Interactive comments on "Looking Through the Haze: Evaluating the CALIPSO Level 2 Aerosol Optical Depth using Airborne High Spectral Resolution Lidar Data" by Rogers et al.

General comments:

This paper evaluates the CALIOP Level-2 aerosol layer optical depth (AOD) (individual layers, as well as column AOD) using an extensive set of suborbital measurements with the NASA airborne High Spectral Resolution Lidar (HSRL) in the North American and Caribbean regions. The absolute and relative differences on the column-AOD, layer-AOD and lidar-ratio are analyzed for both daytime and night-time. In particular, the CALIOP aerosol lidar ratios are assessed for each CALIOP based aerosol subtype to see their influences on the AOD. Such extensive coincident and range-resolved validations on the CALIOP aerosol product are impressive and reveal new insights in contrast to previous comparisons between CALIOP and passive satellite-borne and ground-based AERONET radiometer measurements. These results clearly illustrate the clear relationship between the Lidar Ratio bias and the AOD bias as is to be expected making it even more important to improve future aerosol classification. In addition, the differences between day and nighttime retrieval errors is clearly illustrated demonstrating clearly the impact on signal noise in the retrieval process. This is also illustrated in the comparisons between the column integrated layer and the top layer. In particular, it is clear that additional errors are observed in the column products due to attenuation in the signal due to the upper layers.

It is also interesting that the authors didn't directly estimate the aerosol-layer-height (base and top) from the highly accurate HSRL aerosol profiles, but use the CALIOP reported aerosol-layer-height to estimate HSRL aerosol-layer-AOD (Page-6151, Lines 4-6 from page-top). The benefit of using the same base and top is clearly that one can more clearly attribute observed AOD differences to the different lidar-ratios used in the CALIOP and HSRL algorithms. However, the aerosol-layer-base and top are also important to estimate aerosol-layer-AOD and evaluate CALOP aerosol-layer detecting capability. Thus, a directed study to assess the CALIOP aerosol-layer-height from the HSRL profiles should be considered in the future.

Due to the extensive measurements used and the results obtained, I strongly recommend its publication in AMT.

Specific/Minor comments:

1. In the Abstract: please give the CALIPSO data Version (V3.01, V3.02 or V3.03?).

2. In the section 2.4, "Data collocation and data screening". Are the CALIOP quality flags of "Extinction QC 532" and "FeatureFinderQC" used?

3. About the airborne HSRL data. What are the time and range resolution for deriving aerosol extinction profile and lidar-ratio profile? The aerosol reference or background value (or

"clean air") might influence the retrieval of aerosol backscatter coefficient and thereafter lidar-ratio due to the flight height limit (~7.5 km max for aerosol retrieval).

4. Page 6156, in the Section 2.6 Sample case: 7 Feb 2009.
   Please add the time information to indicate the day-time or night-time?

5. In Section 4.1, Fig.7(b) shows the scattered points or difference between the HSRL-layer-AOD (using CALIOP identified layer base and top) and HSRL-column-AOD in the daytime. This indicates that the undetected aerosols can contribute much to the total AOD and affect the total AOD accuracy though the proper lidar ratios are used for the daytime data. It may help explain the underestimate of CALIOP-column AOD against the passive radiometers such as satellite-MODIS or AERONET. Can you plot the histogram of the ratio of the HSRL-layer-AOD to the HSRL-column-AOD in the daytime?