

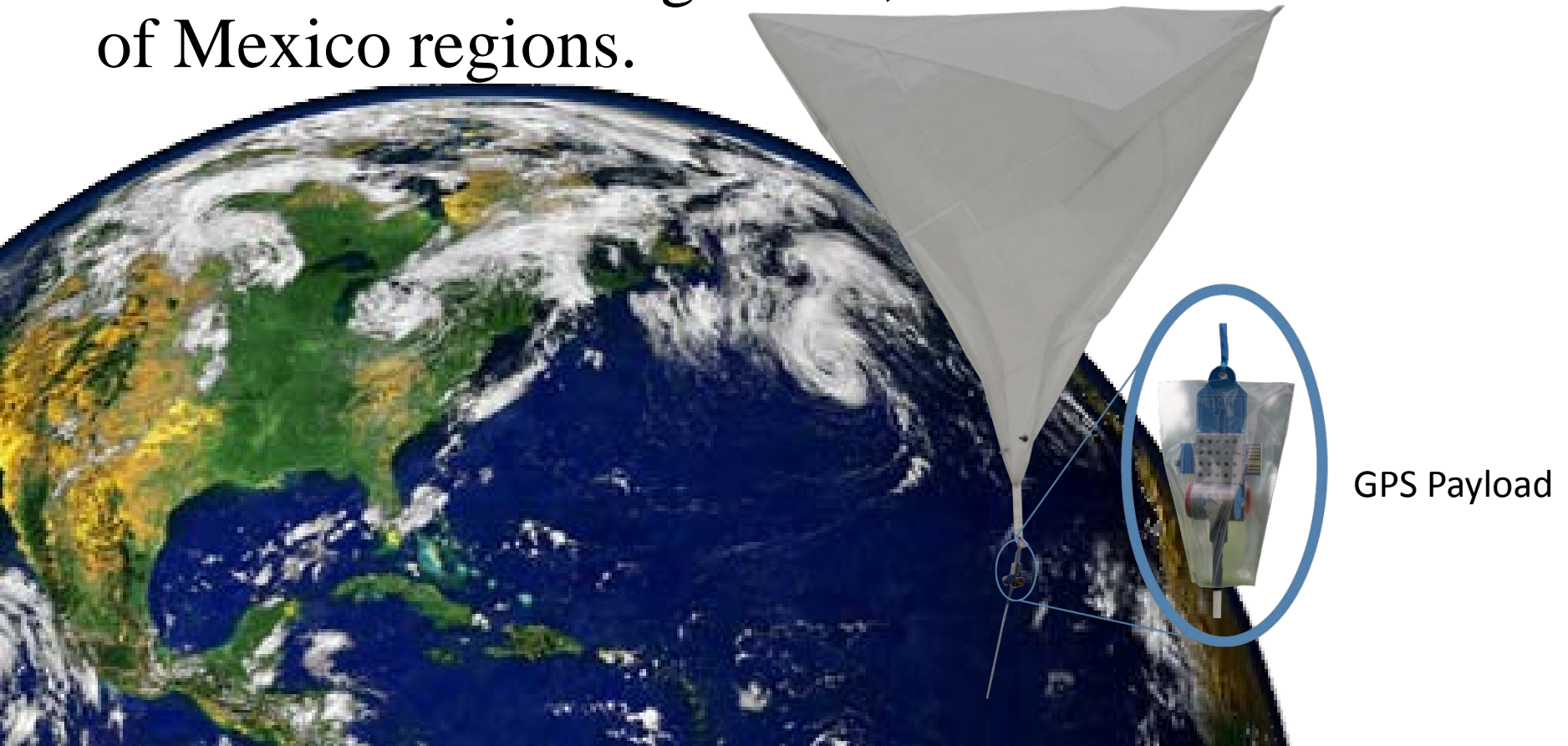
WISDOM

Weather In-Situ Deployment
Optimization Method for Improved
Hurricane Track Forecasting

Northern Gulf Institute
(Mississippi State University)

What is WISDOM?

