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Interactive comment on "Tropical tropospheric ozone column retrieval for GOME-2" *by* P. Valks et al.

Anonymous Referee #2

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General comments

This paper introduces the GOME-2 convective cloud differential (CCD) method for re-trieving tropical tropospheric ozone concentrations. CCD monthly mean tropospheric ozone columns have been calculated on a 1.25 latitude by 2.5 longitude grid for the tropics from January 2007 to December 2013, using MetOp-A and MetOpB GOME-2 data. The applied method is discussed in sufficient detail and validation sources (ozone sondes, EMAC model) support the scientific value of the approach. Some months of data are discussed, nonetheless it would be useful to show some kind of time series of tropospheric ozone data (not only the ozone ENSO index) especially highlighting potential differences or added value resulting from 1920 km and 960 km swath widths of GOME-2A and GOME-2B data and further reflecting changes due to instrument sig-

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nal degradation. Several validation plots are presented, but a discussion of more data especially for EMAC would be useful. The paper is well written and fits the scope of AMT. I recommend publication after minor revisions.

Detailed comments

1. Introduction - The discussed method works for the tropics where a zonally invariant stratospheric column can be assumed. Could you please hint on more details (or give a reference to literature) regarding the situation in the extra tropics and your expectancies e.g. due to rapid variation of the tropopause and larger spatial variability. - The authors list literature references for TOC. I recommend adding [A trajectory-based estimate of the tropospheric ozone column using the residual method, M. R. Schoeberl et. al, DOI: 10.1029/2007JD008773]

3.1 GOME-2 total ozone - The citations for GDP 4.7 refer to Loyola, 2011 (and Hao 2014), which discusses GDP 4.4. Please clarify the different algorithm versions and/or give a quick overview of changes for v4.4. to v4.7. or otherwise where to find them.

3.2 GOME-2 tropospheric NO2 column - Where does the stratospheric NO2 profile climatology come from?

3.3 Cloud properties - Fig 2: Please provide a small statement on observed differences in the comparison of ROCINN vs. ISCCP-D2 cloud pressure distribution. The information in Fig 2 is sparse, maybe the authors could merge the January and July plots, thus showing combined plots in only two panels.

4.1 GOME-2 CCD method - The authors indicate that the selection criteria for deep convective clouds is pc $\leq$ 300 hPa. Later ($\sim$monthly number of pixel occurrence 150 - 800) pc $\leq$ 350 hPa is used. Please explain. Further, is there a lower limit in the number of pixels to be used? Could that be systematically handled by a dynamic criteria on the selected longitude (e.g. 70 E - 170 W). - The authors state, that sub-tropical air is sometimes present in the outer latitude bands (15–20 - N or 15–20 S), resulting in a

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small number of deep-convective cloud tops etc. The boundary for the GOME-2/CCD analysis will be limited to lower latitudes. What is the criteria (e.g. number of deep convective clouds) to determine such a situation and which is the updated latitude band.

5 Tropical tropospheric ozone and NO distributions - Fig 5. It would be interesting to see as well GOME-2A data here. Please indicate why this data has not been considered (e.g. signal degradation, horizontal resolution). - page 741: Replace 'plate' with 'panel'

6 Comparisons with ozonesonde measurements - page 743, line 16: Samoa -> American Samoa - page 753, line 29: You mention the sparse nature of monthly GOME-2 TOC measurements. Please quantify in text and/or if possible add e.g. some histogram on number of contributing measurements to the statistics in Fig 7. - The authors state that the validation with ozone sondes is sometimes difficult because of horizontal coverage of sondes vs. satellite instruments. Still I believe that showing plots (not only information in Table 1) for all relevant SHADOZ stations adds value to the validation part of the paper.

7.2 Tropospheric ozone variations - For Fig. 7 the author state that the model has a larger offset for higher tropospheric ozone columns. Please explain the generally high offset for Natal station in the second half of 2007. Here the model doesn't seem to reflect the seasonal variation very well, while for Ascension Island and American Samoa the situation is better. Is this only tied to issues with the emission datasets as suggested? - For Fig. 8 the high EMAC tropospheric ozone values in the area east of India is shortly mentioned. A difference map on a common grid between GOME-2 CCD and EMAC for the discussed month October 2009 would support this. Again, it would be useful to show more data from other months of EMAC data coverage.

Figures - At least Fig 2, 4, 6, 7 need larger labels.

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 727, 2014.