Mission Summary
990914I Aircraft 43RF
Floyd
Synoptic Surveillance

Scientific Crew (43RF)

Lead Scientist/Radar	F. Marks
AXBT	P. Reasor (CSU)
Dropsonde	C Landsea
Workstation	M. Black
Air-sea interaction Scientist	E. Walsh (NASA/GSFC)
Observers	J. Palca, S. Bear (NPR)

Mission Briefing:

On Tuesday 14 September N43RF was tasked to do a two-plane synoptic surveillance mission with N49RF into Hurricane Floyd as it passed Nassau, Bahamas with a takeoff from MacDill AFB at 1730 UTC and landing at Tampa International Airport around 0230 UTC. The plan called for figure-4 at 14,000 ft with 50 nm legs with GPS drops on the ends of the legs and in the eyewall on the four cardinal directions. One drop was also planned in the eye on the first pass through the center with a backup on the second and last pass through the center. Following the figure-4 pattern N43RF would climb to as high as possible and execute the surveillance pattern covering the area surrounding the S, E, and N sides of the storm while N49RF would sample the far environment N and E of the storm at 41,000 ft. Our final leg would pass just N of the storm over the buoys E of Cape Canaveral, FL and the WSR-88D at Melbourne, FL (KMLB) (Table 1). We planned to drop a string of AXBTs along that final E-W track to sample the sea-surface temperature (SST) and mixed layer depth (MLD) in front of the storm in a region where Dennis had just passed. We also planned some GPS-sonde drops near any buoys and C-MAN sites in Table 1 if possible.

Mission Synopsis

N43RF took off from MacDill AFB at 1815 UTC and headed toward an IP 50 nm N of the storm. As we approached the storm it became apparent that it was farther E and N than the forecast track suggesting the storm had started its anticipated northward turn sparing southern Florida. At about the same time we received the AFRES latest fix confirming our radar presentation (Table 2). We adjusted our IP to reflect the change in position at 1858 UTC (Fig.1).

The LF and TA radars were acting up (the TA wouldn't hold frequency) and the engineers swapped the TA transmitter. The LF showed that the storm had changed considerably from the previous night (Fig. 2), with the near completion of an eyewall replacement cycle. There was only a large outer eyewall (60 nm diameter) encompassing a small inner hub cloud (the remains of the inner eyewall). At 1910 UTC the radar system crashed and the engineers started to diagnose the problem, starting a process that became commonplace on this mission.

We reached our IP (50 nm N of the storm) at 1931 UTC, dropped a GPS sonde and AXBT and tracked S to the center at 14,000 ft. The sonde worked (no winds below 800 mb) and the AXBT gave a SST of 27.5°C (Table 3). With such a large eyewall we attempted 2 eyewall drops on the N side 3 min later, one of which gave no winds. We hit the center at 1943 UTC right over Abaco Island, Bahamas and dropped a sonde that landed on the island with a 932 mb central pressure. We received no winds from this sonde either. We proceeded to track S down the island to a point 50 nm S of the center dropping one more eyewall sondes which had no winds. At 1955 UTC we reached the point 50 nm S of the center, dropped a sonde (which had winds), and turned NE. We produced one radar composite, but no EVTD as the TA radar was still giving problems.

At 2011 UTC we reached the point 50 nm E of the center, dropped a sonde (no winds) and turned W to the center. We attempted a drop in the E eyewall which also had no winds. Dale Carpenter suspected the either a bad batch of sondes or the ribbon used to pull out the launch pin was too tight. He tried loosening the ribbon. We passed through the center at 2029 UTC, two minutes after the AFRES fixed the center, and dropped a sonde which still had no winds. Passing through the eye the radar started working well and we started recording TA data in F/AST mode through the W eyewall. We also attempted dropsondes in the W eyewall and at the point 50 nm W of the center which both failed (one with no winds, one with no launch detect). We reached the end of the figure-4 at 2040 UTC and turned SW to our first surveillance drop. At this time Dale started using a new box of sondes and we never had a problem with the sondes the rest of the flight. Mike Black transmitted two more LF composites and then settled down for some dropsonde processing.

