

# Controlled Meteorological (CMET) balloons

## Opportunities for MILAGRO 2006

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**Smith College and the University of Massachusetts**

**October 24, 2005**





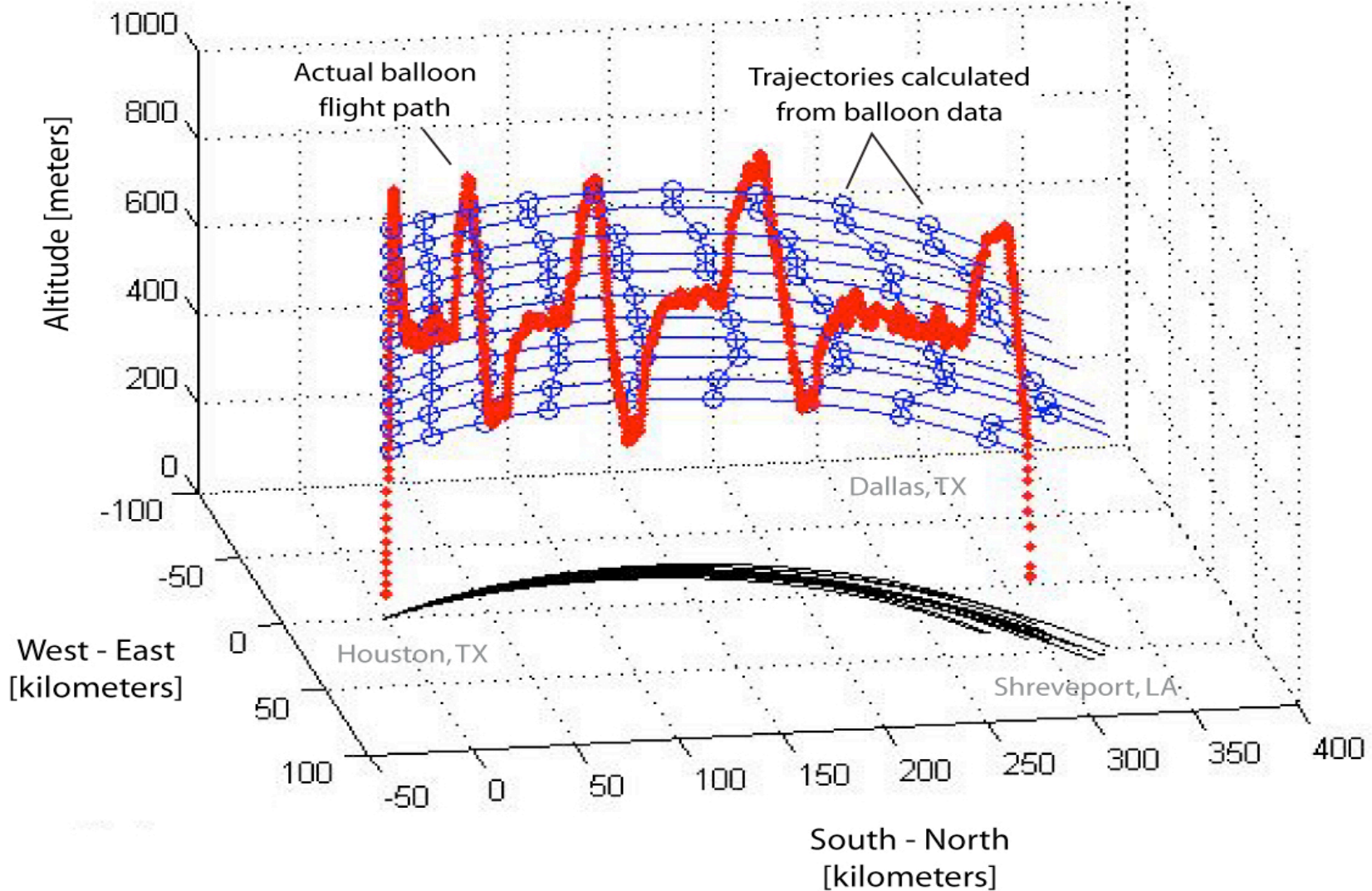


## **CMET Balloon Specifications:**

<b>Payload mass:</b>	<b>400 grams</b>
<b>Flight duration:</b>	<b>multiple days</b>
<b>Altitude range:</b>	<b>0-5 km</b>
<b>Communications:</b>	<b>Iridium satellite</b>
<b>Measurements:</b>	<b>GPS Winds, P, T, RH (aspirated)</b>
<b>Capabilities:</b>	<b>Soundings, Trajectories, Safety</b>



