Space Dynamics Laboratory
Utah State University Research Foundation

Cal/Val Tasks Status

23 October 12

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SDL ATMS Cal/Val Tasks

- Task #16 Geolocation Verification
- Task #23 Raob Validation

Task 16: Geolocation Verification

OBJECTIVE:

Evaluate pointing tolerance of the ATMS FOVs

DESCRIPTION:

- Tools
  - SDL tool to plot geolocated data (GeoBrowser)
  - SDL tool to determine coastline points and compare to coast truth (GeoLocate)
- Cal/Val Phase(s): Sensor Checkout, ICV, LTM
- Sensor mode: normal mode SDRs

Results:

5.2˚	(channels 1,2)	pointing tolerance validated to .3˚
2.2˚	(channels 3-16)	pointing tolerance validated to .2˚
1.1˚	(channels 17-22)	pointing tolerance validated to .1˚

Geolocation Verification Method

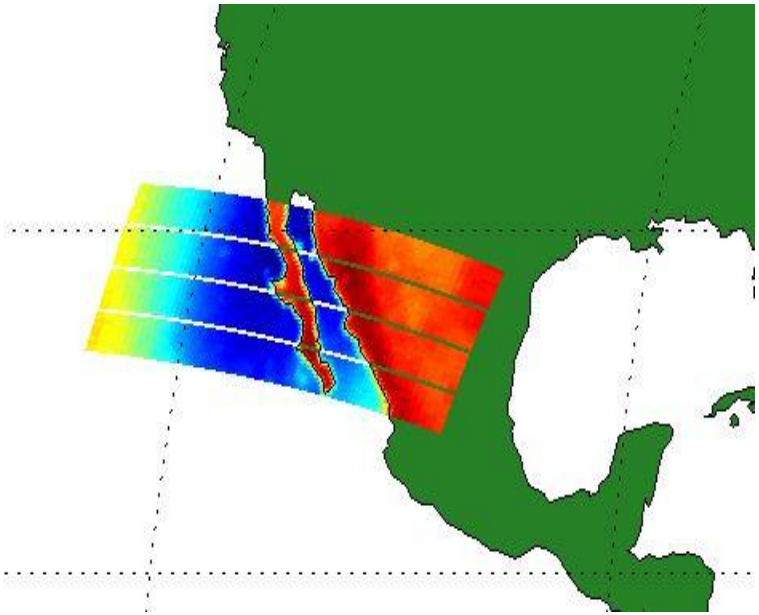
- Pick multiple regions with high coastline contrast and orbits with coastal crossings close to nadir (BP 24-74)
- Calculate the inflection point between every four consecutive points in across-track rows and along-track columns
- Compare points to actual coast (GSHHS fine resolution dataset)
- For each approximate coastline point the intersection of the perpendicular is found on the actual coast. This distance is separated into a North-South and East-West error
- Accumulate error statistics for Channels 1,3,16 & 17

4 Regions

Baja Peninsula

10 Data Sets

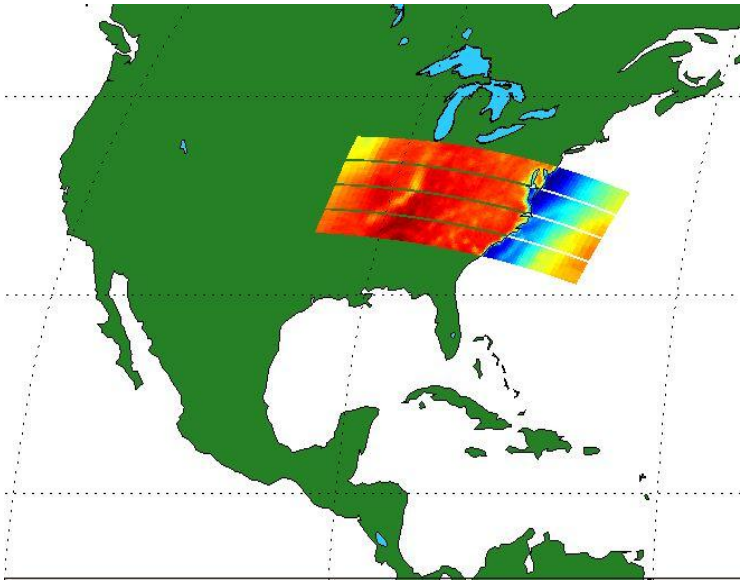
10500 Crossing Pts.



