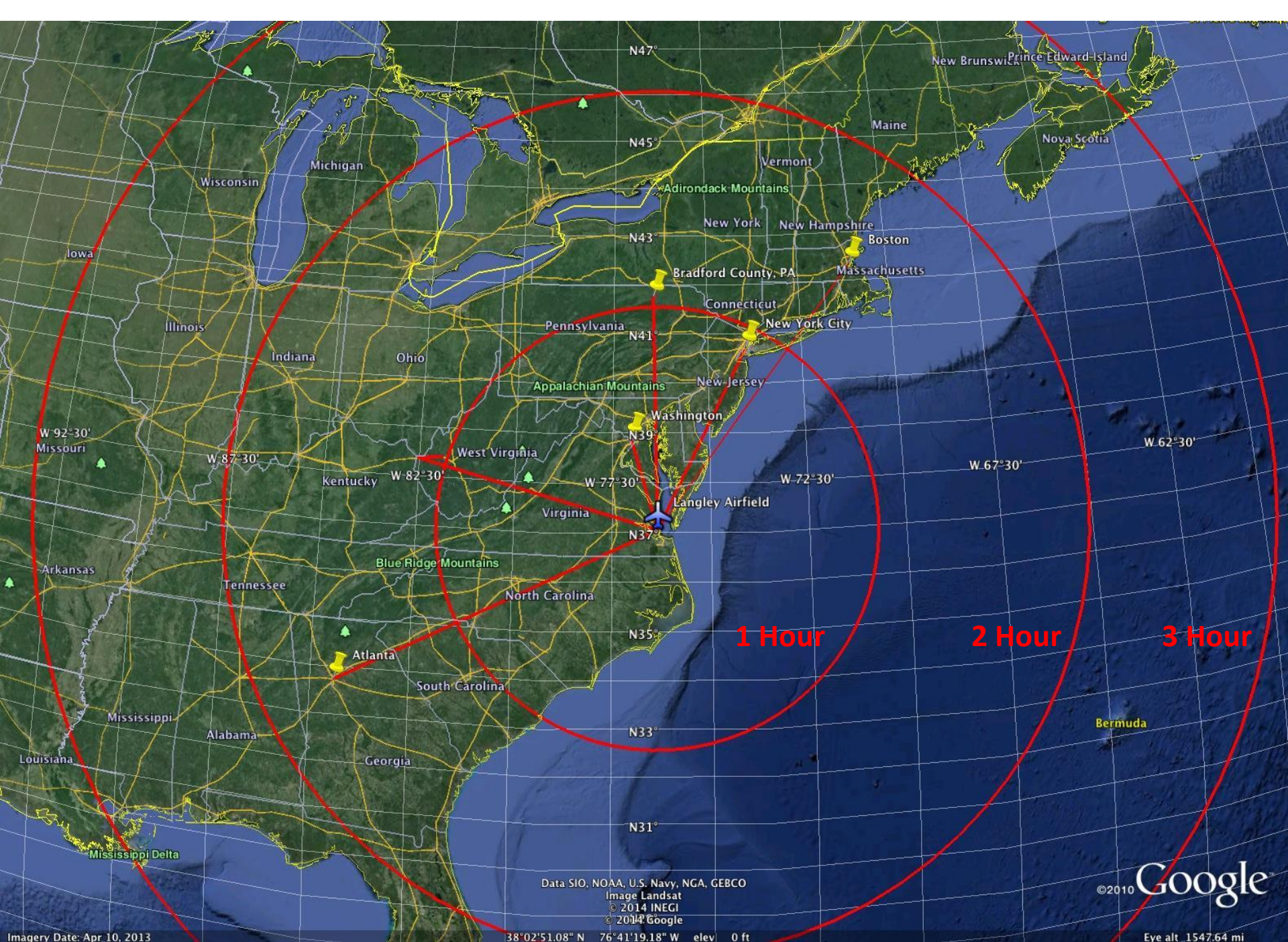


# WINTER Flight Planning

## November 7, 2014





Data SIO, NOAA, U.S. Navy, NGA, GEBCO  
Image Landsat  
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Imagery Date: Apr 10, 2013

38°02'51.08" N 76°41'19.18" W elev 0 ft

Eye alt 1547.64 mi

# Target Regions For WINTER Flights

Urban North	Northeast Corridor Cities: Wash, Balt, Phil, NYC, Bos; Possibly one inland city: Cincinnati or Toronto?
Urban South	Atlanta or smaller cities in North Carolina
Ohio River Valley	Power plants in Pennsylvania, Ohio, West Virginia, Kentucky
Urban far field	Follow forecast transport patterns over Atlantic Ocean
Marcellus	Northern Pennsylvania

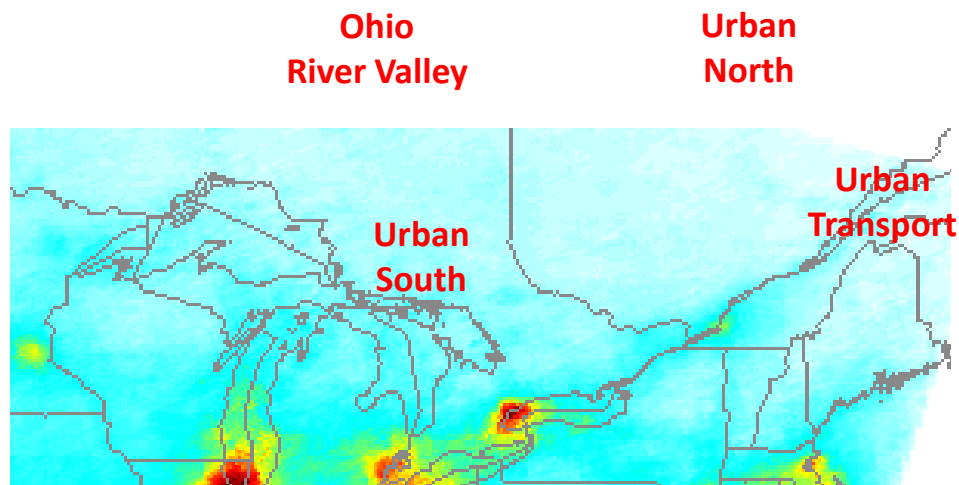
OMI NO<sub>2</sub>, Winter 2011, Russell et al., ACP 2012

## Transit Times @ 500 km hr<sup>-1</sup>

	km	hr
NYC Transit	453	0.9
Washington Transit	209	0.4
Atlanta Transit	817	1.6
OHR Transit	565	1.1
Marcellus Transit	521	1.0
Boston Transit	741	1.5

## Transit Times @ 500 km hr<sup>-1</sup>

Day	11 AM - 7 PM
Night	10 PM - 6 AM
Night into Day	5 AM - 1 PM
Day into Night	3 PM - 11 PM

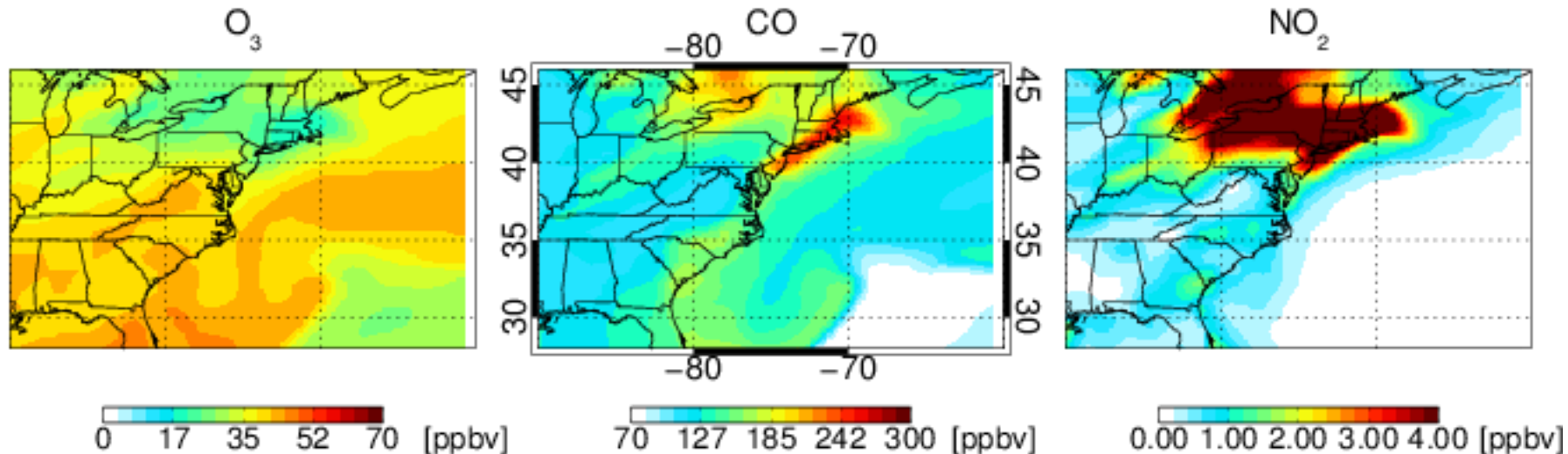


## Flight Matrix

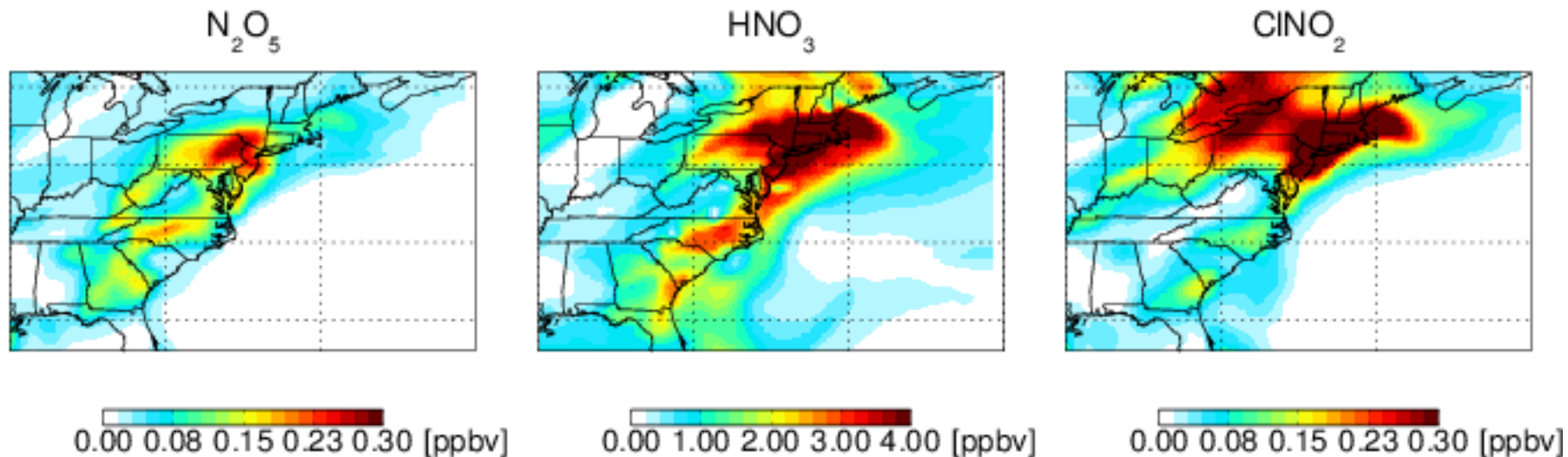
	Day	Night	Night into Day	Day into Night
Urban North	✓	✓	✓	✓
Urban South	✓	✗	✗	✓
Ohio River Valley	✓	✓	✗	✗
Urban far field	✓	✓	✓	✗

