Validation and Comparison of S-HIS and NAST-I Retrievals for THORPEX 2003

CIMSS/SSEC, UW-Madison

NASA Langley Research Center

Presented by

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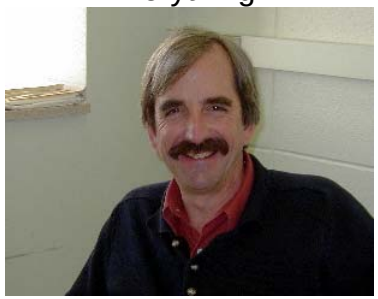
Who's Doing What ?

Not shown: Robert Holz (UW), Allen Larar (LaRC)

Everything



Miscellaneous

Data Processing

Land surface

Cloud properties

Everything

Data Processing

Data Processing

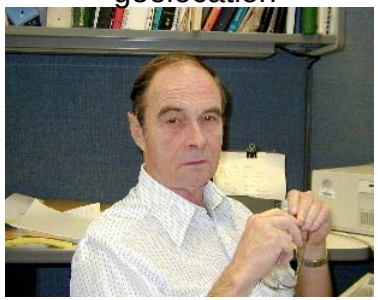
Clouds

Retrievals

Retrievals

MODIS/MAS comparisons

geolocation



DB/IMAPP

PNF/Retrieval

Miscellaneous

Everything

Miscellaneous

Retrievals

and of course ...

2003 Pacific THORPEX Observing System Test

- The 2003 Pacific THORPEX Observing System Test is the first in a series of Pacific and Atlantic observation campaigns in support of the THORPEX Program.
- THORPEX - a Global Atmospheric Research Program, is a 10 year international research program under the auspices of the World Meteorological Organization/World Weather Research Program (WMO/WWRP) to accelerate improvements in weather predictions and the societal value of advanced forecast products.
- THORPEX will examine predictability and observing system issues, and establish the potential to produce significant statistically-verifiable improvements in forecasts of high impact weather.

http://www-angler.larc.nasa.gov/thorpex/

Questions we are trying to answer

- What are we able to retrieve, in terms of vertical and horizontal resolution, from S-HIS observations?
- How do the S-HIS observing capabilities compare to those of the other instruments involved in the experiments?

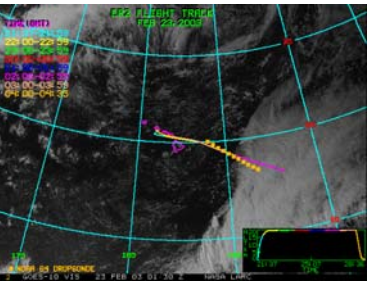
• How do we make the FTS data available for NWP model assimilation?

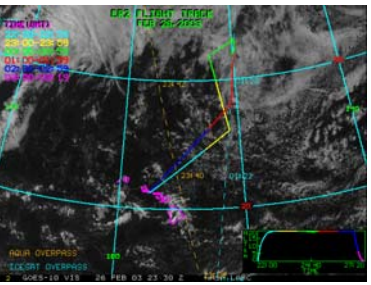
• Which impact do the FTS data have on model analysis and forecast?

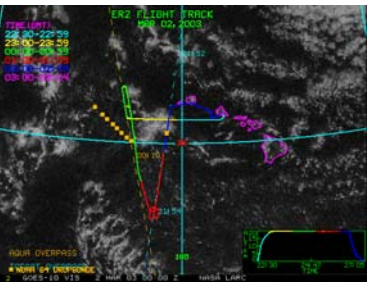
Platforms & Instruments

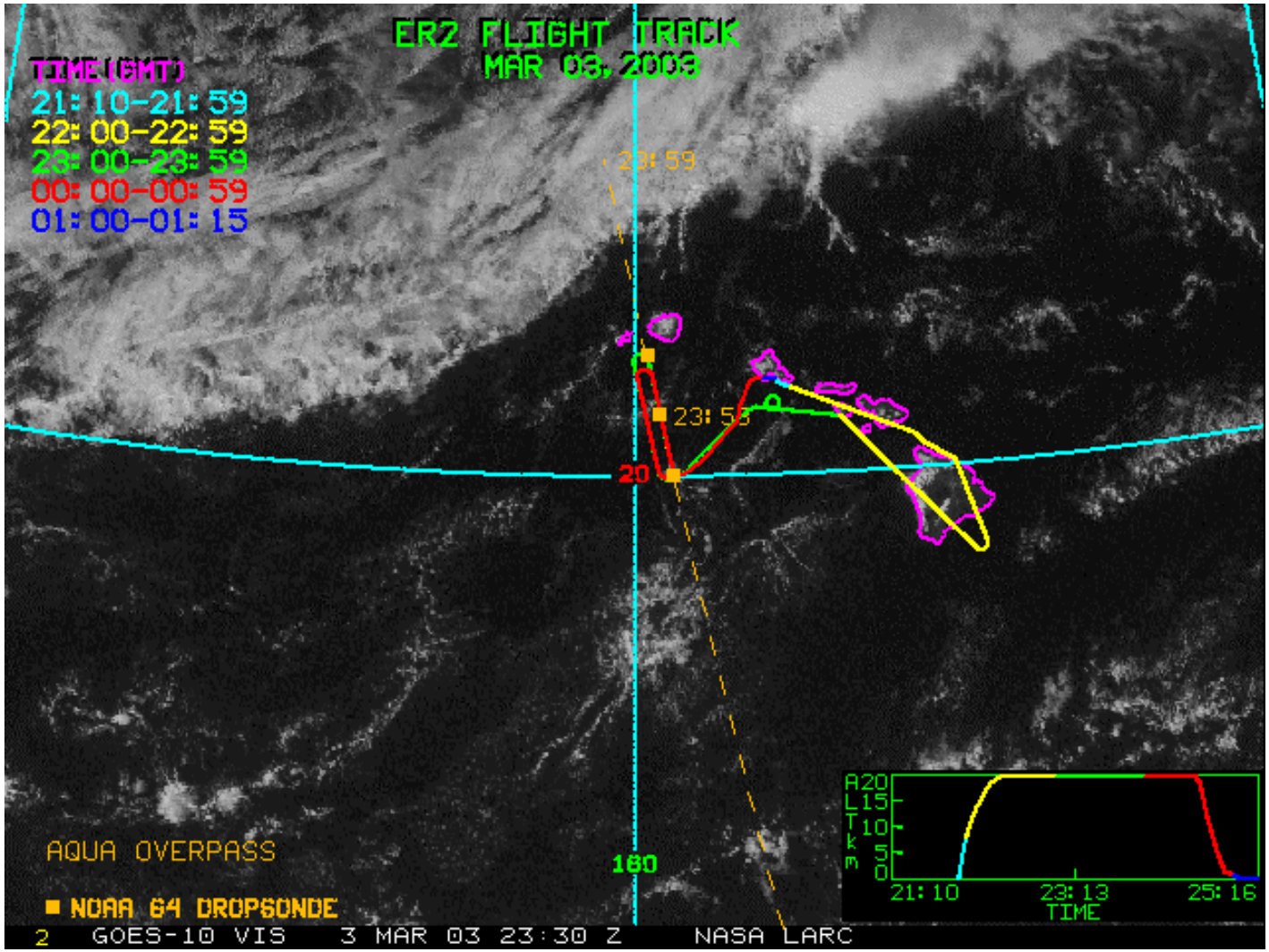
- ER-2 (cruise altitude: 20 km), its instruments are above 94% of the earth's atmosphere
  - NAST-I (FTS, 3.7-16 microns @ .25 cm^{-1})
  - S-HIS (FTS, 3.3-18 microns @ .5 cm^{-1})
  - CPL (Lidar, 1064 nm, 532 nm, and 355 nm)
  - MAS (Vis and IR @ 50 m res)
- G4 (cruise altitude:13 km)
  - Dropsondes

