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## AIRS/IASI Radiance Comparisons

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## JPL AIRS/IASI Comparisons

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### Three Comparisons Performed

1. AIRS-IASI Tropical Clear  
(Warm ~300K) Pagano  
/Aumann
2. AIRS-IASI SNO: Antarctic Granule  
(Cold ~220K) Broberg
3. IASI-SST Comparisons  
AIRS-SST Aumann



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## Tropical Clear Comparison Overview

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- Tropical Clear
  - AIRS Calibration Data Subset (ACDS)
  - Aumann IASI Clear Subset
- One Day: July 4, 2007
- Within 5 Hours of Acquisition
  - Night Only to avoid solar contribution
- Within 10 km of Position
  - All Scan Angles Considered
  - No Slant Path Correction
- No spectral correction
  - Simple interpolation used
  - Window Channel Only Comparisons
- No PC Filtering on AIRS or IASI Data



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# AIRS IASI Overlap All Clear

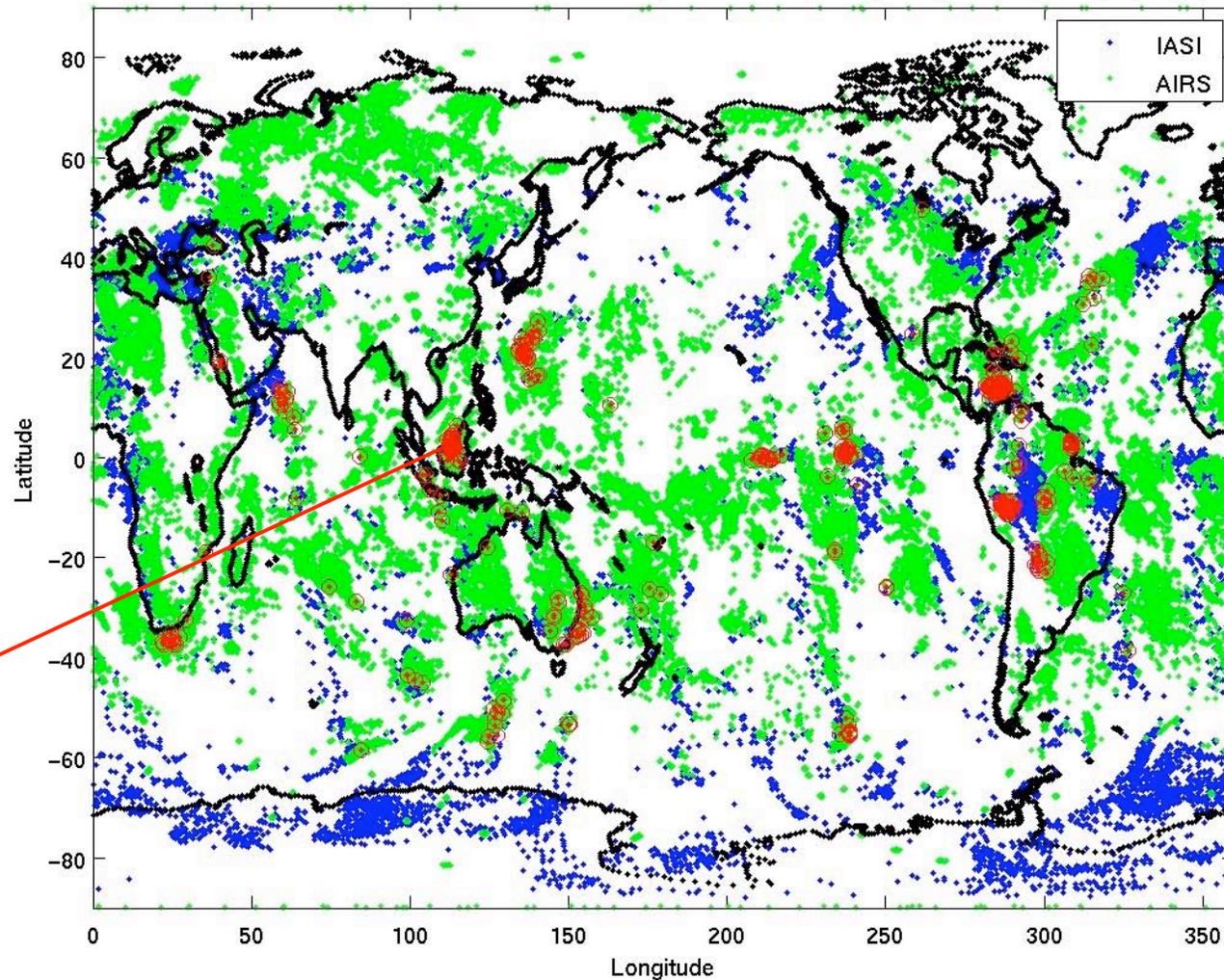
Complete Set of Latitude and Longitude for fpidl = 0 & fpidA = 1 AIRS\_IASI\_Clear\_2007\_07\_04A\_04I\_Night\_v4

