

## Mission Summary

### Danielle

980829H Aircraft N42RF

#### Scientific Crew (N42RF)

Chief Scientist	John Gamache
Flight Meteorologist	Stan Czyzyk
Doppler Scientist	Mike Black
Workstation	Mike Black/Hugh Willoughby
Dropwindsonde	Hugh Willoughby/Mike Black
AXBT	Mike Black/Robert Gall (NCAR)
Cloud Physics	Sean McMillan (AOC) and James Barr (AOC)
Visiting Observers	Roger Smith Robert Gall (NCAR)

#### Mission Briefing:

At mission planning time, Hurricane Danielle was a weak 1 hurricane, officially with 80 knot surface wind speeds, although indications were that actual strength might be decreasing slightly. The first morning visible pictures showed healthy convection near the storm center, and Danielle was still to the east of the axis of the sea-surface wake of Hurricane Bonnie, which had visited the area just to the west only five days before. At 1500 GMT on 29 August, the storm center was estimated to be at 25.1°N, 70.1°W, with a mean sea level central pressure of 988 mb.

Since the mission was to be launched from Opa Locka Airport in Dade County, Florida, and on-station time for the nominal pattern is approximately 5.5 to 6 hours, the mission was expected to be near the maximum duration of 10 hours, unless the pattern was abbreviated. The mission selection for the day was the Vortex Motion and Evolution experiment (VME), normally planned to be a two-NOAA-WP3D-aircraft mission. On 29 August, 1998, however, six planes would be coordinated to observe Danielle simultaneously: the two P3's, the NOAA Gulfstream IV (G-IV), the NASA DC-8 and ER-2, and during portions of the mission, a USAF WC-130 aircraft (whose task was to obtain official fixes and observations of the hurricane). N42RF was to fly at 12,000 ft PA, while N43RF would fly at 16,000 ft PA while near the center, and maximum safe altitude while outside a 50-nautical-mile (nm) radius from storm center. The NASA aircraft were to fly a pattern similar to N43RF, although rotated from N43RF, and close coordination between NASA and NOAA were not required except when dropwindsonde safety made it necessary. The G-IV flew an operational flight around the storm periphery, dropping sondes to determine the near-environmental wind field.

N42RF's mission was to fly 5 rotating figure 4's, where the first, third and fifth would be coordinated with N43RF in an effort to maximize the usefulness of the airborne Doppler radar observations. During the second and fourth figure 4's, and before the first and after the fifth, N43RF would be conducting dropsonde observations 1-3° away from storm center.

#### Mission Synopsis:

Numerous sondes and AXBT's were dropped in the eyewall, or what could best be judged to be the eyeall. Although maximum flight-level winds at 12,000 ft were below 80 kts, an EVTD Doppler wind analysis showed maximum winds at 1 km to be about 80 kts, and at least one GPS dropsonde also reported 80 kts near the surface, thus confirming that Danielle, in spite of its less-than-impressive central appearance, was still a hurricane. The final center fix at 0147 UTC indicated storm center to be at 26.1°N, 71.5°W, thus indicating Danielle's approximate motion during the mission was 14 kts toward azimuth 300. N42RF returned to Opa Locka airport at 034027 UTC, N43RF departed Opa Locka at 183435 UTC, approximately 15 minutes after N43RF, in anticipation of the future flight tracks and the desire to pass

through the storm center simultaneously. Descent to the flight-plan altitude began at 1954 UTC (26.1°N, 73.9°W), and the IP (130 nm from storm center at a bearing from storm center of 300) was reached at 200845 UTC (26.5°N, 73.0°W). There was some difficulty in pinpointing the storm center, since the central convection turned out to be asymmetrically placed to the east of the wind center. The first fix was found to be at 25.7°N, 70.9°W, with a central MSLP of about 986 mb. The full mission of 5 figure 4's were performed, during which 10 hurricane penetrations were made, 24 GPS sondes were dropped and 18 AXBT's (Airborne eXpendable BathyThermographs) were dropped. The particulars concerning fixes, drops and flight legs are shown in the tables.

The tail radar was operated with the Fore/Aft Scanning Technique (FAST) through most of the mission. It was operated with flat scans normal to the flight track between points 10 and 11, and between points 12 and 13. A VTD analysis was performed and transmitted to NHC, using the flat-scan data. The NASA ER-2 was unable to participate in the mission.

#### Evaluation:

This mission represents the first of its kind, in which the structure and evolution of the hurricane core is detailed, while the region from the center to 160 nm from storm center is well mapped with sondes to a depth above 200 mb. Finally the near environment in all quadrants of the storm was mapped with sondes dropped from above 150 mb. The data thus hold great promise for understanding forecast track difficulty, and they should provide the best data set ever for computing the eddy angular momentum transport into the storm, as well as mapping the larger-scale shear of the near environment.

