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Atmospheric Measurement Techniques Discussions

Interactive comment on "Analysis of Global Three-Dimensional Aerosol Structure with Spectral Radiance Matching" *by* Dong Liu et al.

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We thank the reviewer for the comment. The algorithm we used, developed by Barker et al., utilized 0.62–0.67, 2.105–2.155, 8.4–8.7, and 11.77–12.27 μm channels from MODIS, or simply denoted as bands 1,7,29 and 32. Among these bands, bands 1 and 7 are also used for MODIS aerosol retrieval. Therefore, we believe the algorithm can also work for aerosols, as assumed in Barker et al. 2012. We did notice that the choice of channels might not be as beneficial for aerosols as they are for cloudsâĂŤthe sensitivity to aerosols might rely more on using visible channels, and the signal from aerosols could be much weaker. We had done following test in order to test and possibly optimize the algorithm for application on aerosols. We collected 30 days of CALIPSO profiles in 2015 with clear-sky condition and heavy aerosol loading at the east coast

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of China. We expected the manually selected cloudless dataset with heavy loading events would give a clear answer to whether the algorithm could work for aerosols or not. We test the following combination of radiance bands: 1) using bands 1,7,29 and 32 used by Barker et al.; 2) using bands 1 and 7 only; 3) using visible bands 1, 2, 3 and 4. We tested the performance of using these combinations by reconstructing the profile with dead-zone setting for 30 and 100 km. A typical result is shown in the following figure, where the panel a is the original profile, panel b to d corresponds to combination 1 to 3, panel e shows the results of choosing the closest pixels outside the dead-zone. The results we got from this test indicate that the original combination used by Barker et al. could get a pretty successful reconstruction (on average 81.9% and 75.2% matching rate at 30 and 100 km, respectively), which means it can be used to construct aerosol vertical structure. In comparison, using visible channels only have lower matching rate (around 60-70%), especially when aloft aerosol layer are present. The closest pixel method, on the other hand, has very high matching rate at 30 km, but as the dead-zone range increases or if the aerosol layer is not continuous, the simple horizontal shift leads to more errors. In conclusion, we decided to use the channels selected in Barker et al. For reviewer's second concern, we want to clarify that we did not intend to get a 'better' quantification of AOD by expanding active profiles to nearby regions. After all, the active pixel being matched to the passive column could only provide an estimate of the column condition, which is not expected to be better than actual measurements MODIS made there. The advantage of this algorithm is really to help infer a profile and related vertical information, as shown in Figure 2 and Figure 6, which passive-only cannot obtain. As for reviewer's suggestion to validate the constructed aerosol vertical profiles with ground-based observations, we are sorry that our attempt to do so was not carried out, because there were no available lidar stations in the area. Therefore, we took one step back and compared the column total with ground-based AERONET sites. We did show in Figure 7 that constructed aerosol profiles made closer agreement with AERONET AOD than the nadir view only.

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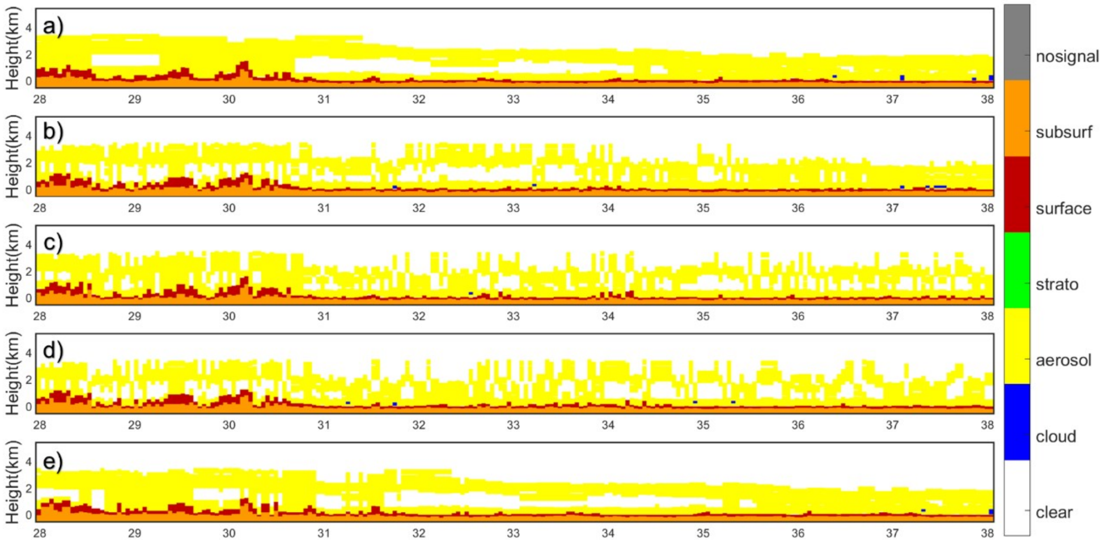

Fig. 1. Reconstruction of CALIPSO profile passing the east coast of China on January 3, 2015 with dead-zone setting for 100 km.

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