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

Anonymous Referee #2

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

General comments: The article is well written, and the datasets are interesting to explore optically thick clouds. However, I do not recommend a publication on this analysis for the following reasons:

1) The title is misleading, because the presented observations are only capable to determine cloud top height of a sub-sample of clouds: those which are optically thick (cloud optical depth > 5) which correspond probably to about slightly less than half of all clouds. Especially many high-level clouds are missed, because these are mostly

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semi-transparent. It would have been helpful for the reader to present this fact in the beginning, with a cloud fraction for low-level, mid-level and high-level clouds. The word 'trends' in the title is also misleading, because the authors show that within the uncertainties no linear trends can be found.

- 2) The authors have shown in an earlier paper (Fig. 4, Lelli et al. 2012) that a bias in cloud top height is still optical depth dependent for optical depth larger than 5, especially for ice clouds, when water clouds are situated beneath (which happens quite often according to CALIPSO-CloudSat analyses, especially in the tropics).
- 3) The data used from three different instruments have different foot print sizes, with a quite coarse spatial resolution. Especially the foot print size of GOME (320 km x 40 km) does not seem to be adequate to study low-level clouds, because these may appear at smaller horizontal extent. In this case a decrease in height might be linked to a decrease in horizontal extent of low-level clouds within the foot prints.
- 4) When using different instruments for trend analysis, calibration is also important as already indicated by B. van Diedenhoven in his interactive comment.

Points 1-4 indicate that it will be very difficult to use these datasets for a linear trend analysis (and why should cloud trends be linear?) in cloud height. Indeed, the authors show that within the uncertainties no linear trends can be found. The maps with trends and their significance (Figs 11-13) are difficult to believe, considering the possible optical depth, vertical structure and foot print size dependent biases listed in points 1-3.

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