IFEX 2010
NOAA's plans for Summer 2010

Robert Rogers

12 November 2009

2010 HRD Field Program Plans

- Continuation of IFEX objectives
- ~750 hours total for all aircraft
- N42RF (P-3) will be available by early June, N43RF available early August, N49RF (G-IV) available early June
- Crews available for two-per-day missions starting early July (Tampa and deployments)

Intensity Forecasting Experiment (IFEX; Rogers et al., BAMS, 2006)

THE INTENSITY FORECASTING EXPERIMENT

A NOAA Multiyear Field Program for Improving Tropical Cyclone Intensity Forecasts

BY ROBERT ROGERS, SIM ABERSON, MICHAEL BLACK, PETER BLACK, JOE CIONE, PETER DODGE, JASON DUNION, JOHN GAMACHE, JOHN KAPLAN, MARK POWELL, NICK SHAY, NAOMI SURGI, AND ERIC UHLHORN

In probing the whole life cycle of these storms—not just mature hurricanes—IFEX is taking a new approach to developing physical understanding and forecast abilities as well as testing and enhancing real-time observational capabilities.

MOTIVATION FOR IFEX. One of the key activities in the National Oceanic and Atmospheric Administration's (NOAA's) strategic plan is to improve the understanding and prediction of tropical cyclones (TCs). The NOAA National Hurricane Center (NHC), a part of the National Centers for Environmental Prediction (NCEP), is responsible for forecasting TCs in the Atlantic and east Pacific basins, while NCEP's Environmental Modeling Center (EMC) develops the numerical model guidance for the forecasters. With support from NOAA's Hurricane Research Division (HRD) and others in the research community, continual progress has been made in improving forecasts of the TC track over the past 30 years (Franklin et al. 2003a; Aberson 2001). Advancements in state-of-the-art global and regional modeling systems at EMC and other operational numerical weather prediction centers have led to improvements in track skill over the past three decades, including a significant acceleration in improvements over the past decade. These advancements include improved assimilation of satellite and

AFFILIATIONS: ROGERS, ABERSON, BLACK, BLACK, CIONE, DODGE, GAMACHE, KAPLAN, AND POWELL—NOAA/AOML Hurricane Research Division, Miami, Florida; DUNION AND UHLHORN—Cooperative Institute for Marine and Atmospheric Studies, University of Miami, Miami, Florida; SHAY—Rosenstiel School for Marine and Atmospheric Science, University of Miami, Miami, Florida; and SURGI—NOAA/NWS/NCEP/Environmental Modeling Center, Washington, D.C.
CORRESPONDING AUTHOR: Robert Rogers, NOAA/AOML Hurricane Research Division, 4301 Rickenbacker Causeway, Miami, FL 33149
E-mail: Robert.Rogers@noaa.gov

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IFEX intended to improve prediction of TC intensity change by:

1)collecting observations that span TC life cycle in a variety of environments

2)developing and refining measurement technologies that provide improved real-time monitoring of TC intensity, structure, and environment

3)Improving understanding of physical processes important in intensity change for a TC at all stages of its life cycle

Focus areas for 2010

IFEX goal 1: Collecting observations spanning lifecycle

- Doppler radar
- Synoptic surveillance
- HWRFx real-time runs
- HFIP real-time runs

IFEX goal 2: New and improved measurement technologies

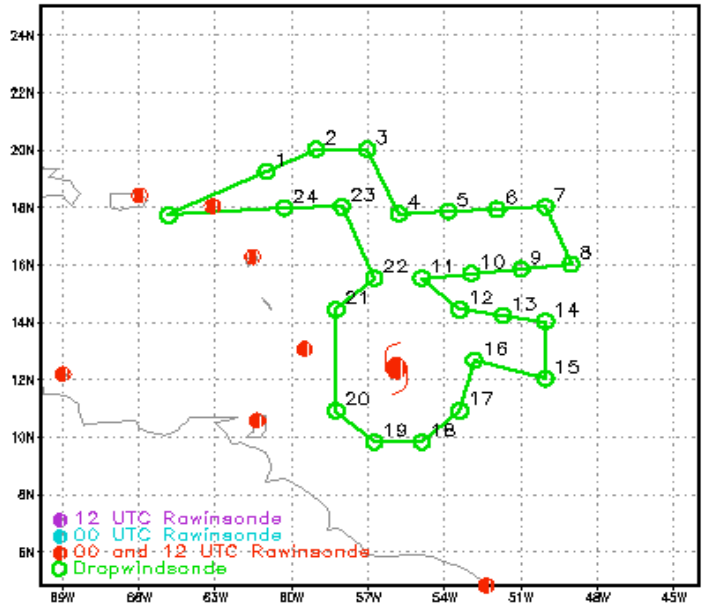
- SFMR evaluations
- Doppler Lidar
- Ocean winds/AWRAP

IFEX goal 3: Improving understanding

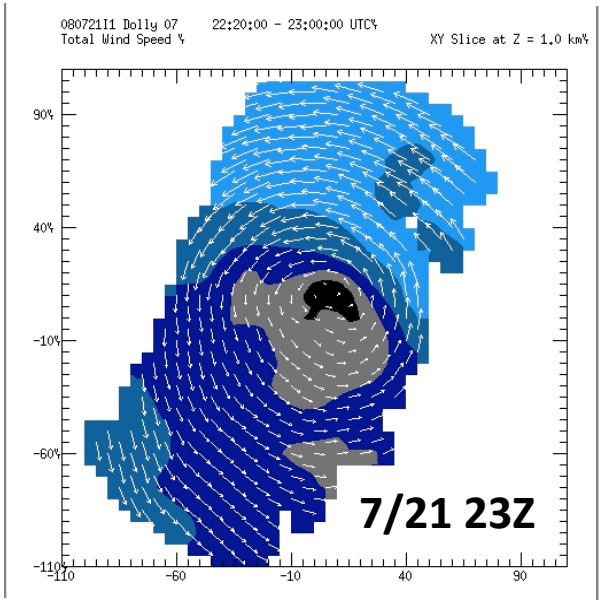
- Genesis
- SAL/vortex interactions
- Rapid Intensity Change
- Ocean observations
- Landfall coordination

