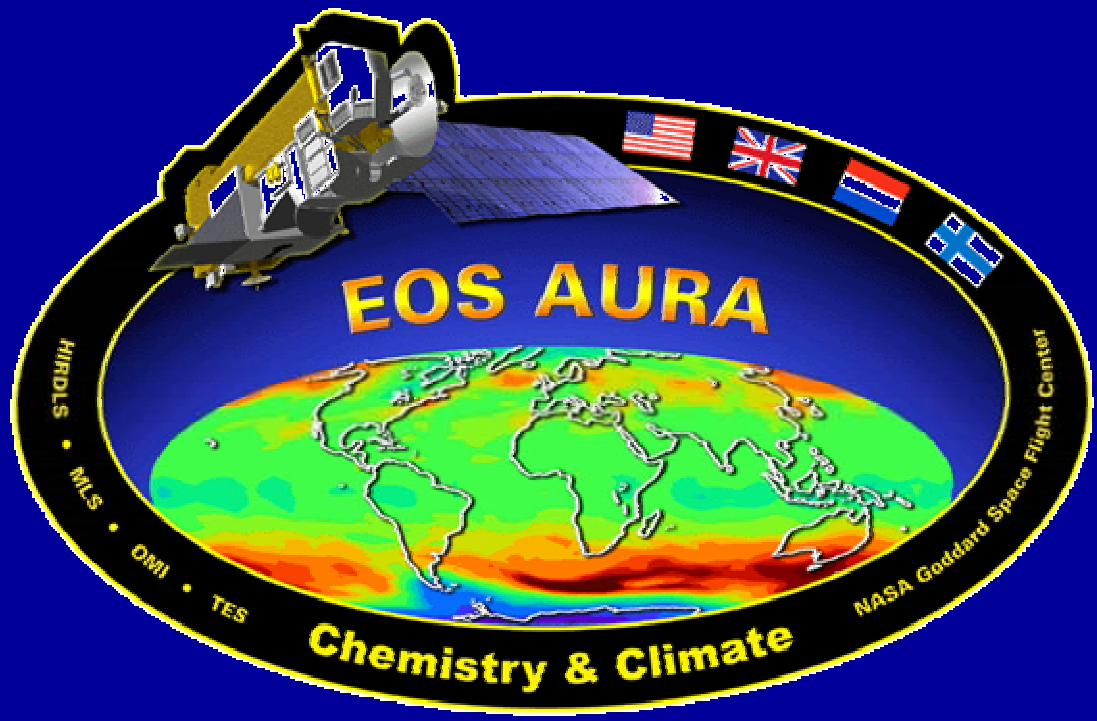
Intex B & Aura Validation



Mark Schoeberl
Aura Project Scientist

Validation of Aura Measurements

- Goals
  - Daylight underflights for OMI - descent into polluted regions
    - OMI: NO_2, HCHO, O_3, UV Flux, Aerosols, Cloud heights
    - Profiles for trace gases, lidar curtains for ozone
  - Underflights for TES, MLS & HIRDLS
    - TES - O_3, CO, H_2O, upper trop HNO_3
    - MLS - O_3, CO, Cirrus ice
    - HIRDLS - O_3, H_2O, CH_4, NO_2, upper trop HNO_3
    - Profiles for trace gases, lidar curtains for ozone
  - TES nadir and OMI validation in cloud free regions
- Flights should be timed for Aura overpass

Aura Tropospheric Requirements

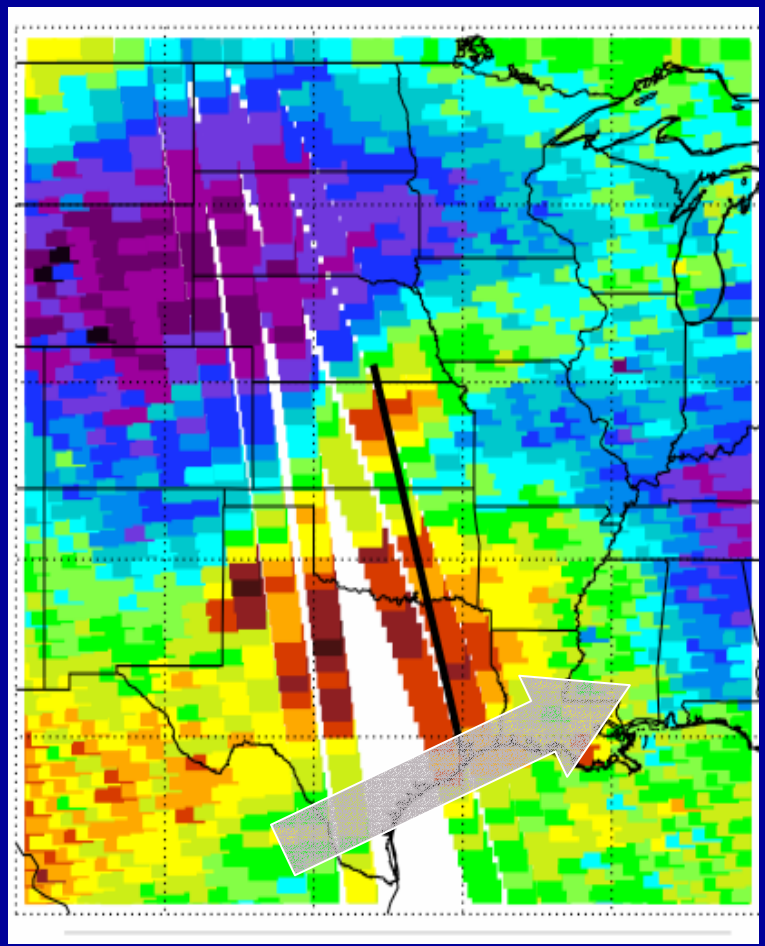
Parameter	Priority	HIRDLS	MLS	TES	OMI
Temperature	[1]	•[2]	•[2]	•	
O_3	1	•[2]	•[2]	•	C_{trop}[1]
H_2O	1	•[2]	•[2]	•	
CO	1		•[2*]	•	
HNO_3	1			•	
NO	1			•[2]	
NO_2	1			•[2]	C_{trop}[1]
Cloud properties	1	•[1]	•[1]	•[1]	•
Cloud detection	[1]	•	•	•[1]	•
Aerosols	1	•[2]		•[1]	•
CH_4	2	•[2]		•	•
HCN	2		•[2]		
N_2O	[2]	•[2]			
CFC-11, CFC-12	[2]	•[2]			
Geopotential Hgt.	[3]	•[2]	•[2]		

