The AIRS/CrIS/IASI (and CHIRP) Radiative Transfer Algorithms

AIRS Science Team Meeting

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Status - 1

- kCARTA calculations of layer-to-space optical depths for all parameters for the 49 and 703 SAF regression profiles for AIRS_L1C, CrIS FSR and IASI are complete.
- AIRS_L1C and IASI SARTA update was released May and June this year.
- Updated version of AIRS using L1C channel set with SRFs referenced to 10-Sep-2010 drift corrected.
- Spectroscopy based on HITRAN 2016 & LBLRTM12.8 CO2,CH4 line mixing.
- The kCARTA is used to generate TOA radiances to compare directly with SARTA for validation.
- CrIS FSR SARTA update for 2019 currently in work.

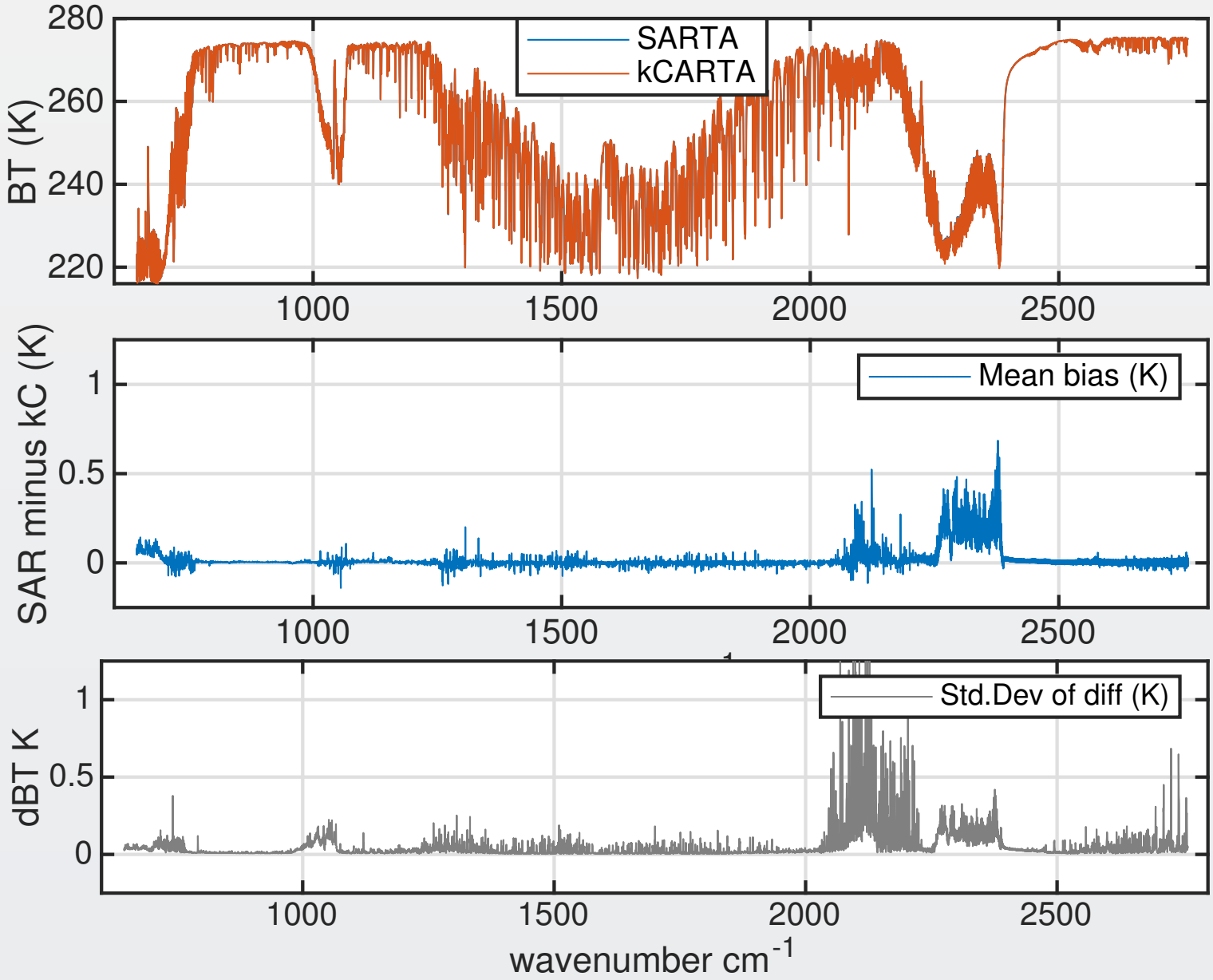
Status - 2

- The 2019 SARTA's include the fixed gases, variable O_3, H_2O, CO_2, CH_4, HNO_3, N_2O, SO_2, NH_3, nonLTE and improved reflected surface thermal.
- AIRS L1c SARTA includes hooks for HDO (δD), the computation is turned off.
- HDO regression is in progress, regression residuals give $\sim$ 10% rms, but we think we know how to improve. What is needed?
- SARTA creation for CHIRP will start soon.

