

# 2010 Observations Team Review

09 November  
HFIP Annual Review  
Miami, FL

# Task 1

## **Conduct NOAA Hurricane Field Program.**

- a) Transmit new data types from P3s and G-IV.
- b) Test new Doppler radar on G-IV.
- c) Complete upgrade airborne radar system from RVP-5 to RVP-8 on P-3s.
- d) Implement and test cross-platform dropwindsonde processing software.

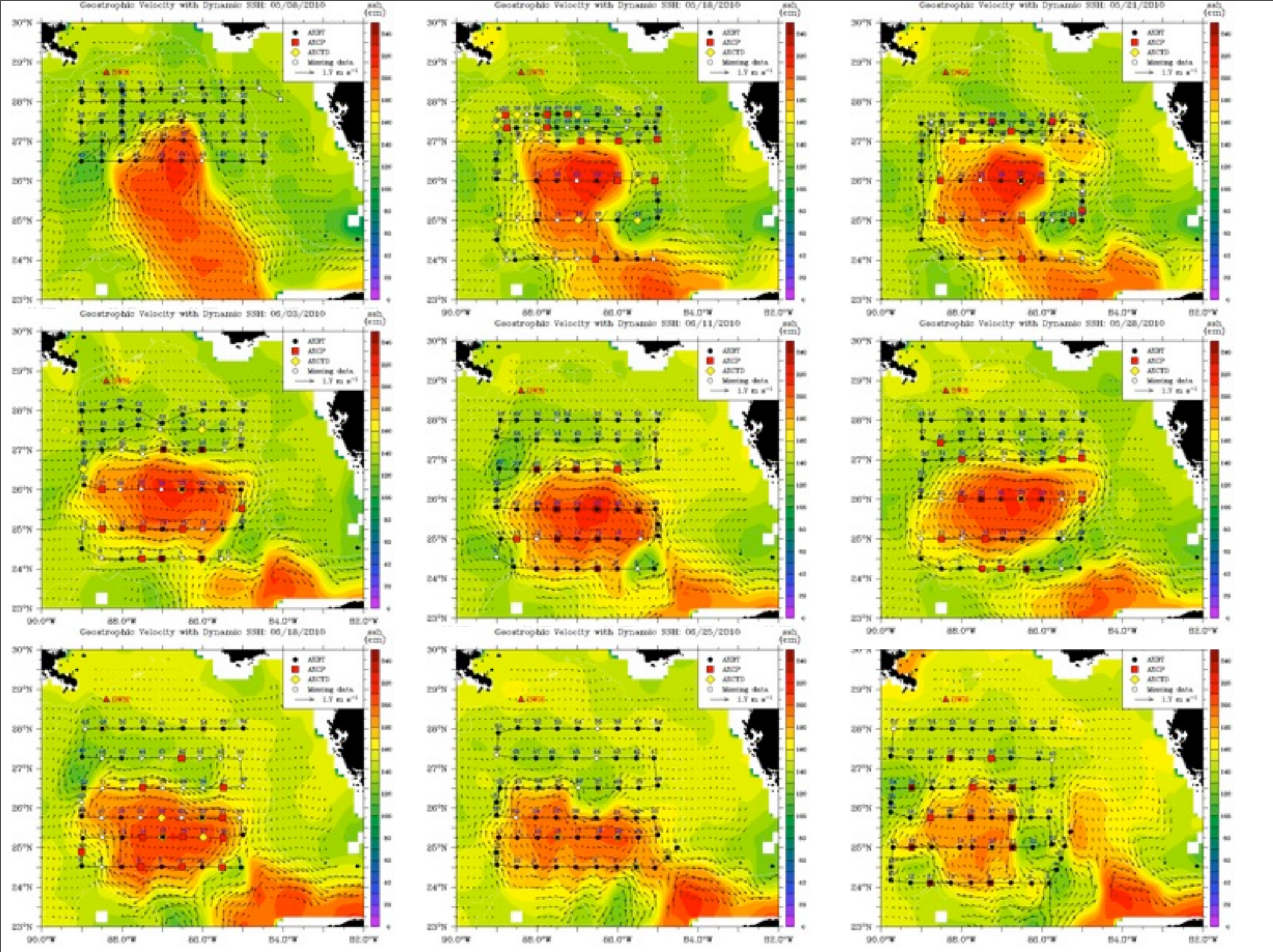


# Goal and Objectives of DWH Flights:

**Goal:** Provide synoptic snapshots of the Loop Current and surrounding eddy field 's thermal, momentum and haline structure. Specific objectives are:

- Observe temperature, current and salinity structure from NOAA P-3 at 7 to 10 day intervals including the MMS (BOEMRE) moorings.
- *Resolve mesoscale ocean variability associated with shedding of Eddy Franklin and calibrate satellite altimetry products.*
- Provide these data to the National Centers (NAVO) and eventually NCEP for assimilation into predictive models for improved trajectory models.
- Measure atmospheric structure using GPS sondes to relate structure to flight level winds.
- Document SST variations from downward looking IR.

*Note: Real thermal structure measurements are more accurate than synthetic profiles.*





