



Weather In-Situ Deployment Optimization Method

WISDOM

2008 Test



## **WISDOM System Description and Initial Test Results**

**AMS Annual Meeting, January 12, 2009  
Phoenix, AZ**

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**NOAA Oceanic and Atmospheric  
Research (OAR)**



**WISDOM** (**W**eather **I**n- **S**itu **D**eployment **O**ptimization **M**ethod): Deploying horizontal balloon sondes in an optimum manner around weather disturbances.

Objective: Improve hurricane track prediction in the 3 to 6 day period prior to landfall.

Students launching a WISDOM balloon/payload during the October 6, 2008 training session in Miami.





## ETC's GPS RF Tag:

- Deployed with the Tetron balloons to collect location, wind data (.3 watts)
- Data transmitted real time via ETC's ground station to NOAA/ESRL.





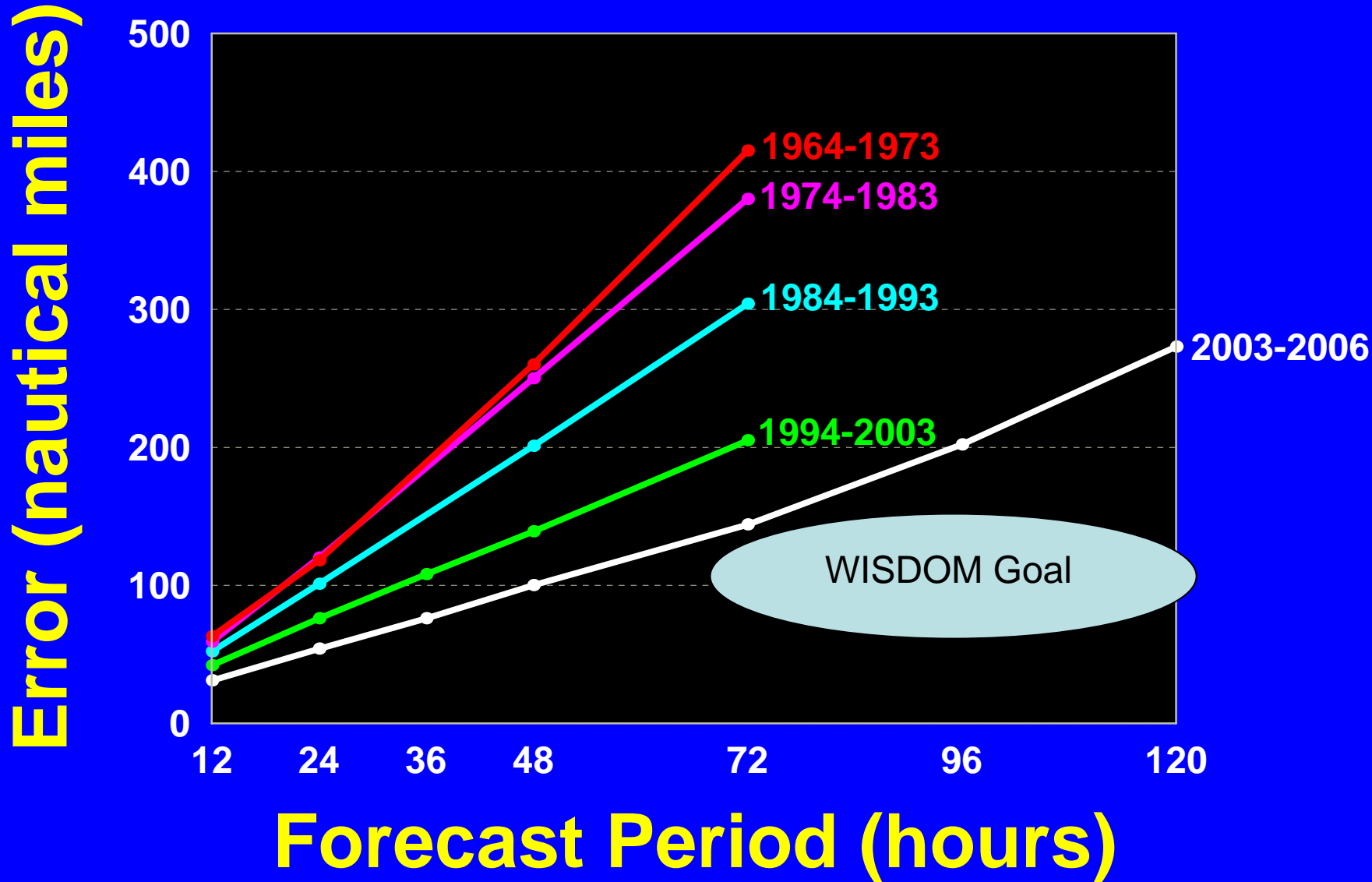
## **WISDOM Partners:**

- NOAA (Office of Oceanic and Atmospheric Research)
- DHS S&T: 3/26/08 \$1 Million support for 08 Test
- DoD
- NASA
- Engenium Technologies Corporation
- Near Space Corporation
- Raytheon
- University of Miami
- Mississippi State University.
- Caribbean Institute for Meteorology and Hydrography



