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Atmospheric Measurement Techniques Discussions

Interactive comment on "Effects of solar activity and geomagnetic field on noise in CALIOP profiles above the South Atlantic Anomaly" *by* V. Noel et al.

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General Comments

NOTE: This reviewer is the Lidar Performance Engineer on CALIOP and the review will reflect that fact, concentrating on instrument characteristics rather than science results.

Overall, I think the paper is well written and the analysis is well-done. I find it interesting from the standpoint of a novel use of CALIOP data, but my impression is that the scientific conclusions are not fully convincing, nor are they unique. The paper demonstrates an alternative way of measuring some the characteristics of the SAA and the time evolution of those characteristics, and at the same time provides some insight into the instrument behavior and stability. The main problem is that it does not sufficiently

differentiate between the two. Changes in the CALIOP noise from the SAA over time can be due to changes in the radiation environment or they can be due to changes in the instrument characteristics. The authors infer that they are due to the former, and I believe that to be correct, but I would like to see a more convincing argument to that effect. The discussion of the time history of noise in clear areas is much less convincing because of the similarity of the underlying annual cycle of the excess noise to that of the detector temperature. The authors need to explain why they believe the changes to be due to changes in the radiation environment rather than temperature-induced changes in the detector dark noise. Measurements of noise as a function of geographic location are much less likely to be influenced by instrument changes, and should provide a valid means of following the evolution of the SAA position over time. I would like to see more emphasis on that discussion, with additional graphs showing the time history of various parameters.

Specific Comments

p 8592 line 19: Unlike the SAA noise, the scattered sunlight noise originates with photoelectrons. The fact that it is visible in Fig. 1 shows that even with the 200 count threshold, the noise measurements do not fully discriminate between noise due to photoelectrons and noise due to radiation-induced pulses. The photoelectron contribution will certainly be dependent upon the receiver gain.

p 8592 line 25: It might be useful to elaborate on the fact that the SAA region has intentionally been chosen to exclude the more southern latitudes of the SAA so as to avoid the influence of sunlight scattering or polar radiation noise. The omission of some of the SAA could have a small effect on the SAA noise analysis.

P 8593, line 1 I would expect the geographic distribution of daytime noise to closely follow the distribution of clouds and snow and ice, which generally is not random.

P 8593, Section 3 and Figure 2 The discussion of Figure 2 seems to be based upon the assumption that changes in the noise are due to changes in the radiation environment.

The possibility that they may be due to changes in the system characteristics should be acknowledged, and an argument made for why you do not believe that to be the case. Periodic polarization calibration measurements show that the relative sensitivities of the two 532 nm channels have varied by as much as 5% over the mission. Since this is similar to the amount of change seen in Figure 2, it does not seem wise to dismiss system changes as a possible source of the observed changes in the SAA noise.

P 8594 lines 11-23 and Figure 3 Some confusion might be avoided by explicitly pointing out that the data shown in Figure 3 include a much larger geographic region than the SAA rectangle used to compute the values in Figure 2. I find the caption of Fig. 3 confusing. Perhaps it would be clearer to say "Evolution with time of the fraction of noisy 333m profiles as a function of latitude for longitudes between 70° W and 30° W (top) and as a function of longitude for latitudes between 40° S and 10° S (bottom)...". Since the noise as a function of geographic position is not likely to be influenced by system changes, I believe that a discussion of the geographic evolution of the SAA is on a solid basis, and I would like to see it expanded. It could include time history plots of the positions of boundaries, widths, etc. A particularly interesting plot would be of the time history of the longitude of the "center" of the SAA, since it should be unaffected by changes in the lidar sensitivity, and would be minimally influenced by scattered sunlight and polar radiation belts. Such a plot might provide improved insight into the westward movement of the SAA.

P 8595 line 5 Some discussion should be provided of the possibility that the underlying yearly cycle in the noise might be at least partially due to the very similar yearly cycle of the PMT temperatures, since the thermionic dark noise from the PMTs increases with increasing temperature.

P 8602 Figure 4 The labels on the vertical axes of the two figures are confusing. Perhaps one of them needs to be changed to something like "Relative deviation...".

Technical Corrections

p 8592 line 5: The actual altitude range for the noise measurement is 65.0-80.0 km . This is a change from the original plan that was reported in Hostetler et. al, 2006.

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