HCHO should be added

Validation/Science Examples from AVE and PAVE

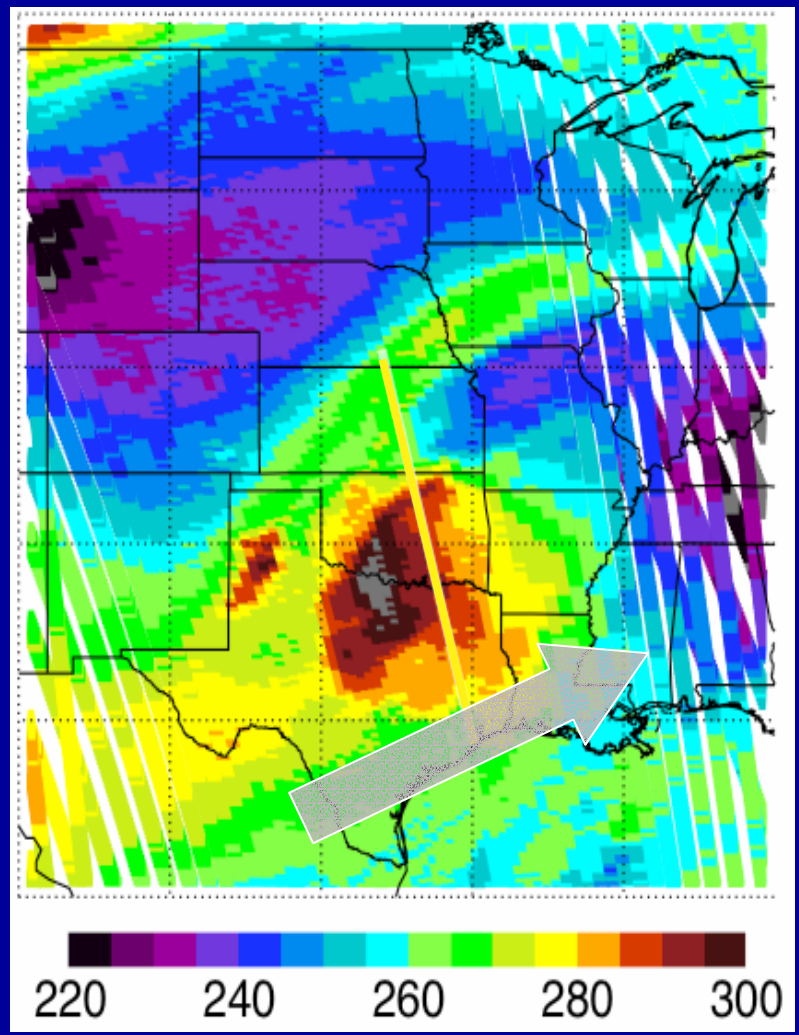
Tropopause Fold from AVE

EP TOMS



11/3/2004

OMI



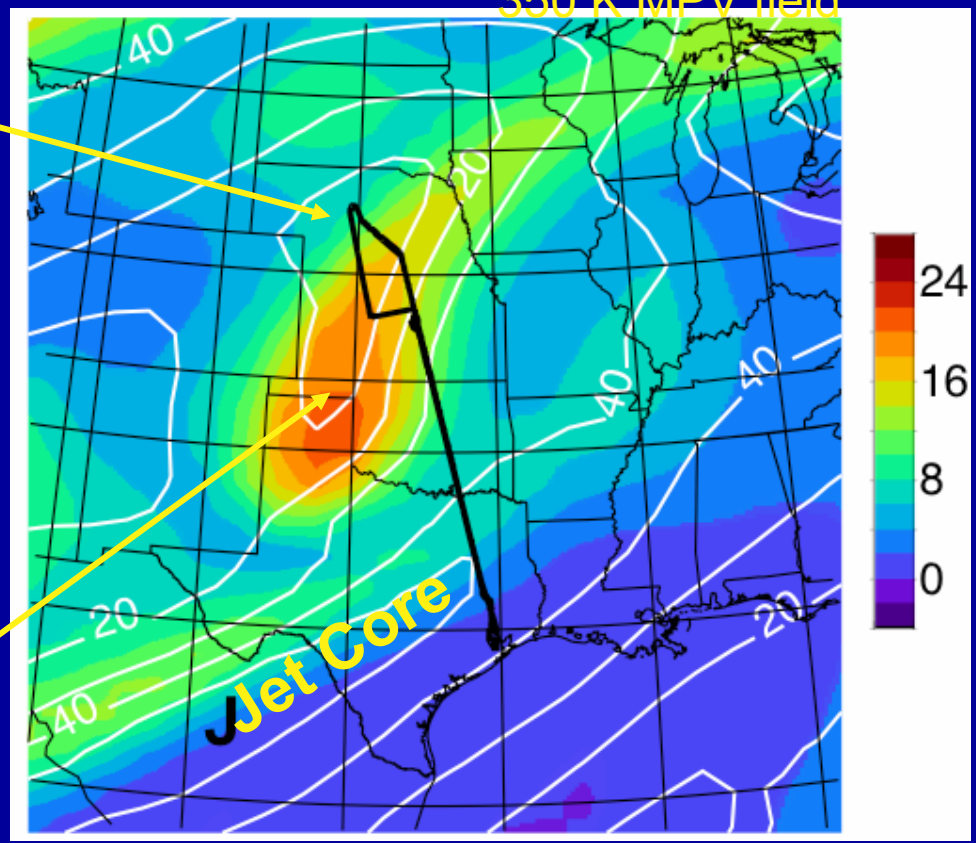
DU

11/3/2004 Flight Track

Tropopause Fold

WB-57F flight track

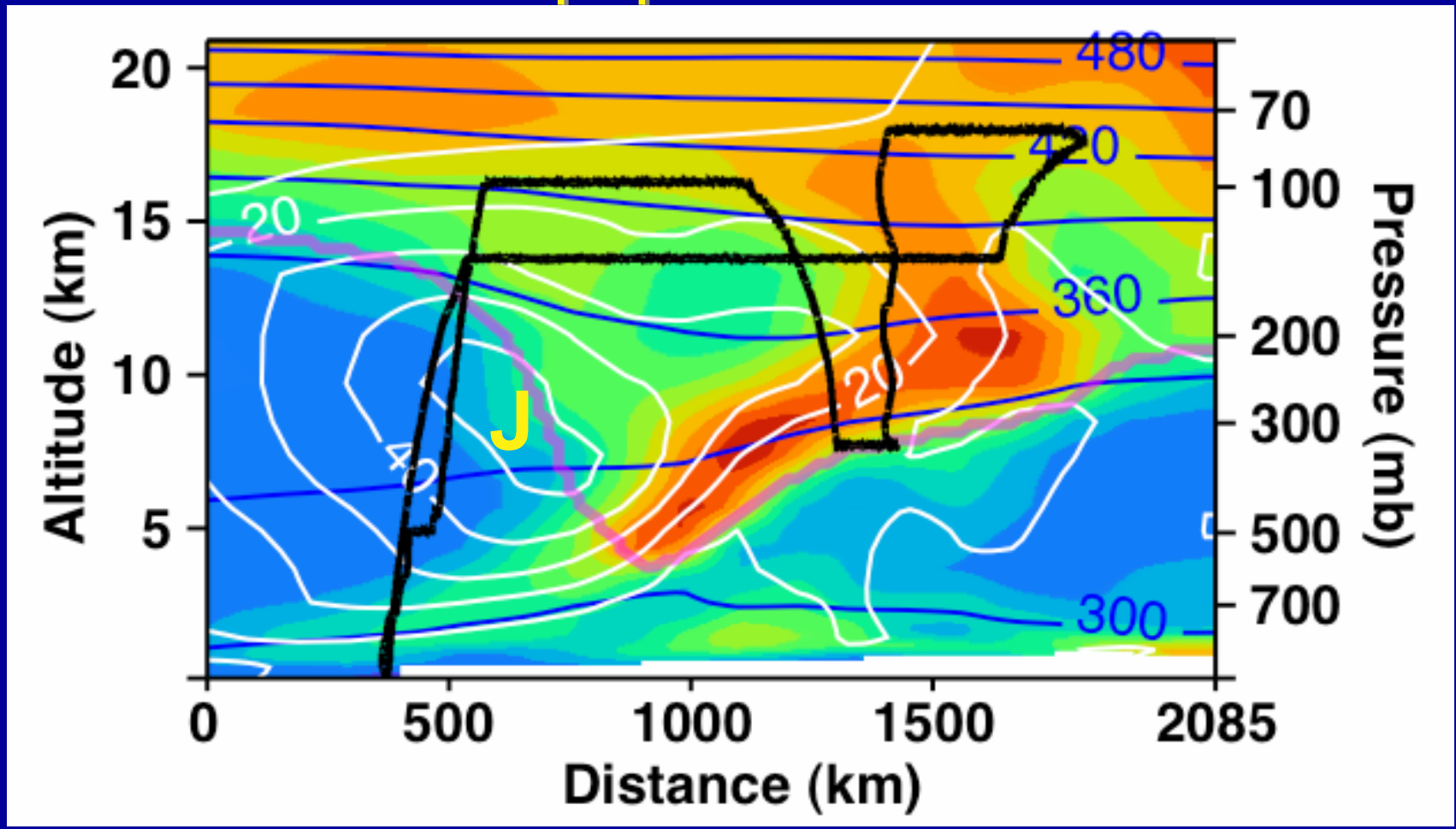
High PV - advected downward by secondary circulation around jet



