



University of Wyoming Inhibition of Snowfall by Pollution Aerosols ISPA 2009

December 1, 2009 - December 19, 2009

Photo courtesy of Vanda Grubisic; DRI

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Date	Flight # (*kml)	Status	Times (UTC)	Hours	Crew/Notes
Dec 19	RF08	Stacks near Steamboat and Montrose.	1559-2015 2100-2214	4.4 1.4	T Drew D Ward L Oolman
Dec 18	RF07	Clouds in the Steamboat area. Flew near Cortez first. Flew a stack near Steamboat on return flight.	1647-1944 2124-0036	3.0 3.3	T Drew D Ward L Oolman
Dec 17	RF06	Clouds in the Steamboat area. Flew near Cortez first. Did a low pass in the smog near Shiprock. Flew four levels near Steamboat on the second flight.	1607-1858 2049-2340	3.0 3.0	T Drew D Ward N Mahon L Oolman
Dec 15	RF05	Flew west of Steamboat and near Cortez. File size exceeded on first flight, data split into two parts.	1601-2020 2139-2308	4.5 1.5	T Drew D Ward L Oolman

Dec 11	RF04	Flew west of Steamboat and near Cortez. Clouds near Cortez prevented flying higher than 10,500 feet.	1727-2138 2251-0027	4.3 1.7	T Drew D Lerach D Ward L Oolman
Dec 10	RF03	On Jeff Snider's advice, we lengthed the amount of time at each level to get better CCN statistics. This was done by either flying each leg twice or flying longer legs. We flew only the Steamboat stack. The system disk drive filled. Landed in Montrose to sort it out. Also, a thermocouple on the CCN had a broken wire. Cancelled the remainder of the flight.	1625-1925 2044-2230	3.4 1.9	T Drew D Ward P Wechsler M Burkhart
Dec 05	RF02	Flew near Steamboat and Cortez. Had problems with the CCN on the ferry to Cortez. Landed and flew the stack after refueling. Was probably starting to have problems with the thermocouple.	1606-1914 2016-2228	3.3 2.3	T Drew D Ward B Cotton L Oolman
Dec 03	RF01	Two stacks, near Steamboat and near Montrose.	1705-2106 2157-2314	3.3 1.4	T Drew D Ward P Wechsler L Oolman
Total Flight Hours			45.4		

ISPA RF08

19 December 2009

1559-2015 Z (4.4 hours)

2100-2214 Z (1.4 hours)

Larry Oolman flight notes.

Crew: Tom Drew, Dan Ward, Larry Oolman

Stacks near Steamboat and Montrose.

Take off.

First Flight

1559

1602 FL105.

1622 FL115. Over Storm Peak

1627-1634 FL090. CPC 800 to south, 1400 north end.

1636-1644 FL090. 5 ppm spike in CO2

1645-1652 FL100. CPC 600 south, 1200 north.

1654-1702 FL100. Spikes in CPC up to 1800.

1702-1707 Wet CCN pad.

1708-1720 FL115. CPC 270 and quite constant.

1722-1732 FL130. CPC 270.

1734-1745 FL150. CPC higher, around 500.

1749 FL100. Heading towards Meeker.

1752-1801 Wet CCN pad.

1834 FL105.

1838 FL105. Single CPC spike to 1700.

1846-1958 FL080. Near Montrose. CPC 600-1600. Winds light.

1900-1911 FL090. CPC around 325.

1913-1924 FL105. CPC around 270.

1924-1927 Wet CCN pad, adjust base line.

1928-1940 FL120. CPC 340.

1942-1953 FL140. CPC 300-400.

1956 FL105. Ferry to Montrose.
2015 Land at Montrose. CPC railed at 10000 coming in for landing.

Second Flight

2100 Take off from Montrose
2102 FL080
2113 FL100. CPC 275
2131 FL100. CPC < 100
2145-2148 Wet CCN pad and adjust baseline.
2156 FL135.
2214 Land at Laramie.

ISPA RF07

18 December 2009

1647-1944 Z (3.0 hours)

2124-0036 Z (3.3 hours)

Larry Oolman flight notes.

Crew: Tom Drew, Dan Ward, Larry Oolman

Clouds in the Steamboat area. Start with stack near Cortez and then fly stack near Steamboat in the afternoon.

