A preliminary comparison of CrIS processing algorithms after the SNPP CrIS MWIR anomaly

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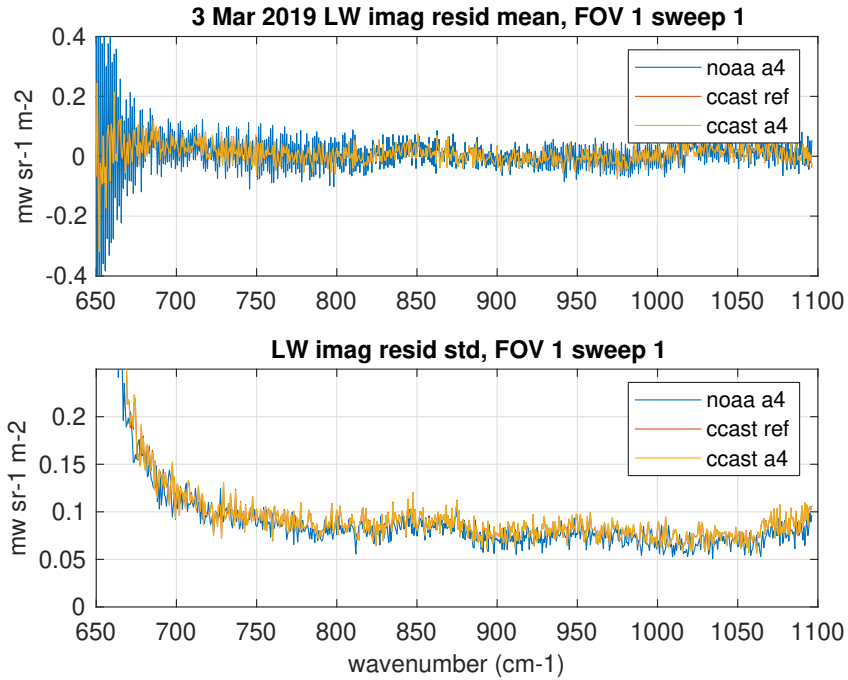
Introduction

- We present a preliminary comparison of NPP CrIS high res products for the NOAA A4, UMBC CCAST A4, and UMBC CCAST reference calibration algorithms, before and after the NPP MW anomaly.
- Complex residuals for the NOAA product are slightly larger before and significanty larger after the anomaly.
- Differences in the NOAA and UMBC CCAST processing include
  - CCAST uses cosine apodization of the extended point set outside the user-grid OPD, rather than truncation or circular shift
  - CCAST uses "small n" psinc (psinc at the decimated sensor grid) for both the ILS and SA matrix
  - CCAST spectral-space processing filters for the reference algorithm have a slightly narrower passband and more gradual rolloff than the A4 filters. The difference is greatest at the low end of the LW band.
- The CCAST reference and NOAA A4 calibration equations and CCAST apodization are described in an appendix.

