

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.

Anonymous Referee #1

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General Comments:

The paper by Noel et al. describes results from an analysis of the noise of CALIOP lidar measurements.

My main criticism is that some of the conclusions of the manuscript seem to be not new.

The authors state themselves in the manuscript, that the anti-correlation between noise and solar activity (with a 1 yr lag) and the westwards shift of the SAA have already been observed by Fürst et al. (2009). Due to the anti-correlation with solar activity the prediction of increased noise after 2014 seems quite trivial. If the aim of the study is to

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confirm the old results using a different data set, this should be stated more clearly.

The only new aspect seems to be the impact of the 11 yr solar cycle on the noise over regions outside the SAA, with an underlying seasonal cycle, which is the same for both hemispheres. There is no real explanation given for especially this kind of seasonal cycle given in the paper.

Although the authors show a correlation with variations of the geomagnetic field (with an unexplained 30 day time lag), this may not be the only reason/possibility. With an appropriate time lag any quantity having a seasonal cycle could be put in relation to the measurements. What about, e.g., a simple effect of varying sun-earth distance?

Since the observed variation of the noise over clear regions is quite small, instrumental issues should also be discussed and, if possible, ruled out. Hurt et al. (2009) list several effects (e.g. drifting etalon) by which the instrumental response varies over time – could these impact the time series?

I also would appreciate a short discussion about the impact of the observed variability of noise over clear regions on the CALIOP data products. Is this something which needs to be considered in data processing or when looking at time series of CALIOP aerosol/cloud products?

In summary, I suggest – in addition to consideration of the specific comments given below – that the authors point out more clearly the new aspects of their study and especially discuss the results over clear areas more thoroughly.

Specific Comments:

1. p. 8591, l. 3.:
CALIOP has two 532 nm channels and one 1064 nm channel. Please explain which of the 532 nm channels you use and why.

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2. p. 8592, l. 9:
Please explain what is meant with '333 m'. Is this the vertical or horizontal resolution of the profiles?
3. p. 8592, l. 11:
As the main quantity for the analysis is the number of noisy profiles, how dependent are the results on the choice of the noise threshold of 200 used here?
4. p. 8593, l. 12:
What is the difference between Level 1 v3.01 and 3.02 data? How are the data combined? Can the combination of the two data sets have an impact on the time series? Please explain.
5. p. 8595, l. 19/20 (and Fig. 4):
'The bottom pane of Fig. 4 shows the relative evolution of the deviation shown in the top pane (i.e. divided by the mean), detrended of solar cycle influence by subtracting the SAA equivalent (as in Fig. 2).'

Please explain how exactly the detrending has been done. What is meant with 'SAA equivalent', and how is it determined?

6. Figs. 1 & 3:
Why does the red box in Fig. 1 not cover the whole SAA region as shown by the underlying map? Furthermore, the latitudinal and longitudinal regions used in Fig. 3 do not match the edges of the red box in Fig. 1. This should be harmonised.
7. Fig. 2:
To clarify the anti-correlation to the solar cycle it would be helpful to plot also a proxy for the solar activity (e.g. F10.7) in the figure.

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Technical Corrections:

1. Citations in the text: 'Furst et al.' should be 'Fürst et al.'
2. Fig. 4:
According to the (left) y axis labels both graphs should have the same units (percent) for the noise deviation. However, values are higher in the lower plot. Probably this is related to a different definition/normalisation of the relative data. Please clarify and update the units/labels as required.

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