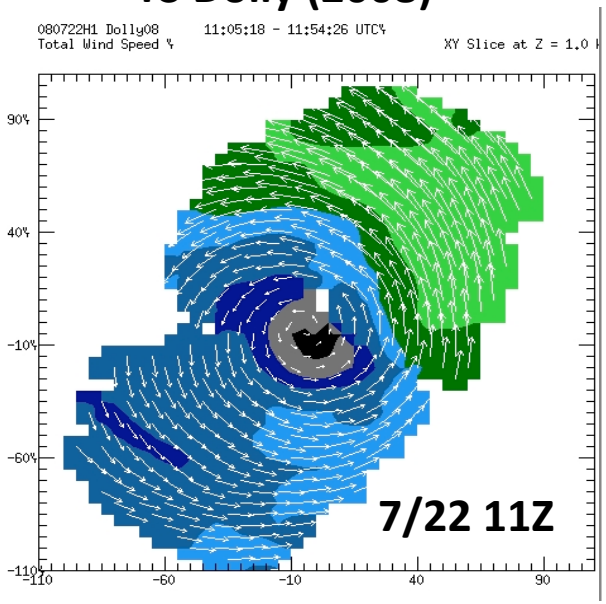
IFEX1: Operational Support Missions

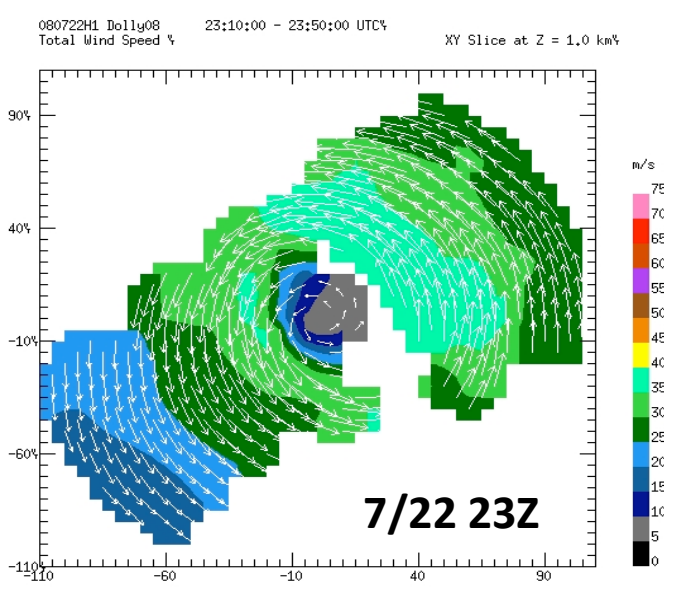
- Doppler radar
- Synoptic surveillance
- HWRF-x real-time runs
- HFIP real-time runs



TS Dolly (2008)

