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Atmospheric Measurement Techniques Discussions

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 #2

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General comments:

Retrieval of cloud-top properties with the Visible Infrared Imaging Radiometer Suite (VIIRS) could be more challenging than its predecessor MODIS, because of the lack of water vapor and CO2 bands in thermal infrared region. This paper "Improvement in cloud retrievals from VIIRS through the use of infrared absorption channels constructed from VIIRS-CrIS data fusion" by Li et al. demonstrated that by leveraging fusion water vapor and CO2 bands from high-spectral resolution instrument CrIS, VIIRS cloud retrievals, including cloud mask, cloud thermodynamic phase, and cloud-top height are generally improved. This paper also shows that those fusion bands have a big boost in

the accuracies of cloud mask/phase algorithm at high latitude. By including the extra fusion bands, cloud-top height retrieval is also improved with lower biases and uncertainties, in particular for those optically thin cirrus clouds with emissivity less than 0.8.

This paper is well organized and written. One of my major concern is that the authors should give more details about the comparisons between VIIRS retrievals and CALIPSO/CALIOP. Furthermore, to highlight the importance of those absorptive fusion bands, it could be worth to check day/night samples separately.

Specific comments:

1. Line 10, Page 7: What the 13.3 channel is not used in the cloud mask detection?

2. Line 15 Page 7: Figures 7 and 8 in Wang et al. 2016 [doi.org/10.1002/2015JD024526] shows the importance of 13.3 and 6.7 channels for difference cases.

3. Line 3, Page 9: I think a 4 degree difference is too large for cloud comparisons. Do you mean 4 km?

4. Line 20, Page 9: How do you define pixel-level cloud fraction here, please clarify.

5. Line 2, Page 10: Could you please give the pixel fraction that CALIOP COTs are less than 0.03?

6. Line 3, Page 10: And it would be helpful if you can provide the cloudy and clear fractions in Table 2.

7. Line 19, Page 10: This is true. However, the authors could apply the same comparison to nighttime pixels to highlight the importance of water vapor and CO2 channels.

8. Table 2: What's the reason that the no fusion cloud mask retrievals are so different between NOAA-20 and SNPP in Arctic (e.g., 74.7% vs. 61.9%)?

9. Section 3.2, Page 12: How do you deal with multi-level clouds and mixed-phase

cloud? Did you use the uppermost cloud layer phases from CALIOP, in multiple cloud-layer cases? Please give more details.

10. Line 11, Page 16: In Figure 5, it is interesting that the fusion cloud-top heights (SNPP) are more negatively biased than no fusion heights in Antarctic. Do you have any speculation? I don't find the same feature in Figure 7 for NOAA-20.

11. Line 13, Page 22: Do you think it's due to artifacts of fusion bands? Since Figure 8c shows that near north pole, passive cloud-top height with fusion bands are higher than Lidar.

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