

# TCS08 Experiment Analysis: Flight Strategies

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# *TCS08 Experimental Analysis: Statistics*



## WC-130J Aircraft Performance

### Research Flights

- Missions: 26
- Mission Flight Hours: 263
- High-Level Missions, 300mb: 12
- TC 700mb Missions: 12
- Buoy Deployment Missions: 2
- Tropical Cyclones: 4



# *WC-130J Capabilities*

- **Endurance:** 12-hour
- **Ceiling:** 300 mb, i.e. 9.7 km (31K ft) altitude
- **Flight level data:** Real-time 30-s mean HDOB, 1-s resolution recorded
- **SFMR surface winds** – TC intensity, ocean surface forcing
  - **Radar Video** - defines eyewall, rainband strength, location and structure.
  - **Real-Time SATCOM** - transmits data to ops center for real-time quick look, flight track adjustments
- **GPS sondes (750)** - 3D storm-scale structure: from 700 mb in TC; from 300 mb in formation cases
- **AXBT's (250)/ Drift Buoys (24)** - define ocean thermal structure, TC-induced response



# *WC-130J Data Status*

- **Flight level data:** HDOB (SFMR on-board processed) , VORTEX: organized by flight, need to organize by data type
- **SFMR surface winds** – needs to be QC'd with dropsondes, organized by type
  - **Radar Video** – READY, MGEG4 video, organized by date and type
  - **Real-Time SATCOM** – Need to check real time data with archive on aircraft- omissions, errors, no SATCOM for some flights
- **GPS sondes (750)** – Temp Drops organized by flight, need to organize by data type, awaiting d-file data processing from EOL
- **AXBT's (250)/ Drift Buoys (24)**- organized by date and data type: four file types:
  - Raw
  - JJXX- AXBT 'temp drop' for distribution on GTS
  - 1-m processed for NAVO
  - 0.1-m processed for NAVO



# *WC-130J Data Status*

- **Drift Buoy-** Two types, 22 buoys
  - **Surface time series:** Files being edited, Qc'd by buoy for storm period (3 days), for post-storm (3 weeks)
  - **Subsurface time series:** 10 subsurface levels to 120 m- QC'd by buoy



# *TCS08 Experiment Analysis: Tools*

## What did we use?

### 1) WC-130J Aircraft (2)

- GPS dropsonde (750, ~ 26/ft) for atmospheric profiling (high-altitude)
- AXBT\*- ocean thermal profiling (250, ~ 13/ft)
- SFMR- surface winds
- Radar Video Recording\*
- ADOS profiler/ Minimet drift buoys (24)

### 2) NRL P3 (1)

- Eldora Doppler Radar- 3D winds
- LIDAR\*- boundary layer wind profiles
- GPS dropsonde- atmospheric profiling (low)



\*First used in TCS08



# *TCS08 Experiment Analysis: Milestones*

## *What did we do?*

1. Developed detailed flight plan and communications strategies
2. Developed and implemented AXBT observing system and implemented drift buoy deployments
3. Implemented high altitude (300 mb) TC formation flight strategy with concurrent GPS sonde and AXBT deployments over a 5 deg grid
4. Provided maximum surface wind and minimum surface pressure observations during TC life cycle for validation of satellite TC Intensity estimates (Hawkins, et al)
5. Provided aircraft SFMR, radar video, AXBT and GPS dropsonde data for initialization/validation of COAMPS-TC coupled model simulations of STYJangmi and other TCS08 typhoons (Doyle, et al)



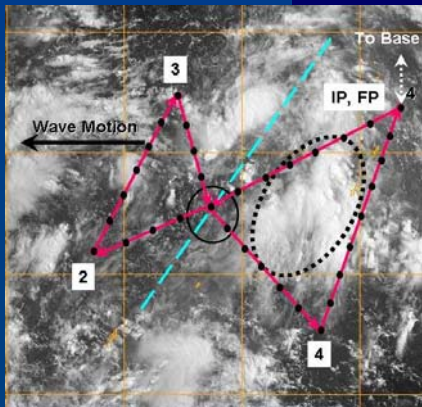


# *TCS08 Flight Patterns: Formation*

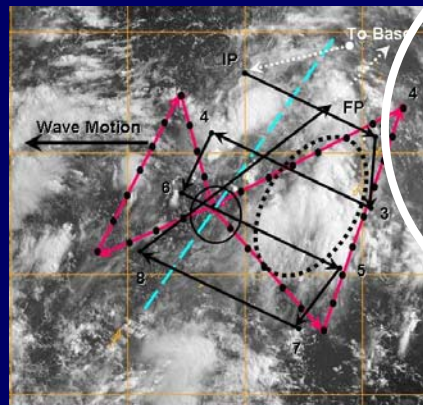
Define multi-level  
vortex and cloud  
cluster evolution

