S-HIS Retrieval Results

HS3 2011 Test Flights

Comparisons to GDAS, IR Satellite, HAMSR, and Dropsondes

Thanks to Shannon Brown (JPL) for the HAMSR cross-sections.
Thanks to Gary Wick *(NOAA) for the drop-sonde data.*

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Bill Smith, Elisabeth Weisz, and Elise Garms (UWisc Grad student)

University of Wisconsin-Madison

HS3 Science Team Meeting, NASA Wallops
7 May 2012

Topics

Pacific Flight Case Study: 9 Sept 2011

- UW Satellite IR Retrievals in support of HS3
- Model <---> S-HIS <---> HAMSR
- S-HIS < --- > Dropsonde

<u>Things to Keep in Mind</u>

#1 Models are not truth.

#2 Observations may be correct yet disagree.

#3 Comparison of observations and models requires

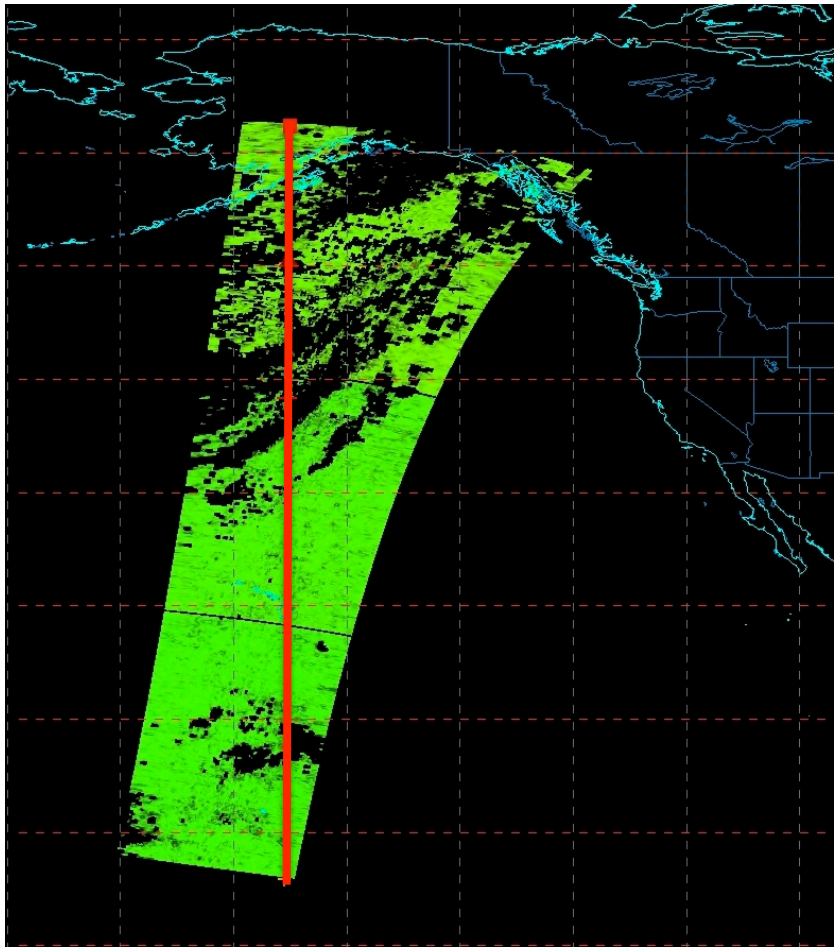
- knowledge of error characteristics

- knowledge of spatial sampling resolution

- knowledge of vertical averaging kernels

Bill Smith's Dual Regression AIRS Retrieval: GH Pacific Flight 09 Sept 2011

Temperature 273K isosurface



155W

DR retrieval applied to AIRS 6 minute granules:

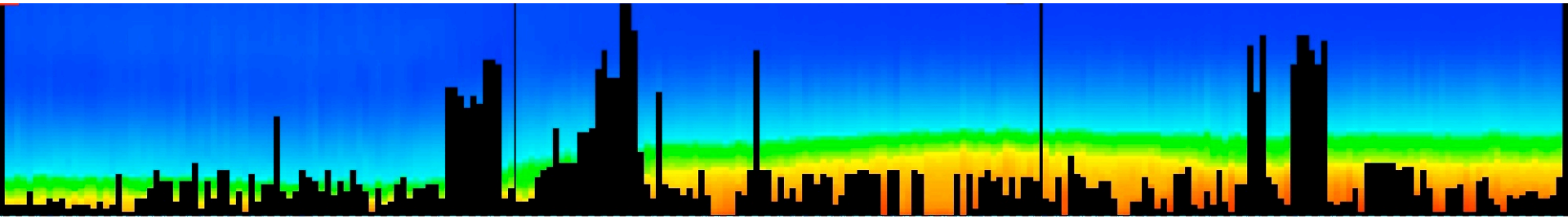
AIRS.2011.09.09.121
AIRS.2011.09.09.122
AIRS.2011.09.09.123

Used McIDAS-V to extract vertical cross-section of atmospheric temperature and water vapor along the North/South longitude 155W coincident with Global Hawk flight track of 09 Sept 2011.

International MODIS/AIRS Processing Package (IMAPP) http://cimss.ssec.wisc.edu/imapp/

Bill Smith's Dual Regresssion AIRS Retrieval: GH Pacific Flight 09 Sept 2011

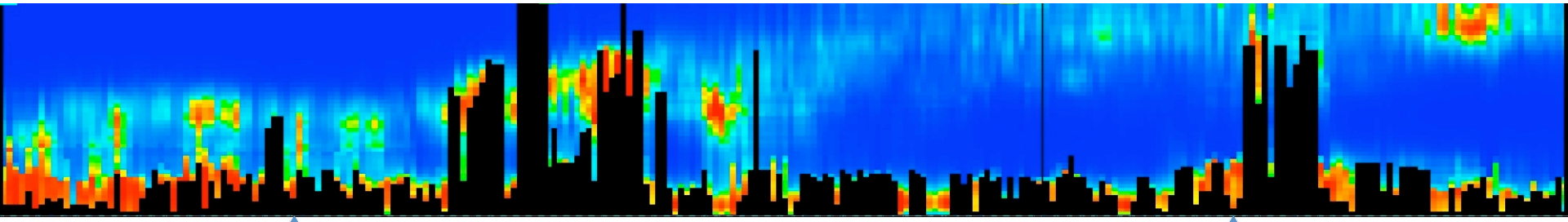
AIRS DR Temperature Vertical Cross-section



New York City Skyline?

InfraRed retrieval above opaque cloud!

AIRS DR Relative Humidity Vertical Cross-section



Alaska

North Pacific

Hawaii

Tropics

50 N

<-----Longitude 155 W----->

10 N

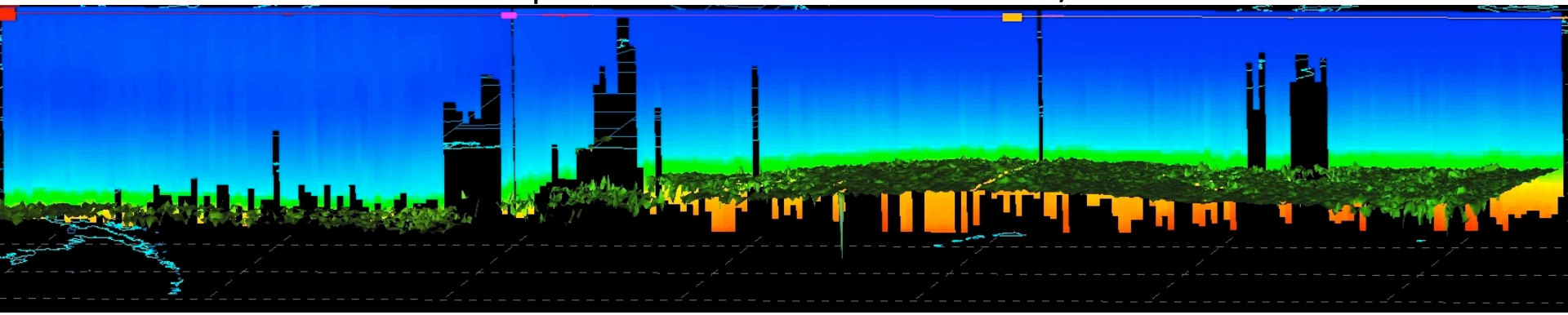
http://cimss.ssec.wisc.edu/imapp/

AIRS.2011.09.09.121-123

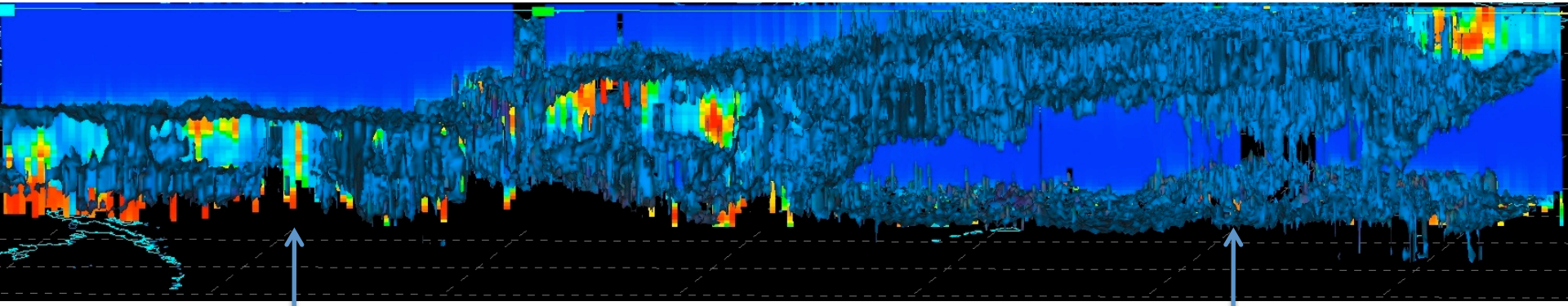
Bill Smith's Dual Regresssion AIRS Retrieval:

