Intercalibration of IASI with AIRS and CrIS

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Overview

- NPP/CrIS started operation Jan. 2013
- "Final" configuration: mid-April 2013
- CrIS extends EOS-AQUA AIRS in the "A.M." orbit
- IASI provides radiances for the "P.M." orbit

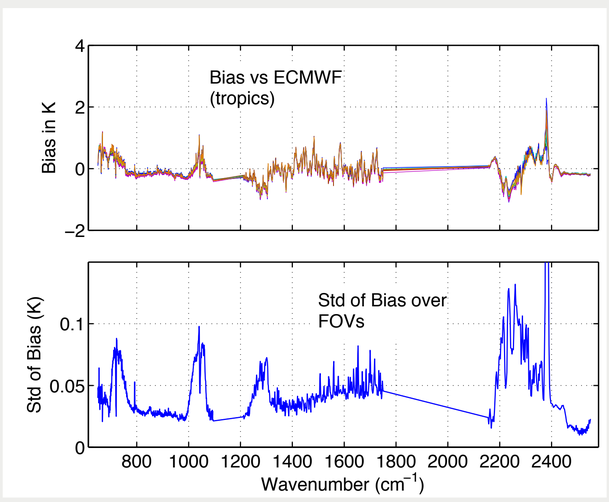
(AIRS + CrIS) together with (IASI) provides 4 daily global observations of the Earth.

Can these three instruments provide a "CLARREO" like climate radiance record for climate change trending with diurnal averages?

Climate research generally uses diurnally averaged quantities.

CrIS

- Three (longwave, midwave, shortwave) focal planes
- Each focal plane is a 3x3 detector array
- Apodization corrections are quite large
- Considerable effort (pre-,post-launch) to ensure common radiometric and spectral response for each of the 9 focal plane detectors. Goal: ~0.03K mean B(T) differences