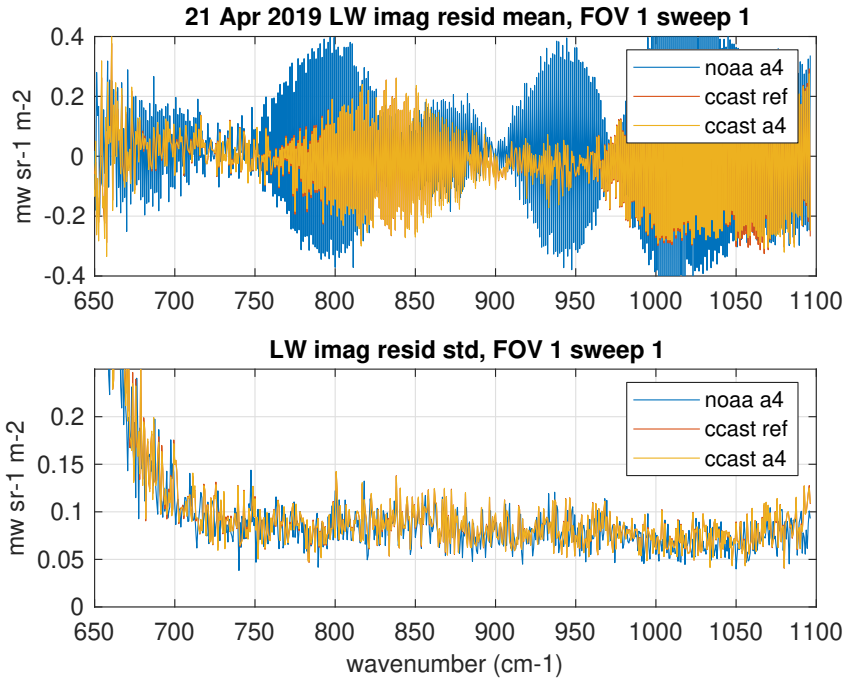
Test Data

- NOAA data are GCRSO-SCRIF HDF5 files from NOAA CLASS. CCAST data are from our regular production runs, with the A4 algorithm selectable as an option.
- CCAST uses 45-scan and NOAA 60-scan granules. For these preliminary tests we simply took the intersection of scans for two overlapping granules, one pair before and one pair after the anomaly.
- The pre-anomaly test set consists of 1110 obs from relatively warm granules, midpoint time 03-Mar-2019 04:07:11. The set is divided into even and odd sweeps (even and odd FORs) and broken out by FOV.
- The post-anomaly test set consists of 1260 obs from another pair of warm granules, midpoint time 21-Apr-2019 04:08:29. The set is also divided into even and odd sweeps and broken out by FOV.
- We show representative cases for corner, side, and center FOVs, for both sweep directions.

LW FOV 1 Sweep 1 Complex Residuals

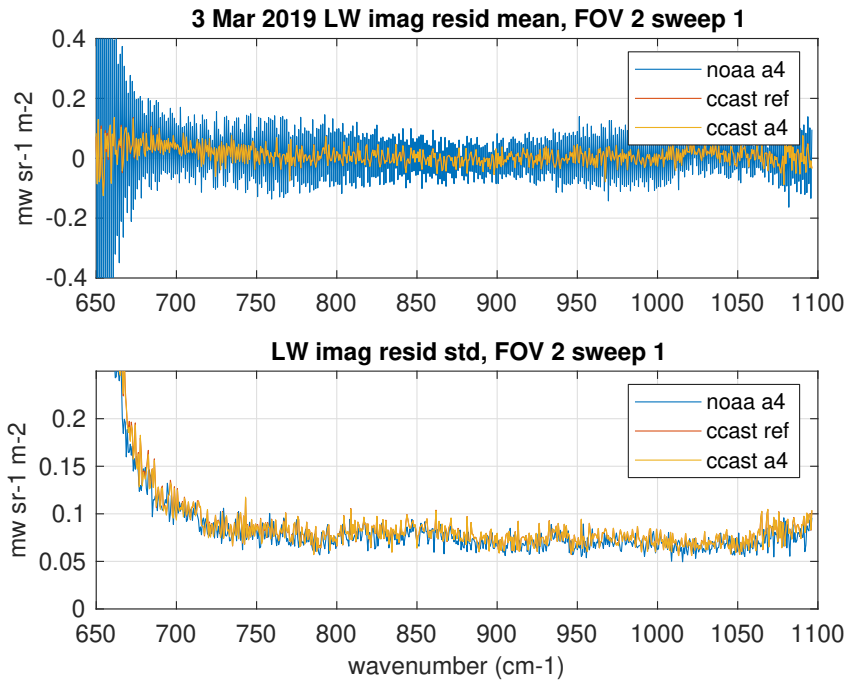


Pre-anomaly complex residual mean and standard deviation. The NOAA complex residual is slightly larger.

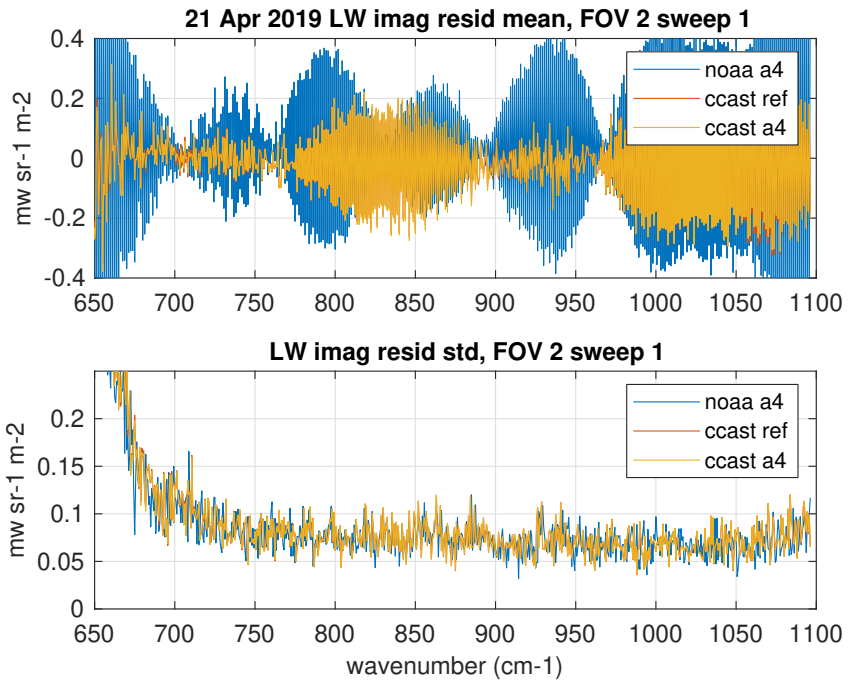


Post-anomaly complex residual mean and standard deviation. The NOAA complex residual is significantly larger.

