Hurricane and Severe Storm Sentinel (HS3)

A Multi-Year Investigation of Atlantic Hurricanes

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HS3 Team

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Outline

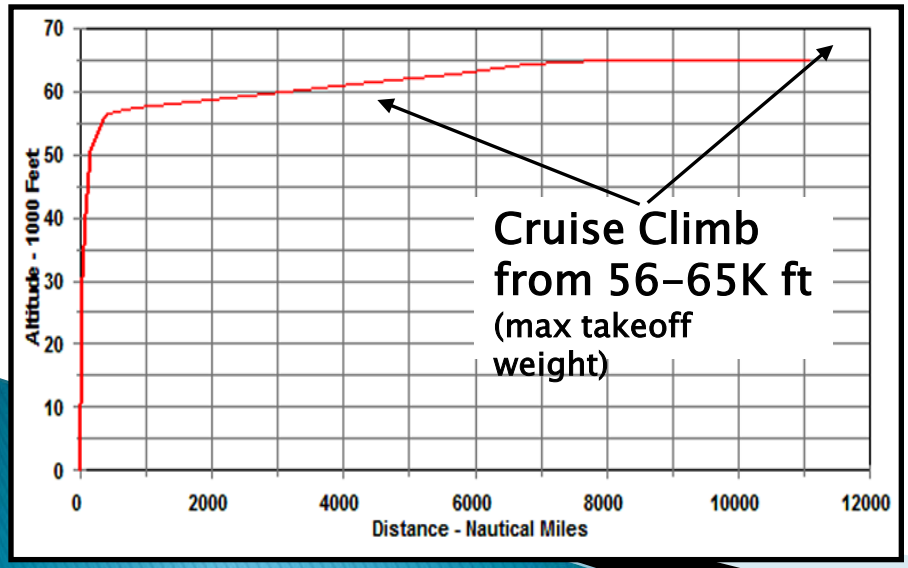
- Mission Overview
  - Science
  - Deployment information
  - Instruments
  - Data policy
- Schedule
- GH — G-IV dropsonde comparisons

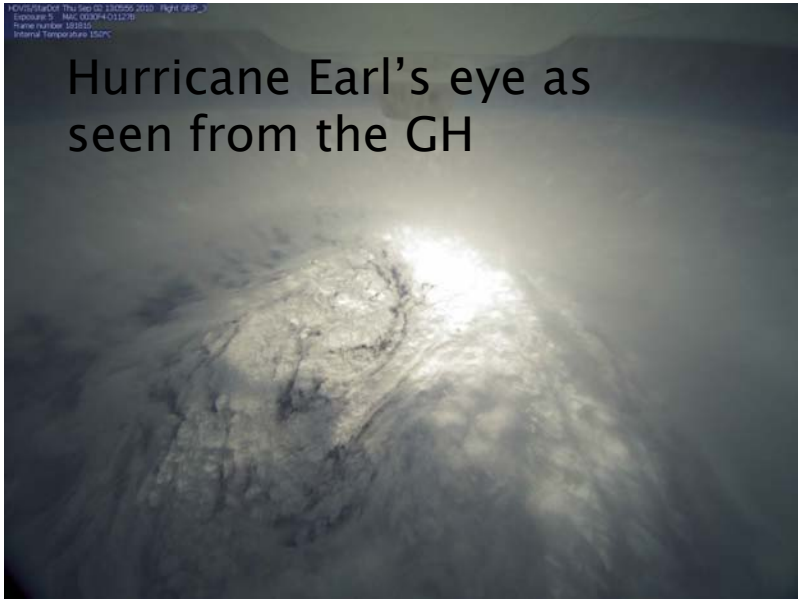
Overarching Science Questions

- What impact does the large-scale environment have on intensity change?
  - The role of the Saharan Air Layer (SAL), dust transport
  - Vertical shear, trough interactions, interactions with the outflow layer
- What is the role of storm internal processes in intensification?
  - Convective bursts and wind field changes
  - Warm-core formation and evolution
- To what extent are these processes predictable?
  - Can the HS3 remote sensing observations lead to forecast improvements?

NASA's Global Hawk Unmanned Airborne System

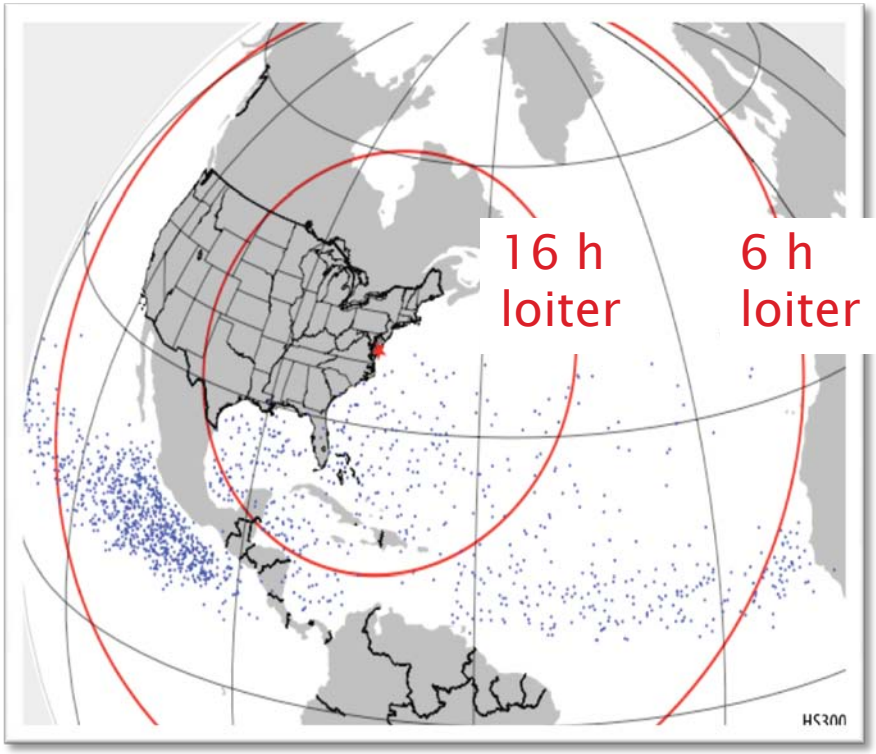
Endurance	> 30 hours
Range	>11,000 nmi
Service Ceiling	65,000 ft
Airspeed (55K+ ft)	335 KTAS
Payload	1,000-1,500 lb
Length	44 ft
Wingspan	116 ft