# Summary of DWH and OHC Flights Deployed (Successful)

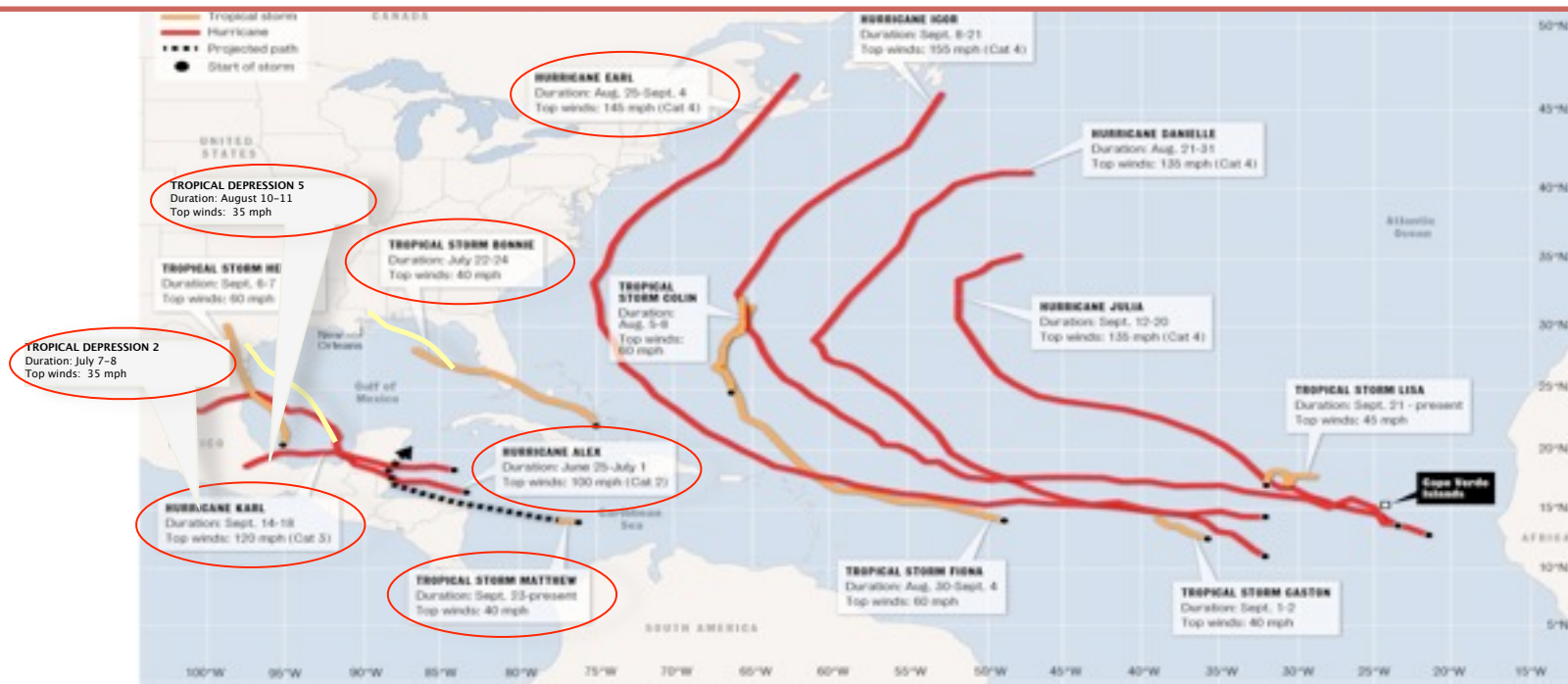


Flight	AXBT	AXCP	AXCTD	TOTAL
100508H	52 (48)	0	0	52 (48)
100518H	29 (28)	26 (10)	11 (10)	66 (48)
100521H	42 (39)	22 (11)	2 (2)	66 (52)
100528H	41 (37)	22 (9)	2 (1)	63 (47)
100603H	37 (34)	23 (11)	6 (6)	66 (51)
100611H	53 (49)	15 (10)	0	68 (59)
100618H	34 (23)	22 (8)	8 (7)	63 (38)
100625H	58 (53)	0	6 (6)	64 (59)
100709H	59 (54)	12 (12)	6 (3)	77 (69)
100724H	35(33)	0	0	35(33)
100812H	6(6)	6(5)	0	12(11)
100909H	62(58)	0	20(17)	82(75)
100924H	30(30)	10(5)	20(20)	60(55)
TOTAL	538(492)	158 (88)	81 (72)	777 (645)



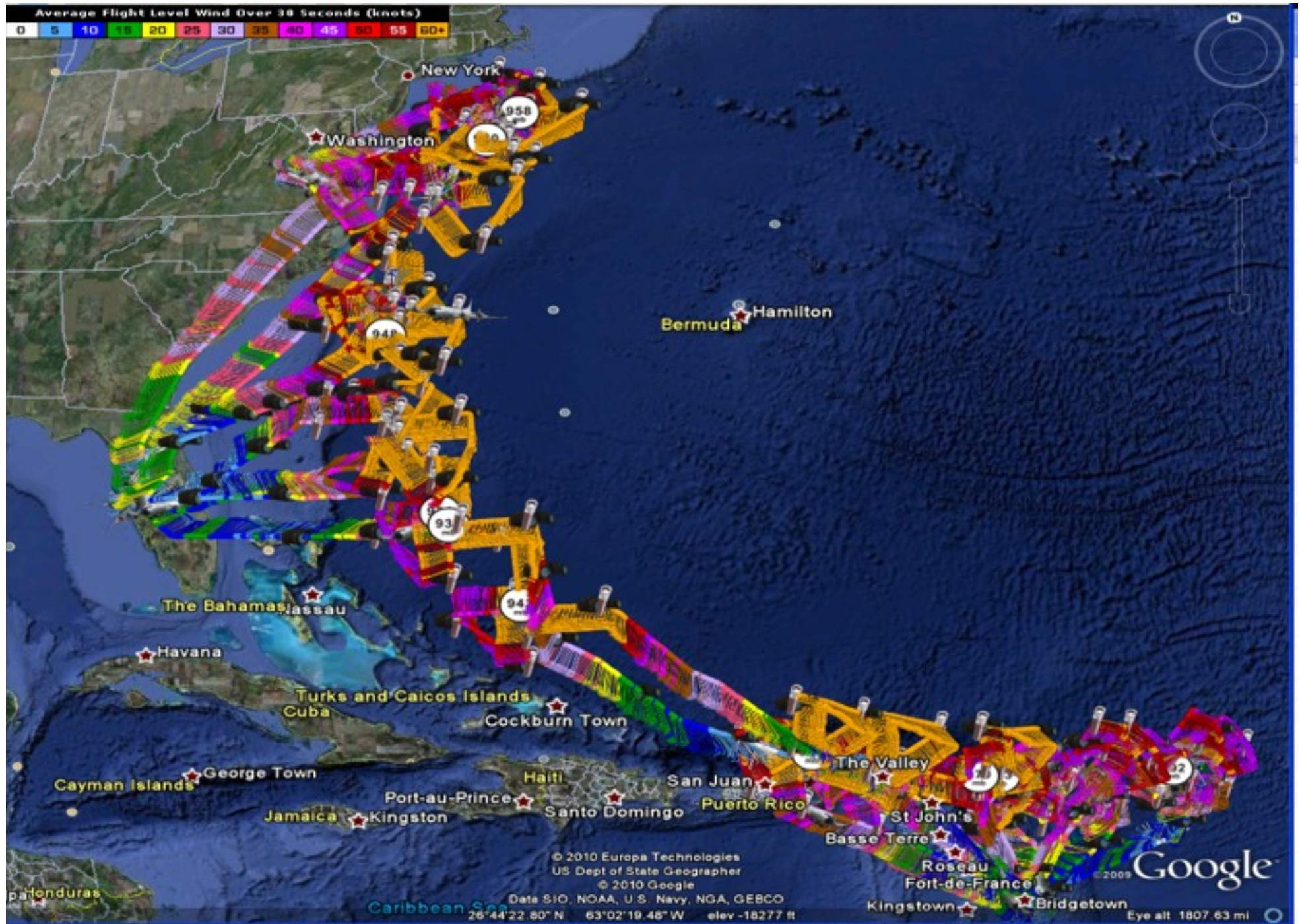
# Intensity Forecast experiment ([IFEX 2010](#))

- Excluding Richard and Tomas:
  - ✓ NOAA aircraft flew ~375 h (22 P-3 and 19 G-IV missions) in 7 tropical systems, and 3 Gulf ocean survey missions
  - ✓ Deployed ~930 GPS dropsondes; ~200 ocean probes (AXBT/CP/CTD)
  - ✓ Performed 65 [Doppler analyses](#) & SO data sets
  - ✓ Performed 100 [H\\*Wind analyses](#)
  - ✓ Performed 380 [HWRFx simulations](#) in 11 storms and 9 invests
  - ✓ 14 HEDAS analyses & HWRFx runs for Hurricanes Earl & Karl
  - ✓ 2 coordinated P-3/Global Hawk missions – 1 each in Earl & Karl
    - ONR DWL installation delayed
    - G-IV TDR acceptance tests delayed
- TD 2 & 5, TS Alex, Bonnie & Matthew, Hurricanes Earl, Karl, Richard and Tomas plus 3 Gulf pre-storm ocean survey missions (+ [10 ocean survey missions](#) in support of DWH spill - unprecedented upper ocean data set over Gulf of Mexico for coupled modeling)