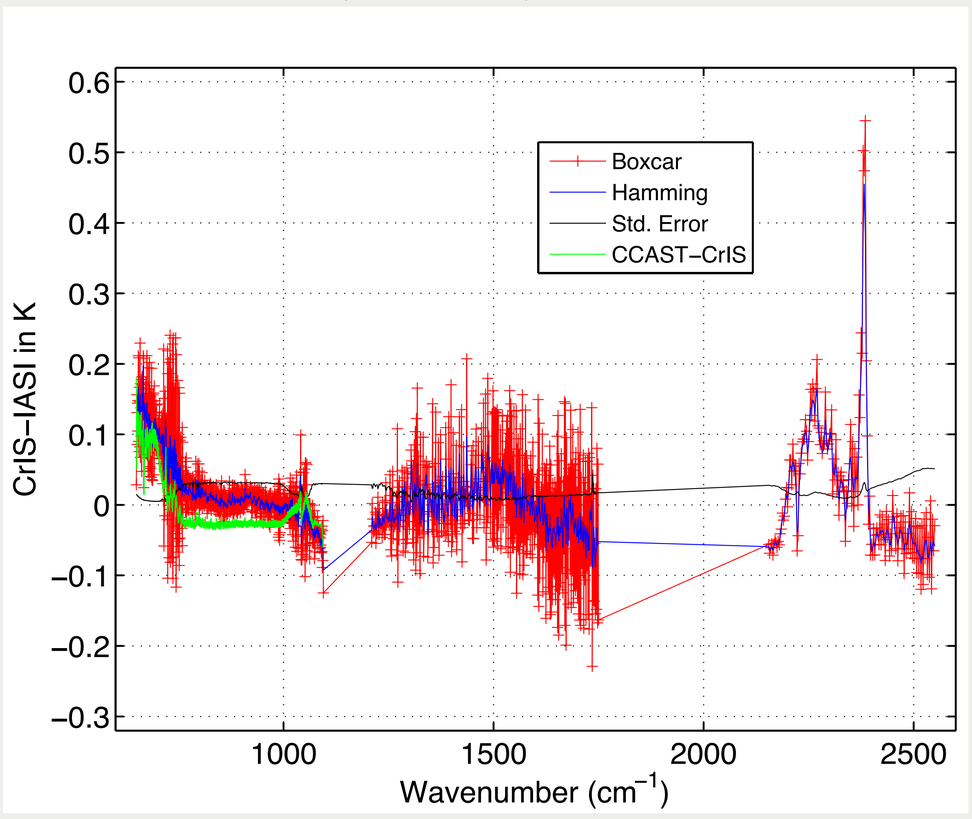


- Clear tropical scenes, simulated radiances from SARTA.
- Std of Bias over FOVs 0.03-0.05K in LW, SW bands.
- Higher Std near 750 cm^{-1} may be due to CO_2 variability in the 220 day average.
- Uniformity among FOVs due non-linearity corrections (Tobin/Revercomb U.W.) and spectral apodization corrections (Present authors, Tobin (UW).

SNOs: Simultaneous Nadir Overpasses (Provided by NASA/JPL NPP Sounding PEATE)

- SNOs used to intercompare CrIS with AIRS and IASI
- IASI-CrIS SNOs limited to two tight latitude ranges at ± 73 deg. latitude.
- AIRS-CrIS SNOs primarily at higher latitudes, but significant number at all latitudes with 10 minute, 8 km window match criteria.

Results use SNO's for month of May 2012 for (IASI-CrIS), and for May 2012-Dec. 2012 for (AIRS-CrIS).

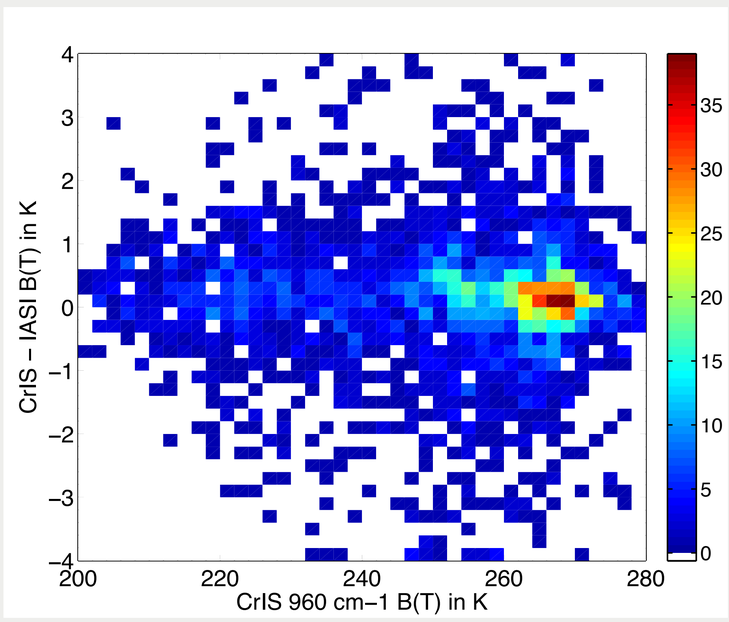


Very good agreement for Hamming apodization (blue curve). Shortwave issues not fully studied.

Slight disagreement in long-wave may be CrIS SDR algorithm. Green curve is the difference between CrIS SDR product and CCAST (CrIS SDR testbed algorithm by UW (Tobin) and UMBC).

IASI vs CrIS for 960 cm^{-1} Channel:

Any scene dependence? (Color scale are counts.)