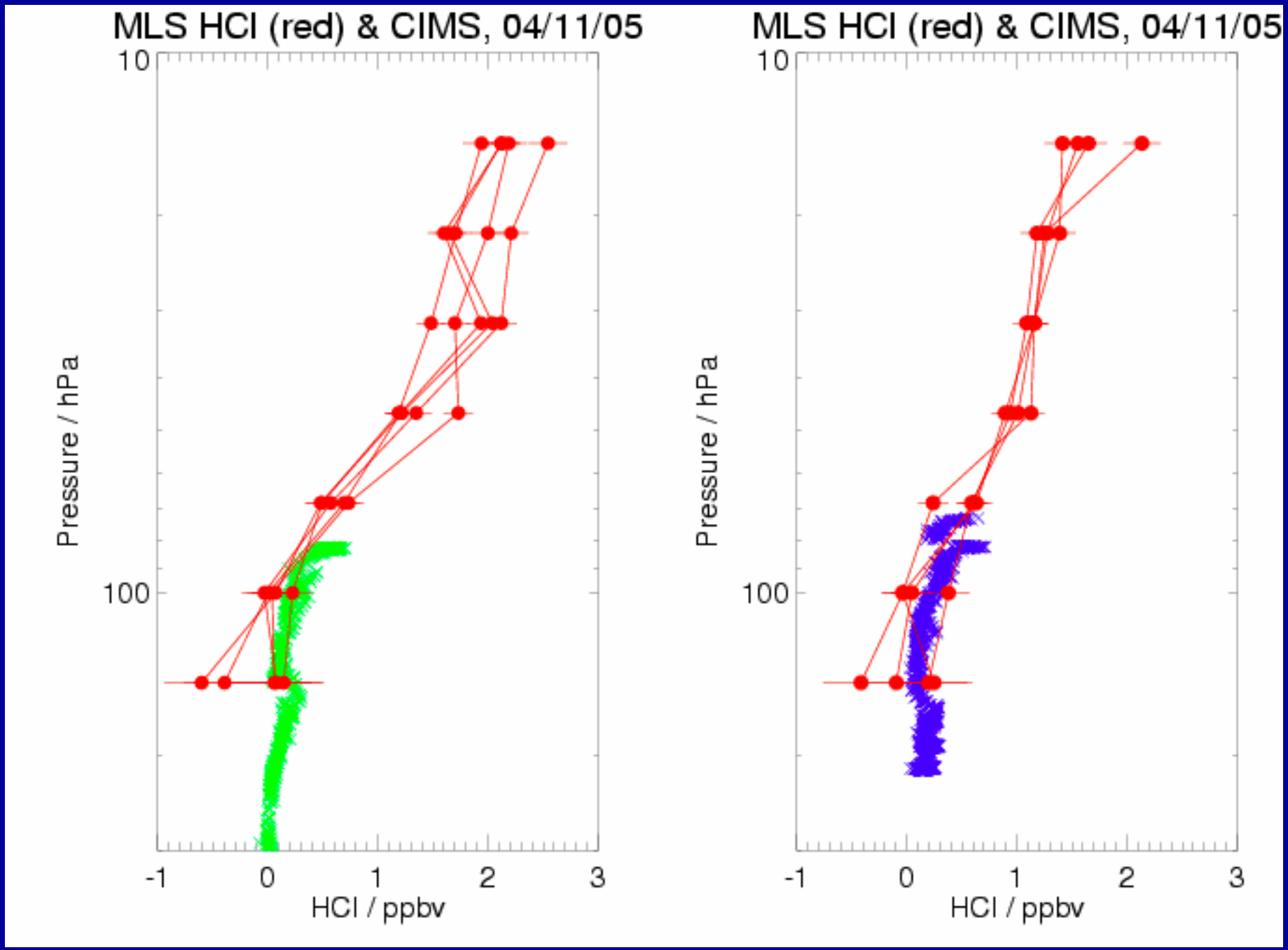
Aura nadir track

11/3/2004 Flight Track

Tropopause Fold

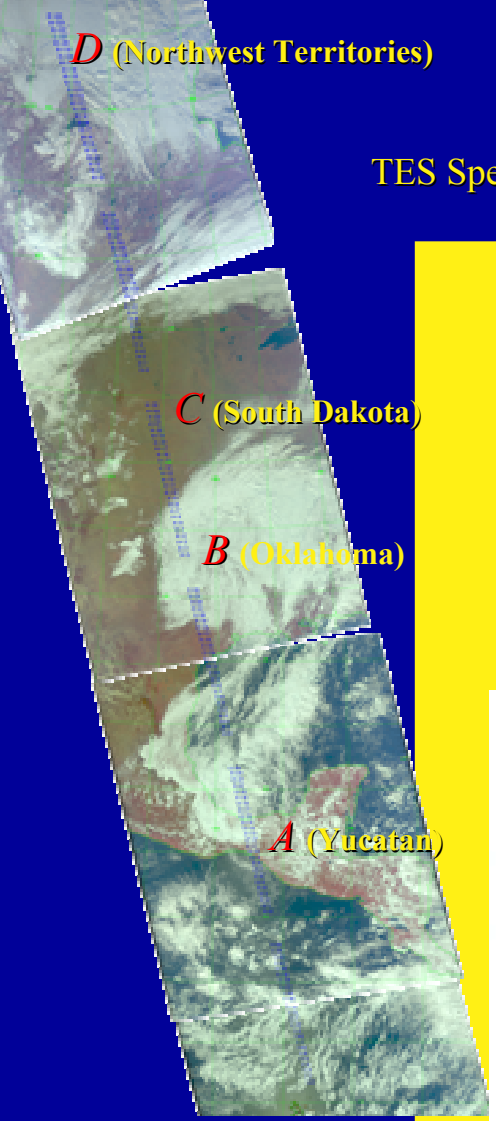


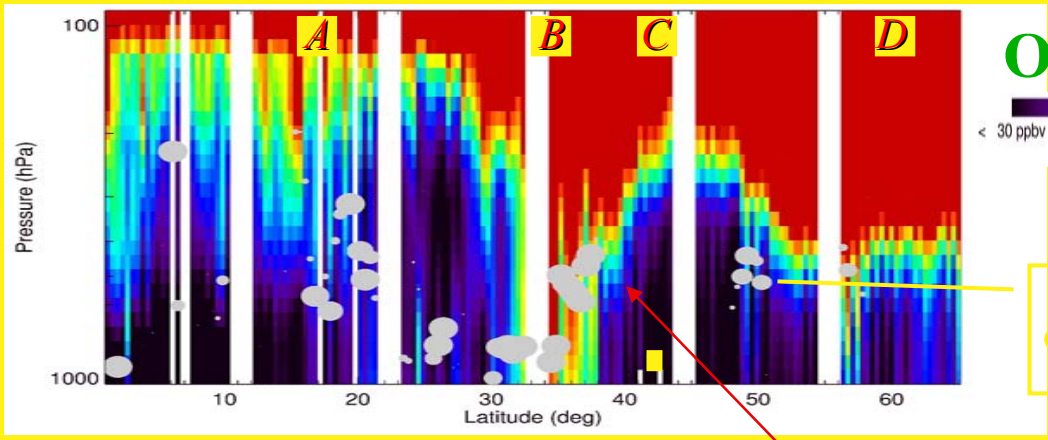
Secondary circulation around jet core pulls stratospheric air downward, folding high pv air below the jet


MLS HCl (red) & CIMS, 04/11/05
10
100
Pressure / hPa
-1
0
1
2
3
HCl / ppbv
MLS HCl (red) & CIMS, 04/11/05
10
100
Pressure / hPa
-1
0
1
2
3
HCl / ppbv