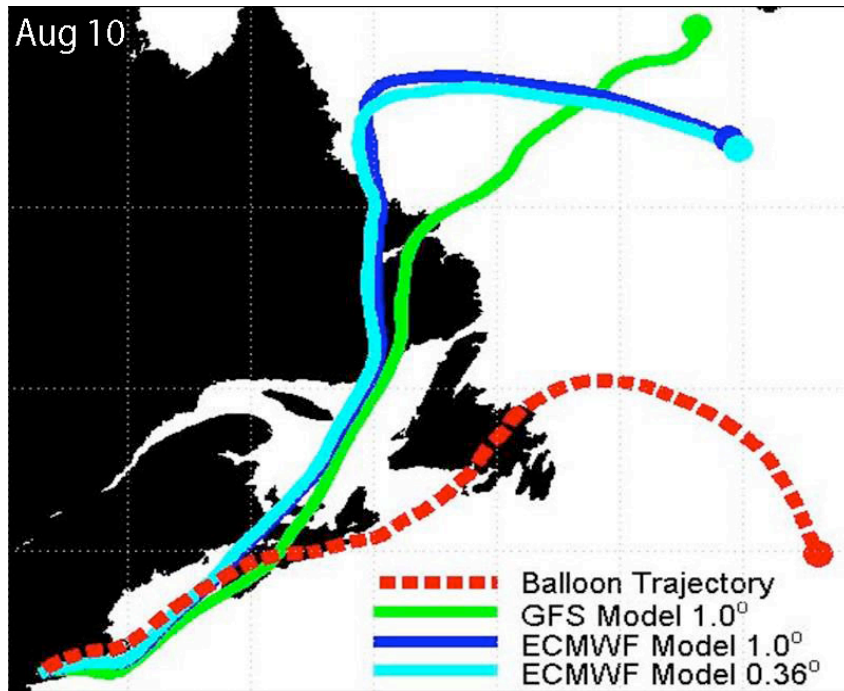
# Observed Shear and Stability during Transport *Houston 2005*