**Clear AIRS**  
**74,841**

**Clear IASI**  
**40,407**

**$\Delta x < 10$  km**  
**Night**  
**719**

**$\Delta t < 5$  hrs**  
**309**





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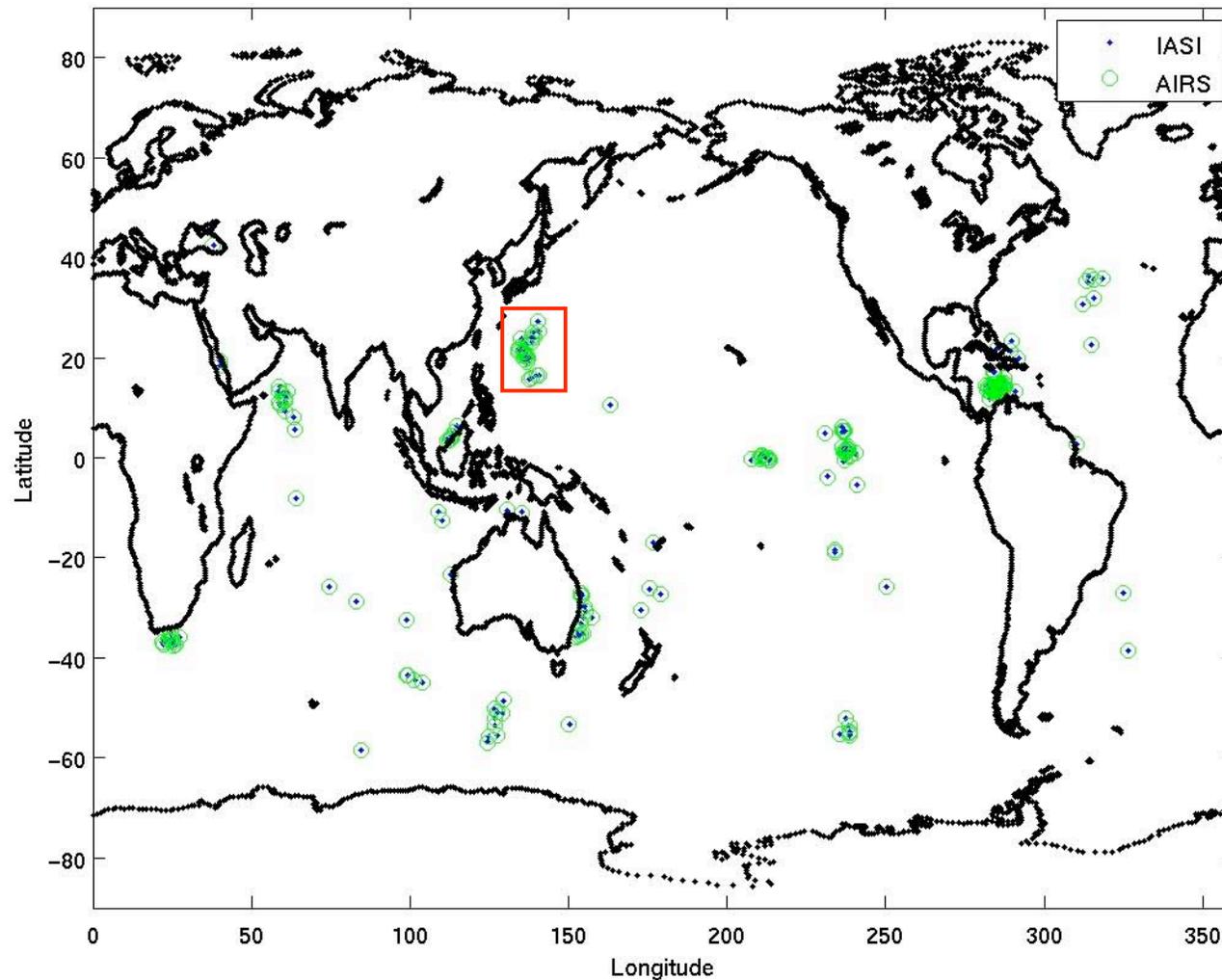
# AIRS/IASI Overlap