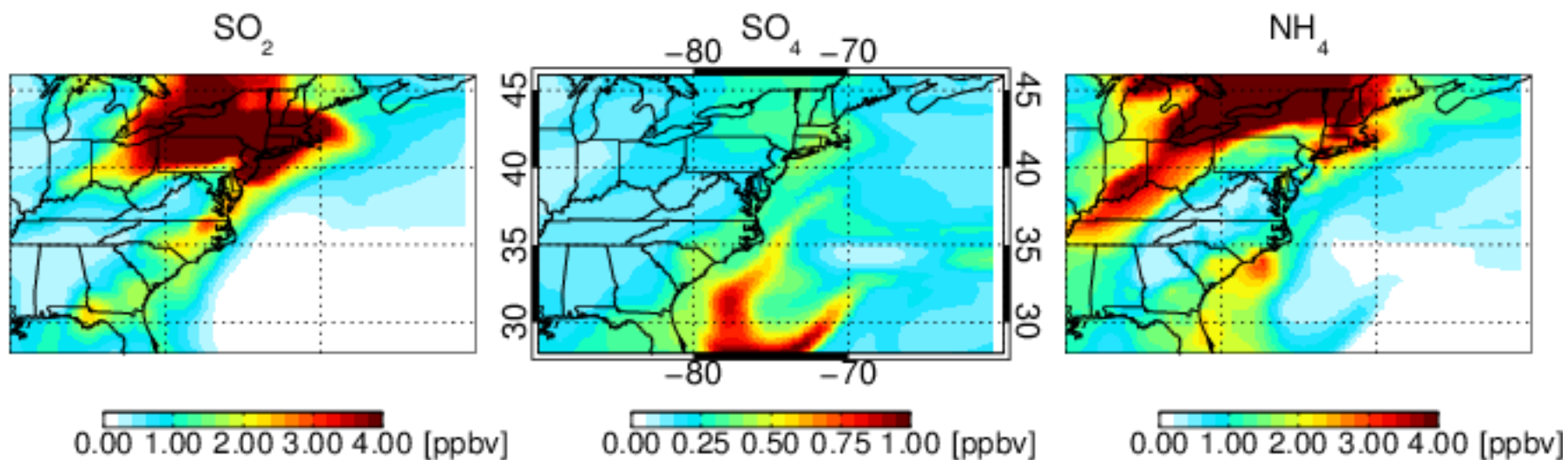
# Example 1: New York City At Night

## Archive Data from February 11-12, 2011

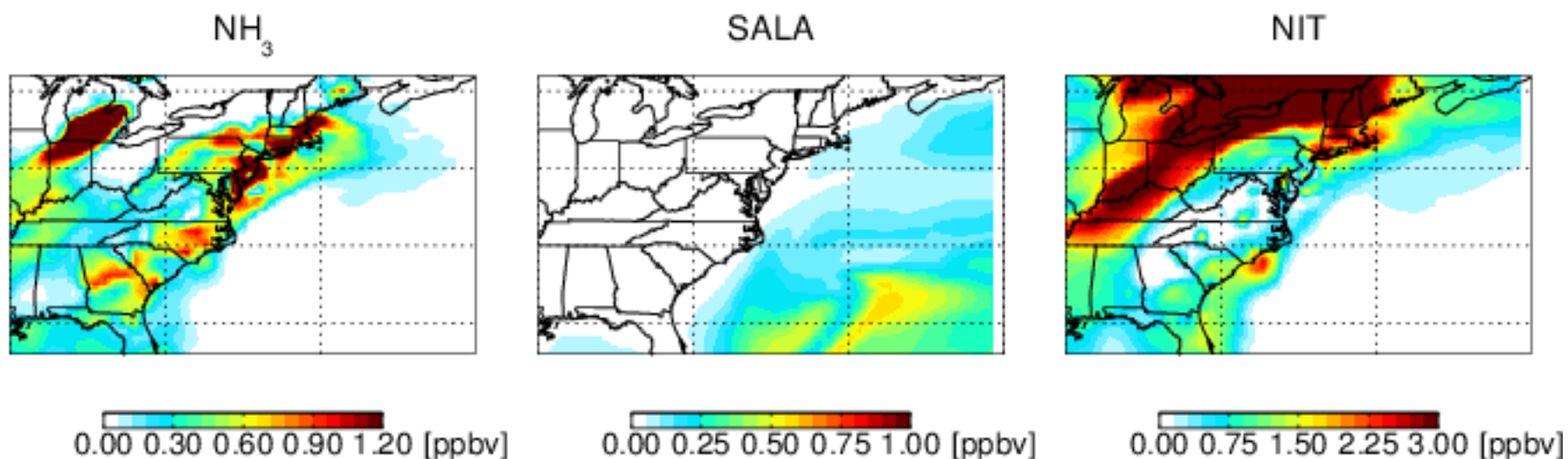


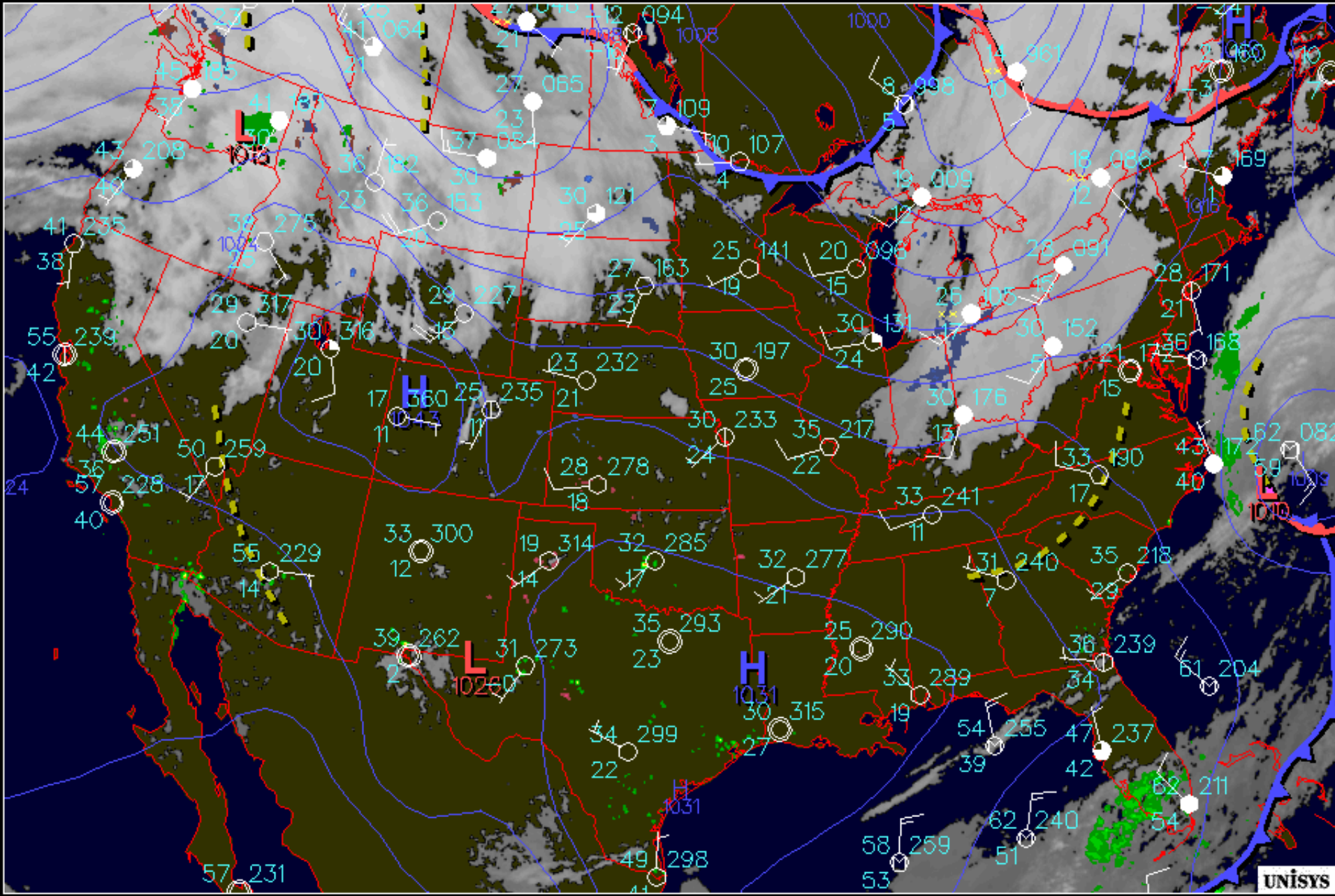
20110212 at 06 GMT (1 am EST), 944 hPa( 0.6 km)



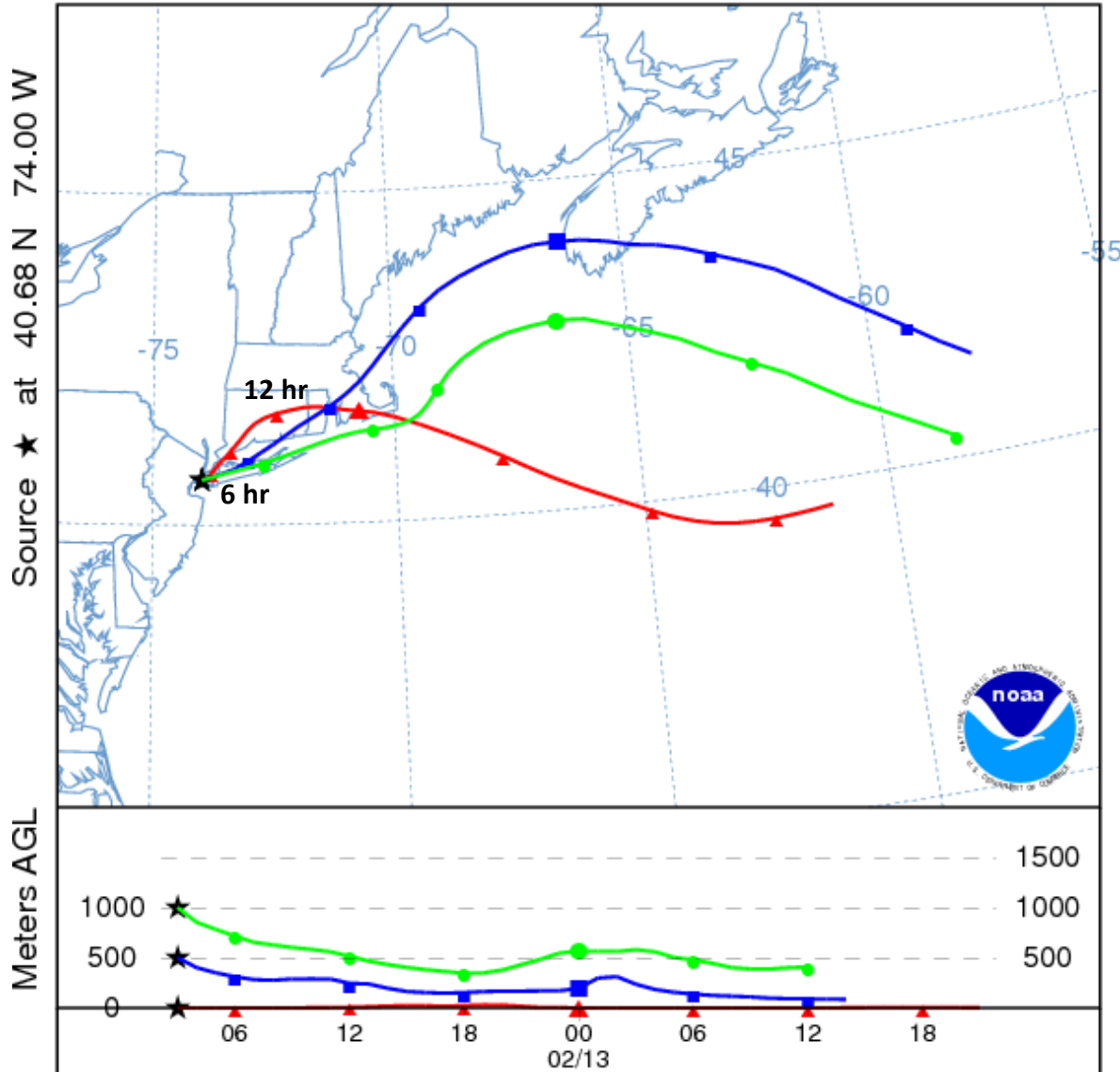


20110212 at 06 GMT (1 am EST), 944 hPa( 0.6 km)

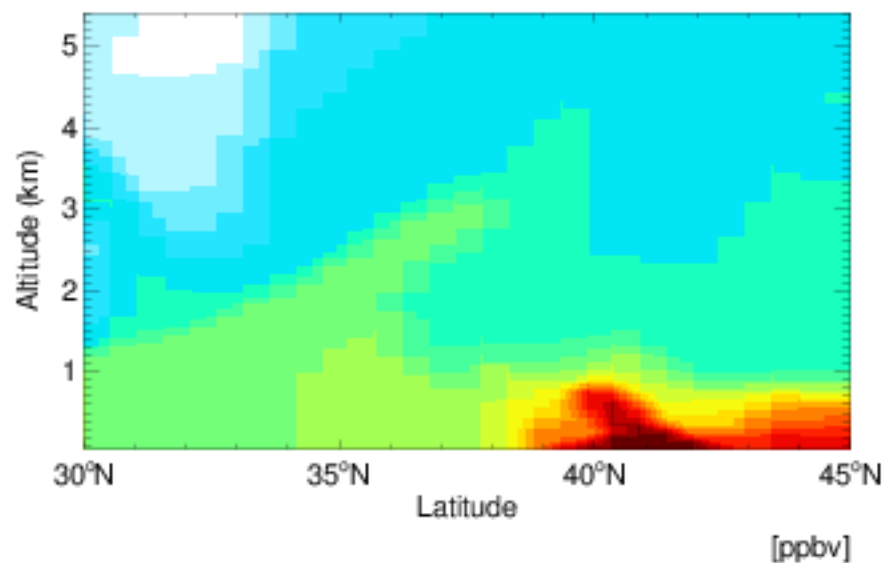




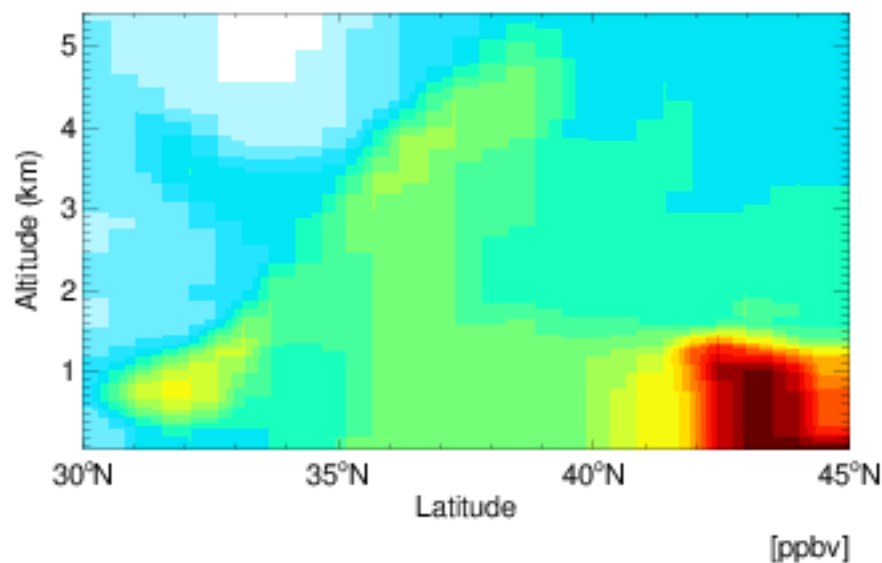
- 48 Hour Forward Trajectory from NYC Starting at 10 PM Eastern Time on February 11<sup>th</sup>
- 3 Trajectories at Surface, 500 m, 1000 m



CO cross section: 75°W

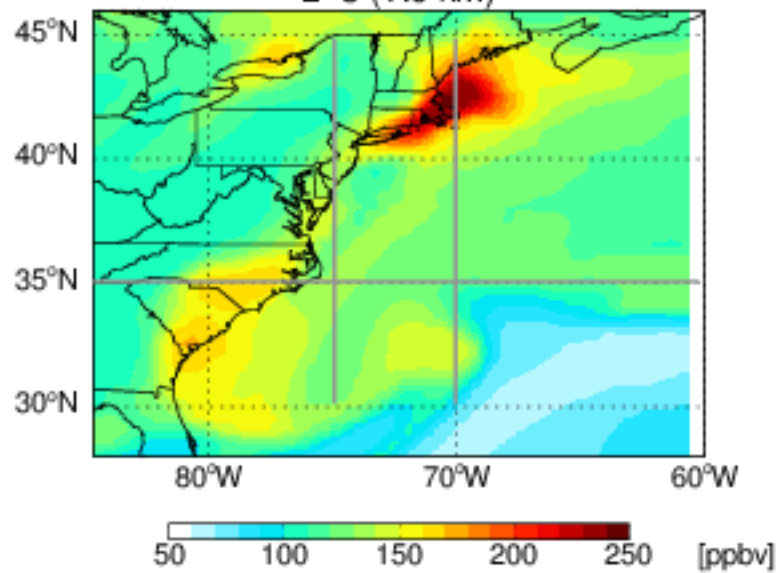


CO cross section: 70°W

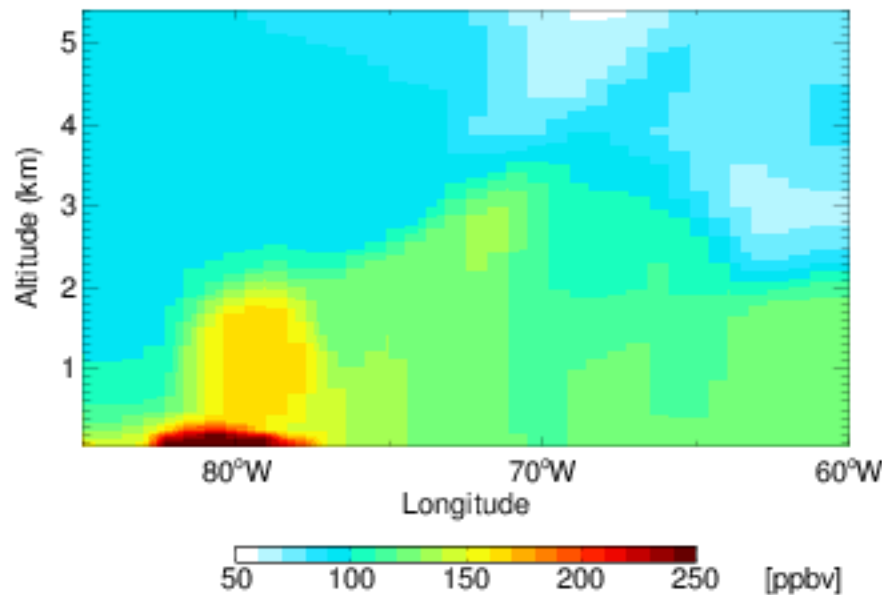


GEOS5 47L CO 110212 at 06:00 GMT

L=8 (1.0 km)