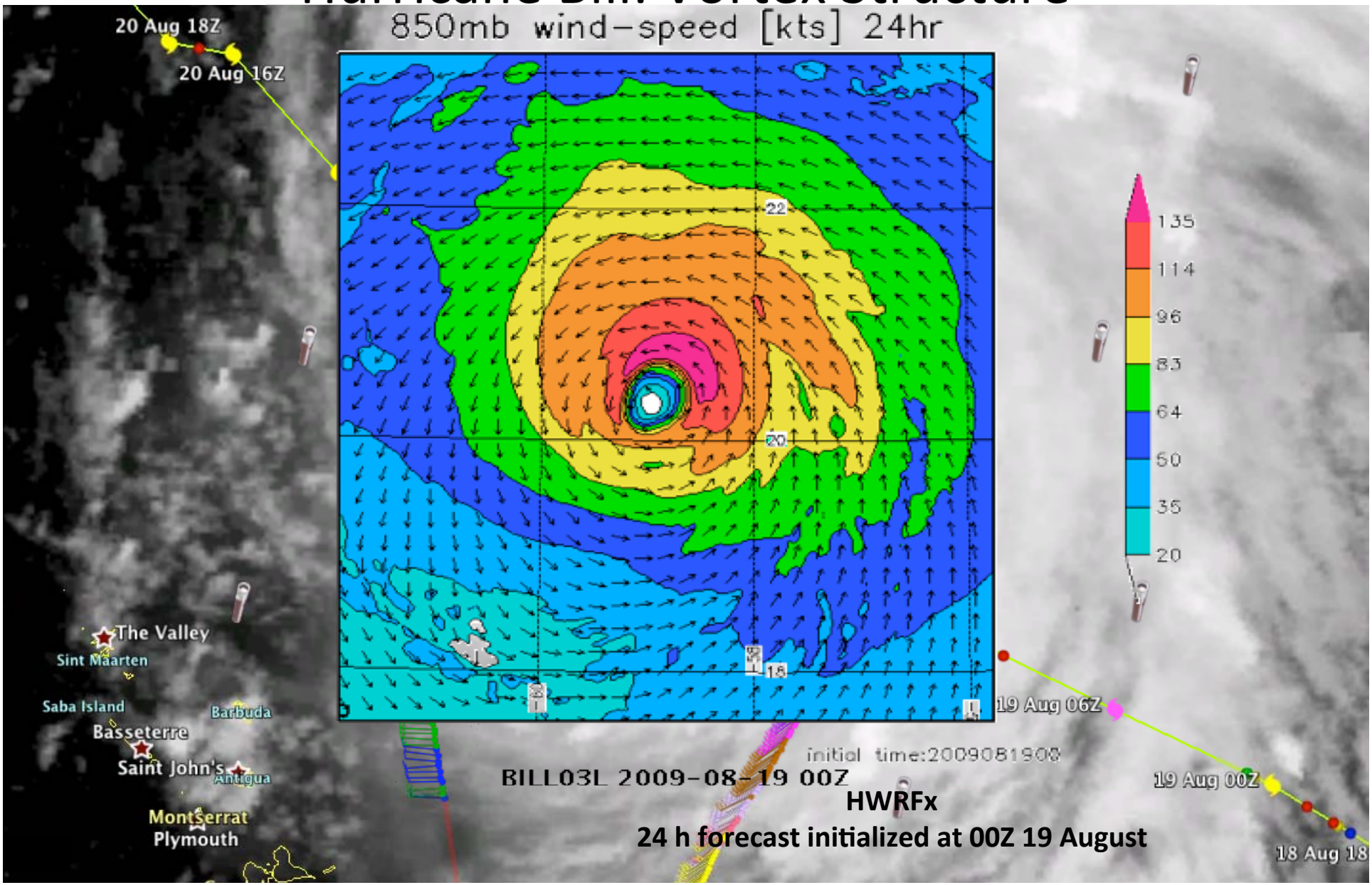






HWRFx Evaluation

Hurricane Bill: Vortex Structure



HWRFx

24 h forecast initialized at 00Z 19 August

IFEX1: HWRF Doppler Support Missions

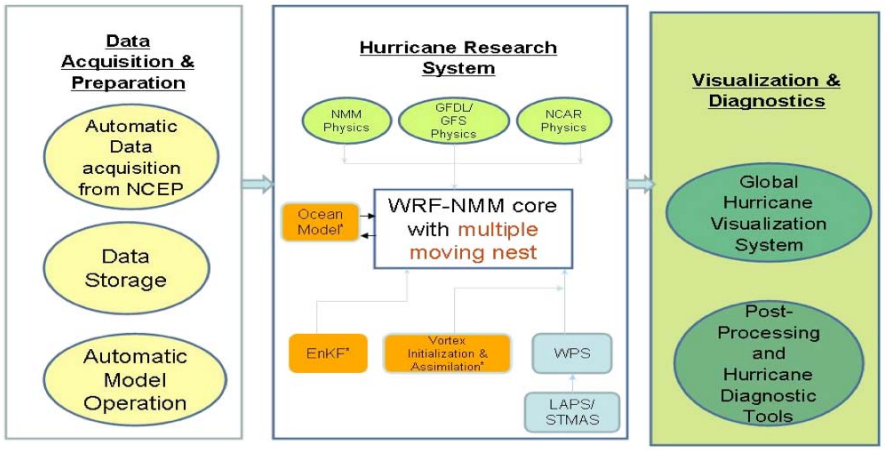
1. 2 P-3 Flights per day--on-station time centered on 0, 6, 12, and 18 UTC analysis periods -optimum 3 days of flights in a row starting at tropical depression or maybe pre-depression stage

1. For example, data for 12 GMT analysis, must be collected from 0900-1500 GMT, and data should arrive at NCO between 0900-1500 GMT. Thus, P-3 takeoffs will be planned (within personnel and safety constraints) to maximize time within this window

IFEX1: Real-time Doppler Data

1. ASCII files containing wind fields at 0.5 & 1.0 km, & vertical cross-sections, available to NHC
2. Real-time 3D wind fields on AOML ftp site for possible assimilation/initialization of models
3. Trimmed, quality-controlled Doppler radials to NCO for assimilation into parallel HWRF - path off aircraft appears not quite ready yet
4. Doppler radial-velocity superobs transmitted to AOML ftp site for researchers to assimilate

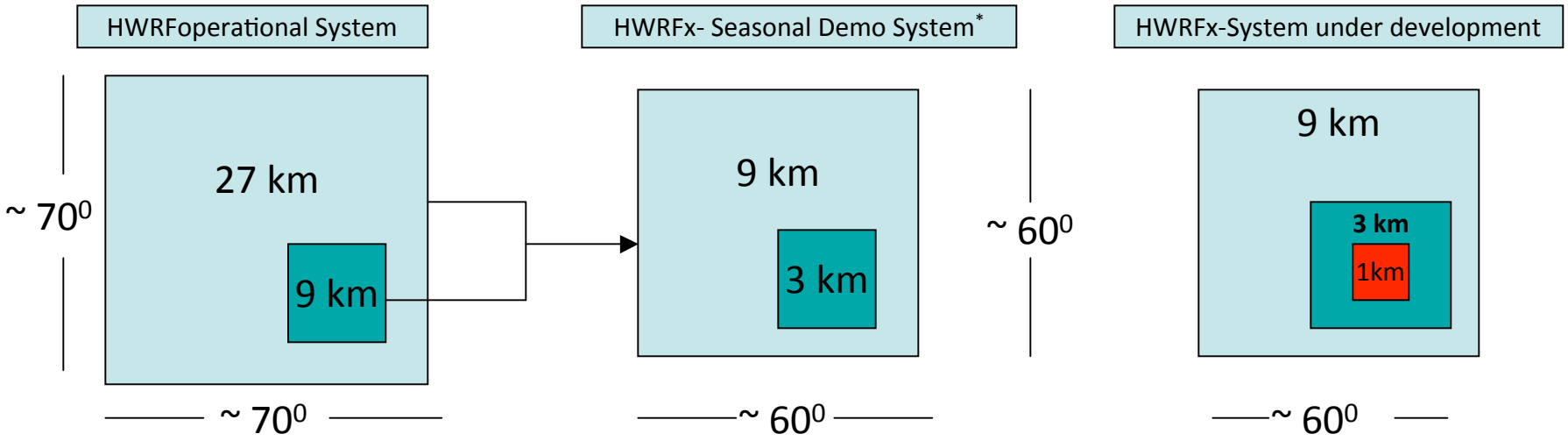
HWRFx-HFIP Demo System



The Hurricane Research System (HRS) is the experimental version of the NCEP's HWRF system specifically adopted and developed to study the intensity change problem at the highest model grid resolution of about 1 km.

* Repository under development under HFIP

Physics scheme	Large domain	Nest domain
Microphysics	Ferrier scheme	Ferrier Scheme
Radiation—Long wave	RRTM	RRTM
Radiation—Short wave	Dudhia Scheme	Dudhia
Surface layer	GFDL surface scheme	GFDL surface scheme
Land surface	NMM LSM	NMM LSM
PBL	GFS scheme	GFS scheme
Cumulus parameterization	SAS	No SAS
Momentum mixing	No	No



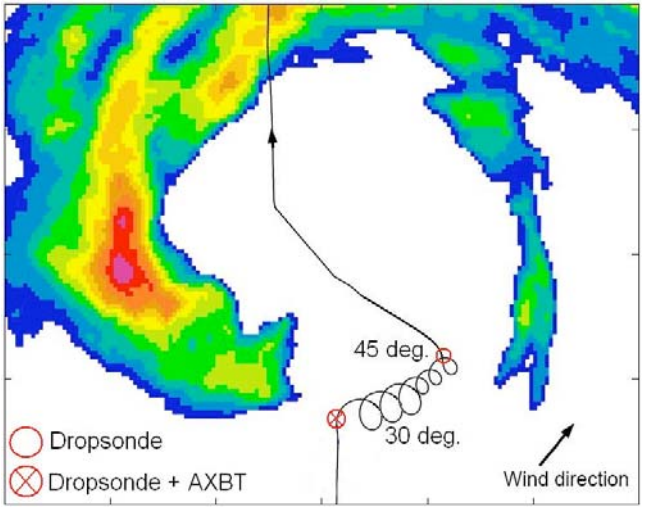
- HWRFx: HWRF initial conditions currently
- EnKF using airborne radar, GPS drops under development
- Coupling with ocean model under development

