

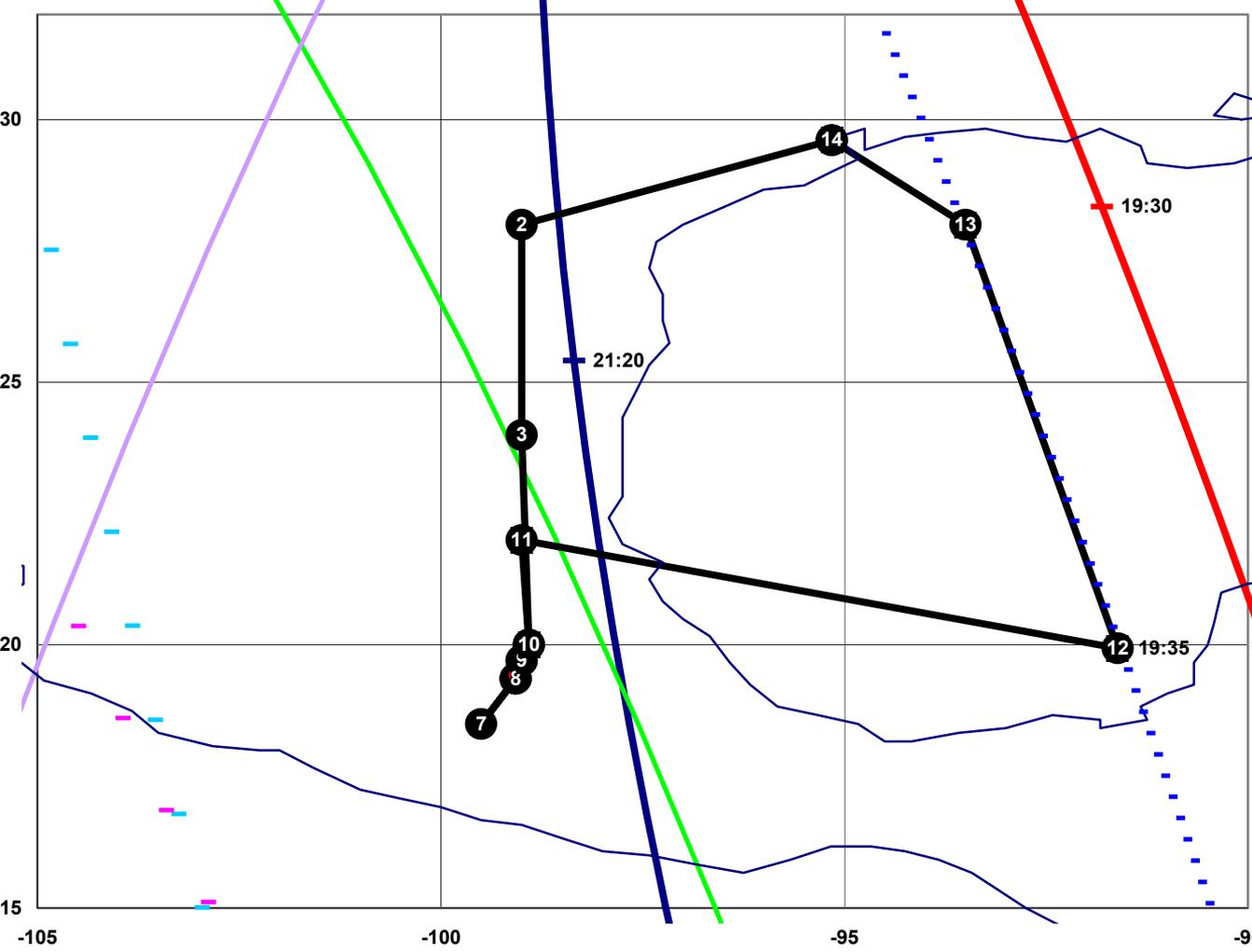
INTEX-B: Flight 7 (Science Flight; March 16, 2006; Thursday)

This was the fifth science flight conducted from Houston. The objectives for this flight included sampling of aged pollution and plume scouting for the C-130 north of Mexico City, sampling fresh Mexico City pollution during weekday conditions, sampling convective outflow over the southern Gulf of Mexico, and satellite validation (TES, OMI, and AIRS) that included a profile under TES at the time of overpass followed by in-progress profiling along the TES special observation track. The nominal flight tracks and profiles are shown in the slides below, but these were modified in flight to take advantage of specific opportunities. Takeoff time was 0845 (LT) and the flight duration was 7.1 hours.

