

# ATTREX Science Flight Report

## 2013-02-21 Science Flight #4

**Takeoff: 1447 UT (0647 local), landing: 1520 (0720 following day), duration: 24.5 hours**

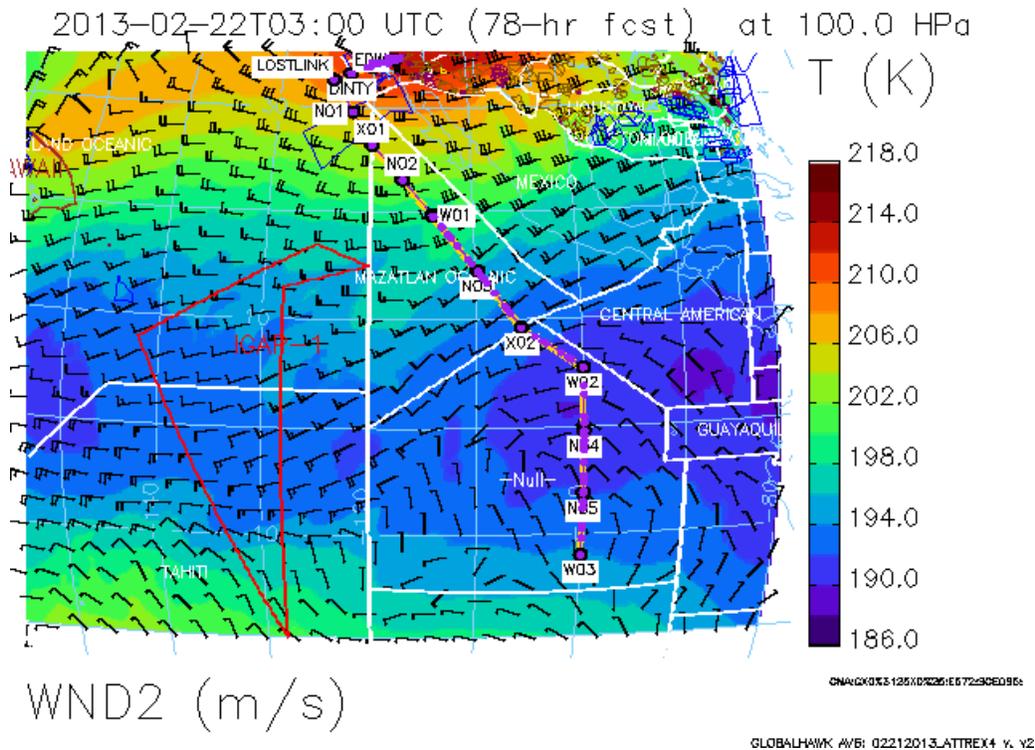
**Mission Scientists: David Fahey, Eric Jensen, Laura Pan, Mark Schoeberl**

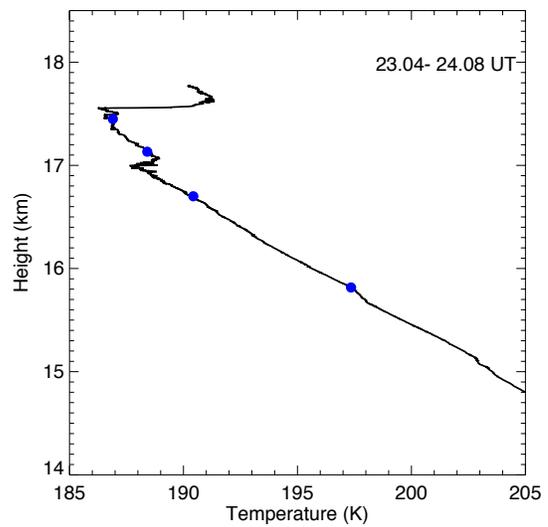
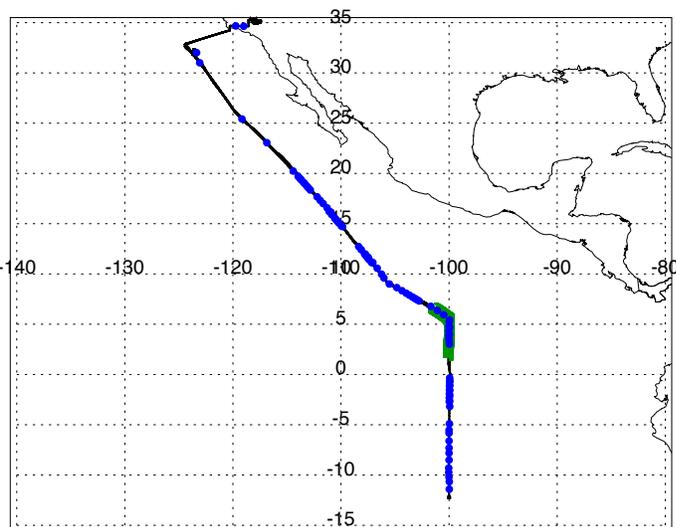
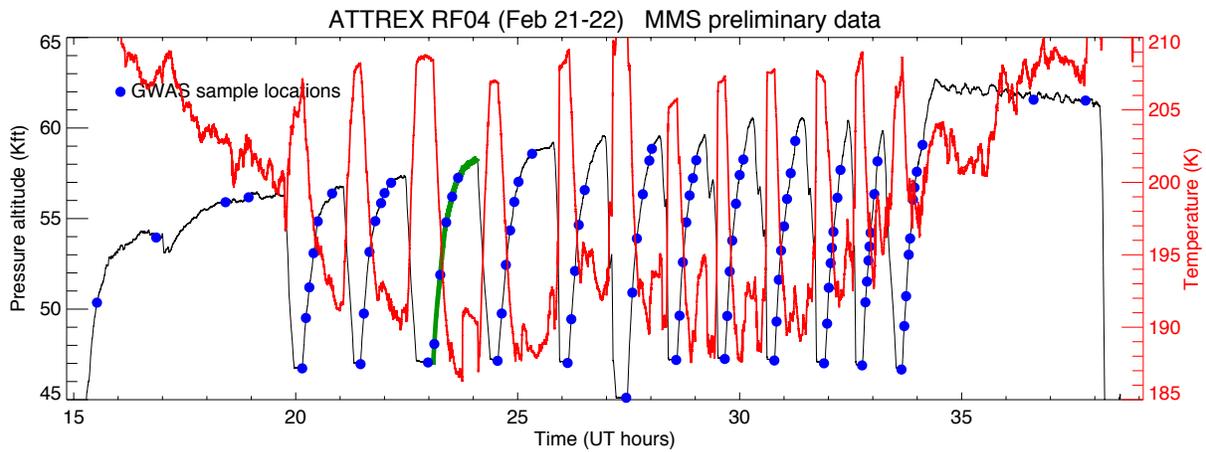
**Payload Managers: David Fratello, David Jordan, Jhony Zavaleta**

