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Pasadena, California

Atmospheric Infrared Sounder

AIRS Calibration Update

Denis Elliott

April 28, 2011

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Calibration and Operations Status
AIRS Science Team Meeting
April 26–28, 2011, Pasadena CA



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Atmospheric Infrared Sounder

Cal Team Members

- Denis Elliott
- Evan Manning
- Margie Weiler
- Ken Overoye
- Rudy Schindler
- Yibo Jiang
- Yuri Beregovski



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Introduction

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- **Purpose—describe on-going activities of the AIRS calibration team**
- **The AIRS calibration is excellent**
 - *Greatly exceeds specifications*
- **Nevertheless, there may be room for improvement**
- **No change to the radiometric calibration for V6**
- **For V6 L1c spectra will be available**
- **For V6 the spectral calibration is improved**

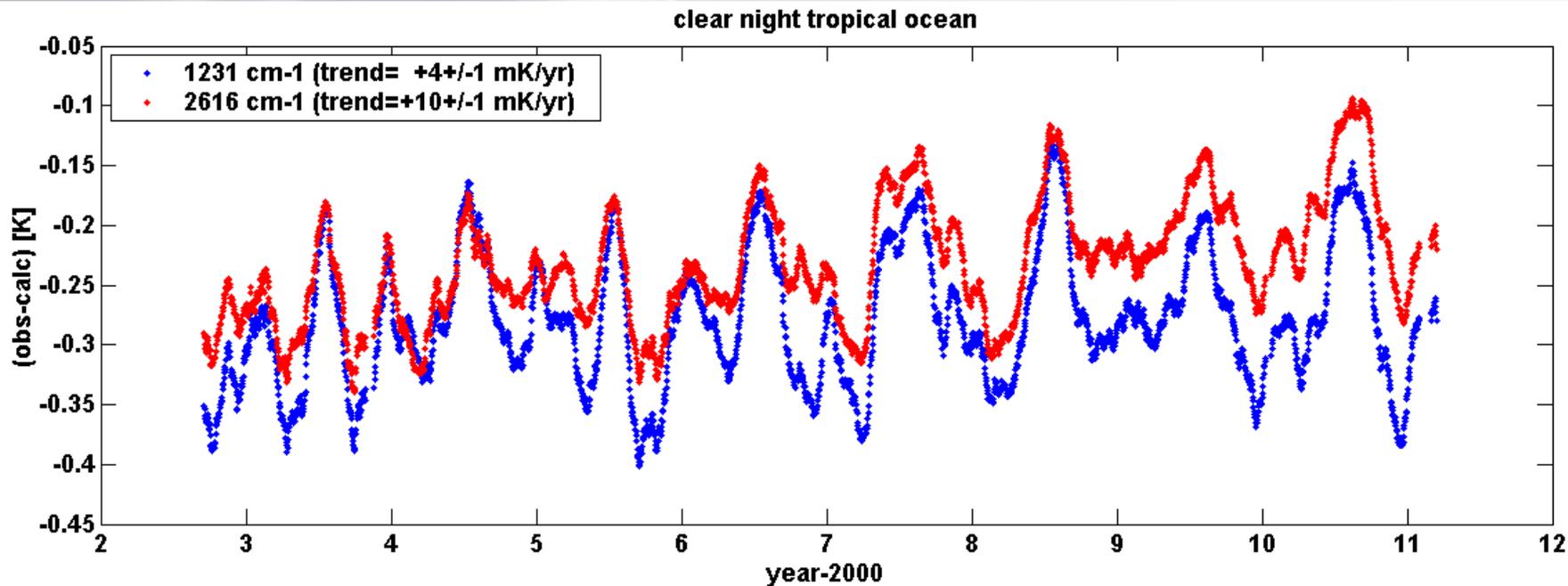


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Atmospheric Infrared Sounder

V5 radiometric calibration is excellent and extremely stable



No plans to change the radiometric calibration for v6



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Pre-launch calibration data analysis

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- **Ken Overoye and Margie Weiler (BAE Systems) are preparing a paper on the AIRS absolute radiometric accuracy based on a detailed re-analysis of prelaunch data**
- **They conclude that AIRS is capable of achieving 50mK accuracy—greatly exceeding specifications**

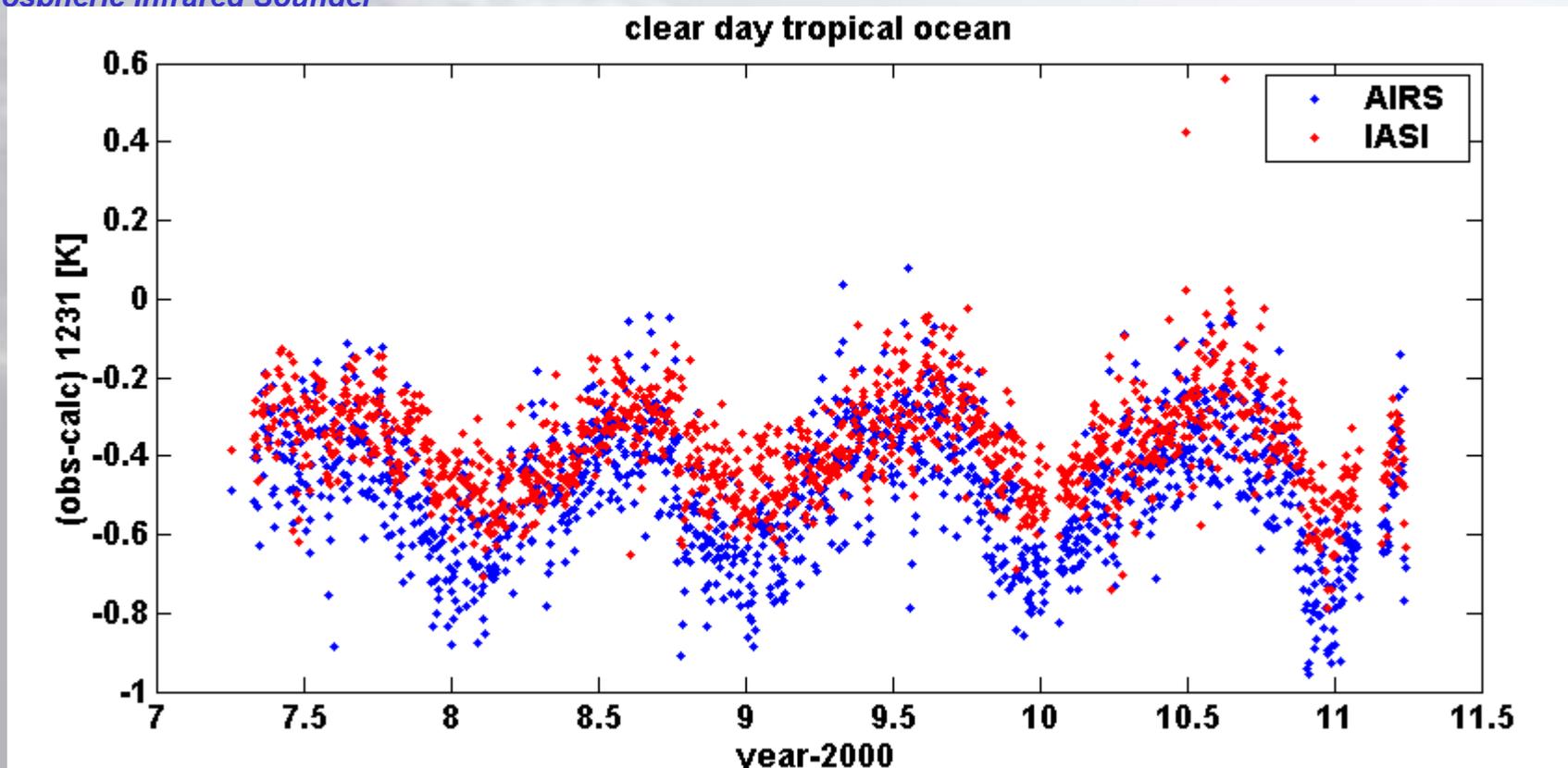


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AIRS/IASI window channel comparison