LW FOV 2 Sweep 1 Complex Residuals

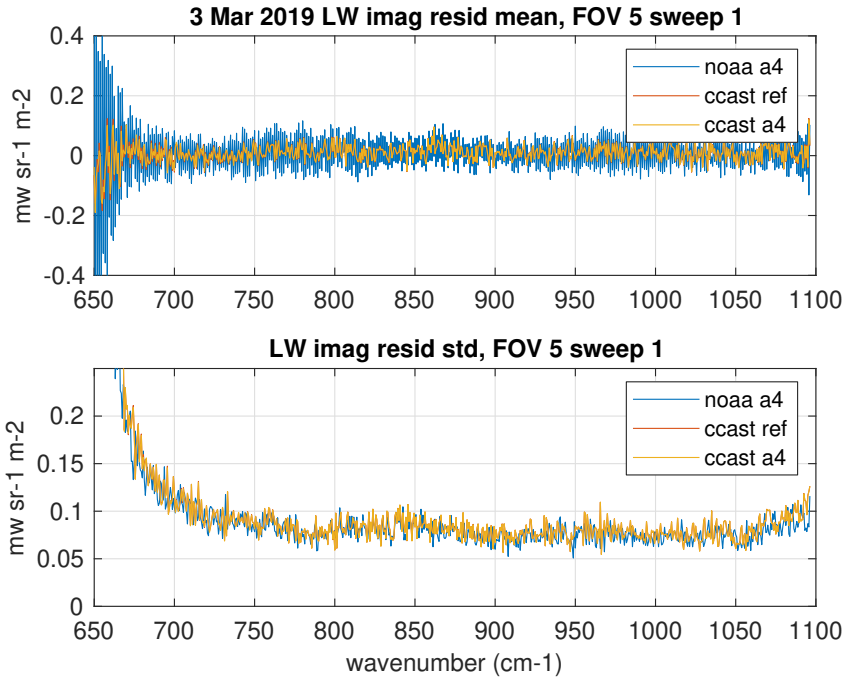


Pre-anomaly complex residual mean and standard deviation. The NOAA complex residual is significantly larger.

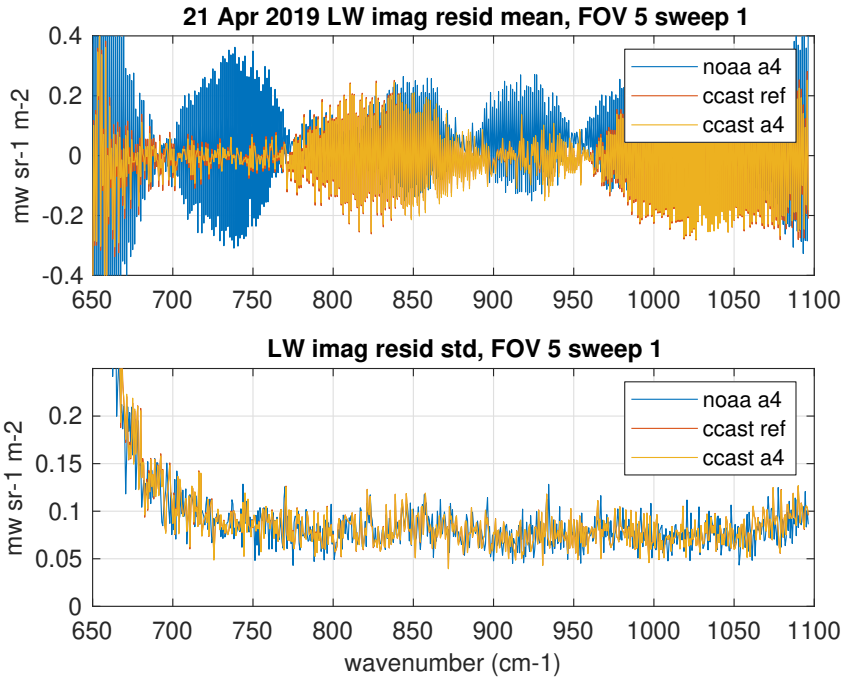


Post-anomaly complex residual mean and standard deviation. The NOAA complex residual is significantly larger.

