

# Evaluation of NUCAPS CO Retrieval and High Resolution Smoke Trajectory Forecasting

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## Collaborators:

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**Jim Davies and Kathy Strabala (CIMSS)**

**Greg Frost and John Holloway  
(NOAA/ESRL)**

**Shobha Kondragunta (NESDIS/STAR)**

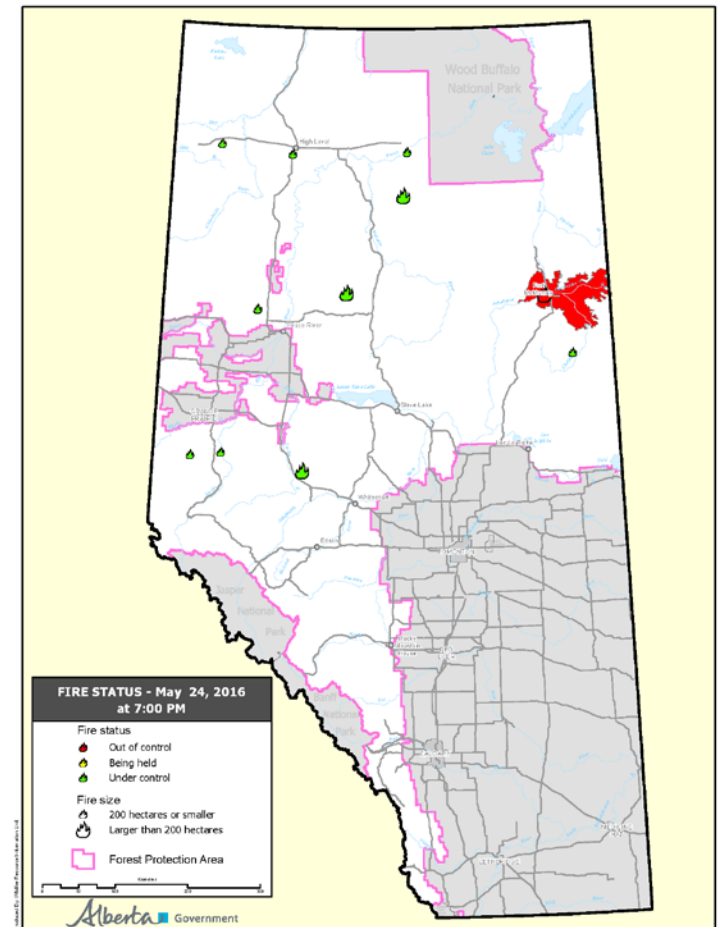
## Fort McMurray wildfire Case study

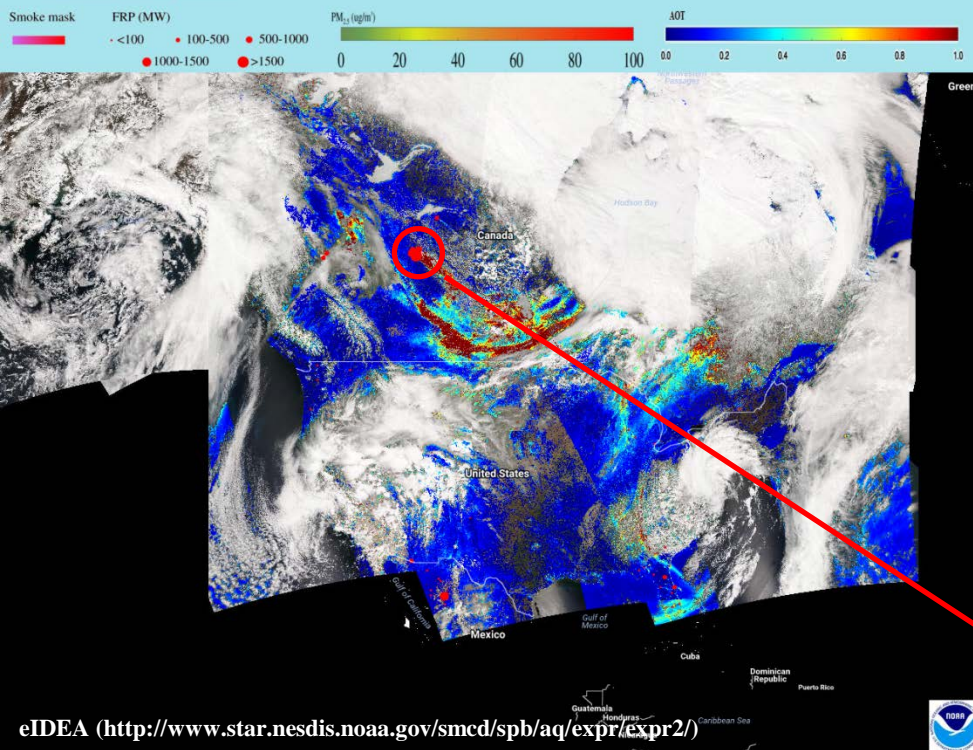
(May 1, 2016) – 9:57 p.m., Mayor Blake has declared a State of Local Emergency in Fort McMurray localized to Gregoire.

(May 4, 2016) –Mandatory evacuation of Anzac, Gregoire Lake Estates and Fort McMurray First Nation.

(May 16, 2016) The evacuation zone has increased north of the city of Fort McMurray.

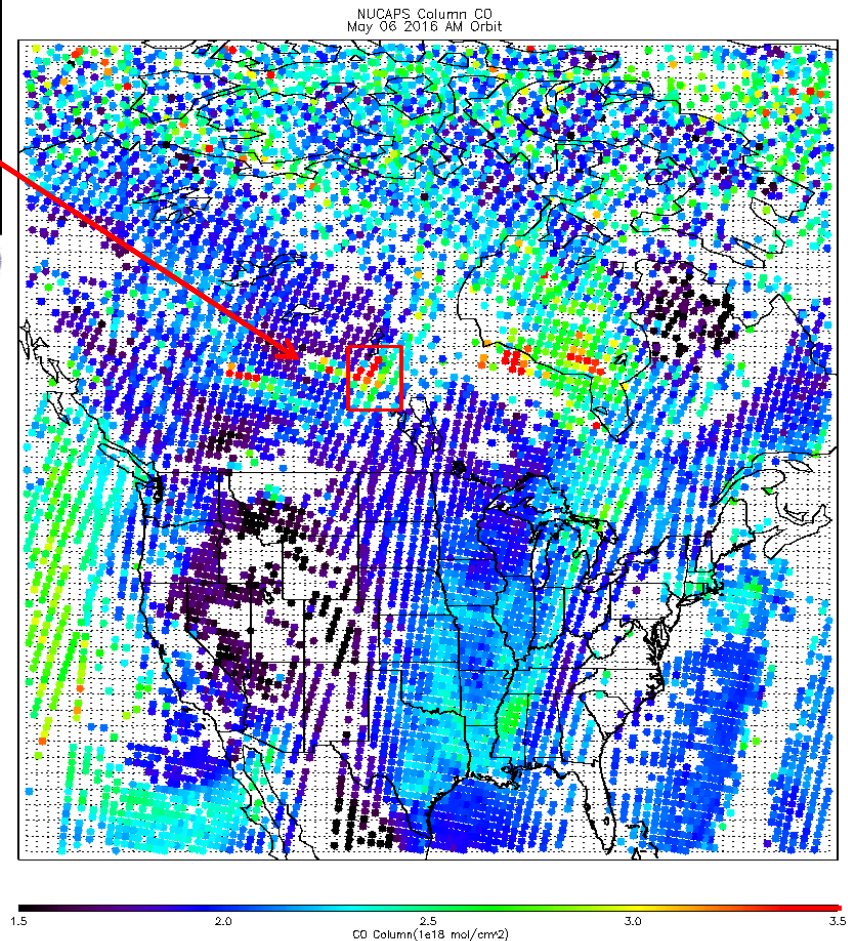
(May 18, 2016) A voluntary, phased re-entry for the safe return of Fort McMurray residents will begin June 1 if future wildfire conditions do not delay restoration efforts.



