2022 NOAA/AOML/HRD Hurricane Field Program - APHEX

SATELLITE VALIDATION EXPERIMENT
Flight Pattern Description

Experiment/Module: TROPICS Satellite Validation Module

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Requirements: No requirements: flown at any stage of the TC lifecycle

Early Stage Science Objective(s) Addressed:

1) Test new (or improved) satellite technologies with the potential to fill gaps, both spatially and temporally, in the existing suite of airborne measurements in TCs. These measurements include improved three-dimensional representation of the hurricane wind field and thermodynamic structure and more accurate measurements of ocean surface winds and underlying ocean conditions [APHEX Goal 2]

P-3 Pattern #1

What to Target: Coordinated underflights of TROPICS satellites in the TC inner core (R ≤ 150 km), near environment (R = 150–300 km), and far environment (R > 300 km).

When to Target: P-3 flight patterns will be adjusted to coordinate temporal and spatial overlap with overpasses by the TROPICS satellite. GPS dropsonde and P-3 tail Doppler radar (TDR) sampling should be timed to be ≤30 min and ≤400 n mi (750 km) from satellite nadir. The TROPICS Pathfinder is in a sun-synchronous orbit and crosses the equator at 1330 LTAN. This time will vary for the six constellation satellites, which are inclined at a 30° angle from the equator.

Pattern: This is a breakaway pattern that involves a flight leg that underflies the TROPICS satellite. A straight leg is ideal but not required. The full satellite swath width is ~2000 km, but the highest priority is coverage of nadir and the area within +/- 750 km of nadir. The P-3 leg should ideally begin ~10–15 min before and continue for ~10–15 min after the satellite passes "overhead". This will equate to a P-3 leg length of ~90–135 n mi (165–250 km). P-3 ferries to and from the storm can also be used to target satellite underflights in the far environment. NASA's MTS aircraft software should be used to coordinate the underflight.

Flight altitude: 10–12 kft (5 kft is minimum altitude for dropsonde launches) in precipitating regions (e.g., inner core) and 20+ kft in non-precipitating regions (e.g., the TC far environment).

Leg length or radii: N/A

Estimated in-pattern flight duration: ~20–30 min

Expendable distribution: During the TROPICS underflight, GPS dropsonde spacing should be at least 20 n mi (~35 km) and ideally 10 n mi (~20 km), which will require ~6-14 dropsondes.

Instrumentation Notes: Use TDR defaults. Use straight flight legs as safety permits. All GPS dropsonde data should be transmitted to the Global Telecommunication System (GTS) in real-time to ensure availability for assimilation into forecast models.

G-IV Pattern #1

What to Target: Coordinated underflights of TROPICS satellites in the TC inner core (R ≤ 150 km), near environment (R = 150–300 km), and far environment (R > 300 km).

When to Target: G-IV flight patterns will be adjusted to coordinate temporal and spatial overlap with overpasses by the TROPICS satellite. GPS dropsonde and P-3 tail Doppler radar (TDR) sampling should be timed to be ≤30 min and ≤400 n mi (750 km) from collocated satellite nadir temperature, and moisture, and precipitation retrievals and will depend on the area of operation (determined on a case-by-case basis). TROPICS Pathfinder is in a sun-synchronous orbit and crosses the equator at 1330 LTAN. This time will vary for the six constellation satellites, which are inclined at a 30° angle from the equator.

Pattern: This is a breakaway pattern that involves a flight leg that underflies the TROPICS satellite. A straight leg is ideal but not required. The full satellite swath width is ~2000 km, but the highest priority is coverage of nadir and the area within +/- 750 km of nadir. The G-IV leg should ideally begin ~10–15 min before and continue for ~10–15 min after the satellite passes "overhead". This will equate to a G-IV leg length of ~140–210 n mi (~260–390 km). G-IV ferries to and from the storm can also be used to target satellite underflights in the far environment. NASA's MTS aircraft software should be used to coordinate the underflight.

Flight altitude: 40–45 kft or as high as possible to provide better vertical sampling by dropsondes that are deployed.

Leg length or radii: N/A

Estimated in-pattern flight duration: ~20–30 min

Expendable distribution: During the TROPICS underflight, GPS dropsonde spacing should be at least 20 n mi (~35 km) and ideally 10 n mi (~20 km), which will require ~6-14 dropsondes.

Instrumentation Notes: Use TDR defaults (though not a requirement for this experiment). Use straight flight legs if possible. All GPS dropsonde data should be transmitted to the Global Telecommunication System (GTS) in real-time to ensure availability for assimilation into forecast models.