S-HIS: Scanning High-resolution Interferometer Sounder

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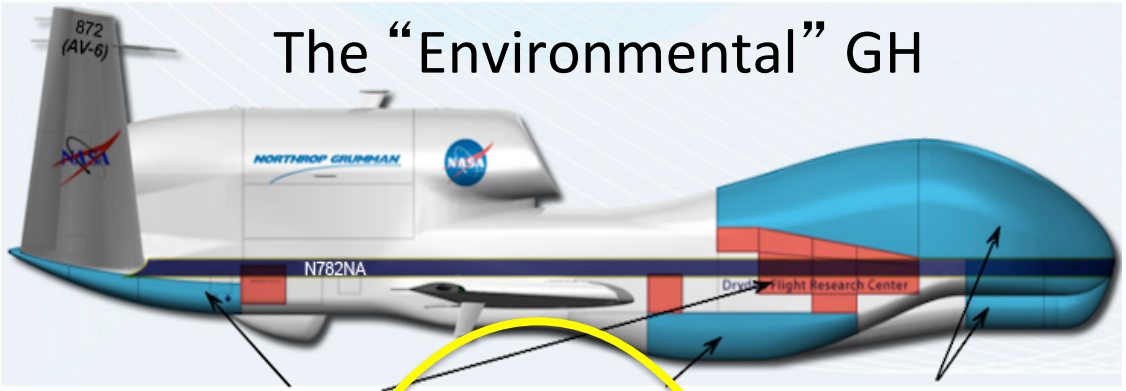
THE UNIVERSITY of WISCONSIN MADISON

Hurricane and Severe Storm Sentinel (HS3) Science & Deployment Preparation Meeting
May 5 – May 7, 2015
NASA Research Park, Moffett Field, CA

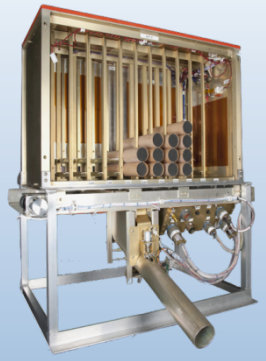
SSEC

The "Environmental" GH



NASA Hurricane and Severe Storm Sentinel HS3

Airborne Vertical Atmospheric Profiling System (AVAPS)



89 Dropsondes / flight

Temperature, Pressure, wind, humidity vertical profiles

NOAA, NCAR

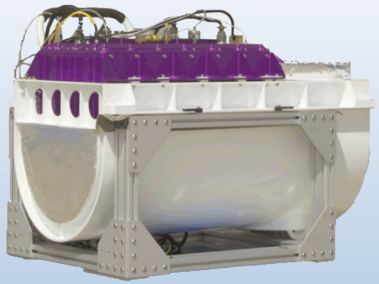
Scanning High Resolution Infrared Sounder (S-HIS)

Upwelling thermal radiation at high spectral resolution between 3.3 and 18 microns.

Temperature, water vapor vertical profiles

U of Wisc, SSEC

Cloud Physics Lidar (CPL)



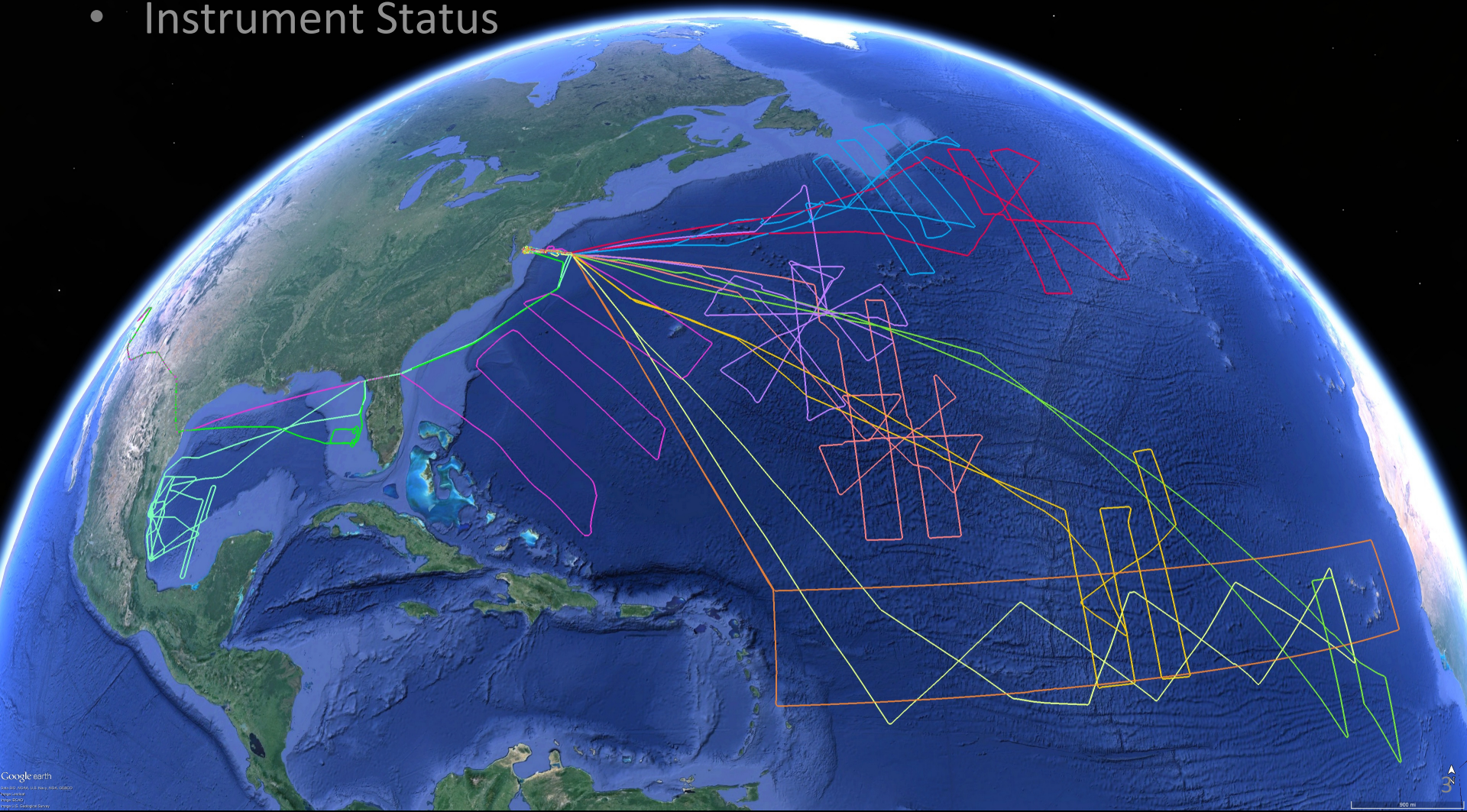
532/1064 nm Lidar Reflection

Cloud structure and depth

NASA GSFC

Topics

- Real-time Data Collection and Processing
- Refined Off-line Processing and Results
- Instrument Status