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- The mean of AIRS - IASI is less than 50 mK
- They both differ from ECMWF in the same way, both on average and seasonally

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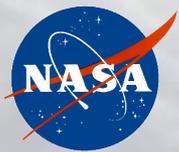
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Validation at the 50 mK level is pushing the State of Art

**Strow's (Obs-Calc) analysis shows excellent agreement
between AIRS and IASI**

- ***Both instruments show the same bias with respect to
ECMWF***

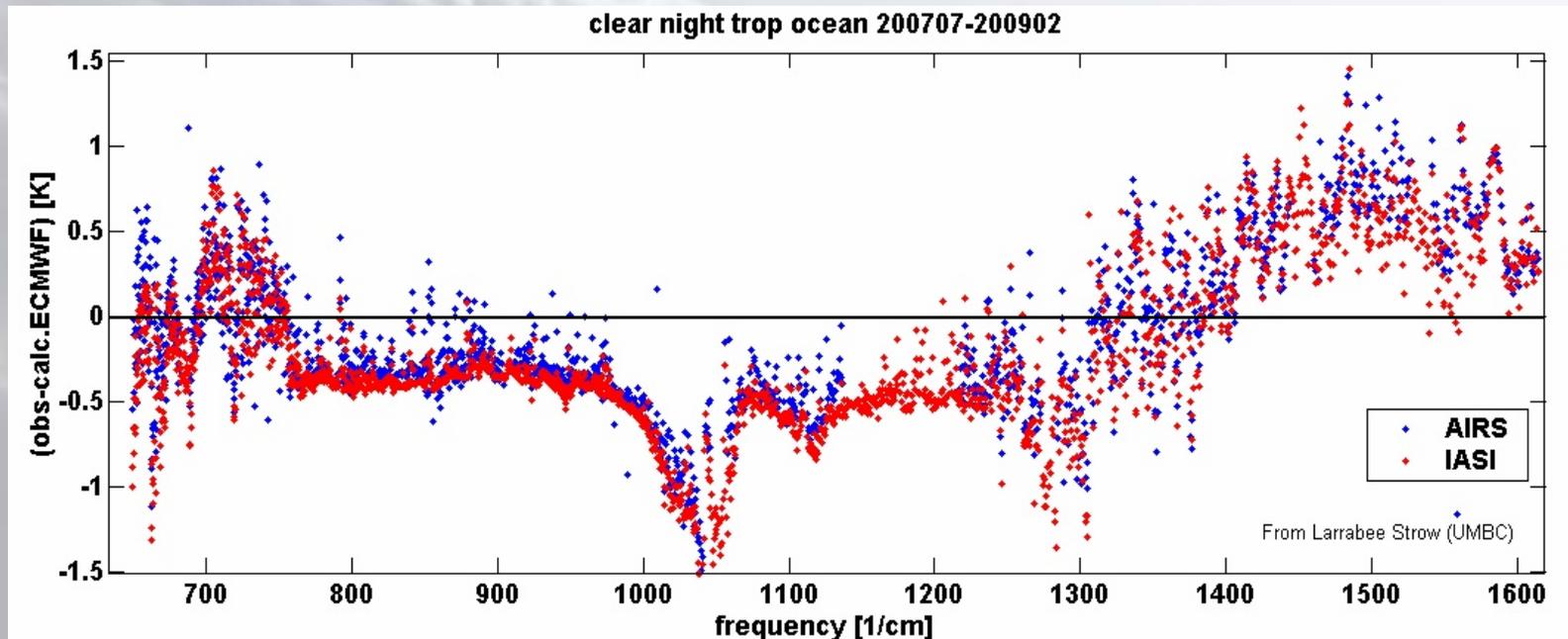


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AIRS and IASI (band 1 and 2) Obs-Calc (Strow)

