

# **“Observations of Atlantic Hurricanes with Air-deployed Drifters”**

by

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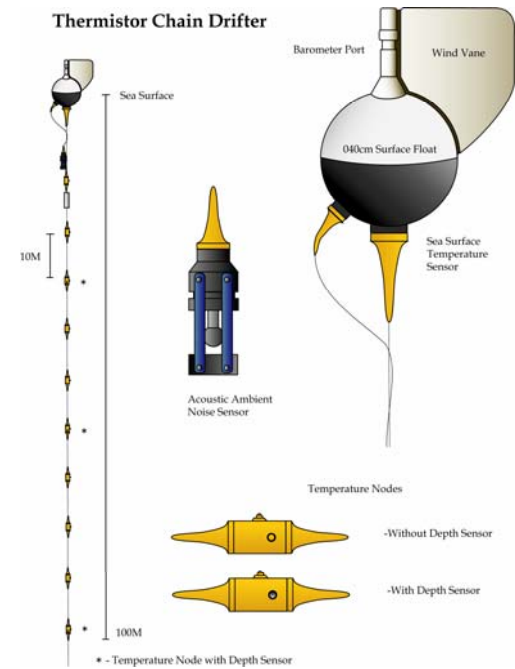
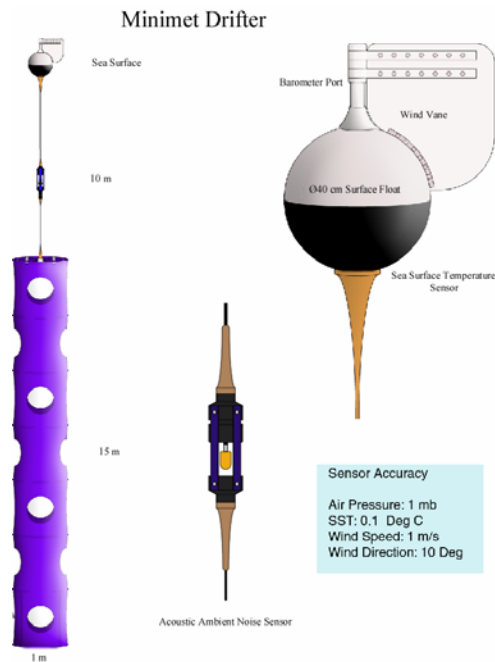
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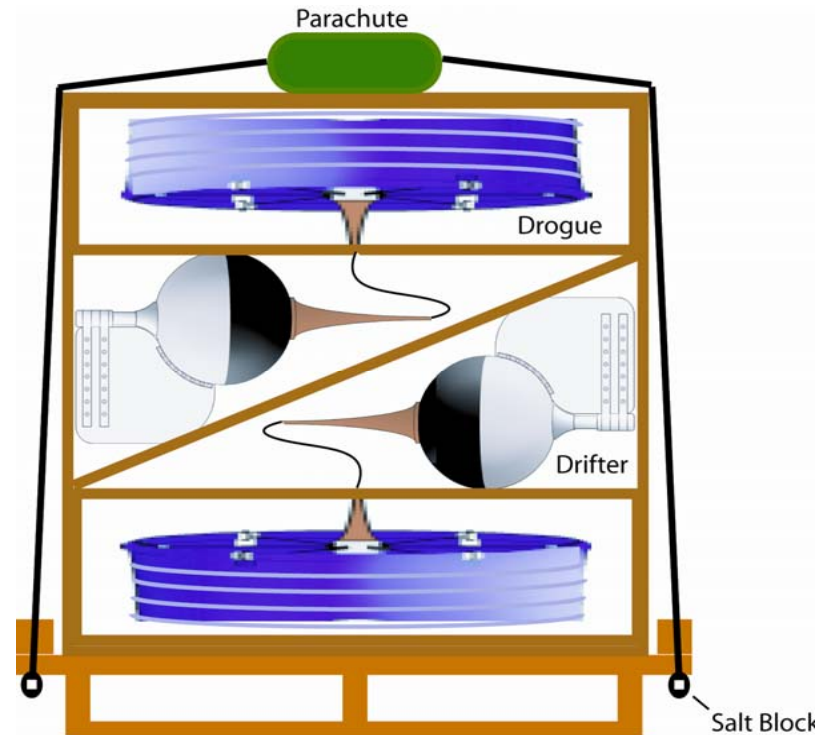
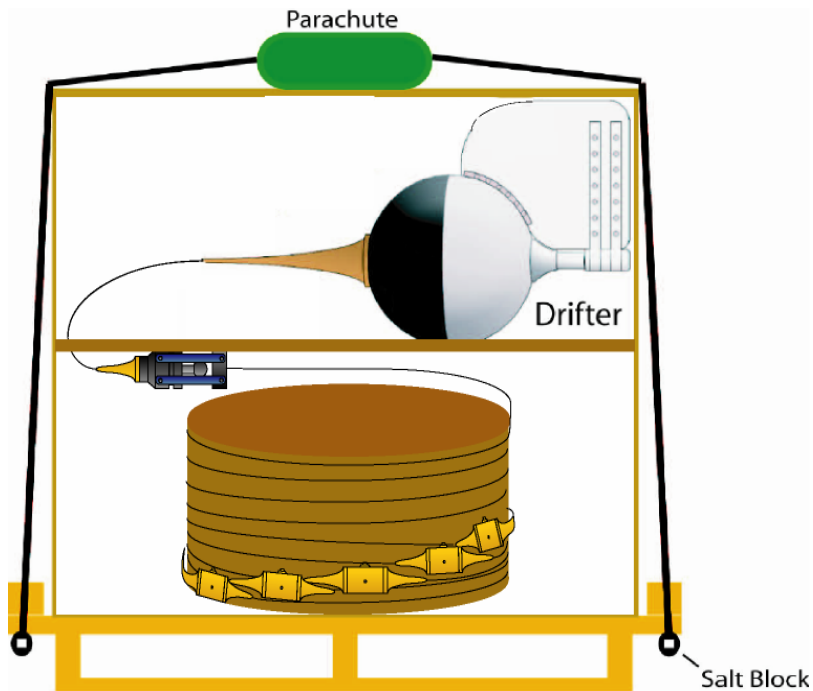
# REVIEW

