

**King Air N2UW flight report for second flight of January 18, 2005**

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**Summary:**

Student day. C130 off at 11Z, KA first flight at 12Z, 146 off at 17Z.

Strange weather – no wind, overcast in the morning with line of Cb to W.

At SPol the VHF radio is finally up.

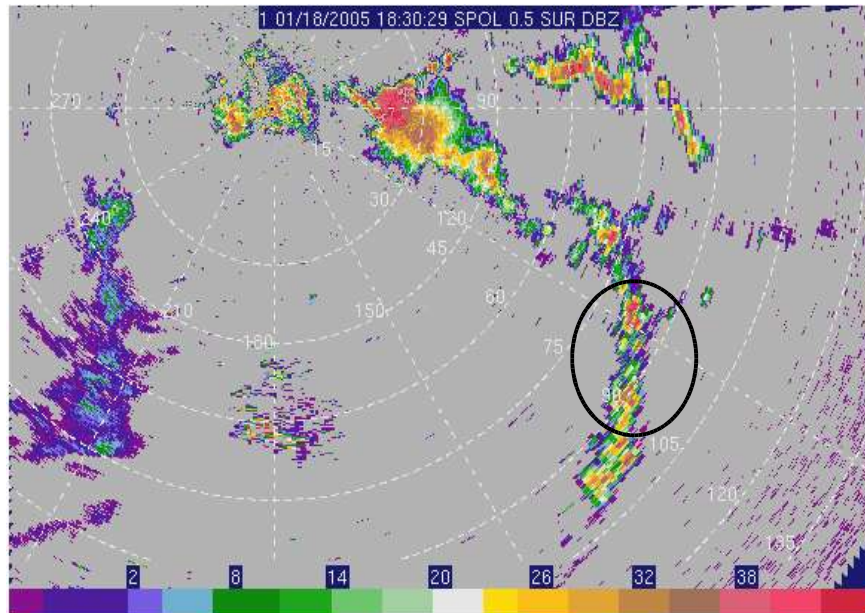
At around 13Z a strong line of echoes ran along a 060-340 direction to the E of Antigua. As it moved toward the west, it spawned a narrow N-S echo line at 14Z which also moved slowly west and developed both in width and intensity producing impressive Cb's by about 14:30Z. The outflow from these storms appeared to kick off an arc of convection. Essentially all of that arc became weaker on the satellite image, and no longer produced radar echoes by 17:15Z, but a Cb at its northern end of the arc generated another outflow pulse and the whole arc re-generated by 17:45Z. The King Air study focused on this arc (even though its earlier evolution wasn't known at the time).

Right after takeoff at 18Z, moved to the line of Cu+ to SE of ANU. This feature remained essentially stationary until it dissipated by 20:15Z. Cloud tops were about 11000' with vigorous turrets. Most of the flight centered on 70 km E, 45 km S of SPol.



Photo on left (18:13:08) shows the line from 3500 m flight altitude during the turn to start a descent to 2500 m for a pass along the length of the line. Photo on the right (19:11:47) is from 200 m flight altitude showing the line from the East side. Both images show that there was a band of As along the line of convection, initially on the west side only (left edge of picture on the left) and later, less extensively, on the east side only.

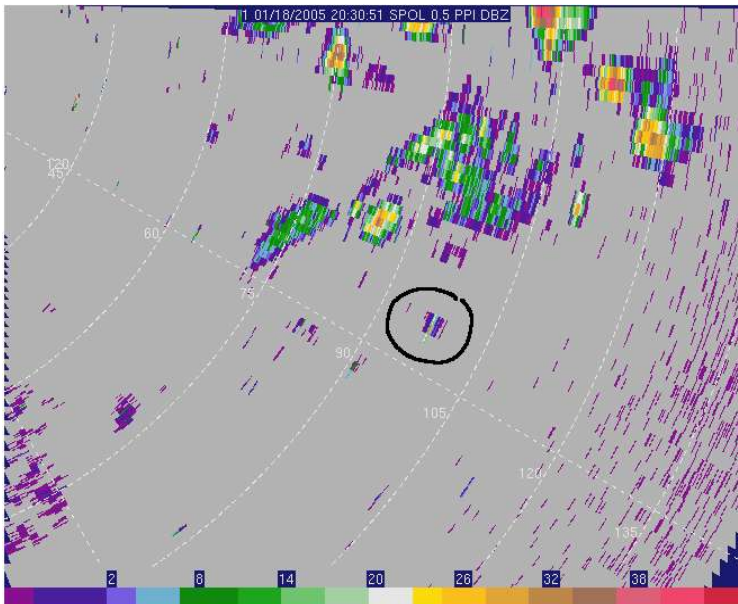
SPol reflectivities reached 30+ dBZ. Sampled the line/arc at various altitudes along the echoes and across it, stepping down and up.



Did soundings on both sides of the line in order to document features of the convergence and cold pool at the surface. Full sounding on the W side, partial on the other; significant wind shifts noted specially at lowest flight altitude (e.g. 19:12:30 !!!). That example is probably real; in general, care needs to be exercised with the wind data due to generally low wind speeds and attendant flip-flops in wind direction.

