Atmos. Chem. Phys. Discuss., 13, C10830–C10832, 2014
www.atmos-chem-phys-discuss.net/13/C10830/2014/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Trends in cloud top height from passive observations in the oxygen A-band" *by* L. Lelli et al.

Anonymous Referee #1

Received and published: 10 January 2014

Review of "Trends in cloud top height from passive observations in the oxygen A-band" by L. Lelli, A. A. Kokhanovsky, V. V. Rozanov, M. Vountas, and J. P. Burrows (acpd-13-31409-2013)

General comments:

This is a useful paper with some interesting results, including the relation between El Nino and cloud height and the fact that the impact of El Nino variations on cloud top height has contributed to downward trend in global cloud top height in the past decade. It is also interesting to see that cloud top height has increased over North Africa and Arabia while decreasing over the central Pacific. What is least convincing is the tropical/global trend in cloud top height because I am doubtful that the time

series from the various instruments can be reliably concatenated. At the very least, the differing results of this study compared with others shows that tropical/global cloud top height trends are uncertain.

Specific comments:

1) p. 31410 Lines 23-25: need better explanation of how high cloud absorbing and radiating warms the atmosphere (hint: high clouds are cold).

2) p. 31411 lines 1-6: The sentence structure is awkward.

3) p. 31412: It would be helpful to have some more detail on how cloud fraction and cloud reflectance are determined since there can be trade-offs between the two in Eq. 1. E.g., measured scene reflectance can result from either/both greater cloud fraction and greater cloud reflectance, but they may have different impacts on retrieved cloud top height.

4) p. 31414 lines 5-6: Considering that getting the right correction and harmonization are critical factors for the time series analysis, more detail should be provided on how this is accomplished.

5) p. 31414 lines 15-16: I would have greater confidence in the harmonization of GOME and SCIAMACHY time series if there were more overlap between the two and they agreed well. There is more overlap between SCIAMACHY and GOME-2, but they do not agree well, which does not give me confidence that the authors can reliably detect changes in cloud top height. Joining at June 2008 seems arbitrary, and the authors do not offer any justification for that point.

6) Fig. 7: It seems like there might be too much smoothing and some shorter time scale information is lost.

7) p. 31417 lines 2-5: It's not clear what this sentence means.

8) To what extent does low/mid cloud fraction increase when high cloud fraction de-

creases because low/mid clouds are no longer overlapped by higher clouds? Perhaps there is no real increase in low/mid cloud fraction, but instead the clouds can be seen due to a reduction of high cloud obscuration?

9) Fig. 8: Is this for the same region used in Figs. 6-7?

10) Fig. 8: I can understand how cloud fraction in a particular vertical interval can change and therefore have a correlation with Nino3.4, but how can cloud top height in a particular vertical interval change? Isn't the vertical interval fixed? Or is average height within that interval changing?

11) Fig. 13: Probably what matters for high clouds is not columnar water vapor, which will be dominated by the boundary layer, but upper tropospheric humidity. One reason larger trends may be seen over North Africa and Arabia is that there are few low-level clouds in those regions due to desert conditions. Thus any increase in high-level clouds will be less diluted by the presence of low-level clouds.

12) I don't see any convincing evidence that an indirect aerosol effect is present. This is speculation on the part of the authors.

Technical comments:

1) p. 31411 line 10: "serie" should be "series"

2) p. 31418 line 19: "lift" should be "lifted"

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 31409, 2013.