

# RACORO Campaign Journal- May 2009

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## Legend for Flight Plots:

- Aerosol
  - PCASP - Aerosol Size Distribution 100-3000 nm at 1 Hz
  - N3 - Ultrafine particle counter (UPC)  $D > 3$  nm at 1 Hz
  - N10 - Condensation particle counter (CPC)  $D > 10$  nm
  - N13 - Condensation particle counter (CPC)  $D > 15$  nm
- Cloud
  - CAS - Cloud drop size distribution 0.5-50 microns
  - 1D CIP - Cloud drop size distribution 25-1550 microns
  - FSSP - Cloud drop size distribution 0.3-47 microns
  - 2D CIP - Cloud drop size distribution 25-1550 microns
- Radiation
  - CM22 - SW radiometer
  - CG-4 - LW radiometer
  - SPN-1 - total and diffuse SW radiometer
  - IRT - infrared thermometer

# 20090506

## Flight Summary

Depart	Return	Hours	Synopsis	Google Earth
16:21 UTC	20:43 UTC	4.4	Cloud missed approaches Ponca-Perry & Cloud triangles at SGP	
Flight hours to date		108.7		

Temp in cloud 15 degrees C.

After departure, we climbed to 3000' which was assigned by ATC. We remained there for about 8 min until we were assigned 5000'. During the climb we noted the boundary layer at cloud top to be around 3600', temp. @ 5000' was 18 degrees C. and there was no overhead cirrus.

At 1637z we requested a lower altitude to get into the clouds and were assigned 3100'. We descended to 3100' and stayed in cloud for some time, arrived there at 1640z.

Very solid layer with significant moisture on the windscreen  
Temp was 12 degrees C.  
Wind 253 @ 06

At 1644z we were assigned 3000'

At 1648z Tops began to lower to 2900' – 3000'. They began to break up but were still thick.

At 1653z we were assigned 4000'.  
Temp. 20 degrees C.  
Wind 318 @ 26

At 1705z over Ponca City I noted the clouds were becoming very broken.

At 1715z we were assigned our final approach descent.

At 1717z tops @ 3000'. We descended to 2700' and leveled off to stay in cloud. Temp. 12 degrees C.  
At 1727z we continued our approach descent to 2400' and leveled off (still in cloud). Temp 15 degrees C.  
At 1729z we continued our approach descent to 1700' which was 500' below base (Bases were 2200')  
At 1731z we commenced our missed approach at 1700' which was 500' below base.

We then climbed to an assigned altitude of 3000' and decided to proceed to the SGP at that altitude for as many triangle patterns we could get while the clouds persisted.

At SGP we spiraled down (from cloud top-clouds broken but significant clouds) to 1600' and back up to the middle of the cloud 2800' (sorry forgot to note the time we began the spiral).  
Cloud tops @ 3000'  
Bases @ 2600'

Triangle 1 2800'

Leg 1 1751z wind 230 @ 10 Temp. 13

Leg 2 1800z 238 @ 13 13

Leg 3 1816z 222 @ 07 19

We had broken clouds thicker to the NE side of the Triangle.

Triangle 2 2900'

Leg 1 1826z wind 259 @ 12 Temp. 15

Leg 2 1835z 268 @ 15 15

Leg 3 1850z 280 @ 07 21

We still had broken clouds, but they were thinning especially to the SW side of the Triangle. Note: Temp. on the SW side was 21 degrees C.

Triangle 3 2100' (base - 500')

Leg 1 1900z wind 237 @ 12 Temp. 17

Leg 2 1910z 280 @ 09 17

Leg 3 1925z 225 @ 10 18

Very thin and broken clouds

Triangle 4 3500' (tops + 500')

Leg 1 1936z wind 238 @ 10 Temp. 20

Leg 2 1943z 321 @ 21 21

Leg 3 1958z 294 @ 17 22

Few to no clouds

Towards the end of the last triangle leg 3 we ramped up to 5500' did a spiral descent over the SGP to 1600' We began the spiral descent at time 2008. We then ramped up to 2700' for RTB.

No issues with the aircraft.

## Weather Summary

Thin, broken clouds.

## Surface Instrumentation Status

nothing to report

## Flight Images



1620 UTC



1652 UTC



1840 UTC



1906 UTC



1626 UTC



1800 UTC



1829 UTC



1911 UTC



1631 UTC



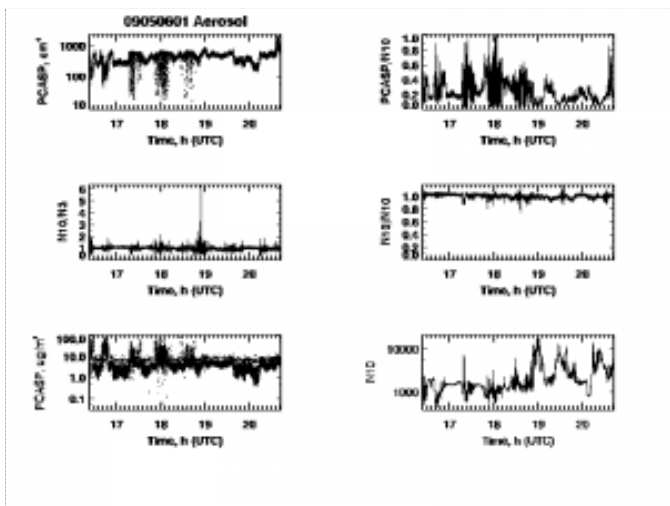
1822 UTC



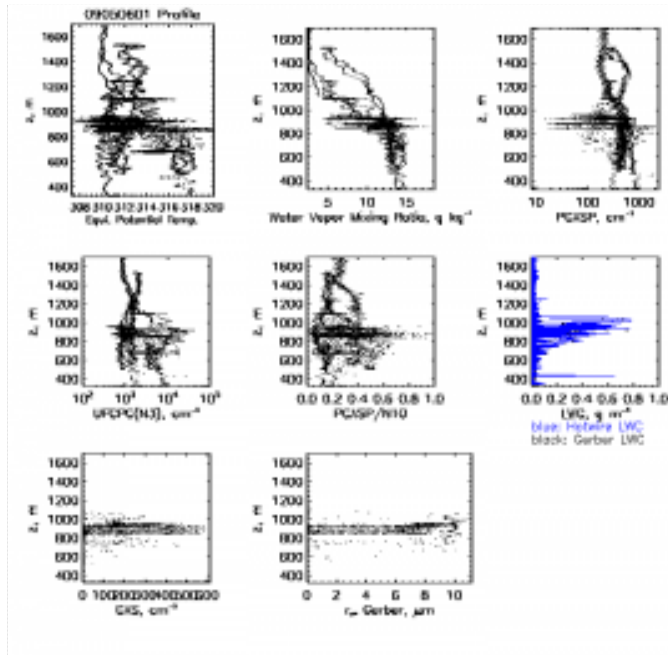
1903 UTC

# Flight Plots

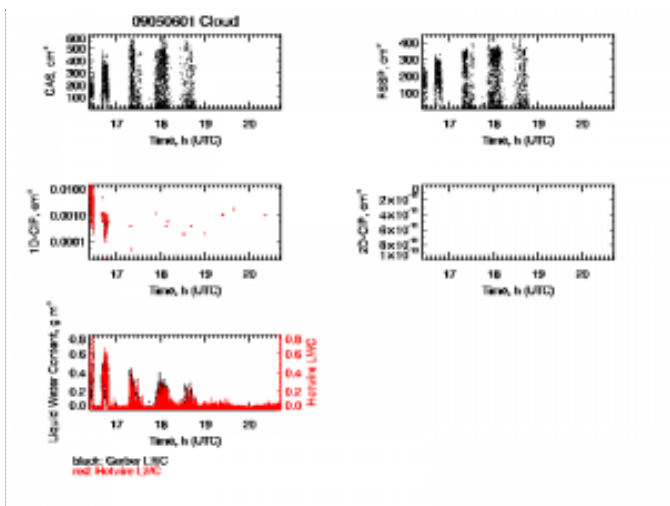
## Aerosol



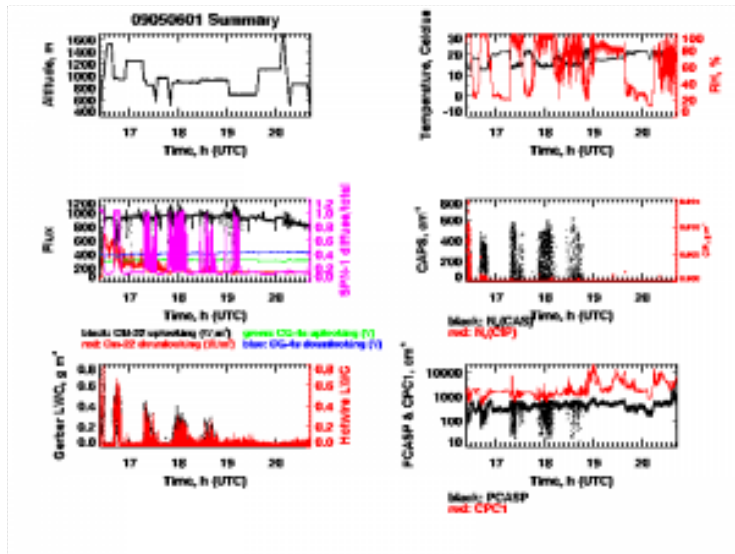
## Profile



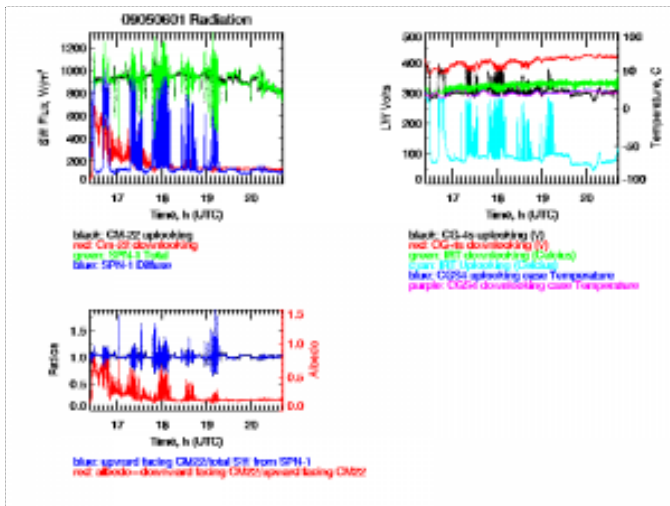
## Cloud



## Summary

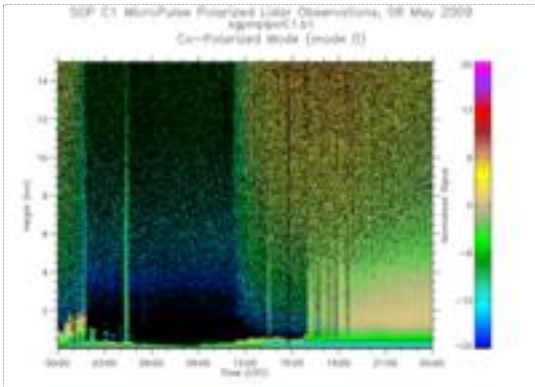


## Radiation

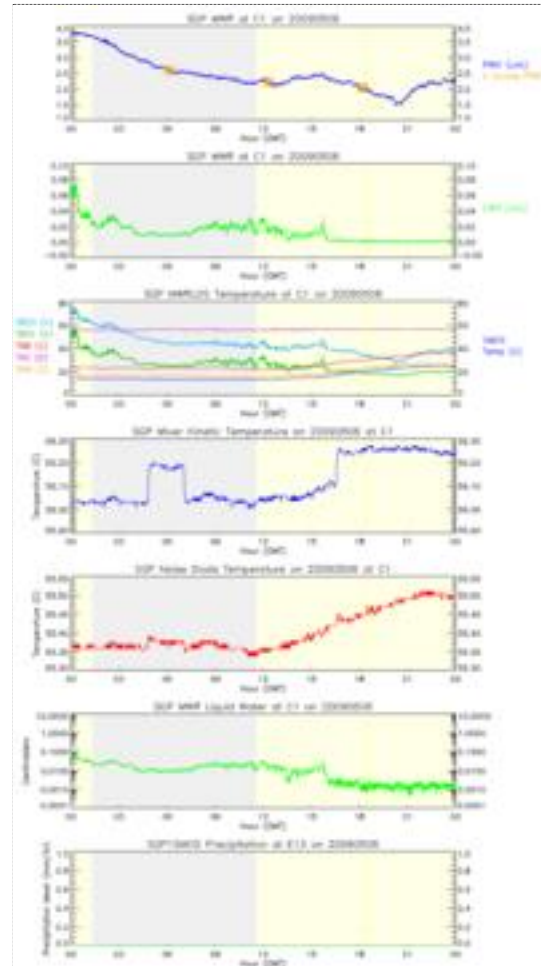


# SGP Plots

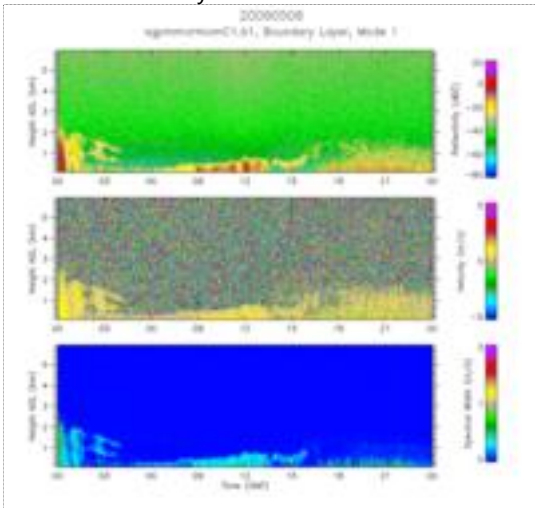
MPL Co-Pol



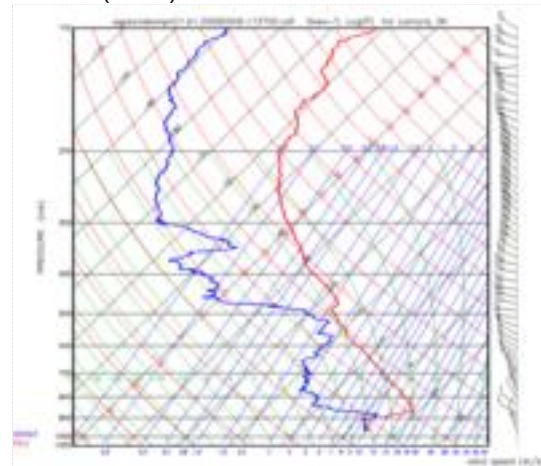
Microwave Radiometer



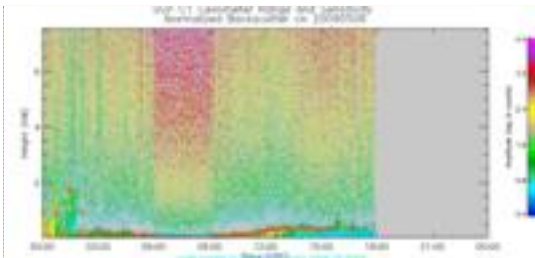
MMCR Bound. Layer Mode



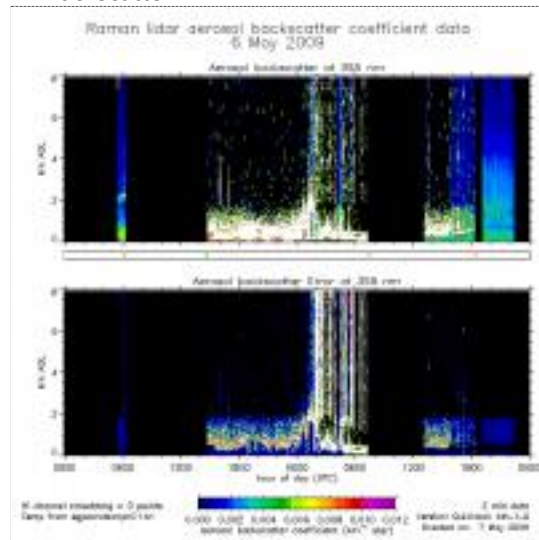
SONDE (11:30)



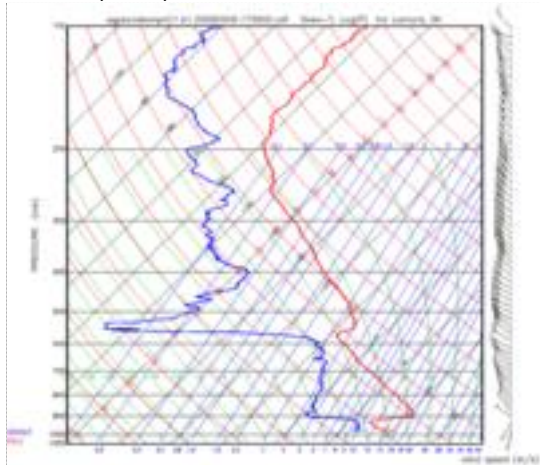
Ceilometer Backscatter



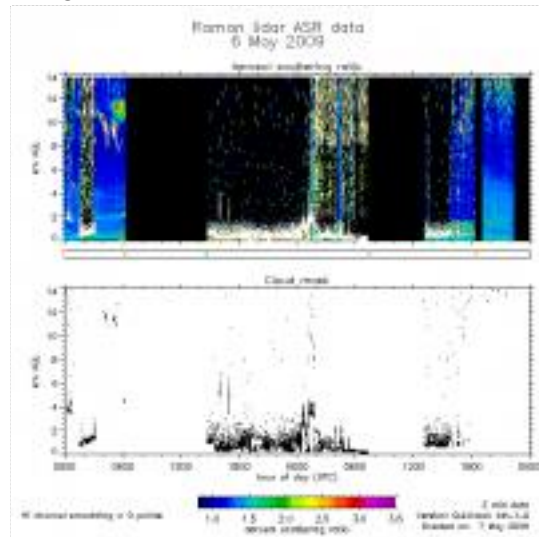
RL Backscatter



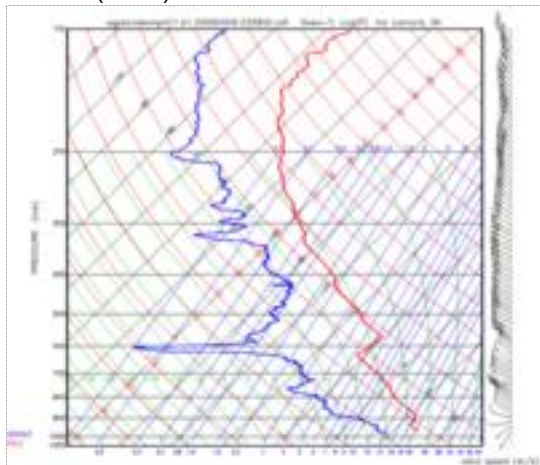
SONDE (17:30)



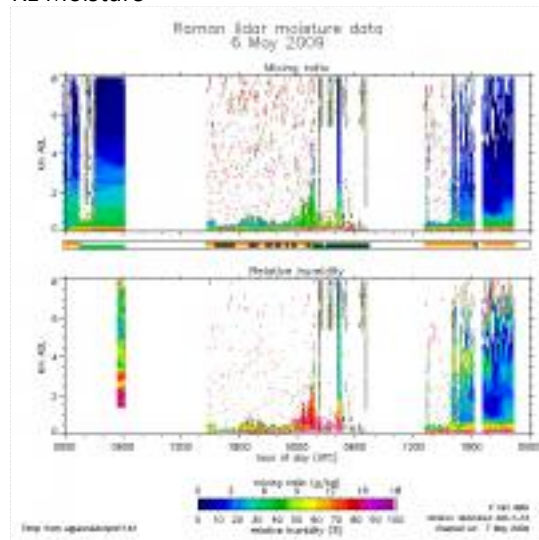
RL ASR



SONDE (23:30)



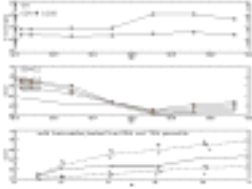
RL Moisture



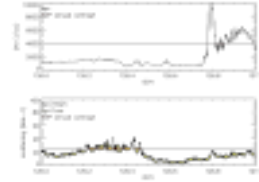


## CCN Activity

I've generated time series plots showing CN concentration and scattering at the ground (i.e. at SGP) and CCN fraction measured at the surface. Elisabeth Andrews - 20 May 2009

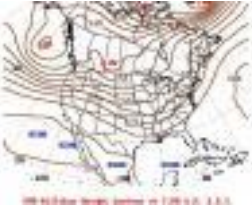


plot of CN and CCN and CCN fraction at SGP



time series of CN and light scattering at SGP

## Weather Maps



map-562



OK City: Overcast; 3-7 knots | Tulsa: Overcast, 8-12 knots; 1057 mb | 61 F/59 F | Pre- and post-cold front

# 20090507

## Flight Summary

Depart	Return	Hours	Synopsis	Google Earth
18:11 UTC	22:53 UTC	4.7	Cloud triangles at SGP	<a href="#">KML</a>
Flight hours to date		113.4		

Departure cloud bases 2600'.

We ferried to the SGP @ bases -500 or 2100'. After departure, clouds were broken but more solid as we approached the SGP. We encountered light drizzle (rain) @ 1832 UTC during the ferry. This was the only drizzle below cloud we encountered.

Wind 199 @ 19

Temp. 23

Triangle # 1 2100' Cloud base -500

Leg 1 1834 wind 194 @ 07 Temp. 20

Leg 2 1844 175 @ 15 20

Leg 3 1900 214 @ 13 22

Spiral from 2100' @ time 1909, to 1600' time 1920, to 6500' time 1928, after triangle # 1. There was traffic with Vance so we stopped @ 6500' which was 1000' above the tops.

During the spiral there were multiple layers that were hard to distinguish.

The lowest layer base 2200' top 2400'.

The second layer base 3500' to 4500'.

The last or top layer was thin base 5000' top 5500'.

Boundary layer was 5500' with a Temp. of 20 @ that altitude.

We decided to attempt a leg in each layer with another leg @ +500 above the top.

Triangle # 2 2600' In cloud.

Leg 1 1928 wind 198 @ 09 Temp. 20

Leg 2 1938 208 @ 13 21

During leg 2 the bases were raising considerably. At the beginning of leg 2 we climbed to 2800'. At the middle of leg 2 we climbed to 3000'

Leg 3 1955 299 @ 16 20

At the beginning of leg 3 we had to climb to 3300'

During the entire triangle # 2 we were chasing the cloud base up. It seemed like the clouds were consolidating (I don't know if this proper terminology) from multiple layers into one defined broken layer of cumulus. Hopefully the pictures will show this.

Triangle # 3 3600' In cloud.

Leg 1 2002 wind 208 @ 16 Temp. 18

Leg 2 2012 208 @ 14 19

Leg 3 2027 192 @ 20 20

Triangle # 4 4000' In cloud.

Leg 1 2037 wind 212 @ 18 Temp. 18

Leg 2 2045 218 @ 14 18

Leg 3 2100 213 @ 13 18

We flew an extra leg because we had plenty of fuel.

Triangle # 5 4500' In cloud.

Leg 1 2109 wind 208 @ 14 Temp. 17

Leg 2 2119 207 @ 14 17

Leg 3 2134 212 @ 19 17

Triangle # 6 5500' Tops +500 average. We still encountered the occasional cumulus top.

Leg 1 2143 wind 355 @ 05 Temp. 18

Leg 2 2153 200 @ 14 18

Leg 3 2206 213 @ 12 18

Boundary layer was @ the tops which was 5000'

We finished with a spiral from 5500' to 1600'. I noted the start of the spiral @ 2213 but forgot to note the time we reached 1600'. RTB at 3500'

No issues with the aircraft.

## Weather Summary

Mostly cloudy.

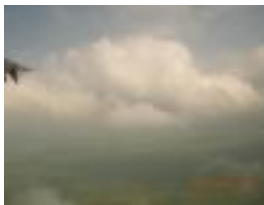
## Aircraft Instrumentation Status

Instruments ran fine. When rebooting the DLH computer to retrieve data Jesse said the computer would not boot. He will call Glen to get this resolved. No DLH data for flight.

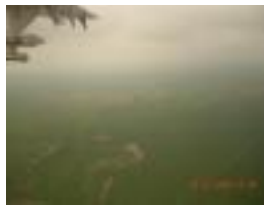
## Surface Instrumentation Status

nothing to report

## Flight Images



2002 UTC



1836 UTC



1847 UTC



1858 UTC



1859 UTC



1917 UTC



1918 UTC



1919 UTC



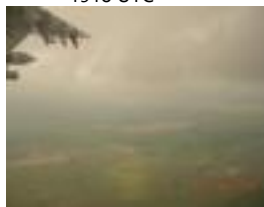
1921 UTC



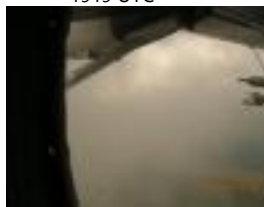
1930 UTC



1945 UTC



1948 UTC



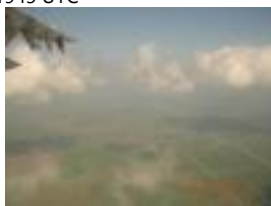
1956 UTC



2005 UTC



2021 UTC



2104 UTC



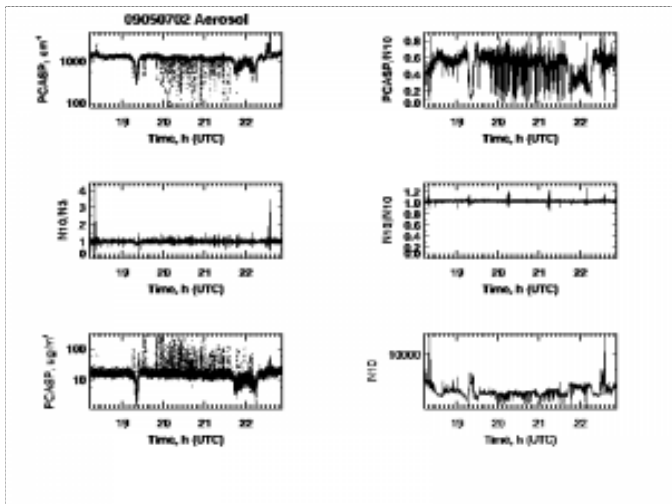
2121 UTC



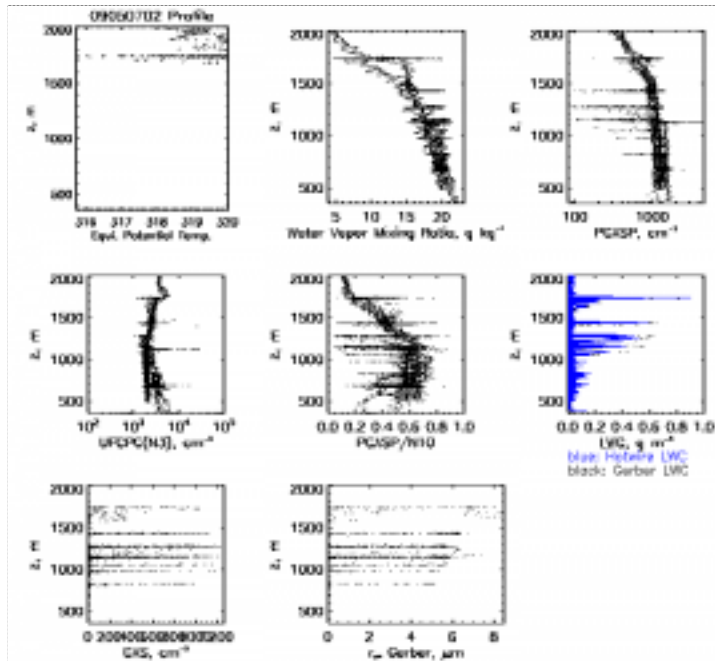
2239 UTC

# Flight Plots

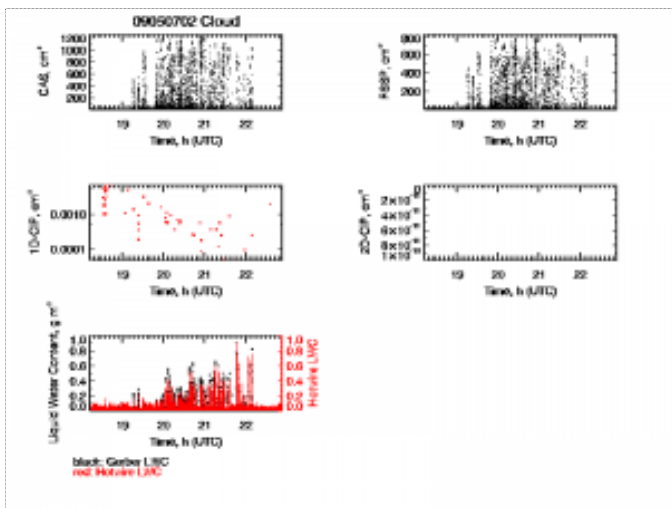
## Aerosol



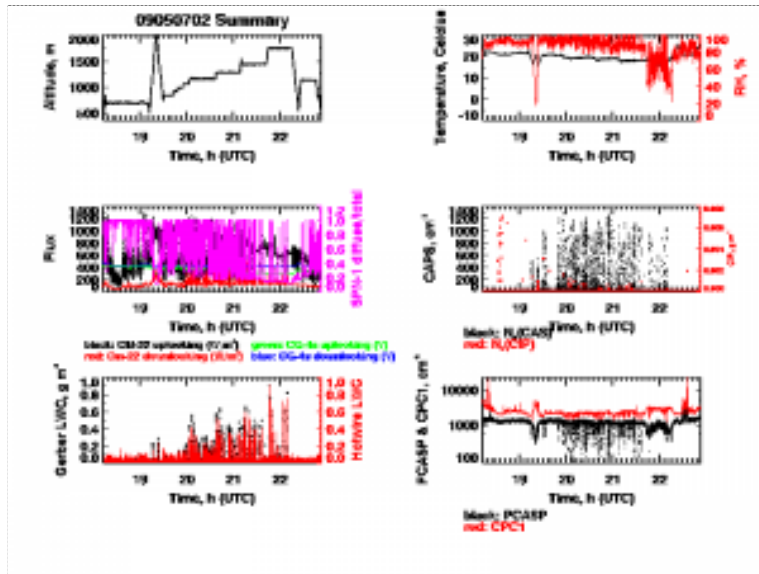
## Profile



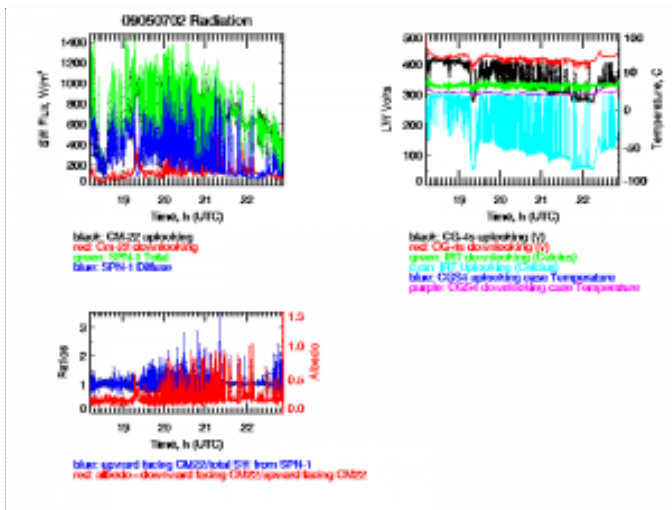
## Cloud



## Summary

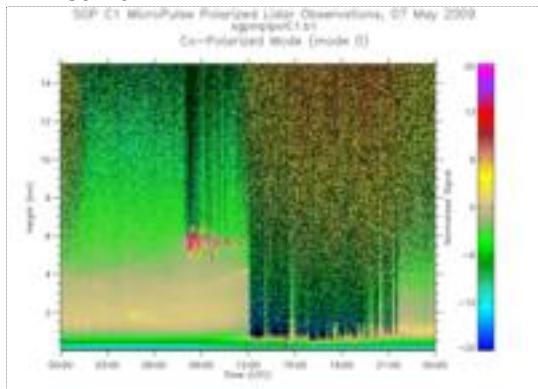


## Radiation

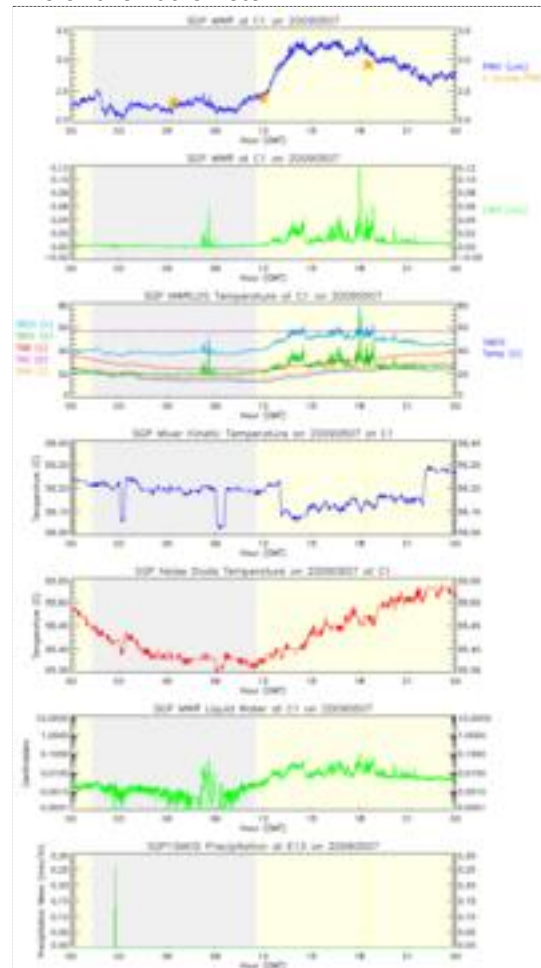


# SGP Plots

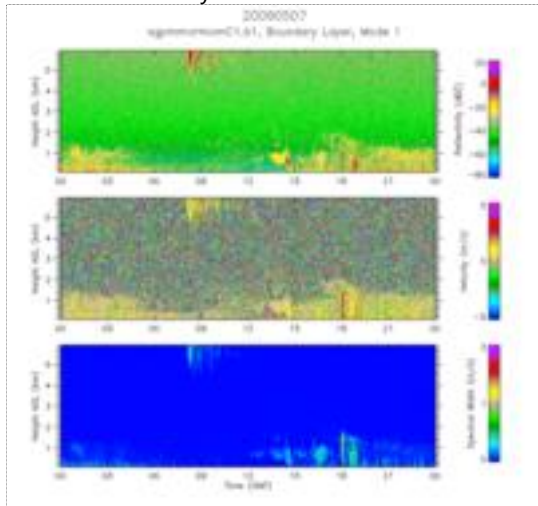
MPL Co-Pol



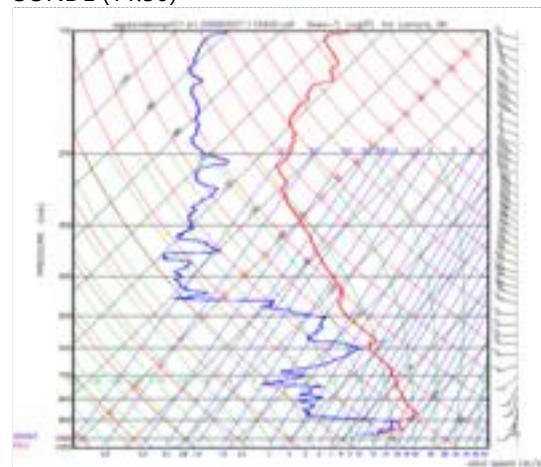
Microwave Radiometer



MMCR Bound. Layer Mode



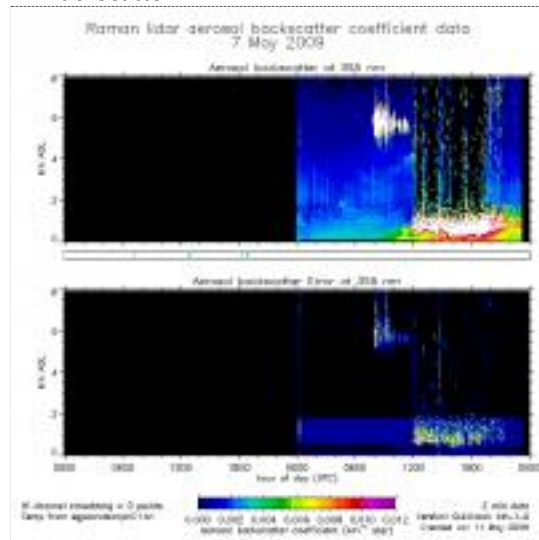
SONDE (11:30)



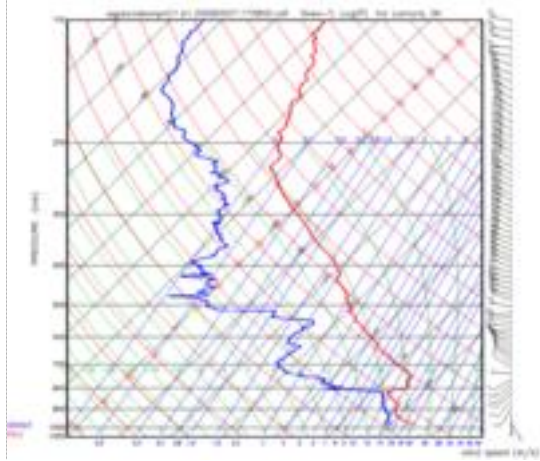
Ceilometer Backscatter



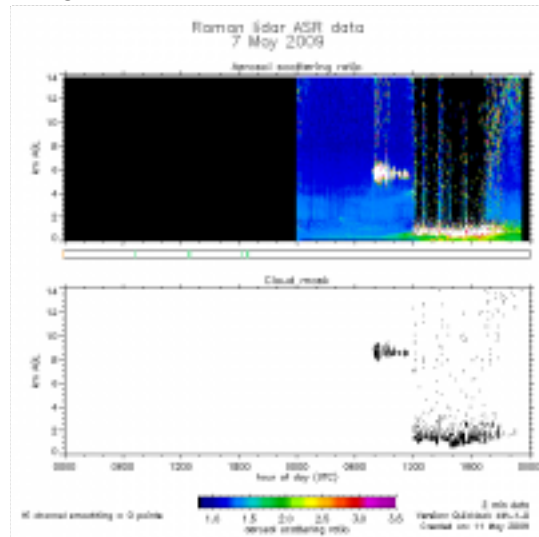
RL Backscatter



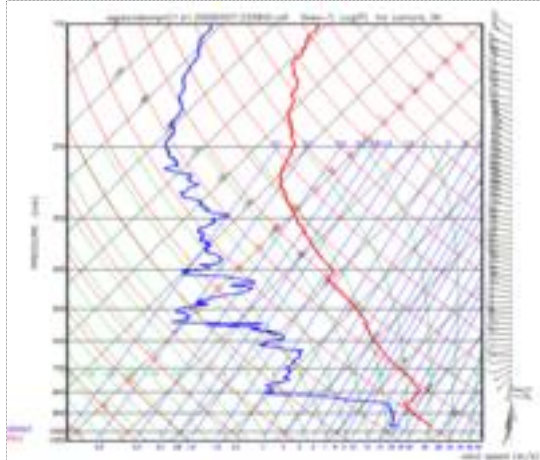
SONDE (17:30)



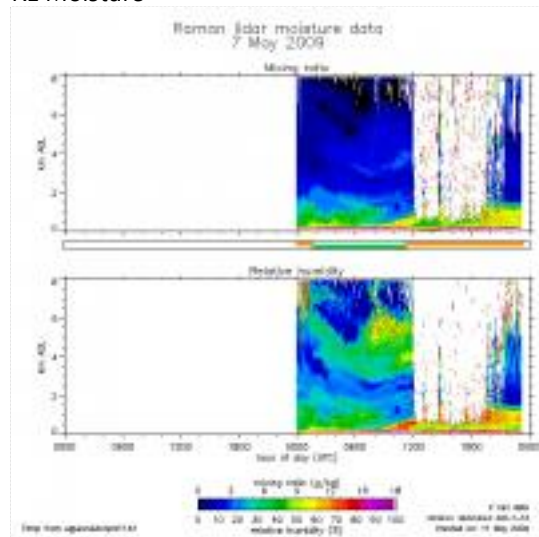
RL ASR



SONDE (23:30)

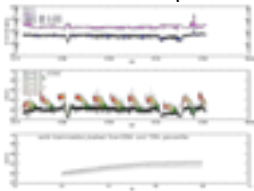


RL Moisture

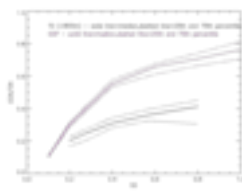


## CCN Activity

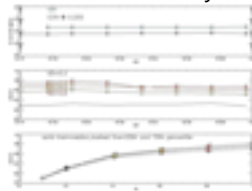
I've generated plots indicative of CCN activity from the Twin Otter CABIN and CCN files (i.e. CCN/CN as  $f(SS)$ ). I've also generated time series plots showing CN concentration and scattering at the ground (i.e. at SGP) and CCN fraction measured at the surface so one can compare with that measured aloft. Elisabeth Andrews - 20 May 2009



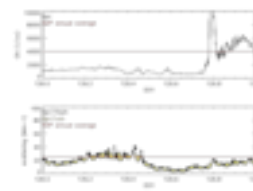
plot of CN and CCN and CCN/CN ratio as  $f(SS)$  from twin otter



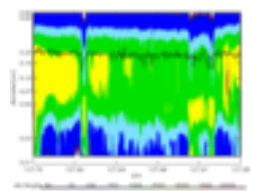
comparison of CCN fraction on twin otter and at SGP



plot of CN and CCN and CCN fraction at SGP



time series of CN and light scattering at SGP



TAMU DMA size distribution and CCN activation diameter

## Weather Maps



map-572

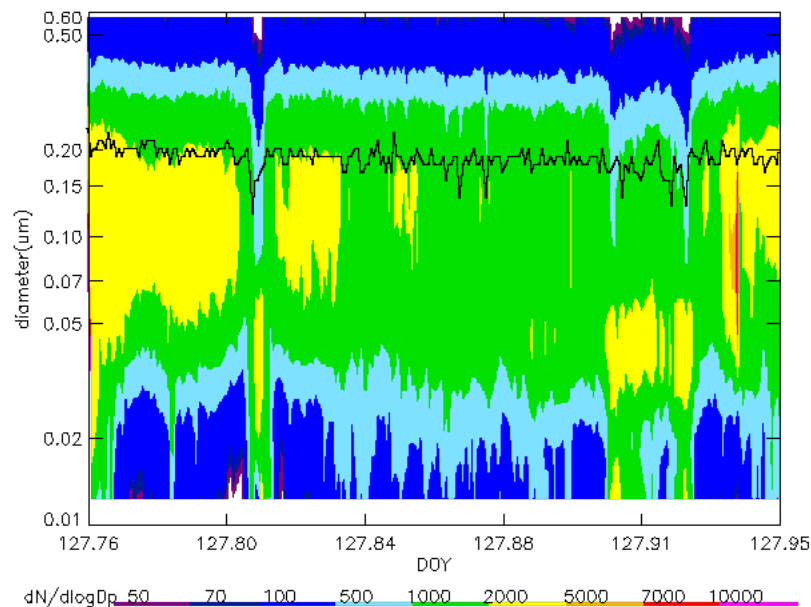


OK City: 1/8 cloud coverage; 3-7 knots | Tulsa: Clear; 3-7 knots, 1088 mb | 77 F/62 F | Pre- and post-cold front

## Comments

I've made size distribution contour plots from the DMA operated by TAMU on the Twin Otter. These plots are overlaid with a line indicating the CCN activation diameter at 0.2% SS based on the CCN measurements on the Twin Otter. To do this, I cumulatively summed the DMA number concentration backwards from largest to smallest diameter bin. I identified the bin diameter where the cumulative summed concentration was closest to the measured CCN concentration and chose that as the CCN activation diameter.