## Additional Constraints on BT1231-AVN

Ocean Only

BT1231<sub>AIRS</sub>  
-AVN < 2 K

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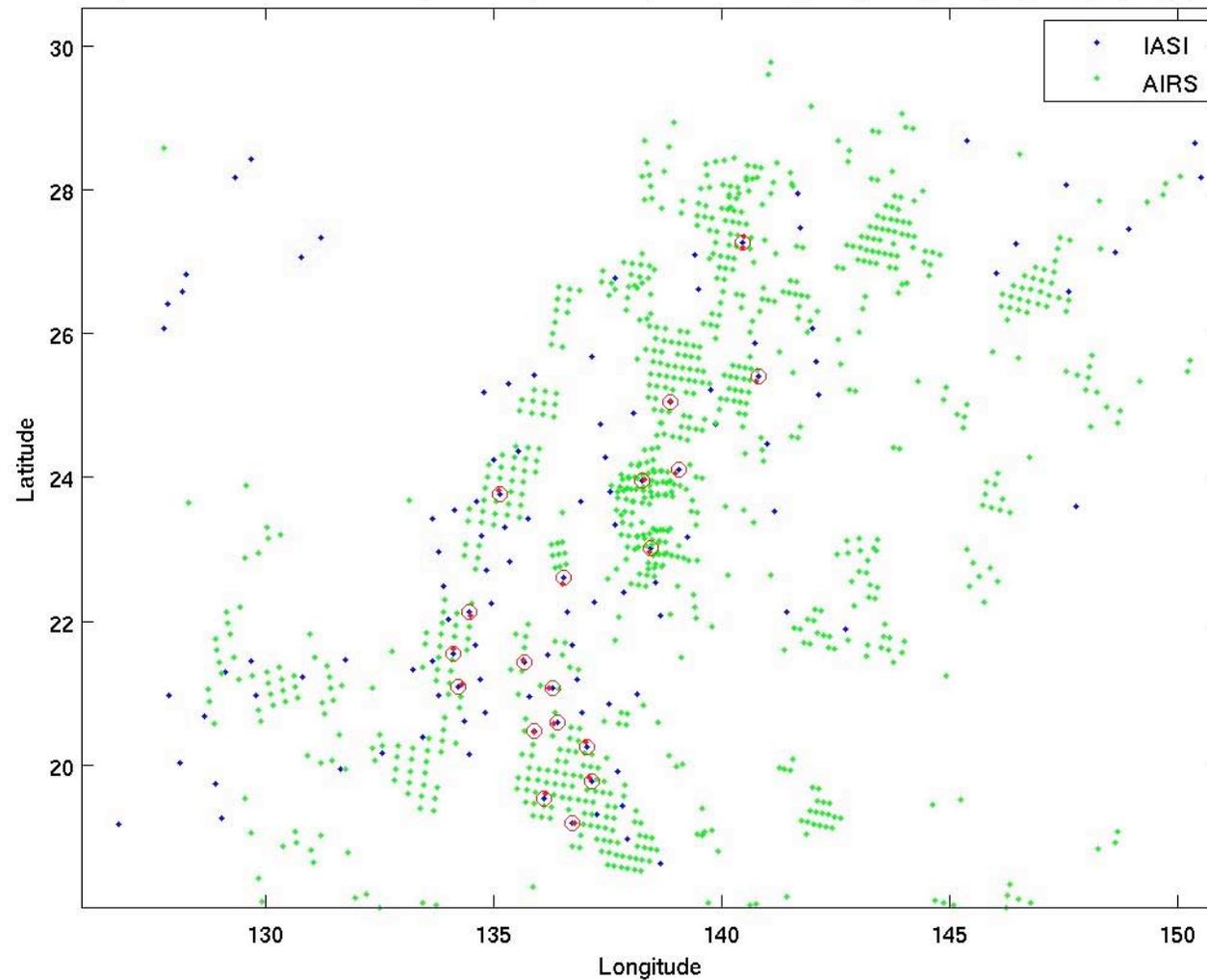


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# Closeup of Overlap Regions Highlights Scan Patterns

Complete Set of Latitude and Longitude for fpidl = 0 & fpidA = 1 AIRS\_IASI\_Clear\_2007\_07\_04A\_04I\_Night\_v3



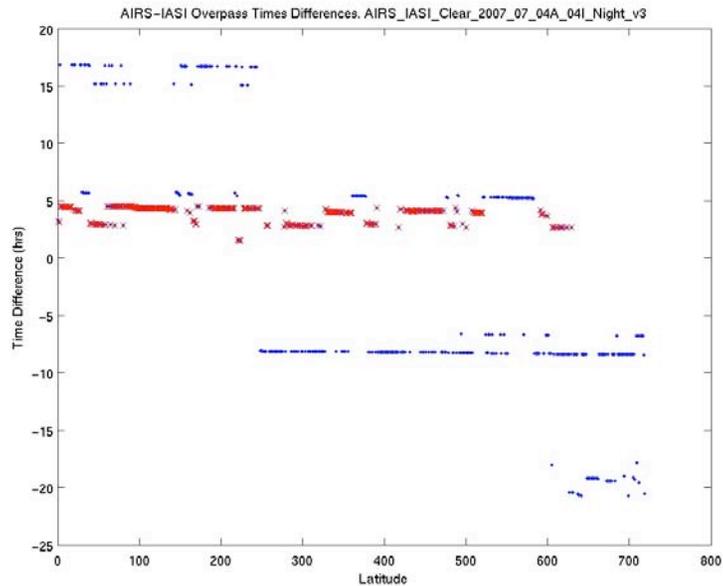


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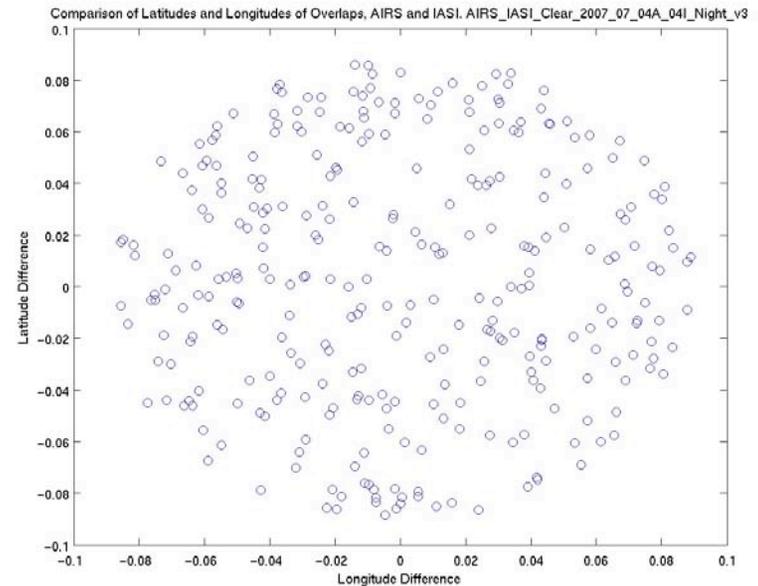
## Overlap Regions Constrained to 5 hrs, $\pm 10$ km