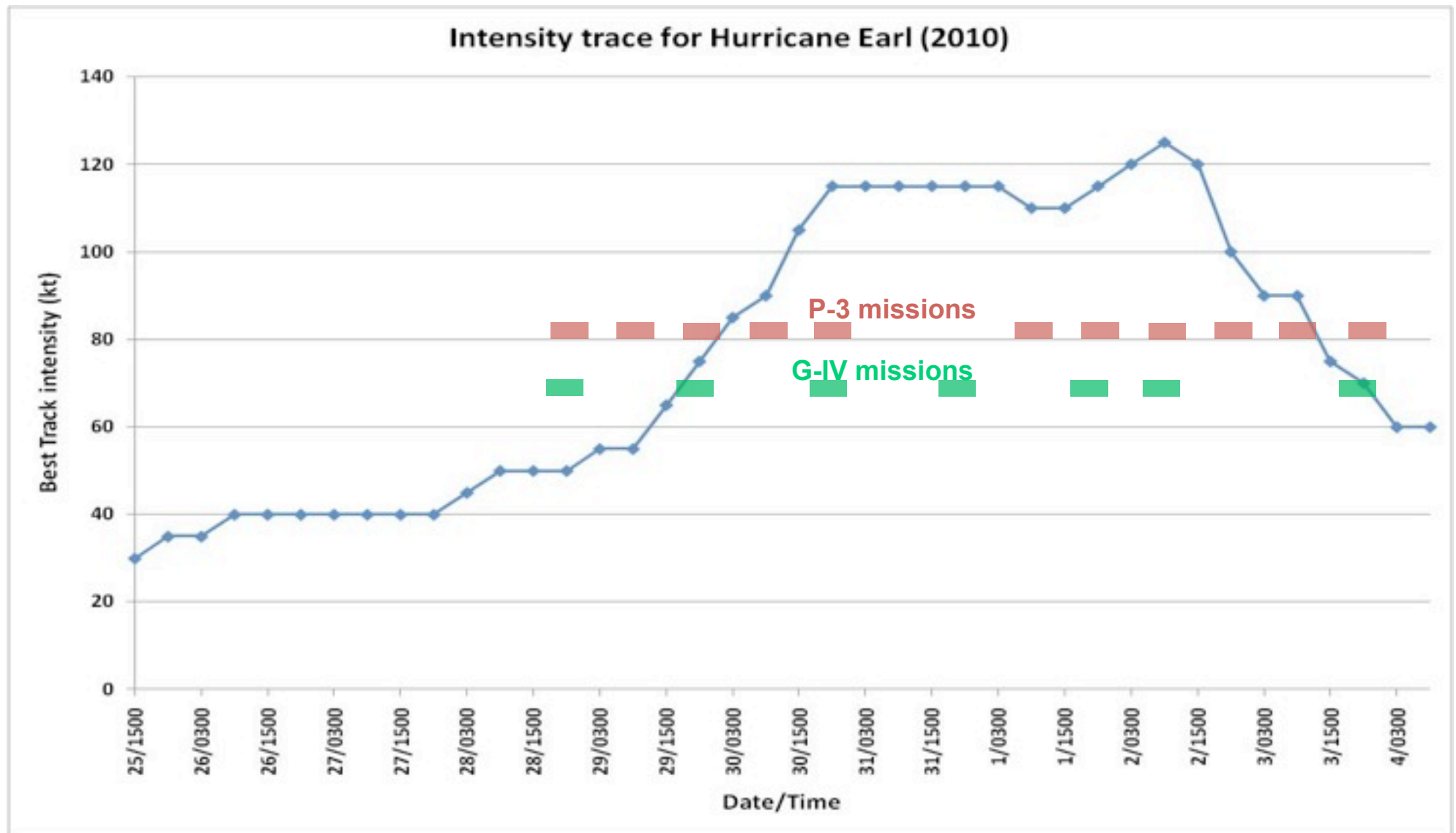




# Geographic coverage of Earl P-3 flights

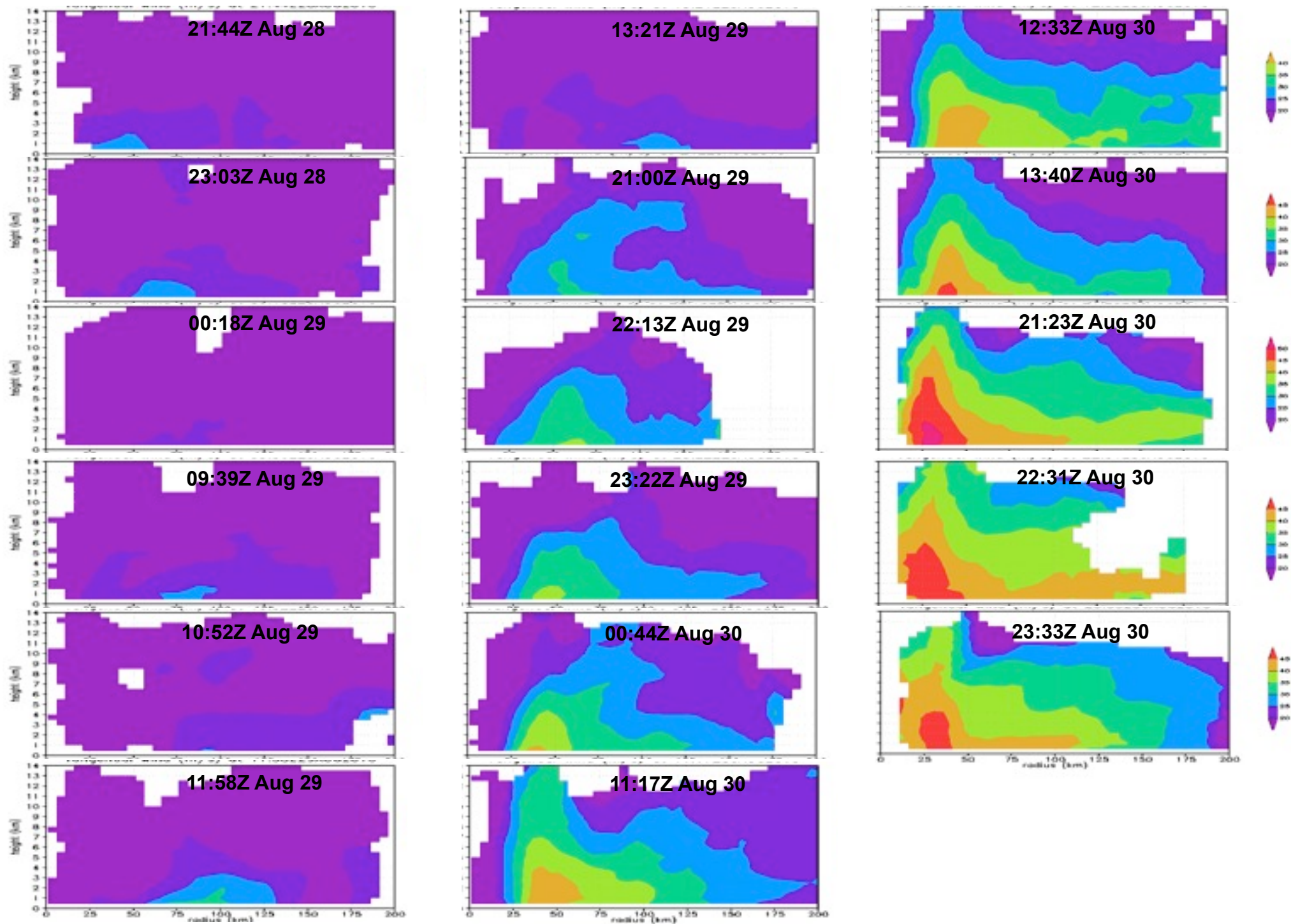


# P-3 and G-IV coverage during intensity evolution



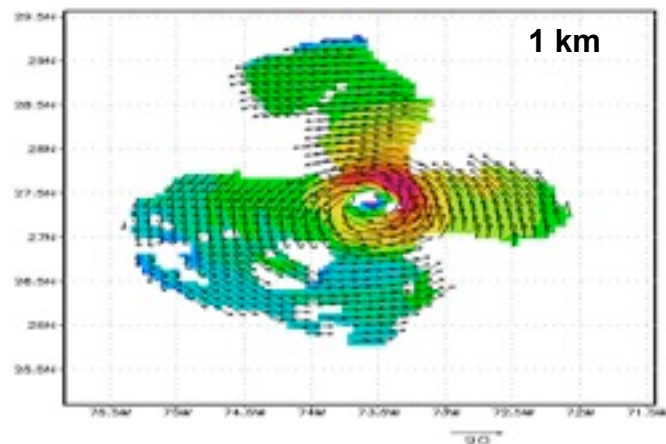
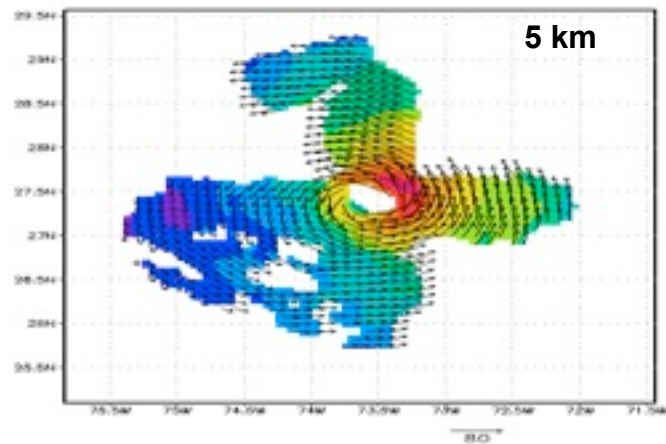