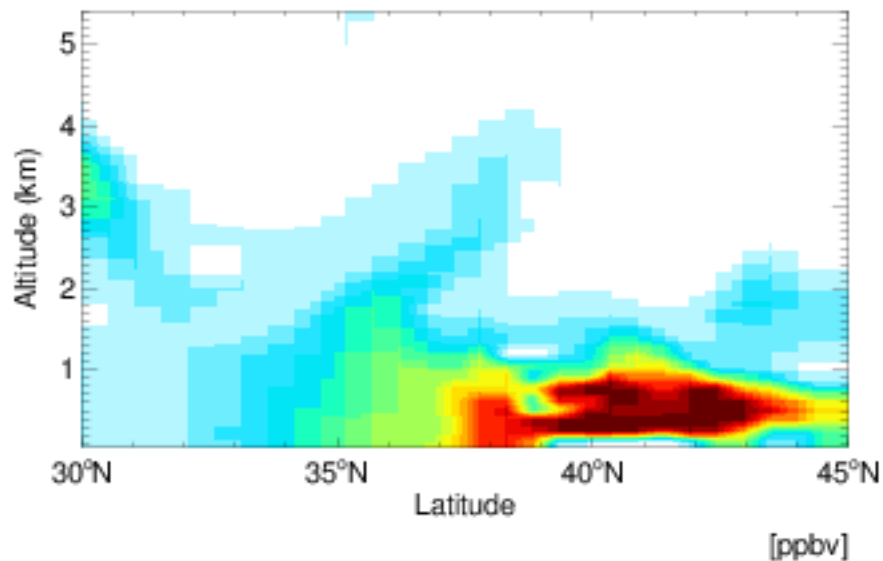


CO cross section: 35°N

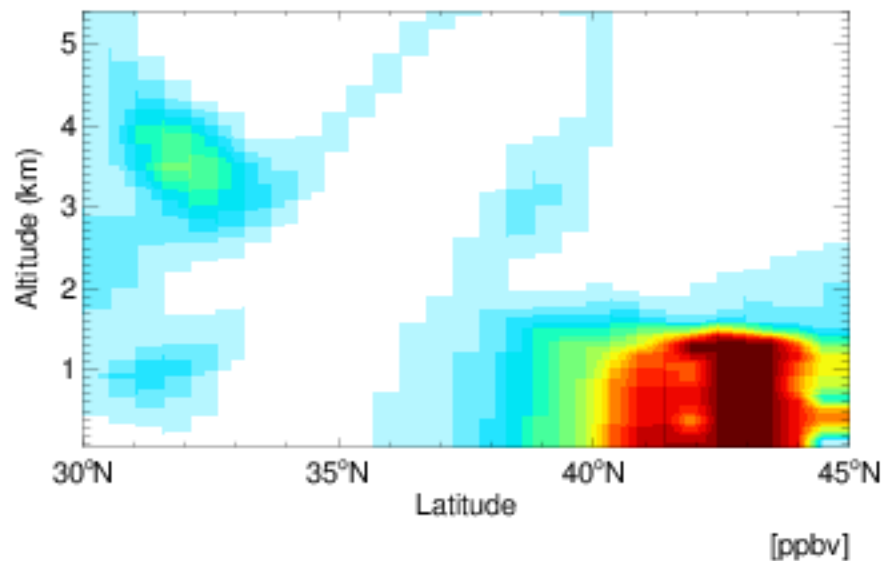




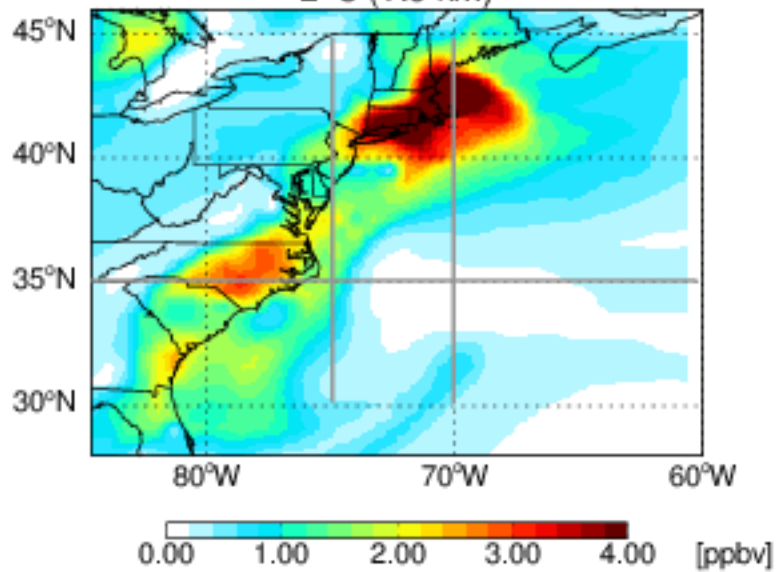
HNO<sub>3</sub> cross section: 75°W



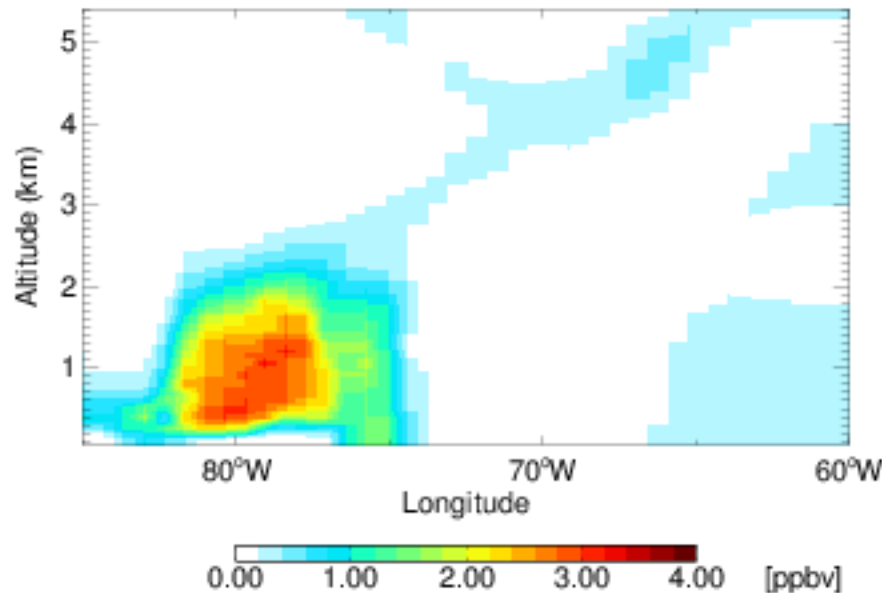
HNO<sub>3</sub> cross section: 70°W



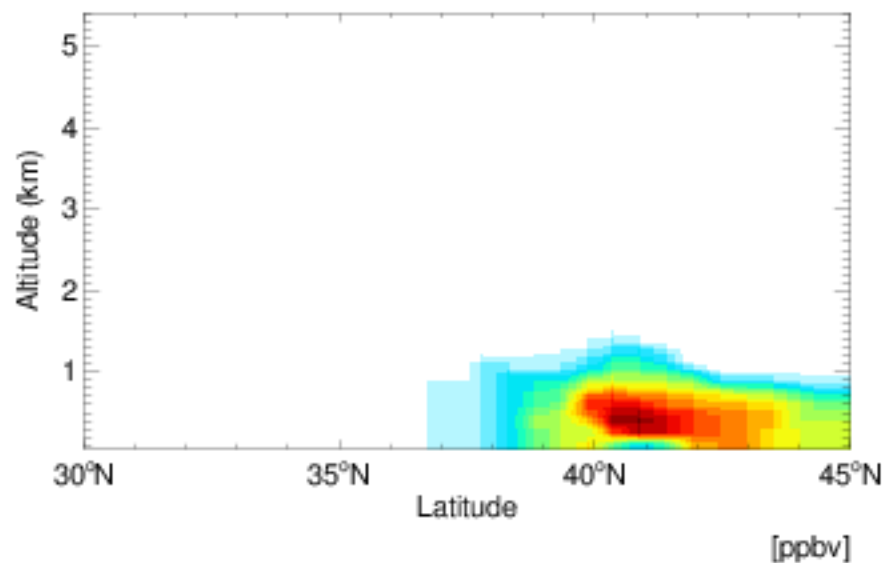
GEOS5 47L HNO<sub>3</sub> 110212 at 06:00 GMT  
L=8 (1.0 km)



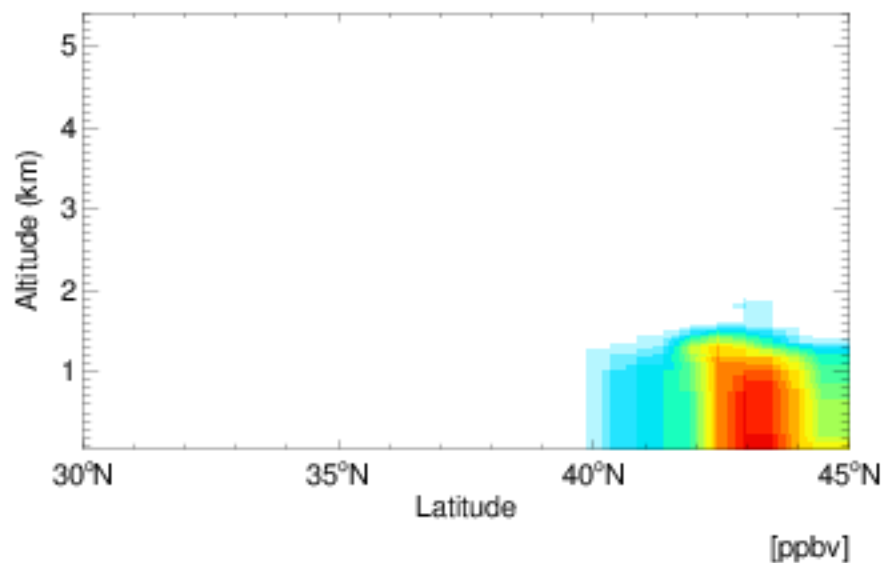
HNO<sub>3</sub> cross section: 35°N



CINO<sub>2</sub> cross section: 75°W

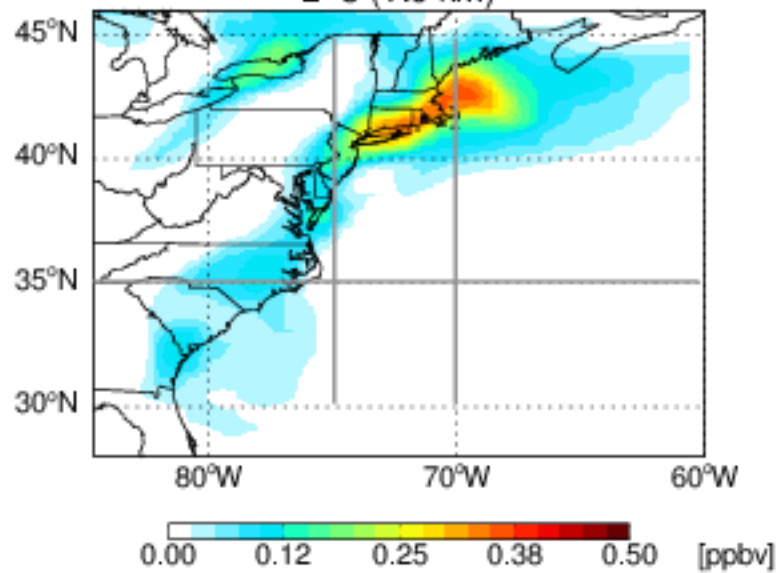


CINO<sub>2</sub> cross section: 70°W

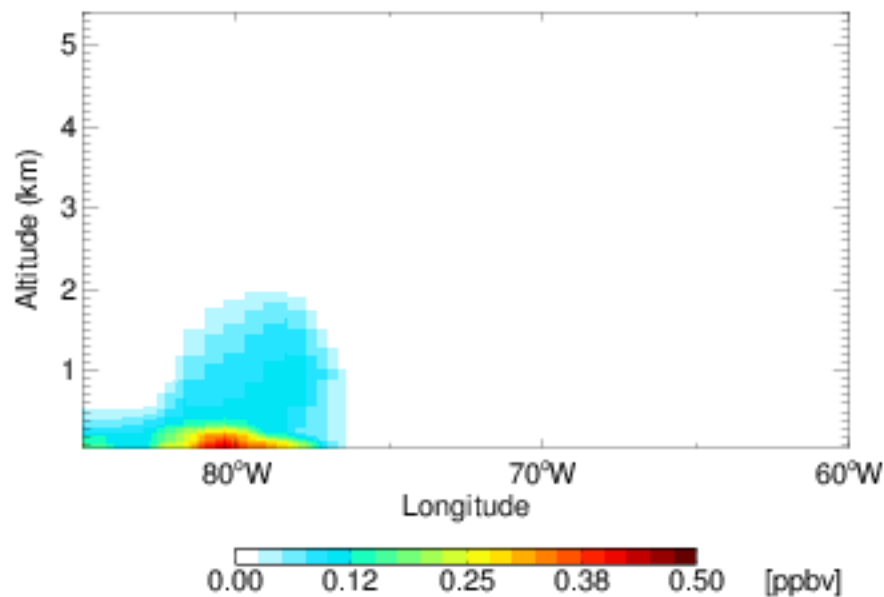


GEOS5 47L CINO<sub>2</sub> 110212 at 06:00 GMT

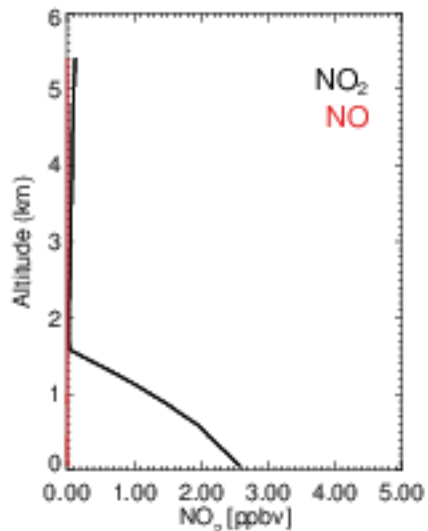
L=8 (1.0 km)



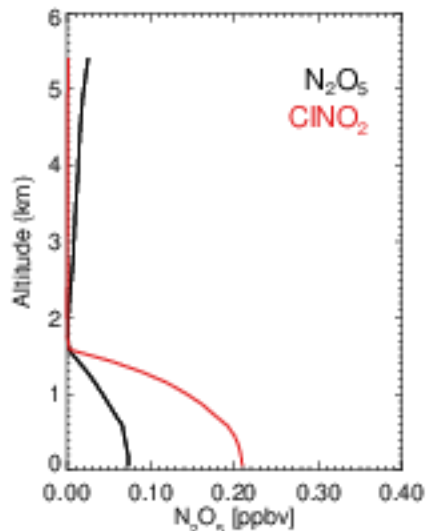
CINO<sub>2</sub> cross section: 35°N



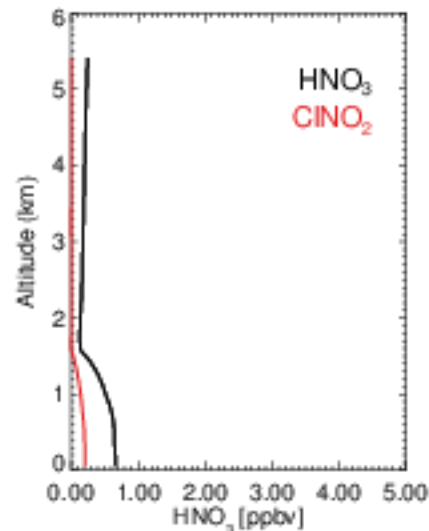
NO<sub>2</sub> and NO



N<sub>2</sub>O<sub>5</sub> and ClNO<sub>2</sub>



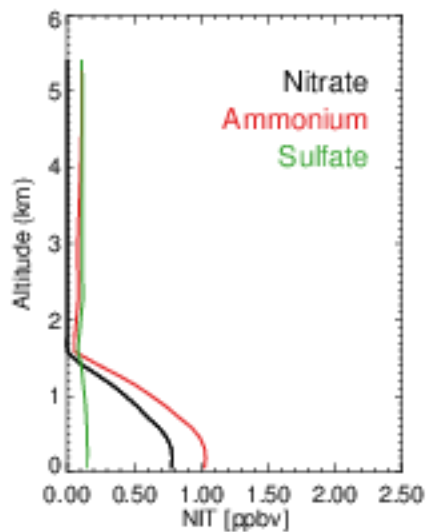
HNO<sub>3</sub> and ClNO<sub>2</sub>



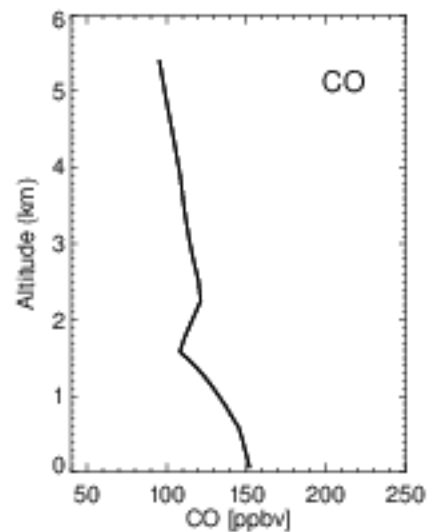
GEOS5 47L SO<sub>2</sub> 100212 at 06:00 GMT

