Mission Summary
991002I Aircraft 43RF
Tropical Cyclone Air-Sea Interaction
Gulf Loop Current/Eddy "Pre-Storm 1" Flight

Scientific Crew (43RF)

Lead Scientist	J. Cione
AXBT Scientists	P. Black
AXCP/AXCTD Scientists	N. Shay, D. Jacob

Mission Briefing:

This was a follow on to the early-season AXBT air-sea interaction flight (990803H) which was 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. Similar to the early season flight, the goal of this experiment was to determine the 'pre-storm' heat content available in anomalous warm eddies and the loop current within the Gulf of Mexico. As with the earlier experiment, three expendable probe types: AXBT (measures temperature vs. depth), AXCP (measures temperature and current vector vs. depth) and AXCTD (measures temperature and conductivity (salinity) vs. depth from which density is calculated) were used to map out the vertical thermal structure within the Gulf of Mexico. Analysis of this data will enable researchers to quantitatively establish the 'initial heat content' available to an encroaching tropical cyclone.

Using the early season Depth to 26^{o}C objective analyses, blended TOPEX and ERS2 satellite altimeter maps from the University of Colorado (CCAR), as well as High resolution AVHRR 3 and 7 day SST analyses from Johns Hopkins University Advanced Physics Laboratory (JHUAPL), estimates of warm core eddy (WCE) and loop current boundaries were established. From these estimates a flight pattern was designed with the goal of 're-mapping' the main Loop Current/Eddy region (MLCER). In addition, the flight pattern sampled a 'new' distinct closed off eddy located to the south and west of the MLCER. The complex structure deduced from the satellite altimeter data was confirmed (to the first order) by the AXBT/AXCP/AXCTD survey.

Mission Synopsis

The flight departed MacDill AFB at 1739 UTC on 10/2 and landed there at 0005 UTC, on 10/3 for a duration of 6.5 hours. The flight pattern consisted of a west to east leg which transected the upper portion of the MLCER, a figure four pattern that sampled the eddy to the SW and a 'butterfly' pattern (3-legged) centered on the southern portion of the MLCER and associated gradient regions. Flight level throughout the experiment was 5 K ft. Since AXCTDs and AXCPs have high failure rates when launched at high speed, it was necessary to slow down the aircraft to 190 kt (indicated) before deploying these expendables.

A total of 31 ocean profilers were deployed, 15 AXBTs, 8 AXCPs and 8 CTDs. Clean signals were observed below the mixed layer for all 15 AXBTs and good signal strength (below 1000 m) was noted for both AXCPs and AXCTDs. One AXCP and one AXCTD hung up at the surface. As such only SSTs were obtained (i.e. no subsurface data).

To the first order, the data from the AXBTs, AXCPs and AXCTDs agreed well with the TOPEX/ERS2, and AVHRR-based eddy boundary pre-flight estimates. Surface winds were estimated to be in the 15 kt range (qualitative- no SFMR or GPS sondes) and as such, a noticeable ocean mixed layer structure was evident for most drops. Mixed layer depths (MLD) ranged from 80m within the warm core structures to minimum values near 15m near the coastal shelf. SSTs did

not exhibit a great degree of variability and ranged between 28.1^{o}C outside the eddies/loop current to near 28.7^{o}C within the MLCER and SW Eddy.

Due to the nature of this mission, relatively low wind conditions present and lack of precipitation, Doppler and C-band radar systems as well as SFMR were not utilized for this mission. It should also be noted that no GPS dropsondes were used.

Problems:

The major problem associated with this flight occurred ~2223Z when the left front windshield cracked in a 'spider web' fashion. As such, Captain Jerry McKim immediately aborted the mission and vectored 43RF back to MacDill. Fortunately, no injuries resulted. Due to the aborted mission we had to eliminate ~25-30% of the pattern beginning with the second leg of the 'butterfly' pattern in the MLCER (see drawings from LPS log sheet for more detail). Still, we were able to drop 6 of our planned expendables along this final leg before reaching MacDill. Initially 42 profilers were planned but only 31 were actually deployed (i.e. 74%). Since we did not finish the desired pattern, a 'follow-up' pre-storm air-sea mission was conducted on 10/4/99 which sampled the areas not covered on this mission.

Joe Cione, 10/7/99