HS3 Mission Overview

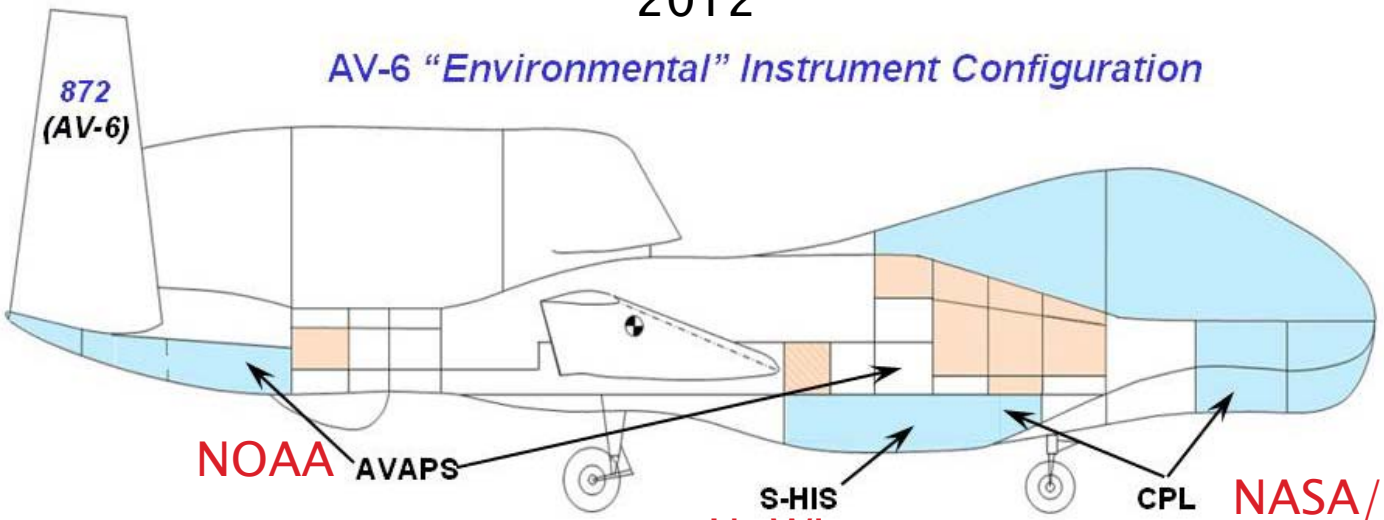
- Two aircraft, one equipped for the storm environment, one for over-storm flights
- Deployments of GHs from the East Coast— Wallops Flight Facility in VA
- One-month deployments in 2012, 2013, and 2014
- 275 flight hours per deployment (10-11 flights)
- ~48-h turn around time

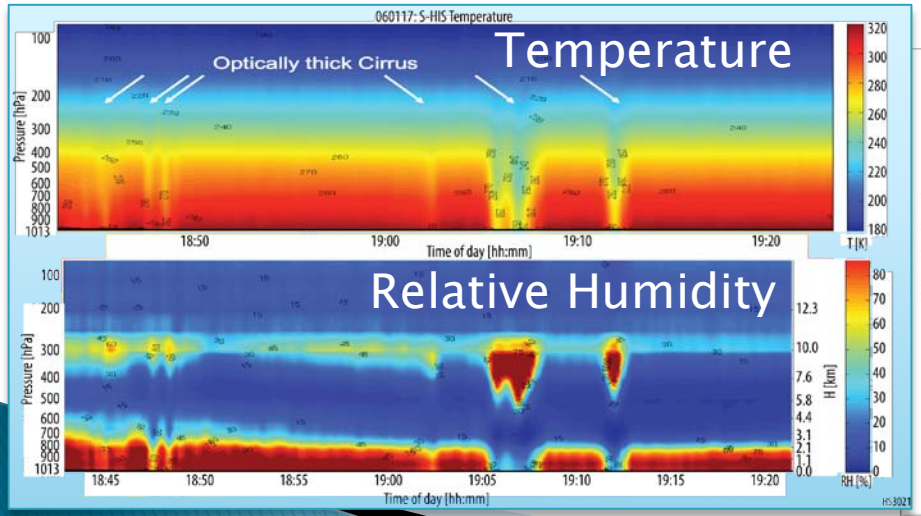


Dots indicate genesis locations. Range rings assume 26-h flights.