Deployment of horizontal balloon sondes into important data-sparse layers of the atmosphere over the Atlantic High Seas, Caribbean and Gulf of Mexico regions.



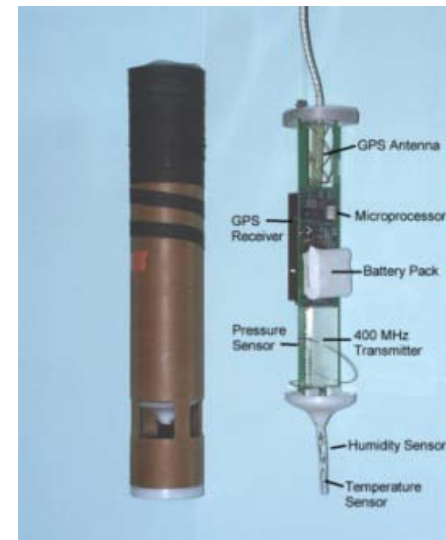
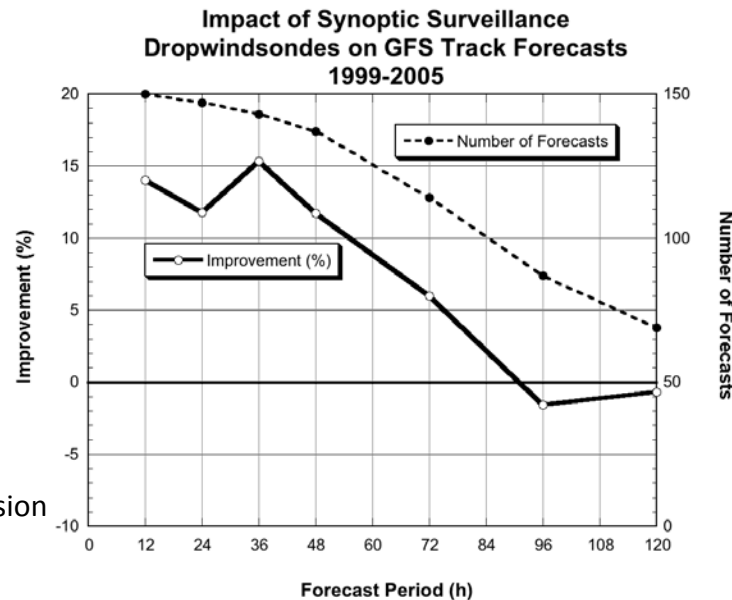
The Objective

Improve 3 - 7 day tropical storm track forecast by launching enough horizontal balloon sondes in the data poor region to better understand a hurricane's synoptic environment (Weather In-Situ) and to monitor the atmospheric steering currents at 12,000 and 25,000 feet.