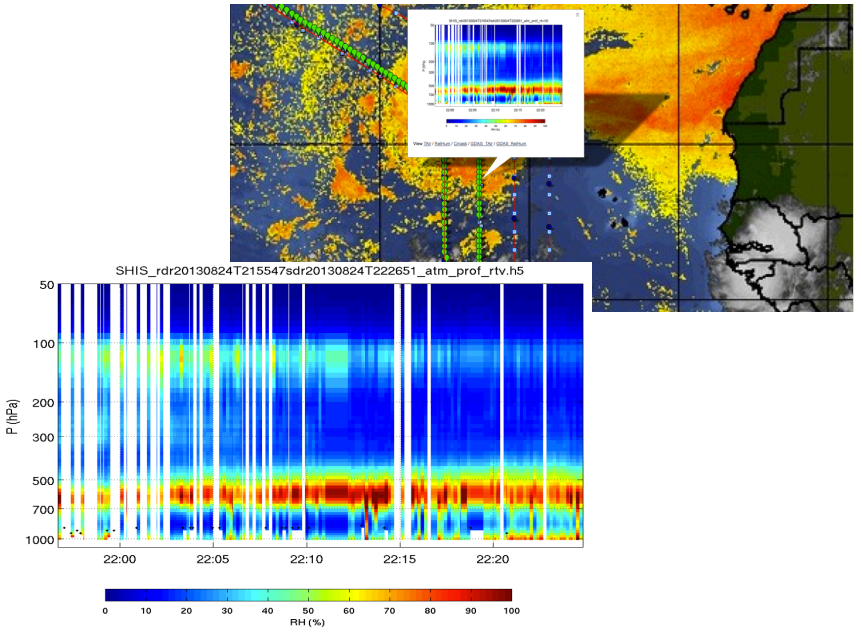


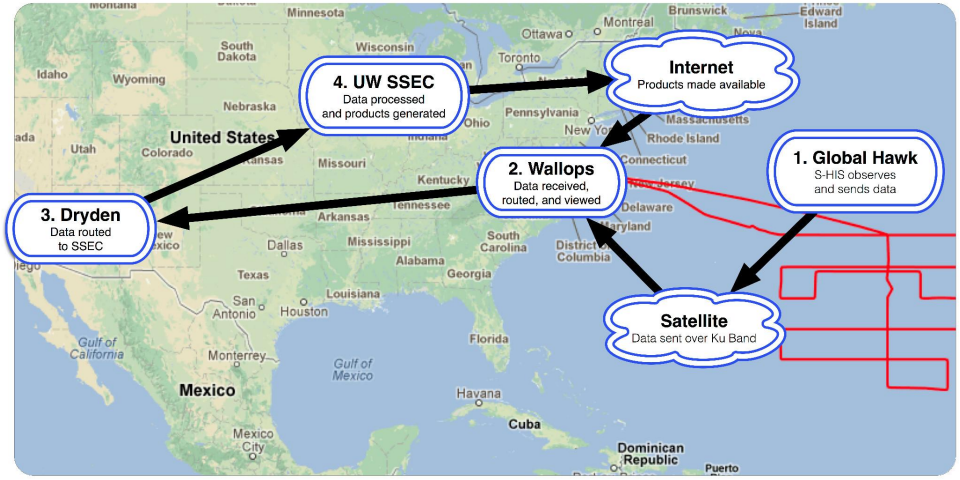
Real-time Data Collection, Downlink, and Processing

Real-Time Products
- Real time data processing software
- < 1 minute from data acquisition to delivery (MTS, website quick-looks)

Near-Line Products
- Full data processing pipeline
- < 30 minutes from data acquisition to delivery (MTS, website quick-looks)

Final Products
- Full data processing pipeline
- Quality control, archived at SSEC, Delivered to NASA post-mission
- Preliminary (no QC) available within 8 hours post-flight

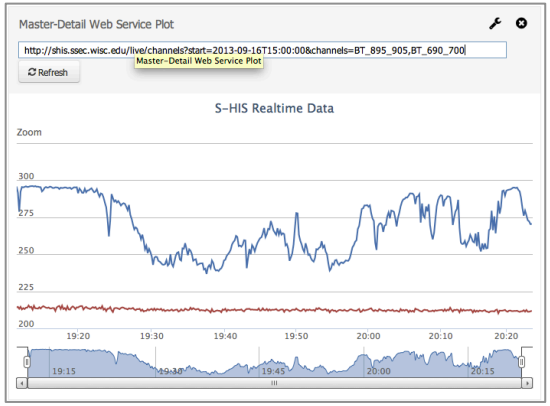




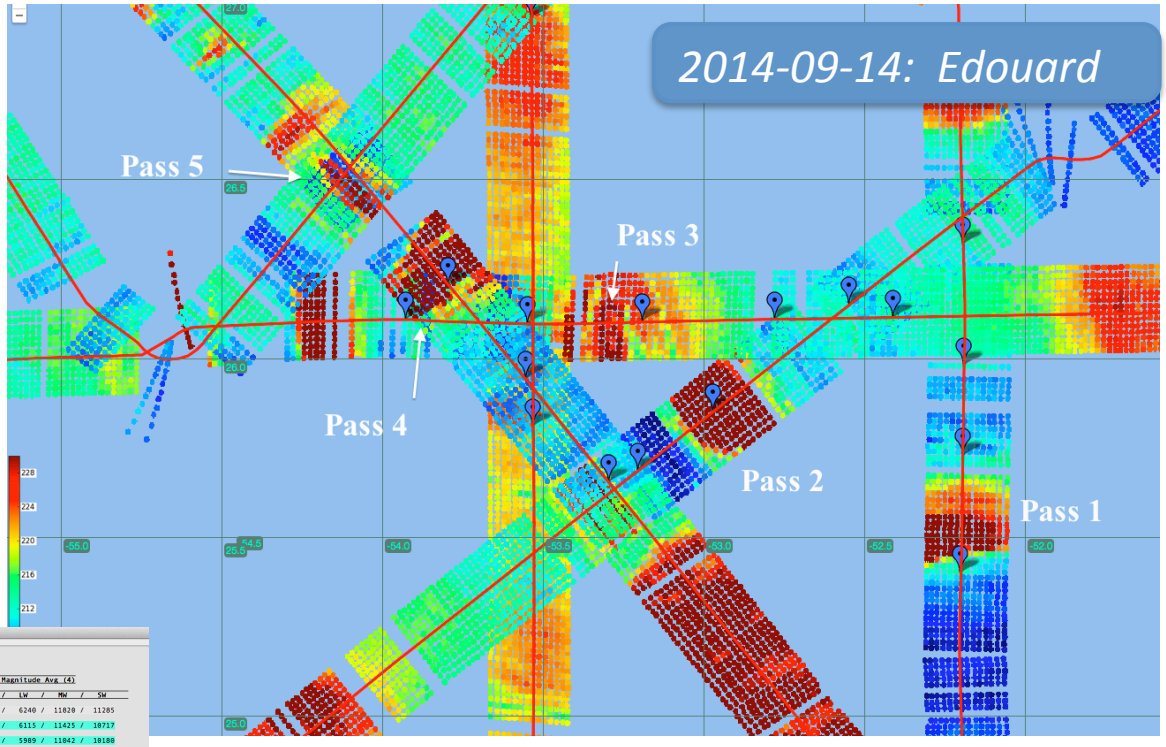
Real-time Data Collection and Processing Brightness Temperature and Instrument Status

