Exceptional Event Request Fairbanks, Alaska - 2009

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Outline

- Background
- Considerations & General Information Sources
- Historical $PM_{2.5}$
- Overview Summer 2009
- Basic Meteorological Products
- Conceptual Model
- Daily Analysis Products
- AK vs CONUS
- Questions

Background

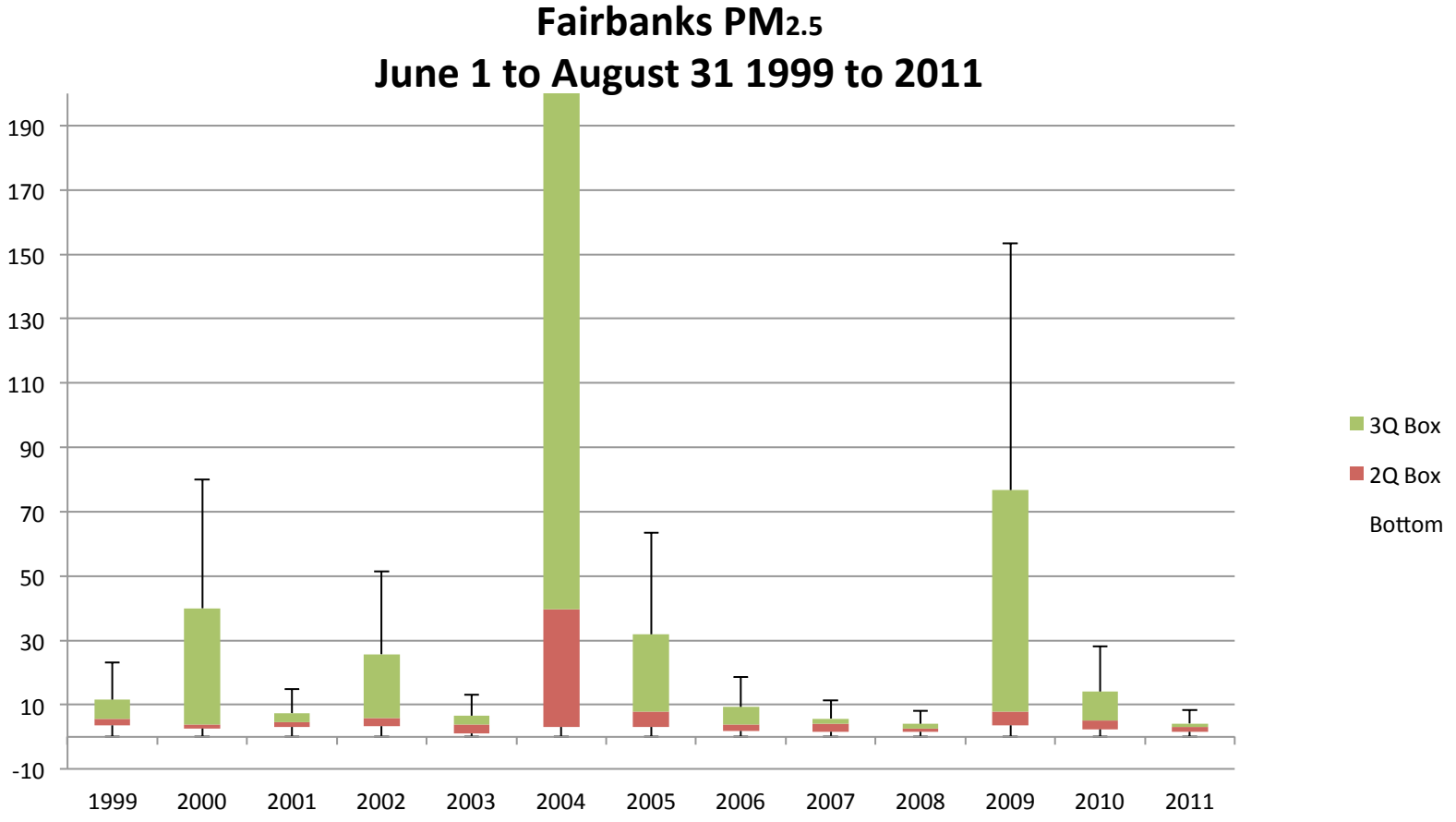
- Fairbanks air quality impacted by wildfire smoke most summers
  - Acres burned in Alaska 1,438,104 acres/yr
  - Extreme variable 43,000 to 6.5 million acres
- Fairbanks is non-attainment - 24-hr $PM_{2.5}$
  - Strong winter time inversions and wood smoke
  - Close to non-attainment for annual $PM_{2.5}$

