CrIS nonlinearity comparisons

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overview

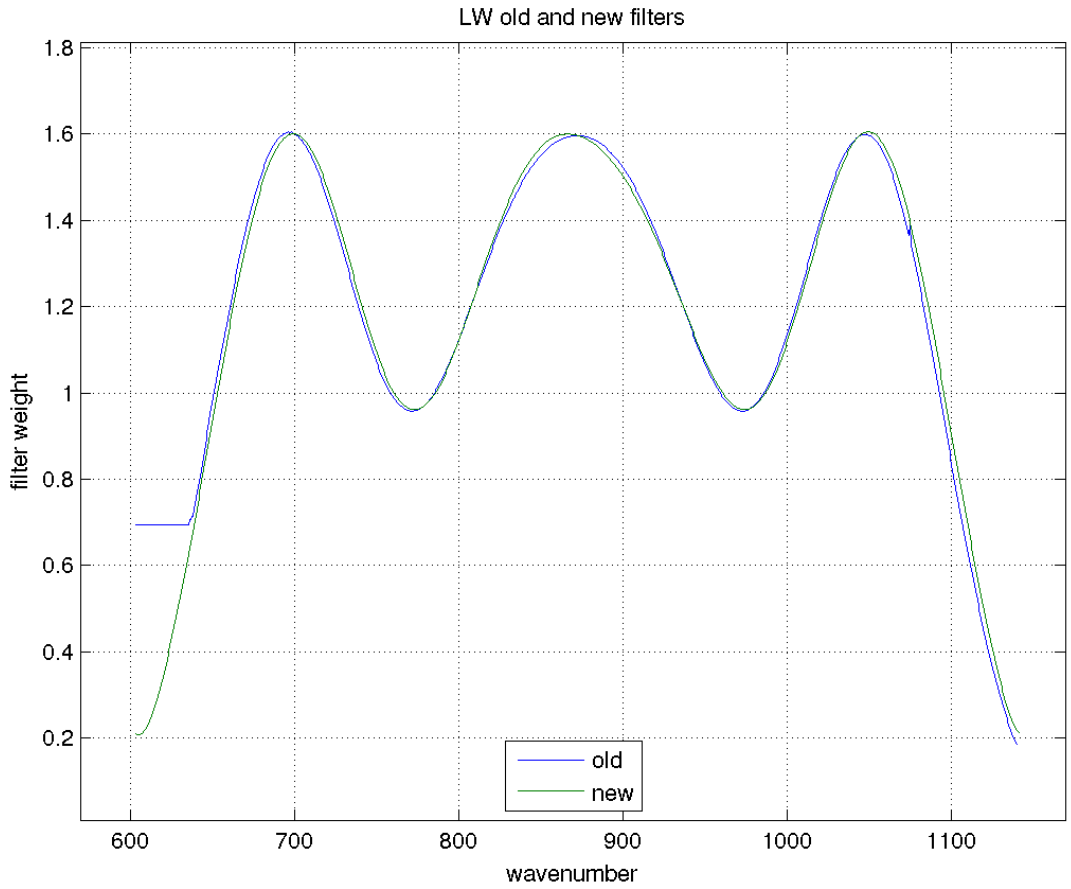
Small nonlinearities in the CrIS detector response can be corrected in ground-segment processing. In this presentation we

- briefly explain the ccast nonlinearity correction
- describe tests for variation in FOV response
- compare ccast and IDPS FOV response
- look at effect of adjusting the a_2 weights
- look at the non-linearity correction in high res mode