Avg from Lat= 35°N–40°N Avg from Lon= 74°W–70°W

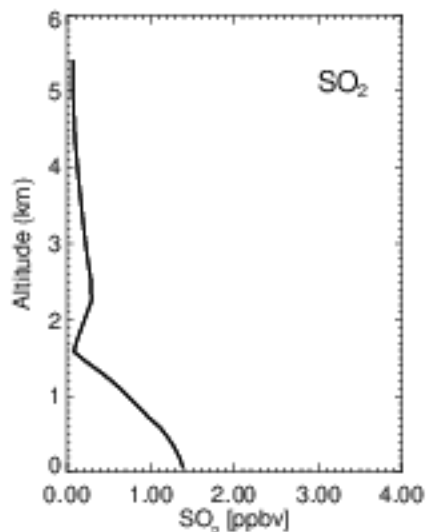
Nitrate, sulfate, Ammonium



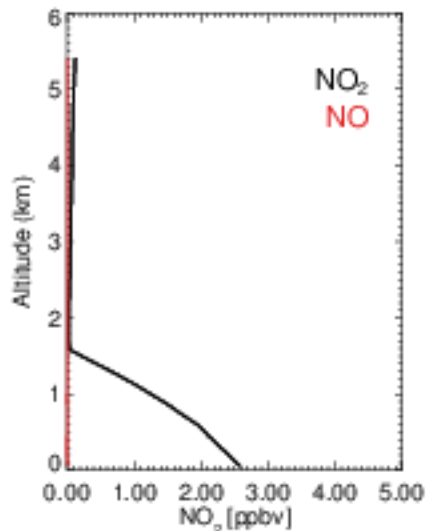
CO



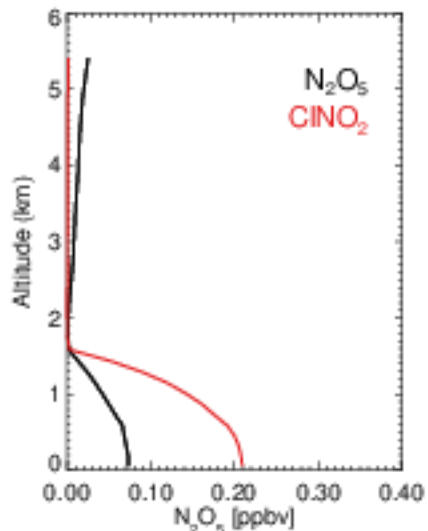
SO<sub>2</sub>



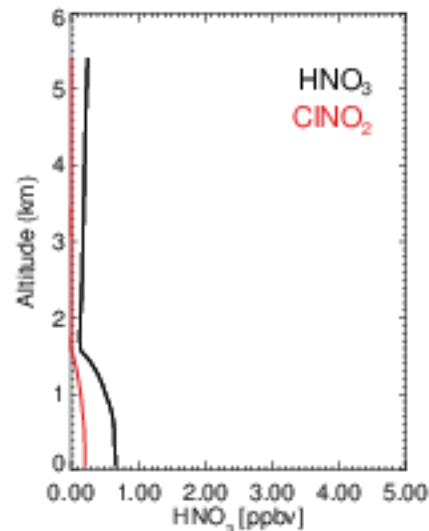
NO<sub>2</sub> and NO



N<sub>2</sub>O<sub>5</sub> and ClNO<sub>2</sub>



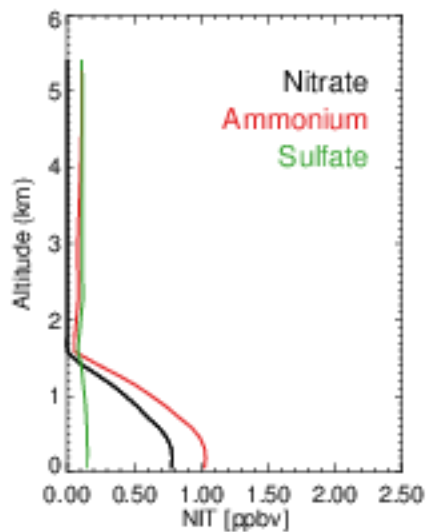
HNO<sub>3</sub> and ClNO<sub>2</sub>



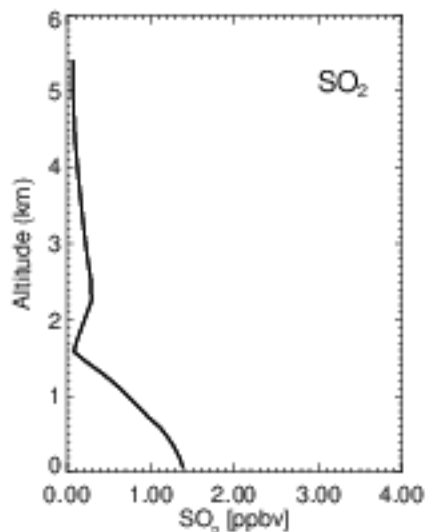
GEOS5 47L SO<sub>2</sub> 100212 at 06:00 GMT

Avg from Lat= 35°N–40°N Avg from Lon= 74°W–70°W

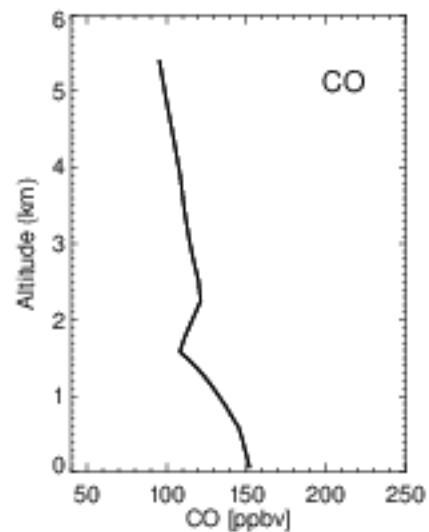
Nitrate, sulfate, Ammonium



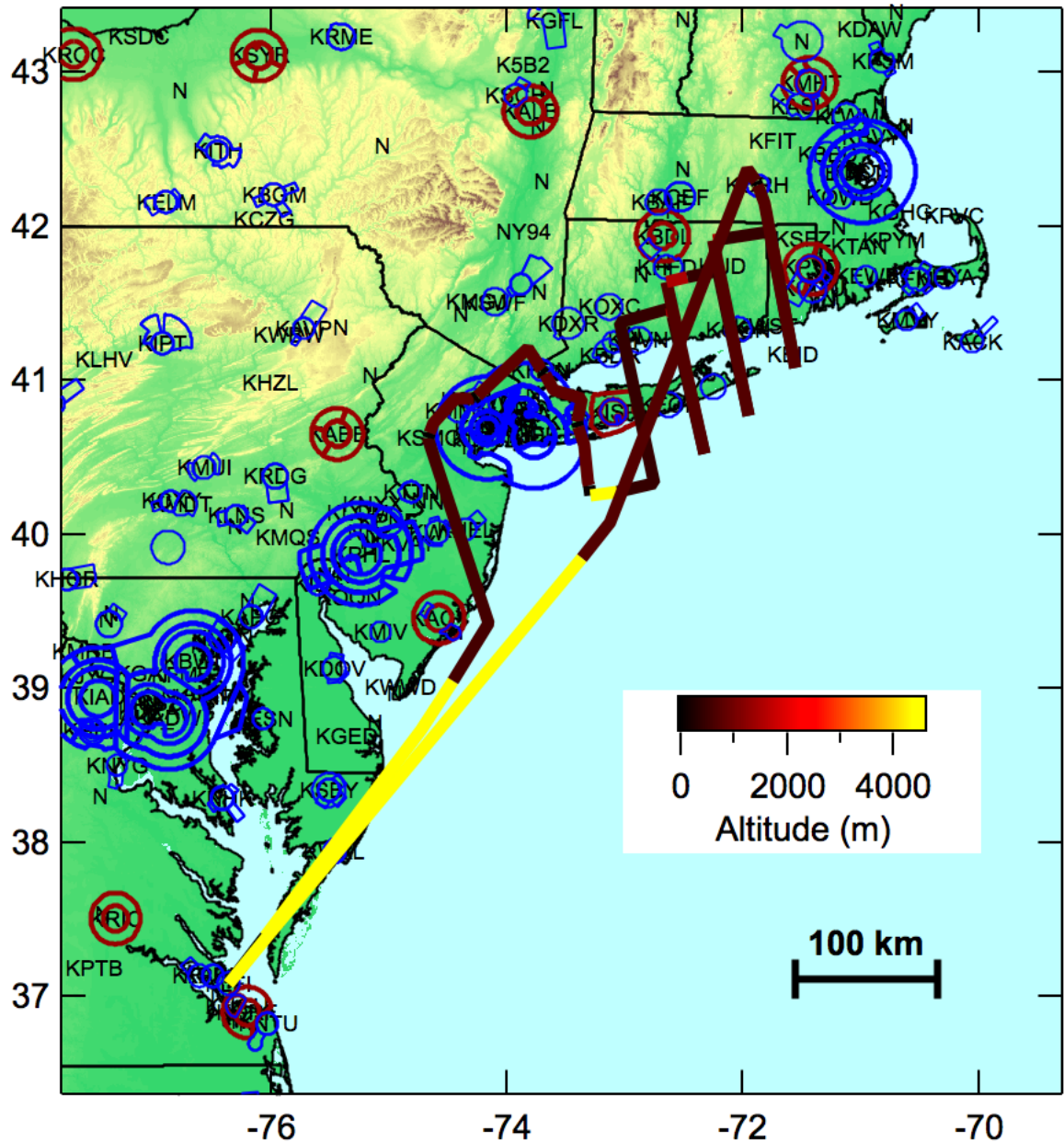
SO<sub>2</sub>



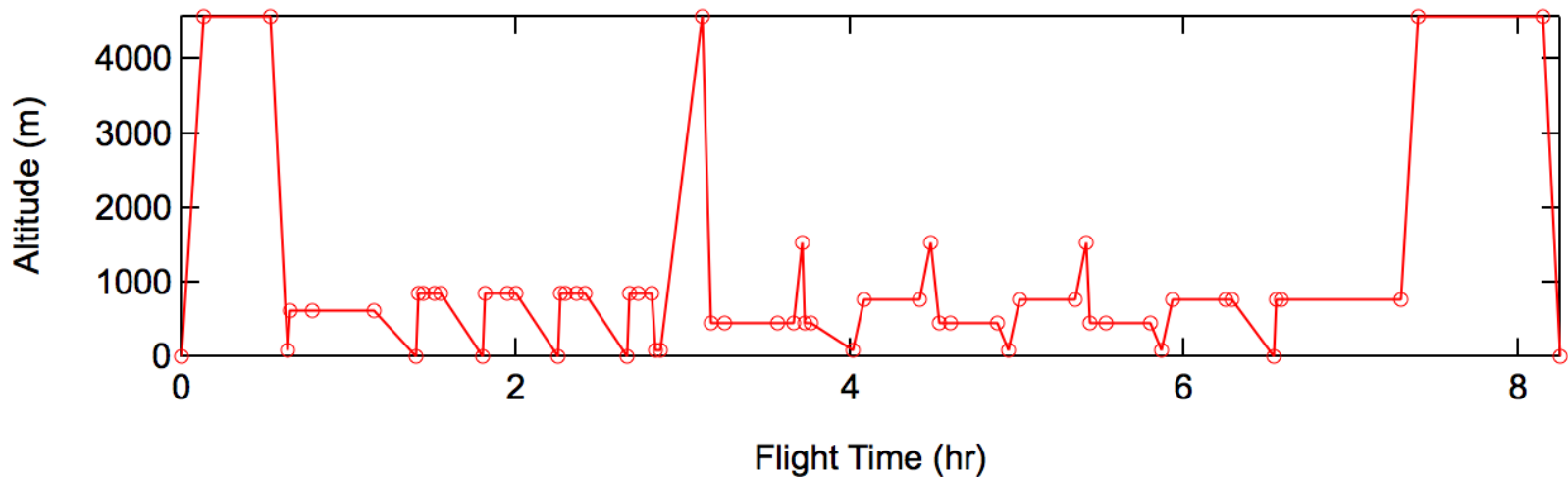
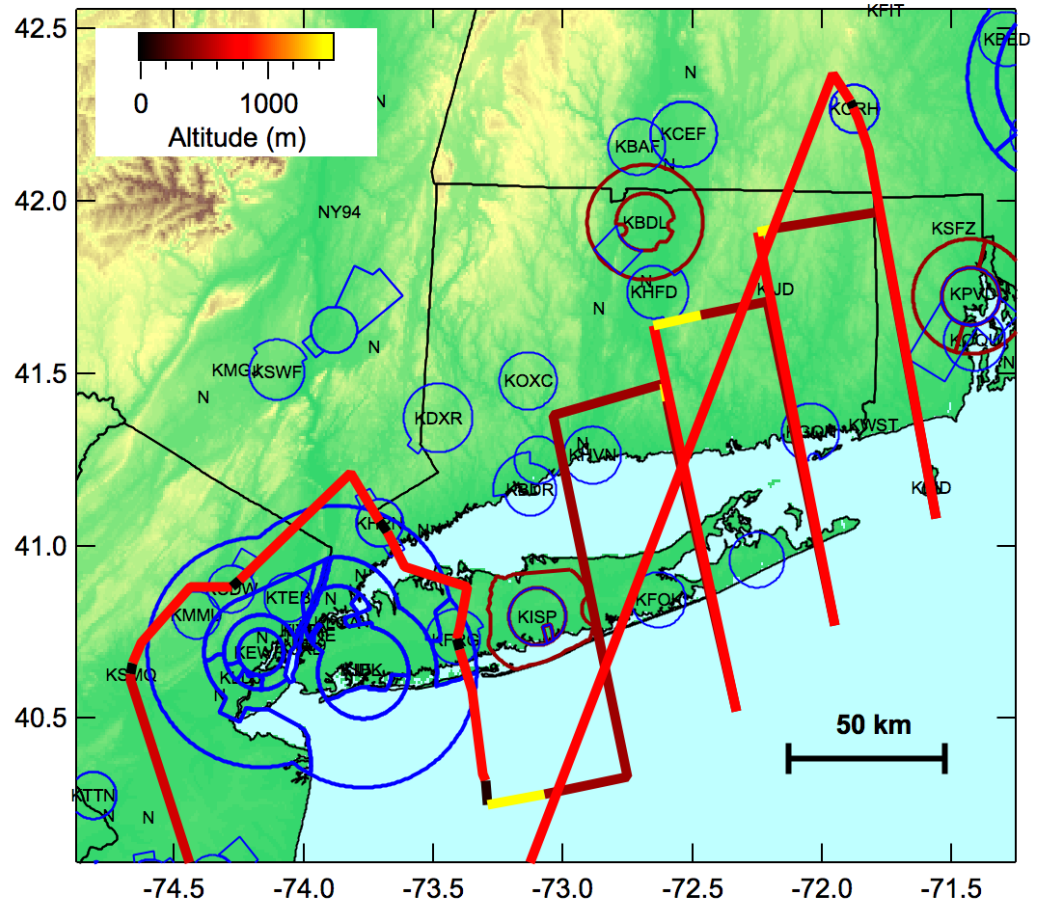
CO