McIDAS-V 3-D Visualization. *See Elise for a Demo→*

AIRS DR Temperature Vertical Cross-section w/ 273K isosurface



AIRS DR Relative Humidity Vertical Cross-section w/ 40% RH isosurface



50 N

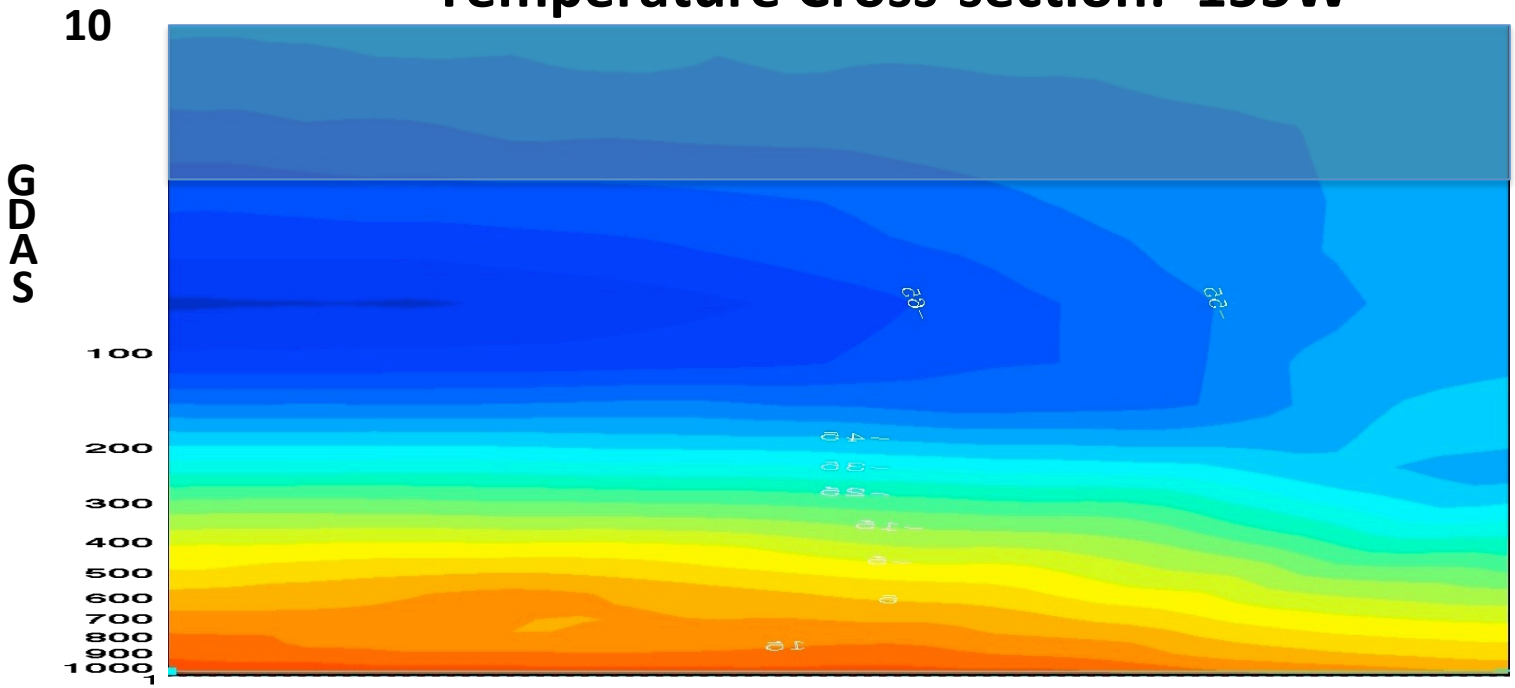
Longitude 155 W

10 N

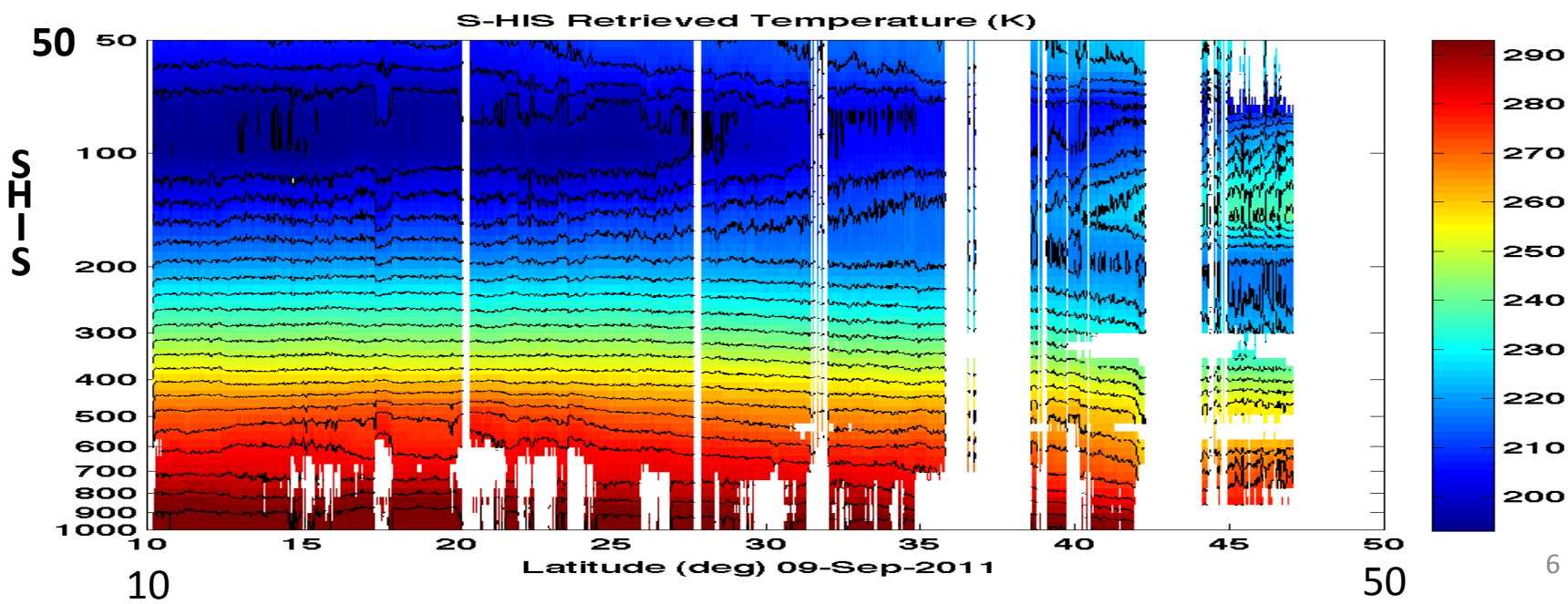
http://www.ssec.wisc.edu/mcidas/software/v/

