

Status of AIRS RTA Maintenance

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AIRS Science Team Meeting
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Overview

- HITRAN changes smaller than other issues (tuning)
- Slowly working to re-create Scott Hannon's RTA coefficient production, but will take a long time
- Main issue are changes in CO₂, CH₄, N₂O, etc, not HITRAN: are they still valid in RTA?
- Present approach: modify tuning

This work: Examine (a) ECMWF Biases and (b) ARM Best Estimate sonde measurements from 2012-2014.

Thanks to Lori Borg and Dave Tobin (UW-SSEC) for preliminary ARM-BE sonde data.

RTA Models

- SARTA w/o Tuning: April 2008 model, no tuning, used HITRAN 2008
- SARTA with Tuning: Above model with empirical absorption coefficient tuning based on radiosonde intercomparisons. One scaling factor for all levels. Used by AIRS V6 PGE
- kCARTA 2008: UMBC's pseudo LBL code using HITRAN 2008 (no tuning)
- kCARTA 2012: UMBC's pseudo LBL code using HITRAN 2012 (no tuning)

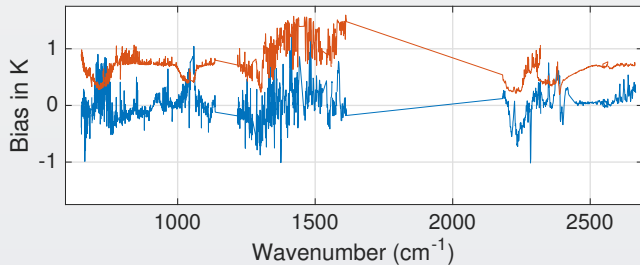
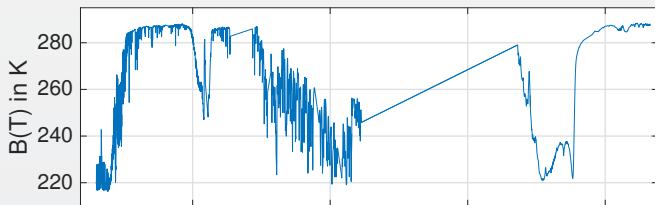
CO₂ varied using interpolation of NOAA-ESRL Mauna Loa measurements. CH₄ and N₂O only varied for ECMWF bias intercomparison.

ECMWF: Jan 20, 2016

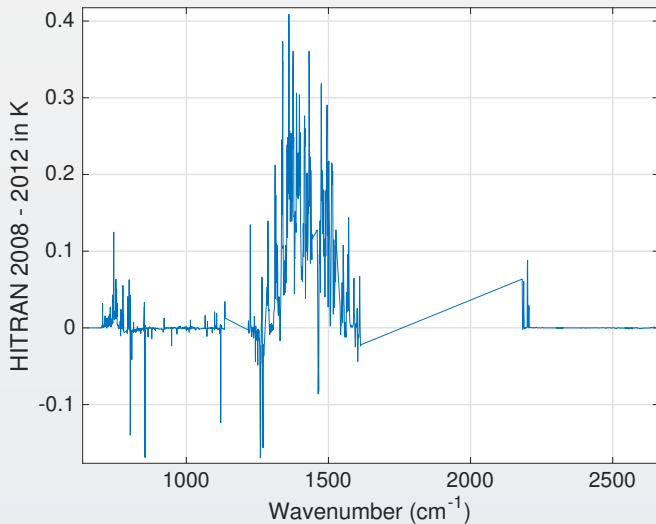
- AIRS bias tunes to ECMWF
- CrIS SDR Team Focus Day
- Implemented nominal corrections for trace gases
- Compare tuning to no-tuning, and to recent LBLRTM CO₂ modifications
- LBLRTM comparisons possible due to Sergio creating kCARTA database for non-water gases using LBLRTM
- Showing 30 - 50 degree latitude clear ocean night spectra. Tropical are similar.