-- Elisabeth Andrews - 17 Jun 2009



# 20090508

## Flight Summary

Depart	Return	Hours	Synopsis	Google Earth
15:16 UTC	19:10 UTC	3.9	Cloud out and backs at SGP	<a href="#">KML</a>
Flight hours to date		117.3		

After Departure we climbed to 4100' to take a look at the cloud bases. We soon realized we were in a huge hole and descended back to what we found to be the cloud base at 2100'. We ferried to the SGP @ 1600' bases -500.

About 10 miles from SGP we ramped up to 6000' and conducted a spiral from that altitude to 1600' Time we started the spiral 1549.

It was a broken layer tops 3500' and bases 2600'.

We noted the thin nature of the clouds and decided to jump in them before they dissipated.

Leg 1 in cloud @ 2800'

Start time 1607

We figured the wind to be roughly 020 @ 16

Ran a line from SGP tracking 020 for 30 nautical miles

Temp. 15

Noted wind mid leg was 060 @13 but stayed on track.

Noted high cirrus to the East at the end of the track.

End time 1628.

This was a very thin layer of clouds but a solid field so we decided to fly two outbound and inbound legs at two different altitudes to maximize cloud time.

Leg 2 in cloud @ 2800' reverse track of 200 back to SGP.

Start time 1630

End time 1643

Leg 3 in cloud @ 3000'

Start time 1652

Wind roughly 020 @ 14 Temp. 15

Ran same track and distance at this altitude.

Noted the wind mid track 047 @ 18 we stayed on track.

Noted the clouds were drying out significantly toward the NE side of the line. In all the clouds were starting to thin out and the bases were rising.

End time 1710

Leg 4 in cloud @ 3300' reverse track of 200 back to the SGP.

Start time 1713

We bumped up the altitude to remain in cloud.

End time 1726

Leg 5 above cloud @ 4000'. Tops +500. Tops were 3500'. Boundary Layer was 3600'

Start time 1728

Wind was 103 @ 7 but we stayed on the 020 – 200 track because we were above the boundary layer. We ran the same distance.

Temp 18

End time 1746

Leg 6 above cloud @ 4000' reverse track of 200 back to SGP.

Start time 1748

End time 1801

At the end of leg 6 we descended over the SGP for a base -500' leg.

Tops 3500

Bases 2900



Leg 7 below cloud 2400'. Bases -500

Start time 1809

Wind was 060 @ 23

We ran a 060 line 30 miles from the SGP.

End time 1827

Leg 8 below cloud 2400' on reverse track of 240 to SGP

Start time 1829

End time 1842

Spiral descent to 1600' and ramp to the boundary layer 4500'

Ramp down to 2500' for the ferry back to Guthrie.

Bases 3600'

Tops 4100'

No issues with the airplane.

## Weather Summary

Mostly cloudy with broken cumulus.

## Aircraft Instrumentation Status

DLH computer started back up and was operational. Glenn headed to Guthrie to check things out. No DLH data for flight.

## Surface Instrumentation Status

nothing to report

## Flight Images



1525 UTC



1550 UTC



1633 UTC



1730 UTC



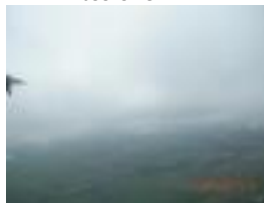
1810 UTC



1530 UTC



1625 UTC



1658 UTC



1738 UTC



1817 UTC



1542 UTC



1627 UTC



1719 UTC



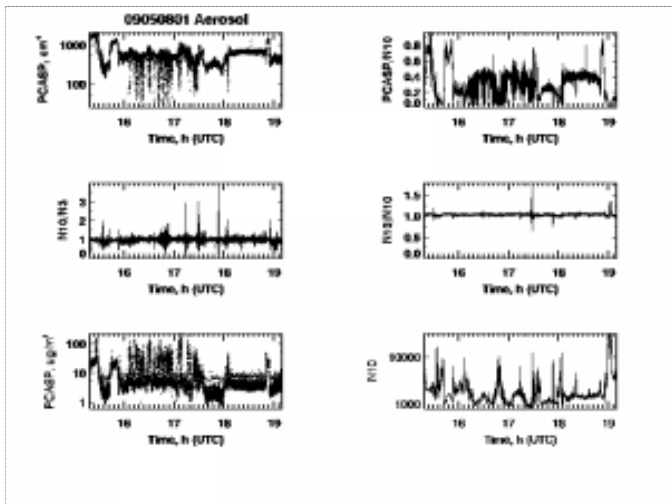
1747 UTC



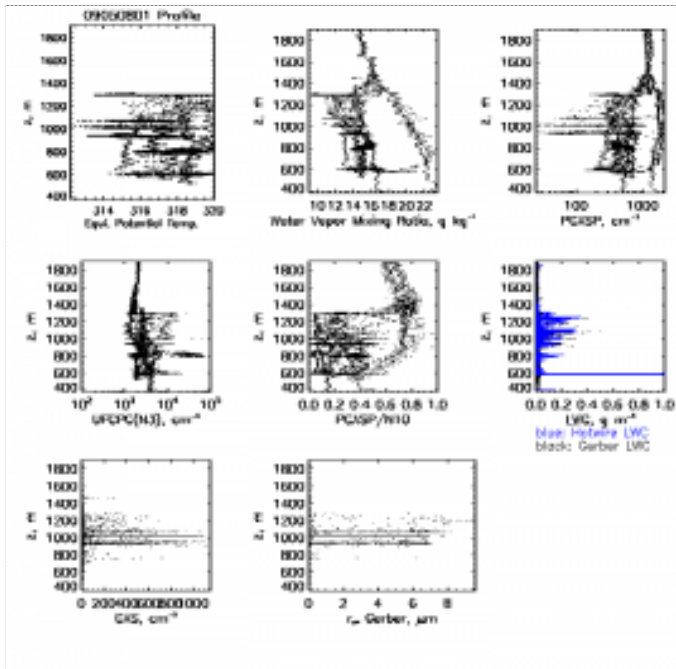
1847 UTC

# Flight Plots

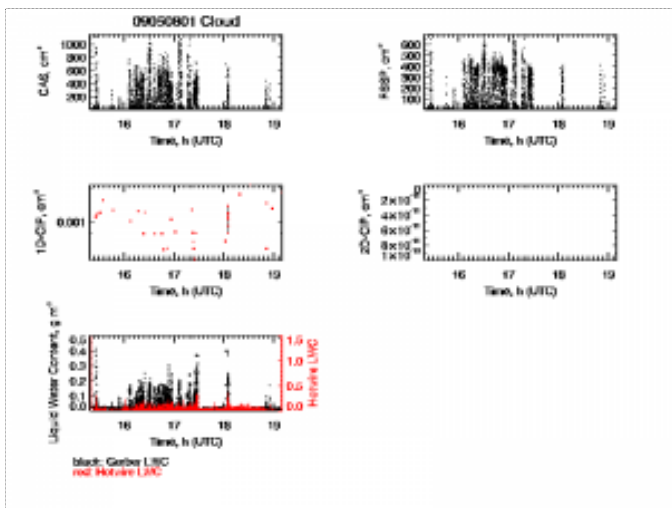
## Aerosol



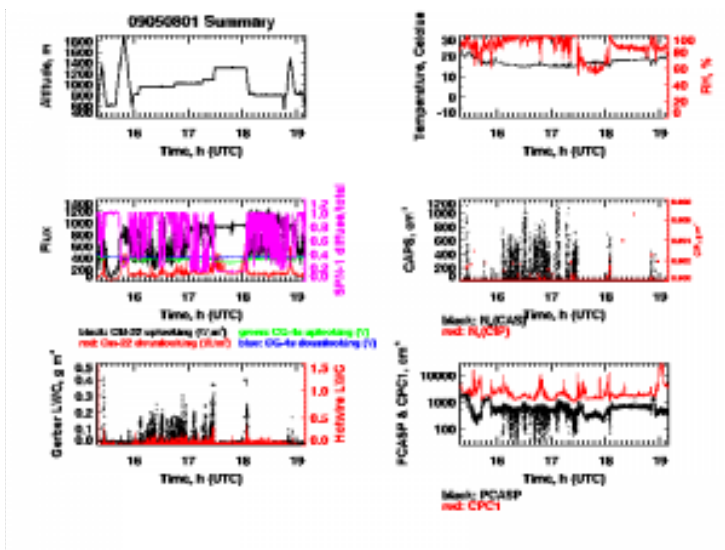
## Profile



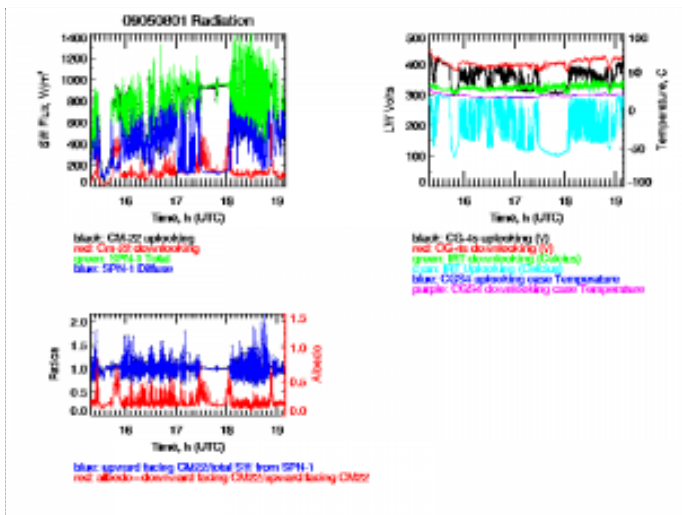
## Cloud



## Summary

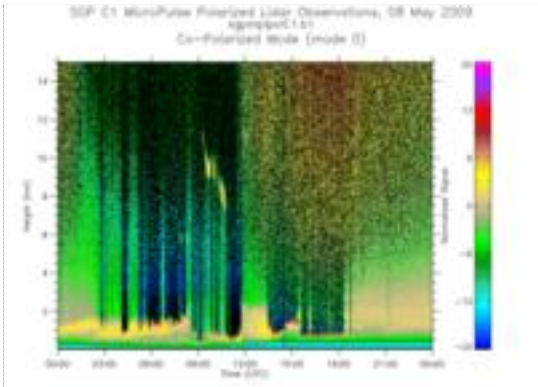


## Radiation

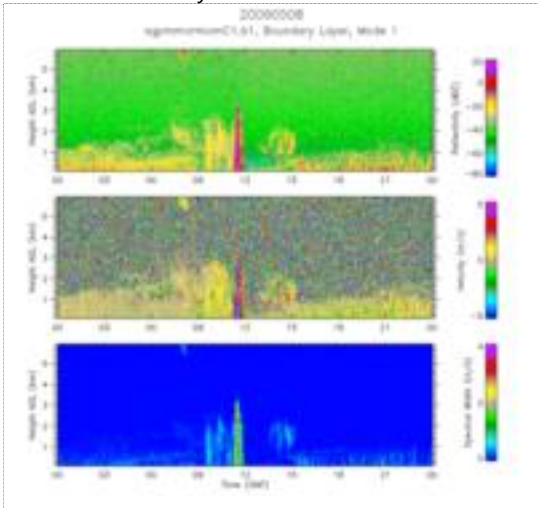


# SGP Plots

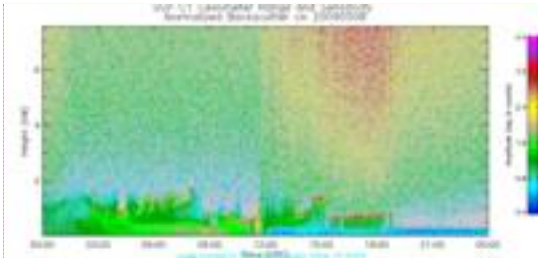
MPL Co-Pol



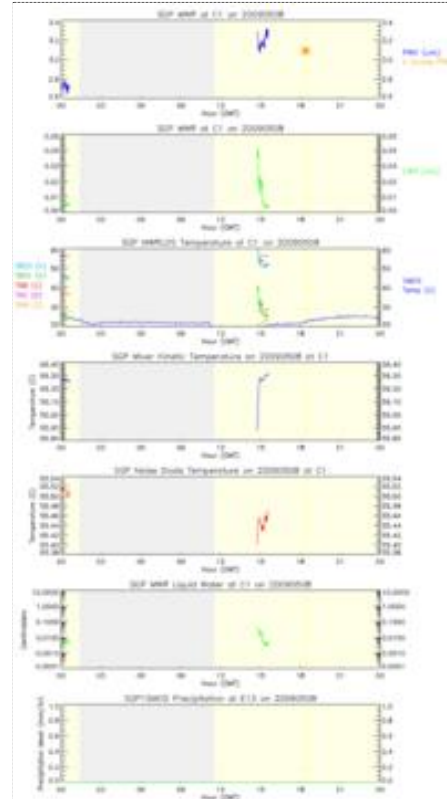
MMCR Bound. Layer Mode



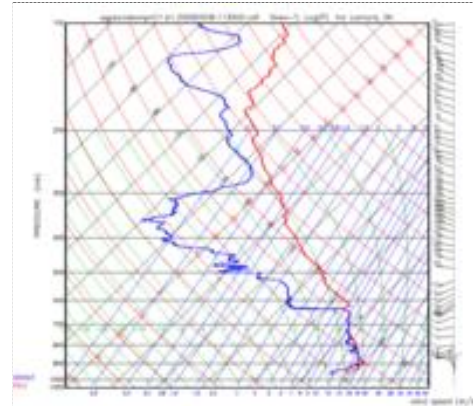
Ceilometer Backscatter



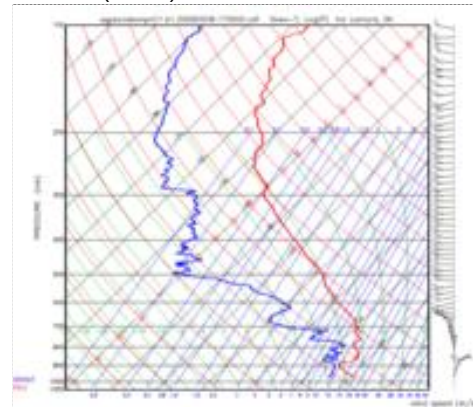
Microwave Radiometer



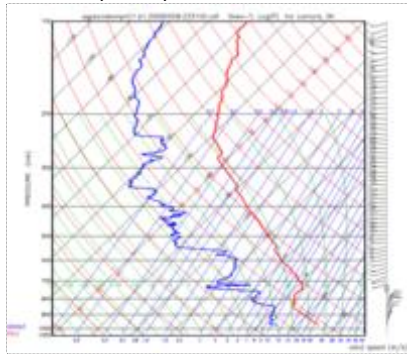
SONDE (11:30)



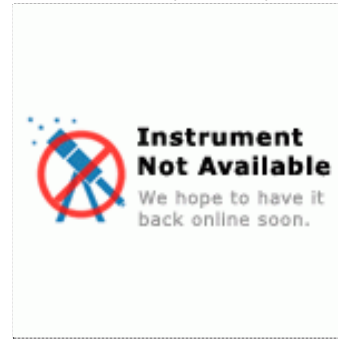
SONDE (17:30)



SONDE (23:30)

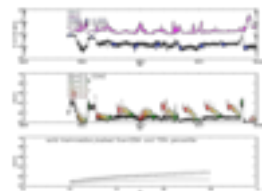


RL Backscatter, RL ASR, RL Moisture

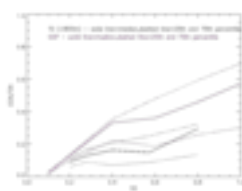


## CCN Activity

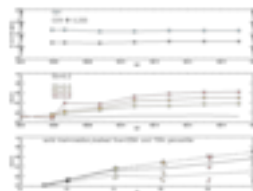
I've generated plots indicative of CCN activity from the Twin Otter CABIN and CCN files (i.e. CCN/CN as f(SS)). I've also generated time series plots showing CN concentration and scattering at the ground (i.e. at SGP) and CCN fraction measured at the surface so one can compare with that measured aloft. Elisabeth Andrews - 20 May 2009



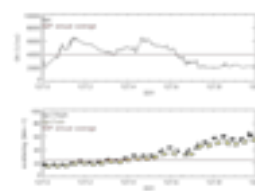
plot of CN and CCN and CCN/CN ratio as f(SS) from twin otter



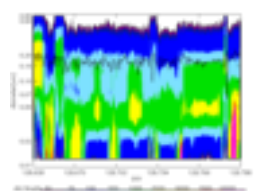
comparison of CCN fraction on twin otter and at SGP



plot of CN and CCN and CCN fraction at SGP



time series of CN and light scattering at SGP



TAMU DMA size distribution and CCN activation diameter

## Weather Maps



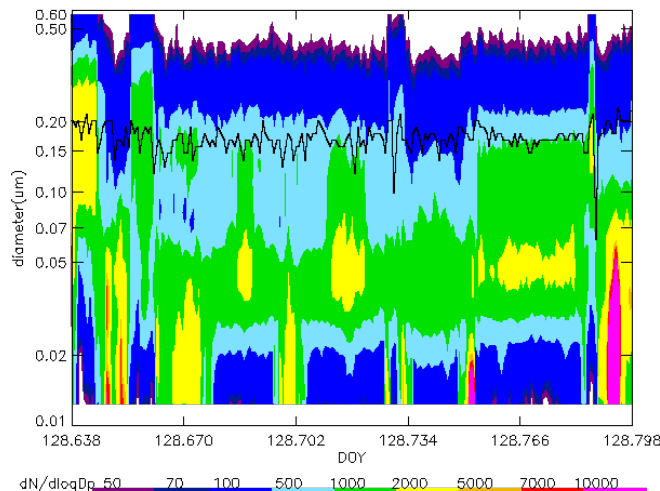
map582



OK City: Overcast; 8-12 knots | Tulsa: 1/8 cloud coverage; 8-12 knots; 1050 mb | 80 F/72 F

## Comments

I've made size distribution contour plots from the DMA operated by TAMU on the Twin Otter. These plots are overlaid with a line indicating the CCN activation diameter at 0.2% SS based on the CCN measurements on the Twin Otter. To do this, I cumulatively summed the DMA number concentration backwards from largest to smallest diameter bin. I identified the bin diameter where the cumulative summed concentration was closest to the measured CCN concentration and chose that as the CCN activation diameter.-- Elisabeth Andrews - 17 Jun 2009



# 20090513

## Flight Summary

Depart	Return	Hours	Synopsis	Google Earth
15:31 UTC	19:27 UTC	3.9	Surface albedo & Cloud out and backs at SGP	<a href="#">KML</a>
Flight hours to date		121.2		

We got off late due to winds gusting over 35kts.

Out of Guthrie, we climbed to the cloud bases. It was a thin scattered layer at 3400. We flew out to the CF at 2900'.

Near the site we climbed to 6000' and did a spiral down to 1500'/500 agl (1556z). At 5000' the winds were 70 knots...

We did the pinwheel pattern at 1600'/600' agl. Times were 1612-1708. Skies were still thin scattered.

We did the paperclip pattern at 1600'/600 agl. Times were 1711-1753. Skies were scattered to broken,

We began the upwind/downwind legs. These were all 20 nm long and oriented along 220 degrees.

Leg #1. 1804z. Bases of the clouds were 4800. We did this leg at 4300. This was a downwind leg. We ended up north of Ponca City.

Leg #2. 1818z. Tops of the clouds were 6800. We did this leg at 7300. The clouds were thicker at the north end of the leg. UW.

Leg #3. 1832z. Mid level in the clouds, 5800'.DW.

Leg #4 1843z. Mid level. 5500'. UW.

We RTB'd at 1858. We turned South and descended to 5300', just above the bases for 20 nm. We climbed up to 7500' and did a slant descent to 1500'/500 agl. Tops were 6500', Bases 5100. It was a scattered to broken layer.

## Weather Summary

Thin scattered and broken clouds.

## Aircraft Instrumentation Status

Jesse said everything was fine, but no PCASP data.

## Surface Instrumentation Status

nothing to report

## Flight Images



1609 UTC



1609 UTC



1616 UTC



1644 UTC



1709 UTC



1816 UTC



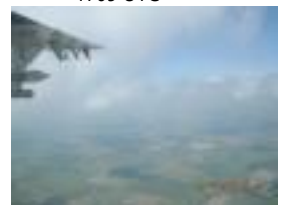
1821 UTC



1832 UTC



1834 UTC



1844 UTC



1847 UTC



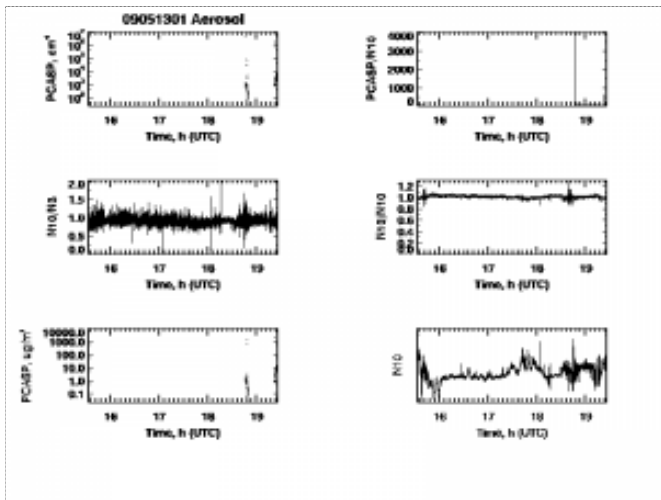
1859 UTC



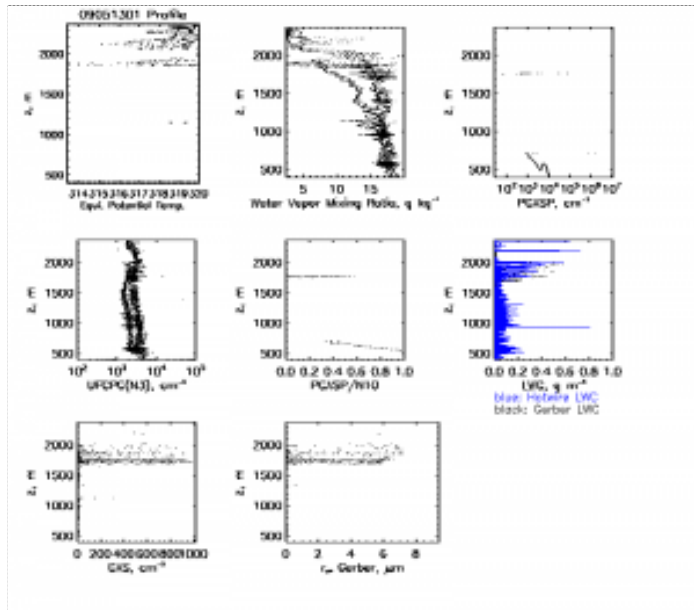
1902 UTC

# Flight Plots

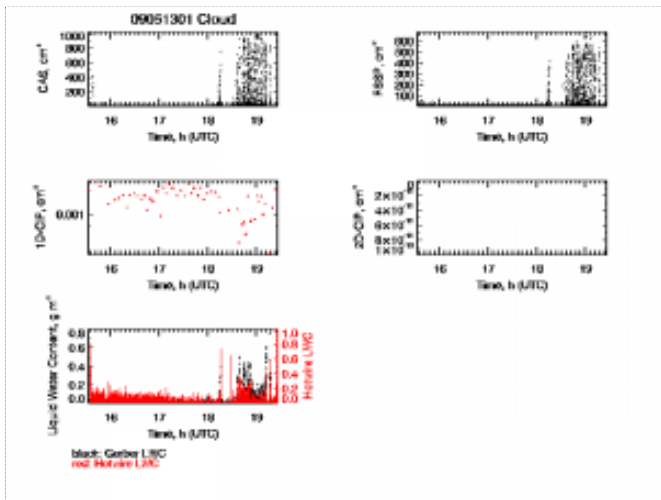
## Aerosol



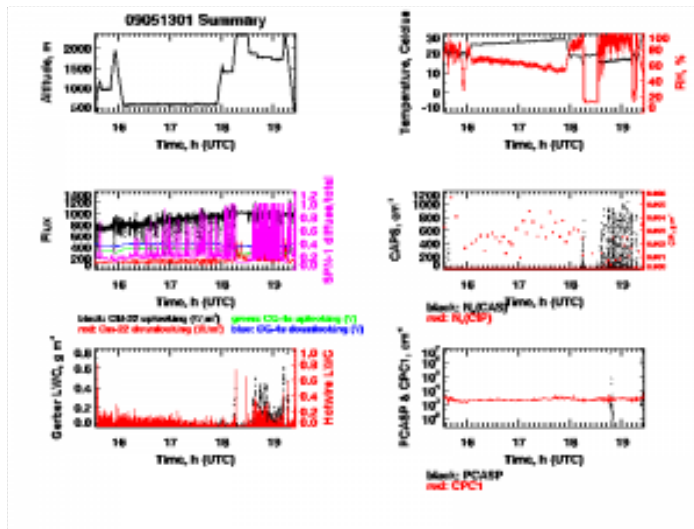
## Profile



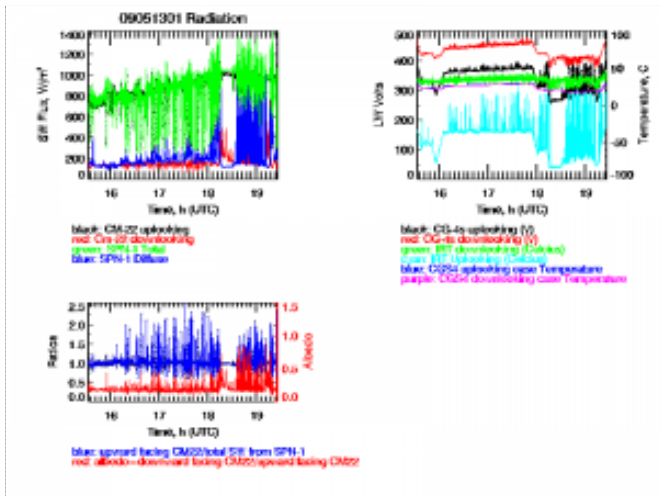
## Cloud



## Summary

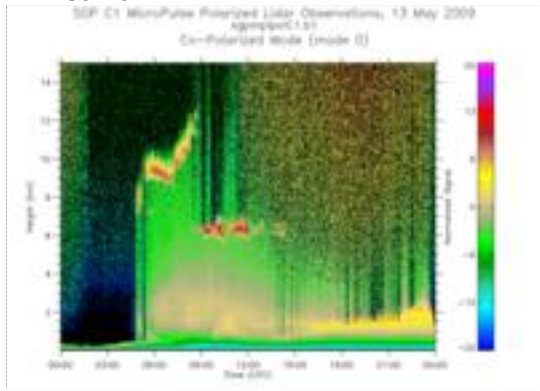


## Radiation

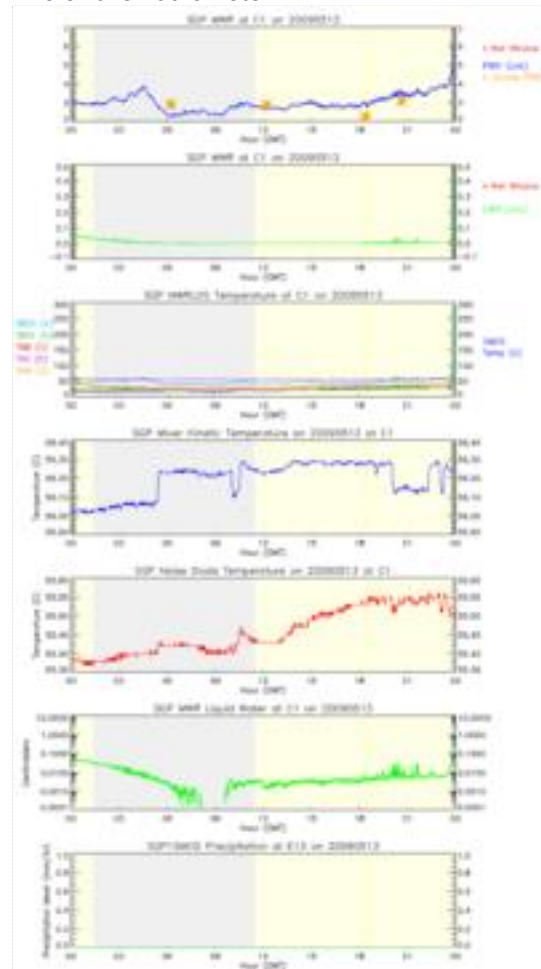


# SGP Plots

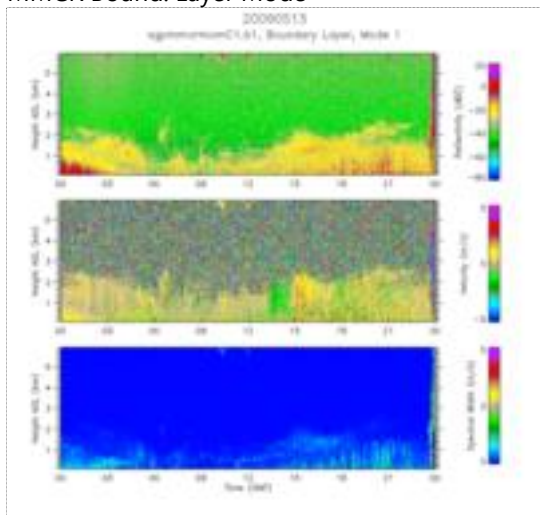
MPL Co-Pol



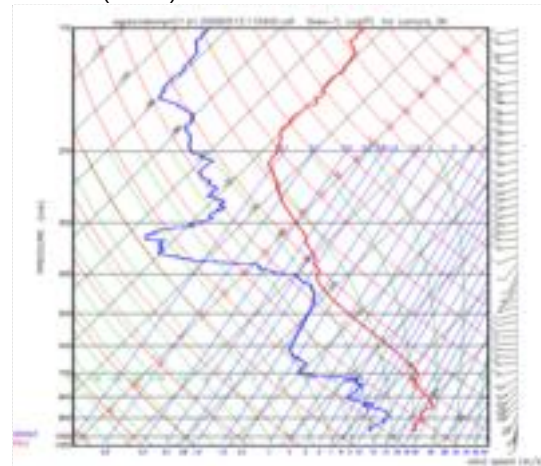
Microwave Radiometer



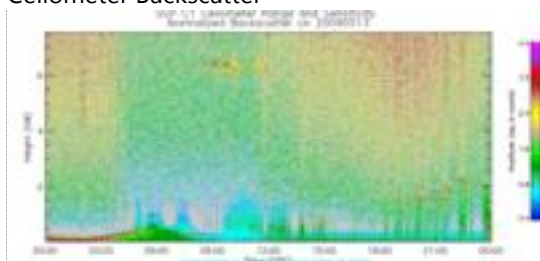
MMCR Bound. Layer Mode



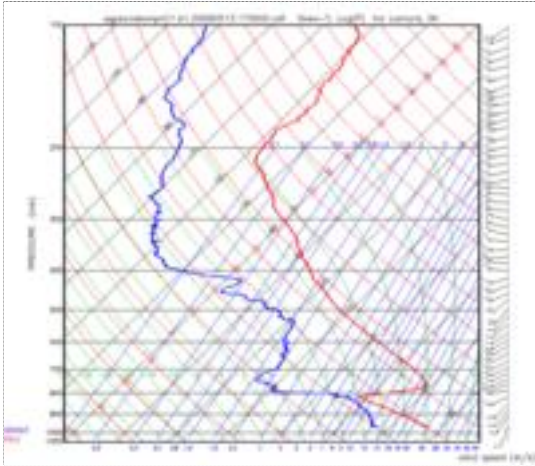
SONDE (11:30)



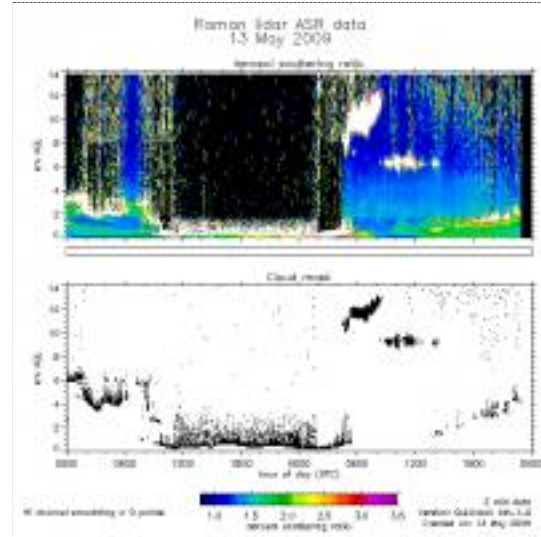
Ceilometer Backscatter



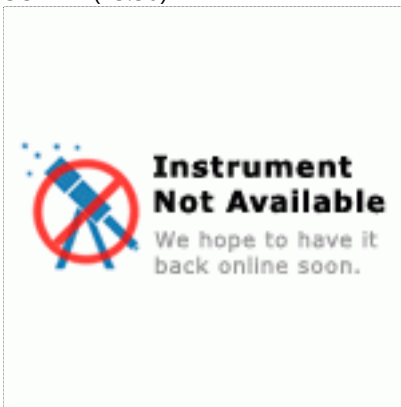
SONDE (17:30)



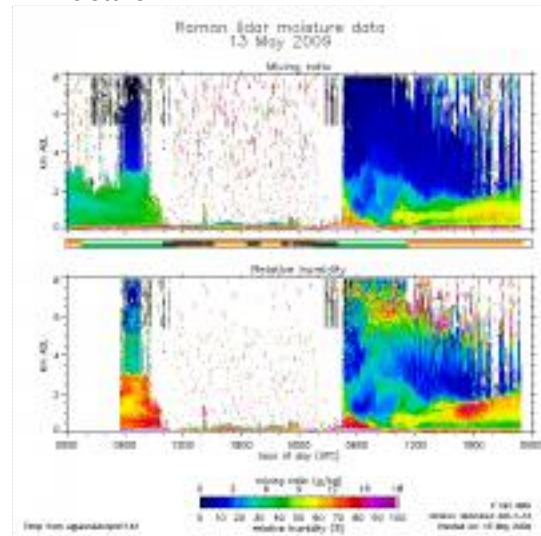
RL ASR



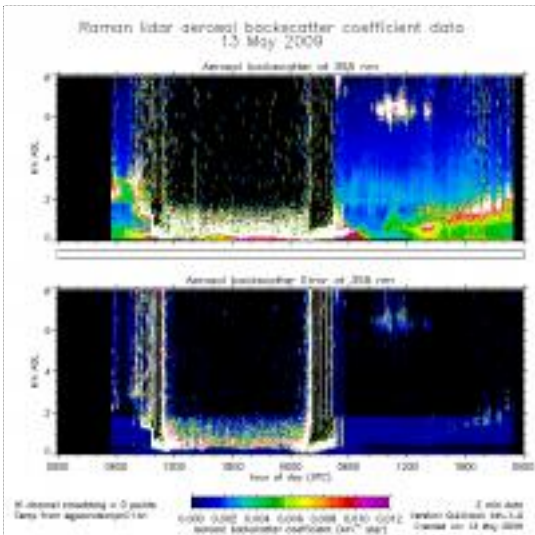
SONDE (23:30)



RL Moisture



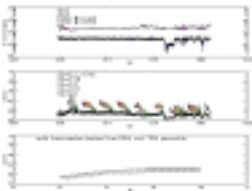
RL Backscatter



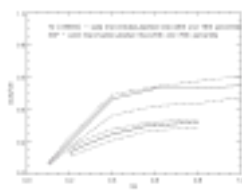


## CCN Activity

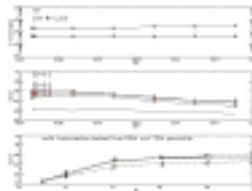
I've generated plots indicative of CCN activity from the Twin Otter CABIN and CCN files (i.e. CCN/CN as  $f(SS)$ ). I've also generated time series plots showing CN concentration and scattering at the ground (i.e. at SGP) and CCN fraction measured at the surface so one can compare with that measured aloft. Elisabeth Andrews - 20 May 2009



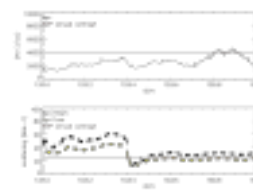
plot of CN and CCN and CCN/CN ratio as  $f(SS)$  from twin otter



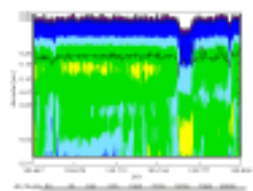
comparison of CCN fraction on twin otter and at SGP



plot of CN and CCN and CCN fraction at SGP



CN\_SCAT\_SGP2009\_05\_13



TAMU DMA size distribution and CCN activation diameter

## Weather Maps



map5132

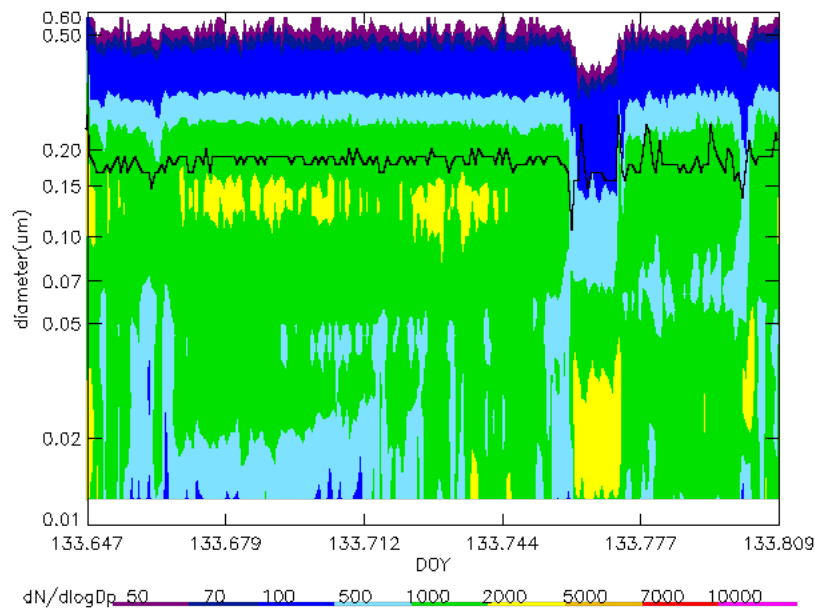


OK City: 1/8 cloud coverage; 8-12 knots | Tulsa: Clear; 8-12 knots; 1100 mb | 87 F/54 F

## Comments

I've made size distribution contour plots from the DMA operated by TAMU on the Twin Otter. These plots are overlaid with a line indicating the CCN activation diameter at 0.2% SS based on the CCN measurements on the Twin Otter. To do this, I cumulatively summed the DMA number concentration backwards from largest to smallest diameter bin. I identified the bin diameter where the cumulative summed concentration was closest to the measured CCN concentration and chose that as the CCN activation diameter.