- Commencing in 1998, SVP-Wind drifters were deployed in tropical Atlantic in 'Hurricane Alley' from ships and airplanes.
- A review of wind data from more than 100 drifters that had reported on GTS in 2003 showed that NOT ONE drifter had experiences Hurricane wind conditions of 27m/sec wind.
- In 2003, 2004, 2005 and 2007 SVP-W (Minimet) and SVP-T(z) (ADOS) drifters, targeted to specific hurricanes, were deployed by 53rd Hurricane Hunter C-130 aircraft in the tropical North Atlantic.
- For 2008 hurricane season there will be 70 drifters awaiting deployment at Keesler AFB, MS

# C-130 deployed buoys



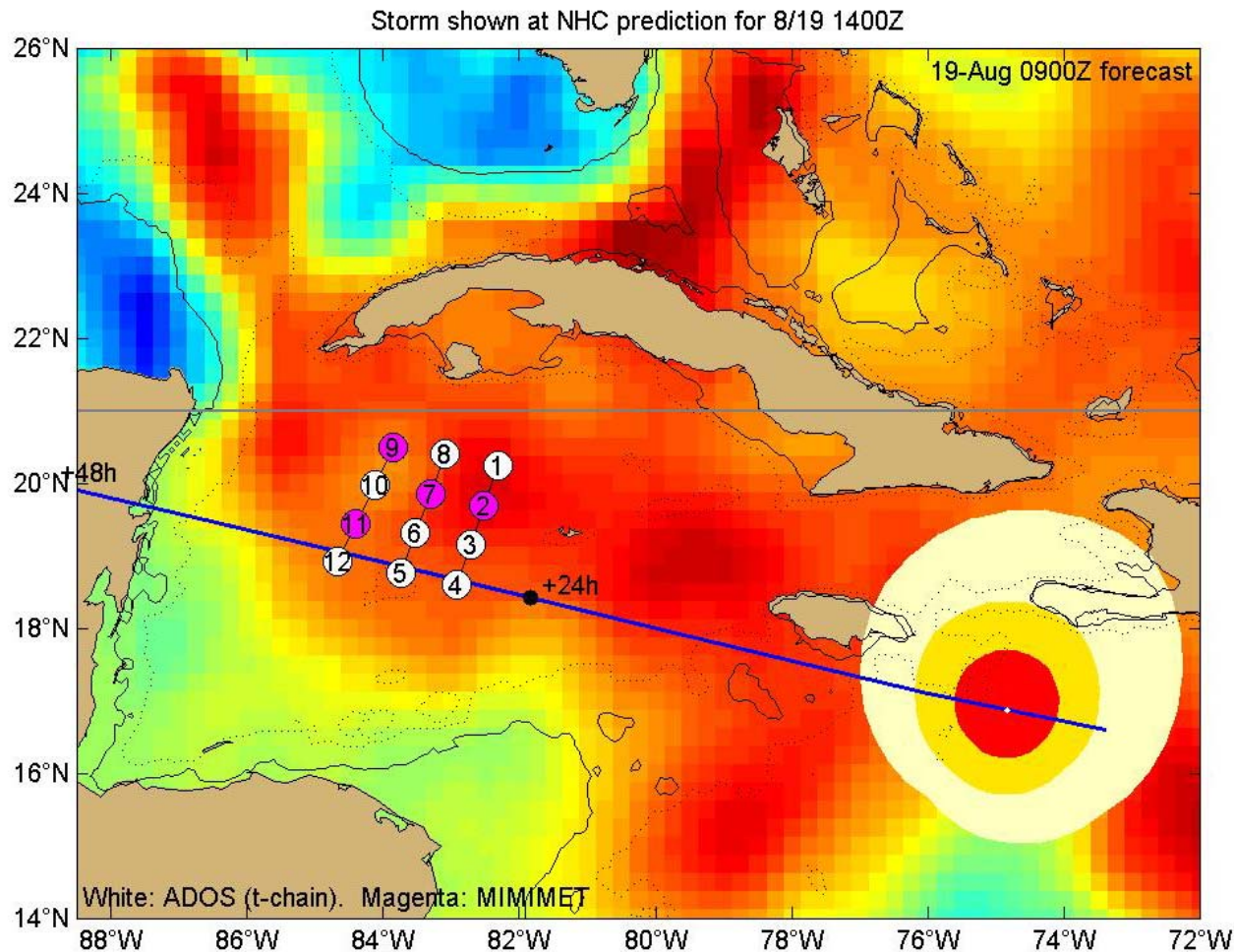
# Air-Deployment Packaging



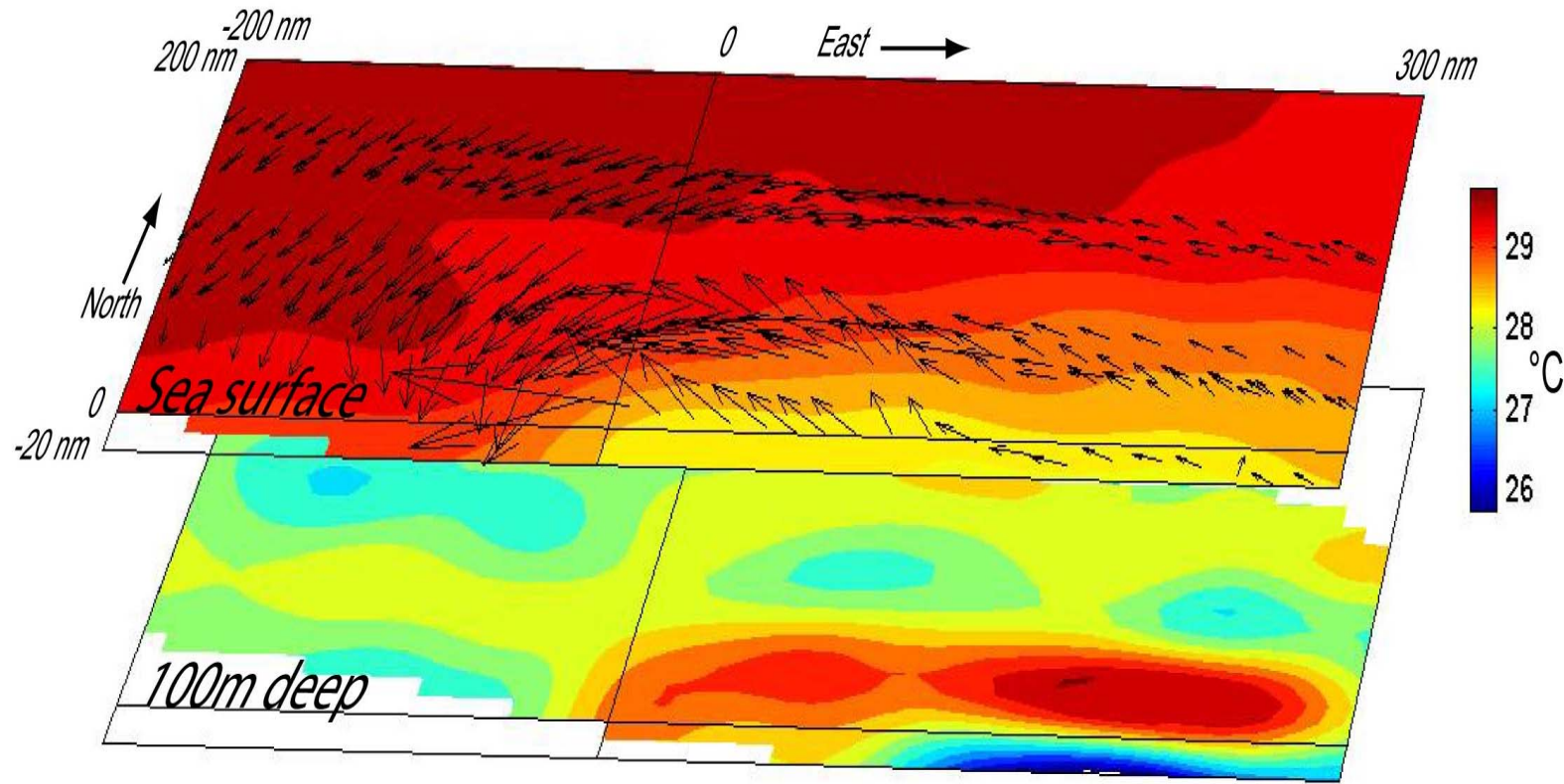
On August 19, 2007

4 Minimets and 8 ADOS drifters deployed in path of  
category 4 Hurricane “Dean”

All buoys sent data to Argos through Dean



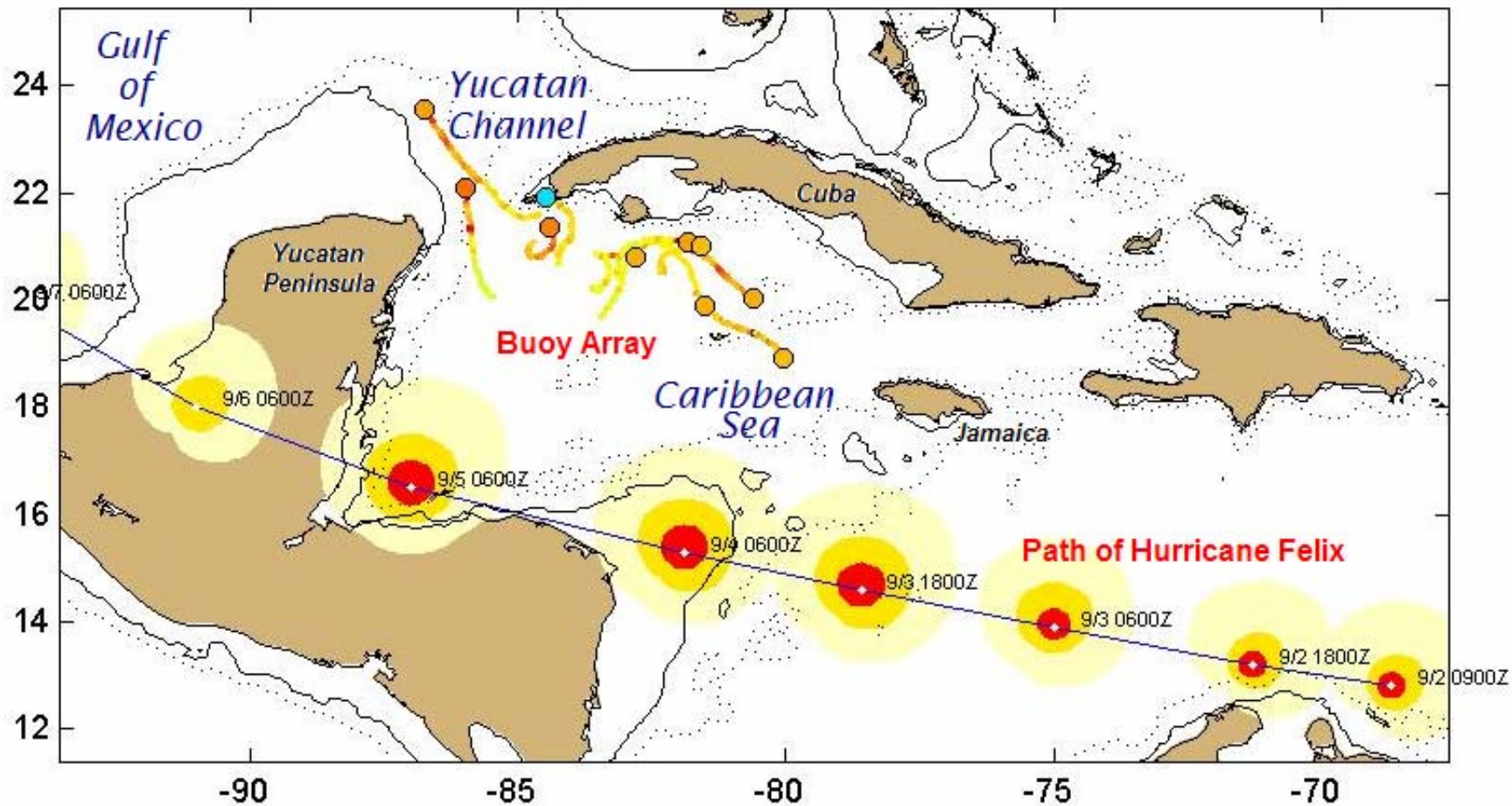
Top: Sea surface temperature (shading, °C) and winds (arrows) measured by the hurricane drifter array at top. Bottom: subsurface temperatures at a depth of 100m.