Current Hurricane Synoptic Observations

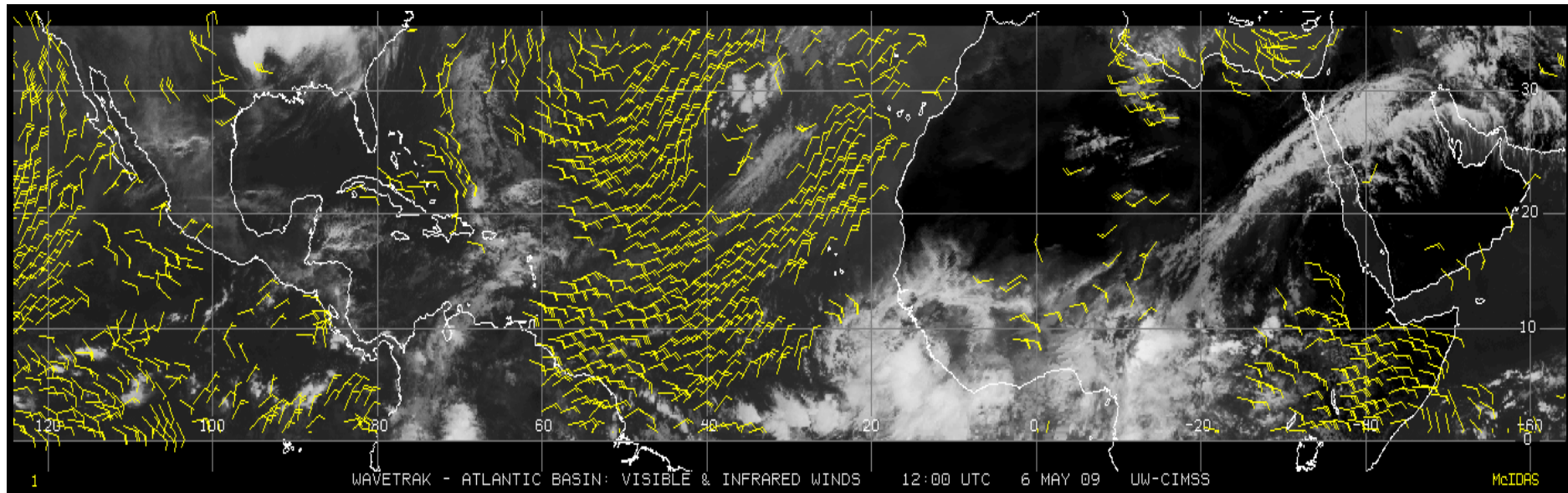
- G-IV aircraft hurricane synoptic surveillance program
- Since 1997 G-IV has completed more than 175 synoptic surveillance missions



Graph provided by
Sim Aberson
NOAA/Hurricane Research Division

Other Synoptic Observations

- Satellite sounder observations of atmosphere at 200 mb and 850 mb (38Kft and 5Kft respectively)
- Aerosondes (?) – Unmanned Aerial Vehicles (UAV)
- Other



WISDOM Synoptic Applications

- Great potential to fill critical science data gaps of a hurricane's external environment.
- Monitor primary hurricane atmospheric steering currents at 12,000 and 25,000 feet.
- Updated sensor package for 2009 will have pressure sensors to monitor atmospheric pressure at float altitudes. Possibly others sensors will be added (temp, wind data, humidity)
- Ground truth model derived winds.

NOAA's Hurricane Research and Forecast Improvement Initiative 2008

- Provide the basis for NOAA and other agencies to work towards a national effort to coordinate national hurricane research needed to SIGNIFICANTLY improve guidance for hurricane track, intensity, and storm surge forecasts
- Engage and align the inter-agency and larger scientific community efforts towards addressing the challenges posed to improve hurricane forecasts.