### Selected Simultaneous Samples



$\Delta t < 5$  hrs  
309

### Spatial Distribution of Overlap Samples



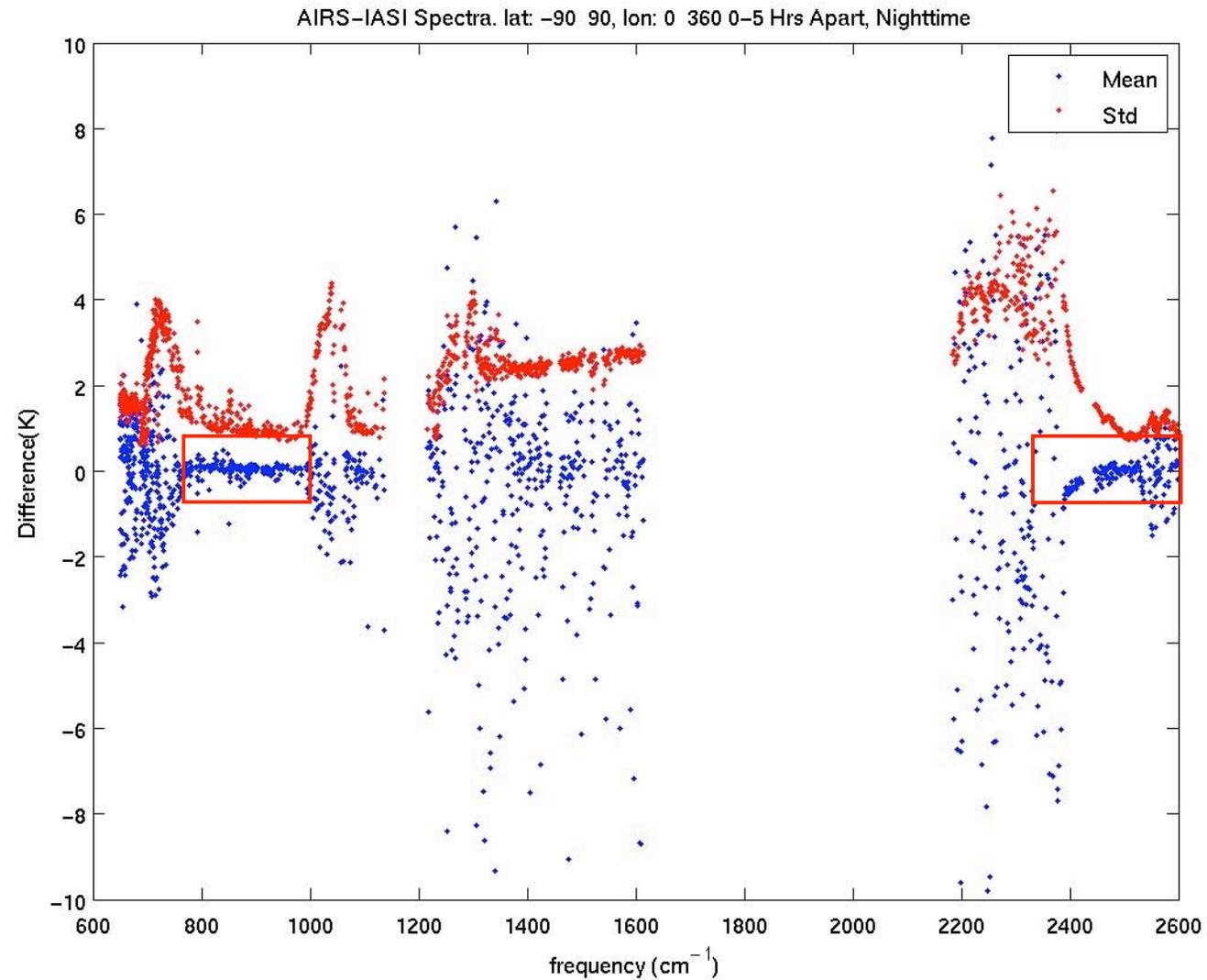
BT1231<sub>AIRS</sub>  
-AVN < 2 K  
Ocean Only  
197



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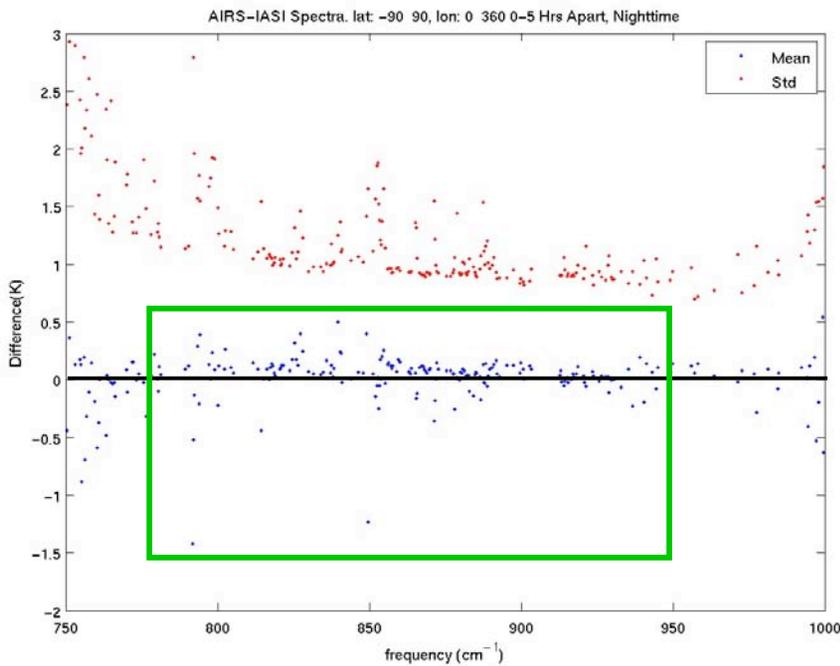
## Difference Spectrum: AIRS-IASI Uniform clear and warm conditions