First Flight

- 1647 Take off after sitting at the end of the runway for almost an hour waiting for the fog to lift.
- 1654 FL150. Ferry to Cortez. Dew point temperature below -50 C
- 1703 Pulled LWC100 breaker to see if it was causing noise in the first channel of the PCASP. It wasn't.
- 1718 FL120. At cloud base over Hayden.
- 1742 FL100. Near Grand Junction. VMC conditions
- 1803 Wet CCN pads.
- 1815-1825 FL080, first leg on stack near Cortez. CPC around 1200 and more uniform than previous days..
- 1827-1840 FL090, CPC similar.
- 1842-1852 FL105, CPC 300 to 450
- 1855-1907 FL120, CPC 300
- 1909-1919 FL140, CPC 300 to 400 with spikes over 1400.
CCN pad fell and baseline was too low after wetting.
- 1921-1933 FL140, Repeat this level.
- 1944 Land at Cortez

Second Flight

- 2124 Take off from Cortez
- 2125 Adjust CCN baseline from -8.8 to -7.4 V
- 2127 FL100. Start CCN.
- 2133 FL100. Spikes in CPC from 300 to 1000, associated with 2 m/s wave.
- 2205 FL100. North of Grand Junction, spike in CPC to about 5000. CPC remains elevated 1500-2500.
- 2224 Drop to FL095 at Meeker to stay below the clouds. CPC around 6000
- 2228 Wet pad. Downwind of Craig. CPC peaks over 8000. CO2 up to 10 ppm higher.

2237 By Hayden. single peak in CO2 to over 440 ppm. CPC peaks at 1800.
2244-2251 FL090. Start of stack near Steamboat. North end more polluted than south end with CPC over 7000
2253-2301 FL090
2302-2309 FL100 after clearing clouds.
2312-2321 FL100. CPC spike to almost 10000 at beginning of track. Intercept own exhaust?
2323-2332 FL120 climbing to FL122 to clear clouds. CPC 450-1200.
2334-2346 FL140. CPC mostly around 350.
2347-2354 Wet pad.
2355-0007 FL160. CPC around 300, dew point temperature -50 C.
0000-0002 FL160. Maneuver for close aircraft.
0008 FL150. Starting back to Laramie.
0035 Land.

ISPA RF06

17 December 2009

1607-1858 Z (3.0 hours)

2049-2340 Z (3.0 hours)

Larry Oolman flight notes.

Crew: Tom Drew, Dan Ward, Nick Mahon, Larry Oolman

Clouds in the Steamboat area. Start with stack near Cortez and then flyh stack near Steamboat in the afternoon.

First Flight

1607 Take off
1613 FL160.
1641 FL120.
1652 FL105. South of Meeker
1727-1732 Wet CCN pads.
1734-1745 FL080, first leg on stack near Cortez. CPC 1100 with spikes almost to 3000 in north half of line.
1677-1800 FL090, CPC 200-800, higher and more variable to north.
1802-1812 FL105, CPC 300 to 450
1814-1826 FL120, CPC 350 to 650
1828-1838 FL140, CPC 280 to 380
1842-1850 FL060, Drop into the smog in New Mexico, CPC to 6000, CCN detector voltage railed at 10V, PCASP concentration over 1600.
1858 Land at Cortez

Second Flight

2049 Take off from Cortez
2051 FL100
2133-2144 Wet pads.
2204-2211 FL090, near Steamboat. CPC highly variable 700-4500.
2212-2218 FL090, CPC highly variable 350-3700.
2220-2225 FL100, CPC highly variable 450-4000.
2226-2233 FL100, CPC highly variable 400-6000.
2243-2251 FL140, above clouds, CPC 300-400. CCN faults, restarted at 2245.

2303-2305 Wet pads

2309-2315 FL150, above clouds, CPC 300-400.

2315 FL150, ferry to Laramie.

2340 Land

ISPA RF05

15 December 2009

1601-2020 Z (4.5 hours)

2139-2308 Z (1.5 hours)

Larry Oolman flight notes.

Crew: Tom Drew, Dan Ward, Larry Oolman

Flew west of Steamboat and near Cortez. Lost some data during the middle of the first flight because the file size exceeded 4 GB. The data for this flight was split into two parts.

First Flight

1601 Take off
1603 FL105, ferry to Steamboat
1626 FL115, over Storm Peak.
1631-1638 FL090, CPC around 800 to the south to over 1200 to the north.
1640-1648 FL090
1649-1657 FL100, CPC 400 (south) to 1300 (north)
1559-1707 FL100
1710-1719 FL115, on longer track slightly west. CPC 300-400.
1721-1723 Wet CCN pads
1727-1730 FL130, disk file size exceeded. CPC about 500
1826 FL105, started new file on ferry to Cortez.
1907-1919 FL080. Near Cortez. CPC 650-2300.
1921-1934 FL090. CPC variable between 200-350.
1935-1947 FL105. CPC variable between 375-675.
1948-1959 FL120. CPC variable between 325-475.
2001-2012 FL140. CPC variable between 325-400.
2020 Land at Cortez

Second Flight

2139 Take off from Cortez, climb to FL115.
2231-2238 Wet pads
2250 FL135. Loose CCN in climb until 2257

ISPA RF04

11 December 2009

1727-2138 Z (4.3 hours)

2251-0027 Z (1.7 hours)

Larry Oolman flight notes.

