentration value would have been on June 11, 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 Spruce Pine monitor on June 11, 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 Spruce Pine on June 11, 2007, we opted to develop a model using meteorological measurements to estimate what the fine particle concentration value would have been on June 11, 2007 at Spruce Pine 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 Spruce Pine on June 11, 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 Spruce Pine on June 11, 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 Spruce Pine on June 11, 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 30.8 micrograms per cubic meter would have occurred at Spruce Pine on 6/11/2007. Thus, without the nearby wildfires, there is less than 1 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 60.6 micrograms per cubic meter, which exceeded the daily fine particle standard, would not have occurred at Spruce Pine if there had not been wildfires at Dobson Knob and Shortoff Mountain on June 11, 2007.

-Data description-

For each day in the 2nd quarter (2Q) of 2004, 2005, 2006 and 2007 on which there was a valid fine particle (PM<sub>2.5</sub>) concentration I acquired the following meteorological data to model the PM<sub>2.5</sub> concentrations:

AT daily mean ambient temperature at the PM<sub>2.5</sub> monitoring station  
RH daily mean relative humidity at the PM<sub>2.5</sub> monitoring station

WS24 daily arithmetic mean wind speed at NGRF, the United States Forest Service (USFS) met station at Grandfather [Mountain], NC.

VWD24 daily vector average wind direction at NGRF

WG24 daily mean wind gust speeds at NGRF

RN24 daily total precipitation at NGRF

RN24.lag1 previous day total precipitation at NGRF

-Linear Models-

WG24 was not available for 2Q2004, so I made two models:

- 1- use all 4 years of data, but do not fit WG24 in the model
- 2- use only 2005, 2006 and 2007 data and do fit WG24 in the model

-Method of analysis-

-1- Define a covariate for each 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 06/11/2007 (actual concentration 60.6), and PM.e2 is the covariate for 06/14/2007 (actual concentration 61.0)

-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 if there is an exceptional event

-3- Fit linear models as defined in each model below. The coefficients associated with PM.e1 and PM.e2 are estimates of the expected concentrations that would have occurred if there had not been an exceptional event.

-4- Results

-4.1- Model 1 using 2004 data and not fitting WG24

Call: aov(formula = PM2.5 ~ AT + RH + WS24 + VWD24 + RN24 + RN24.lag1 + PM.e1 + PM.e2, data = SPtest.df, na.action = na.exclude)

Minimum	1 <sup>st</sup> Quartile	Median	3 <sup>rd</sup> Quartile	Maximum
-17.16	-3.119	-1.164e-016	1.741	20.42

	Value	Standard. Error	t value	Probability (> t )
--	-------	-----------------	---------	--------------------

(Intercept)	-239.3077	86.3132	-2.7725	0.0066
AT	0.4420	0.1229	3.5960	0.0005
RH	0.3529	0.1232	2.8638	0.0051
WS24	-0.5368	0.4161	-1.2901	0.1999
VWD24	0.0005	0.0053	0.1042	0.9172
RN24	-0.8898	1.1647	-0.7640	0.4466
RN24.lag1	-3.0699	1.6378	-1.8744	0.0637
PM.e1	15.3187	5.4003	2.8366	0.0055
PM.e2	10.2719	5.6221	1.8271	0.0706

Residual standard error: 5.298 on 104 degrees of freedom

Multiple R-Squared: 0.3746

F-statistic: 7.786 on 8 and 104 degrees of freedom, the p-value is 3.82e-008

-4.2- Model 2 not using 2004 data and fitting WG24

Call: aov(formula = PM2.5 ~ AT + RH + WS24 + VWD24 + RN24 + RN24.lag1 + WG24 + PM.e1 + PM.e2, data = SPtest.df, na.action = na.exclude)

Minimum	1 <sup>st</sup> Quartile	Median	3 <sup>rd</sup> Quartile	Maximum
-17.93	-3.692	0.006094	2.776	17.43

	Value	Standard. Error	t value	Probability (> t )
(Intercept)	-204.4483	101.6507	-2.0113	0.0479
AT	0.5755	0.1585	3.6319	0.0005
RH	0.3051	0.1443	2.1141	0.0379
WS24	4.3237	2.6302	1.6438	0.1045
VWD24	-0.0064	0.0079	-0.8098	0.4207
RN24	-0.5393	1.2784	-0.4219	0.6743
RN24.lag1	-3.8925	2.0356	-1.9122	0.0597
WG24	-1.8495	0.9000	-2.0550	0.0434
PM.e1	17.4130	5.7316	3.0381	0.0033
PM.e2	9.2996	6.0477	1.5377	0.1284

Residual standard error: 5.567 on 74 degrees of freedom

Multiple R-Squared: 0.4317

F-statistic: 6.247 on 9 and 74 degrees of freedom, the p-value is 1.615e-006

29 observations deleted due to missing values

-5- Discussion

Both of the linear models explain less than half 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 in the context of normal approximations. The expected values are as shown in the Coefficients tables, and  $2.33 \times$  Std. Error defines a 99-percent upper bound under the observed uncertainty.

This means that "but for the exceptional events":

-5.1- under model 1 there is less than 1 percent probability that the concentrations would exceed:

$$\text{PM.e1} = 15.3187 + 5.4003 \times 2.33 = 27.90141 = 27.9$$

$$\text{PM.e2} = 10.2719 + 5.6221 \times 2.33 = 23.37141 = 23.4$$

-5.2- under model 2 there is less than 1 percent probability that the concentrations would exceed:

$$\text{PM.e1} = 17.4130 + 5.7316 \times 2.33 = 30.76764 = 30.8$$

$$\text{PM.e2} = 9.2996 + 6.0477 \times 2.33 = 23.39077 = 23.4$$





### Dobson Knob

Nebo NC

US

#### Notes:

Dobson Knob

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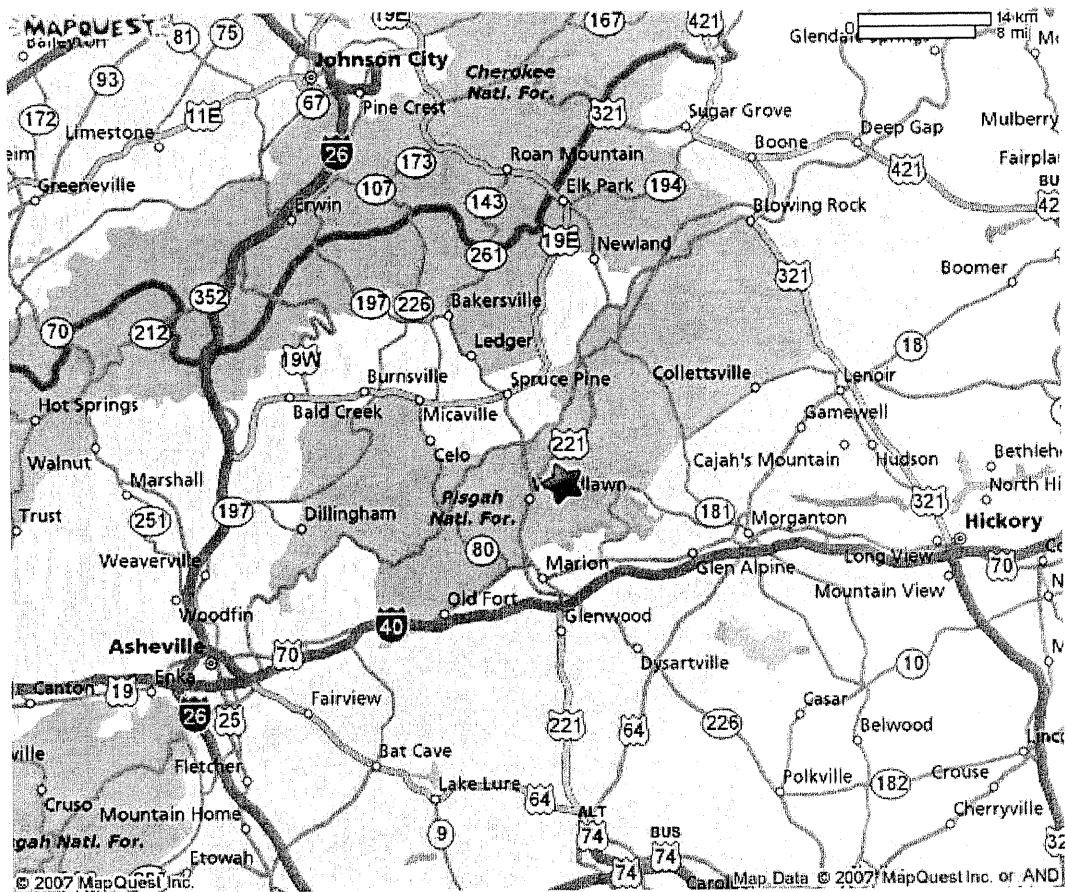
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**Shortoff Mountain**  
Morganton NC  
US