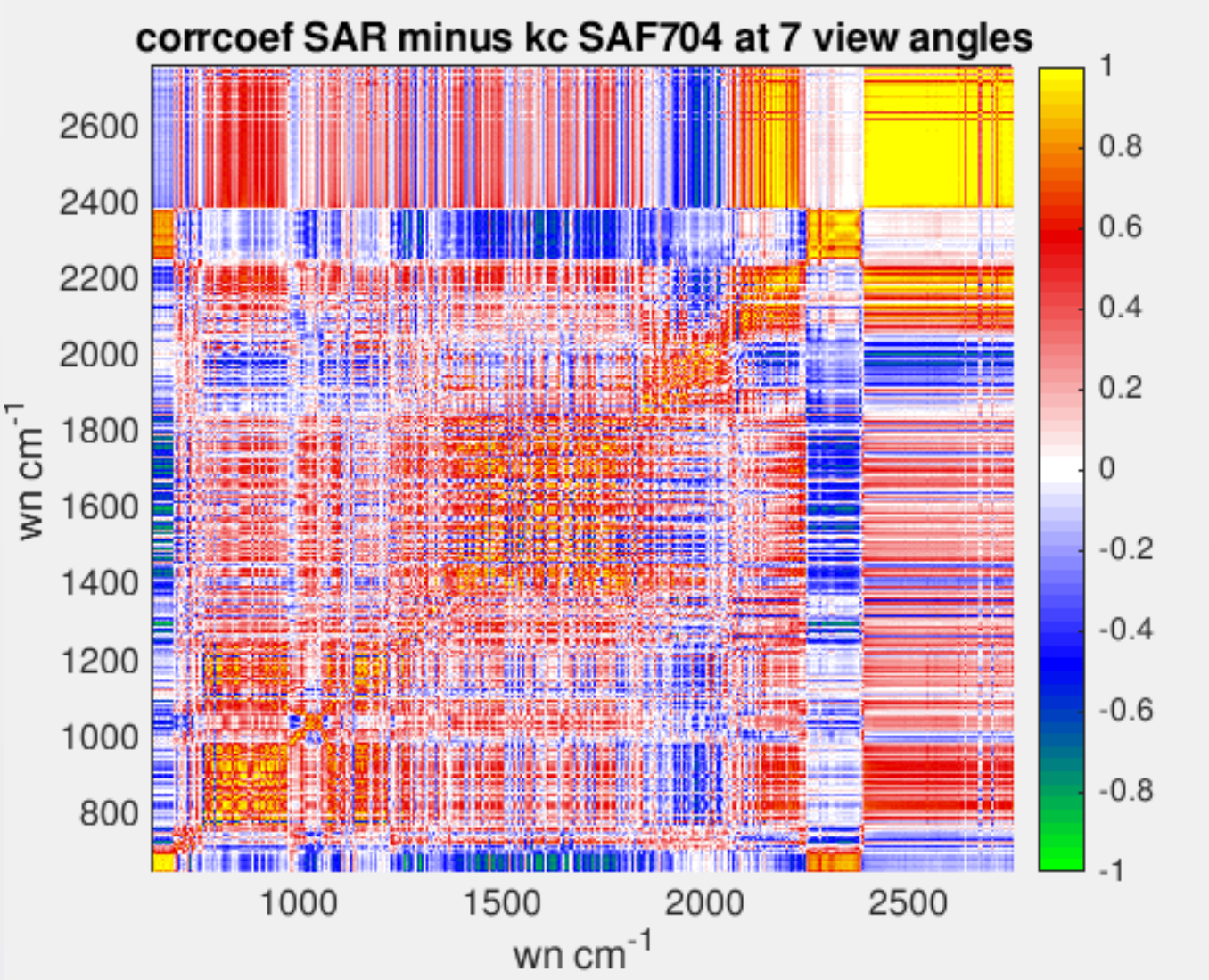
SARTA Versions

CrIS NSR	HITRAN 2012	Retired
CrIS FSR	HITRAN 2012	Will update
AIRS L1b	HITRAN 2008	Retired
IASI	HITRAN 2016	Enhanced SW Continuum
AIRS L1c	HITRAN 2016	Enhanced SW Continuum
CHIRP	will be HITRAN 2016	Enhanced SW Continuum