US East Coast

12 Data Sets

7500 Crossing Pts.

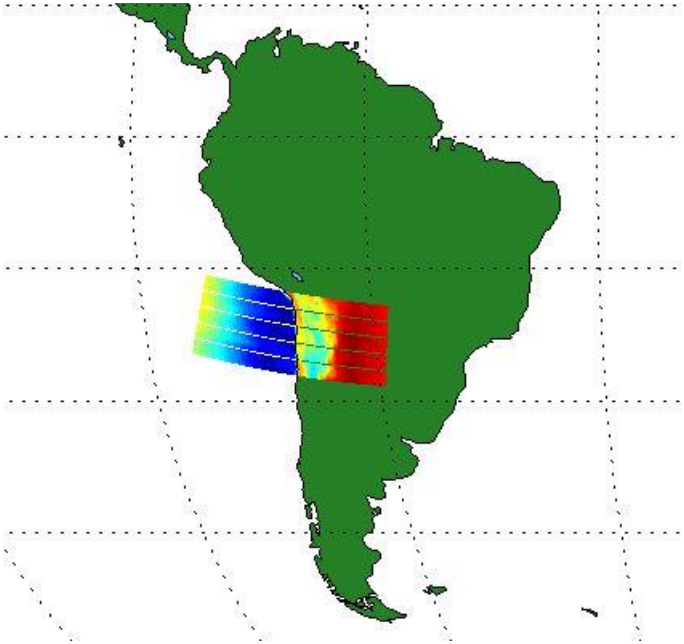


4 Regions

South America West Coast

12 Data sets

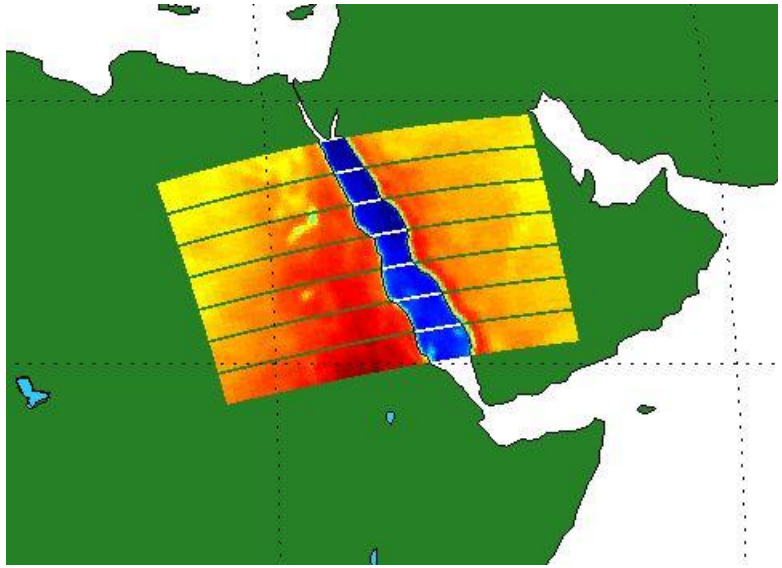
4500 Crossing Pts.



Red Sea

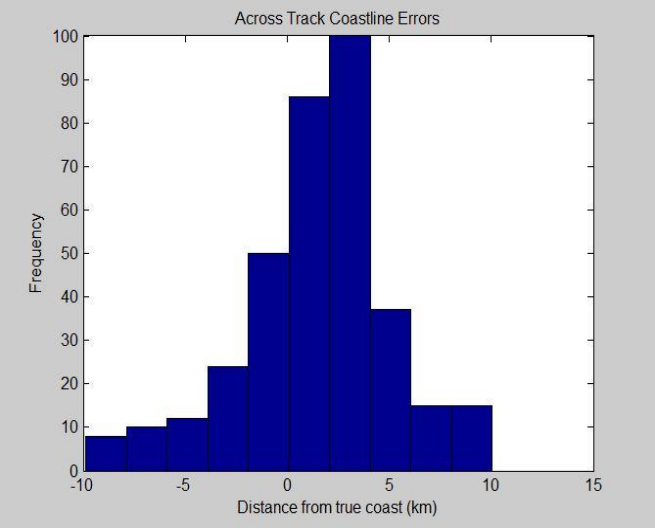
9 Data sets

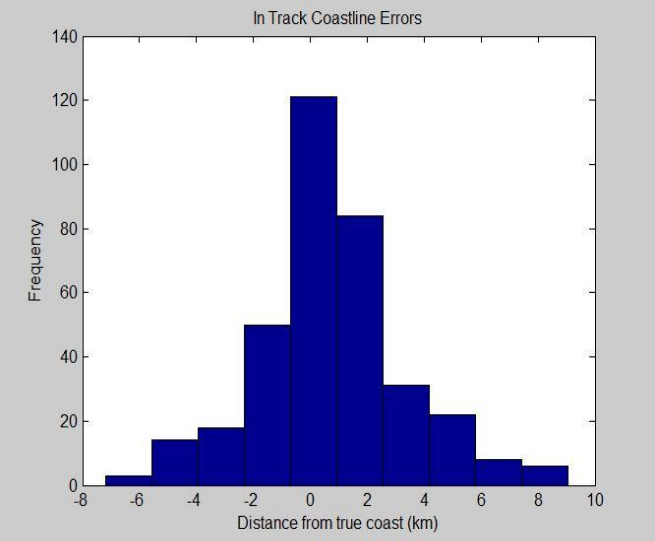
5800 Crossing Pts.



Red Sea

Example Data Set



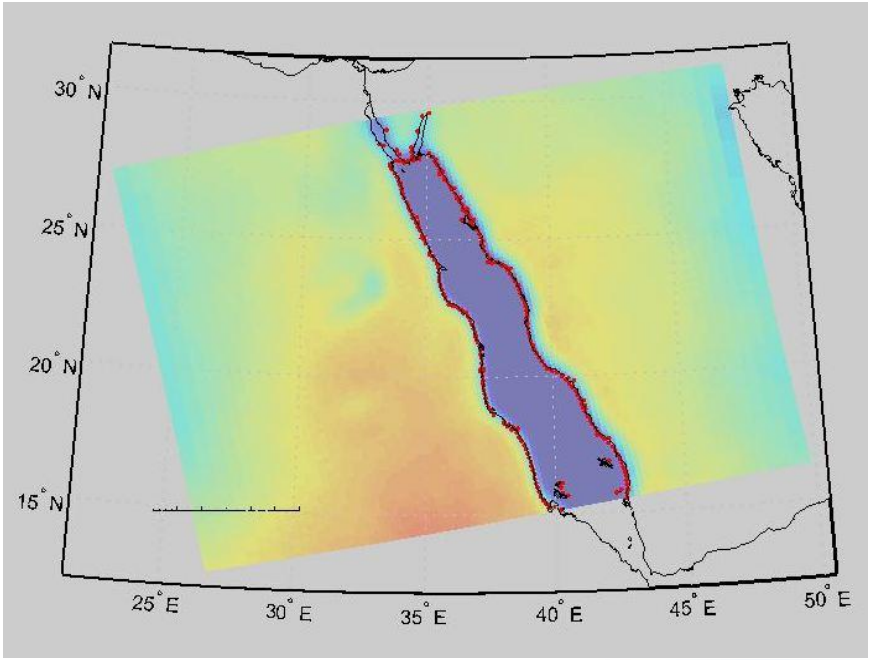


Orbit 668

14 Dec 11

7 Granules

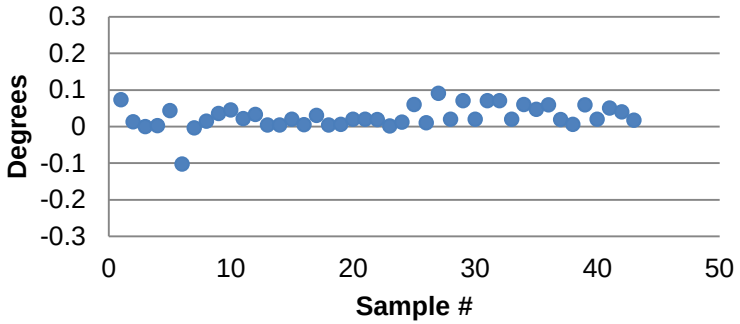
271 Crossing Pts. (Channel 1)