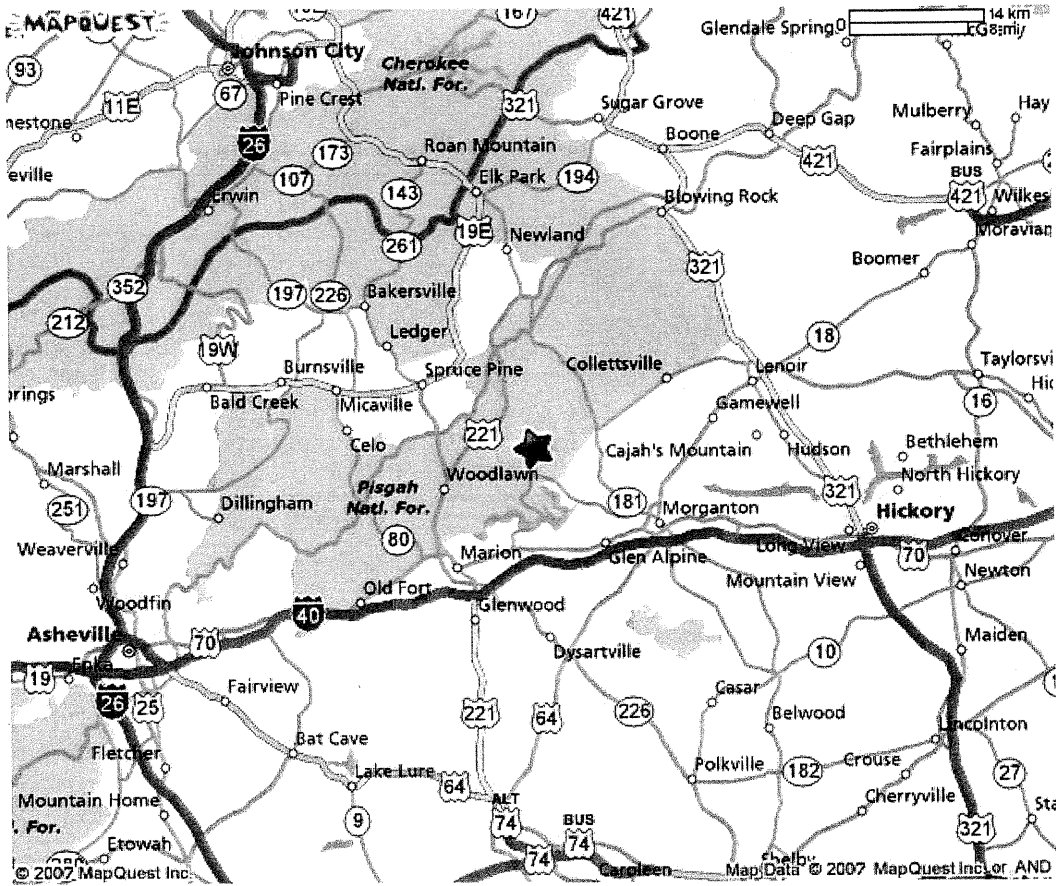
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Live Search



15

STATE CLIMATE OFFICE OF NORTH CAROLINA  
 NC CRONOS Database

Data retrieval from NGRF - Grandfather for 2007-06-10 thru 2007-06-15 (6 days)  
 142 records for this period of record (98.6% data available; 2 missing records)

Latitude: 35.76° Longitude: -82.04°

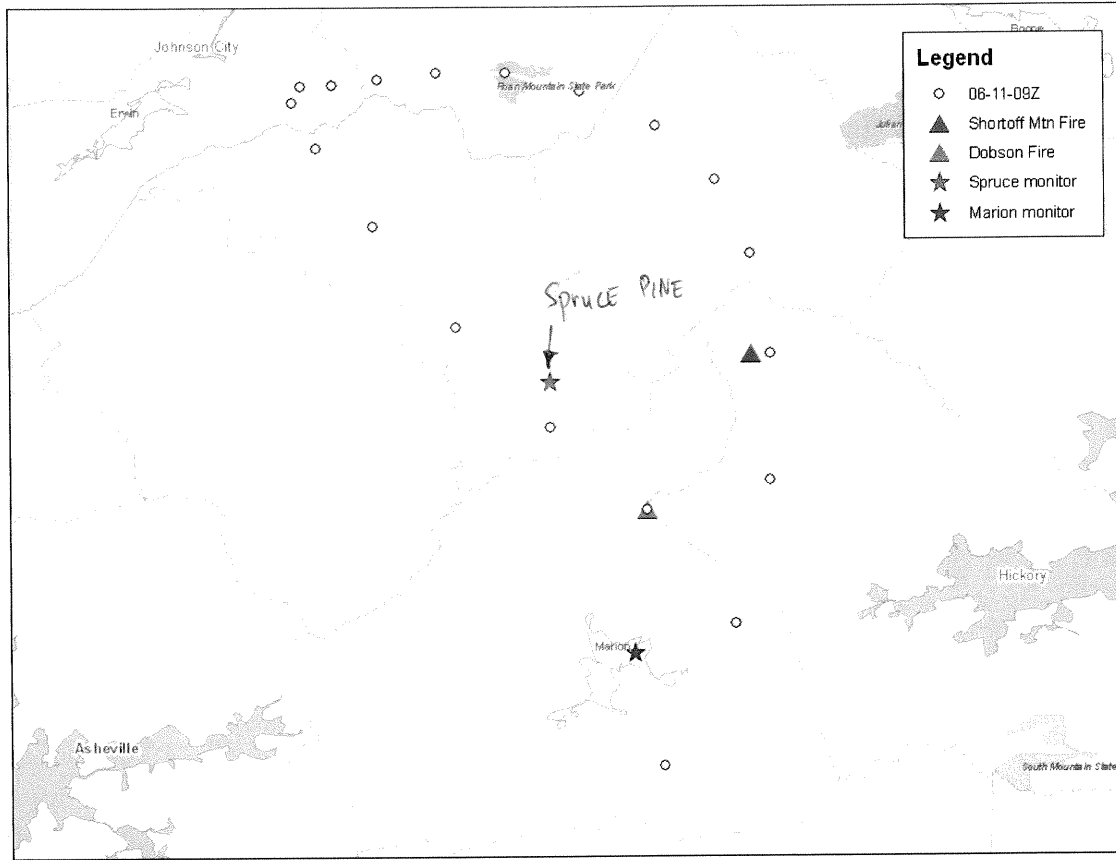
Date/Time (EST)	6.1m Wind Speed (10 min avg) (mph)	6.1m Wind Direction (10 min avg)	6.1m Wind Gusts (mph)
6/10/2007 0:00	2.9	West Southwest (254°)	8
6/10/2007 1:00	2	South Southwest (208°)	6
6/10/2007 2:00	2	South Southwest (203°)	7
6/10/2007 3:00	2	South Southwest (200°)	4
6/10/2007 4:00	2	South (186°)	6
6/10/2007 5:00	2	South Southwest (202°)	6
6/10/2007 6:00	0.9	South (189°)	7
6/10/2007 7:00	0.9	South Southeast (156°)	4
6/10/2007 8:00	2	South Southwest (206°)	3
6/10/2007 9:00	2.9	North (354°)	6
6/10/2007 10:00	4	Northwest (305°)	10
6/10/2007 11:00	4	Northwest (324°)	10
6/10/2007 12:00	2.9	West (270°)	10
6/10/2007 13:00	2	Northeast (48°)	6
6/10/2007 14:00	4	West Northwest (287°)	7
6/10/2007 15:00	2.9	North Northwest (334°)	7
6/10/2007 16:00	2.9	Northwest (322°)	8
6/10/2007 17:00	2.9	West Northwest (298°)	7
6/10/2007 18:00	0.9	East Southeast (105°)	5
6/10/2007 19:00	0.9	South (189°)	4
6/10/2007 20:00	0.9	South (182°)	3
6/10/2007 21:00	0.9	East Southeast (102°)	4
6/10/2007 22:00	0.9	South Southeast (160°)	3
6/10/2007 23:00	0.9	South (179°)	3
6/11/2007 0:00	0.9	South (188°)	2
6/11/2007 1:00	0.9	Northwest (319°)	2
6/11/2007 2:00	0.9	South Southwest (195°)	3
6/11/2007 3:00	0	South Southeast (165°)	2
6/11/2007 4:00	0.9	South Southeast (147°)	2
6/11/2007 5:00	0	South (181°)	1
6/11/2007 6:00	0	West Northwest (294°)	1
6/11/2007 7:00	2	Northeast (52°)	3
6/11/2007 8:00	2.9	Northwest (312°)	7
6/11/2007 9:00	0	East Northeast (61°)	6
6/11/2007 10:00	2	North (353°)	5
6/11/2007 11:00	2	North Northwest (338°)	4
6/11/2007 12:00	2	Northwest (315°)	6
6/11/2007 13:00	2	West Northwest (299°)	9
6/11/2007 14:00	2	East Northeast (70°)	6
6/11/2007 15:00	2	Northeast (49°)	5
6/11/2007 16:00	2	North (357°)	5
6/11/2007 17:00	0.9	North (2°)	3
6/11/2007 18:00	0.9	North (6°)	3
6/11/2007 19:00	0	Northwest (310°)	3
6/11/2007 20:00	2	North Northwest (331°)	5
6/11/2007 21:00	0.9	North Northwest (345°)	4
6/11/2007 22:00	0.9	North Northwest (344°)	2
6/11/2007 23:00	0.9	North (10°)	7
6/12/2007 0:00	0.9	North Northeast (26°)	5
6/12/2007 1:00	0	West Northwest (296°)	3
6/12/2007 2:00	0	West (278°)	3
6/12/2007 3:00	0.9	Southeast (126°)	2
6/12/2007 4:00	2	South Southeast (149°)	5
6/12/2007 5:00	0.9	East (95°)	4