AIRS.2011.09.09.121-123

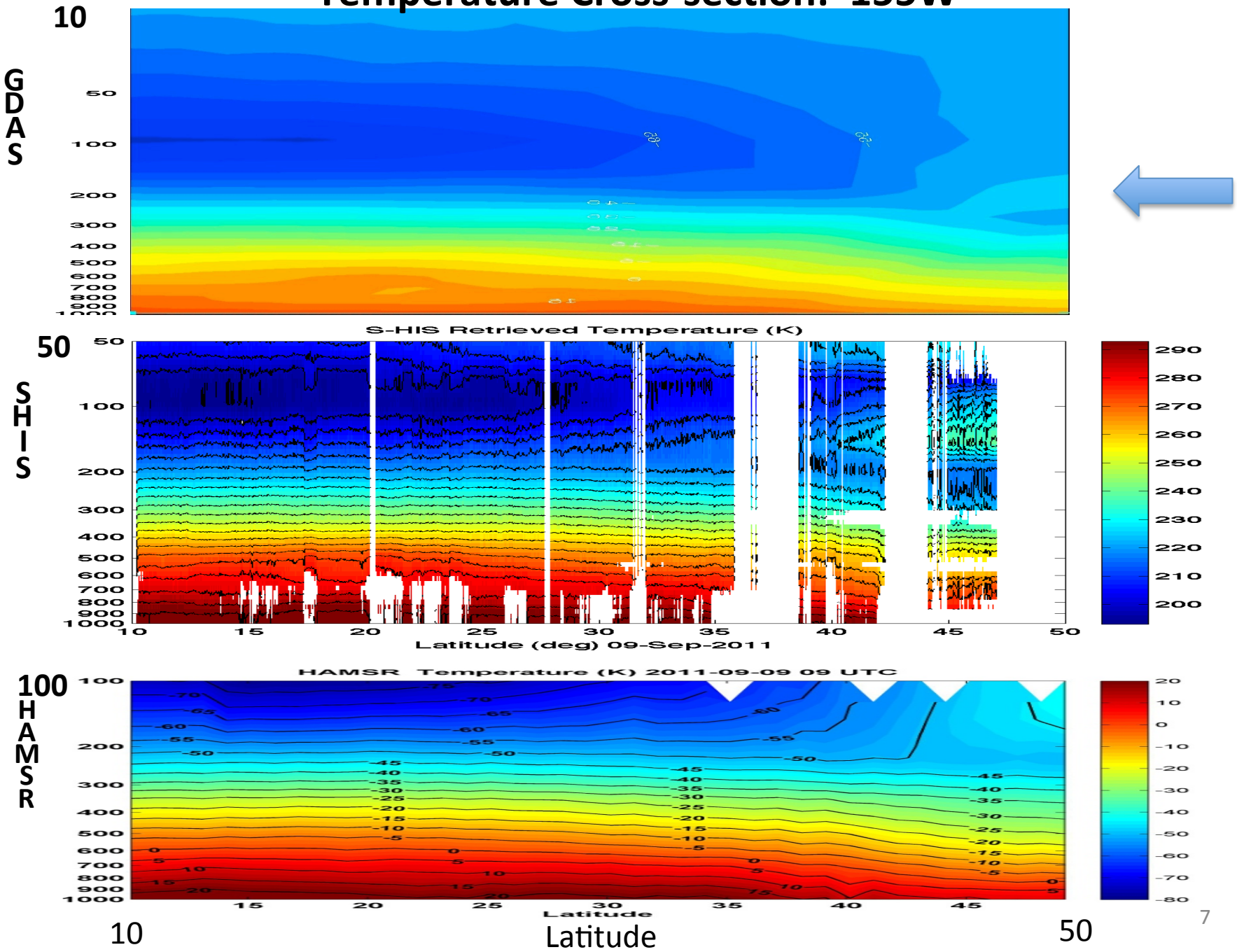
Temperature Cross-section: 155W



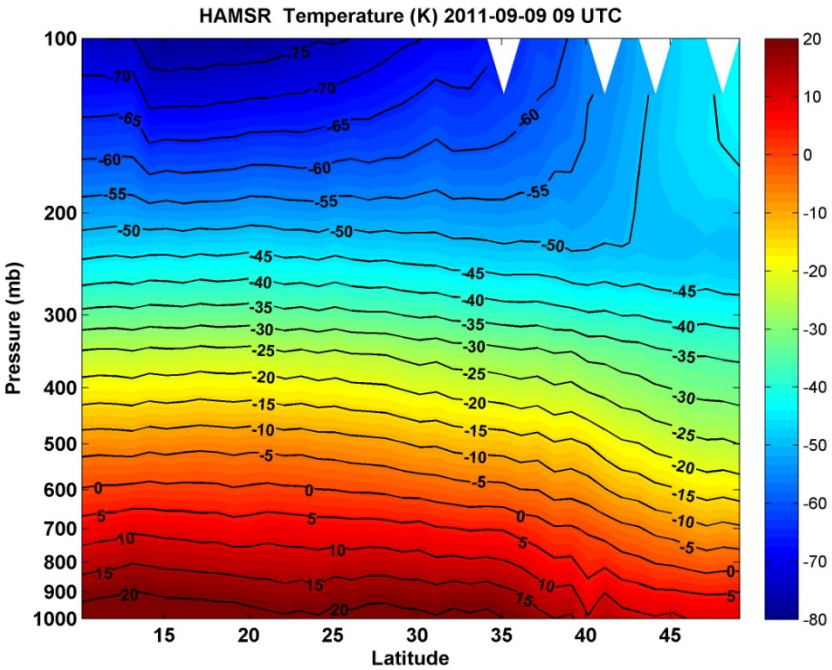
NWP Model



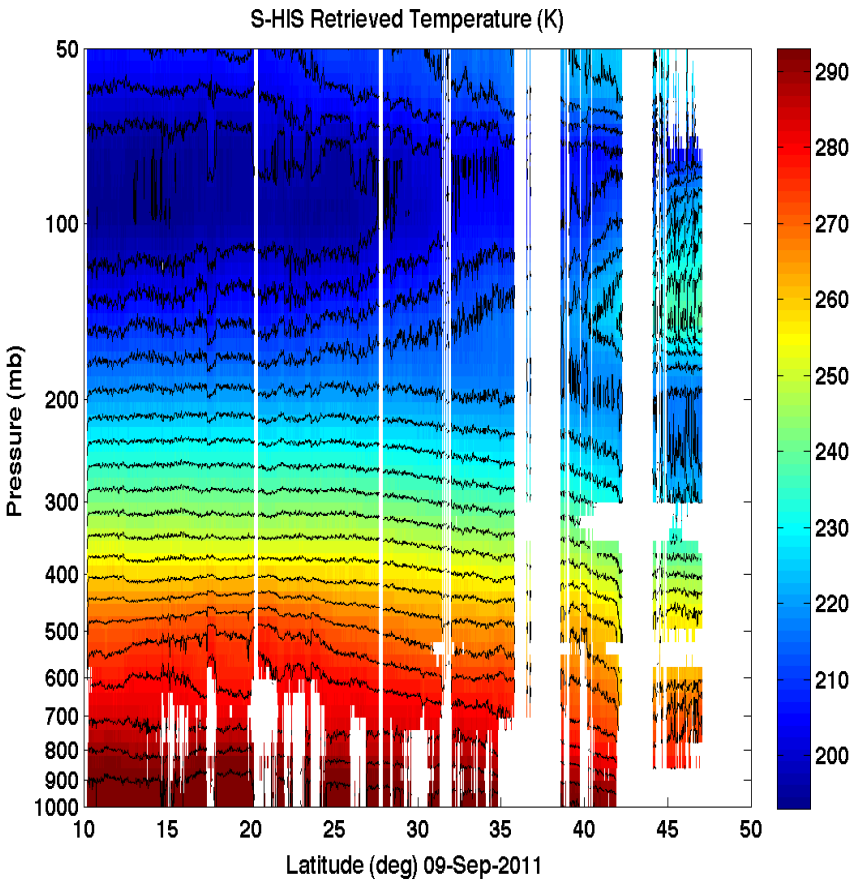
Temperature Cross-section: 155W



HAMSR

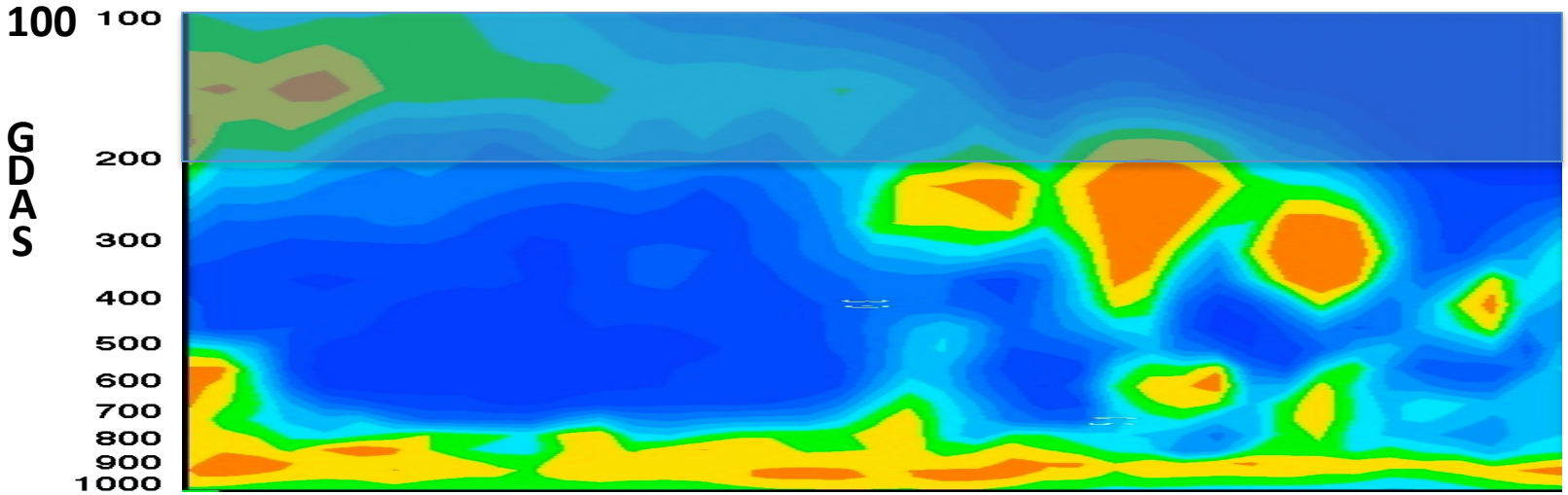


S-HIS