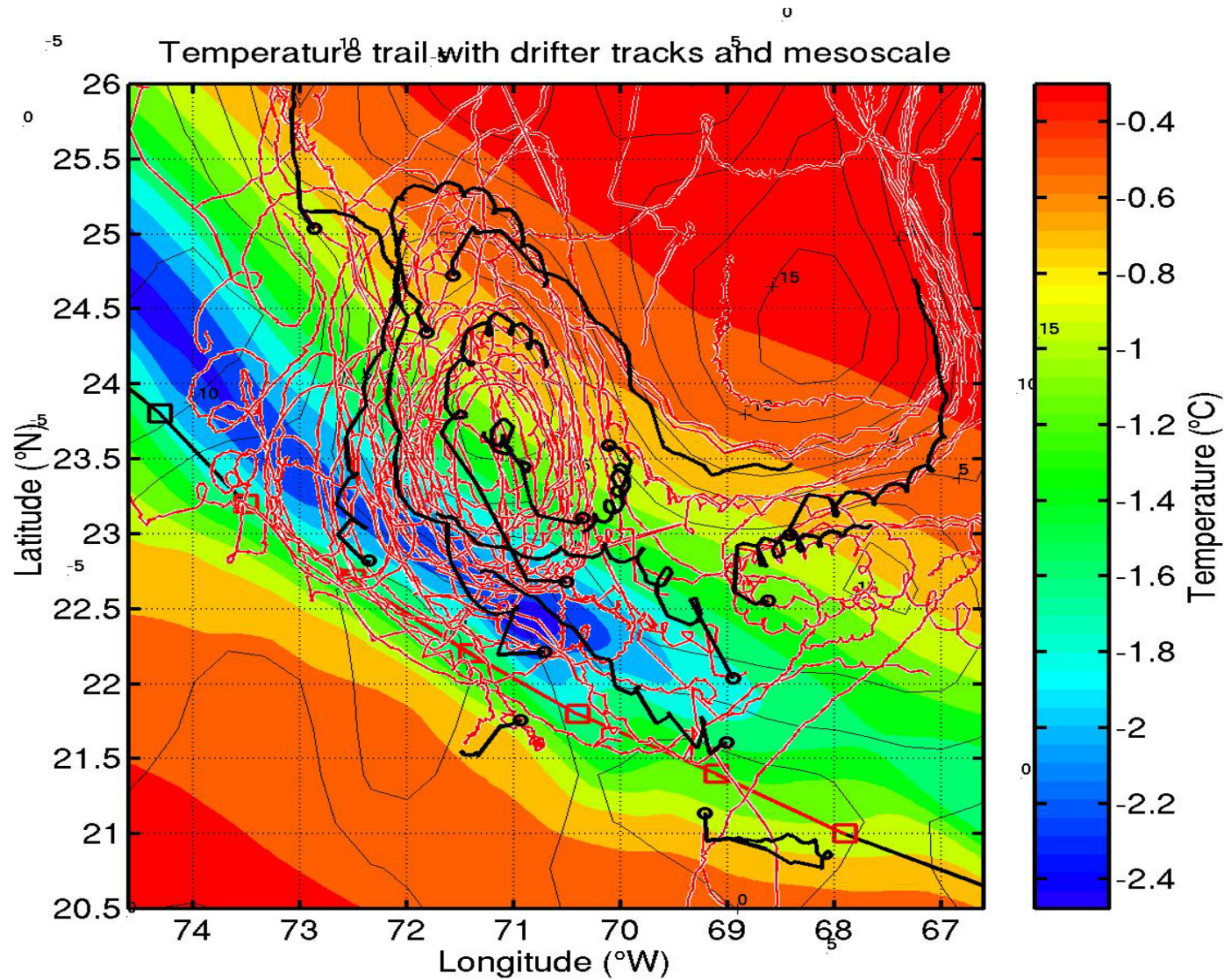


After Dean passage, one drifter went aground on Cuba, two stopped working and 9 are producing “good” data 57 days later.

**Hurricane Felix (fr/5am Sunday advisory) and Buoy Array**

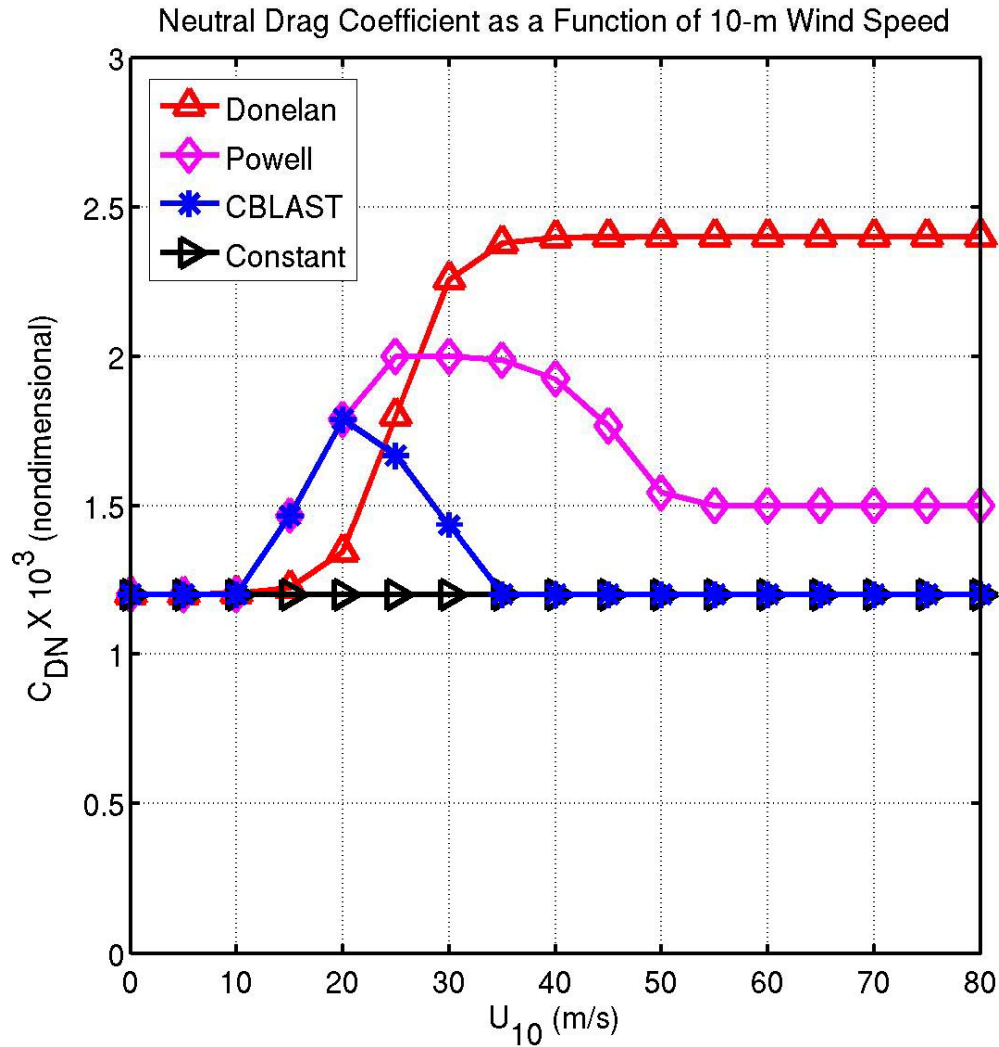


Observed cold “wake” of Hurricane “Frances” in Sept 2004 (red squares)  
with drifter tracks (pink and black) and absolute sea level (light black)  
*(Courtesy of S. Zedler)*