**Time Conversion Table**

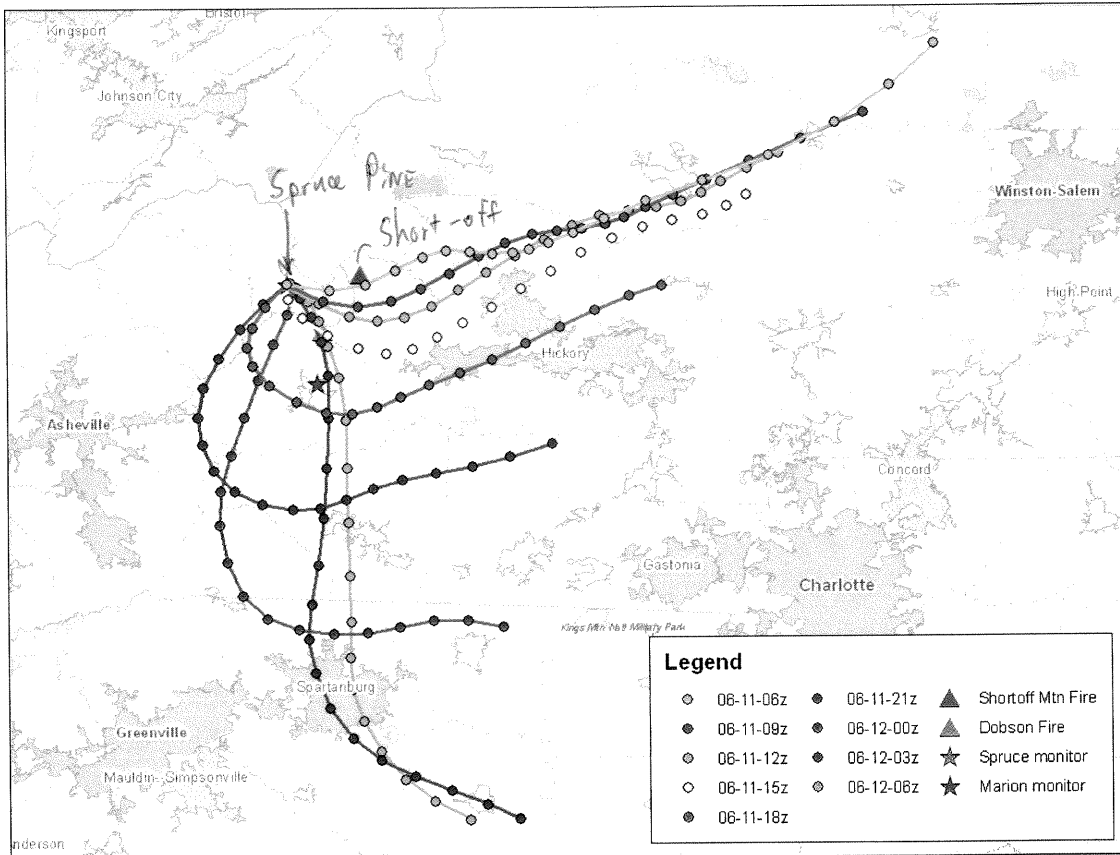
Z Time (UTC)	Pacific Standard Time	Mountain Standard Time	Central Standard Time	Eastern Standard Time
00Z	4:00 PM	5:00 PM	6:00 PM	7:00 PM
03Z	7:00 PM	8:00 PM	9:00 PM	10:00 PM
06Z	10:00 PM	11:00 PM	12:00 AM	1:00 AM
09Z	1:00 AM	2:00 AM	3:00 AM	4:00 AM
12Z	4:00 AM	5:00 AM	6:00 AM	7:00 AM
15Z	7:00 AM	8:00 AM	9:00 AM	10:00 AM
18Z	10:00 AM	11:00 AM	12:00 PM	1:00 PM
21Z	1:00 PM	2:00 PM	3:00 PM	4:00 PM

Z Time (UTC)	Pacific Daylight Savings Time	Mountain Daylight Savings Time	Central Daylight Savings Time	Eastern Daylight Savings Time
00Z	5:00 PM	6:00 PM	7:00 PM	8:00 PM
03Z	8:00 PM	9:00 PM	10:00 PM	11:00 PM
06Z	11:00 PM	12:00 AM	1:00 AM	2:00 AM
09Z	2:00 AM	3:00 AM	4:00 AM	5:00 AM
12Z	5:00 AM	6:00 AM	7:00 AM	8:00 AM
15Z	8:00 AM	9:00 AM	10:00 AM	11:00 AM
18Z	11:00 AM	12:00 PM	1:00 PM	2:00 PM
21Z	2:00 PM	3:00 PM	4:00 PM	5:00 PM

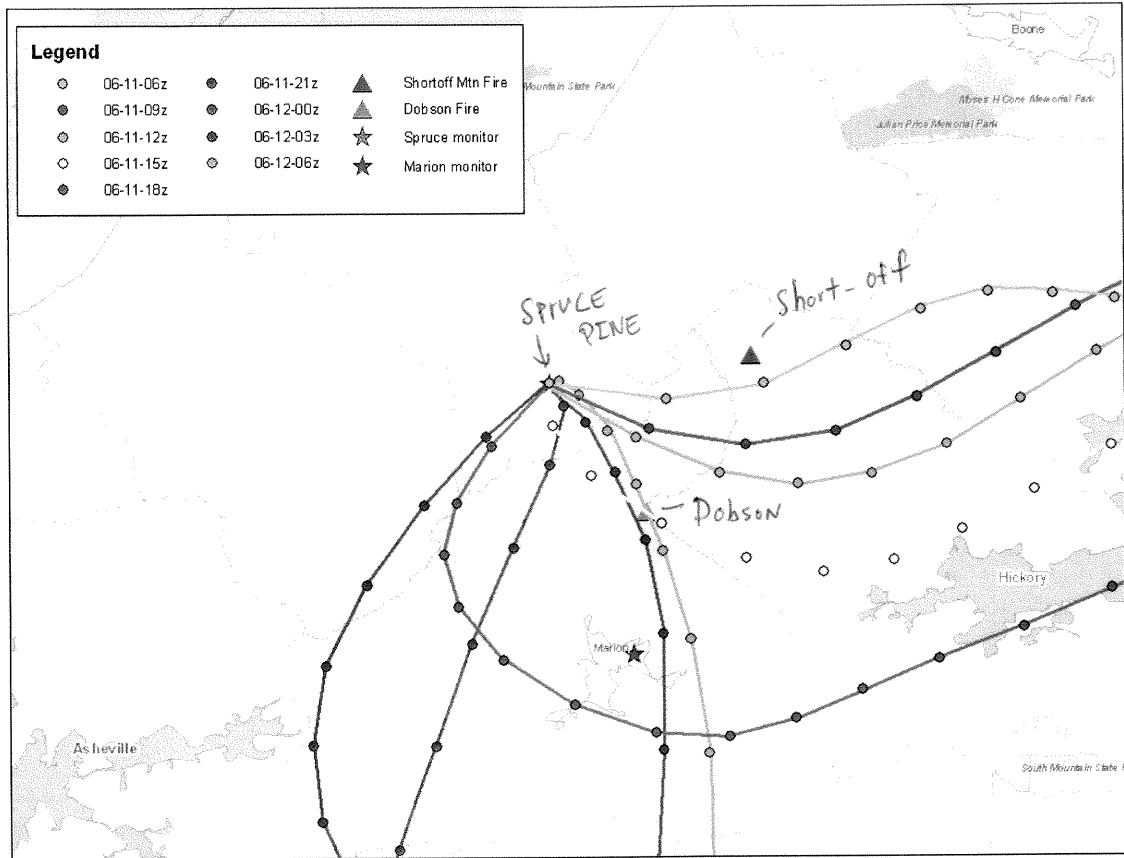
History of "Z-time" (UTC,GMT,etc) by Harold Maybeck