Results - IASI

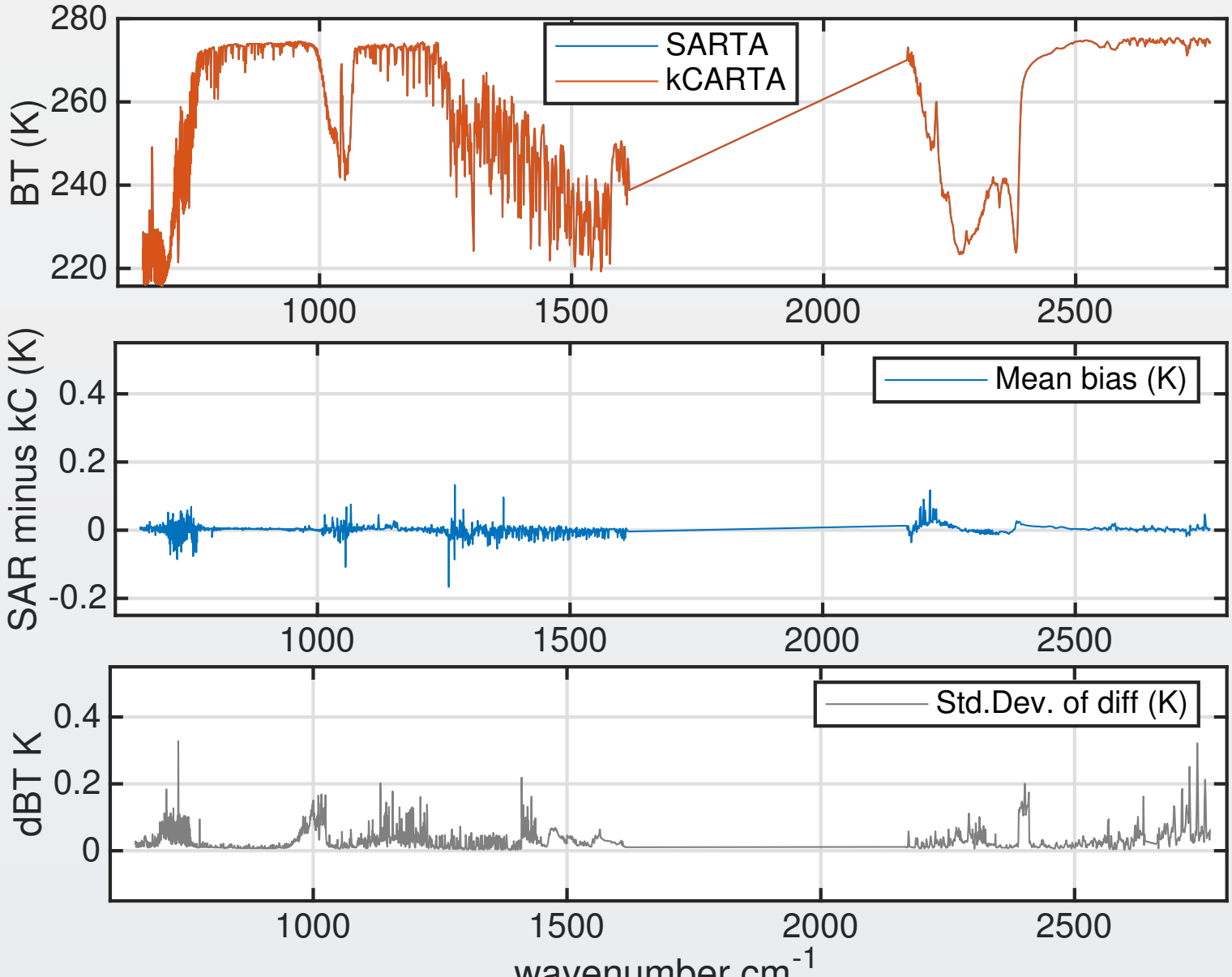


IASI: Parameterization Error Correlations