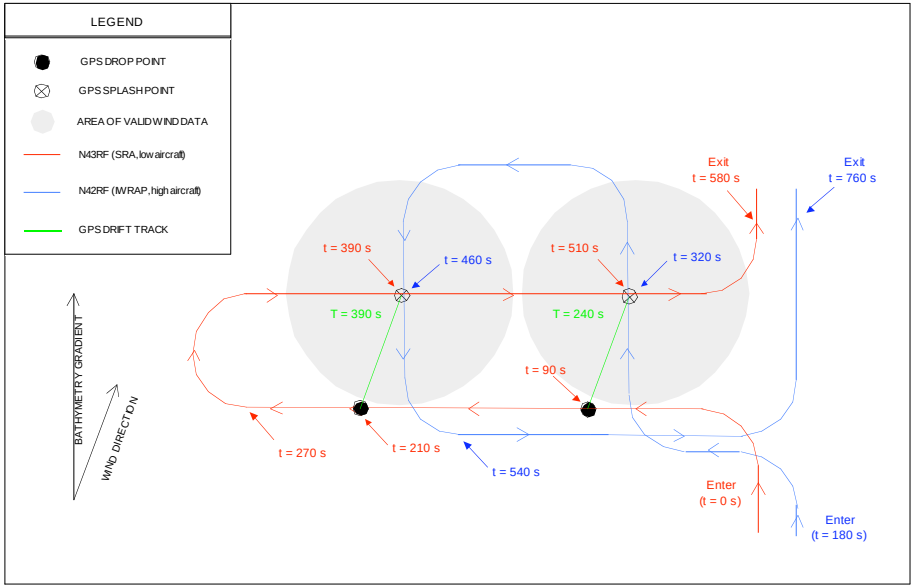
FY09 HFIP Real-time Test

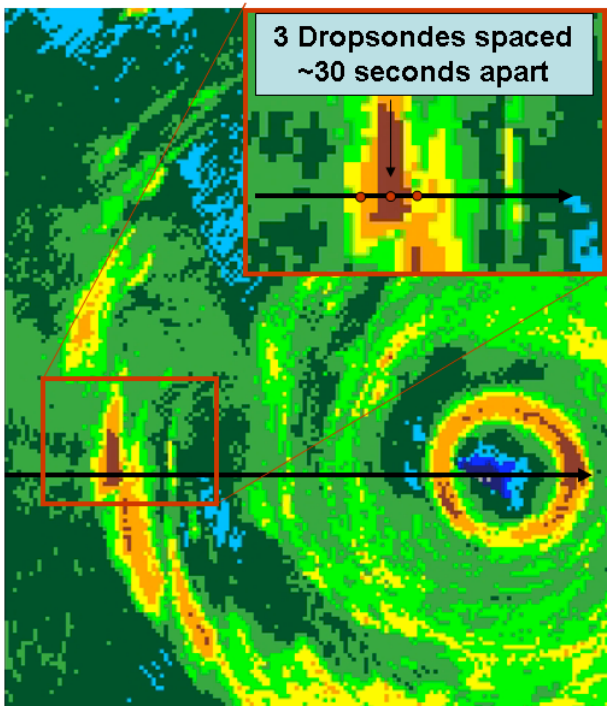
- Diverse NOAA (HRD, ESRL, NCEP/NHC, NCO, EMC), Navy (NRL), NCAR, and university (FSU, PSU, SUNYA, URI, TACC) team testing on-demand capability to support operational hurricane forecasting.
- Build upon FY08 HFIP HRH & TACC efforts to use high resolution:
  - **Global** (FIM and GFS at 10-km, plus 15-km FIM ensembles); and
  - **Regional** models, both operational and experimental (HWRF, GFDL, 4-km HWRF, 4-km NCAR/AHW, 3-km HWRFx, 4-km FSU/ARW, 4-km FSU/MM5, 5-km COAMPS-TC, and 4.5-km PSU/ARW using EnKF to assimilate Doppler radar superobs) to demonstrate on-demand capability and multi-model regional ensembles.
- NCEP model fields & NOAA P-3 Doppler radar superobs automatically from NCO to ESRL and TACC, experimental models run, standard output products generated for forecasters, and products transferred to NHC.
- **Products**
  - ATCF tracks (Marchok and other trackers)
  - HRH diagnostic suite (track (Marchok tracker), intensity, RI)
  - Ensemble diagnostics
  - New diagnostic and evaluation tools