Note: LBLRTM uses HITRAN 2012+, and different lineshapes

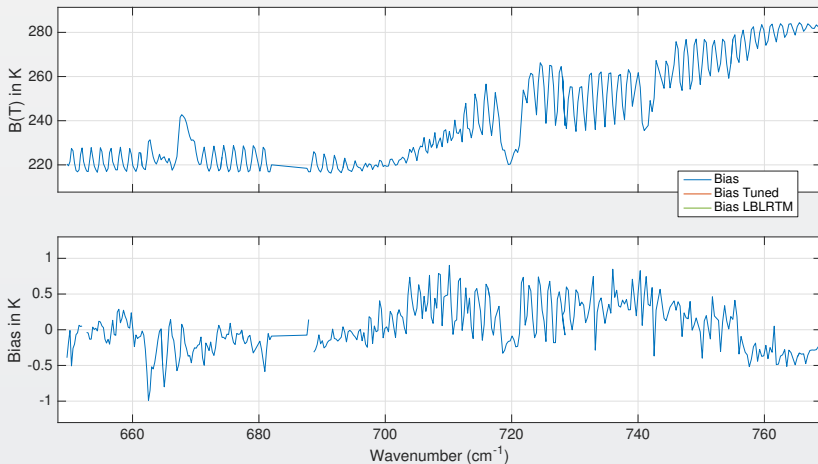
Mid-Lat Ocean Biases: No Tuning



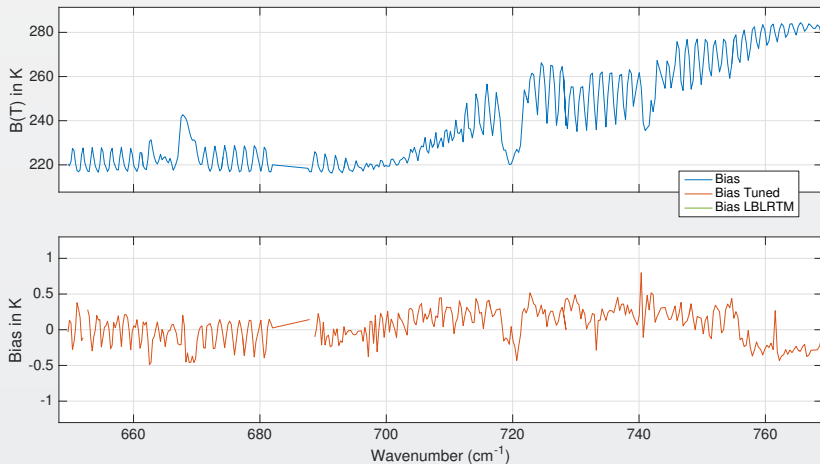
Effect of Upating to HITRAN 2012



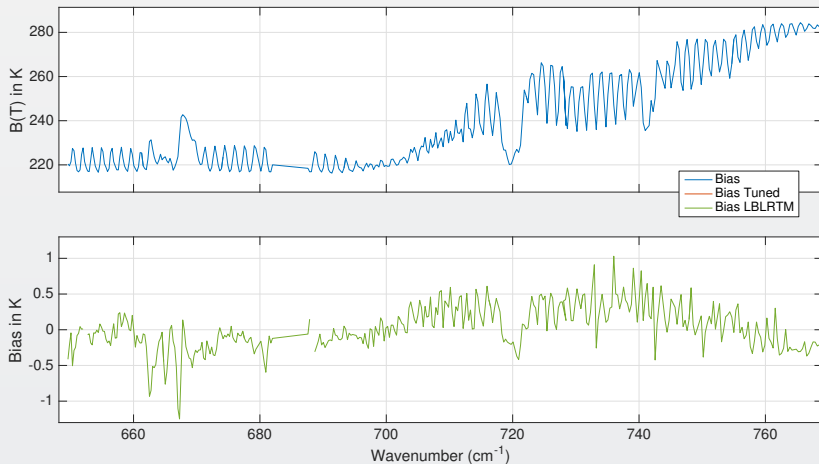
Longwave Region



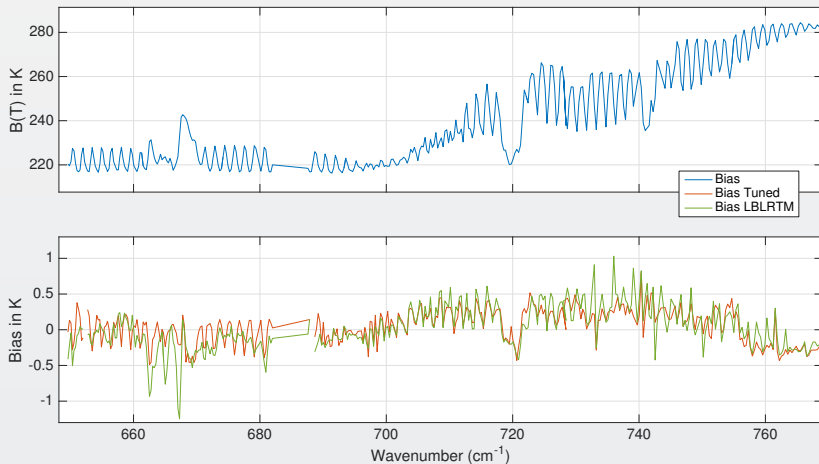
Longwave Region



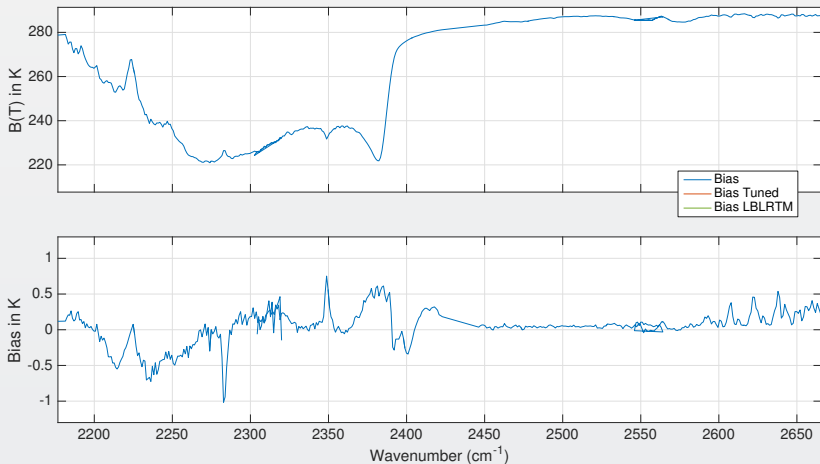
Longwave Region



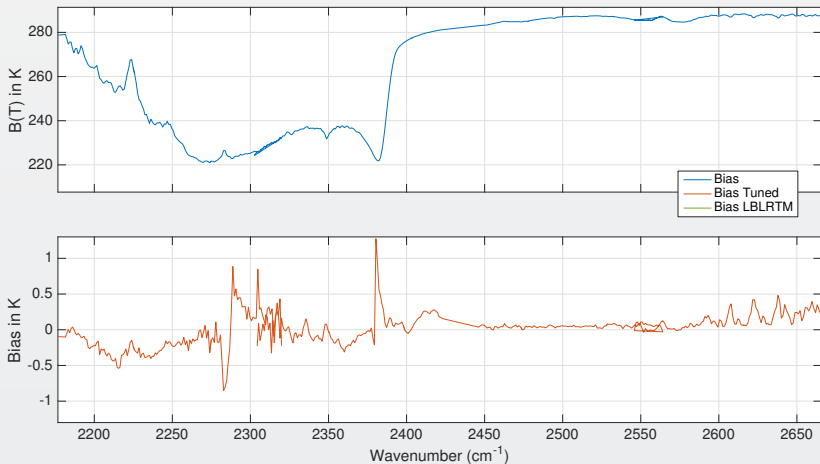
Longwave Region



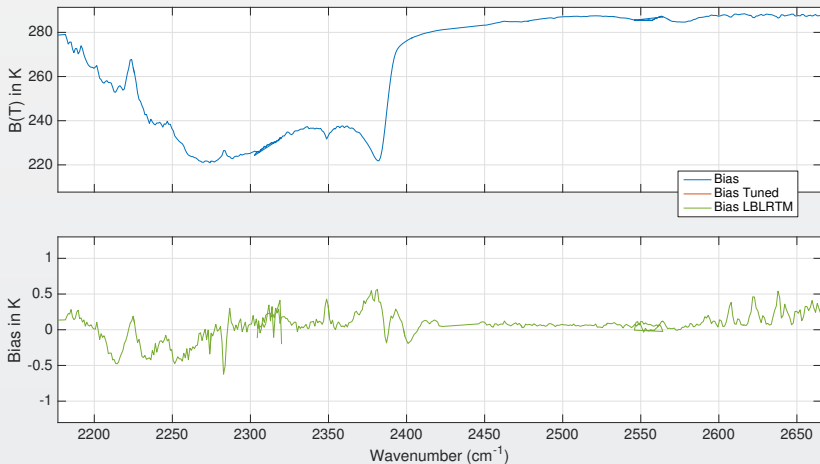
Shortwave Region



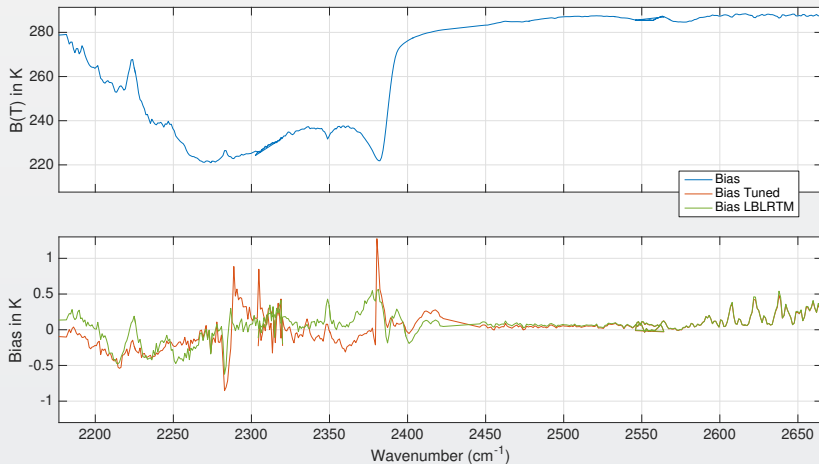
Shortwave Region



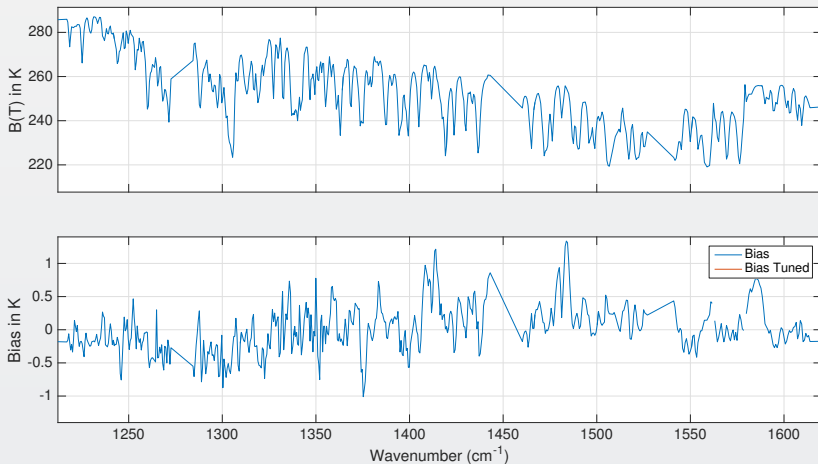
Shortwave Region



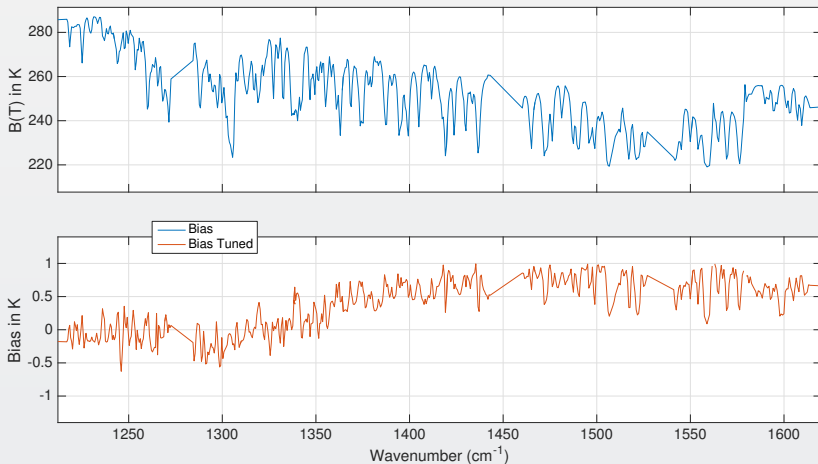