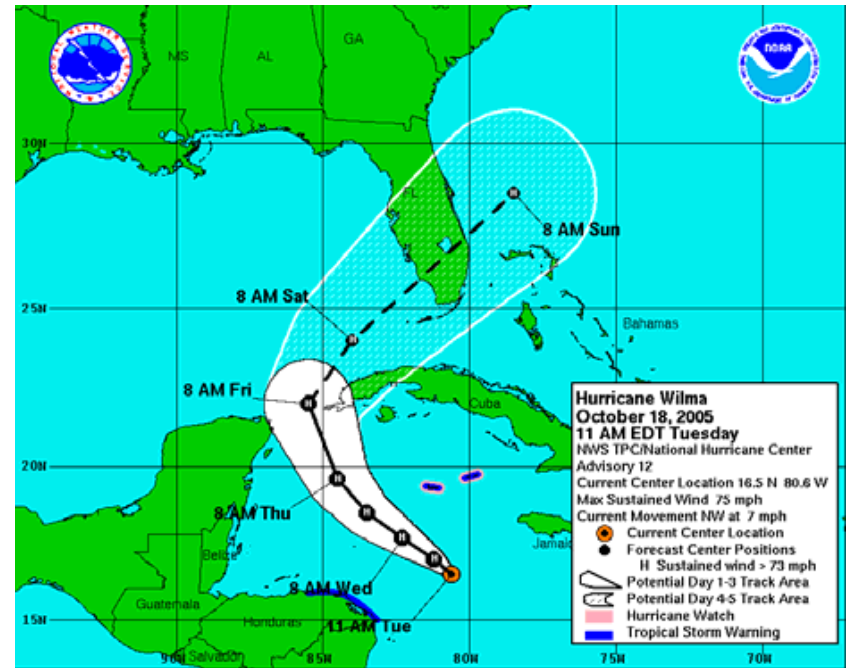
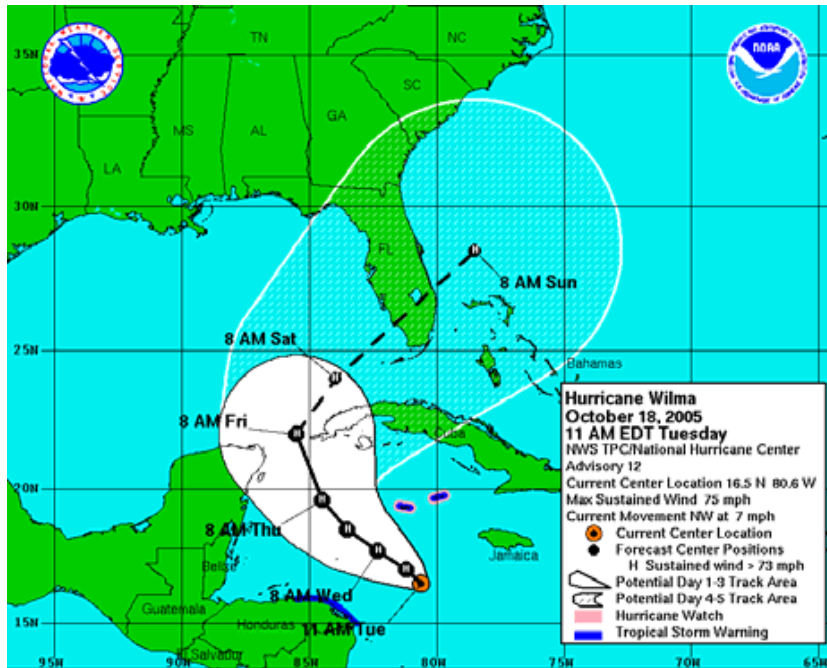
Goals of Hurricane Research and Forecast Improvement Initiative 2008

Specific metrics include:

- Reduce average track error by 50% for Days 1 through 5.
 - Current error at 48 hours ~100nm
 - Goal is 50nm at 48hours
- Reduce average intensity error by 50% for Days 1 through 5.
- Increase the probability of detection (POD) for rapid intensity change to 90% at Day 1 decreasing linearly to 60% at Day 5, and decrease the false alarm ratio (FAR) for rapid intensity change to 10% for Day 1 increasing linearly to 30% at Day 5.
- Extend the lead time for hurricane forecasts out to Day 7.
- NOAA is pursuing operational system architecture that can accommodate quantum leaps in research and technology.

Goals of Hurricane Research and Forecast Improvement Project 2008

50% reduction in track error for days 1-7



Charts from NOAA's Hurricane Forecast Improvement Project Initiative Document
July 18, 2008

