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L1c

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AIRS L1C, Freq Cal, RTA

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October 17, 2008

Overview

- RTA upgrades
- Frequency Calibration
- L1C issues
- A new method for deriving spectroscopy from radiances??

RTA

- New RTA ready, now IASI and AIRS RTA's have identical physics
- More recent HITRAN used, so ozone and water changed
- Empirical RTA tuning not yet done using coincident sondes
- Minor coefficient changes; additional CO_2 coefficient and Non-LTE coefficient
- RTA has several regression coefficient sets to account for frequency variability, fringe movements (Nov. 2003), and base CO_2 amounts.

name		yoffset(um)	Tef(K)	CO2(ppmv)
m130x370	:	-13.0	155.770	370
m140x370	:	-14.0	155.770	370
m130x385	:	-13.0	155.770	385
m140x385	:	-14.0	155.770	385
m130	:	-13.0	156.339	385
m140	:	-14.0	156.339	385
m150	:	-15.0	156.339	385

- Implementation at JPL?

Frequency Calibration

- Use a cross-correlation technique on M12 (LW) for ν calibration
- Cross-correlate L2CC radiances with Calc radiances. Calcs done using ECMWF.
- One ν calibration per granule.

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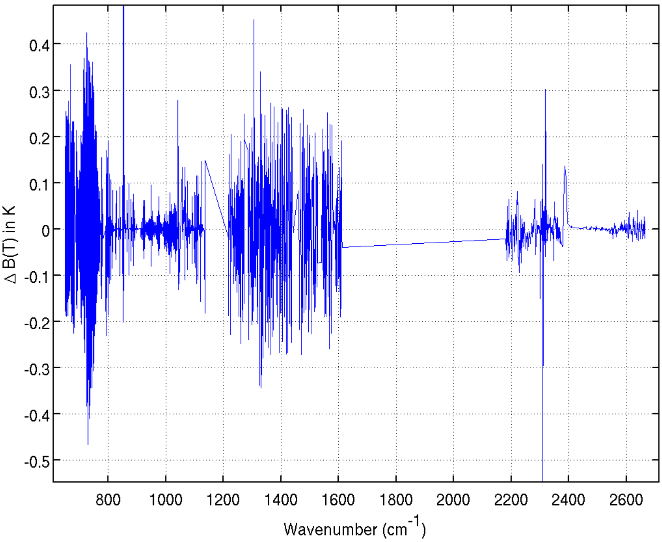
Δ B(T) for a dx = 1 um