# Example NYC Night Flight Plan (10 PM – 6 AM)

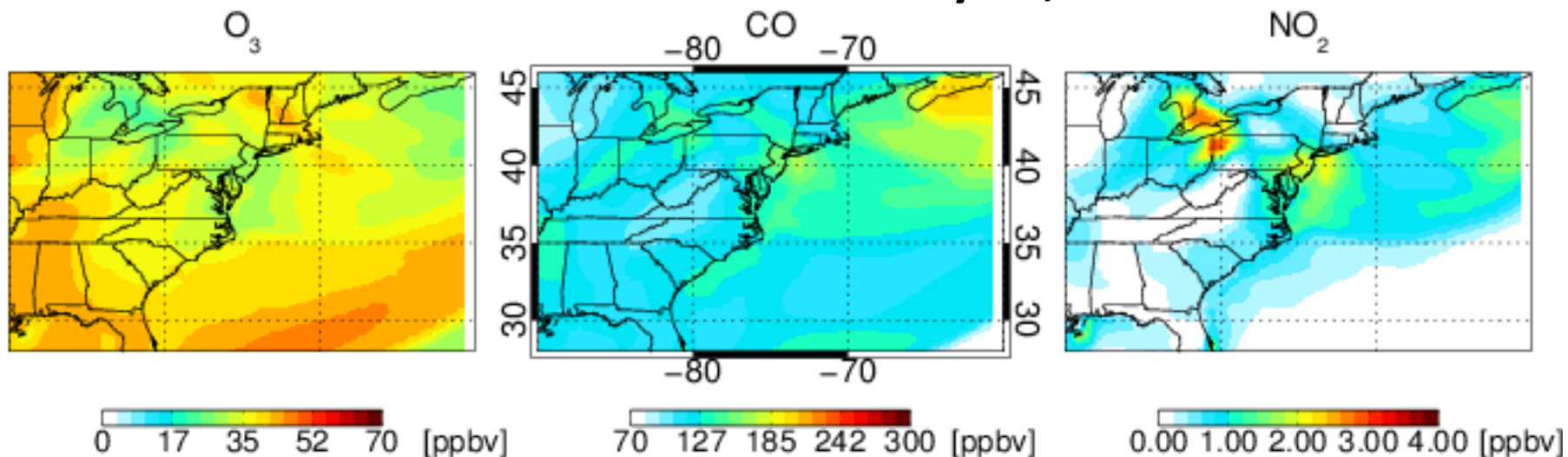


# Example NYC Night Flight Plan (10 PM – 6 AM)

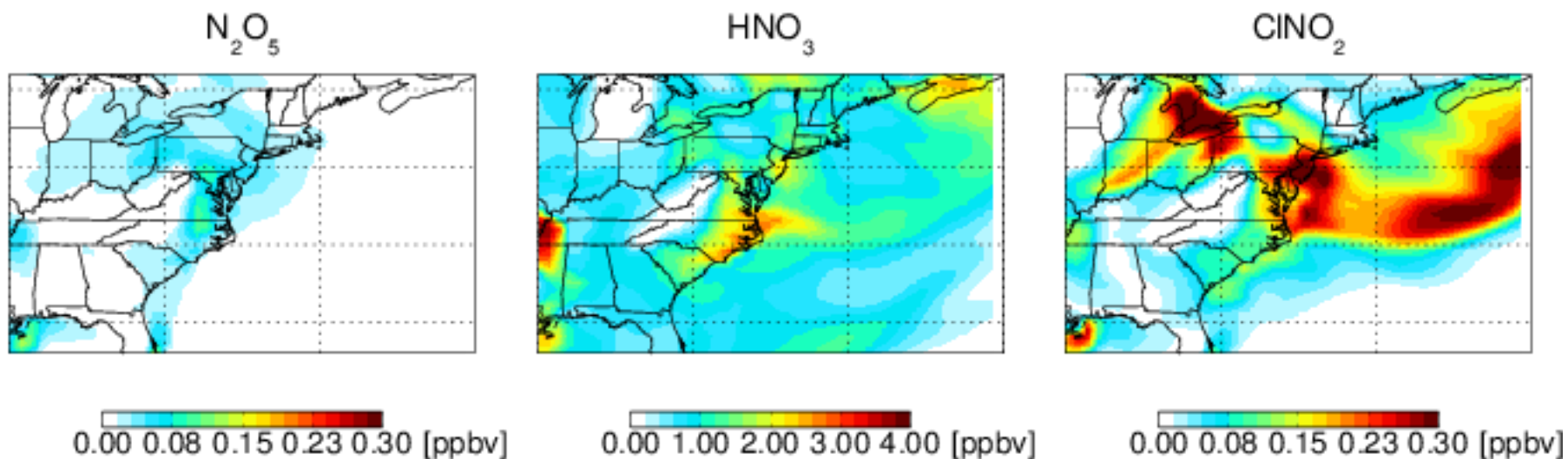


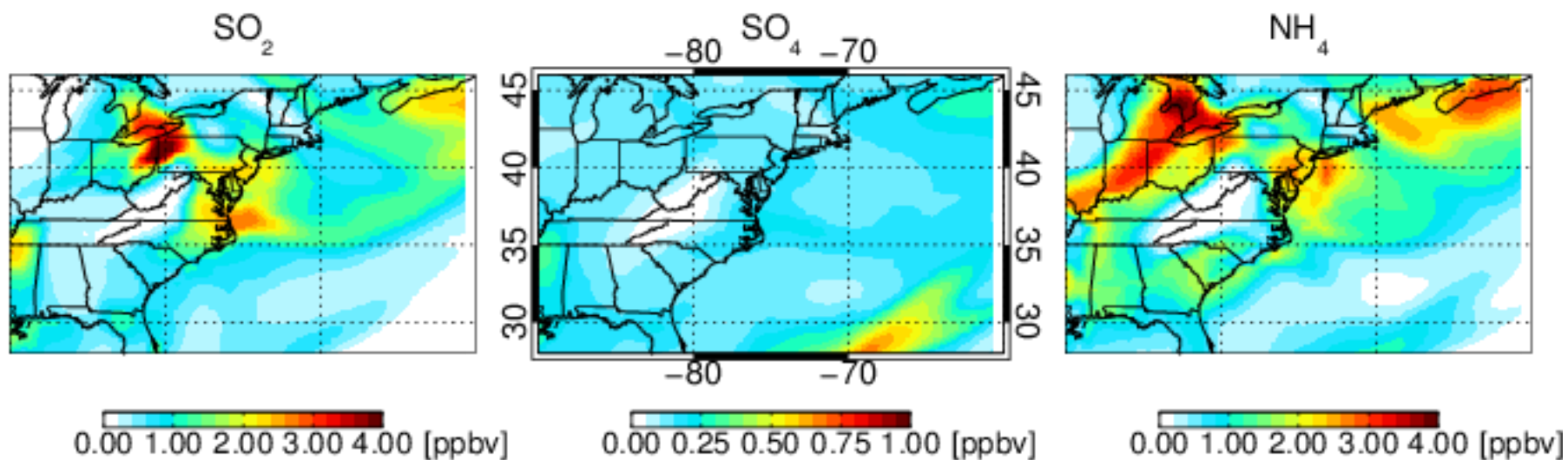
# Example 2: Urban Offshore, Night Into Day

## Archive Data from February 13, 2011

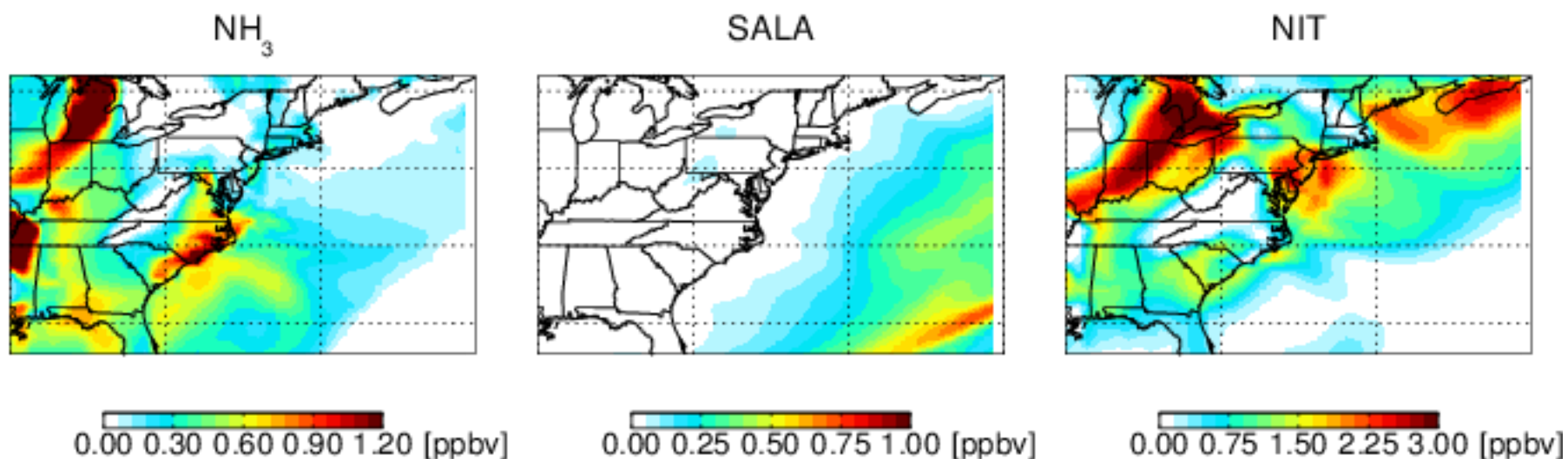


20110213 at 12 GMT (7 am EST), 944 hPa( 0.6 km)

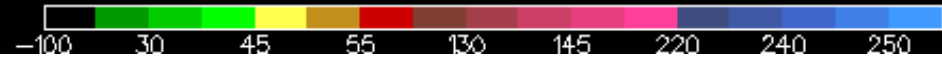
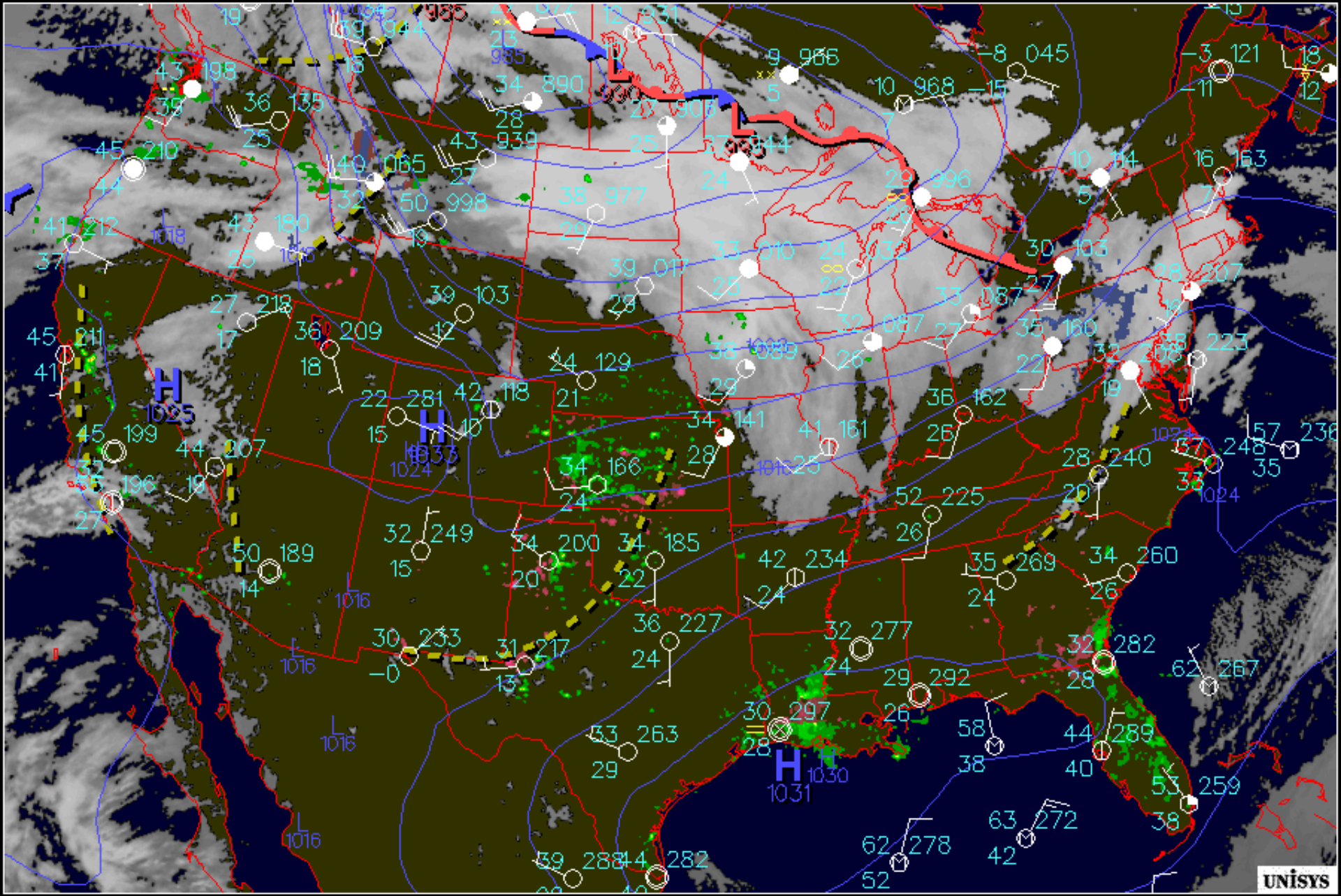




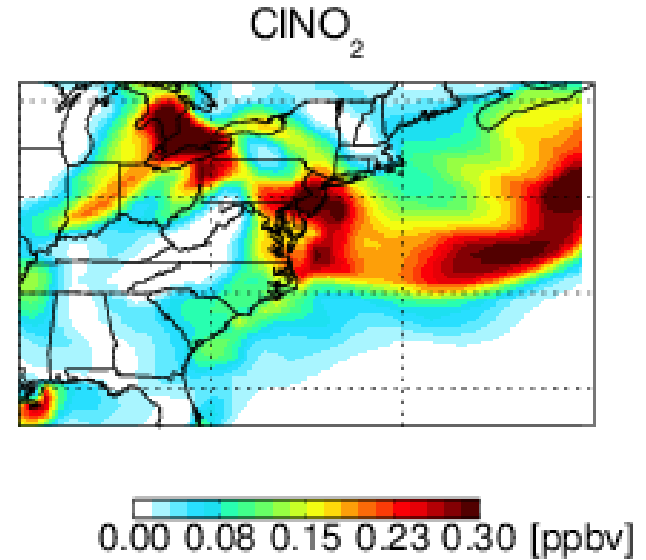
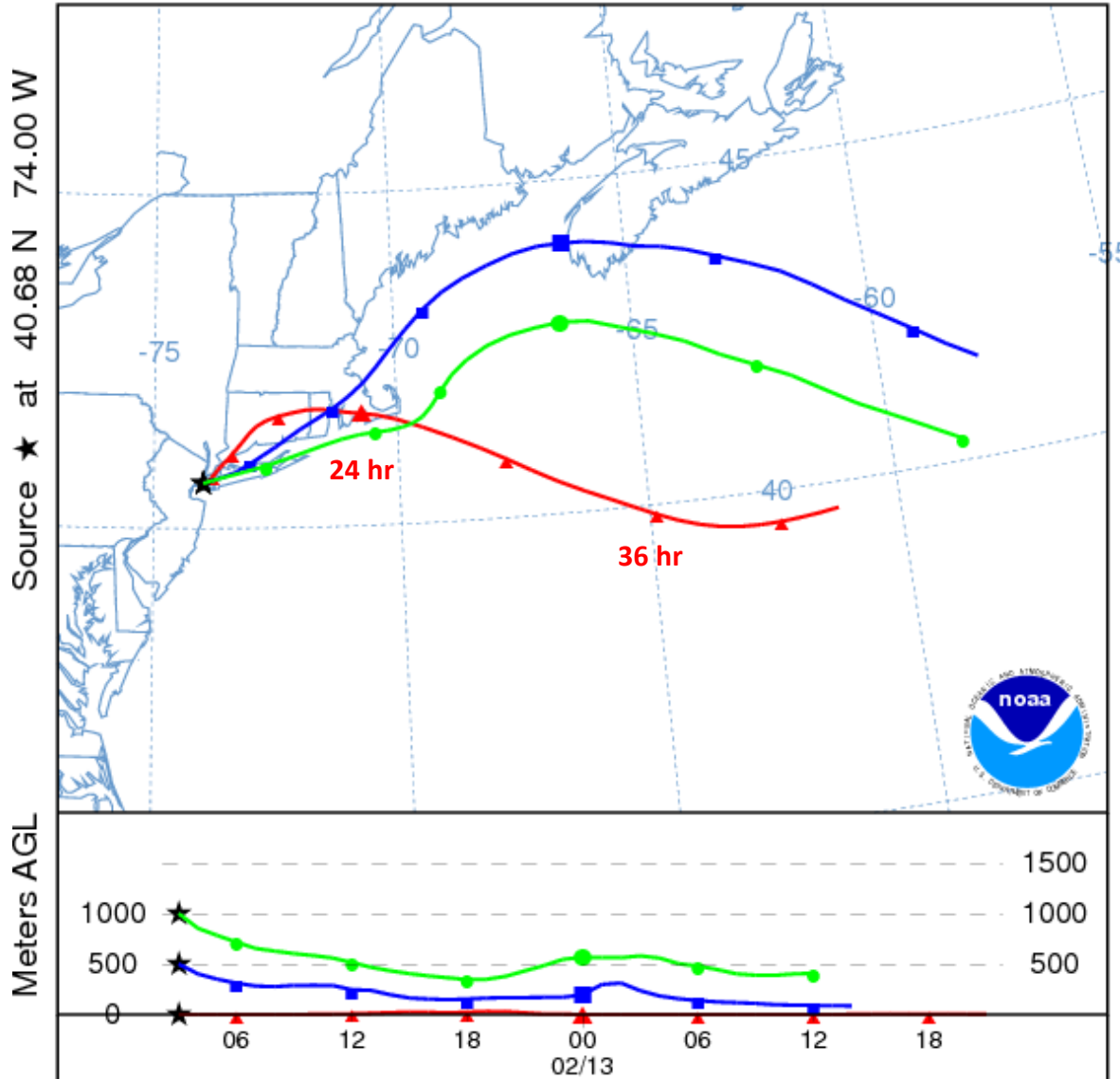
20110213 at 12 GMT (7 am EST), 944 hPa( 0.6 km)