-- Elisabeth Andrews - 17 Jun 2009



# 20090516

## Flight Summary

Depart	Return	Hours	Synopsis	Google Earth
17:00 UTC	22:19 UTC	5.3	Turbulence at SGP	<a href="#">KML</a>
Flight hours to date		126.6		

No storms. There was cirrus overhead the entire time. It was broken becoming scattered towards the end of the flight. Some contrails formed towards the end. There were no clouds below the cirrus.

We climbed out to 4500' and cruised to the CF at 4500. Boundary layer was ~3000' according to the temp/dewpoint. We had the last bit of turbulence associated with the BL at 3500'.

We did a spiral from 4500 to 1500'/500 agl over the CF at 1732 Z. Tops of the BL were around 3500'.

We began our turbulence legs at 2000'. Each leg was 30 nm long.

Leg # 1 2000' winds 025/19; 1741z Upwind

Leg # 2 2200' winds 015/20; 1805 z Downwind

Leg # 3 2400' winds 020/20; 1823Z UW

Leg # 4 2600' winds 020/20; 1845 DW

Leg # 5 2800' winds 020/20; 1903Z UW

Leg # 6 3000' winds 030/25; 1927Z DW

Leg # 7 3200' winds 035/22; 1945Z UW

Leg # 8 3400' winds 030/22; 2008Z DW

We only had time for 4 legs so we split the remaining legs between 3400 and 2000'. We descended 350' each leg.

Leg # 9 3050' winds 030/20; 2027Z UW

Leg # 10 2700' winds 035/14; 2050Z DW

Leg # 11 2350' winds 035/13; 2107Z UW

Leg # 12 2000' winds 030/18; 2131Z DW

We did a spiral from 1500 to 5500 over the CF at 2146Z. We RTB'd at 2153Z at 3000'.

## Weather Summary

Broken cirrus turning to scattered; clear skies below.

## Aircraft Instrumentation Status

Everything is back to normal

## Surface Instrumentation Status

nothing to report

## Flight Images



1708 UTC



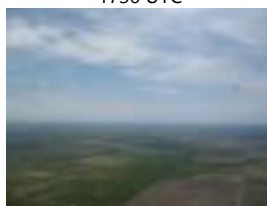
1736 UTC



2111 UTC



1720 UTC



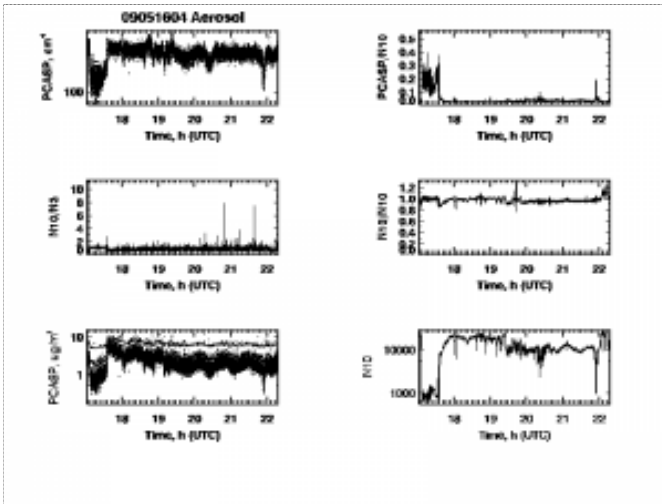
2005 UTC



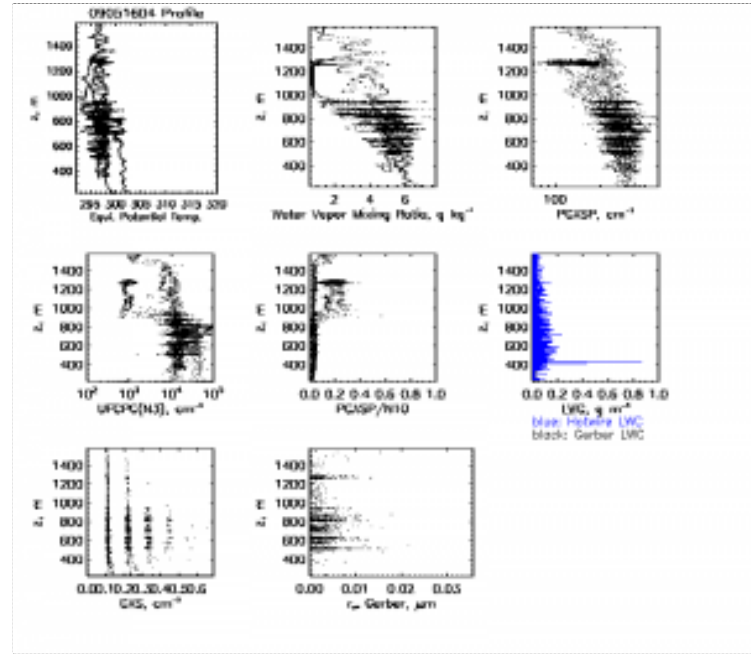
2153 UTC

# Flight Plots

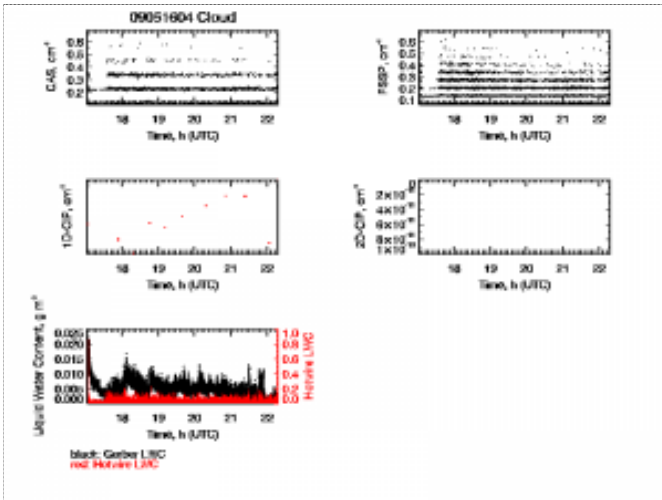
## Aerosol



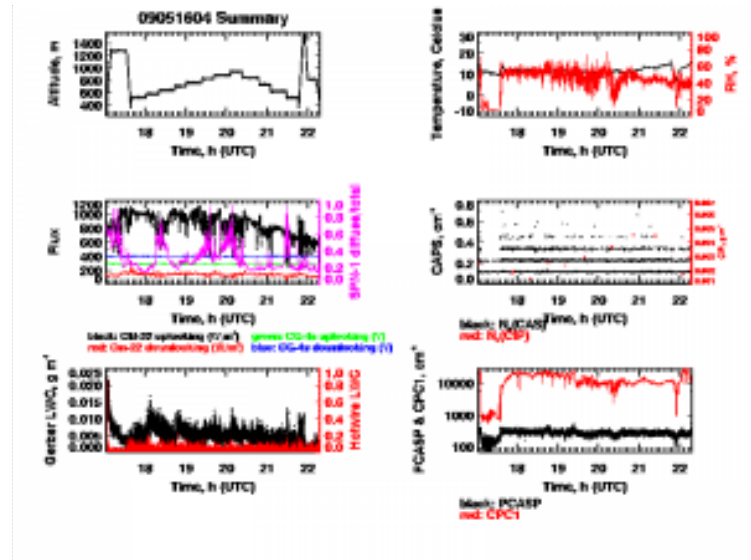
## Profile



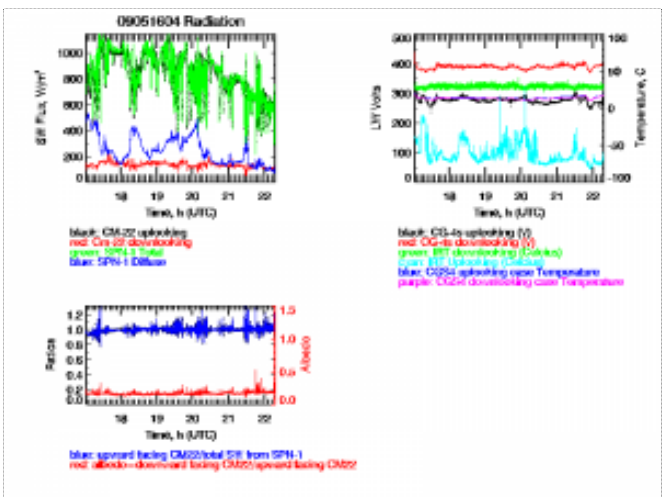
## Cloud



## Summary

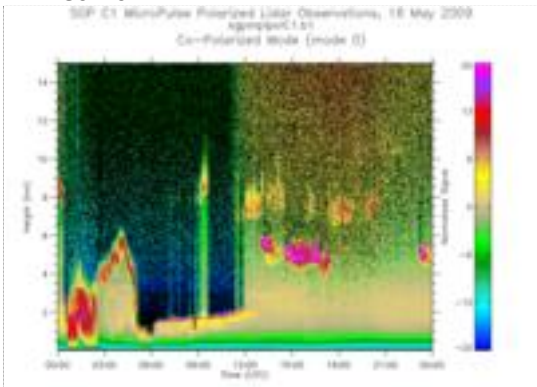


## Radiation

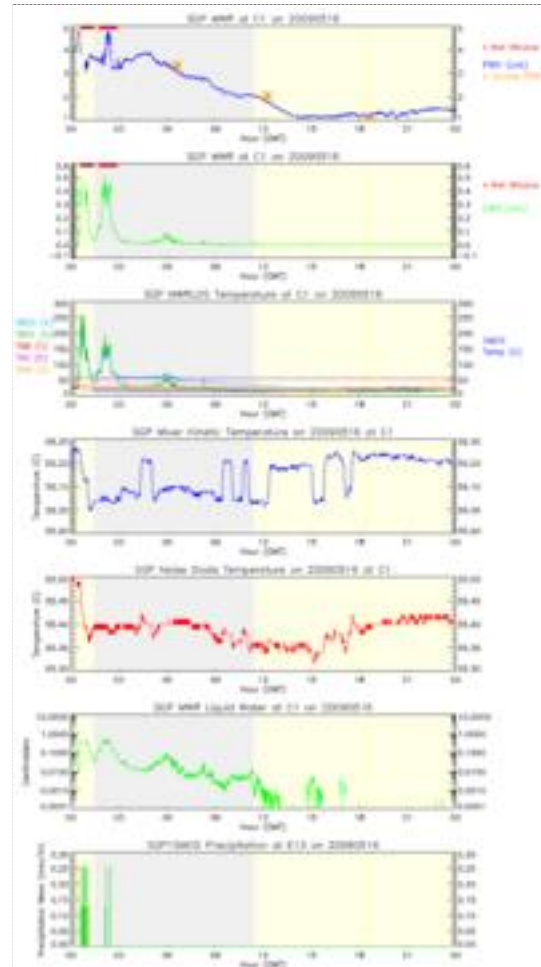


# SGP Plots

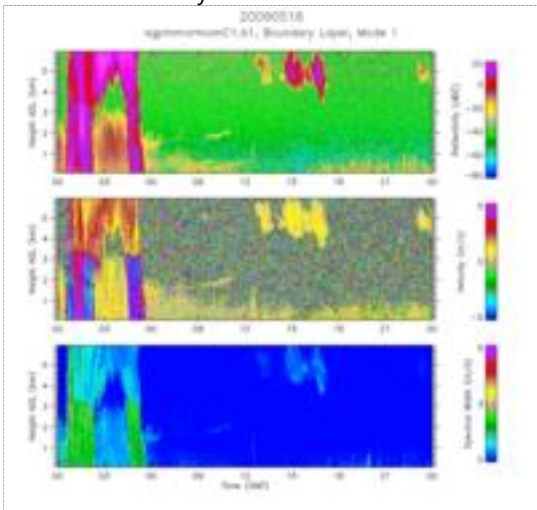
MPL Co-Pol



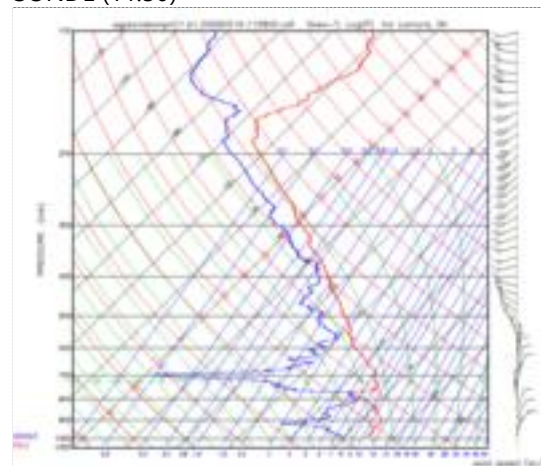
Microwave Radiometer



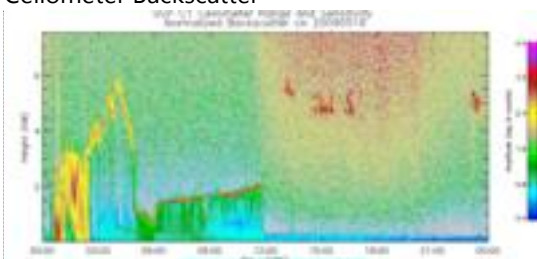
MMCR Bound. Layer Mode



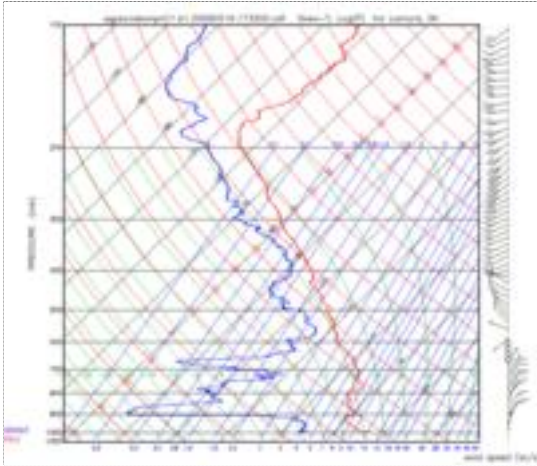
SONDE (11:30)



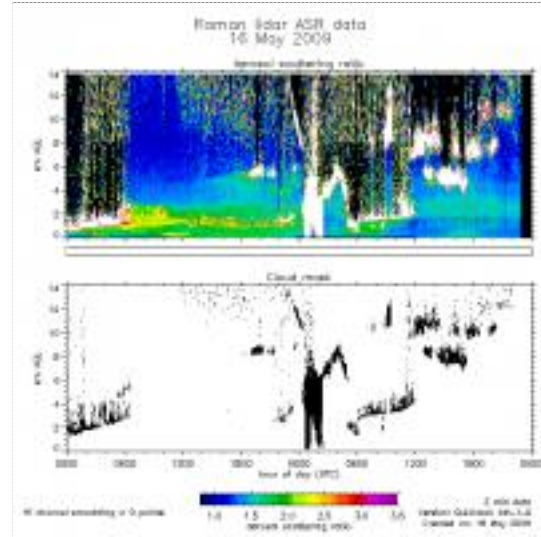
Ceilmeter Backscatter



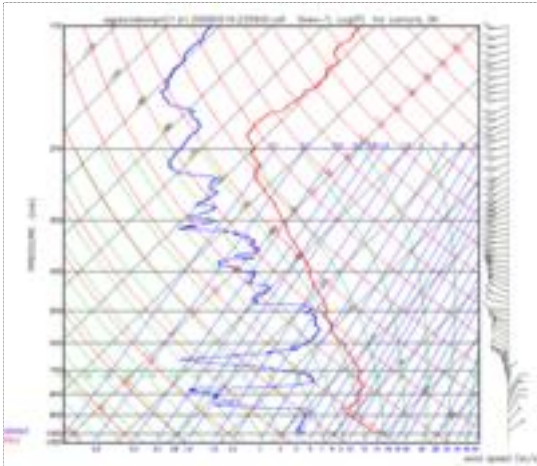
SONDE (17:30)



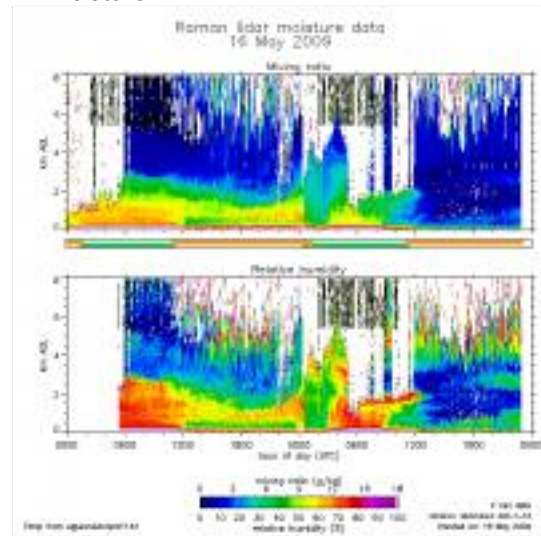
RL ASR



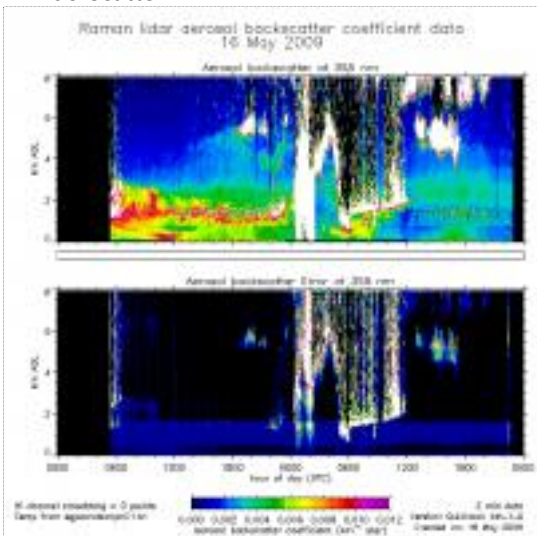
SONDE (23:30)



RL Moisture

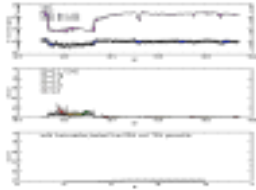


RL Backscatter

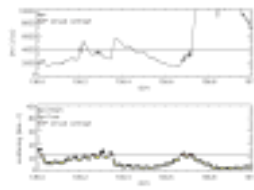


## CCN Activity

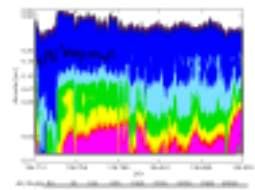
I've generated plots indicative of CCN activity from the Twin Otter CABIN and CCN files (i.e. CCN/CN as  $f(SS)$ ). I've also generated time series plots showing CN concentration and scattering at the ground (i.e. at SGP). For this flight the CCN instrument at the surface was doing different scans so I have not made the plot of CCN fraction measured at the surface or the comparison between surface and airborne CCN activity. Elisabeth Andrews - 20 May 2009



plot of CN and CCN and CCN/CN ratio as  $f(SS)$  from twin otter



time series of CN and light scattering at SGP



TAMU DMA size distribution and CCN activation diameter

## Weather Maps



map5162

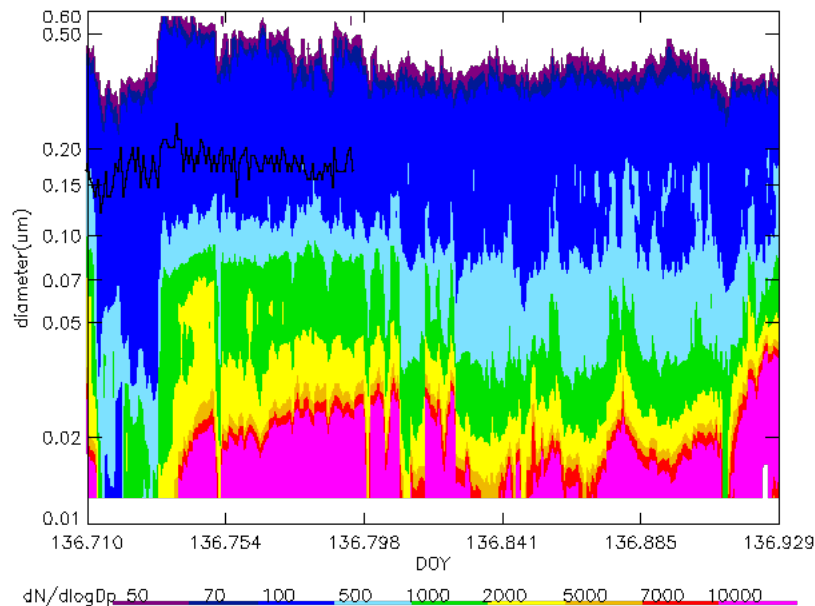


OK City: Broken; 8-12 knots | Tulsa: Clear; 18-22 knots; 1076 knots | 79 F/67 F | Post-cold front

## Comments

I've made size distribution contour plots from the DMA operated by TAMU on the Twin Otter. These plots are overlaid with a line indicating the CCN activation diameter at 0.2% SS based on the CCN measurements on the Twin Otter. To do this, I cumulatively summed the DMA number concentration backwards from largest to smallest diameter bin. I identified the bin diameter where the cumulative summed concentration was closest to the measured CCN concentration and chose that as the CCN activation diameter.

-- Elisabeth Andrews - 17 Jun 2009



# 20090517

## Flight Summary

Depart	Return	Hours	Synopsis	Google Earth
16:10 UTC	21:05 UTC	4.9	Radiometer tilt characterization away from SGP	<a href="#">KML</a>
Flight hours to date		131.5		

We departed out of Guthrie and initially climbed to 7500 and flew 125 miles SE to the OK/TX border where we began the patterns at 12,500.

We were as close to zero pitch as we could be. There were fluctuations of about a degree either side of zero pitch. Legs were 5 nm long.

The first square patter began at 1710Z. There was no cirrus or contrails. There was a small patch of lower clouds on the very distant horizon to the S-SE. There was a haze layer at or near 12,500

Leg #1 130 degrees.

Leg #2 220 deg.

Leg #3 310 deg.

Leg #4 040 deg.

45 degree leg 175 deg. We pitched up 2, 5, and 7 degrees for 15 seconds each. We pitched down 2, 5 and 7 degrees for 15 seconds each.

We did the circle patterns. We kept flaps in. Our pitch was anywhere from zero to +4 degrees. It was the best we could do.

2 degrees to the left. 1731Z

2 degrees to the right. 1739

5 degrees to the left. 1747

5 degrees to the right. 1754

7 degrees to the left. 1801

7 degrees to the right. 1808.

Square #2. Flaps added for zero pitch. No cirrus or contrails. Lower patch of clouds to the distant SSE had dissipated. 1818Z

Leg #1 164 deg.

Leg #2 254 deg.

Leg #3 344 deg.

Leg #4 074 deg.

45 deg. Leg 209 deg. We pitched up 2, 5, and 7 degrees for 15 seconds each. We pitched down 2, 5 and 7 degrees for 15 seconds each.

We did the circle patterns. We kept the flaps up this time to try and minimize the pitch changes and flew at 110 KIAS. Our pitch was the same...anywhere from zero to +4 degrees.

2 degrees to the left. 1838z

2 degrees to the right. 1846

5 degrees to the left. 1854

5 degrees to the right. 1901

7 degrees to the left. 1908

7 degrees to the right. 1917

Square #3. Zero pitch. No cirrus or contrails. No lower clouds. 1930Z.

Leg #1 235 deg.

Leg #2 325 deg.

Leg #3 055 deg.

Leg #4 145 deg.

45 deg. Leg 280 deg. We pitched up 2, 5, and 7 degrees for 15 seconds each. We pitched down 2, 5 and 7 degrees for 15 seconds each.

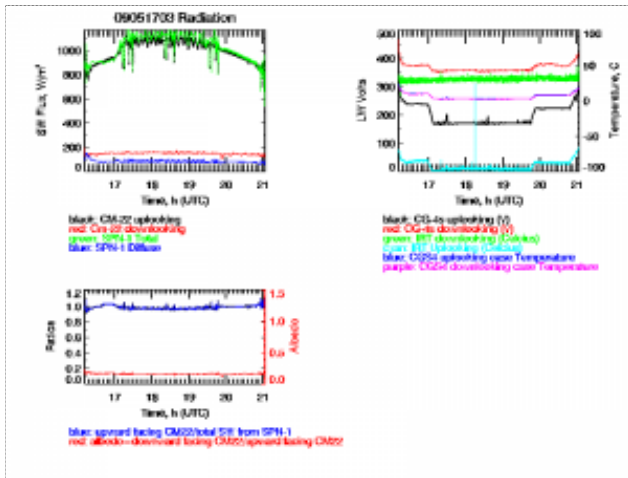
We RTB's at this point and came back at 8,500.

No issues with the plane.

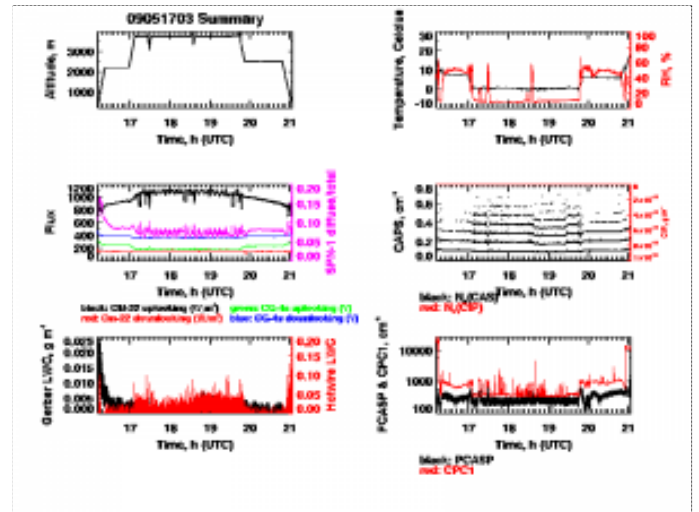




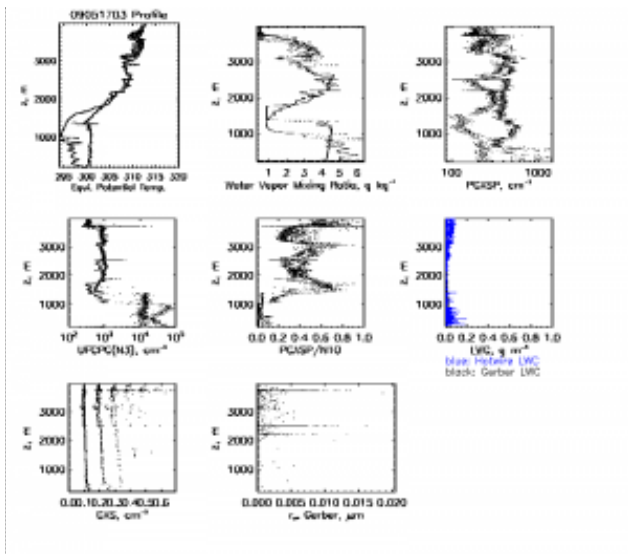
## Radiation



## Summary

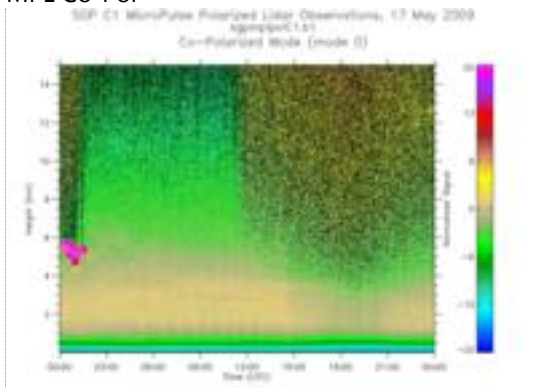


## Profile

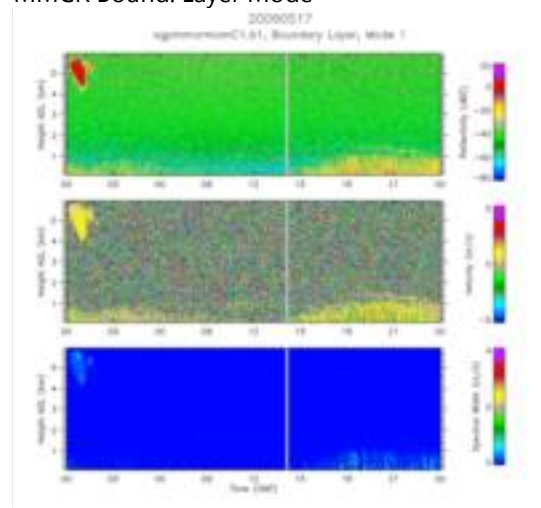


## SGP Plots

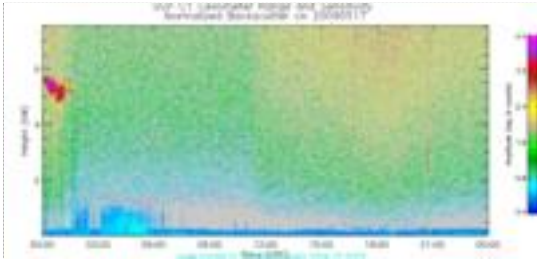
### MPL Co-Pol



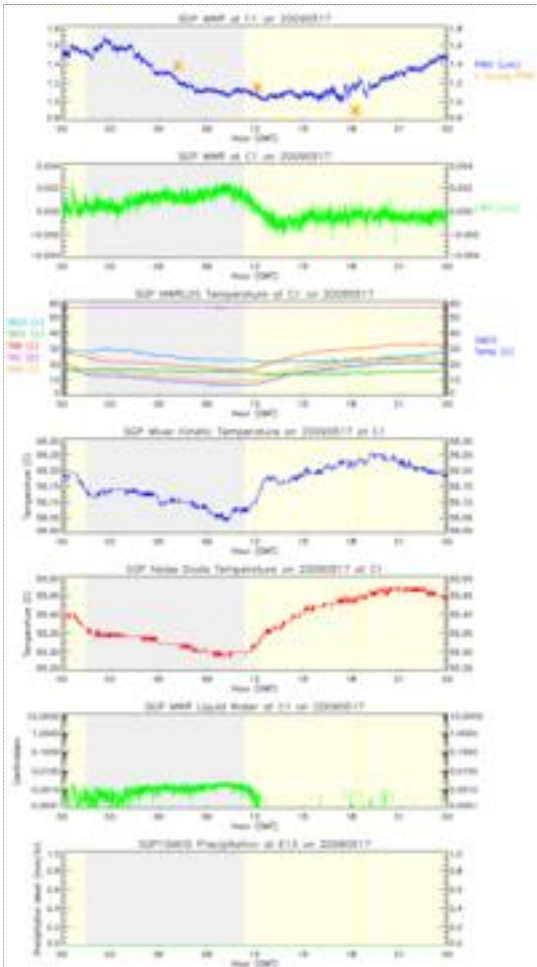
### MMCR Bound. Layer Mode



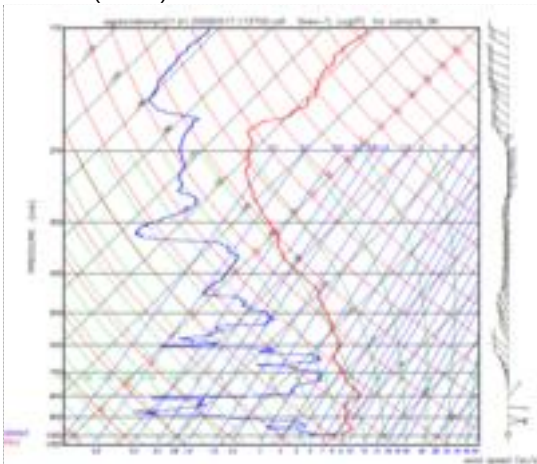
Ceilometer Backscatter



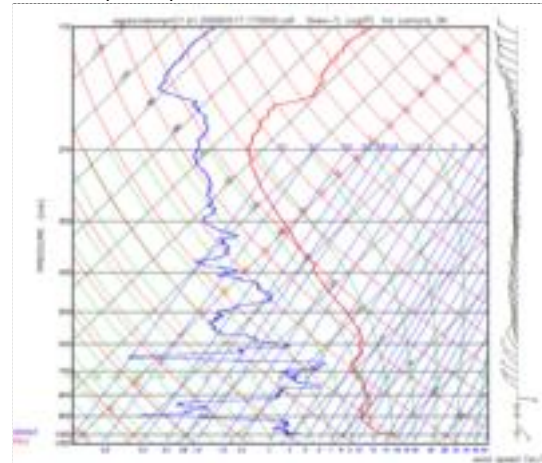
Microwave Radiometer



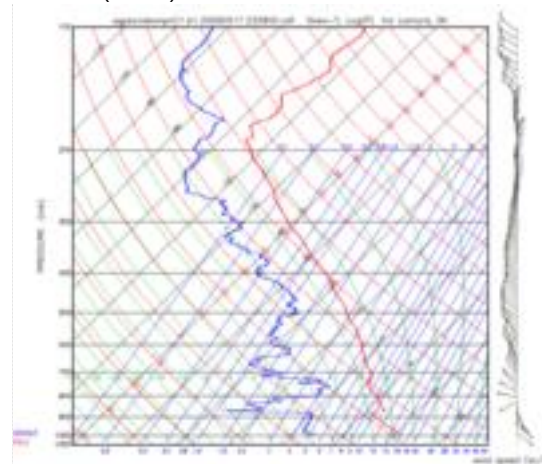
SONDE (11:30)



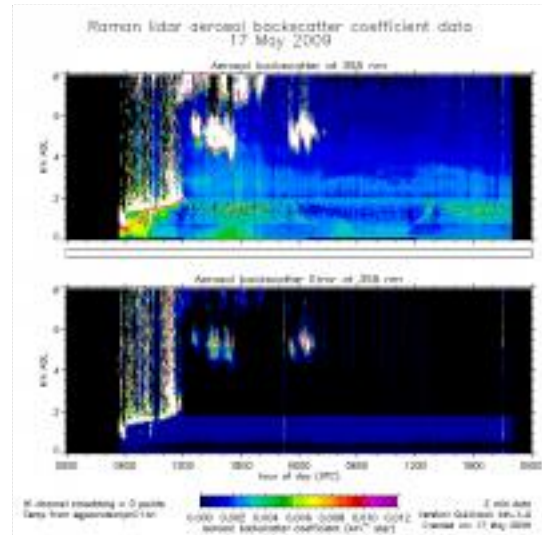
SONDE (17:30)



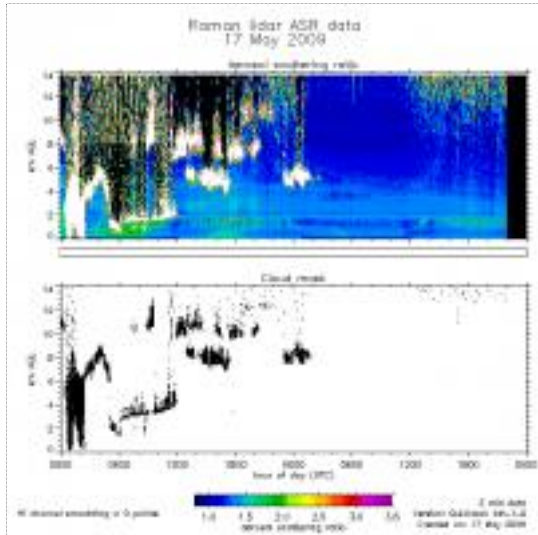
SONDE (23:30)



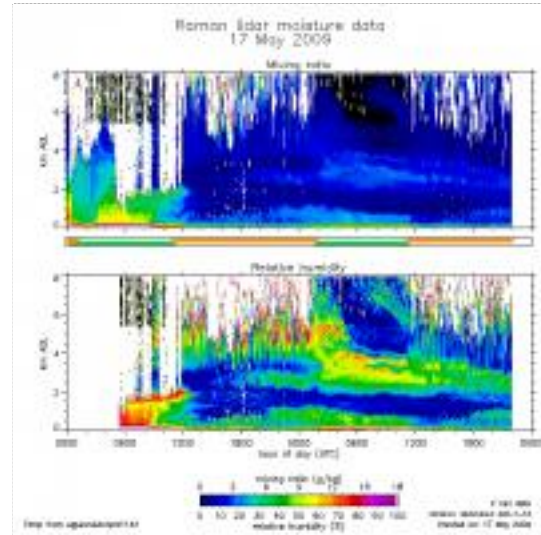
RL Backscatter



## RL ASR



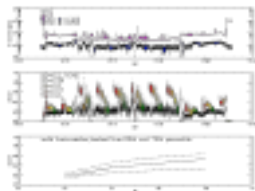
## RL Moisture



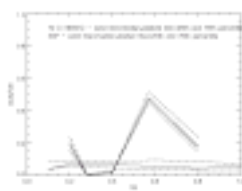
## CCN Activity

I've made size distribution contour plots from the DMA operated by TAMU on the Twin Otter. These plots are overlaid with a line indicating the CCN activation diameter at 0.2% SS based on the CCN measurements on the Twin Otter. To do this, I cumulatively summed the DMA number concentration backwards from largest to smallest diameter bin. I identified the bin diameter where the cumulative summed concentration was closest to the measured CCN concentration and chose that as the CCN activation diameter. Elisabeth Andrews - 17 Jun 2009

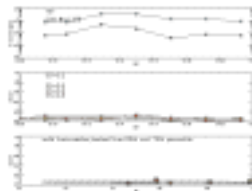
I've generated plots indicative of CCN activity from the Twin Otter CABIN and CCN files (i.e. CCN/CN as f(SS)). I've also generated time series plots showing CN concentration and scattering at the ground (i.e. at SGP) and CCN fraction measured at the surface so one can compare with that measured aloft. Elisabeth Andrews - 17 Jun 2009



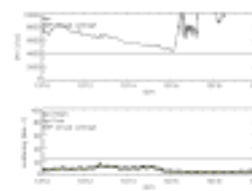
plot of CN and CCN and CCN/CN ratio as f(SS) from twin otter



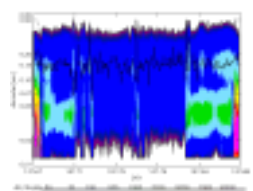
comparison of CCN fraction on twin otter and at SGP



plot of CN and CCN and CCN fraction at SGP



time series of CN and light scattering at SGP



TAMU DMA size distribution and CCN activation diameter

## Weather Maps



map5172



OK City: Broken; 13-17 knots | Tulsa: Clear; 13-17 knots; 1233 mb | 67 F/39 F

# 20090518

## Flight Summary

Depart	Return	Hours	Synopsis	Google Earth
12:27 UTC	17:36 UTC	5.2	Surface albedo & Turbulence at SGP	<a href="#">KML</a>
Flight hours to date		136.6		

We departed Guthrie and climbed to 4500' enroute to the CF. The BL was ~3900'.