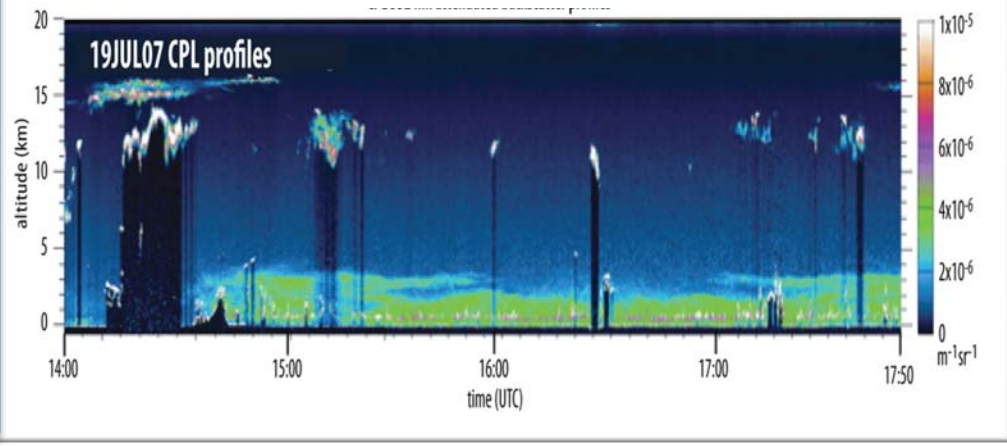
Environmental Payload

2012

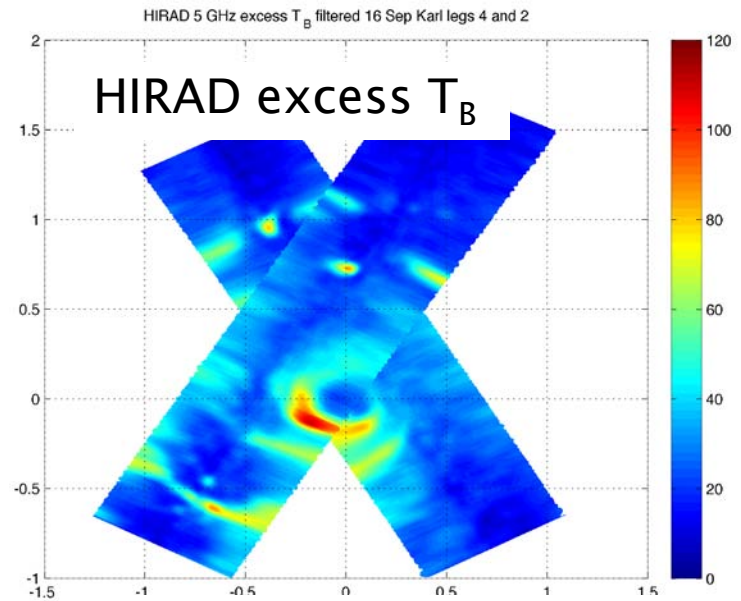


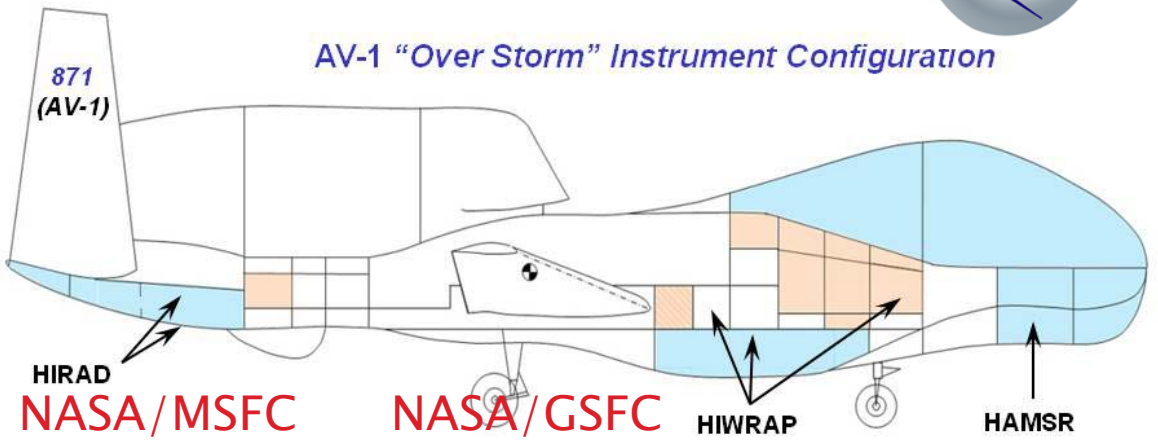


Aerosol Backscatter

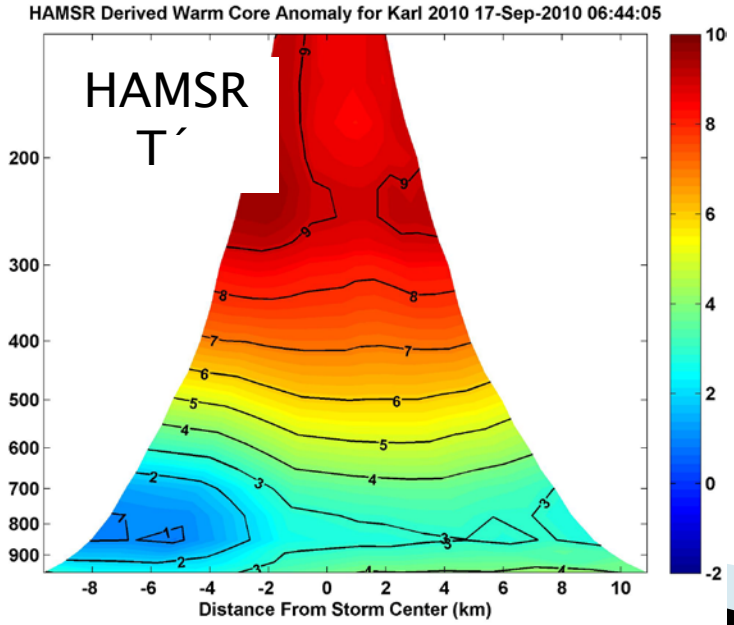


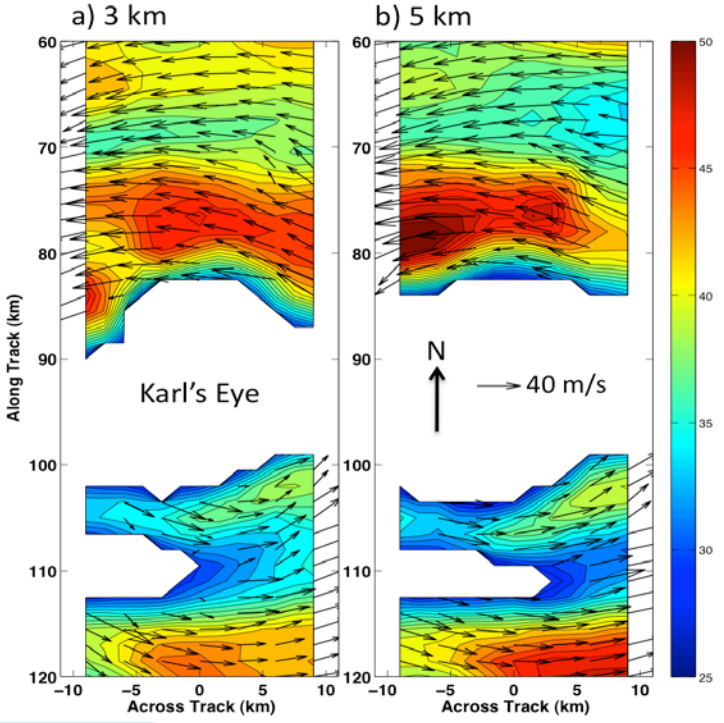
Over-Storm Payload





NASA/MSFC NASA/GSFC JPL

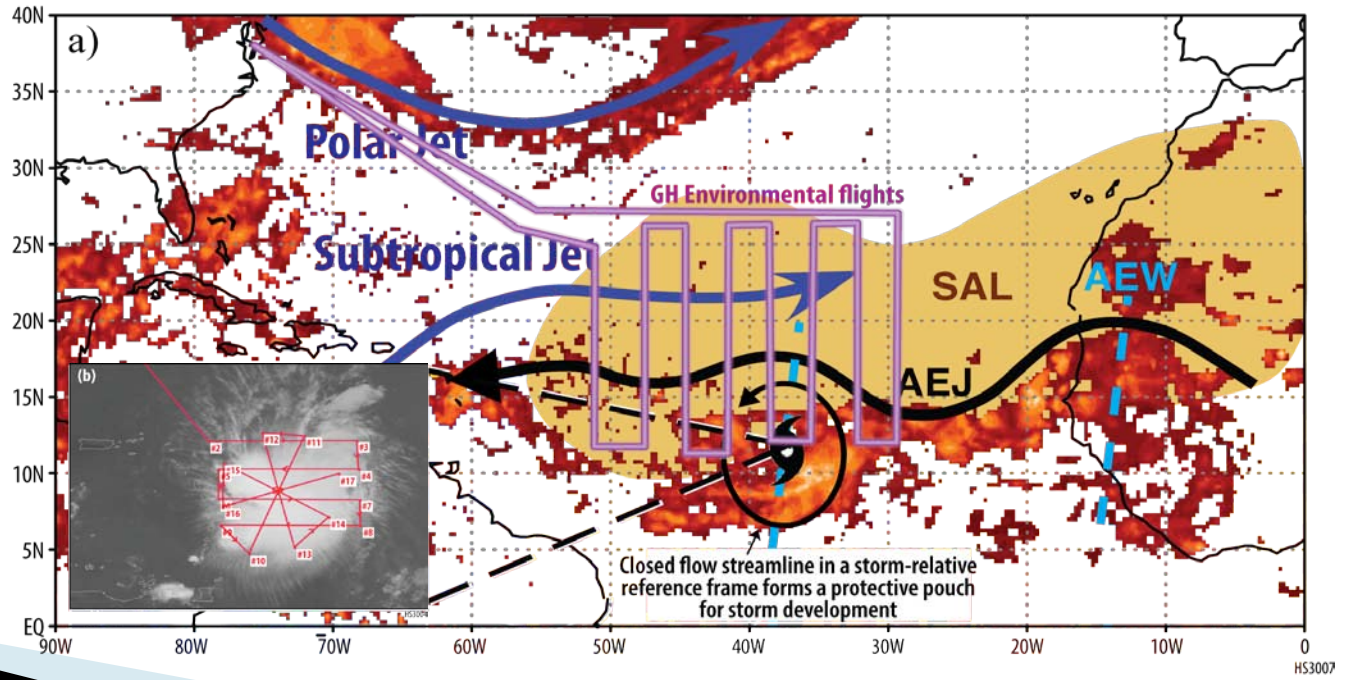




HIWRAP dBZ and vector winds

HS3 Science Collaborations

- Operations to be closely coordinated with other available aircraft (e.g., NOAA P-3s, G-IV) to maximize data coverage and continuity, similar to GRIP
- Will fly east of operational aircraft when necessary