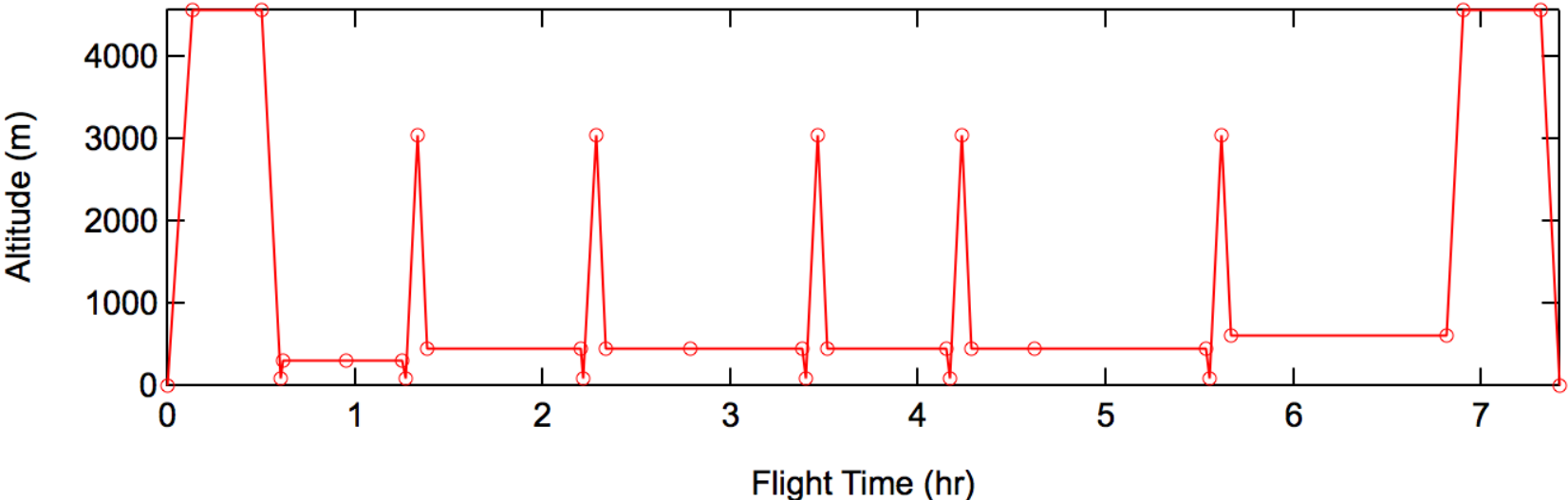
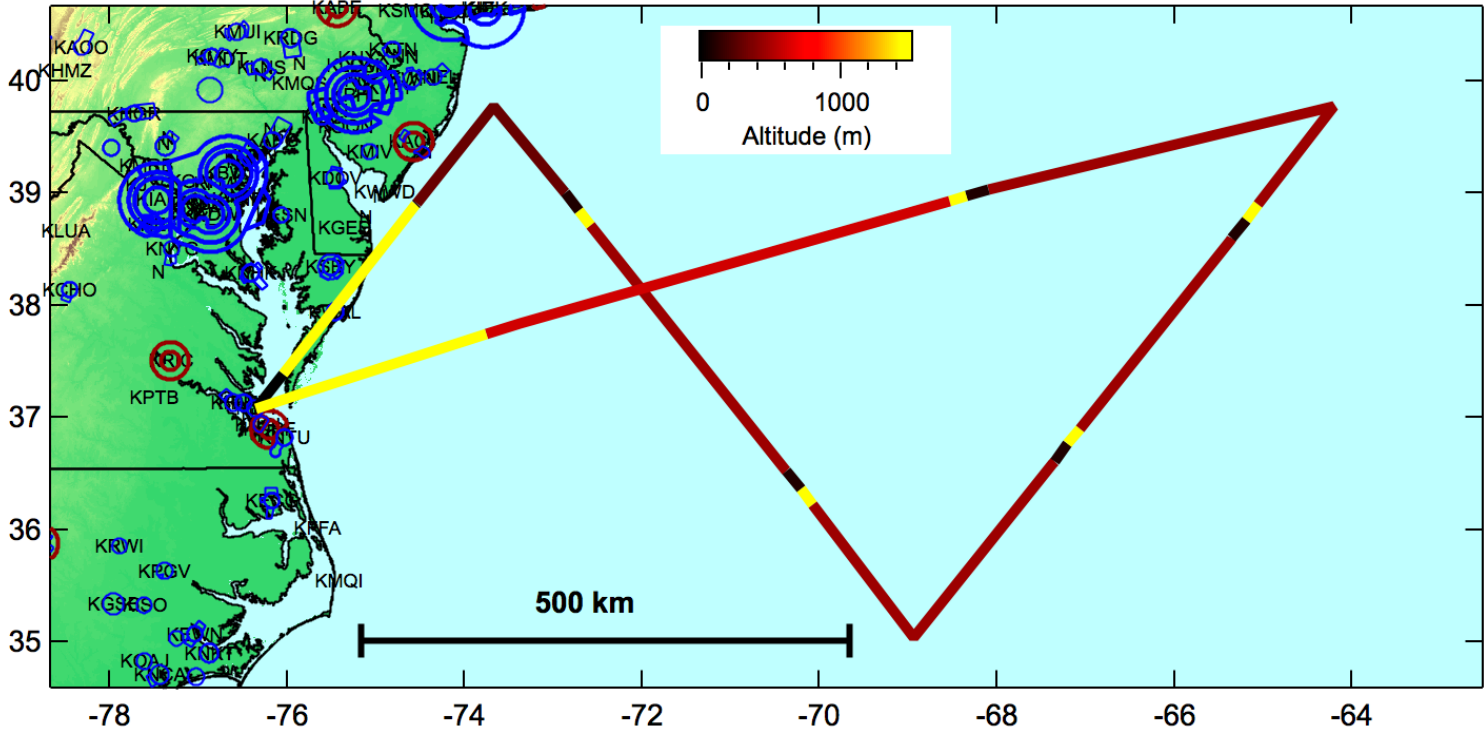
- 48 Hour Forward Trajectory from NYC Starting at 10 PM Eastern Time on February 11<sup>th</sup>
- 3 Trajectories at Surface, 500 m, 1000 m



Takeoff on February 11<sup>th</sup>:  
10 PM Local

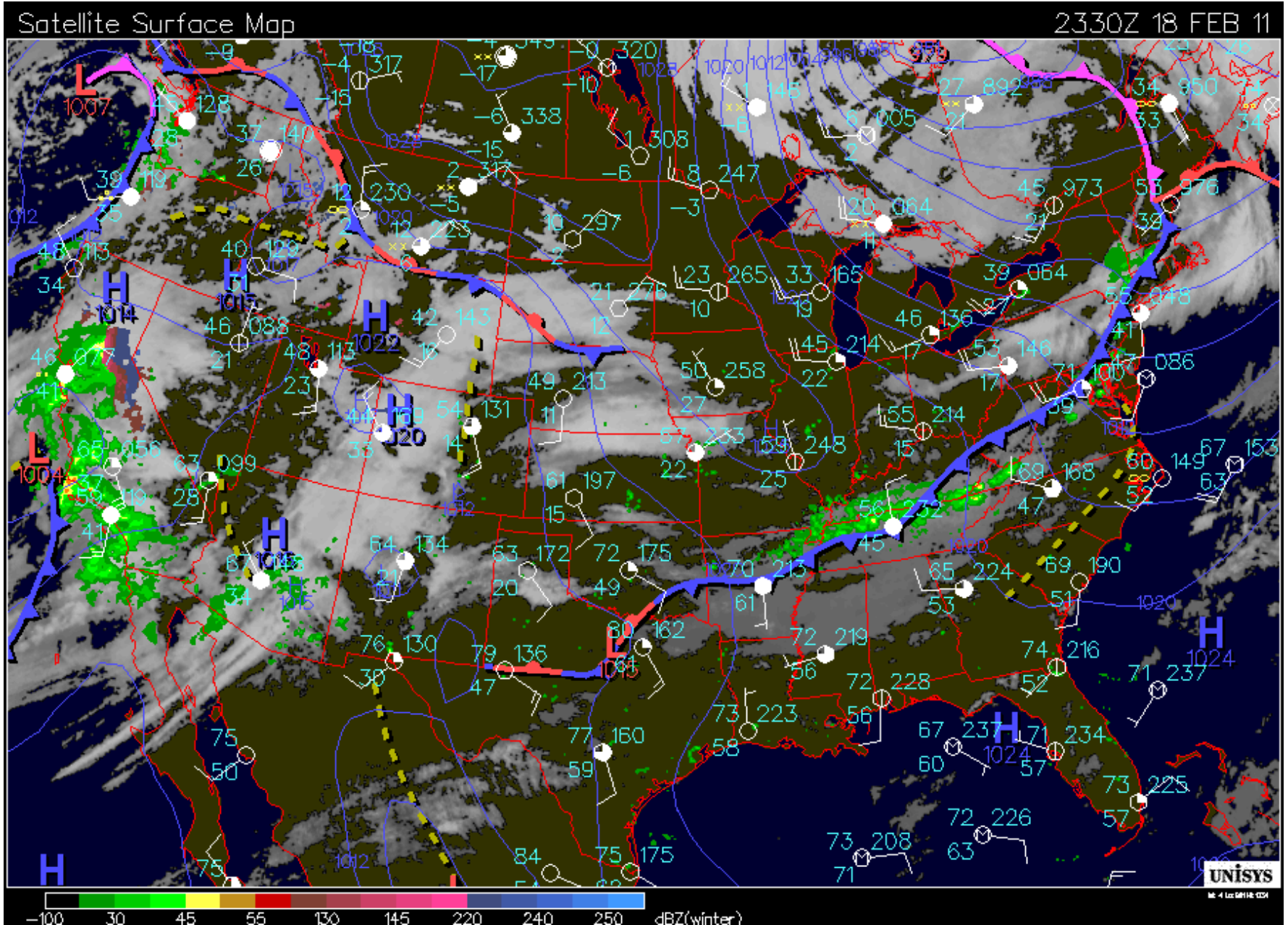
Takeoff on February 13<sup>th</sup>:  
5 AM Local

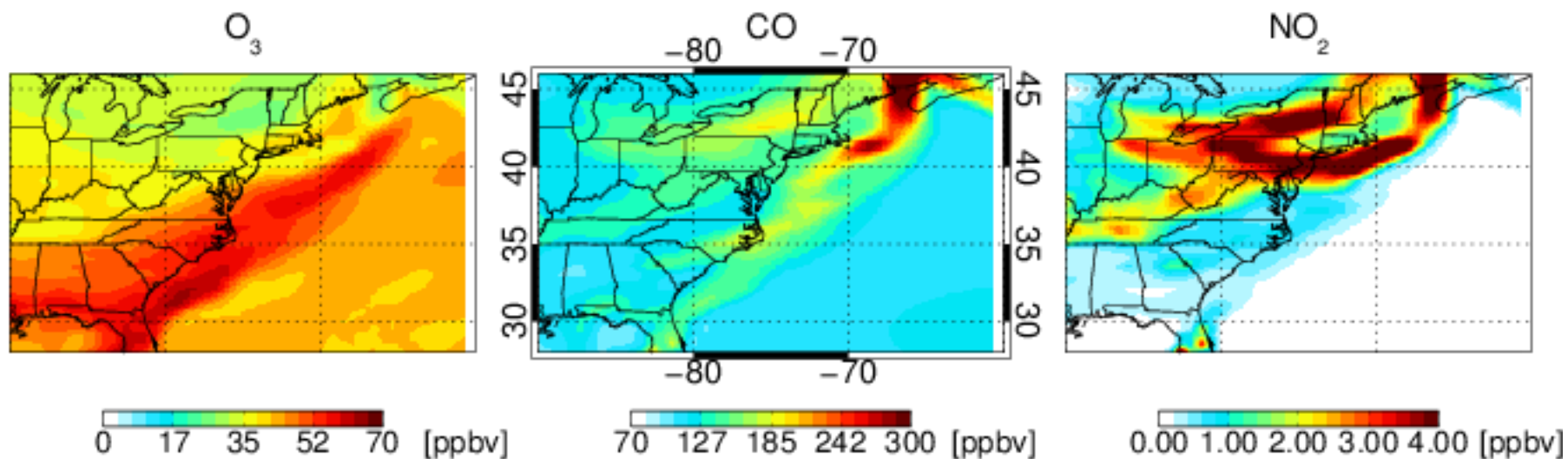
# Long Range Transport Flight, Night Into Day (5 AM Takeoff)