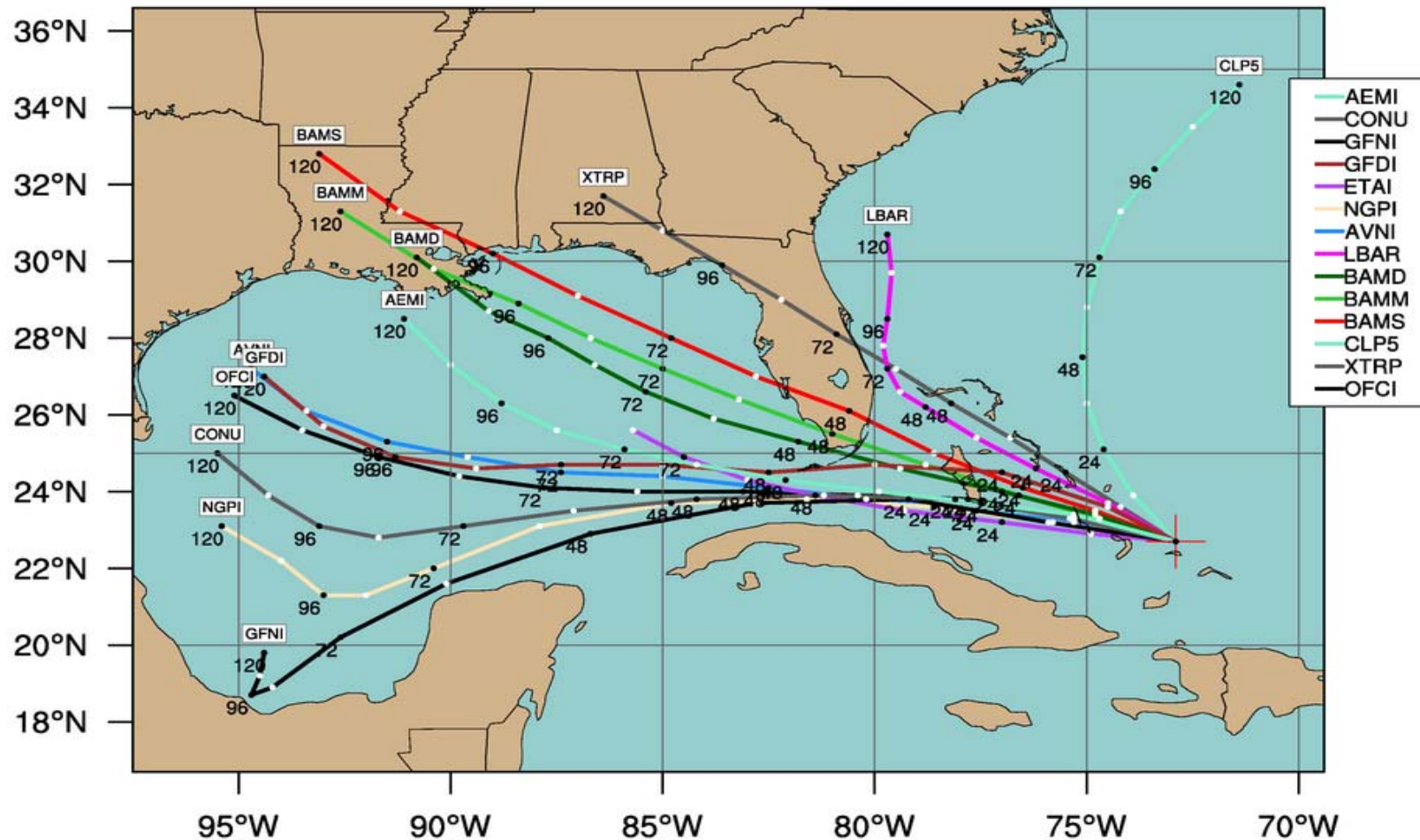
- The problem: Data poor region in the far Atlantic.
- Hurricane Tracks: Slow but steady improvement.
- **WISDOM**: Discretionary flood of data using balloons.
- Example: Hurricane Rita.
- NOAA Schedule: Develop 2008 – 2014.
- Deploy in 2009 into high-impact hurricane with several hundred balloons.