Also sampled a line of small Cu that sprung up to W, but by that stage the situation was quite complex, with stratus layers, small Cu etc. Earlier, the line had a very systematic organization, specially on the E side. Photos to show this.

During the last part of the flight (20:20 to 20:40) studied a small cell. Caught it at its max growth and followed its life cycle after that. No updraft noted on the first pass, but 3-6 m/s on two subsequent passes. Monitored the evolution at 5400', then went all the way to 500' to sample the precip.



Highest reflectivity in the middle of this echo is due to the King Air. Echo was detectable on SPol until 20:56, having moved 5 km in 42 minutes toward the N since its first appearance. Because of its distance from SPol, this echo was seen only on the 0.5° scans.



Photo on left was taken at 20:23 at the beginning of the sampling of this isolated cell.

At time of the first King Air pass (20:22) the WCR echo extended only to about 700 m above the ocean, but by 20:26 precipitation was reaching the surface. Cloud top maximum was at about 2200 m. Cell diameter was about 4000 m.

Last activity of the day was an intercomparison with MetMan–BEA146 in clear air and in cloud. They directed it in excellent fashion. Clear air at 9000', in cloud at 7000'.

From microphysics perspective, the most remarkable thing was the abundance of raindrops in updrafts in the upper regions of the clouds. Raindrops of up to 1 mm diameter were detected at 2500 m altitude in concentrations (2D-C; good images) near  $40 \text{ L}^{-1}$  over a 400-m stretch(18:19:30). In the immediately adjacent updraft, and in many other updrafts, drops of up to 0.4 mm were seen. Total concentrations (2D-C probe) reached  $80 \text{ L}^{-1}$ , in general increasing with altitude. LWC were relatively low, maximum  $1.5 \text{ g m}^{-3}$ ; together with large range of theta-e values in the upper portions of clouds (>2200 m) this indicated strong entrainment. This is not due to a lack of vigorous updrafts; maximum vertical velocities increased with altitude to near  $10 \text{ m s}^{-1}$  in the vicinity of 2000 meters. Droplet concentration to about  $80 \text{ cm}^{-3}$ .

#### **Flight notes:**

- 1745 engines started. Filed for 090/40, FL 110.
- 1758 T/O. MetMan has 050-090, 3500' and lower; currently at 060/80
- 1808 C130 at 340/27 5000' getting ready to fly circle
- 1810 arc of Cu on right wing.
- 1815 cleared 090-120 / 30-80 nm, FL110 and below  
C130 has 010-050 / 40-80 < 2500'
- 1816 at 8000' pass toward the S.
- 1817 pileus just ahead;  $3 \text{ m s}^{-1}$  updraft when passing below it.

1818 C130 on 030 radial  
1820 end of run on E side of arc, 8000'  
SPol switching to cover 120 to 270 azimuth  
1830 back to S, still 8000'  
1836 pointer set in  $5 \text{ m s}^{-1}$  updraft; then 90/270 and down to 6000'  
MetMan 055/70; C130 on 030 inbound at 300'  
183840 at pointer, 6300'  
1840 90/270 on N end, going back; photos E side of line  
1843 at pointer, 6000'; continue; red NRE (nose radar echo)  
1846 S end; 180 turn back to pointer, 4000'  
1850 030 heading; precip; collapsing at the pointer  
1851 will swing out to look  
MetMan has 040-090 / 25-60 nm; 4000'-15000'  
1855 out on E side  
1857 target – strong visually;  $2 \text{ m s}^{-1}$ , then  $3 \text{ m s}^{-1}$  in next tower on E heading  
1859 90/270 west heading; nothing at the pointer  
1906 on west side; lining up on turret  
1908 out on E side; descent to 500'  
1912 aiming at precip while crossing under the line  
1917 on west side; will do sounding in racetrack parallel to line  
1924 11000' end of sounding  
1927 crossing; dome to 11000'  
1931  $1-2 \text{ m s}^{-1}$  over large distance; pointer set on far side – didn't register in right spot;  
283 heading, 6000'  
1935 east-bound; still good stretch with updraft  
1936 MetMan at 065/39; 7000'  
1937 90/270  
1939 weak cloud while crossing  
2002 precip from cloud remnant; 2000'; heading to NRE  
2009 target is dark turret  
2014 shallow Cu line; will sample along its length  
2017  $40 \text{ cm}^{-3}$

- 2020 see vigorous Cu on E of main line; going there; climbing to 6000'
- 2021 lined up on target; photo
- 2031 5400'; reset pointer
- 2033 4000'  
3000'; rain to the surface; weak  
MetMan at 045/30; 1500'
- 2037 3000'
- 2039 3000'; few drops on windshield
- 2045 climb to 8000' for intercomparison with MetMan.
- 2051 under pileus;  $2 \text{ m s}^{-1}$
- 2014 end of west leg; event 5
- 2105 165 heading; event 5; 10.4 C
- 2110 end of run; slow left; 7000'
- 2116 MetMan in trail, going to cloud
- 2124 end of cloud run; got heavy precip, bumps, etc.
- 2147 L/D