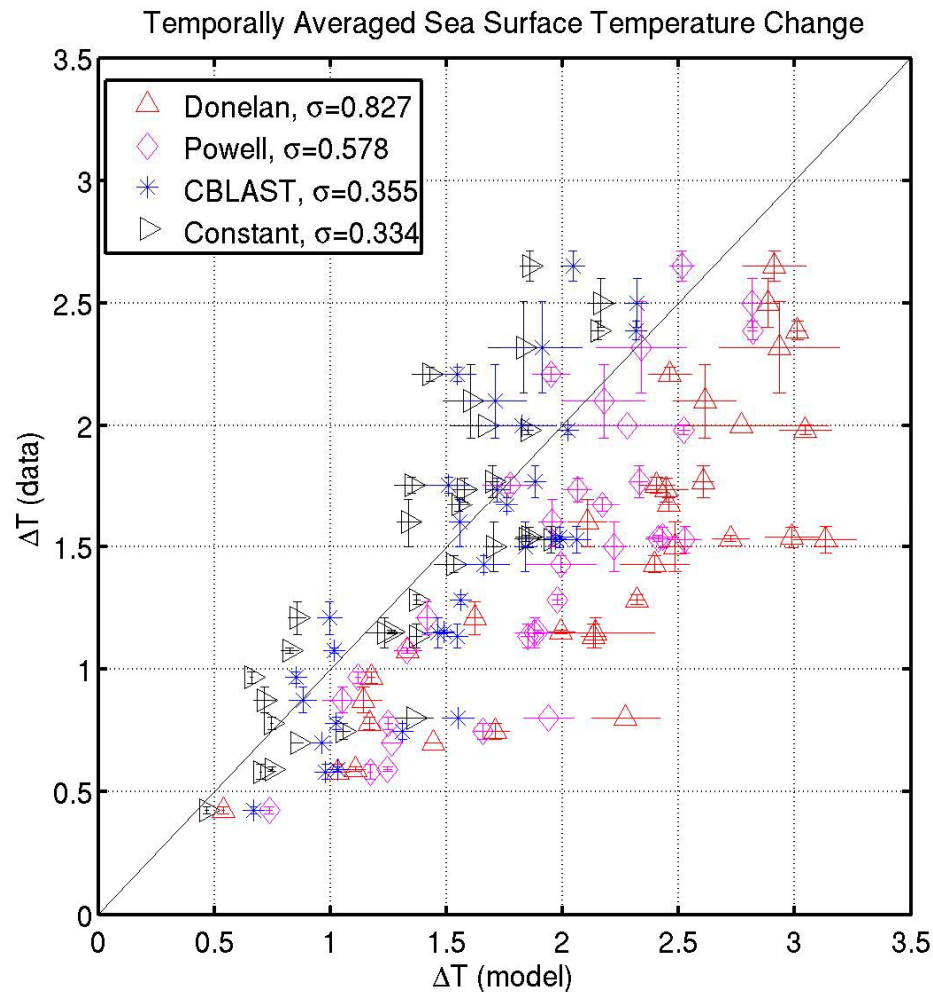


# Drag coefficients for stress as function of wind speed used in Frances simulations. *(Courtesy of S. Zedler)*

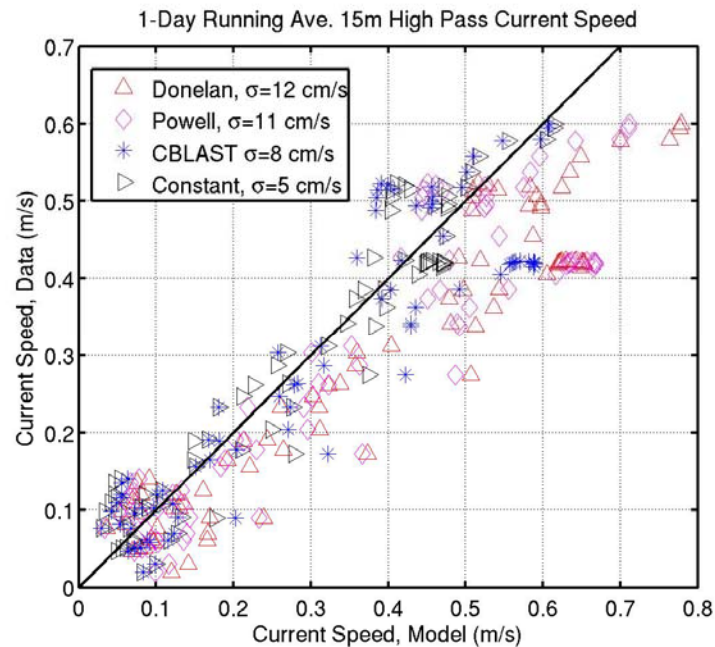


Model simulated vs observed change of SST averaged 24 hours before and after passage of Frances for different  $C_D$  formulations

*(Courtesy of S. Zedler)*



Model simulated vs observed daily average high frequency speed at 15m depth after passage of Frances for different  $C_D$  formulations  
(*Courtesy of S.Zedler*)



# Summary of Modeling Results

- Model response is fully three-dimensional and non-linear components in momentum and vorticity balances are important
- Model simulations show “sensitivity” to drag coefficient value at hurricane force winds
- Best simulation of observations is with hurricane force drag coefficient decreasing with wind speed
- Decay of near inertial motions in observations is faster than in model



# Development of SVP-T(z)-Mini

- Existing SVP-T(z=150m) weighs 160kg, packed for C-130 deployment in 120cm cube box
- New configuration weighs 12kg, packed for P-3, or small aircraft, deployment in 10cm dia, 100cm length tube
- First sea tests off San Diego in early 2008
- Proposed research program for deployments of arrays of SVP-T(z=150m)-Mini in Western Pacific Typhoons in 2008-2009