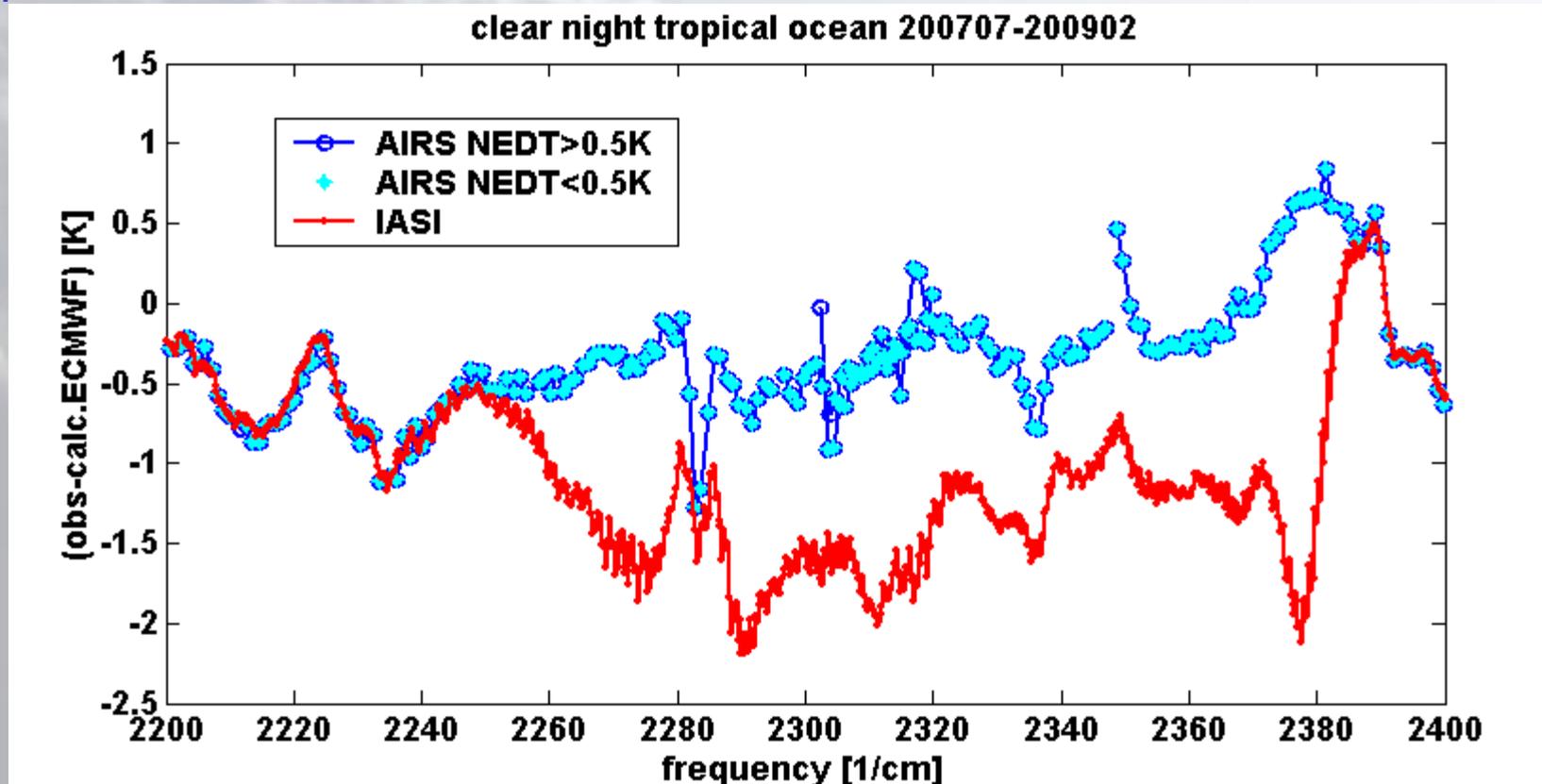


- AIRS and IASI show the same (obs-calc) bias in many channels. This indicates an error in ECMWF
- For some channels the AIRS (obs-calc) is up to 300 mK larger than for IASI. This is where there is room for improvement.



AIRS and IASI (band 3) Obs-Calc (Strow)

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- There are large differences between AIRS and IASI under very cold conditions between 2240 and 2390 cm^{-1} (IASI data truncation).

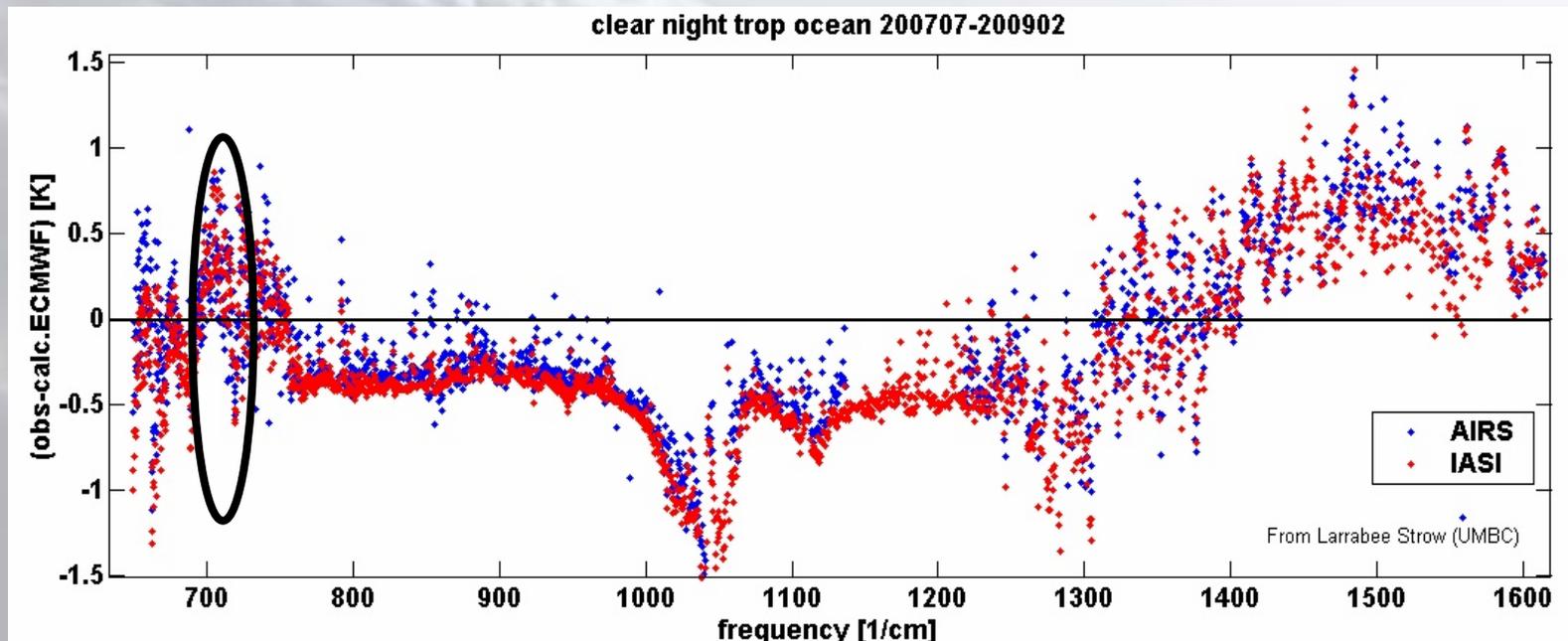


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AIRS and IASI Obs-Calc (Strow)

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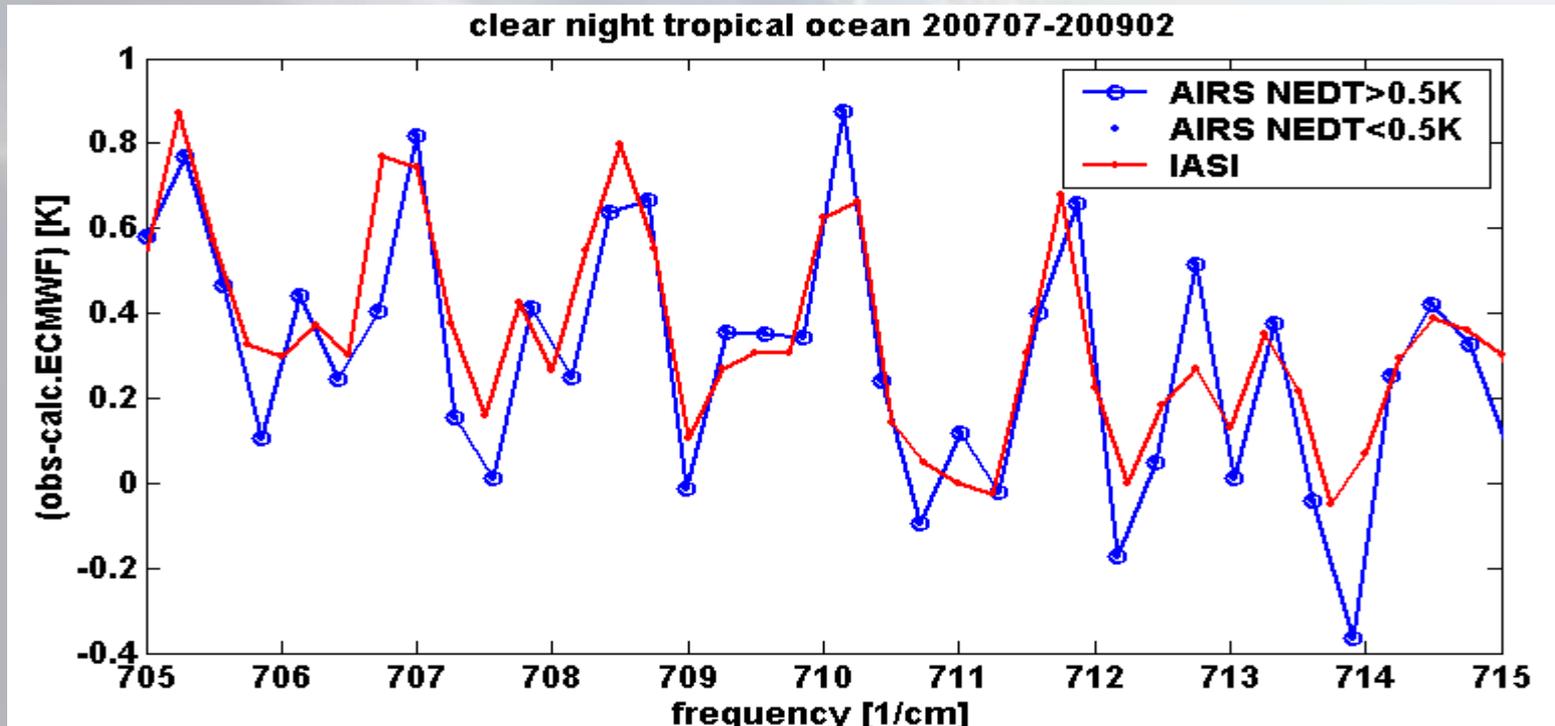
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Calibration data analysis