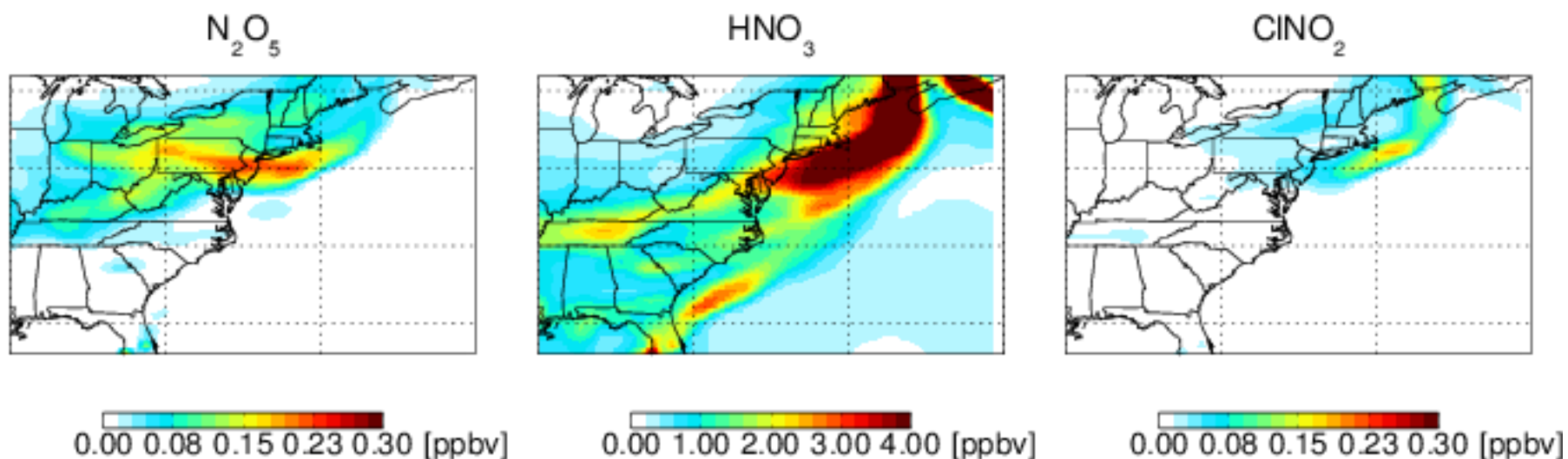
# Example 3: Atlanta, Day Into Night

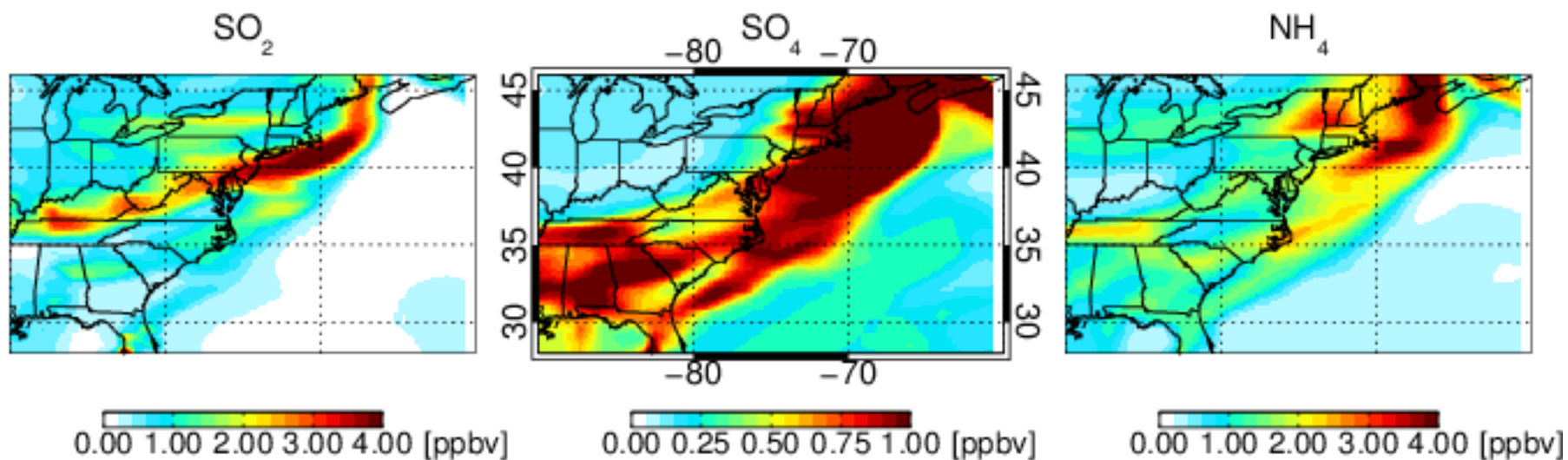
## Archive Data from February 18-19, 2011



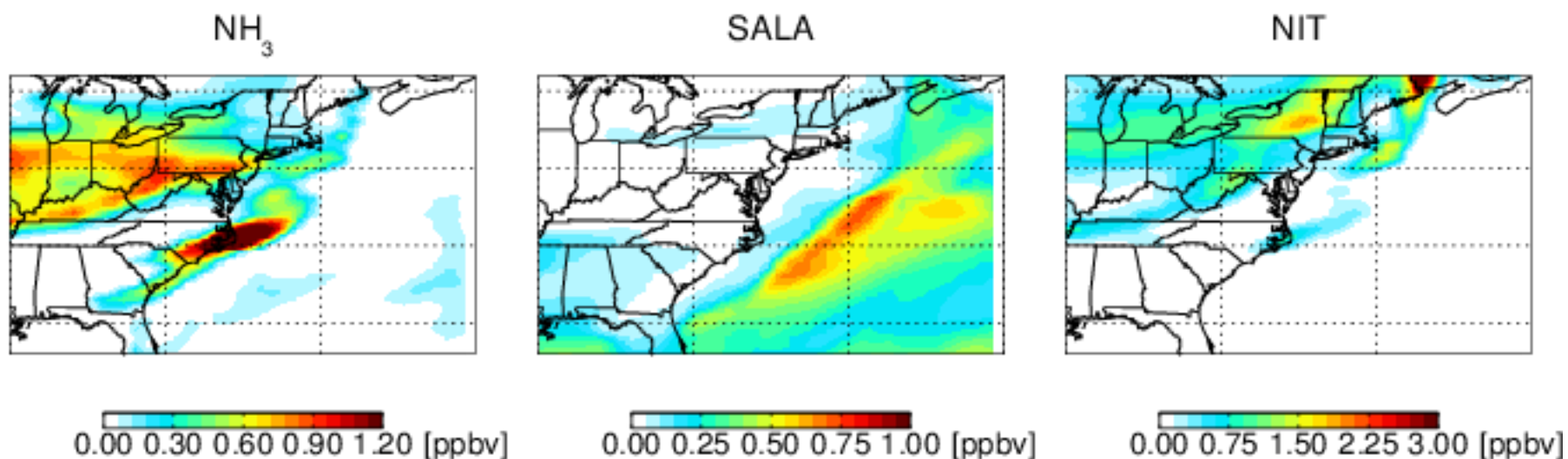


20110219 at 00 GMT (7 pm EST), 944 hPa( 0.6 km)

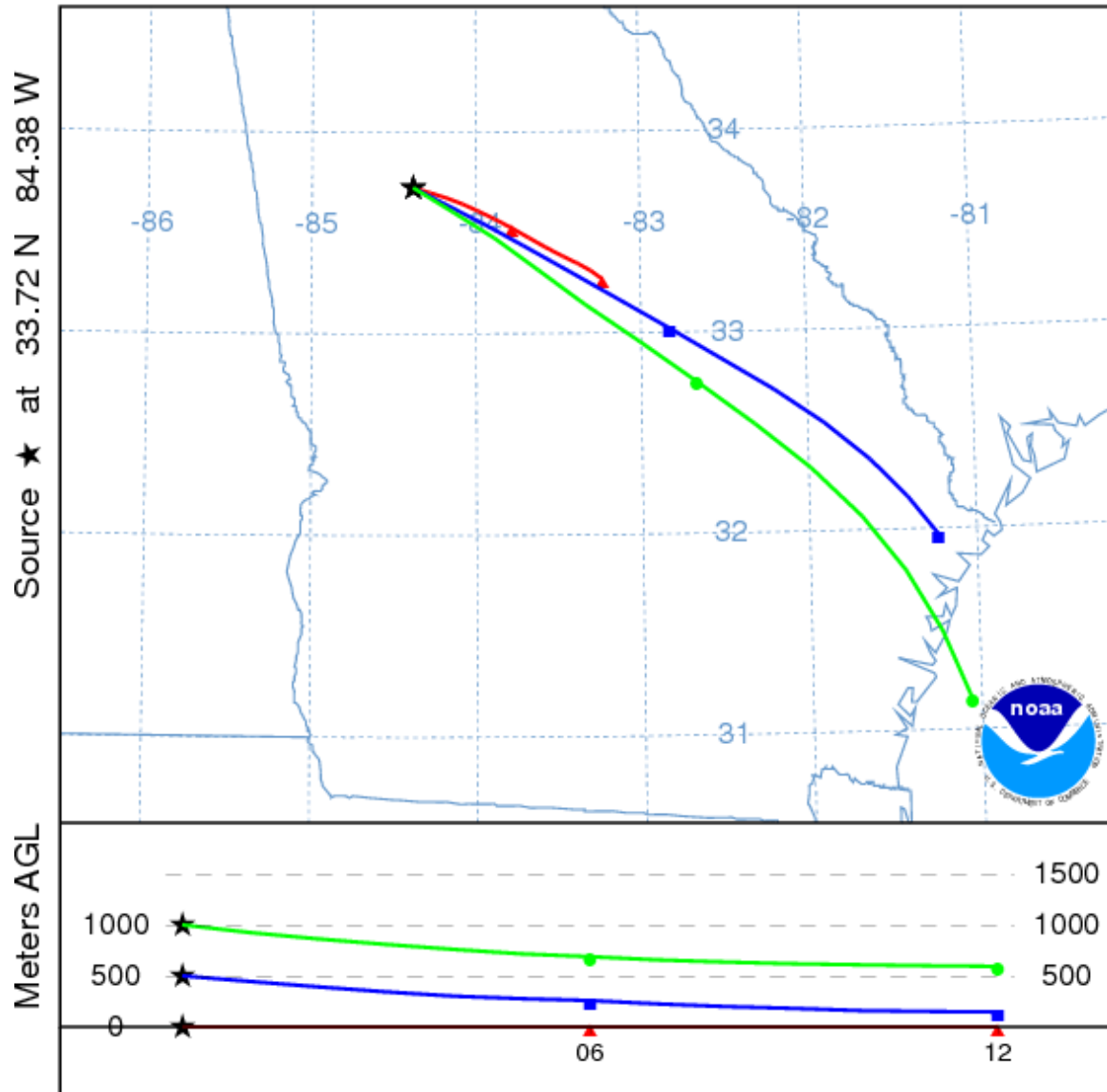




20110219 at 00 GMT (7 pm EST), 944 hPa( 0.6 km)

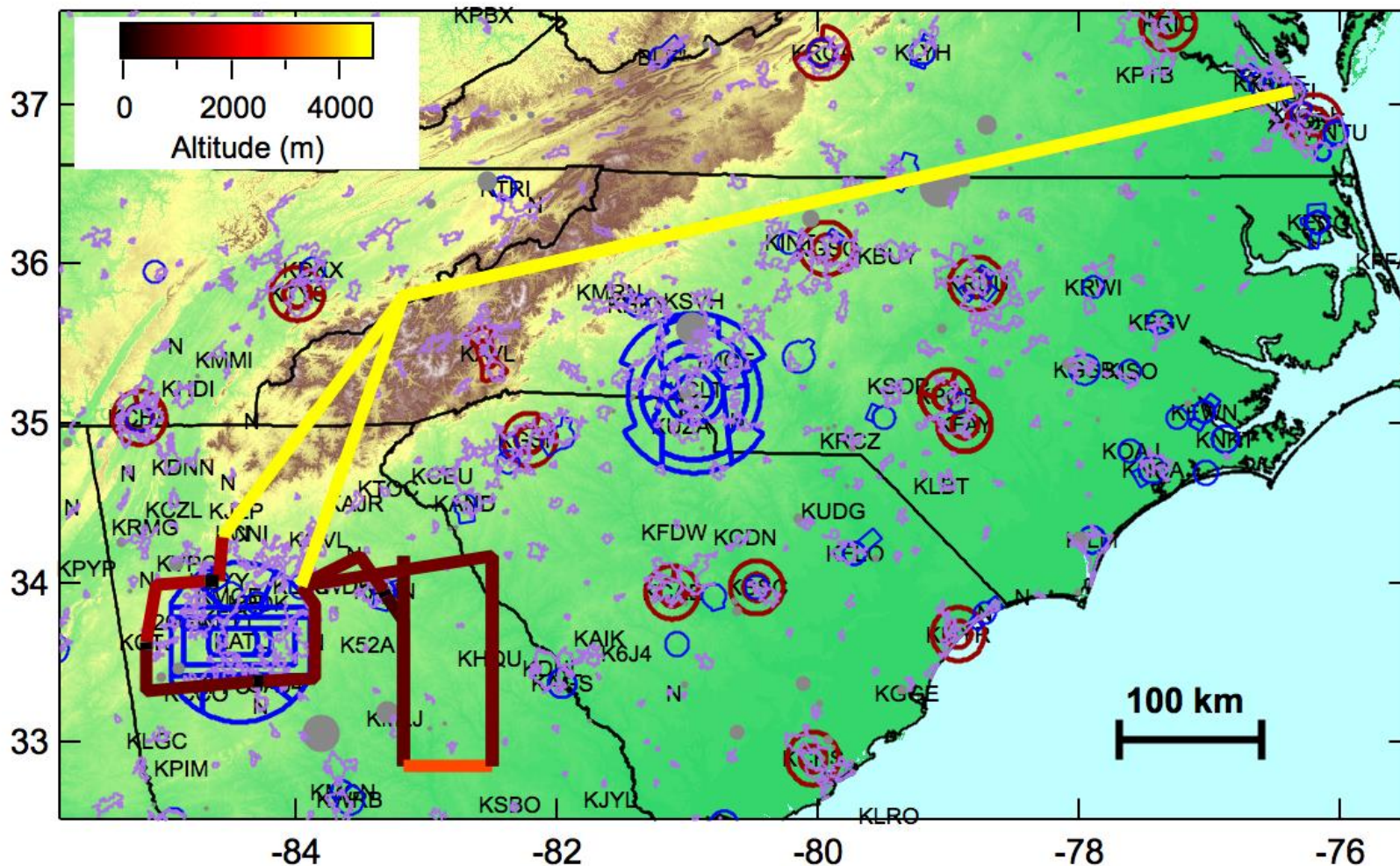


- 12 Hour Forward Trajectory from Atlanta Starting at 7 PM Eastern Time on February 18<sup>th</sup>
- 3 Trajectories at Surface, 500 m, 1000 m

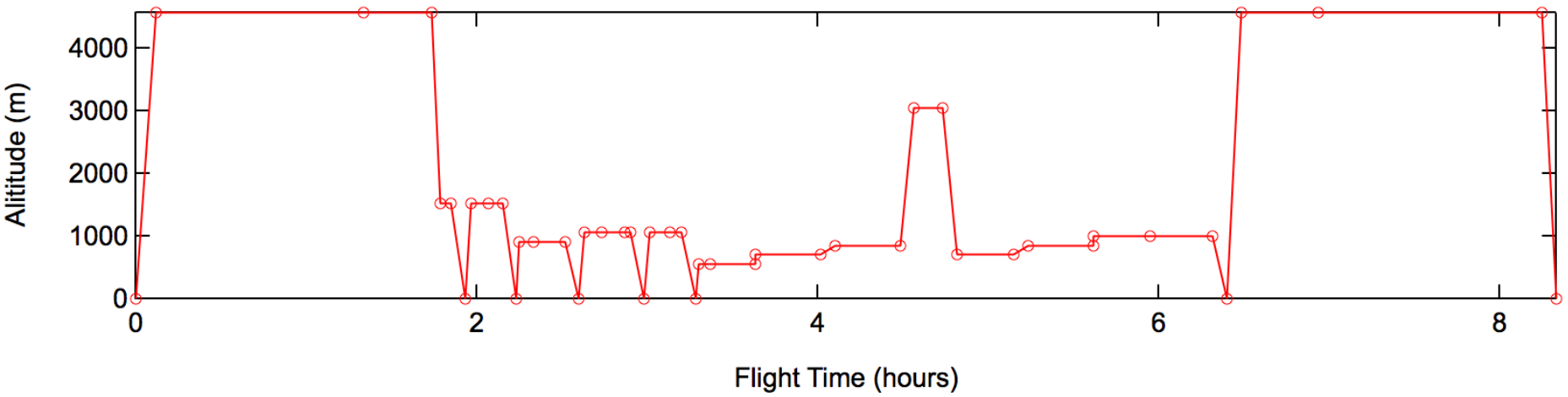
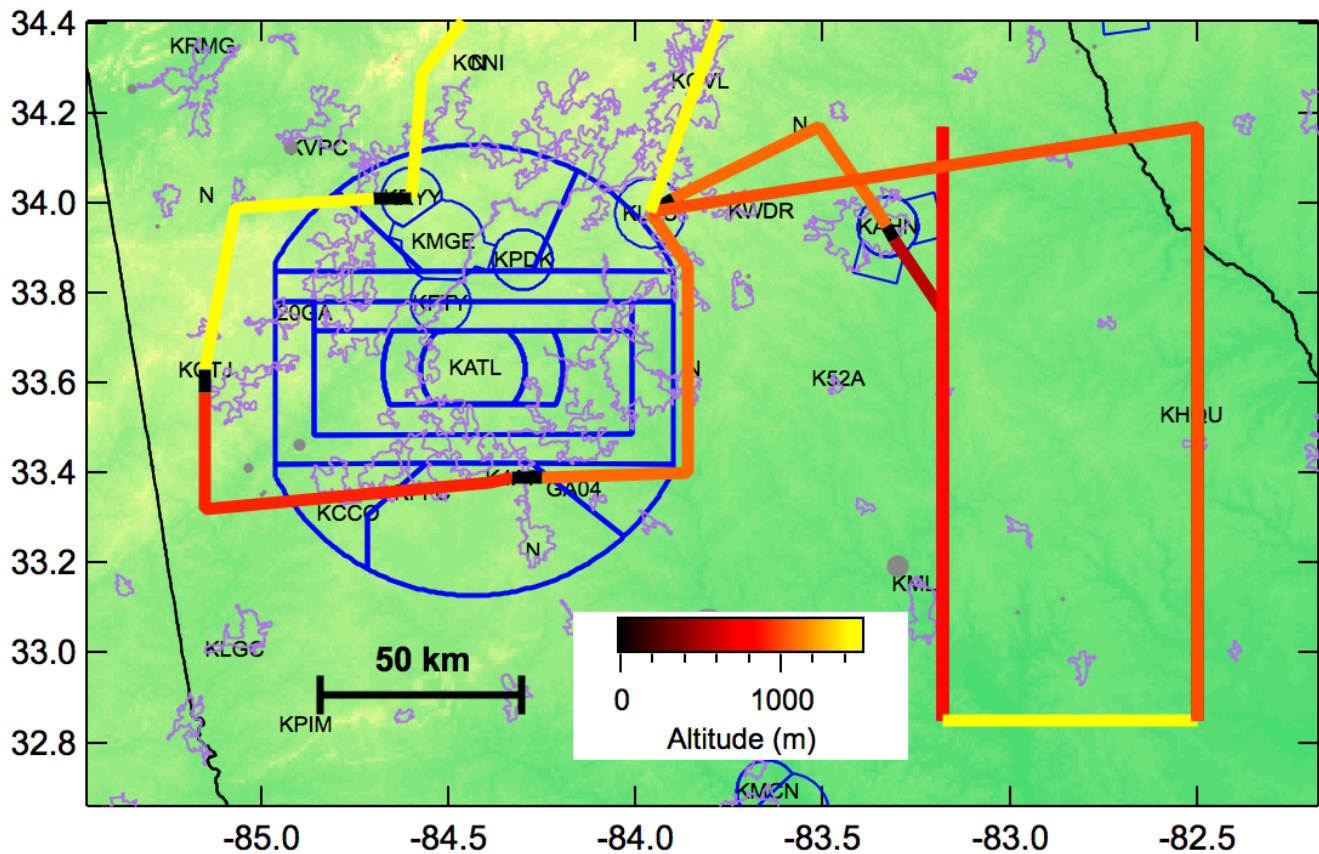