Shortwave Region



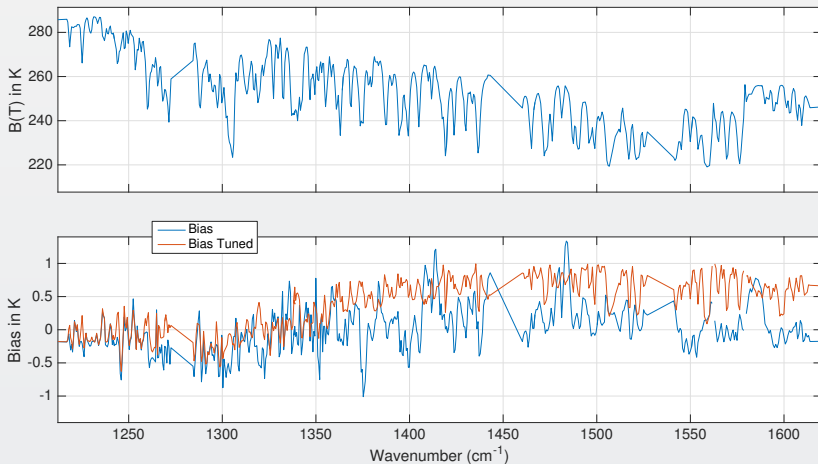
Midwave Region



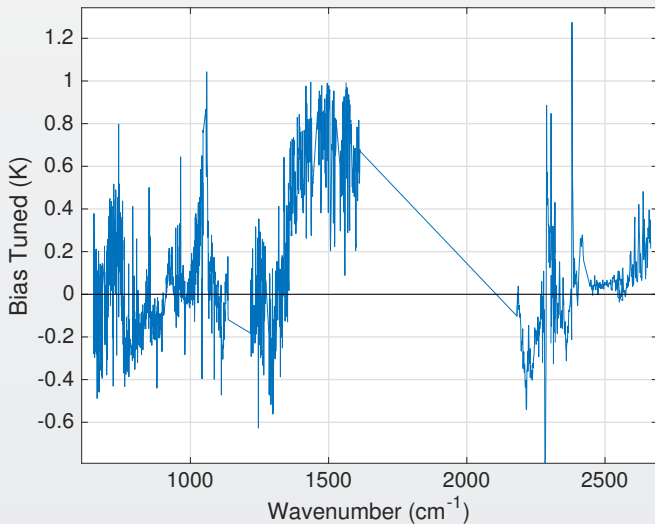
Midwave Region



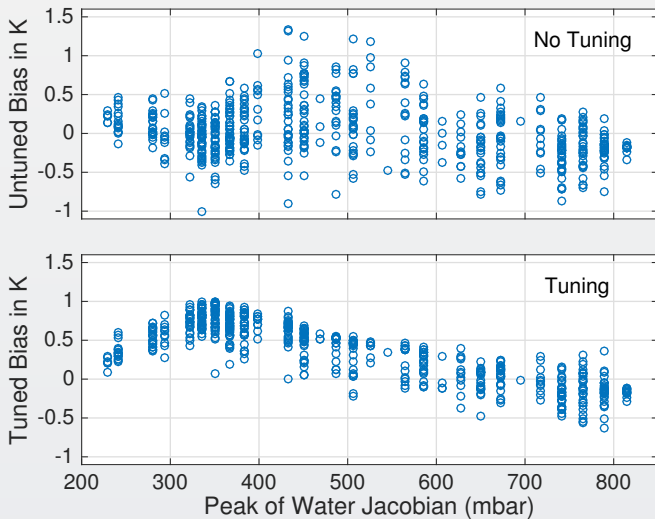
Midwave Region



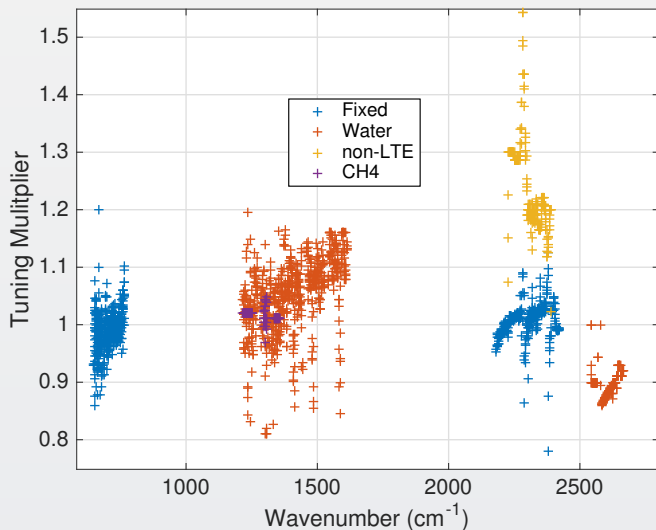
Full Spectrum Bias with V6 PGE Tuning



Biases versus Peak of Water Jacobians



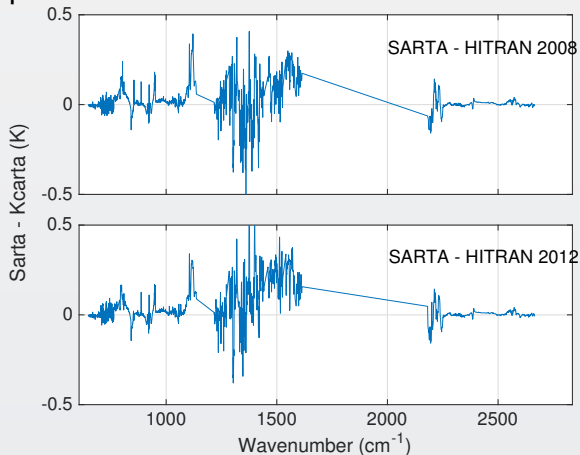
Tuning Multipliers In V6 PGE RTA



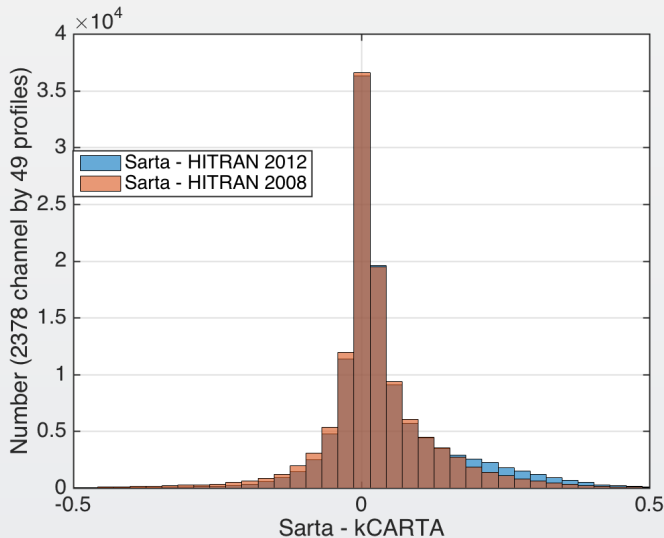
Parameterization Errors: 2016

Sarta - kCARTA (HITRAN 2012 or 2008)

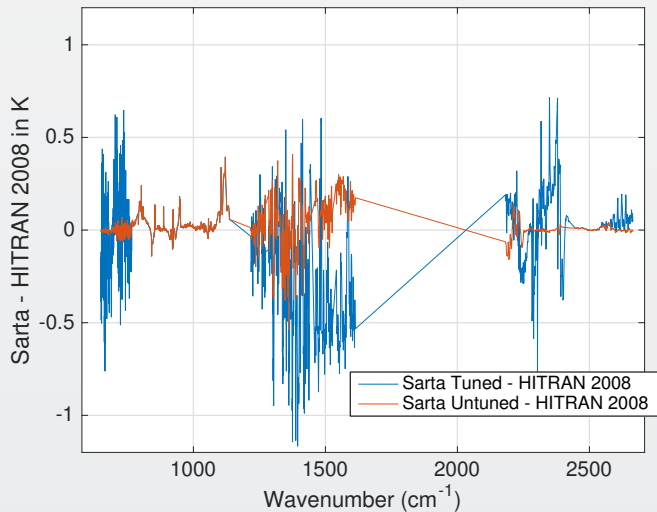
SARTA trained with HITRAN 2008, Means over 49 training profiles



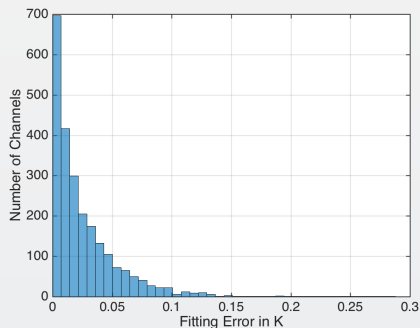