LW FOV 5 Sweep 1 Complex Residuals

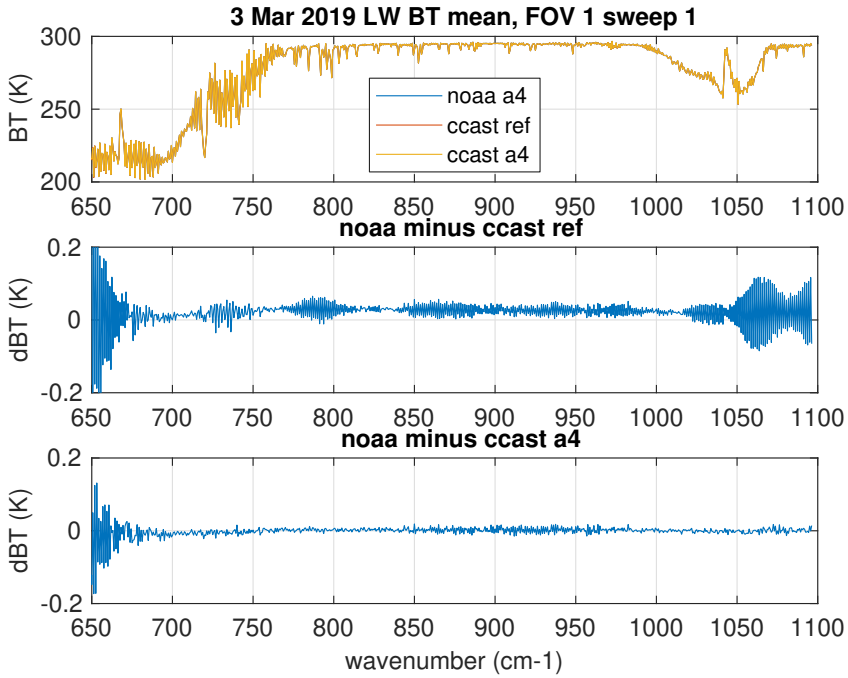


Pre-anomaly complex residual mean and standard deviation. The NOAA complex residual is slightly larger.

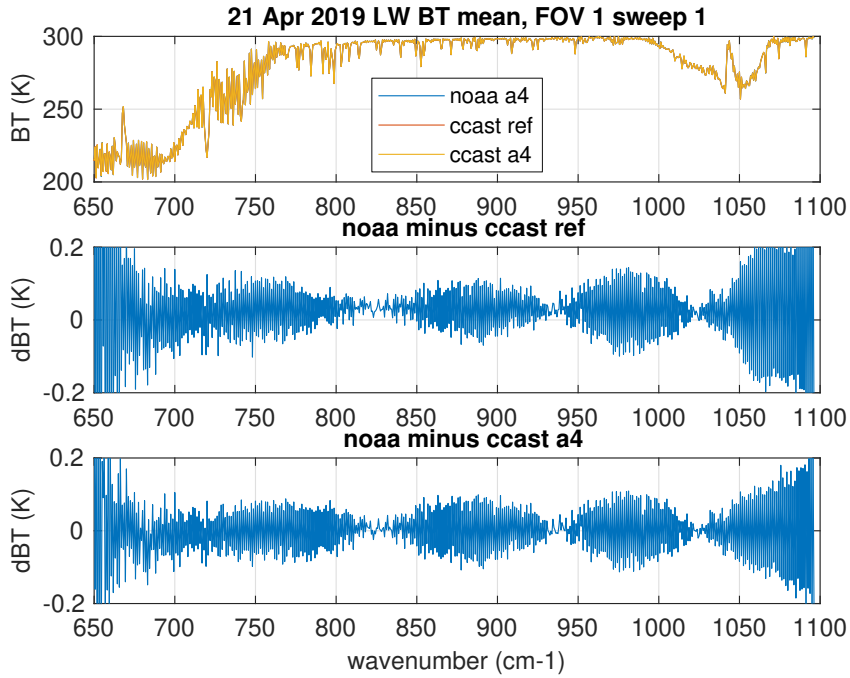


Post-anomaly complex residual mean and standard deviation. The NOAA residual is generally larger.

LW FOV 1 Sweep 1 BT Spectra

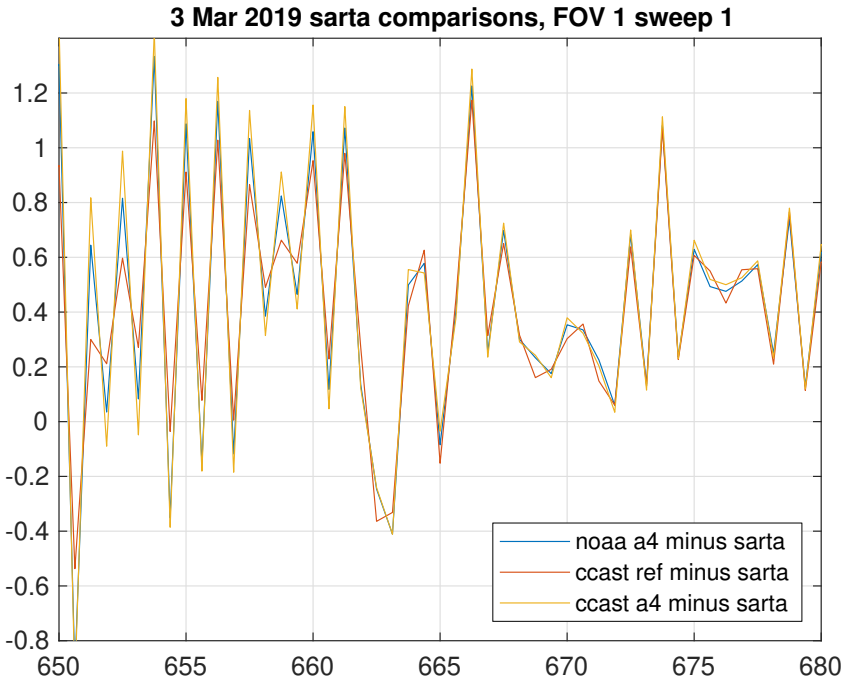


Pre-anomaly mean BT spectra for NOAA A4, CCAST ref, and CCAST A4. The CCAST A4 and NOAA A4 algorithms are in good agreement.