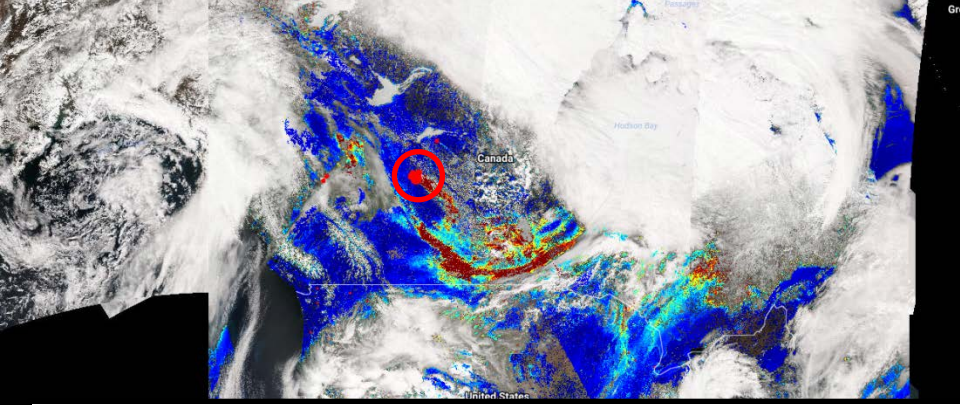


## CSPP NUCAPS trace gas EDR

- ☐ Include averaging kernel, apriori, interpolation and inverse matrices for applying to model (or insitu) profiles for data assimilation (or validation) activities.

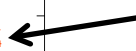
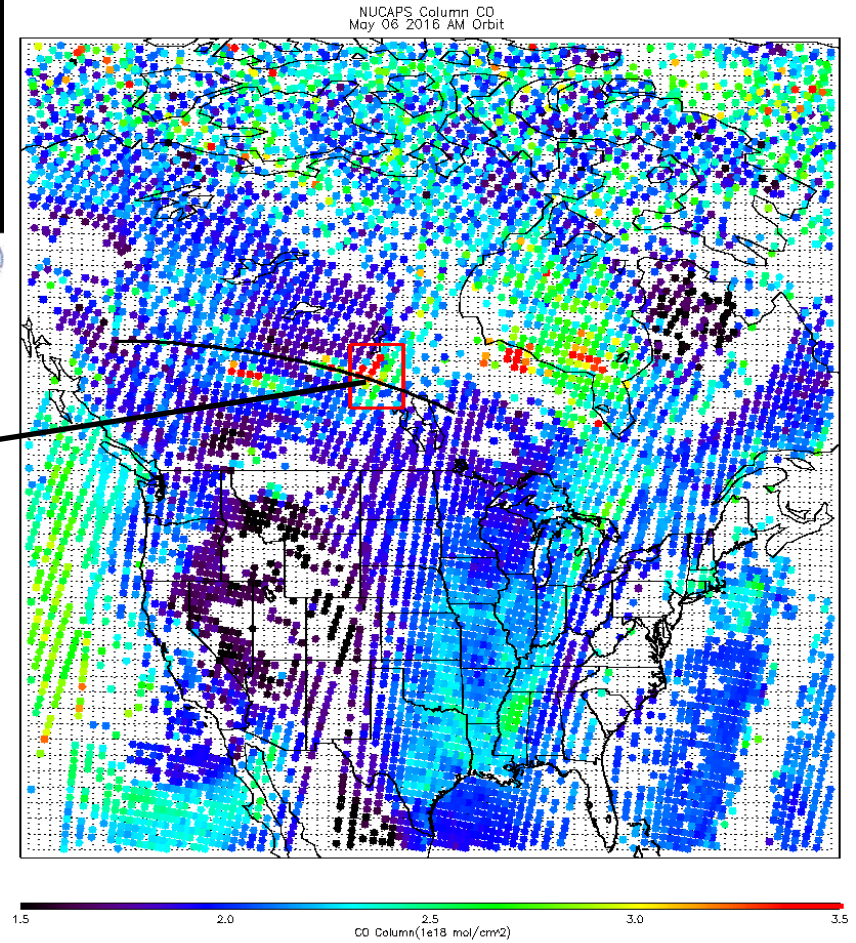
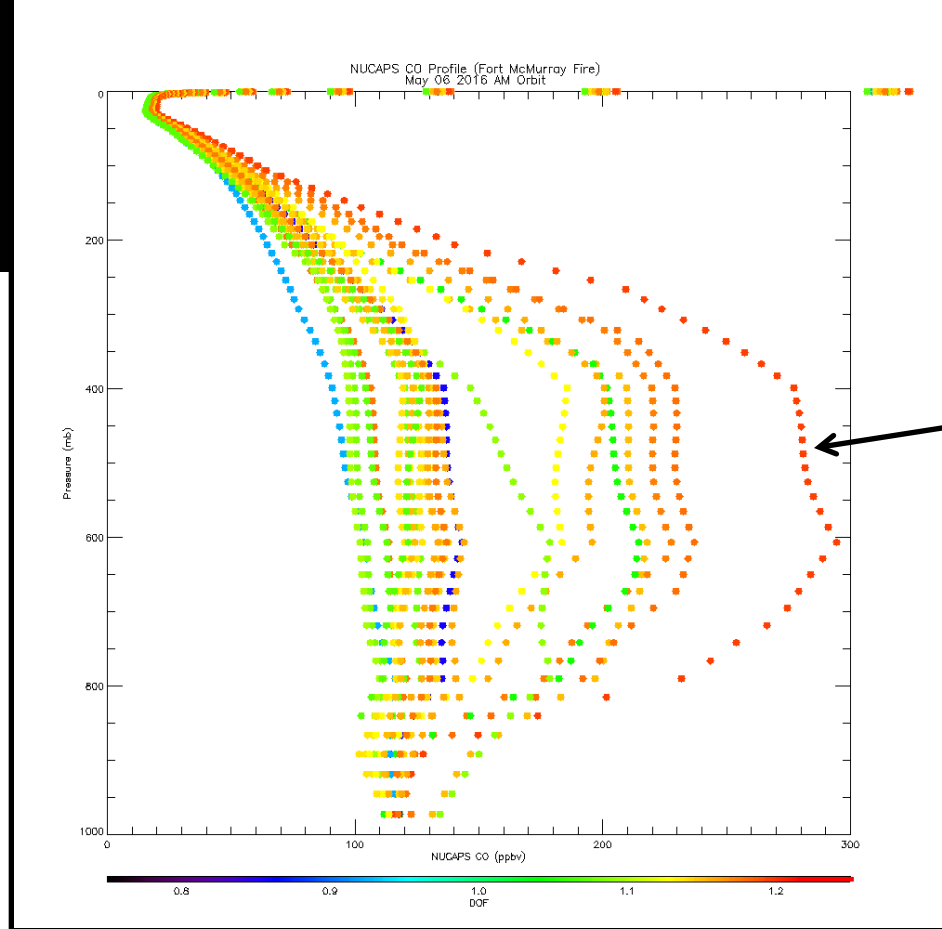


- ☐ Files also include surface parameters, degrees of freedom, and combined microwave and infrared quality flags.
- ☐ Will be used within CSPP for IDEA-I NUCAPS smoke forecasts and also in collaboration with colleagues at NOAA/ESRL for NUCAPS CH<sub>4</sub> and CO retrieval validation activities.



# CSPP NUCAPS trace gas EDR

- ☐ Include averaging kernel, apriori, interpolation and inverse matrixes for applying to model (or insitu) profiles for data assimilation (or validation) activities.