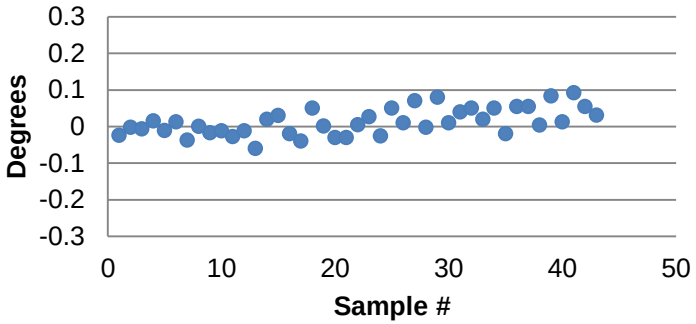
Channels 1, 3
Mean Errors

Specification Channel 1: ±.3 ° ; Channel 3: ±.2°

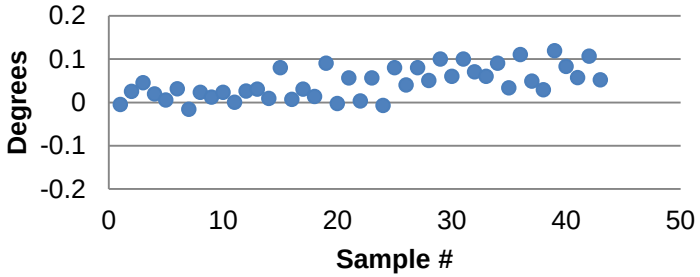
Channel 1
In-Track Mean



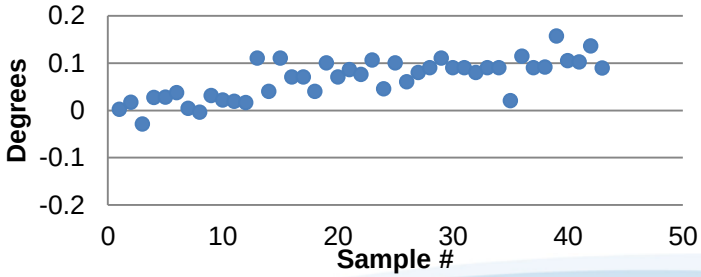
Channel 1
Cross-Track Mean



Channel 3
In-Track Mean

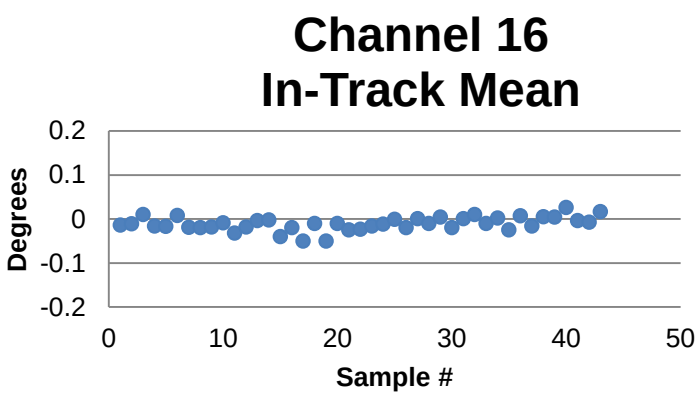


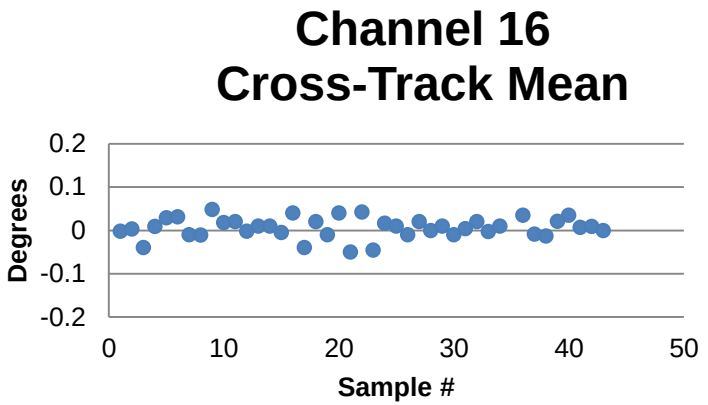
Channel 3
Cross-Track Mean

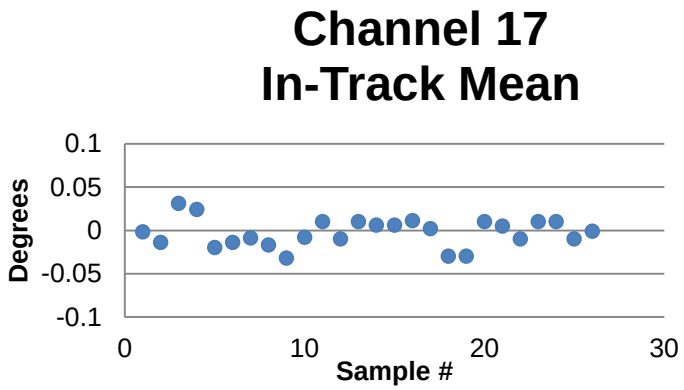


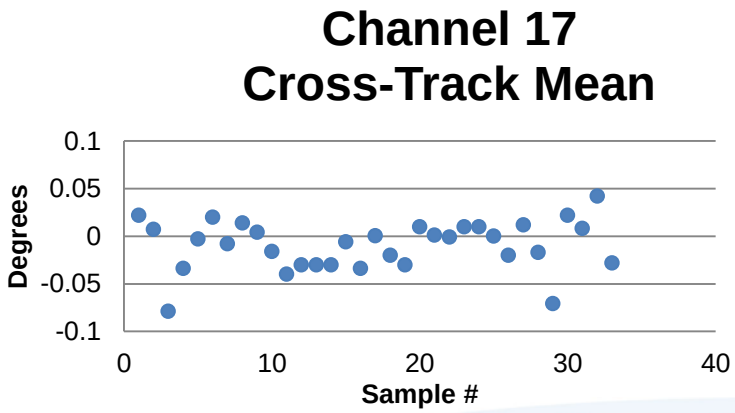