Orange shading is 24-h precipitation

HS3 Data Plan

- All data to be publically available
  - Some data products to be made available in real time
  - Following each deployment, ~6-9 months for data QC, processing
  - Links to data, as well as all mission information, at

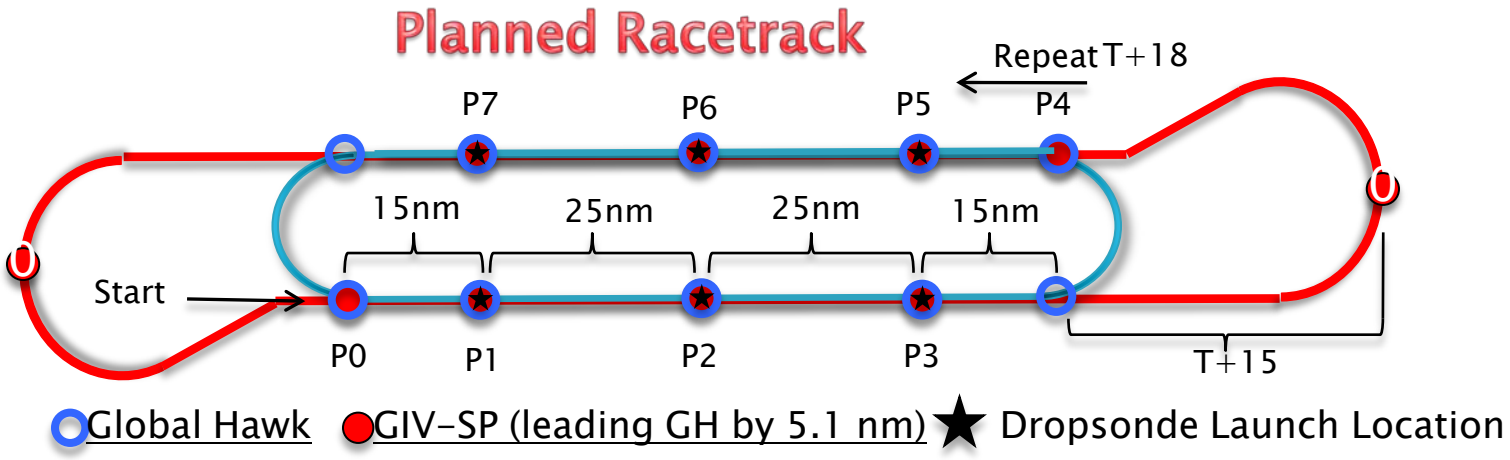
    www.espo.nasa.gov/hs3/

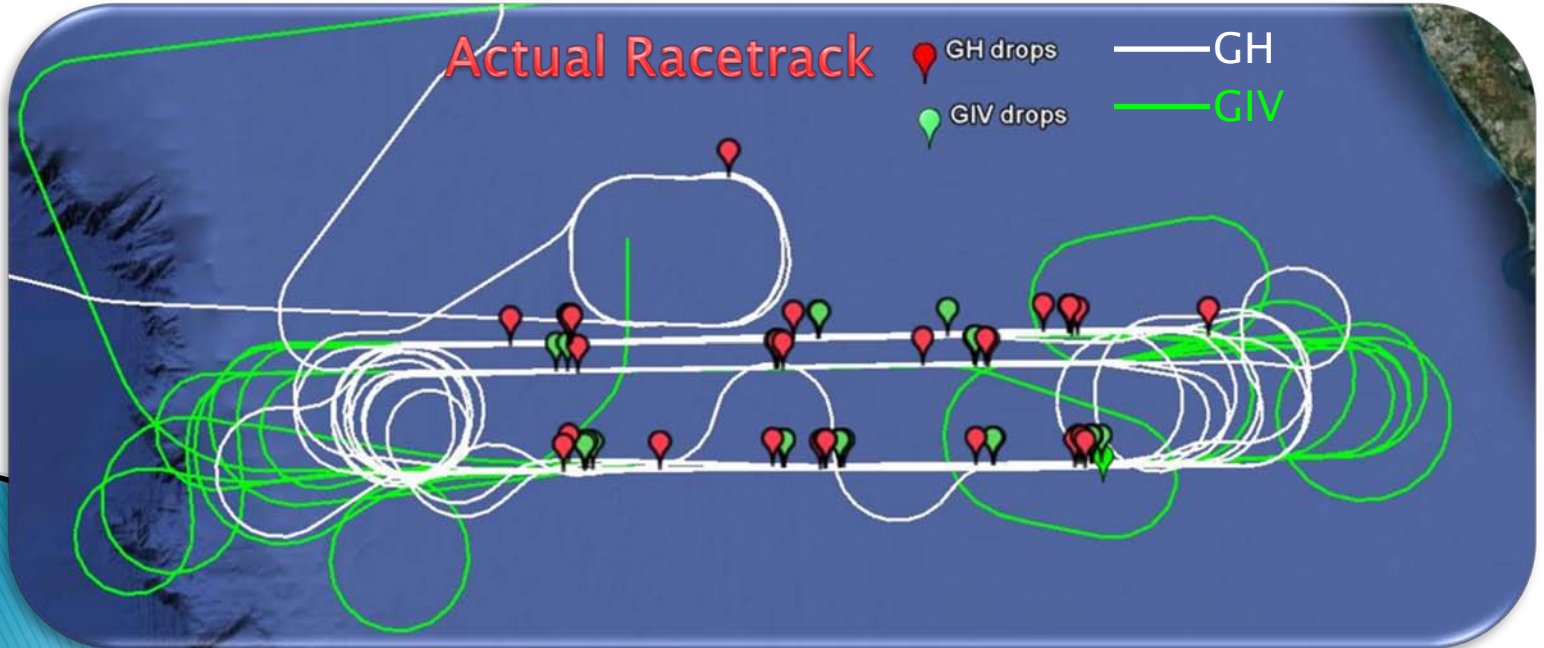
Schedule

- 2012
  - Env. GH Sept. 1 to Oct. 5
  - Over-storm GH Sept. 8 to Oct. 5
  - Some schedule risk for over-storm GH due to ongoing GH experiment
- 2013-2014
  - Aug 26-Sept 21