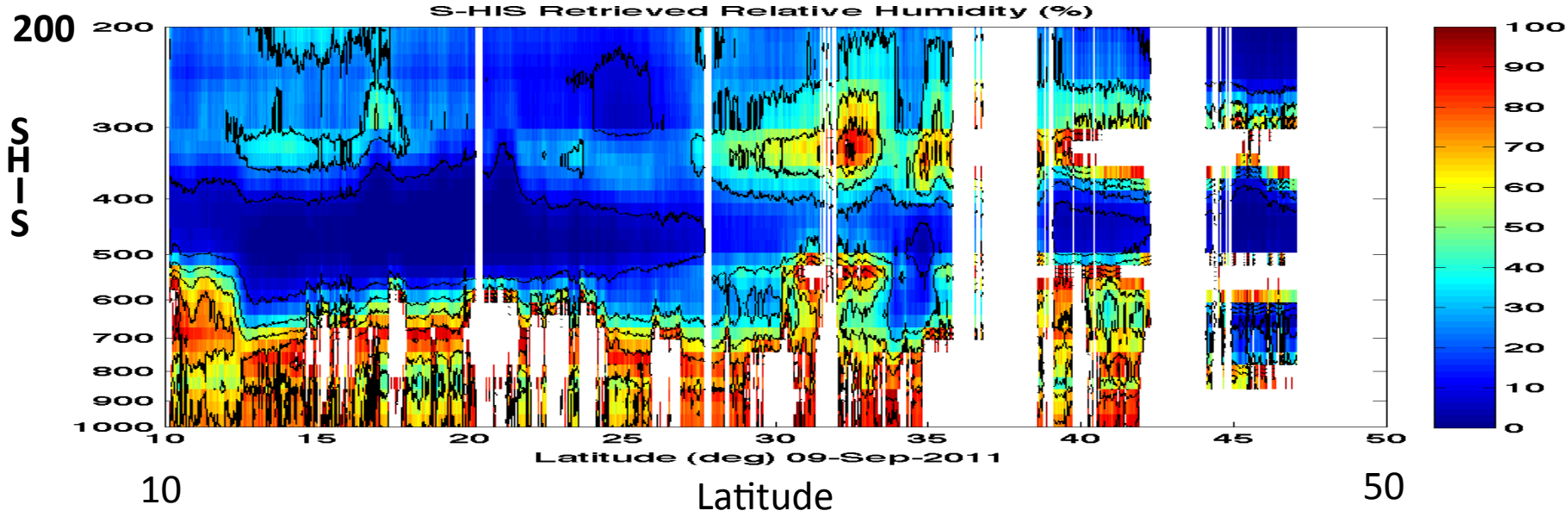


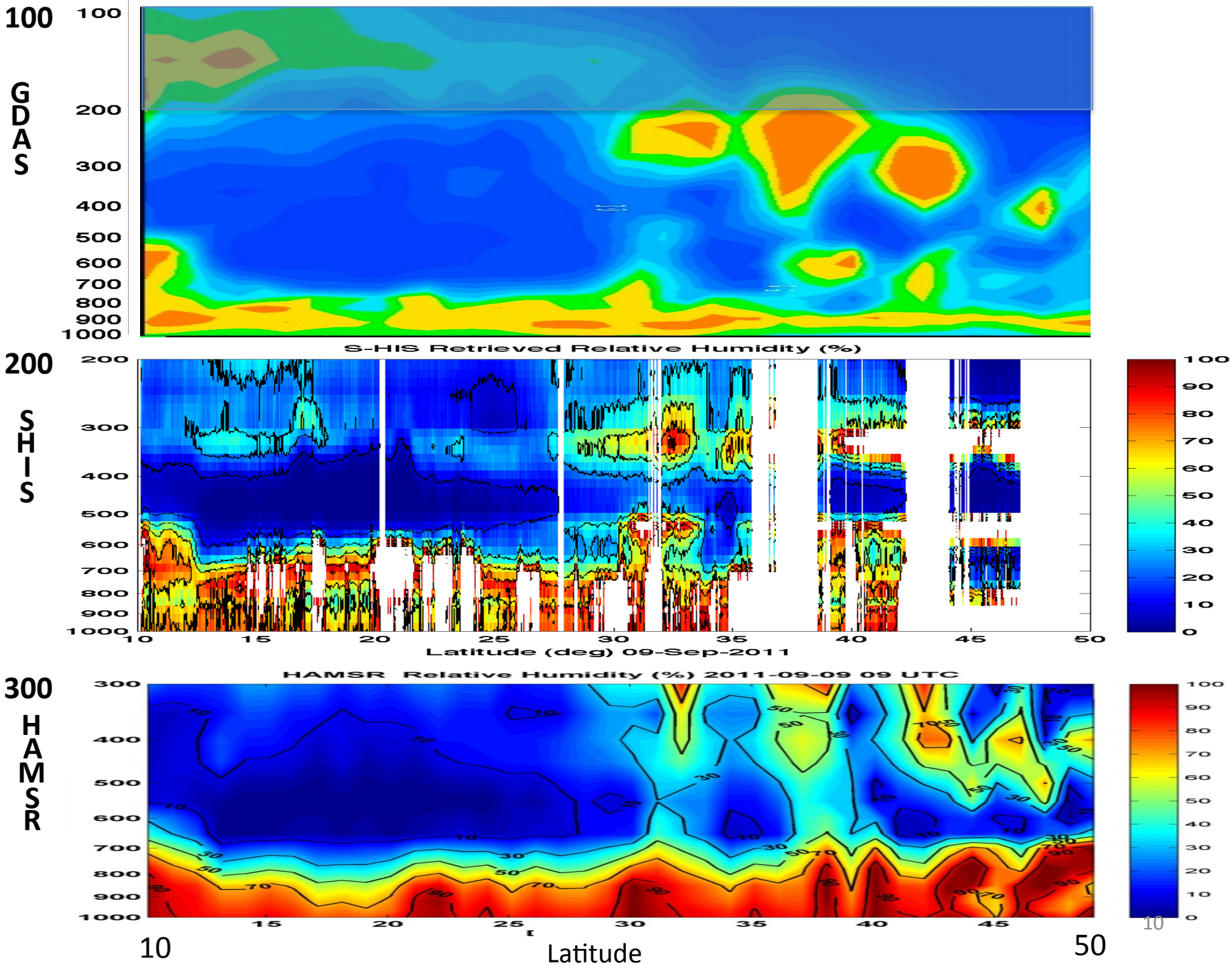
- S-HIS exhibits higher vertical resolution in the upper troposphere
- This may be due to the large number of channels peaking at this altitude.
- S-HIS has an advantage over satellite hyperspectral IR in this regard.