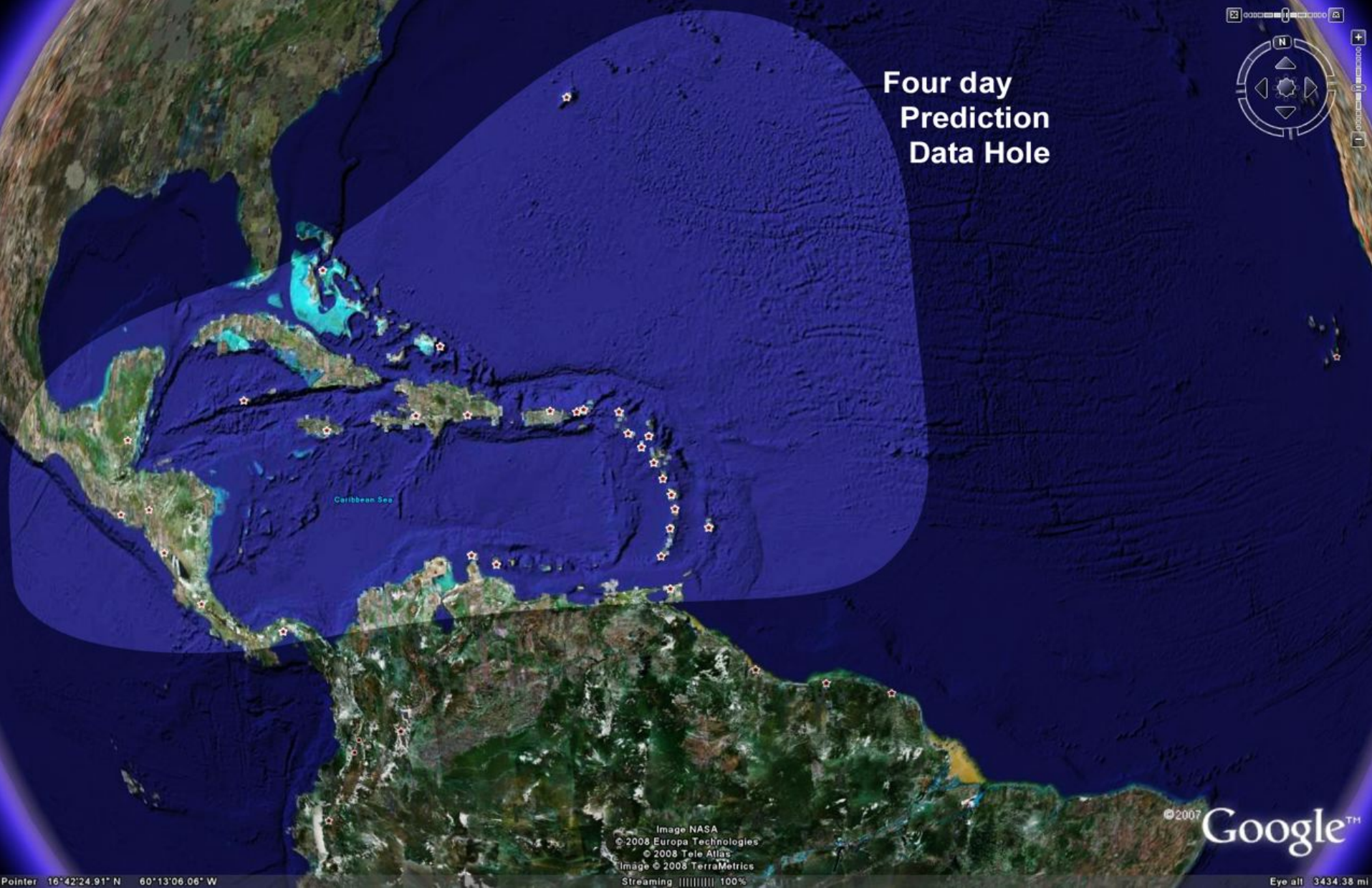
# NATIONAL HURRICANE CENTER ATLANTIC TRACK FORECAST ERRORS



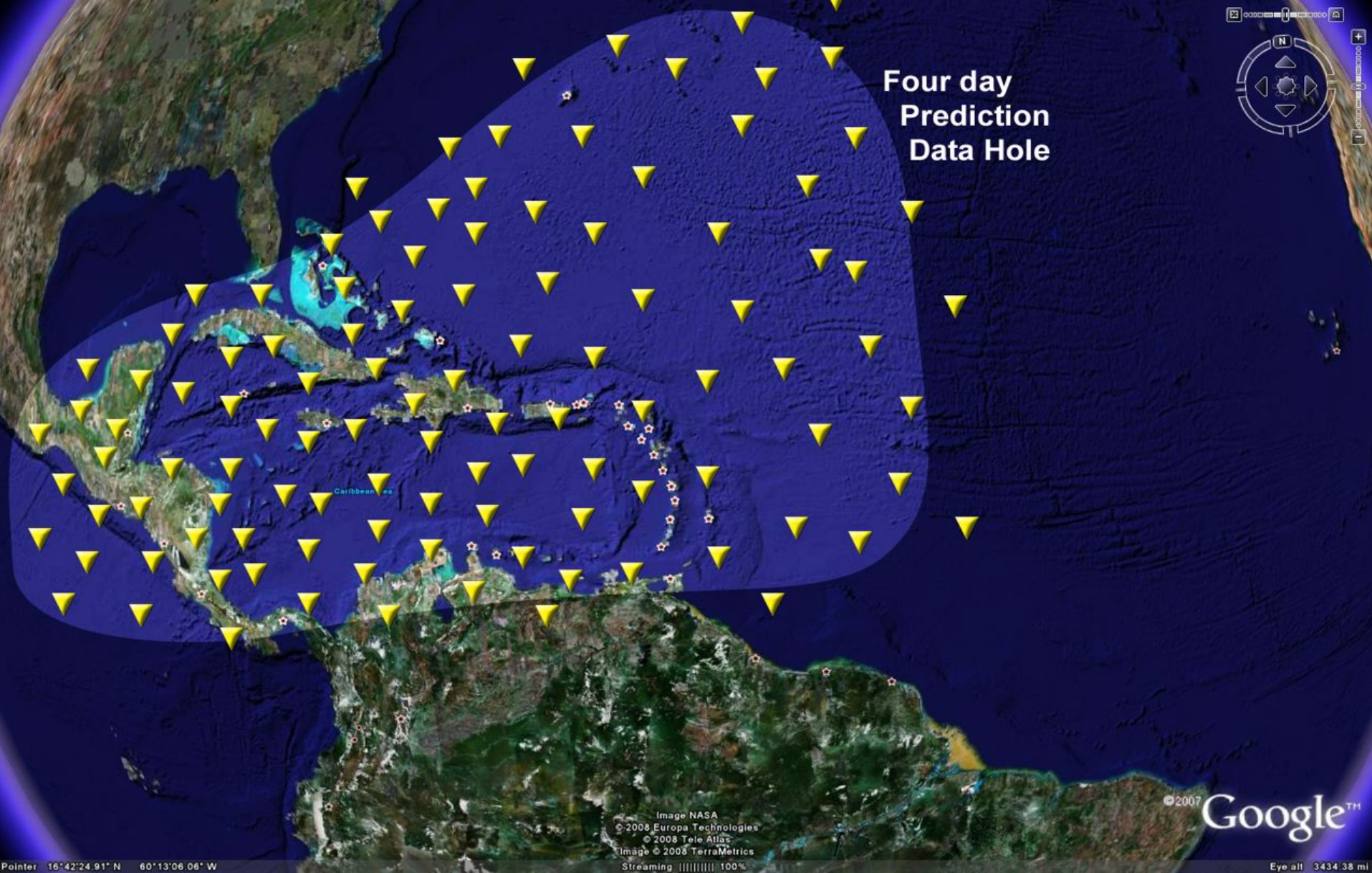
# AL18

Early-cycle track guidance valid 0000 UTC, 19 September 2005





The hurricane prediction can be improved by getting enough observations in the data void.



