Radiative Transfer Algorithm Updates

AIRS Virtual Science Team Meeting

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Summary

- What is the Stand-alone radiative transfer algorithm (SARTA)
- Who uses SARTA.
- Current SARTA build status.
- Plans.

The SARTA

- The Stand-alone radiative transfer algorithm (SARTA) is constructed using kCARTA
- Therefore SARTA has the same spectroscopy as kCARTA.
- SARTA was developed 18 years ago for the AIRS.
- It uses sets of coefficients that parameterize atmospheric transmittances derived using a set of training profiles.
- Is written in Fortran
- Permits very fast computation of radiances for predefined spectral response functions.
- Has a version for clear sky radiance calculations and for cloudy radiances.

Who uses SARTA

- SARTA is used to compute clear and all-sky radiances for any and all FoVs from AIRS, CrIS and IASI missions.
- Is fast enough to make whole-mission modelling easily manageable. Faster than kCARTA *way* faster than LBL.
- Currently used in ASL for the RTP production for analysis of sensor performance and global studies and geophysical retireval.
- Is used in the AIRS geophysical product retrieval.
- Is used in NUCAPS.

Current Spectroscopy

- HITRAN 2016
- CO2, CH4 line mixing from LBLRTM12.8
- MT CKD3.2
- CO2 CIA from WV and N2 by Hartmann (4.3 um)
- Single parameter surface emissivity.

Possible Future Improvements

- HITRAN 2020,
- Line Mixing package from the HITRAN folks (Iouli Gordon)
- Currently use kCARTA at 0.0025 cm-1, can update to 0.0005 cm-1 in 15 um region
- poss. linear-in-tau RT.
- poss. Nalli surface emissivity parameterization.
- poss. look into running off NLTE from Manuel esp. the extreme solar angles

Current SARTAs at ASL

- The following SARTAs are in use at ASL:
  - AIRS vL1B (2008) as supplied to JPL.
  - AIRS vL1C (2016).
  - CrIS NSR v2008, & v2016.
  - CrIS FSR v2016
  - IASI v2008 and v2016.
  - CHIRP v2016 (under test).

Validating by bias and residual

- After completing the fast coefficient regression, top-of-atmosphere (TOA) radiances predicted by SARTA are compared to those from kCARTA from the training set or extended profile set.