Base of Operations

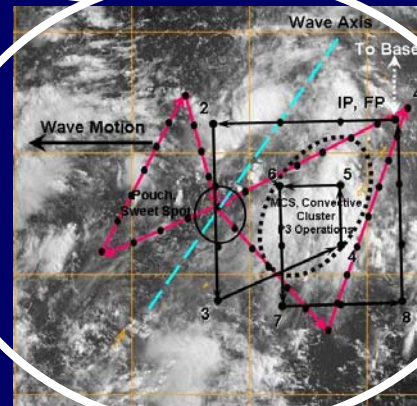
Most frequently used



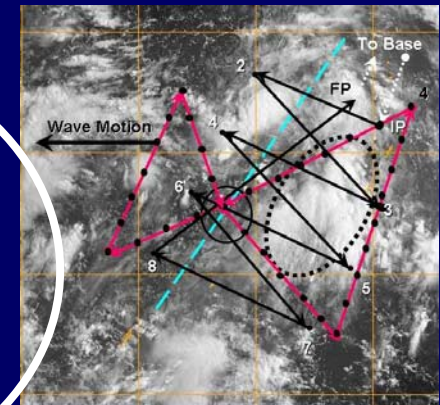
**Bow-Tie**



**Racetrack**



**Square Spiral**



**Zig-Zag**





# TCS08 Flight Patterns: TC Structure

Base of Operations

Define mean vortex  
Observe Pmin, Vmax

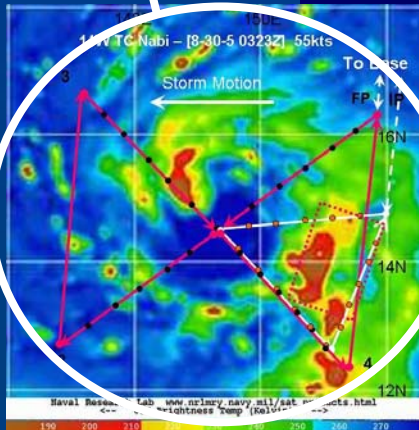
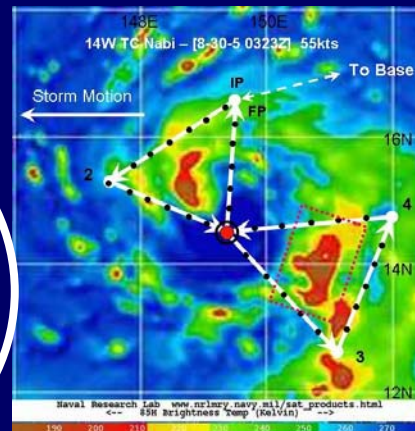
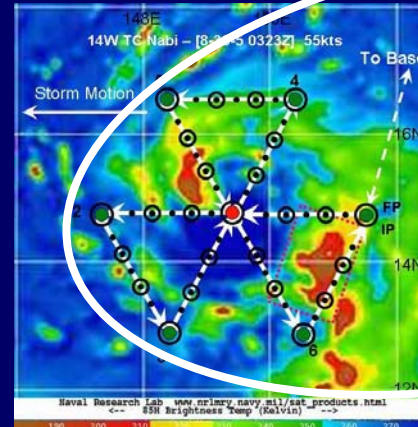