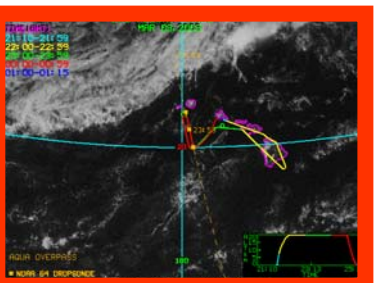
Flights

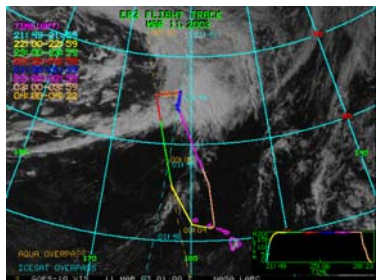


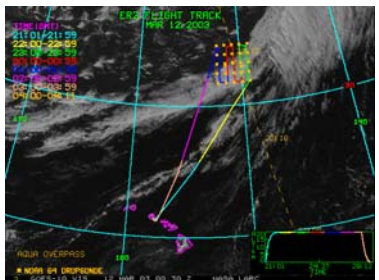


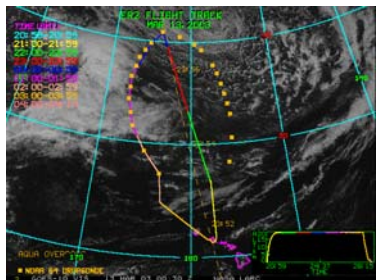


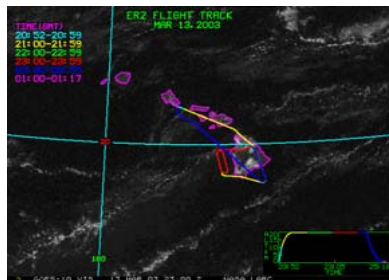

ER2 FLIGHT TRACK
MAR 03, 2003
TIME(GMT)
21:10-21:59
22:00-22:59
23:00-23:59
00:00-00:59
01:00-01:15
23:59
23:53
20
AQUA OVERPASS
180
NOAA 64 DROPSONDE
A20
L15
T10
k5
m0
21:10
23:13
25:16
TIME
2 GOES-10 VIS 3 MAR 03 23:30 Z NASA LARC