The first surveillance drop was just NW of Andros Island. We then proceeded to a point just off the NE coast of Cuba (23.5N, 79.5W) where we turned to the E to a point .300 nm SE of the center. We then zig-zagging N along the E side of the storm. We encountered an intense rainband with lightning ~200 nm E of the center at 2355 UTC. Unfortunately, the main data system failures started getting worse at this time, crashing from 2355-0009 UTC, causing us to have problems with drop 19 (Table 3). Chris Landsea manually input the flight level data from the 10 s listing to get the sonde out. Richard McNamara and Jorge Delgado swapped the CPUs on the main data system and we were up again for a while. We limped along with data system problems heading N along the NE side of the pattern. At 0103 and 0130UTC the data system crashed again and was revived within a few minutes, but Barry Damiano noted that the tape drive might not be recording data. We discussed the data recording problems and agreed to try to finish out the surveillance pattern transmitting the drops back to NHC even if the data system was not recording data provided the onboard data display was still working. We reached the far NE portion of our pattern at 0126 UTC and turned WSW to track toward Cape Canaveral N of the storm laying down a string of AXBTs along with our dropsondes.

As we tracked WSW N of the center it became apparent that the storm was farther N than we had expected and would pass only about 80 nm S of our track. We decided to alter our plan slightly to add an 8000 ft leg near the shore toward KMLB to acquire some storm surge and wave spectra data, as well as provide some intercomparison with the KMLB WSR-88D radar. We planned the decent to correspond with a GPS sonde drop over buoy 41009 just E of Cape Canaveral (Table 1). Along this leg the data system crashed one more time at 0159 UTC and Richard couldn't bring it up and record the data as well. Ed Walsh said he had his own source of the necessary flight level data (as did the radar data system) so we proceeded with the planned low-level beach run. Unfortunately, the only record of the AXBTs was from the 5-s onboard listing. We completed our last surveillance drop at 0218 UTC and descended to 8000 ft by our

combo drop near buoy 41010 at 0229 UTC. At 0236 UTC, in rainbands 80 nm NW of the center the TA was set to FAST and we started the 8000 ft run at the beach within Doppler range of KMLB. We crossed the beach at 0252 UTC passing directly over Patrick AFB. Ed Walsh was ecstatic with the surge and wave data. We turned W heading for Tampa recording radar data inland until we passed S of Orlando. We landed at Tampa International at 0319 UTC.

Accomplishments

This mission was a very draining experience with radar and main data system problems. Considering all of the data system problems the AOC and HRD crew did a fantastic job to get all of the surveillance drops out for NHC and to get some really good landfall research data (wave, surge, and Doppler radar data) along the coast of FL at the end of the mission. The AOC crew, particularly Barry Damiano, Richard McNamara, Jorge Delgado, and Dale Carpenter, deserve special credit for accomplishing the tasked operation surveillance mission despite all of the equipment problems. The mission was successfully completed thanks to their hard work and dedication.

Penetrations: 2
GPS sondes: 26, 7 failed
AXBTs: 8, 3 failed

Problems:

Although the primary operational surveillance mission was accomplished, there were several major glitches during this mission that compromise the research quality of the data.

1) Only 17 of 26 dropsondes released were transmitted. 7 were failures (all in the inner core figure-4) , and the last two over buoys were worked up but not transmitted since they were near the end of the mission. All scheduled drop points were covered except the east and west points of the figure-4 in the inner core of Floyd at the beginning of the flight.

2) The CPU for the main data system failed intermittently during the flight, crashing numerous times leaving data gaps as long as 10 min. The AOC engineers and technicians swapped the CPUs a number of times with limited success. Each time the system would come up for a while and then the problems would start again. It finally crashed near the end of the mission and was brought up only to initialize the final 5-6 GPS sondes and could not record the last 40 minutes of the mission on tape. (turned out the tape drives were dying and the heads were bad causing numerous parity errors which resulted in lost data and system problems)

3) The radar system worked poorly at the beginning of the mission. The AOC engineers had it working intermittently during the figure-4 segment, with consistent data only for the last half of the second leg in the figure-4. There was enough data to work up and transmit two composites but not VTDs. The radar system worked well after that with a few intermittent failures. The LF and TA reflectivities were low (7-8 dBZ). We did however get great Doppler data near KMLB WSR-88D at the end of the mission.