The initial structure of the storm core was somewhat disorganized (Fig. 1) as N42RF approached it, but it appeared to become better organized by the end of the mission (Fig. 2), and it was quite well organized on 30 August in a follow-up multi-aircraft mission. The data from the 29 and 30 August should provide insights into the role of the environment and sea surface in modulating storm structure and intensity.

#### Problems:

- 1) Radar data system went down briefly at 2220 UTC, and had to be reset.
- 2) Tail (Doppler) radar recording down from 2220 to 2235 UTC and from 0030 to 0038 UTC.
- 3) Dropsondes worked until the last three, the first two having little data, and the last was a failed drop.
- 4) The VTD analysis indicated too intense a hurricane showing winds above 100 knots on the side of the hurricane with little data. More care will be taken in the future to be sure the functional fits are not over-extrapolating.

John Gamache  
9 September 1998

## Flight points

<u>Point</u>	<u>Tim</u>	<u>Position</u>	<u>Comments</u>
IP	200845 UTC	26° 31'N, 72° 57'W	
1	203545 UTC	25° 40'N, 71° 10'W	coordinated with N43RF
2	2044 UTC	25° 44'N, 70° 52'W	good center fix
3	2055 UTC	25° 25'N, 70° 14'W	
4	210740 UTC	26° 22'N, 70° 29'W	coordinated with N43RF
2	212030 UTC	25° 41'N, 70° 58'W	
5	213240 UTC	25° 0'N, 71° 23'W	
6	213630 UTC	24° 56'N, 71° 4'W	
2	214815 UTC	25° 45'N, 71° 7'W	
7	215750 UTC	26° 23'N, 71° 9'W	
8	220930 UTC	25° 43'N, 71° 48'W	
2	221920 UTC	25° 47'N, 71° 5'W	
9	223500 UTC	25° 50'N, 70° 15'W	circling for coordination
10	225040 UTC	26° 24'N, 71° 11'W	coordinated with N43RF
2	225910 UTC	25° 47'N, 71° 14'W	continuous perpendicular scanning for VTD
11	231110 UTC	24° 58'N, 71° 15'W	
12	232600 UTC	25° 53'N, 70° 26'W	coordinated with N43RF
2	233700 UTC	25° 54'N, 71° 18'W	continuous perpendicular scanning for VTD
13	234610 UTC	25° 52'N, 72° 2'W	
14	235100 UTC	25° 30'N, 71° 56'W	
2	235930 UTC	25° 49'N, 71° 19'W	
15	000950 UTC	26° 12'N, 70° 37'W	
16	002350 UTC	26° 27'N, 71° 50'W	
2	003320 UTC	25° 52'N, 71° 26'W	
17	004310 UTC	25° 18'N, 71° 1'W	
18	010210 UTC	26° 21'N, 70° 33'W	maneuvering and coordination with N43RF
2	011500 UTC	26° 1'N, 71° 31'W	
19	012410 UTC	25° 40'N, 72° 8'W	
20	013910 UTC	25° 37'N, 71° 12'W	coordinated with N43RF
2	014710 UTC	26° 4'N, 71° 33'W	very good flight-level fix 984mb
FP	020040 UTC	26° 40'N, 72° 14'W	End pattern, climbing out

### GPS Sonde Drops

Drop	Sonde ID	Time	Position	comments
1	982430031	2043	25° 41'N, 70° 53'W	Eye Drop
2	982430154	211529	25° 58'N, 70° 48'W	Inside wind max
3	982430071	212917	25° 10'N, 71° 16'W	Rainband SW of center
4	982430069	212952	25° 9'N, 71° 18'W	" " " "
5	981950007	213829	25° 4'N, 71° 2'W	" S " "
6	981950073	213935	25° 10'N, 71° 3'W	" " " "
7	981950024	214810	25° 44'N, 71° 7'W	Eye Drop
8	981950066	222619	25° 47'N, 70° 44'W	Rainband
9	981950016	222806	25° 47'N, 70° 25'W	Rainband
10	974740134	2257	25° 57'N, 71° 14'W	Not processed
11	981950001	230356	25° 26'N, 71° 15'W	Inner band
12	981810039	230750	25° 10'N, 71° 15'W	Rainband
13	982430177	230828	25° 8'N, 71° 15'W	Rainband
14	981810039	2332	25° 54'N, 70° 54'W	Eyewall
15	982430157?	000124	25° 53'N, 71° 11'W	NE inner band/eyewall
16	982010036	000619	26° 4'N, 70° 50'W	
17	982430024	000650	26° 5'N, 70° 48'W	
18	981810036	003857	25° 32'N, 71° 11'W	SW eyewall
19	982430178	005456	26° 2'N, 70° 48'W	NE rainband
20	981750004	010532	26° 16'N, 70° 48'W	NE eyewall
21	982010059	010729	26° 13'N, 70° 57'W	NE eyewall
22	981750009	014149	25° 46'N, 71° 19'W	SW eyewall (No Wind)
23	982430095	014252	25° 49'N, 71° 21'W	SW eyewall (Little data)
24	981950005	015943	26° 45'N, 72° 12'W	Fail

980829H1

DANIELLE

(min.) (max.)