Four day  
Prediction  
Data Hole

©2007 Google™

Image NASA  
© 2008 Europa Technologies  
© 2008 Tele Atlas  
Image © 2008 TerraMetrics  
Streaming ||||| 100%

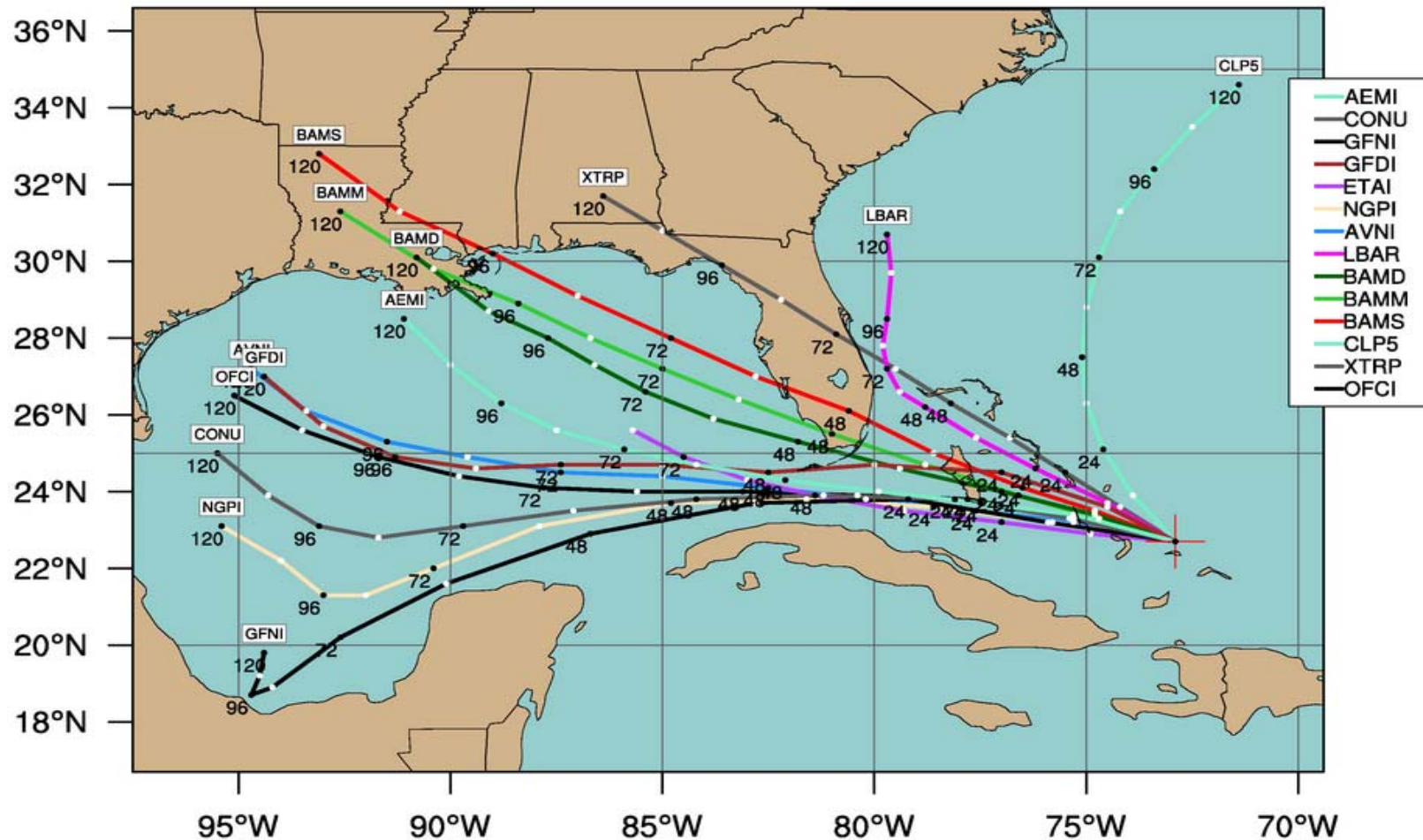
Pointer 16°42'24.91" N 60°13'06.06" W

Eye alt 3434.38 mi

Flood the data poor region with enough balloons to improve forecast by one day.