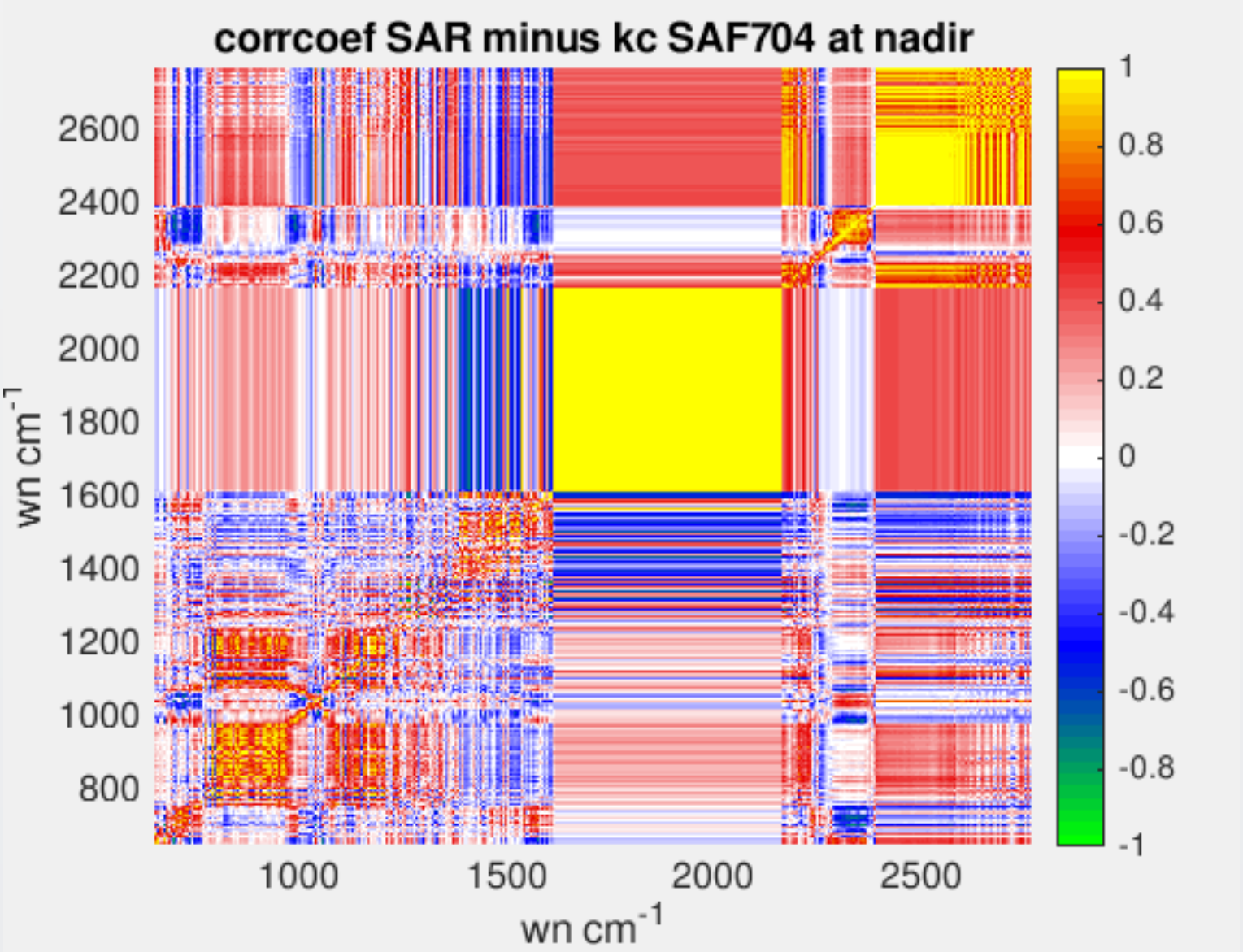


This does not include correlations due to spectroscopy errors.