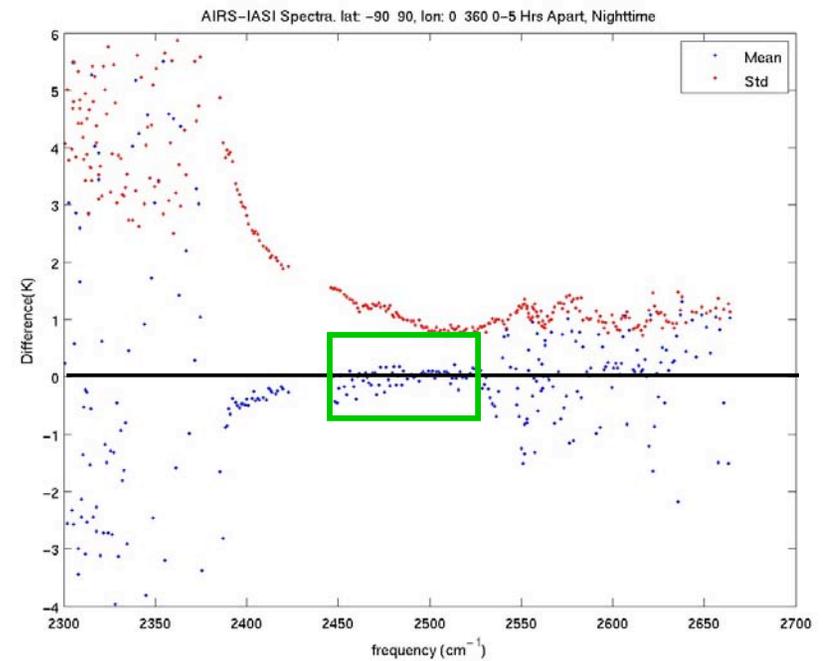
# Mean Difference and Standard Deviation in Window Regions (Sigma $\sim < 1K$ )