All of the instruments aboard the DC-8 performed well throughout the flight. The GT-LIF instrument was able to stay online through the duration of the flight. The surface analysis at flight time contained high pressure over the U.S. East and West Coasts, along with a developing wave cyclone over the Middle Mississippi River Valley. A cold front extended southwest of the cyclone into central Texas. The lower troposphere was dominated by high pressure ridges east and west of Texas as well as a weak closed high over the southern Gulf of Mexico (mostly at 850 and 700 mb). A trough was located over the middle Mississippi River Valley. The flow at 500 and 250 mb was more zonal, with the polar jet stream located north of Texas, and the subtropical jet oriented southwest to northeast over northern Mexico and central Texas. The subtropical jet continued to transport high level moisture (cirrus) over the northern part of the flight area. These circulation features produced weak onshore flow over northern Mexico in the lowest levels. Southeast winds were just offshore of Mexico. This pattern generally persisted through 700 mb, although the winds were lighter and more variable in direction due to the weak high pressure center mentioned above. Winds over northern Mexico at 500 mb and above were from the southwest. Southeast Texas and extreme northern Mexico were blanketed by low clouds and high level cirrus. There was little cloud cover over most of the southern half of the flight track. Widely scattered thunderstorms had occurred in the Mexico City area the previous afternoon and would occur again in this area after we had departed. Low level winds over Mexico were very light and from variable directions. This meant that local mesoscale circulations dominated the winds—especially topographic circulations. A Mexico City radiosonde release at 1800 GMT (shortly after we had left) revealed that the mixed layer extended to about 10,000 ft MSL. The temperature lapse rate in the boundary layer was approximately dry adiabatic, indicating a well mixed layer. Lapse rates above the boundary layer were rather strong, providing the instability needed for the thunderstorms that developed.

The first portion of the flight was directed to encounter emissions from Mexico City that were expected to be transported to the north. The DC-8 made a quick descent into this pollution layer at 25N, 99W from very clean free-tropospheric conditions (O₃ 35-40 ppbv, CO ~70 ppbv, CH₂O ~30 pptv, and hot/cold CN ~0.25) and found an abrupt transition to polluted conditions at 13 K ft (O₃ ~48 ppbv, CO ~150 ppbv, ppbv levels of CH₂O, and hot/cold CN ~0.65). This layer was monitored with DIAL as the DC-8 flew further south over east-west transects by the C-130 at 21.5N and 20.25N. DIAL observations showed little change in the depth of the polluted layer as the DC-8 flew south, and this information was passed to the C-130 through a chat connection established for the first time between the two aircraft. As the DC-8 approached Mexico City, overflight of the ground sites (T₀, T₁, and T₂) and the city showed the boundary layer depth to be more shallow than on previous flights, which was consistent with our late morning (1100 hrs) crossing of the city compared to earlier flights. DIAL also showed high ozone spilling out of the Mexico City Basin to the southwest, similar to previous overflights. Passing back over the city at 9000 ft, the DC-8 was just able to reach into the top of the boundary layer revealing polluted conditions exceeding previous overflights (SO₂, NO₂, and CH₂O all exceeding 20 ppbv and CO ~2.5 ppmv). Ozone, however, only reached ~100 ppbv. These differences could be due to a combination of lower boundary layer depth as well as weekday conditions since earlier overflights were conducted on the weekend. DC-8 pilots also noted active wildfires to the east of the city. Just beyond the city, the DC-8 conducted a terrain-following path back along the original high altitude approach from the north. In-progress profiling along the southern Gulf of Mexico toward the Yucatan peninsula revealed a layer of elevated ozone and aerosol at about 9000 ft. This layer appeared to be well-aged pollution (O₃ 60-80 ppbv, CO ~180 ppbv, HNO₃ ~ ppbv) circulating around the weak high over the southern Gulf of Mexico. At the southernmost point of the flight, a spiral from the surface to 40 K ft was executed during the TES overpass. Clean conditions persisted during the spiral (O₃ 30-40 ppbv and CO 60-70 ppbv) until reaching the uppermost 500 feet where convective outflow was encountered (O₃ ~80 ppbv, CO ~140 ppbv, and several hundred pptv NO). While profiling to the north along the TES track, a polluted layer distinct from the marine boundary layer was again encountered and may be related to the layer encountered earlier over the southern Gulf of Mexico. A final boundary layer run was flown before returning to Houston to continue gathering offshore NO₂ statistics for OMI validation (observed values were up to a few ppbv).