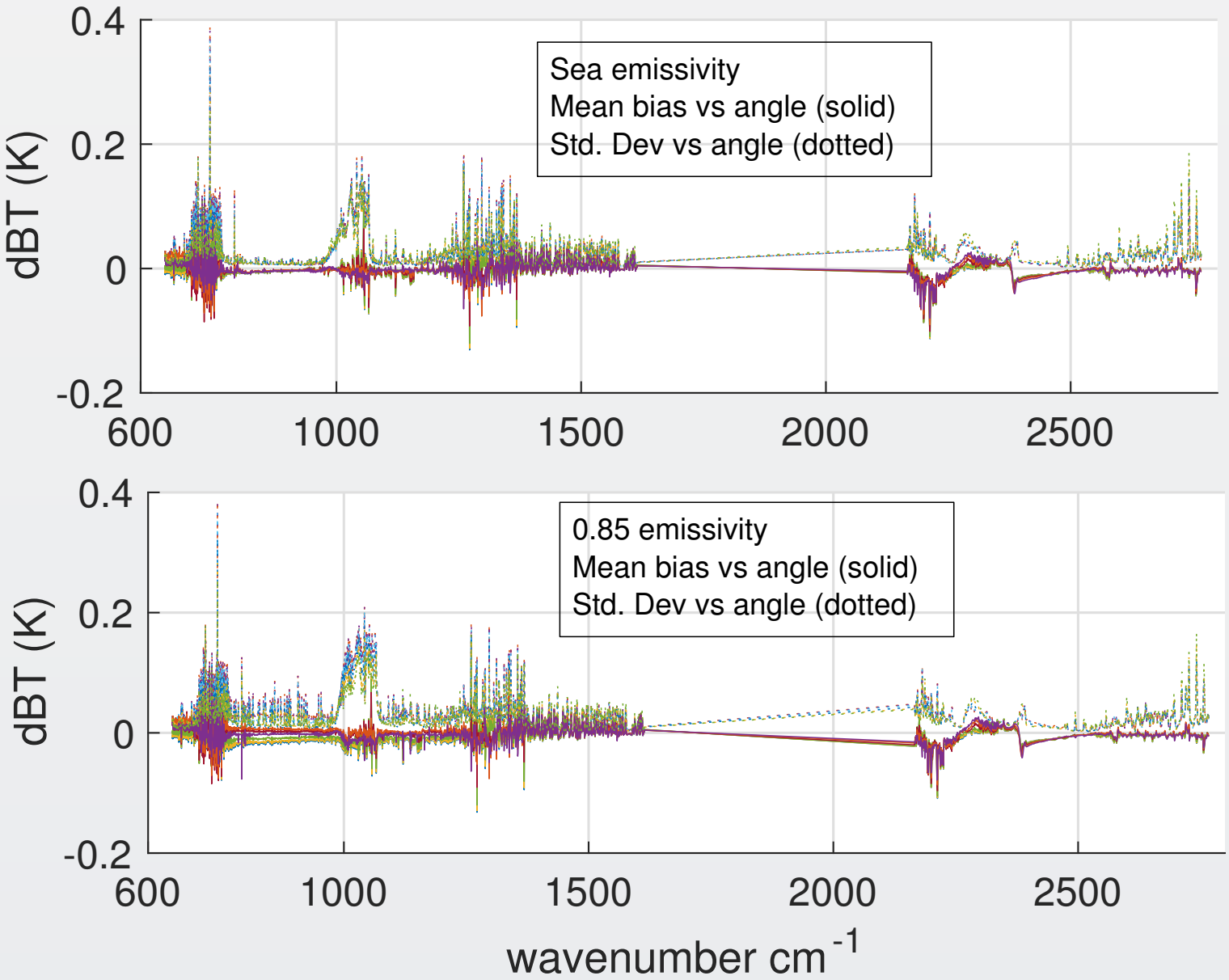
Results - AIRS_L1C



AIRS: Parameterization Error Correlations



AIRS_L1C Mean & Std. Dev Errors vs angle



Standard Deviations

- Std. deviations are over 49 fitting profiles and 6 secant angles
- The fitting profiles span global variability very nicely
- Std. Dev. will be smaller with a global average profile data set