2008 WISDOM Review

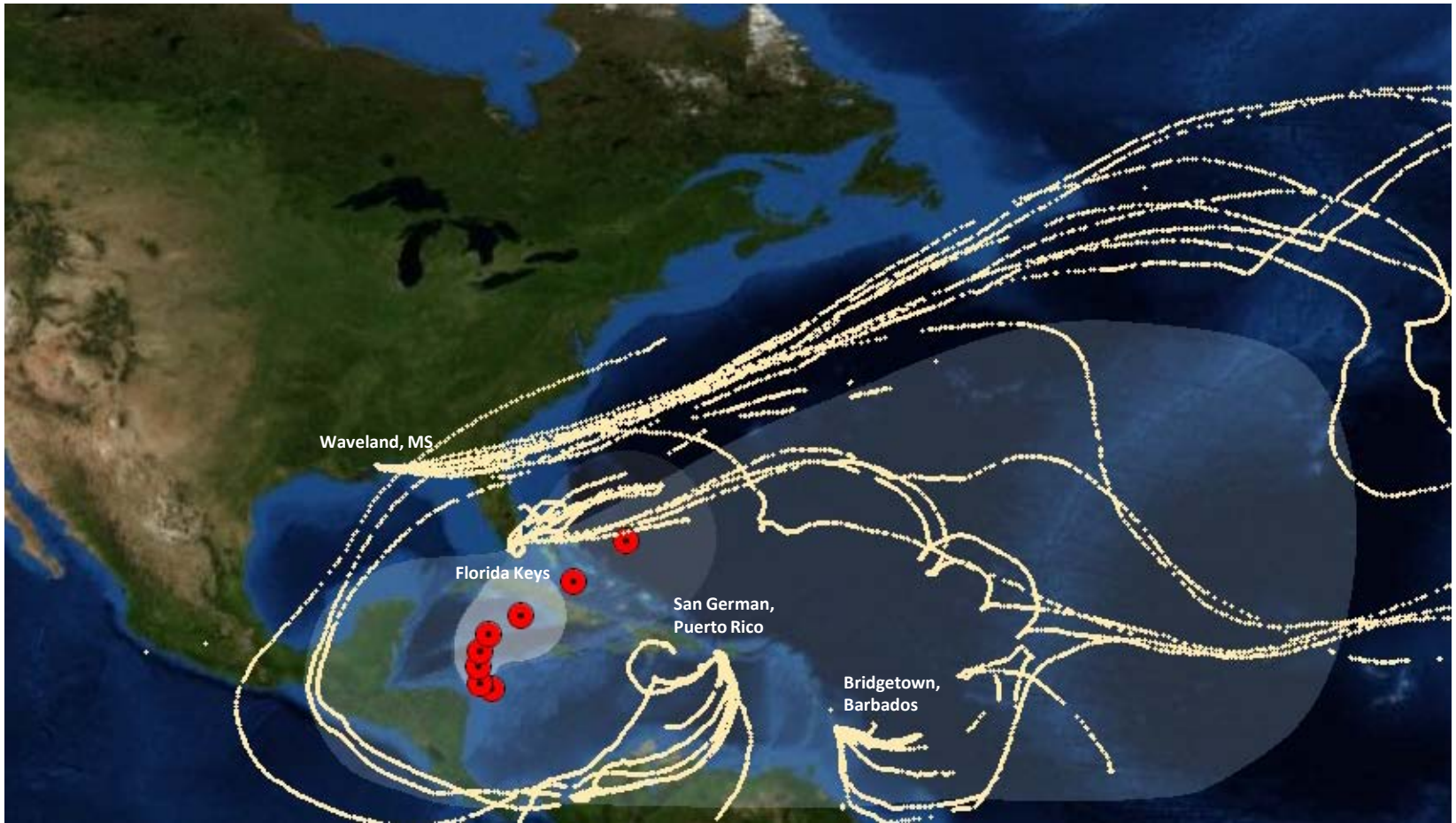
WISDOM 2008

- Funding for WISDOM was delayed so the project did not really begin until late in the hurricane season – September
- Testing of the system was conducted by Near Space Corporation (NSC), designers and makers of the tetron balloon and Engenium Technologies Corp. (ETC), designers and makers of the GPS payload.
- Training was conducted by NSC in Miami at the Atlantic Oceanographic and Meteorological Laboratory in August with teams from MSU, UM, NCAR and Barbados. Teams successfully launched two tetrons.
- October - simultaneous test launches from MS Coast, Florida Keys, Puerto Rico and Barbados.
- November - Hurricane Paloma rapidly formed. Teams were dispatched and launched over 57 balloons over 3 days.
- December – WISDOM classified OPERATIONAL!