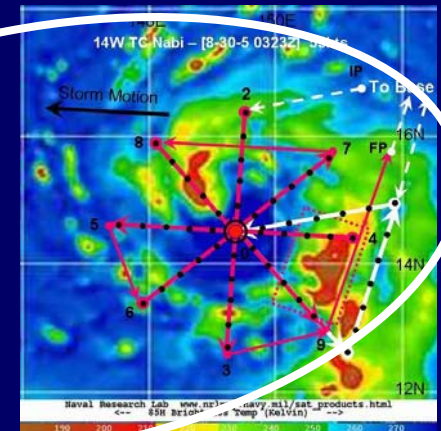
Figure 4



Bow-Tie



Butterfly

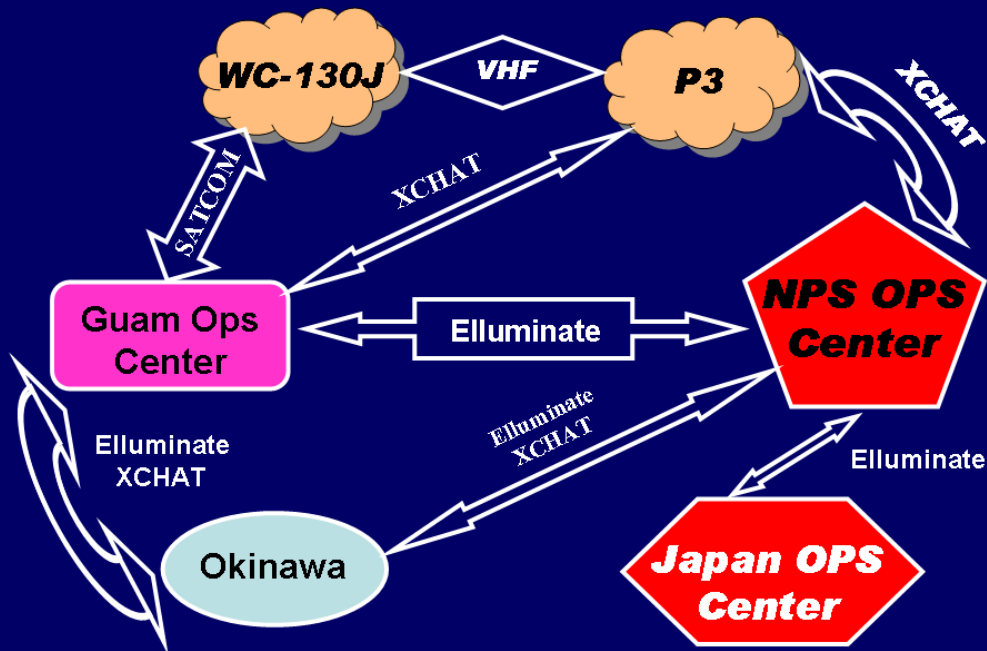


Rotated Fig 4

Define structure, TC asymmetries

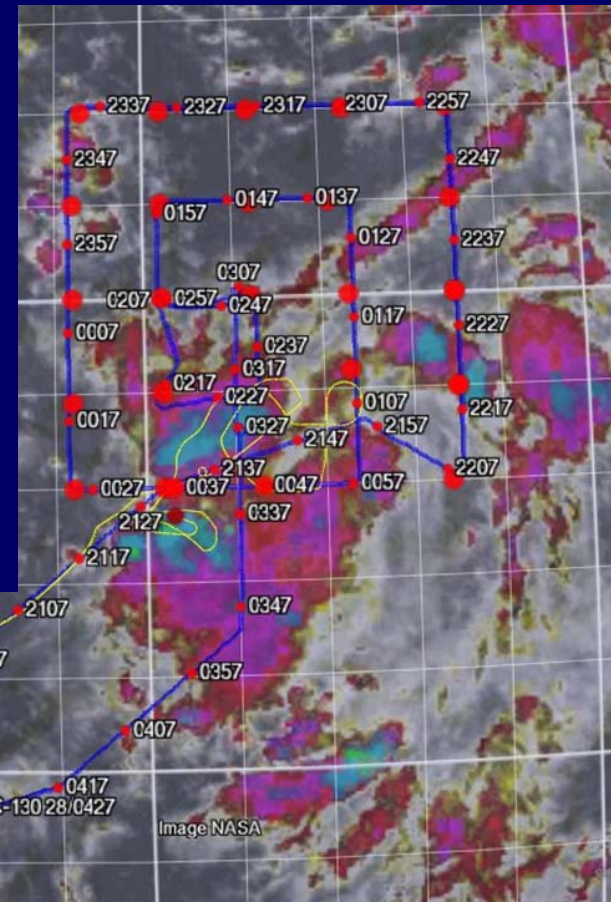


# TCS08 Experiment Analysis: Situational Awareness



## Real-Time Communications

## Real-Time Data Fusion



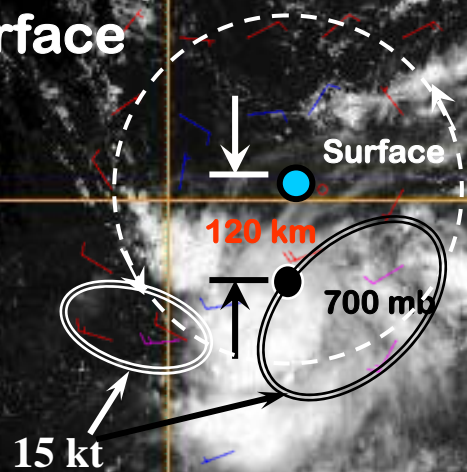
**Google-Earth**  
**MTS IR Sat**  
**WC-130J:blue**  
**P3: yellow**  
**TCS08**  
**Aug 27-28**

Developers:  
Joe Turk, NRL/JPL  
Bob Creasey, NPS



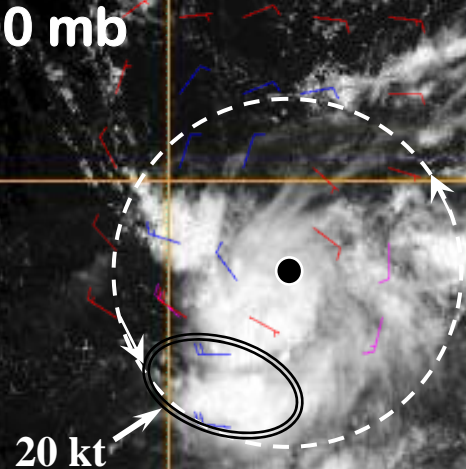


# TCS-25 27-28, Aug Surface

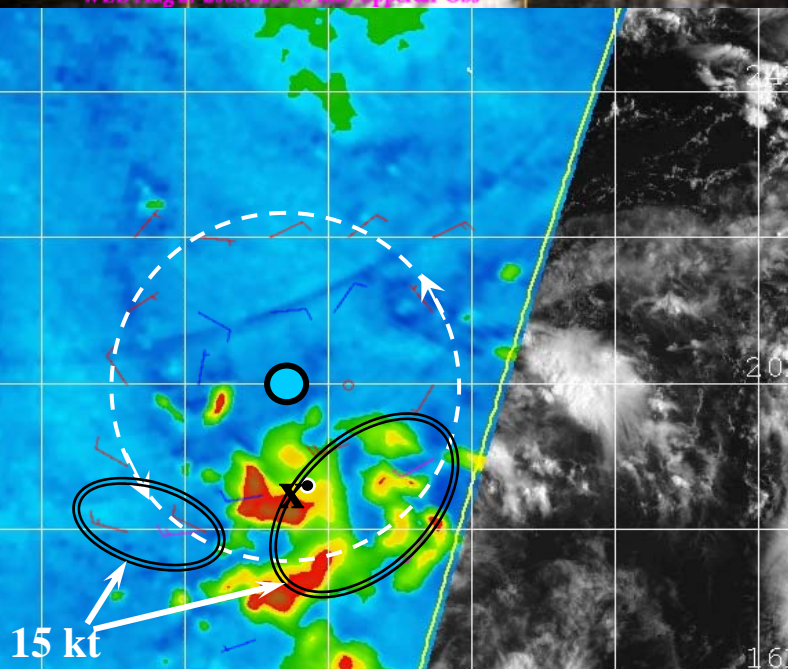


THU Aug 28 2008 0300 (0 mb) Upperair Obs  
THU Aug 28 2008 0000 (0 mb) Upperair Obs  
WED Aug 27 2008 2100 (0 mb) Upperair Obs