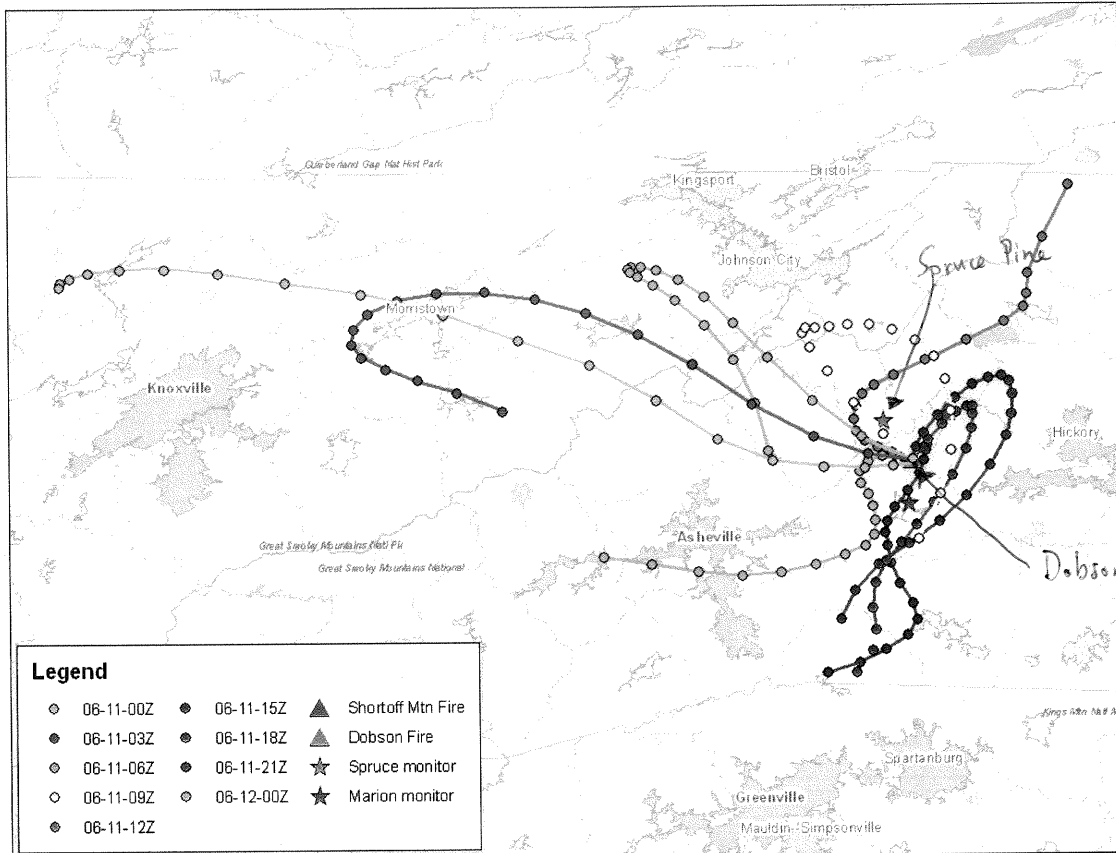
Spatial relationship between the Spruce Pine and Marion monitoring stations to the Dobson and Short off wildfires. Yellow line is one of many forward trajectories (at 100m height) from the Dobson fire.



HYSPLIT back trajectories (50m) on 6-11-07 indicate that air parcels passed through the fires and smoke before reaching the Spruce monitor.

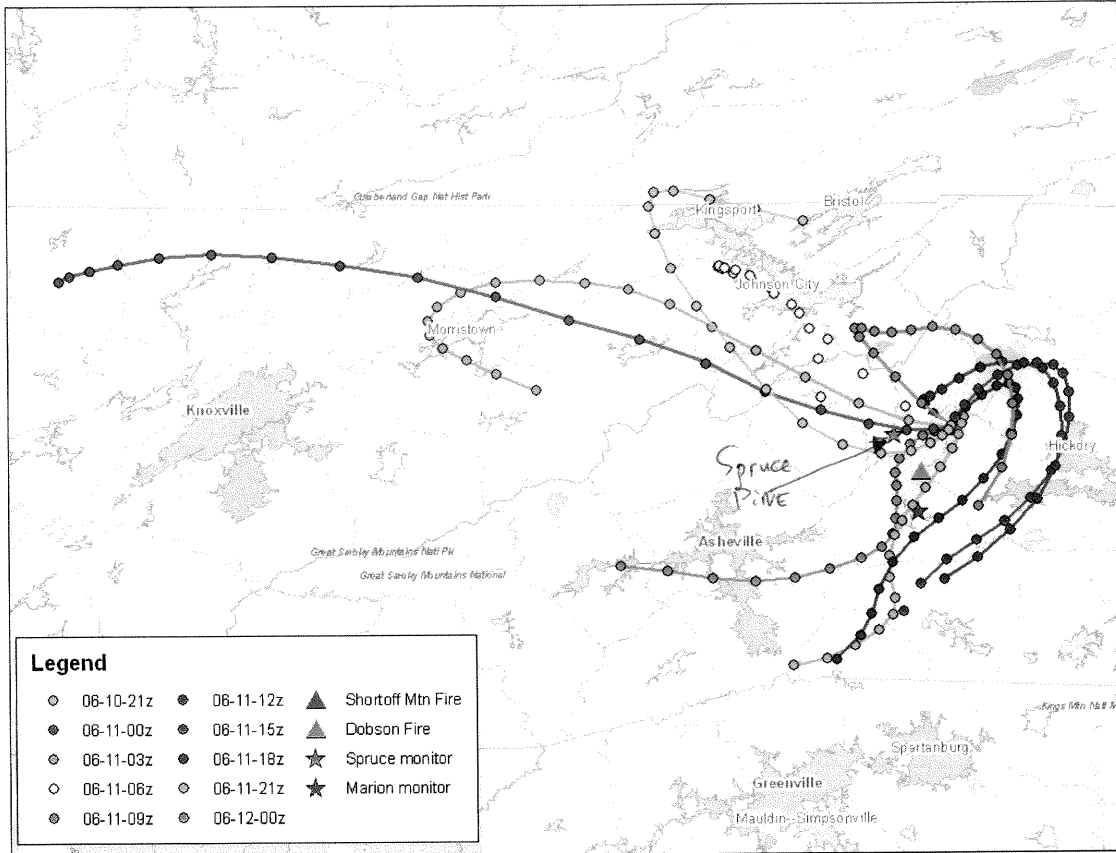


A zoomed version of the back trajectories on 6-11-07 at the Spruce Monitor.

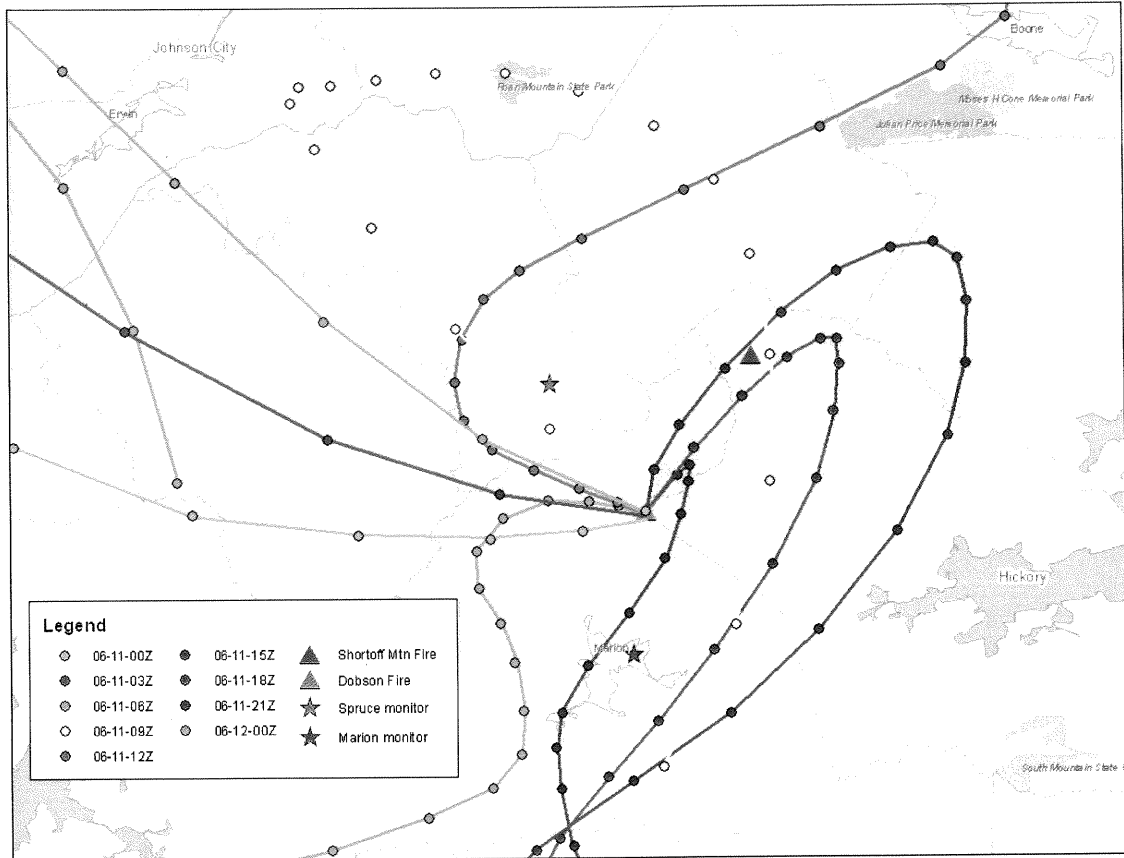


Several Dobson fire forward trajectories impacted the Spruce monitor with smoke on 6-11-07.

