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Geoscientific Instrumentation Methods and Data Systems Discussions

Interactive comment on "Radiometric flight results from the HyperSpectral Imager for Climate Science (HySICS)" *by* Greg Kopp et al.

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[The supplement with this comment has the latest version of the paper and addresses the suggestions from both reviewers.]

Dear Reviewer #2,

Thank you very much for these helpful comments, and also for the compliments on the paper itself presented in the friendly, unassuming nature of your review! Such personal pleasantries have made this paper's peer-review process very enjoyable.

Addressing each of your issues and questions (hopefully with the same unassuming demeanor):

1) Vibration of CNTs would be a potential concern for a rocket-launched spacecraft

instrument, although tests so far (done by others, not us) indicate CNTs are very robust and do not particulate. I have another program that will be testing CNTs for direct solar-irradiance applications, where the CNTs will be subjected to those applications' more extreme vibe, thermal-vacuum, and UV-radiation tests, but that's not done yet. For the low-exposure use on this relatively non-critical coating on the backside of the slit inside the HySICS's spectrometer in the much more benign balloon-launch environment described in this paper, a vibe concern is probably more detail than should be added to the sentence, which is the only mention of CNTs in the paper.

2) I've elaborated on the description of the grating, explaining it as a "saw-tooth" pattern of four "teeth," each being a region of smoothly- and monotonically-varying blaze angles. The proposed improved grating would avoid the discontinuity in blaze angle at the edge of each tooth by varying smoothly but non-monotonically several times across the entire grating, with each optimized at different wavelengths spanning the spectrum.

You're right, "smoothly-" and "continually-" varying are the same the way I used them. I've replaced the one use of "continually" with "smoothly" to avoid any potential confusion.

3) With the focus of this paper being on the results of our short-duration balloon flight #2, I agree, long-term degradation concerns such as these are beyond the scope of this paper, but would be quite appropriate for a description of the design for a spaceflight instrument.

Still, a short (and only partial) answer to your question is that this is the inverse of the issue we have with our solar-viewing instruments, which look at the Sun nearly all the time with a different aperture than they use for calibrations, so they provide lots of opportunity to have solar UV bake contamination onto the post-aperture optics with different patterns for the solar- and calibration-apertures. On HySICS, we look at the ground nearly all the time with only intermittent solar observations. Those solar observations with the 500-micron aperture don't let in much light to start with, and that

light is spread by the 0.5-degree spatial extent of the Sun before reaching the first optic. The combination of the small aperture and the infrequent solar exposure reduces some concerns about the long-term degradation.

Nevertheless, I do have plans to track any such degradation for a spaceflight instrument, but that more complete answer takes much more time to explain...

4) Thank you!!!

5) Good idea. I've added more detail to the caption for this figure.

6) Those two uses of "fixed-pattern noise" were in sentences regarding dark measurements, whereas "flat fielding" is generally thought of as a pixel-dependent gain adjustment applied to higher signal levels. The fixed-pattern noise can include flat-fielding variations as well as constant pixel-dependent offsets (say from zero) or bad pixels, both of which can have a larger relative contribution when measuring low signal levels such as the cases mentioned where the term "fixed-pattern" is used.

7) That really is Earth-reflected irradiance and not an uncertainty. While the plot shows the spectral dependence of various uncertainties, there is some (NASA-driven) desire to have a "simple" single-number uncertainty to quote rather than needing to show an entire spectral plot. Thus I computed a spectrally-averaged uncertainty weighted by a typical expected signal. Since these instrument uncertainties are relevant for Earth-looking scenes, I use a globally-averaged reflected-solar signal level (with spectral dependence shown in grey in the figure) and spectrally weighting the net uncertainty by it. This weighting means that spectral regions with very little signal have very little effect on the net average uncertainty; while the instrument uncertainties in regions of high spectral signal are more importantly weighted.

I've added some text (mostly naming of colors in the plots) to hopefully make this more clear in the paper; but as it is/was, I believe the wording is correct. (And hopefully it's both correct and more clear now. ;-)

Technical Correction Responses:

1) In the version you have, "SSI" should be defined on page 2, line 5 where I first used it. If not, it is defined around there on the latest version. Thanks!

2) With "NPOESS" now being a nearly-obsolete acronym from an obsolete program, this is probably even more important to define for future readers. Good idea, and I've done so now. (But my, what a *long* acronym "NPOESS" is âĂŤ not to mention NPP!)

3) It is indeed missing, but that was intended to be implicit to avoid adding a fifth occurrence of "aperture" to the three sentences in that paragraph. I've instead now moved the first use of "apertures" in the subsequent sentence to this position, thinking that "apertures" may be more clearly implicit in that next sentence.

4) Opps, yep, definitely! I've got that corrected now.

Thanks for the meticulousness it takes to catch these kind of errors, and apologies for having missed them!

Best,

Greg

Please also note the supplement to this comment:
http://www.geosci-instrum-method-data-syst-discuss.net/gi-2016-37/gi-2016-37-AC3-supplement.pdf

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