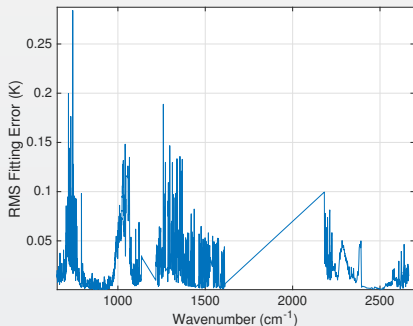
Histogram of Training Errors: 2016



Sarta Tuning Differences vs kCARTA: 2016



What RTA Accuracy Did we have in 2008?

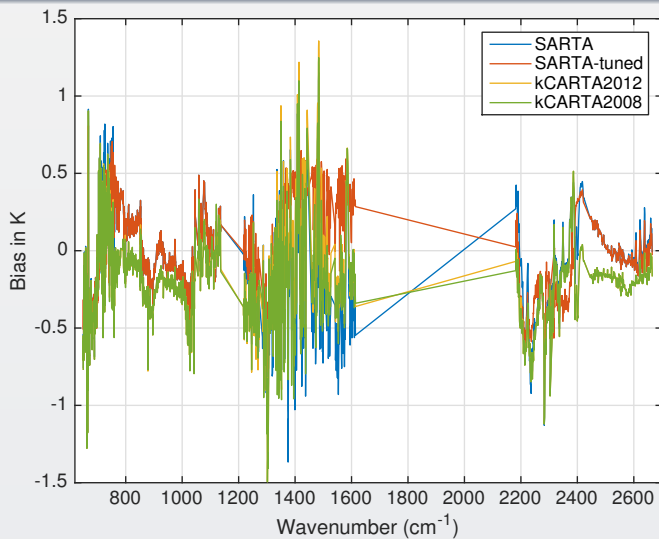


We did not store LBL output used for RTA coefficient regression
 We have been unable to run ancient kCARTA version Scott used
 We now (last 4 years) use version control!

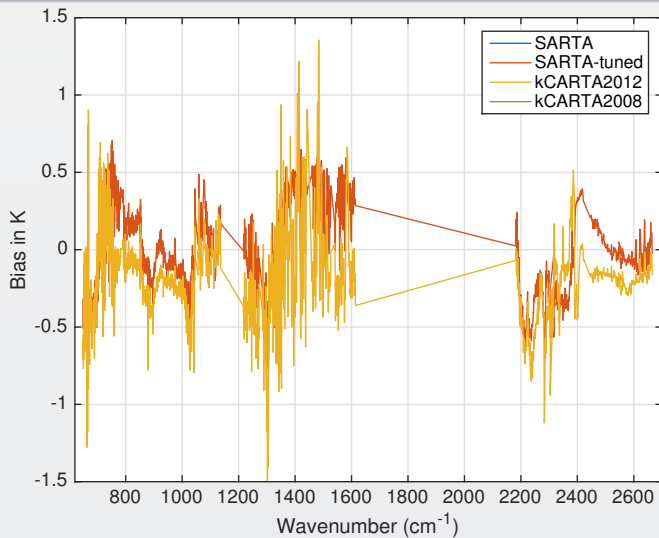
Sonde Biases: Procedures

- Match to AIRS: 20 km, 2 hours (saw no dependence on these variables)
- Water profiles to 150 mbar, temperature to 25 mbar
- Fill in remaining levels using ERA
- Subset results to nominally achieve zero bias in window region