### Summary:

This flight provided a survey of TTL composition in the eastern Pacific. As shown in the figures below, the flight plan took the aircraft southeast to 100 W and then due south to about 12.5 S. The flight included 24 profiles through the TTL, with multiple GWAS samples on each of the ascents. Clouds were sampled in the upper TTL near 5 N. Sharp structures were apparent in the water vapor concentration near the tropopause, and filaments of midlatitude lower stratospheric air were sampled in the tropics.

Instruments generally performed well. NOAA ozone had a computer failure near the end of the flight.





### Flight Log:

Engine Start by 1400Z

No Instrument of Ku problems during power up

1436Z Taxi

1447Z takeoff

FCDP power recycled and OK now

1459Z Edwards balloon launch

1508Z waiting for HDVIS

Fuel freeze temp measured -71.0F

1544Z Approaching the coast at 52kft

1546Z Pfister weather update: Thick cirrus expected at <40kft at W01 for first dive schedule for about 2000Z. No turbulence expected. Some convection seen east of track at W02 (5N) is stationary and no threat. At NO4 (5S), convection to the east is moving east and not expected to be threat.

1634Z Past LostLink CPL laser waiting for permission, 54kft

1649Z MMS maneuvers in progress

1709Z MMS maneuver will be limited to box. Pitch down can't be accomplished at cruise without altitude command so will need to wait until at or below 45kft on range to complete

1713Z Box not perfect but MMS decided good enough and we are headed south again

CPL on finally

1752Z PI instrument report

NOAA O3 OK

NWV OK

SSFR OK

GWAS OK

CPL Nominal

MMS OK

MTP OK

HUPRS OK

FCDP OK no particles

DOAS OK

DLH OK

UCATS OK

1754Z Instrument roll call shows everyone doing fine. Aircraft at 55kft headed to first profile location at 19N 113W expected to be reached around 1945Z (1145Pacific)

1821Z DOAS achieved sun calibration without changing track. The delay due to MMS box maneuver let the sun rise sufficiently.

1901Z Note increase in Ozone as a PV feature is encountered.