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There are outliers in this excellent agreement which require further analysis

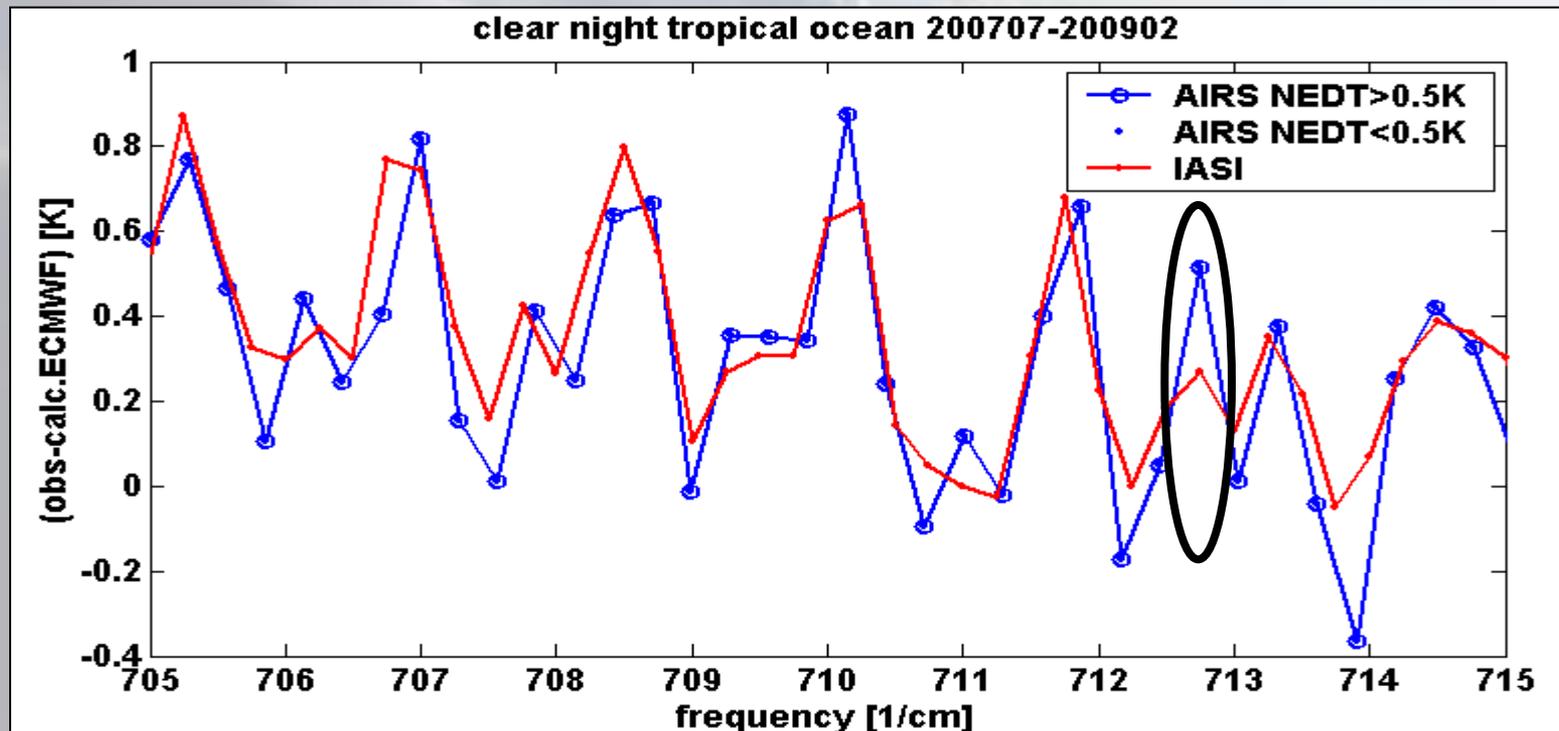




Calibration data analysis

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- Select the AIRS 712.74 and IASI 712.75 cm⁻¹ channels
- They sound the atmosphere near 400 hPa (about 250K)