Over the CF we did a spiral from 4500' to 1500'/500' agl.

We did the pinwheel pattern at 1600'. Times 1305-1401.

We did the paperclip pattern at 1600'. Times were 1405-1447.

We did the turbulence legs starting at 2000'.

Leg #1 2000' winds 195/17 Downwind

Leg #2 2400' winds 205/17 Upwind

Leg #3 2800' winds 210/25 DW

Leg #4 3200' winds 210/24 UW

Leg #5 3600' winds 205/19 DW

Leg #6 4000' winds 210/24 UW

Back over the CF we climbed to 5300' and did a spiral down to 1500'/500 agl. 1658Z. BL was ~ 4600'.

We RTB'd to Guthrie at 3500'.

## Weather Summary

High cirrus.

## Aircraft Instrumentation Status

No CIP (it was turned on but the record button was not pushed)

## Surface Instrumentation Status

nothing to report

## Flight Images



1259 UTC



1306 UTC



1317 UTC



1329 UTC



1442 UTC



1259 UTC



1309 UTC



1319 UTC



1355 UTC



1715 UTC



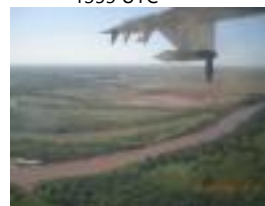
1306 UTC



1316 UTC



1320 UTC



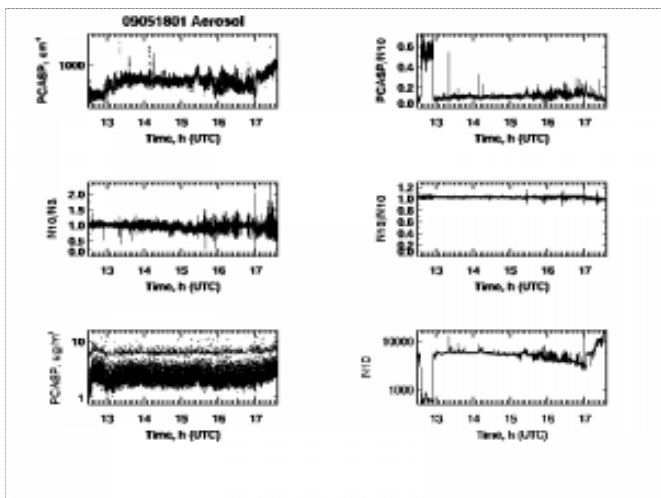
1433 UTC



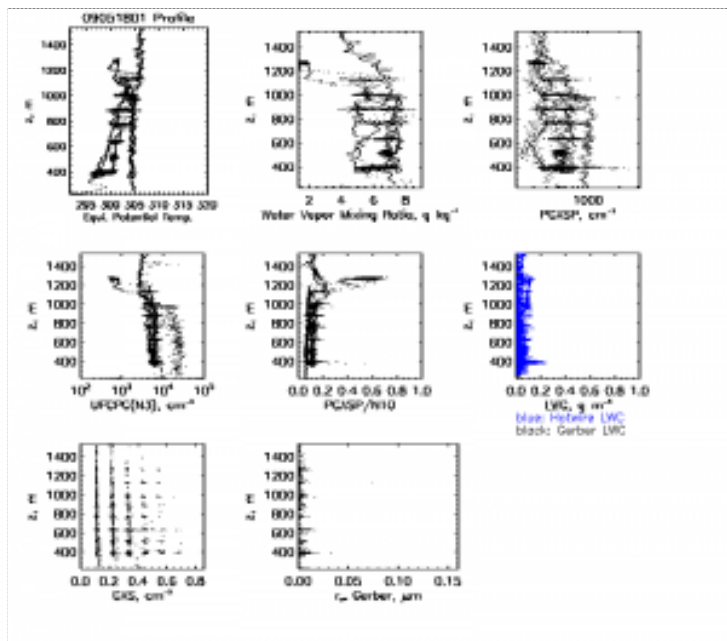
1716 UTC

# Flight Plots

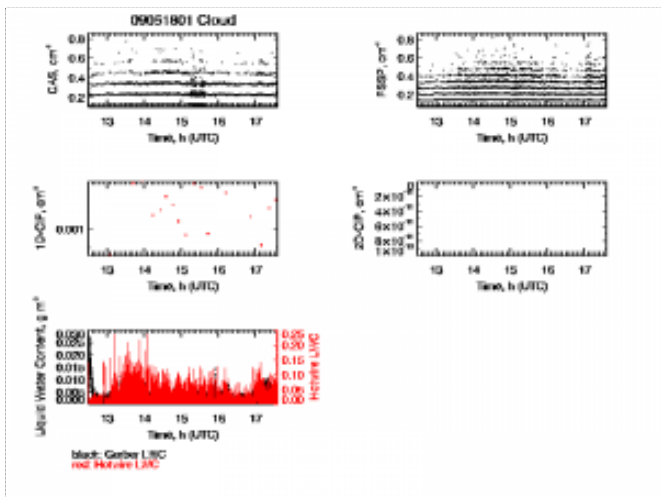
## Aerosol



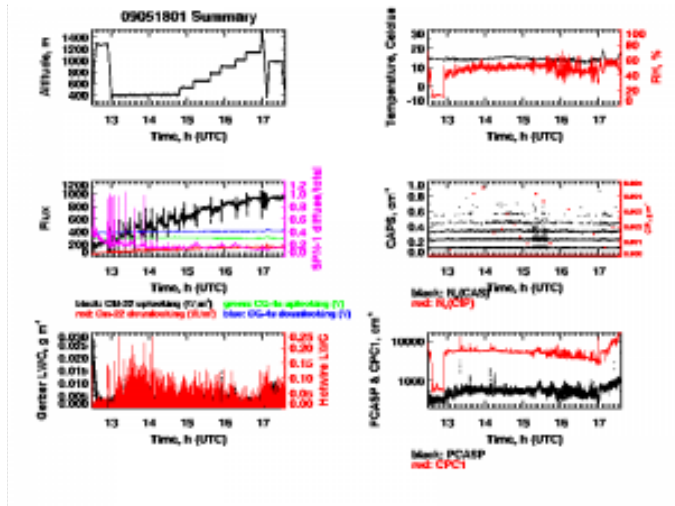
## Profile



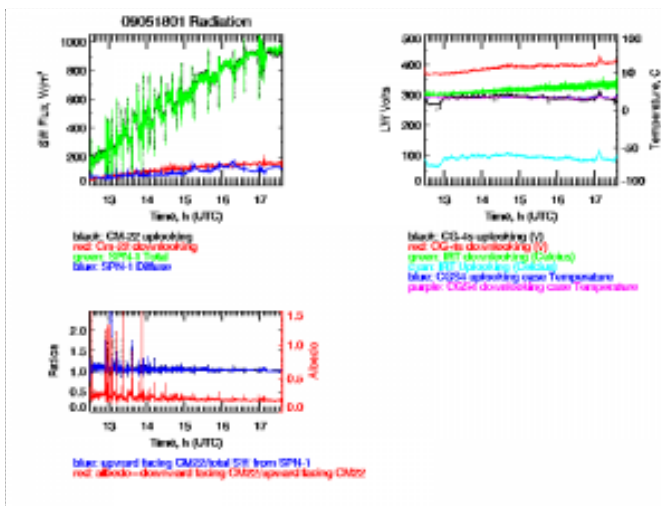
## Cloud



## Summary

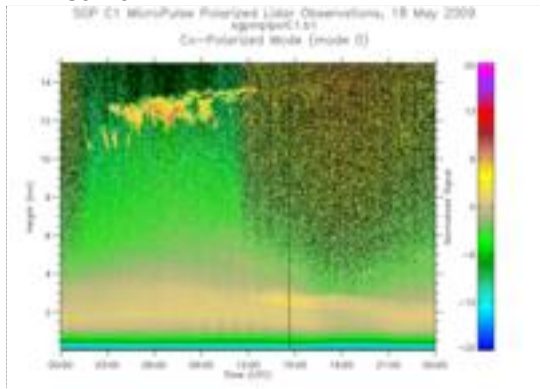


## Radiation

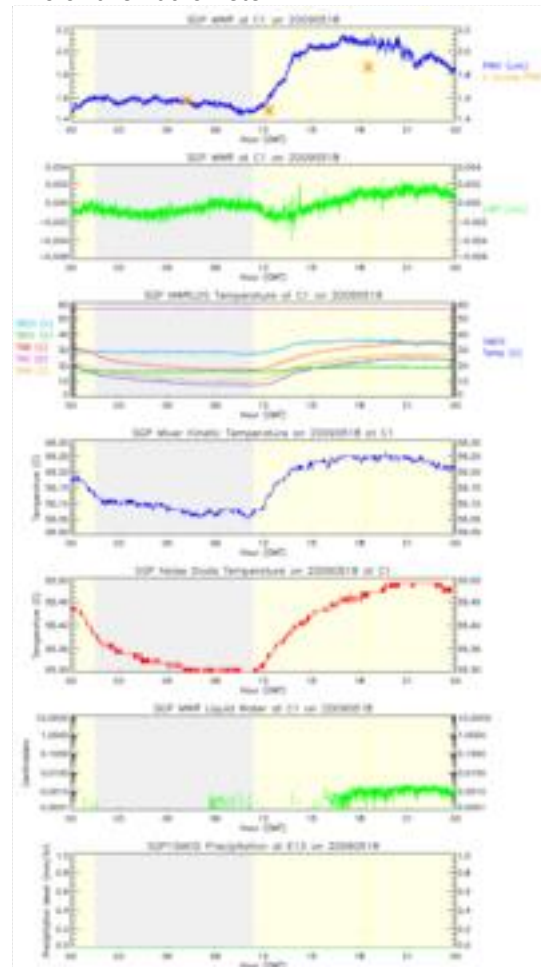


# SGP Plots

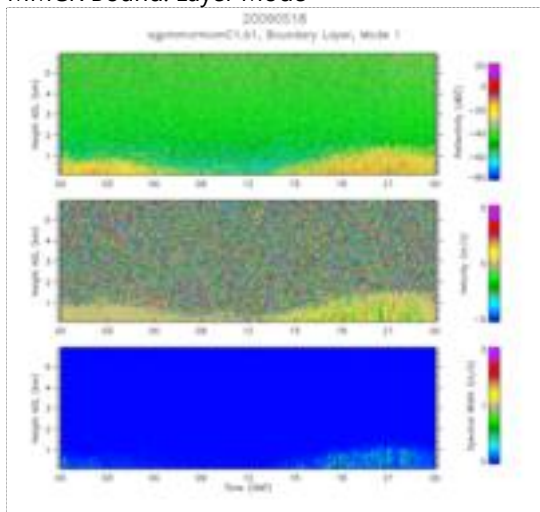
MPL Co-Pol



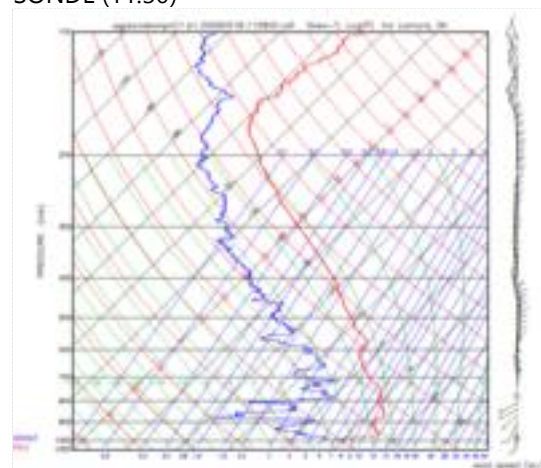
Microwave Radiometer



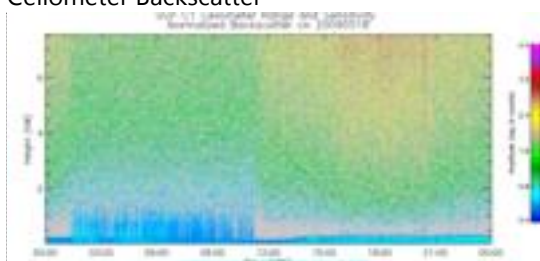
MMCR Bound. Layer Mode



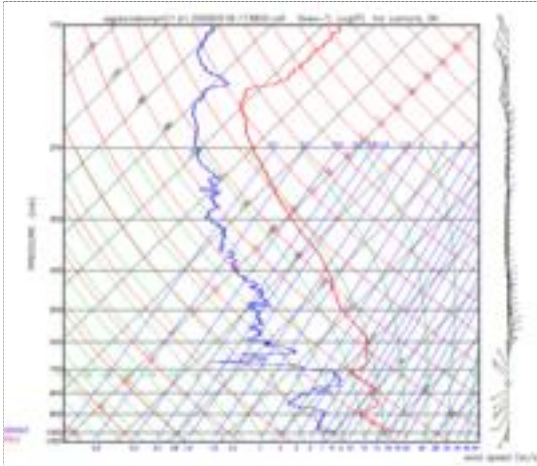
SONDE (11:30)



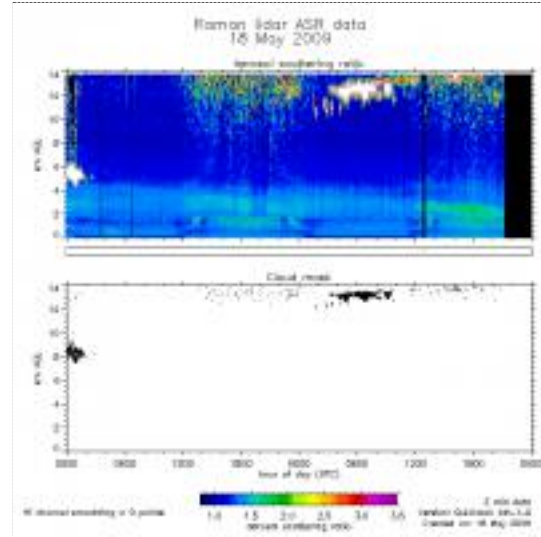
Ceilometer Backscatter



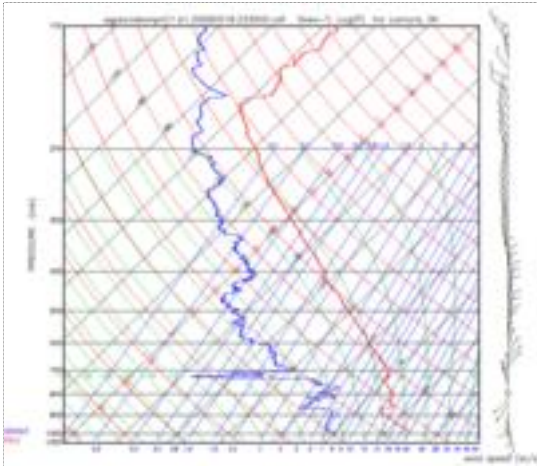
SONDE (17:30)



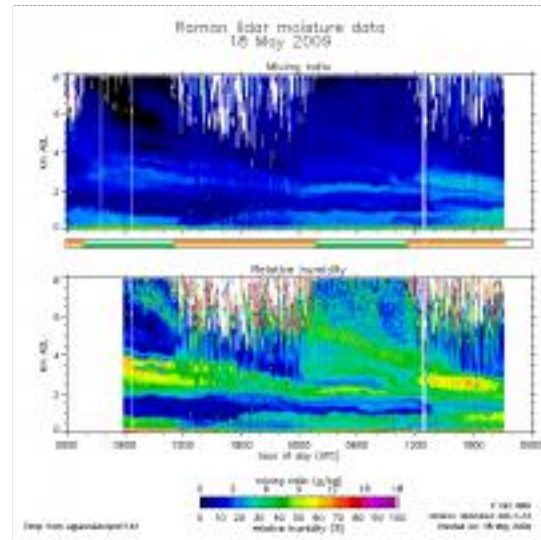
RL ASR



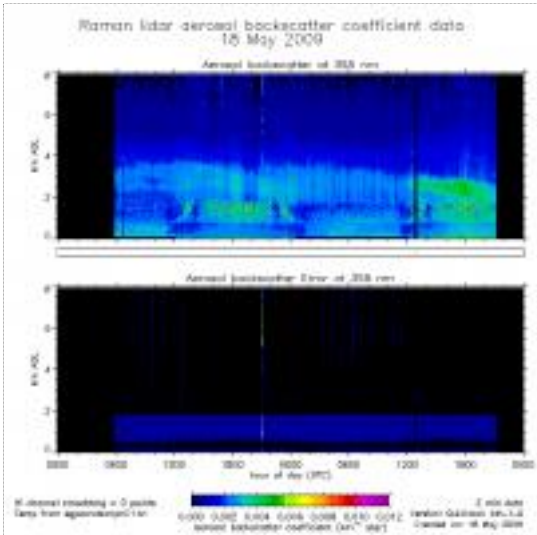
SONDE (23:30)



RL Moisture



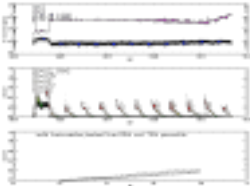
RL Backscatter



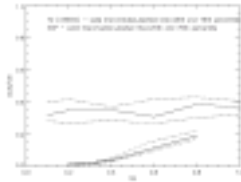
## CCN Activity

I've generated plots indicative of CCN activity from the Twin Otter CABIN and CCN files (i.e. CCN/CN as  $f(SS)$ ). I've also generated time series plots showing CN concentration and scattering at the ground (i.e. at SGP) and CCN fraction measured at the surface so one can compare with that measured aloft. Elisabeth Andrews - 17 Jun 2009

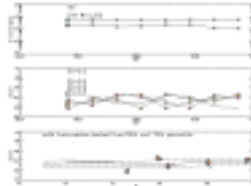
I've made size distribution contour plots from the DMA operated by TAMU on the Twin Otter. These plots are overlaid with a line indicating the CCN activation diameter at 0.2% SS based on the CCN measurements on the Twin Otter. To do this, I cumulatively summed the DMA number concentration backwards from largest to smallest diameter bin. I identified the bin diameter where the cumulative summed concentration was closest to the measured CCN concentration and chose that as the CCN activation diameter. Elisabeth Andrews - 17 Jun 2009



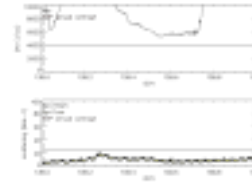
plot of CN and CCN and CCN/CN ratio as  $f(SS)$  from twin otter



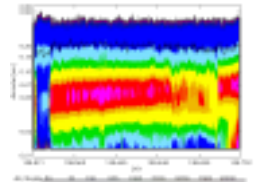
comparison of CCN fraction on twin otter and at SGP



plot of CN and CCN and CCN fraction at SGP



time series of CN and light scattering at SGP



TAMU DMA size distribution and CCN activation diameter

## Weather Maps



map5182



OK City: 1/8 cloud coverage; 3-7 knots | Tulsa: Clear; 3-7 knots; 1230 mb | 70 F/41 F



# 20090519

## Flight Summary

Depart	Return	Hours	Synopsis	Google Earth
12:32 UTC	17:33 UTC	5.0	Radiometer tilt characterization away from SGP	<a href="#">KML</a>
Flight hours to date		141.6		

We ended up about 90 miles South of Guthrie, near Ardmore.

Altitude was 12,500'. Square legs were 5 nm, zero to one degree pitch.

Square #1. 1324Z

Leg #1 079

Leg #2 169

Leg #3 259

Leg #4 349

45 degree 124

There was a patch of cirrus sitting on the NNE horizon. It was present the whole flight. There were 2 very short lived contrails distant east. Nothing between us and the sun.

We pitched up and down +/- 2, 5, 7 degrees. We lost 1500 feet. We did left and right 360 degree turns at ~7 degrees of bank, 1346 & 1354Z.

Square #2. 1403Z

Leg #1 085

Leg #2 175

Leg #3 265

Leg #4 355

45 degree 130

There was 1 very short lived contrail distant east. Nothing between us and the sun.

We pitched up and down +/- 2, 5, 7 degrees. We lost 1100 feet. We did left and right 360 degree turns at ~7 degrees of bank, 1423 & 1430Z.

Square #3. 1439Z

Leg #1 092

Leg #2 182

Leg #3 272

Leg #4 002

45 degree 137

There were 2 very short lived contrail distant east. Nothing between us and the sun.

We pitched up and down +/- 2, 5, 7 degrees. We lost 1100 feet. We did left and right 360 degree turns at ~7 degrees of bank, 1458 & 1505Z

Square #4. 1515Z

Leg #1 096

Leg #2 186

Leg #3 276

Leg #4 006

45 degree 141

There was a long lived contrail to the NW. Nothing between us and the sun.

We pitched up and down +/- 2, 5, 7 degrees. We lost 1000 feet. We did left and right 360 degree turns at ~7 degrees of bank, 1453 & 1539Z

Square #5. 1546Z

Leg #1 100

Leg #2 190

Leg #3 280

Leg #4 010

45 degree 145

No contrails that we saw. Nothing between us and the sun.

We pitched up and down +/- 2, 5, 7 degrees. We lost 1000 feet. We did left and right 360 degree turns at ~7 degrees of bank, 1607 & 1613Z.

Square #6. 1626Z

Leg #1 108

Leg #2 198

Leg #3 288

Leg #4 018

45 degree 153

Nothing between us and the sun.

We pitched up and down +/- 2, 5, 7 degrees. We lost 1000 feet. We ran out of time to do the 360 degree turns.

We RTB's at 1644Z at 10,500'.

No issues with the plane.

## Weather Summary

Clear skies.

## Aircraft Instrumentation Status

Jesse said everything ran fine

## Surface Instrumentation Status

nothing to report

## Flight Images



1244 UTC



1328 UTC



1440 UTC



1704 UTC



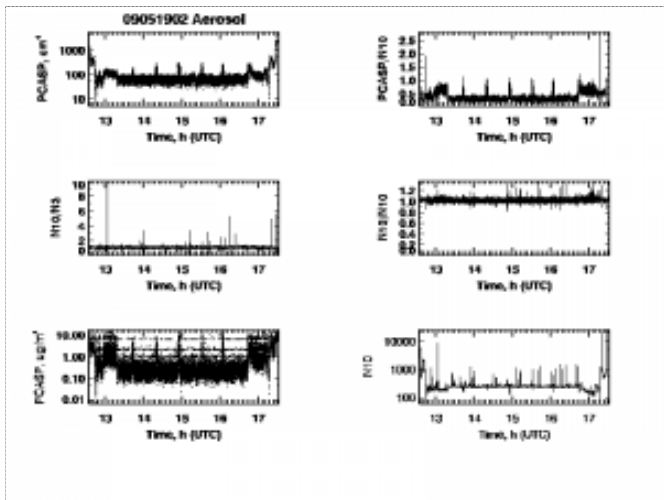
1705 UTC



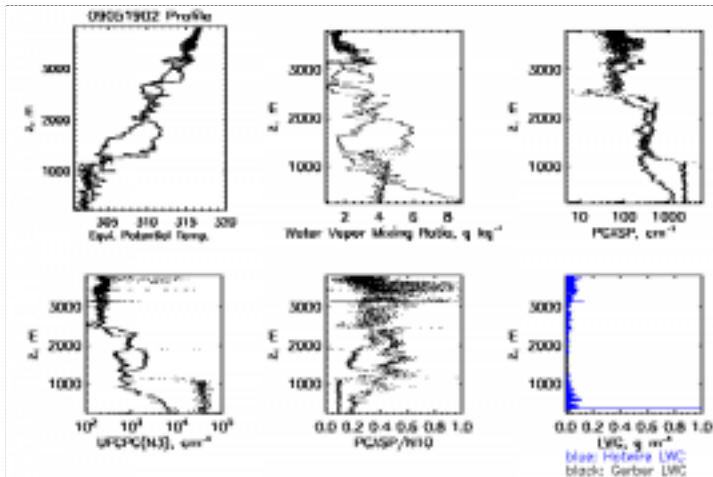
1605 UTC

# Flight Plots

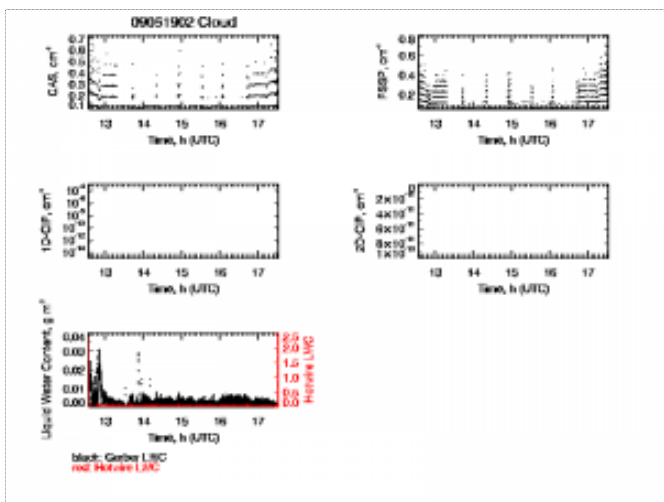
## Aerosol



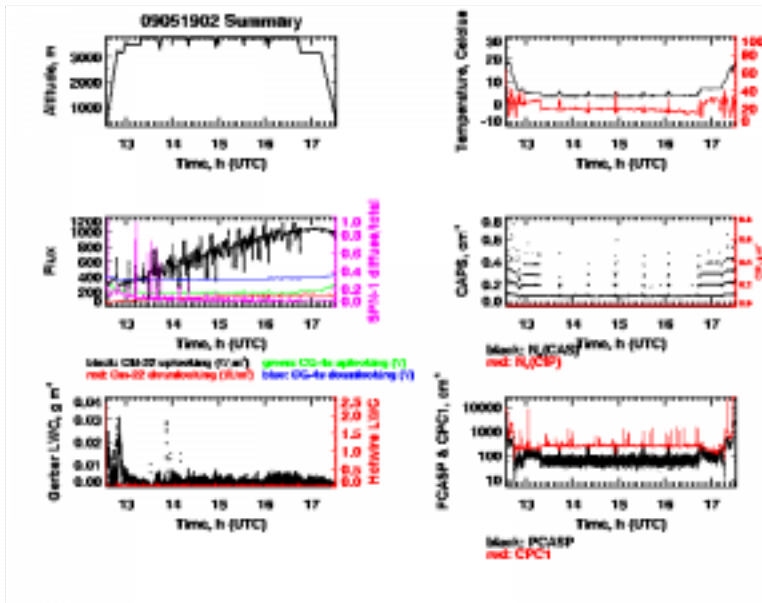
## Profile



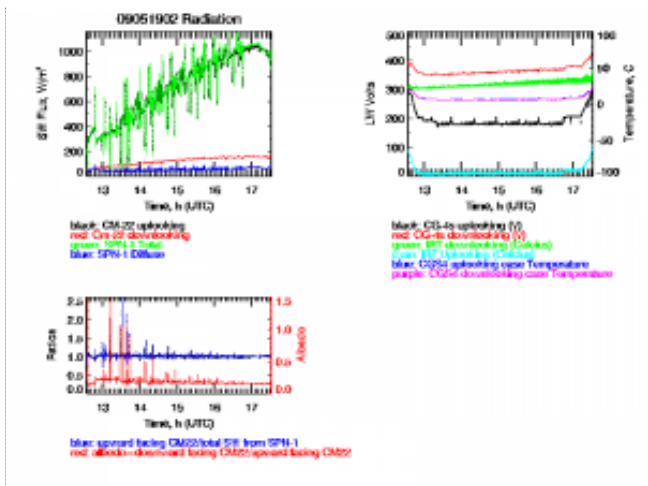
## Cloud



## Summary

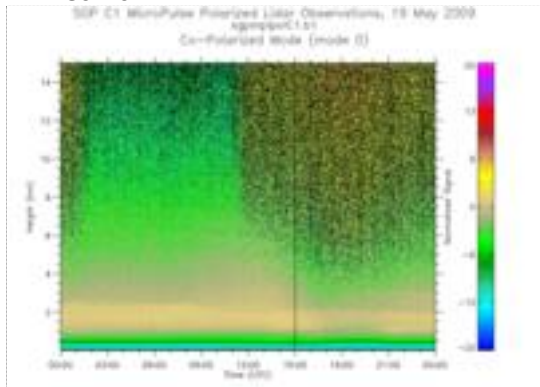


## Radiation

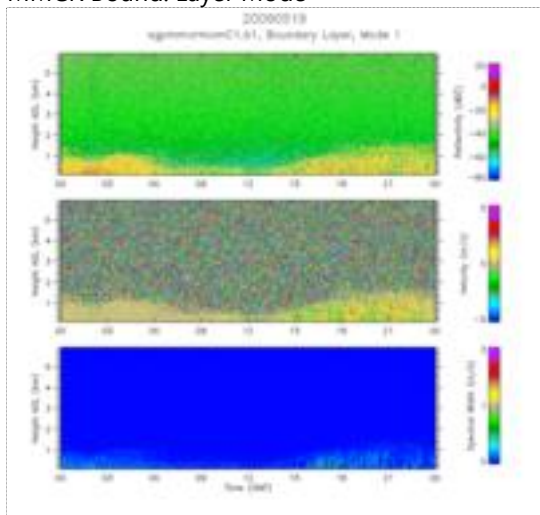


# SGP Plots

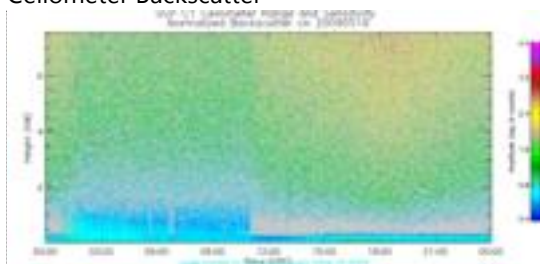
MPL Co-Pol



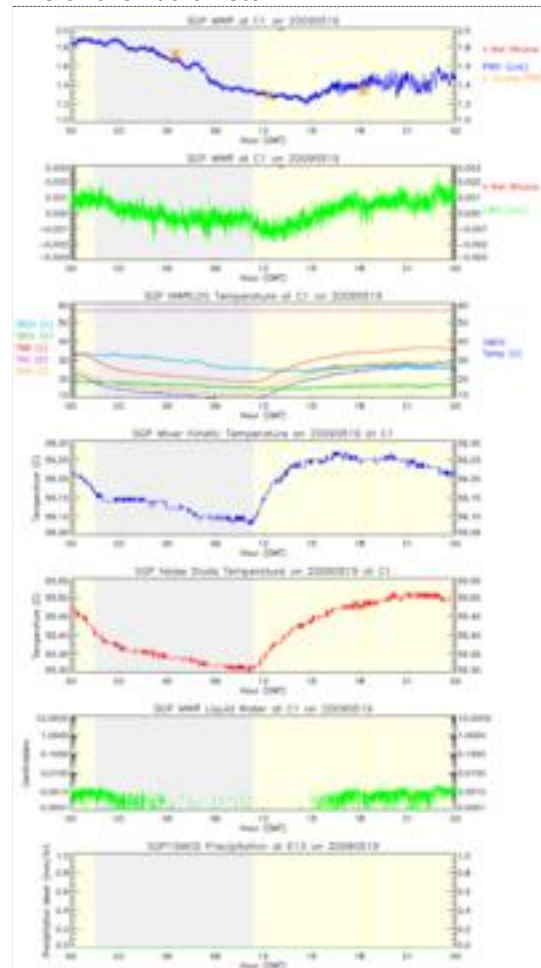
MMCR Bound. Layer Mode



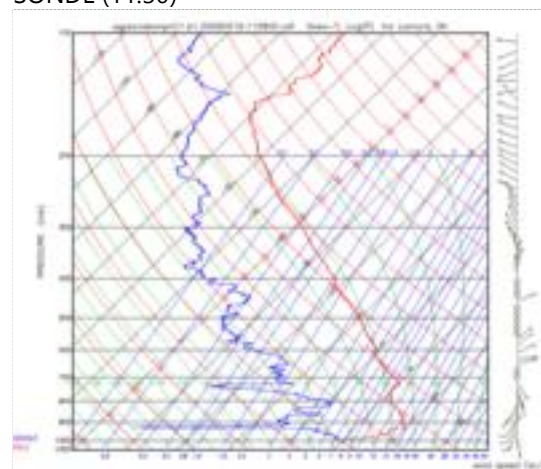
Ceilometer Backscatter



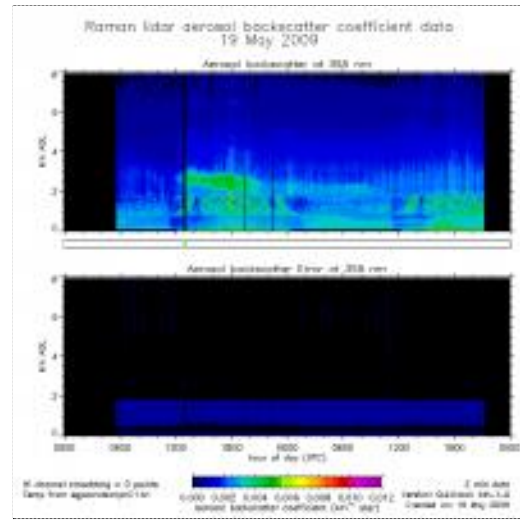
Microwave Radiometer



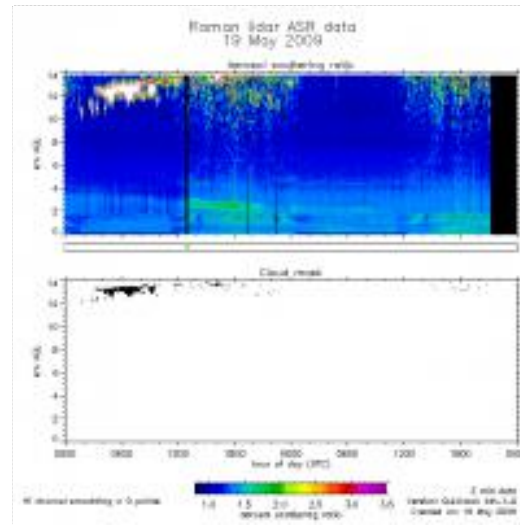
SONDE (11:30)



