Stratus early in flight before line sampling

Below: Cloud line studied for 1\textsuperscript{st} objective

Detrainment region of the cloud line

Below: The Barbuda tail sampled for the 2\textsuperscript{nd} Objective
General cloud characteristics:

Initially during the flight there was a large field of stratus. One deck was between 6000 and 8600 ft and the second was near 11000 ft. There appeared to be no breaks at all in the stratus. Further out from Barbuda, breaks in the stratus appeared and a distinct line of convection developed to the northeast of Barbuda. This line became the target for the line sampling pattern for the C-130. The line persisted during and beyond the flight pattern for this first objective. Following the sampling of this line, the flight was diverted to study the Barbuda tail. Although no distinct tail was noted on the radar, the tail was very evident visually and had several rainshafts as well as a funnel cloud. Overlying stratus was present in the vicinity of the tail. The tail was sampled for the remainder of the flight.
**General Comments:**

There were three principal objectives for the student flight, namely: 1) Intercomparison of aerosol characteristics with the Antiguan ground site; 2) Study of aerosol processing along a cloud line; 3) Study of Barbuda’s tail. Each of the objectives was successfully carried out.

**Overview of C-130 Flight Pattern:**

<table>
<thead>
<tr>
<th>Time (UTC)</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1113-1120</td>
<td>Fly by of ground sampling site (1500 ft)</td>
</tr>
<tr>
<td>1120-1146</td>
<td>Ferry out to 15,000 ft circle</td>
</tr>
<tr>
<td>1146-1300</td>
<td>Flying circle patterns (15,000 and 1500 ft)</td>
</tr>
<tr>
<td>1300-1310</td>
<td>Sampling at 300 ft with clear above</td>
</tr>
<tr>
<td>1310-1540</td>
<td>Line study</td>
</tr>
<tr>
<td>1540-1609</td>
<td>Ferry to Barbuda</td>
</tr>
<tr>
<td>1609-1815</td>
<td>Tail study</td>
</tr>
<tr>
<td>1815-1830</td>
<td>Aerosol sampling at 1500, 900, and 300 ft</td>
</tr>
<tr>
<td>1830-1850</td>
<td>Ferry to ground site</td>
</tr>
<tr>
<td>1850-1900</td>
<td>Fly by of ground sampling site (1500 and 300 ft)</td>
</tr>
<tr>
<td>1900-1913</td>
<td>Return to airport</td>
</tr>
</tbody>
</table>