Channels 16, 17
Mean Errors

Specification: Channel 16 ±.2° ; Channel 17 ±.1°









Summary

12 days of data

4 geographic regions

40+ data sets per channel

100 – 300 crossing pts. each data set

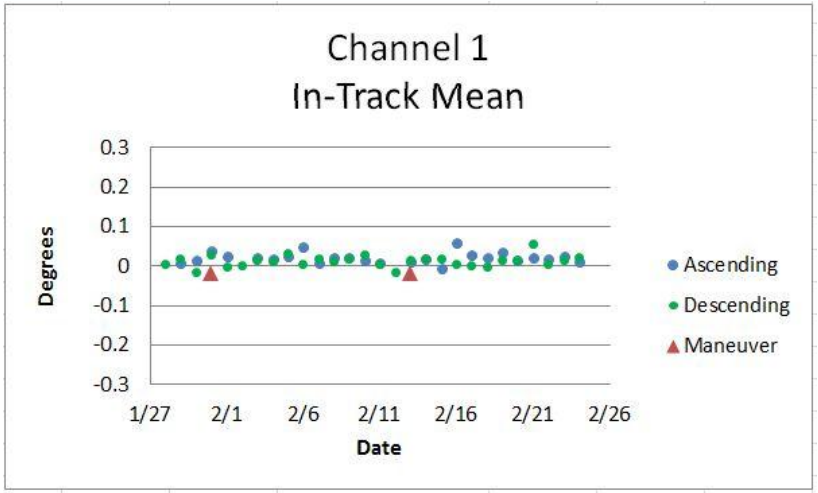
28K total crossing points

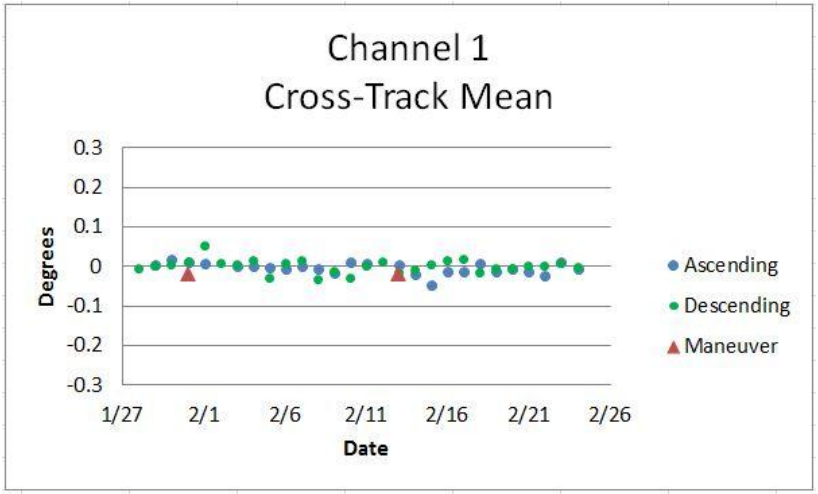
Slight mean bias on some channels

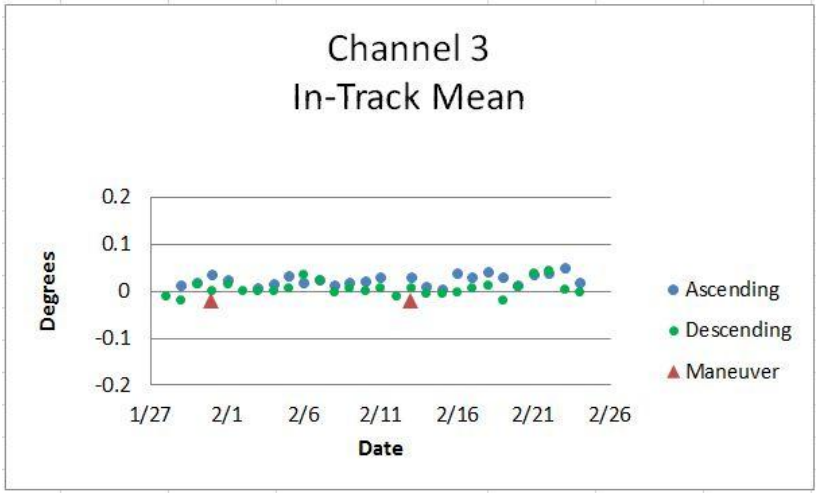
Bias well below OPSCON limits

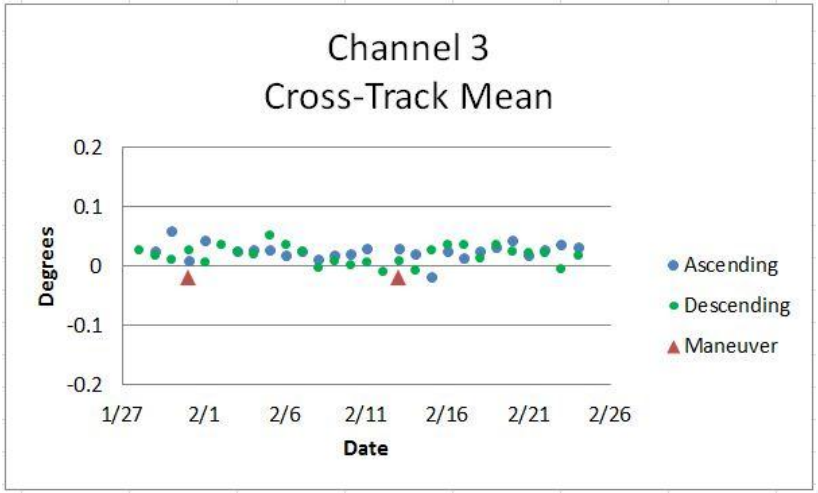