Water Vapor Cross-section: 155W

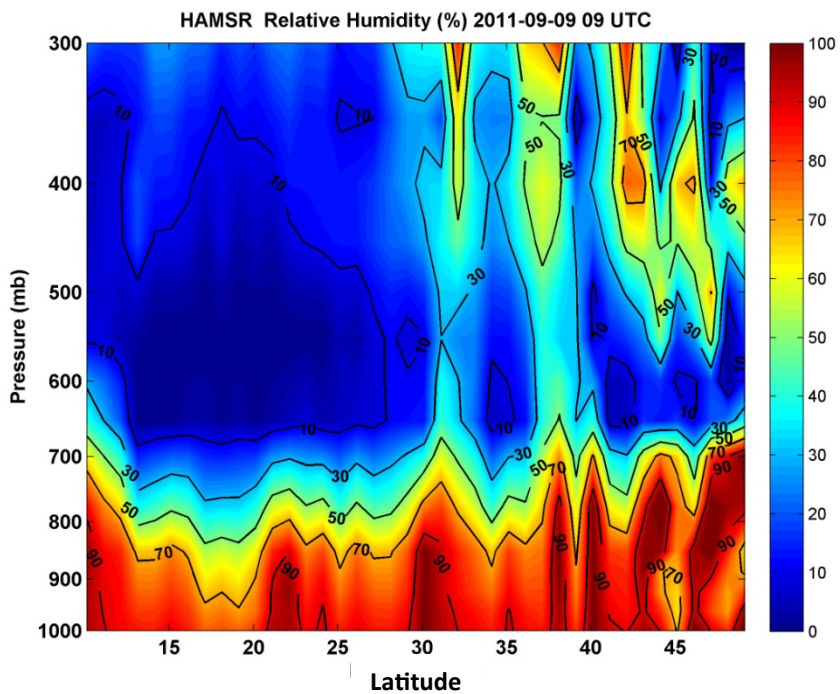


NWP Model

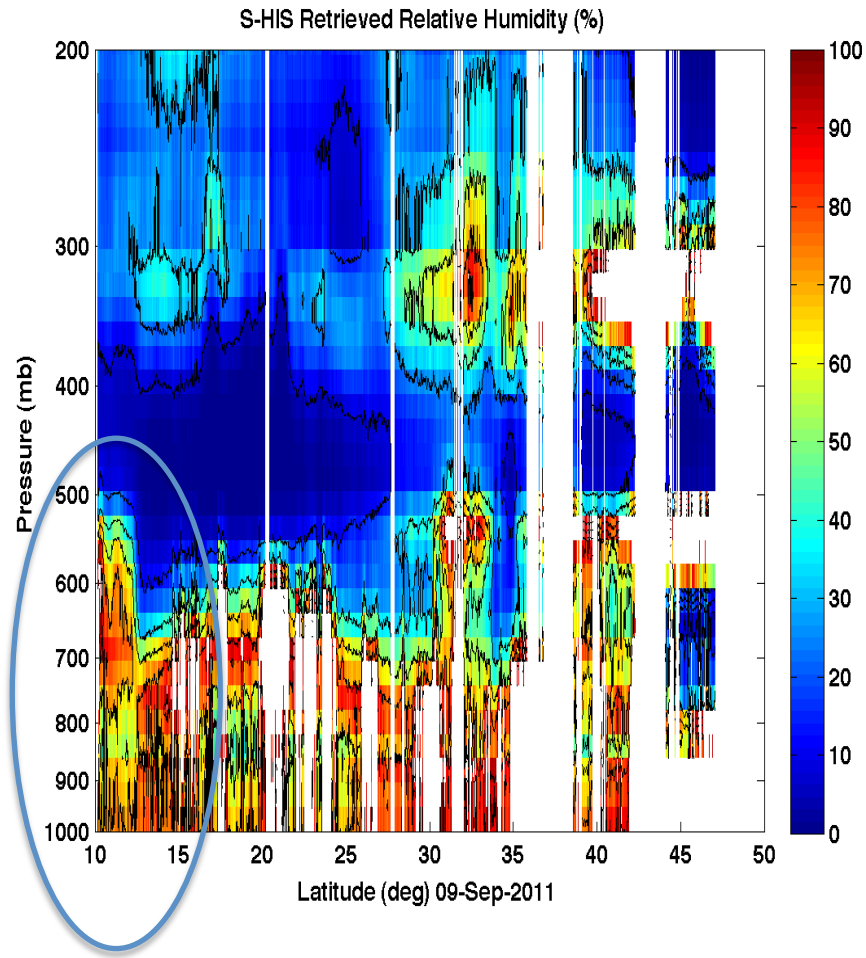



100
GDAS
200
SHIS
300
HAMSR
S-HIS Retrieved Relative Humidity (%)
Latitude (deg) 09-Sep-2011
HAMSR Relative Humidity (%) 2011-09-09 09 UTC
10
Latitude
50

HAMSR

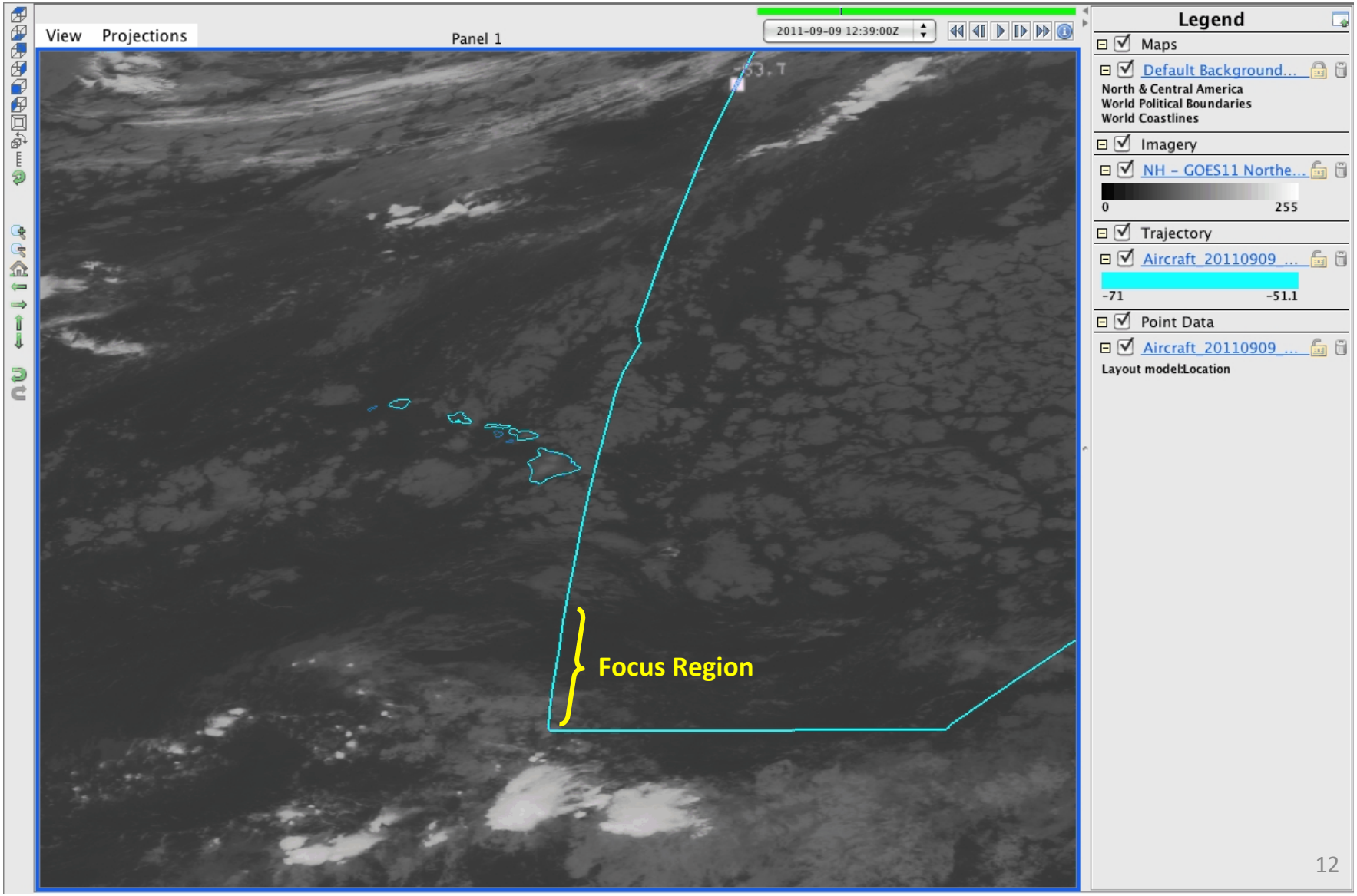


S-HIS



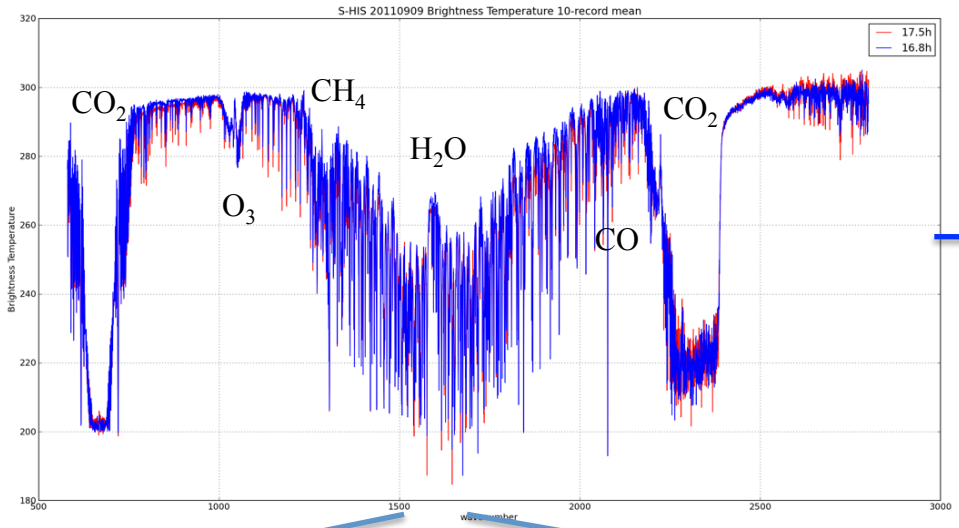
- S-HIS boundary layer top is consistently higher than HAMSR
- This may be a effect of higher vertical resolution in the IR observations.

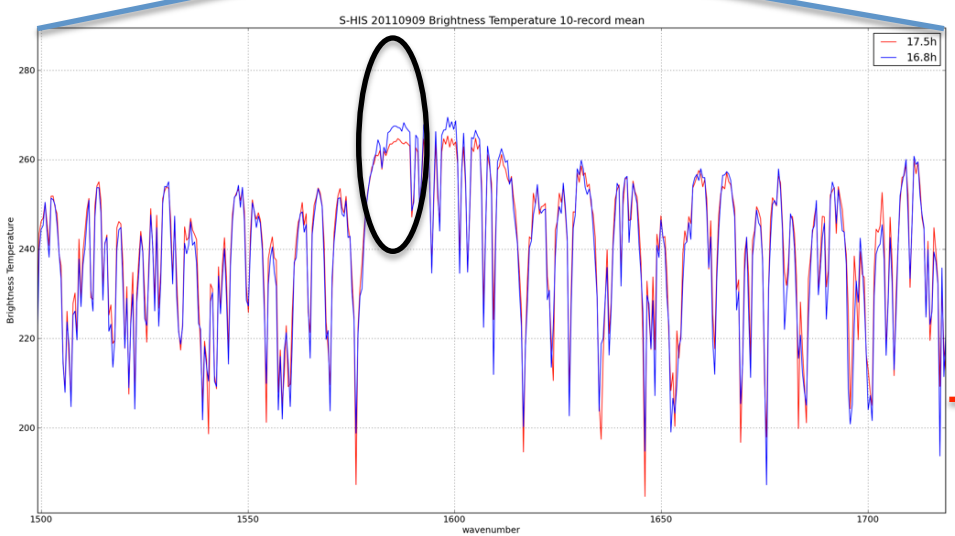
GH Track Animation over GOES 10.5 μm image using McIDAS-V



