

Mission Summary
980823H Aircraft 42RF
Bonnie Five-Aircraft Synoptic Flow

Scientific Crew (42RF)

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Mission Briefing:

This flight was part of a 5-plane (two NOAA WP-3D Orion aircraft, NOAA G-IVSP Gulfstream jet aircraft, NASA DC-8 jet aircraft and high-altitude NASA ER-2 aircraft), synoptic-flow mission to drop GPS sondes in the environment around a developing tropical storm. This flight was the third in a series. This mission dropped 22 GPS sondes into the inner core (within 50 nm of the center). Of these, 11 were dropped into the eyewall along 8 radial legs in 8 octants of the storm (two failed) and 3 were dropped in the eye (one failed). Seven AXBTs were dropped into the eyewall (1 failed) and one in the eye which failed. Three interesting drops were also obtained in the feeder band wrapping around the storm at a radius of 50 mi from E to N to W. The flight was flown at max altitude 500-450 mb, except for the two rotating Figure 4 patterns in the inner core which were flown at 550 mb (15 kft). The purpose of the flight was to provide improved initial conditions for track models and to discern the eyewall structure of a minimal stationary hurricane.

Mission Synopsis

The flight departed St. Croix International (TISX) at 1745 UTC, 23 August and landed at MacDill AFB, FL at 0145 UTC, 24 August. A total of 33 GPS sondes and 8 AXBTs were dropped during this mission, from 20 kft (15 kft in the inner core), 8 of which were coincident. Two AXBTs and 3 GPS sondes failed. The Figure 4 legs were oriented SE-NW, SW-NE, N-S and E-W. Maximum flight-level wind in the inner core was 85 kt in the western feeder band and SE eyewall, 70 kt at the surface and 106 kt at 925 mb in the E eyewall. Minimum central pressure was 956 mb and the inner eye diameter was 25 nm, while the outer eye/rainband diameter was 80-90 nm. The storm was stationary.

A major feeder band consisting of several thinner bands was observed spiraling into the inner core to form an outer eyewall from the SE, E, through NE, N and NW. [Strongest eyewall convective bands, with cloud turrets extending to 55-60 kft](#) (as observed by the ER-2), were along the E sector of the inner eyewall (45 dBZ reflectivities). The eyewall was open to the west. A strong CB developed within the clear eye region on the south side as we traversed from N-S, and containing the flight level wind max of 85 kt. 85 kt flight level wind maxima were also observed in the outer band to the N, NW and W of the center. The inner E eyewall had only 65 kt winds at flight level, but 105 kt at 925 mb.

GPS dropsonde wind profiles in the W eyewall, where convection was weak, differed dramatically from those in the E eyewall, where convection was very strong. Profiles in the W showed nearly constant 65-70 kt winds with height down to 400m, near the top of the well-defined boundary layer. Winds decreased linearly from there to the 10-m level where winds were 45 kt. In the E, winds increased downward from 60 kt to 106 kt at 850 mb, maintaining nearly constant wind with height to 60 m, then decreasing rapidly to 70 kt at the 10-m level. In the 106 kt high wind layer,

strong inflow was observed with wind direction veering inward by more than 60 deg between 850 mb and the surface. The convection was therefore associated with an enhanced inflow jet in the lowest levels on the E side of the storm. The strong inflow, enhanced southeasterly horizontal flow and strong convection associated with strong updrafts on the east side coupled with enhanced horizontal flow in the upper levels on the W side, some outflow in the low levels and subsidence in the W suggest the vortex was interacting with westerly or northwesterly shear (strong environmental SE low level winds, weak upper level winds). This notion is supported by hodograph plots of mean storm-domain winds computed from TA Doppler radar data.

Doppler radar showed a strong low level wind max of over 100 kt on the east side of the center. The 500 mb center seemed to be displaced about 12 km NE of the surface center, which could be clearly identified by a swirl in the low clouds within the 500 mb eye.

Excellent tail Doppler and [lower fuselage radar](#) data were also obtained (3 radar composites were transmitted to NHC in real-time, but no EVTD wind fields were sent). We also collected some good F/AST data along a N-S line of convection 10 nm W of the west eyewall. Cloud microphysics data were also collected (good ice data in the rainbands W of the center and rain data in the inner core).

The successful AXBT launches in the S, SE and E eyewalls reported SSTs between 27.2-26.2C, about 2-3 deg cooler than the 29.0 C SSTs observed 2 days ago. Estimates of ocean mixed layer depth in this region ranged between 60-90 m in this area, about 20-30 m deeper than 2 days ago, suggesting that strong mixing had occurred beneath the storm in the 12-18 hrs that it had remained stationary. This cooling under the eye and E eyewall semicircle may have been primarily responsible for the cessation of the storm deepening and decrease in convection.

Evaluation:

This flight is part of a landmark 5-plane synoptic flow experiment for determining the environmental flow structure of the atmosphere around a developing TC while also determining the oceanic thermal structure beneath the inner core. It marks the first time in history that 5 research aircraft have flown a coordinated pattern simultaneously in a hurricane.

Problems:

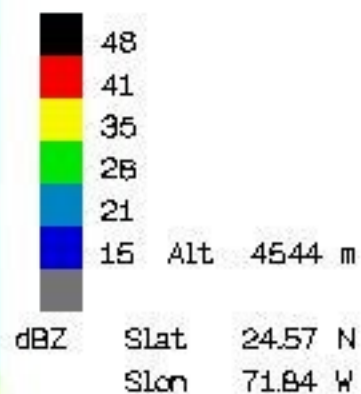
Difficulties were again encountered in deploying GPS sonde pairs on either side of the convective eyewall during the SW-NE transit due to a GPS receiver channel failure in the aircraft. This lead to missed drop points in the eyewall.

Peter G. Black

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360 X 360 km

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