2011 Test Flights—Comparison with G-IV

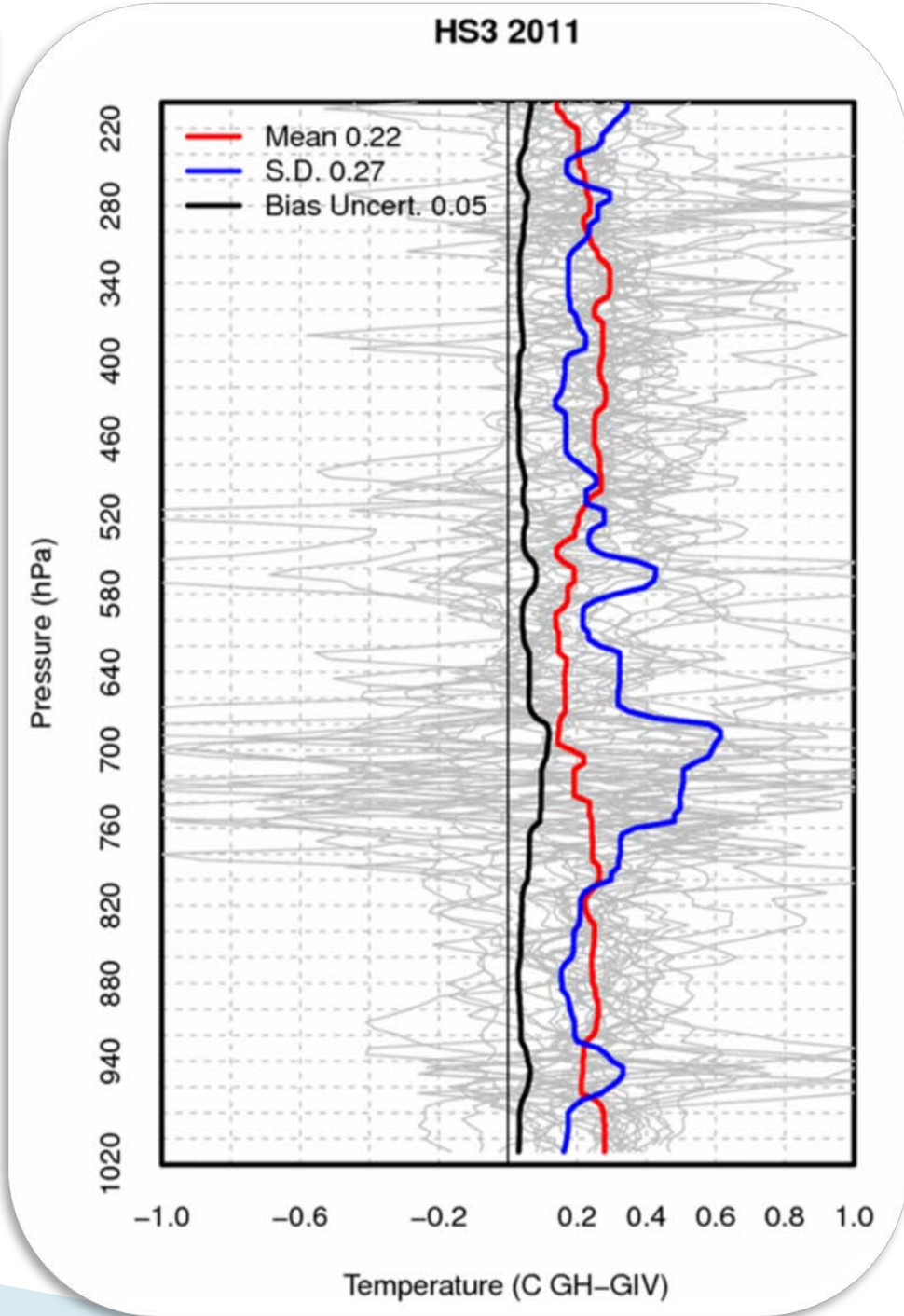
Total 27 pairs on 9/14/2012 11-15 UTC (7-11am EST)





