Mission Summary
990806H Aircraft 42RF
Early-Season: Tropical Cyclone Air-Sea Interaction
Gulf Loop Current/Eddy Flight II

Scientific Crew (42RF)

Lead Scientist	P. Black, L. Shay (US/RSMAS)
AXBT Scientist	J. Cione
AXCP/AXCTD Scientist	D. Jacob (UM/RSMAS)
Observers	G. Goni, E. VanCoverden

Mission Briefing:

This mission was the second early-season, air-sea interaction flight designed to map the boundaries of the Gulf Loop Current and associated warm anticyclonic eddies as well as obtain an initial estimate of the heat content anomalies associated with these features. The experiment designed to measure the current and density anomalies associated with these features as a complement to the thermal anomalies mapped during the 990803H flight, as well as relate the in situ data to TOPEX and ERS-2 satellite-derived estimates of upper layer heat content and layer thickness relative to 20 and 26°C water. The experiment is designed to determine the effect of heat content in anomalous warm eddies in the Gulf of Mexico on hurricane intensity change. A secondary objective was to test the aircraft receiver system for the AXCP (measures temperature and current vector vs. depth) and AXCTD (measures temperature and conductivity (salinity) vs. depth from which density is calculated) probes.

With the help of the thermal analysis from the 990803H AXBT flight, this second flight was designed to map the currents associated with the main Loop Current region and the main anticyclonic warm eddy in the process of breaking off from the northwest region of the Loop Current. The flight pattern zig-zagged across these features while most AXCPs were dropped across the region of strongest thermal gradient, and hence expected strongest currents.

Mission Synopsis

The flight departed MacDill AFB at 1207 UTC and landed there at 2036 UTC, a duration of 8.5 hours, and was conducted at radar altitiude of 5 kft (1.5 km, 850 mb). The flight pattern consisted of a saw-tooth pattern across the Loop Current and warm eddy to the northwest.

After the Mark 10 receiver was switched, success rates exceeded 95%. All data was recorded on 90 minute Digital Analog Tapes for processing within the laboratory. Based on the two AXCPs and AXCTDs deployed on the 3 Aug flight, AOC corrected the problem of 7 dB loss in the cable connecting the antenna to the receiver by adding a preamplifier yielding a 3 dB gain in the signals entering the Mark 10 receiver and Mark 12 cards. A second issue dealt with altitude and speed. It was decided to fly the aircraft at 5000 feet at a speed of 190 knots as per previous deployments.

A total of 18 AXBTs were deployed, all CAD-launched. Clean signals were observed to 350 m on all AXBTs. 18 AXCPs and 16 AXCTDs were also launched. One AXCTD and 4 AXCPs failed due to a defective receiver system. Following receiver replacement with a backup system excellent data was obtained to 1500 m.

Profilers deployed: 18 AXCPs, 16 AXCTDs, and 18 AXBTs
Successful Profilers: 15 AXCPs, 14 AXCTDs, 18 AXBTs
Success Rates: 83% (AXCPs) , 87% (AXCTDs) , 100% (AXBTs)

Evaluation:

Additional detail was added to the structure of the double-lobbed eddy pattern diagnosed by the AXBTs and TOPEX/ERS2 blended analysis from 3 August. Preliminary scientific findings are:

1) Upper layer thicknesses were within 5-10% of those estimated from remote sensing techniques using TOPEX and ERS-2 altimetry;
2) Deep isothermal layers were evident within the Loop Current and warm eddy regions, whereas outside of this regime, shallow mixed layers were eivdent in the data; and
3) Near-surface currents exceeded 1.5 m s^{-1} with large current gradients in the vertical including evidence of internal waves trapped within the eddy.

All data were recorded on 90-minute Digital Analog Tapes (DATs) for post-processing.

Problems:

A defective AXCP/AXCTD receiver was detected, and replaced in flight. This unit is being returned to Sippican, Inc. for repair or replacement. In addition, five profilers will be replaced since the receiver problem was due to the factory.

Peter Black and Nick Shay
8/15/99