TES Retrieval through Clouds

TES Special Observation: Nadir Step & Stare for Nov 3, 2004 (150 observations from 1N to 65N)



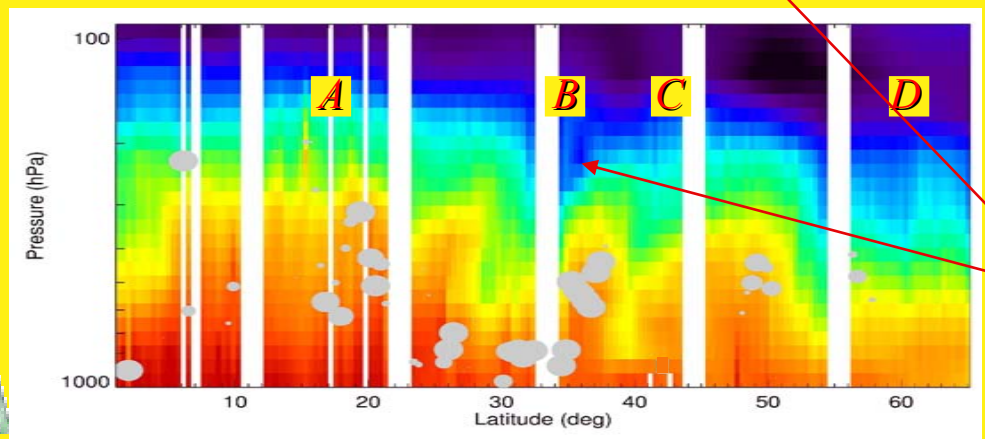


Ozone

< 30 ppbv > 100 ppbv

Ozone Volume Mixing Ratio

Cloud effective OD = 3.0
Cloud effective OD = 0.3



Water

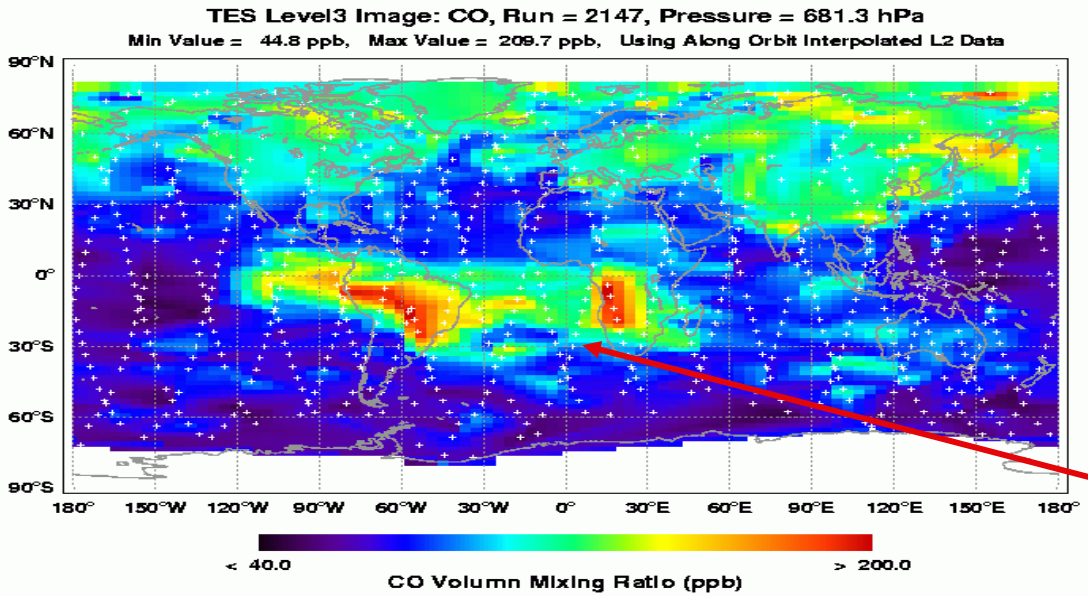
< -6.67 > -1.50

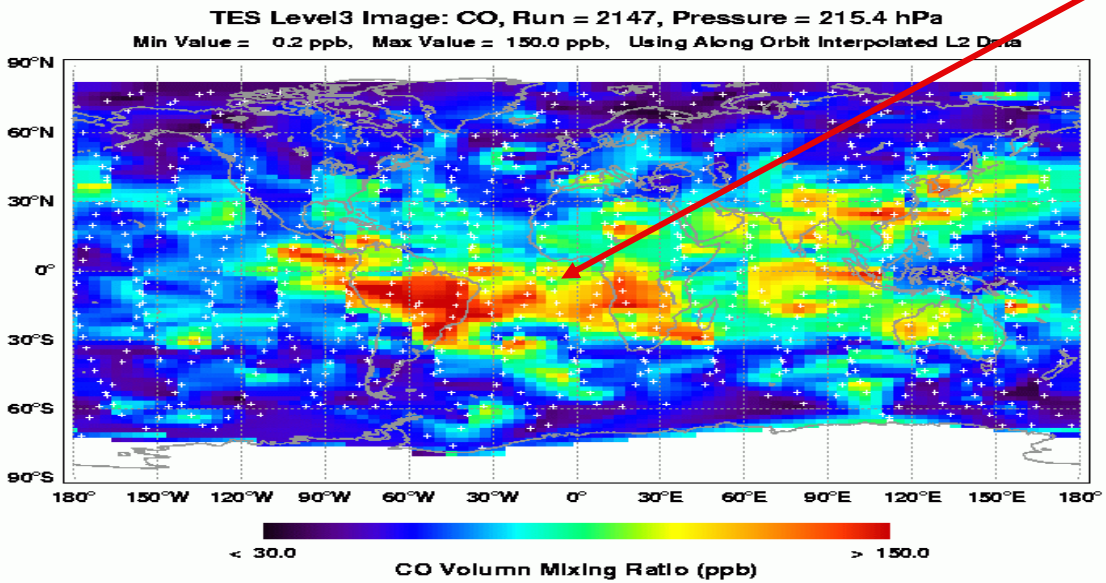
H_2O log(VMR)

Intrusion

The TES retrievals for ozone and water with the TES retrieved cloud effective optical depth and height shown with gray circles. The ozone and water retrievals both indicate a stratospheric intrusion around 35°N (near B), and show TES's capability to retrieve through thin clouds and above thick clouds.

TES Carbon Monoxide





Sept. 20, 2004

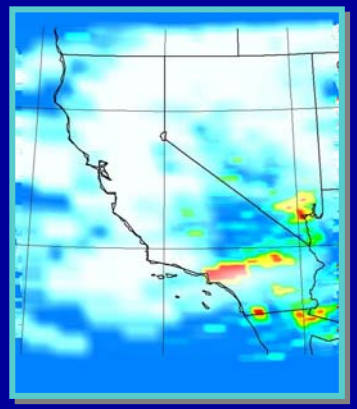
Lower troposphere

High values of CO near biomass burning regions and NH cities. CO in the upper trop is lofted by convection and fires.