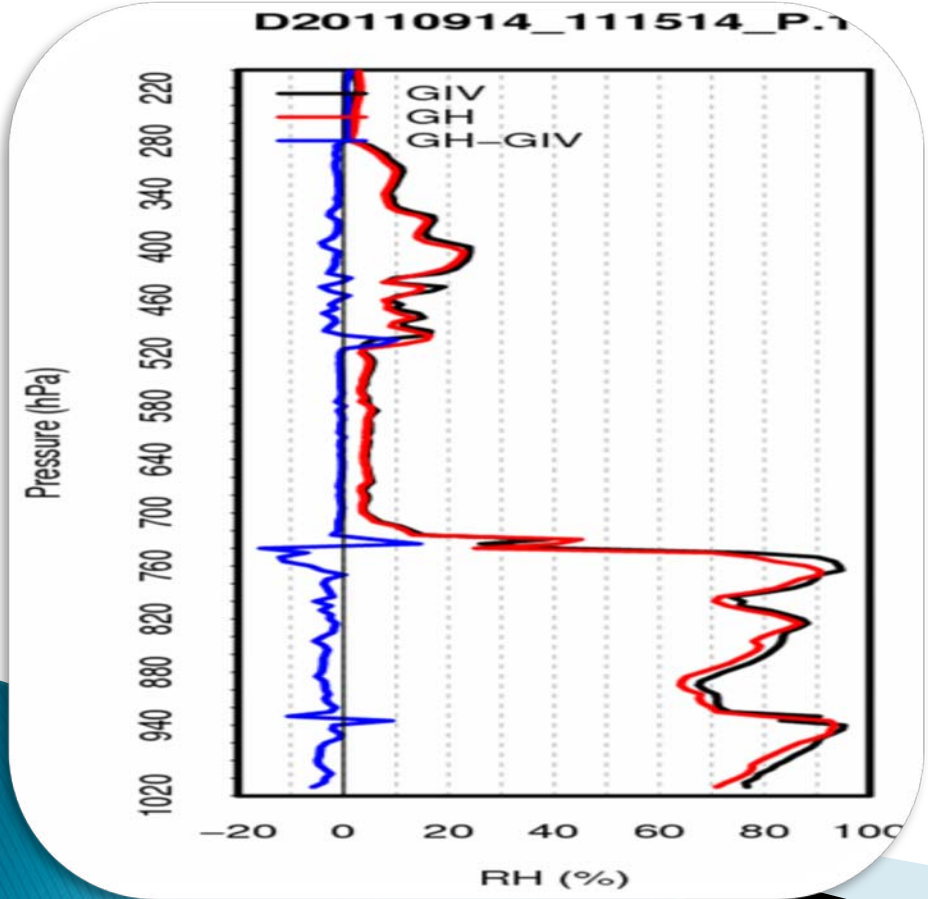
Temperature Differences

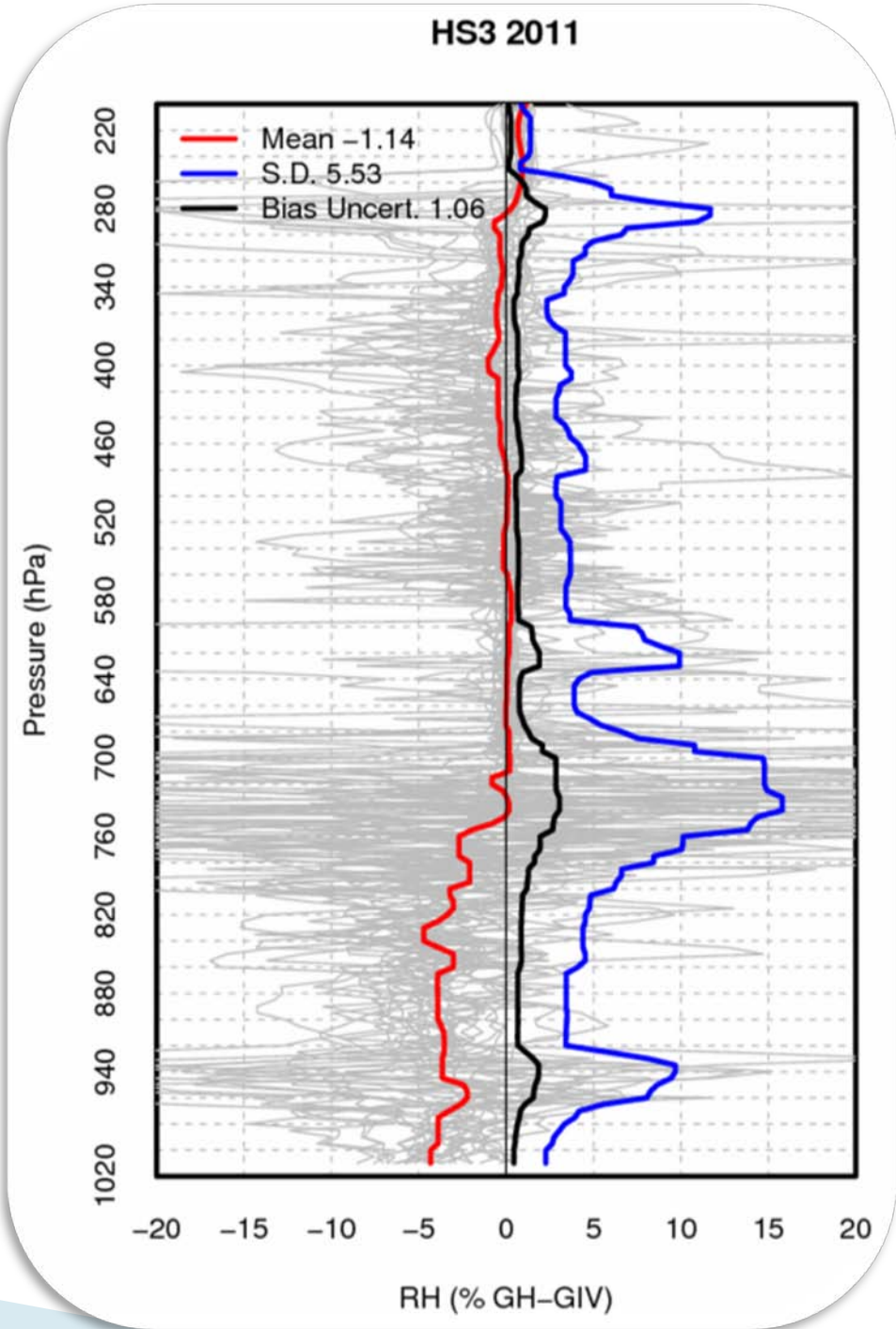
- A warm bias in the GH data with a mean of 0.22°C.
- The bias is significant compared with the uncertainty of the bias.
- The reproducibility (2 * S.D.) is 0.54°C on average.



RH Differences

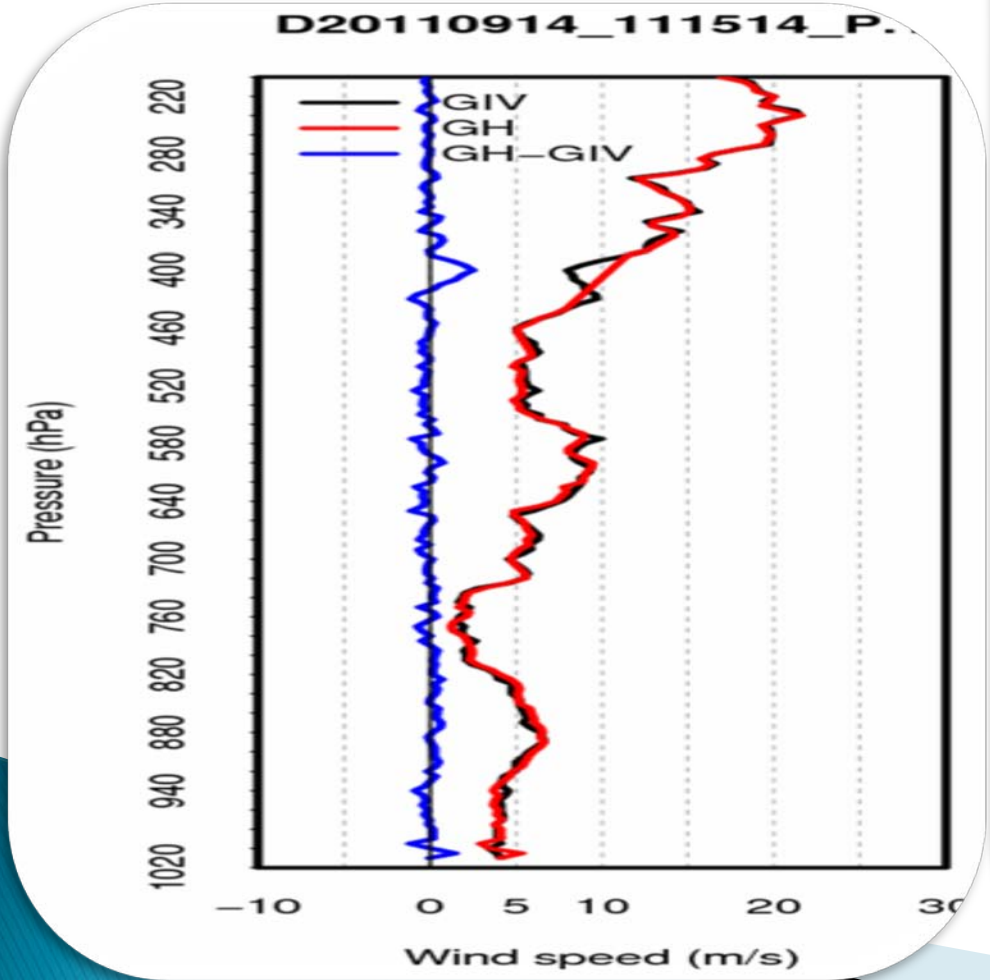
- Good agreement above ~750 hPa.
- A dry bias of ~4% below ~750 hPa.
- The reproducibility (2 * S.D.) is 11% on average.