With reliable KU, Real-Time brightness temperatures and dual regression retrievals were served to the GHOC-E with 40 to 45 second latency

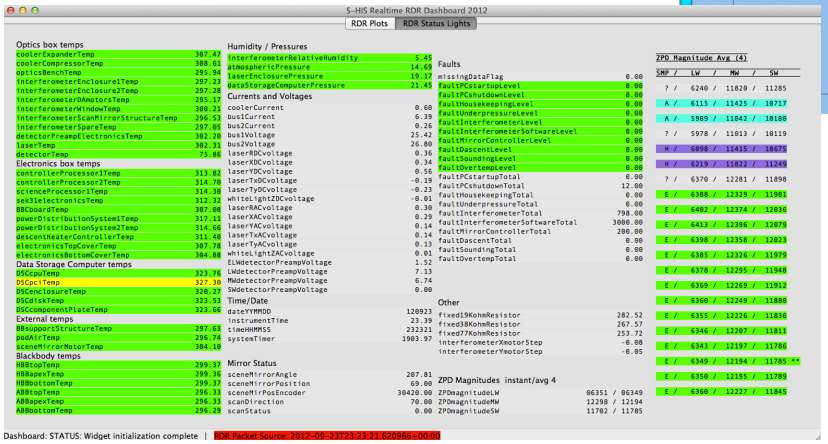
BT Timeseries (900 cm^{-1})



2014-09-14: Edouard

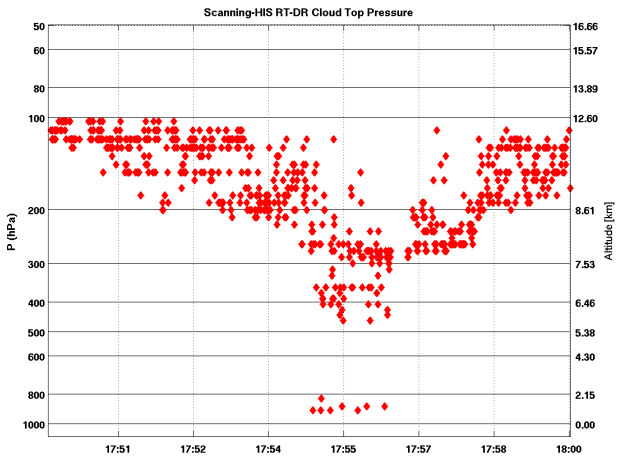


BT Map (900 cm^{-1})

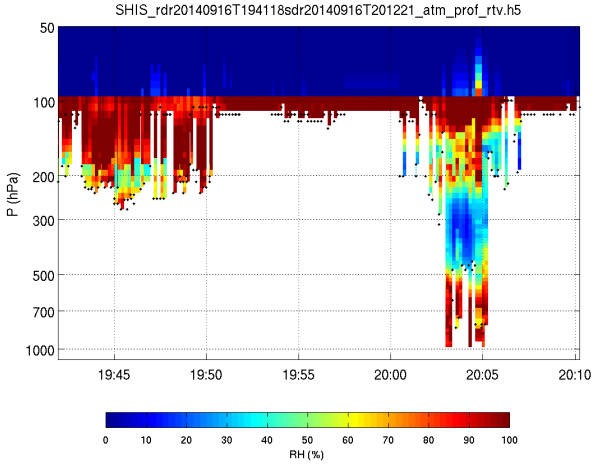


S-HIS Engineering Data

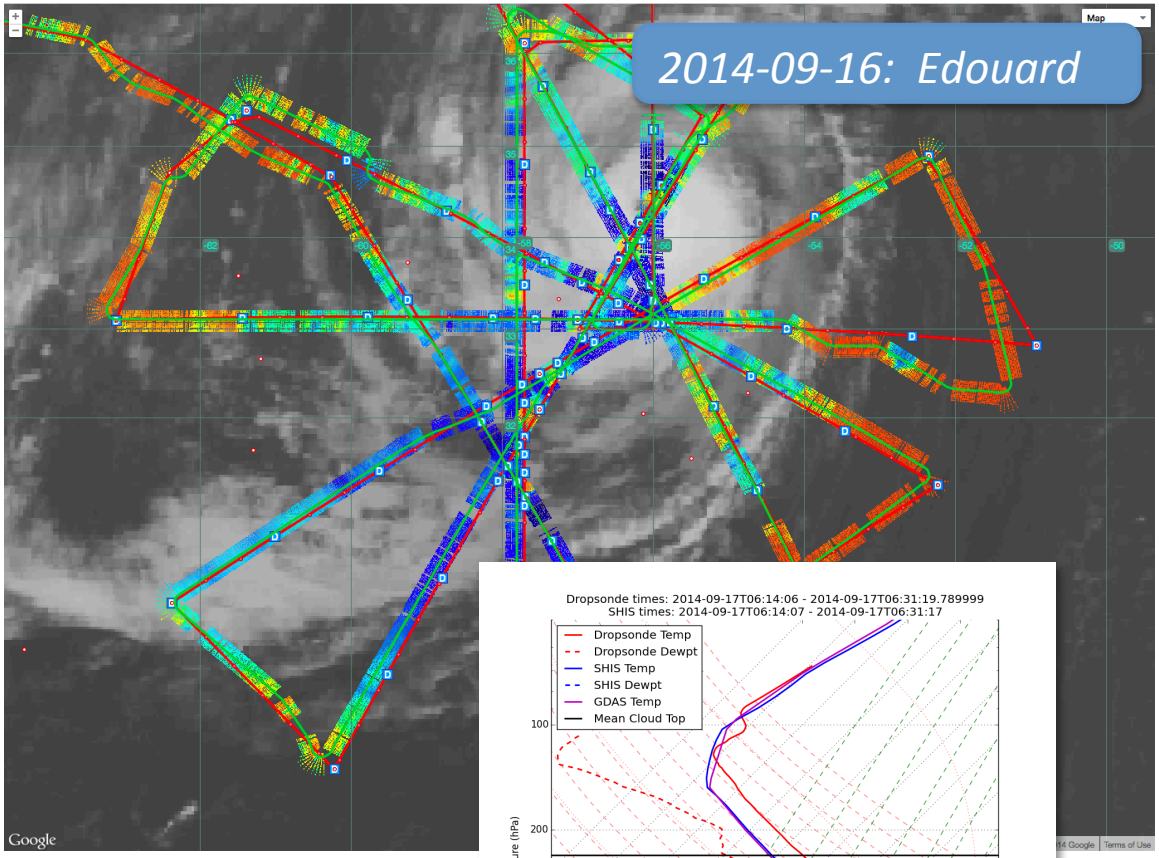
Real-time Data Collection and Processing
Real-Time Dual Regression (DR) Retrievals