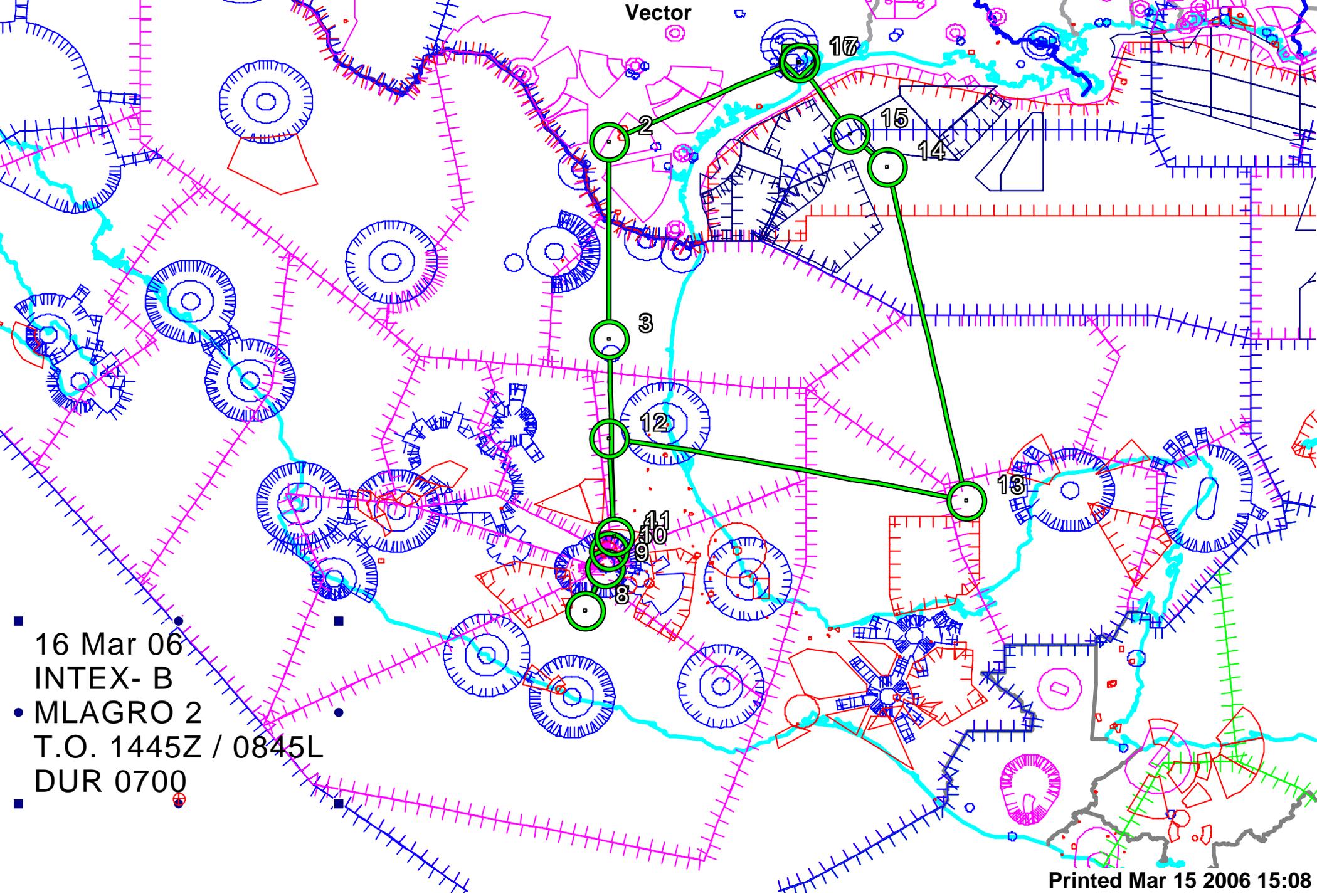
Flight 7
 16 March 2006
 Takeoff:
 0820 hrs