Satellite Retrievals

Global Assimilation

Regional Prediction

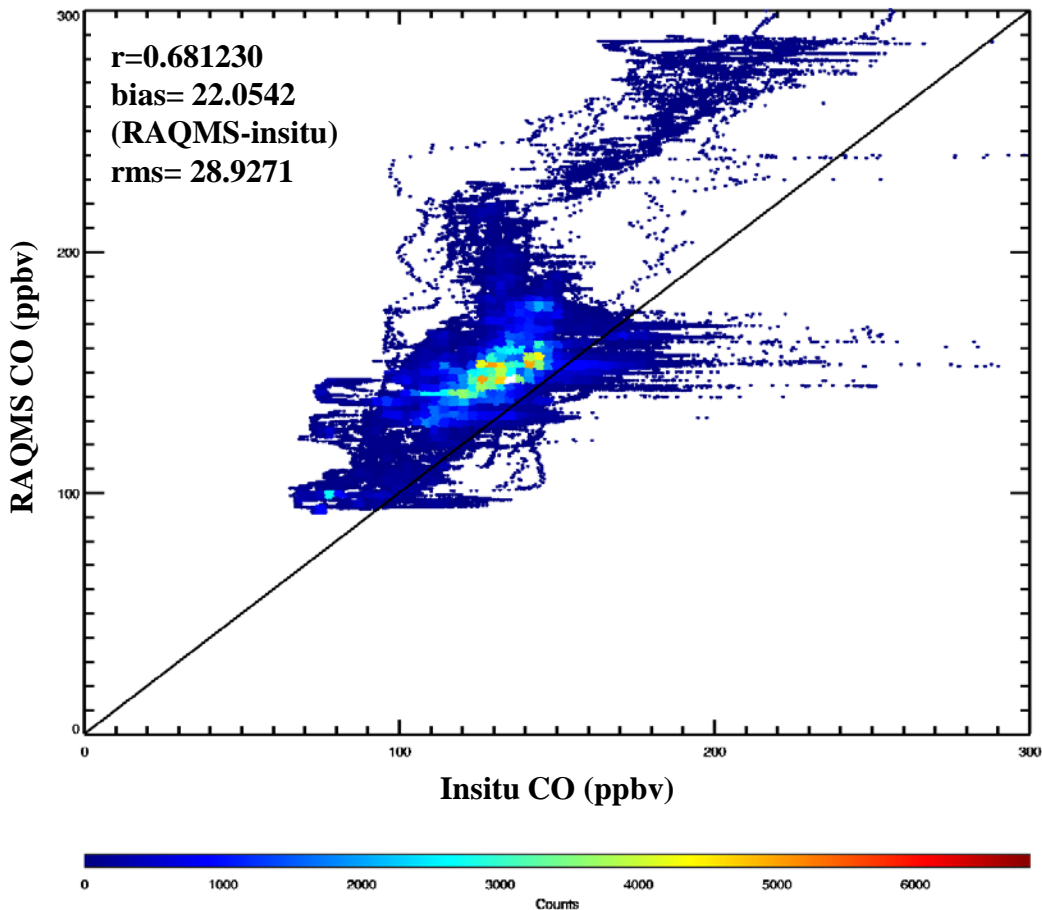
Validation

# RAQMS

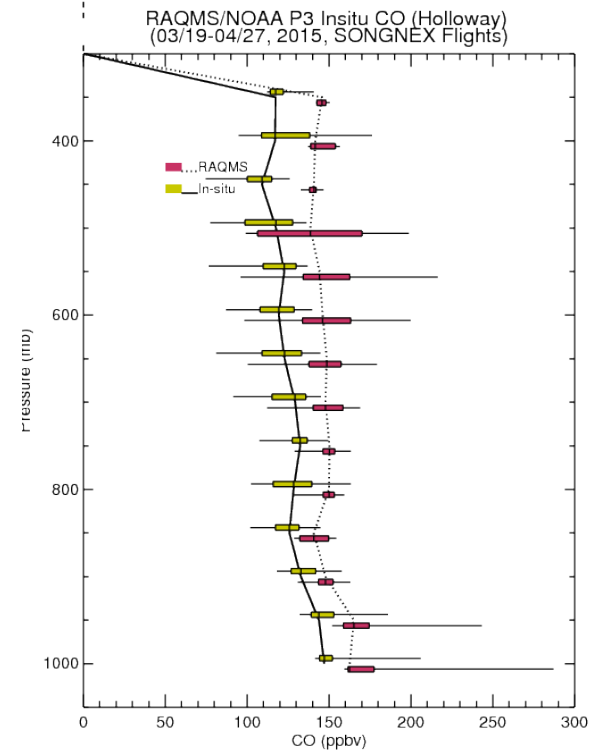
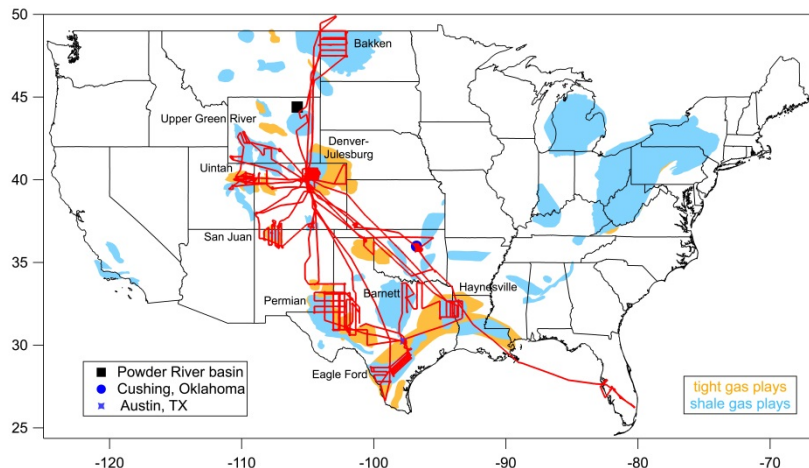
Realtime Air Quality Modeling System

## Evaluate RAQMS vs insitu CO during NOAA/ESRL SONGNEX 2015 for indirect NUCAPS CO validation

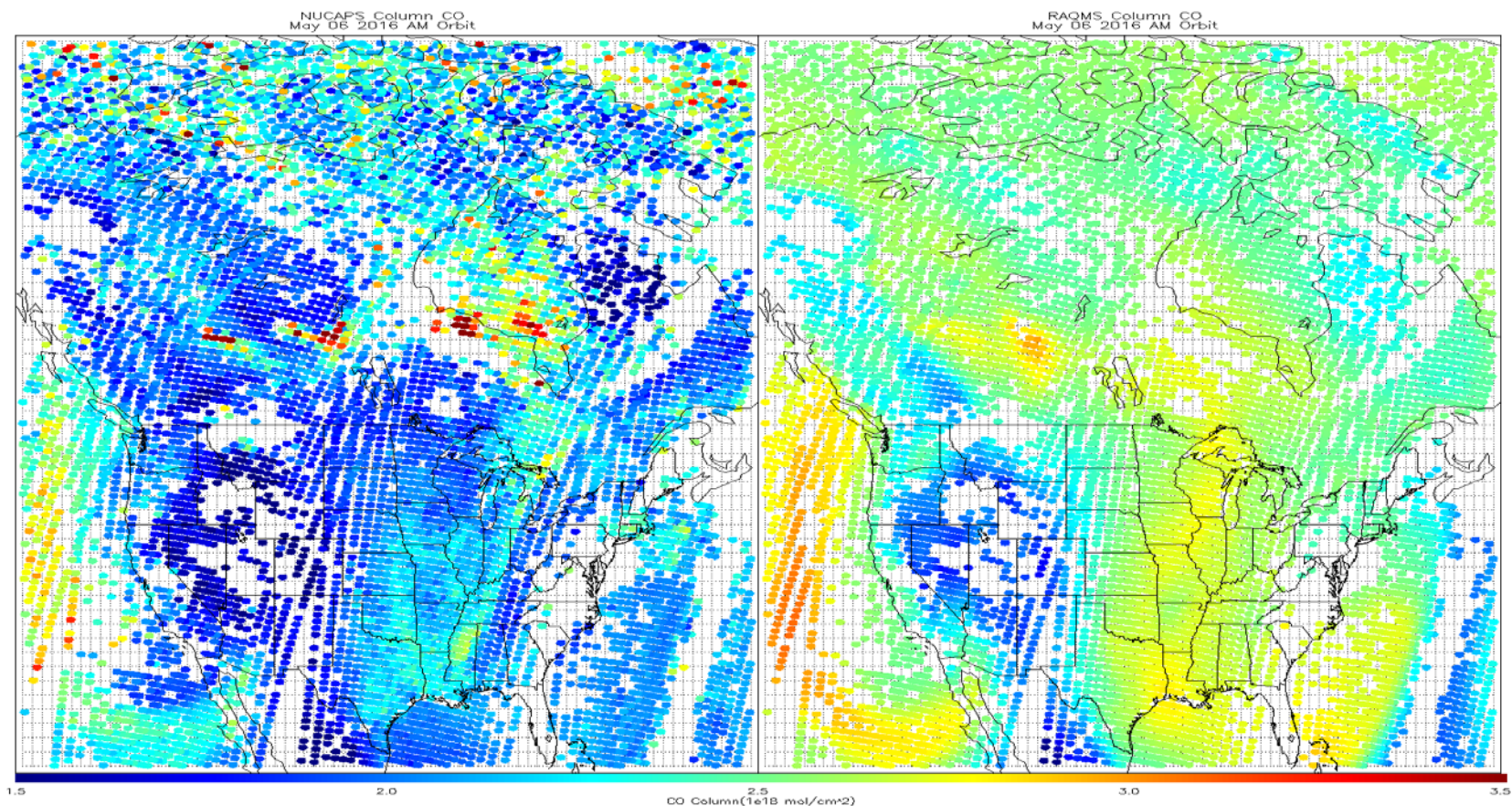
### RAQMS vs Insitu SONGNEX 2015 (March 19-April 27, 2015)