Spacecraft maneuver Geolocation

COLA – 31 Jan OMPS Limb Pitch – 13 Feb









Summary

30 continuous days of Geolocation error analysis

Overlapping 2 Spacecraft maneuver events

No shift in mean error detected

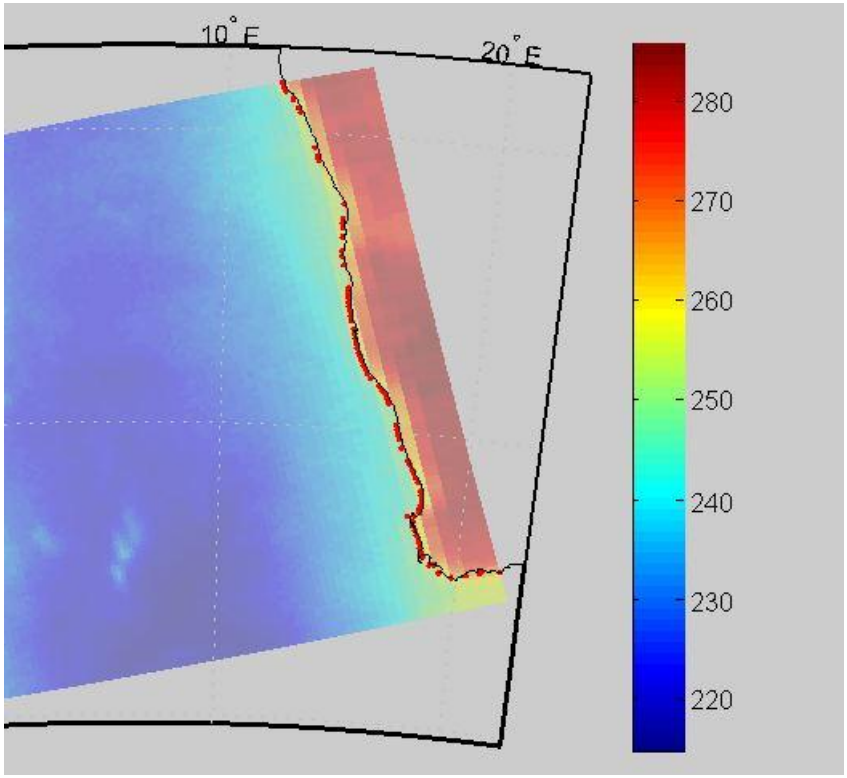
Edge of Scan Geolocation Error Analysis

Use BPs 1-10, 86-96

5 Geographic Regions

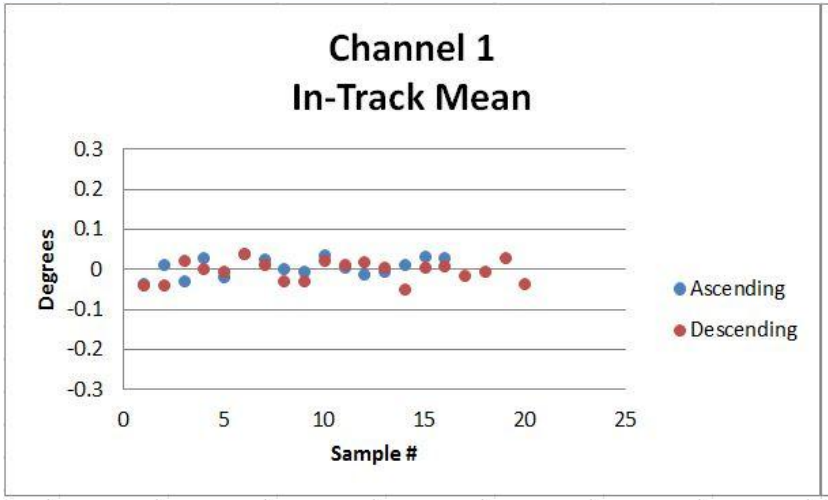
30 Data sets

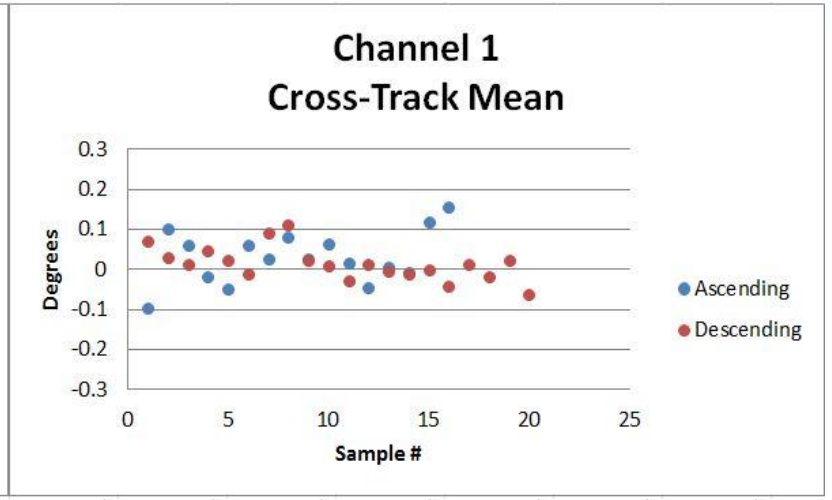
16K Total crossing pts.

