ccast calibration equations

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calibration equation

The CCAST reference calibration equation is

$$r_{\mathrm{OBS}} = F \cdot r_{\mathrm{ICT}} \cdot f \cdot \mathrm{SA}^{-1} \cdot f \cdot \frac{\mathrm{ES} - \mathrm{SP}}{\mathrm{IT} - \mathrm{SP}}$$

- r_{OBS} is calibrated radiance at the user grid
- F is Fourier interpolation from sensor to user grid
- f is a raised-cosine bandpass filter
- r_{ICT} is expected ICT radiance at the sensor grid
- SA^{-1} is the inverse of the ILS matrix
- ES is earth-scene count spectra
- IT is calibration target count spectra
- SP is space-look count spectra

notes

- the IT and SP looks are averaged over several scans
- we divide the count spectra by the numeric filter at the sensor grid, but this cancels out in the ratio $(\mathrm{ES} - \mathrm{SP})/(\mathrm{IT} - \mathrm{SP})$
- F is a zero-filled double Fourier interpolation
- $f \cdot \mathrm{SA}^{-1} \cdot f$ can be considered as a physically-based smoothing of the rows and columns of SA^{-1}

alternate calibration equation 2

Alternate calibration equation c2 is

$$r_{\mathrm{OBS}} = F \cdot r_{\mathrm{ICT}} \cdot f \cdot \frac{\mathrm{SA}^{-1} N^{-1} (\mathrm{ES} - \mathrm{SP})}{\mathrm{SA}^{-1} N^{-1} (\mathrm{IT} - \mathrm{SP})}$$

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alternate calibration equation 1

Alternate calibration equation c1 is

$$r_{\mathrm{OBS}} = F \cdot r_{\mathrm{ICT}} \cdot f \cdot \frac{\mathrm{SA}^{-1} \cdot f \cdot N^{-1}(\mathrm{ES} - \mathrm{SP})}{\mathrm{SA}^{-1} \cdot f \cdot N^{-1}(\mathrm{IT} - \mathrm{SP})}$$

- r_{OBS} is calibrated radiance at the user grid
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CrIS ILS

the CrIS ILS for FOV_i can be represented as

$$\int_{\mathrm{FOV}_i} w_i(\theta)\,\mathrm{sinc}(2\pi d(v - v_0\cos\theta))\,d\theta$$

- d is max OPD
- v is frequency
- v_0 is reference or channel frequency
- $\mathrm{sinc}(x) = sin(x)/x$ for $x \neq 0$, 1 for $x = 0$.
- $\mathrm{sinc}(2\pi d(v - v_0\cos\theta))$ gives the ILS for a single ray at off-axis angle θ
- integration is over the intersection of on-axis arcs with FOV_i, with $w_i(\theta)$ the length of an intersecting arc at off-axis angle θ