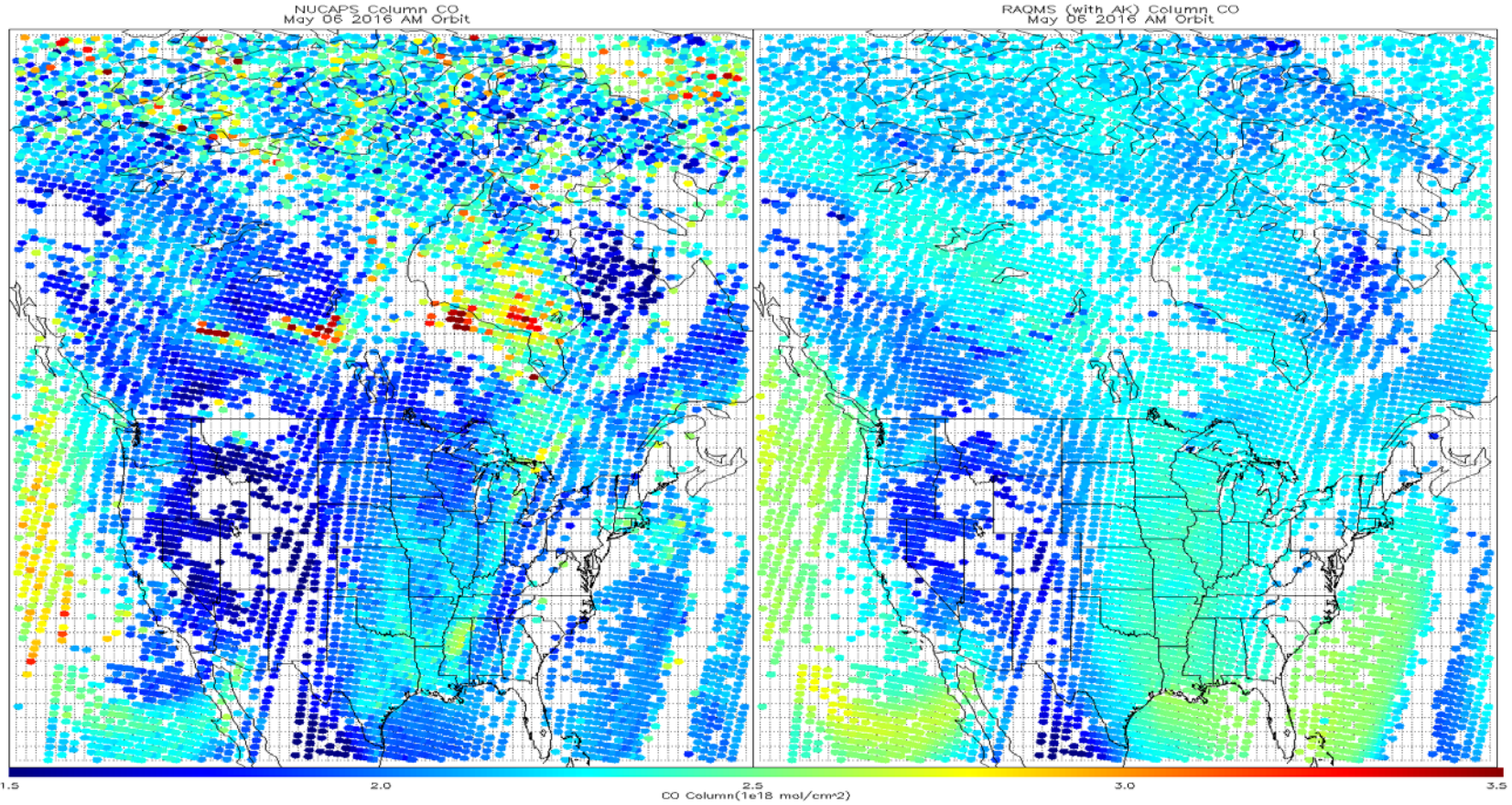
## SONGNEX 2015 Shale Oil and Natural Gas Nexus



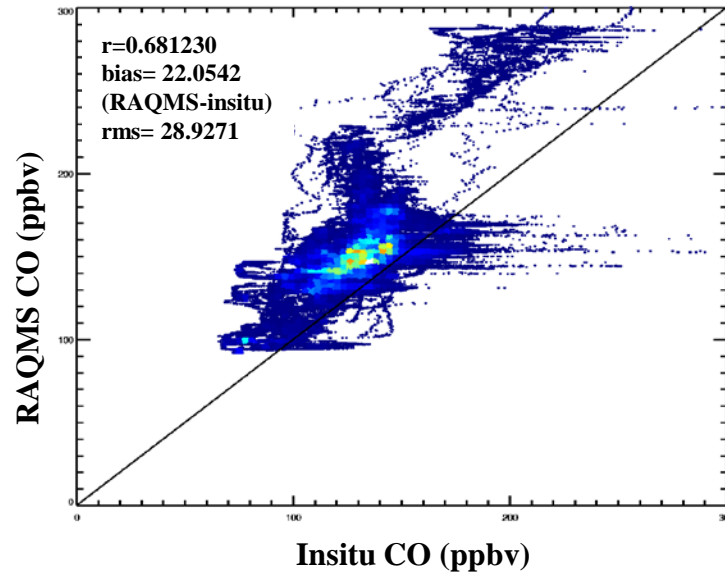
# NUCAPS verses RAQMS Column CO May 06, 2016 AM Orbit



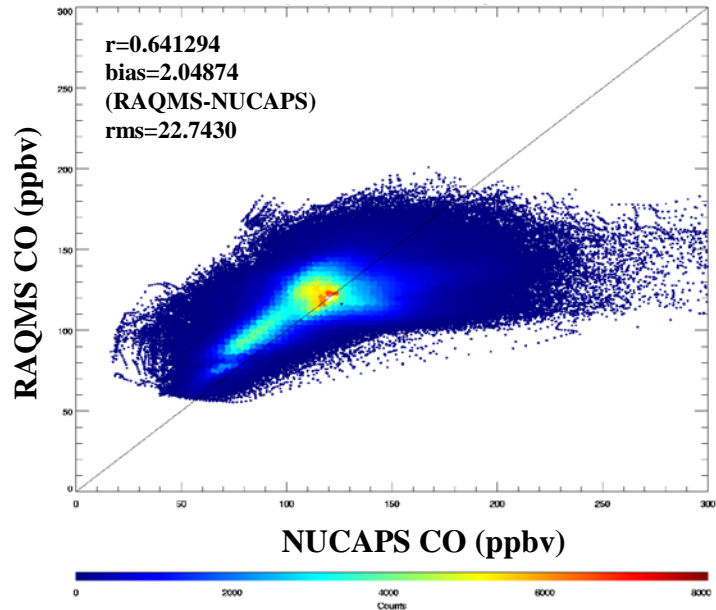
# NUCAPS verses RAQMS (AK) Column CO May 06, 2016 AM Orbit