- MLS
- - - MLS timing
- HIRDLS
- - - HIRDLS timing
- - - TES-Special
- - - TES-Special timing
- - - OMI-East Edge
- - - OMI-West Edge
- AIRS swath
- MOPITT timing
- MOPITT swath
- DC-8 Flight Path
- Mexico City

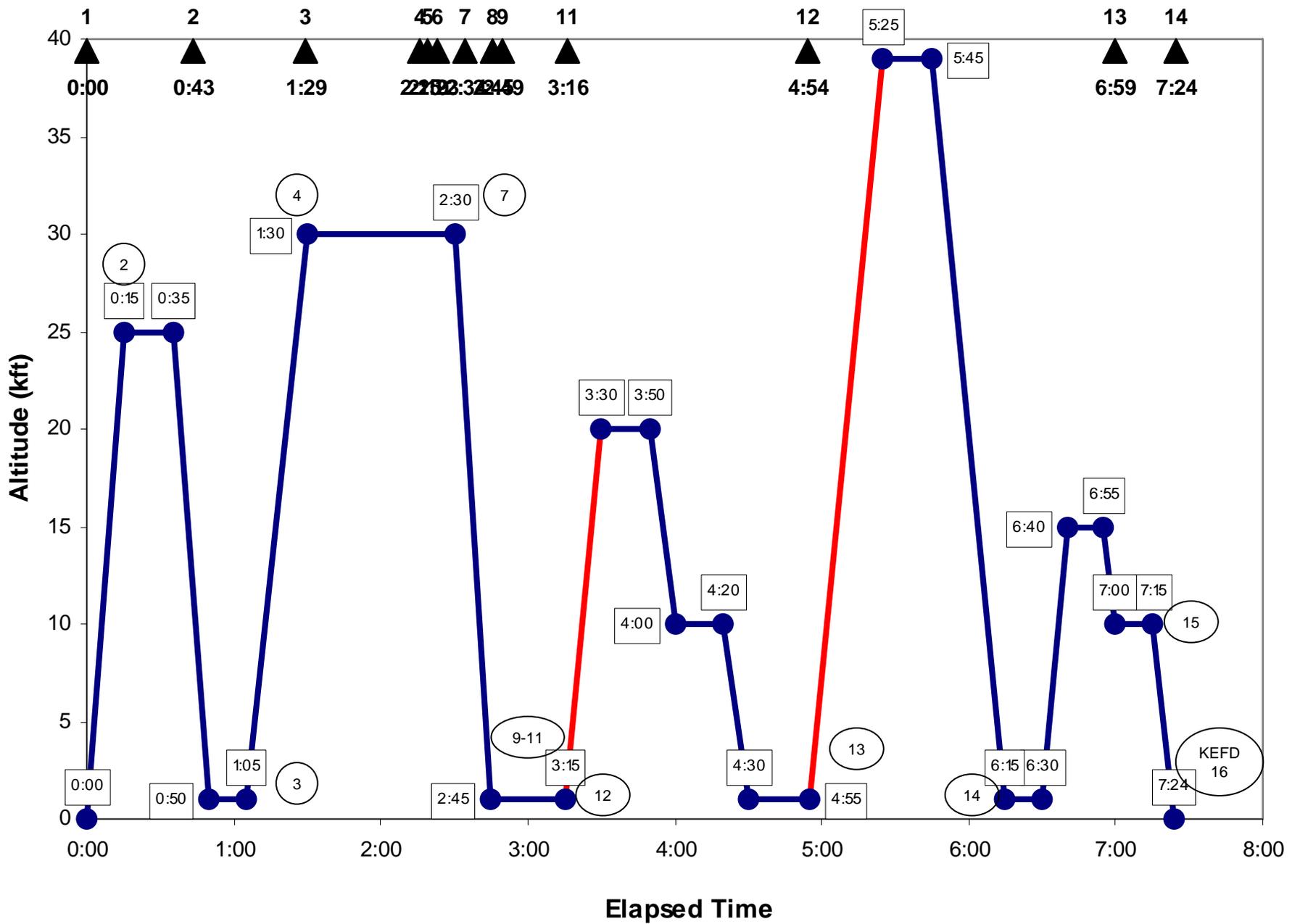
Point	1	2	3	4 (T2)	5 (T1)	6 (T0)	7	8 (T0)	9 (T1)	10 (T2)	11	12	13	14
Latitude	29.60733	28	24	20.01018	19.70307	19.35898	18.5	19.35898	19.70307	20.01018	22	19.9426	28	29.60733
Longitude	-95.1588	-99	-99	-98.9088	-98.9986	-99.0735	-99.5	-99.0735	-98.9986	-98.9088	-99	-91.6152	-93.5	-95.1588
Cum. Ft. Time	0:00	0:43	1:29	2:15	2:19	2:23	2:34	2:45	2:49	2:53	3:16	4:54	6:59	7:24
Leg Ft. Time		0:43	0:46	0:46	0:03	0:04	0:10	0:10	0:04	0:03	0:23	1:23	1:35	0:25
Local Time	8:20	9:03	9:49	10:35	10:39	10:43	10:54	11:05	11:09	11:13	11:36	13:14	15:19	15:44
UTC	14:20	15:03	15:49	16:35	16:39	16:43	16:54	17:05	17:09	17:13	17:36	19:14	21:19	21:44
Spiral											0:15	0:30		