methods

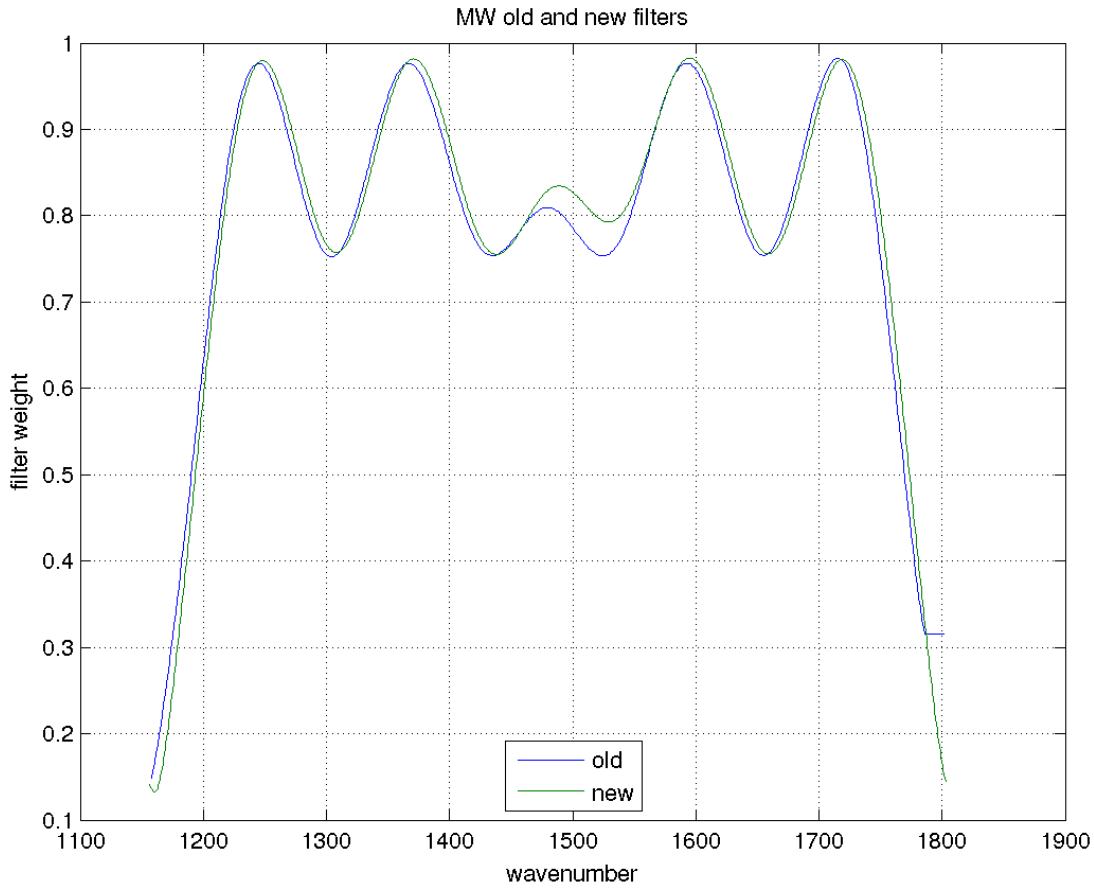
- the ccast nonlinearity correction follows the CrIS ATBD with the UW form of the correction factor, $(1 + 2a_2 V_{\mathrm{DC}})$
- in the DC level integral, the count spectra are divided by the numeric filter at the sensor grid
- the filter is obtained from time-domain weights, and the frequency domain representation should be normalize to match the filters used for the original a_2 fitting
- starting with time-domain weights, and including this normalization, the same code works for both regular and high resolution instrument modes