Pitch= 1.6; 4.6



52 Roll= -2.9; 7.4

50

47 Track=115.2;118.3

45

42 Drift=-10.8; -4.6

40

37 Tilt= 1.7; 2.5

35

32 Alt= 3643 m

30

27 Olat= 24.65 N

25 Olon= 72.11 W

22 Rlat= 25.70 N

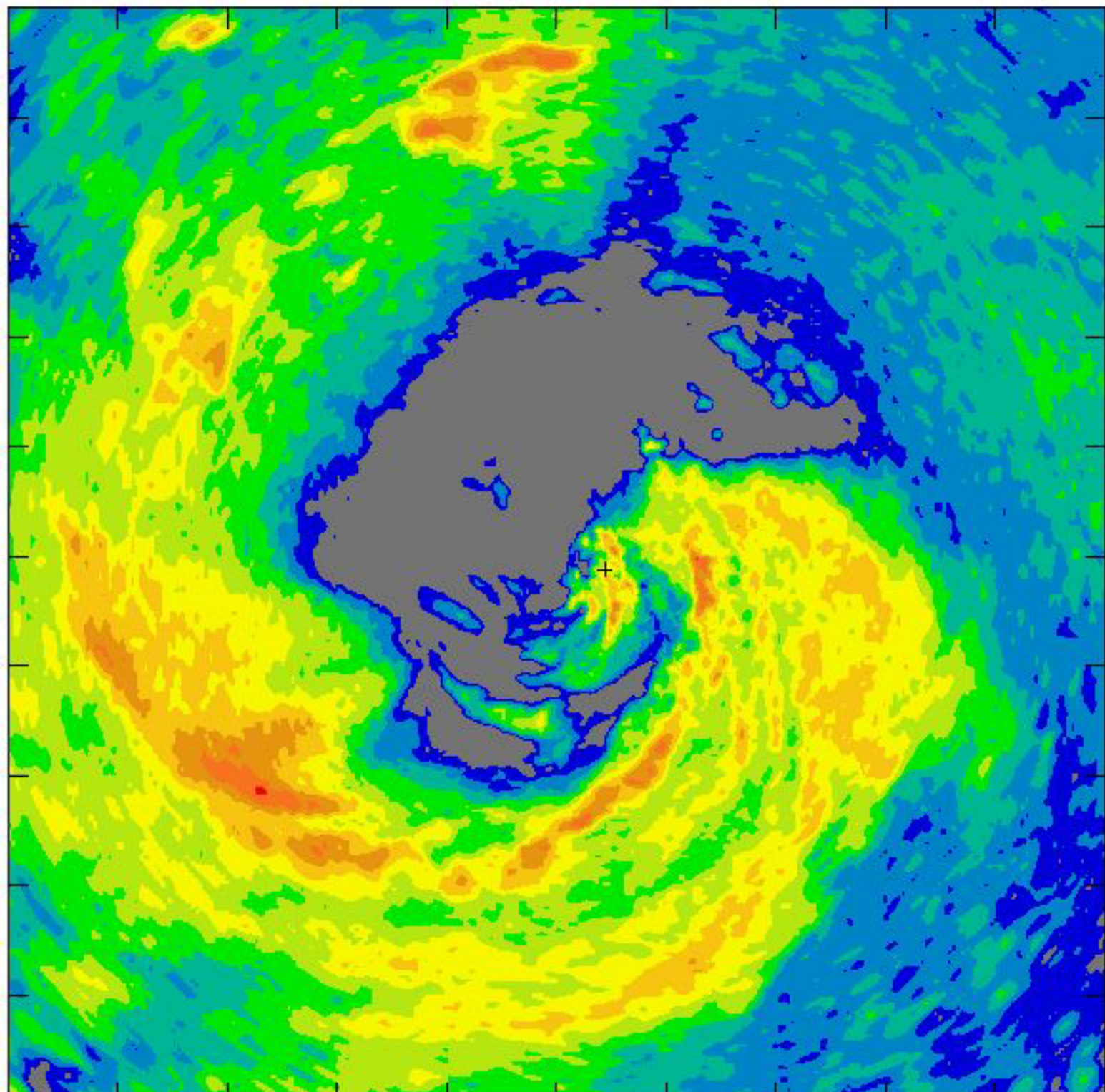
20 Rlon= 70.81 W

dBZ

204527 Z

Lower Fuselage

240 X 240 km



980829H1

DANIELLE 1

(min.) (max.)

Pitch= 1.7; 2.4



dBZ

014713 Z

Lower Fuselage

240 X 240 km

