2023 NOAA/AOML/HRD Hurricane Field Program - APHEX

EARLY STAGE EXPERIMENT
Flight Pattern Description

Experiment/Module: Flight-Level Assessment of Intensification in Moderate Shear [FLAIMS] Module

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Requirements: TD, TS, Category 1

Early Stage Science Objective(s) Addressed:

1) Collect datasets that can be used to improve the understanding of intensity change processes, as well as the initialization and evaluation of 3-D numerical models, particularly for TCs experiencing moderate vertical wind shear [*APHEX Goals 1, 3*].

2) Obtain a quantitative description of the kinematic and thermodynamic structure and evolution of intense convective systems (convective bursts) and the nearby environment to examine their role in TC intensity change [*APHEX Goals 1, 3*].

P-3 Pattern #1

What to Target: The quadrant (or azimuthal region) of maximum wind speed in a moderately sheared weak TC, either during a period of intensification or when imminent intensification is likely.

When to Target: Ideal conditions are when substantial intensification is either ongoing or believed to be imminent. This could be either a moderately misaligned vortex that is exhibiting convective bursts, or a vortex that has recently become aligned. When conditions are favorable, this module should be flown every 6-12 h.

Pattern: Fly repeated straight radial legs along the same azimuth, either beginning from the center and continuing outward to 105 n mi, or beginning at the outer point and continuing inward to the center, depending on where the module is initiated relative to the region of maximum winds. At the vortex center (outer point of the leg), the P-3 turns around and flies outbound (inbound), i.e., the center is not crossed. This pattern is repeated such that there are a total of 2–6 combined inbound and outbound radial legs. Optionally, the leg length can be shortened if the inner-core and maximum winds are confined to well within 105 n mi.

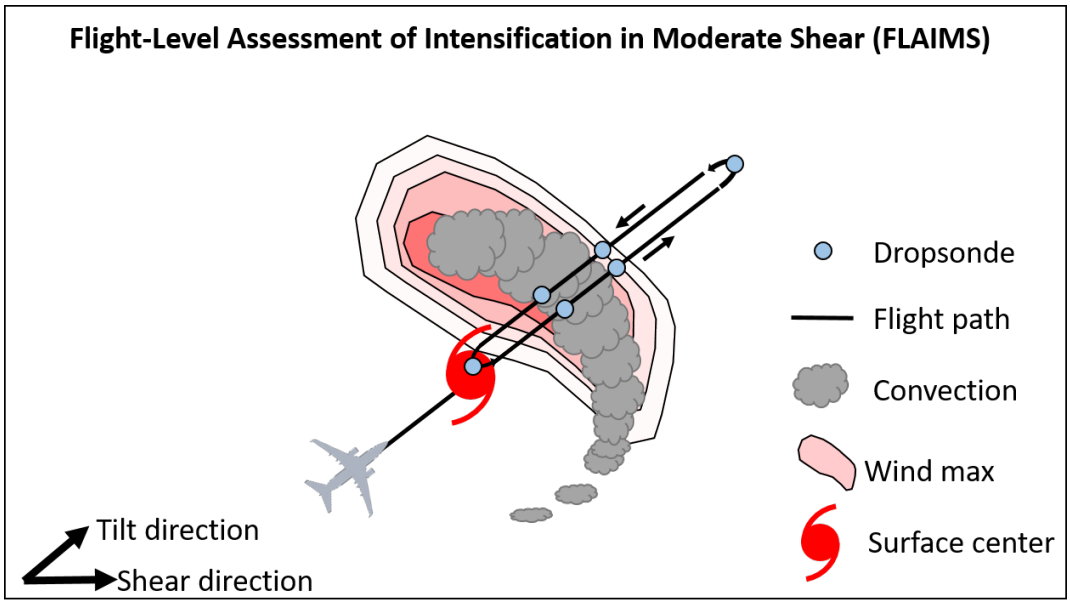

Figure 1, showing a schematic illustration of the FLAIMS module. In this example, the initial point of the module is the low-level vortex center, and an initial outbound leg is followed by an inbound leg along the same azimuth where the maximum flight-level winds are found. Following this inbound leg and center penetration, the plane turns around at the vortex center location and begins another outbound leg. This can be repeated for a total of 2–6 combined inbound and outbound legs. Note that the initial leg can alternately be inbound, and the module can either end with a center crossing or at the outer point.

Flight altitude: 10–12 kft

Leg length or radii: 105 n mi (194 km), but optionally can be shortened as described above.