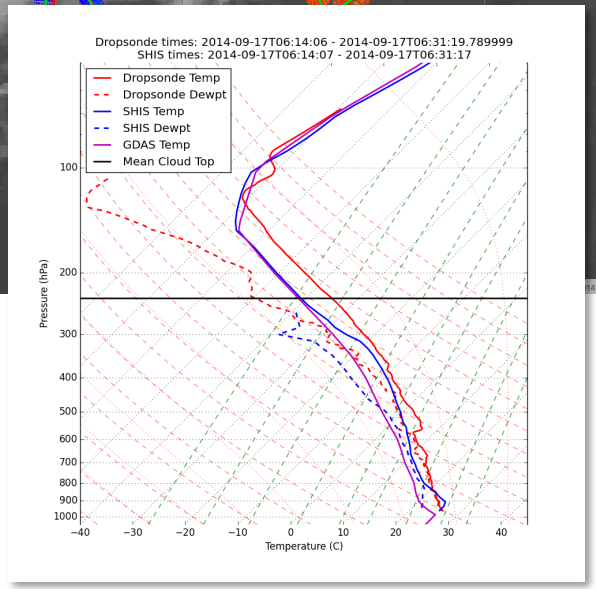


10 minute history of retrieved CTP
Second eye transect



S-HIS relative humidity profile retrieval during the third eye transect



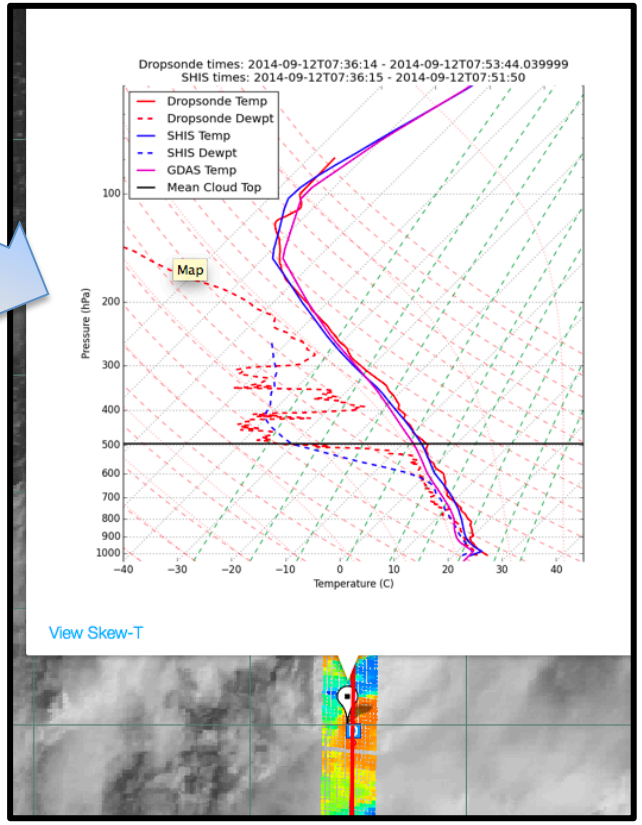


Comparison between dropsonde, S-HIS, and GDAS profiles for transect 9

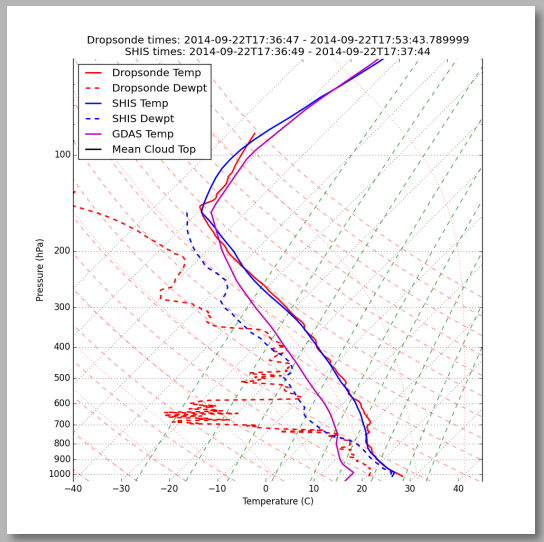
Real-time Data Collection and Processing
Added in 2014: SHIS/AVAPS Comparison Skew-T

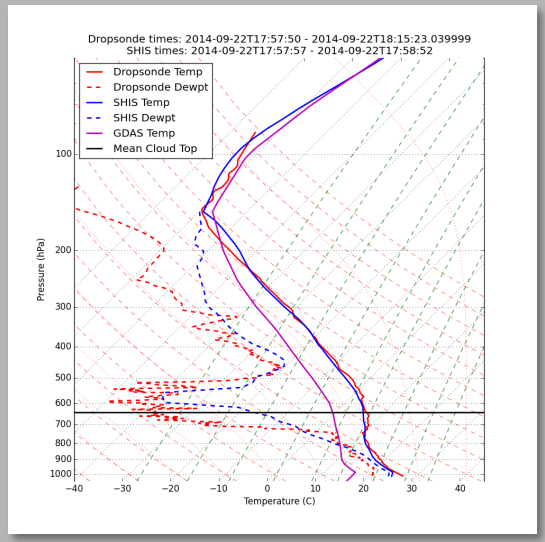
2014-09-12: "SHIS/AVAPS Comparison Skew-T" Plot added to MTS

- average of S-HIS retrievals from data collected during the sonde drop
- simple outlier rejection applied