Scanning-HIS Brightness Temperatures

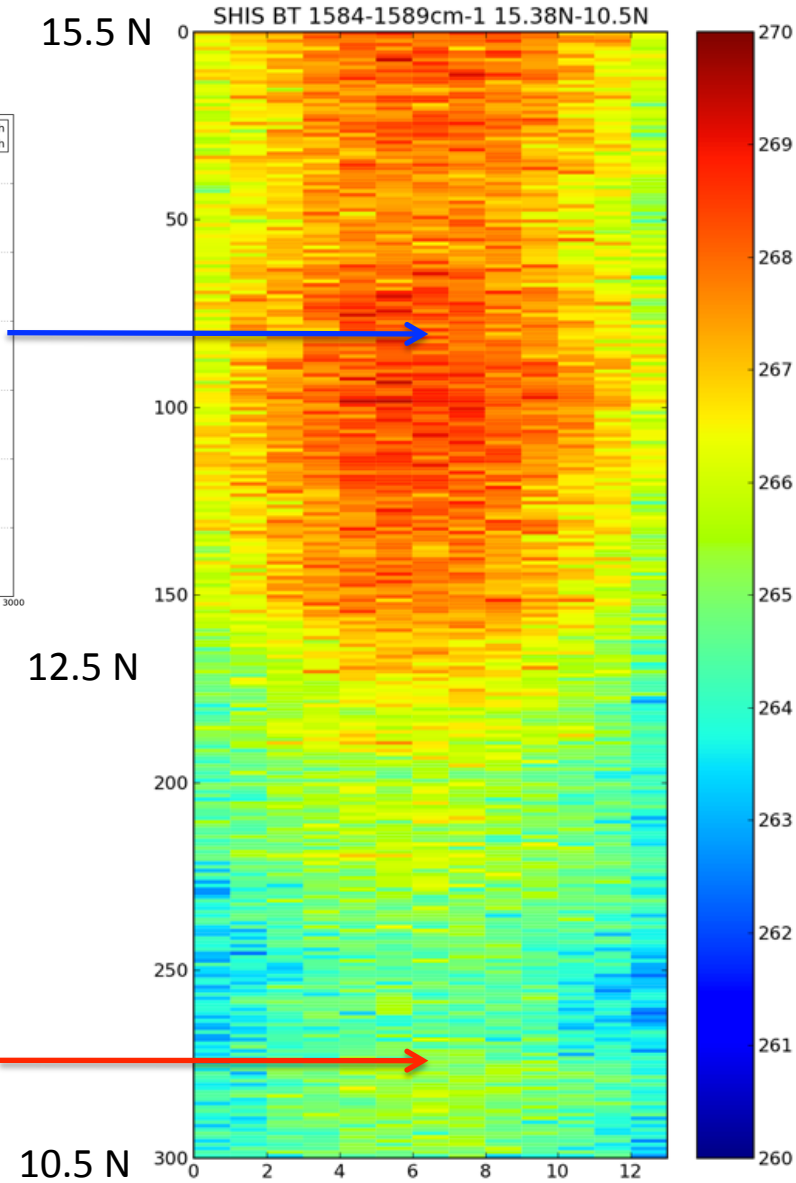
Observed Spectra (9/9/2011)