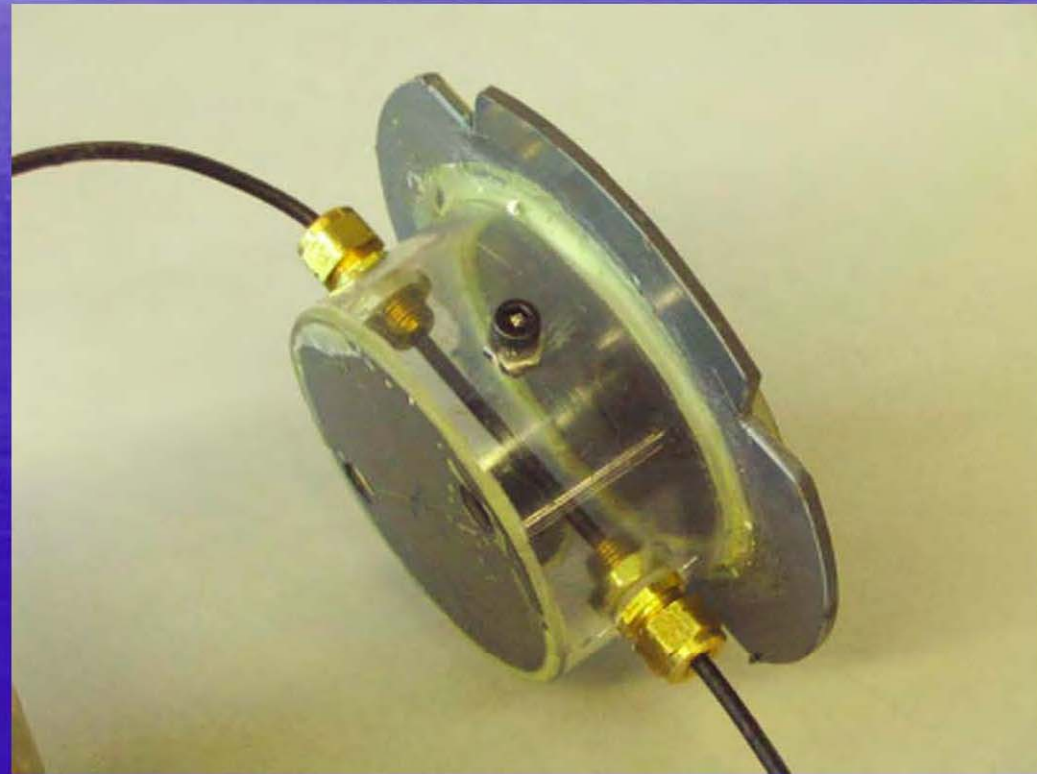
# SmartSensor Spools

- 15 meters per spool of 1/8-inch Spacelay.
- Two spools shown here.
- Length of 10 spools and ballast: 15.5 inches.



