
Subject: Re: Calculate sensor response functions
Posted by [Paul Van Delst\[1\]](#) on Fri, 22 Jan 2010 15:51:54 GMT
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Christian Haselwimmer wrote:

> Hi,
> I want to calculate sensor response functions (for E0-1 Hyperion)
> based upon centre wavelength and bandwidth but am struggling to figure
> out the best way to do this with IDL. I was wondering if anybody could
> provide some advice or possibly existing code to do this.

Well, sensor response functions are typically measured, not calculated, since the sensor response depends on a whole bunch of things (detector response, foreoptics transmission, the emissivities/reflectivities of the optical surfaces, etc.).

Without the measured SRFs or those modeled by the instrument builder, a really simple approach is to use some sort of modified Gaussian curve:

$$\text{SRF} = \text{EXP}(-a * |x - x_0|^n)$$

where a is a multiplier determined from the half power (HWHM) points,

$$a = \frac{-1 * \text{LN}(0.5)}{\frac{n}{\text{HWHM}}}$$

and x is the frequency in cm-1
x0 is the central frequency in cm-1, and
n is the exponent supplied by the user.

Or, if you want a longer tail to your SRFs, you can use a modified Lorentzian shape:

$$\text{SRF} = \frac{1}{\text{PI}} \frac{\text{HWHM}}{(x - x_0)^2 + \text{HWHM}^2}$$

Or some combination of the two.

But either way, the SRFs would be completely made up. Comparing calculations using made-up SRFs and actual instrument radiances will be biased because of that.

Hyperion is a grating spectrometer, so you may be able to come up with a better instrument model based on the actual instrument specs, but you'd need to know a lot more info (I think). As an example, Lockheed-Martin provided the following SRF model for the EOS Aqua AIRS instrument (also a grating spectrometer, but ~3-15um) back in the 90's:

$$\text{SRF}(x-x_0) = \exp(-a * (x-x_0)^2) + \$$$

$$(b * (1 - \exp(-a * (x-x_0)^2)) * (d + |x-x_0|)^c)$$

where a, b, c, and d are the SRF coefficients based on their analysis of the AIRS optical model.

The above SRF model was great for testing, but we still needed the actual measured responses for modeling the instrument when it was launched.

Maybe you should contact the NASA/GSFC and/or USGS instrument scientists to determine where that data is available?

Anyway....

cheers,

paulv