IFEX2: Instrument Evaluations

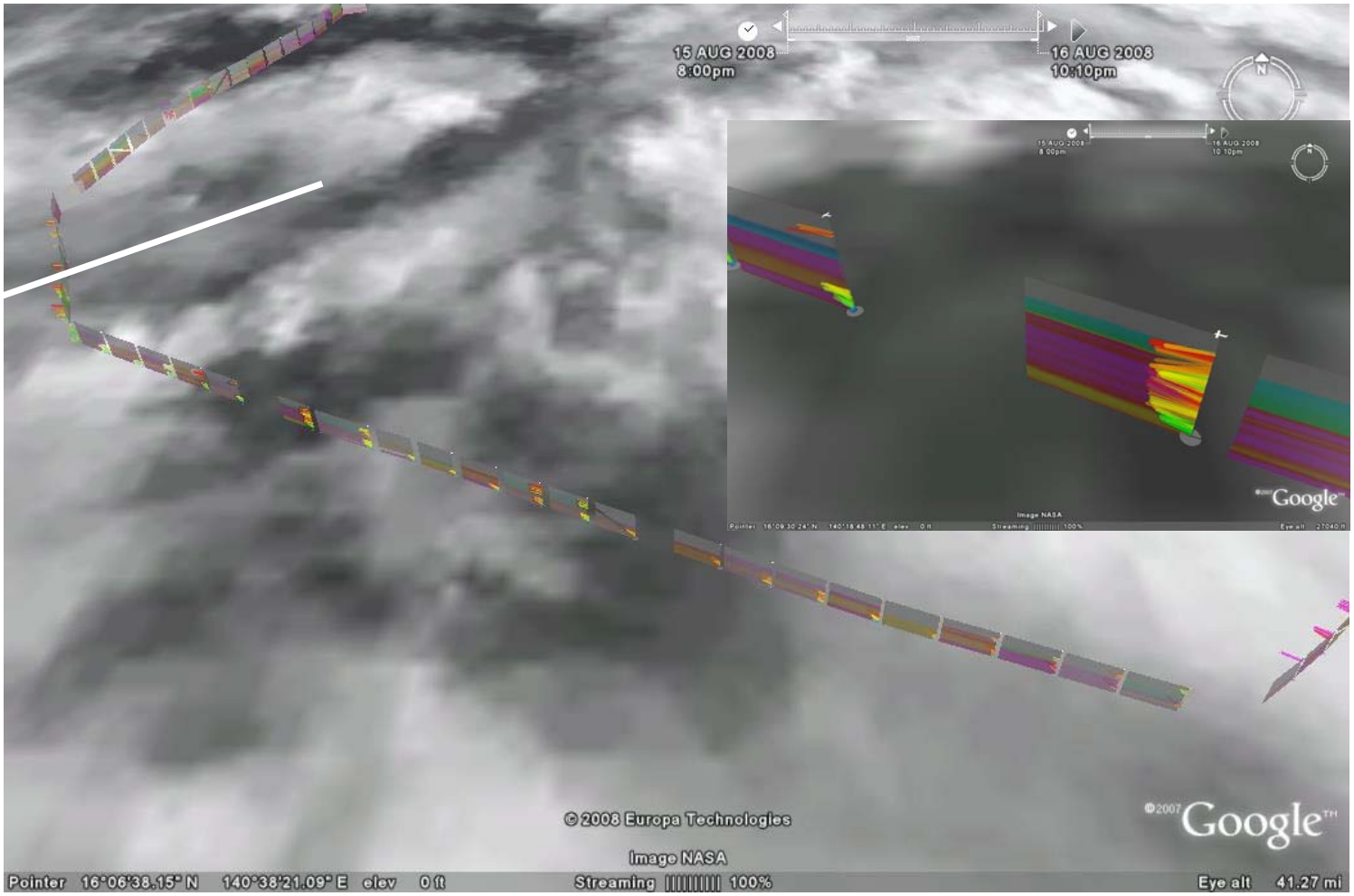
- SFMR:
  - Shallow bathymetry
  - Heavy rain
  - High incidence angle
- Doppler Lidar
- NESDIS Oceanwinds/AWRAP







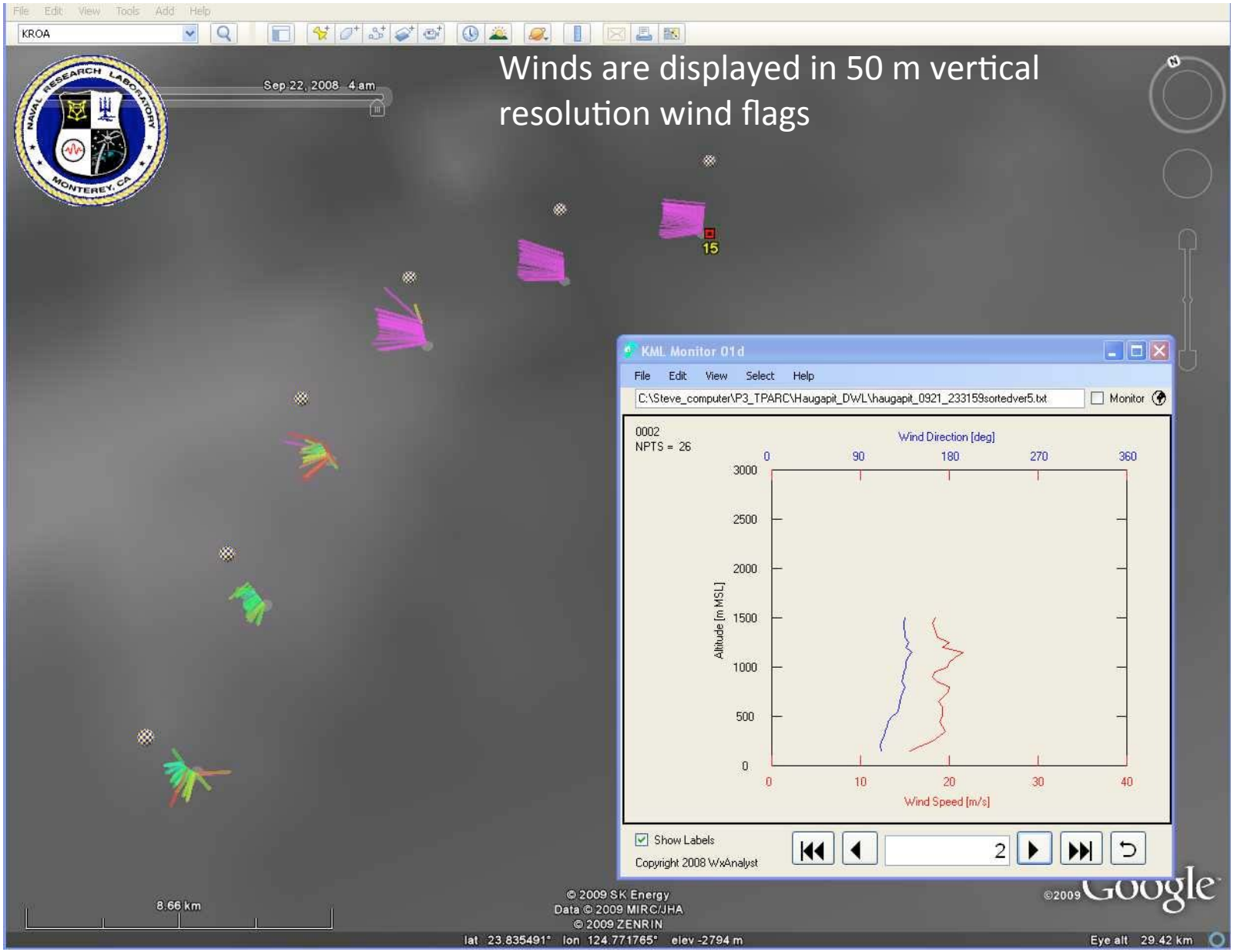
Example of P3DWL data display in Google Earth