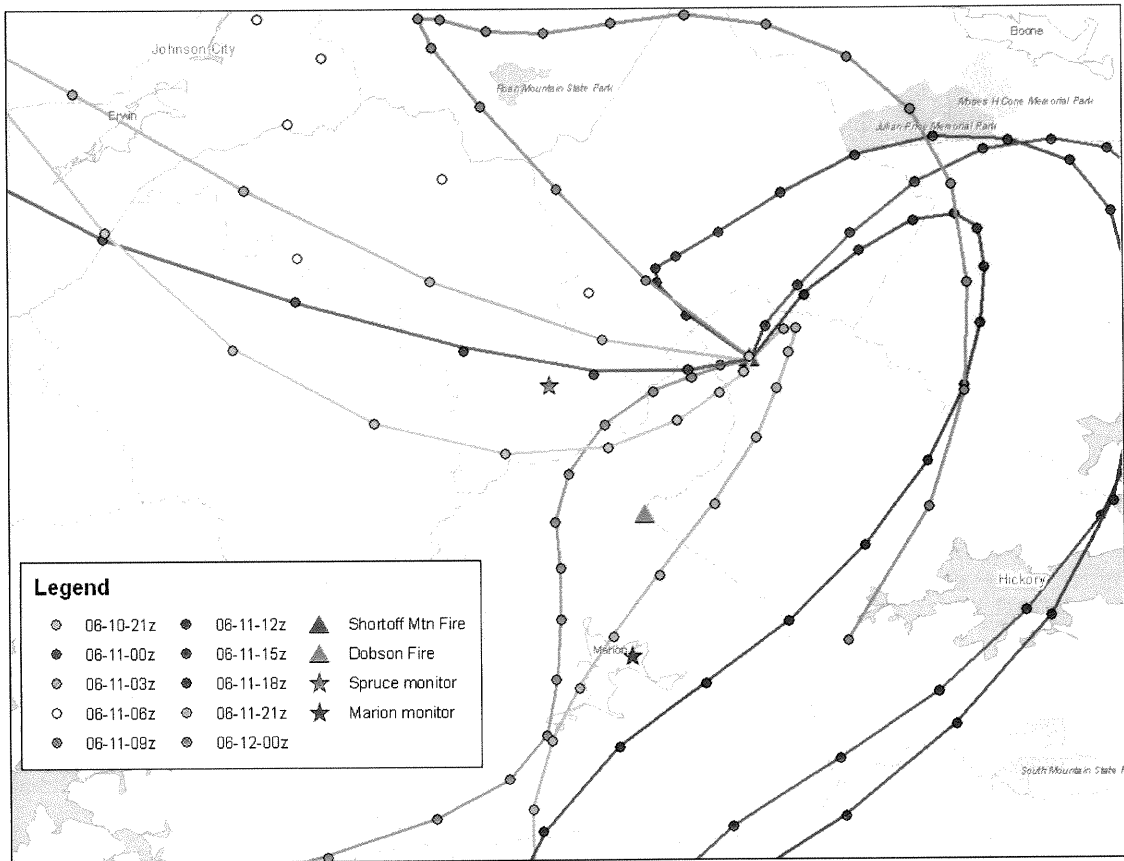




Several Short off fire forward trajectories impacted the Spruce monitor with smoke on 6-11-07.

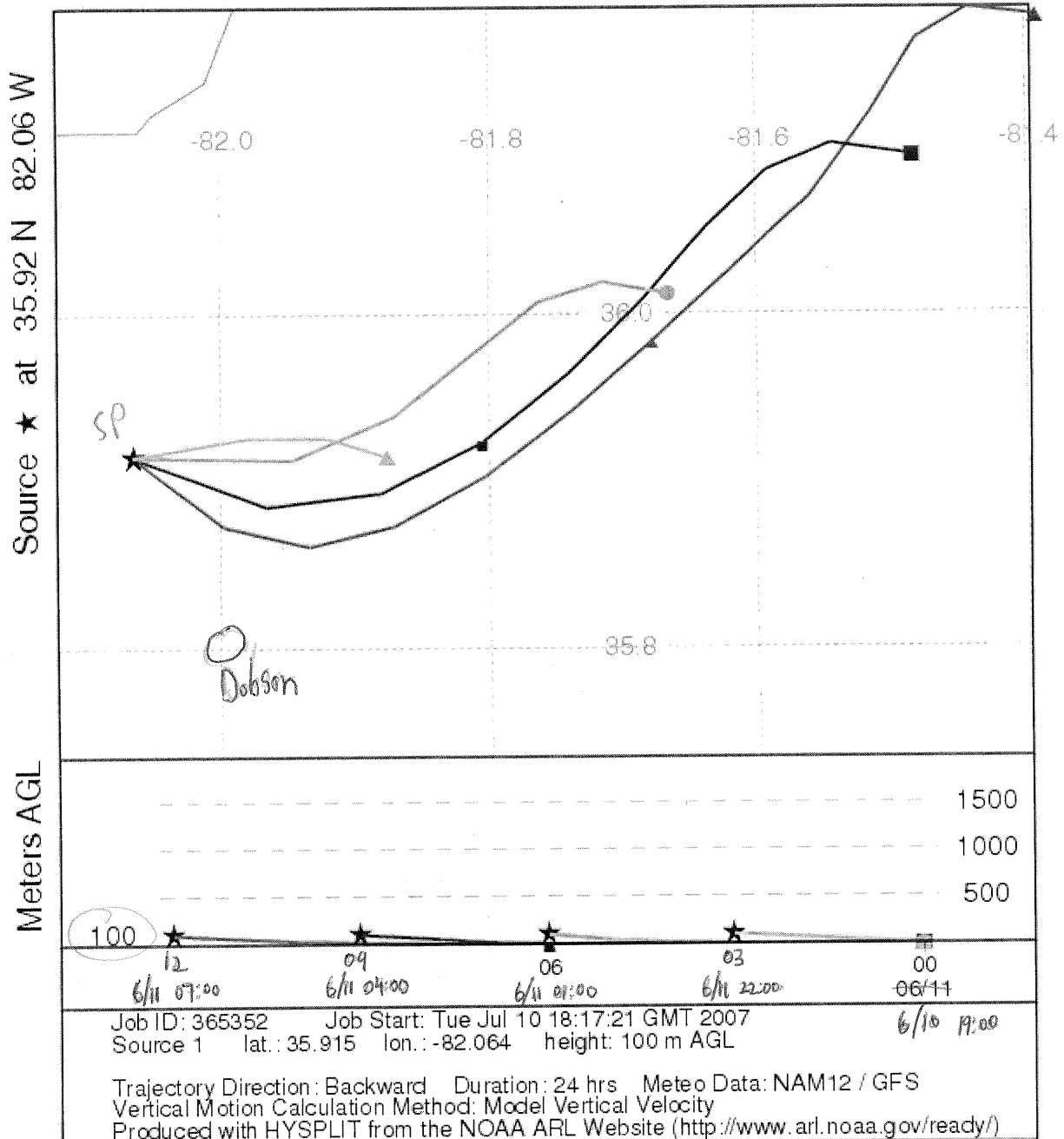


A zoomed version of the Dobson forward trajectories on 6-11-07.



A zoomed version of the Shortoff forward trajectories on 6-11-07.

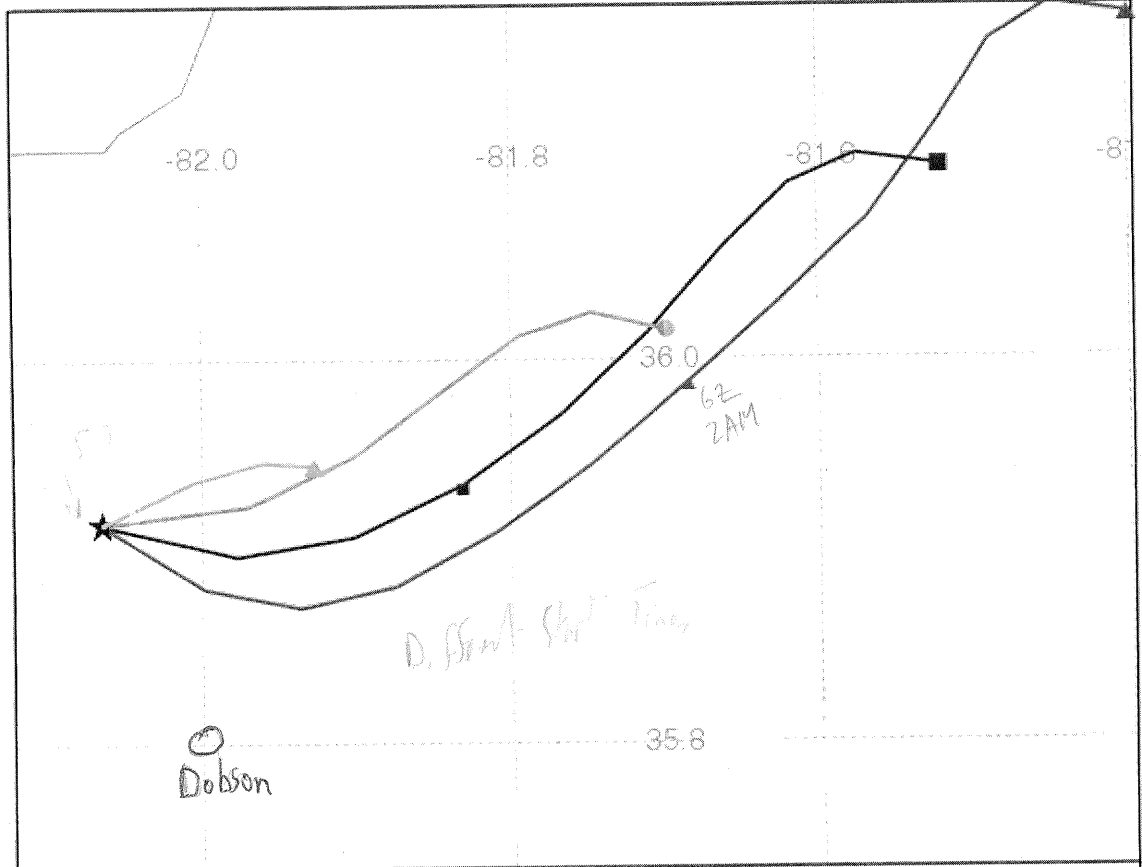
NOAA HYSPLIT MODEL  
 Backward trajectories ending at 12 UTC 11 Jun 07  
 NAM Meteorological Data