Vector



■ 16 Mar 06
● INTEX- B
● MLAGRO 2
T.O. 1445Z / 0845L
DUR 0700

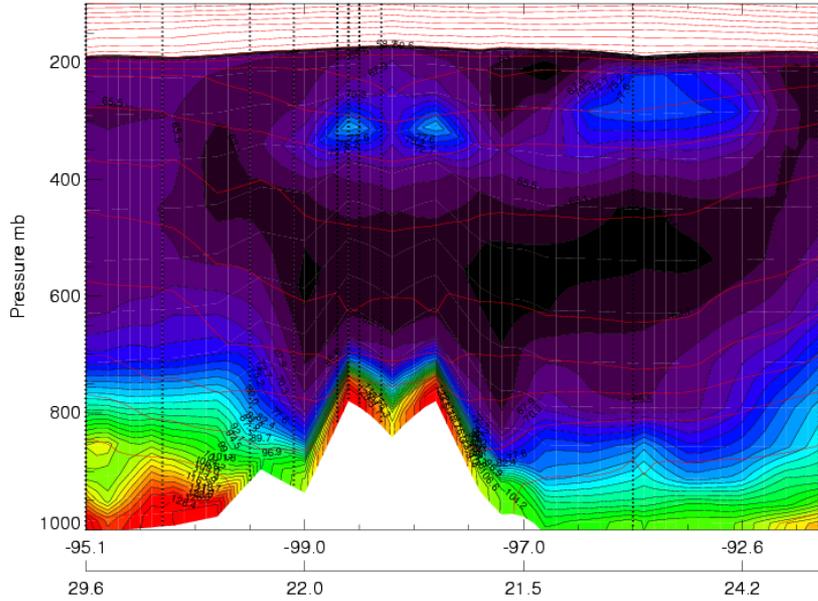
Printed Mar 15 2006 15:08



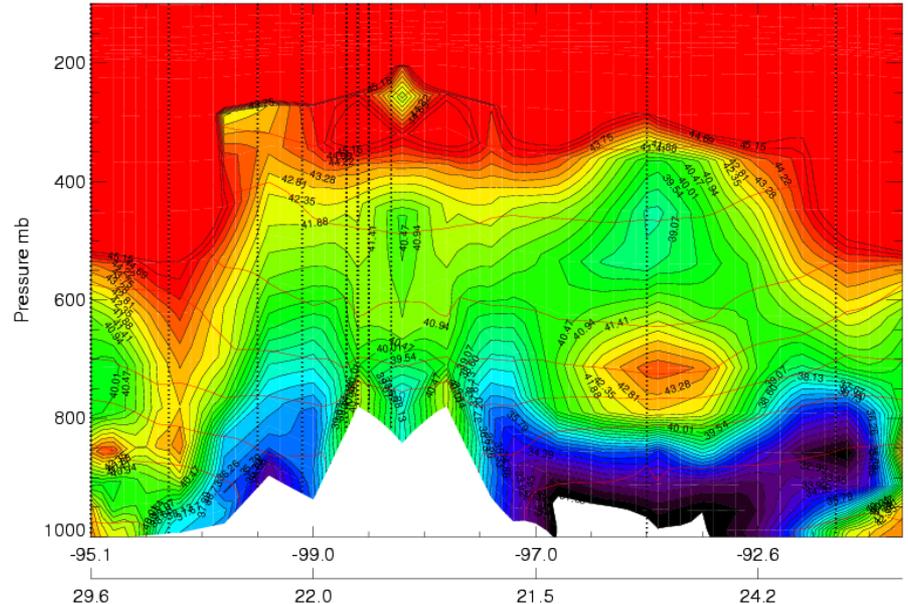