2008 Launch Sites



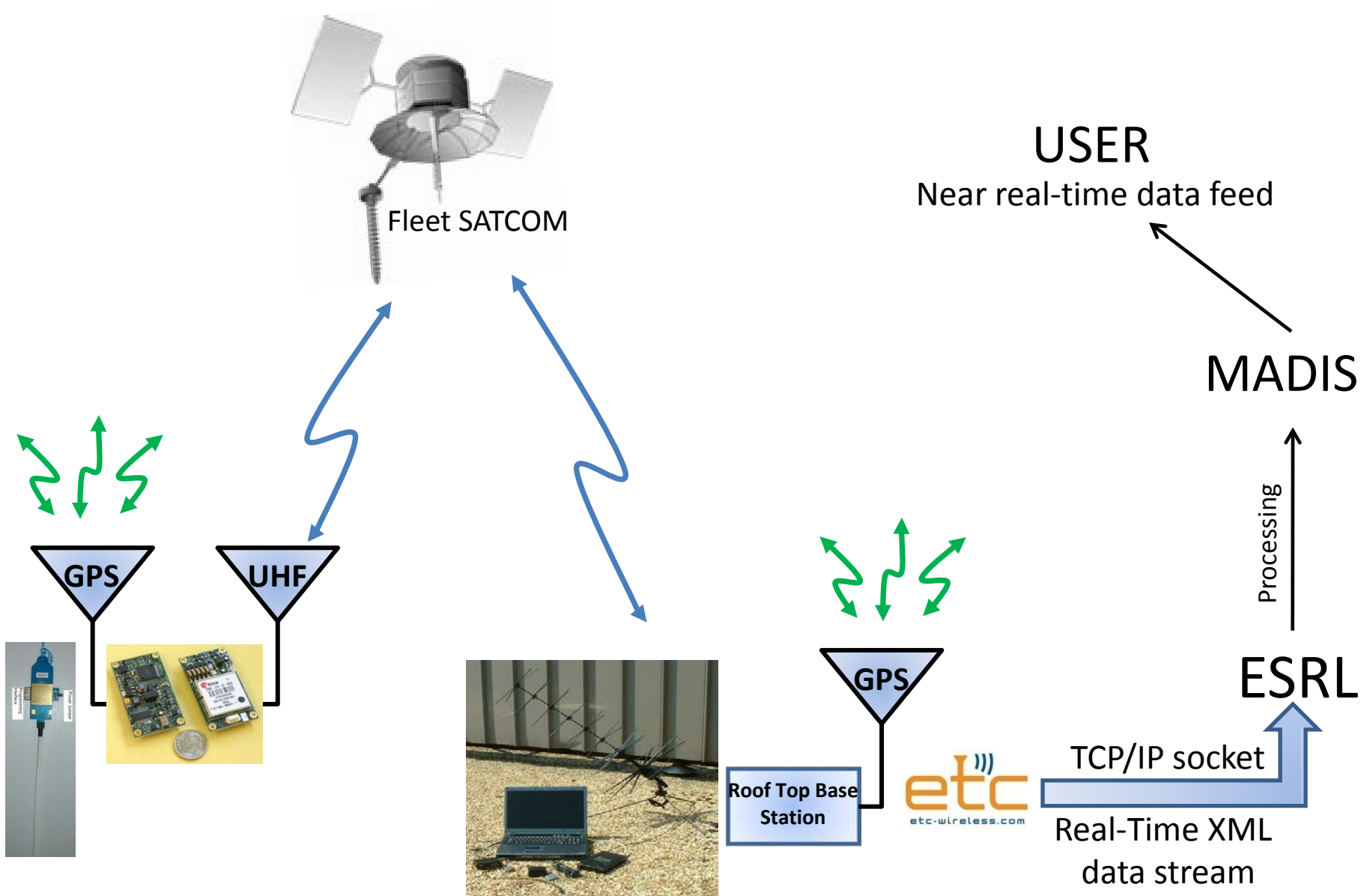
Hurricane Puloma storm track with WISDOM float tracks overlaid