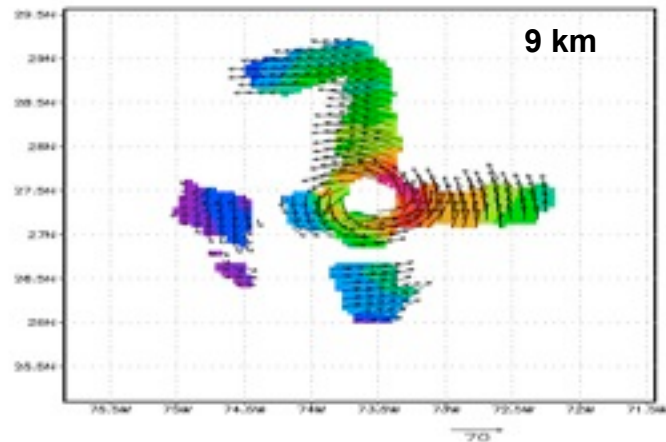


# Evolution of axisymmetric tangential wind (shaded, m/s) during RI

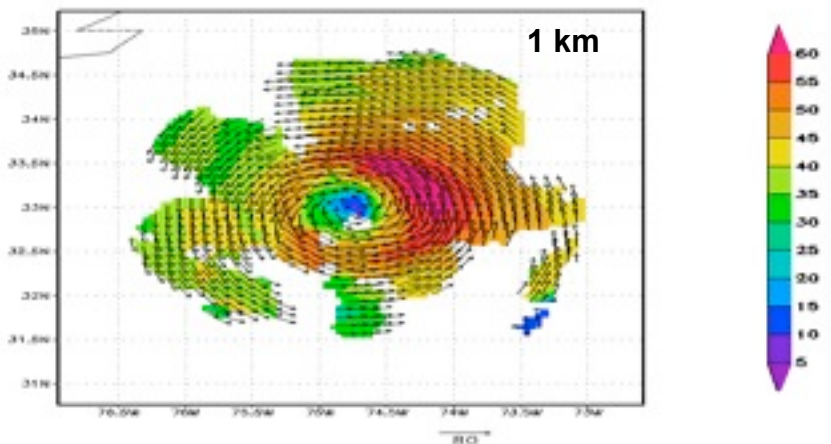
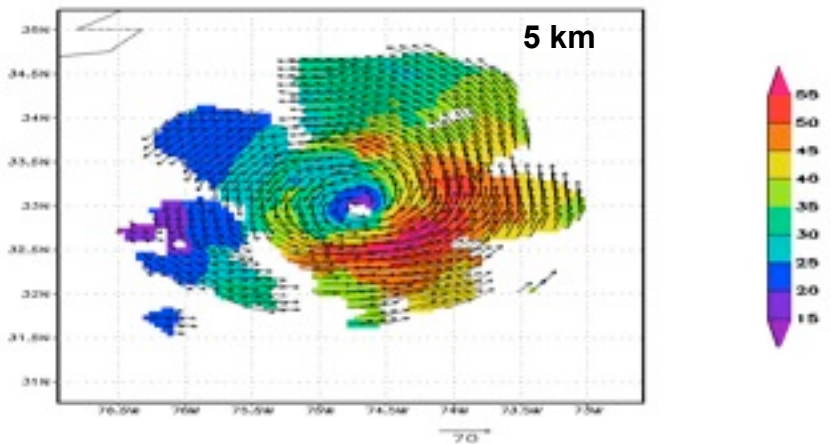
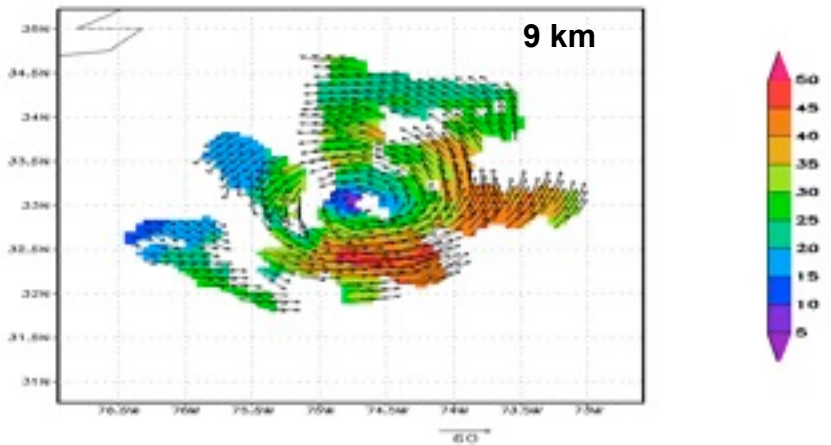