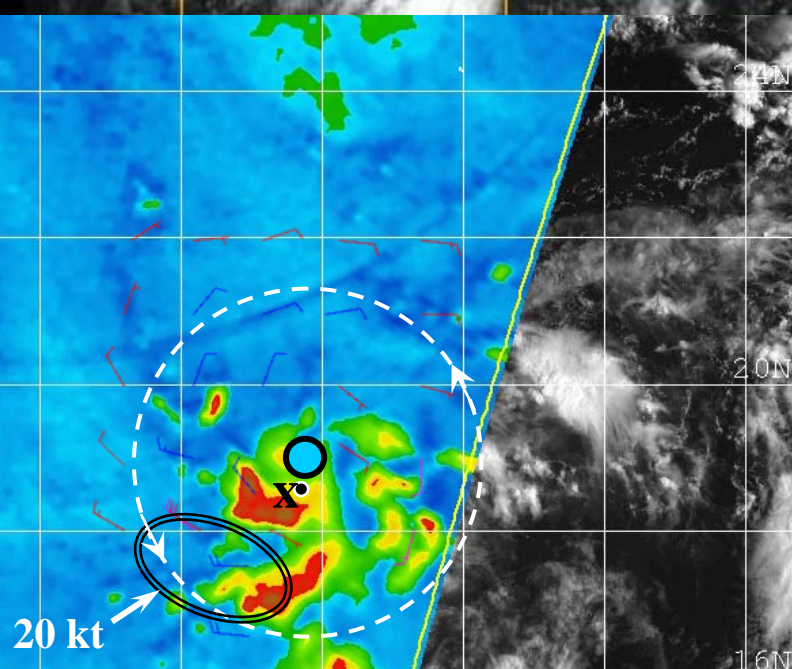
# TCS-25 27-28, Aug 700 mb



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THU Aug 28 2008 0000 (700 mb) Upperair Obs  
WED Aug 27 2008 2100 (700 mb) Upperair Obs