4) The first AXBT drop was recorded on tape, but the others were recorded only on the 5 s printed listing because of the data system limitations after the final crash.

5) The aircraft APU failed before take off forcing us to delay take off and restart many of the data systems possibly adding to our other problems.

Frank Marks
Frank.Marks@noaa.gov

Table 1. Buoy, C-MAN, and WSR-88D locations for the 19990914I Floyd flight.

Site ID	Latitude (°N)	Longitude (°W)	Location
41009	28.50	80.18	CANAVERAL
41010	28.89	78.55	CANAVERAL EAST
SPGF1	26.70	78.99	Settlement Point, GBI
KMLB	28.10	80.64	Melbourne, FL (ASOS)
KMLB	28.1133	80.6542	Melbourne, FL WSR-88D

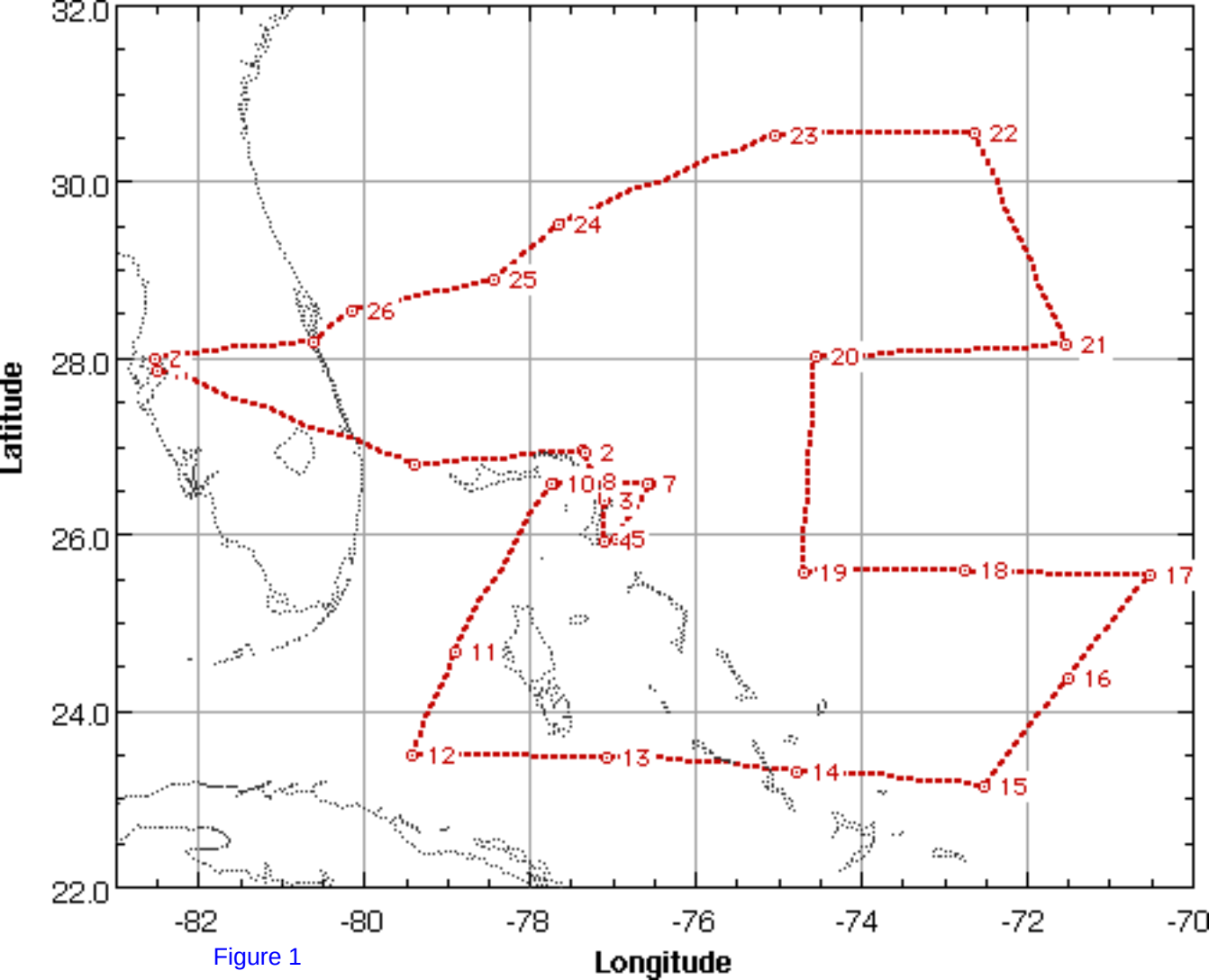
Table 2: Center fixes for Floyd from N43RF and the Air Force (AFRES) on 14 September. Sea level pressures were provided in some eye drops.