**C-130 Flight notes: UTC time is used**

- 1052 Heavy rain shower at airport
- 1113 Takeoff
- 1118 Flying by ground sampling site (1500 ft altitude)
- 1124 Winds system down - Rebooting system
- 1124 Large area of stratiform rain present, located between 6000-8000 ft altitude – east edge = 57W, south edge = 17N, north edge = 20N
- 1125 Appears to be a dry layer impeding convection
- 1126 Broke out of stratiform clouds at 8600 ft; another stratus deck overhead
- 1130 Rainbow in clouds to west
- 1132 Rain on windshield
- 1134 Wind system up
- 1145 Rainbow below us
- 1146 Begin 15,000 ft circle (heading 270°)
- 1159 Radar echoes north of Barbuda, both to the east and west; tops around 6 km
- 1203 Radar echoes with 2.5 km tops as well
- 1203 West edge of stratus field at 63W
- 1203 Turbulence
- 1205 Sampling clouds poking through status layer
- 1205 Detrainment (downshear) side of clouds = ESE
- 1207 Cumulus below without stratiform
- 1218 Finished 15,000 ft circle
- 1219 Turbulence
- 1226 Line of cumulus to right of plane
1231 Starting second circle at 1500 ft (in clear air); Stratus are gone. Nice cloud line out ahead of us.
1239 Chemical concentrations are low: FSSP concentrations are 1/10 of normal levels. Winds are maximum of 3 m/s (closer to 2 m/s flight average) as compared to normal wind speeds of 10 m/s. Seas are glassy: low waves and no whitecaps.
1246 Turbulence. Clouds with precipitation.
1250 Gust front – wind changes just prior.
1250 Under Rainshafts – rain on windshield.
1253 Rain on windshield – cumulus with precip all around.
1300 Finished 1500 ft circle. Descending (at 500 ft/min) to 300 ft to fly beneath a clear area for 5 minutes.
1304 Line: NE end VOR 61˚, DME 62.9 nmiles. Orientation 060-240 magnetic.
1304 Now at 300 ft.
1309 Well mixed layer at 1000 ft.
1310 Ascend to 1500 ft at 500 ft/min.
1310 Line reorienting itself: heading closer to 45˚, direction 060-210 magnetic.
1312 Line to north with stratus.
1313 Line dead ahead – cross under line.
1318 Along side loud debris from line approximately just below cloud base.
1315 1100 ft mixed layer top; decrease (drop) in SO₂.
1319 VOR 5˚, DME 65.2 nmiles, heading 40˚, 18.21˚ N, 61.96˚ W.
1319 Jump in SO₂.
1320 Hit underside of cloud – some turbulence.
1321 Rain on windshield.
1323 Under cloud with good rainshaft – just below cloud base.
1324 Rain on windshield – passing through rainshaft.
1325 Turned to sample east side upshear of line.
1326 VOR 4˚, DME 62.8 nmiles, direction 040-200 magnetic.
1326 Ran alongside cloud line just at/above cloud base (1500 ft).
1329 Hit cloud patch at approximately the base.
1335 Turn – descend to 500 ft.
1337 Turned upwind, now below cloud base (500 ft altitude), on upshear side, sampling along cloud line.
1340 Rain on windshield.
1344 Rain on windshield.
1347 Turning around to sample rainshafts under the line, still at 500 ft altitude.
1350 Rain on windshield.
1354 Rain on windshield.
1402 Climbing to 1500 ft (at 500 ft/min) to fly through the cloud line (along line axis).
1405 Rain on windshield.
1410 Cloud base appears to be approximately 1000 ft.
1411 Rain on windshield.
1415 Climbing to 2500 ft at 500 ft/min.
1420 Sampling cloud line at 2500 ft.
1423 Rain on windshield.
1430 Climbing to 4500 ft and sampling cloud line
1436 Still in rain at 4500 ft
1440 Rain on windshield
1443 Heavier rain on windshield
1446 Can see cloud top near southwest edge of line
1447 Exit the line
1452 Swapping altitude blocks with the King Air. Sampling line at 6000 ft. Rain on windshield
1508 Climb to 8000 ft; break away from cloud line to double check direction of cloud top shear (confirm detraining region)
1512 Climbing to 10,000 ft, starting half way up line (smaller sample) to sample in cloud
1515 Rain on windshield
1519 Line orientation 065-250 magnetic. Possible island tail off Barbuda
1523 Sampling cloud line detraining region
1531 Rain on windshield – from stratus overhead
1540 Break Line study – ferry to Barbuda
1609 Arrive upwind of Barbuda to begin tail study
1610 Leg along east side of Barbuda at 300 ft
1614 Rain on windshield
1615 Turn north to do leg east of Barbuda at 1000 ft
1619 Finished 1000 ft leg east of Barbuda
1625 Turn south over Barbuda flying at 1000 ft
1630 Over Barbuda
1634 first small white caps of the day seen SW of Barbuda
1636 Northbound leg at 1000 ft west of Barbuda
1640 Rain on windshield
1645 Southbound leg at 300 ft west of Barbuda
1653 Funnel cloud emerging from the base of cloud along tail
1655 Turbulence under tail
1700 Turn north at 300 ft along line further west of Barbuda
1702 Passing under tail
1705 Turn south at 1000 ft
1711 Precipitation
1718 Turn north at 1000 ft further west of previous track
1720 Tail/stratiform clouds
1726 Turn south at 300 ft
1726 Aerosol on south side of tail much more variable and higher concentration than north side
1728 Slight turbulence
1730 Tail
1734 Turn at 1500 ft
1740 Rain on windshield
1745 Rain on windshield
1746 Rain on windshield
1747 Out west of Barbuda, strong cell to WSW
1750 Turn at 3000 ft flying along line
1755 Starting at Barbuda
1756 Rain on windshield
1758 Small tail to north of other tail
1801 Turn at 5000 ft – clipped cloud top on turn
1805 5000 ft leg – shooting tail
1808 Rain on windshield
1810 Slight south deviation on this pass. More turbulence and rain on windshield
1815 Flight leg at 1500 ft → descend at 500 ft/min → flight leg at 900 ft → descend at 500 ft/min → flight leg at 300 ft (now ~1830). Climb to 1500 ft
1830 300 ft leg, switching to 1500 ft ferry to ground site. In and out of mixed layer.
1845 Approach cloud near cloud base, rain on windshield
1850 Fly by ground sampling site at 1500 ft
1856 Fly by ground sampling site at 300 ft
1900 Climb back to 1500 ft for landing
1913 Landed
RICO, Flight #rf16

Flight track for RF016
RF16 Flight profile: Note data gap beginning at 1646 during the 8000 ft (~2600 m) pass
RICO, Flight #rf16

RF16 Cloud Penetrations