THU Aug 28 2008 0300 (0 mb) Upperair Obs



THU Aug 28 2008 0300 (700 mb) Upperair Obs



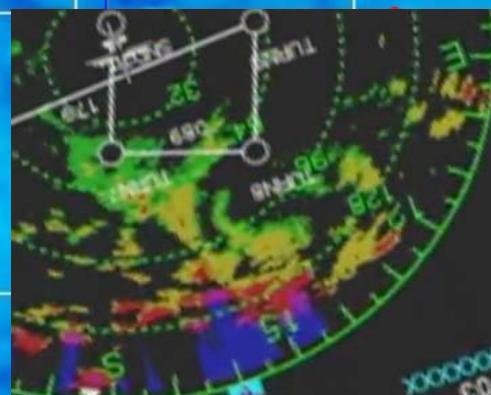
SSMIS- F16

27 Sept, 2213 GMT

WC-130J sondes- SFC

27 Sept, 21 UTC -

28 Sept, 03 UTC

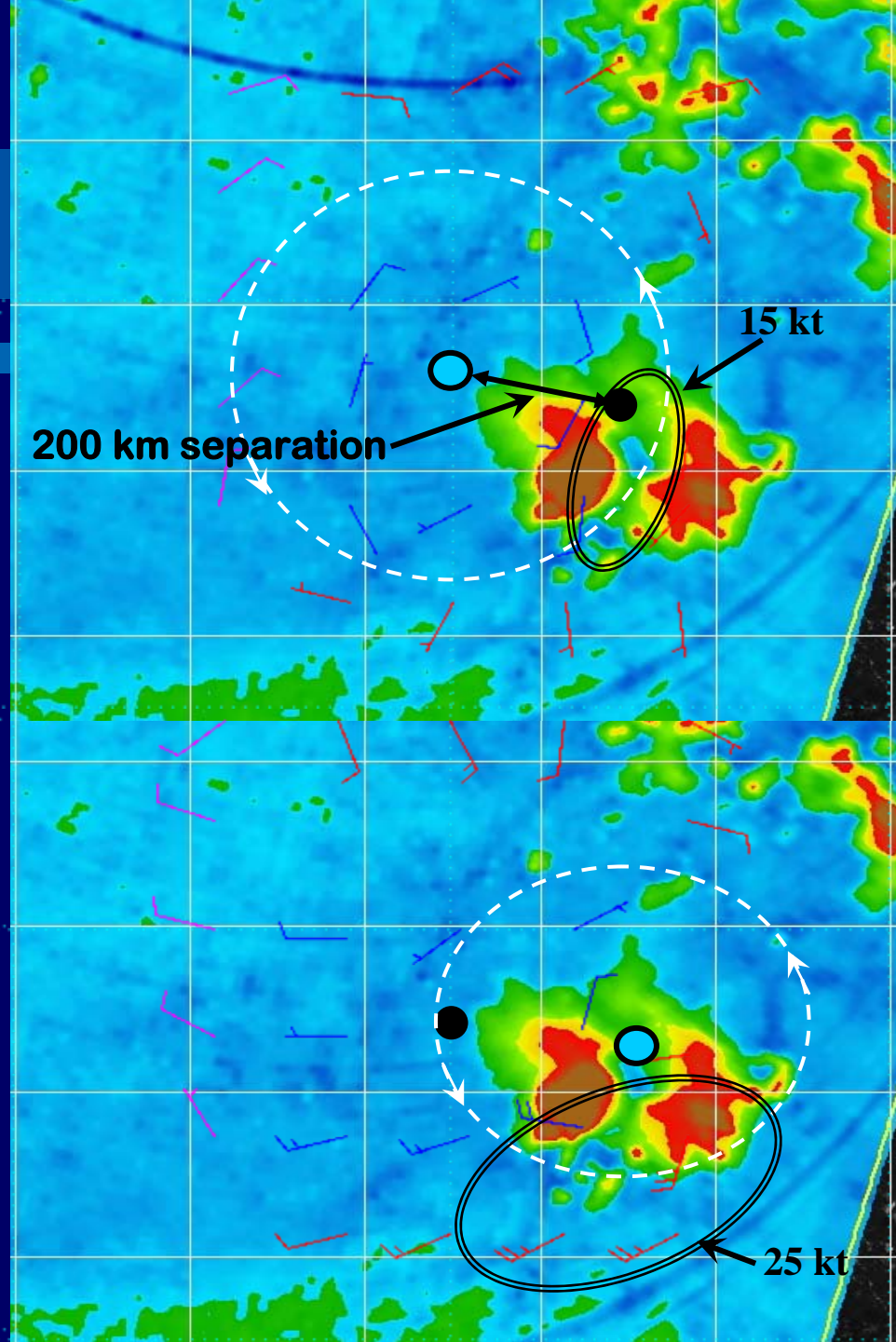
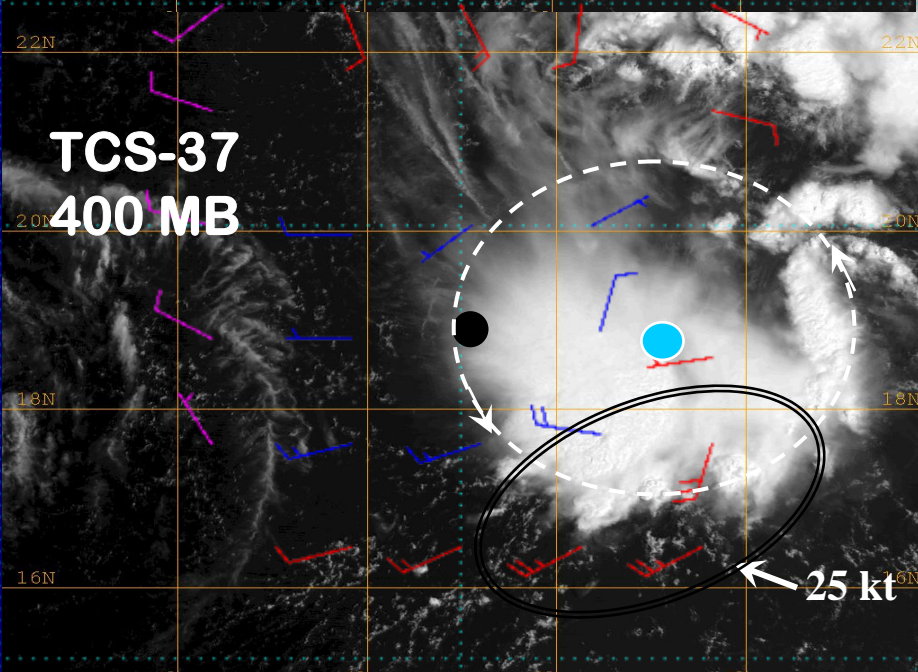
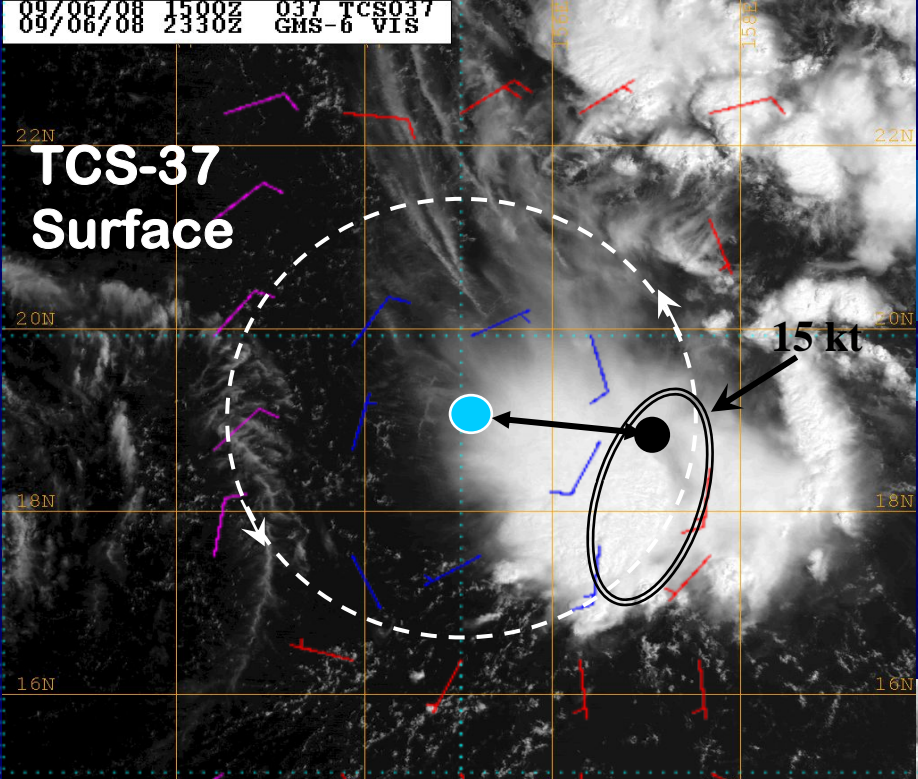