## Longwave Window



**Mean Difference: 0.0356 K**  
**Standard Deviation: 0.1319 K**

## Shortwave Window



**Mean Difference: -0.0063 K**  
**Standard Deviation: 0.1961 K**

Uniform clear and warm conditions

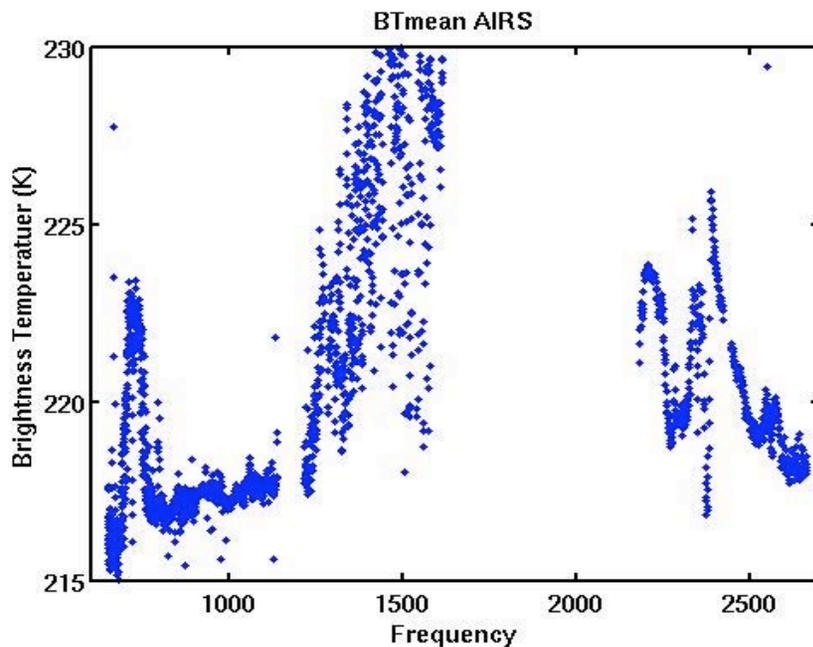


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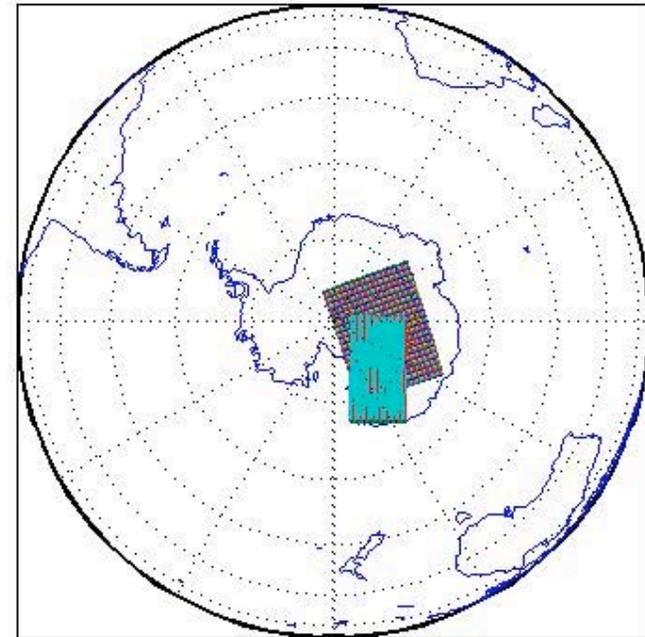
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## AIRS-IASI Simultaneous Overpass Comparison Conditions

- Single Antarctic granule (AIRS 20070403.148)
- Land (99.7%)
- 33 minutes between overpasses
- Nighttime; sol zen  $> 90^\circ$
- Cold; median BT of 219 K



iasi20070403.304.dtg.mat



- 1109 matches, footprints within 0.06 deg, or 6.7 km
- No additional filtering.
- Matches made independent of cloudy/clear, scan angle, land/ocean; no PC filtering

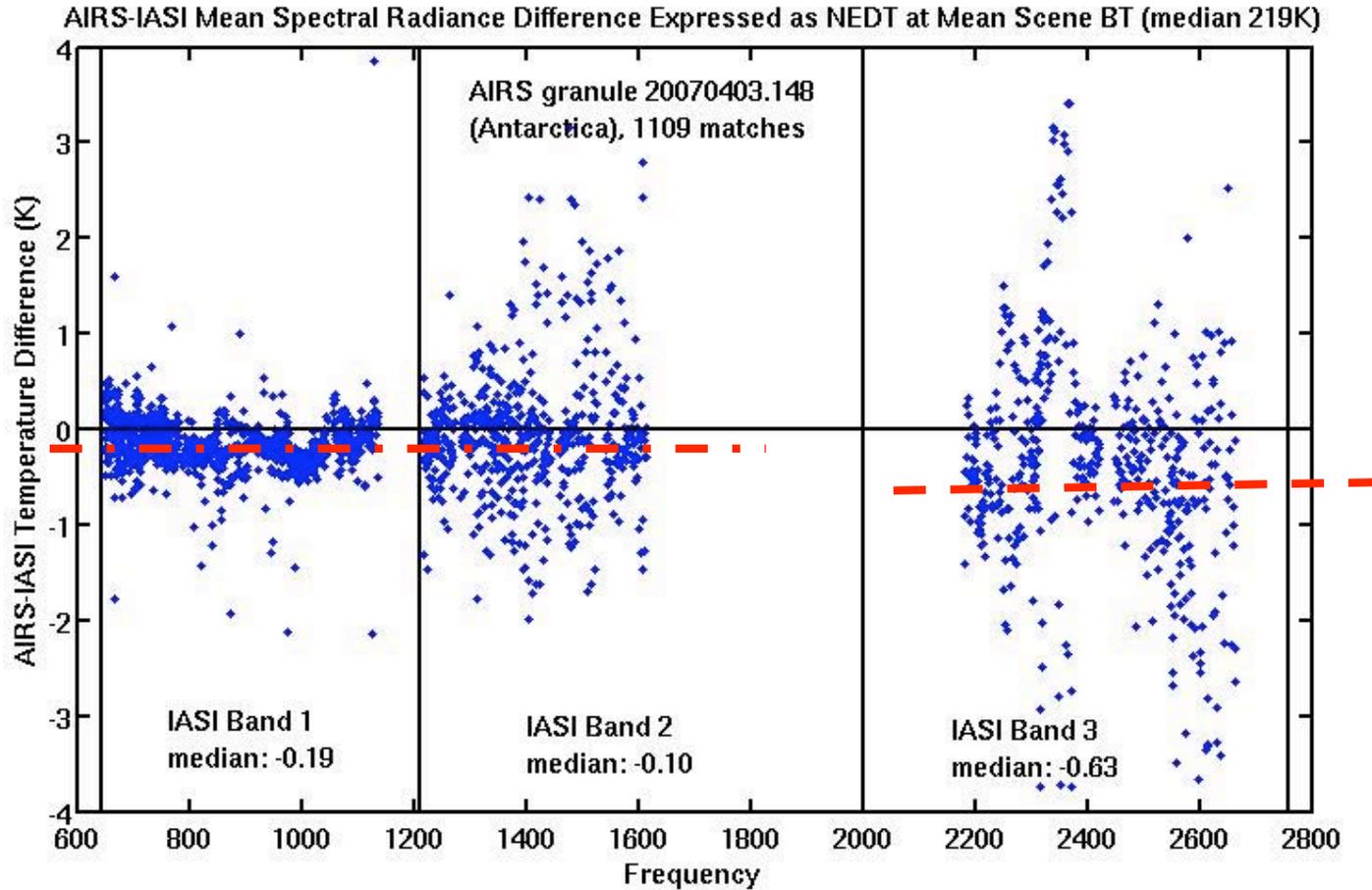


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## AIRS-IASI Comparison Result