Note: In-Progress profiling in **Blue**; Spirals in **Red**; Way points annotated with CIRCLES

RAQMS Curtains 18Z 03/16

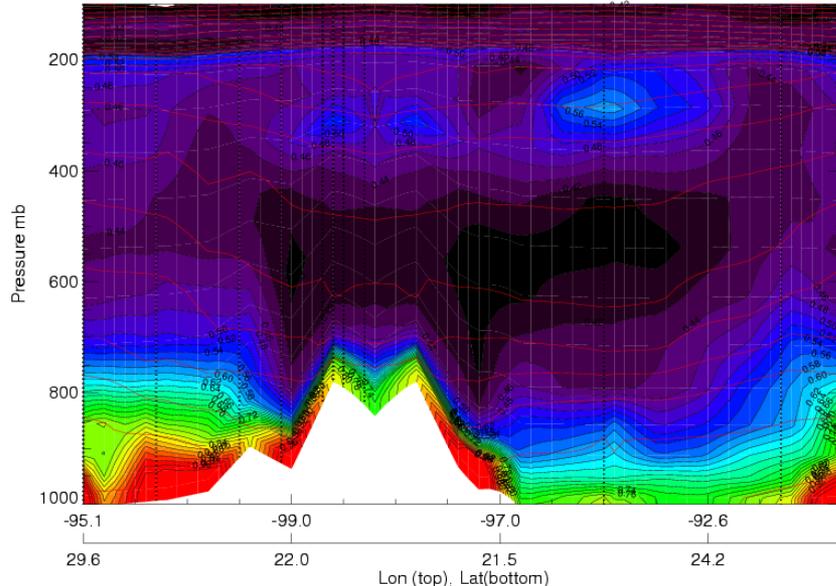
CO (ppb) CI= 2.41926
RAQMS_20060316_18Z_30hr_fcst_curtain.dat