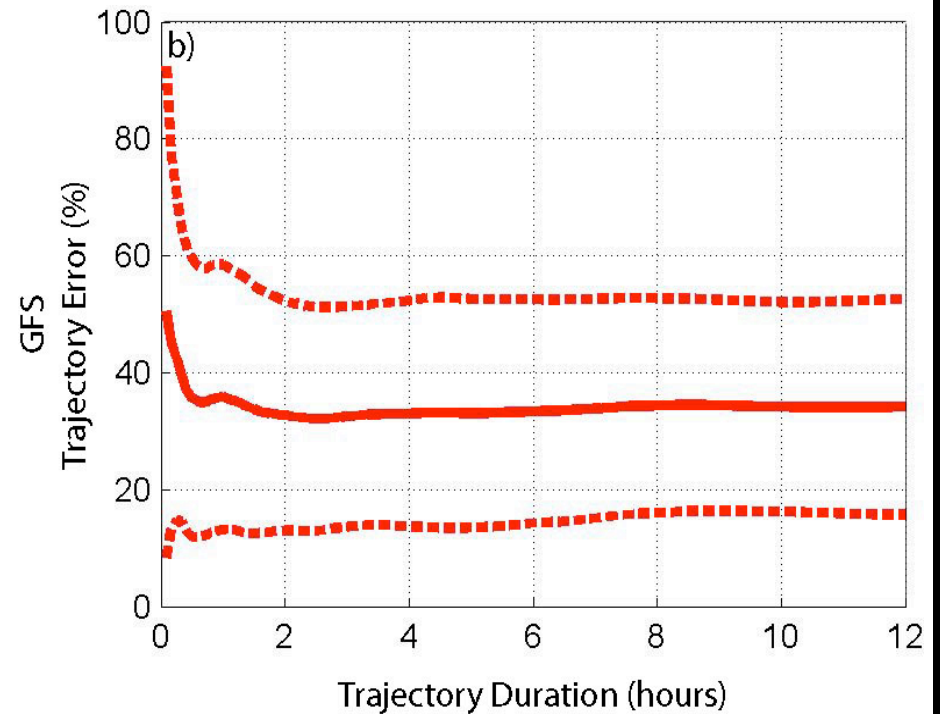


# Wind Field and Trajectory Model Validation

## ICARTT 2004



**Single Flight Error**  
August 10-15, 2004

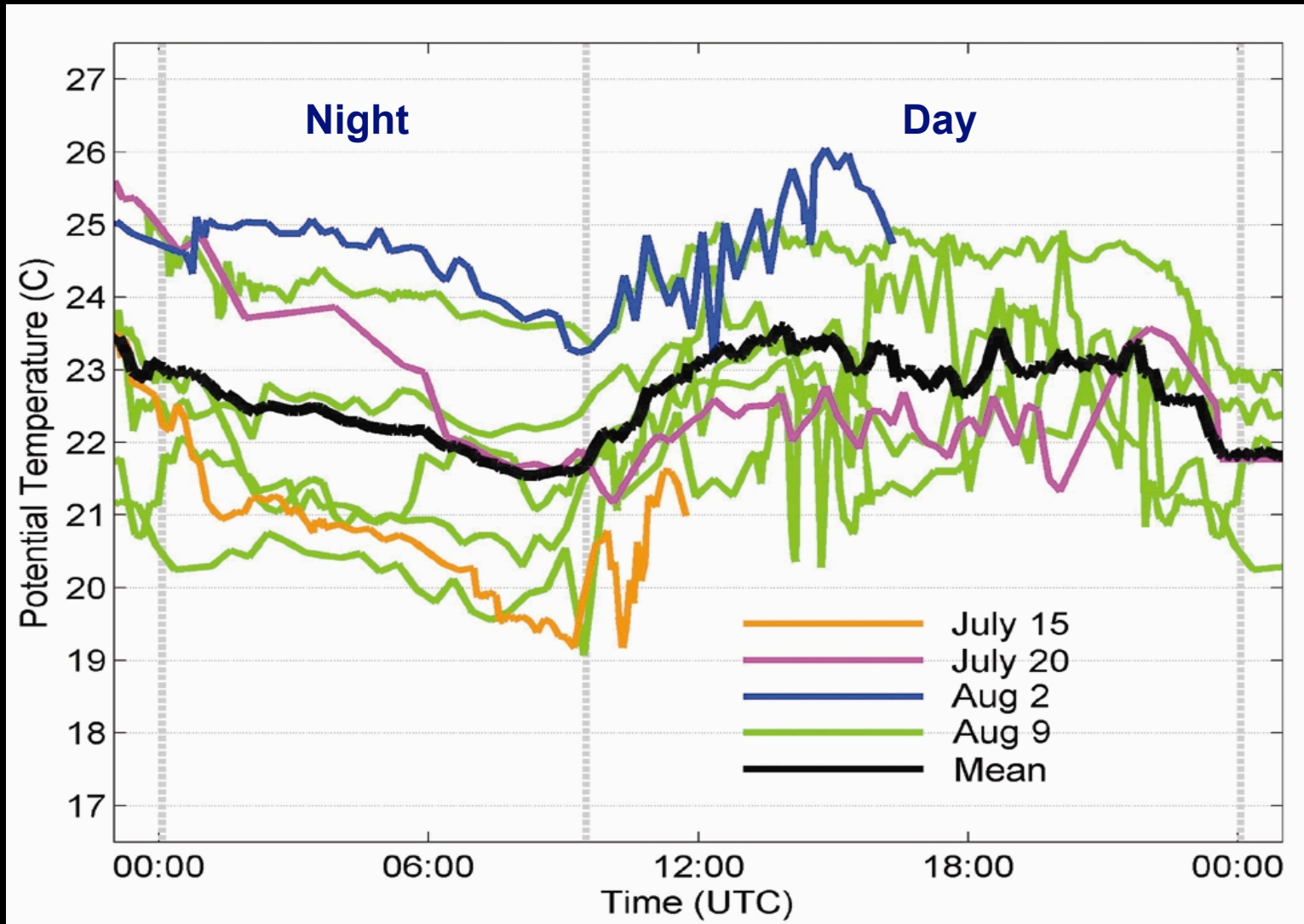