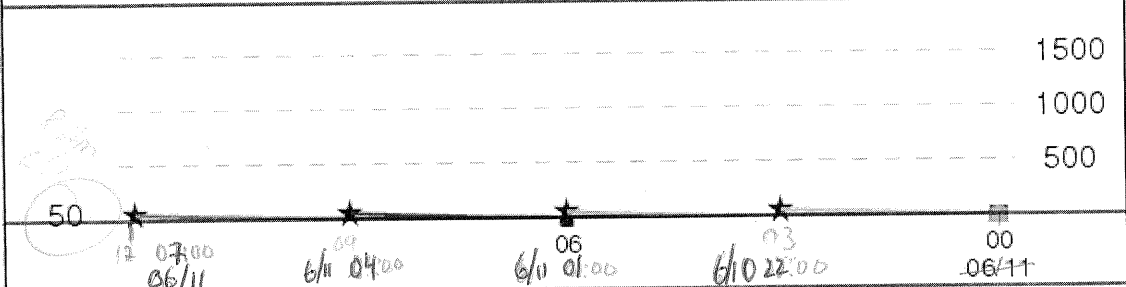
NOAA HYSPLIT MODEL  
 Backward trajectories ending at 12 UTC 11 Jun 07  
 NAM Meteorological Data

03  
 9 PM Jun 10

Source ★ at 35.92 N 82.06 W



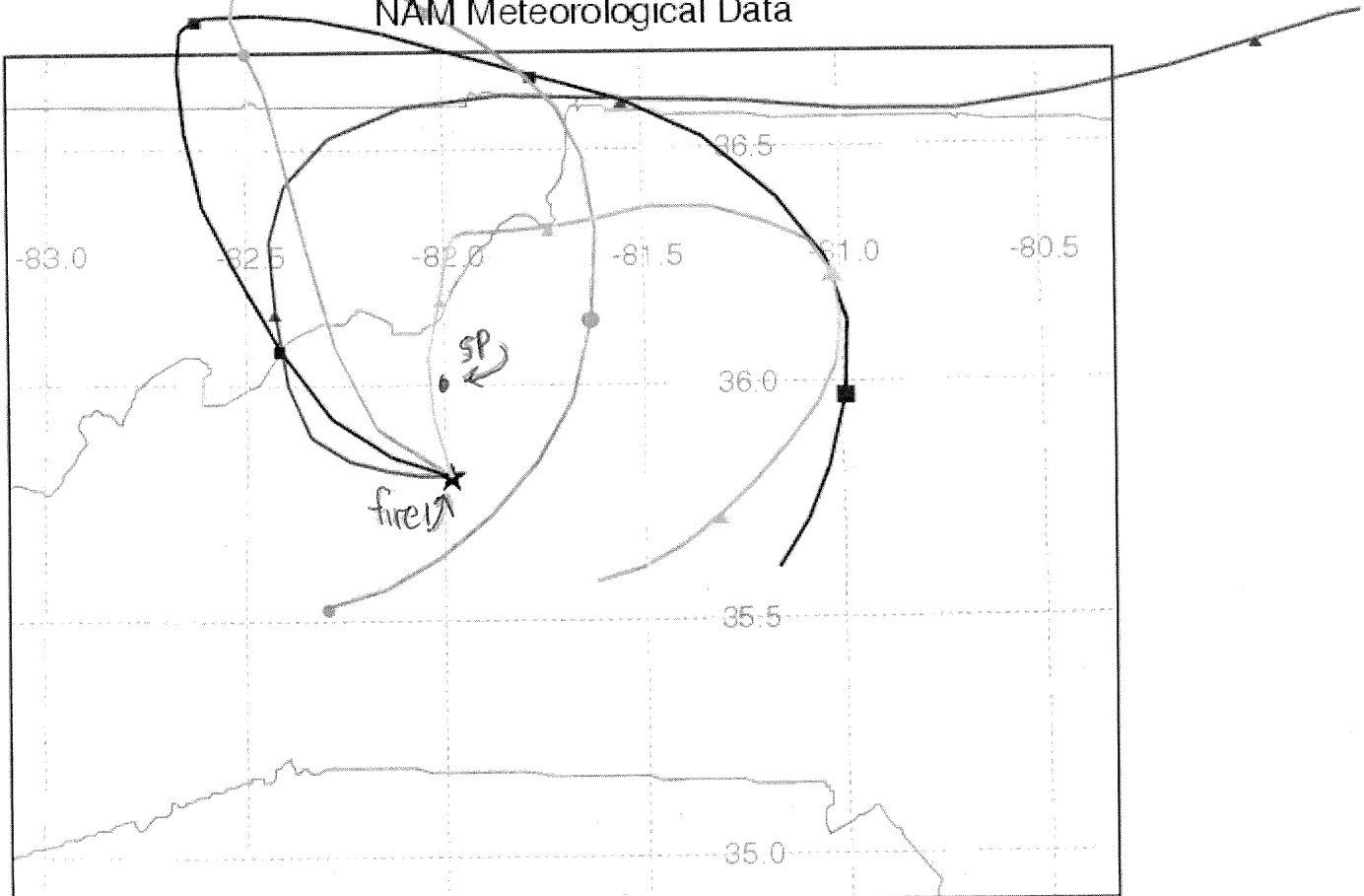
Meters AGL



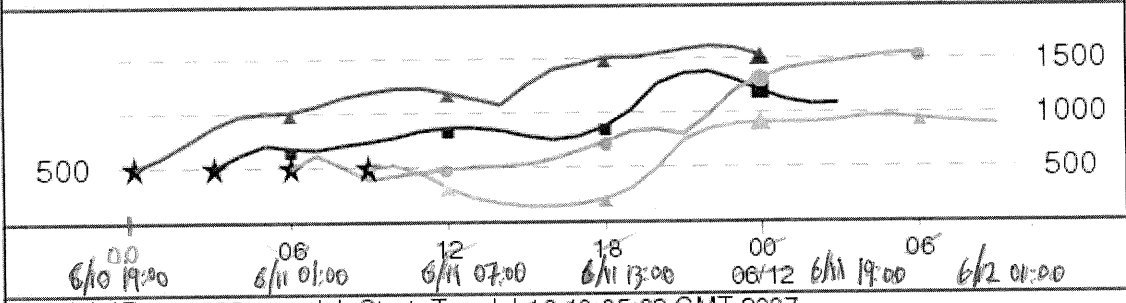
Job ID: 365363    Job Start: Tue Jul 10 18:18:33 GMT 2007  
 Source 1    lat.: 35.915    lon.: -82.064    height: 50 m AGL  
 Trajectory Direction: Backward    Duration: 24 hrs    Meteo Data: NAM12 / GFS  
 Vertical Motion Calculation Method: Model Vertical Velocity  
 Produced with HYSPLIT from the NOAA ARL Website (<http://www.arl.noaa.gov/ready/>)

NOAA HYSPLIT MODEL  
 Forward trajectories starting at 00 UTC 11 Jun 07  
 NAM Meteorological Data

Source ★ at 35.81 N 81.98 W



Meters AGL



00 06 12 18 00 06  
 6/11 19:00 6/11 01:00 6/11 07:00 6/11 13:00 06/12 01:00 6/12 07:00