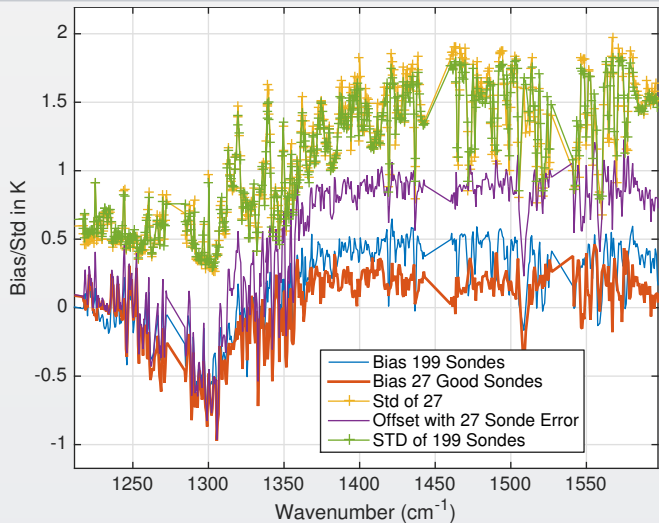
Last Meeting: LIN GRUAN Site



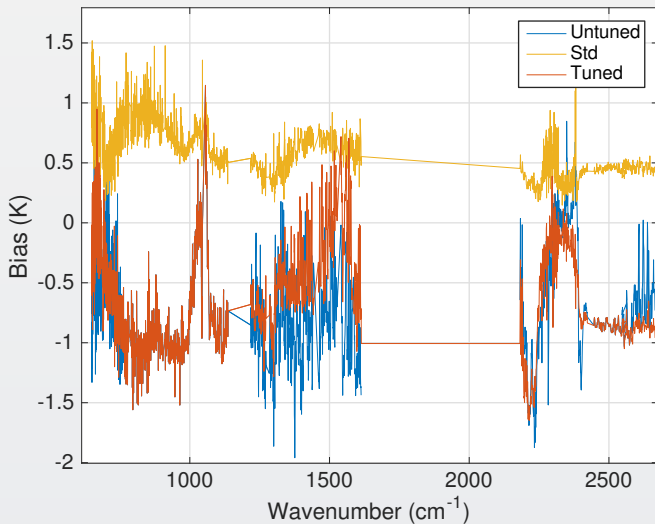
Last Meeting: LIN GRUAN Site



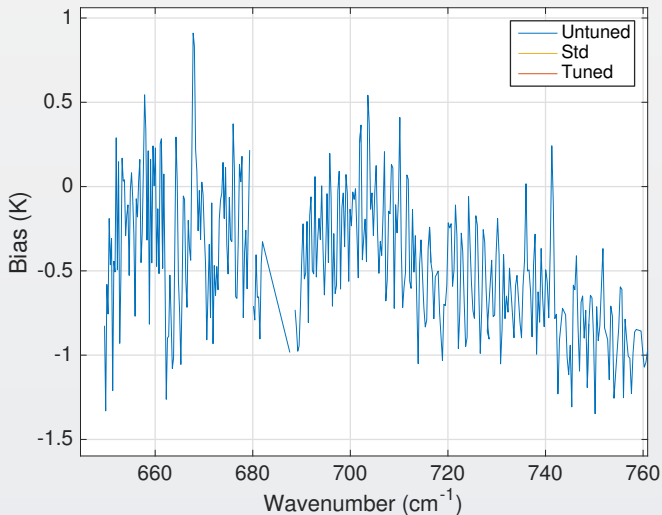
Last Meeting: LIN GRUAN Site



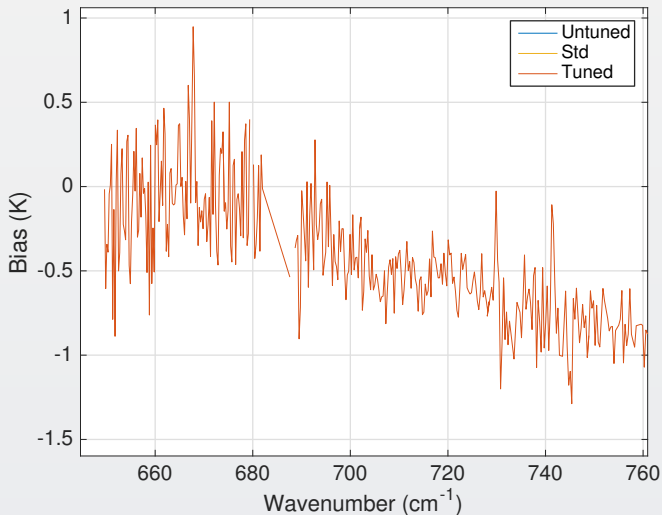
Tropical Western Pacific (TWP)