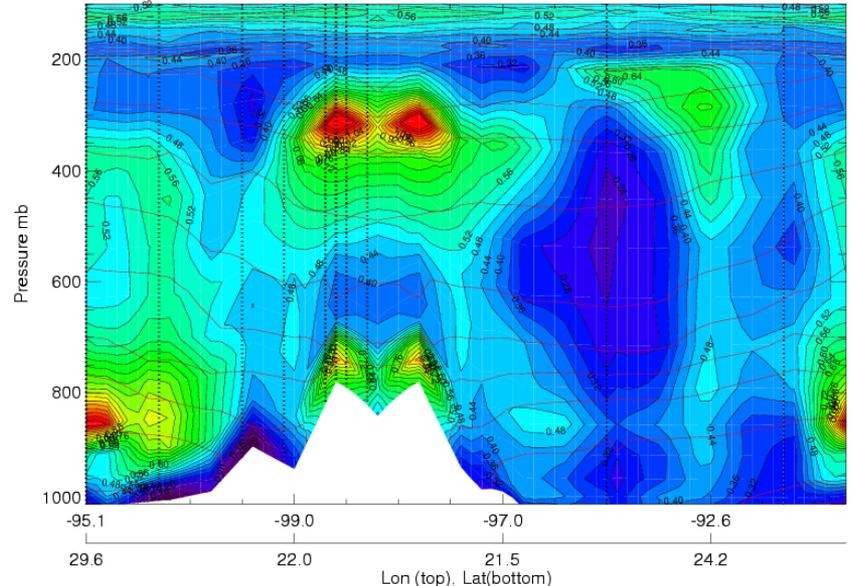
O3 (ppb) CI= 0.467972
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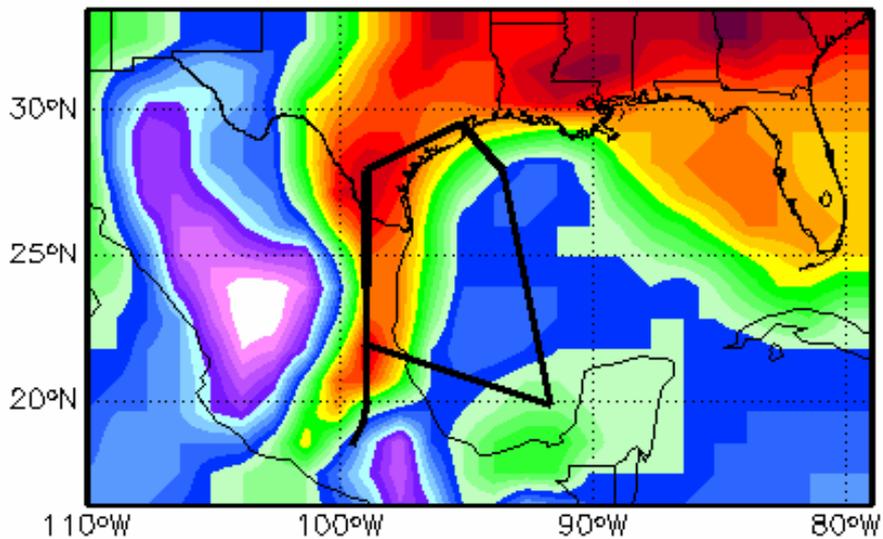
Ethane (ppb) CI= 0.0200885
RAQMS_20060316_18Z_30hr_fcst_curtain.dat