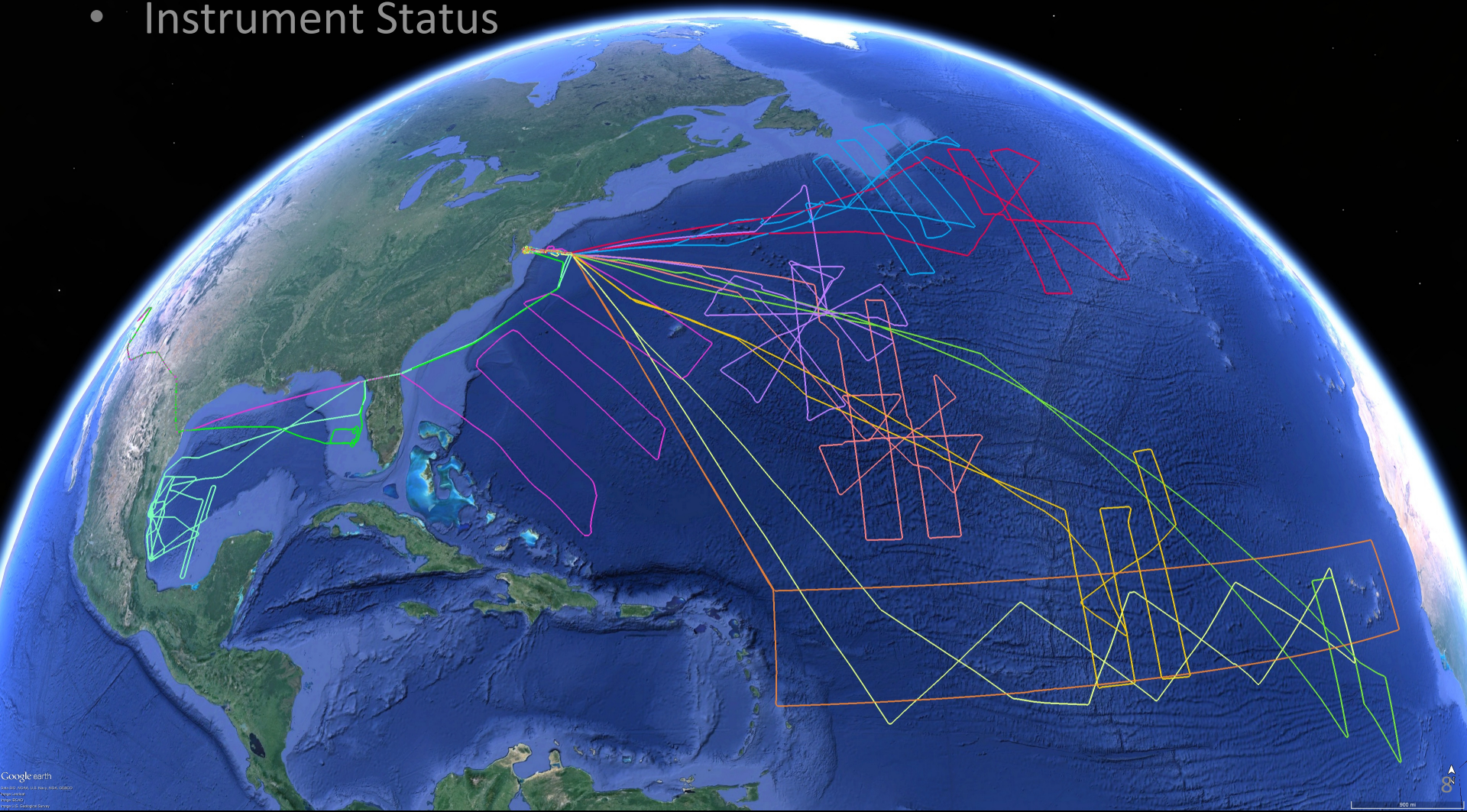
2014-09-22: Refined field of view averaging and selection algorithm applied to the S-HIS retrievals used in the AVAPS comparisons improved the temperature and dewpoint agreement





Topics

- Real-time Data Collection and Processing
- Refined Off-line Processing and Results
- Instrument Status



Refined Off-line Processing and Results

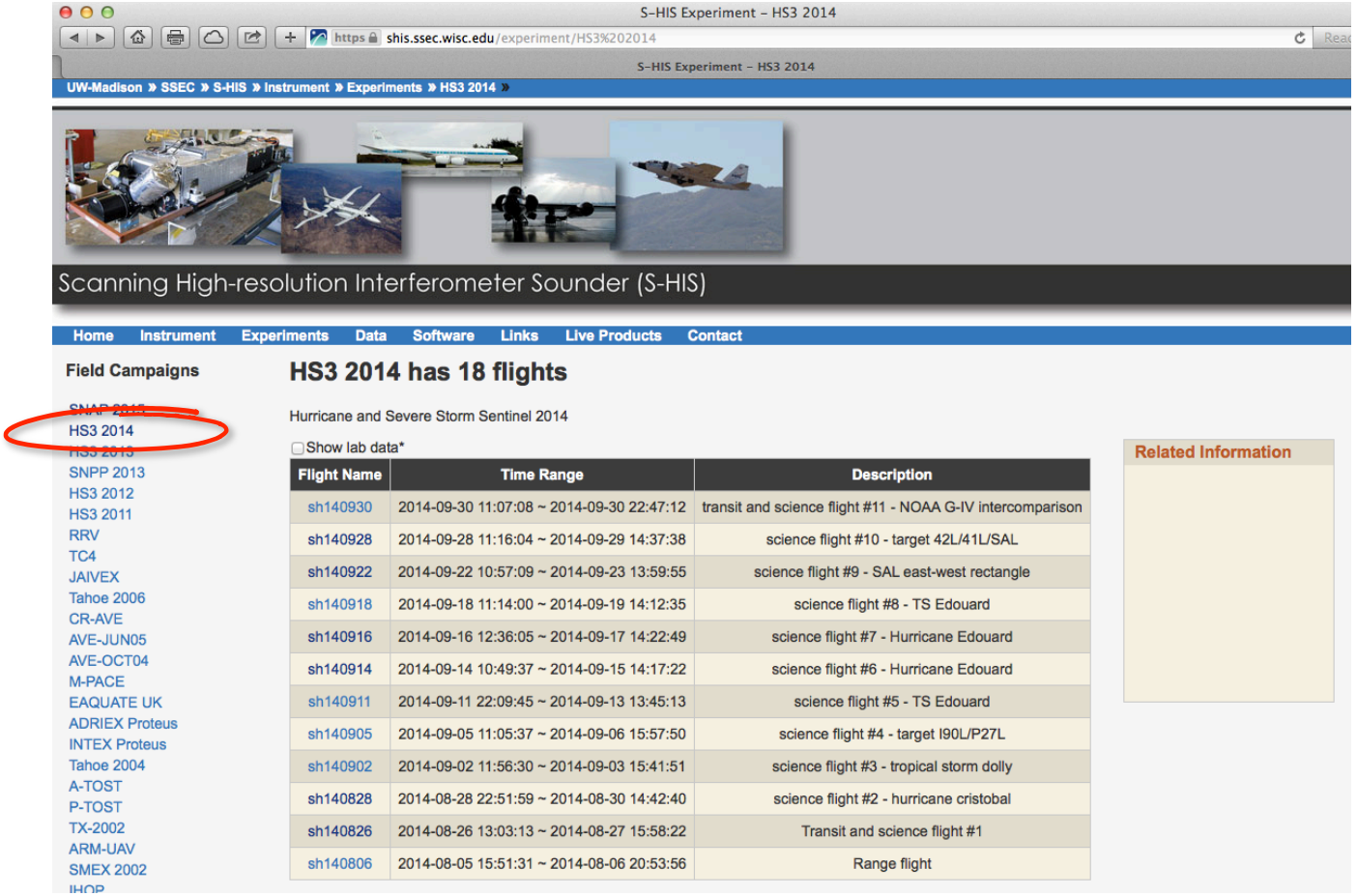
- 2014 processing is complete
- Small changes were made to the Dual Regression (DR) Retrieval product (see following slide)
- We will reprocess entire dataset (2011 – 2014) within the next few months
  - File format changes to comply with GHRC DAAC recommendations
- Data is currently available for download via S-HIS data repository:
  - http://download.ssec.wisc.edu/files/hs3_shis/
- Data products will be archived to GHRC DAAC after final reprocessing
- Dual-regression (DR) retrieval method produces high-quality atmospheric state profiles in addition to surface and cloud properties. A linear regression is applied to the radiances in conjunction with classification schemes and decision-making steps to obtain retrieval products. We evaluate:
  - atmospheric state profiles (comparison with AVAPS dropsondes)
  - retrieved cloud top (comparison with CPL measurements)
- See DeSlover, et al. poster: *S-HIS dual regression analysis for the 2012 and 2013 campaigns relative to AVAPS and CPL measurements*