WISDOM Components

- Super-pressure tetraoan
- Inflation components to inflate tetraoan to float at a specific altitudes of 12K and 26K ft.
- Mini 100 gram GPS/SATCOM radio payload
- Base station
- Data processing by NOAA's Environmental Systems Research Laboratory (ESRL)
- Data distribution by the Meteorological Assimilation Data Ingest System (MADIS)

WISDOM Operational Architecture



WISDOM Field Operations



WISDOM Launch Video



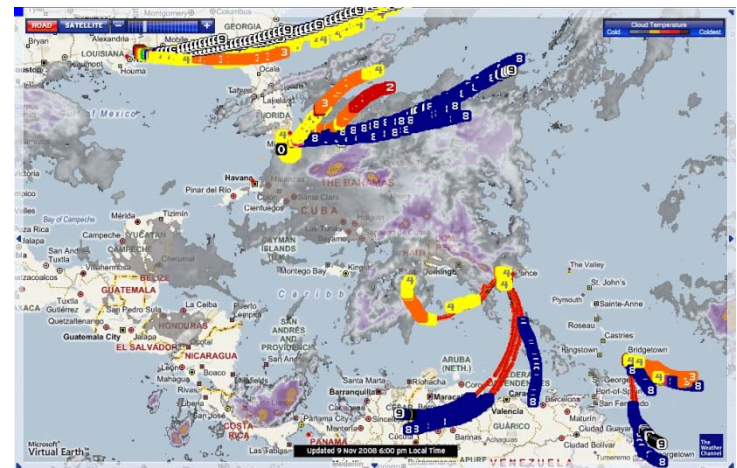
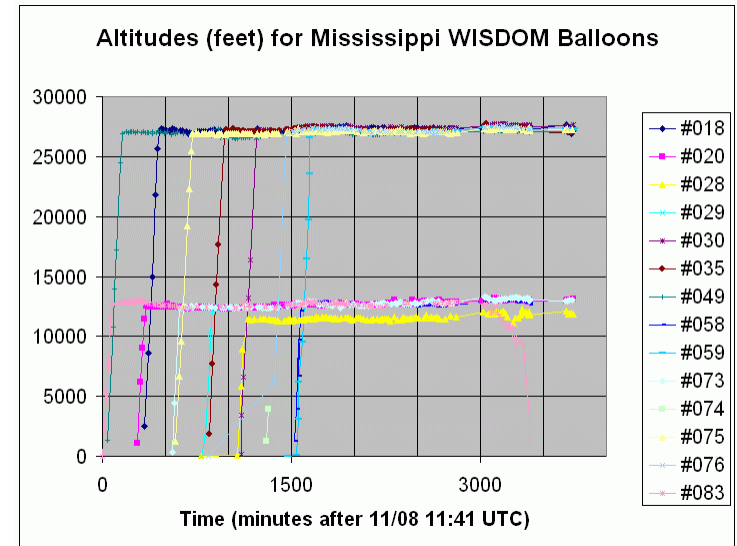
Wait for Animation...

VERTEX 3-D Video of WISDOM Balloon Tracks

- VERTEX video clip



Wait for Animation...



WISDOM 2009

- Quantify the forecast improvement generated by inclusion of WISDOM data (launching about 200-250 balloons per two storms)
- Determine optimum number of balloons to launch and their potential impact by performing OSSE runs and develop better launch location algorithms (Deployment Optimization Method).
- Update the MADIS data server and the WISDOM webpage
- Expand the number of launch locations and training to Yucatan Peninsula and Cape Verdes Islands
- Develop a visualization model

Making It Work

- NOAA (Office of Oceanic and Atmospheric Research)
- DHS
- DoD
- NASA
- Engenium Technologies Corporation (ETC)
- Near Space Corporation
- Raytheon
- CIMH (Caribbean Institute for Meteorology and Hydrology)
- Northern Gulf Institute, Mississippi State University

NOAA Director: Dr. Alexander (Sandy) MacDonald

NOAA Program Manager: Ms. Justyna Nicinska

Questions?