King Air N2UW flight report for January 19, 2005
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Summary:

Deep Cu+ developed to E of Antigua and provided good targets for study of vertical structure and rain development. Most notably, the general area of this set of observations was the same as that of the afternoon of the previous day, both being located in the close vicinity of the mini-cyclone shown below in the VIS image at 12:15.

The first sign of this development was a large set of smaller echoes at about 20Z on Jan 18, located at 015º/100km from SPol. These echoes gradually merged and formed a solid echo patch and a convergence line around 22Z. The echo grew and became more circular in shape reaching 60 km diameter at its maximum development (01Z to 02Z on Jan 19). At that stage, rotation is clearly evident in both the reflectivity and Doppler data, as seen in the image below.

The storm moved very little and broke up by 05Z Jan 19. Small echo patches drifted toward the SSW and formed two separate regions with indications of cyclonic rotation. One of these (near 045º/70km from SPol) was sampled extensively between 12:10 and 12:30. This one is seen in the VIS image of 12:15 UTC and in the radar image below. First the S end of this group, later its N end were sampled. By about 16Z the echo pattern evolved into narrow wind-parallel lines.
Another notable element of the day's observations was the documentation of rain in and near vigorous updrafts.

**Narrative:**

Morning started with As illuminated by sun – lots of small vertical striations. Saw Cu+ in the distant E. SPol reported scattered echoes. Still no wind, air felt less humid.

Started out at same time as C130, back-taxied together.

Headed E and picked up a Cu+ at 8000' at much the same location that we sampled yesterday. Tried a few cloud tops and found them all soft. Sampled weakly precipitating cell at various altitudes.
Finally, in the same vicinity, picked a small, narrow, hard tower (barely big enough to fit the King Air in it). No impressive vertical velocity on the first penetration, but the cloud broadened and had 5+ m/s at 6000' later on. Followed this cell for an hour by stepping down, and with repeated penetrations at the selected altitudes to look at temporal changes apart from vertical variation. All this was done with the butterfly pattern, using the pointer, until the last few penetrations at low altitude, which were done with 90/270 turns, after an updraft/precip couple defined a direction. Significantly, on several passes, heaviest precipitation and strongest updraft were coincident or barely separated. This was also the case in the clouds sampled later on.

By the time the sequence just described was completed, the C130 finished the circle patterns and started sampling rain below cloud base in a sector defined by the 015-060 radials and 30-80 nm. Joined them in that area, with clearance of 5000’ and above. Tried to coordinate location but that proved futile. Bob Rauber was using guidance from Eric at SPol. Found only weak precip at 5000’ just N of SPol and in locations possibly approaching the volume viewed by RVSJ, so decided to climb to 8000’ and look further NE. Found a cluster with some growth, in addition to older cloud mass going to maybe 12kft, at 023/68. SPol also reported this to be one end of an array (line) of possible targets. Made several penetrations at 8000’, and 5500’, including UD, SD and DD.

**Flight notes:**

1152 T/O; no chat available.  
As at 4500’ (ralt). Climbing to 12,000’  
1203 at 12,000’ +4C. Moving to cluster seen toward the SE.  
1206 S heading, target selected; will do butterfly pattern with stepped descent  
120839 photo over the right wing  
121337 at pointer, dissipating cloud but still +ve vertical velocities  
1217 at 6000’  
121923 at pointer at 5000’; CPAS had to be restarted, few minutes of WCR data possibly lost  
122150 4000’ reset the pointer in updraft  
122545 rain at pointer, 1600’; can see through it  
1228 2304’ (ralt); hunting for good cloud base with updraft - not much luck  
1235 4000’ N heading, target, pointer set  
1239 new target seen but it is out of our area  
1240 returning toward the pointer via a tall, disheveled cloud with protrusion to one side  
124237 at pointer – nothing left  
1246 doing roughly 270 turn to get on 135 heading, which appears to be orientation of line as judged by eye. The nose radar is unreliable. This at 4000’, then climb.
1250  climb to 8000'
1257  target – small, hard looking, pointer set even though only 1 m/s found
1301  back to pointer using butterfly pattern
1302  target on right wing
1304  went for shoulder, reset pointer there in 4 m/s updraft
1305  passing other Cu
1307  8000'; finding 1-2 m/s updraft, descending
1308  photo right wing
1309  7000', 4 m/s updraft

[ C130 taking 015-060, 30-60 sector ]
1315  5500' (ralt) 5 m/s up
1319  red NRE (nose radar echo)
1322  4 m/s up, rain at the same time; doing this by pointer in butterfly pattern
1326  red NRE, 2 nm from pointer, then 8 m/s updraft; changing to 90/270 pattern
1329  7 m/s up, 4 m/s down and rain on E-bound leg
1333  at pointer; just past it find 11 m/s up and heavy rain

[ to the NW of the sampled cloud it is clear of smaller clouds ]
1339  rain in/near 5 m/s updraft, 3 mm drops, strong attenuation; another 90/270 and descent
1341  change to SD mode at pointer, 3700' (ralt)
1346  1700' (ralt), just about cloud base
1350  photo of large dome with little shelf cloud on one side
1351  target – has rain; 568' (ralt)
1356  end of 560' run at limit of clearance; climb to 6000', new clearance arranged in coordination with the C130 (it has 010-060, 30-80 nm, 3000' and below) while it is sampling rainshafts.
1400  climb, roughly at pointer, clear air; cloud to left
1405  large clear area between area we sampled and Barbuda; N of Barbuda large cloud mass
1415  6300' (ralt); looking for opportunity with SJ
1419  chasing NRE vicinity 010/38 – not much interest
1429  climb to 8000' heading 020
1437  WCR has been SD, now UD
1438  023/70 target, 1 mm drops at 8000'; pointer set
1447  back the third time; SD
1452  back at pointer, DD, to side of NRE no its center
1454  descend and return with DD
1455  photo of adjacent cell to S; followed by photo of time display
145710 lined up on target; 5400' (ralt), DD
   red NRE to left by 2 km
1500 rain to surface; smooth run – good for DD
1503 UD, 180 turn to what was red NRE, but it is weaker by the time it is traversed
1508 moving further S
1513 tower with pileus, 5 m/s up; pointer set; 90/270
1519 back
1523 1 km offset added to pointer; 5000'; SD mode
152702 at offset pointer; bumpy - end of study
1542 L/D