Time (UTC)	Latitude (N) (deg min)	Longitude (W) (deg min)	Aircraft
1854	26 13	77 05	AFRES, 932 mb
1943	26. 25	77 07	N43RF, 932 mb
2027	26 34	77 16	AFRES, 932 mb
2029	26 34	77 16	N43RF, 932 mb
0209	27 42	78 02	N43RF radar fix

Table 3: Splash locations of sondes transmitted during the 19990914I Floyd mission. Here MBL = mean boundary layer wind (fffdd; fff = wind direction in deg and dd = wind speed in kt), LST WND = height of last wind (meters), and SST = sea surface temperature (tenths of °C).

#	Sonde ID	Time (UTC)	Lat (°N)	Lon (°W)	Comments
1	983720810	1934	26.95	77.36	EYEWALL 000=
2	983720778	1935	26.93	77.35	MBL WND 05107 EYEWALL 000=
3	983620731	1942	26.40	77.10	EYE (NO WINDS)=
4	983620760	1949	25.92	77.11	not transmitted (NO WINDS)
5	983720775	1949	25.95	76.97	MBL WND 24106 LST WND 011 EYEWALL 180=
6	983310189	2020	26.57	76.55	eyewall 090 not transmitted (NO WINDS)
7	983620743	2021	26.57	76.58	eyewall 090 not transmitted (NO WINDS)
8	983620661	2029	26.60	77.30	EYE (NO WINDS)=
9	983620678	2035	26.57	77.72	eyewall 270 not transmitted (NO WINDS)
10	983620594	2035	26.57	77.75	eyewall 270 not transmitted (NO WINDS)
11	984325501	2104	24.66	78.91	LST WND 010 MBL WND 29541=
12	985035055	2120	23.49	79.43	LST WND 012 MBL WND 27531=
13	984325474	2143	23.46	77.09	MBL WND 23534 LST WND 010=
14	985035114	2207	23.32	74.79	LST WND 010 MBL WND 18037=
15	985035105	2232	23.14	72.51	LST WND 011 MBL WND 15525=
16	985158013	2250	24.37	71.51	LST WND 010 MBL WND 15030=
17	983310106	2308	25.55	70.52	LST WND 010 MBL WND 13031=
18	984325182	2332	25.61	72.76	LST WND 010 MBL WND 14043=
19	985035112	2359	25.58	74.70	LST WND 050 MBL WND 18535=
20	985035309	0024	28.02	74.55	LST WND 006=
21	985035054	0058	28.15	71.54	LST WND 011 MBL WND 13035=
22	984325412	0126	30.55	72.65	LST WND 010 MBL WND 11533=
23	983310034	0149	30.53	75.06	LST WND 011 MBL WND 10044 SST 273=
24	983620593	0217	29.51	77.67	LST WND 010 SST 279 RAINBAND=
25	984325549	0228	28.90	78.45	at buoy 41010 not transmitted
26	983310162	0246	28.53	80.15	at buoy 41009 not transmitted

Note: Sondes 4, 6, 7, 9, 10 had no winds and were not transmitted. Sondes 25 and 26 were good but were not transmitted because of time constraints.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30.0
28.0
26.0
24.0
22.0
Latitude
-82
-80
-78
-76
-74
-72
-70
Longitude
1
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3
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Figure 1