Post-anomaly mean BT spectra for NOAA A4, CCAST ref, and CCAST A4. The differences suggest high frequency components with different periods, that is.

LW FOV 1 Sweep 1 Sarta Residuals



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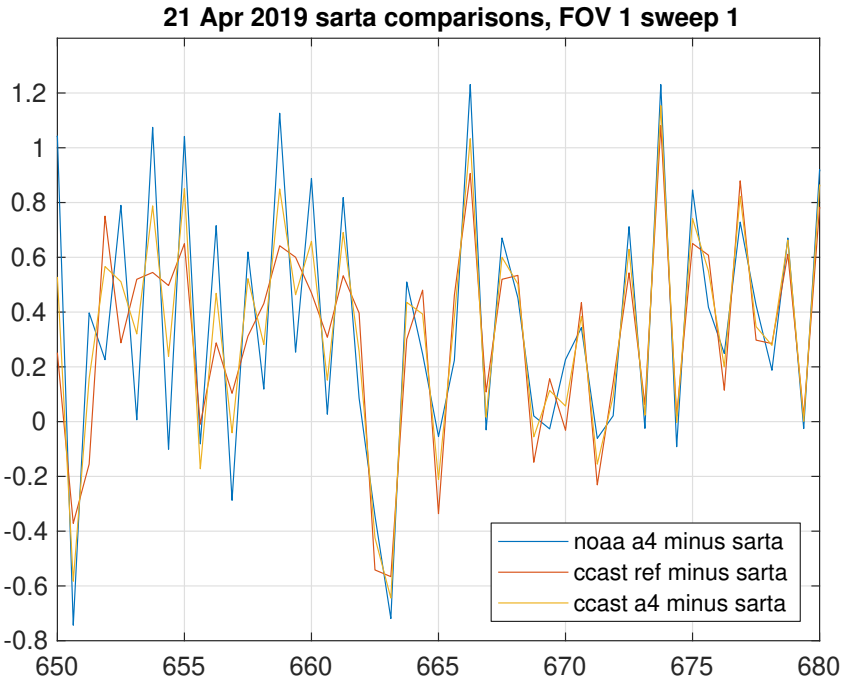

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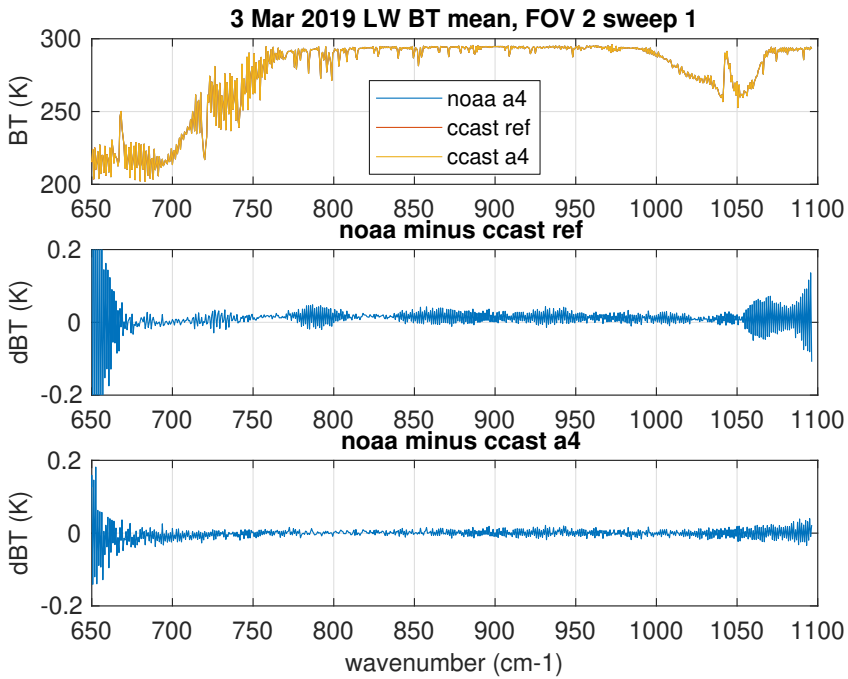