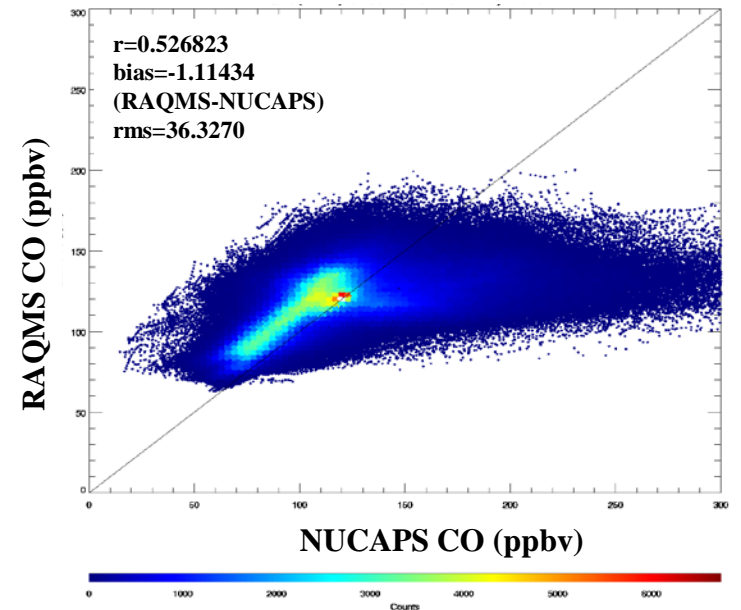
**RAQMS vs Insitu SONGNEX 2015  
(March 19-April 27, 2015)**



**RAQMS vs NUCAPS AM Orbit  
(May 1-16, 2016)**



**RAQMS vs NUCAPS PM Orbit  
(May 1-16, 2016)**

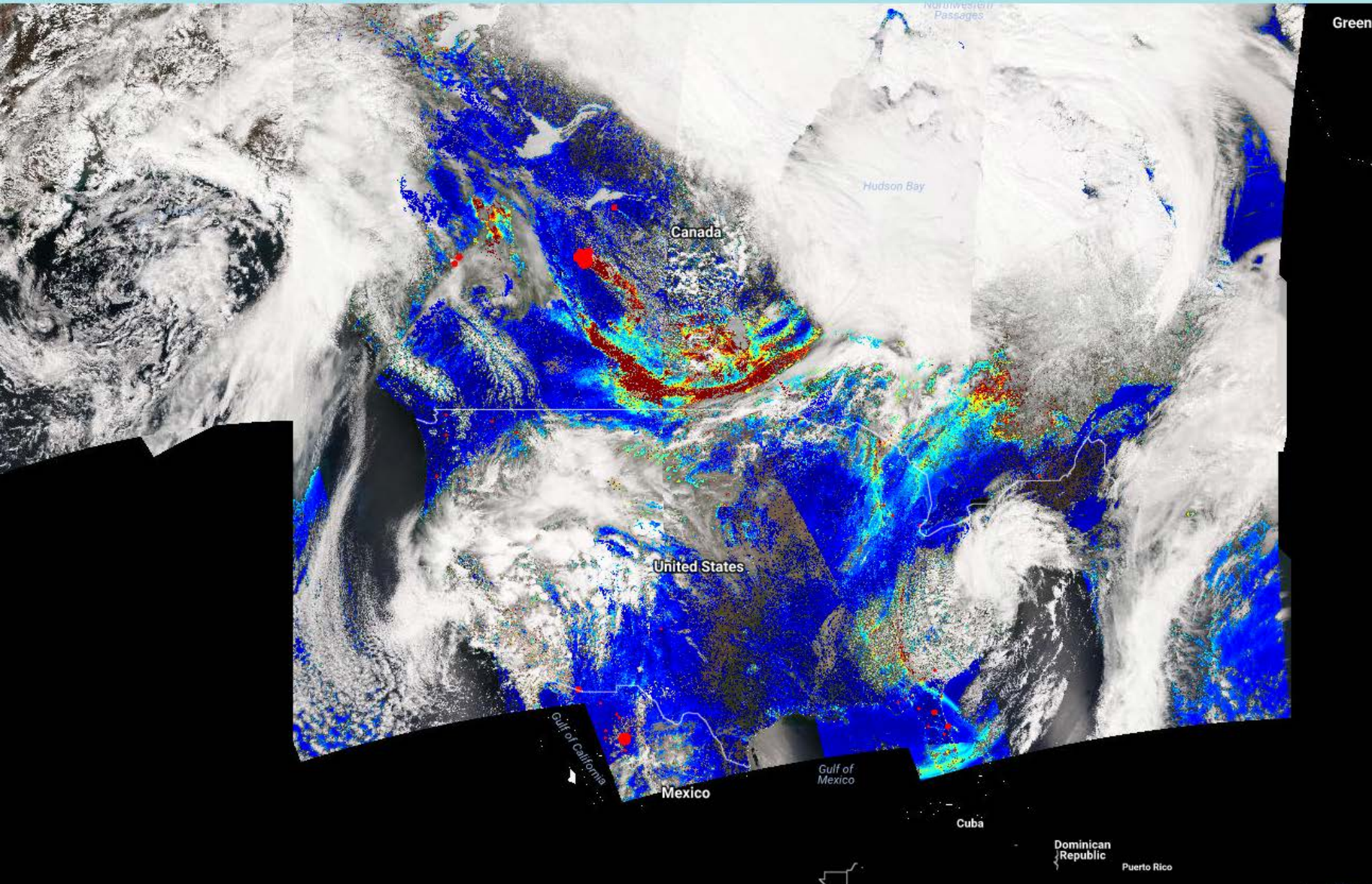
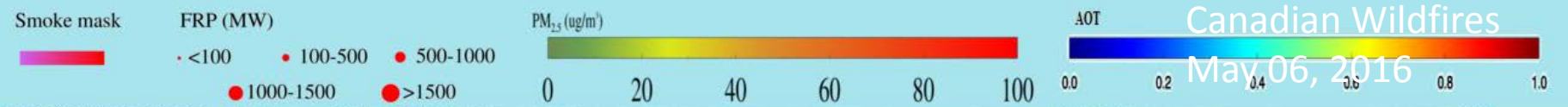


# High Resolution Trajectory-Based Smoke Forecasts

- **Goal:** Provide low latency, web-based, high resolution forecasts of smoke dispersion for use by NWS Incident Meteorologists (IMET) to support on-site decision support services for fire incident management teams.
  - Project utilizes VIIRS AOD and NUCAPS CO retrievals to initialize trajectory-based, high spatial resolution smoke dispersion forecasts.
  - Project is an extension of Infusion of satellite Data into Environmental Applications-International (IDEA-I) trajectory based aerosol forecast capabilities and will be tested and released within CSPP prior to transition to Operations at NESDIS.