Winds are displayed in 50 meter vertical resolution wind flags;
Panel between wind profiles contains aerosol loading as function of height

Courtesy G. D. Emmitt

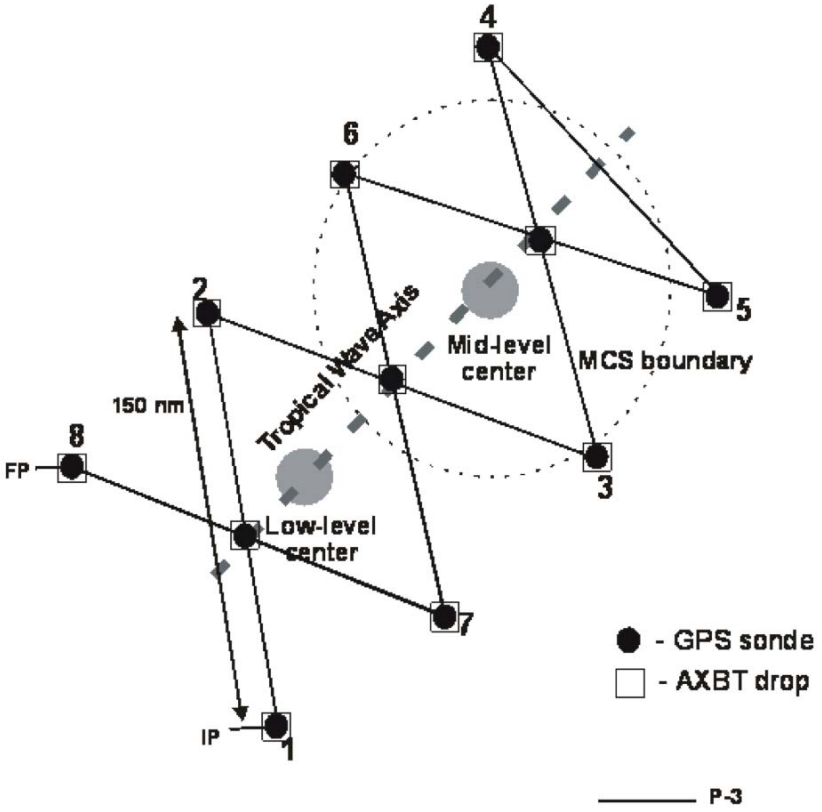
Example of P3DWL data display in Google Earth