CH4 (ppb) CI= 0.0399552
RAQMS_20060316_18Z_30hr_fcst_curtain.dat

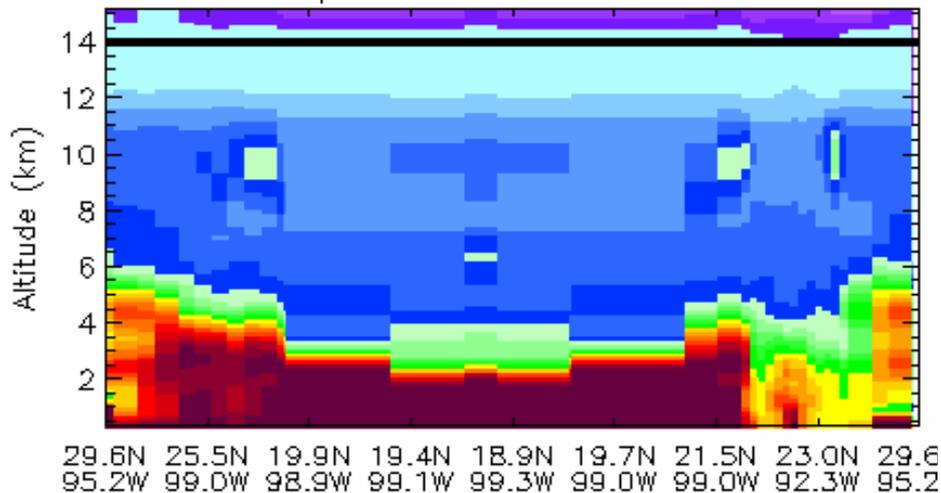


CO columns 20060316 18 GMT



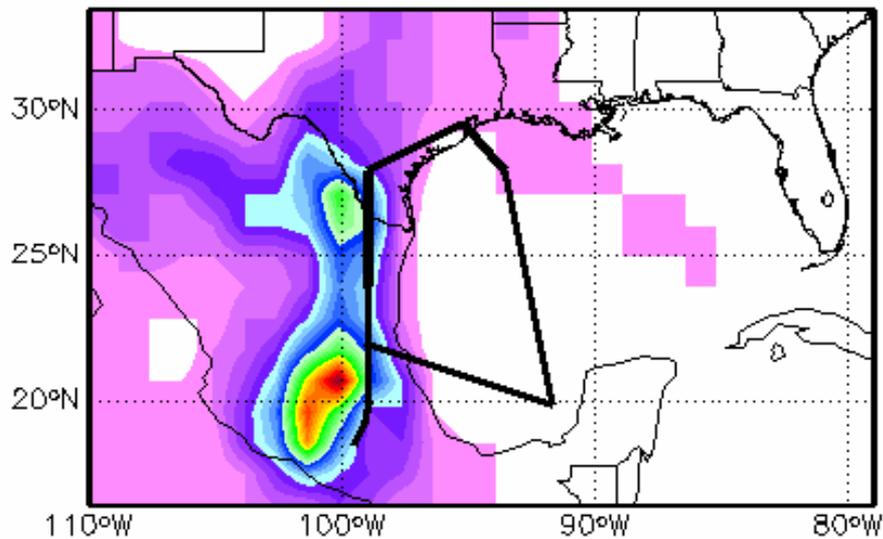
0.76 1.01 1.25 1.49 $[10^{18} \text{ molec/cm}^2]$

Curtain plot – CO 20060316 18 GMT



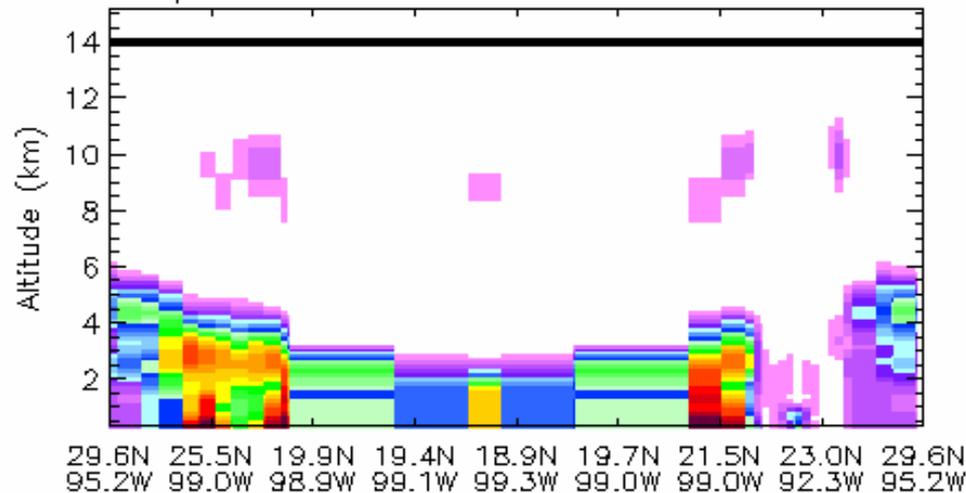
0 30 60 90 120 [ppbv]

C. American FF CO 20060316 18 GMT at 930 hPa (0.7 km)



0 31 63 95 [ppbv]

Curtain plot – C. American FF CO 20060316 18 GMT



0 12 25 37 50 [ppbv]

GMAO Forecast initialized at 3/15 12Z