Refined Off-line Processing and Results

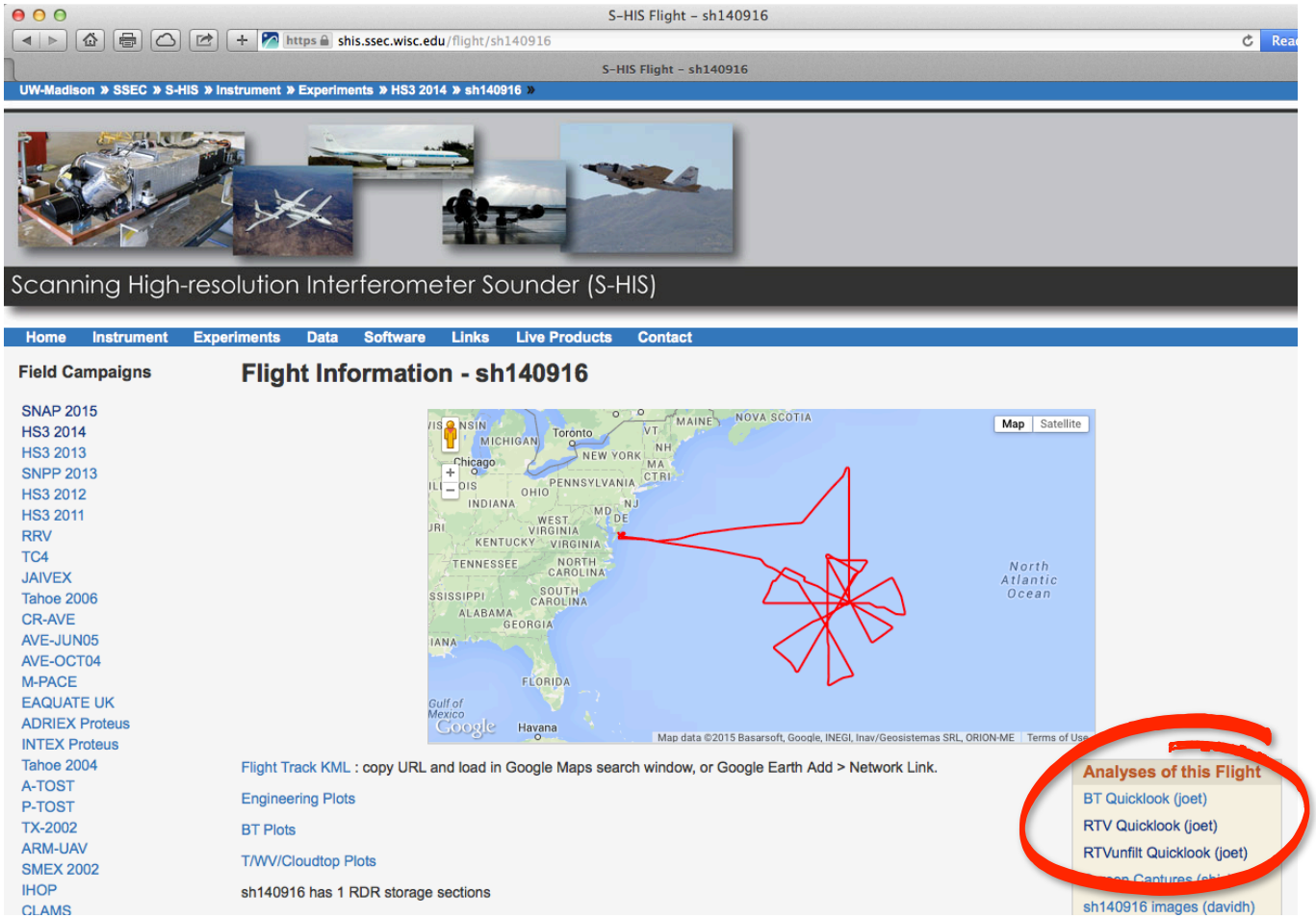
- DR-RTV and radiance are filtered for S-HIS “flight segments”
- DR-RTV files also filter out any retrievals that aren't considering "high quality" based on the dual regression retrieval QFlag1 variable.
- For the HS3 Mission a statistical bias correction is applied to the S-HIS data
- However, as a result of comparisons with time and space coincident dropsondes, a cold bias was found to remain in the retrievals, believed to be due to undetected cirrus cloud, which prevails during the HS3 flights within the hurricane environment and where most of the dropsonde data is obtained.
- As a result, a “nearest neighbor” technique was developed to filter out erroneous temperature, and associated dewpoint temperature, retrievals, which exhibit a cold bias due to undetected cirrus cloud contamination. The retrieval files for which this nearest neighbor filtering is applied end with the suffix _filt.h5, while the unfiltered files end in _unfilt.h5.
- See Smith, et al. talk: *Atmospheric Profiles from S-HIS During the HS3 Field Campaigns - Retrieval Technique and Results*

Refined Off-line Processing and Results: New Quicklooks

- New Quick-looks added to S-HIS webpage for 2014 mission
- Will retroactively produce quick-looks for prior HS3 seasons
- shis.ssec.wisc.edu