Considerations and Summary Sources

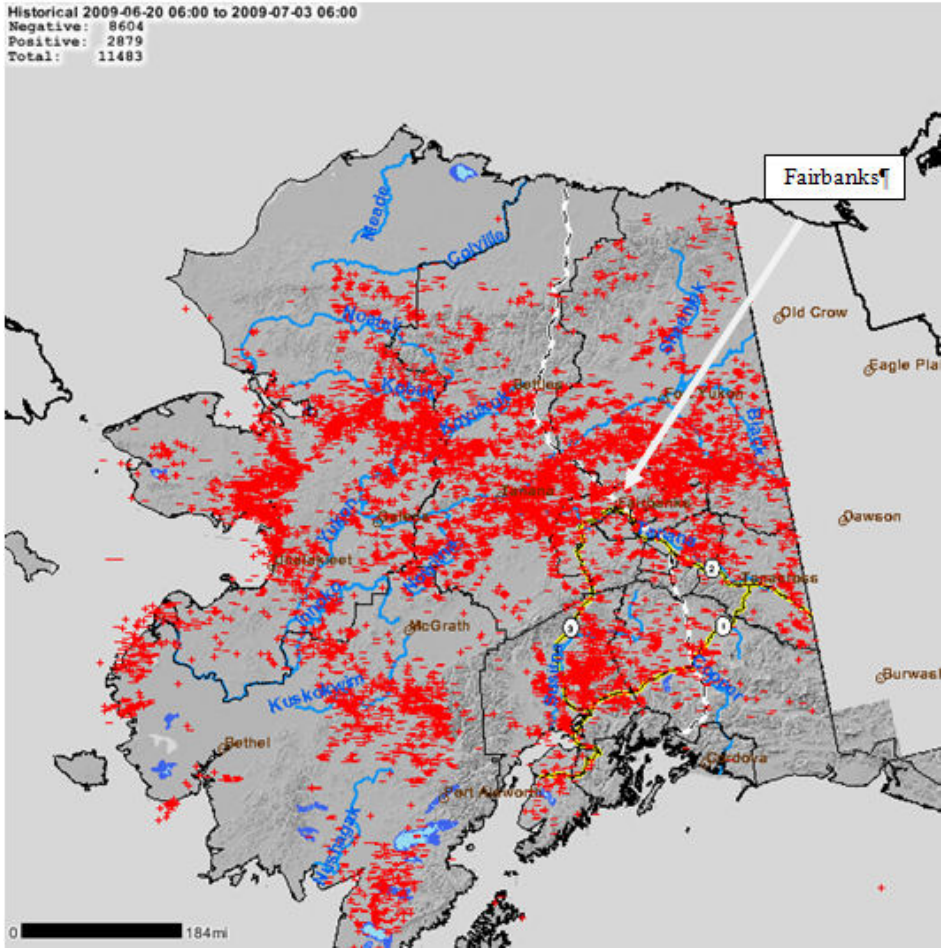
- EER must meet Regulatory guidance but;
  - May be read by general public

- Seasonal Summary Sources:
  - BLM Fire Weather meteorological summary
  - NWS/UAF Geophysical Institute summary
  - AK Fire Service fire summary

Historical $PM_{2.5}$



2009 Summer
Jun 20-Jul 3 Lightning



Overview
Summer 2009

- Jun 20 – Jul 3 2009, Interior Alaska 11,483 lightning strikes
- 527 Fires
- 2,951,598 acres burned that summer
- Fairbanks 6 FRM days 24-hr $PM_{2.5}$ > 35µg/m^3 between July 6 to August 8, 2009