# Evolution of wind speed (shaded, m/s) from 1-9 km altitude

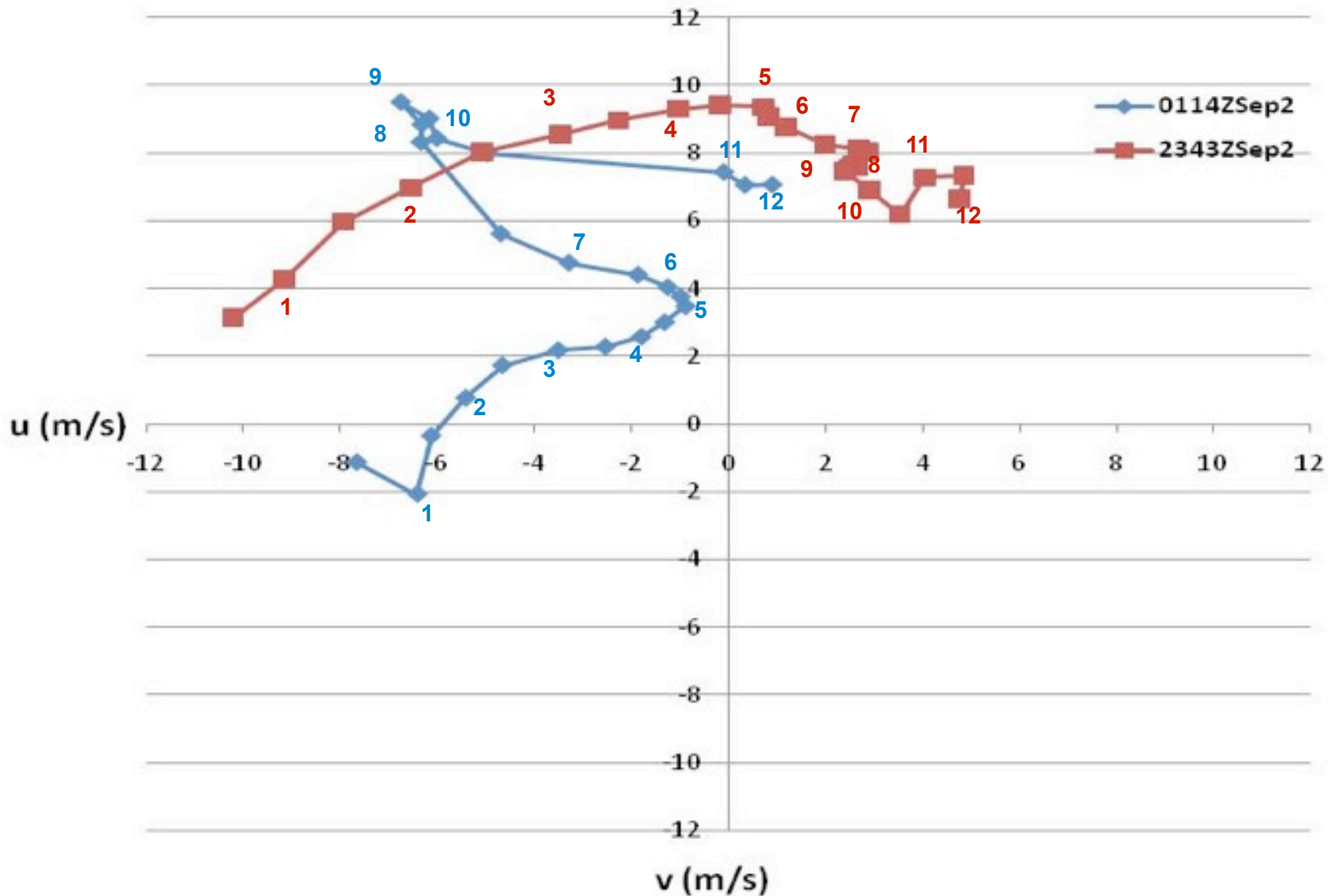
0114Z Sept 2



2343Z Sept 2

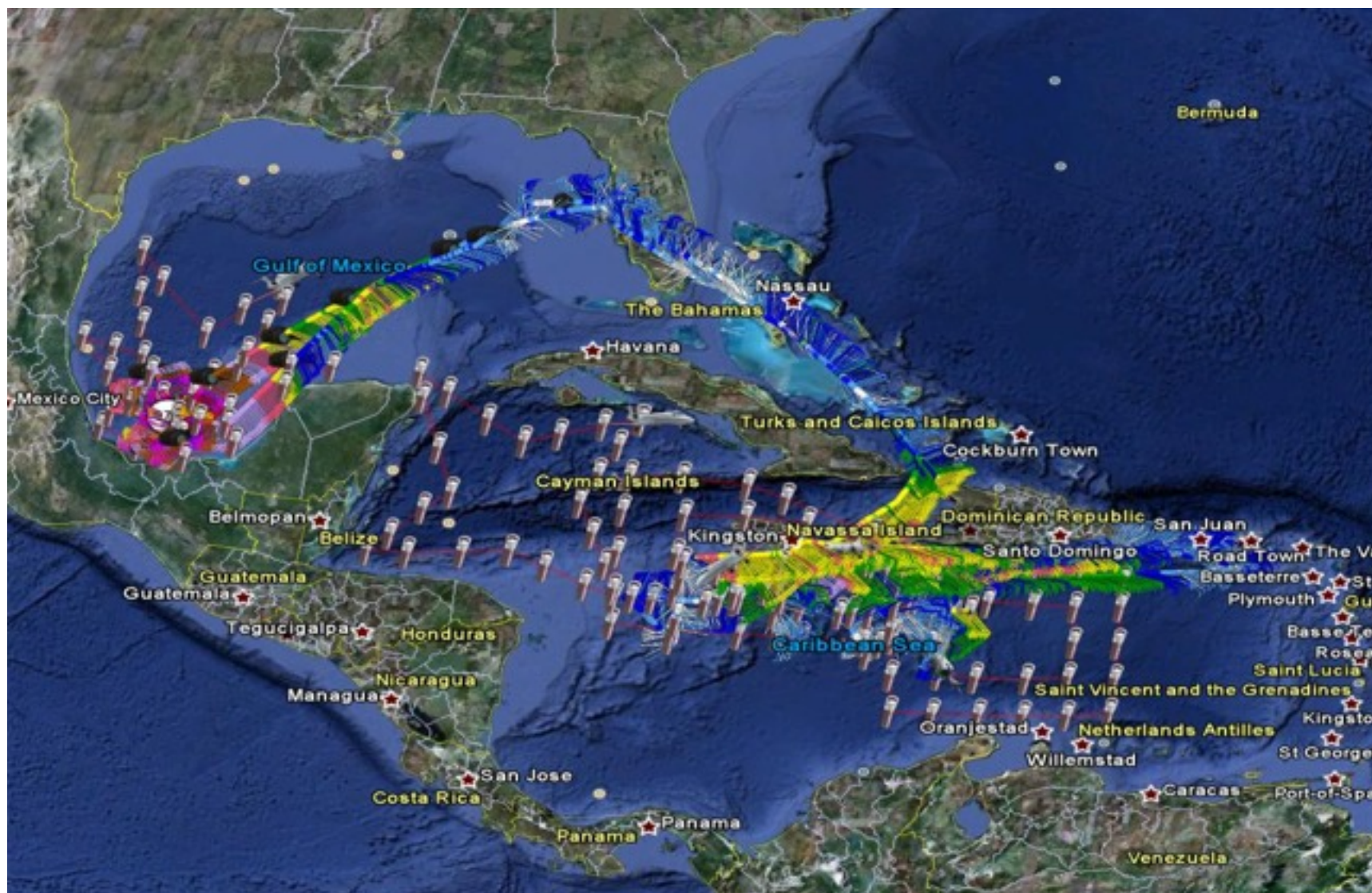


# Hodographs of environmental winds (m/s) from 0.5-12 km altitude

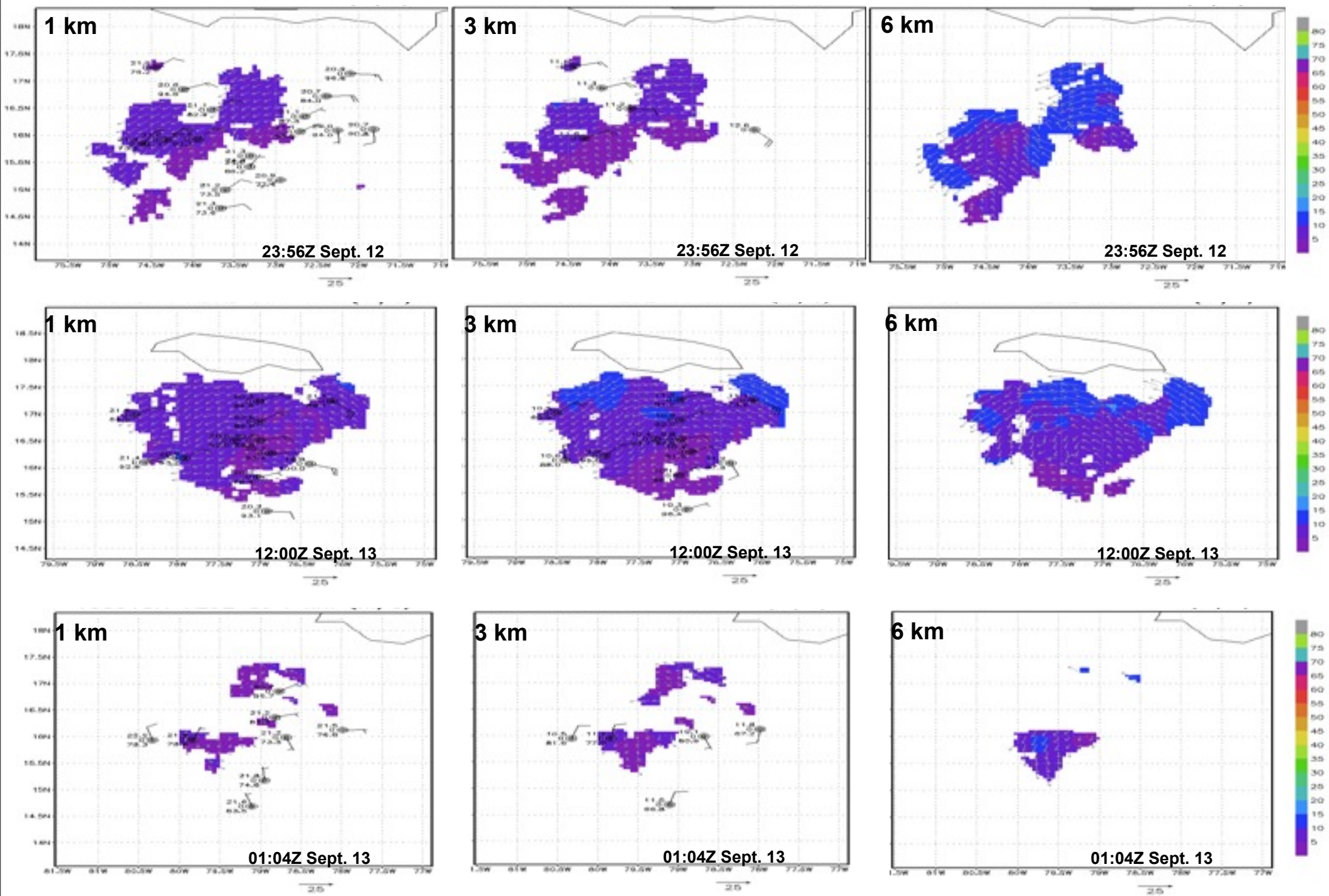




# Geographic coverage of P-3 and G-IV flights into Karl



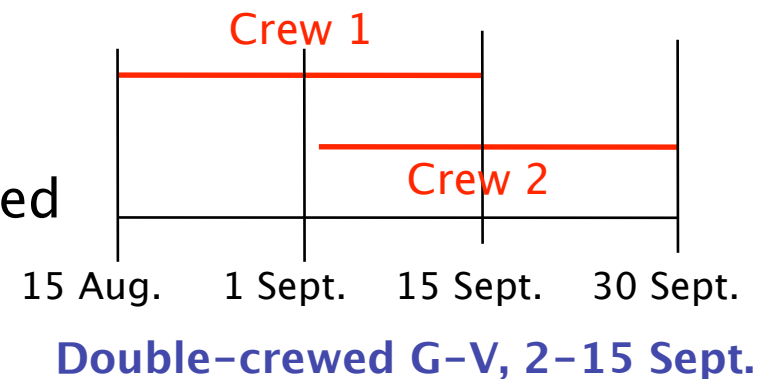
# Doppler and dropsonde composites during genesis stage of Karl





# PREDICT (PRE-Depression Investigation of Cloud-systems in the Tropics)

- 15 August – 30 Sept. 2010
- Base: St. Croix Virgin Islands
- NCAR G-V: ~173 research hours used
- 26 flights, 8 disturbances
  - Test (1)
  - PGI27 (2)
  - PGI30 (2)
  - PGI36 – Fiona – (3)
  - PGI38 – ex-Gaston – (5)
  - PGI44 – Karl – (6)
  - PGI46 – Matthew – (4)
  - PGI50 – Nicole – 2
  - PGI48 (1)
- 537 dropsondes used