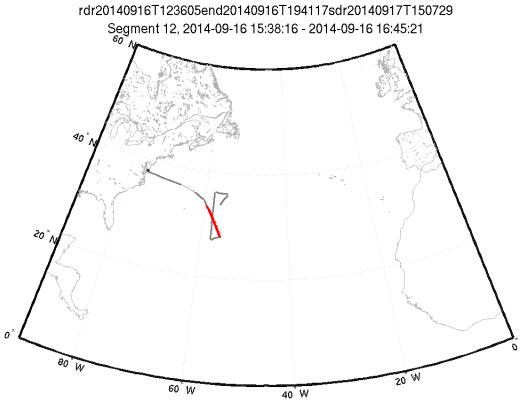


Refined Off-line Processing and Results: New Quicklooks

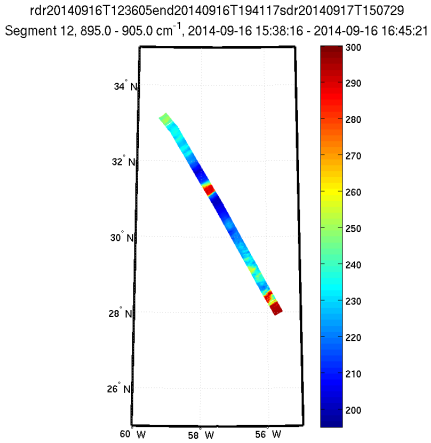


Refined Off-line Processing and Results: New Quicklooks Brightness Temperatures

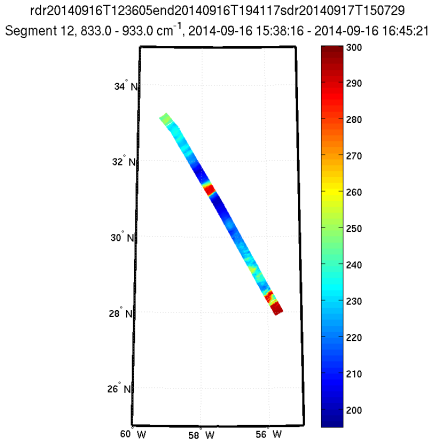
Column 1: Flight Segment



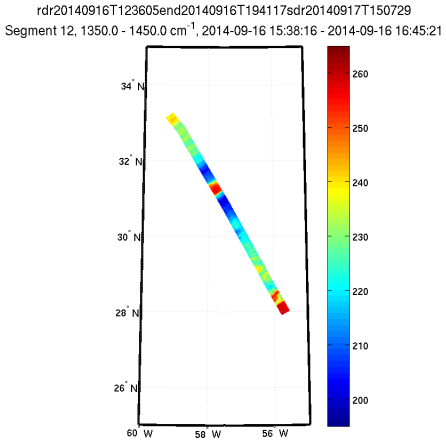
Column 2: LW Window (895 – 905 cm^{-1})



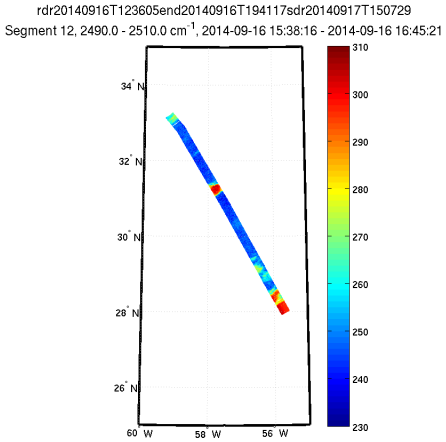
Column 3: MASTER #48 Equivalent (833.0 – 933.0 cm^{-1})



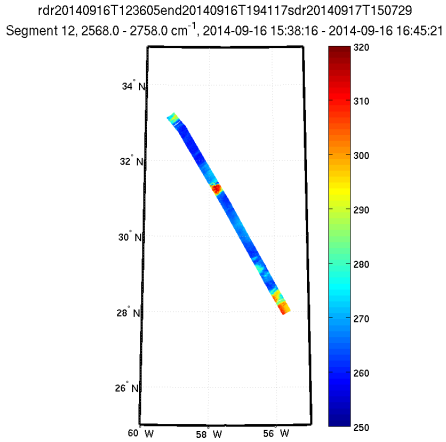
Column 4: Upper Trop H_2O 1350.0 – 1450.0 cm^{-1}



Column 5: SW Window 2490.0 – 2510.0 cm^{-1}



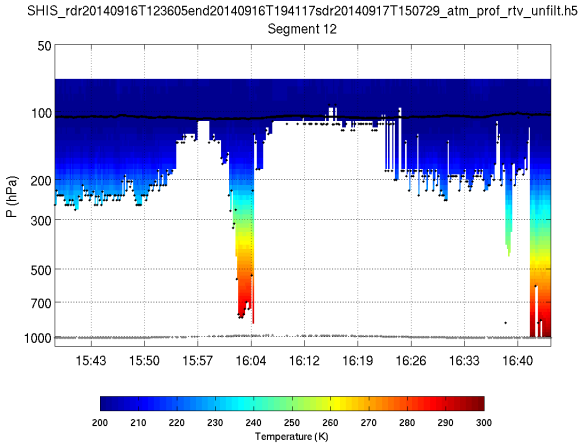
Column 6: MASTER #30 Equivalent (2568.0 – 2758.0 cm^{-1})



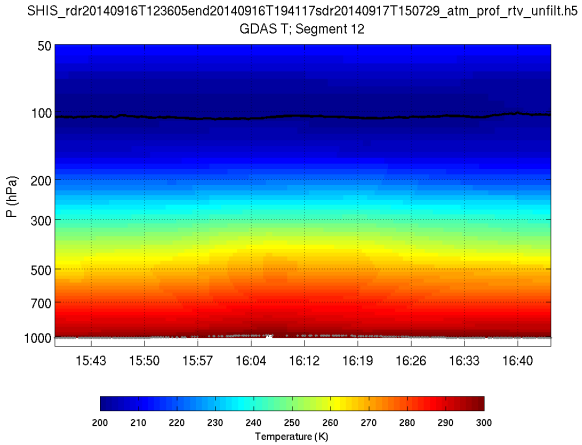
Refined Off-line Processing and Results: New Quicklooks Retrievals

Column 1: flight segment (not shown here)