LW numeric filter



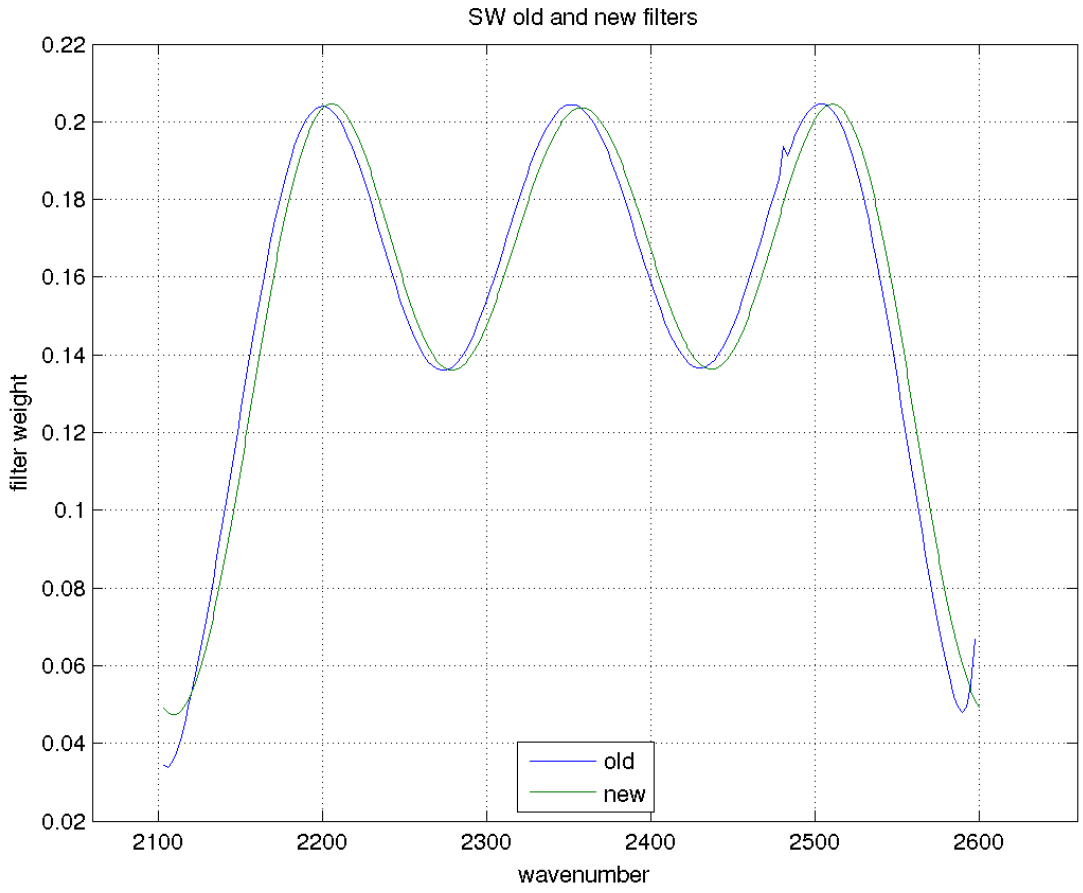
The old (c. 2008) and most recent LW numeric filters, with the new filter normalized to match the old

MW numeric filter



The old (c. 2008) and most recent MW numeric filters. The new filter is normalized to match the old.

SW numeric filter



The old (c. 2008) and most recent SW numeric filters. The new filter is normalized to match the old.

methods

- take the average of each FOV over the course of sample period for FOR 15 and 16 ascending, and compare these with the average for FOV 5
- to the extent that different FOV views dissapear in the averages, this can reveal differences in detector response
- we look at sample periods of three days, two weeks, and for the full course of the 27-28 Aug 2013 high res test
- for some tests the ccast processing was rerun with modified a_2 values

conclusions

- data collection looks very stable
- the metrology laser residuals look good for a bench test
- the *a* and *b* weights are very close to 1 and 0 respectively, suggesting our estimate of 22 torr cell pressure is not too far off. But earlier tests assuming a 10 cm cell and 25 torr also gave a good fit.
- the difference between the nominal and fitted cell pressures might be due to the CO_2 being a partial pressure
- results were similar for sweep direction 1

applications

- gas cell tests may help resolve questions about the best form of the ILS and calibration equations.
- we have both good calculated data and observations averaged over many looks. But the spectral signal is small relative to the BB as seen thru the filters, and not always larger than the obs to obs variance.
- our initial tests found no significant difference in periodic vs regular sinc in compairing obs minus calc or sweep directions.
- we did see a 1 or 2 PPM improvement in the metrology laser residuals with a calibration equation of the form

$$\tau_{\text{obs}} = f(\text{SA}^{-1} f(\text{FT}_2 - \text{FT}_1)/\text{SA}^{-1} f(\text{ET}_2 - \text{ET}_1))$$