Estimated in-pattern flight duration: 1–3 hr if standard leg lengths are flown.

Expendable distribution: Release dropsondes at each vortex center point and outer point, as well as the leg midpoint and RMW.

Instrumentation Notes: TDR analyses should be generated for each radial leg.

P-3 Pattern #2

What to Target: The quadrant (or azimuthal region) of maximum wind speed in a moderately sheared weak TC, either during a period of intensification or when imminent intensification is likely.

When to Target: Ideal conditions are when substantial intensification is either ongoing or believed to be imminent. This could be either a moderately misaligned vortex that is exhibiting convective bursts, or a vortex that has recently become aligned. When conditions are favorable, this module should be flown every 6-12 h.

Pattern: This is a modified version of Pattern #1, whereby instead of turning around after the initial outbound radial leg and immediately flying inbound along the same azimuth, a leg is flown to a point 45 degrees downwind, followed by an inbound radial leg to the center (completing a triangle), and then finally another outbound leg is flown along the original azimuth. This "Triangle FLAIMS" can optionally be repeated multiple times. The initial radial leg could alternatively be inbound, but in such a case, this needs to be the azimuth that is further downwind (north in the example schematic below), in order for the non-radial side of the triangle to be flown in the downwind direction. As with Pattern #1, the radial legs can be optionally shortened if the maximum winds are confined to well within the 105 n mi standard leg length.

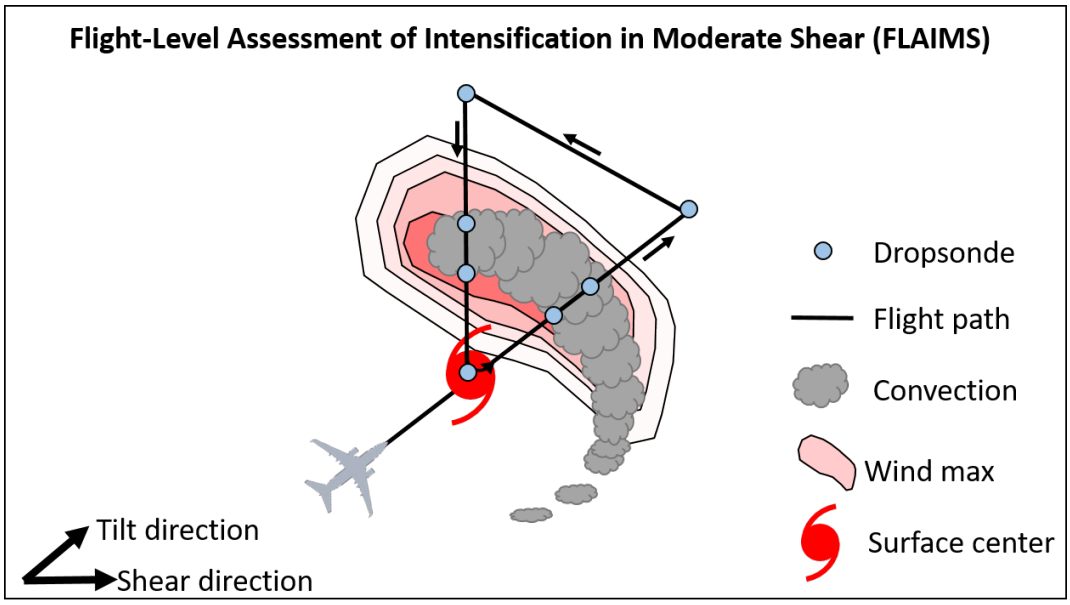

Figure 2, showing a schematic illustration of Pattern #2 for the FLAIMS module. In this example, the initial point of the module is the low-level vortex center, and an initial outbound leg is followed by a leg that flies 45 degrees downwind, and the triangle is then completed by flying inbound to the center. Following this inbound leg and center penetration, the plane turns around at the vortex center location and begins another outbound leg along the same azimuth as the initial outbound leg. This can be repeated multiple times.

Flight altitude: 10–12 kft

Leg length or radii: 105 n mi (194 km), but optionally can be shortened as described above.

Estimated in-pattern flight duration: Each triangle will take just over an hour to complete (assuming standard 105 n mi leg lengths).

Expendable distribution: Release dropsondes at each vortex center point and outer point, as well as the leg midpoint and RMW.

Instrumentation Notes: TDR analyses should be generated for each radial leg.