S-HIS: Scanning High-resolution Interferometer Sounder

Joe Taylor, Hank Revercomb, Fred Best, Dave Tobin, Bob Knuteson, Bill Smith, Elizabeth Weisz, Dan DeSloover, Ray Garcia, Dave Hoese
University of Wisconsin Space Science and Engineering Center
The “Environmental” GH

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

2014-09-14: Edouard

BT Timeseries (900 cm⁻¹)

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

2014-09-16: Edouard
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](http://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 1:** Flight Segment

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

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

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

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

### Column 4: Upper Trop H\(_2\)O 1350.0 – 1450.0 cm\(^{-1}\)

- **Column 4:** Upper Trop H\(_2\)O 1350.0 – 1450.0 cm\(^{-1}\)

### Column 5: SW Window 2490.0 – 2510.0 cm\(^{-1}\)

- **Column 5:** SW Window 2490.0 – 2510.0 cm\(^{-1}\)

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

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

---

<table>
<thead>
<tr>
<th>Segment</th>
<th>LW Window 895 – 905 cm(^{-1})</th>
<th>MASTER #48 Equivalent 833.0 – 933.0 cm(^{-1})</th>
<th>Upper Trop H(_2)O 1350.0 – 1450.0 cm(^{-1})</th>
<th>SW Window 2490.0 – 2510.0 cm(^{-1})</th>
<th>MASTER #30 Equivalent 2568.0 – 2758.0 cm(^{-1})</th>
</tr>
</thead>
</table>

---

The images show the geographic distribution and brightness temperature for each segment.
Refined Off-line Processing and Results: New Quicklooks Retrievals

Column 1: flight segment (not shown here)

Column 2: Retrieved Temperature

Column 3: Retrieved RH

Column 4: GDAS Temperature

Column 5: GDAS RH

Column 6: Retrieved - GDAS T

Column 7: Retrieved – GDAS RH
Topics

• Real-time Data Collection and Processing
• Refined Off-line Processing and Results
• 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*
• 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)