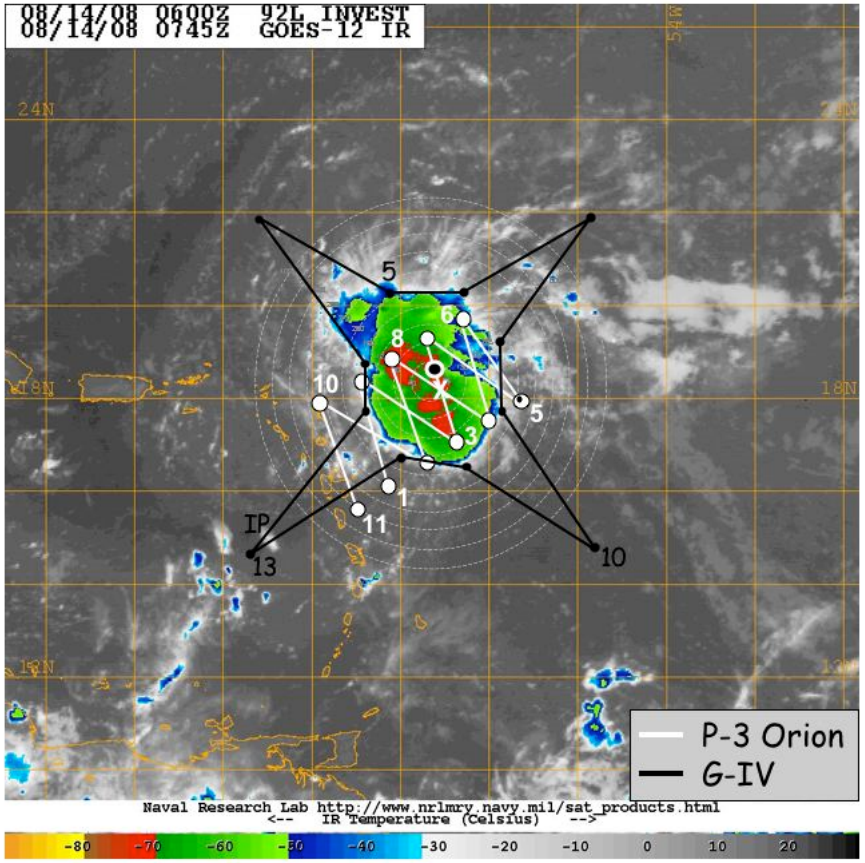


Courtesy G. D. Emmitt

IFEX3: Tropical cyclogenesis experiment

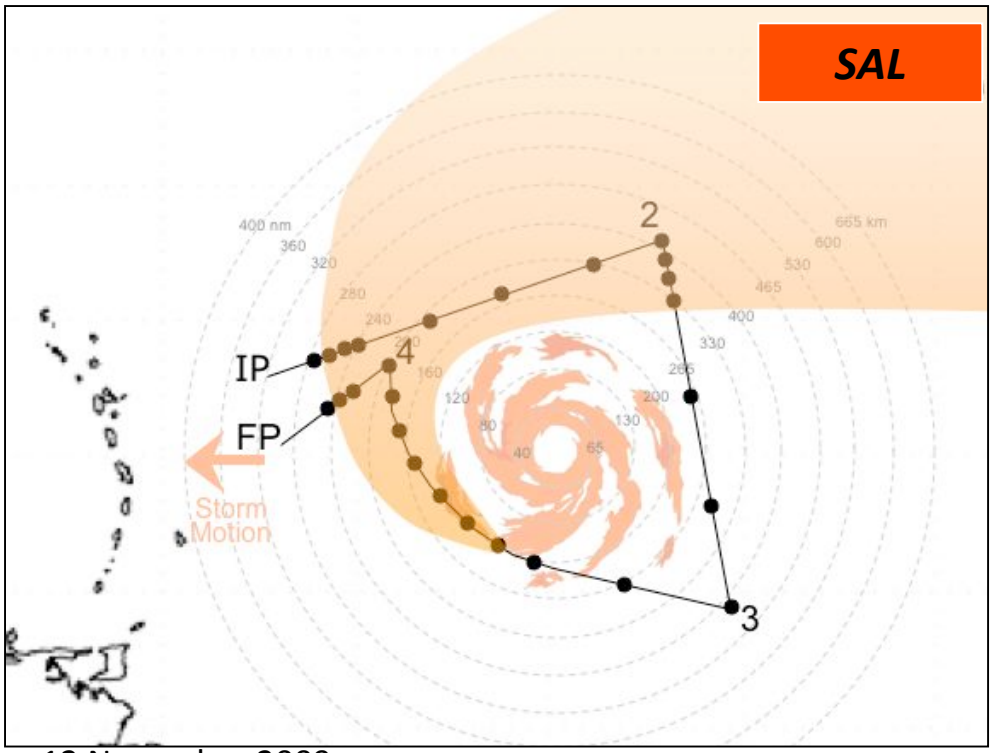
- Convective/mesoscale interactions during genesis (e.g., “bottom-up” vs. “top-down”, convective vs. stratiform processes)
- Synoptic-scale influences on genesis (e.g., SAL, “marsupial” paradigm)
- Coordinated G-IV/P-3 missions provide multiscale, broad temporal coverage

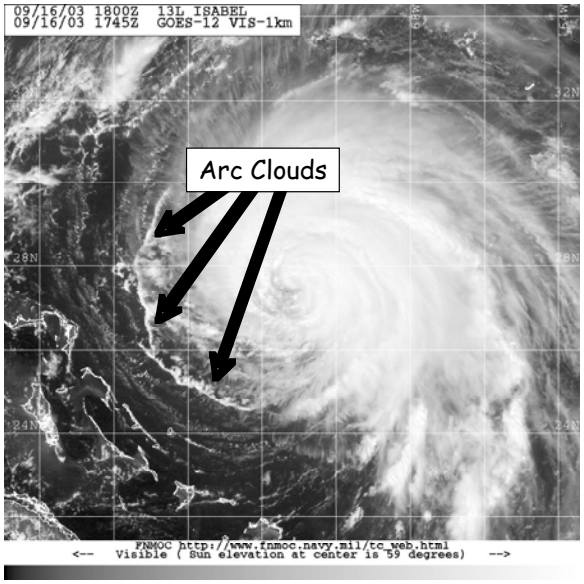


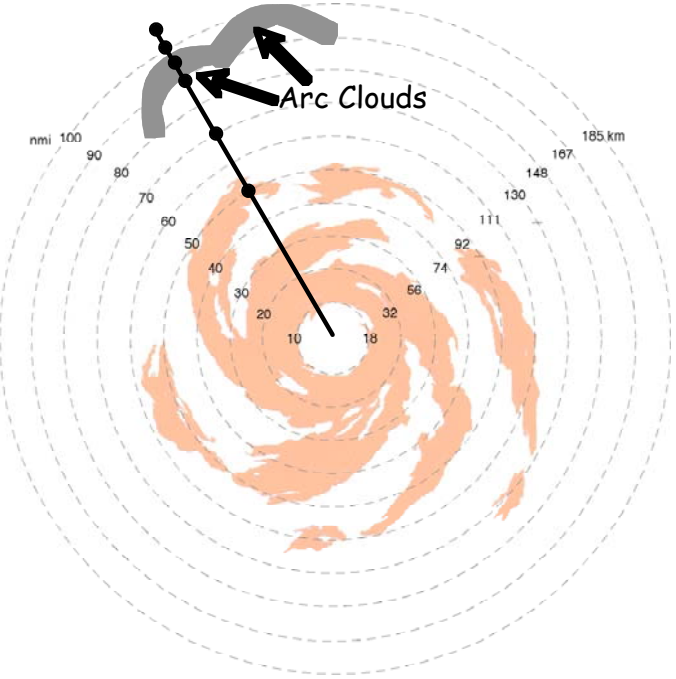


IFEX3: Environmental Interactions (G-IV/P-3)