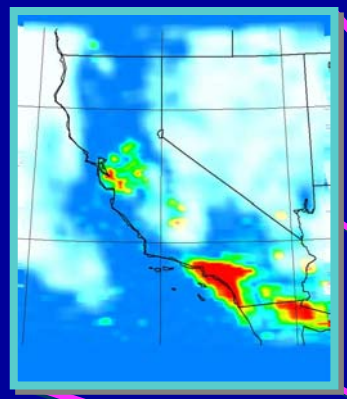
Upper troposphere

OMI NO_2

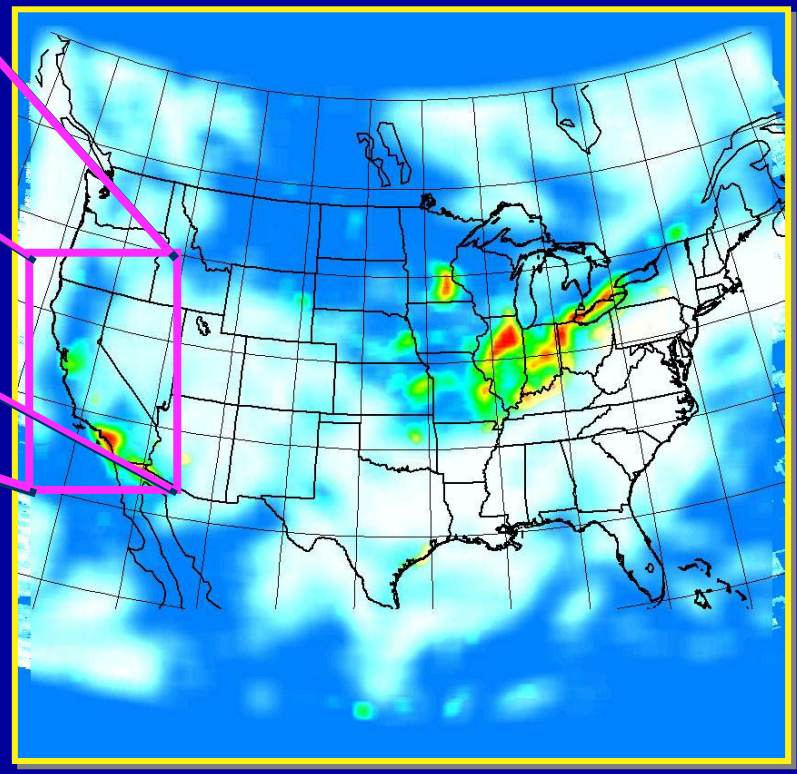
November 11



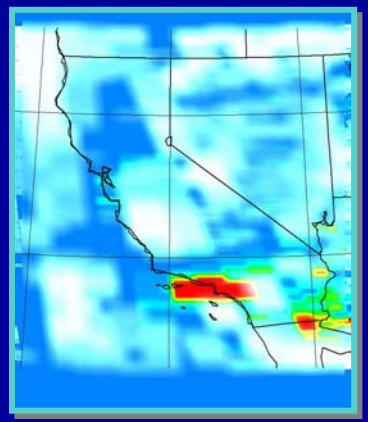
November 12



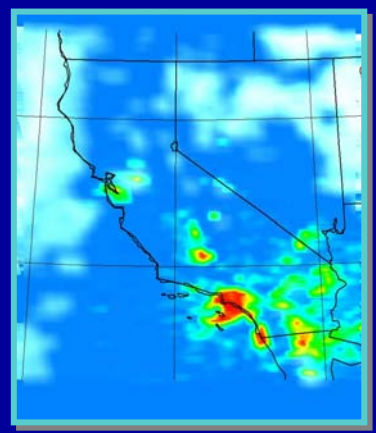
November 12, 2004



November 13

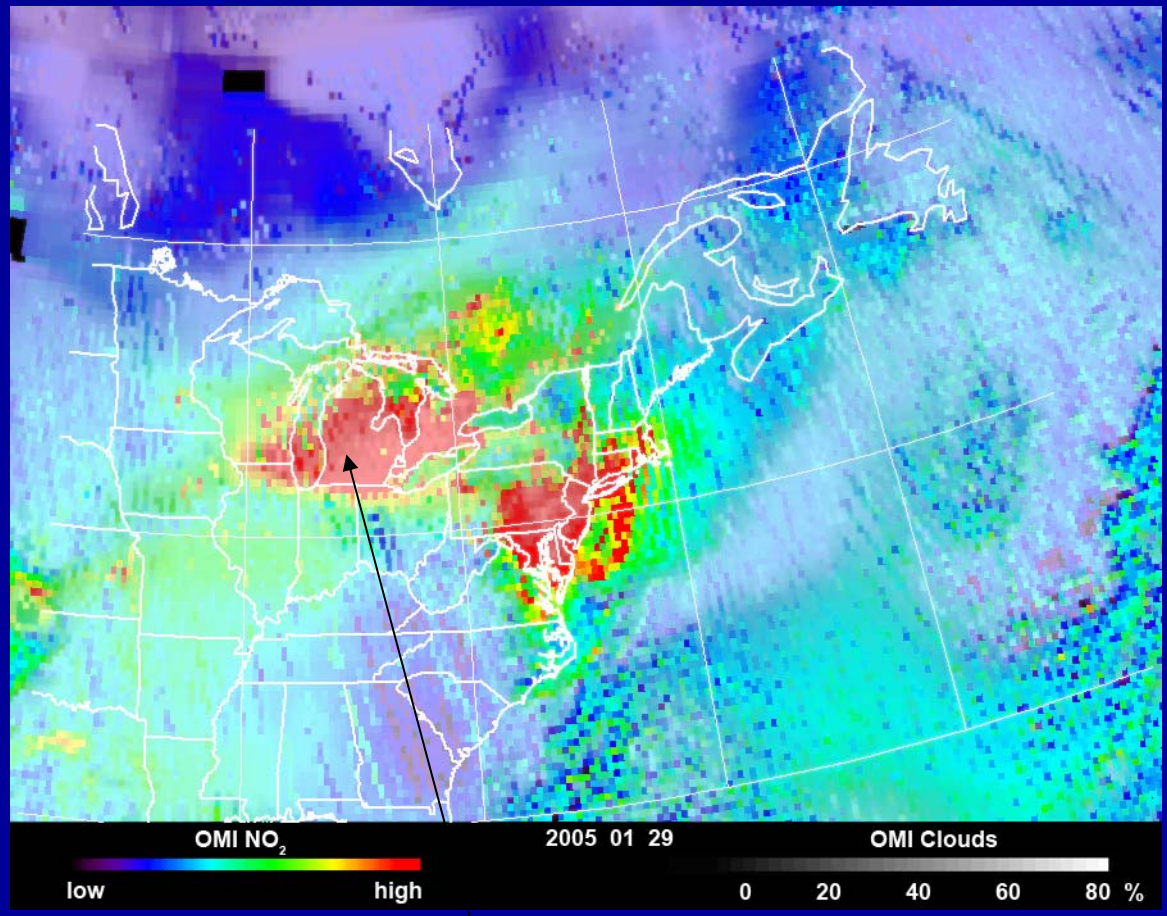


November 14



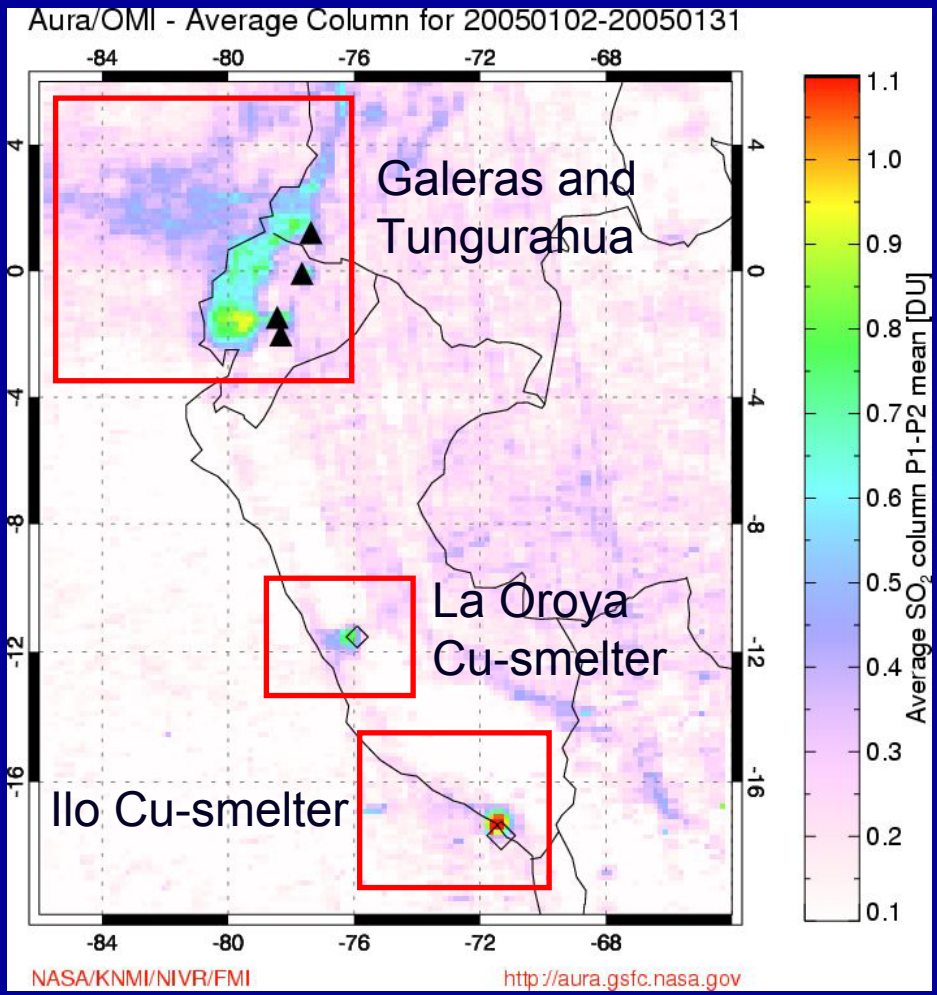
OMI high resolution allows near real time mapping of NO_2