**Statistical Error**  
N=14 12-hour trajectories



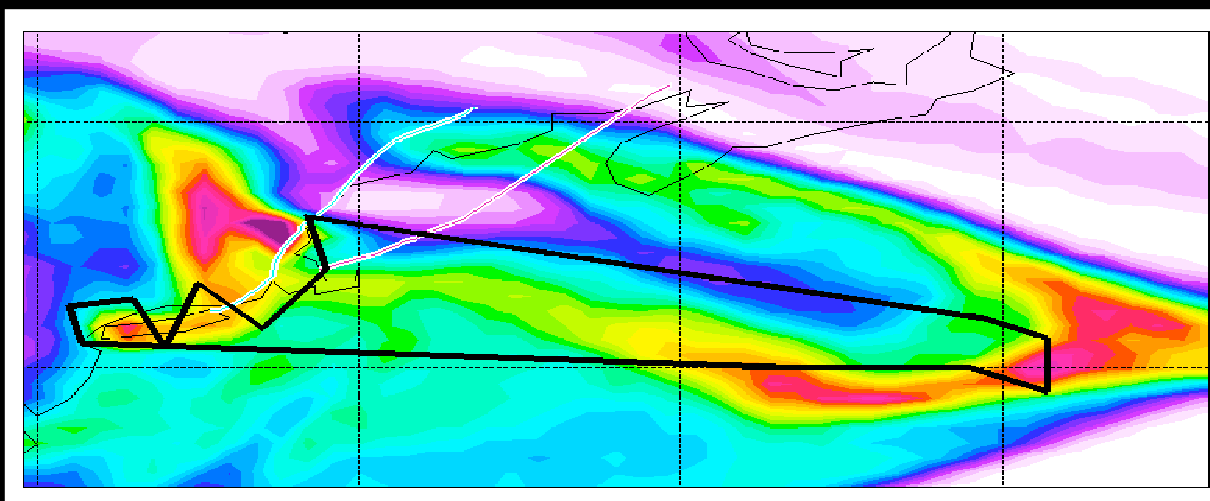
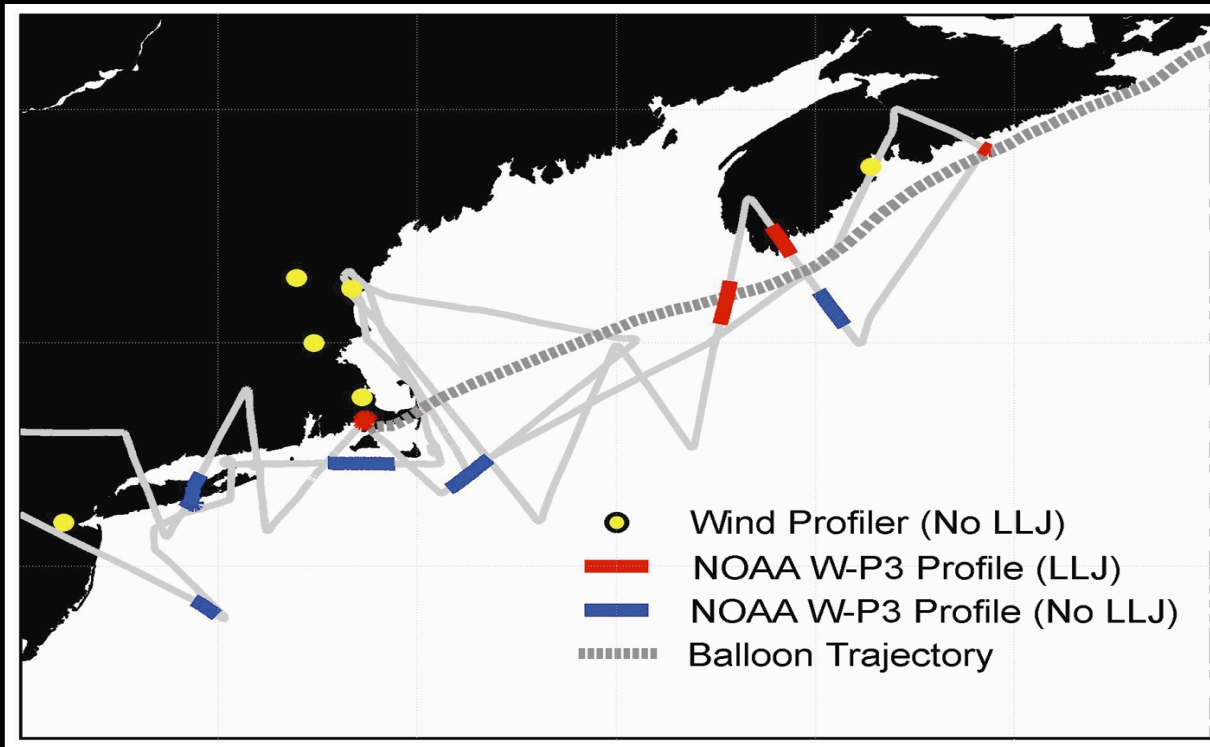
# Observed Radiative Heating and Cooling Rates