- Saharan Air Layer (SAL)/vortex interaction
- Arc-cloud observation

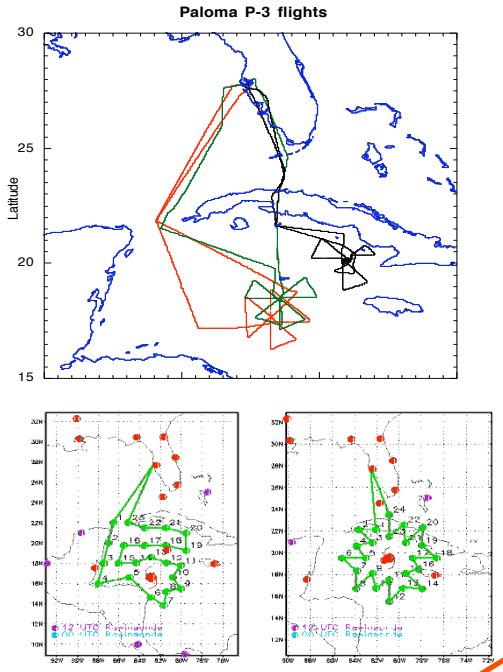


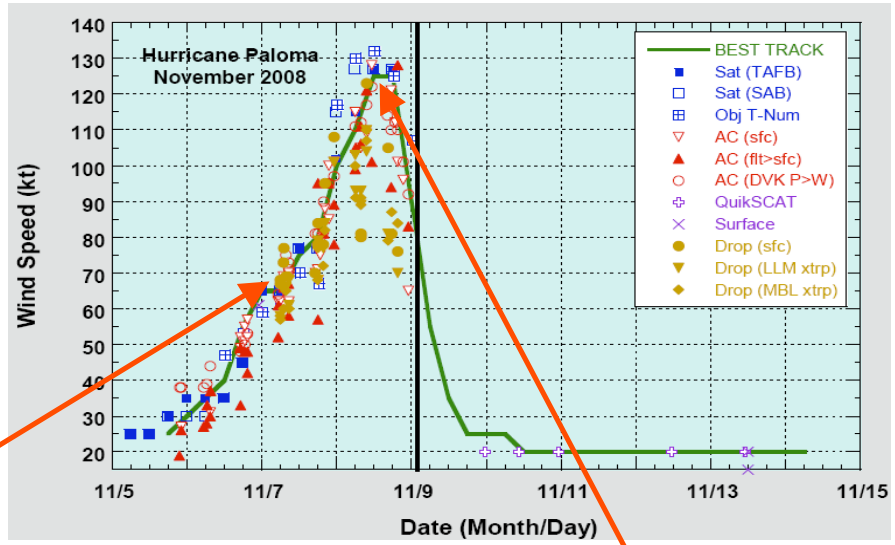


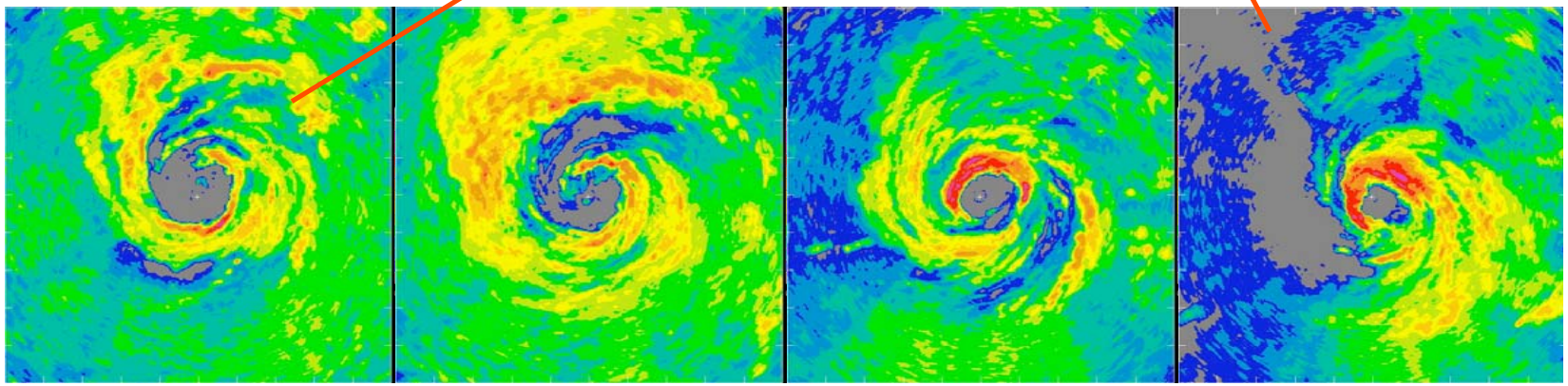


IFEX3: Rapid Intensity Change

- Build on Paloma 2008 success







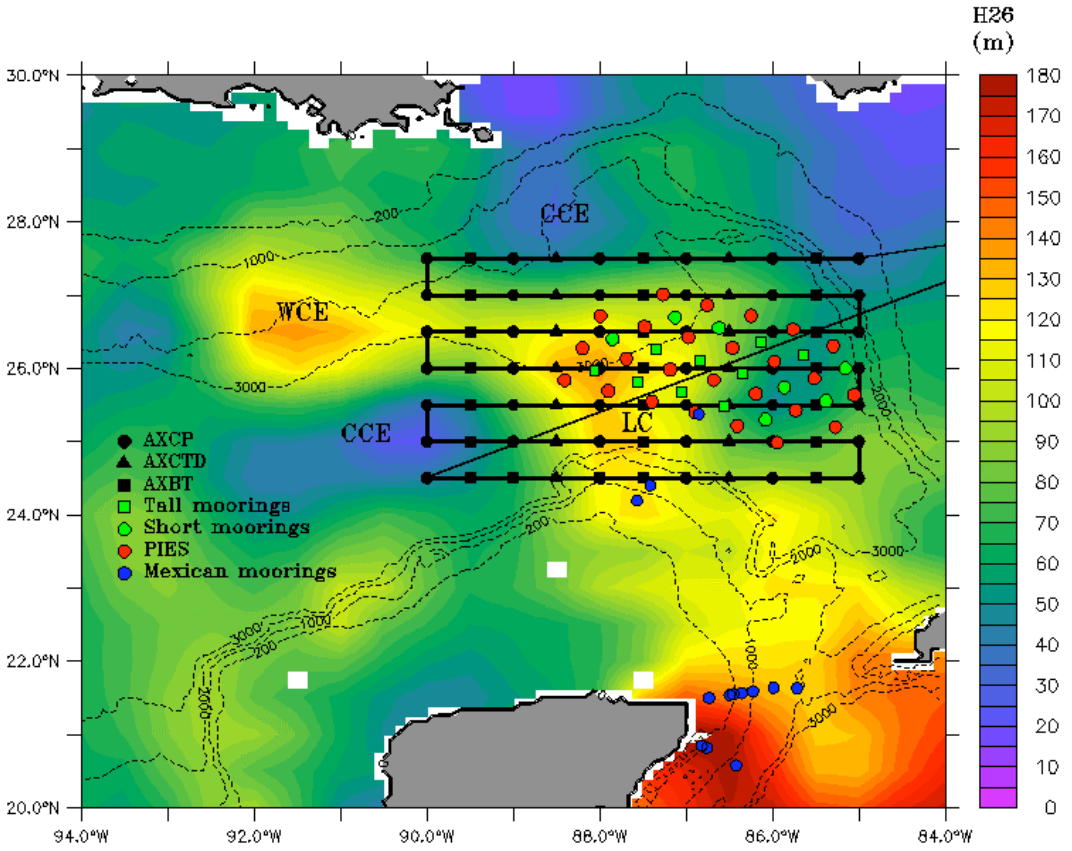
IFEX3: Airborne Ocean Surveys Over Loop Current During TC Passage

Deliverables include:

V, T, S profiles to 1000 m @ 2-m resolution.

Surface winds (SFMR, GPS) provided by HRD.

Atmospheric profiles of V, T and RH @ 5-m resolution.



Goal: To observe and improve our understanding of the LC response to the near-surface wind structure during TC passages. Specific objectives are:

1. Determine the oceanic response of the LC to TC forcing; and,
2. Influence of the LC response on the TC's boundary layer and intensity.

IFEX3: Landfall Coordination

- Ground sensors (DHC)
  - FCMP towers
  - TTU Sticknet
  - Mobile radars
  - Coastal Mesonets
- InLAND decay
- Offshore convection