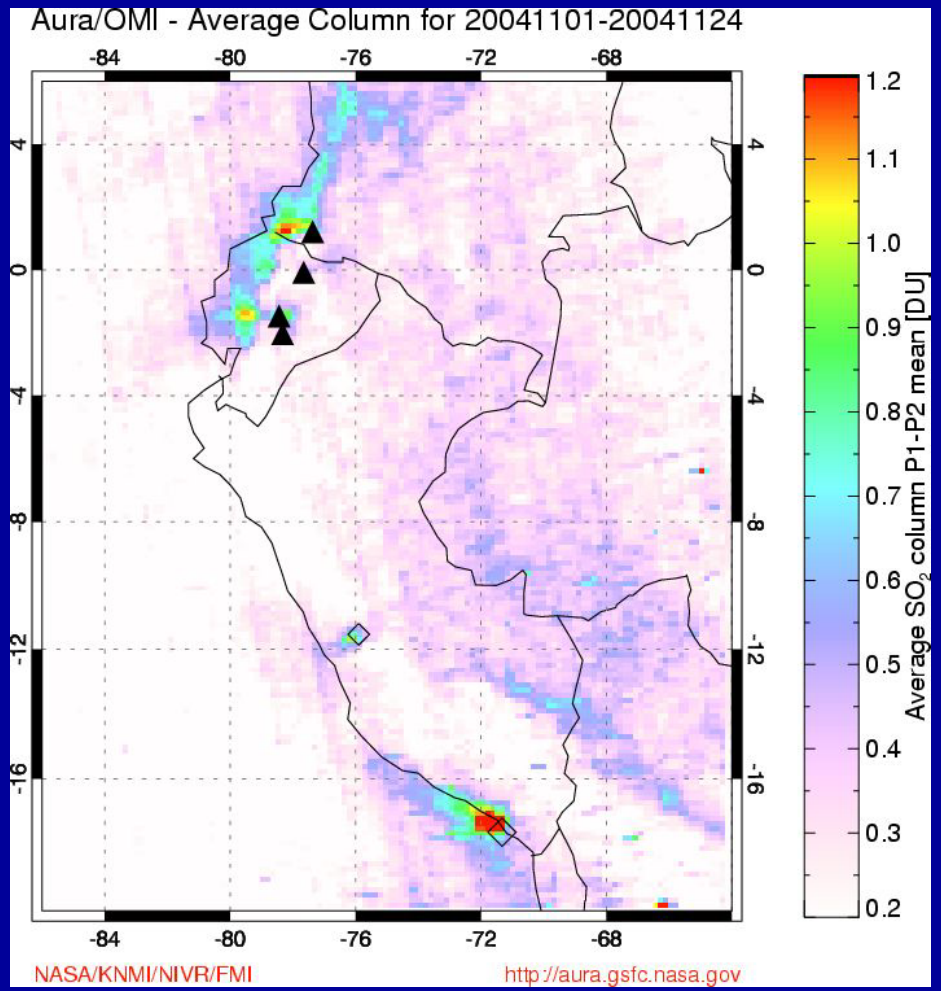
OMI NO_2



PAVE flight went in to this region

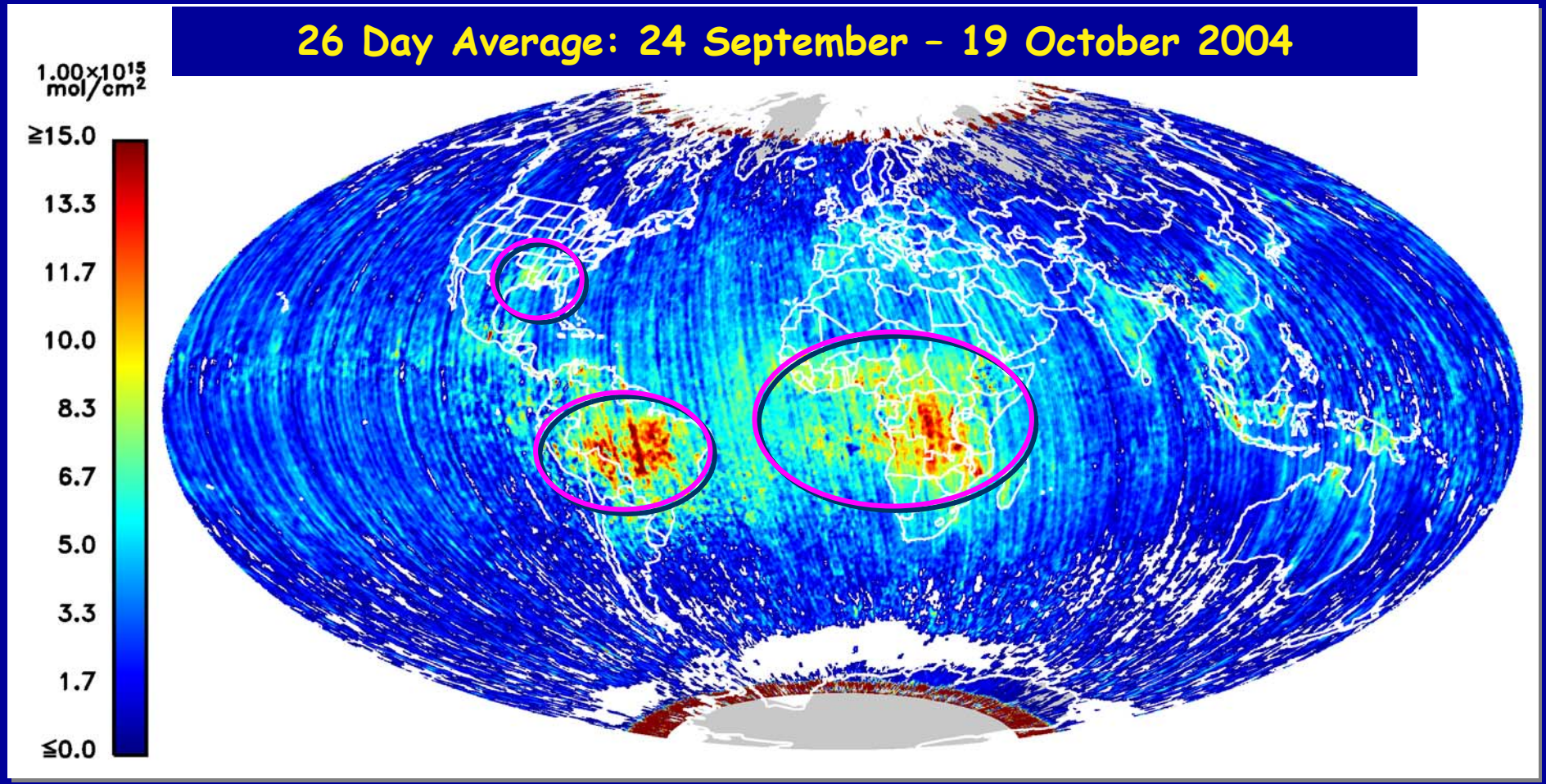
OMI SO_2 measurements





Sep 2004	Oct 2004	Nov 2004	Dec 2004	Jan 2005
G&T: 1150 td^{-1}	G&T: 2200 td^{-1}	G&T: 4550 td^{-1}	G&T: 10850 td^{-1}	G&T: 5300 td^{-1}
Or: 2150 td^{-1}	Or: 2600 td^{-1}	Or: 750 td^{-1}	Or: 750 td^{-1}	Or: 500 td^{-1}
Ilo: 4100 td^{-1}	Ilo: 3500 td^{-1}	Ilo: 3600 td^{-1}	Ilo: 3500 td^{-1}	Ilo: 1250 td^{-1}

OMI HCHO: Biomass Burning, Anthropogenic Emission



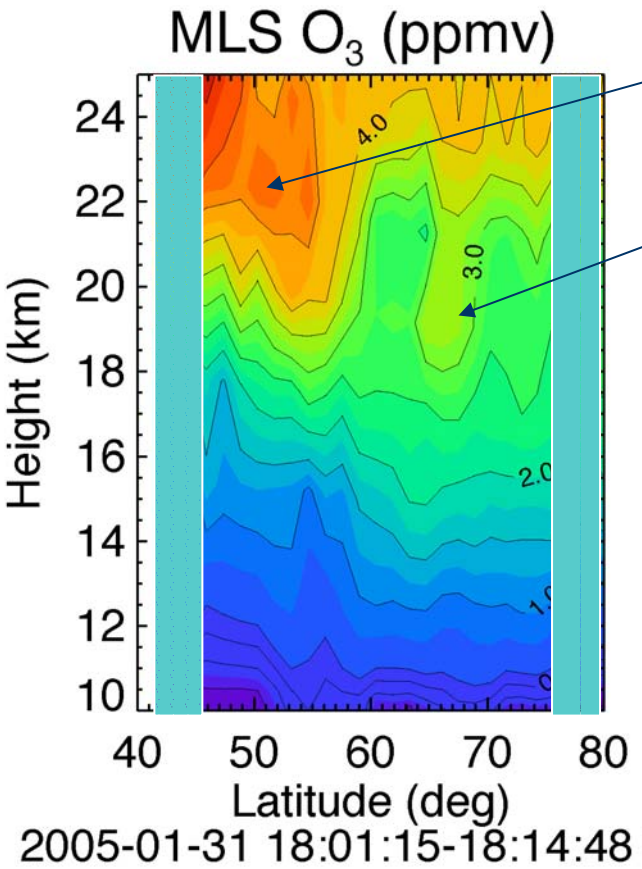
