

Interactive comment on “Screening for Snow/Snowmelt in SNPP VIIRS Aerosol Optical Depth Algorithm” by Jingfeng Huang et al.

Anonymous Referee #2

Received and published: 4 July 2018

This paper presents a modified NDSI-based snow detection scheme, which has been applied to the operational NOAA VIIRS IDPS and EPS aerosol algorithms. The proposed scheme effectively mitigated the snow contamination in AOD product by more accurately filter out pixels containing melting snow over high latitude regions. This is achieved by combining NDSI with various tests, such as brightness temperature, spatial variability, and spatial adjacency tests. Since snow contamination in the retrieval pixel even small amount could potentially lead to a significant high bias in AOD, it is important to implement more rigorous snow detection schemes in the aerosol algorithms and examine the impacts. The manuscript is well written and easy to follow. I believe that addressing the following comments would improve the quality of the paper further.

[Thank you very much for your very valuable comments that are extremely helpful to improving the quality of the paper.](#)

General comments:

1. The proposed snow detection scheme consists of several steps. I would recommend to extend Figure 2 and include AOD plots at every step, so that the readers can easily understand the impact of each step. The plot should probably be zoomed in more to better show the details. Plots of the test variables, i.e., NDSI, BT, and spatial variability, would help as well.

[Thanks for this valuable comment. The new snow and snowmelt scheme work as a whole for snow and snowmelt contamination removal, so we would think that a comparison between Figure 2\(a\) and 2\(b\) are sufficient to show the significant improvements in the new scheme from the old VRA based scheme, and at the same time, it avoids potential confusion to readers by adding too many subplots.](#)

[Meanwhile, we agree readers may want to know how the three components \(NDSI test, snow adjacency test, and spatial filter\) play their roles in the combined effect in the new scheme. Such information is much better shown in Figure 5 with more quantitative evaluation and discussions within Section 4.](#)

2. One can assume from Figure 4 that the proposed scheme results in some false alarm (snow detection in low latitudes, and low AOD in some snow-contaminated pixels). I would

recommend to discuss this together with potential future work to further refine the scheme, as I think retaining good pixels is as important as removing bad pixels.

This is a very good point. In the algorithm development, in addition to avoid snow and cloud contamination, we strive to avoid over-screening as well. In Section 3, we particularly discussed the complement impact of the spatial filter that it also effectively screens low level 'popcorn' cumulus clouds at low latitude regions. Since both cloud and snow conditions are unfavorable conditions for meaningful satellite aerosol retrievals, the homogeneity test provides additional quality assurances to the VIIRS aerosol retrievals in terms of both snow and cloud screenings. However we agree that residual false alarm may still remain even after the snow/snowmelt screening scheme is updated. It is a daunting challenge to verify whether the low AOD in some snow-contaminated pixels are real AOD signals or contaminated by snowmelt conditions that are not necessarily causing high AOD retrievals like snow conditions. We are adding more discussion on Page 9 in Section 5 that the algorithm should be further improved in future work: "In future work, in order to reach more quantitative statistics for a better understanding of the relative contributions from each test, more testing dates at different seasons are needed. The additional testing will not only help find seasonal variability of the tests, but also help identify any residual snow and snowmelt contaminations or any over-screened AOD retrievals, both of which are valuable for further algorithm improvement. "

3. In Figure 6, I wonder if the three data points at AERONET AOD of ~ 0.05 and VIIRS AOD of ~ 0.2 are retrieval-related or snow-related.

On Line 277-282, we have discussed the two points in the red circles are retrieval-related, which was verified by our additional testing runs with the new EPS algorithm. For the additional three points at AERONET AOD of ~ 0.05 and VIIRS AOD of ~ 0.2 , we agree with the reviewer that it seems the new snow/snowmelt scheme did not screen the matchup out as snow/snowmelt contamination. Given our confidence on the performance of the new scheme, we believe the remaining bias (~ 0.15) are not snow or snowmelt related, and the aerosol algorithm should be improved to further reduce the retrieval bias and data uncertainty.

Specific comments I don't find further specific comments other than the other reviewers'.

Thanks.