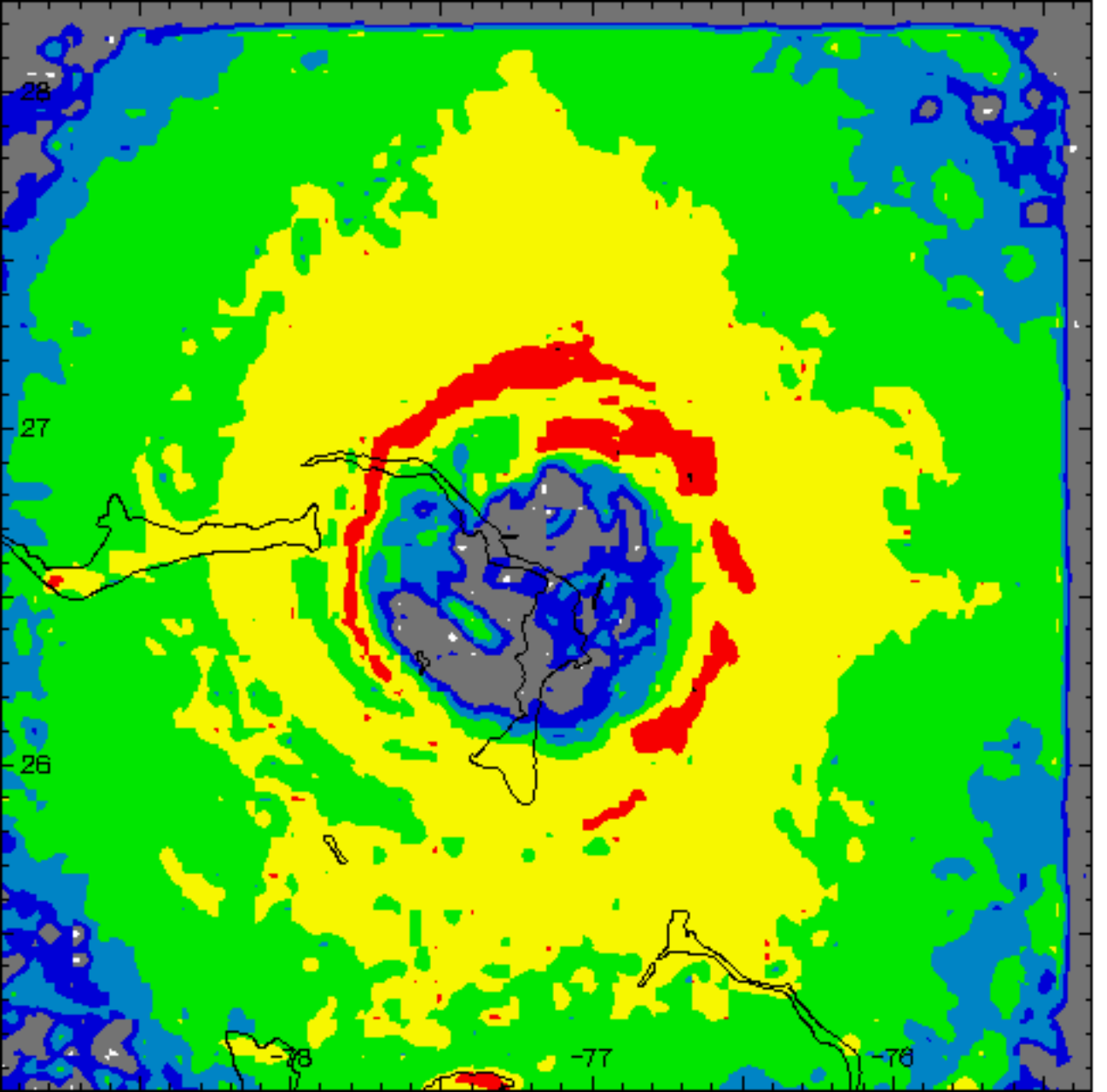

Figure 2

99091411

FLOYD

202931 Z to
202931 Z

48
41
35
28
21
15 Alt 3934 m

dBZ

Slat 26.65 N
Slon 77.15 W

360 X 360 km

produced by
HRD / AOC