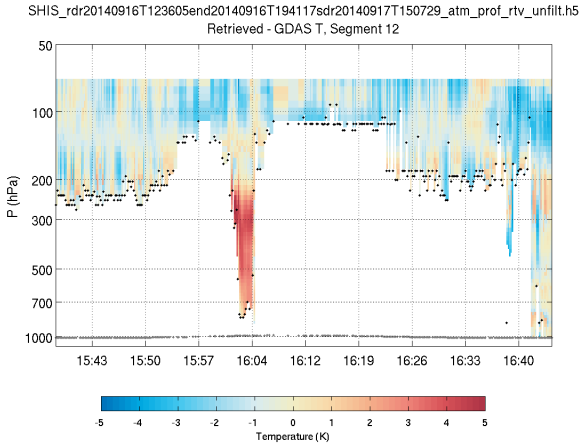
Column 2: Retrieved Temperature



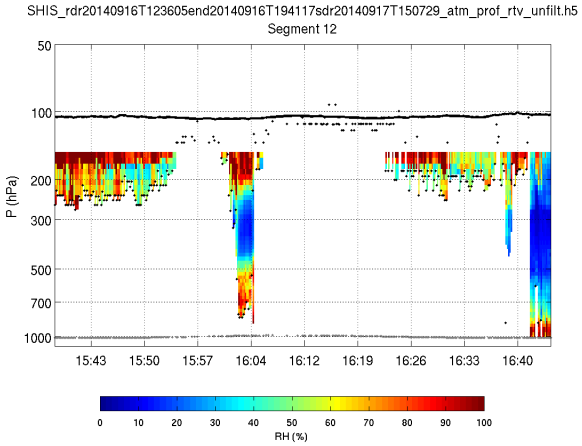
Column 4: GDAS Temperature



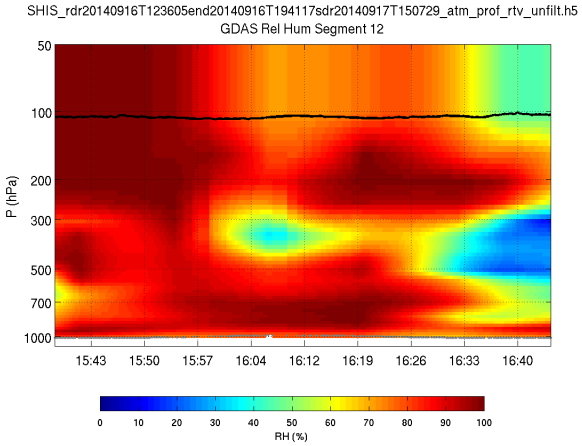
Column 6: Retrieved - GDAS T



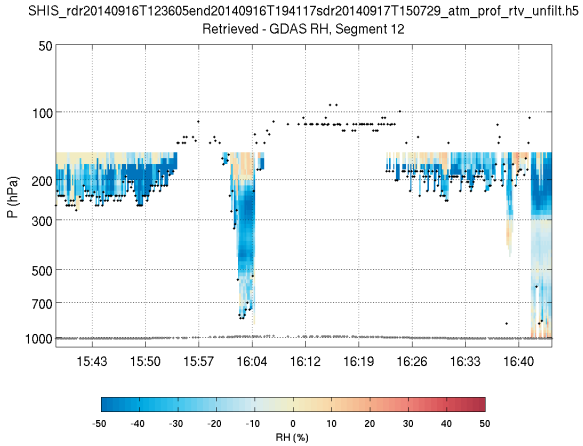
Column 3: Retrieved RH



Column 5: GDAS RH



Column 7: Retrieved – GDAS RH



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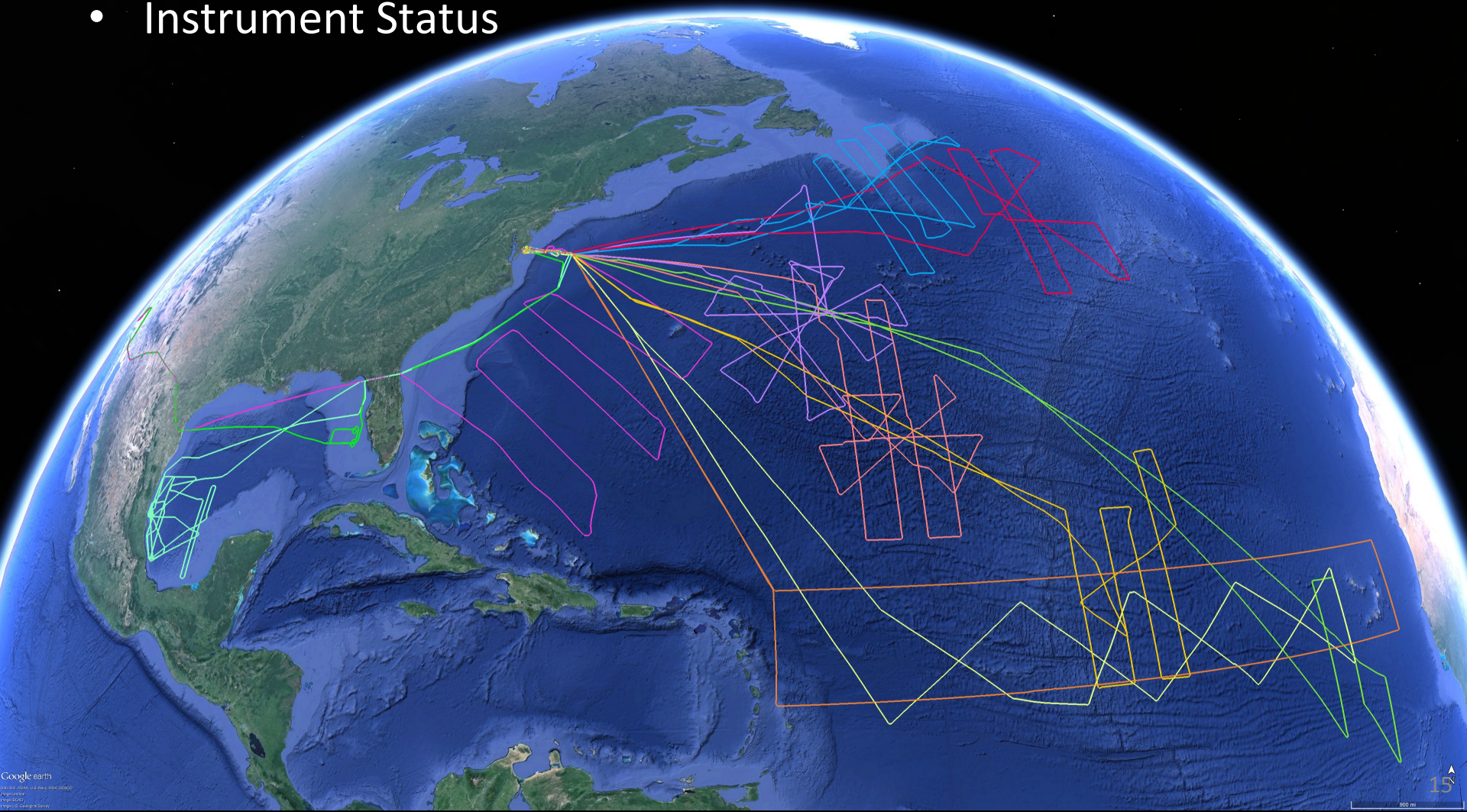

Instrument Status

- S-HIS sustained > 99% uptime
  - Only outages were associated with planned power cycles (to address a Stirling cooler issue)
- Real-time products were available during all flights in 2014
- Some issues with KU downlink for early HS3 2014 flights
- Remained in Zone 25 for 2014 (no wing pods)
- See Joe Taylor, et al. poster: *Scanning High-resolution Interferometer Sounder (S-HIS) Radiometric Calibration and Performance During HS3*

Conclusion

- Data sets from 2011, 2012, 2013, and 2014 are available via SSEC data distribution site: http://download.ssec.wisc.edu/files/hs3_shis/
- Data sets will be uploaded to the NASA Marshall archive after final reprocessing
- Retrieval Products will be compared with AVAPS dropsondes and CPL data for all years (2011, 2012, 2013 complete; 2014 in progress)