Data Gathering Meteorological Products

- NWS Observations
  - http://www7.ncdc.noaa.gov/CDO/dataproduct
- Local Maps and Analysis
  - Local NWS but difficult to get is not saved during the event
- MODIS – satellite images
  - http://www.gina.alaska.edu/modis-gallery?year=2010
- Skew-Ts
  - http://weather.uwyo.edu/upperair/sounding.html

Concepts
Meteorological Model

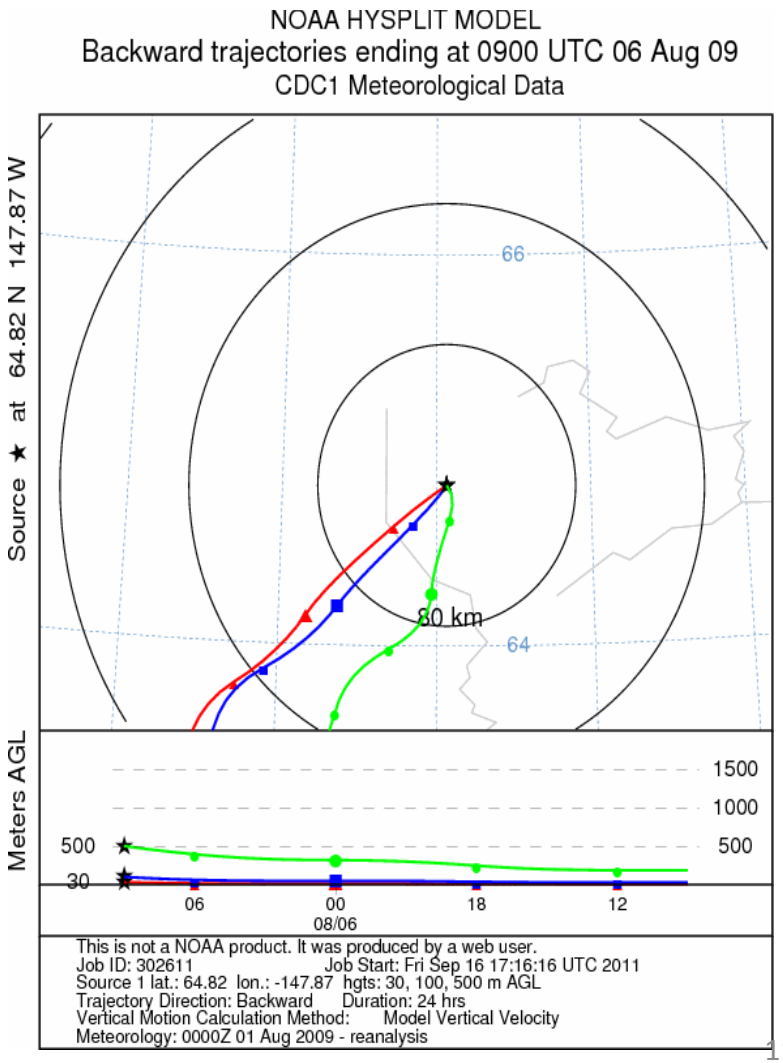
- No other significant smoke sources in summer
- Fairbanks non-fire years 24-hr $PM_{2.5}$ average 6-7µg/m^3
  - HYSPLIT accepted by EPA
  - HYSPLIT is cost effective – free on the internet
    - http://ready.arl.noaa.gov/HYSPLIT.php
  - WRF/Chem - fire locations/activity and smoke
    - Useful for days with 24-hr $PM_{2.5}$ average <35µg/m^3

Conceptual Model

- Exceedances: 6 FRM; 16 FEM/FRM; 30 >12µg/m^3
  - Treat as a single event but describe each day
- Develop a standard daily analysis 3 pages
  - Pg 1. Daily discussion
  - Pg 2. 4-panel products
    - HYSPLIT Graph
    - HYSPLIT backwards trajectory on map
    - HYSPLIT backwards trajectory on MODIS imagery
    - Hourly $PM_{2.5}$ data
  - Pg 3. Hourly surface weather observations

