**Atmospheric
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Discussions**

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Interactive comment on "Increased UV radiation due to polar ozone chemical depletion and vortex occurrences at southern sub-polar latitudes in the period (1997–2005)" *by* A. F. Pazmino et al.

A. F. Pazmino et al.

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Dear Reviewer,

Thank you for useful and constructive comments to our manuscript. Here is our answer to your questions and comments:

1) Since in equation 1 zonal mean were calculated to determine the values outside the vortex, longitudinal variations were eliminated. Longitudinal climatological patterns as the "croissant" would not then be reflected in the analysis. Since the "croissant" produces larger ozone values on the Australian side of the vortex than in the South-American side, then the values in equation 1) would produce larger increases in the South-American side than in the Australian side, than those that

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would have resulted of using values outside the vortex without performing zonal mean. The authors should consider this fact.

We agree with your comment. Longitudinal asymmetry in ozone fields are now taken into account. We have thus computed a 1°x1° latitude-longitude ozone climatology of situations outside of the vortex from TOMS and ATOLL model, which is used in the new version of the manuscript. However, the results and conclusions are generally very close to the initial ones: the mean TOC differences are mostly similar with differences on the order of 1-3% while the mean POC differences show somewhat lower changes with differences ranging from 3-7% in absolute value (see new Tables 1a and 1b, respectively). For section 6 "Combined effect of cloud cover and vortex occurrences on UV radiation", the main difference is observed in September for the region 3 (Australia and New Zealand) with higher values of regional average ozone change (27.5% instead of 22.7%). Nevertheless, the main conclusion considering the region 1 (South of America continent) as the area the most affected in a cloudiness decrease scenario still holds (see new Table 2) (not only in the cloudiness decrease scenario) The new ozone climatology is explained in section 2.1. In page 6507, line 12 we have replaced the sentence: "The TOC outside vortex climatology ... A moving average ... values" by "The TOC outside vortex monthly climatology is computed with a resolution of 1°x1°. A climatology varying with latitude and longitude was chosen in order to reflect TOC climatological changes as a function of longitude as noted in Malanca et al. (2005). A monthly average is performed in order to take into account the dependence of TOC with season and to avoid the weak number of situations outside of the vortex for the higher latitudes" The following Malanca et al. reference was added. Malanca, F.E., Canziani, P.O., and Argüello, G.A.: Trends evolution of ozone change between 1980 and 2000 at mid-latitudes over the Southern Hemisphere: Decadal differences in trends, J. Geophys. Res., 110, D05102, doi: 10.1029/2004JD004977, 2005.

Note that we do not use a moving average and polynomial fit for the ozone climatology. The monthly average of TOC at each 1°x1° is computed for the 1997-2005 period.

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2) RAF is a function of Solar Zenith Angle, so, the authors should discuss why the RAF values are the same for the three months, while Solar Zenith Angles decrease from September to November.

You are right. Modeled RAF value varies with SZA. However, the variability in the experimental conditions make the RAF determined in this work statistically undistinguishable from the reference RAF=1.1 and also the SZA dependence remains unobservable. We added the following sentence about this subject (page 6515, line 28): From data of Fig. 5, we calculated the radiation amplification factor (RAF) for each month following its definition d(lnUVI)=-RAF*d(lnTOC) (Madronich et al., 1998). Model results show that the RAF depends on the SZA (Micheletti et al., 2003). However, due to the variability in the experimental conditions (change of the noon SZA within the month, not all points correspond to absolute clear-sky conditions, large differences between the ozone vertical profile inside and outside the vortex, etc.), the determined RAFs are statistically undistinguishable (within 2s) from the theoretical reference value of RAF=1.1 (Madronich et al., 1998) that it is also represented in Fig. 5 (black lines), and also the SZA dependence remains unobservable. Micheletti, M.I., Piacentini, R.D., and Madronich; S.: Sensitivity of biologically active UV radiation to stratospheric ozone changes: effects of action spectrum shape and wavelengths ranges, Photochem. Photobiol., 78(5), 456-461, 2003.

3) Different periods are used at different calculations of the analysis: a) April 1st – Dec 31st, (page 6506 “The classification.....”) b) September, October, November (page 6507, “The study was focussed on.....”) c) July to November (page 6507, “The first step to calculate....&# 8221;) This should be explained.

This is explained in the new version of the manuscript adding the following sentences: Point a) is explained in page 6506, line 2 This period was chosen to evaluate specially the vortex evolution. The vortex is firstly developed in the upper stratosphere in Mars to April. Then since June the vortex is well developed at the different isentropic levels.

It generally breaks up at the end of November, beginning December. Point b) is explained in page 6507, line 8 This period was chosen since it shows the more frequent vortex occurrences over sub-polar regions, with its consequent ozone depletion and UV changes. Point c) is explained in page 6507, line 12 This period was chosen to fit correctly the evolution of UV with the polynomial fit since not enough UV values outside of the vortex are available before July over the $50°$S-$60°$S latitude band.

4) For TOC climatology, a moving average was first computed and then a third-order polynomial was used to fit, while for the UVI only a third-order polynomial. It should be briefly discussed. In this new version, no moving average and polynomial fit is computed for ozone. Instead, the monthly average of TOC at each $1°$x$1°$ is computed for the 1997-2005 period (see answer 1).

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 6501, 2008.