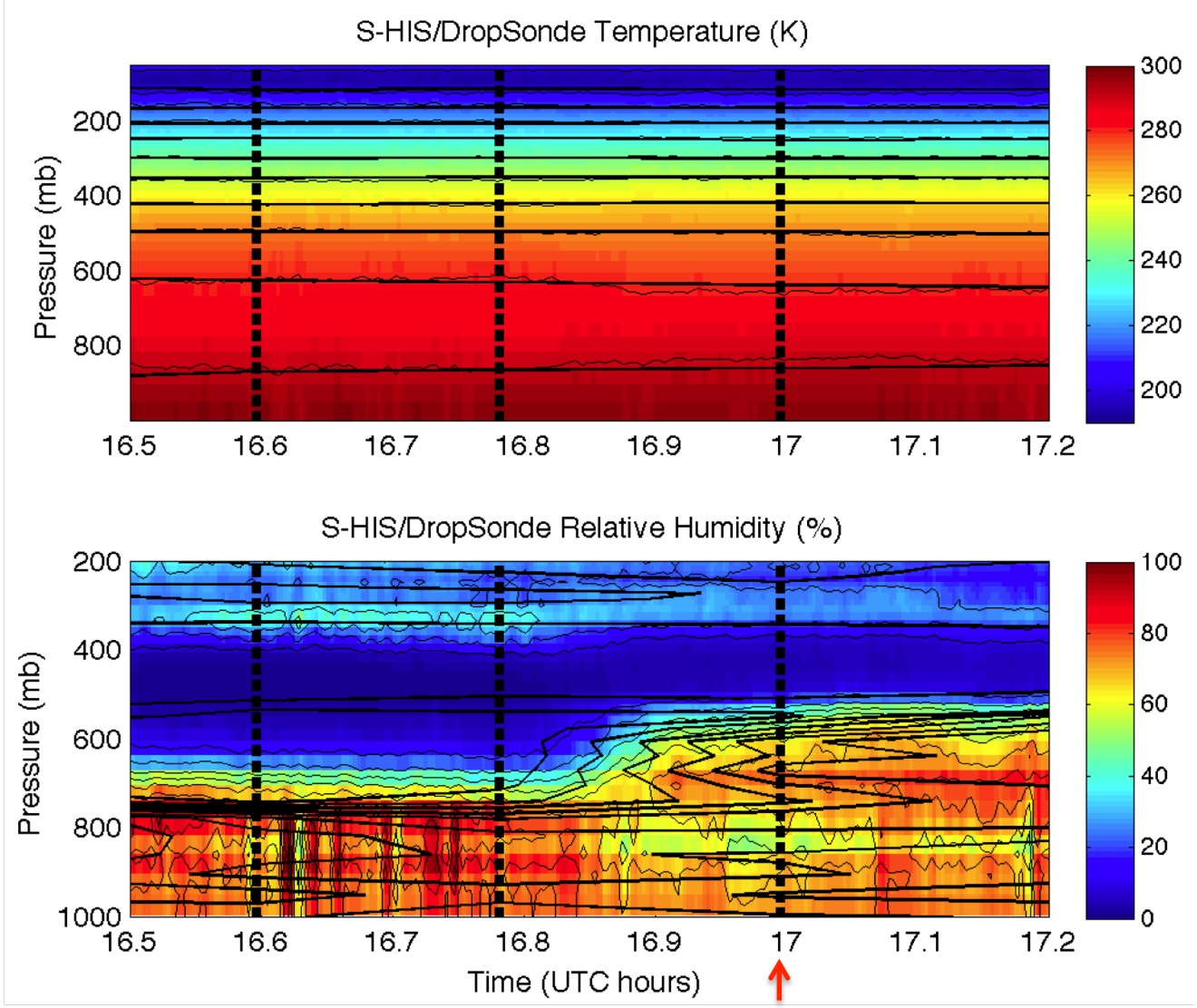
1500 Wavenumber (cm^{-1}) 1700

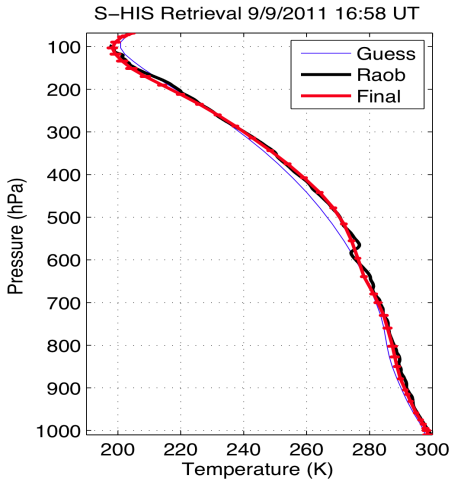
B.T. Map 1584-1589 cm^{-1}

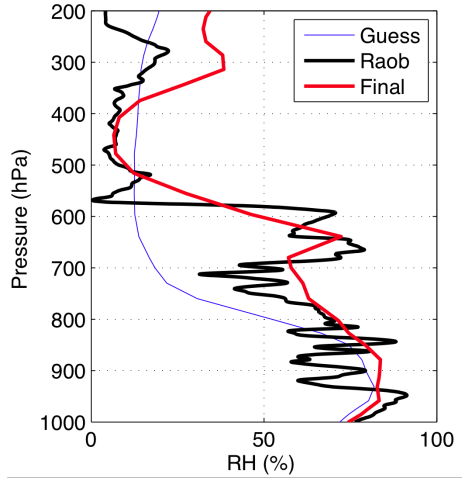


16.3-17.2 UTC 9/9/2011

UW Scanning-HIS T/WV Retrieval Example: 9/9/2011



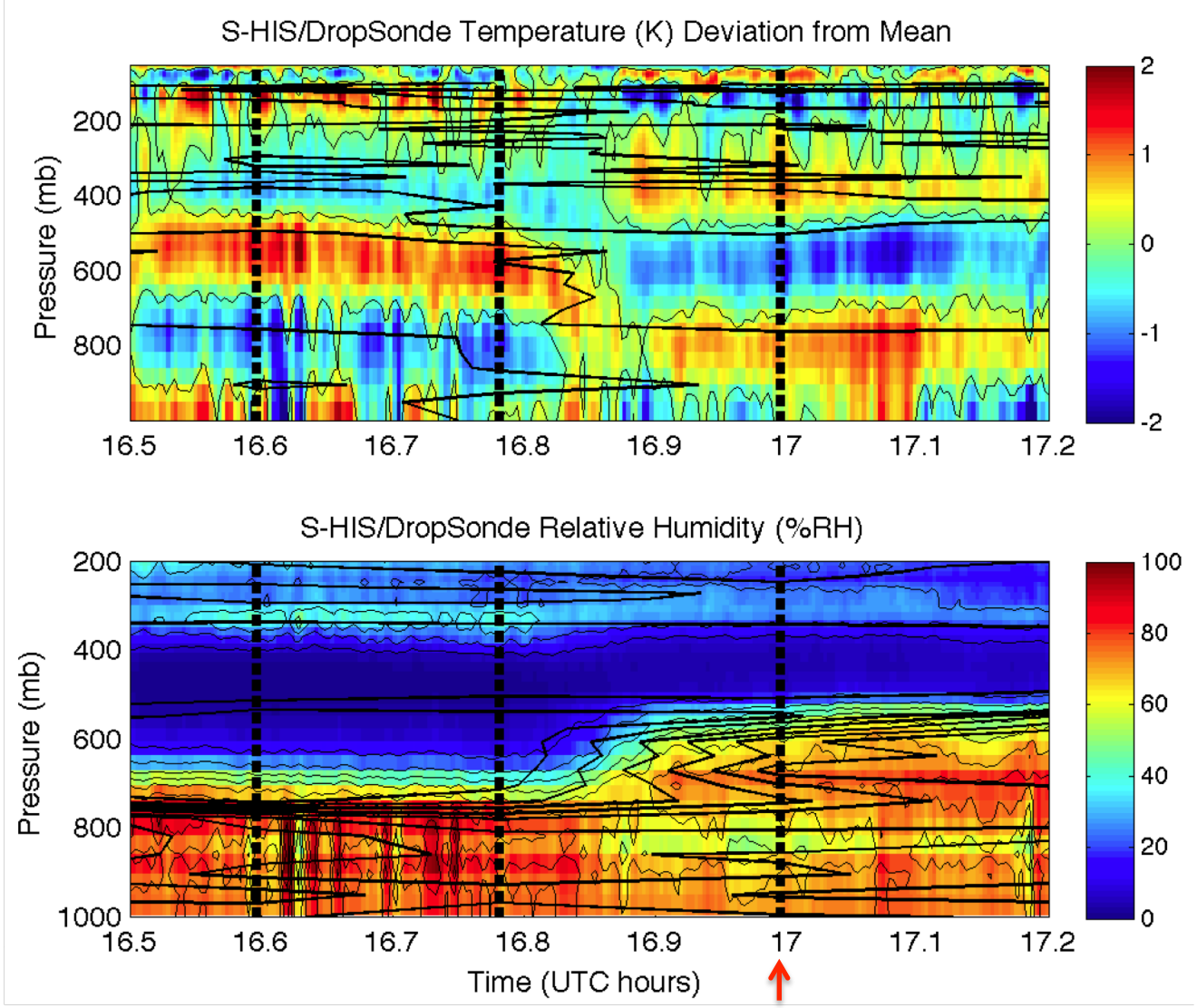


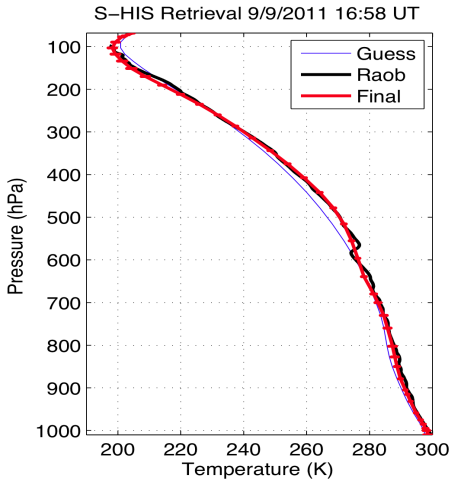


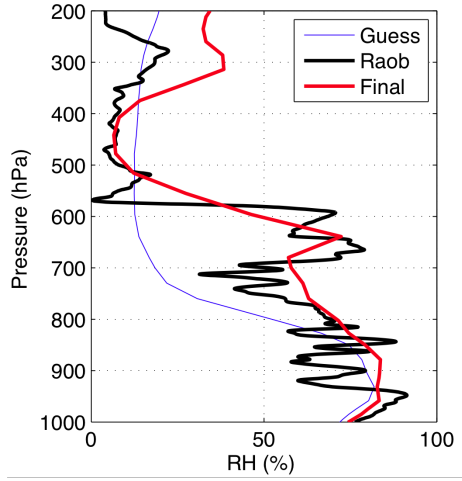
Dropsonde contours (thick lines) on S-HIS cross-section.