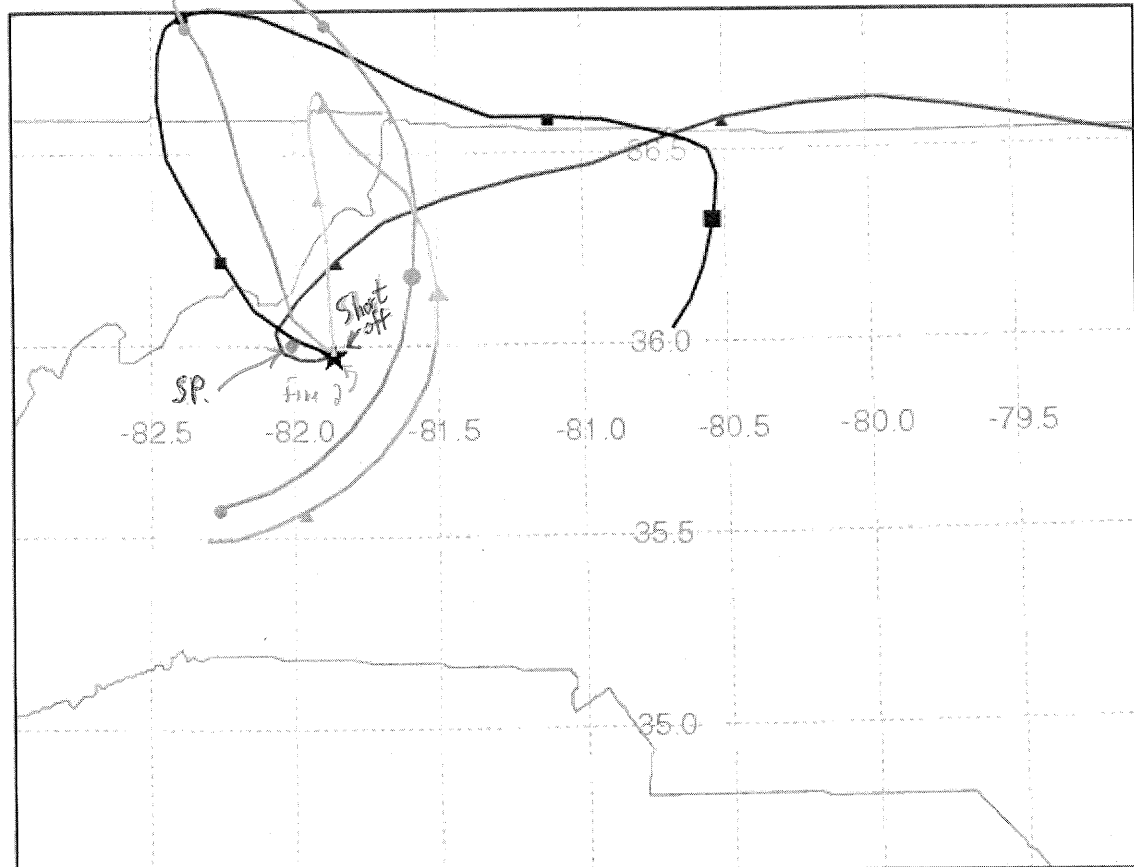
Job ID: 365325 Job Start: Tue Jul 10 18:05:02 GMT 2007  
 Source 1 lat.: 35.806 lon.: -81.983 height: 500 m AGL

Trajectory Direction: Forward Duration: 24 hrs Meteo Data: NAM12 / GFS  
 Vertical Motion Calculation Method: Model Vertical Velocity  
 Produced with HYSPLIT from the NOAA ARL Website (<http://www.arl.noaa.gov/ready/>)

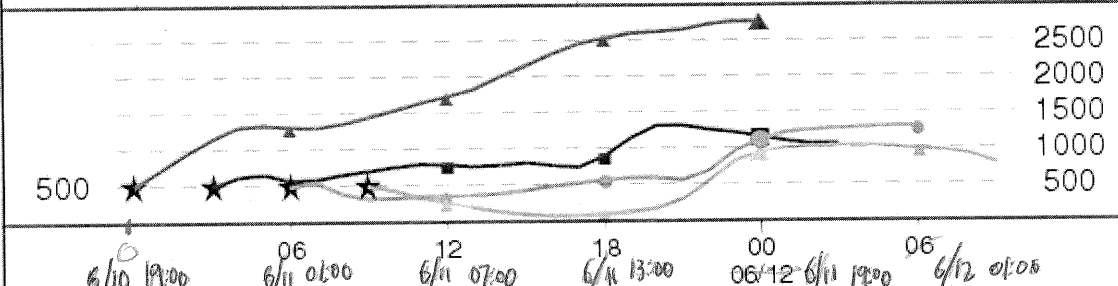
Fire 1

NOAA HYSPLIT MODEL  
 Forward trajectories starting at 00 UTC 11 Jun 07  
 NAM Meteorological Data

Source ★ at 35.98 N 81.86 W



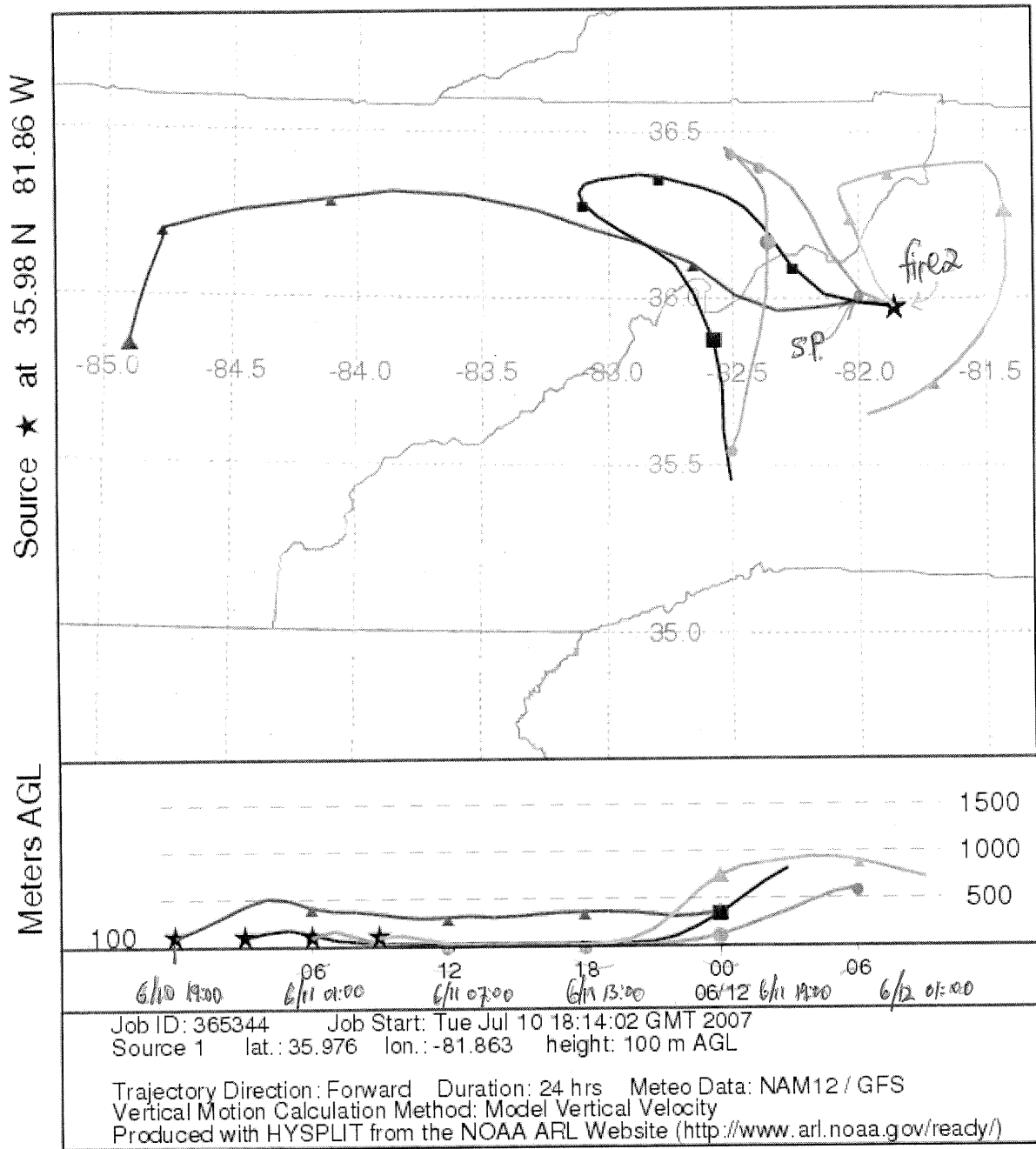
Meters AGL



Job ID: 365337 Job Start: Tue Jul 10 18:09:13 GMT 2007  
 Source 1 lat.: 35.976 lon.: -81.863 height: 500 m AGL  
 Trajectory Direction: Forward Duration: 24 hrs Meteo Data: NAM12 / GFS  
 Vertical Motion Calculation Method: Model Vertical Velocity  
 Produced with HYSPLIT from the NOAA ARL Website (<http://www.arl.noaa.gov/ready/>)

*Handwritten:* FIRE 2 Shot off

NOAA HYSPLIT MODEL  
 Forward trajectories starting at 00 UTC 11 Jun 07  
 NAM Meteorological Data