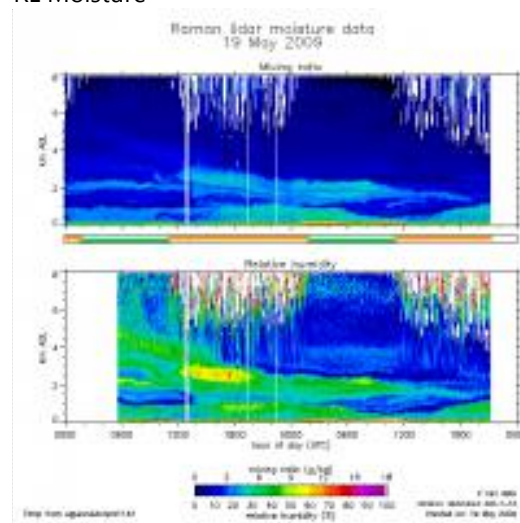
### RL Backscatter



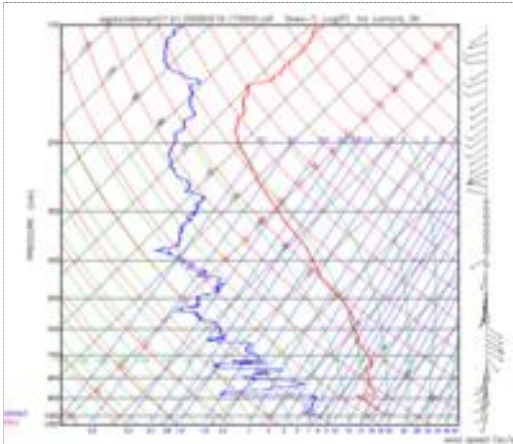
### RL ASR



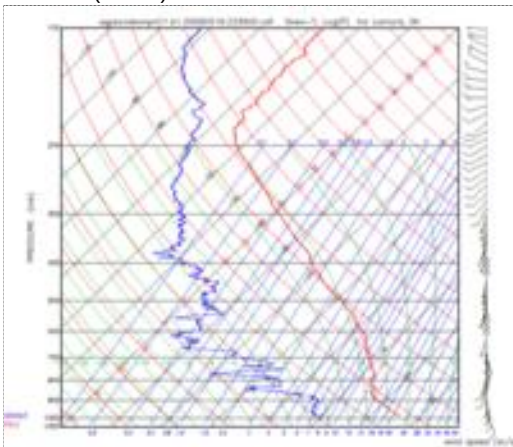
### RL Moisture



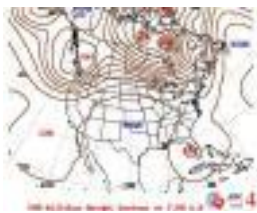
### SONDE (17:30)



### SONDE (23:30)



# Weather Maps



map5192

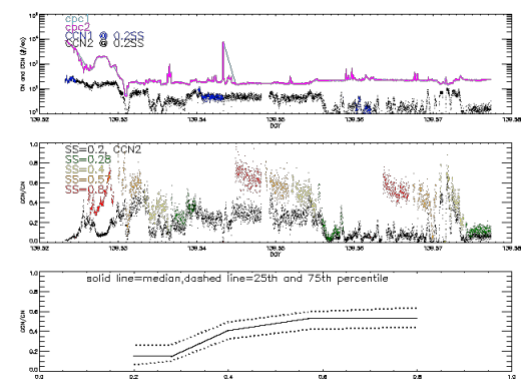


OK City: 1/8 cloud coverage; 8-12 knots | Tulsa: Clear; 8-12 knots; 1210 mb | 73 F/49 F

## Comments

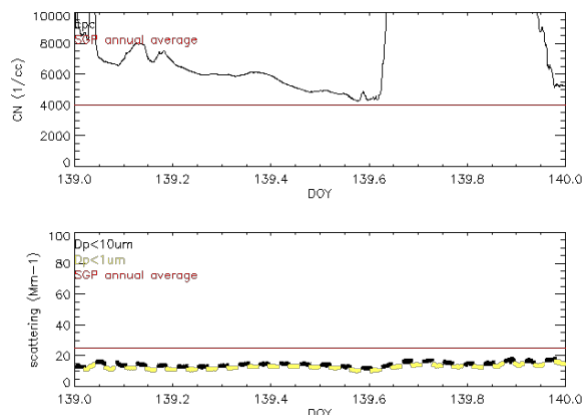
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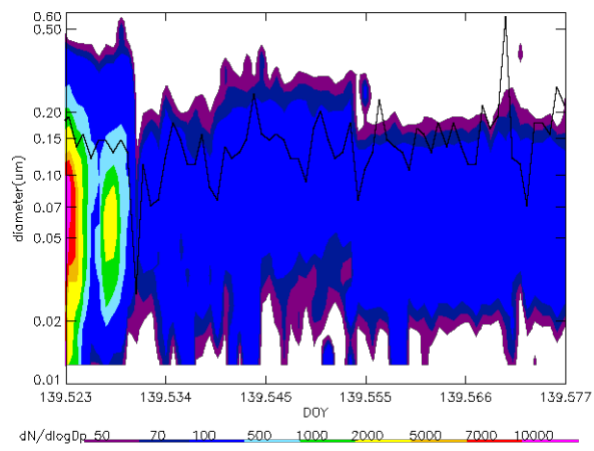


plot of CN and CCN and CCN/CN ratio as f(SS) from twin otter

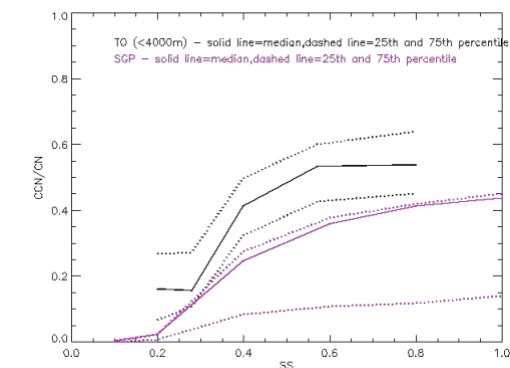
plot of CN and CCN and CCN fraction at SGP



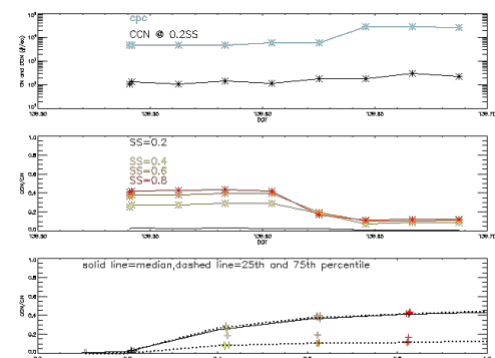
time series of CN and light scattering at SGP



TAMU DMA size distribution and CCN activation diameter



comparison of CCN fraction on twin otter and at SGP



# 20090522

## Flight Summary

Depart	Return	Hours	Synopsis	Google Earth
15:25 UTC	19:52 UTC	4.5	Cloud triangles at SGP	<a href="#">KML</a>
Flight hours to date		146.1		

We climbed out of Guthrie to the cloud base of 5500 and transitioned to the CF at 3500. There were 2 layers of clouds in the area 4000 & 5200, but the higher one only stuck around about 5 miles north of Guthrie. We went below the lowest layer.

Over the CF we began our triangle pattern.

Triangle # 1 3500', 500' below the clouds.

Leg # 1 1554Z

Leg # 2 1603

Leg #3 1617

The Ponca City Cessna was in the area during this triangle through the 2nd triangle.

We went past the CF 0.5 nm each time before we climbed or descended. We went to 1500' and did a spiral climb to 10500 at 1629Z. We could not get higher than that due to the amount of clouds and the temperature was 1 degree. The cloud tops extended above 13,000 according to the Cessna pilot.

Triangle #2 10,500'. The cloud tops were above us.

Leg # 1 1646

Leg # 2 1655

Leg #3 1708

Triangle #3 9000'

Leg # 1 1719

Leg # 2 1728 We had to maneuver around a large buildup on this leg.

Leg #3 1740 We has to maneuver around buildups on this leg.

Triangle #4 7500'. We noticed the majority of the cloud tops to the East were not nearly as high as when we first got out there. They were building to the west.

Leg # 1 1750

Leg # 2 1759

Leg #3 1812 We had to maneuver around a buildup.

Triangle #5 5500' Above the bases.

Leg # 1 1825. We maneuvered to hit a cloud on this leg.

Leg # 2 1834

Leg #3 1847

Back over the CF we climbed to 10,500 and did a spiral down to 1500' at 1905Z. Tops were still above us ~ 12,000 with higher tops to the West. We RTB'd at 1926 and came back at 5300. Bases were 5800.

## Weather Summary

Broken cumulus with thin cirrus above.

## Aircraft Instrumentation Status

Jesse said everything appeared to run fine.

## Surface Instrumentation Status

nothing to report

# Flight Images



1535 UTC



1633 UTC



1724 UTC



1808 UTC



1538 UTC



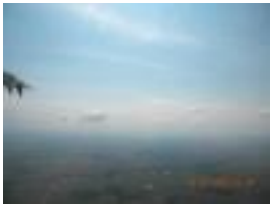
1637 UTC



1728 UTC



1812 UTC



1539 UTC



1648 UTC



1737 UTC



1824 UTC



1548 UTC



1650 UTC



1746 UTC



1845 UTC



1553 UTC



1654 UTC



1749 UTC



1902 UTC



1600 UTC



1715 UTC



1756 UTC

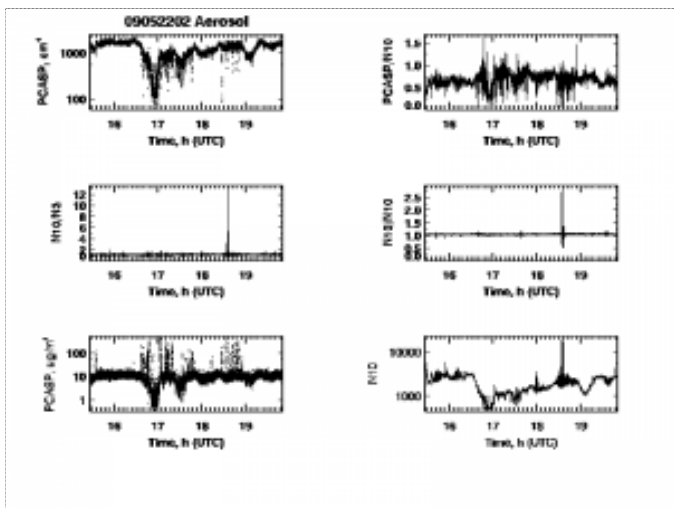


1906 UTC

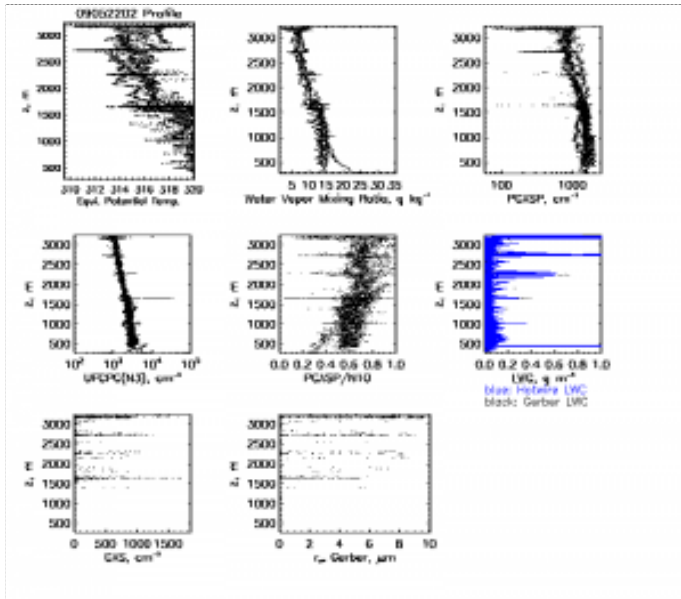


# Flight Plots

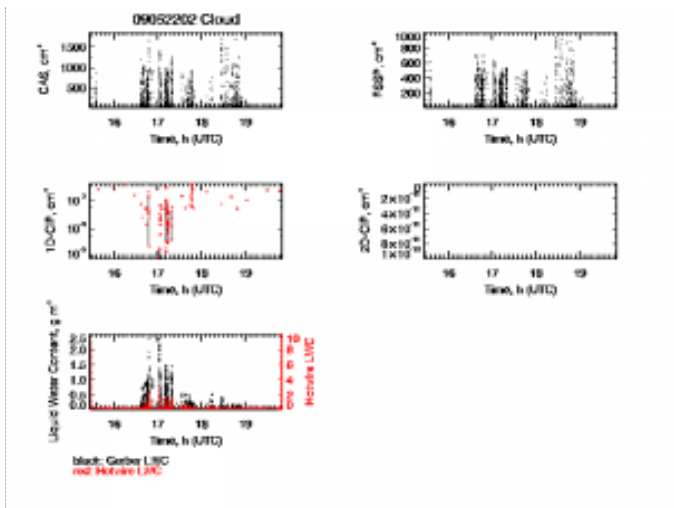
## Aerosol



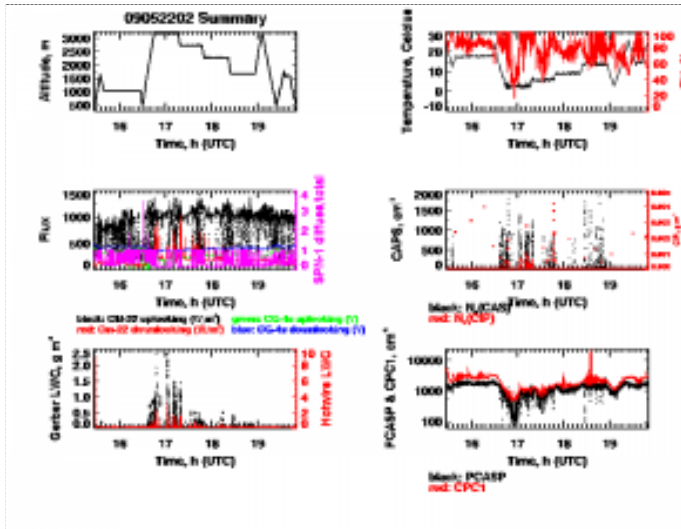
## Profile



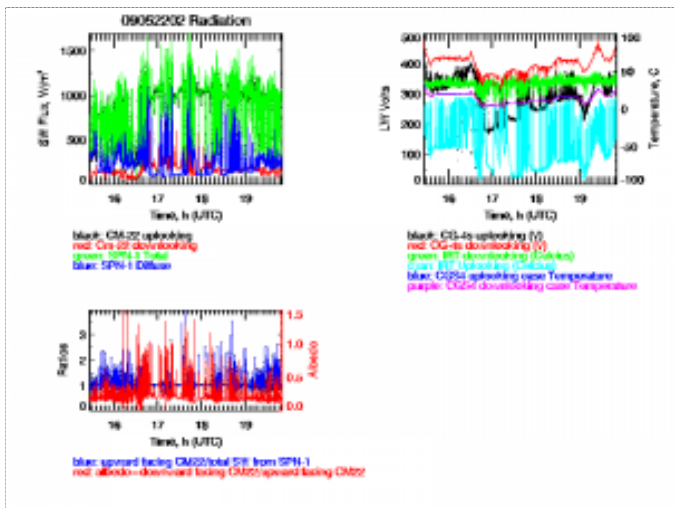
## Cloud



## Summary

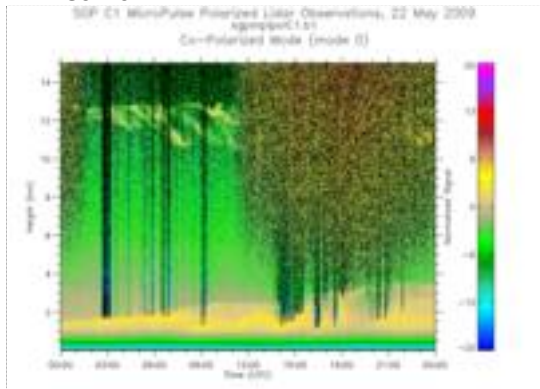


## Radiation

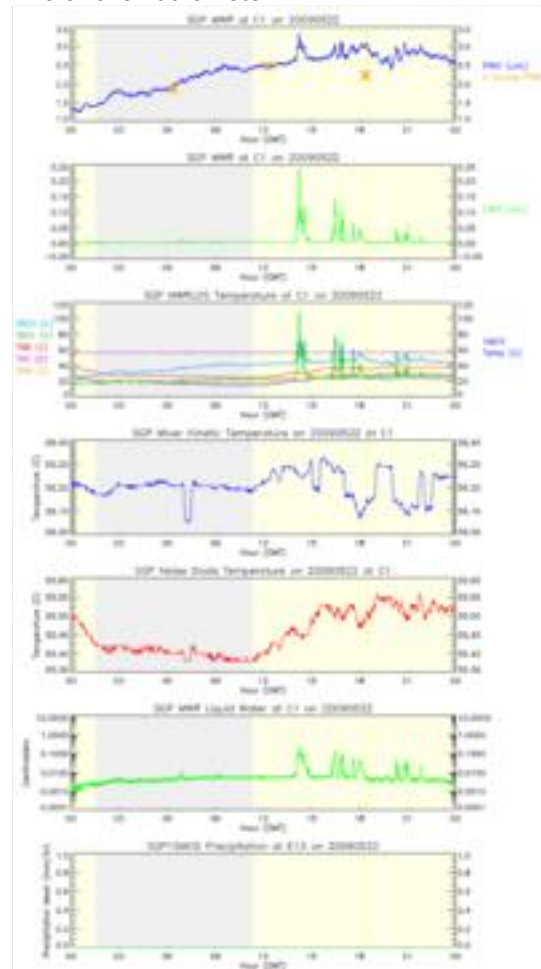


# SGP Plots

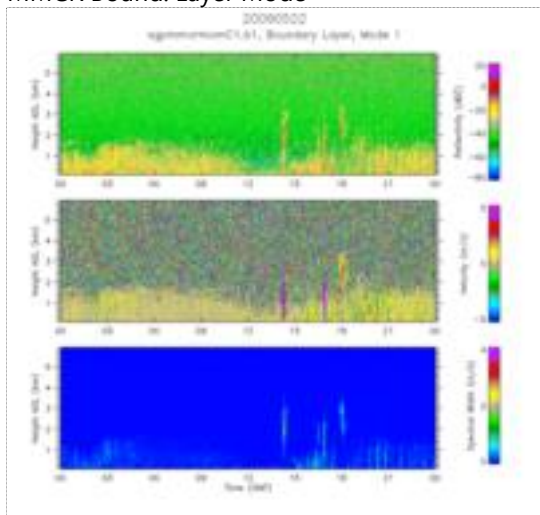
MPL Co-Pol



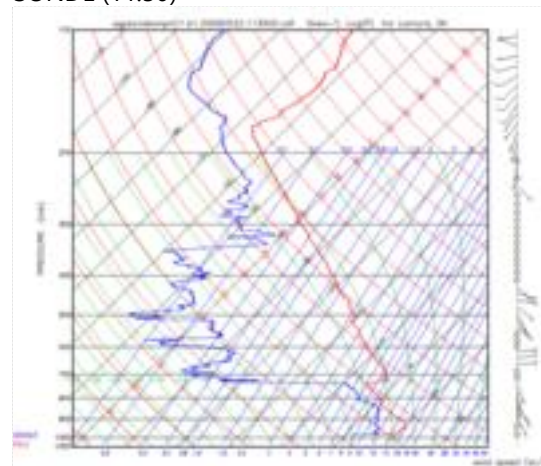
Microwave Radiometer



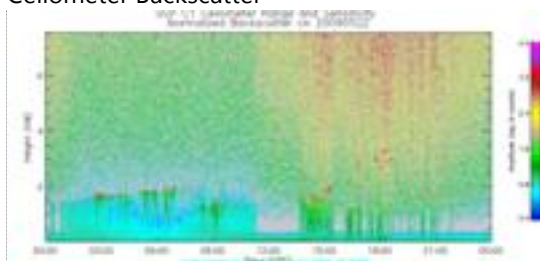
MMCR Bound. Layer Mode



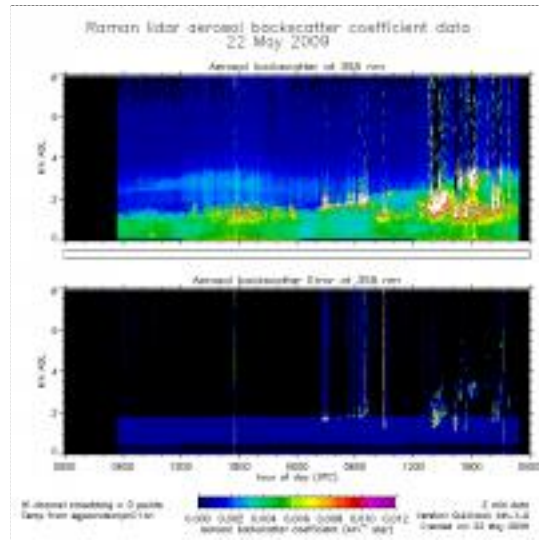
SONDE (11:30)



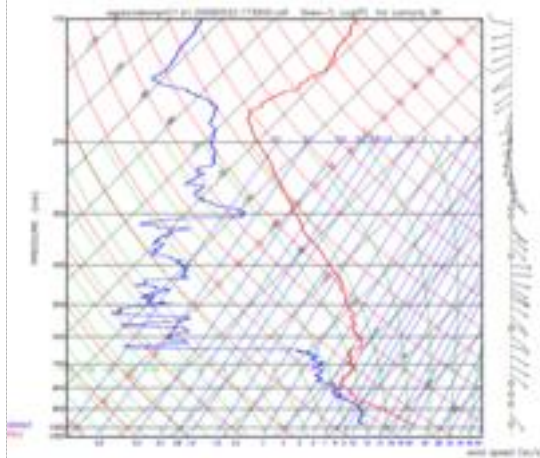
Ceilometer Backscatter



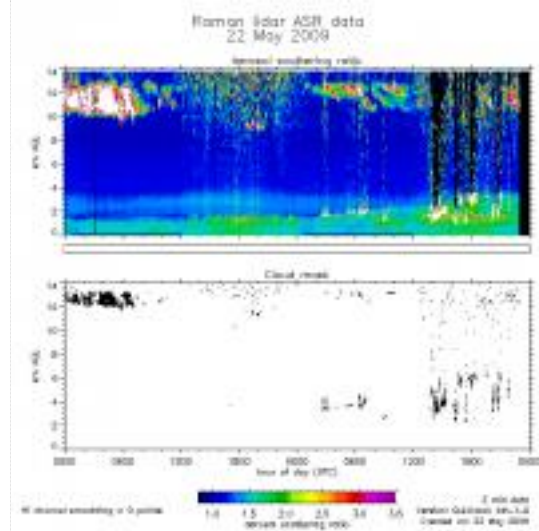
RL Backscatter



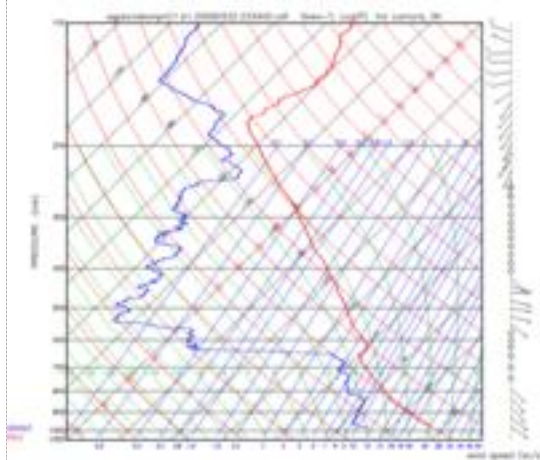
SONDE (17:30)



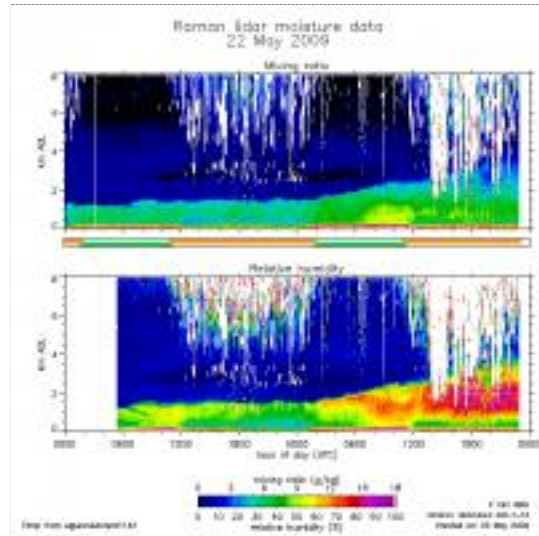
RL ASR



SONDE (23:30)



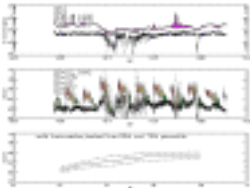
RL Moisture



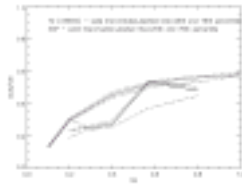
## CCN Activity

I've made size distribution contour plots from the DMA operated by TAMU on the Twin Otter. These plots are overlaid with a line indicating the CCN activation diameter at 0.2% SS based on the CCN measurements on the Twin Otter. To do this, I cumulatively summed the DMA number concentration backwards from largest to smallest diameter bin. I identified the bin diameter where the cumulative summed concentration was closest to the measured CCN concentration and chose that as the CCN activation diameter. Elisabeth Andrews - 17 Jun 2009

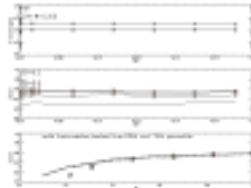
I've generated plots indicative of CCN activity from the Twin Otter CABIN and CCN files (i.e. CCN/CN as  $f(SS)$ ). I've also generated time series plots showing CN concentration and scattering at the ground (i.e. at SGP) and CCN fraction measured at the surface so one can compare with that measured aloft. Elisabeth Andrews - 17 Jun 2009



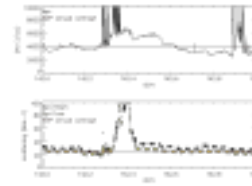
plot of CN and CCN and CCN/CN ratio as  $f(SS)$  from twin otter



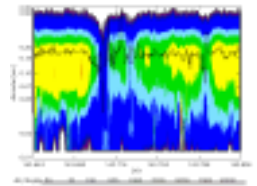
comparison of CCN fraction on twin otter and at SGP



plot of CN and CCN and CCN fraction at SGP

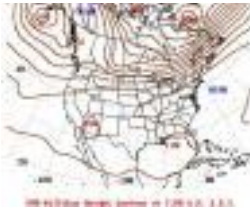


time series of CN and light scattering at SGP



TAMU DMA size distribution and CCN activation diameter

## Weather Maps



map-5222



1/8 cloud coverage; 8-12 knots; 1155 mb | 78 F/54 F | Pre-cold front

# 20090523

## Flight Summary

Depart	Return	Hours	Synopsis	Google Earth
14:23 UTC	19:15 UTC	4.9	Cloud triangles at SGP	<a href="#">KML</a>
Flight hours to date		151.0		

We departed Guthrie and climbed up to 6000'. There were no clouds. We descended towards the CF. The aerosol layers were different on the climb out than they were on the descent to the CF, so we decided to mix things up a little bit.

We did a spiral over the CF from 1500-10,500'. Start time 1451Z.

We descended to the highest concentration layer at 4800' and did our first triangle at 3 different altitudes.

Leg #1 1526Z. 4800'.

Leg #2 1537Z. We descended to 4500' for this leg. Clouds started to move into the area, we were above them.

Leg #3 1549Z. We descended to 4200' for this leg. We went 2nm past the CF on each of the triangles.

Clouds had formed enough at this point to start working them.

Triangle #2 Cloud bases 4000'. Triangle altitude 3500'. Cloud tops ~4400'.

Leg #1 1603Z

Leg #2 1613Z

Leg #3 1625Z

Triangle #3 Bases 4400'. Triangle altitude 4800'

Leg #1 1639Z

Leg #2 1649Z

Leg #3 1701Z

Triangle #4 5200'.

Leg #1 1714Z

Leg #2 1725Z. Cloud bases rose on this leg, we ended up just in the bases. The tops really began to grow, too.

Leg #3 1736Z

Triangle #5 6000'. Near the tops of the cloud field. There were higher tops in the area.

Leg #1 1750Z

Leg #2 1800Z

Leg #3 1812Z

We climbed to 10,500 and did a spiral descent over the CF to 1500' at 1831Z. There were some cloud tops extending above our altitude. Bases were 6000'.

We RTB'd at 1849 at 5500' then 5000' because the bases dropped to 5500'

No issues with the plane.

## Weather Summary

Broken cumulus with occasional cirrus above.

## Aircraft Instrumentation Status

Jesse said there was no issue with instrumentation

## Surface Instrumentation Status

nothing to report

## Flight Images



1438 UTC



1452 UTC



1538 UTC



1538 UTC



1539 UTC



1550 UTC



1556 UTC



1604 UTC



1619 UTC



1632 UTC



1639 UTC



1658 UTC



1713 UTC



1719 UTC



1734 UTC



1742 UTC



1750 UTC



1808 UTC



1813 UTC



1821 UTC



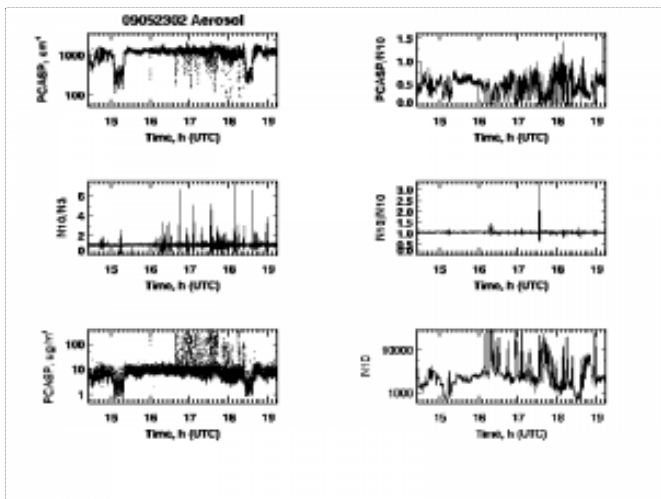
1825 UTC



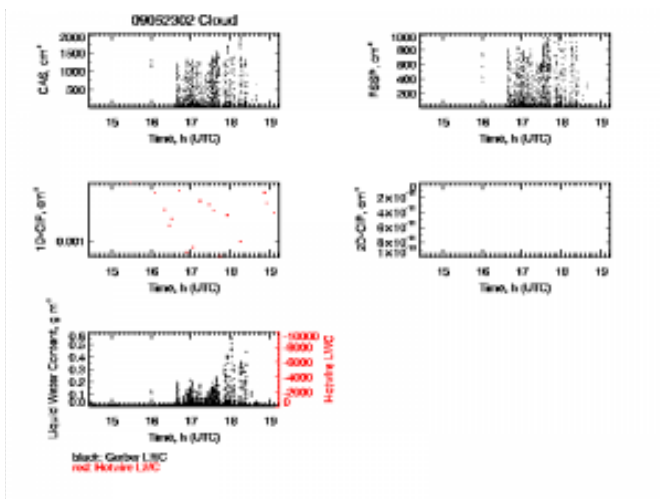
1441 UTC

## Flight Plots

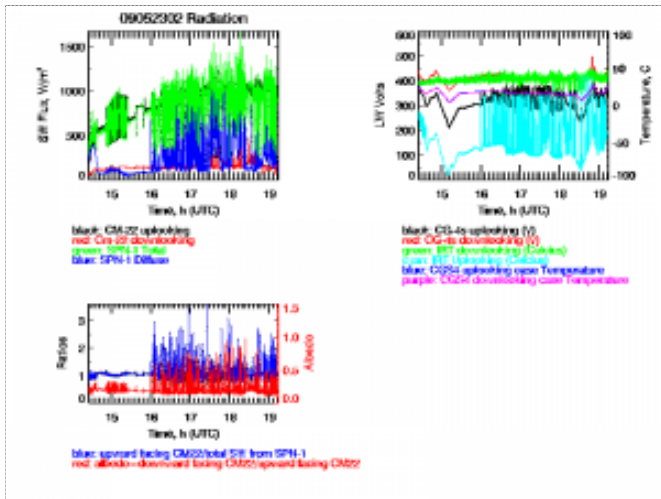
### Aerosol



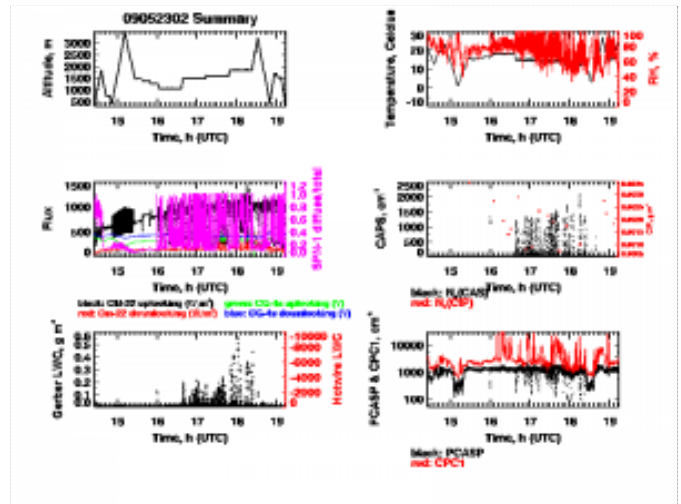
### Cloud



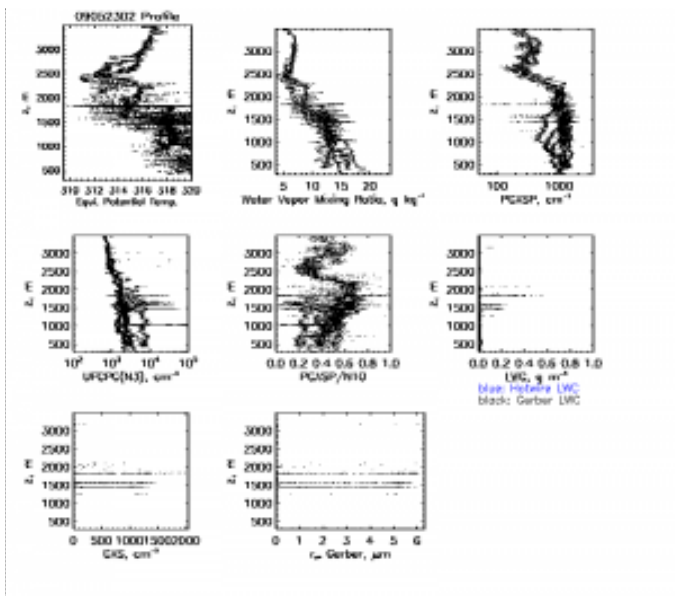
## Radiation



## Summary

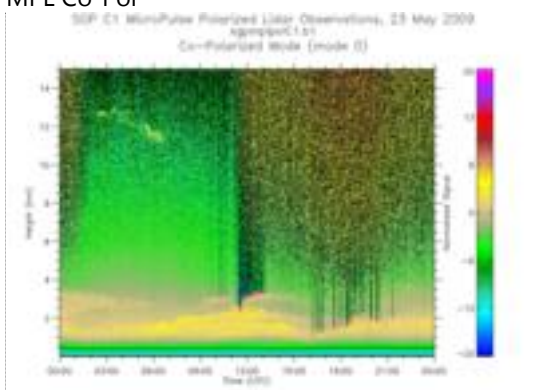


## Profile

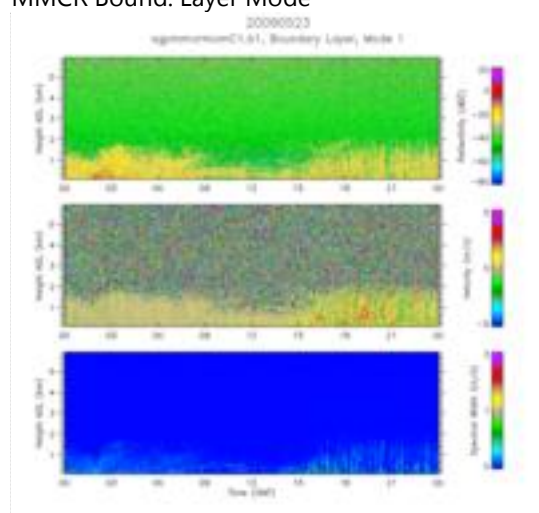


## SGP Plots

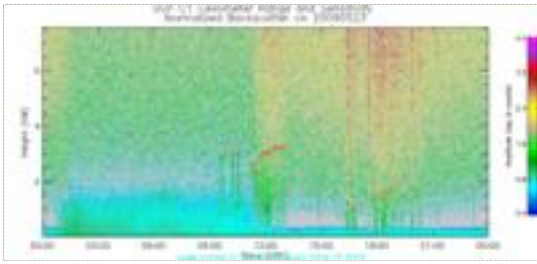
### MPL Co-Pol



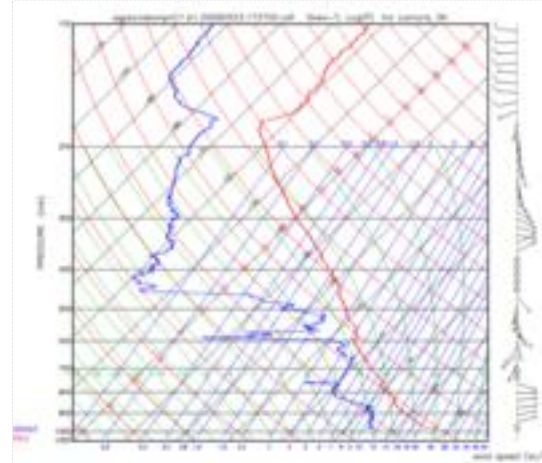
### MMCR Bound. Layer Mode



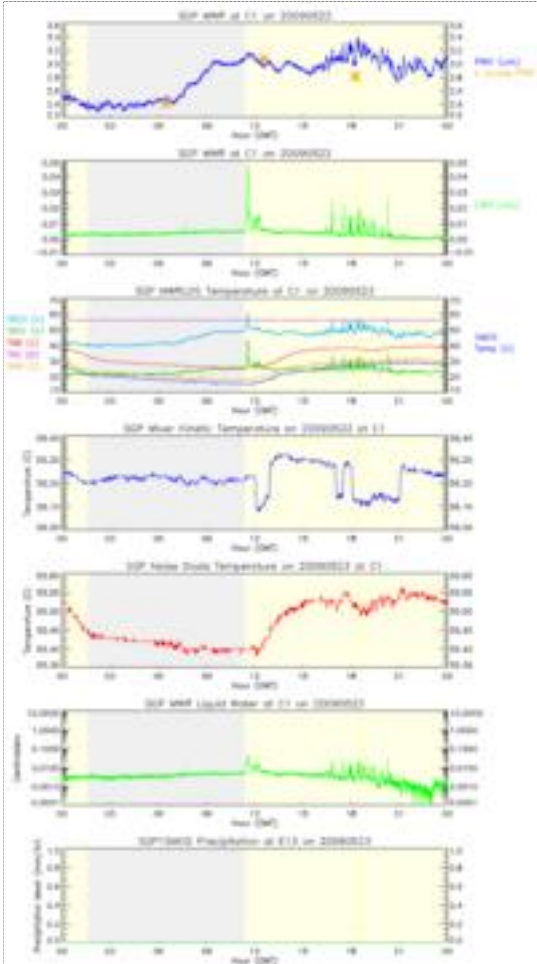
Ceilometer Backscatter



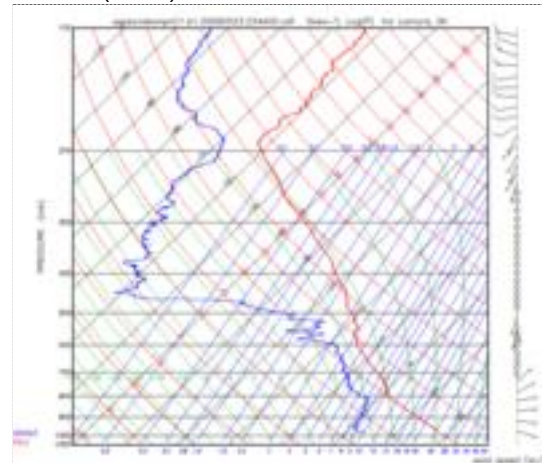
SONDE (17:30)