# AL18

Early-cycle track guidance valid 0000 UTC, 19 September 2005



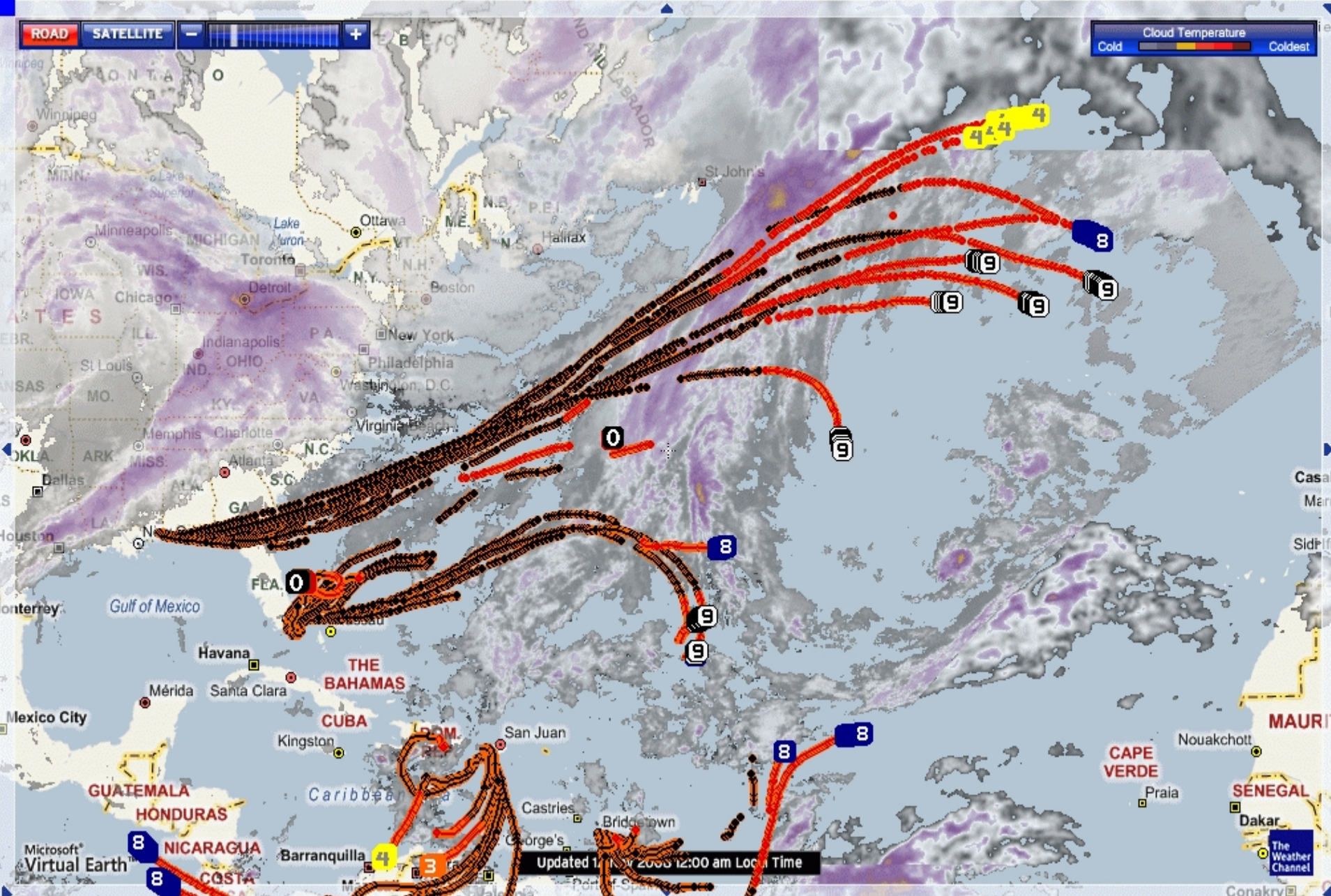


## Tests conducted 2008:

- 10 Prototypes launched from Hawaii in August
- First Field Test w/ 19 balloons in October
- Hurricane Paloma Launch - 57 balloons in November
- Successful data transmission to ESRL via DoD Satellite