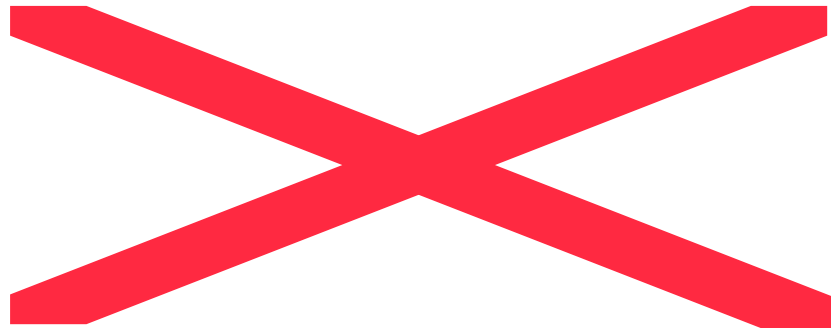
*220 balloon flight hours during ICARTT 2004*





# Coordinated Aircraft Experiments





***Objective: Quantify the evolution of ozone, water vapor, temperature, atmospheric stability, and wind velocity within targeted MC pollution outflow events.***



# Flight Planning & Coordination Tools

Rahul Zaveri, John Hubbe, Robert Hannigan  
Pacific Northwest National Laboratory

**Lagrangian Flight Planner**

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Rahul A. Zaveri, John M. Hubbe, Robert V. Hannigan, and Carl M. Berkowitz  
**Pacific Northwest National Laboratory**

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# Pre-Flight and Real-Time Flight Planning Tool

**Mouse Pointer**

Lat: 32.9662    32    58.0    from the last point clicked on map

Lon: -94.4064    -94    24.4

Heading    Dist (nm)    ETE (min)

286.0    5621.75    1873.9

**Mouse Click**

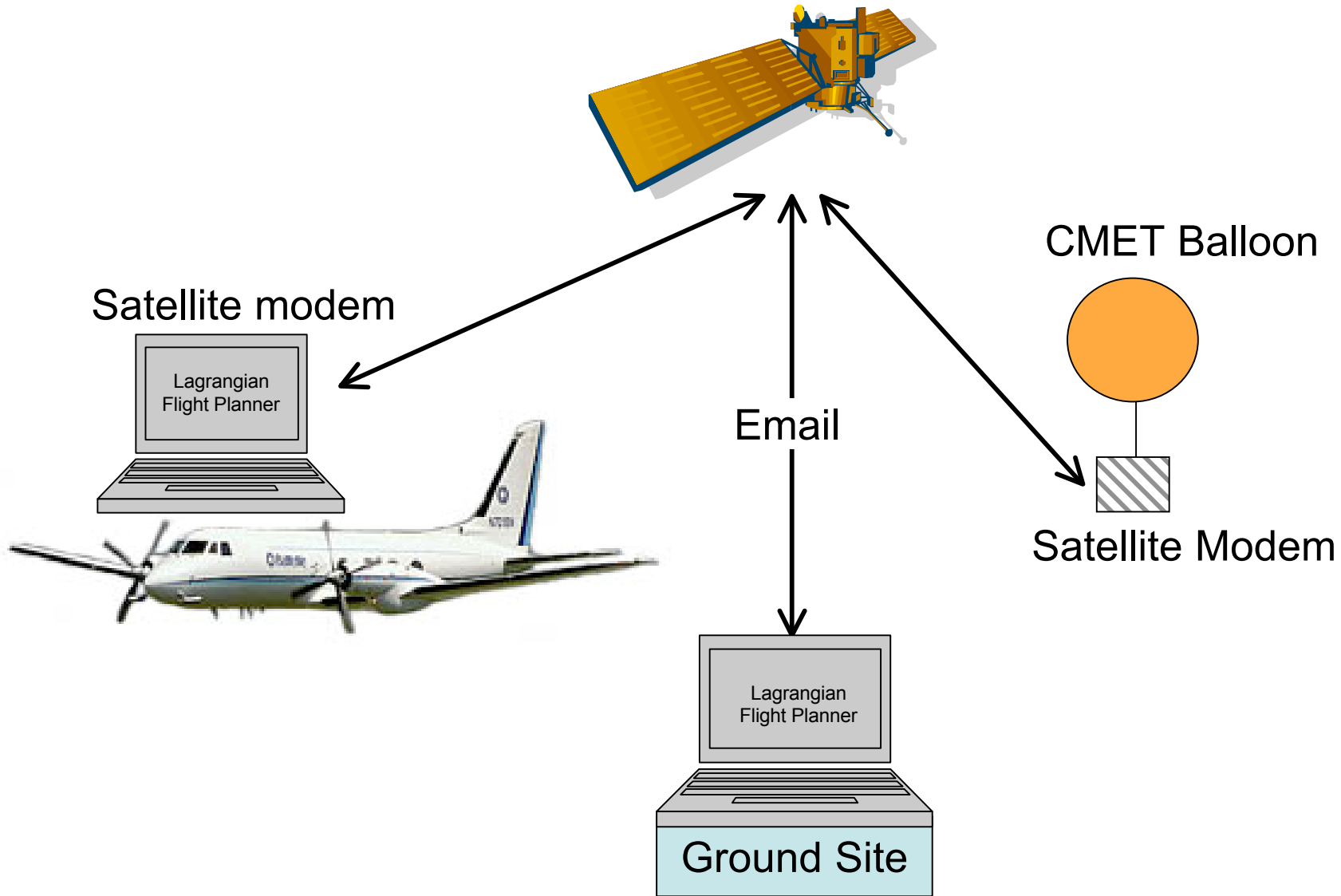
Way Point	Lat:	Heading	Dist (nm)	ETE (min)	Cumulative Dist (nm)	Cumulative ETE (min)	Add Time (min)
<input checked="" type="checkbox"/> Plot Way Pt							
<input type="checkbox"/> Plot and Log		.99	0	0	0	0	2

