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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Evaluation of ozonesondes, HALOE, SAGE II and III, Odin-OSIRIS and SMR, and ENVISAT-GOMOS, -SCIAMACHY and -MIPAS ozone profiles in the tropics from SAOZ long duration balloon measurements in 2003 and 2004" *by* F. Borchi and J.-P. Pommereau

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Answers to anonymous referee #1

The authors thank the reviewer for his positive comments. All his points have been taken.

1) General comments Although the various retrieval versions are carefully indicated in

the text they are not indicated in the abstract and could in the future, when new improved versions are available, lead to incorrect conclusions on the accuracy of various datasets being drawn by a casual reader.

We share the comment. All retrieval versions are now included.

2) The paper would benefit of the methodology used to correct for horizontal and vertical movements were described in a little more details even if a reference to earlier work is given. This is particularly true since it would not significantly affect the length of this otherwise long paper.

We agree with the idea of a stand alone paper. Most useful details on the method are now given even if repeated from the previous paper.

3) The language in the paper is generally very good but I did note a few errors:

Page 10088 line 4 “for long “should be “for a long time”

Page 10098 line 13 “provides” should be “provided”

Page 10103 line 4 “could” should be “can”

All points taken.

Answers to anonymous referee #2

The authors thank the reviewer for his positive comments and his suggestions which have all been taken and included.

1) Section 2.2: A little more explanation why the two proxies were used for horizontal and vertical transport could be useful here. Especially the vertical motion diagnostic is somewhat questionable. The altitude difference between the 370K and 340K surfaces is a 2-D field, yet you need 3-D information for the ozone data. Is the same 2-D proxy field used at all altitudes? Does that not imply assumption of uniform sinking? How about sheared flow and mixing in this respect?

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The description of the objective and the method for separating atmospheric and instrument contributions has been expanded. The altitude difference between 370 and 340 K surface is indeed a 2D information. It's an indicator of the existence of local convection in the troposphere below the balloon and thus of possible overshooting in the TTL and the lower stratosphere currently not captured in global or even meso-scale models. This has been better explained.

2) Figure 2: It seems in the UTLS region there is a lot less zonal variability of ozone in 2003 than in 2004 and 2001. Do you have any explanation for that?

The difference between 2003 and the two other years is due to the limited duration of 9 days of the flight across the Pacific only compared to the 34 or 39 days of the other flights. Furthermore, the higher altitude of the maximum variability is due to the weight of the strong upward displacement of the ozone profile above hurricane Erika shown in Fig 1. The small variability at 14 km is is little significant since it is mainly due to the limited number of profiles available there, only 3, over the non-convective east Pacific, the western part being covered by high altitude clouds. This is better explained now.

Answers to anonymous referee #3

The authors thank the reviewer for his positive comments and his suggestions, which have been all taken as described below.

1) The numbers listed here fail to define the actual accuracy with which the tangent heights are determined. The GPS position is very accurate but is probably in earth centre coordinates this does not mean that the altitude, the distance from the Earth's surface to the tangent height, is known to that accuracy since some reference geoid needs to be used to define that quantity. Furthermore, the relationship between (P,T, Z, n) from model and that defined by p, T together with tangent altitudes is not described.

Following the reveiwer's comments we have explored in more details the question of altitude accuracy. The specification provided by theGPS manufacturer is a precision on

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altitude measurements of ś 16 m (90%). This includes the precision of the conversion between the center of the geoid and the Earth surface using a Earth Gravitational Model accurate within a few meters over 90% of globe, but +20/-40 m in extreme cases. The second source of error is the density profile used in the ray tracing model for calculating the refracted optical path. The profile used is the standard profile at 15°N. Compared to the ECMWF profiles along the balloon flight (showing a dispersion of ś 6% in density), the 15°N is at lower edge. As a result the average SAOZ profile could be low biased by 24 m at 20 km and 72 m at 15 km. Overall, the accuracy of SAOZ altitude is estimated to +64/-16 m at 20 km and +140/-16 m at 15 km, very consistent with the +30 ś25 m between 17 and 24 km found with the lidar of Reunion island. The above considerations have been included in the text.

2) Comment: Since the altitude of the station is well known, there is no error introduced due to the use of a reference geoid in this case. See above comments

3) What do you expect to the precision to be, ab initio, based on your knowledge of the instrument, the measurement geometry and the inversion method? The precision of ozone concentration is estimated from the precision of column density measurements given by the spectral fitting propagated in the retrieval scheme. The figures provided in Borchi et al. 2005 and repeated now in the text are: 1.5% at 20 km degrading to 5% at 17.5 km, 10% at 15 km and 23% at 10 km. Compared to this, the study based on the variability gives 2 % in the stratosphere, 5-6 % at the tropopause and 7-8 % at 12 km in the upper troposphere. These figures are consistent with the estimation, but in the troposphere where they are better than estimated. The reason identified for this is a systematic error in the spectral analysis due to water vapour bands not well removed. This is also explained now in the text.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 10087, 2006.