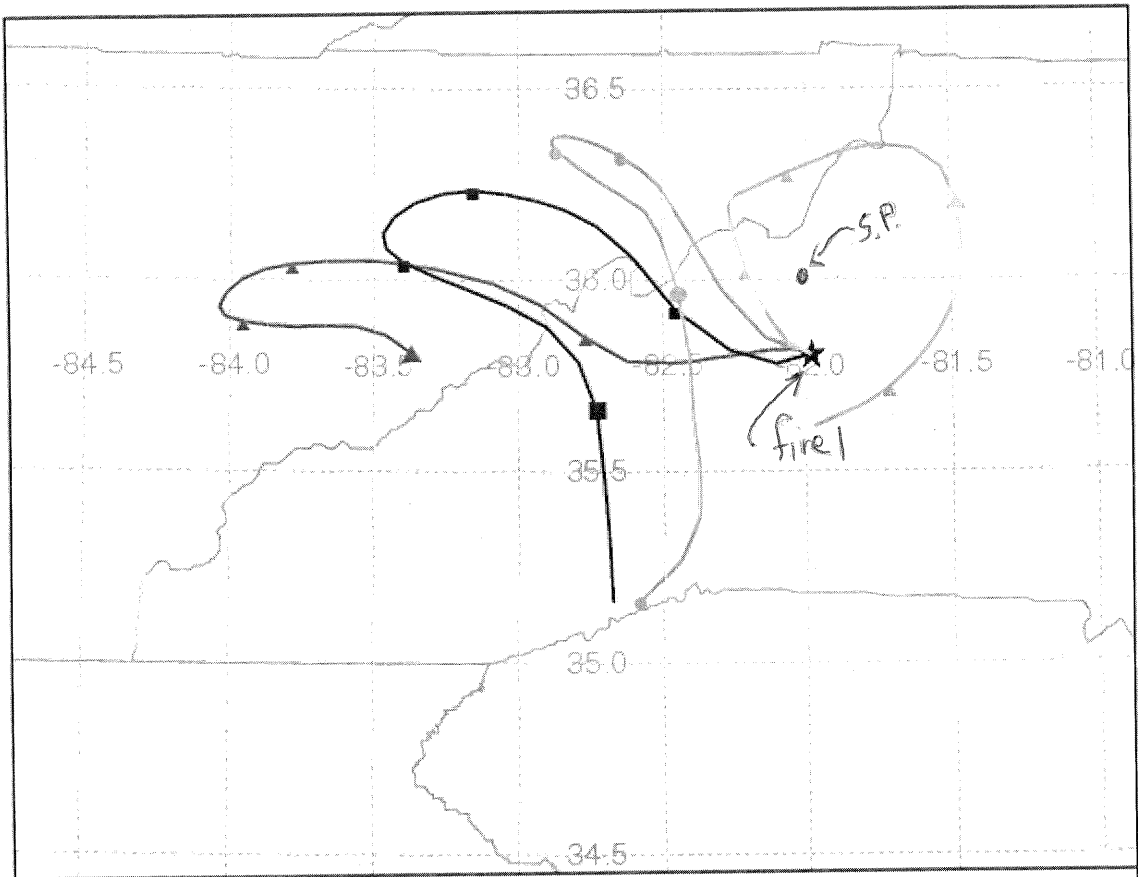


FIRE 2

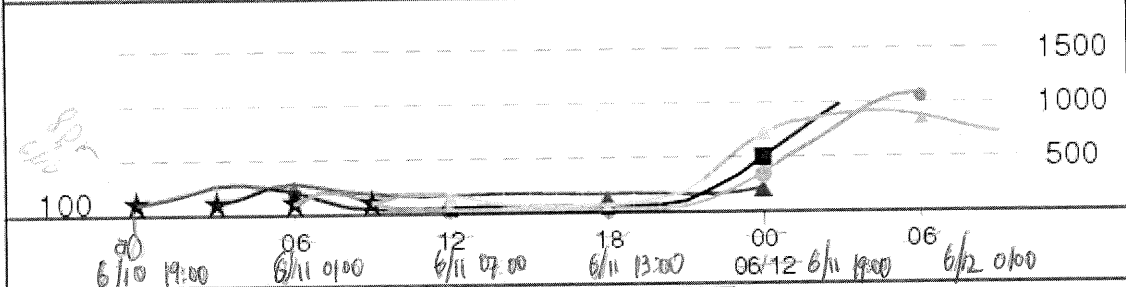


NOAA HYSPLIT MODEL  
 Forward trajectories starting at 00 UTC 11 Jun 07  
 NAM Meteorological Data

Source ★ at 35.81 N 81.98 W



Meters AGL



Job ID: 365291 Job Start: Tue Jul 10 17:52:26 GMT 2007  
 Source 1 lat.: 35.806 lon.: -81.983 height: 100 m AGL  
 Trajectory Direction: Forward Duration: 24 hrs Meteo Data: NAM12 / GFS  
 Vertical Motion Calculation Method: Model Vertical Velocity  
 Produced with HYSPLIT from the NOAA ARL Website (<http://www.arl.noaa.gov/ready/>)

fire 1

FIG 4.5 F K M CONCENTRATIONS ug/ml

Site ID1	371730002	371110004	371110004	371110004	371210001	371210001	371210001	370870010
Site ID2	109	105	106	107	108	103		
Region	ARO	ARO	ARO	ARO	ARO	ARO	ARO	ARO
Site	BY	MJ	MJ	SP	SP	WV		
06/02/2007	24.96	17.46	8.03	15.71	21.58			
06/05/2007	7.46	7.96	8.03	7.79	8.46			
06/08/2007	10.17	12.21	30.38	11.83	8.87			
06/11/2007	23.83	28.46	30.38	60.58	26.79			
06/13/2007	15.12	32.50		61.04	11.21			
06/14/2007	15.12	17.17		17.75	23.29			
06/17/2007	19.21	25.79	23.89	10.08	8.67			
06/20/2007	7.62	10.08	22.01	17.67	15.96			
06/23/2007	17.13		15.06	13.62	17.92			
06/26/2007	15.58	14.71		14.71	18.42			
06/29/2007	16.13	16.62						
Average	15.72	18.30	19.87	23.08	16.12			

TABLE 4.3 FKIWI CONCENTRATIONS ug/ml

Site_ID1	370710016	370710016	370350004	370350006	370250004	370350005	371590021
Site_ID2	306	307	311	301	309	313	
Region	MRO	MRO	MRO	MRO	MRO	MRO	
Site	GM	HC	HU	KA	RS	UR	
06/01/2007		27.70					7.04
06/02/2007	9.62	11.75					
06/03/2007		5.29					
06/04/2007		11.21					9.04
06/05/2007		8.25					
06/06/2007		9.96					
06/07/2007		12.67					15.21
06/08/2007	12.97	9.71					
06/09/2007		17.92					17.92
06/10/2007	17.66	25.08					
06/11/2007		22.17					
06/12/2007		13.33					14.92
06/13/2007		14.38					
06/14/2007	12.97	14.81					
06/15/2007		21.83					25.83
06/16/2007		25.12					
06/17/2007	23.64	27.17					
06/18/2007		26.21					
06/19/2007		11.46					13.38
06/20/2007	11.13	15.21					
06/21/2007		21.46					
06/22/2007		20.00					17.00
06/23/2007	18.12	24.96					
06/24/2007		24.92					
06/25/2007		17.33					24.13
06/26/2007	18.24	26.92					
06/27/2007		20.63					
06/28/2007		17.58					15.29
06/29/2007	13.72	11.83					
06/30/2007							
Average	15.34	17.82					15.98



From 25 Post

NC1	MARION 371E-08 6/15/2007	155	78	32	55	71	8	59	76	104	101	152	17	206	266	53	-16	-16	92	123	146	16	20	213	206	266	11,625	-16	266
NC1	HICKORY 371E-08 6/15/2007	163	157	122	112	114	119	121	132	147	147	152	31	223	23	205	166	162	186	175	218	203	199	206	213	206	266	11,625	266
NC1	MARION 371E-08 6/16/2007	168	141	125	117	147	148	145	152	157	167	184	198	202	224	224	226	272	248	263	236	239	267	292	296	296	21,629	117	331
NC1	MARION 371E-08 6/16/2007	313	305	308	312	308	303	302	315	277	249	237	218	21	207	218	229	233	236	231	253	258	301	29	27	333	26,894	208	323
NC1	HICKORY 371E-08 6/17/2007	297	358	308	274	266	272	302	318	323	259	282	21	228	183	203	229	233	236	238	248	258	268	271	271	323	27,594	183	358
NC1	HICKORY 371E-08 6/17/2007	297	358	287	288	29	298	299	299	311	289	281	254	214	228	225	229	276	254	299	239	30	295	295	332	374	27,637	214	374
NC1	HICKORY 371E-08 6/18/2007	298	285	337	319	321	374	333	327	339	334	319	314	272	154	173	166	265	328	312	271	271	168	143	17	392	27,637	143	392
NC1	HICKORY 371E-08 6/19/2007	315	295	288	321	359	321	326	324	328	322	243	189	183	191	176	106	106	194	138	134	151	162	188	217	371	22,325	31	371
NC1	MARION 371E-08 6/20/2007	282	265	267	285	49	67	4	66	72	149	106	127	129	122	102	69	77	75	83	84	95	10	102	217	217	107,297	21	219
NC1	HICKORY 371E-08 6/20/2007	147	17	177	219	21	183	188	94	0	0	118	128	147	137	102	69	77	75	83	84	95	10	102	133	219	11,610	0	219