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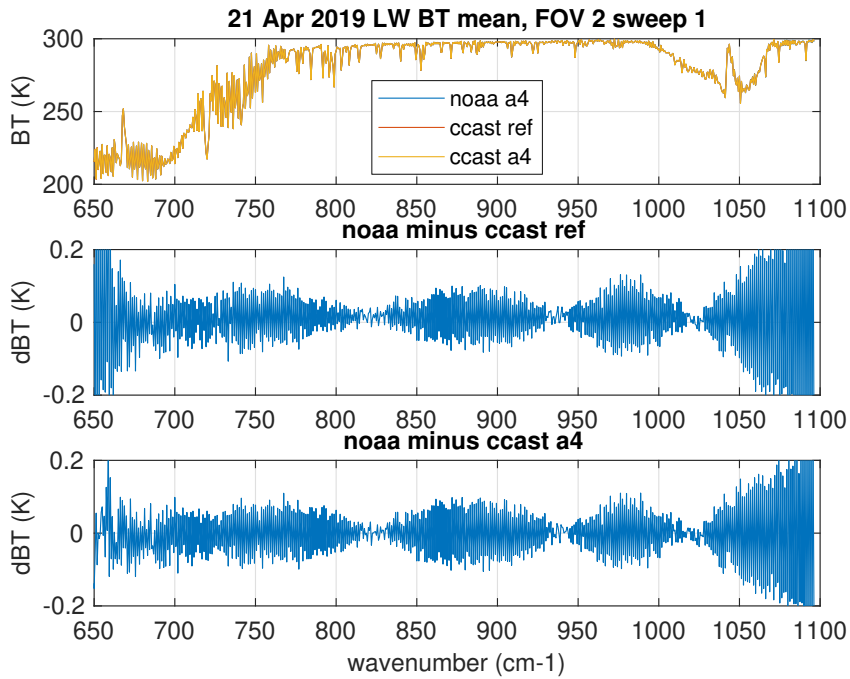
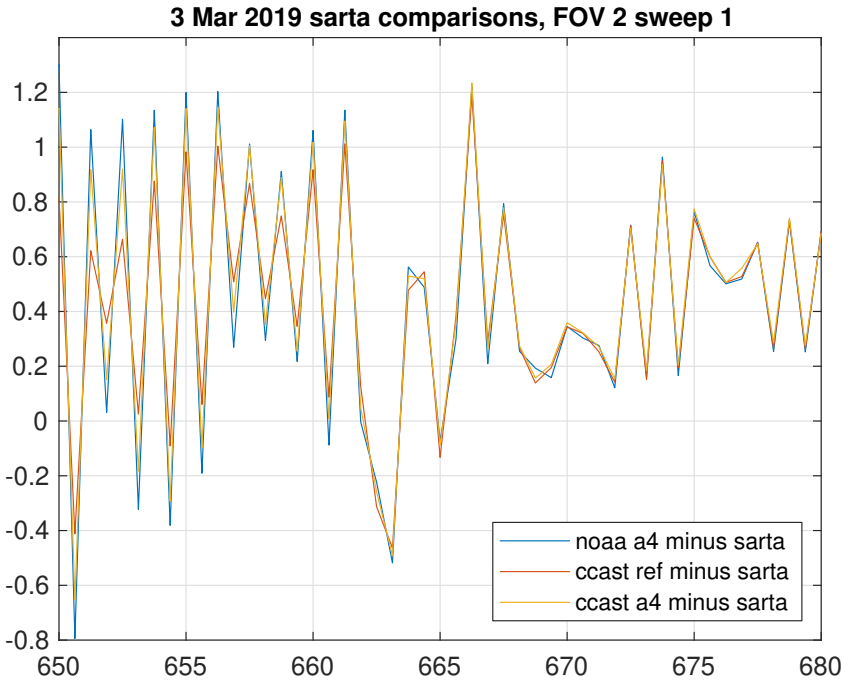


Post-anomaly mean BT spectra. The differences suggest high frequency components with different periods, that is, different ringing.