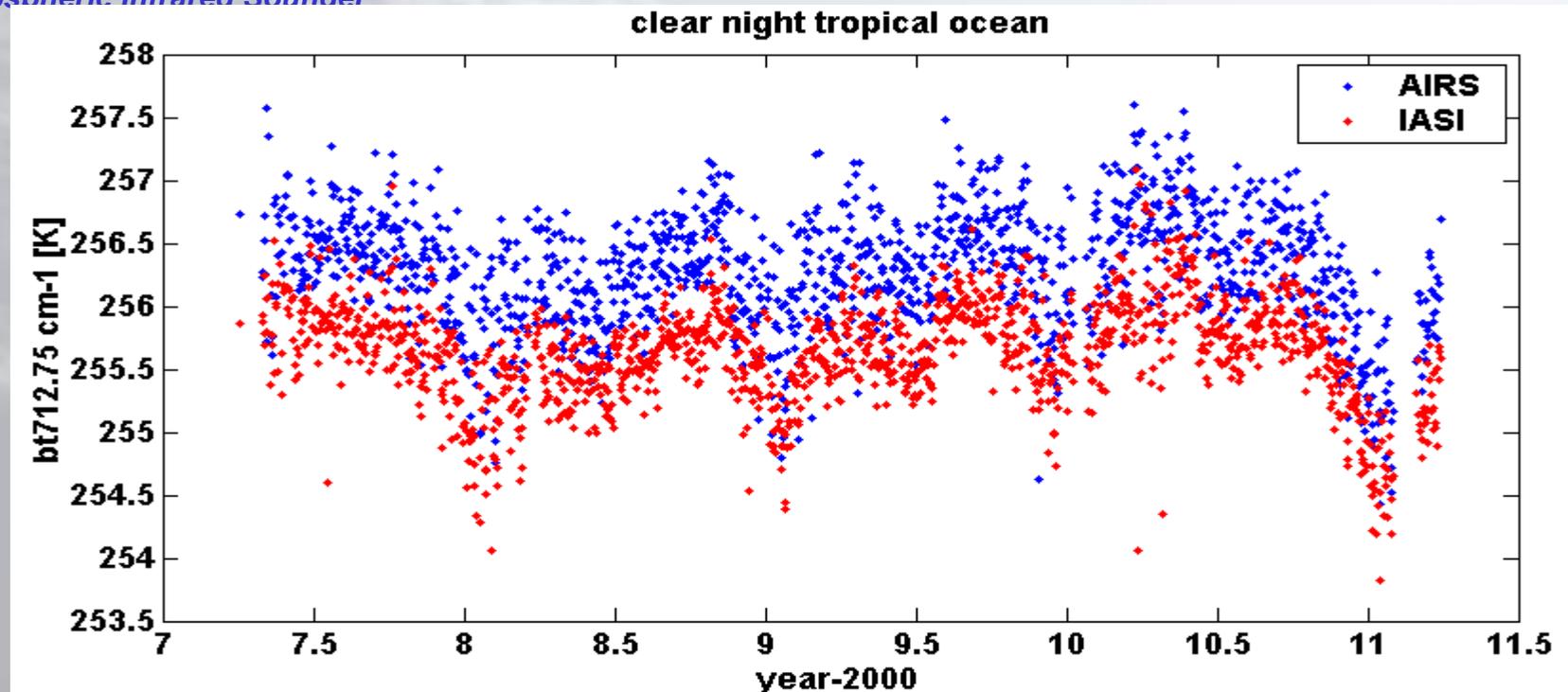


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The AIRS/IASI 400 hPa sounding channel difference has been stable

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- The mean of AIRS - IASI is 500 mK
- 350 mK of this 500 mK difference is due to the difference in the SRF shape. Only the centroids are aligned.

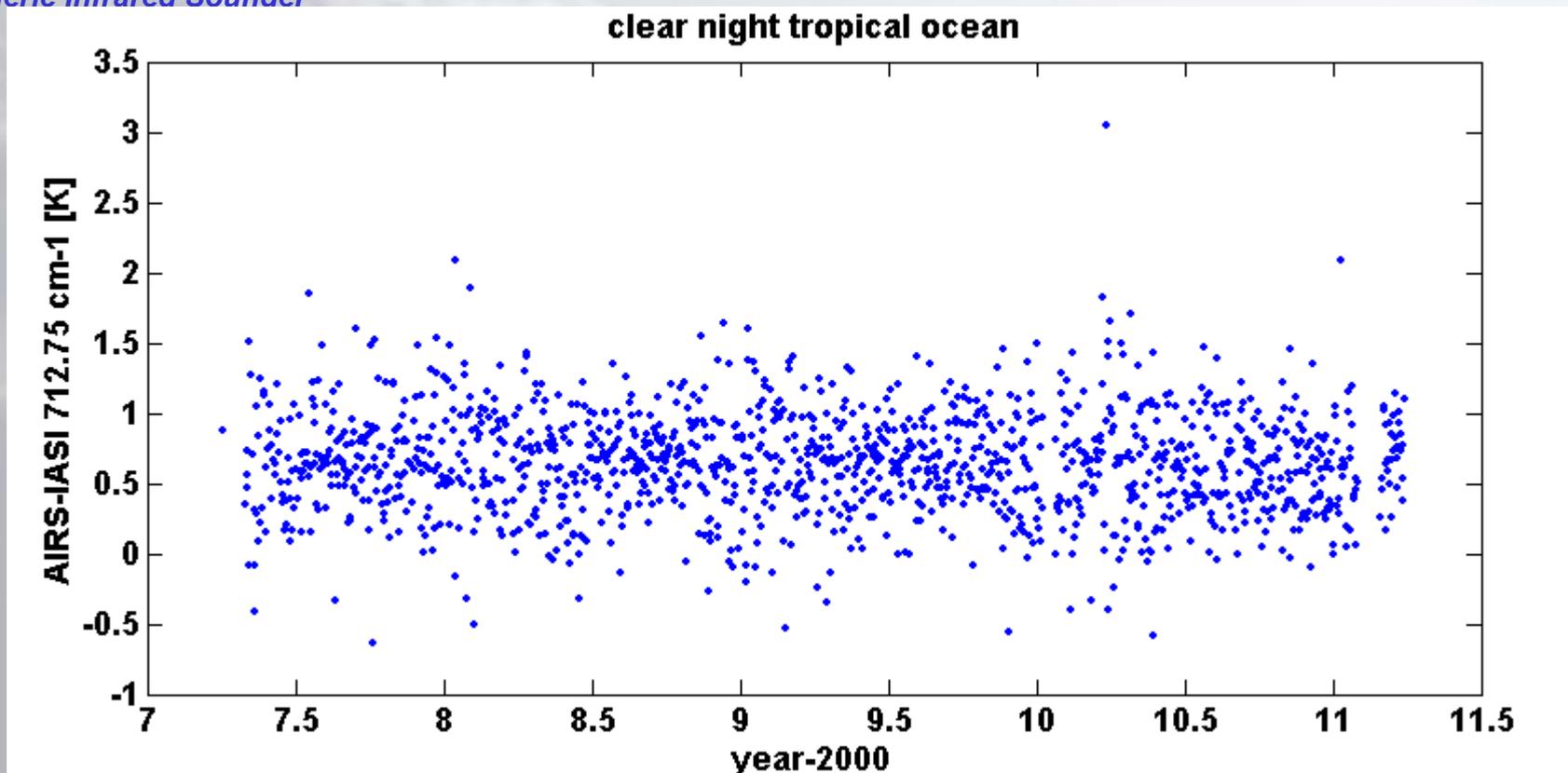


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AIRS/IASI 400 hPa sounding channel comparison

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- The stdev of AIRS - IASI is less than 0.3 K
- This is consistent with the AIRS/IASI detector noise



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Calibration discrepancies at extreme temperatures

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- **AIRS L1b spectra include spectral overlap channels. For some overlap channels we see more than 50 mK differences at extreme temperatures**
- **We are looking at DomeC and DCC data.**
- **IASI has spectral overlap channels in the L1b data. They have been used to empirically aligns the spectral bands in the IASI L1c spectra. IASI L1b is not available.**