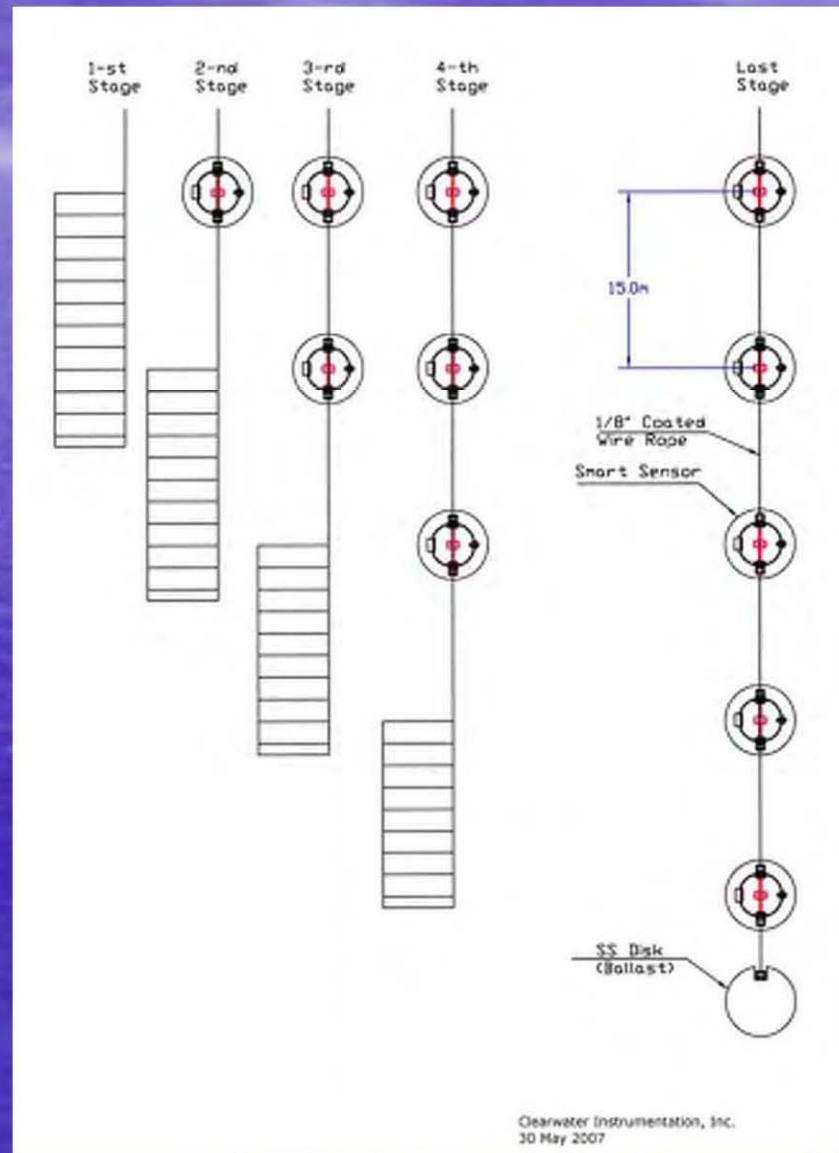
# SmartSensor Mini-Puck Mock Up

- Potted in urethane
- Thermistor on top
- Pressure sensor on bottom
- Wire stress relieved inside fittings
- Wire wrapped outside puck





# Spoiled Deployment

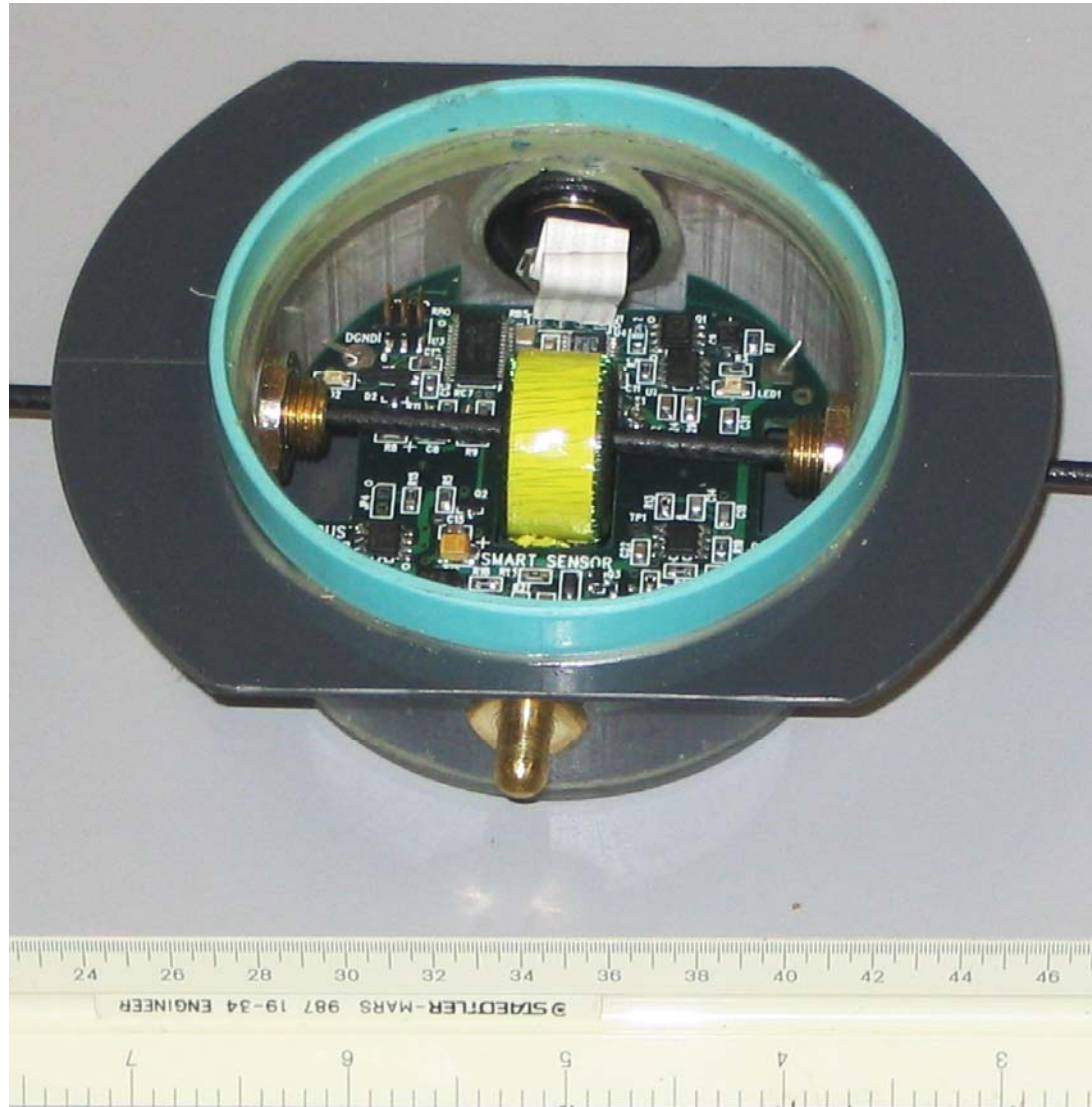




# Prototype 10 sensor spool



# Prototype puck



# Prototype electronics, antenna and power case



# CONSLUSIONS

- “Operational” system for targeted C-130 air deployments of various SVP drifters is completed.
- “High quality” measurements of Pa, SST, wind direction and  $T(z=150\text{m})$  through hurricanes can be made
- Meteorological research and operational hurricane monitoring aircraft cannot deploy these large packages
- New “operational” mini system for acquisition tropical cyclone surface and subsurface data is in development