LW FOV 2 Sweep 1 Sarta Residuals



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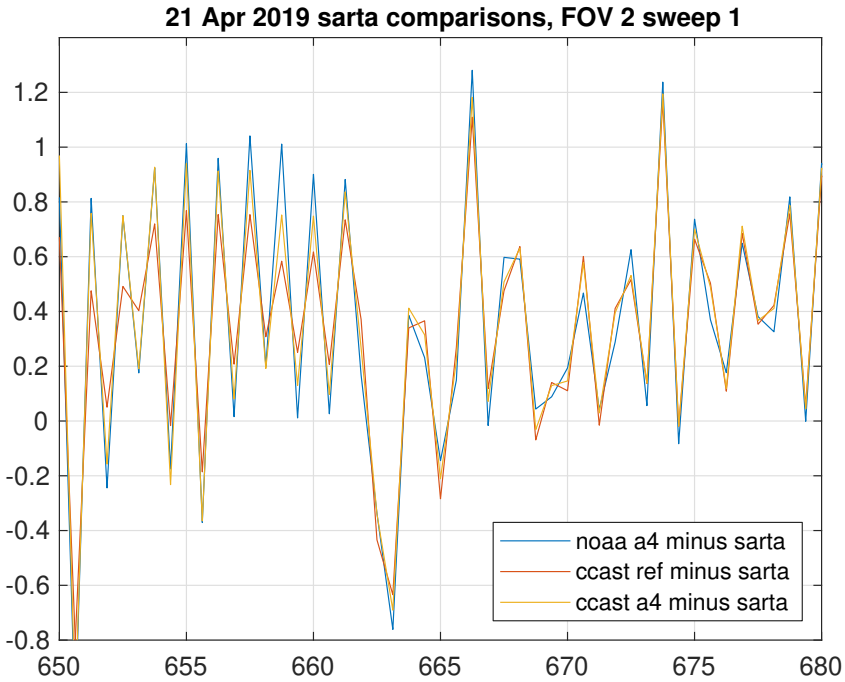

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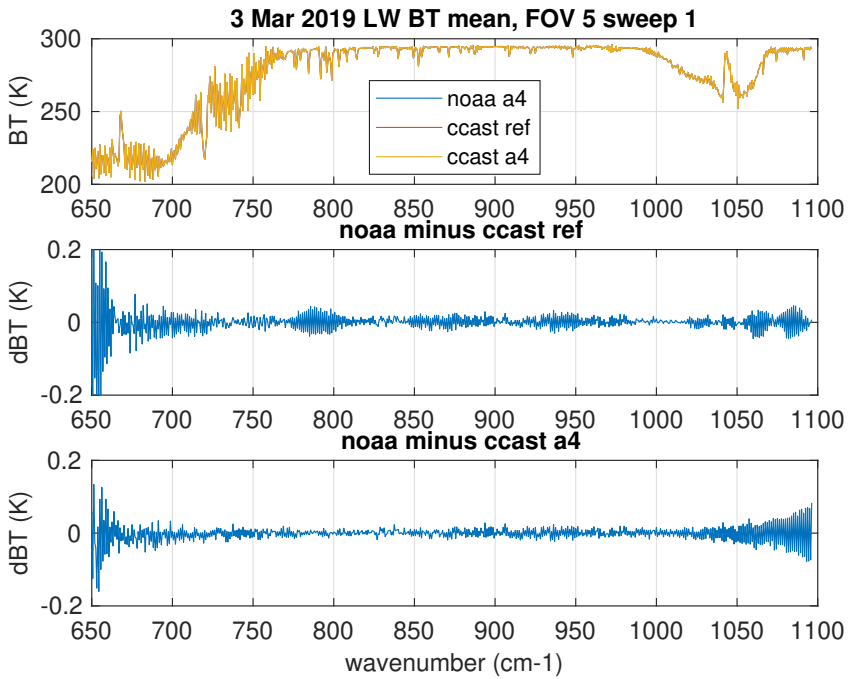
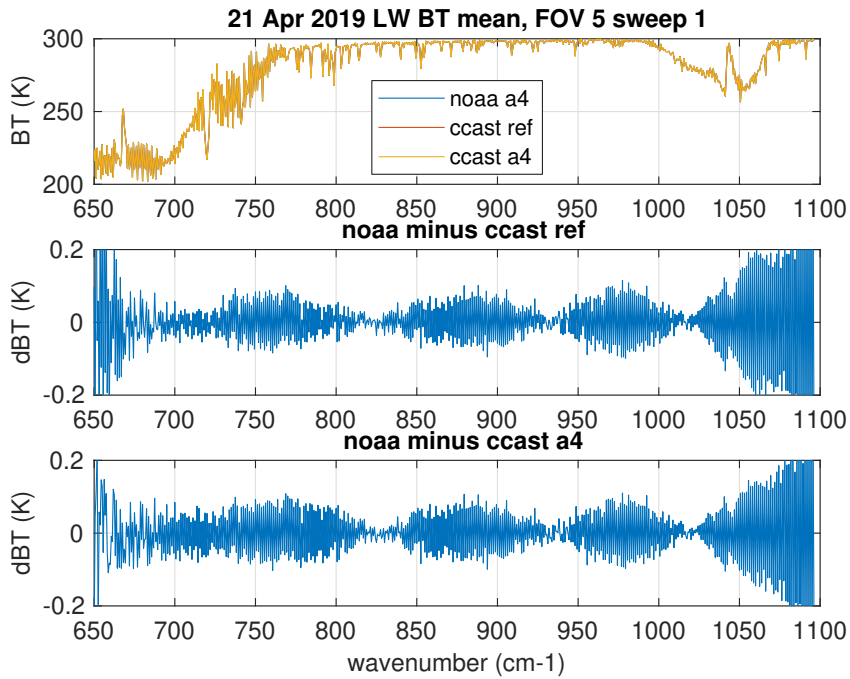
LW FOV 5 Sweep 1 BT Spectra



Pre-anomaly mean BT spectra. The CCAST and NOAA algorithms are in relatively good agreement.