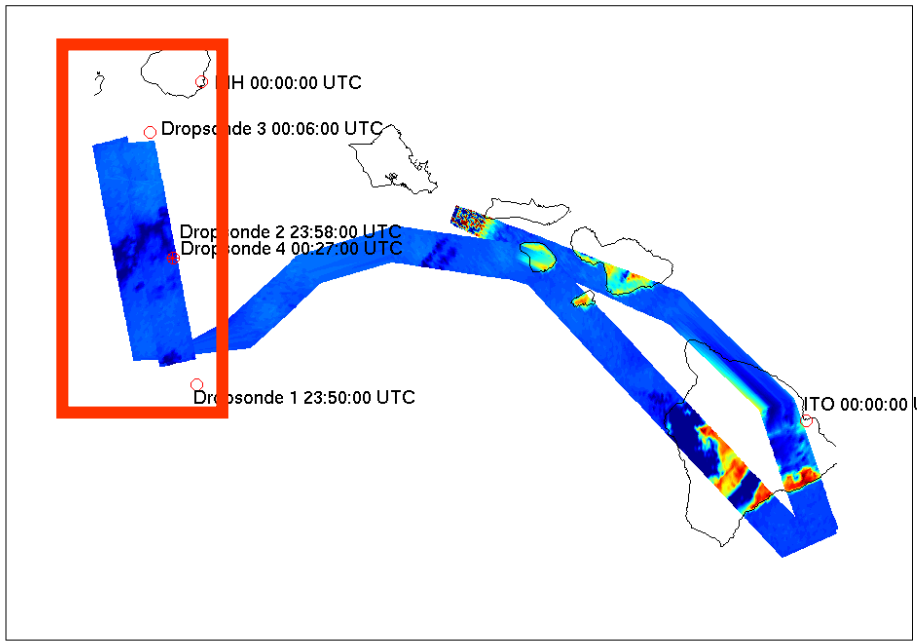


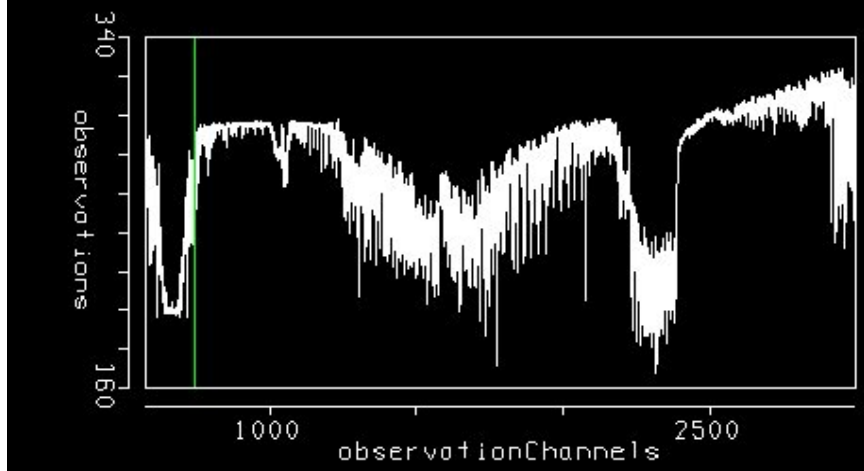




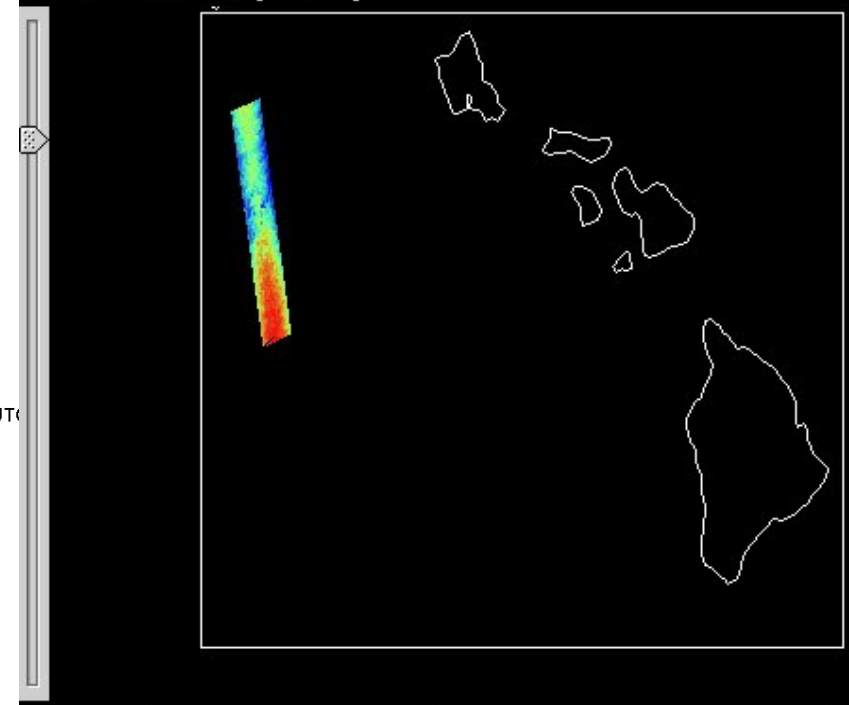


Case Study
03 March 2003





Channel: 744.50 [cm^-1]



Set Color Range | Get linear combinations

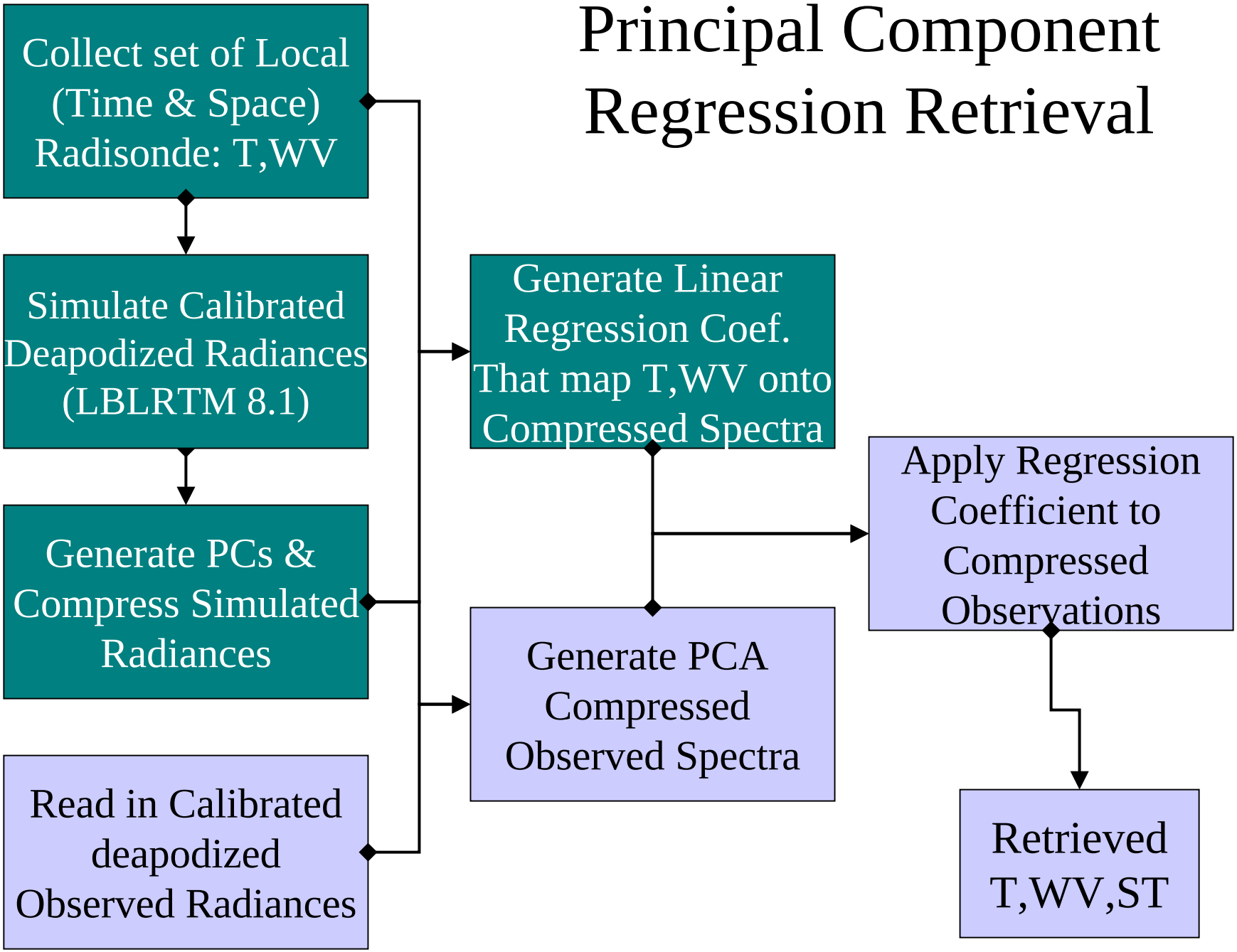
Instrument:

Lat = 21.18 Lon = -157.51

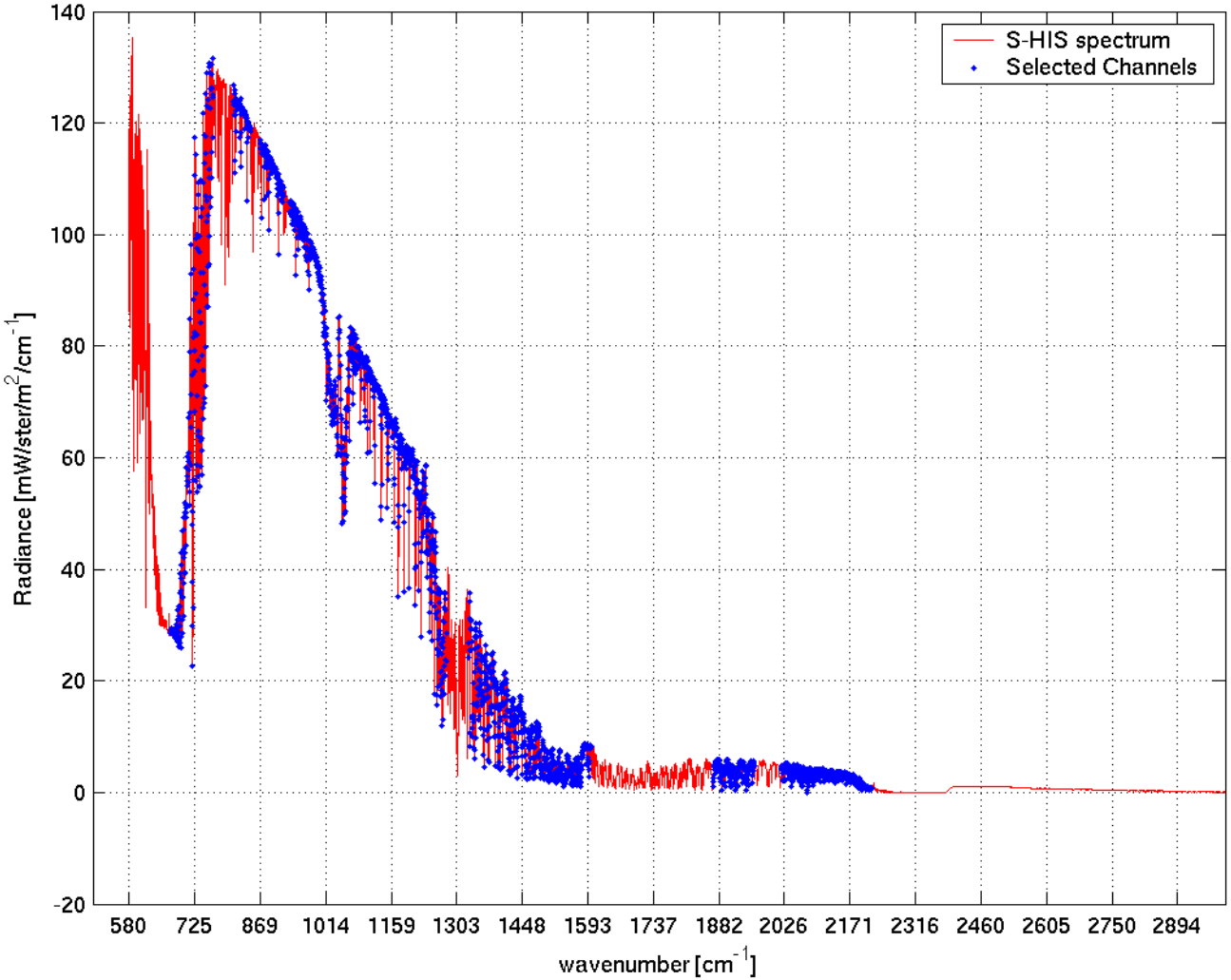
Time = 725.00 [offset (s)]

FOV angle = -30.42 [degrees]

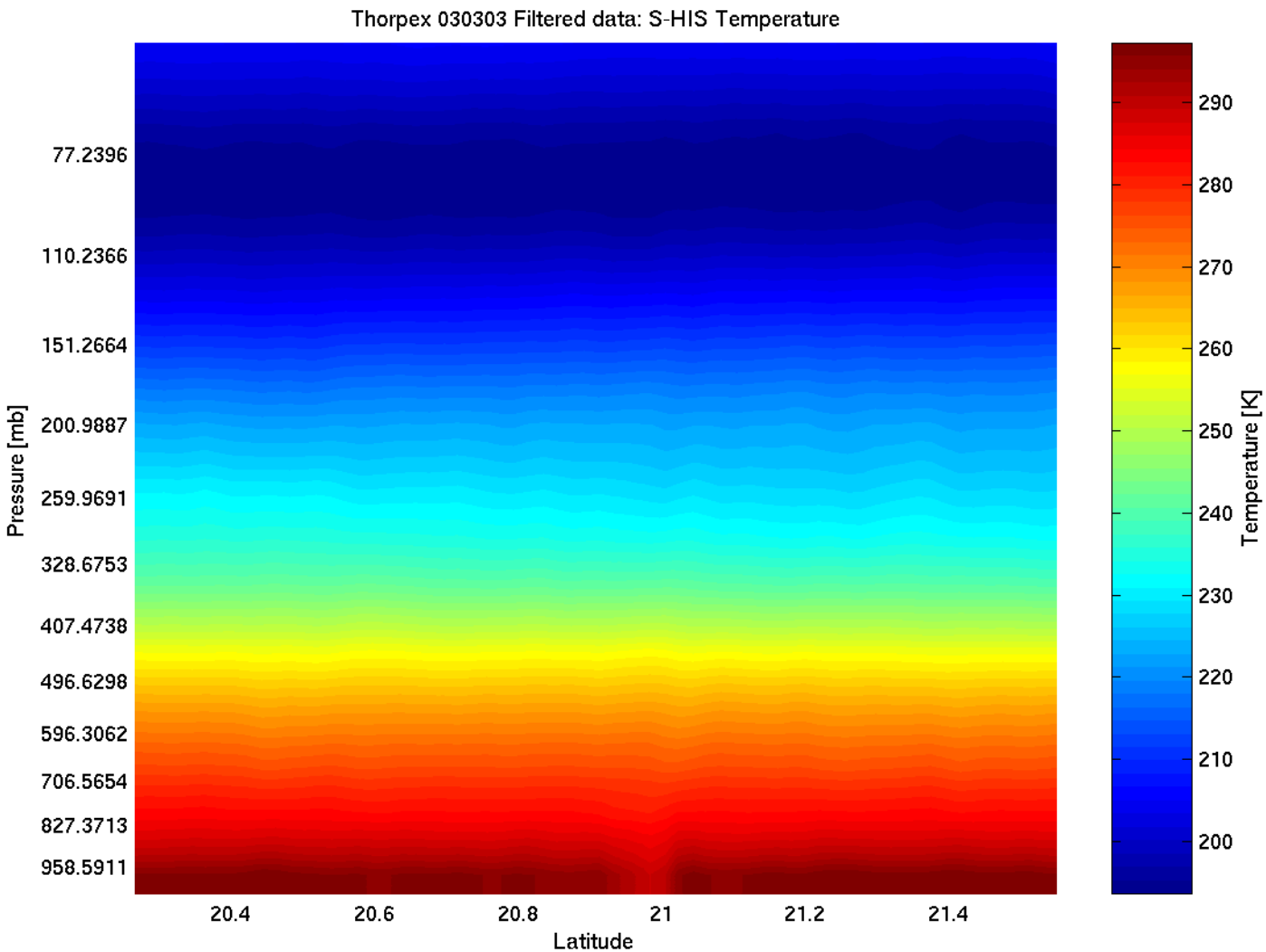
Principal Component Regression Retrieval