THU Aug 28 2008 0300 (0 mb) Upperair Obs

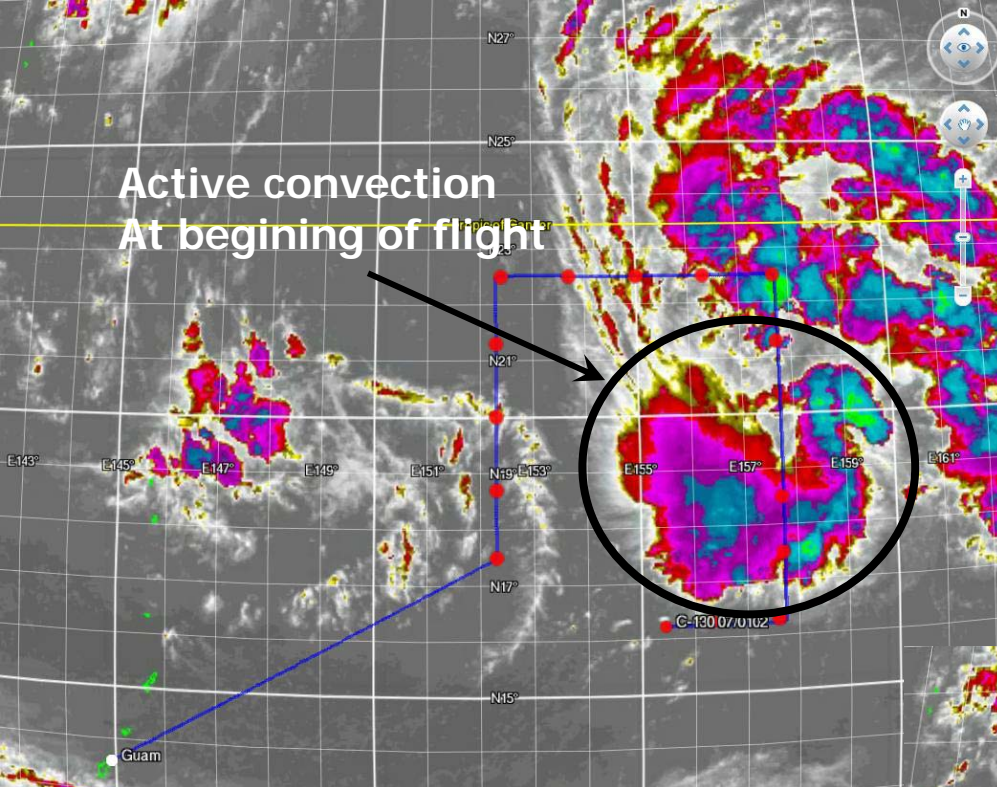
THU Aug 28 2008 0000 (0 mb) Upperair Obs

