2023 NOAA/AOML/HRD Hurricane Field Program - APHEX

MATURE STAGE EXPERIMENT
Flight Pattern Description

Experiment/Module: Tropical Cyclone Diurnal Cycle Module

Investigator(s): Jason Dunion (PI), Jun Zhang (Co-PI), John Knaff (NESDIS/STAR-CIRA/Colorado State University), Chris Slocum (NESDIS/STAR-CIRA/Colorado State University)

Requirements: Categories 2–5

Mature Stage Science Objective(s) Addressed:

1) Collect observations targeted at better understanding internal processes contributing to mature hurricane structure and intensity change [*APHEX Goals, 1 3*].

2) Collect observations targeted at better understanding the response of mature hurricanes to their changing environment, including changes in vertical wind shear, moisture and underlying oceanic conditions [APHEX Goals 1, 3].

P-3 Pattern #1:

What to Target: Sample the near environment (R~80-160 n mi / R~150-300 km) and environment (R~215 n mi / R~400 km) of the TC boundary layer. This module can be an add-on to the Gravity Wave Module and can be conducted in any quadrant of the storm.

When to Target: TC distance to land should be ≥250 n mi (≥460 km). Optimally, this module should be conducted during the peak day (~15–21 LT) or night (~03–09 LT) phases of the TCDC. Additionally, this module should only be conducted if consecutive 12-hr P-3 missions are planned and the module can be conducted in the same quadrant of the storm for 2 consecutive missions. Separation between the 2 consecutive missions should be ~9-15 hr and should include 1 day and 1 night mission.

Pattern: Any standard P-3 pattern that provides symmetric coverage (e.g., Rotated Figure-4, Figure-4 Butterfly, etc.). This module can be conducted during the inbound ferry to the IP [Option A, Fig. 1] or during the final outbound leg in the pattern [Option B, Fig. 2]. A series of 6 dropsondes will be deployed in a straight radial leg to (or from) the storm.

- Option A (inbound, Fig. 1): a series of 6 dropsondes should be deployed, the 1st at R=215 n mi (~400 km). If there is a primary rainband near R=215 n mi (~400 km), the 1st drop should be adjusted to be just inside that band. Deploy the 2nd dropsonde at R=160 n mi (R~300 km) and then dropsondes every 20 n mi starting at R=140 n mi (~260 km) and ending at R=80 n mi (~150 km).
- Option B (outbound, Fig. 2): a series of 6 dropsondes should be deployed, the 1st at R=80 n mi (~150 km), then every 20 n mi and ending at R=160 n mi (~300 km). The 6th dropsonde should be deployed at R=215 n mi (~400 km). If there is a primary rainband near R=215 n mi (~400 km), the 6th drop should be adjusted to be just inside that band.

There are no requirements for dropsondes inside or outside of R=80-215 n mi (~150-400 km). However, routine dropsondes inside of R=80 n mi (~150 km) would be beneficial to the module science objectives.

MATURE STAGE EXPERIMENT
Flight Pattern Description

Flight altitude: 8-12 kft pressure altitude (radar altitude is acceptable) or as high as possible to provide better vertical sampling by GPS dropsondes that are deployed.

Leg length or radii: Leg lengths should be ~ 135 n mi, spanning from R=80 to R=215 n mi (~150-400 km) from the storm center.

Estimated in-pattern flight duration: ~25-30 min

Expendable distribution: 6 dropsondes (1 dropsonde near ~ R=215 n mi (~400 km), 5 dropsondes spaced 20 n mi apart from R=80 n mi (~150 km) to R=160 n mi (~300 km).

Instrumentation Notes: Use TDR defaults. GPS dropsondes should be quality controlled and transmitted to the GTS in real-time. Use straight flight legs as safety permits.

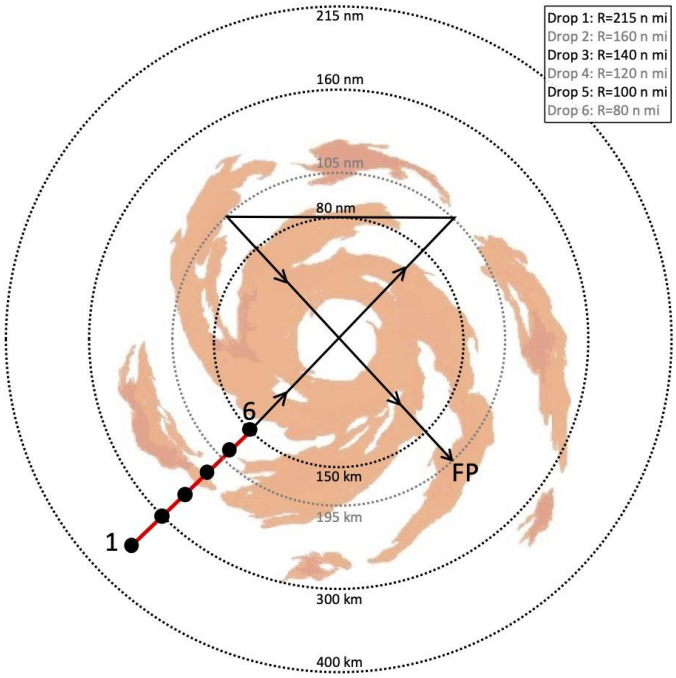

Figure 1. *TCDC Module (Option A) with 6 dropsondes (black circles) launched. The 1st dropsonde is deployed at R=~215 n mi (~400 km). The 2nd dropsonde is deployed at R=160 n mi (R~300 km) and then dropsondes every 20 n mi starting at R=140 n mi (~260 km) and ending at R=80 n mi (~150 km).*

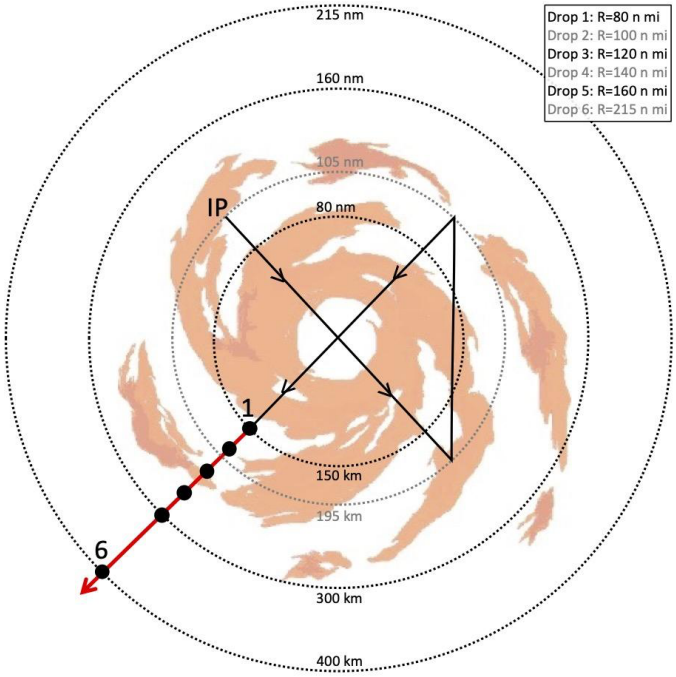

Figure 2. *TCDC Module (Option B) with 6 dropsondes (black circles) launched. The 1st dropsonde is deployed at R=80 n mi (~150 km), then every 20 n mi and ending at R=160 n mi (~300 km). The 6th dropsonde is deployed at R=~215 n mi (~400 km).*