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ν Calibration

Binned by 2 deg in latitude, 16 days in time

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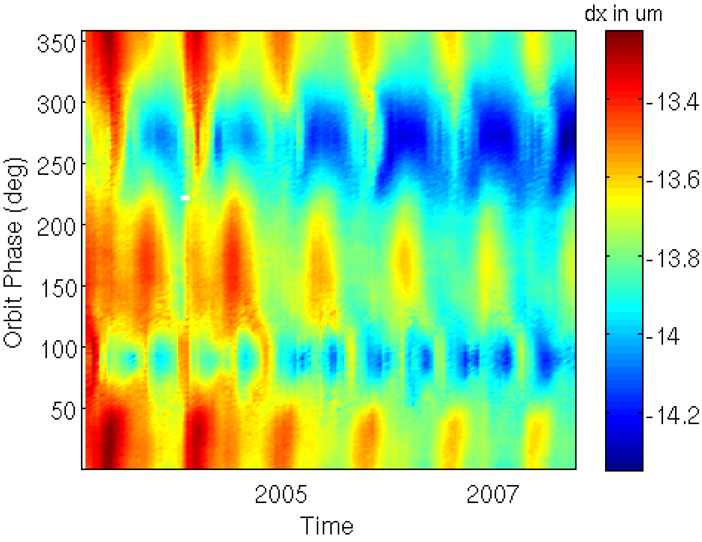
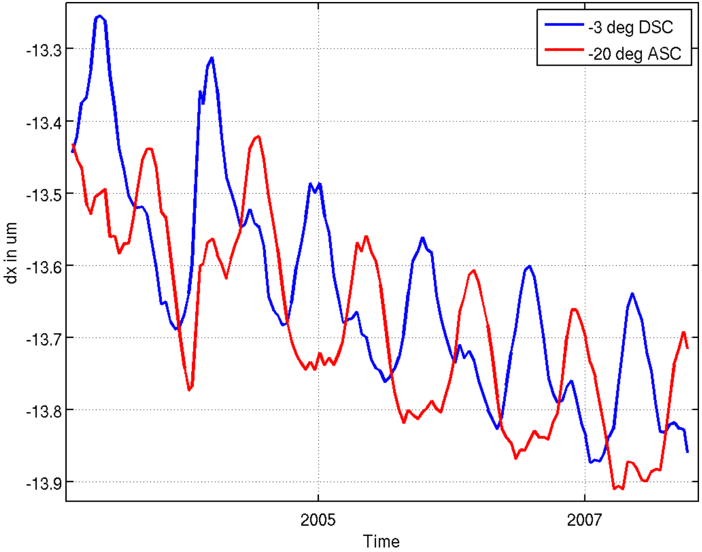
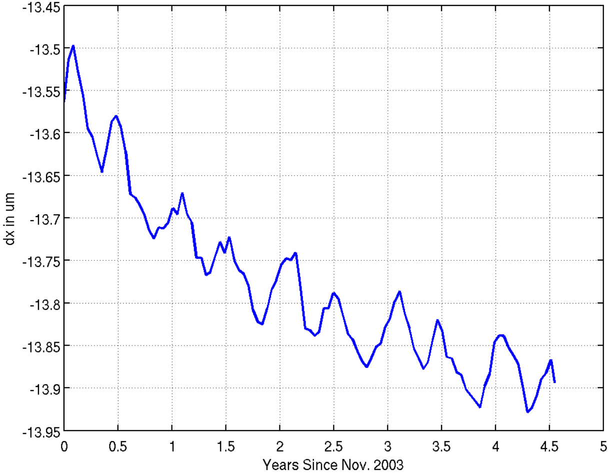


Example Latitude Bins



Time Dependent Drift: Raw Data

Good news, drift is slowing down



Frequency Calibration Model

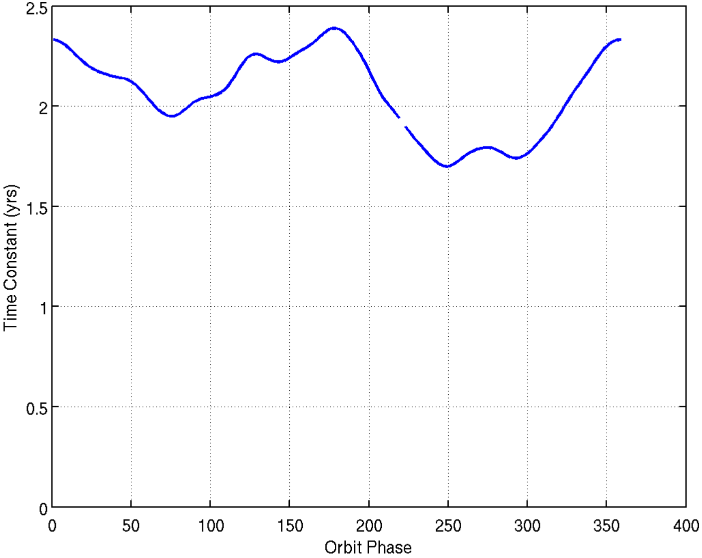
Raw ν calibrations were binned by 2 deg. in orbit phase, giving 180 data sets which were fit to the following expression:

$$\nu(t) = \nu_o - b_1 exp(-t/b_2) + \sum_{i=1}^{3}[a_i \sin(2\pi t + \phi_i)]$$

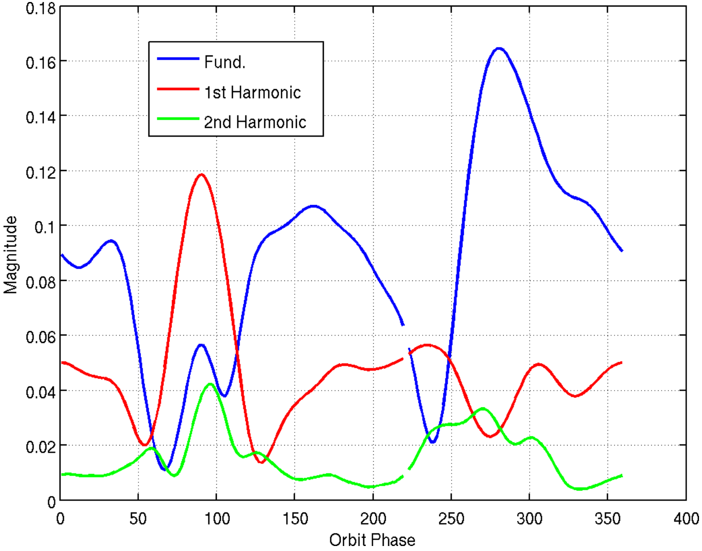
From now on, results are only for post-Nov. 2003. Separate fits for Aug. 2002 to Nov. 2003.

Fast behavior in which of the 180 equations you use (orbit phase). Slower behavior is in time.