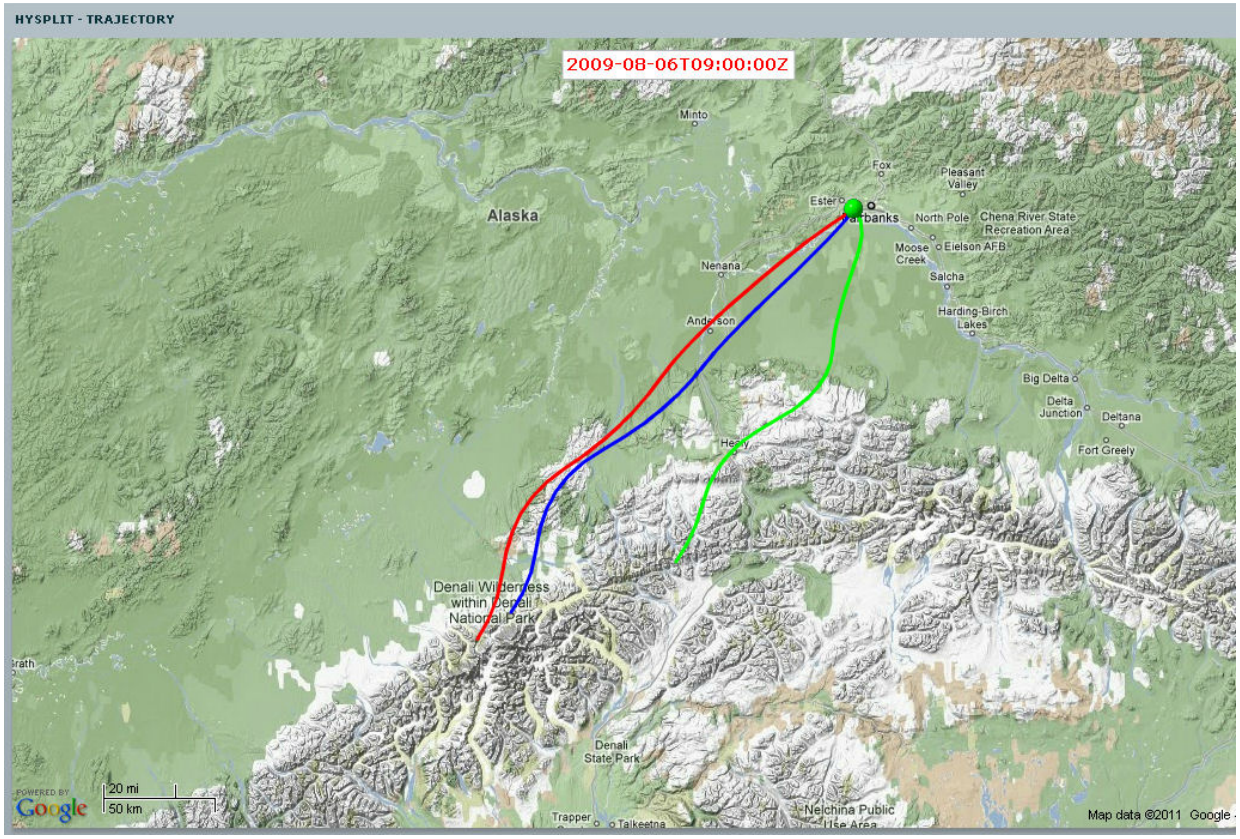
Page 2, 4-Panel Trajectory on Graph

- Documents met data used, height and time of trajectories



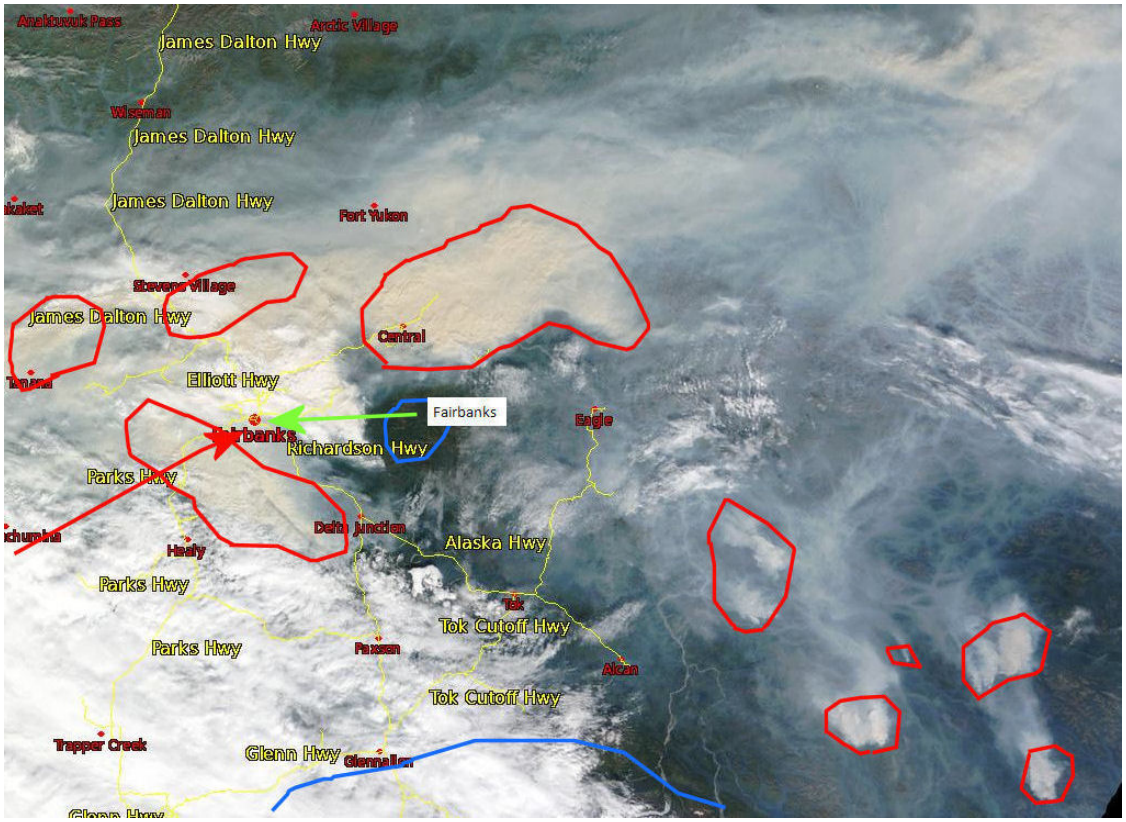
Page 2, 4-Panel Trajectory on Map

- Completed by HYSPLIT - Documents trajectory in relation to land features



Page 2, 4-Panel Trajectory on MODIS

- MODIS hand drawn trajectory lowest



Page 2, 4-Panel
PM2.5 hourly concentrations

- Document beginning and end smoke

05- Aug	HRLY PM2.5
0:00	30.4
1:00	35.5
2:00	30.2
3:00	33.1
4:00	36.5
5:00	36.3
6:00	36.0
7:00	42.6

05- Aug	HRLY PM2.5
8:00	40.9
9:00	69.7
10:00	52.1
11:00	36.0
12:00	31.1
13:00	81.7
14:00	243.3
15:00	319.2

05- Aug	HRLY PM2.5
16:00	409.6
17:00	475.2
18:00	456.9
19:00	994.8
20:00	994.8
21:00	667.1
22:00	570.0
23:00	481.6

Final Daily Format

- Page 1 - Discussion
  - Highlight each area of 4-panel
  - Incorporate statements from Fire Reports
    - "Explosive behavior" suppression efforts, etc
  - Highlight significant meteorological changes
- Page 2 - 4-panel daily document
  - HYSPLIT Products and $PM_{2.5}$ hourly data
- Page 3 - NWS Observations