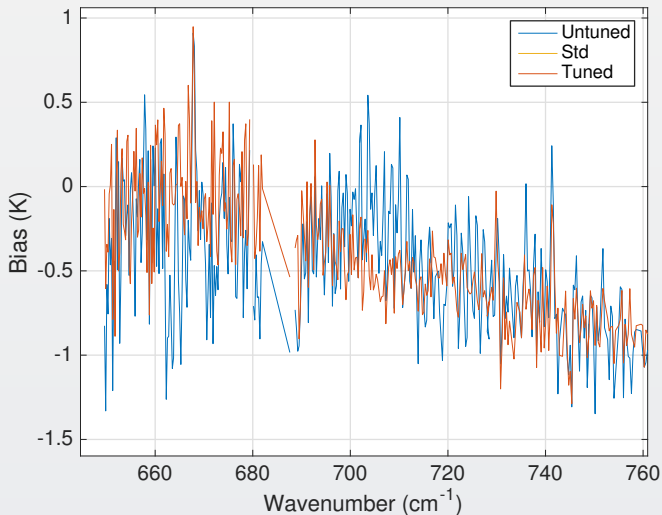
TWP Longwave



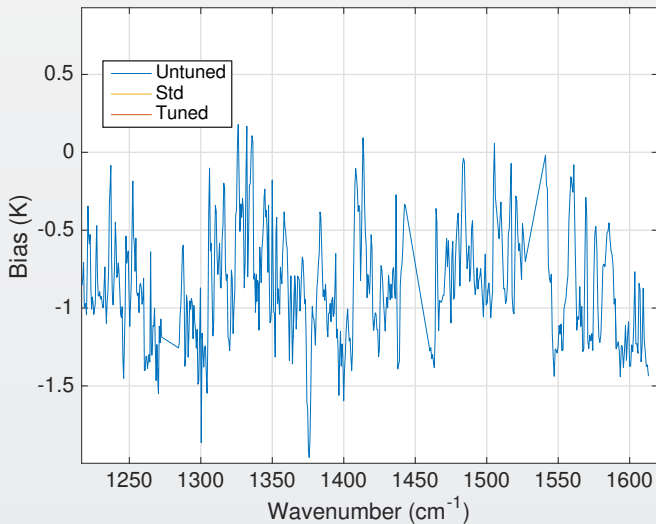
TWP Longwave



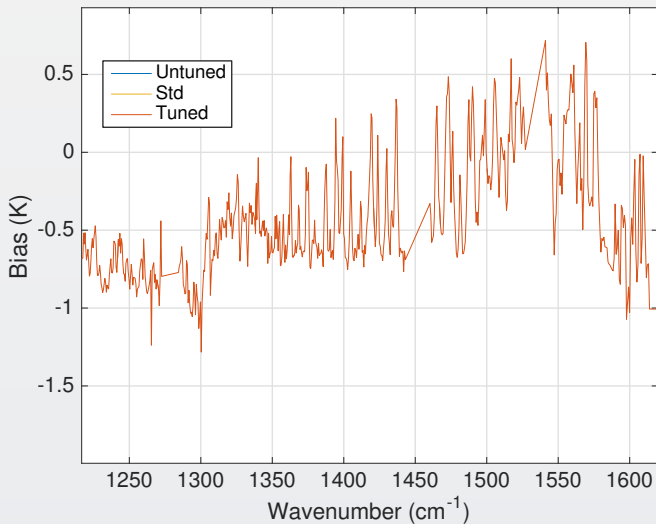
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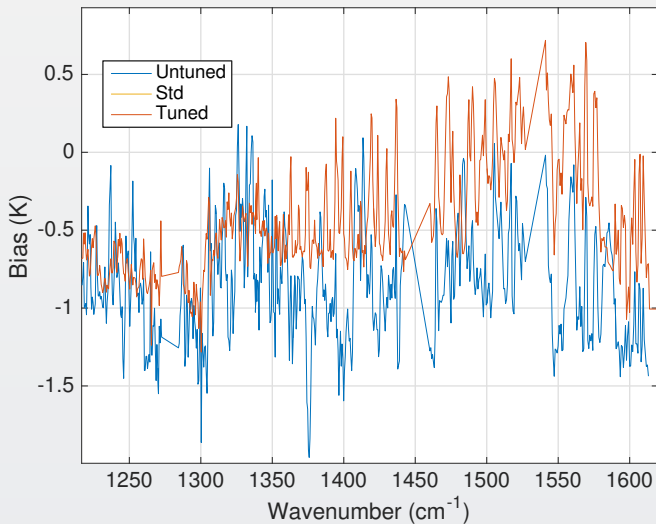
TWP Midwave



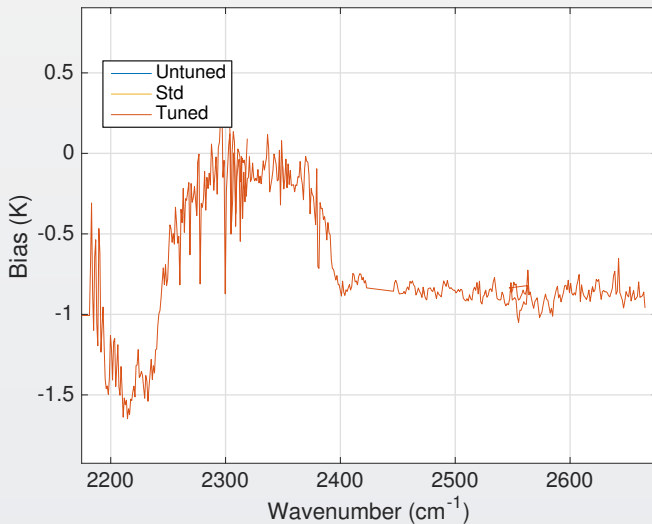
TWP Midwave



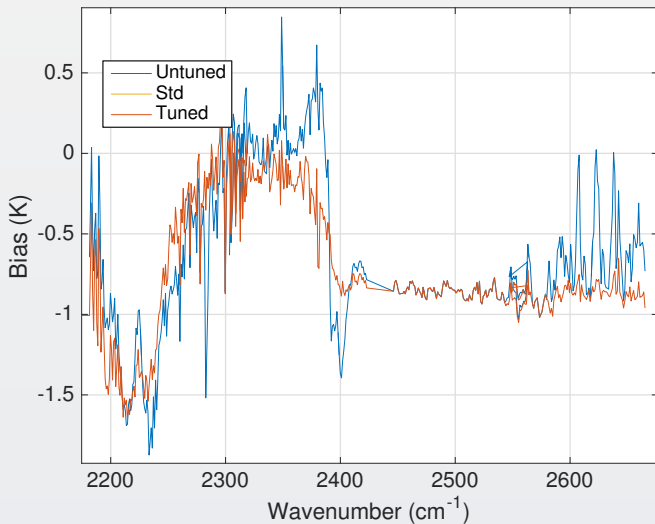
TWP Midwave



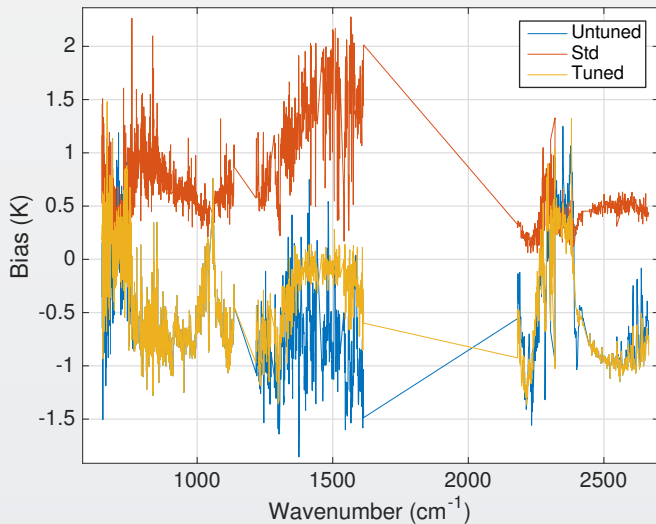
TWP Shortwave



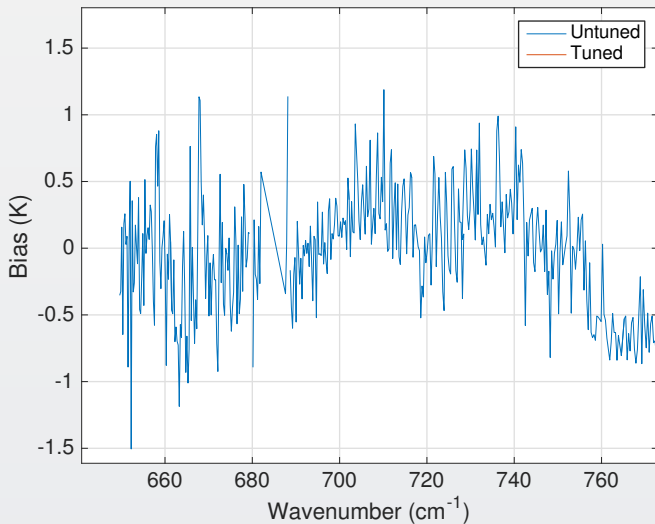
TWP Shortwave



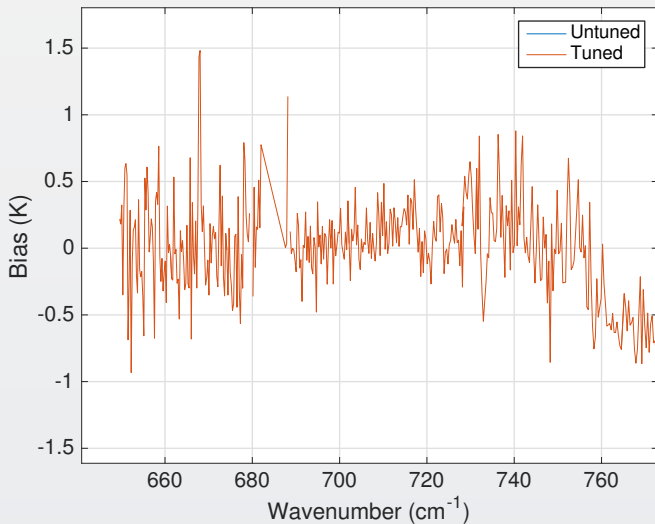
Eastern North Atlantic (ENA)



