

MODULE DESCRIPTION
13. Tropical Cyclone Eye Mixing Module

Principal Investigator: Sim Aberson

Links to IFEX: Goal 3: Improve our understanding of the physical processes important in intensity change for a TC at all stages of its lifecycle

Significance: Eyewall mesovortices have been hypothesized to mix high entropy air from the eye into the eyewall, thus increasing the amount of energy available to the hurricane. Signatures of such mesovortices have been seen in cloud formations within the eyes of very strong TCs, and from above during aircraft penetrations. However, the kinematic and thermodynamic structures of these features have never been directly observed. Observations within the eye below the inversion can allow for the study of these mesovortices and improve knowledge of small-scale features and intensity changes in very strong TCs.

Objective: The objective is to directly observe the kinematic and thermodynamic structures of eyewall mesovortices for the first time. This would allow research into the impact these features have on subsequent intensity changes.

Requirements: A TC with a clearly defined visible eye, eyewall, and inversion and an eye diameter of at least 25 nm is needed. This should only be done during daytime missions. The inversion level is defined as the interface between cloudy air below and clear air above inside the eye.

Hypothesis: Eyewall mesovortices play an important role in tropical cyclone intensity change.

Description: Although this is not a standalone experiment, it could be included within any missions during aircraft passage through the eye. The P-3 will penetrate the eyewall at the altitude proposed for the rest of the flight. Once inside the eye, the P-3 will descend from that altitude to a safe altitude below the inversion while performing a figure-4 pattern. The leg lengths will be determined by the eye diameter, with the ends of the legs at least 2 nm from the edge of the eyewall. Upon completion of the descent, the P-3 will circumnavigate the eye about 2 nm from the edge of the eyewall in the shape of a pentagon or hexagon. Time permitting; another figure-4 will be performed during ascent to the original flight level. Depending upon the size of the eye, this pattern should take between 0.5 and 1 h.

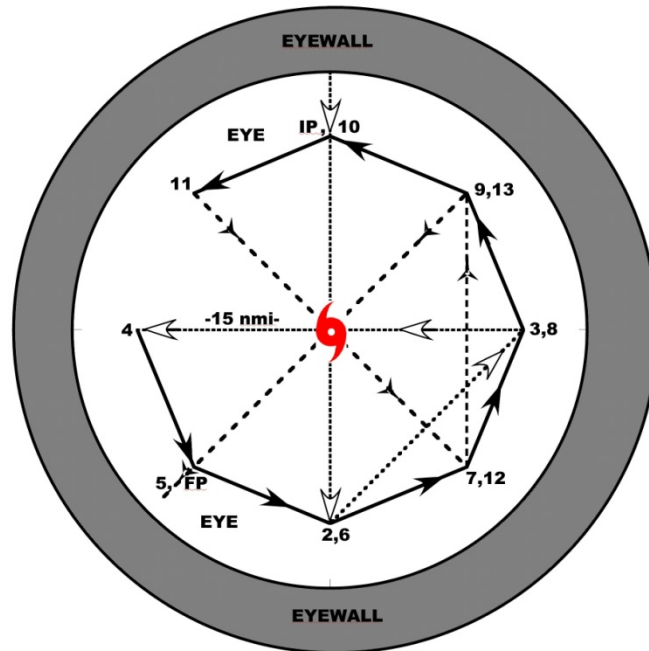


Figure 13-1. The P-3 approaches from the north, penetrates the eyewall into the eye, and descends below the inversion while performing a figure-4 (dotted line) in the eye. The P-3 circumnavigates the eye in an octagon or pentagon (solid line), and then ascends while conducting another figure-4 (time permitting) rotated 45 degrees from the original (dashed line).