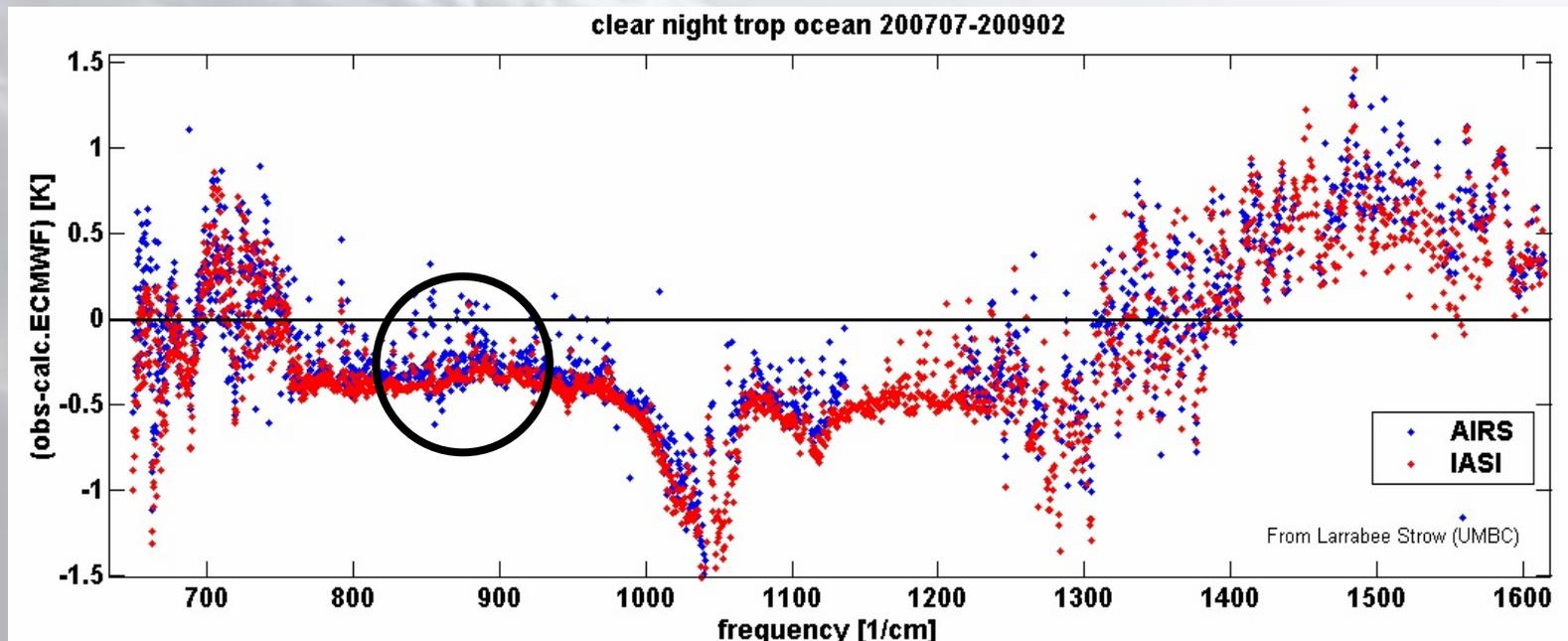


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AIRS and IASI Obs-Calc (Strow)

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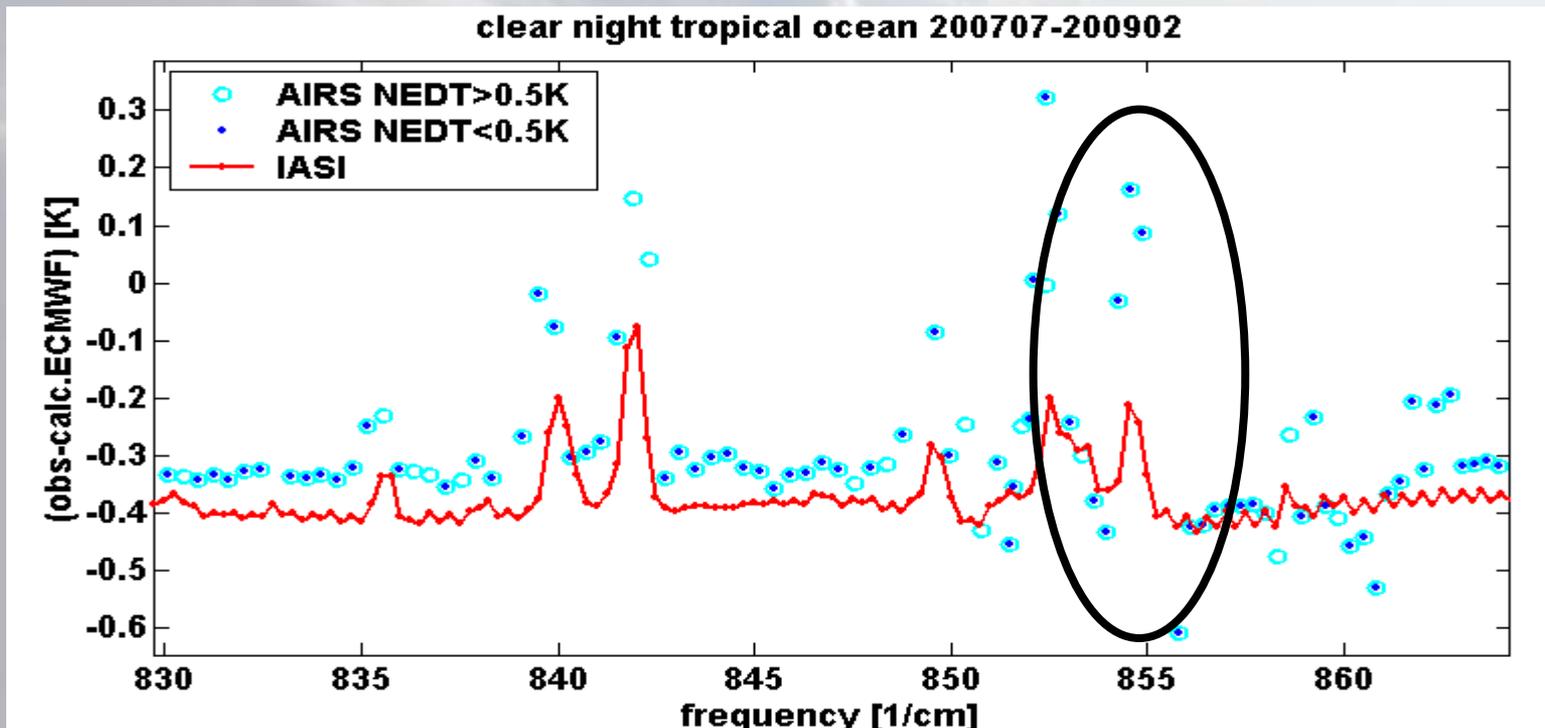
Focus on the 856 cm-1 overlap region



Calibration data analysis

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- The spectra overlap region shows differences even at 300 K
- This require further analysis
- Few radiometric outliers are noise outliers