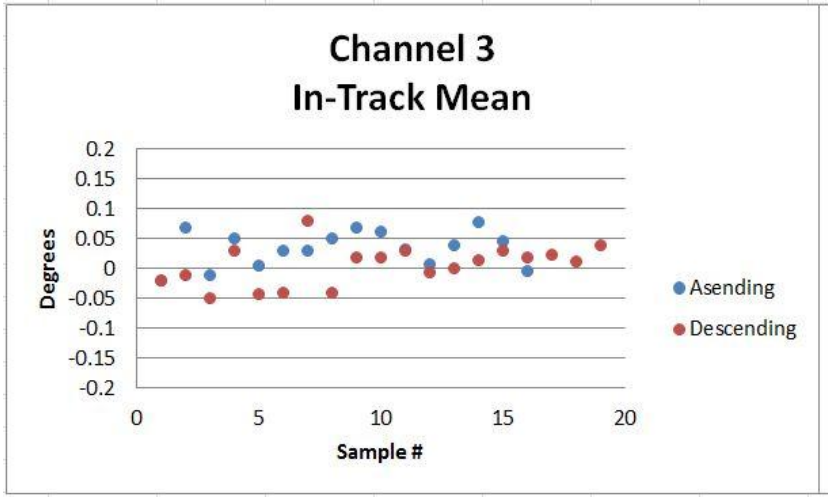


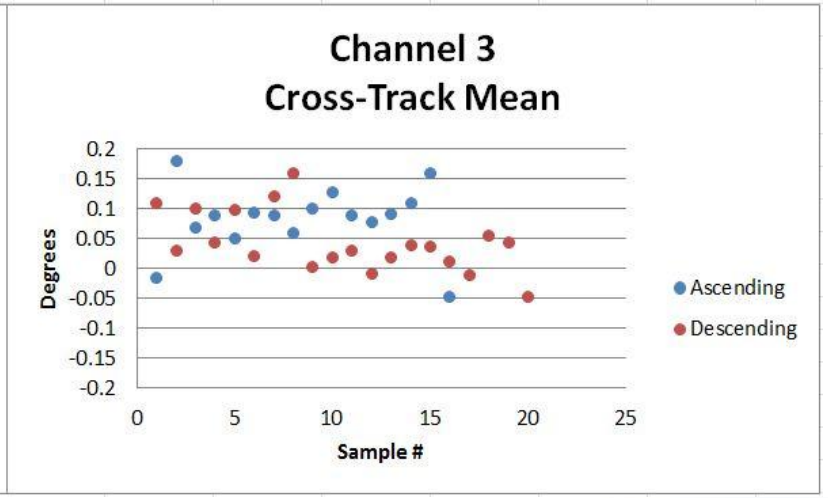
Edge of Scan Results
Channels 1, 3

Specification: Channel 1 ±.3° ; Channel 3 ±.2°



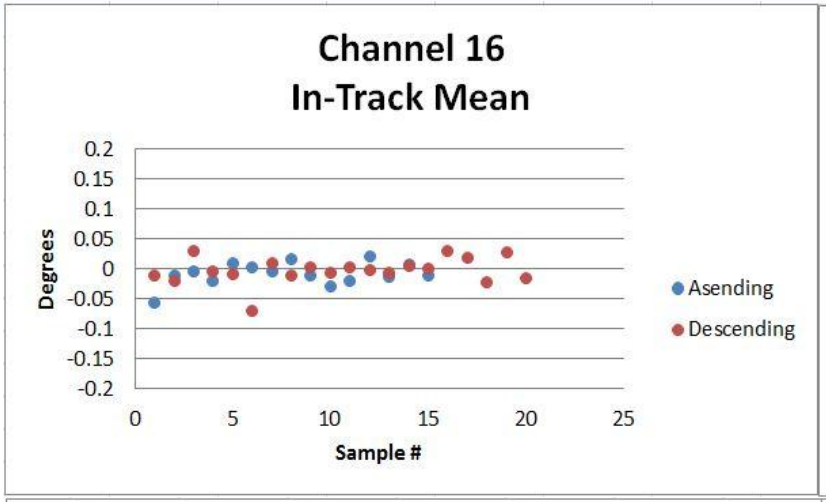


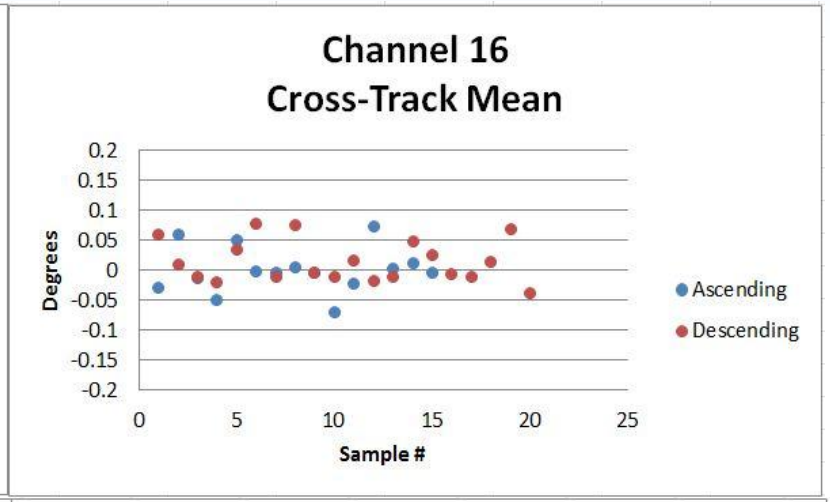


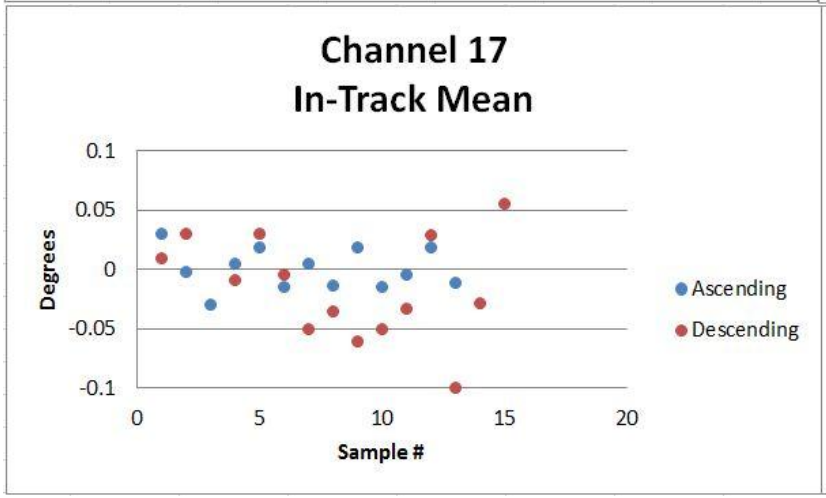


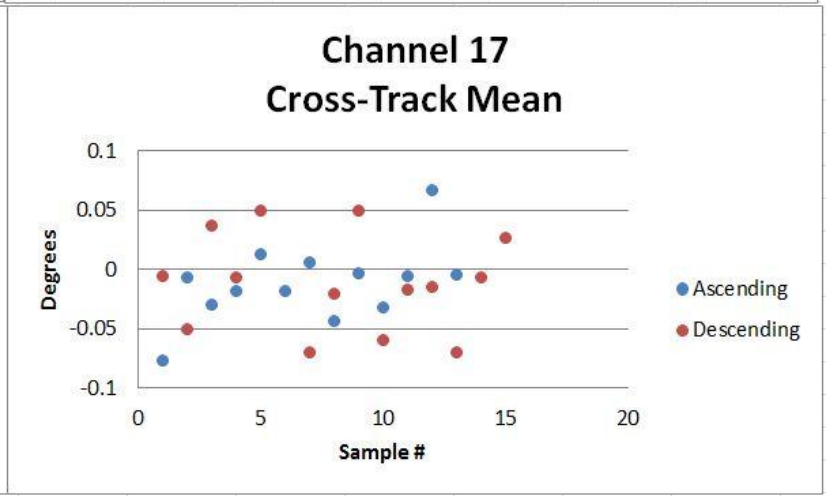
Edge of Scan Error Results
Channels 16, 17

Specification: Channel 16 ±.2˚ ; Channel 17 ±.1˚









Summary

Error analysis using first and last 10 beam positions

Approximately 16K data points

Some slight biases detected

Biases well within the OPSCON limits

Results consistent with previous error analyses

Common Code Geolocation Tool Set

Goal: Produce a stand alone Geolocation error analysis tool for use by NOAA STAR during LTM.

Investigate the Land/Sea fraction method of Geolocation error analysis.(“Bennartz, ‘98”)

- Define mean & standard deviation of brightness temperatures as a function of Land/Sea fraction for a large data set.
- Generate a theoretical data set of mean & std deviation for a number of navigation errors.
- Compare theoretical curves to actual curves to define the error.

Integrate the Land/Sea fraction method into our existing tool set and compare.

Utilize data sets from heritage sensors in comparisons

Generate standalone tool kit for NOAA STAR use and provide annual support and updates

Task 23: Raob Validation

OBJECTIVE:

Validate ATMS radiance calibration through independent observations

DESCRIPTION:

- Tools
  - SDL - GeoBrowser Toolkit
