

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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1 Major comments

The main concern from M. Hunt is that our paper does not discuss enough the importance of changes in instrumental characteristics, instead making the assumption that all changes in noise with time can be traced back to a change in the Earth’s radiative environment. Following this comment, we have made efforts to reduce known sources of bias in our results (by lessening the importance of sunlight scattering in our noise results, see Sect. 4 in our common reply) and amended the text throughout to make this important distinction clearer.

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M. Hunt also point out that the discussion of the noise history in clear areas is weak, and provides an alternative explanation for the origin of its yearly cycle. We found his explanation to be much more plausible than ours, see answer to specific comment 6 below.

Finally, M. Hunt suggests that we expand our discussion of the geographic properties of the SAA. See answer to specific comment 5 below.

2 Specific Comments

1. M. Hunt points out that sunlight scattering comes from photoelectrons, which means that sunlight scattering noise is affected by instrument gain. Therefore, the influence of sunlight scattering on noise levels means their change with time can be of instrumental origin instead of being due to environmental changes. Following this comment, we have increased the noise threshold to strongly limit the influence of sunlight scatter on our noise results. See Sect. 4 in our common reply for a discussion of how we chose the new threshold. This is related to specific comment 3 from Reviewer 1.
2. M. Hunt suggests that we explain that we selected the SAA region to avoid including southmost latitudes that are affected by sunlight scattering in DJF. Thanks to the choice of a new noise threshold (see comment 1 above and Sect. 4 in the common reply), it has become possible to include the southern latitudes of the SAA without fear that it will be affected by sunlight scattering. This is related to specific comment 6 from Reviewer 1.
3. M. Hunt points out a mistake in the text : we described the geographic distribution of clouds as “random”, which it is not. This has been corrected.
4. M. Hunt points out that the influence of changes in instrument characteristics

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on noise changes above the SAA cannot be ruled out. He explains the relative sensitivities of the two 532nm channels have varied by as much as 5% over the course of the mission, the same order of magnitude that the noise changes described here. We now mention in the text that the influence of instrumental changes cannot be ruled out as a possibility. We also mention that since our results agree very well with previous works, the noise changes are likely driven by changes in the radiative environment.

5. M. Hunt suggests improvements in the caption of Fig. 3 to decrease the chance of its misunderstanding. We have tried to improve the caption. M. Hunt also suggests that including history plots describing the evolution with time of geographical features of the SAA would improve the paper and provide insights into the westward movement of the SAA. Following this advice, we have included plots that describe how the boundaries and center of the SAA evolve with time (new Fig. 4 and 5). These plots helped quantify that the SAA moves westward by $0.3^\circ/\text{year}$, a result that agrees very well with previous works.
6. M. Hunt points out the yearly cycle modulating the noise in clear areas bears a striking resemblance to the temperature cycle of the photomultiplier tubes part of the 532nm detection chain. We agree that while researching our original submission we did not consider enough changes in instrumental characteristics as possible explanations for our results. We find M. Hunt's explanation for the noise cycle to be more convincing than our original theory of an unexplained process linking noise in clear areas to the Earth's geomagnetic activity. We have adopted this explanation in the revised manuscript. Following this change and the new figures describing how the geographic extent of the SAA changes with time (specific comment 3), the paper is now more tightly focused on the SAA, which we think is a positive change.
7. The Reviewer finds the two panels of Fig. 4 (noise levels in clear areas, now

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Fig. 6) confusing. This echoes comment 5 from Reviewer 1. We agree with both Reviewers that the description was confusing. Following the change in noise threshold, noise fluctuations in clear areas are now very small and the initial detrending brings less value to the analysis. Since it moreover adds confusion to the description, we have chosen to only show the noise fluctuation. The confusing section has been removed.

3 Technical comment

1. The Reviewer points out that the altitude range for noise measurements has changed since the Hostetler et al. 2006 reference used in the paper. We have fixed the error and now use the correct altitude range (65-80km) in Sect. 2, second paragraph.

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 8589, 2013.

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