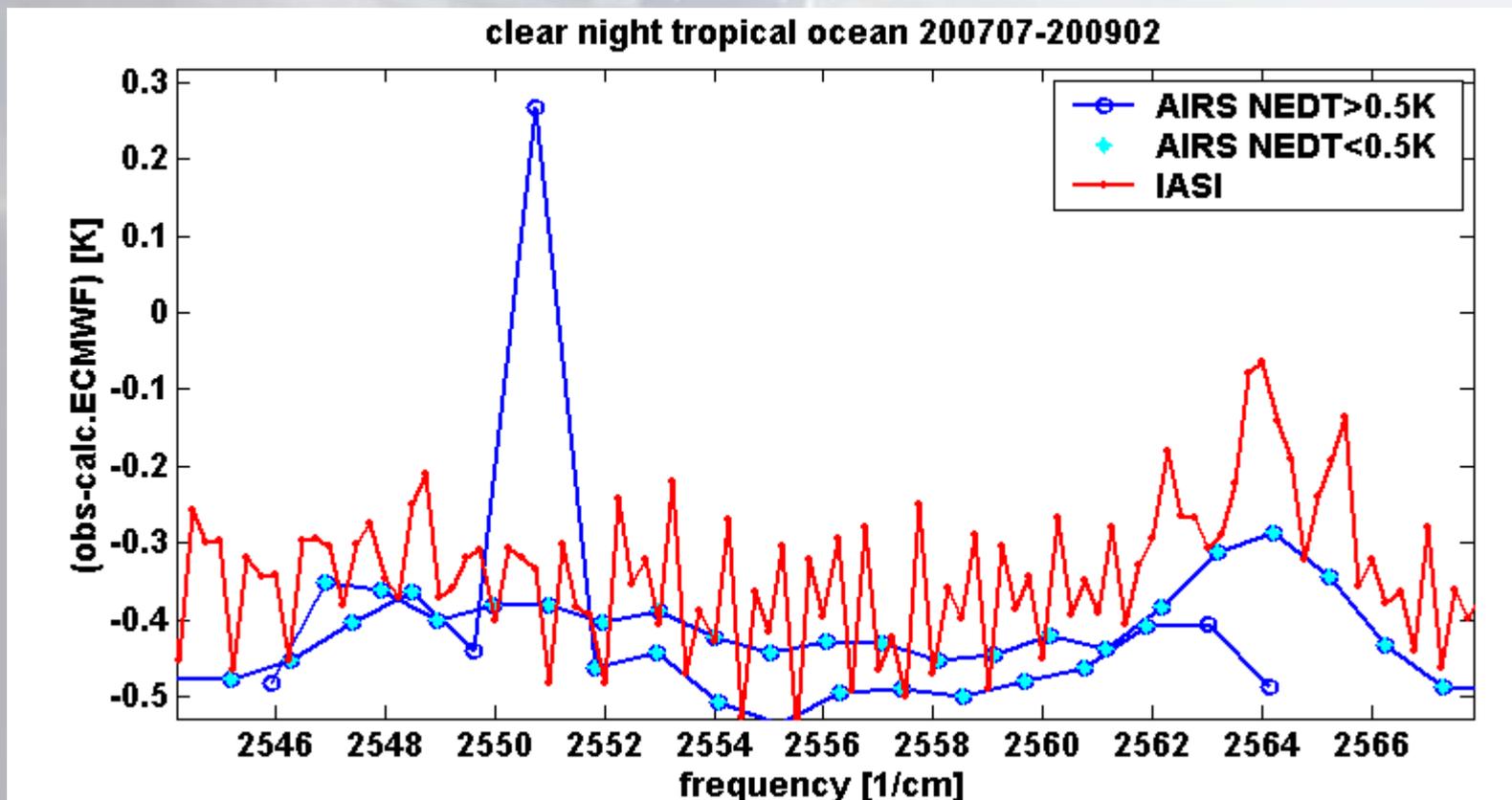
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Calibration data analysis

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- Some spectra overlap region shows 100 mK differences even at 300 K
- Some but not all radiometric outliers are noise outliers





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Spectral Calibration

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- **The V5 L1B spectral calibration algorithm meets the FRD requirements. It determines the SRF positions to within 10 ppmf.**
- **For Climate applications 0.5 ppmf is required**
- **The V6 L1b has an algorithms to determine the amount of spectral shift versus time within 0.5 ppmf**
- **The RTA has the capability to calculate the radiances at the true SRF centroids.**
- **A review copy of the ATBD for the spectral calibration is in circulation**



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L1C

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L1C spectra are derived from radiometrically and spectrally corrected L1b spectra, including empirical corrections.

A software package can be used to create “cleaned” spectra from L1b spectra.

Noisy or dead channels are dynamically detected and replaced using PCA with the most likely correct valued. Typical accuracy is better than 200 mK.

Channels modified by the cleaning process are marked.

The prolonged use of cleaned channels is not for climate.



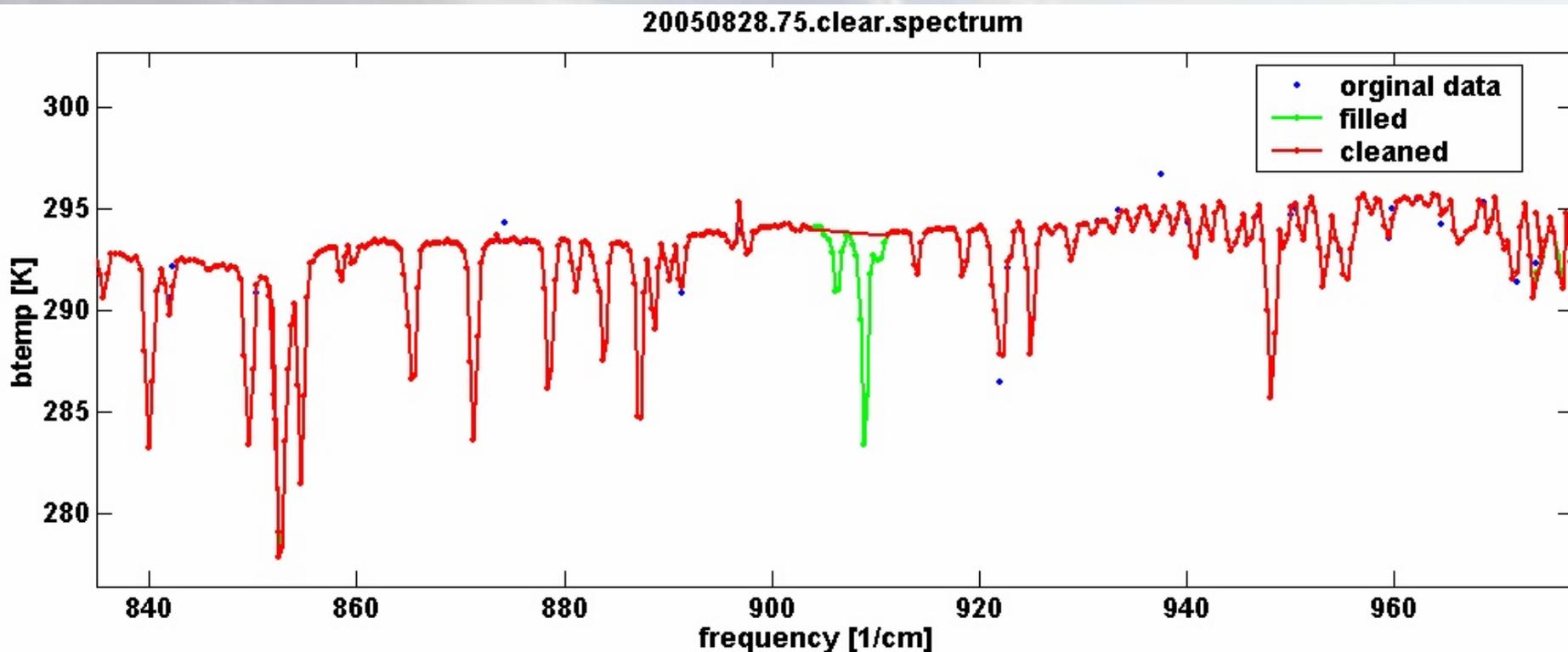
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L1C

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Cleaned spectra can also be ordered from the DACC

The availability of L1c eliminates the need for equivalent software in the regression, angle correction and SCCNN modules.

The cleaned spectra are suitable for spectral convolution and interpolation

We have an test version of clean+gap fill. This option will be for V7.