HCHO: Principal intermediate in the oxidation of hydrocarbons

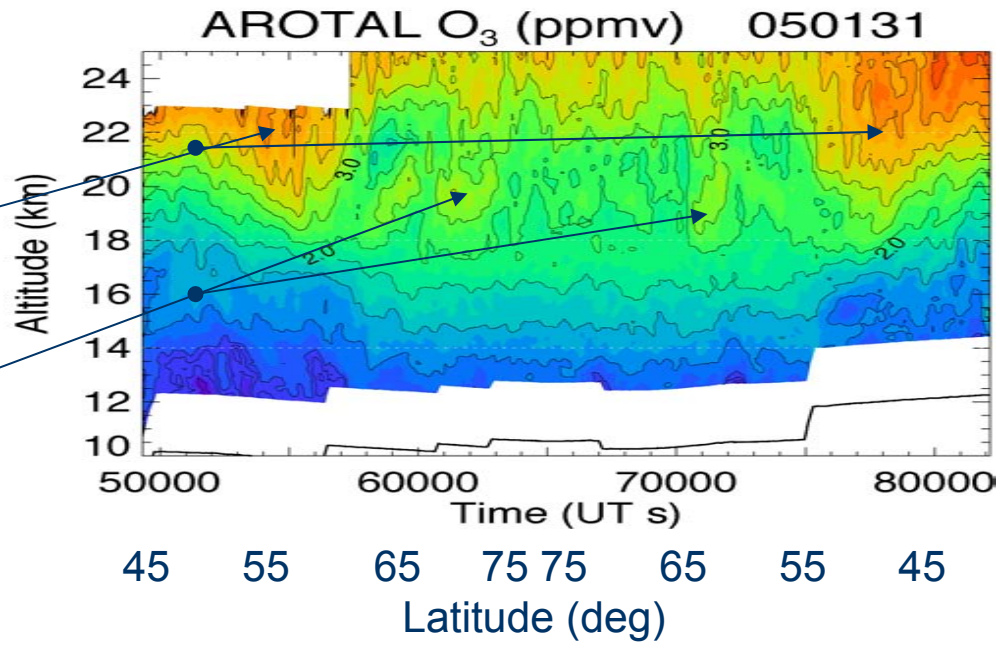
From Tom Kurosu

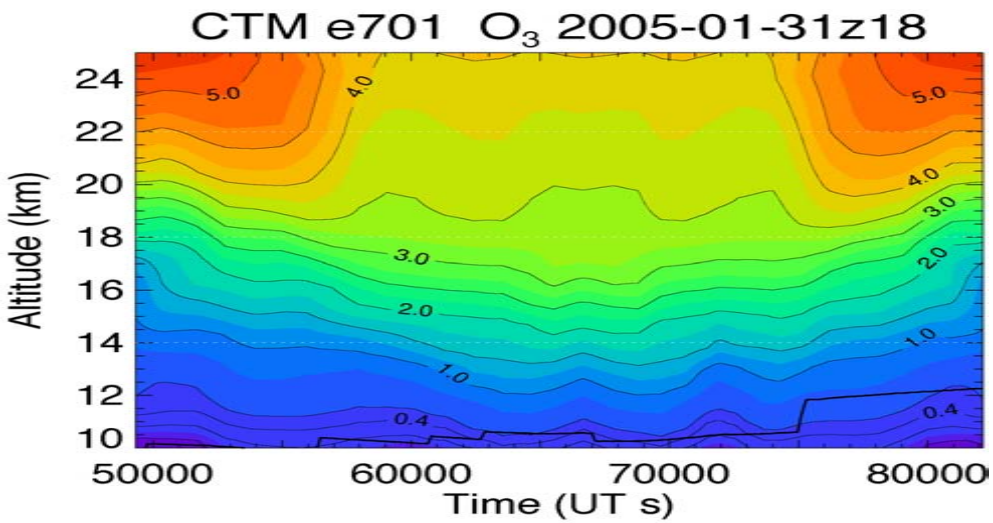
PAVE Payload Instruments

Instrument	Experimenter	Product
AROTAL	McGee	Ozone & temperature profile (above)
DIAL	Browell	Ozone and aerosol profile (above and below)
FastOz	Avery	In situ ozone
FTIR	Coffey	NO_2, HNO_3, CH_4, etc. (slant column)
CAFS	Shetter	O_3 column
ASUR	Nothalt	ClO, HCl, N_2O, HNO_3, CO
DACOM	Sachse	CH_4, N_2O, CO
HNO3	Dibb	HNO3
DLH	Diskin	H2O
TD-LIF	Cohen	NO_2
ICATS	facility	In situ temperature
MTP	Mahoney	Temperature profile