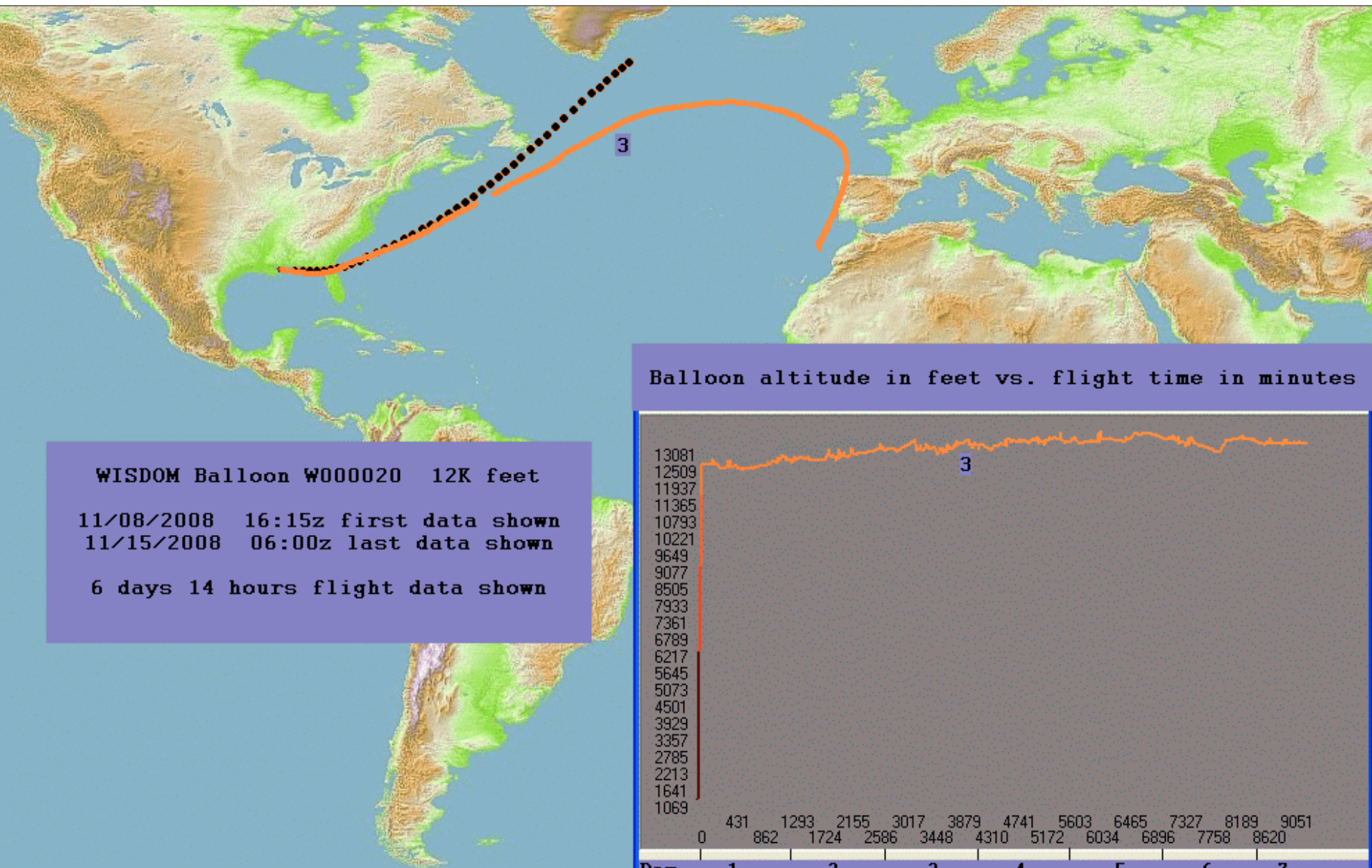




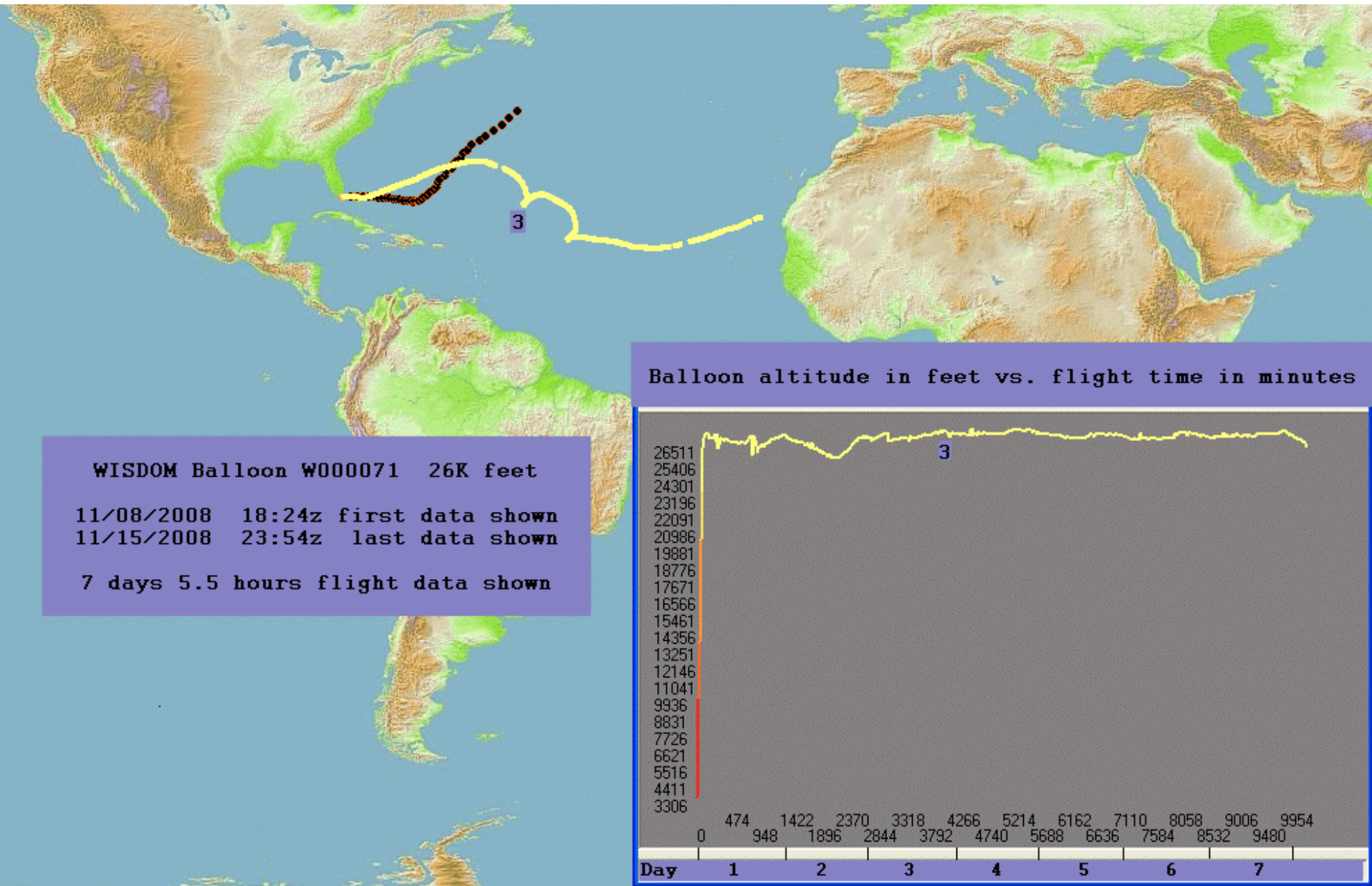


WISDOM balloon trajectories deployed around Hurricane Paloma, as located on Nov 12. <sup>14</sup>