  - NPROVS – Profile Display
  - NOAA STAR – CRTM
- Cal/Val Phase(s): ICV, LTM
- Sensor mode: normal mode SDR

Results:

Database of coincident radiosonde and ATMS observations.

Comparison of observed and calibrated response (radiance and brightness temperature).

Method

Generate a database of coincident Raobs and ATMS observations.

“Good” Matchup

90 min or less time differential

Less than 50% cloud cover

Over water trajectory

Use sounding data as input to the CRTM

Compare calculated radiances with observed

Matchup Summary

Contains Raob matchup dates, release times, overpass times, orbit numbers, etc. organized by location.

Raob Matchups Summary

Location	Station ID	Lat,Lon	0Z Release	Overpass T	Delta Time	12Z Release	Overpass T	Delta Time	Matchups
			(Average)	(Average)	(Average)	(Average)	(Average)	(Average)	
Hilo	91285	19.72 N, 155.07W	23:00	23:30	31min	11:00	11:45	47min	45
Lihue	91165	21.98 N, 159.35 W	23:00	23:30	35min	11:00	11:45	52min	71
Athalassa	17607	35.15N 33.40E	None	0:45	N/A	11:00	11:30	29min	41
Casale Brindisi	16320	40.65N 17.95E	23:00	0:45	81min	11:00	11:34	34min	54
Lerwick	3005	60.13N 1.18W	23:15	1:25	2hrs 30min	11:15	11:40	41min	22
Cagliari	16560	39.25N 9.05E	22:45	1:00	2Hrs 15min	10:50	12:00	70min	16
Kuwait Int	40582	29.22N 47.98E	23:30	22:30	60min	11:30	10:20	70min	49
King Fahd	40417	26.45N 49.82E	23:00	22:15	45min	11:05	10:00	65min	46
								Total	344

Summary | Hilo | Lihue | Athalassa | Casale Brindisi | Lerwick | Cagliari | Kuwait Int | King Fahd