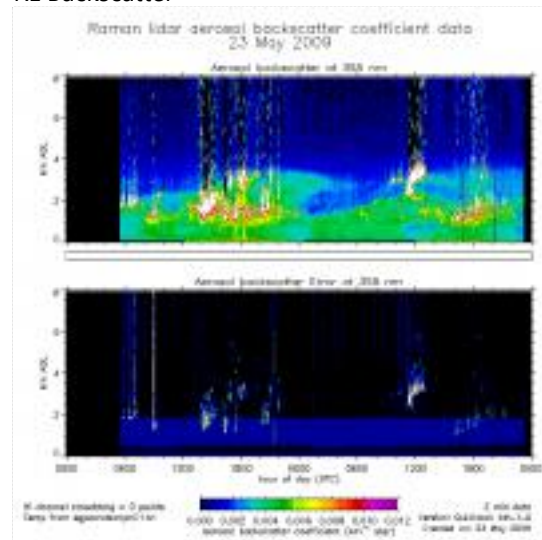
Microwave Radiometer



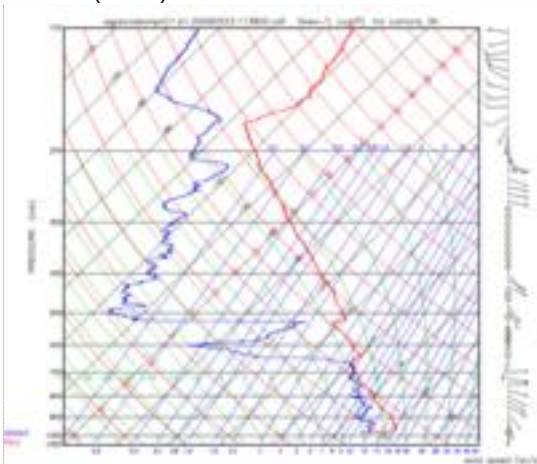
SONDE (23:30)



RL Backscatter

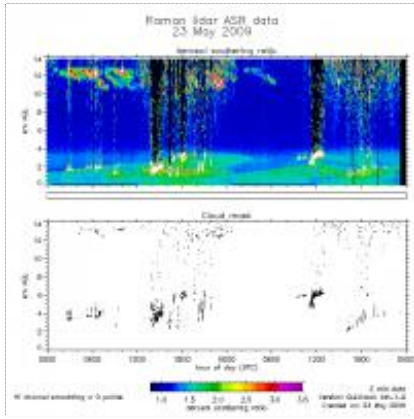


SONDE (11:30)

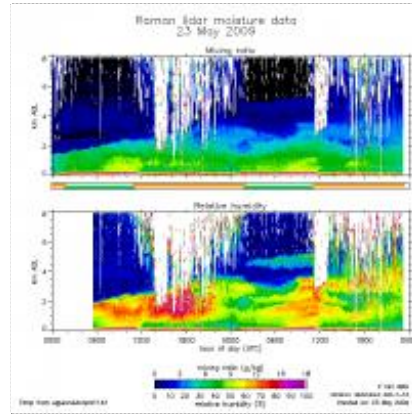




RL ASR



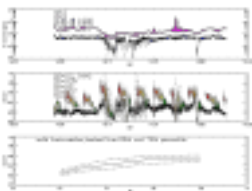
RL Moisture



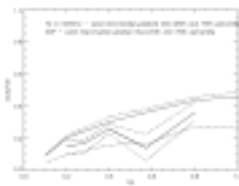
CCN Activity

I've made size distribution contour plots from the DMA operated by TAMU on the Twin Otter. These plots are overlaid with a line indicating the CCN activation diameter at 0.2% SS based on the CCN measurements on the Twin Otter. To do this, I cumulatively summed the DMA number concentration backwards from largest to smallest diameter bin. I identified the bin diameter where the cumulative summed concentration was closest to the measured CCN concentration and chose that as the CCN activation diameter. Elisabeth Andrews - 17 Jun 2009

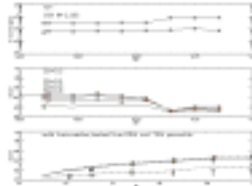
I've generated plots indicative of CCN activity from the Twin Otter CABIN and CCN files (i.e. CCN/CN as f(SS)). I've also generated time series plots showing CN concentration and scattering at the ground (i.e. at SGP) and CCN fraction measured at the surface so one can compare with that measured aloft. Elisabeth Andrews - 17 Jun 2009



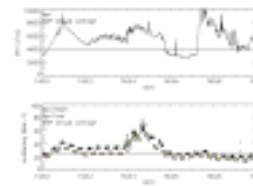
plot of CN and CCN and CCN/CN ratio as f(SS) from twin otter



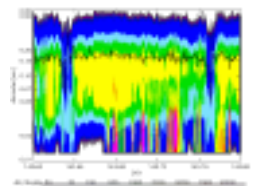
plot of CN and CCN and CCN/CN ratio as f(SS) from twin otter



plot of CN and CCN and CCN fraction at SGP

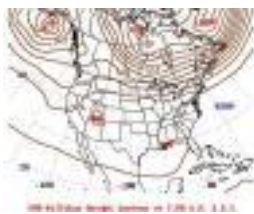


time series of CN and light scattering at SGP

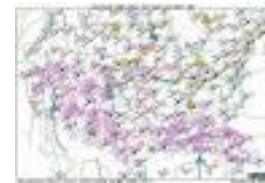


TAMU DMA size distribution and CCN activation diameter

Weather Maps

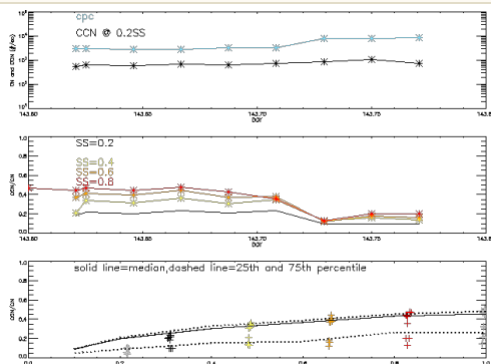


map-5232

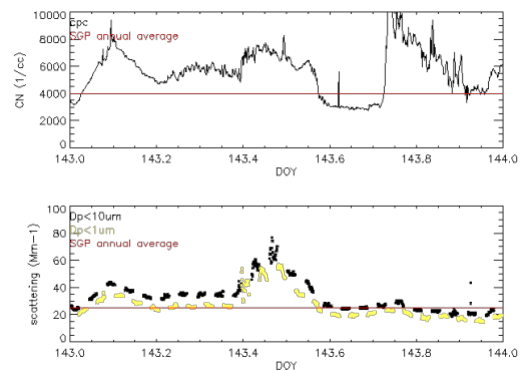


1/8 cloud coverage; 8-12 knots; 1155 mb | 78 F/54 F | Pre-cold front

Comments



plot of CN and CCN and CCN fraction at SGP



time series of CN and light scattering at SGP

# 20090524

## Flight Summary

Depart	Return	Hours	Synopsis	Google Earth
15:26 UTC	19:50 UTC	4.4	Cloud triangles at SGP	<a href="#">KML</a>
Flight hours to date		155.4		

We departed out of Guthrie and climbed to cloud bases of 3500' and transitioned out to the CF at 3000'. We flew out of the cloud field 17 north of Guthrie into clear air.

There were clouds near the CF. Once there, we got a new cloud base of 3400' and began the triangle patterns. We went 2 nm past the CF on each pass.

Triangle #1 3400, 500' below the bases.

Leg #1 1559Z

Leg #2 1609Z

Leg #3 1622Z

Back at the CF we dropped to 1500' and spiraled up to 8500' at 1643Z. Bases had risen slightly to 4000'. Average cloud tops around 6500'. Some cloud tops extended above us to ~9000'.

Triangle #2. 7000' 500 above the average tops.

Leg #1 1650Z

Leg #2 1700Z

Leg #3 1712Z

Triangle #3. 5700' Upper portion of the cloud. Cirrus from the Low pressure to the east moved over top of us during this triangle and the clouds stopped developing.

Leg #1 1724Z

Leg #2 1735Z

Leg #3 1747Z

Triangle #4 5500'. We were near mid level of the clouds at the start of the triangle, but the clouds kept dissipating. We were at or near the bases by leg #3.

Leg #1 1759Z

Leg #2 1809Z

Leg #3 1822Z

Triangle #5 5900'. The bases had risen significantly, and the clouds began to build up again...shomewhat. We were mid level during most of this leg. Sometimes over, sometimes under. There was no constant today.

Leg #1 1834Z

Leg #2 1844Z

Leg #3 1856Z

Back at the CF we climbed to 8500' and spiraled to 1500'. 1909Z. Cloud tops extended above ~10,000'. Bases were 5800'.

We RTB'd at 1921Z and climbed to cloud bases of 5800' and came back to Guthrie at 5300'.

Cloud bases, tops, and sizes varied significantly from one side of the triangle to the other during the entire flight, except the first triangle.

No issues with the plane.

## Weather Summary

Clear skies followed by broken to scattered cumulus with cirrus overhead.

## Aircraft Instrumentation Status

Jesse said, "No problem" with instruments.

## Surface Instrumentation Status

nothing to report

## Flight Images



1559 UTC



1600 UTC



1605 UTC



1613 UTC



1628 UTC



1643 UTC



1645 UTC



1645 UTC



1649 UTC



1705 UTC



1710 UTC



1728 UTC



1731 UTC



1751 UTC



1753 UTC



1820 UTC



1834 UTC



1834 UTC



1857 UTC



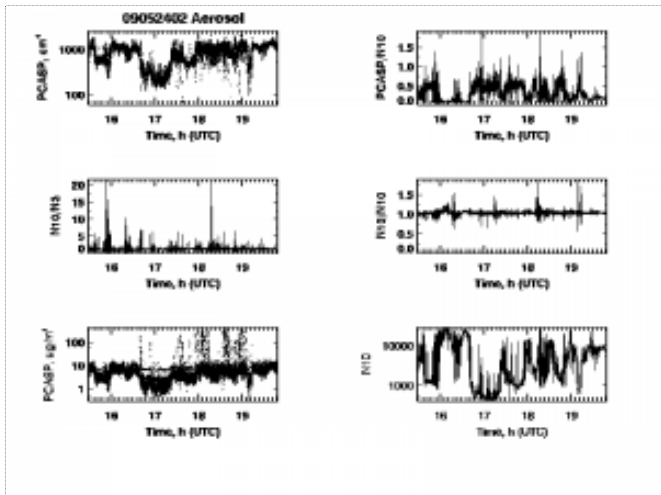
1909 UTC



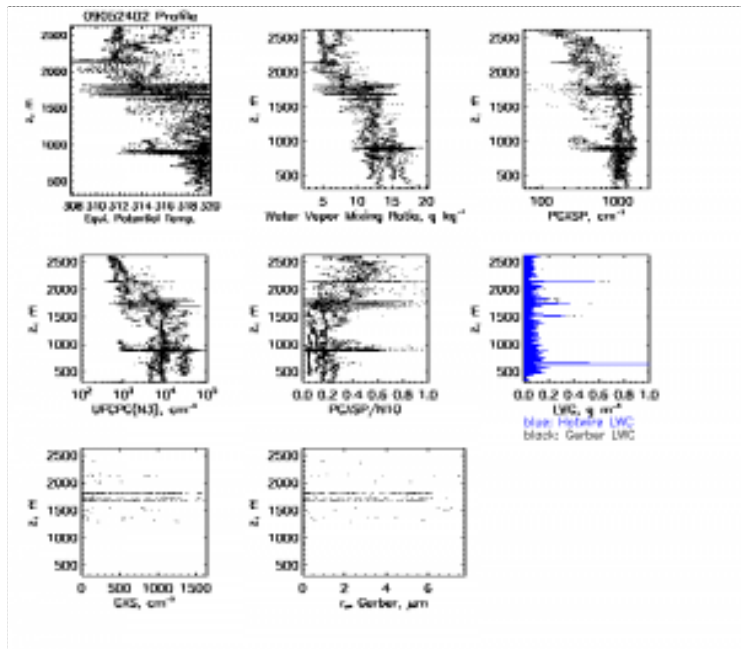
1915 UTC

# Flight Plots

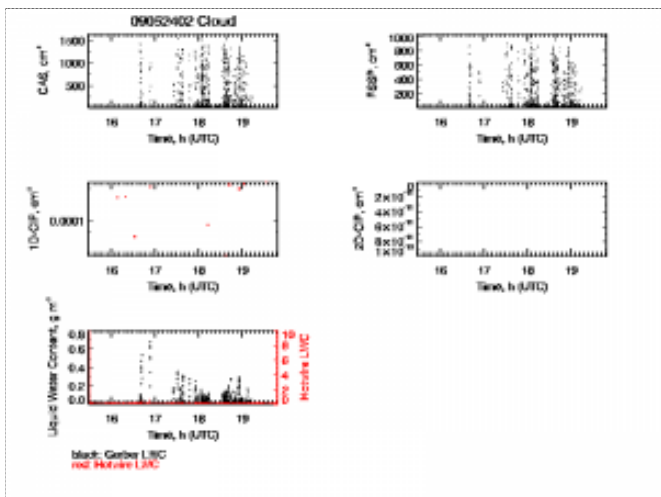
## Aerosol



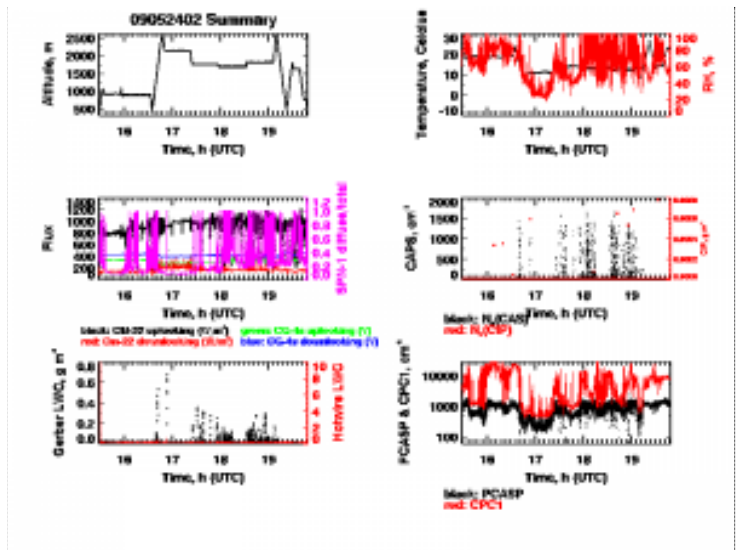
## Profile



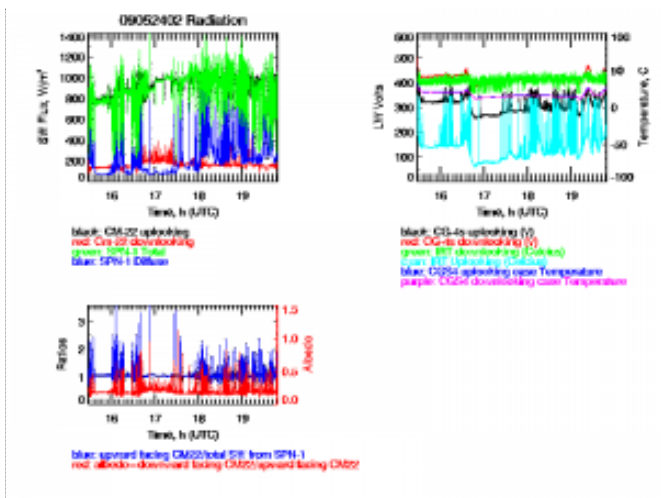
## Cloud



## Summary

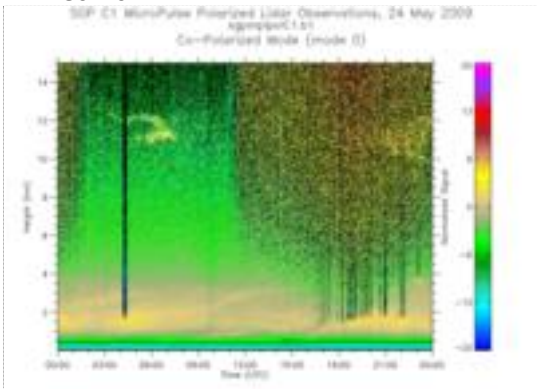


## Radiation

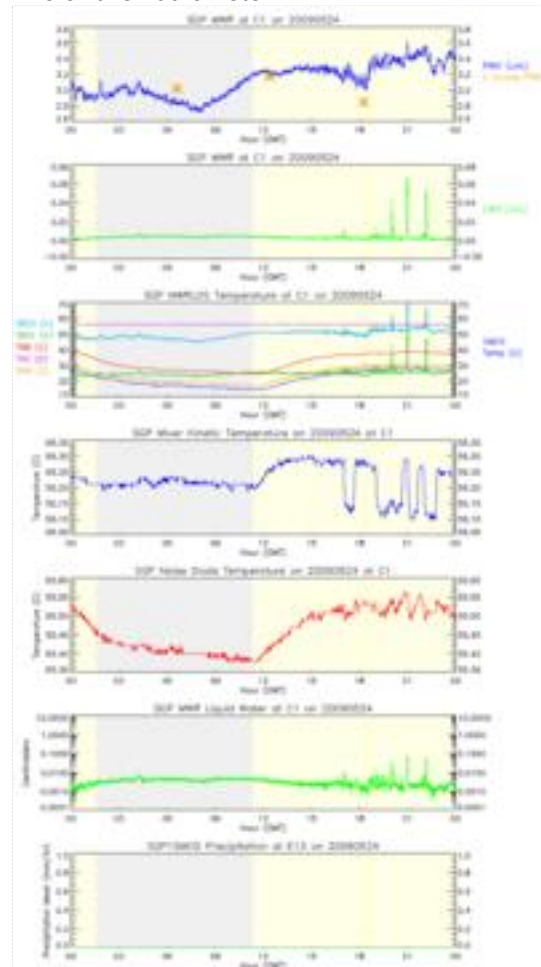


# SGP Plots

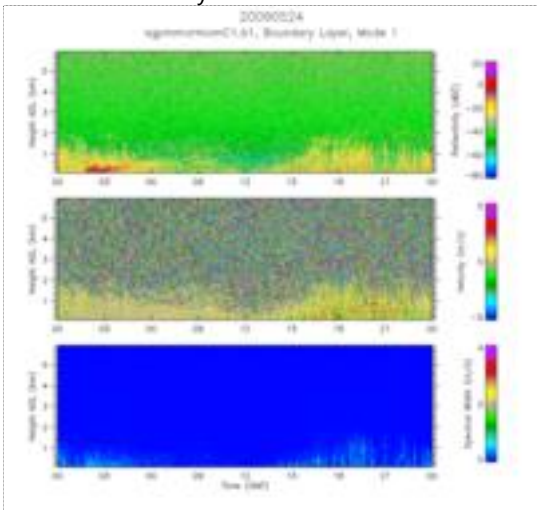
MPL Co-Pol



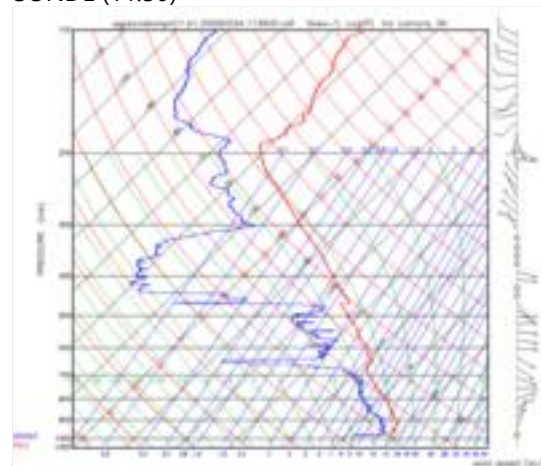
Microwave Radiometer



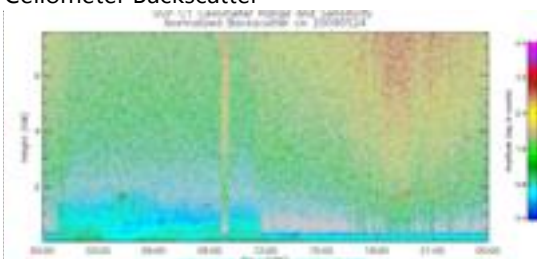
MMCR Bound. Layer Mode



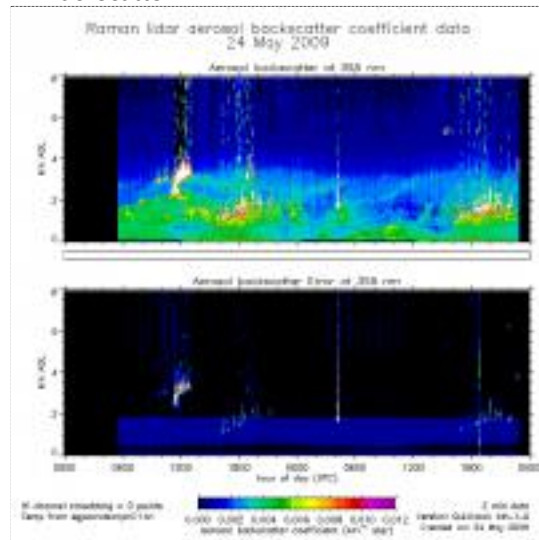
SONDE (11:30)



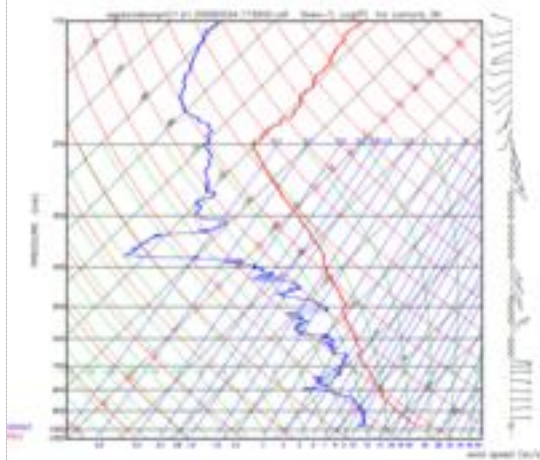
Ceilometer Backscatter



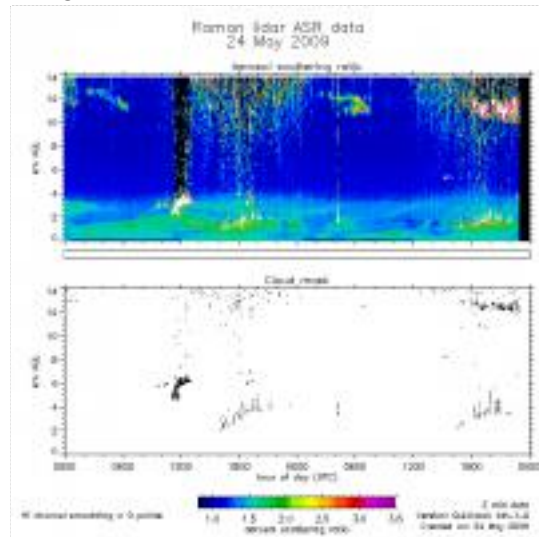
RL Backscatter



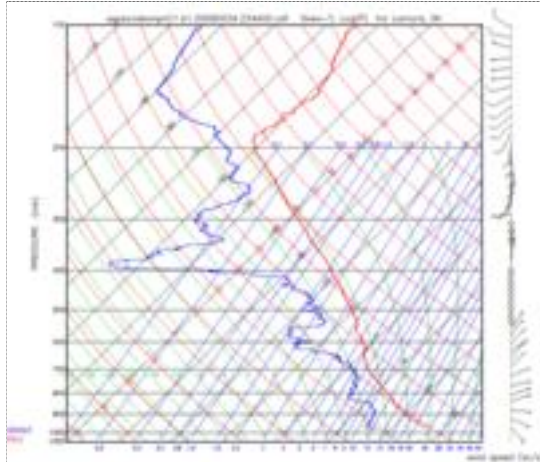
SONDE (17:30)



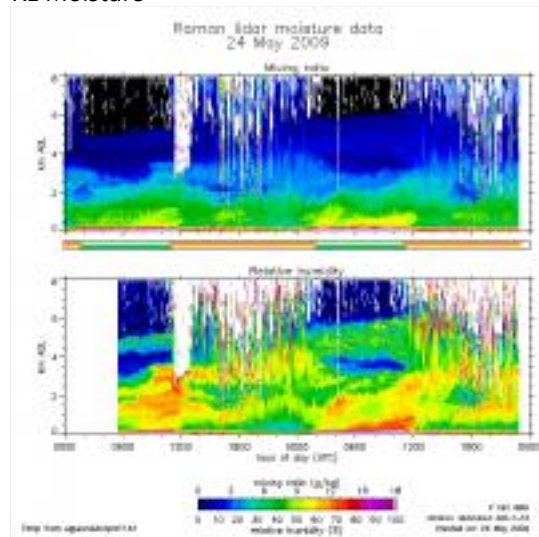
RL ASR



SONDE (23:30)



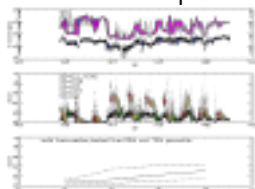
RL Moisture



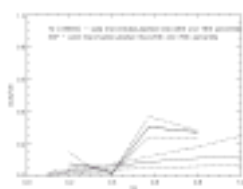
## CCN Activity

I've made size distribution contour plots from the DMA operated by TAMU on the Twin Otter. These plots are overlaid with a line indicating the CCN activation diameter at 0.2% SS based on the CCN measurements on the Twin Otter. To do this, I cumulatively summed the DMA number concentration backwards from largest to smallest diameter bin. I identified the bin diameter where the cumulative summed concentration was closest to the measured CCN concentration and chose that as the CCN activation diameter. Elisabeth Andrews - 17 Jun 2009

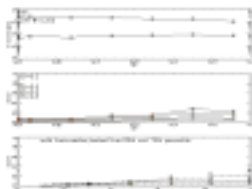
I've generated plots indicative of CCN activity from the Twin Otter CABIN and CCN files (i.e. CCN/CN as  $f(SS)$ ). I've also generated time series plots showing CN concentration and scattering at the ground (i.e. at SGP) and CCN fraction measured at the surface so one can compare with that measured aloft. Elisabeth Andrews - 17 Jun 2009



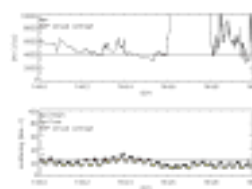
plot of CN and CCN and CCN/CN ratio as  $f(SS)$  from twin otter



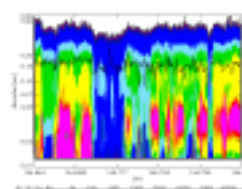
comparison of CCN fraction on twin otter and at SGP



plot of CN and CCN and CCN fraction at SGP



time series of CN and light scattering at SGP



TAMU DMA size distribution and CCN activation diameter

## Weather Maps

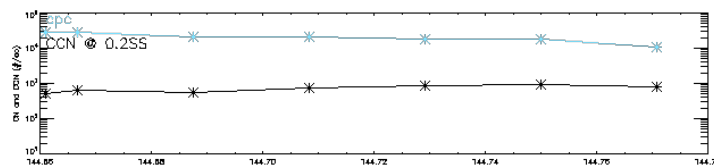


map-5242

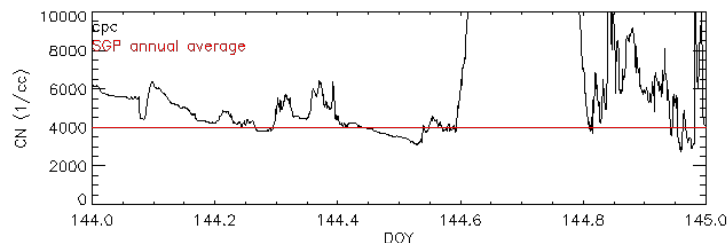


Broken; calm winds; 1134 mb | 71 F/54 F | Pre-cold front

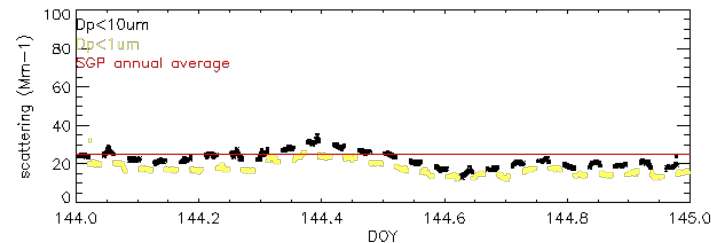
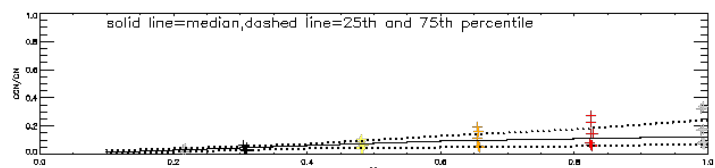
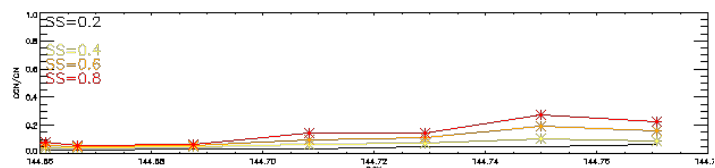
## Comments



plot of CN and CCN and CCN fraction at SGP



time series of CN and light scattering at SGP



# 20090526

## Flight Summary

Depart	Return	Hours	Synopsis	Google Earth
16:54 UTC	21:14 UTC	4.3	Cloud triangles at SGP	<a href="#">KML</a>
Flight hours to date		159.7		

We departed out of Guthrie and climbed to the bases at 3000' and flew to the CF at 2500'.

Over the site it was pretty clear. We did the first triangle at 2500'.

Triangle #1 2500'

Leg #1 1726Z

Leg #2 1735Z

Leg #3 1749Z

Back at the CF we descended to 1500' and did a spiral climb to 7000' time 1802Z. There were scattered clouds in the area at this time. Bases were 4800-4900 and the tops were 5000'.

Triangle #2. 5500'. This was supposed to be the on top leg, but the clouds were all over the place. By the middle part of leg #2 we were in them, and by the end of leg #3 we were below them,

Leg #1 1814Z

Leg #2 1823Z

Leg #3 1838Z

Triangle #3 5800'

Leg #1 1850Z

Leg #2 1859Z

Leg #3 1914Z

Triangle #4 6500'

Leg #1 1926Z

Leg #2 1934Z

Leg #3 1948Z

Triangle #5 6800'

Leg #1 2000Z

Leg #2 2008Z

Leg #3 2022Z

Back over the CF we climbed to 8000' and did a spiral descent to 1500' at 2034Z. Tops of the clouds were just above 8000' bases were 6500'.

We RTB'd at 2046Z at 5500'. Cloud bases were 6000'-5500'.

## Weather Summary

Broken to scattered cumulus with cirrus above.

## Aircraft Instrumentation Status

DLH turned off sometime during flight. Jesse turned it on and off loaded the data that was on there, but no DLH data for flight.