Crew: Tom Drew, Dave Lerach, Dan Ward, Larry Oolman

Flew west of Steamboat and near Cortez. Attempts to eliminate noise from the heated inlet to the Licor were unsuccessful. Except for a short test, the heater on the inlet was left unplugged.

First Flight

1727 Take off
1729 FL105, ferry to Steamboat
1747 Heated inlet still causing noise on Licor, unplug it.
1753 FL115, over Storm Peak. Had to restart AV software.
1759-1806 FL100, CPC around 400 to the south to over 800 to the north.
1807-1815 FL100
1817-1824 FL090, CPC 550 (south) to 1100 (north)
1826-1833 FL090
1833-1836 Wet CCN pads
1836-1844 FL110, CPC 200-350
1846-1854 FL110, VDET on CCN shifts at 1850.
1859-1908 FL125, on longer flight track slightly to the west. CPC about 300
1910-1922 FL150, CPC 300-375
1924-1934 FL160, CPC 380-550
1938-2047 FL105, ferry to Cortez, occasional high spikes in the CPC (over 2000).
1934-1941 Wet CCN pads
2009-2013 Wet CCN pads, VDET on CCN looks strange.
2041-2045 Wet CCN pads
2051-2103 FL080. Near Cortez. CPC around 800 at ends of track and over 2000 in the center.
2105-2116 FL090. CPC variable between 450-1100. Cloud base FL100 north, higher to south. Thick haze in New Mexico.
2117-2129 FL105. CPC variable between 400-600. Tenuous virga at 2124. CCN reset itself 3 times on this leg.

2138 Land at Cortez

Second Flight

2251 Take off from Cortez, climb to FL115.

2257 FL105

2309 Descend to FL090 to stay out of clouds

2319 Pick up IFR to FL200

2345 Descend to FL150

0027 Land

ISPA RF02

5 December 2009

1601-1914 Z (3.3 hours)

2116-2228 Z (2.3 hours)

Larry Oolman flight notes.

Crew: Tom Drew, Dan Ward, Bill Cotton, Larry Oolman

Flew west of Steamboat and near Cortez. Left the heated inlet unplugged. Eliminated the noise in the Licor.

First Flight

1606 Take off
1609 FL125. Ferrying to Steamboat
1614 Descend to FL120
1628 Over Storm Peak Laboratory
1633-1640 FL100, CPC 650 to south, increasing to 900 to north.
1642-1651 FL120, CPC around 475.
1653-1701 FL140, CPC around 475.
1703-1711 FL160, CPC around 600.
1713-1720 FL180, CPC around 650.
1726 FL105, ferry to Cortez
1749 Unable to get CCN running correctly after wetting pads.
1914 Land at Cortez

Second Flight

2016 Take off from Cortez.
2020-2028 FL080, CPC around 1100 with spikes to 1600.
2029-2038 FL100, CPC around 1100.
2040-2047 FL120, CPC 400-600.
2049-2057 FL140, CPC 400-600.
2100 FL105, Ferry back to Laramie.
2130-2143 Wet CCN pads.
2213 FL135.

ISPA RF01

3 December 2009

1705-2106 Z (3.3 hours)

2157-2314 Z (1.4 hours)

Larry Oolman flight notes.

Crew: Tom Drew, Dan Ward, Perry Wechsler, Larry Oolman

Flew two stacks, west of Steamboat and near Montrose. There was significant noise in the Licor data. This was later determined to be from the heated inlet.

First Flight

1705 Take off
1801-1819 FL140, ferry to Steamboat
1819-1825 FL090, Start flight stack west of Steamboat. CPC around 1500 cm-3
1828-1836 FL110, Wet CCN pads prior to start of leg, CPC around 1300, over 2000 at north end
1836 FL123, cloud base
1838-1845 FL135, above clouds. CPC around 250.
1848-1856 FL150, CPC 250 at south end increasing to 450 at north
1859-1905 FL170, CPC varying between 300 and 650 cm-3
1859-1905 FL170
1911-1957 FL105, ferry to Montrose area. Wet pads and adjust baseline at end of ferry
1958-2005 FL080, start of stack near Montrose. CPC 2400 at north, spikes over 6000 near south end of line
2007-2015 FL100. CPC similar as last leg
2017-2024 FL120. CPC more variable
2026-2034 FL140. CPC around 350 cm-3
2037-2043 FL160. CPC around 400.
2106 Land at Montrose

Second Flight

2157 Take off from Montrose.
2207 At FL100
2209 Climb to FL105
2252 Climb to FL135. Put CCN in bypass to see if noise in Licor goes away - it didn't

2301-2302 In thin cloud.

2314 Land