< -0.2 K for Bands 1&2; -0.6 K for Band 3



IASI appears to be slightly warm under very cold conditions



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## IASI Calibration Monitoring using the tropical ocean SST

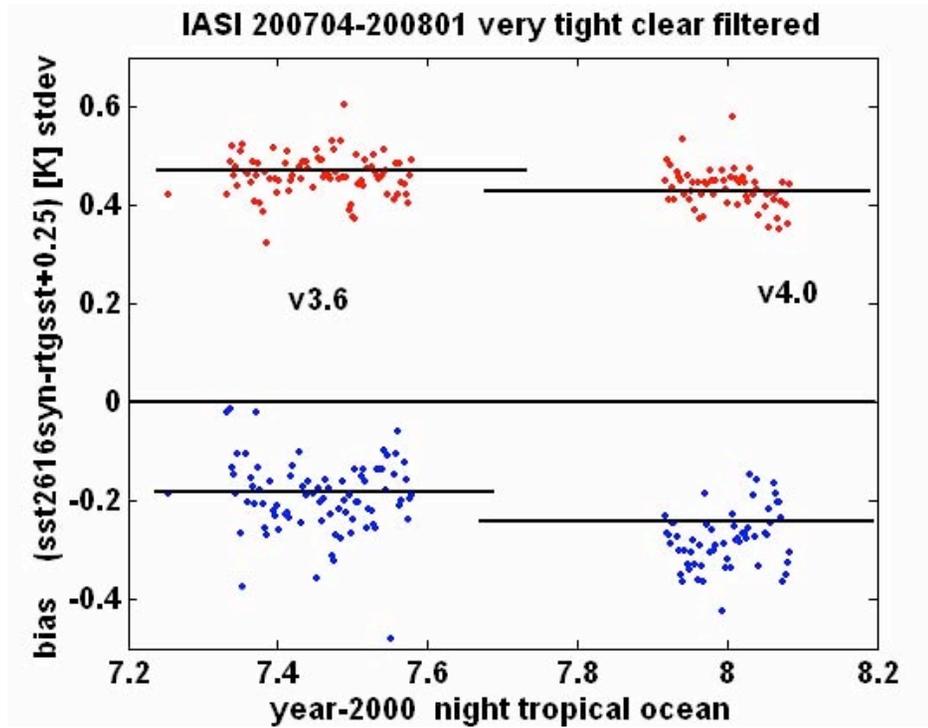
- Band 3 (Shortwave)
  - uses the synthesized  $2616\text{ cm}^{-1}$  and  $2607\text{ cm}^{-1}$  channels
  - Synthesized by average of 93 window channels and 45 water channels between  $2600\text{ cm}^{-1}$  and  $2650\text{ cm}^{-1}$
  - Note: CrIS does not have coverage above  $2550\text{ cm}^{-1}$ . Can use  $1231\text{ cm}^{-1}$  but with reduced accuracy ( $0.5\text{K}$  vs  $<0.1\text{K}$  with  $2616\text{ cm}^{-1}$ )
- Ultra clear; using very tight spatial coherence test
- Yield is 1% of the night tropical ocean footprints ( typically 1500 matchups per day)
- same % as AIRS clear



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# IASI.sst2616syns- RTGSST



IASI

Version 3.6

mean=-0.19 K  
stdev= 0.46 K

Version 4.0

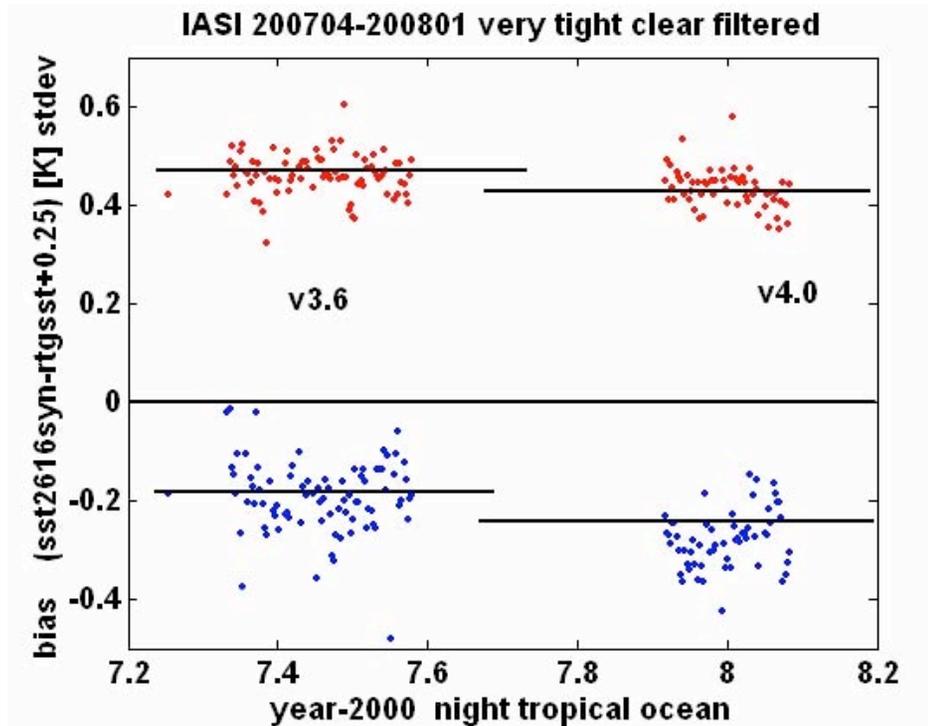
mean = -0.28  
stdev = 0.43



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## IASI.sst2616syns- RTGSST



IASI

Version 3.6

mean=-0.19 K  
stdev= 0.46 K

Version 4.0

mean = -0.28  
stdev = 0.43

Is this change in the bias the effect of a trend or the change in the software version or a change in the RTGSST?