## Surface Instrumentation Status

nothing to report

## Flight Images



1700 UTC



1809 UTC



1841 UTC



1953 UTC



1728 UTC



1815 UTC



1850 UTC



2002 UTC



1729 UTC



1820 UTC



1926 UTC



2025 UTC



1738 UTC



1833 UTC



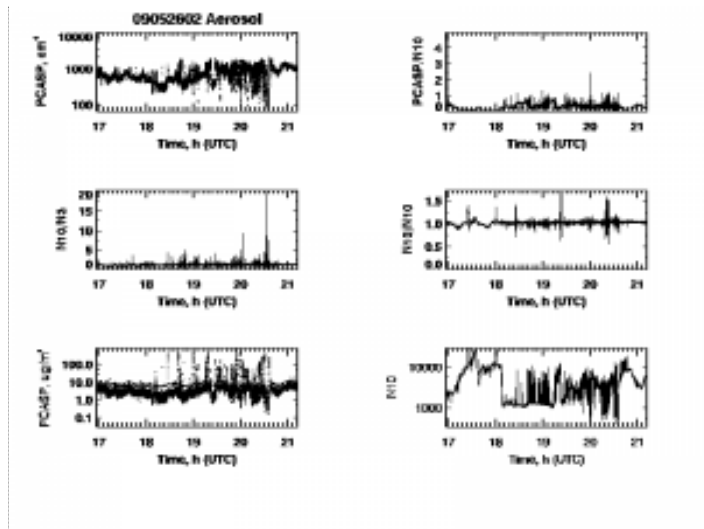
1931 UTC



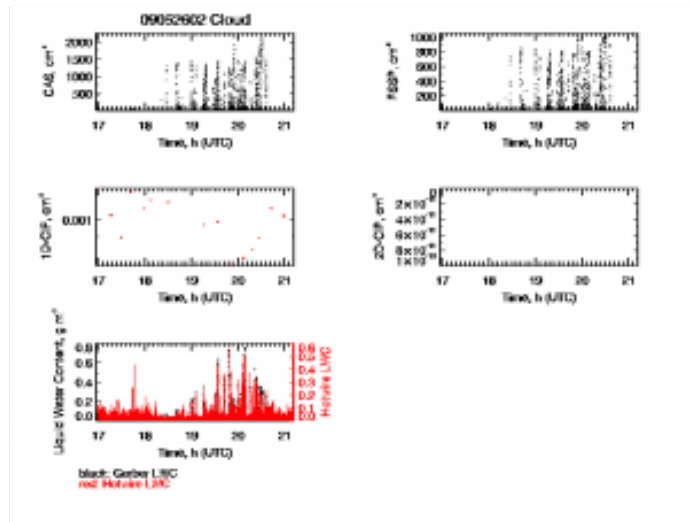
2034 UTC

## Flight Plots

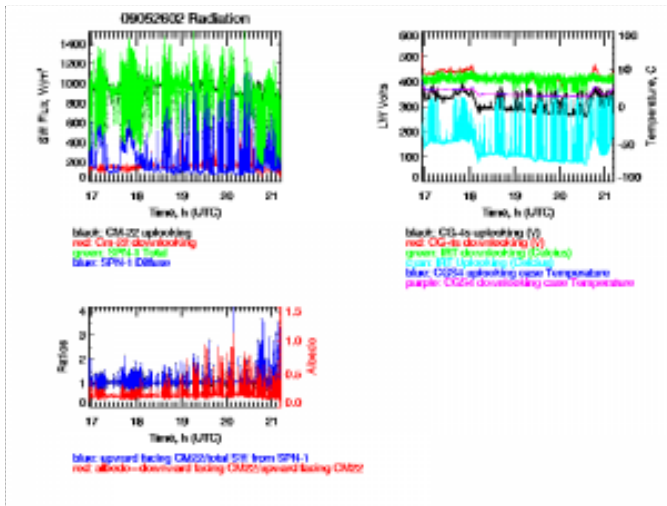
### Aerosol



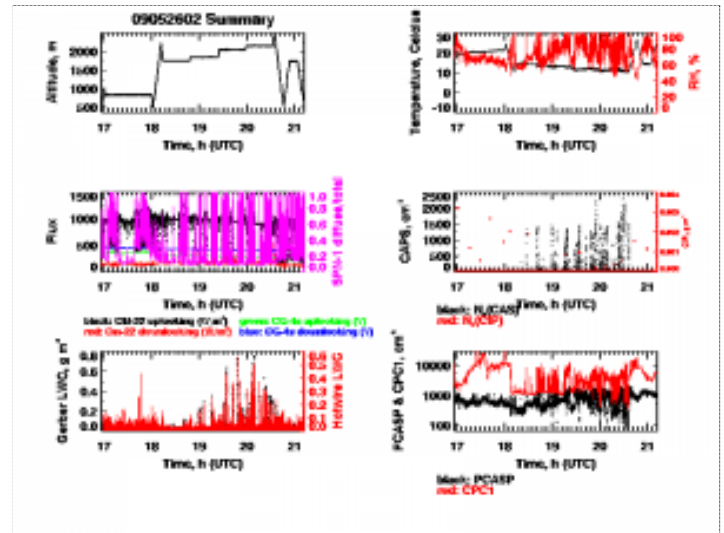
### Cloud



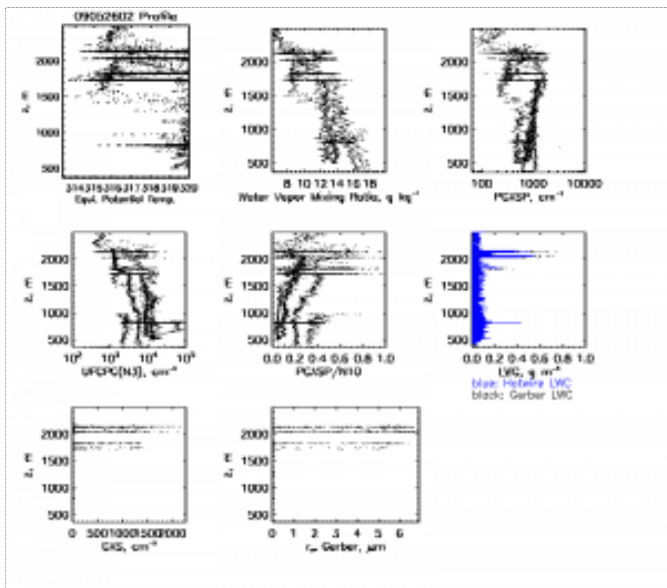
## Radiation



## Summary

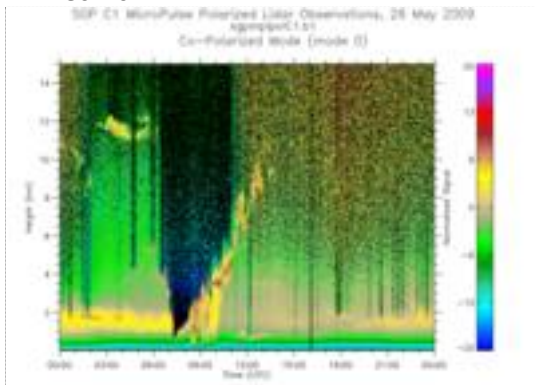


## Profile

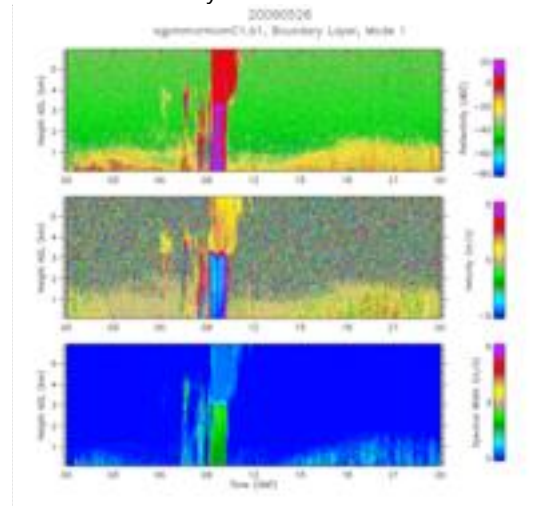


## SGP Plots

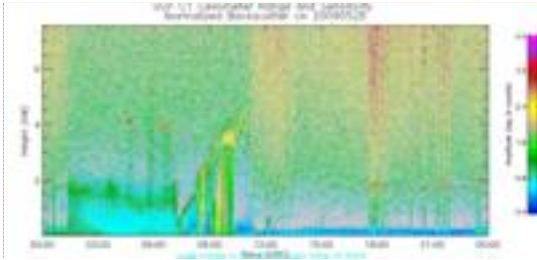
### MPL Co-Pol



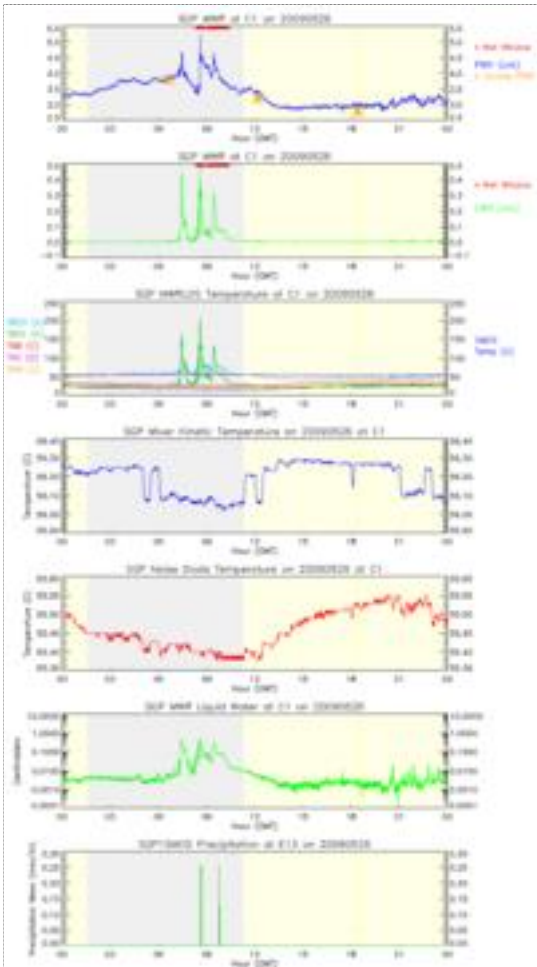
### MMCR Bound. Layer Mode



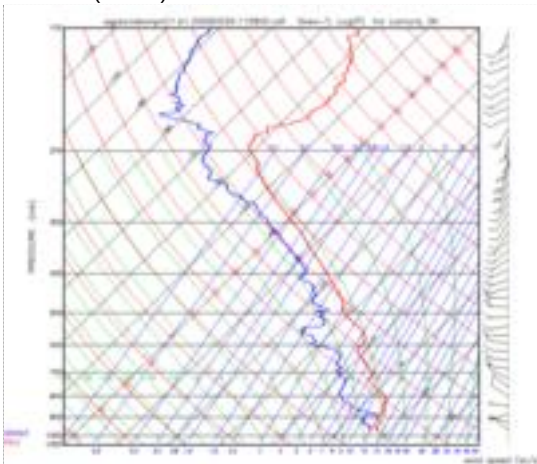
Ceilometer Backscatter



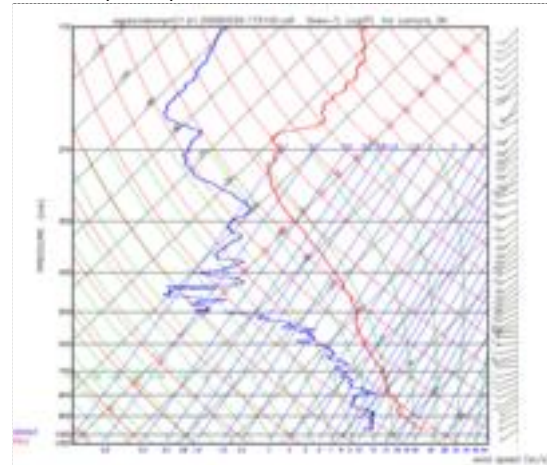
Microwave Radiometer



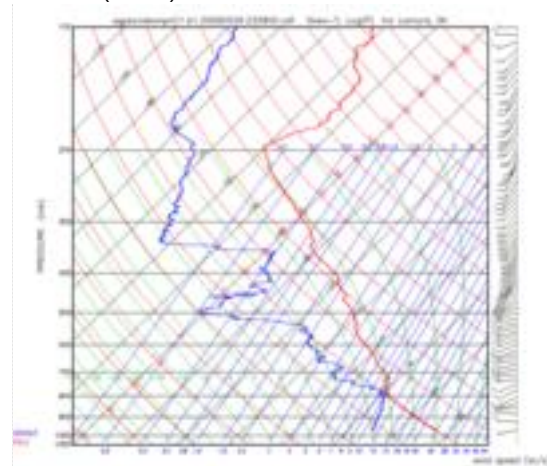
SONDE (11:30)



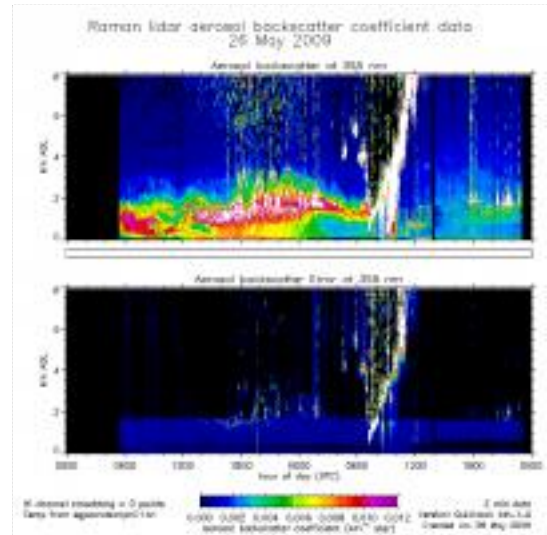
SONDE (17:30)



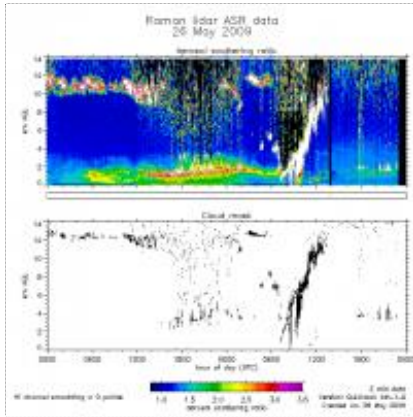
SONDE (23:30)



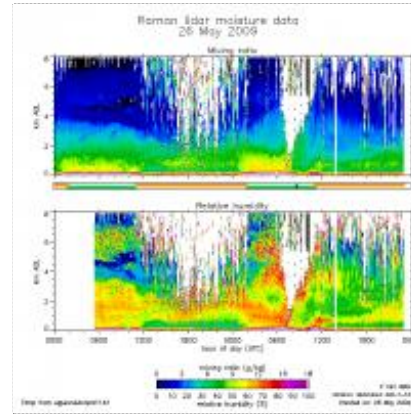
RL Backscatter



RL ASR



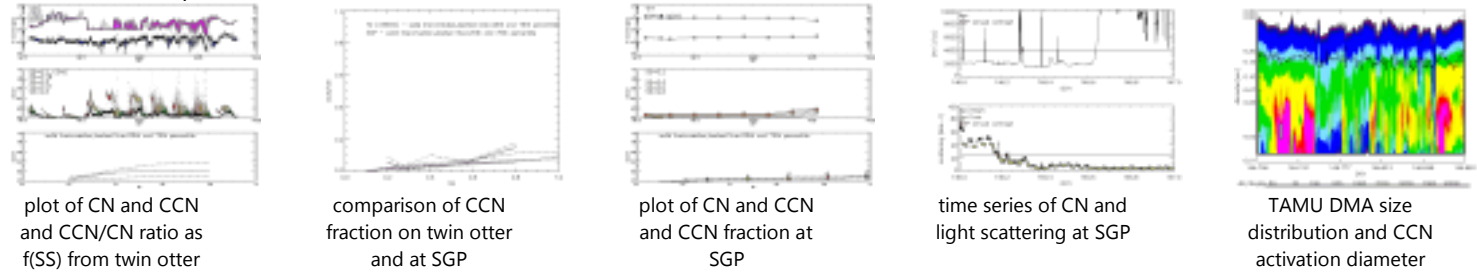
RL Moisture



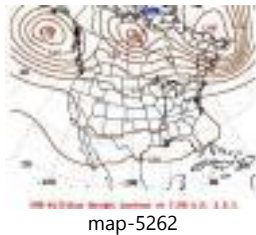
CCN Activity

I've made size distribution contour plots from the DMA operated by TAMU on the Twin Otter. These plots are overlaid with a line indicating the CCN activation diameter at 0.2% SS based on the CCN measurements on the Twin Otter. To do this, I cumulatively summed the DMA number concentration backwards from largest to smallest diameter bin. I identified the bin diameter where the cumulative summed concentration was closest to the measured CCN concentration and chose that as the CCN activation diameter. Elisabeth Andrews - 17 Jun 2009

I've generated plots indicative of CCN activity from the Twin Otter CABIN and CCN files (i.e. CCN/CN as f(SS)). I've also generated time series plots showing CN concentration and scattering at the ground (i.e. at SGP) and CCN fraction measured at the surface so one can compare with that measured aloft. Elisabeth Andrews - 17 Jun 2009



Weather Maps

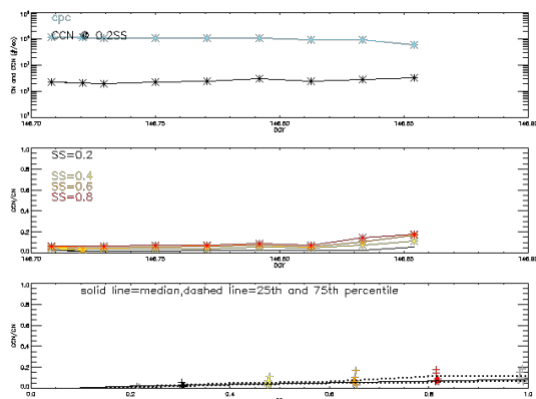


map-5262

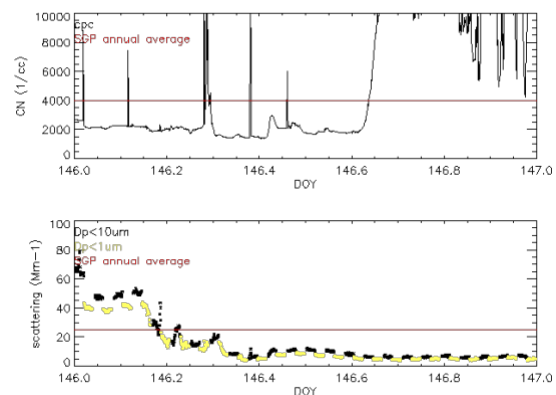


OK City: Broken; 8-12 knots | Tulsa: Clear; 8-12 knots; 1033 mb | 75 F/60 F | Pre-cold front

Comments




plot of CN and CCN and CCN fraction at SGP



time series of CN and light scattering at SGP

# 20090527

## Flight Summary

Depart	Return	Hours	Synopsis	Google Earth
17:56 UTC	21:43 UTC	3.8	Cloud missed approaches Ponca-Perry & Cloud triangles at SGP	
Flight hours to date		163.5		

We departed out of Guthrie IFR and climbed to 6000'. Bases were 3500, tops 4500, second layer bases 5000' tops 5500'. Solid overcast.

We proceeded to just west of Ponca City and did the full approach into Perry. Tops were 5300 bases 3000. On the missed Bases were 3400 tops 5500'.

We climbed up to 6000' again and cancelled the IFR and proceeded to begin the triangles.

We did the first triangle at 6500 because 6000 wasn't available.

Triangle #1 6500' Winds were 340/22

Leg #1 1902

Leg #2 1911

Leg #3 1923.

Triangle #2 6000' Winds 330/24

Leg #1 1937

Leg #2 1946

Leg #3 1958

We couldn't get lower due to traffic in the area. We took a descent towards Ponca City to get below the clouds. Tops were 5200 bases 3500'.

Triangle #3 3500', bases were at 4000'. Winds 320/20.

Leg #1 2037

Leg #2 2046

Leg #3 2059

We did a spiral from 4000' to 1500' and came home at 3500'. There was no chance we were going to get to operate in the clouds today. There was too much IFR traffic in the area.

## Weather Summary

Cloudy and solid overcast skies.

## Aircraft Instrumentation Status

DLH ran fine today.

The 2D-S shut off twice (not sure why) but start right back up.

## Surface Instrumentation Status

nothing to report

## Flight Images



1801 UTC



1805 UTC



1851 UTC



1803 UTC



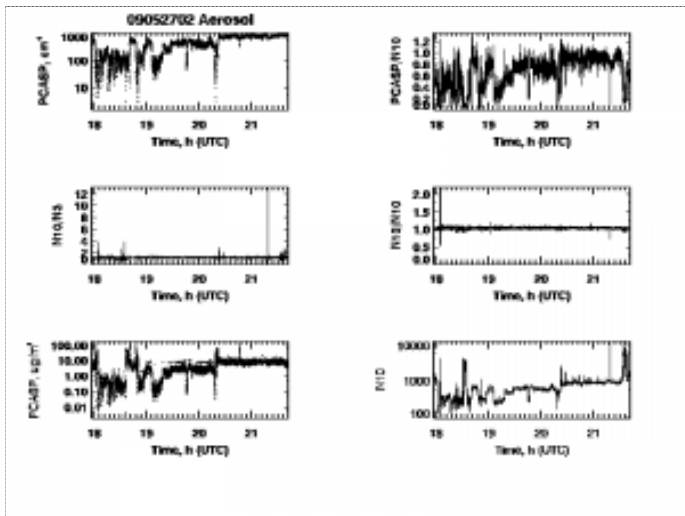
1808 UTC



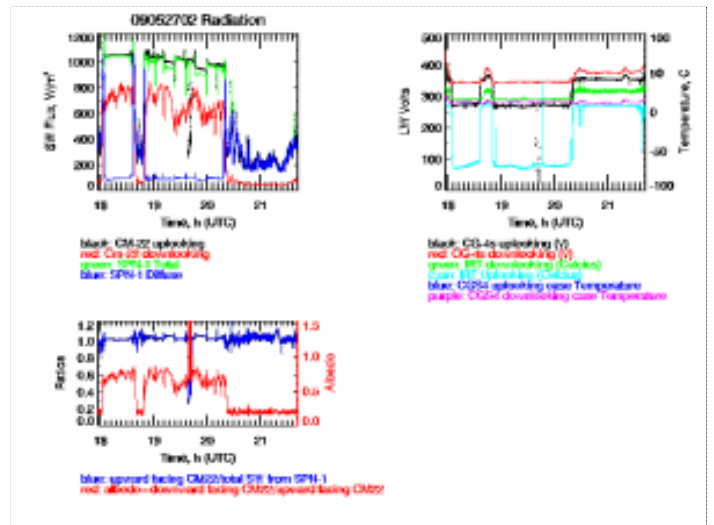
2023 UTC

## Flight Plots

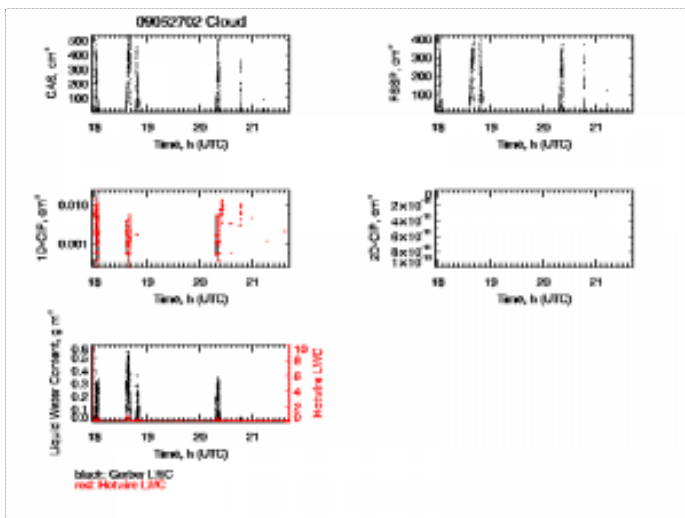
### Aerosol



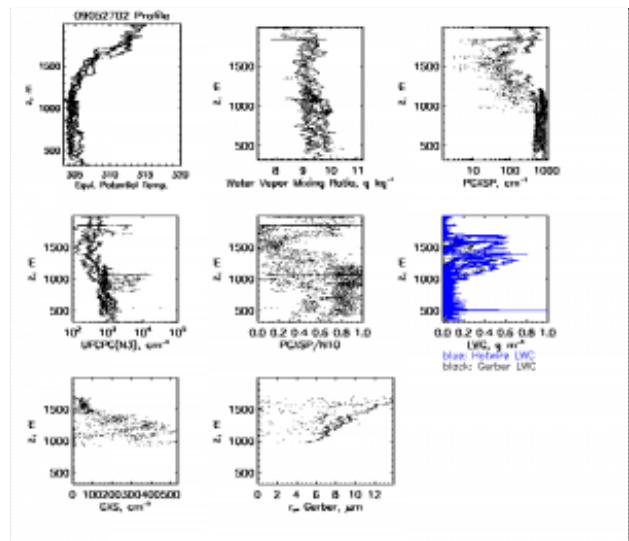
### Radiation



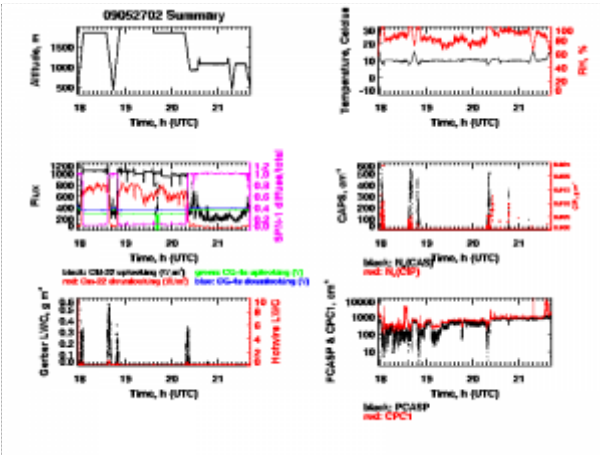
### Cloud



### Profile

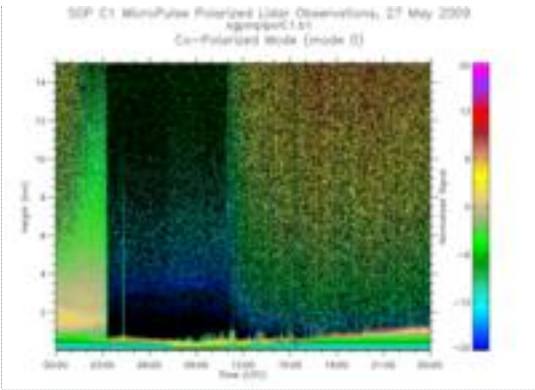


# Summary

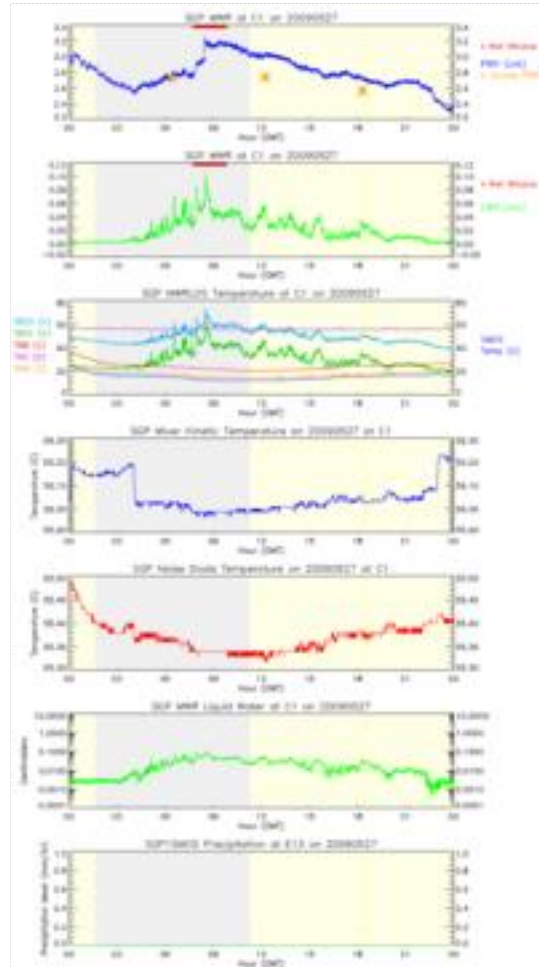


# SGP Plots

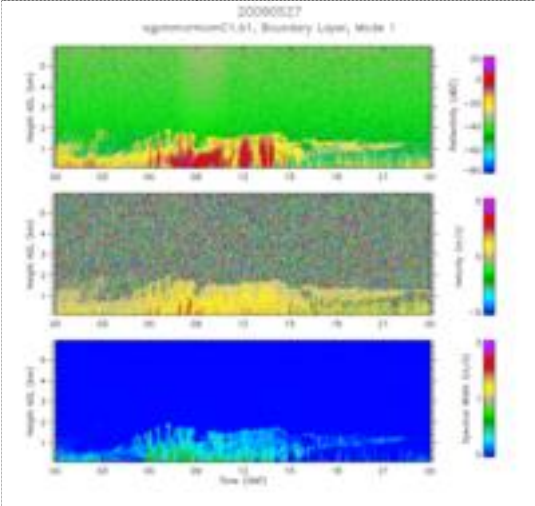
## MPL Co-Pol



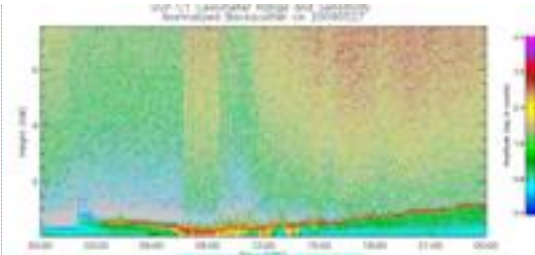
## Microwave Radiometer



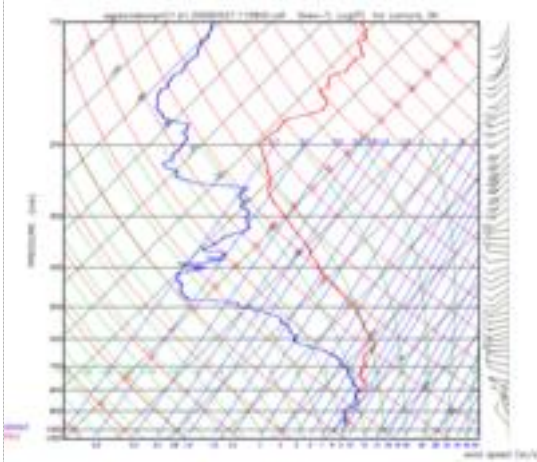
## MMCR Bound. Layer Mode



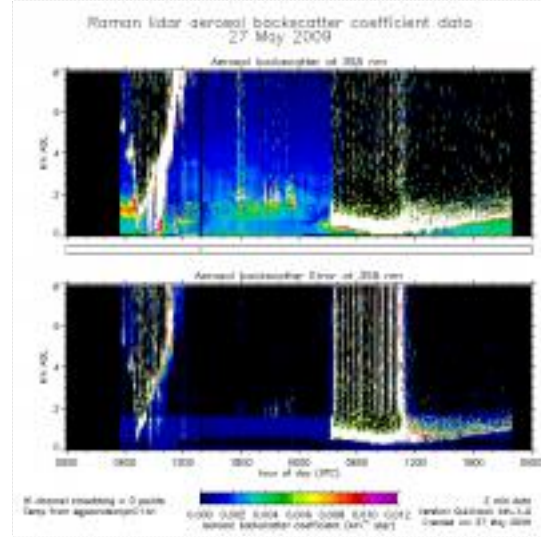
## Ceilometer Backscatter



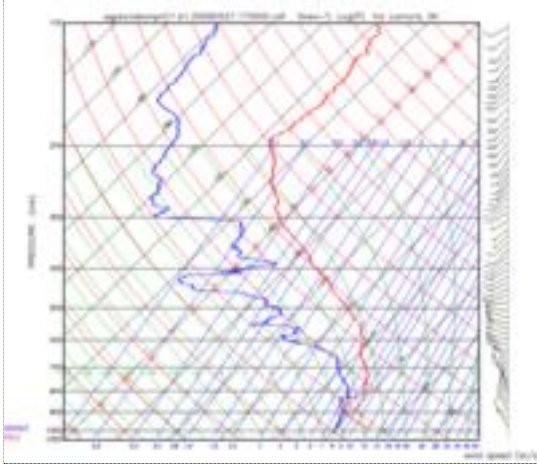
SONDE (11:30)



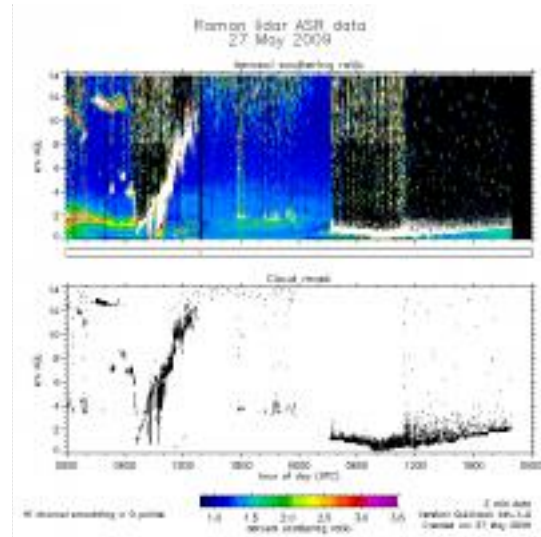
RL Backscatter



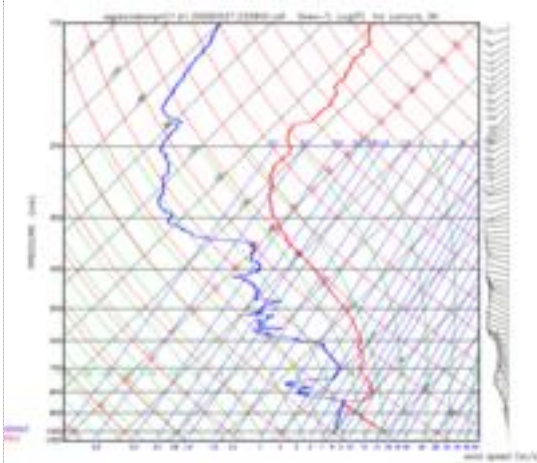
SONDE (17:30)



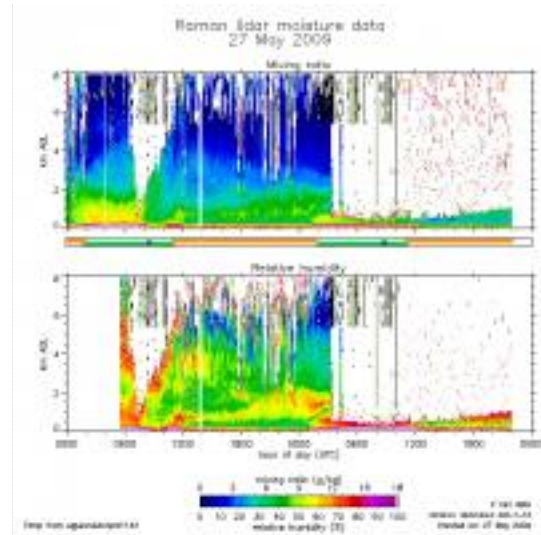
RL ASR



SONDE (23:30)



RL Moisture

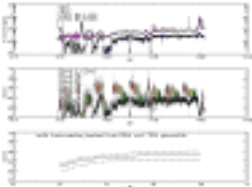




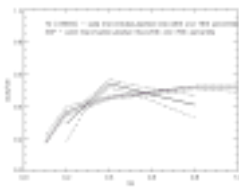
## CCN Activity

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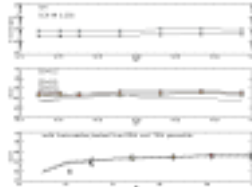
I've generated plots indicative of CCN activity from the Twin Otter CABIN and CCN files (i.e. CCN/CN as f(SS)). I've also generated time series plots showing CN concentration and scattering at the ground (i.e. at SGP) and CCN fraction measured at the surface so one can compare with that measured aloft. Elisabeth Andrews - 17 Jun 2009



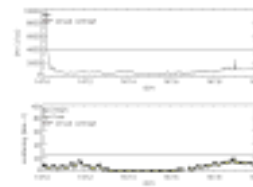
plot of CN and CCN and CCN/CN ratio as f(SS) from twin otter



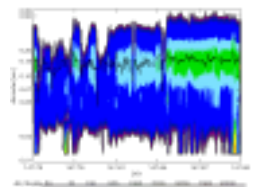
comparison of CCN fraction on twin otter and at SGP



plot of CN and CCN and CCN fraction at SGP

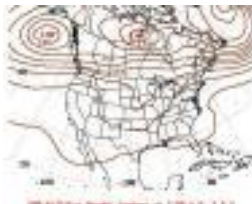


time series of CN and light scattering at SGP



TAMU DMA size distribution and CCN activation diameter

## Weather Maps

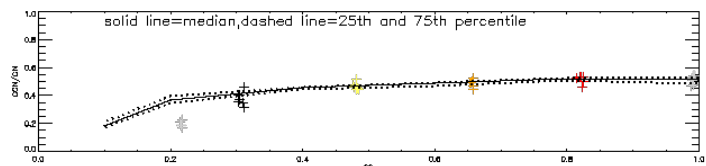
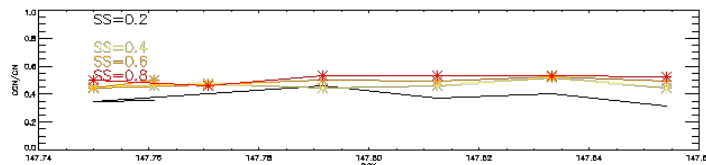
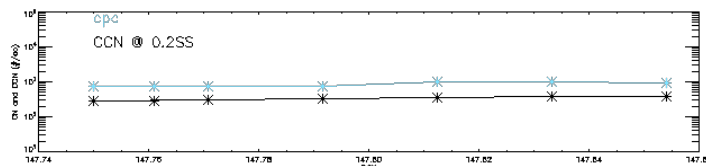


map-5272

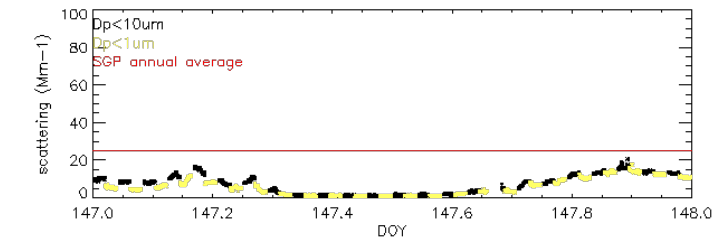
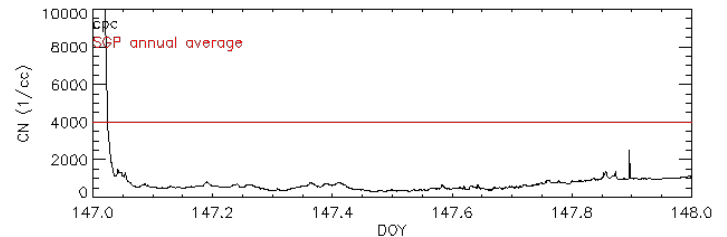


OK City: Scattered; 3-7 knots | Tulsa: 1/8 cloud coverage; 3-7 knots; 1045 mb | 79 F/63 F | In cold front

## Comments



plot of CN and CCN and CCN fraction at SGP



time series of CN and light scattering at SGP

# 20090530

## Flight Summary

Depart	Return	Hours	Synopsis	Google Earth
16:57 UTC	22:27 UTC	5.5	Aerosol long-leg variability & Turbulence at SGP	[ NONE ]
Flight hours to date		169.0		

We departed Ponca City and climbed to the CF. BL was ~5000'. We continued the climb to 6000' and did a spiral over the CF to 1500'.

We did two 100 nm legs aligned with the wind.

The first leg started was downwind. Winds were 240/11 shifting to 260/14 along the leg. Times were 1725-1813.

The second leg was back to the CF upwind tracking 249. The winds were 250/15. Times 1815-1916.

Back at the CF we began the turbulence legs.

Leg # 1 2000', winds 240/15; time 1922Z Downwind

Leg # 2 2400', winds 245/16; 1940Z, Upwind

Leg # 3 2800', winds 245/12; 2002Z, DW

Leg # 4 3200', winds 240/17; 2021Z, UW

Leg # 5 3600', winds 240/11, 2041Z, DW

Leg # 6 4000', winds 235/14; 2100Z, UW

Leg # 7 4400', winds 220/16, 2120Z, DW I think the winds were off on this leg.

Leg # 8 4800', winds 235/20, 2141Z, UW

Back over the CF we climbed to 8500 and did a spiral descent to 1500' at 2203.

We RTB's at 2215 and 2500'.

No issues with the plane.

## Weather Summary

Clear skies.

## Aircraft Instrumentation Status

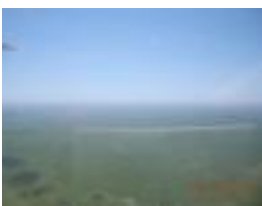
DLH would not turn on. Jesse has called Glenn.

CPCs and PCASP drop out last hr of flight.

