

# ***Interactive comment on “Radiometric consistency assessment of hyperspectral infrared sounders” by L. Wang et al.***

## **Anonymous Referee #2**

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Radiometric Consistency Assessment of Hyperspectral Infrared Sounders —————  
————— Wang et al

The paper describes and intercomparison of radiance measurements from four different hyperspectral instruments based on colocated pixels viewed almost simultaneously and through similar, near-nadir slant paths. Care has been taken to allow for the different spectral resolutions and spatial inhomogeneities (although I have some doubts about the details of the methods used).

Similar intercomparison exercises, using similar techniques, have already been performed with these instruments, but it is a question of sufficient importance that an independent study is justified to check the reproducibility of the results.

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1) The authors note that there have been several very similar intercomparison studies with these instruments yet, apart from a few specific details and qualitative comments, very little attempt is made to put the new results into the context of previous work. What did the other authors conclude, and are these results consistent? I would have expected to see another section of discussion devoted to this.

2) The authors also claim that a key feature of this work is the improved accuracy arising from applying tighter coincidence criteria. However, I would have liked to have seen some proof of the importance of this by way of plots showing how the biases and/or scatter change as a function of relaxing the criteria. The criteria used seem to have been arbitrarily chosen and may be too tight in terms of reducing the amount of data available for comparison (with the associated loss of representativeness and geographical coverage, particularly for the IASI comparisons).

3) Scene Uniformity. It seems that the identification of uniform scenes is based entirely on the variability within the CrIS pixel, without regard for the uniformity within the IASI or AIRS pixel which may only have a 50% overlap. A better approach would have been to extend the VIIRS uniformity test to include the area covered by both pixels or, in the case of IASI, also apply a similar test using the colocated AVHRR radiance cluster analyses. As applied, though, I would expect a number of IASI/AIRS pixels to contain some cloud contamination and therefore have a net cold bias. Could this explain some of the observed CrIS-IASI warm bias in the window regions?

4) AIRS data gaps. The approach in simply averaging the AIRS spectra over missing spectral points is questionable and requires some justification. For example, using LBLRTM simulated spectra for a variety of scenes it should be possible to establish the magnitude of the error associated with this assumption. In particular, whether there is any geographical distribution to this error which might contribute to the observed CrIS-AIRS differences.

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5) Section 2: Overall the summary of instruments and datasets reads like extracts from relevant documentation. There should be some attempt to present the information in a more uniform manner, eg FOV size and shape, equatorial crossing time, specified radiometric and spectral accuracy for each instrument. A sketch of the superimposed instrument FOVs would be useful.

6) 'Nadir': I'm a little unclear about the meaning of 'nadir' in SNO. I would expect it to mean some subset of the instrument observations, presumably restricted by the zenith angle about the vertical. However, on p7167/25 it mentions that during SNOs the satellites view the same area from different altitudes but doesn't explicitly state that the angle is also the same. So what range of angles is included in the definition of nadir? And is this just an ad-hoc definition or if there is some objective basis for setting the range. Table 2 suggests that for intercomparisons, zenith angles also have to match within  $\cos(\text{zen}) = 0.01$  - comparing  $\sec(\text{zen})$  seems more logical since this translates more directly to airmass - but how does this 0.01 variation fit within the +/- variation assumed within the definition of 'nadir' observations? On p7169, it mentions that the CrIS swath width is wider than AIRS because the satellite is higher. I assume this comment refers to the geographical width of the swath within the definition of 'nadir' otherwise, of course, the absolute swath width is set by the instrument design rather than being particularly limited by altitude.

#### SPECIFIC COMMENTS \_\_\_\_\_

p1765/27, p1766/12: I assume all three instruments are on sun-synchronous platforms otherwise the notion of equator crossing time would make no sense, but this is only specifically mentioned for IASI and CrIS.

p7167/17: so what is the effective spectral resolution of CrIS data after apodization with the Hamming function?

p7169/25: if you're going to say 'well corrected' rather than just 'corrected' I would expect some reference to work which demonstrates that the correction is exceptionally

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accurate rather than merely part of the L1 processing.

p1766/13: 1.30pm and 1.30am - say which is the ascending and descending node.

p7170/29: While Fig 6b shows that CrIS and IASI exhibit the same spectral features, it would indeed be remarkably bad spectral calibration from one instrument or the other if they didn't. So saying 'spectral lines well matched' is perhaps too positive, and unnecessary a statement.

p7171/4: 'to date' - specify the date on which this comment applies.

p7173/9: 290K seems remarkably warm for >70degN - add some comment on where/when these data originate.

Table 1: it would be helpful to say whether these equator crossing times are ascending or descending.

Figure 3: Strictly speaking, the IASI and CrIS FOVs are superimposed on the VIIRS image rather than the other way around. 'image at M16 band' would read better as the 'image from the M16 band' and it would also be helpful to note here that this is the 11.8micron window region, and to give the approximate geographical location (which appears to be over northern Canada). And what is the significance of the larger circle in the Figure?

Figure 4: what is the significance of the large cross in the figures?

Figure 5: a useful addition to this plot would be, instead of having the horizontal red line showing the mean difference, have a line showing the mean difference as a function of the VIIRS STD/AVG threshold, and add further lines/shading showing the SD about this mean. I expect this would back-up the claim that the mean and SD converge for  $\text{STD/AVG} < 0.05$  but also demonstrate the sensitivity to the choice of threshold value.

Figure 6: How many spectra have been averaged here?

Figure 9: For comparison, it would be useful if the lower panels included some & Fig

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10 estimate of the expected contribution to the SD due to instrument noise. Also, the caption should explain the significance of the shading.

## GRAMMATICAL/TYPOGRAPHICAL ERRORS \_\_\_\_\_

p7164/18: 'sounde's' should be 'sunder's'

p7164/27: 'hypepsectral' should be 'hyperspectral'

p7165/4: 'briefs', also line 8 'briefed'. The verb 'brief' does not mean to 'provide a brief summary', which is how it is being used here. I suggest replacing with 'summarises' and 'summarised'.

p1765/9: 'passtime' - 'crossing time' is more conventional, and the term which is actually used in Table 1.

p1765/10: 'channel number' suggests the identification number of a particular channel. I would use 'number of channels'

p7166/9-10: Either 'Hereafter', or 'in the following parts', but not both in the same sentence.

p7166/14: 'Fields of Regards' should be 'Fields of Regard'

p7167/4: 'mode since 4 December' should be 'mode on 4 December', or better to rephrase as 'CrIS has been operating in FSR mode since 4 December'

p7167/5: 'different altitude' should be 'different altitudes'

p7186/Fig 2 caption: 'ARIS' should be 'AIRS'

p7169/23: 'self-apodizatio' should be 'self-apodization'.

p7169/26: 'instrumen's' should be 'instrument's'.

p7169/26: 'affects ILS' should be 'affects the ILS'.

p7169/26: 'product' should be 'products'

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p7170/22: rather than 'full resolution mode operated for SNPP' I think it should read 'SNPP was operated in full resolution mode'.

p7173/6: 'composed by' should be 'composed of'

p7173/6: 'and and' repeated

p7173/9: 'less' should be 'fewer'

p7192/Fig 8 caption: 'byLBLRTM' should be 'by LBLRTM'.

p7175/1: 'is no' should be 'are no'

p7175/1: 'implies for' should be 'applies to'

p7184 Table 3: 'Differences at 25' should be 'Differences in 25'

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