Page 1 - Discussion Example Aug 5, 2009

- **August 5, 2009**
- Figure 52, MODIS imagery shows that the smoke continues to increase in area and intensity across all of Central and Northern Alaska and into Canada. Very dense smoke is visible on the MODIS imagery to the southwest and to the northeast of Fairbanks.
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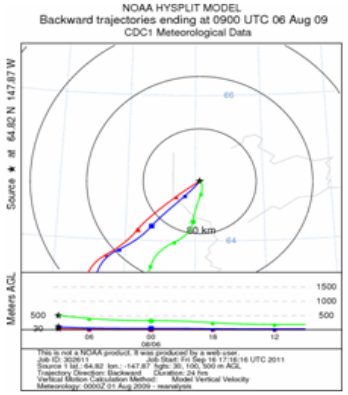
- The HYSPLIT backwards trajectory indicates airflow from the southwest, across the Minto Flats fire, transporting dense smoke into the city of Fairbanks.
-
- Observations at the Fairbanks airport show decreases in visibility throughout the period. This is indicative of the increase in smoke concentration at the Fairbanks Airport.
-
- FRM 24 hour $PM_{2.5}$ concentration was 127.7µg/m^3 for this date. As occurred on July 30 when the smoke was very dense, the FRM filter were overloaded so the average is not a complete 24 hour period. Only 19 hours of FRM data was available on this date. Secondary $PM_{2.5}$ 24 HR average was 155.56µg/m^3.when averaged for the same 19 hours as the FRM data. However, if all concentrations of the secondary measurement for the 24 hour period are used, the average is 258.53µg/m^3.

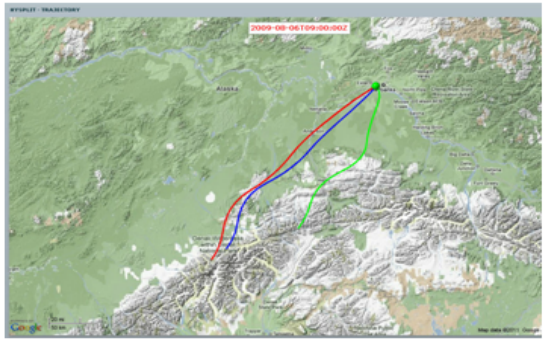
Page 2
Daily 4-panel

August 05, 2009 All end points/arrow heads terminate at Fairbanks, Alaska

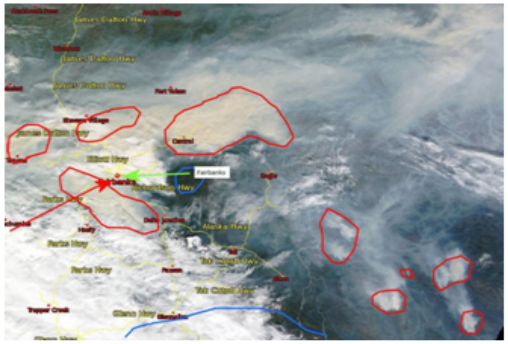
Trajectories are directly from the HYSPLIT model except the 30m trajectory on MODIS imagery is hand drawn



A.HYSPLIT Backwards Trajectory Forecast from August 06, 2009, 00LST backward to August 05, 2009, 00LST.



B. HYSPLIT Trajectory forecast on Google Earth map.
Red = 30m, Blue = 100m, Green=500m



C. August 05, 2009, 12:54 PM LST MODIS imagery with 30m trajectory
(red outline is fire, blue is smoke)

05-Aug	HRLY PM2.5
0:00	30.4
1:00	35.5
2:00	30.2
3:00	33.1
4:00	36.5
5:00	36.3
6:00	36.0
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05-Aug	HRLY PM2.5
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D. Hourly $PM_{2.5}$ for August 05, 2009