NOAA Dropsonde
9/9/2011 16:58 UTC

UW Scanning-HIS Temperature/WV Retrieval Cross-section

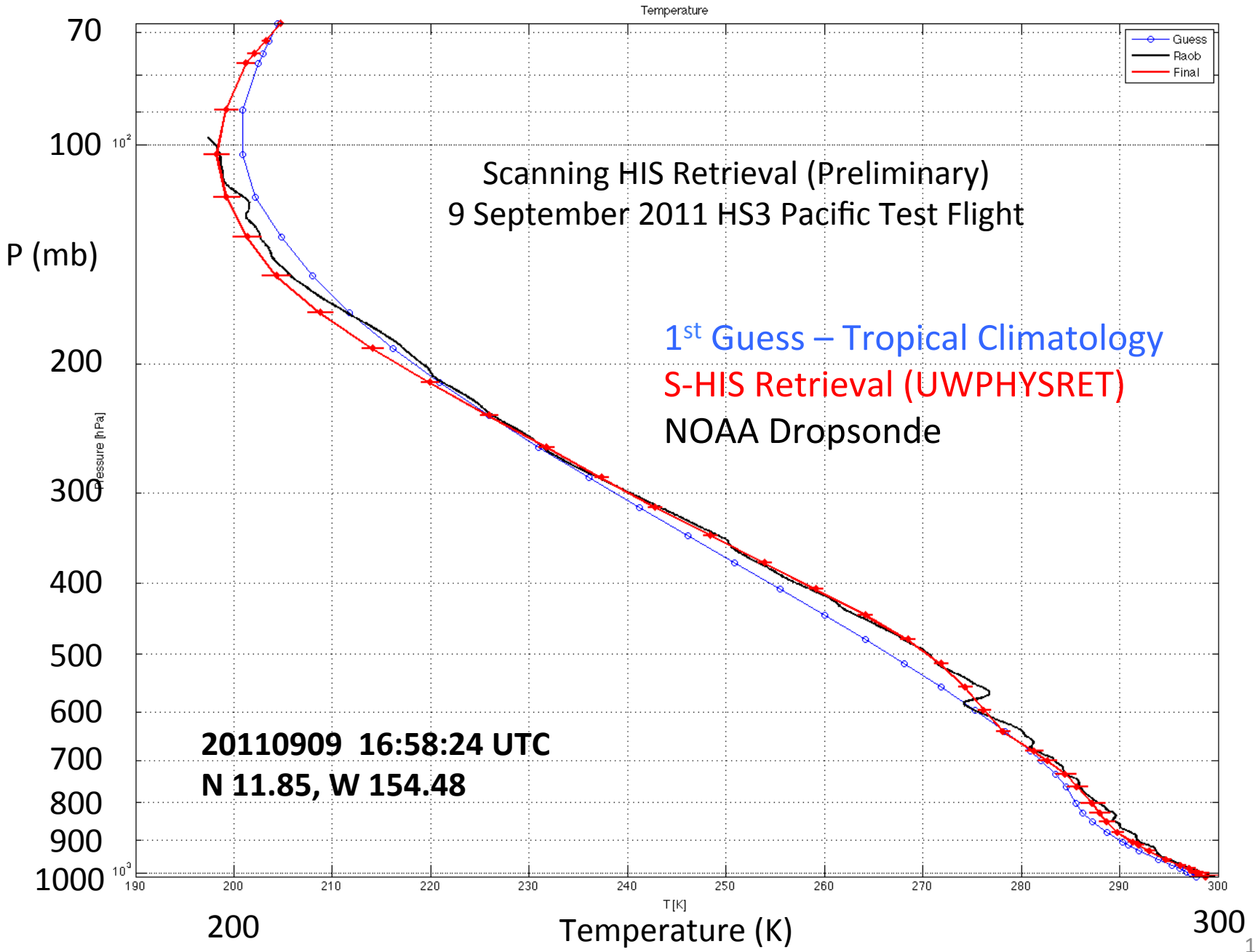


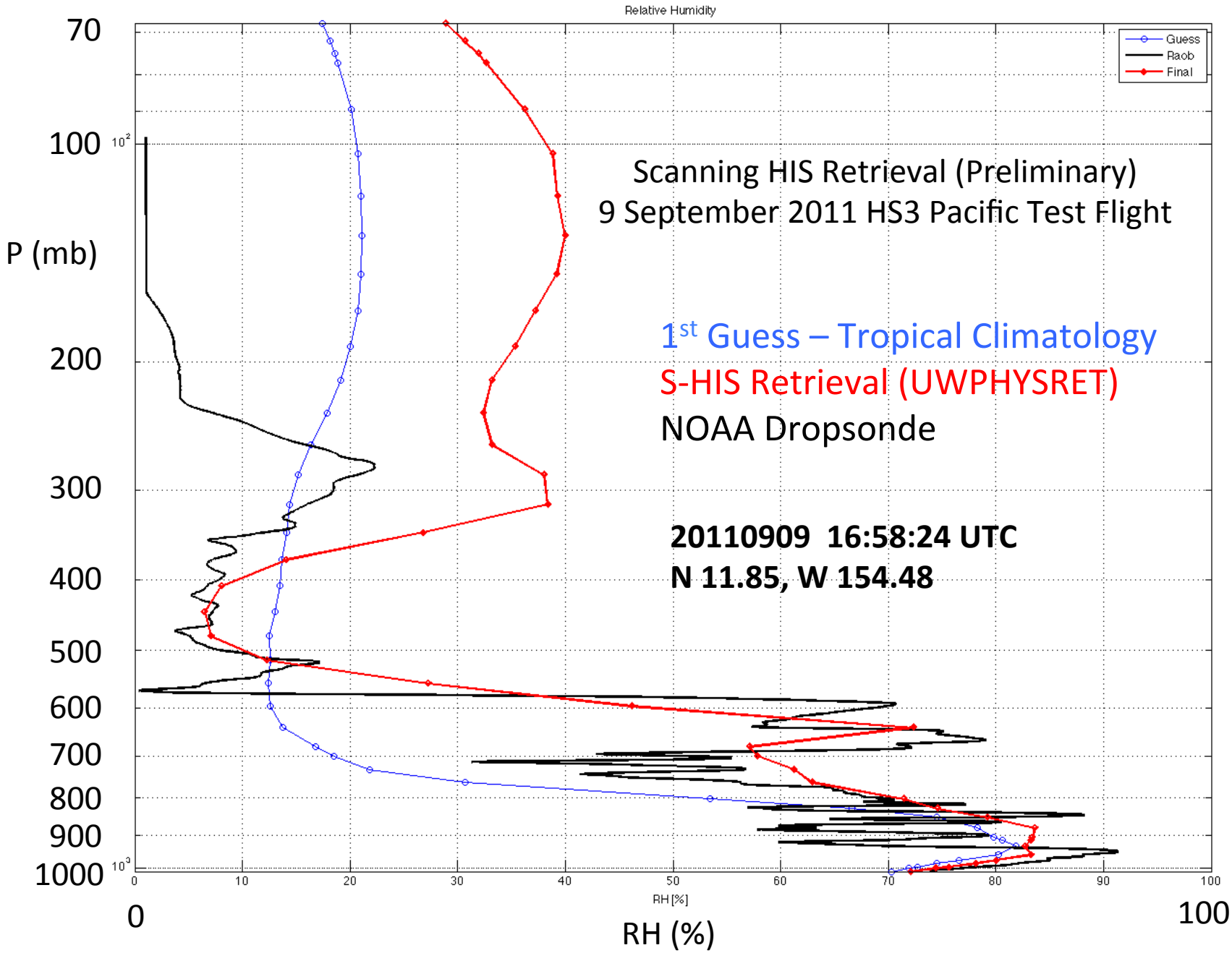


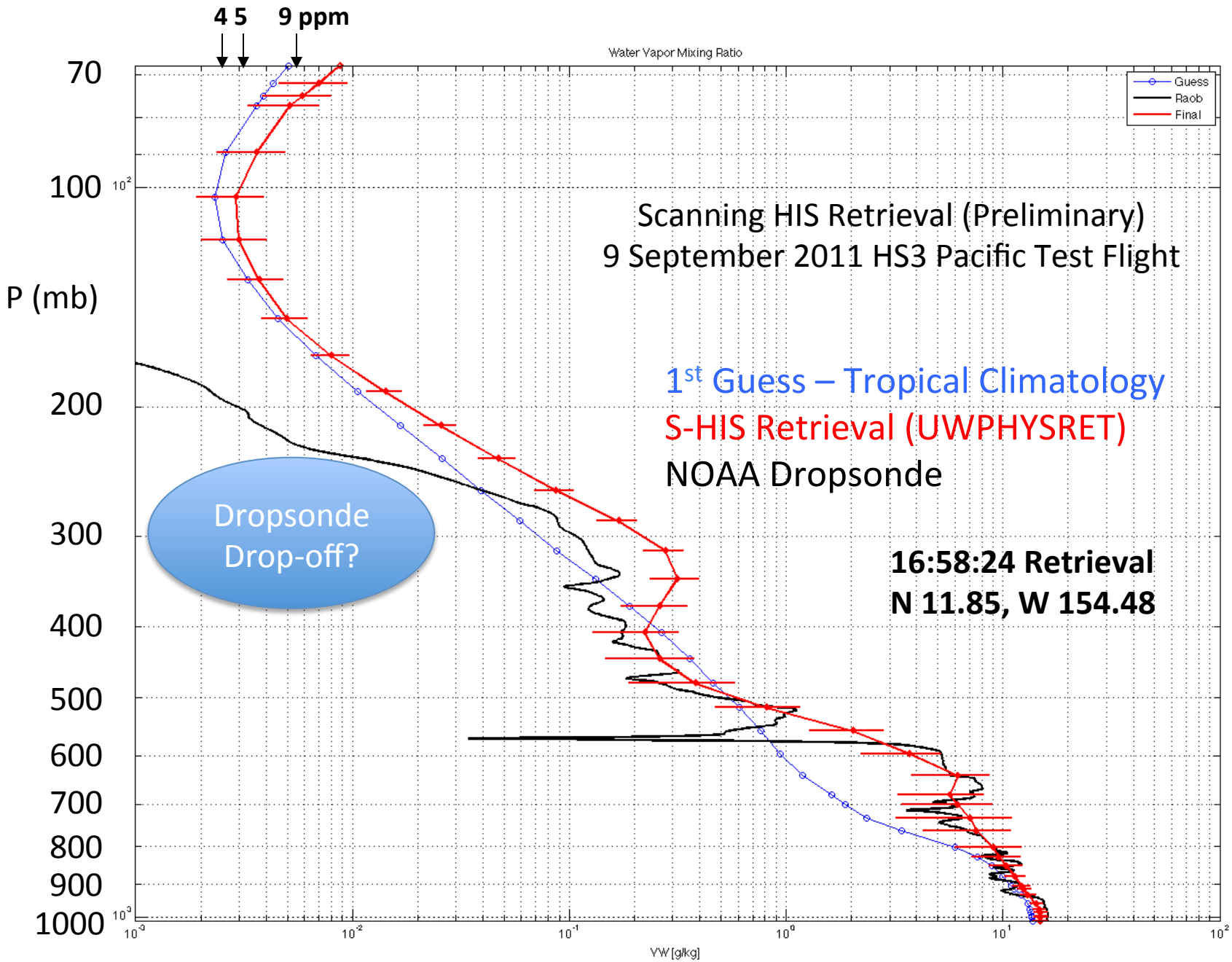


Dropsonde contours (thick lines) on S-HIS cross-section.

NOAA Dropsonde
9/9/2011 16:58 UTC


Temperature
Guess
Raob
Final
Scanning HIS Retrieval (Preliminary)
9 September 2011 HS3 Pacific Test Flight
1st Guess – Tropical Climatology
S-HIS Retrieval (UWPHYSRET)
NOAA Dropsonde
20110909 16:58:24 UTC
N 11.85, W 154.48
P (mb)
70
100
200
300
400
500
600
700
800
900
1000
Pressure [hPa]
190
200
210
220
230
240
250
260
270
280
290
300
T [K]
200
Temperature (K)
300


Relative Humidity
Guess
Raob
Final
Scanning HIS Retrieval (Preliminary)
9 September 2011 HS3 Pacific Test Flight
1st Guess – Tropical Climatology
S-HIS Retrieval (UWPHYSRET)
NOAA Dropsonde
20110909 16:58:24 UTC
N 11.85, W 154.48
P (mb)
70
100
200
300
400
500
600
700
800
900
1000
0
10
20
30
40
50
60
70
80
90
100
RH [%]
RH (%)


4 5
9 ppm
Water Vapor Mixing Ratio
Guess
Raob
Final
Scanning HIS Retrieval (Preliminary)
9 September 2011 HS3 Pacific Test Flight
1st Guess – Tropical Climatology
S-HIS Retrieval (UWPHYSRET)
NOAA Dropsonde
Dropsonde Drop-off?
16:58:24 Retrieval
N 11.85, W 154.48
P (mb)
70
100
200
300
400
500
600
700
800
900
1000
VW [g/kg]
Mixing Ratio (g/kg)

S-HIS Retrieval Conclusions

- The inherent vertical resolution of observations need to be taken into account when comparing data and models.
- S-HIS IR has higher vertical resolution than HAMSR microwave but HAMSR has continuous profiling through cloudy regions.
- Drop-sonde absolute humidity measurements above 400 mb may have a *dry bias. (Hank and Gary Wick have discussed this)*.
- See Elise for a demo of 3-D satellite IR retrievals by Bill Smith including a case study of Hurricane Ioke. Exciting new possibilities using NPP CrIS, ATMS, and VIIRS.

The best way to exchange HS3 data would be for investigators to submit the 2011 flight data to the ESPO data archive. We are now in the 6-9 month period and ready to submit products.