# WISDOM Hurricane Paloma Launch November 7-9, 2008



# WISDOM Hurricane Paloma Launch November 7-9, 2008



WISDOM Balloon W000071 26K feet

11/08/2008 18:24z first data shown

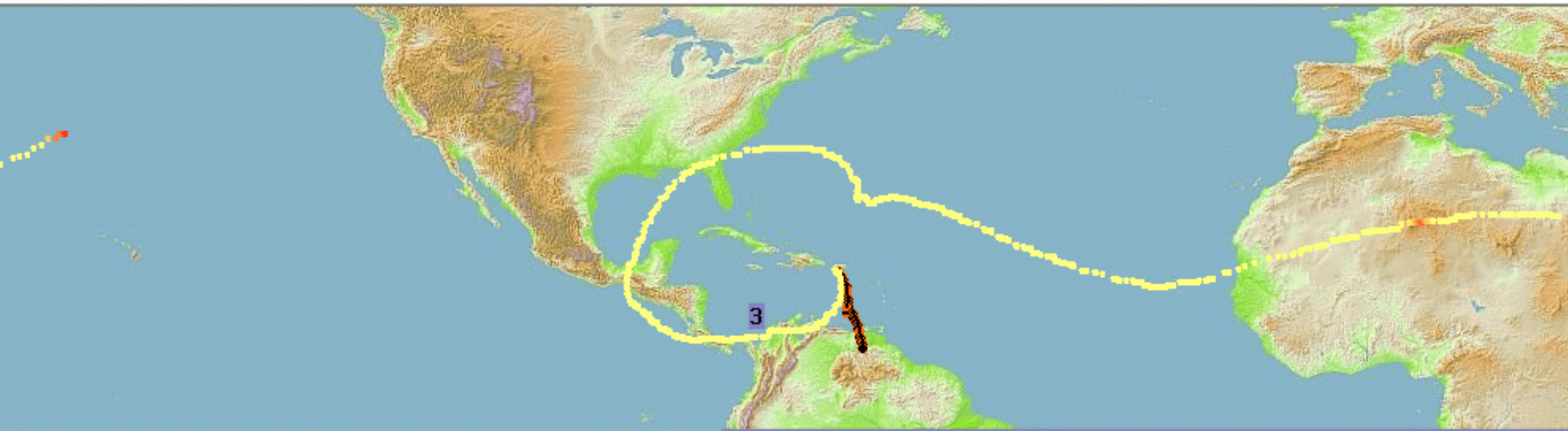
11/15/2008 23:54z last data shown

7 days 5.5 hours flight data shown

Balloon altitude in feet vs. flight time in minutes



# WISDOM Hurricane Paloma Launch November 7-9, 2008

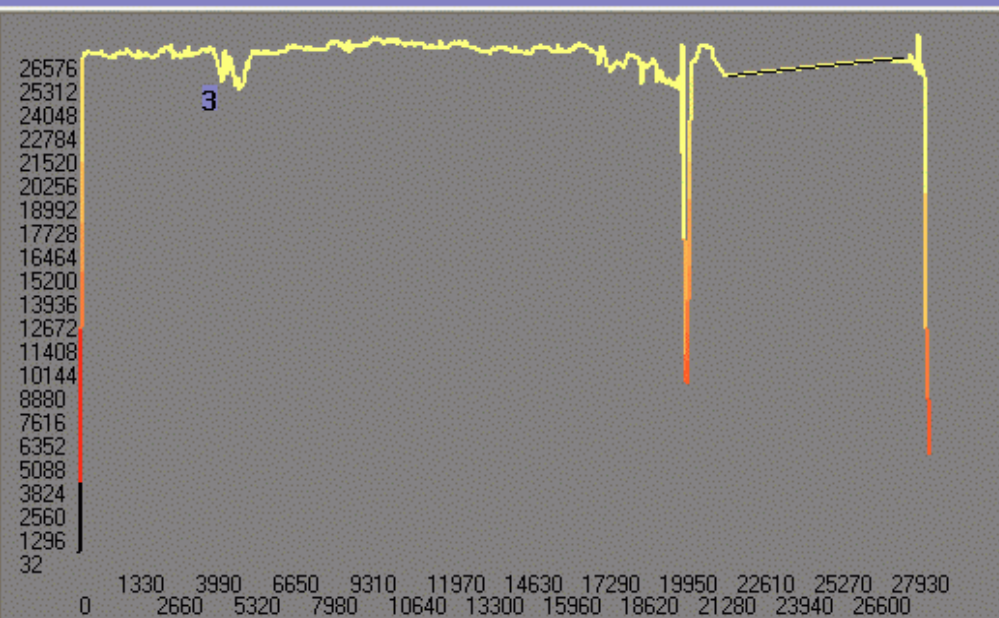


WISDOM Balloon W000054 26K feet

3 day track Predict 11/07 12z GFS  
11/07/2008 14:50z first data  
11/27/2008 21:21z last data