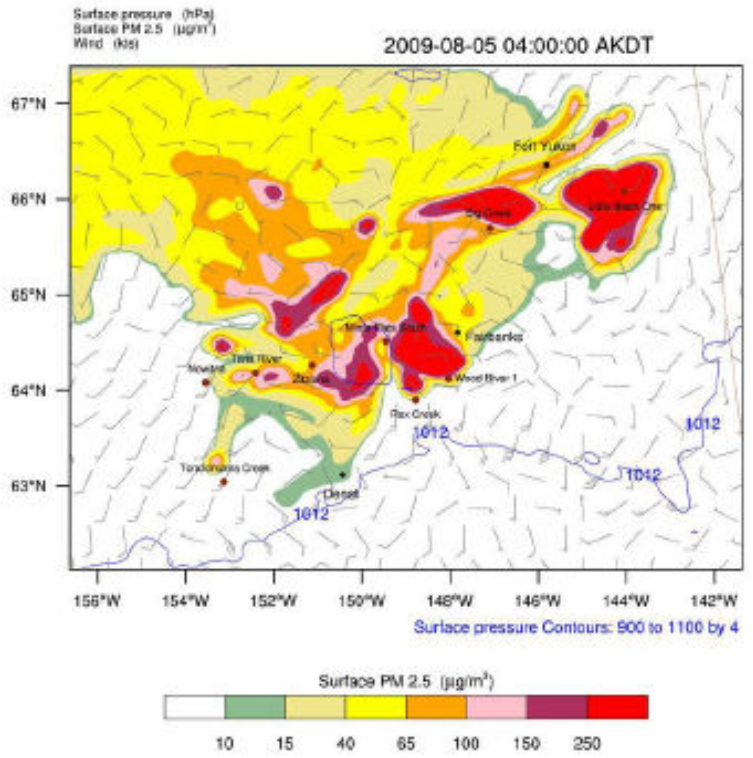
Page 3
NWS Observations

- Documents surface winds
- Documents smoke

USAF	WBAN	YR--MODAHRMN (LST)	DIR (From)	SPD (MPH)	GUS (MPH)	VSB (SM)	WW	WW
702610	26411	200908042353	***	0	***	6	4 (Smoke)	**
702610	26411	200908050053	40	3	***	6	4 (Smoke)	**
702610	26411	200908050153	***	0	***	6	4 (Smoke)	**
702610	26411	200908050253	30	3	***	6	4 (Smoke)	**
702610	26411	200908050353	40	3	***	5	4 (Smoke)	**
702610	26411	200908050453	50	3	***	5	4 (Smoke)	**
702610	26411	200908050553	***	0	***	5	4 (Smoke)	**
702610	26411	200908050653	***	0	***	6	4 (Smoke)	**
702610	26411	200908050753	990	5	***	6	4 (Smoke)	**
702610	26411	200908050853	50	3	***	7	**	**
702610	26411	200908050953	60	3	***	3	4 (Smoke)	**
702610	26411	200908051053	***	0	***	2	4 (Smoke)	**
702610	26411	200908051153	***	0	***	2.5	4 (Smoke)	**
702610	26411	200908051253	***	0	***	2.5	4 (Smoke)	**
702610	26411	200908051353	***	0	***	3	4 (Smoke)	**
702610	26411	200908051453	***	0	***	1.8	4 (Smoke)	**
702610	26411	200908051553	***	0	***	0.8	4 (Smoke)	**
702610	26411	200908051653	***	0	***	0.5	4 (Smoke)	**
702610	26411	200908051753	230	3	***	0.5	4 (Smoke)	**
702610	26411	200908051853	***	0	***	0.5	4 (Smoke)	**
702610	26411	200908051953	250	5	***	0.5	4 (Smoke)	**
702610	26411	200908052053	***	0	***	0.5	4 (Smoke)	**
702610	26411	200908052153	***	0	***	0.5	4 (Smoke)	**
702610	26411	200908052253	210	5	***	0.8	4 (Smoke)	**

No Exceedance Except For

- HYSPLIT used for CCR – no actual fire data
- ADEC contract with UAF Geophysical Institute
  - WRF/Chem model
    - Fuel type,
    - Loading
    - and fire intensity



Other Supporting Documents

- Media Newspaper articles – internet search
- Air Quality Advisories – in house
- PM2.5 data – in house
- AICC Daily Incident Reports (Fire Reports) – limited time on the internet – 2 years
- Model information – research documentation

Alaska vs CONUS

- Limited access and limited observation data
  - In years with a large number of fires, even fires that cause significant smoke may not be flown for days - difficult to show relationship to fire size/ activity and $PM_{2.5}$ concentrations
- Little interference from industrial sources
  - Makes modeling easier = less costly

Questions

2009 Fairbanks EER:

http://www.dec.state.ak.us/air/am/am_projects.htm

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