1/31/05 Ozone Comparisons





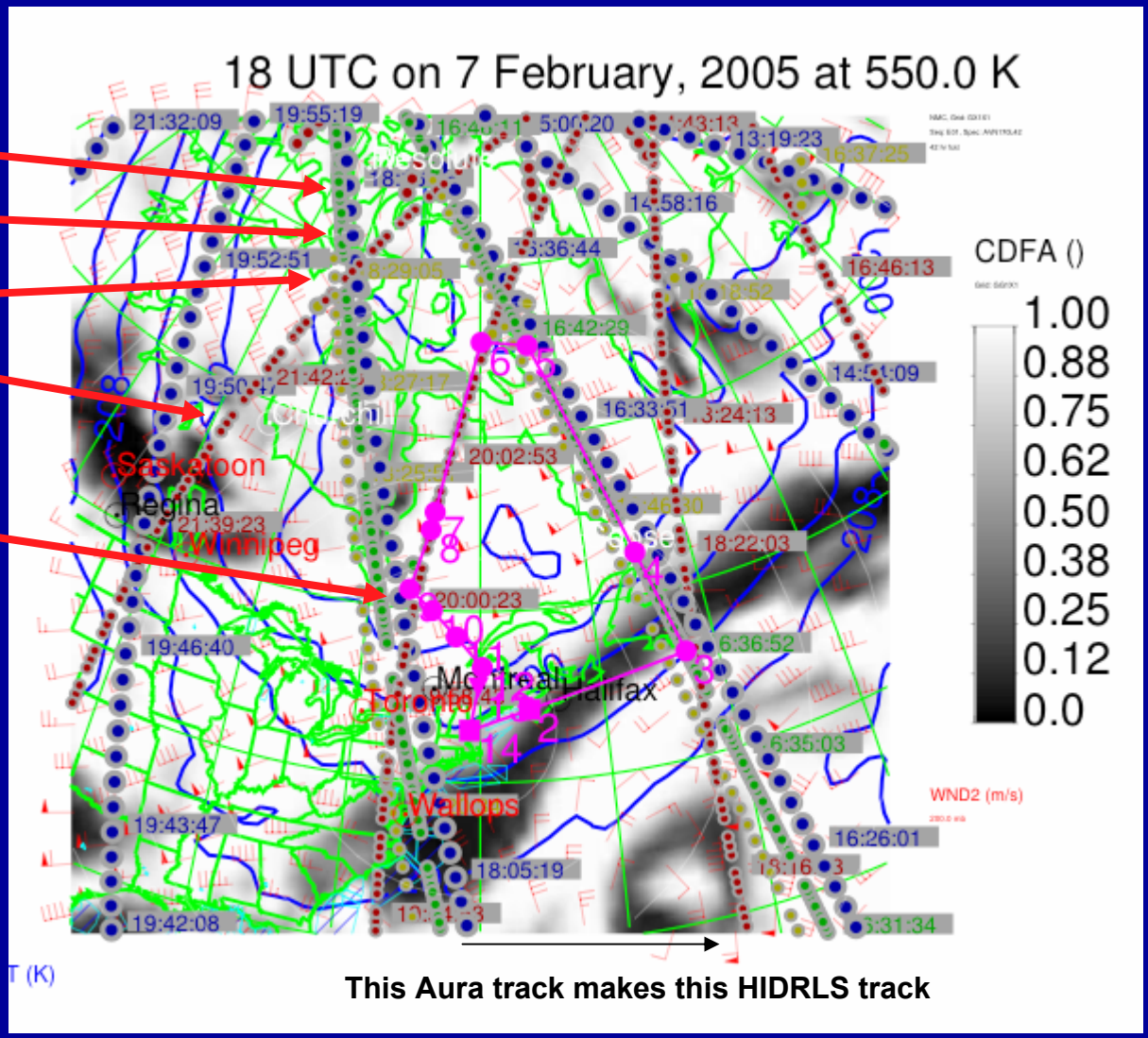


Randy Kawa

Flight Plan 2/7/05

MLS
TES Nadir
TES Limb
HIRDLS

Sun Run



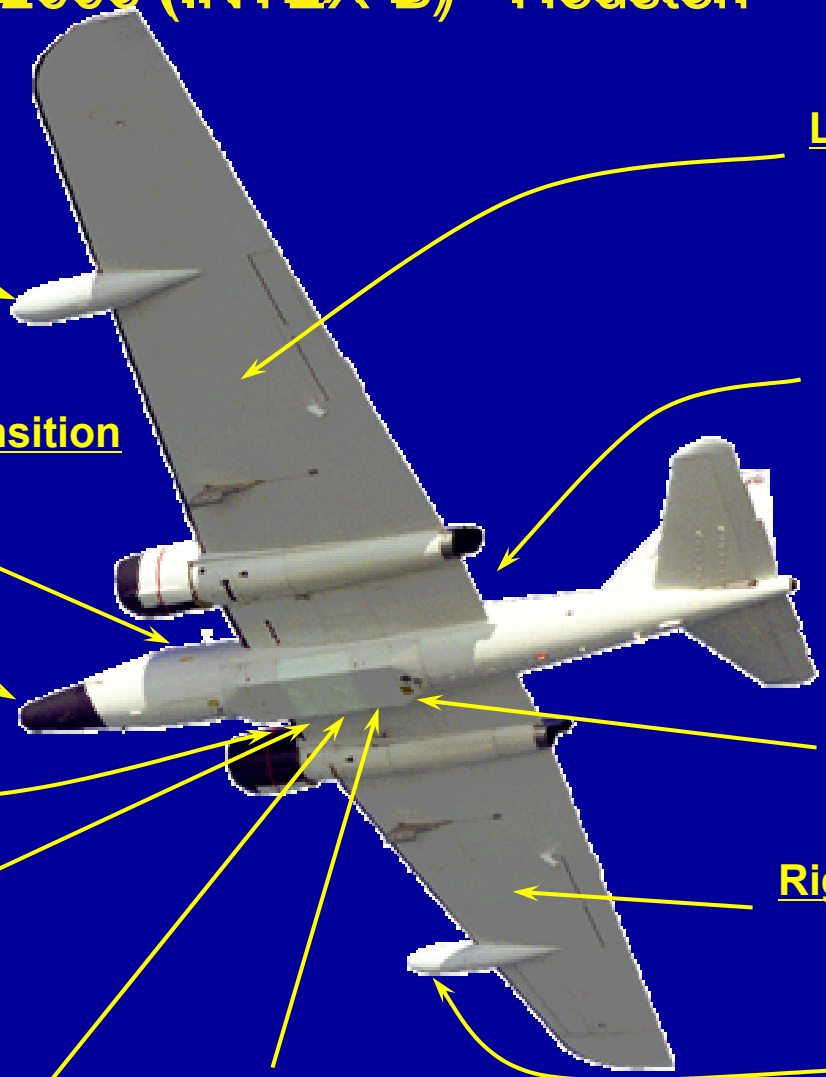
Up the Aura Track - down the HIRDLS track + sun run

Schedule

- March deployment with AVE?
- April deployment with DC-8 only?

AVE WB-57 payload

March 2006 (INTEX-B) - Houston



Left Wing Pod
H_2O-Vap, MTP, CAPS

Left Wing Hatches
JLH

Upper Equip Bay
CAFS

Nose
P/T

Fwd UEB/Transition

Pallet 1
CIMS/O3

Aft Transition
PANTHER, CAFS

Pallet 2
Argus, FCAS, NMASS

Right Wing Hatches

Right Wing Pod
SHIS

Pallet 3
CPL

Pallet 4
Isotope Instrument

2 weeks of science flights + 1 week integration

Summary

- Aura validations have been very successful so far
- For Aura it is critical that flights are coordinated with Aura - time and place.
  - Can't neglect HIRDLS
- Schedule:
  - Sonde campaign in Costa Rica July-August (Ticosonde II)
  - AVE Houston summer '05
  - Isotope shoot out - summer '05
  - AVE Costa Rica January 06
  - Intex B (Houston) 57+DC8
  - Intex B (Elsewhere) DC8