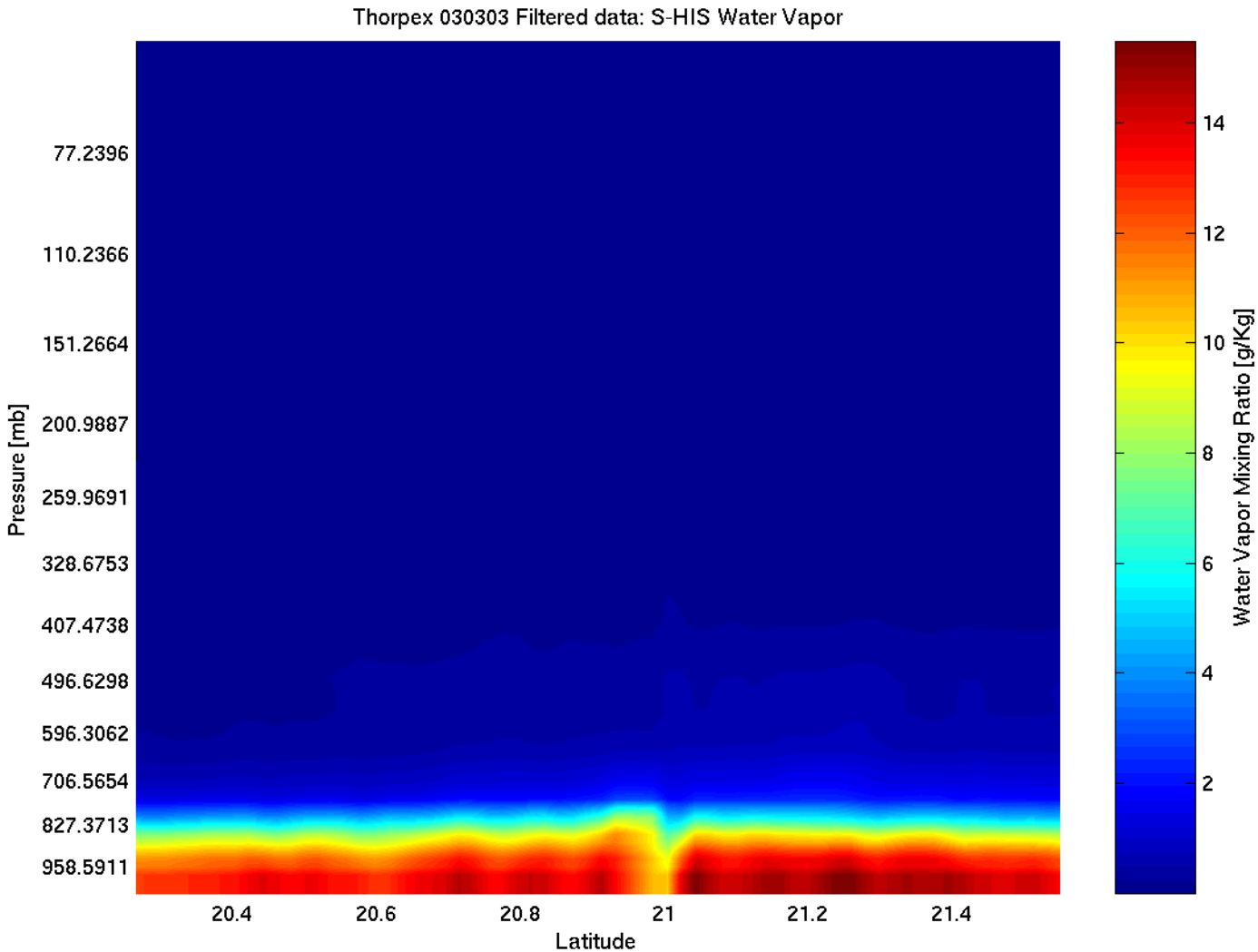
Selected Channels



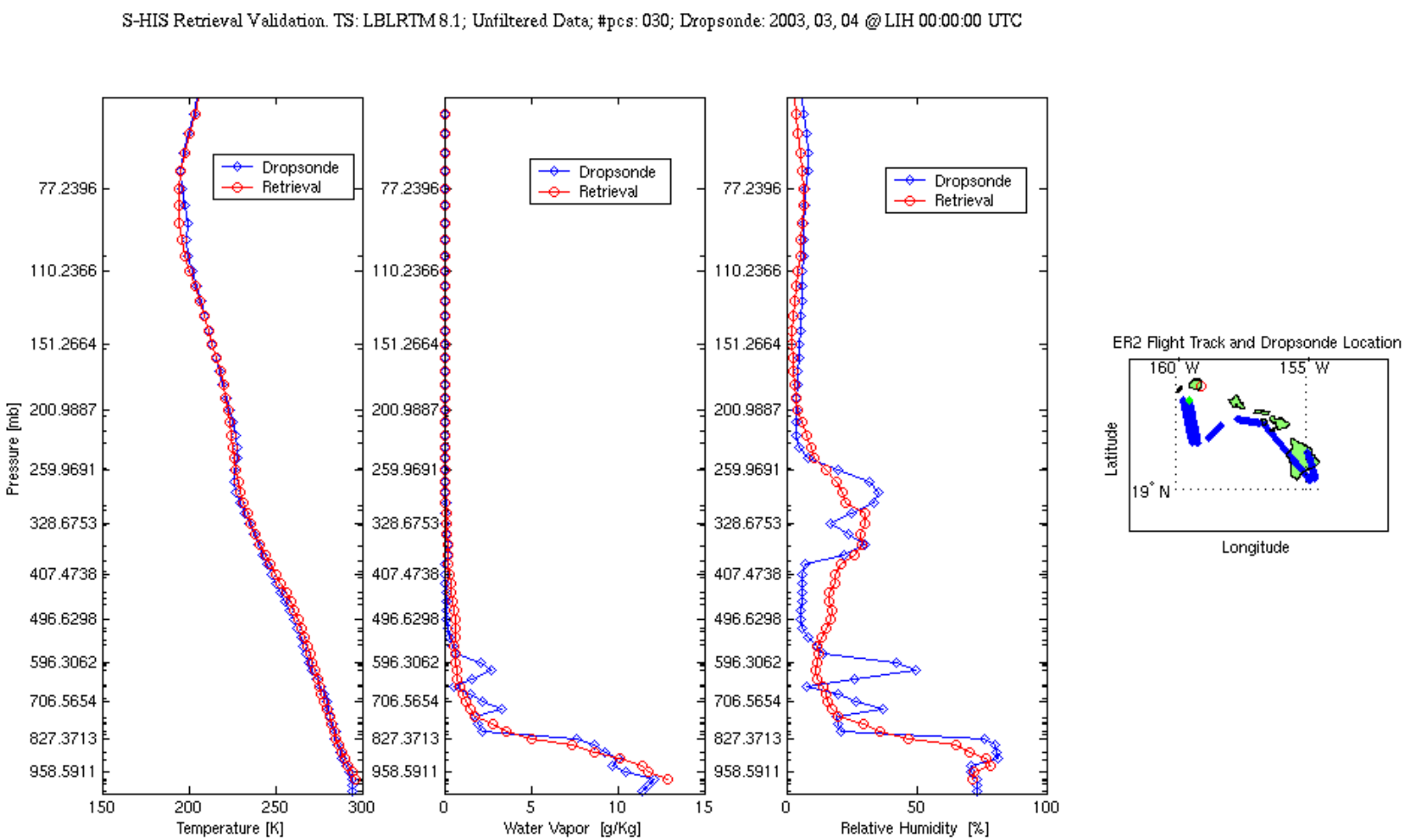
S-HIS Temperature Cross-Section

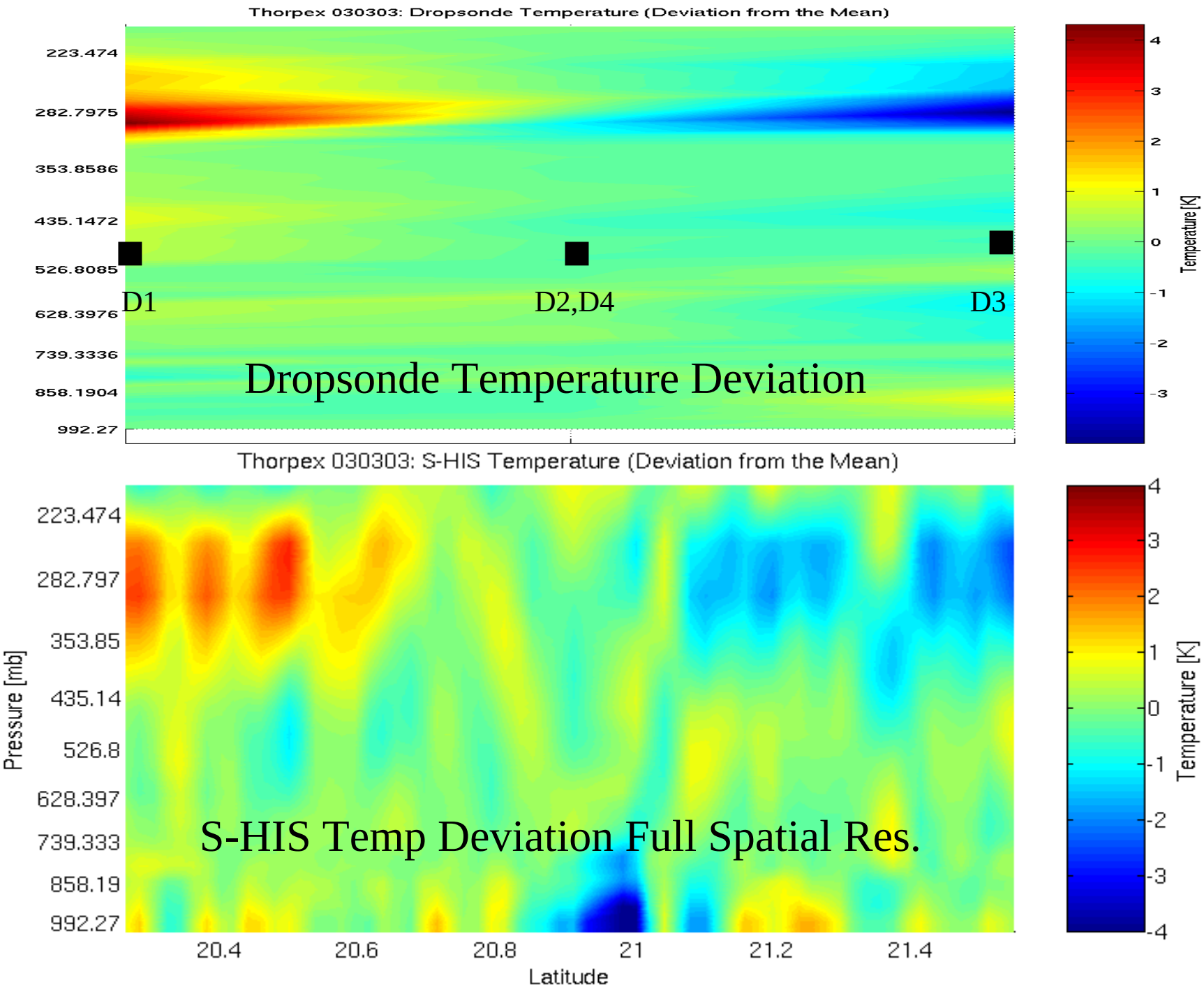


S-HIS Water Vapor (MR) Cross-Section

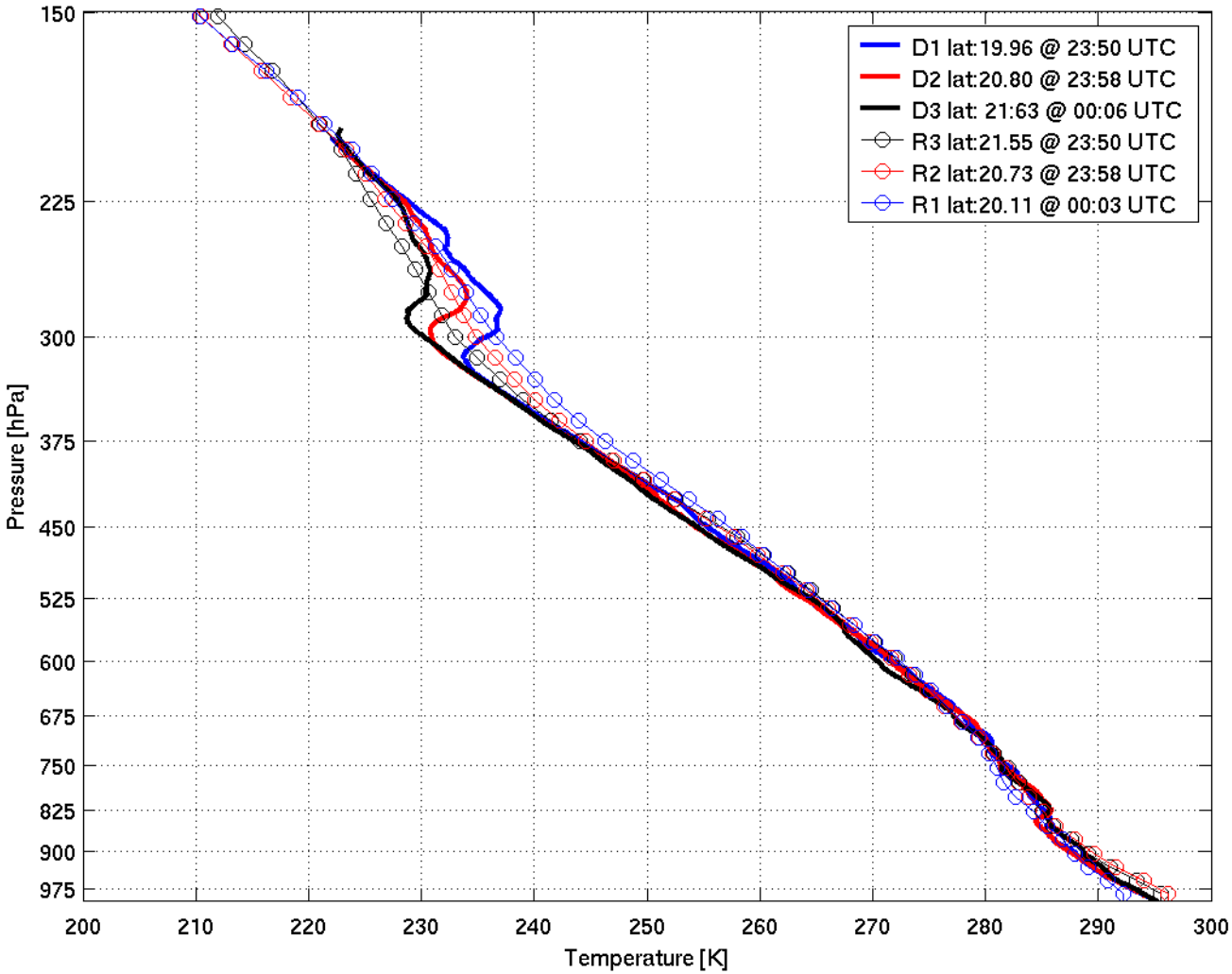


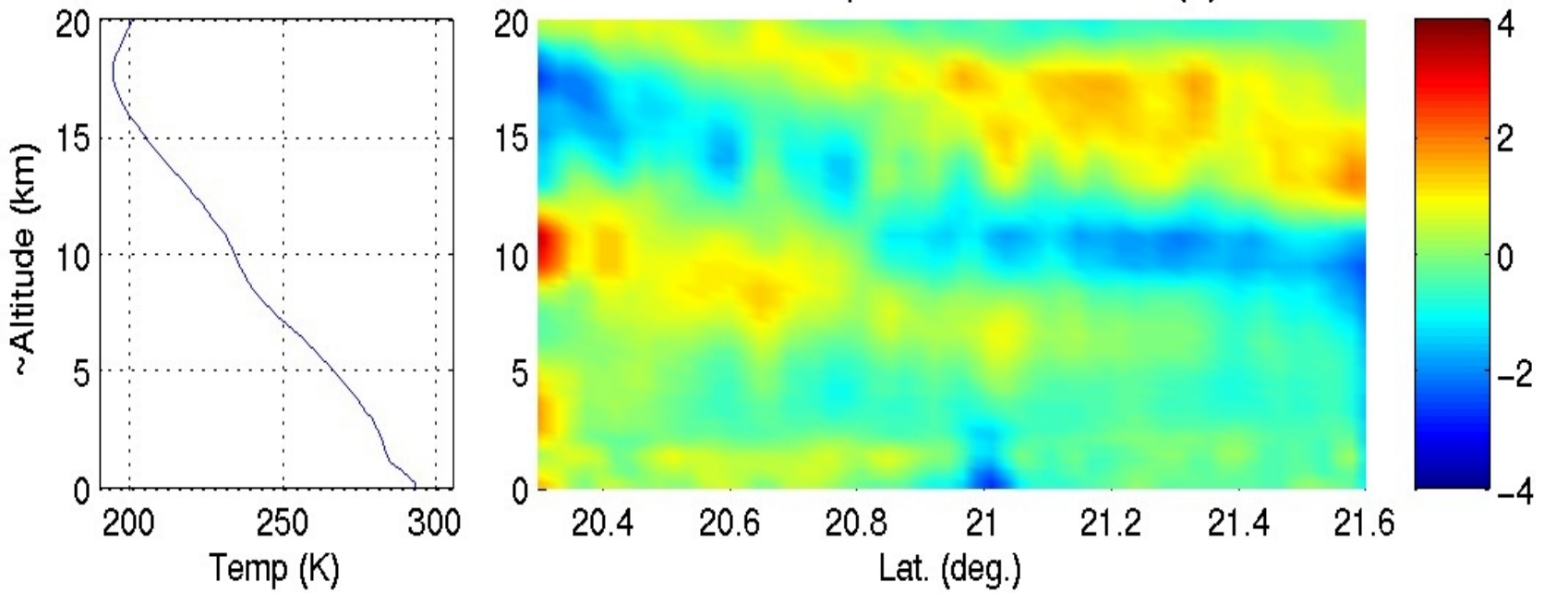
S-HIS Radiosonde Validation

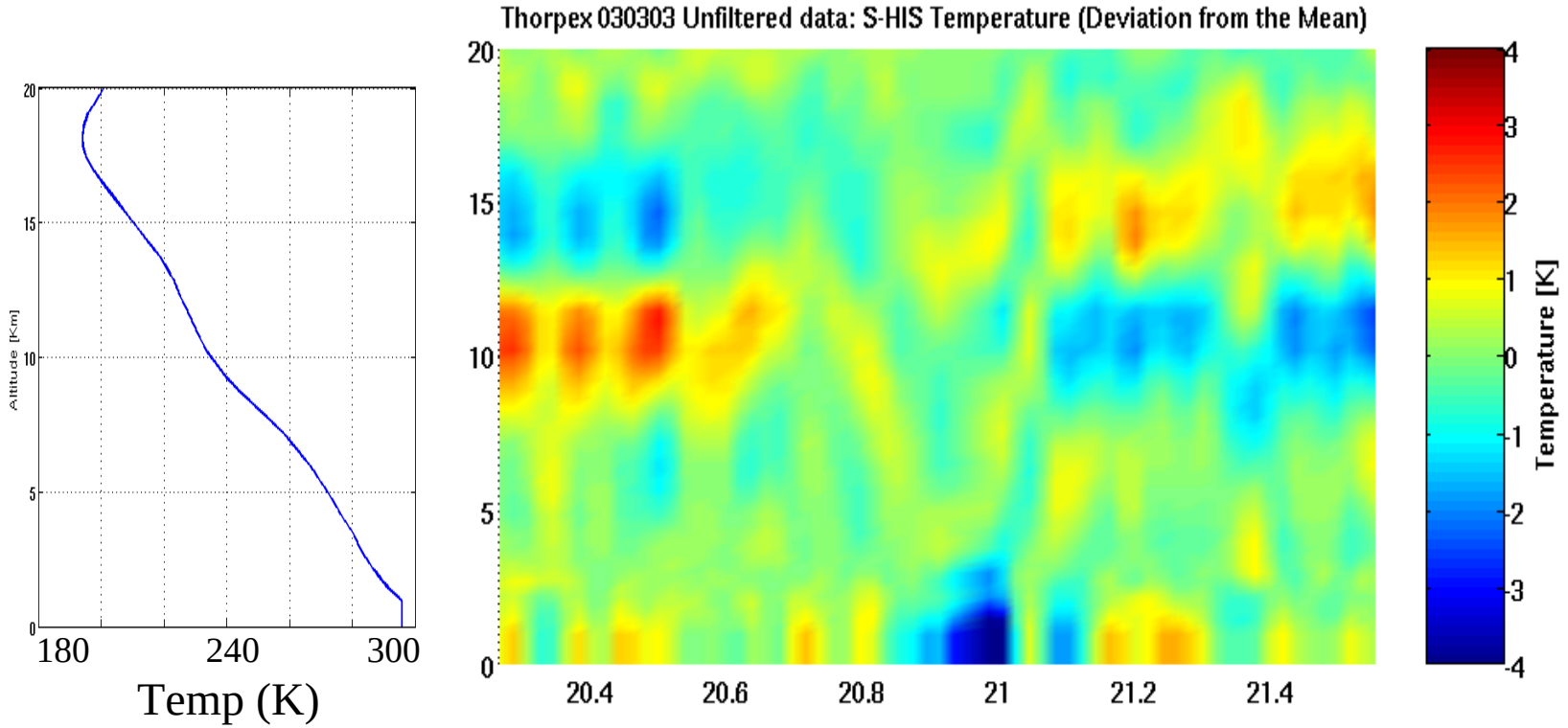



Thorpex 030303: Dropsonde Temperature (Deviation from the Mean)