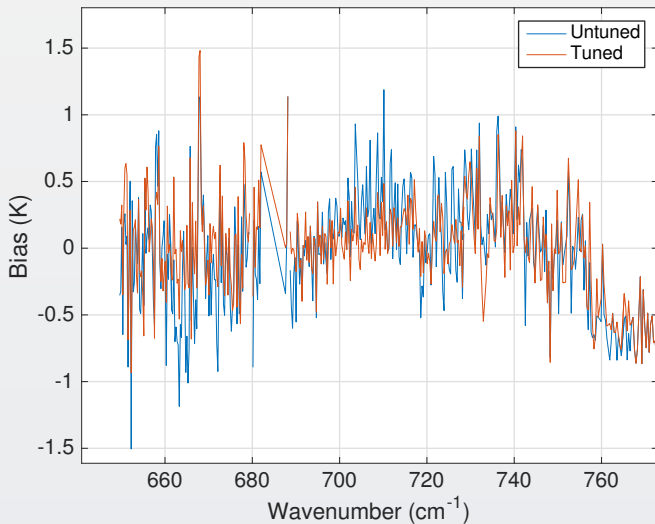
ENA Longwave



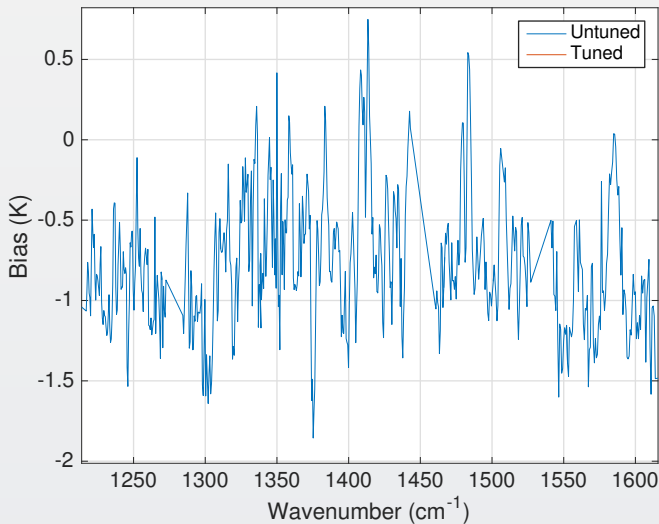
ENA Longwave



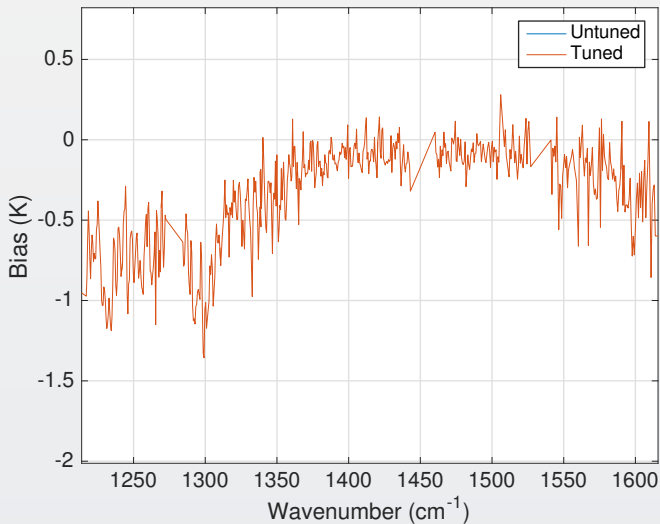
ENA Longwave



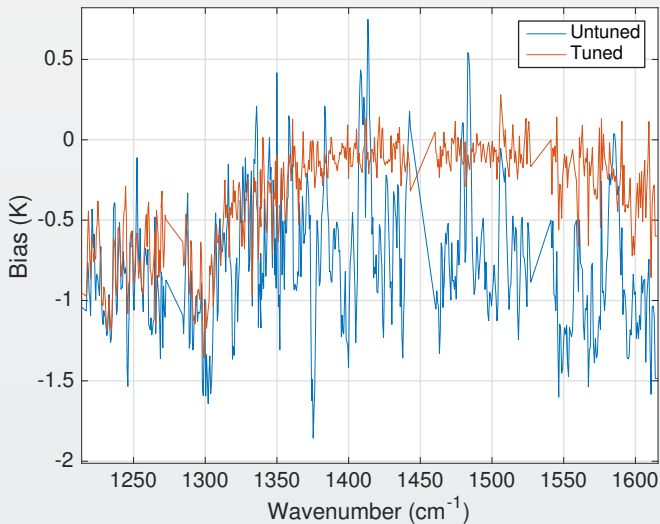
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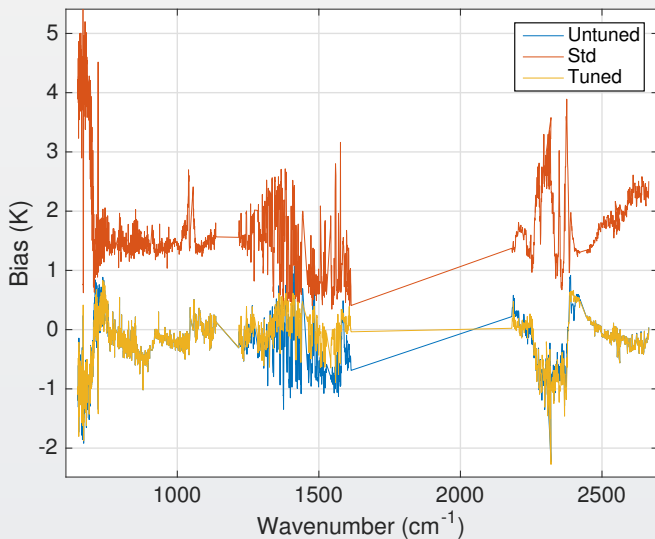
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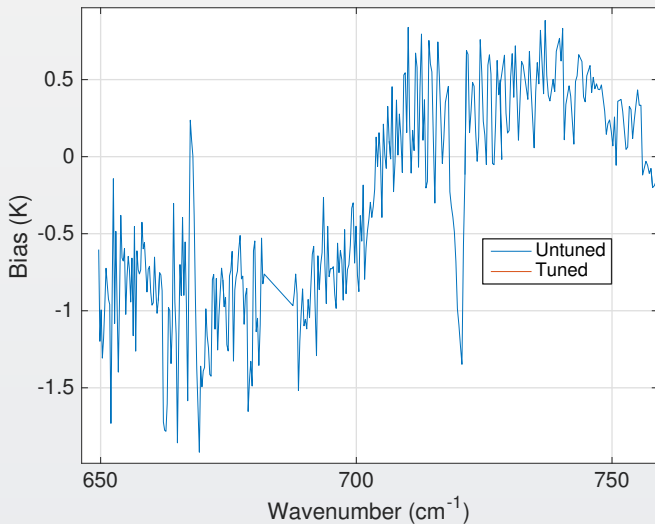
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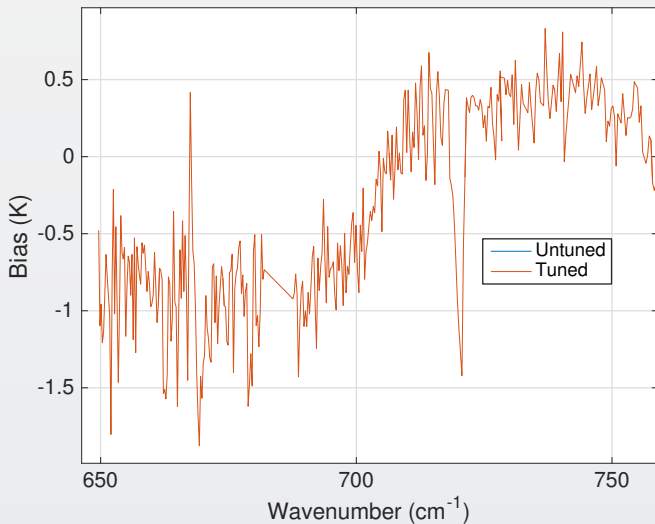
North Slope Alaska (NSA)