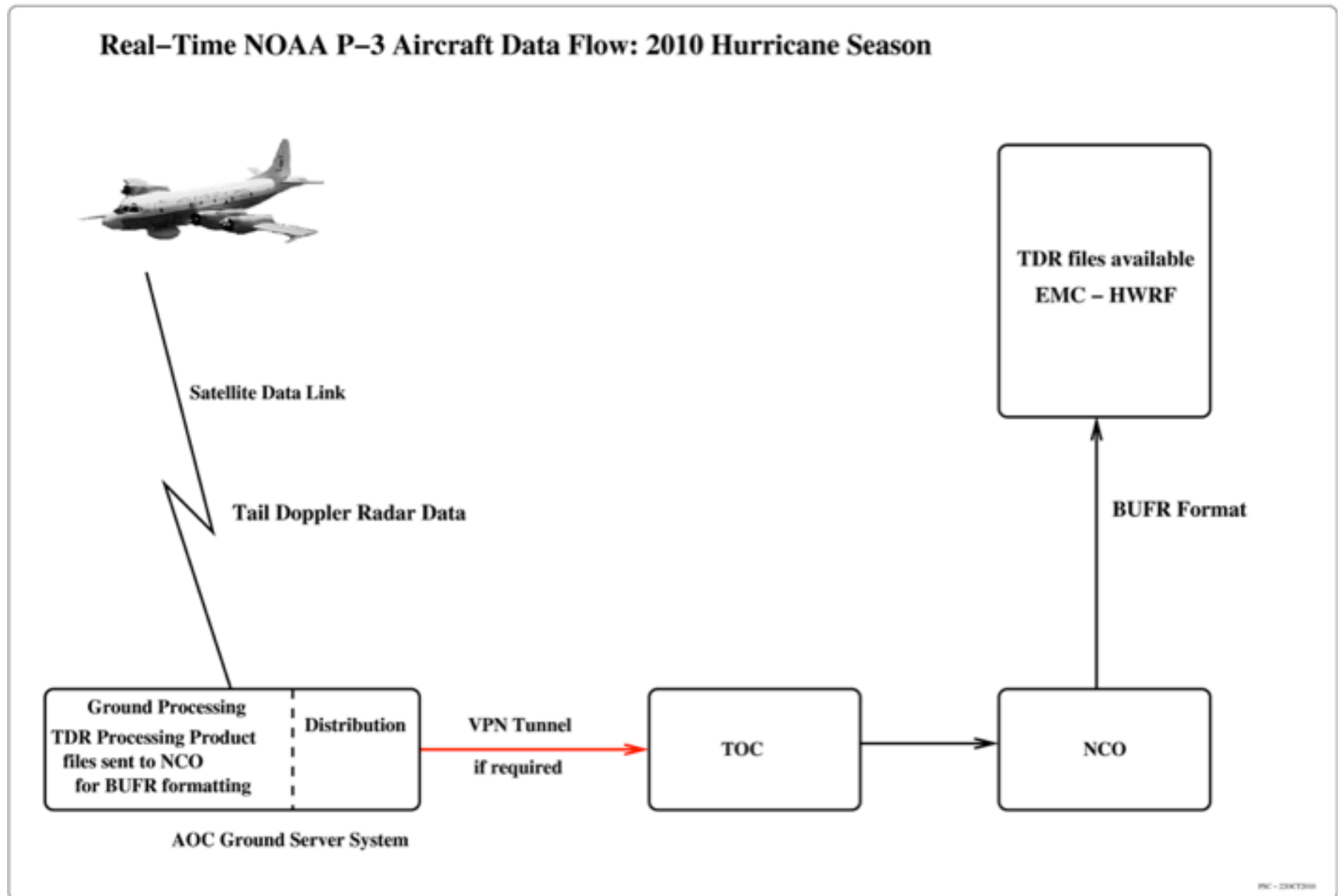




# Real-Time Data Transmission from the NOAA P-3 Aircraft

- TDR processed files were automatically and robustly relayed from both N42 and N43 to the ground and made available in BUFR format at NWS/NCEP/EMC
  - TDR processing script places processed TDR files in a predefined directory upon which automated routines transfer the data (see following figure) and make available in BUFR format
  - A “heart beat” was been implemented on the satellite data link to maximize data transfer reliability
  - Both P-3 aircraft have been upgraded to the Swift Broadband SATCOM system
- This is a cooperative effort between: AOC, NCEP/NCO, NWS/TOC, NESDIS, AOML/HRD, NCEP/EMC, and Remote Sensing Solutions.

# Real-Time Data Transmission Schematic for the 2010 Hurricane Season



# **Real-Time Data Transmission from the NOAA P-3 Aircraft**

- The following items are not yet fully completed due to late FY10 funding availability
  - Incorporation of the AXBT data into the real-time transmission scheme shown in previous figure
  - Redundancy of AOC data relay servers
- FY11 plans include
  - Completion of FY10 goals listed above
  - Demonstrate implementation of TDR processing on the ground where currently this processing requires a person on the P-3 aircraft



# Task 2

Attempt to obtain near-surface observations  
with low-altitude long-endurance aircraft  
(LALE)

# Task 3

Work with the Digital Hurricane Consortium to obtain real-time observations during landfall events.

[No landfall events]

# Task 4

Take delivery of 3rd P-3 (N44RF) and begin modifications and system integration.

[ongoing]

# Task 5

Conduct Observation Strategy Analyses for regional and global atmospheric and ocean models and for diagnosis of hurricane intensity and structure.

- a) Put together a clear plan for atmospheric and oceanic OSSEs necessary for hurricane Observation Strategy Analysis
- b) Perform a surface wind Observation Strategy Analysis.
- c) Create a prototype oceanic OSSE.
- d) Create a prototype regional OSSE for hurricanes.
- e) Complete calibration and verification of global OSSE system and aircraft flight instrument design specification to hurricanes.



# Global OSSE System

ECMWF 13 month forecast (May 2005–June 2006) for a nature run

NCEP/EMC GFS and GSI for assimilation system;

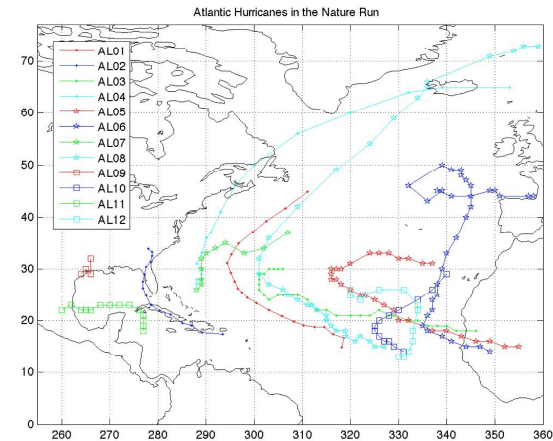
Synthetic obs: conventional from NCEP/EMC and satellite from NASA; calibrated by adjusting obs errors and OSEs to compare statistics from real data vs synthetic runs

11/8/10

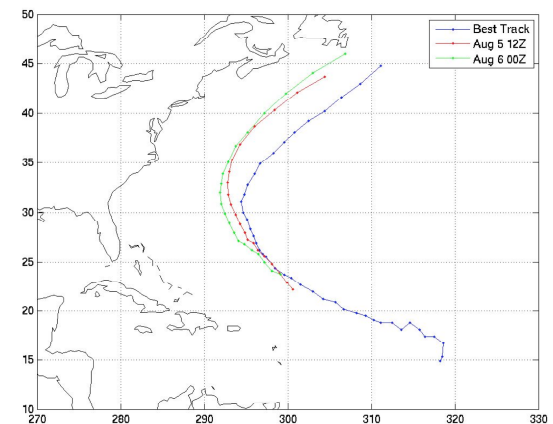
# UAS data impact on hurricane tracks

AL01 from Aug. 2005  
NR is selected for the  
preliminary  
experiments.

Chosen forecasts  
starting 12Z Aug. 5  
(red) and 00Z Aug. 6  
(green) for AL01.