WED Aug 27 2008 2100 (0 mb) Upperair Obs









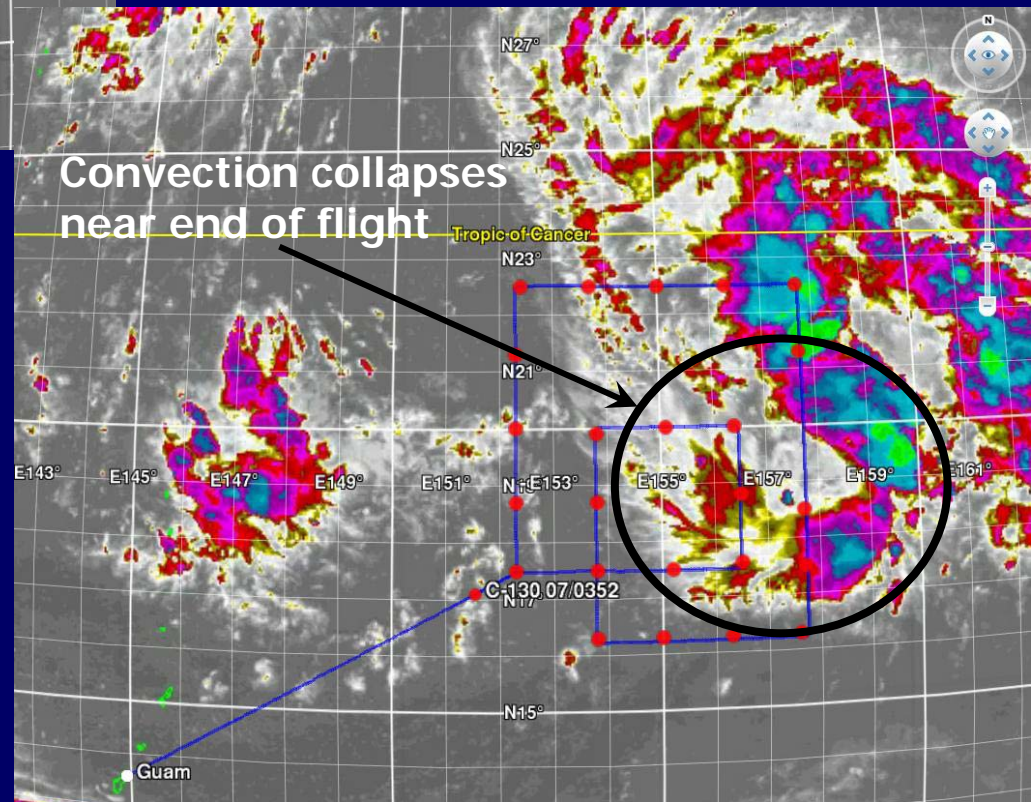
# Data Fusion: Google-Earth Enhanced IR + WC-130J flight track, Dropsonde locations



0330 UTC  
7 Sept, 2008

TCS-37

0030 UTC  
7 Sept, 2008







# *TCS08 Experiment Analysis: RESULTS I*

*(Preliminary)*

- 1) **Hypothesis I: Concurrent low- and mid-level vortices were observed in developing and non-developing TC Formation cases with 120 – 200 km separation (In Tropical Wave/ TUTT interaction cases), i.e. not single tilted vortex, but distinct vortex pairs**

**Challenge is to learn to distinguish developers from non-developers**