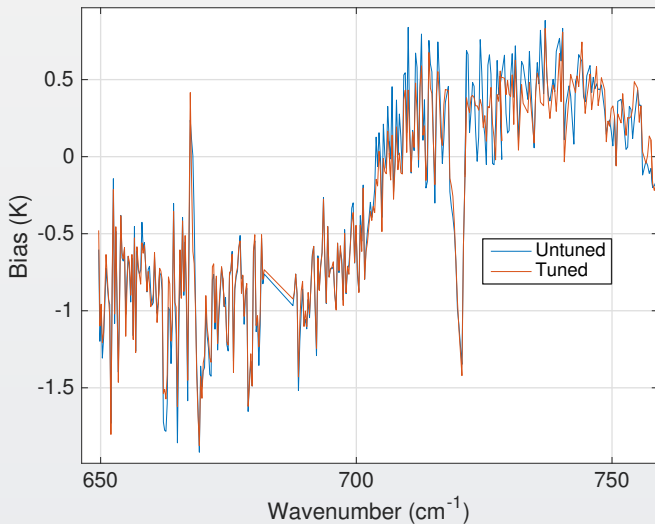
NSA Longwave



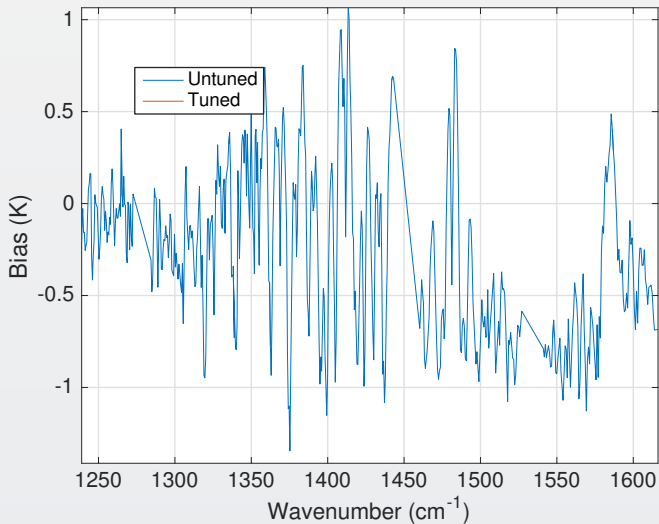
NSA Longwave



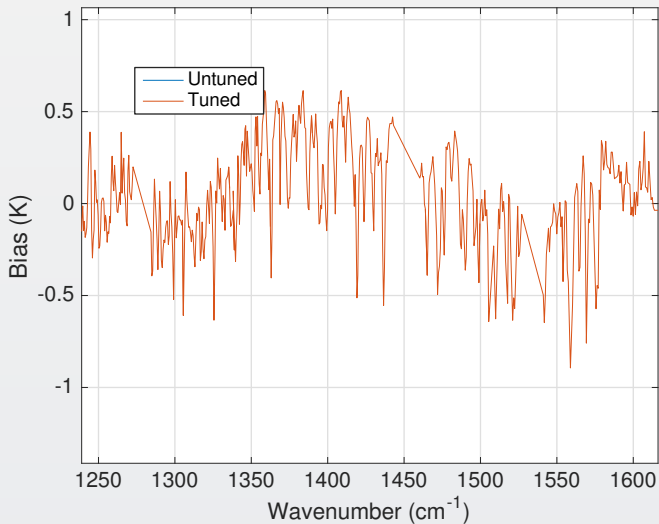
NSA Longwave



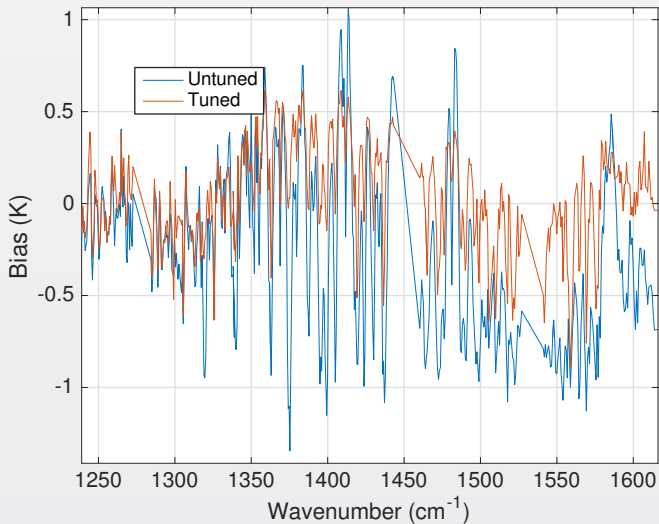
NSA Midwave



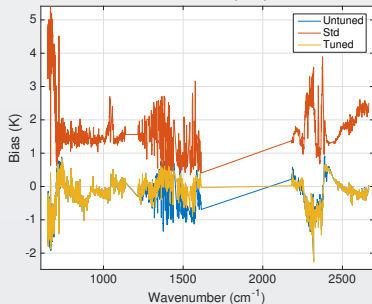
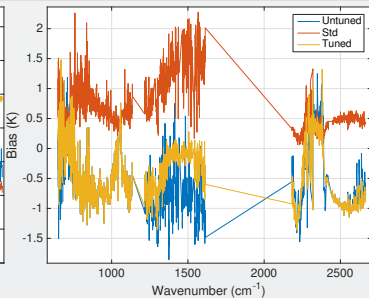
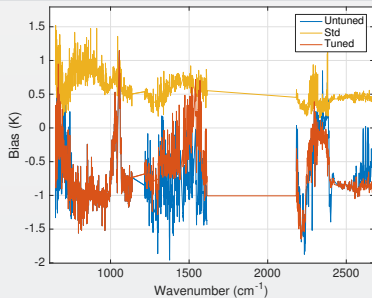
NSA Midwave



NSA Midwave



Summary: All Three Sites



Summary

- Situation is complex and will require more careful analysis of sonde results, esp. Q/A
- Need to determine state of RS92 corrections. Literature suggest you really need FP to get to our noise levels.
- HITRAN 2012 improvements can likely be introduced with tuning?
- GRUAN results better, but limited to LIN site.
- Software to generate a new parameterization using more profiles (esp. colder profiles) is a long way off. (RTA unfunded for 5 years and lost Scott.)
- Present system to parameterize transmittances was very hands-on.