## Surface Instrumentation Status

Nothing to report

## Flight Images



1749 UTC



1749 UTC



1801 UTC



1806 UTC



1806 UTC



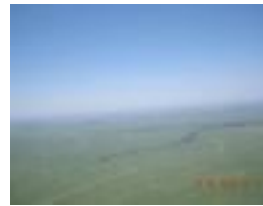
1808 UTC



1838 UTC



1840 UTC



1846 UTC



1912 UTC



1926 UTC



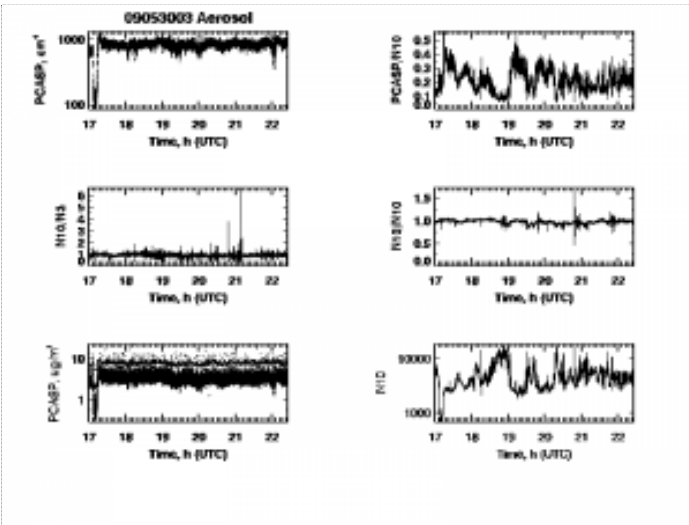
1937 UTC



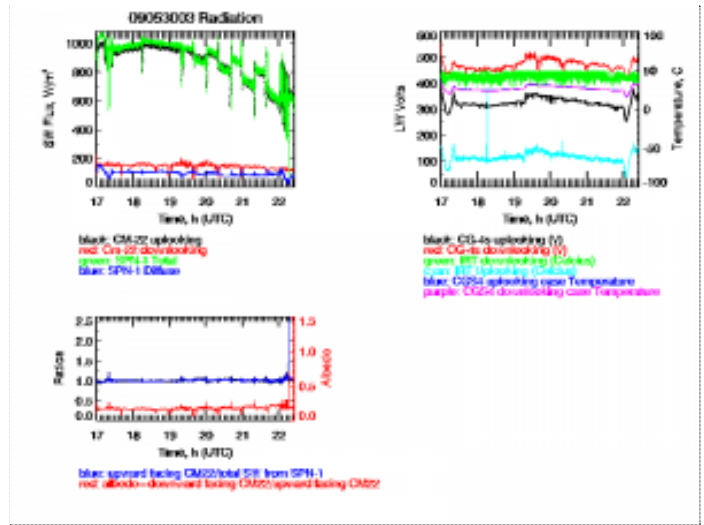
2055 UTC

## Flight Plots

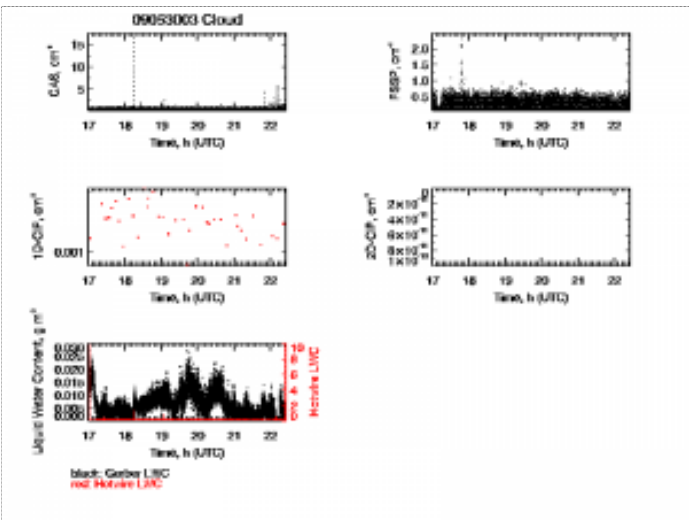
### Aerosol



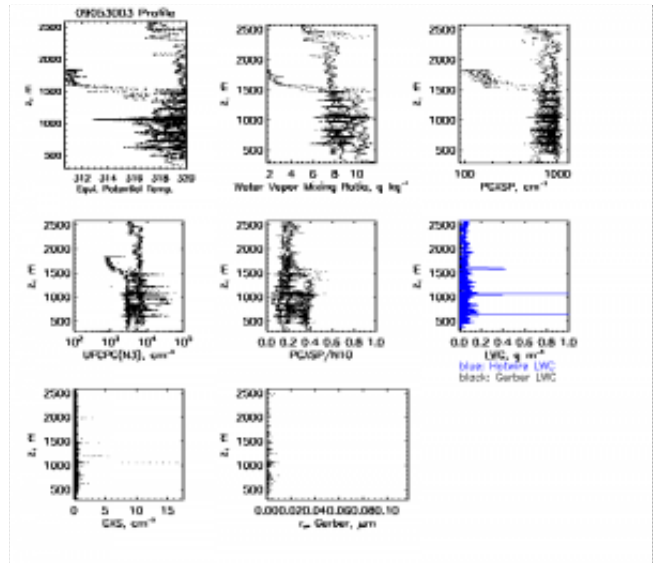
### Radiation



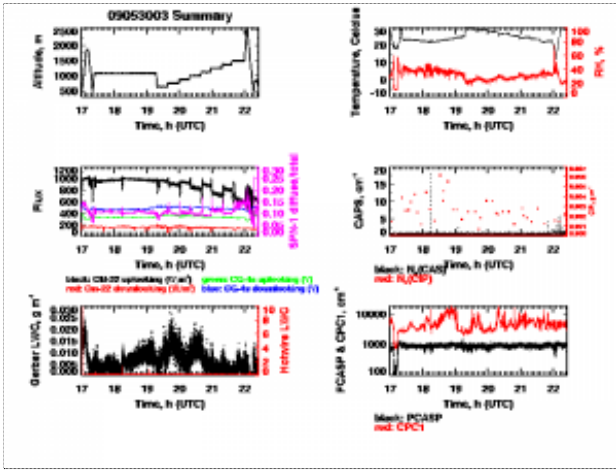
### Cloud



### Profile

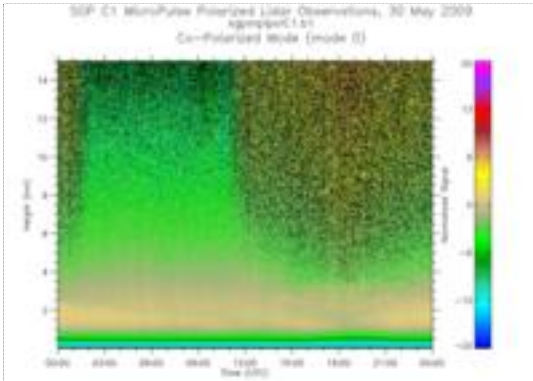


# Summary

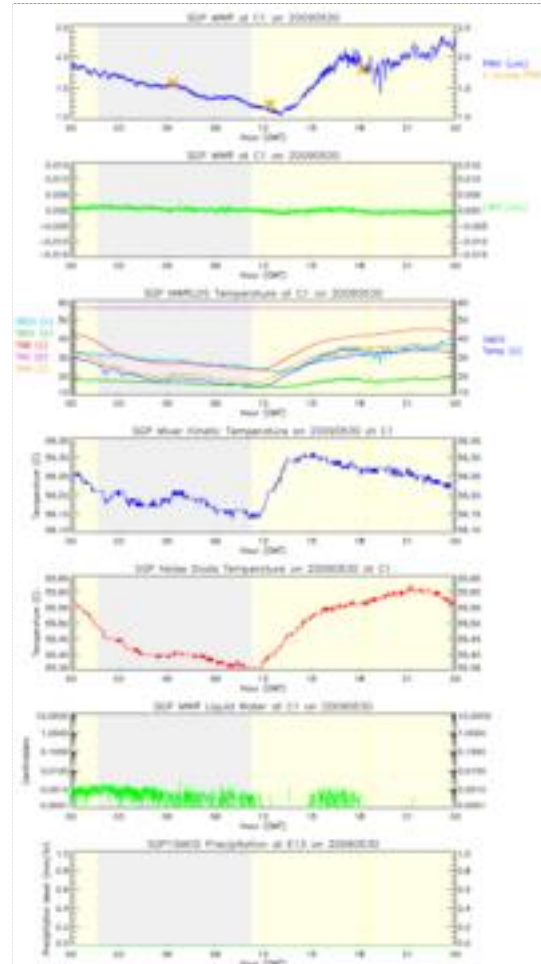


# SGP Plots

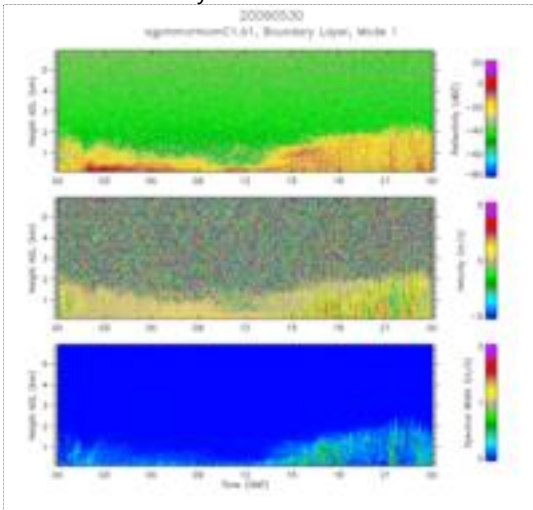
MPL Co-Pol



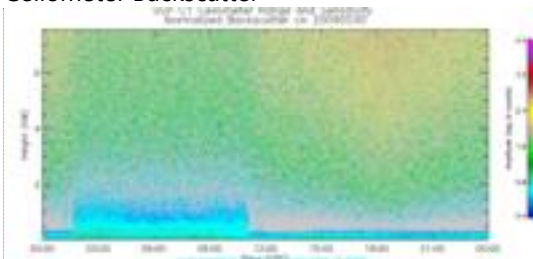
Microwave Radiometer



MMCR Bound. Layer Mode

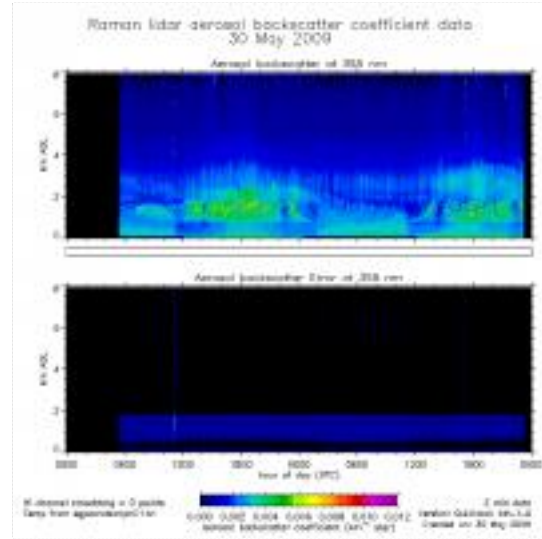
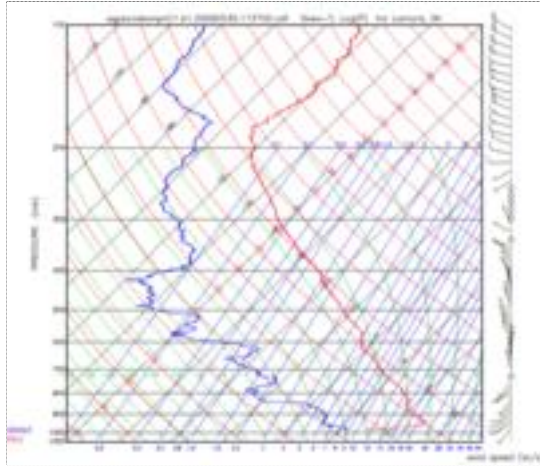


Ceilometer Backscatter

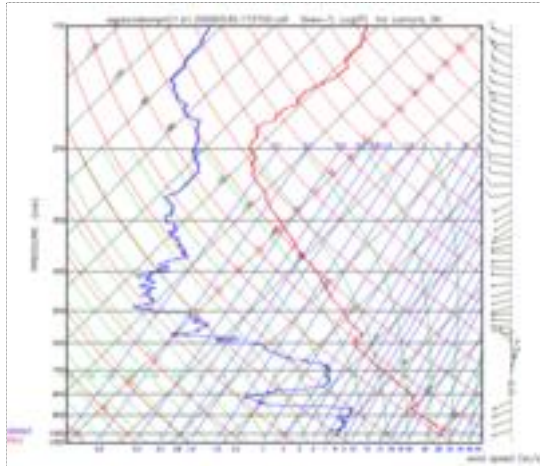


RL Backscatter

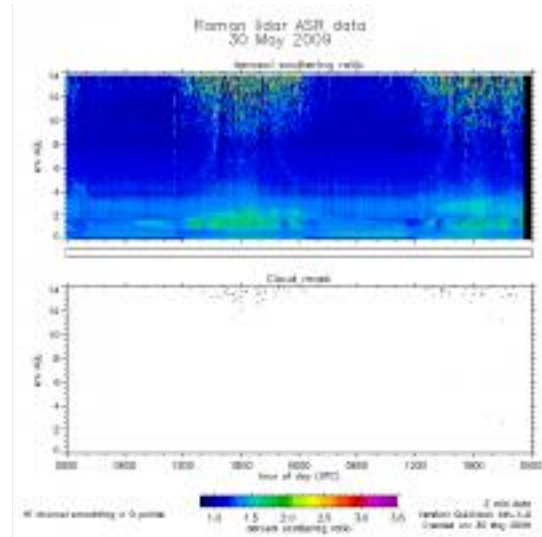
SONDE (11:30)



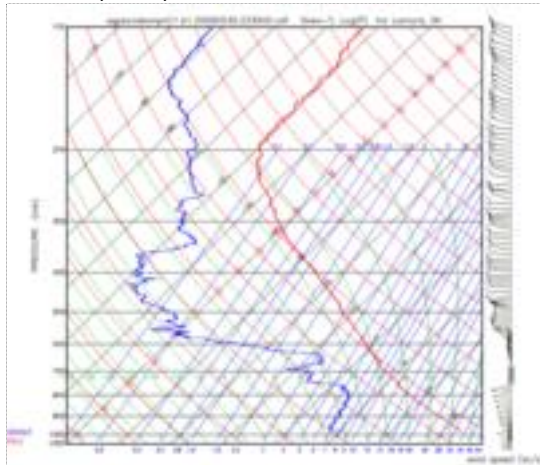
SONDE (17:30)



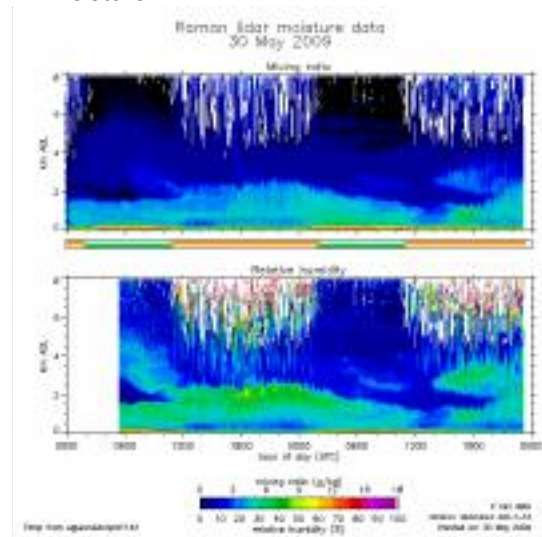
RL ASR



SONDE (23:30)



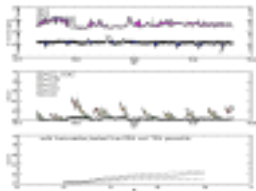
RL Moisture



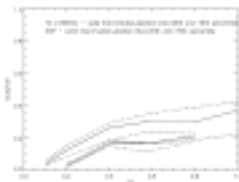
## CCN Activity

I've made size distribution contour plots from the DMA operated by TAMU on the Twin Otter. These plots are overlaid with a line indicating the CCN activation diameter at 0.2% SS based on the CCN measurements on the Twin Otter. To do this, I cumulatively summed the DMA number concentration backwards from largest to smallest diameter bin. I identified the bin diameter where the cumulative summed concentration was closest to the measured CCN concentration and chose that as the CCN activation diameter. Elisabeth Andrews - 17 Jun 2009

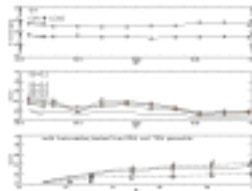
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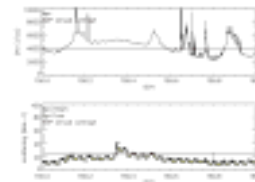
plot of CN and CCN and CCN/CN ratio as f(SS) from twin otter



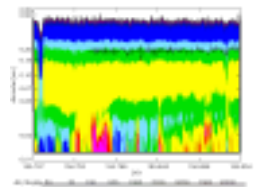
comparison of CCN fraction on twin otter and at SGP



plot of CN and CCN and CCN fraction at SGP



time series of CN and light scattering at SGP



TAMU DMA size distribution and CCN activation diameter

## Weather Maps

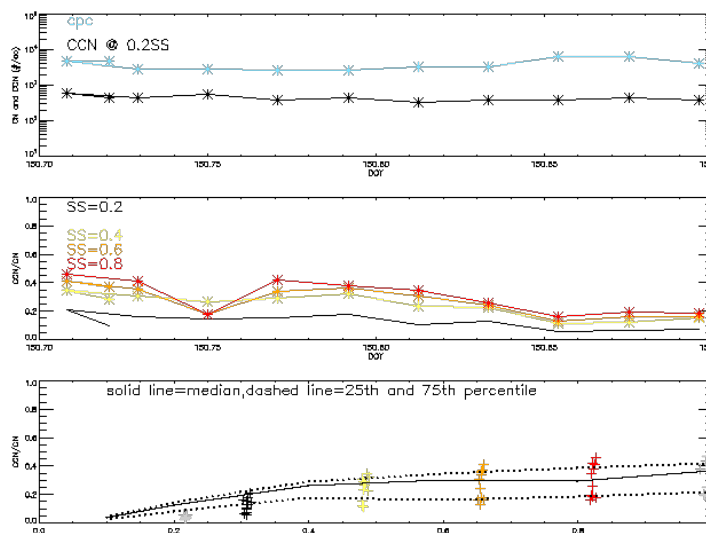


map5302

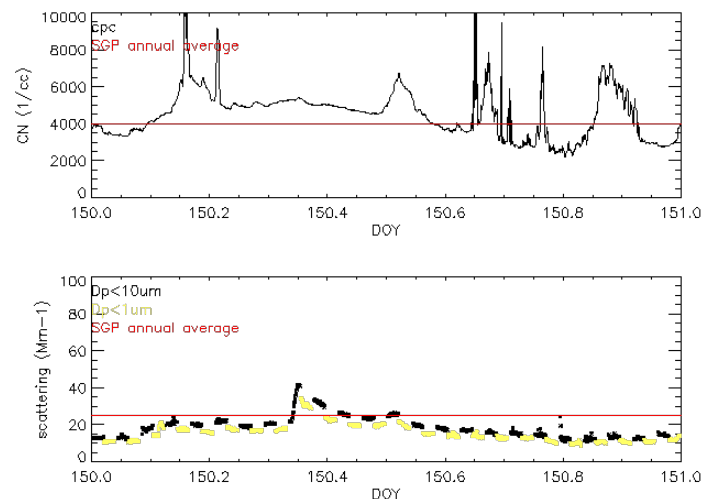


Both OK City and Tulsa: Clear, calm winds; 1149 mb | 85 F/49 F | High pressure

## Comments



plot of CN and CCN and CCN fraction at SGP



time series of CN and light scattering at SGP

# 20090531

## Flight Summary

Depart	Return	Hours	Synopsis	Google Earth
16:57 UTC	22:06 UTC	5.2	Aerosol long-leg variability & Turbulence at SGP	<a href="#">KML</a>
Flight hours to date		174.1		

We climbed out of Ponca City to 8000' towards the CF. Over the CF we descended from 8000' to 1500'. Top of the BL was ~ 7500'

We did our first 100nm leg at 3500'. Downwind heading was 035 and the winds were 215/18. They stayed steady throughout the leg. Times were 1743Z-1821Z.

The upwind altitude was 4500' and the heading was 215. The winds were the same direction 215/15. Time were 1823Z-1925Z.

Back at the CF we began the turbulence legs.

Leg # 1 2000'; winds 190/17; 1931Z Downwind

Leg # 2 2800'; winds 200/15; 1949Z Upwind

Leg # 3 3600'; winds 200/12; 2012Z DW

Leg # 4 4400'; winds 190/20; 2032Z UW

Leg # 5 5200'; winds 215/15; 2055Z DW

Leg # 6 6000'; winds 200/15; 2135Z UW

Back at the CF we climbed to 8500' and did a spiral to 1500. Time 2135.

We RTB'd @ 2149Z and 2500'.

## Weather Summary

Clear skies.

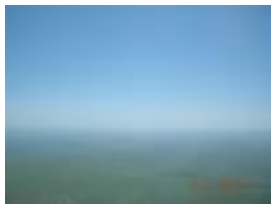
## Aircraft Instrumentation Status

No DLH data.

## Surface Instrumentation Status

nothing to report

## Flight Images



1844 UTC



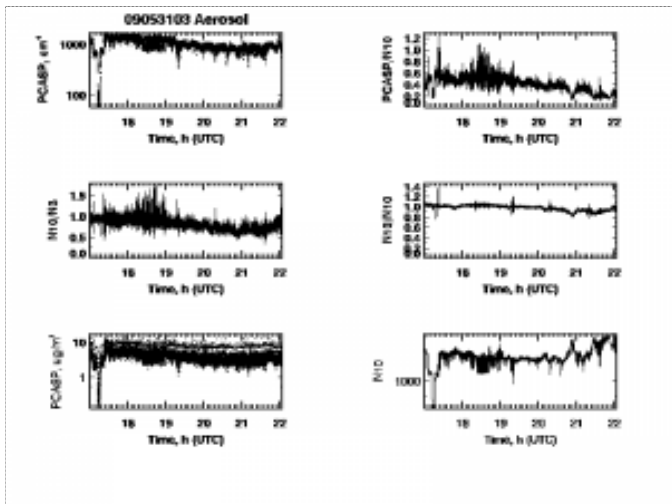
2122 UTC



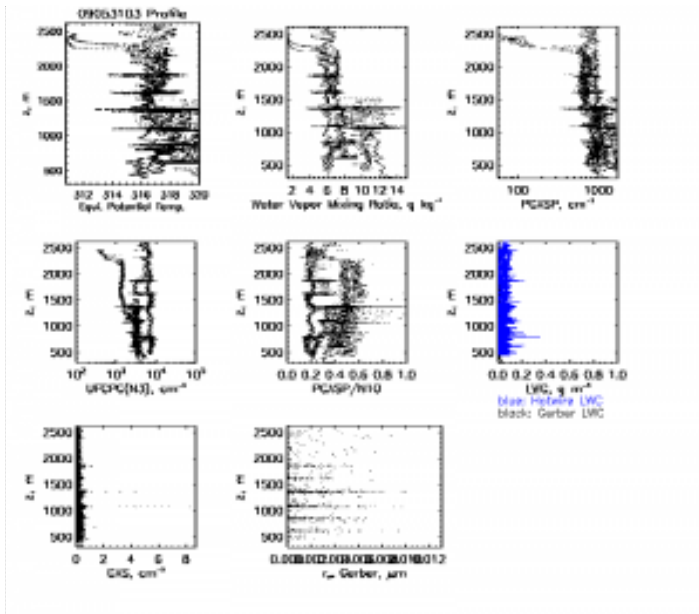
2123 UTC

# Flight Plots

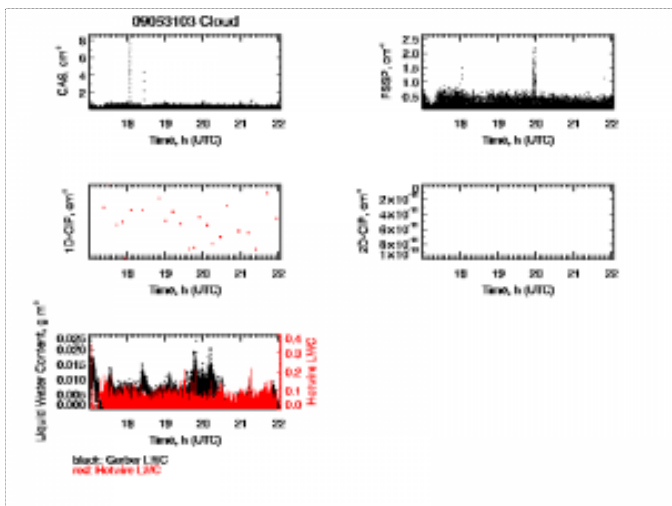
## Aerosol



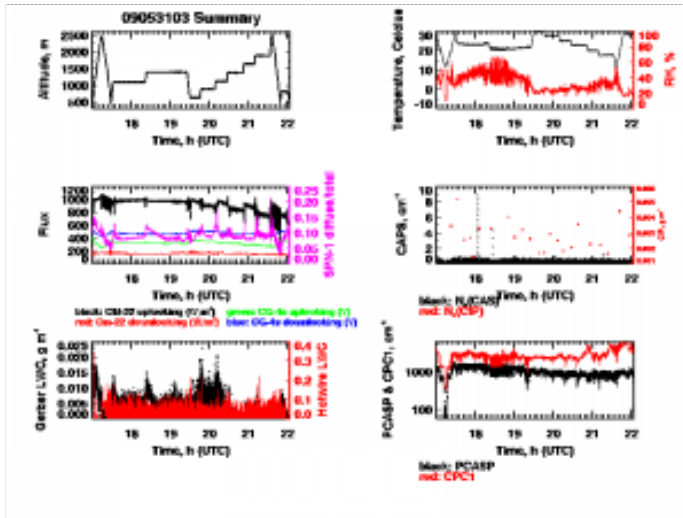
## Profile



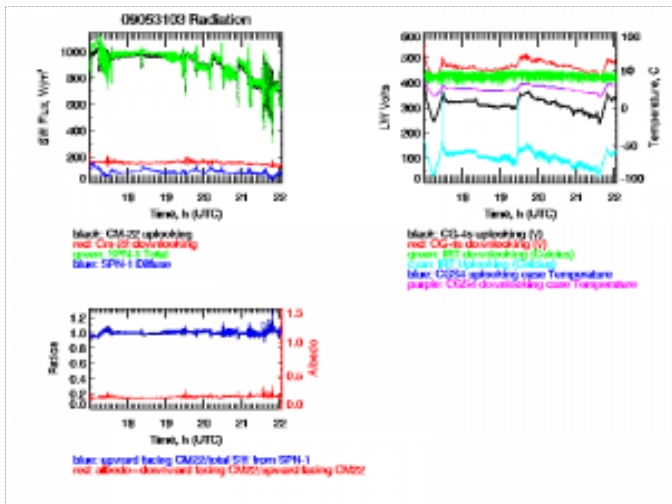
## Cloud



## Summary



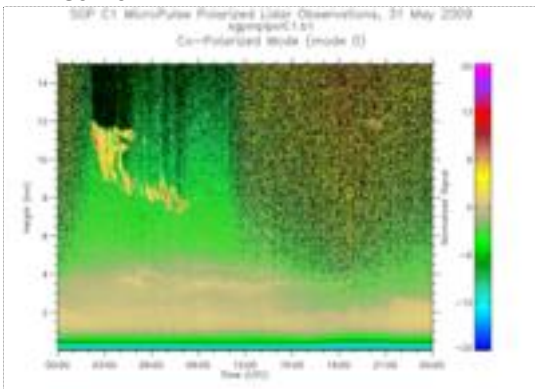
## Radiation



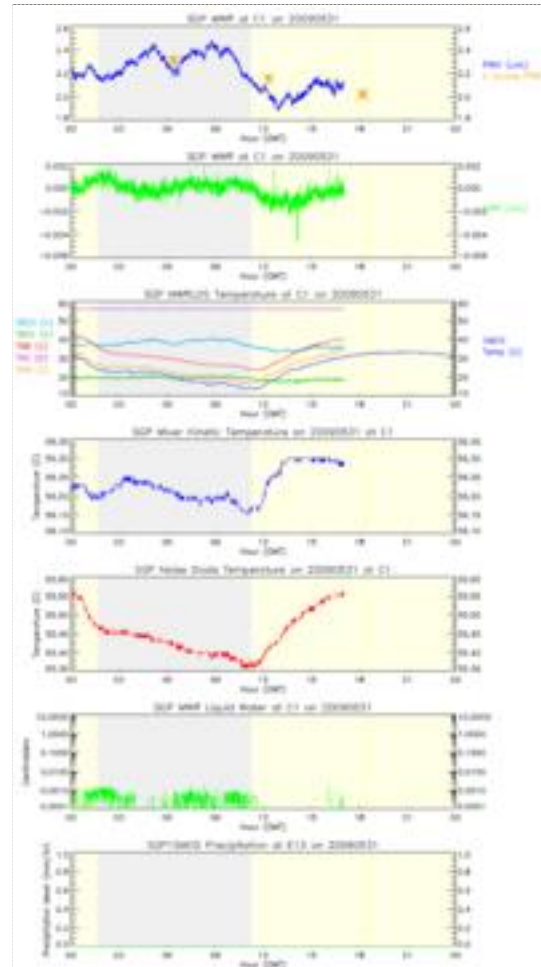


# SGP Plots

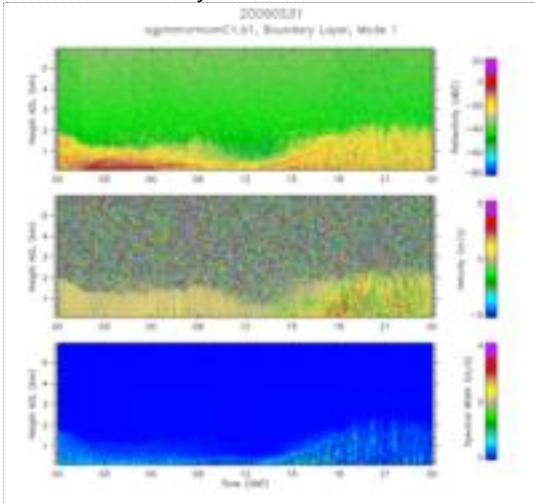
MPL Co-Pol



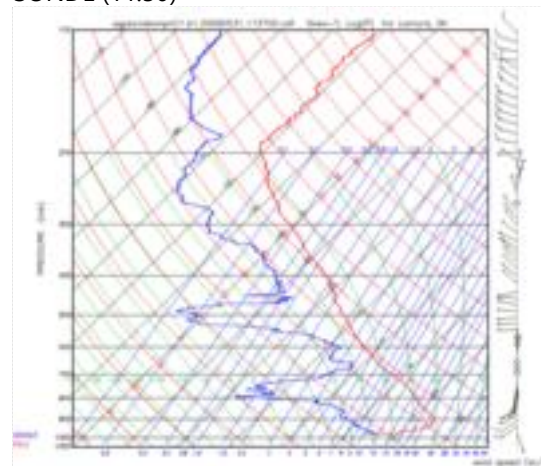
Microwave Radiometer



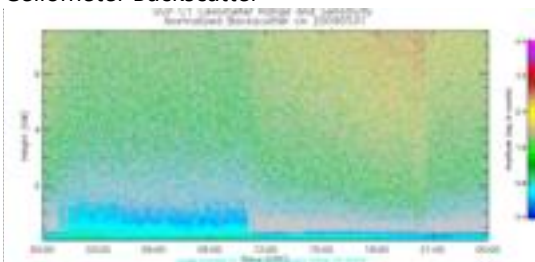
MMCR Bound. Layer Mode



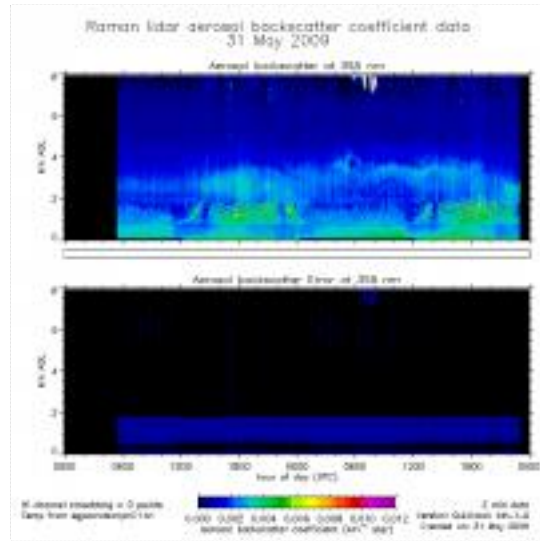
SONDE (11:30)



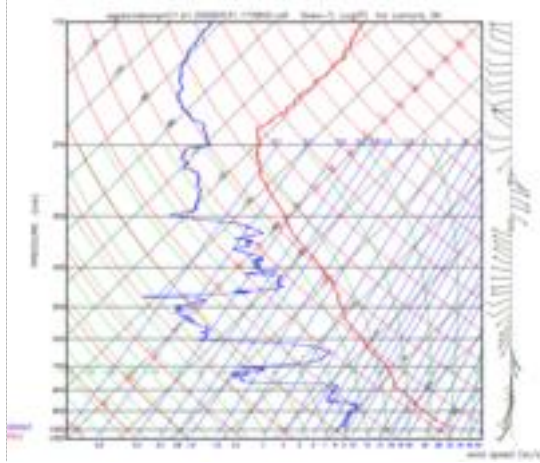
Ceilometer Backscatter



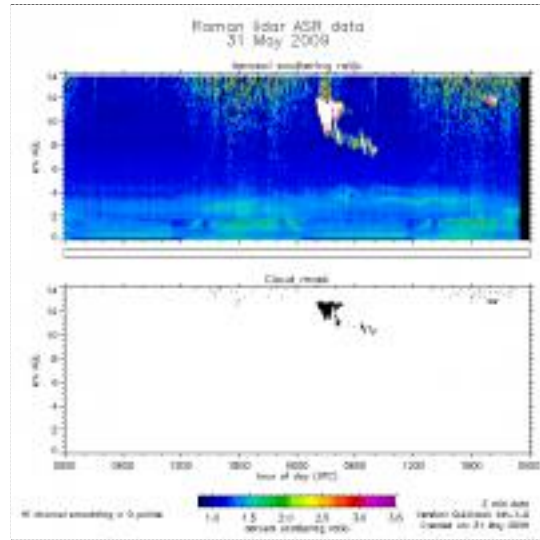
RL Backscatter



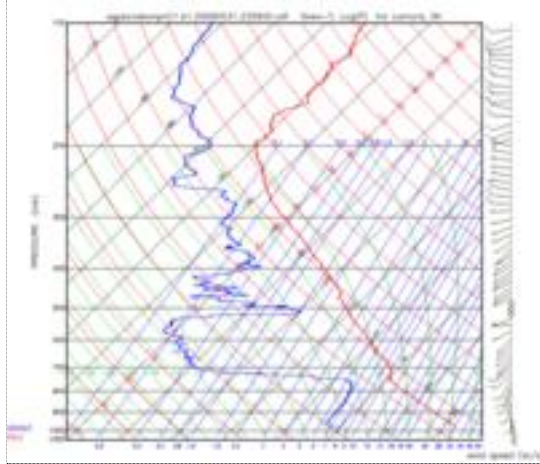
SONDE (17:30)



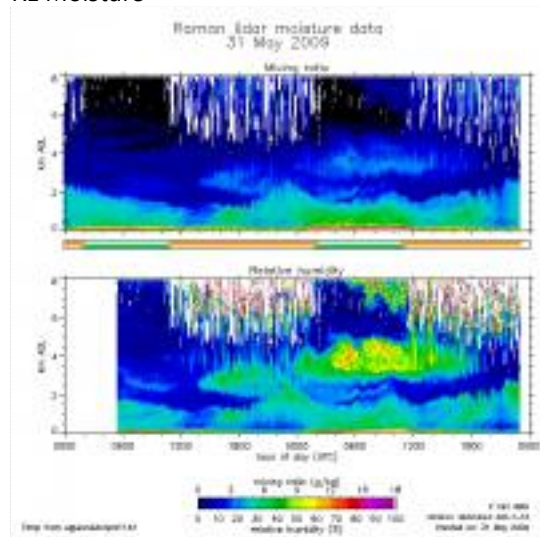
RL ASR



SONDE (23:30)



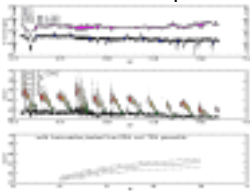
RL Moisture



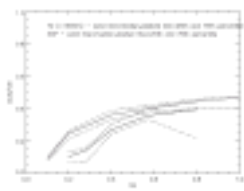
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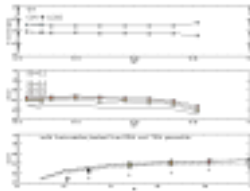
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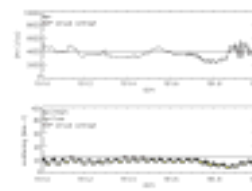
plot of CN and CCN and CCN/CN ratio as f(SS) from twin otter



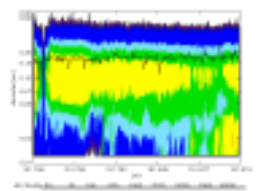
comparison of CCN fraction on twin otter and at SGP



plot of CN and CCN and CCN fraction at SGP



time series of CN and light scattering at SGP



TAMU DMA size distribution and CCN activation diameter

## Weather Maps

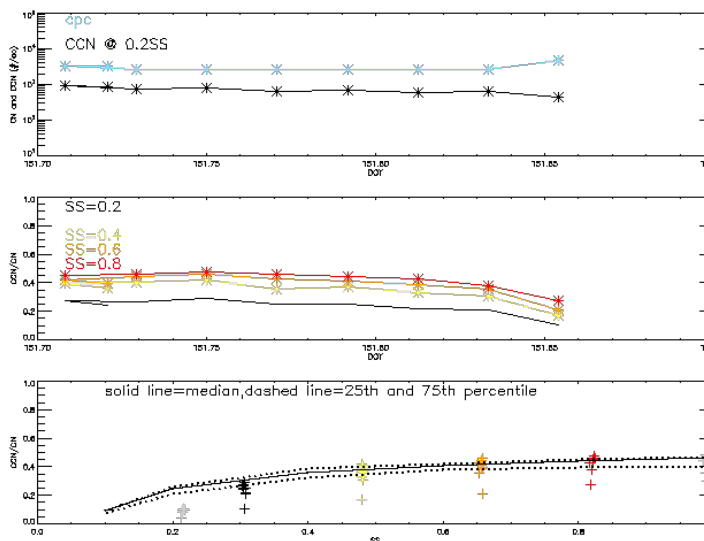


map5312

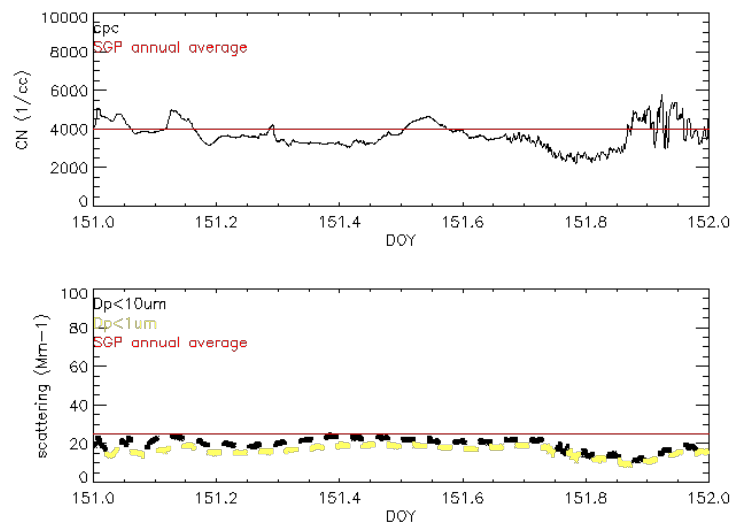


OK City: 1/8 cloud coverage; 3-7 knots | Tulsa: Clear; 3-7 knots; 1111 mb | 86 F/56 F

## Comments



plot of CN and CCN and CCN fraction at SGP



time series of CN and light scattering at SGP