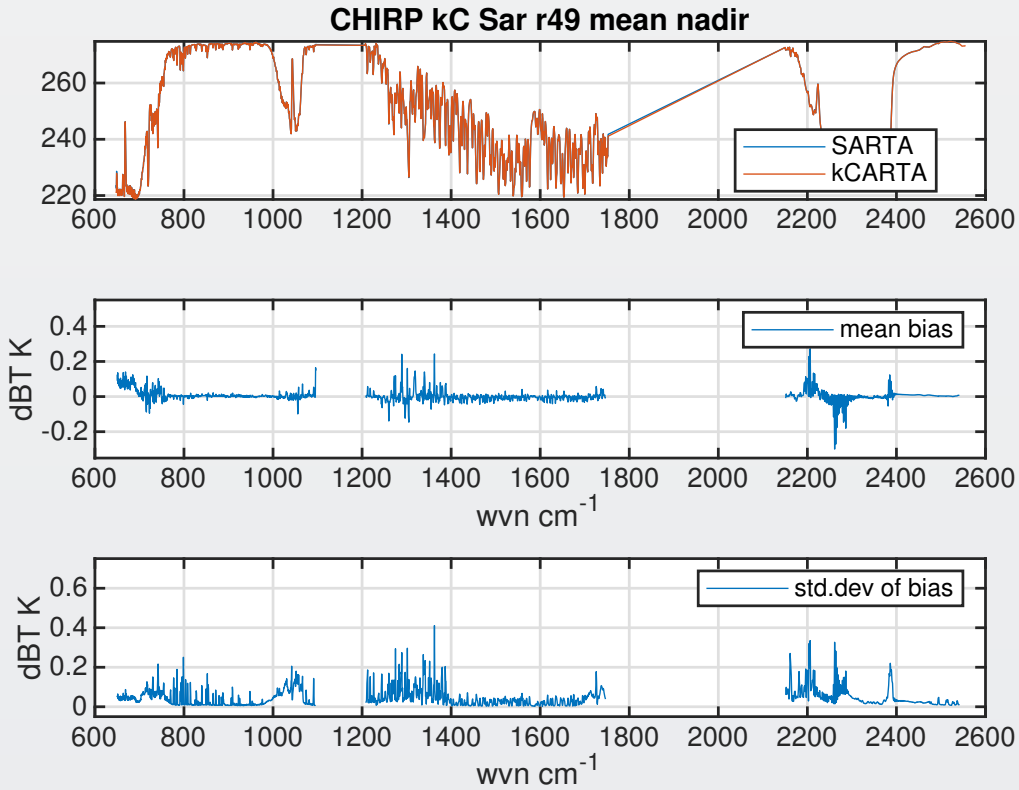

Figure 1: CHIRP channels. AIRS bias relative to SNPP from global

Example of optimization

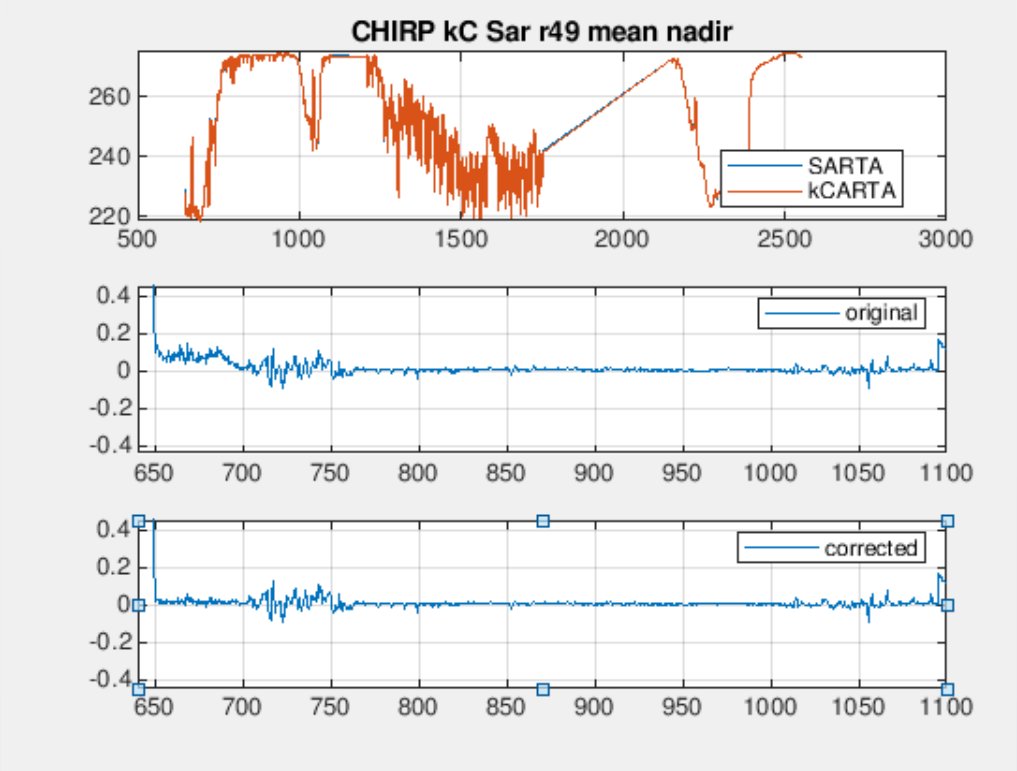

Figure 2: CHIRP SARTA bias compared to kCARTA, with and without improved regression.