Archived Data

Available on CasaNosa

Data files are organized by release location then date

Example  Athalassa

Feb

9Feb1108

day month release time

Included Files

.txt .png .mat

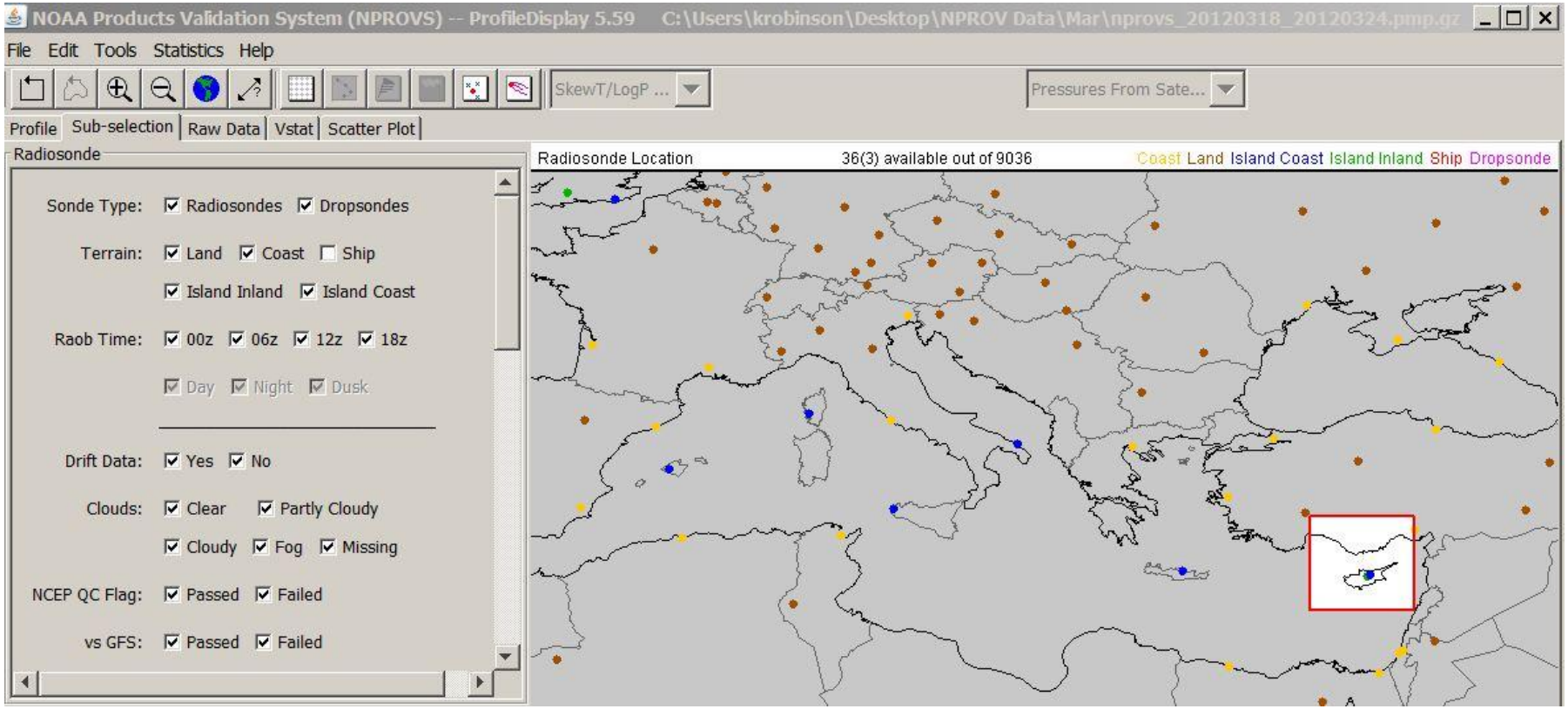
Example: 9Feb1108.txt

9Feb1108.png

9Feb1108.mat

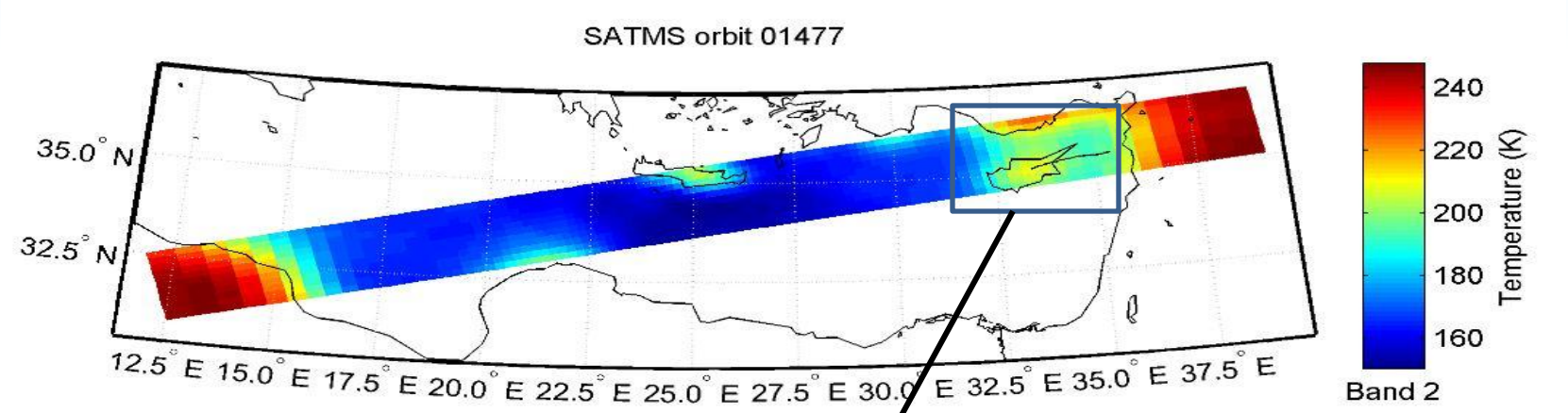
NPROVS Profile Display

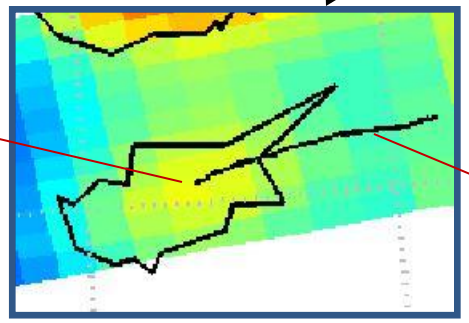
Used for matchup identification and sounding data .txt file generation



Example

9Feb1108





Athalassa Release Site

Radiosonde Trajectory

9Feb1108.mat

(48 Levels)

.mat file contains complete matchup data

WMO Station ID

Matchup date and time

Observed radiosonde Parameters

Radiosonde position

ATMS pointing, scan #, FOV

Land fractions for each FOV (3 Bands)

SDR brightness temps (22 Channels)

Field	Value	Min	Max
stationId	17607	17607	17607
stationDate	'02/09/2012'		
stationTime	'11:08'		
raobPressure	<1x48 double>	20.3000	993
raobFcstTemp	<1x48 double>	206.7500	286.0400
raobTemp	<1x48 double>	206.0400	287.5400
raobDwpt	<1x48 double>	NaN	NaN
raobLats	<1x48 double>	35.1400	35.4300
raobLons	<1x48 double>	33.3900	35.3900
filenames	<1x1 cell>		
raobFilename	'9Feb1108.txt'		
pt	<1x48 struct>		
landFraction	<48x3 double>	0	0.9966
temperature	<48x22 double>	191.9658	273.1727

Compare Calculated to Observed

Use Raob pressure, Temperature, and water vapor profiles as inputs to the CRTM Atm. structure

Compare the calculated radiance to the observed values to assess SDR calibration accuracy

Trend statistics for a significant data set

Questions