Takeoff Time from Langley = 3 PM

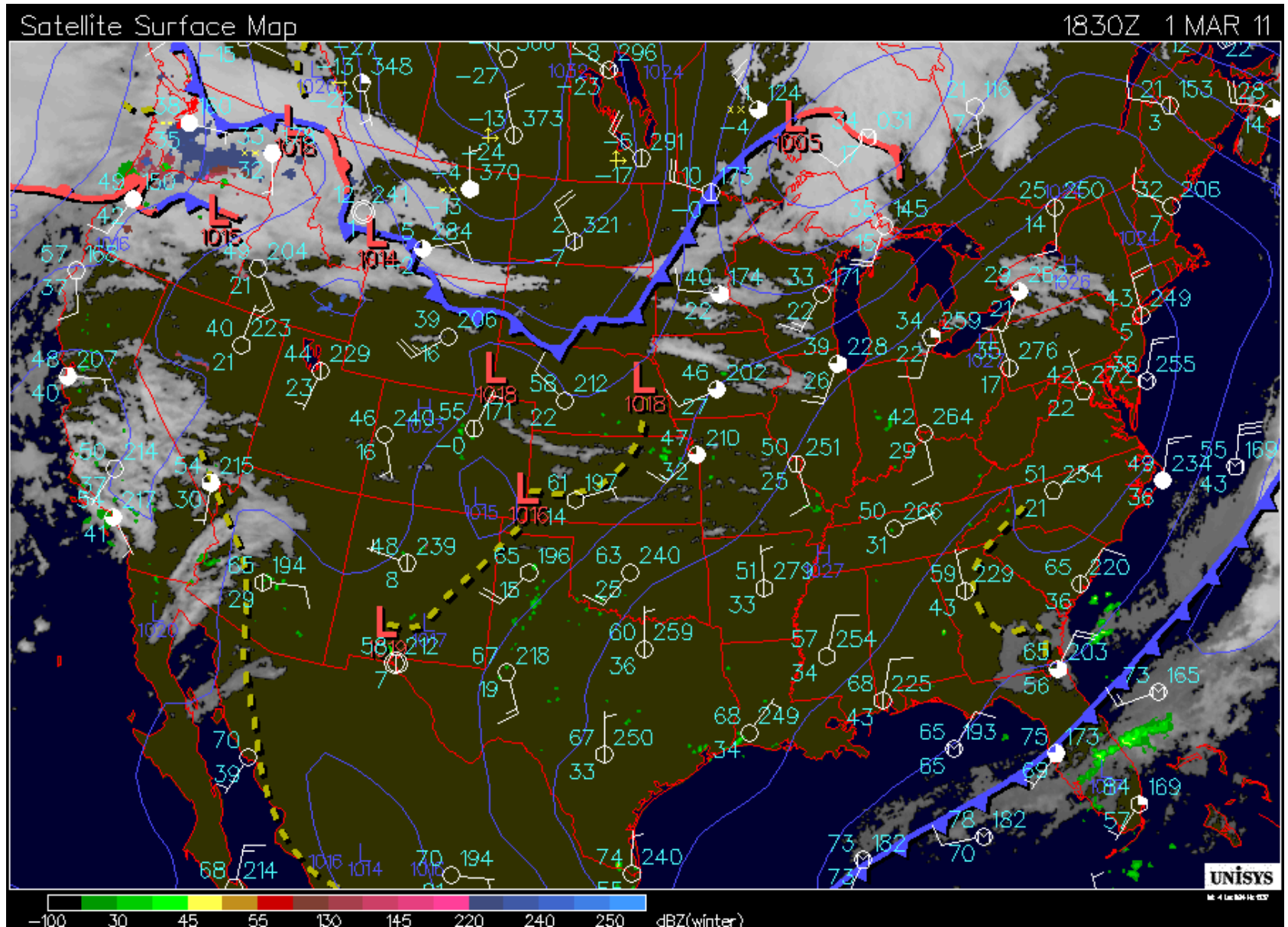
# Atlanta Flight, Day into Night, 3 PM Takeoff

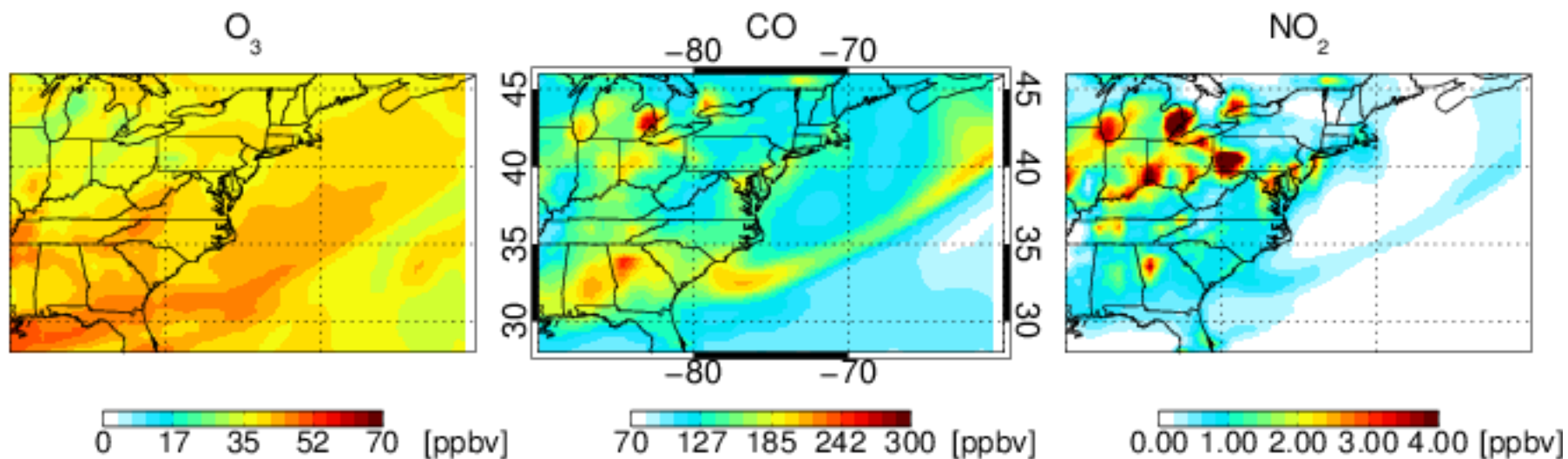




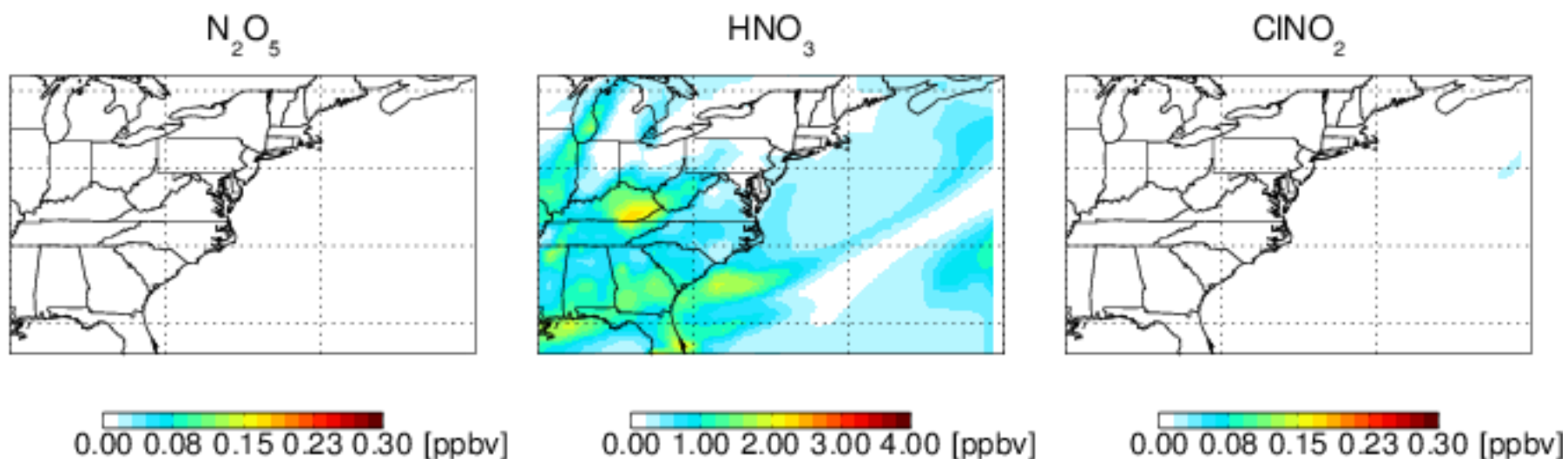


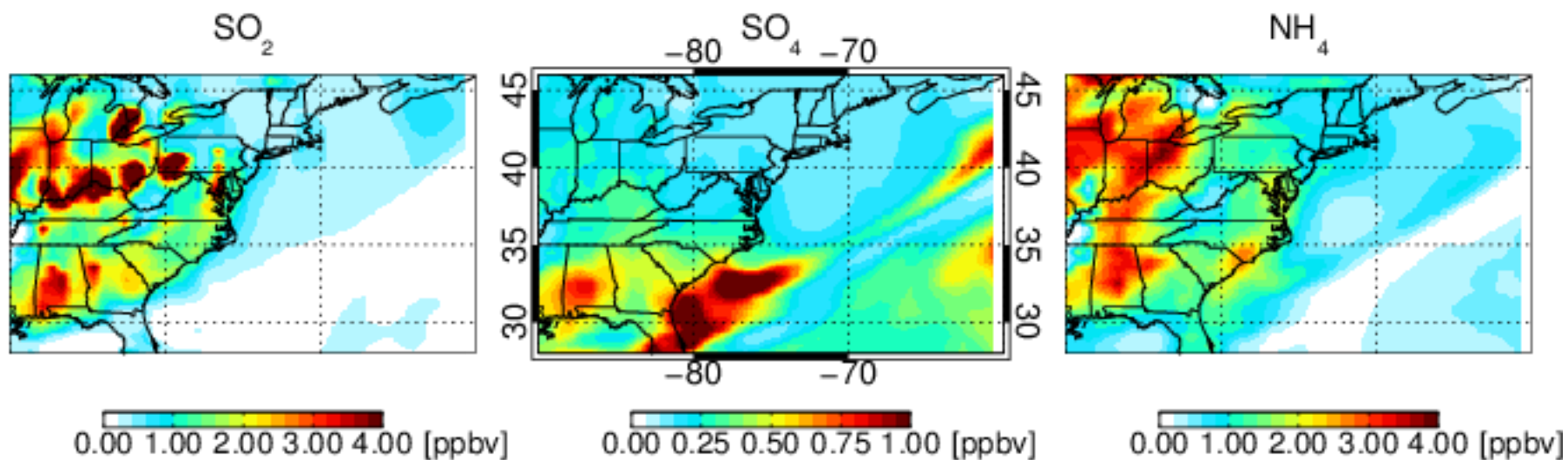
# Example 4: Ohio River Valley Power Plants, Daytime Archive Data from March 1, 2011



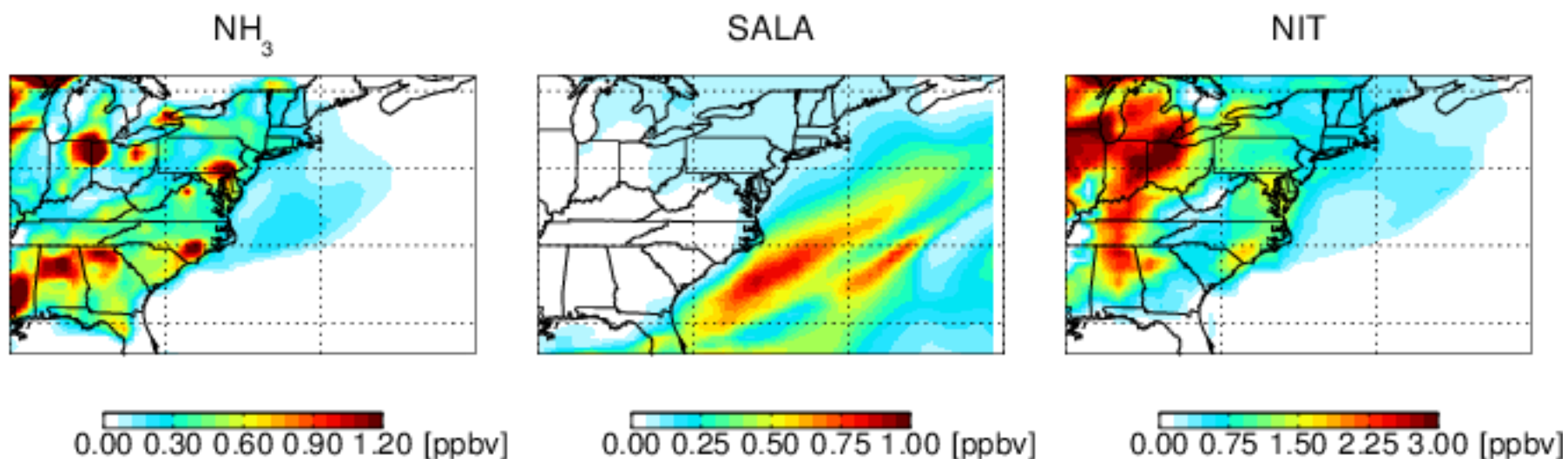


20110301 at 18 GMT (1 pm EST), 944 hPa( 0.6 km)





20110301 at 18 GMT (1 pm EST), 944 hPa( 0.6 km)



- 12 Hour Forward Trajectory from WV-OH-KY Border Starting at Noon Eastern Time on March 1st
- 3 Trajectories at Surface, 500 m, 1000 m