1924Z Approaching W01 start of first dive 1940Z

1943Z Descent begun to 45kft

2000Z Laura Pan is now mission scientist

2000Z leveled at FL450

2008Z GWAS completed sample. Begin to ascend  
Ozone is around 80 ppb at 45kft at the lowest level of this first dip  
2056Z ready for the second descent  
2104Z start the 2<sup>nd</sup> descent from 382K, FL556  
2119Z leveled at FL450, ~ 358 K theta level, ~ 80ppb ozone, 7 ppm H2O  
2120Z EJ taking over for LPan  
2127Z Climbing back up to cruise altitude  
2226Z Descending from FL562  
2235Z LP is taking back the MS chair  
2245Z reached FL450. Out of KU about an hour ago  
2206Z ready for ascent  
2306Z Eric Jensen is now mission scientist  
2323Z Cirrus detected at FL532 by NOAA total water  
2324Z Dropped below structural temperature limit; plan to stay below for ~40 min.  
2327Z CDP detected cloud at FL542  
2333Z Water vapor dropped below 2 ppmv  
2354Z Climbed above cold point into warmer air.  
0005Z Descending from FL573  
0009Z Descended through sharp, cold, dry cold-point layer  
0011Z Tenuous cloud detected at FL524  
0033Z Climbing back up from FL450  
0115Z Still climbing up, at 4South. There is a convective system (tops at 45K or less) about 100 nautical miles to the east that has been brewing since the beginning of the flight. MTP shows a double tropopause structure, min at 57.6kft (which we are currently just below in altitude). Still below the skin temp limit (which cannot be named).  
0121Z Though we are at the edge of the cold temperatures and going south purportedly heading toward warmer air, TATs have gone down. Static T at 187K. There has been 1.5K fluctuations in the past 3 minutes.  
0125Z CPL asked to power down. MMS T down to 186.7K. Latitude is -5.5. We are preparing to descend with various power down sequences. Ozone currently at 150ppbv. Recent minima have been 50-70 (instrument dependent).  
0135Z Quite a bit of structure in the MTP data. CPT is at 58.1. We are at -6. GEOS-5 forecast for location of minimum temperature (in altitude) actually has an increase with decreasing latitude.  
0138Z ITAR ALERT – the rest of this log will be in code. (just kidding).

0147Z Descent initiated. Temperatures are warmer because we are a bit above the minimum temperature and because we have traveled south to warmer air (at -7.5 deg lat). Heading down. Static temp is 206K and decreasing. Descent is open spoiler (fast). Temp is dropping, now 204.5 (0149Z). At pressure of 79mb (min attained was 76.5) temperatures level off (this is the minimum T).

0152Z TT2 fault reached (cold fuel going into avionics compartment). So, we are opening the spoilers to speed the descent. Our pressure is now 93 mb. At about 100mb have a temp peak. Sure enough, as MTP was indicating all along, there was a “double trop” with a lower (warmer) cold point at 100mb, and the higher one at 80mb or so.

0155Z Note that we passed through a water vapor min of 2.1 ppmv 2 minutes ago. Believe the lower 100mb min temp is associated with another water vapor minimum of 3.5 ppmv.

0157Z After about 10 minutes we are at 45kft.

0203Z Terse EJensen replaces verbose LPfister

0207Z Climbing back up from FL450

0210Z Instrument status:

UCATS: OK

DLH: OK

DOAS: OK

FCDP: OK

Ozone and H2O: OK

SSFR: OK

GWAS: OK

CPL: Excellent

MMS: OK

MTP: OK

Viper: OK

0244Z 180 deg turn at 12 S

0258Z Descending from FL586. Spoilers open. Plan is to go down to FL430.

0305Z Brief ascent from FL500 to warm TT4

0313Z Ozone about 80-100 ppbv at FL430

0328Z Climbing back to cruise altitude

0410Z Descending from FL586

0430Z Ozone concentration as low as ~30 ppbv at FL450; Convection in the vicinity

0435Z Climbing back up from FL450

0513Z Descending from FL586

0540Z Climbing back up from FL450

0556Z Sharp decrease in water vapor climbing above ~FL545

0630Z Water vapor ledge apparent on descent as well.

0705Z water vapor feature at roughly the same altitude, not as sharp

0746Z leveled off at FL450, 358K, turning back Ku

0800Z Instrument Status check

UCATs good

DLH good

DOAS Ok

FCDP Ok

OzH2O Op Normally

SSFR Running fine

GWAS fine

CPL good to go

MMS

MTP good

HuPers Good

0825Z Reaching FL592, 415K at latitude 13.47, start descent. At the top of this profile, ozone reached ~ 300 ppb, water vapor ~ 2 ppm.

0836Z Reached FL450

0846Z at N03, ready to ascend. Last sawtooth.

0920Z Increasing ozone as the plane descends, possibly related to a filament of high Lat Lower stratospheric air.

0926Z Mark S takes over mission scientist chair

0954Z passing through ozone filament on ascent

1001Z filament has low methane & n2o, higher water and high ozone as expected from theories developed 20 years ago – corresponds to pv filament

10:11Z Ozone going up and down - now up to 750

10:14Z Ozone falling rapidly

10:16Z Ozone back up – may be past filament into polar air

10:50Z My interpretation is that the filament was an intrusion of mid-latitude air into the polar air – we were confused by the PV plots which suggested a filament of polar air rather than an intrusion – inward vs outward wave breaking

12:12Z Ozone dropping and N<sub>2</sub>O & CH<sub>4</sub> increasing, water dropping .

13:58Z Instruments off ready for descent

14:14Z Turning instruments back on at 45 kf – performing box

14:53Z MMS box complete descending – descending to 15 kf