Derived $d\nu$ Time Constant

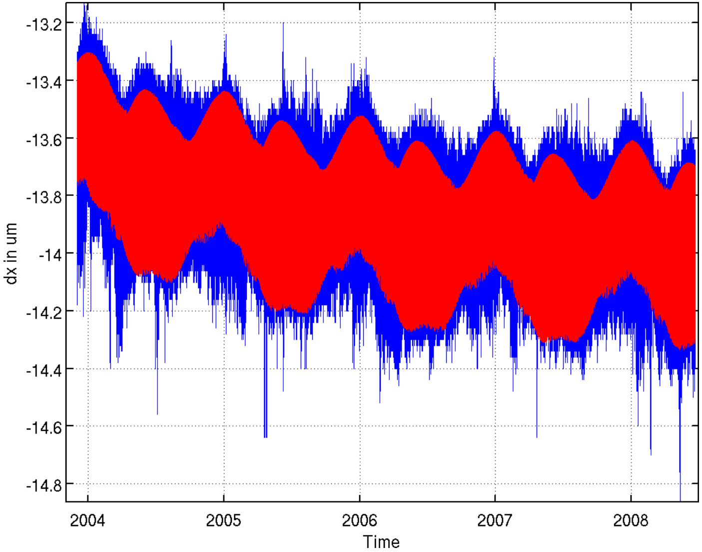


Amplitude of Sinusoidal Terms

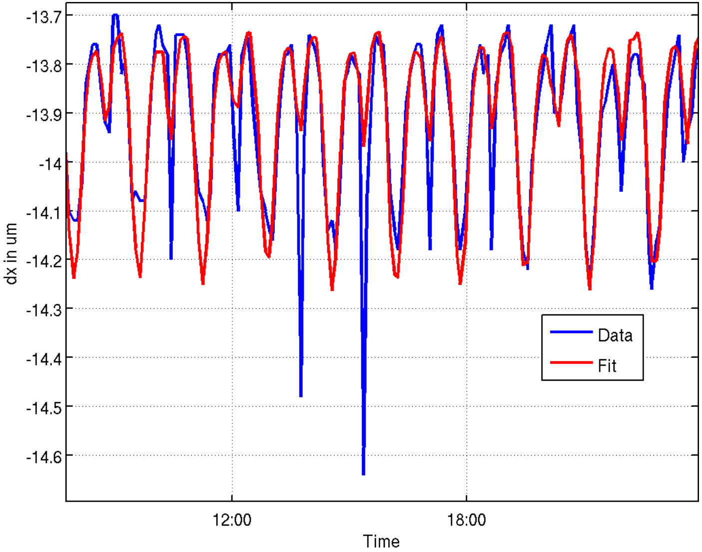


Observed and Computed dx

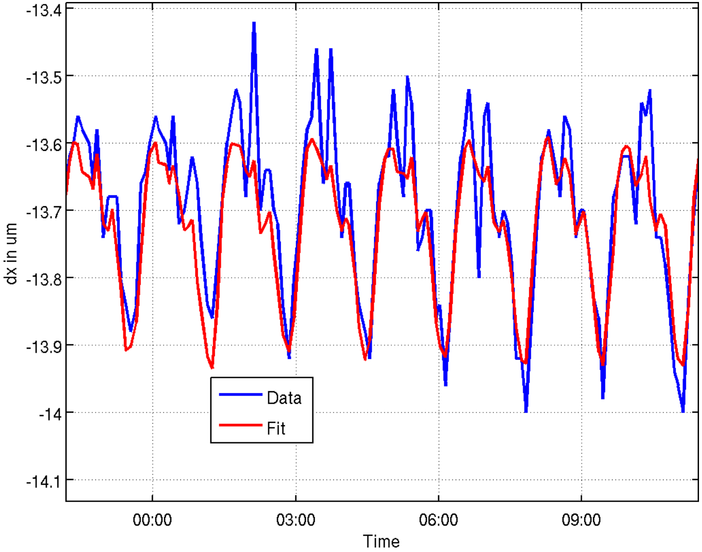
Highest error obs removed (1.5%).



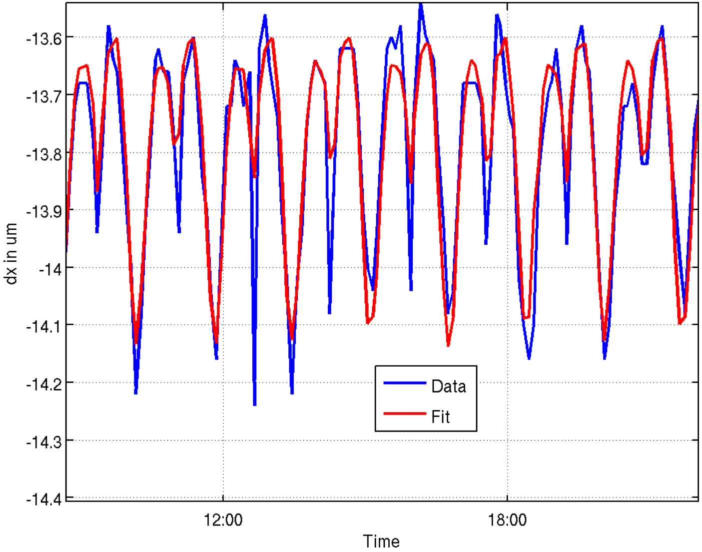
Zoom of Obs and Computed dx



Zoom of Obs and Computed dx



Zoom of Obs and Computed dx



Max B(T) Errors Over 5.8 Years

Includes Orbital Swings

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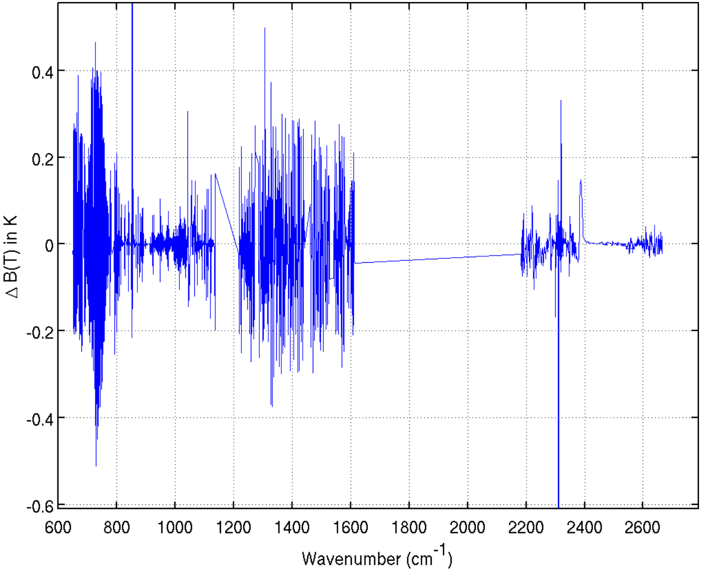

Implementation

Basic idea: Once know $\Delta\nu$, create two RTA calculations with nominal atmospheric state to determine $dR/d\nu$. Then $R_{L1c} = R_{obs} + dR/d\nu \times \Delta\nu$.

