

Interactive comment on “Improvement in cloud retrievals from VIIRS through the use of infrared absorption channels constructed from VIIRS-CrIS data fusion” by Yue Li et al.

Anonymous Referee #1

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The present manuscript describes and validates the improvement of cloud retrievals from the VIIRS instrument on board of Suomi-NPP platform using radiances from CrIS hyperspectral instrument on board of the same platform.

The authors, using a fusion methodology, extracted broadband channels information from CrIS spectrally resolved measurements for simulate MODIS channels around 15 micron and 6.7 micron. In this way they can apply methodologies developed for MODIS to VIIRS that doesn't cover these spectral bands for cloud detection and retrieval. This improvement has been validated with CALIPSO dataset.

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The manuscript topic is for sure appropriate for the Journal but in the present form has some incompleteness that should be fit before publication. Incompleteness can be identified divided into two main topics: Hyperspectral instruments and Validation.

- Regarding hyperspectral instruments as I said, in this work the authors use the spectrally resolved measurements of CrIS to simulate moderate resolution channels. In doing this the authors omitted to describe and acknowledge the great diagnostic power inside the spectral resolution and coverage of instruments like CrIS. For a reader who is not an expert in the field, it might appear that CrIS (and all the hyperspectral instruments) is a less accurate instrument than VIIRS because it has a worse spatial resolution. As an example, consider sentence at lines 15-21 of page 2 and lines 1-5 of page 3. It seems that CrIS has channels at 15 and 6.7 micron, missing in VIIRS instrument, but with degraded spatial resolution. I think that the authors should spend a sentence to indicate the peculiarities of hyperspectral instruments and add a figure showing a typical CrIS measurement in comparison with the spectral coverage of the channels used in the methodology described in the manuscript. Moreover I wish to recall that already 15 years ago it has been shown that with hyperspectral observation alone in the atmospheric window between 800-900 cm^{-1} is possible to detect and classify clouds. The authors can find an example in the following papers doi:10.1364/AO.41.000965 and doi:10.1016/S0022-4073(02)00083-3.
- About the validation, I have some doubts regarding the spatial distance between VIIRS and CALIPSO used for the colocation. While on the one hand I can imagine that a distance of less than 4° can reduce the concomitances between the two instruments, on the other a distance of 200 kilometers make the difference in spatial resolution between VIIRS and CrIS practically not appreciable. Probably a sentence that best justifies this choice is necessary. Also in relation to the results of the validation itself.

Other Specific Points

- Page 2. Line 19. As I said before, CrIS has not only channels MODIS-like at 6.7 and 15 microns, but it covers the spectral ranges that MODIS cover with two channels with thousand channels.
- Page 4. Line 11. Remove absorption before channel.
- Page 4. Line 19. The step (b) of the fusion method is not clear. The convolved sounder radiances are already at coarser spatial resolution. In the text it seems that the authors further degraded spatial resolution. Please clarify.
- Page 6. Line 16. Please insert a reference to the ACHA algorithm. If not, please place here the reference to the ATBD now at Page 7, line 2)

For these reasons I suggest to accept this manuscript subject to minor but necessary revisions.

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