May 06, 2016

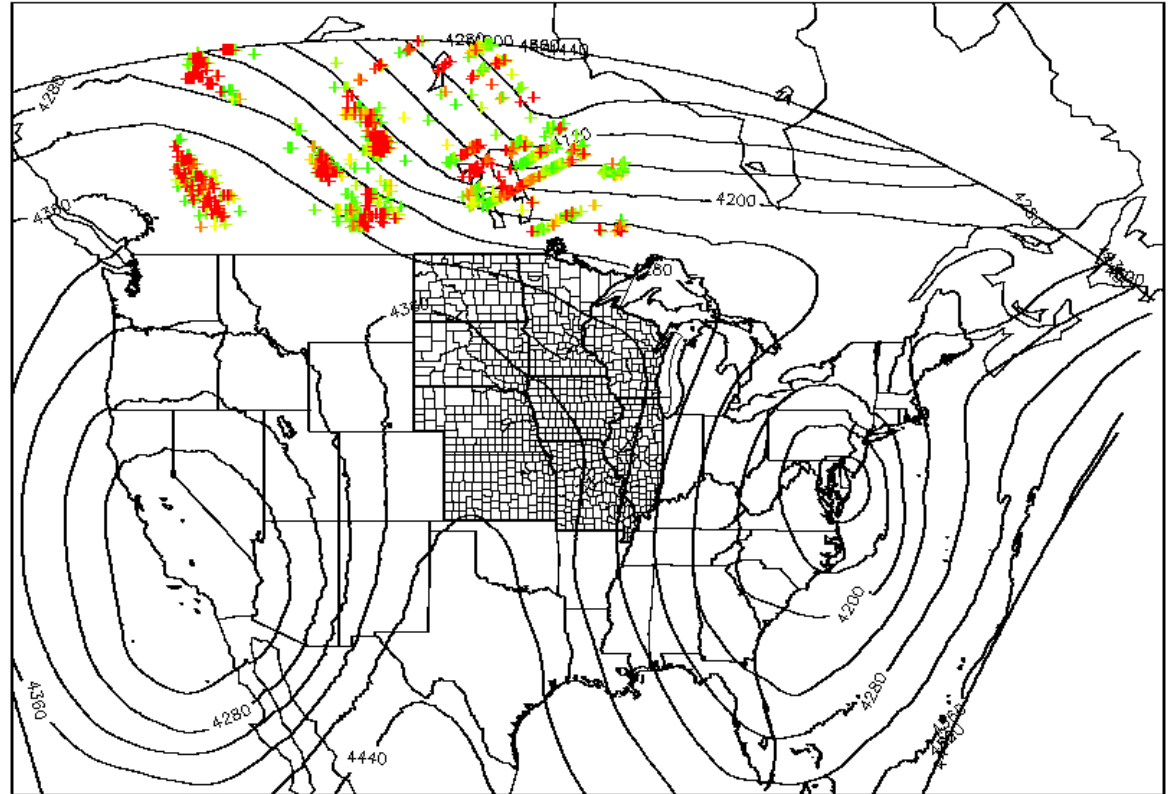


# IDEA-I High resolution (NAM 4km) trajectory forecast

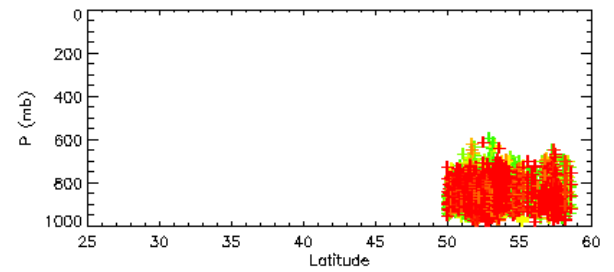
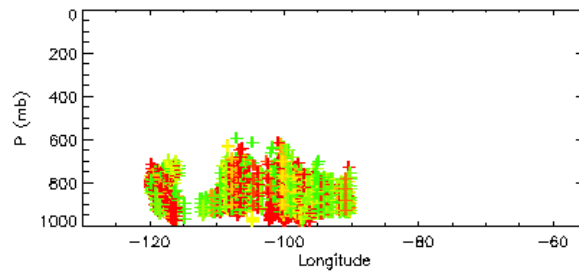
## Fort McMurray Wildfire

May 06, 2016

2016050617 High Resolution VIIRS AOD Trajectories  
NAM 600mb Heights Contoured



+



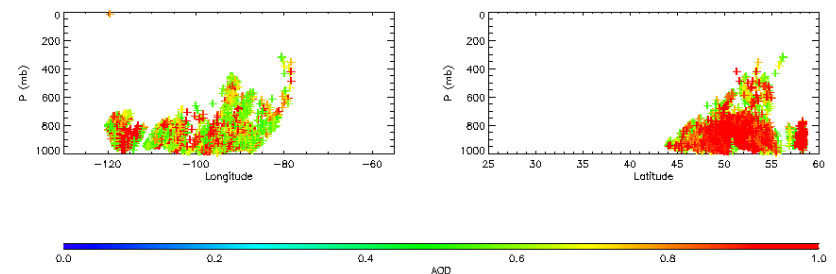
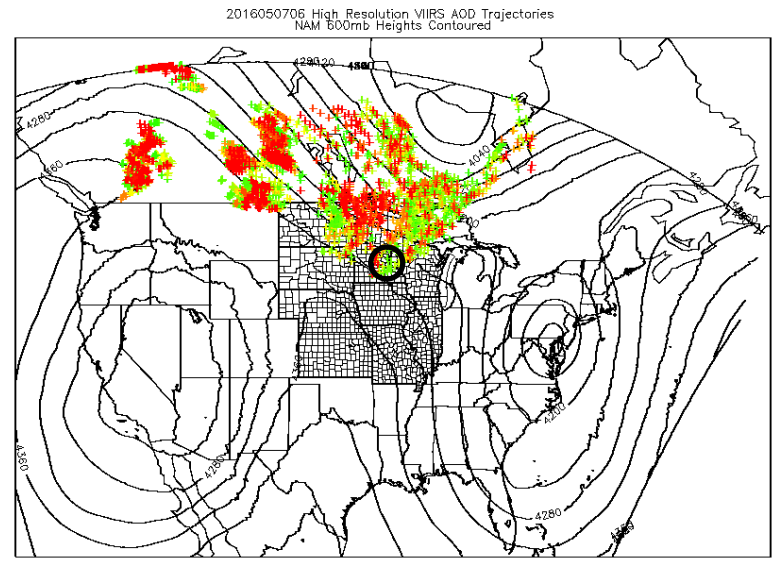
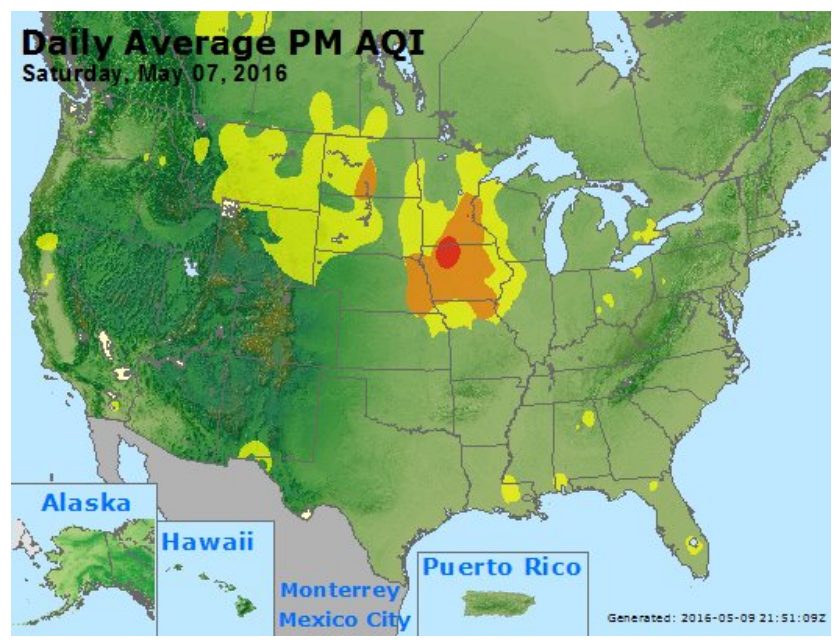
- IDEA-I high resolution trajectories initialized at each 6km VIIRS pixel (only AOD>0.5 initialized)
- Upper panel shows NAM 600mb heights
- Lower panels show longitude and latitude cross sections
- IDEA-I high resolution trajectory forecast colored by initial AOD