1. Calibrate with reasonably clear FOVS
2. Develop smooth model for calibration
3. Use model to: (1) produce L1c (2) modify CC'd radiances in L2;

- Calibration
  - Inputs: Clear only (poles?), CC'd radiances?
  - Auxillary info: ECMWF, AVN, limited climatology?
  - CPU intensive
- Corrections
  - Create L1c, *need "cloudy" state for RTA calcs*
  - Create ΔB(T) for L1b, for ACDS only?
  - Correct L2cc radiances instead for retrievals?

Biases vs ECMWF Vary with Secant of Viewing Angle

- Empirical corrections used average biases
- Spectroscopy, constituent abundance errors will vary with viewing angle/secant
- Assume ECMWF errors do not depend on secant angle
- Fit $dbias = offset + slope \times \Delta secant$; *offset* very small
- If assume $bias = (inst\_bias, model\_bias) + slope \times secant$ can use above fit to determine slope, and then solve for (inst_bias,model_bias)
- Still need atmospheric constituent amount/profile to get spectroscopy

Fit Results: Slope of dbias/dsec

Secant varies from 1 to 1.37

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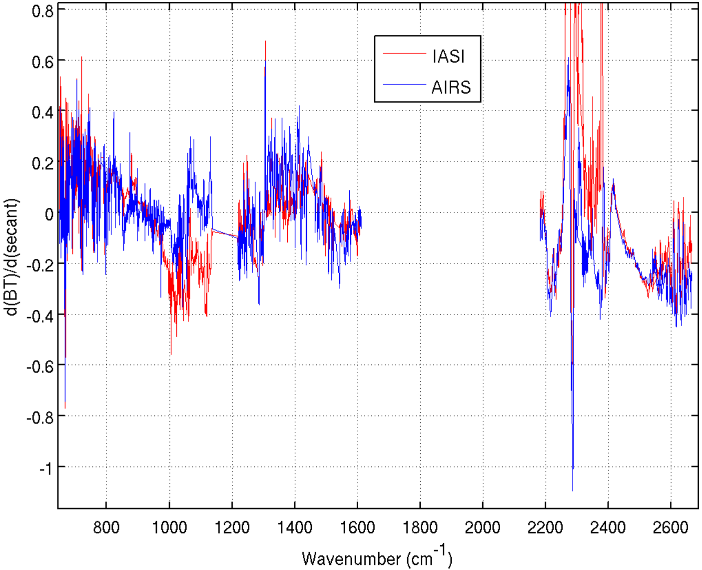

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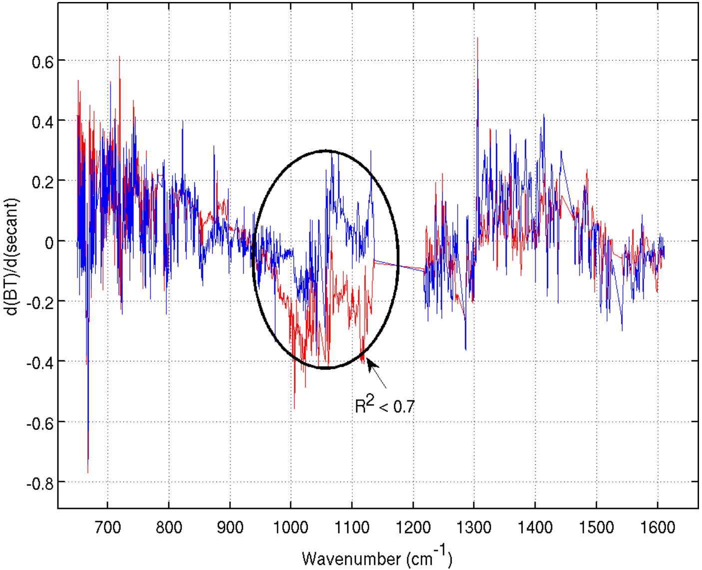
Fit Results: Slope of dbias/dsec, zoom



Fit Results: Slope of dbias/dsec, zoom