- Draft flight-plans based on wind forecasts for FAA.
- Plots both the balloon and aircraft positions in real time and allows the flight scientist to update the flight plan at any time.
- Can also be used with forecast trajectories
- Provides navigational info useful for communication with the pilots and the FAA air traffic controllers.
- Enhances safety



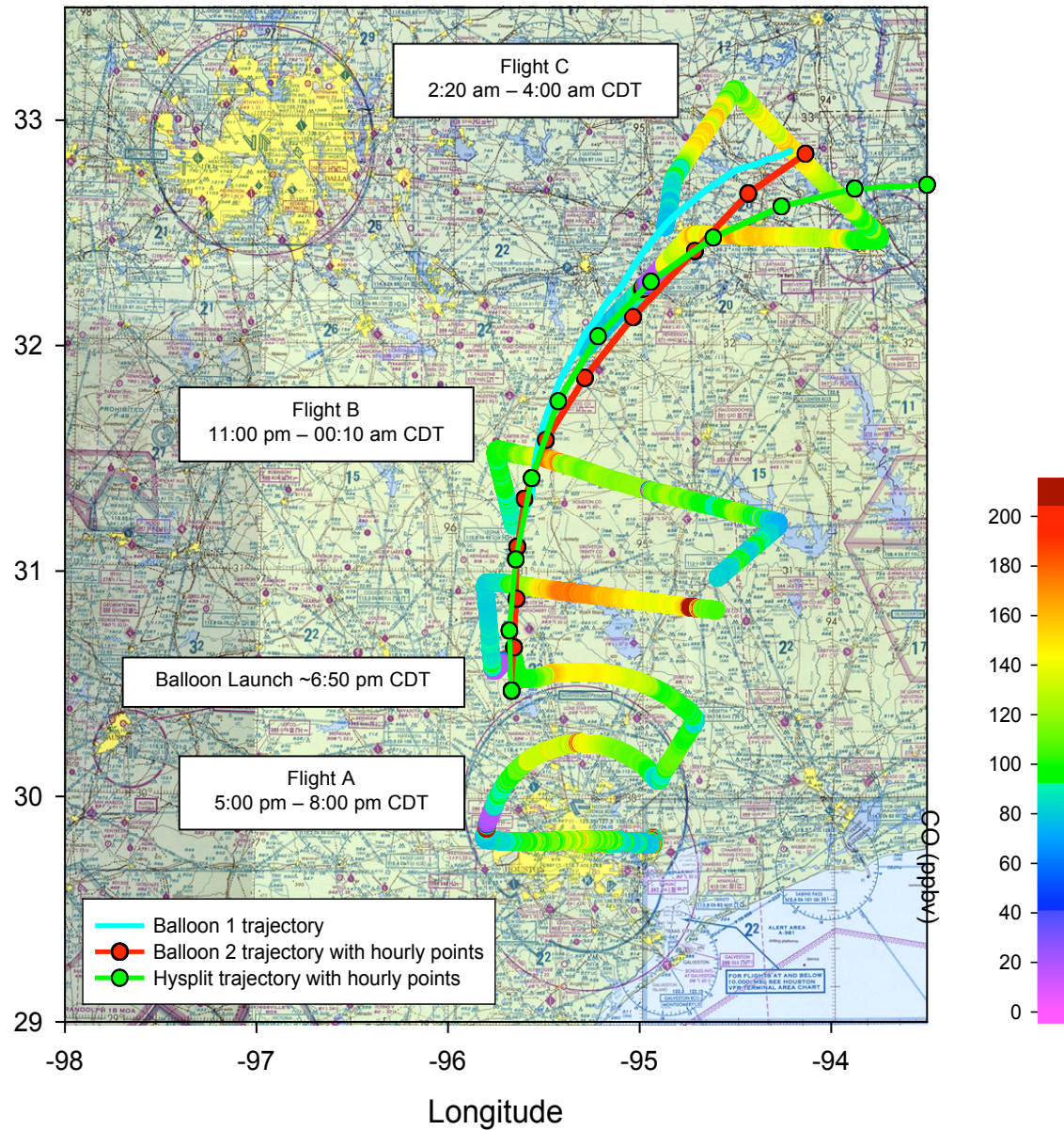
# Data Communication & Chat Protocol

Iridium Satellite Network



# Southeast Texas Transport Study

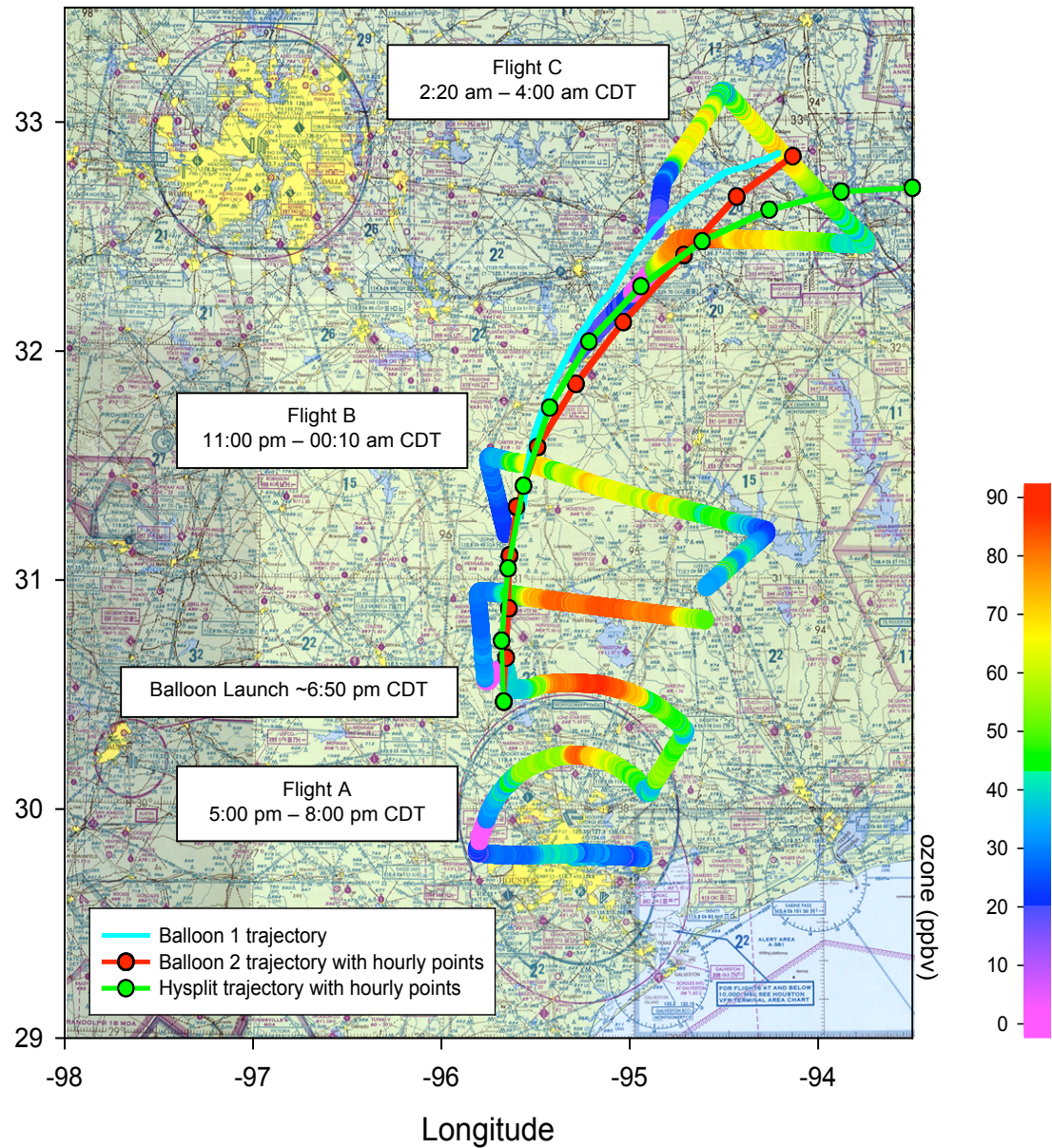