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Summary and Conclusions

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- **No changes to radiometric calibration in L1B for V6**
- **L2 (using the new RTA) will take advantage of the improved spectral calibration (see Evan's talk to follow)**
- **Validation and the search for improvements for radiometric calibration are an ongoing effort for V7 to establish AIRS L1b as the climate benchmark.**
- **The AIRS climate data benchmark is the combination of L1b and extensive validation documentation in the open literature.**



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Thanks for your attention



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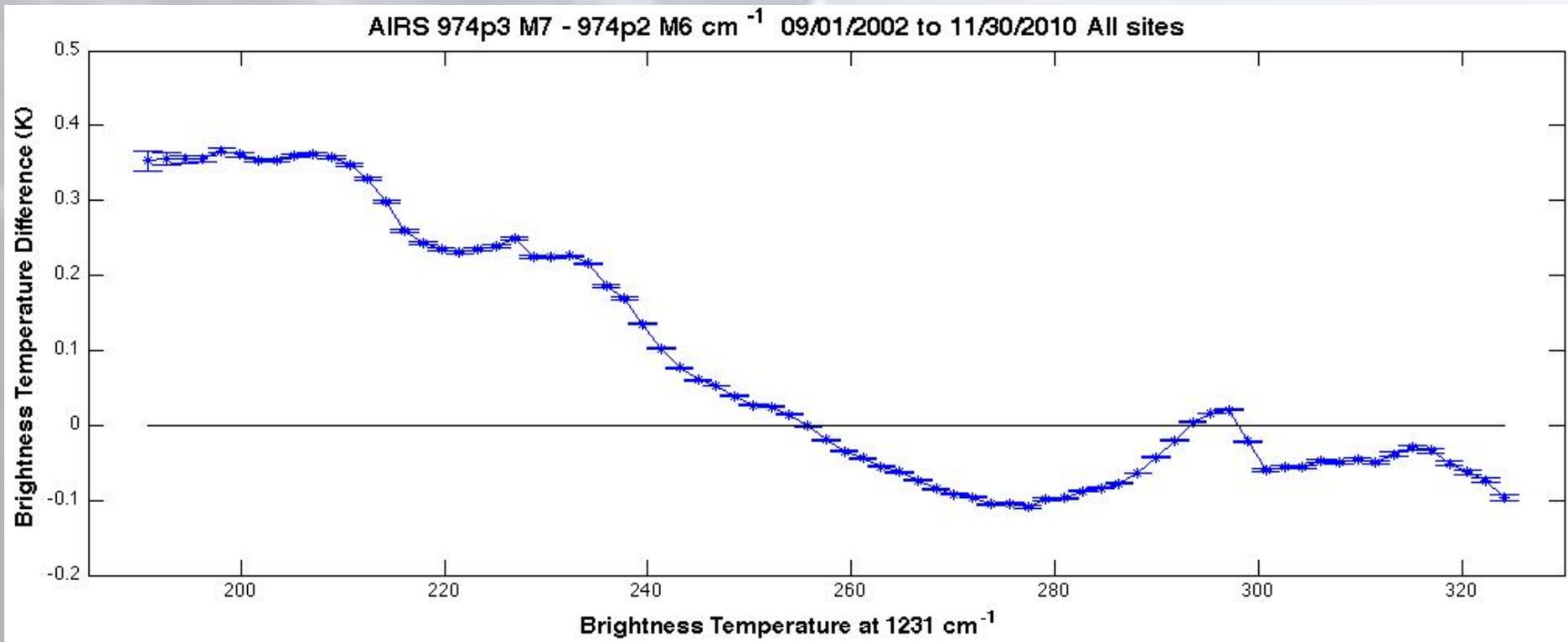
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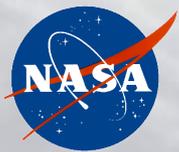
Backup



Overlap pair at 974 cm⁻¹

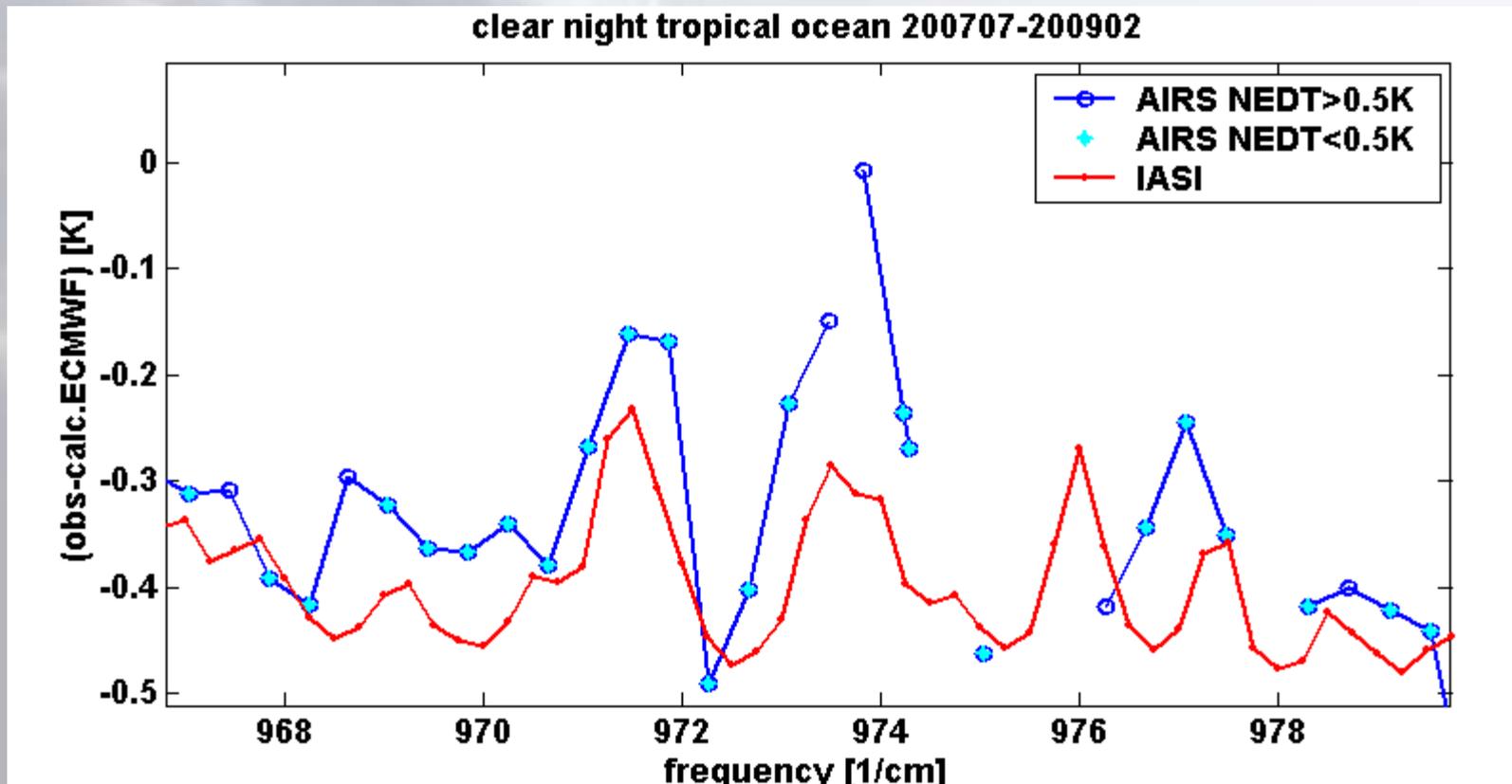
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Overlap in the 974 cm⁻¹ region

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Day vs night—no difference

Atmosp