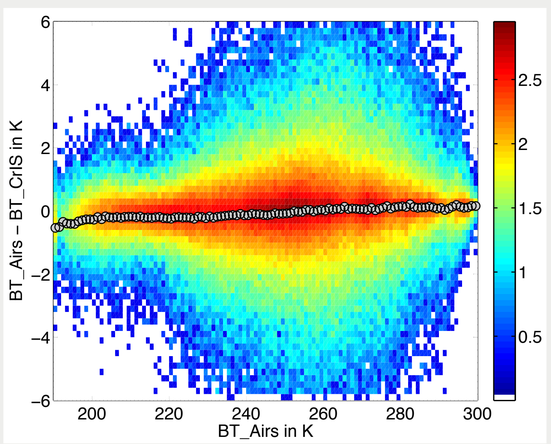


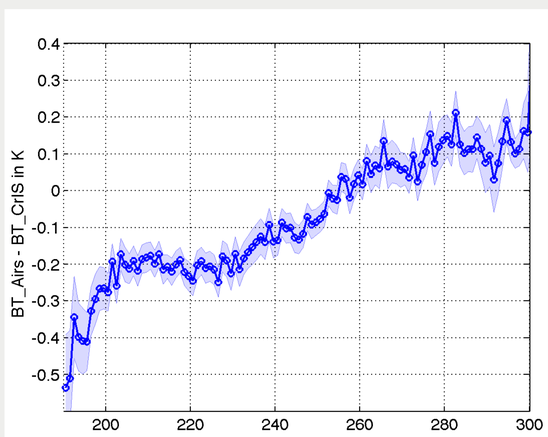
Mean CrIS-IASI = 0.02K ± 0.02K (Std. Error)

No visible scene dependence. Will soon have improved statistics.

AIRS vs CrIS for 960 cm^{-1} Channel: 220 Days

We see below some scene dependence for AIRS vs CrIS, CrIS warmer than AIRS for cold scenes. 2-σ errors shown with shading.

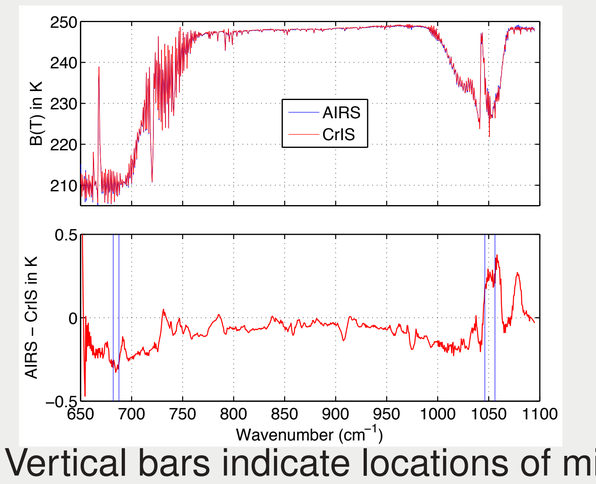


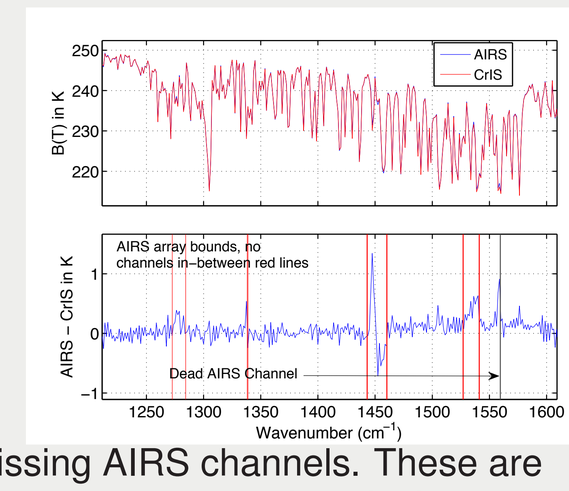


Statistics too low to be definitive yet for IASI vs CrIS. This approach show one must be careful with global inter-comparison statistics.

Mean SNO Differences: AIRS vs CrIS for Long-Wave, Mid-wave

AIRS L1b converted to L1c (remove popping channels, add missing channels). Then AIRS SRF (spectral response) converted to CrIS SRF. Slightly smoothed (vs ν) in long-wave.





Vertical bars indicate locations of missing AIRS channels. These are inserted in L1c in order to improve conversion of AIRS to CrIS for AIRS channels the do exist. In general very good agreement (again CrIS warmer in 750 cm^{-1} region). L1c code from H. Aumann, NASA/JPL.

Conclusions

- Early CrIS vs AIRS, IASI assessment very encouraging, at the 0.1-0.2K level
- Spectral differences among instruments needs more work to create a "Climate" radiance record (CDR).
- All three instruments appear to be very stable, so most of the work to create a CDR is in removing SRF differences.

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