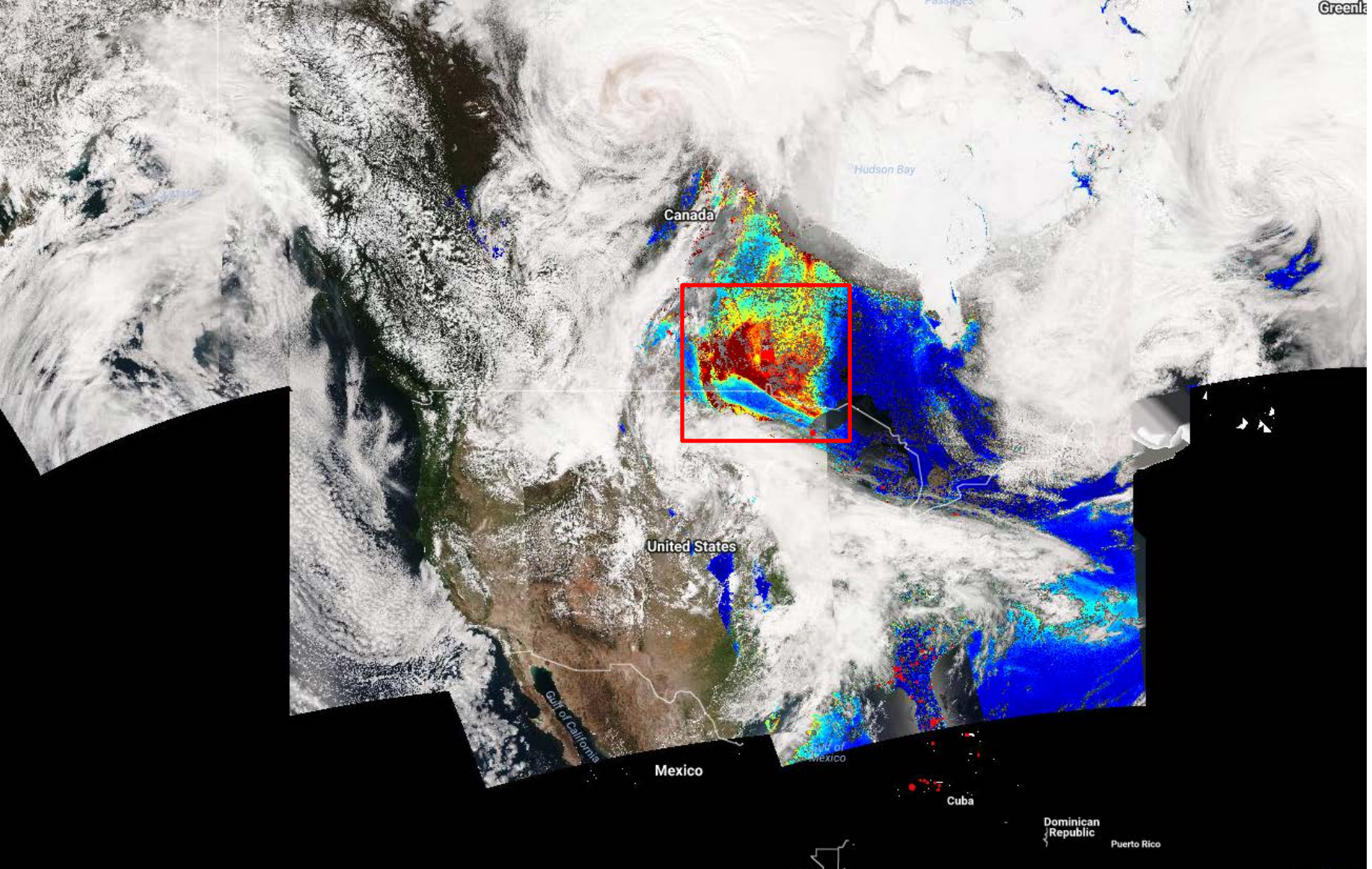
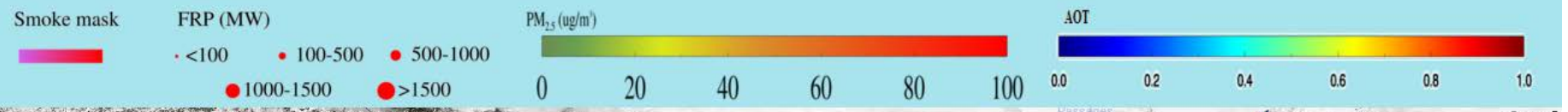
From Andy Edman/NWS

**SPECIAL WEATHER STATEMENT  
NATIONAL WEATHER SERVICE TWIN CITIES/CHANHASSEN MN  
127 AM CDT SAT MAY 7 2016**

...SMOKY CONDITIONS TO PERSIST THROUGH THE OVERNIGHT HOURS...

WIDESPREAD SMOKE FROM BOTH THE LARGE CANADIAN WILDFIRES AND A SMALLER WILDFIRE NEAR LAKE HATTIE IN HUBBARD COUNTY MINNESOTA HAS BLOWN INTO CENTRAL MINNESOTA...PARTICULARLY WITHIN AND NEAR THE TWIN CITIES METROPOLITAN AREA...DUE TO STRONG WINDS FROM THE NORTHWEST. VISIBILITIES HAVE BEEN REDUCED TO BETWEEN 1 AND 3 MILES...AND AIR QUALITY HAS BEEN SIGNIFICANTLY IMPACTED.