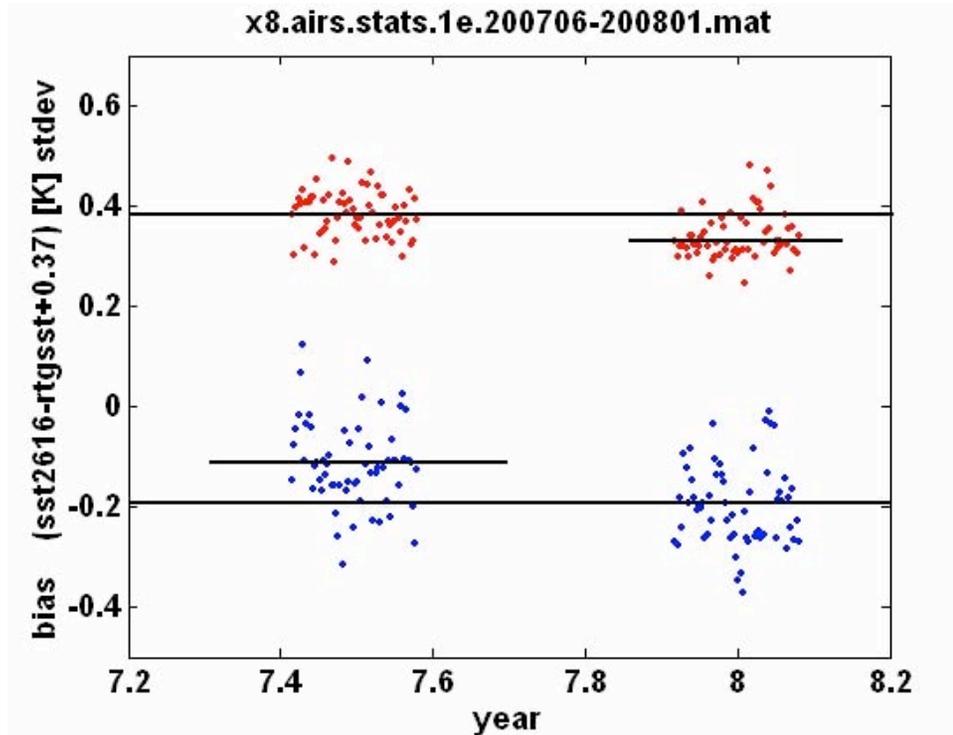
Evaluate using (IASI-rtgsst)-(AIRS-rtgsst) double difference



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## AIRS.sst2616- RTGSST



AIRS

mean=-0.12 K  
stdev= 0.38 K

Version 4.0

mean = -0.21  
stdev = 0.33



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## Double difference shows no effect of IASI version change in July 2007

IASI  
sst2616syn-rtgs

AIRS  
sst2616-rtgs

Version 3.6

June/July  
2007

mean=-0.19 K  
stdev= 0.46 K

mean=-0.12 K  
stdev= 0.38 K

Version 4.0

Dec2007  
Jan 2008

mean = -0.28  
stdev = 0.43

mean = -0.21  
stdev = 0.33

delta bias = 90 mK

90 mK



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## Double difference shows no effect of IASI version change in July 2007

	IASI sst2616syn-rtgs	AIRS sst2616-rtgs
	Version 3.6	
June/July 2007	mean=-0.19 K stdev= 0.46 K	mean=-0.12 K stdev= 0.38 K
	Version 4.0	
Dec2007 Jan 2008	mean = -0.28 stdev = 0.43	mean = -0.21 stdev = 0.33

delta bias = 90 mK

90 mK

The change in the bias is the same in AIRS and IASI is  
due to a seasonal effect in the RTGSST



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## Summary and Conclusions

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- **3 Methods of comparison applied**
- **AIRS – IASI: Tropical Ocean Clear Night**
  - Window “Bands” show agreement to  $< 0.1\text{K}$  @ 300K
  - Indicates On-board Blackbodies are accurate
- **AIRS – IASI: Antarctic Simultaneous Overpass**
  - MW, LW “Bands” show agreement to  $< 0.2\text{K}$  @ 220K
  - SW Agreement  $< 0.6\text{K}$  @ 200K; Could indicate a problem with IASI SW Calibration
- **IASI – SST v. AIRS – SST : Clearest Ocean Buoy Comparisons**
  - SW Agreement  $< 0.1\text{K}$  (@300K)
- **Agreement seen in these three tests is exceptional for spaceflight instruments. Very difficult due to large number of spatial, spectral and scene contrast effects**
- **IASI Radiometry is Accurate to the Levels Required for Climate Observations in Clear Uniform Scenes in MW and LW. SW seen to have high errors at cold scene temperatures**