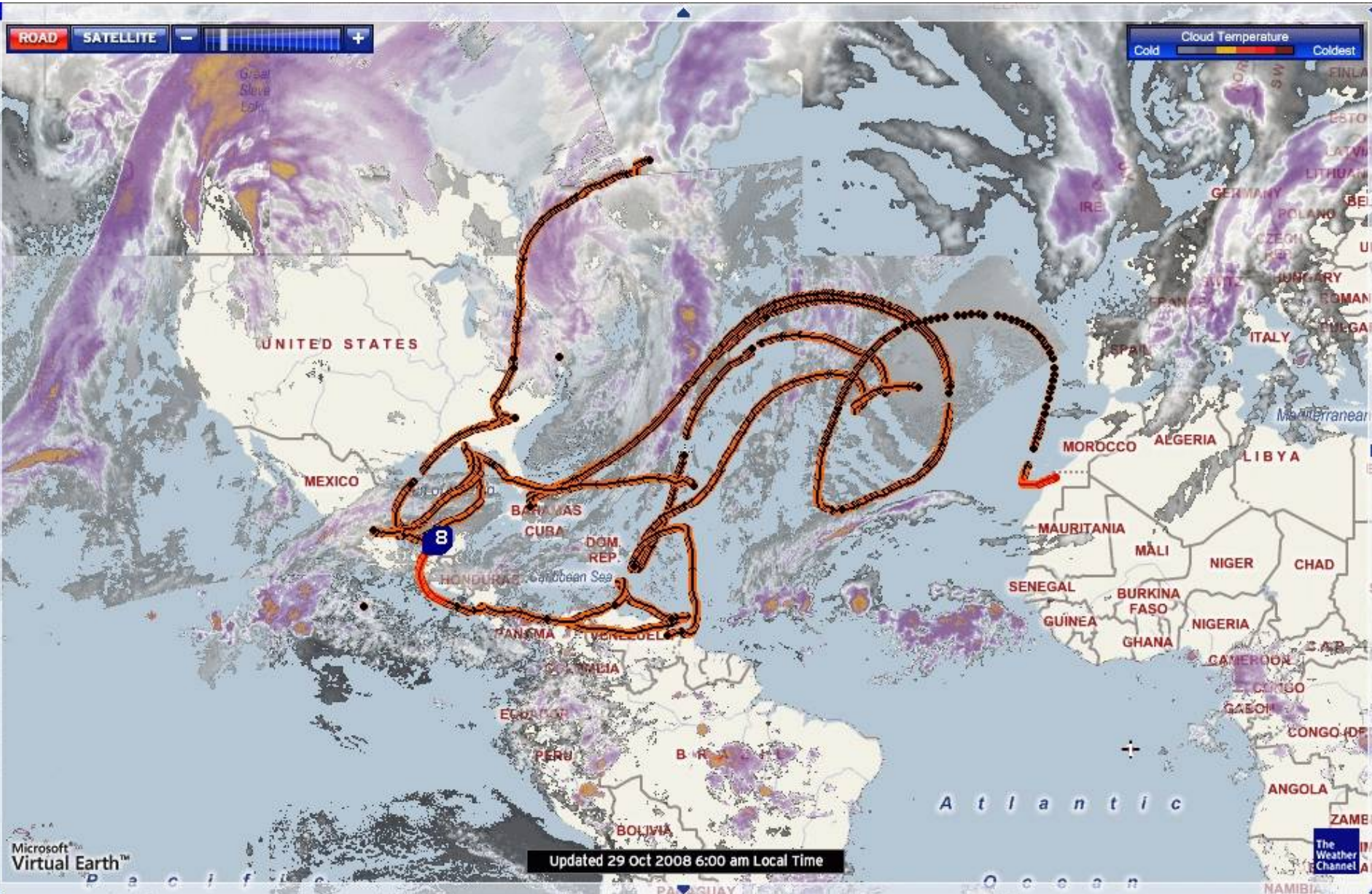
20 days 7 hours flight time  
Crossed International Date Line

Balloon altitude in feet vs. flight time in minutes



# WISDOM First Test Deployment Trajectories as of 10/29/08

Balloons were launched on 10/18/08



http://wisdom.noaa.gov

NOAA Weather In-Situ Deployment Optimization Method - Windows Internet Explorer

http://wisdom.noaa.gov/index2.html

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**Operation s status**

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### WISDOM: Deploying horizontal balloon sondes in an optimum manner around weather disturbances

The WISDOM project seeks to improve the 3 to 7 day predictions of Atlantic hurricane track and intensity by deploying specialized balloons into important data sparse regions of the atmosphere. An interagency effort is underway, sponsored by DHS and NOAA, to test the concept during the 2008 hurricane season.

- The general system consists of a given set of ground-based release points in a large area around a weather disturbance.
- Each release point can release any number of balloons that will follow some trajectory through the atmosphere and communicate pertinent measurements to some collection point.
- Advanced modeling techniques will be used to identify the best regions for data collection and the optimal balloon launch sites.
- "Super-pressure" balloons will rise rapidly to a specified altitude and float along the previously estimated trajectory into the targeted region.
- Each balloon will carry a mini (100 gram) GPS unit, atmospheric measuring devices, and transmitters to send location and weather data at regular intervals to satellite or surface receivers.

The long term goal is to saturate the data void for every major storm with several hundred balloons to measurably improve the 3 to 7 day hurricane forecast. Observations from these data void areas will significantly improve the 24 hour forecast, saving lives and property, conserve energy, and potentially save millions of dollars.

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National Oceanic and Atmospheric Administration (NOAA) | U.S. Department of Commerce | NOAA Research  
Published by ESRL/Global Systems Division

Main WISDOM site provides updated project operation status and access to resources.



## WISDOM 2008 Conclusions

- WISDOM balloons work well, and could deliver large amounts of data in critical storm-steering areas.
- The balloons will require cut-down switch to terminate flights at our discretion.
- Balloon costs can be reduced from several thousand \$ per balloon (includes one time engineering costs) to several hundred \$.
- If the program can find funds in 2009, we would:
  - (1) Simulate balloon releases to determine how many balloons would deliver significant (12 to 24 hour) hurricane track improvements 3 to 6 days before landfall.
  - (2) Do a proof of concept experiment in major hurricanes to see what improvements would be actually realized (assimilated into GFS and FIM).