Overview of the Tropical Cyclone Intensity (TCI) Experiment: High-Resolution Observations of Hurricanes Patricia, Joaquin, and Marty

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Tropical Cyclone Intensity (TCI) Experiment Background

Role of Outflow in TC Intensification

- Has been relatively unexplored
- Few detailed observations of outflow layer coordinated with inner core observations

Key Science Issues

1) Document the inner-core at high-resolution, and the larger-scale outflow TC intensity change
2) Explore co-evolutionary processes
3) Understand the impact of inner core and outflow observations on TC intensity and structure predictions

NASA WB-57 Aircraft:
- Duration ~9 h, range ~2000 nm, speed ~400 kt, cruise altitude ~60,000 ft
- Based at Elington AFB; TC deployed to: i) Hartingen TX (EPAC); ii) Warner Robbins AFB, GA (WALT)
- Coordination: NASA GH, NOAA-P3, AF C-130
- C-130 deployed AUB in TROPICS

Real-Time Flight Ops Tools

NCAR EOL Field Catalog NASA Mission Tools Suite (MTS)

Joaquin Deployment Decision

- Can we define the outflow for what we observe with high-density AMVs and TCI (average 225 profiles/hr)
- TCI Ops Center at NRL (Monterey); Flight Ops Center at aircraft

- September 28, 2015: Was 1.5 hrs before the first intended science flight, for time to reposition the aircraft and personnel
- The TCI mission scientists, forecast team, aircraft team, and NASA mission control team daily to develop and act upon aircraft deployment plans
- Joaquin forecasts

Joaquin Forecasts

- Hurricane Joaquin (Oct 2-5)
- Hurricane Marty (Sep 27-28)
- Hurricane Patricia (Oct 20-24)

Real-World Observations of Hurricane Marty

- Hurricane Marty (Cat 1) intensified in the presence of moderate shear TC performed 2 missions with transects across eye and outflow
- Profiling over the inner core gravity waves, and tropopause with anomalous warm anomaly (C)

Joaquin unexpectedly underwent RI in moderate to strong shear conditions

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Patricia (Cat 5) entered the southwestern Pacific Oct 27-29
- 185 kts (poorly forecasted)
- Intensified from a TS to Cat 5 in 24 h
- Hurricane Patricia (23 Oct)

- Hurricane Patricia was mood intense TC recorded since Gyration disappeared in 1960
- Patrick was transected 
- Hurricane Patricia (Oct 20-24)

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Summary and Future Directions

- Key Findings
  - Unprecedented set of dropsonde and HRAD observations in Hurricanes Marty, Patricia, and Tropical Storm Erika
  - ~600 dropsondes deployed in 11 WB-57 flights
  - High-resolution observations of inner core and outflow from ~60 km
  - Dropsondes & AMVs (UW) analyzed in real time (NCAR catalog, NASA MTS)
- Future Research
  - Utilize TCI observations (HHSS, HRAD, AVHRR) and high-resolution models to test hypotheses and theories on interactions of TCs and convection
  - Qualify impact of TCI data on forecasts using advanced assimilation methods

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