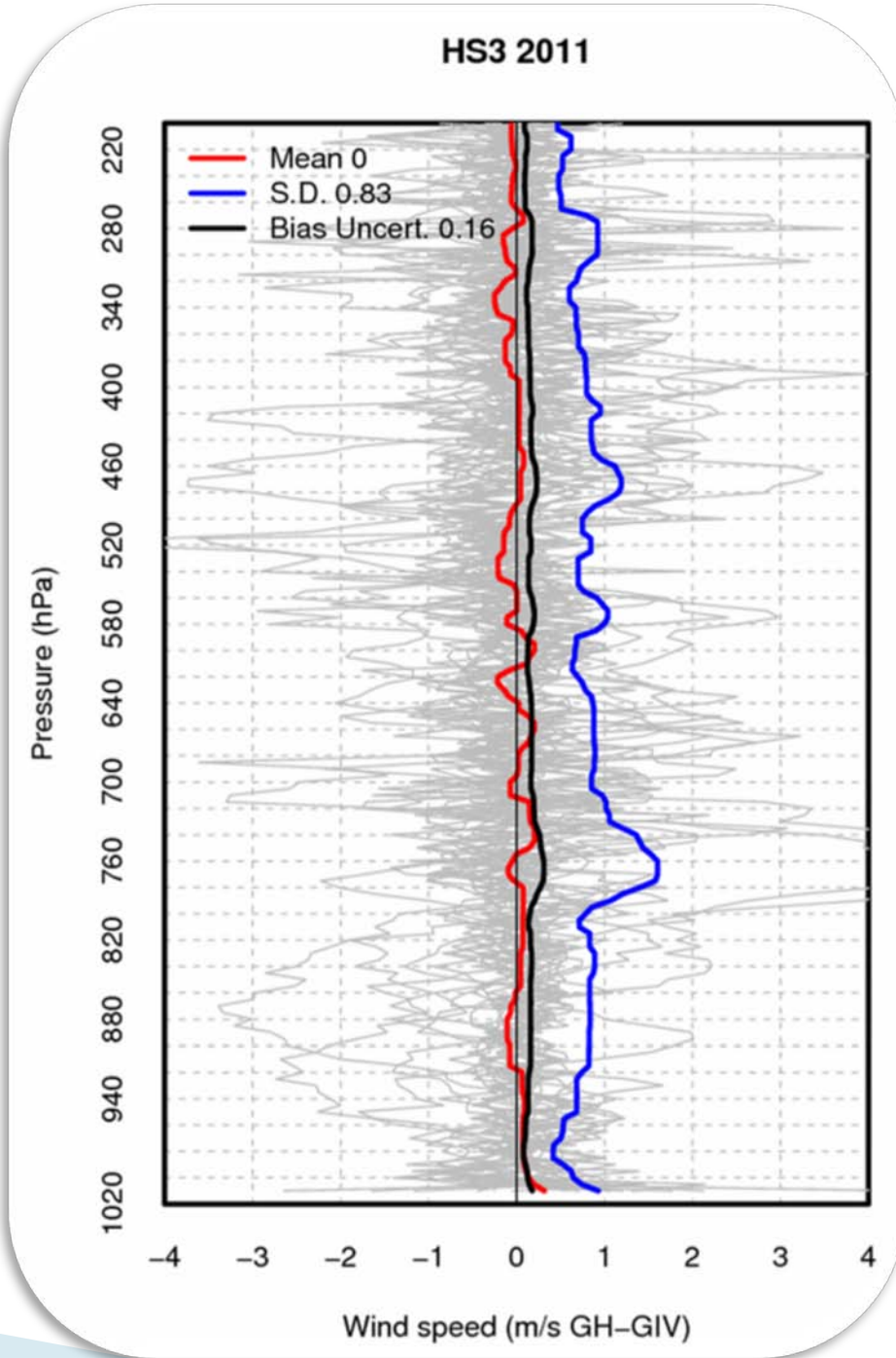




Wind Speed Differences

- Excellent agreements with no mean bias.
- The reproducibility (2 * S.D.) is 1.66 m/s on average.



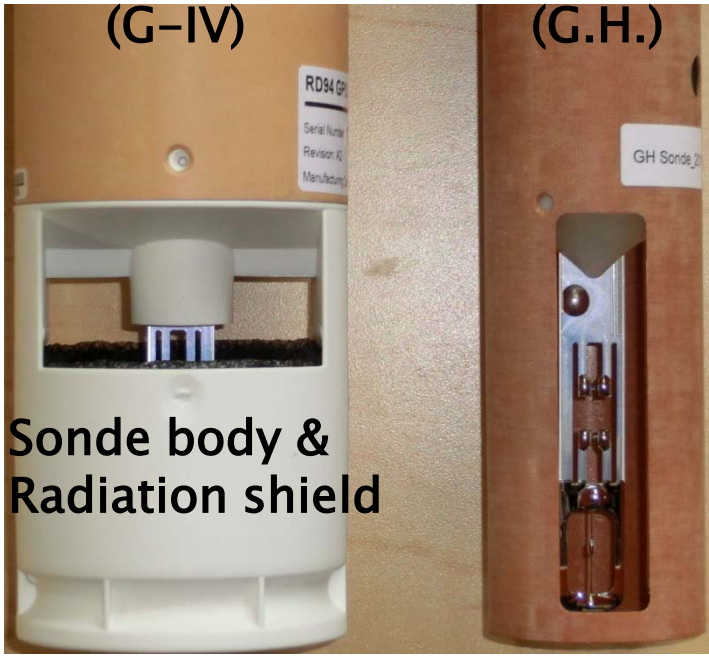


Suspected reasons for warm/dry biases

- **Solar radiation heating:** G-IV sonde has black radiation foam (BRF) and has PTU sensor module in the shade, so no direct solar radiation heating, while GH dropsonde has no BRF, and three large windows make it susceptible to direct solar radiation heating.
- **Contamination:** The sensor cover of GH dropsondes was removed in the hanger for several hours. Possible RH sensor contamination?