Tracks of all Atlantic tropical cyclones



Control runs of AL01

11/8/10

# Flight path scenarios

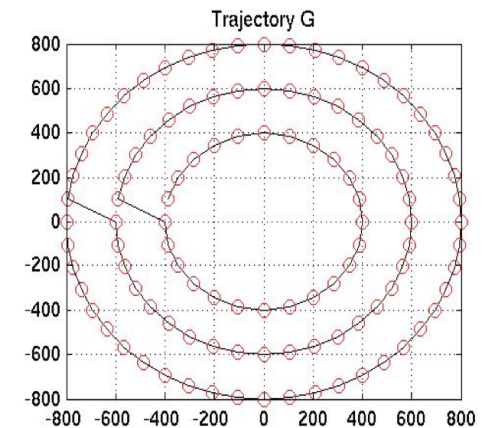
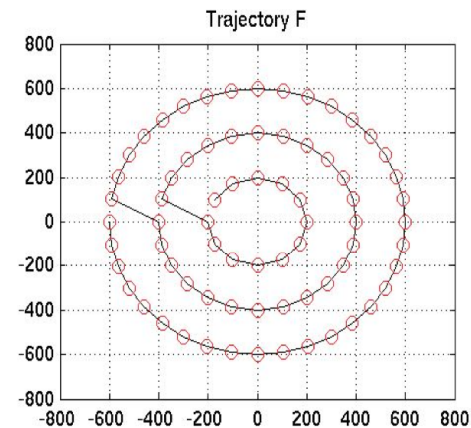
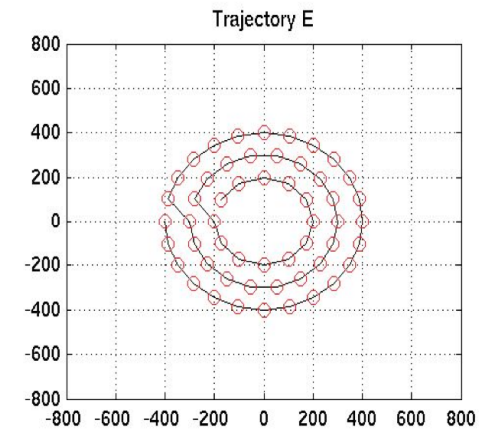
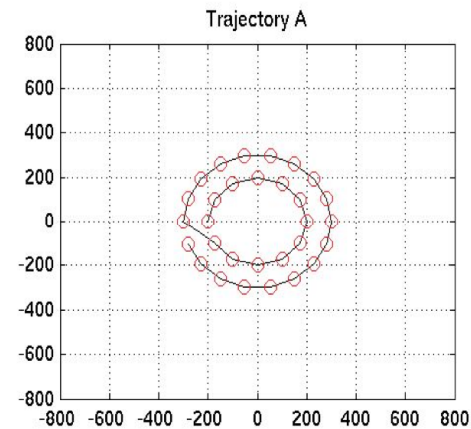
Track A: UAS flies at 200–300 km

Track E: 200, 300 and 400km

Track F: 200, 400 and 600 km

Track G: 400, 600, 800 km

radii from the center of the storm



# Progress on OSSEs

-An ocean OSSE toolbox is now in late stages of development and evaluation at AOML/CIMAS and is nearly ready to address the HFIP goal of using ocean OSSEs to improve initialization. We are now in the process of setting up an initial OSSE to specifically address the impact of the P3 observations on the circulation and upper-ocean structure over the eastern Gulf of Mexico. Upon completion of this initial experiment, the system will be ready to address more general questions concerning observing system design for ocean model initialization in the tropical/subtropical Atlantic basin.

-A preliminary global atmospheric OSSE to evaluate the potential impact of Global Hawk dropsondes on hurricane track forecasts was performed in conjunction with NOAA's UAS program by GSD and AOML in collaboration with EMC. These experiments evaluated alternative targeting scenarios, and demonstrated reduction in the along-track error for the first hurricane studied.

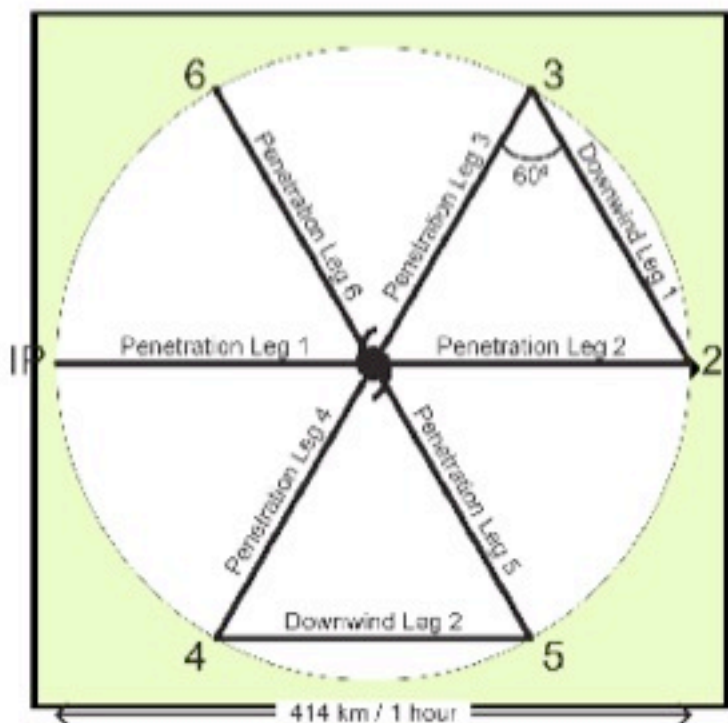
-Two regional OSSE experiments to study impact on hurricane intensity forecasts were initiated and are progressing.



# Data Assimilation


## OSSEs

### Simulation of Aircraft Dropwindsonde Observations:



- One complete leg per assimilation cycle
- Total leg length = 500 km
- Drop release points determined based on starting point, track direction, release point resolution
- Release point resolution = 25 km (i.e., 20 release points per leg)
- Track direction rotated by 50° between legs

◆ ..... ✈ ..... ➡ Flight altitude = 700 mb

Dropsonde advected by winds >  Model quantities extracted every ~ 50 mb  
U, V, T, Q observed

# Task 6

Create portals for observations and related software packages and continue to populate data warehouses for OSEs and verification, including making digital products available for assimilation, diagnostics, verification, and physical parameterizations

# Data Web Portal at HRD

- Currently under development: 1<sup>st</sup> cut version scheduled for 2011 season
- Provide web-based access to observational data sets
  - Web-based metadata retrieval using an industry-standard database query architecture
  - Retrieval of observational and model raw data and graphical products in standard formats such as GRIB, BUFR, NetCDF, HDF5, XML, CSV, etc...
  - Real-time generation of observational and model diagnostic products
- Linked to other existing data sources (CIRA, CIMSS, NHC, JPL, NRL, EMDAC, NOMADS) thru metadata
  - Provide access to satellite raw data and imagery
  - Provide access to raw and post-processed hurricane model data and imagery
- Use HPCC super-computers and network resources
  - HPCC supercomputers will generate model diagnostic products in real-time
    - Post-process output data from the HFIP community models and operational models
    - Generate graphical diagnostic products
  - HPCC mass-storage systems
    - Facilitate the archival of large data sets of raw and post-processed model data

# HRD's Data Web Portal...cont

- Provide meteorological data visualization tools
  - Web-based, multi-map interface for observation-to-model and model-to-model inter-comparison (Google Web Toolkit)
  - AWIPS2 plugin developments for observational and model data visualization
- Enhance collaboration with the community
  - Partners can ingest their data into HRD's Web Portal
    - Take advantage of the product generation capabilities put in place
  - Partners can visualize their own products using common visualization tools
    - Provide speedy collaboration among partners through exchange of KML and bookmark links to website
    - Users can bring in their own external sources of data through KML
  - Partners can develop their own visualization/diagnostic tools
    - Link to HRD's Web Portal as a data source
- Provide statistics on how NOAA products are visualized and integrated together (mash-ups) for diagnostics
  - Mine properties (color, variables, contour type) of user generated graphics
  - Mine properties of overlays and animations generated by users