223.474
282.7975
353.8586
435.1472
526.8085
628.3976
739.3336
858.1904
992.27
D1
D2,D4
D3
Dropsonde Temperature Deviation
Temperature [K]
Thorpex 030303: S-HIS Temperature (Deviation from the Mean)
Pressure [mb]
223.474
282.797
353.85
435.14
526.8
628.397
739.333
858.19
992.27
S-HIS Temp Deviation Full Spatial Res.
20.4
20.6
20.8
21
21.2
21.4
Latitude
Temperature [K]

Single Profile Comparisons




~Altitude (km)
Temp (K)
Lat. (deg.)


Thorpex 030303 Unfiltered data: S-HIS Temperature (Deviation from the Mean)
Altitude [Km]
Temp (K)
Temperature [K]

Conclusions/Discussion

- Using S-HIS we were able to observe vertical and horizontal atmospheric structures with good accuracy
- Would a current assimilation scheme retain or reject radiances for the presented case?
- We found good agreement with Radiosonde and NAST-I retrievals. There are still differences between their retrievals that are going to be further investigated
- To which extend do we expect them to agree?
- Regression Retrieval is non-optimal (in terms of accuracy) but does take advantage of all the available data (spectrally and spatially) and provides reliable results in an efficient way.
- How do we allow an assimilation scheme to take advantage of a larger percentage of available high spectral resolution data?