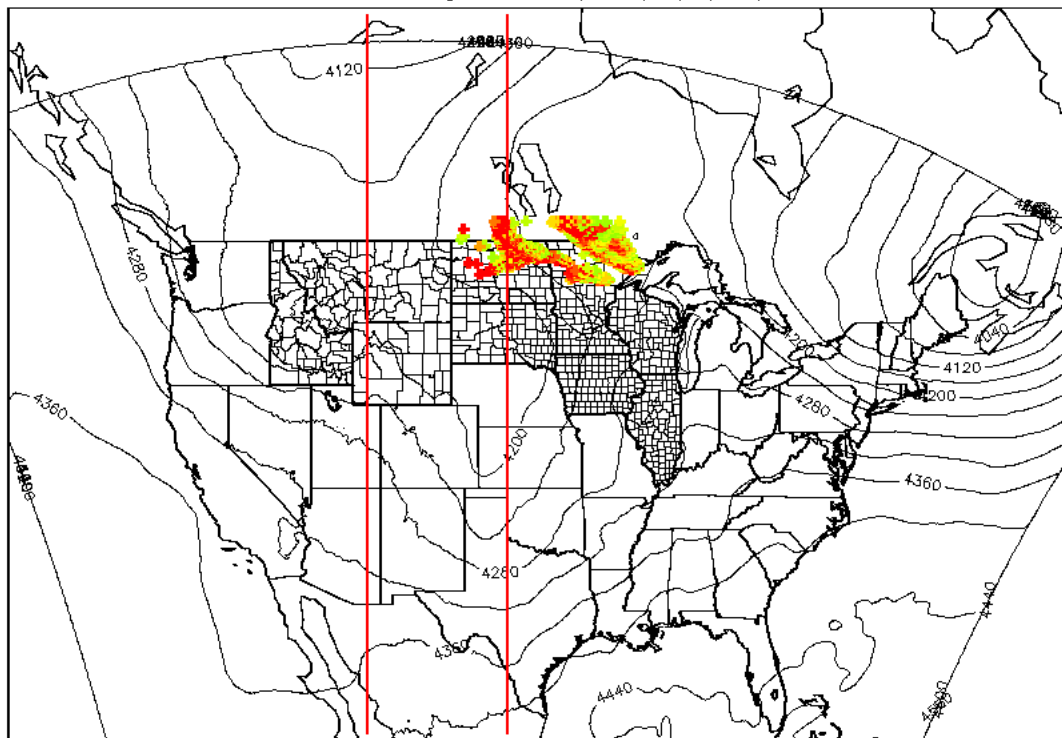




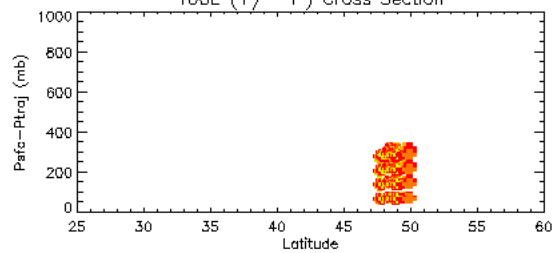
Greenland



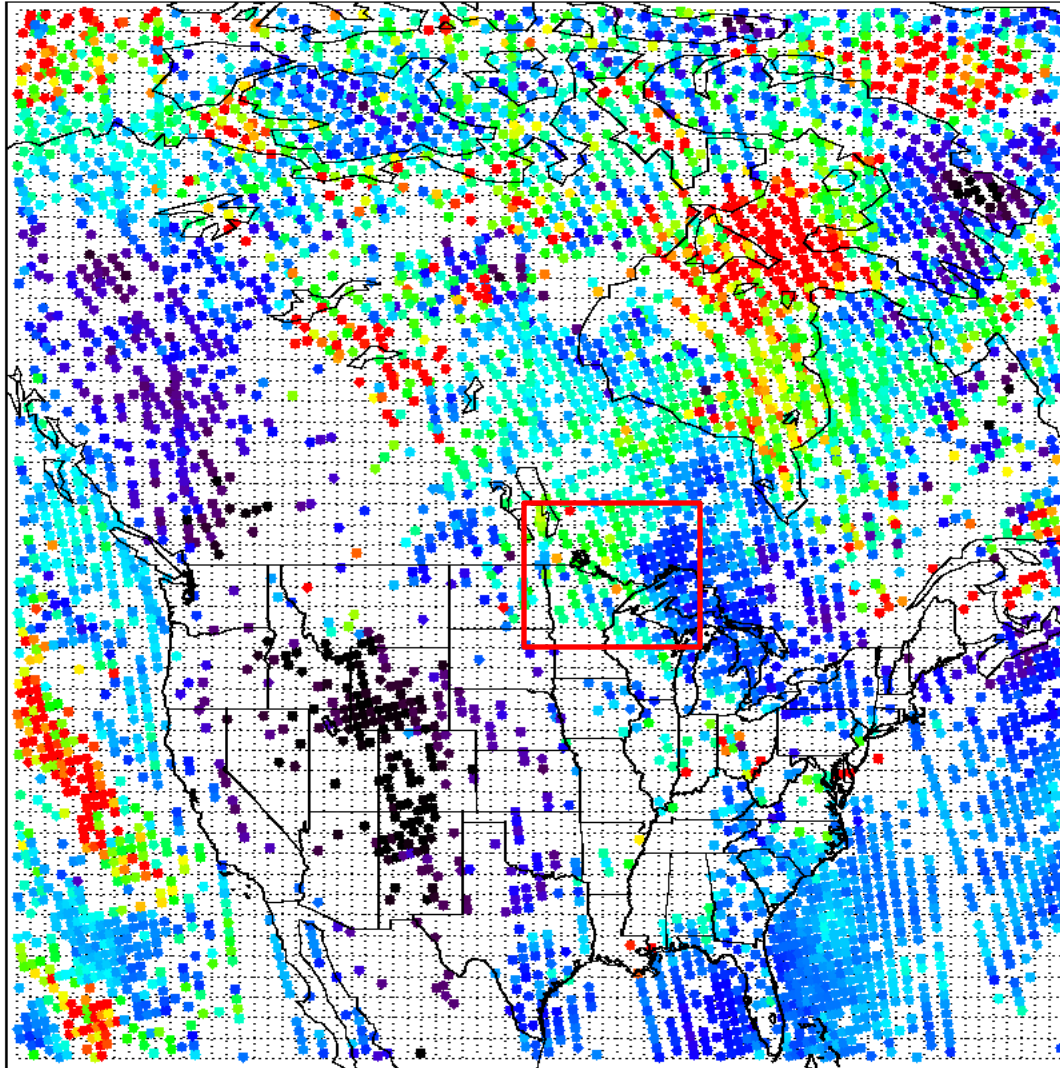
2016050919 High Resolution VIIRS AOD Trajectories  
NAM 600mb Heights Contoured/PCP (mm/hr) Purple



100E (+/- 1°) Cross Section

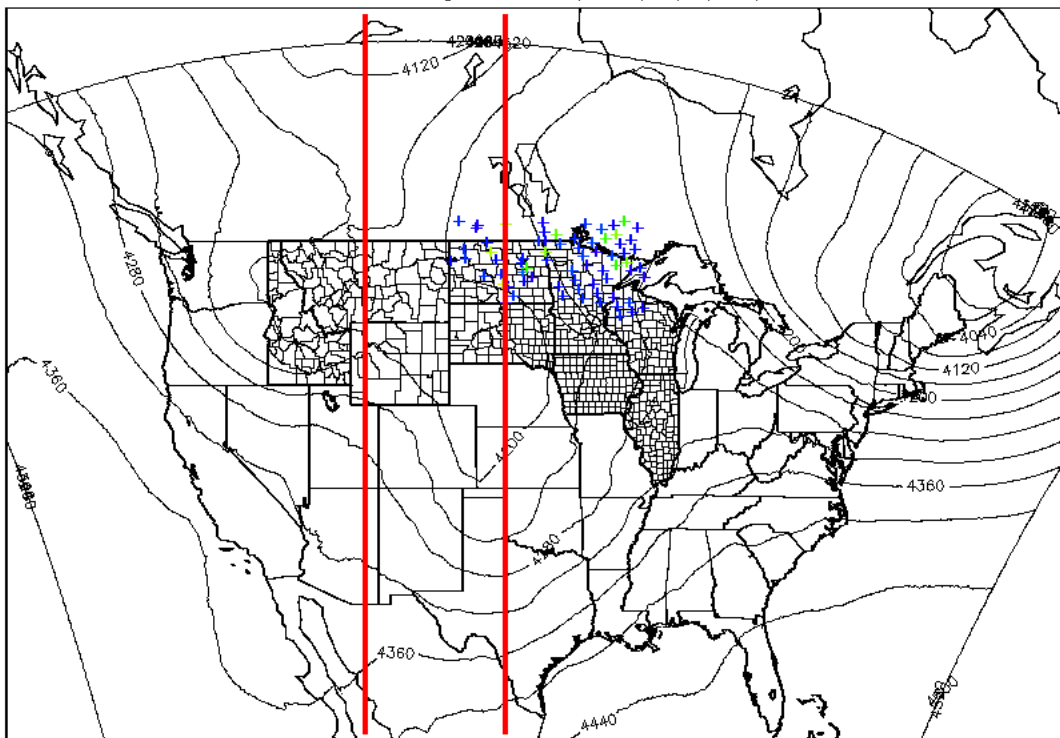


NUCAPS Column CO  
May 09 2016 PM Orbit

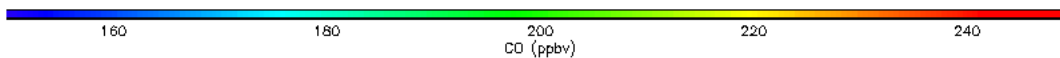
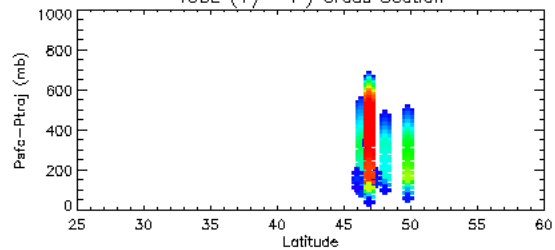


1.5 2.0 2.5 3.0 3.5  
CO Column(1e18 mol/cm<sup>2</sup>)

2016050918 High Resolution NUCAPS\_CO Trajectories  
NAM 600mb Heights Contoured/PCP (mm/hr) Purple



100E (+/- 1°) Cross Section



**VIIRS True Color Image May 9, 2016 20:15 UTC**

**Smoke from Fort McMurray fire imbedded with low pressure system over northern Canada**

**Questions?**



NOAA/NASA

**(From NOAA Environmental Visualization Laboratory)**