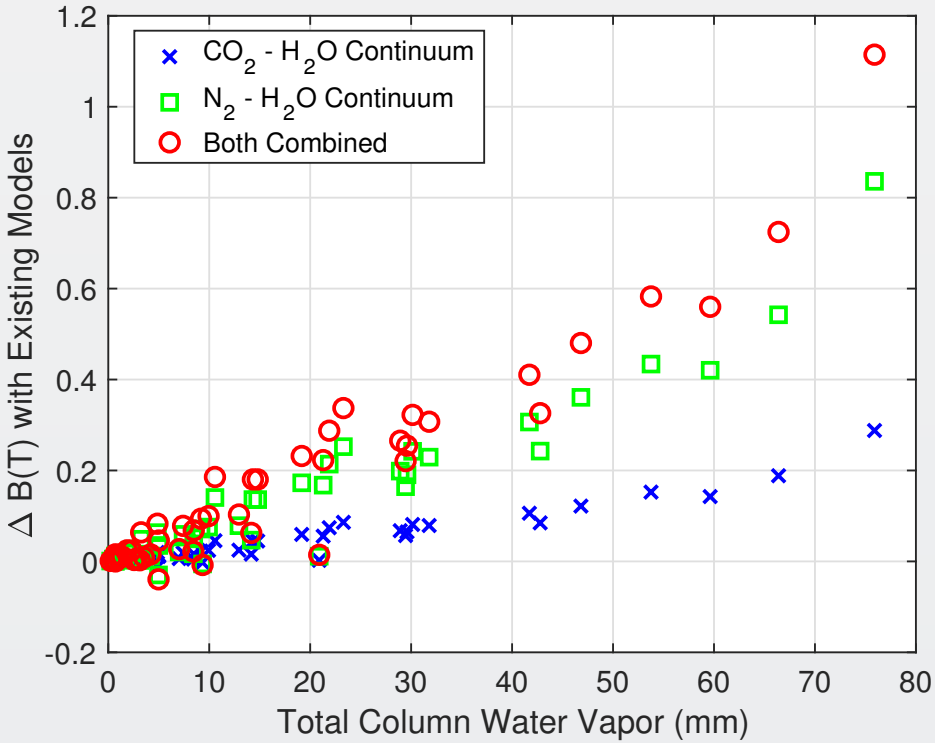
New Spectroscopy (other than HITRAN)

New Shortwave Continuum (Hartmann)

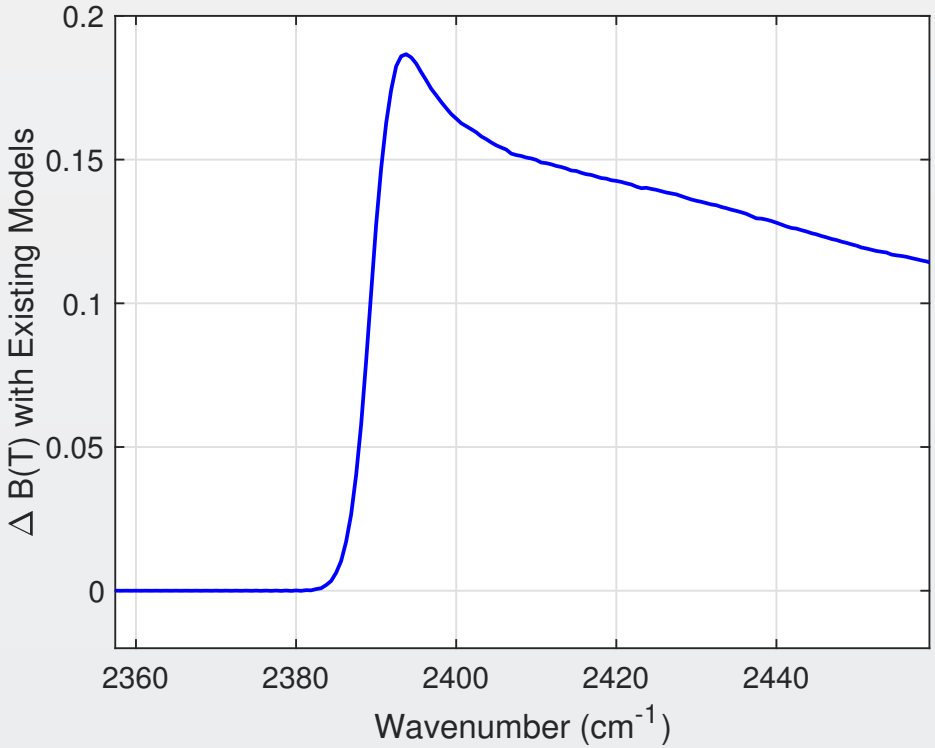
- Important new physics, N_2-H_2O and CO_2-H_2O continuum
- Affects temperature sounding region
- Existing RTAs have dependence on H_2O wrong! Either using quadratic on none.
- Hartmann has published these improvements (GRL 2018)
- We have partially validated them and included them in new RTA

New Continuum Characteristics

Δ B(T) a 2400 cm^{-1} vs column water



Spectral effects for 20 cm water



Conclusions

- SARTA AIRS L1c delivered
- But, might be better to just jump to CHIRP radiances and CHIRP RTA??
- Hope to finalize HDO soon, but would like input on accuracy needs
- Will be doing more validation on Hartman continuum, quick look very encouraging