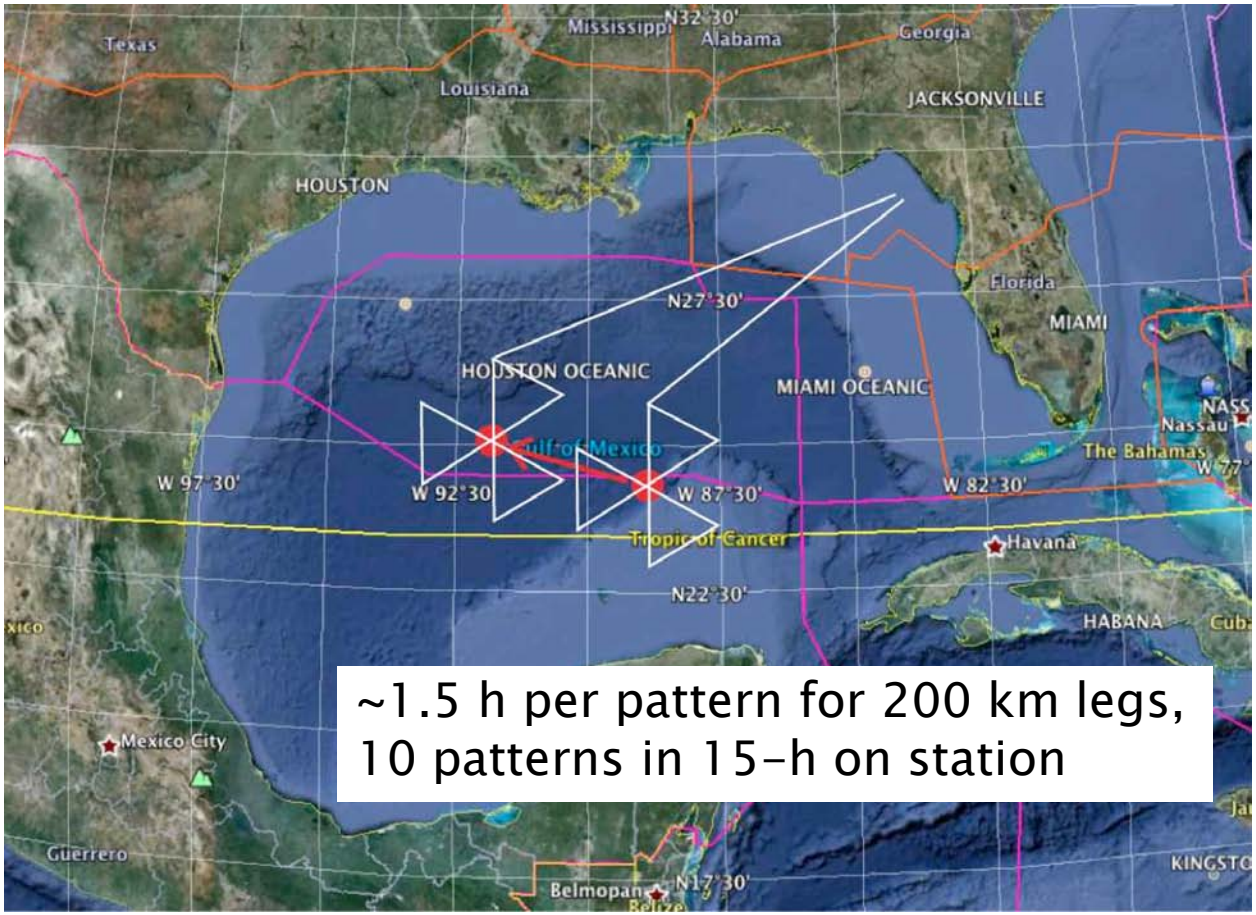
AVAPS II Dropsonde (G-IV)

Mini Dropsonde (G.H.)



Potential Flight Modules

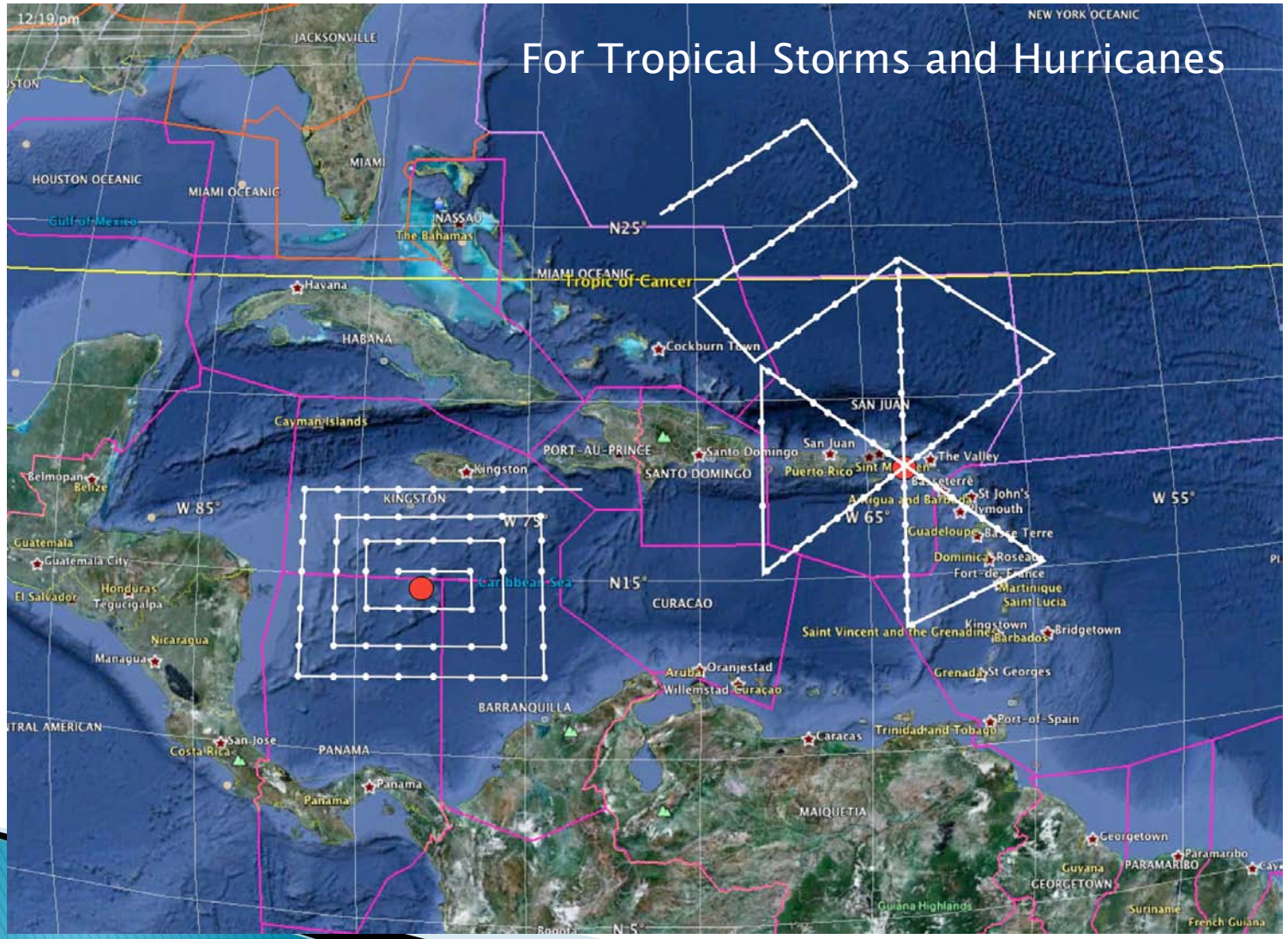
Over-Storm Global Hawk Flights



~1.5 h per pattern for 200 km legs,
10 patterns in 15-h on station

Potential Flight Modules

Environmental Global Hawk Flights



Potential Flight Modules

Environmental Global Hawk Flights