CO: July 26-27, 2005

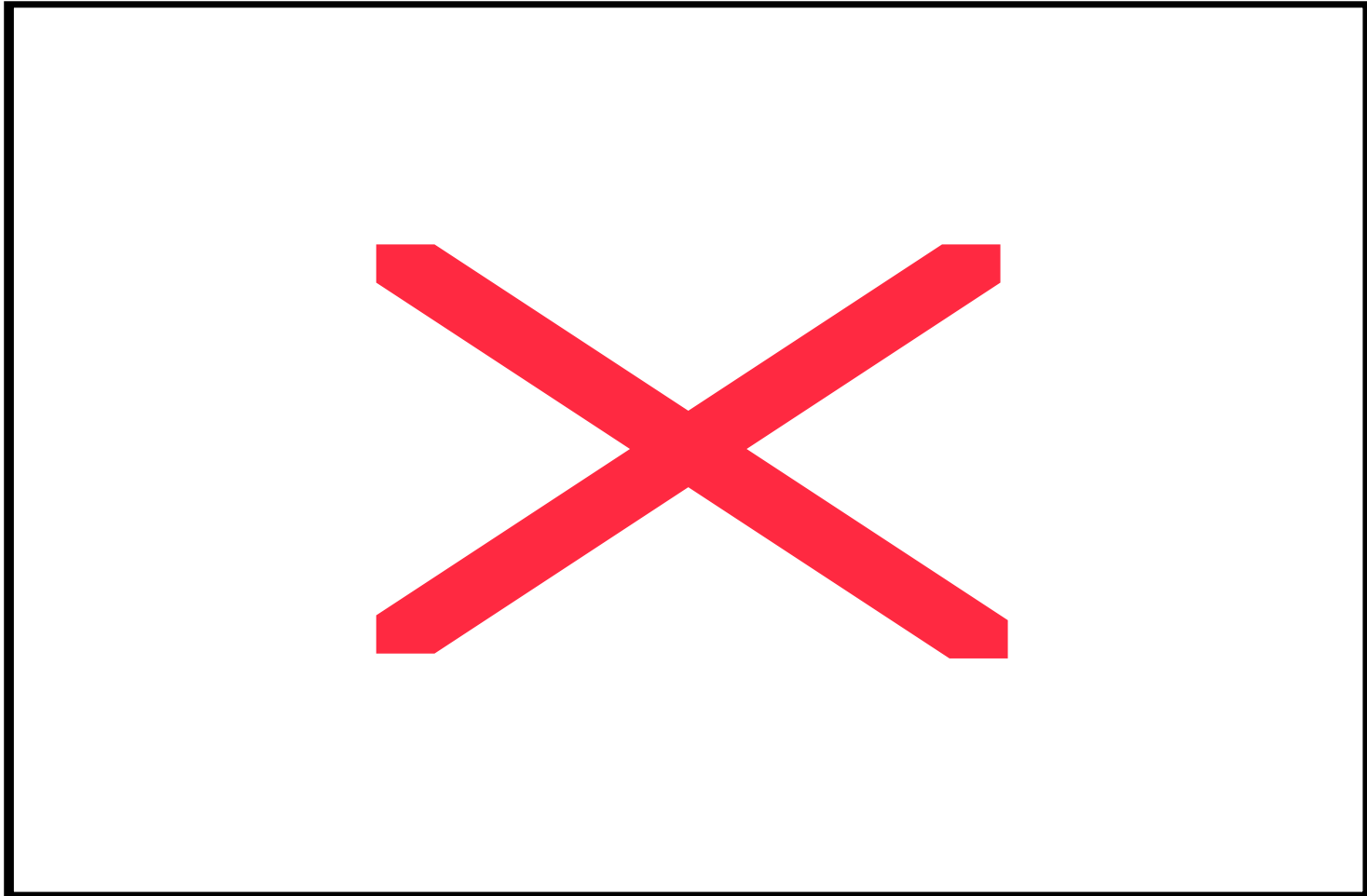




# Southeast Texas Transport Study

Ozone: July 26-27, 2005





**Objective: Support coordinated aircraft studies of long-range transport and chemical processing within the MC pollution outflow.**