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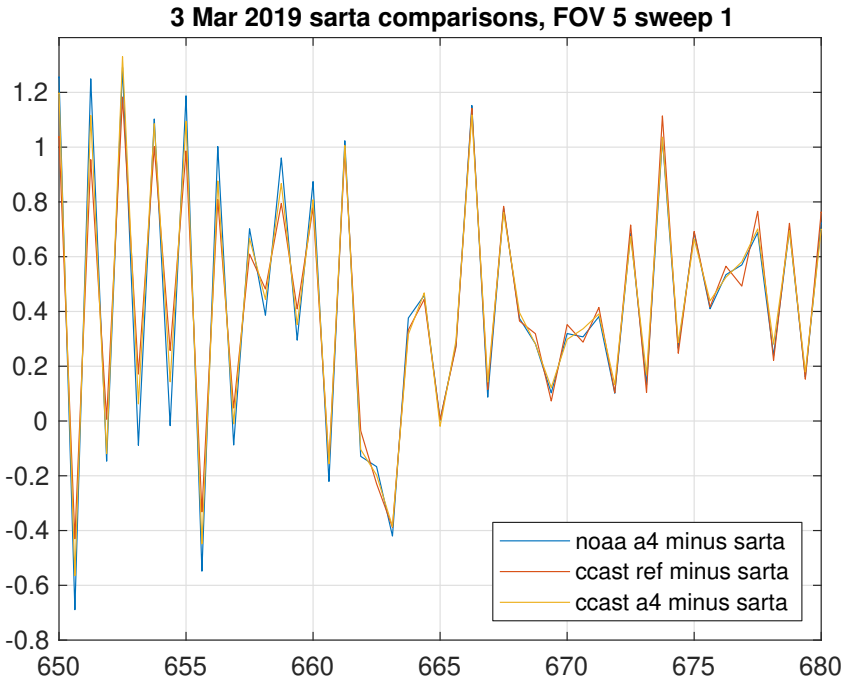
LW FOV 5 Sweep 1 Sarta Residuals



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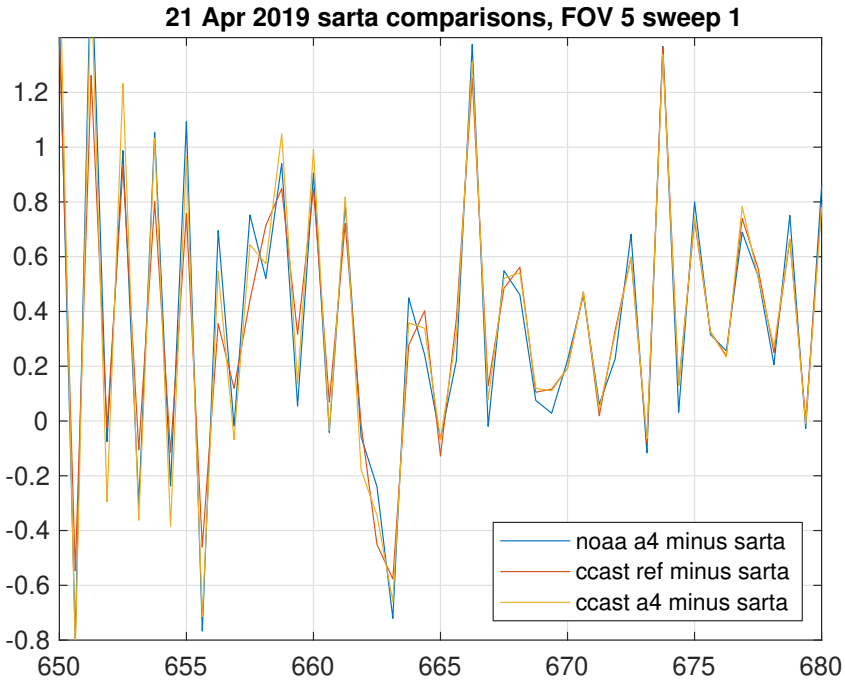

Post-anomaly mean BT spectra. The differences suggest high frequency components with different periods.

Conclusions

- Complex residuals for the NOAA product are slightly larger before and significanty larger after the anomaly.
- This may be due to the mild cosine apodization working better for the case of a significant ZPD shift.
- Because the complex residuals are smaller, we suspect the CCAST BT spectra are closer to reference truth after the anomaly. But this needs to be verified.
- The slightly larger NOAA complex residuals before the anomaly are puzzling, we do not recall seeing this in earlier tests.
- The CCAST complex residual standard deviation is larger than NOAA for the SW side and corner FOVs. This may be due to the different forms of the SA matrix.
- The next step is comparison with calculated reference truth, from clear matchups.