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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A UT/LS ozone climatology of the nineteen seventies deduced from the GASP aircraft measurement program" *by* C. Schnadt Poberaj et al.

Anonymous Referee #2

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The paper deals about investigations on a historical UT/LS ozone climatology derived from measurements of the Global Atmospheric Sampling Program (GASP) made from four commercial and one research aircraft during 1975-1979. From historical perspective a very interesting data set with large potential for scientific use. The major topics of the paper are: (i) evaluation of the quality of GASP-ozone data (ii) presentation and investigation of the large scale ozone distribution in UT/LS derived from GASP and compare with corresponding distributions obtained from MOZAIC (iii) comparison of early ozone sonde records from different stations with GASP over period 1975-1979.

Particularly the homogenization and evaluation of GASP ozone data can be of large

scientific interest such that this study is certainly appropriate for ACPD. Unfortunately, the paper in its present form is suffering in several aspects like its length, structure while the results and discussion are not clearly and adequately presented. I would recommend to publish the paper, but first after drastic reduction of length of the paper and after major revisions have been made. (see my comments). The GASP ozone data set is certainly of large scientific interest and therefore I strongly encourage the authors to submit a revised manuscript following the recommended revisions.

General comments:

The length of the paper is far too long (67 pages): a drastic reduction by at least a factor two should be achieved. Removal of all reduncies and all non-relevant text passages (some examples I have given in my specific comments).

The present manuscript should stronger focus on the evaluation of the quality of the GASP-ozone data. Several rather large corrections of the GASP data had been made, however, the authors failed to quantify the uncertainties inherent to these corrections adequately. A thorough uncertainly analysis and assessment on GASP-data quality should be provided. This part of the paper is very essential and build the base for any further use of this comprehensive GASP-ozone data set. However, it needs substantial improvements such that afterwards also a real quantitative use and comparison with other data can be made. This is a pre-requisite for a any further investigations of long term trends of ozone in the UT/LS

The presentation and investigations of the large scale ozone distributions of GASP-UT/LS and comparison with MOZAIC is far too long and too detailed. Much of the observed features seen in GASP-UT/LS have been seen before in MOZAIC or other observations and have been reported and discussed in scientific literature by other investigators. The authors should therefore constraint to report only major observed features and interprete these briefly with appropriate references. Only really new scientific findings should be discussed more but without falling into too many details.

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To validate GASP-ozone data with early ozone soundings is very doubtfull because the quality of early UT/LS-sounding data in itself is already questionable. Particularly, a major source of uncertainty in UT/LS- sonde data is the linear scaling of the sonde profile with relative large total ozone corrections (CF= 0.9-1.3), which are most likely biased by improper functioning of the sonde at altitude region (Z=20-30 km) with the largest amounts of ozone. A better approach would be to validate UT/LS ozone sonde data through comparison with GASP-data and investigate the impact of total ozone correction on the sonde accuracy in the UT/LS region. Therefore, I strongly recommend the authors to remove this topic from the paper and address it exclusively in a separate paper.

Specific comments:

Because the paper first needs substantial revisions, shortening its length, removing redundancies and text passages with non-relevant details, I only will give some specific comments as examples.

Abstract Still too long, too detailed

1 Introduction

Too long, too detailed

2. Data and Methodology

P3456/17: Why no measurements below Z=6 km??

Fig.1: On what scale (latitude, longitude, time) the number of measurements are determined???

Section 2.1.1

Too long and too many non-relevant information. The basics of photometry is not subject of the paper and all the technical details of the instrument can be simply referenced to appropriate literature. For example: on page 3457 lines 12-18, 24-28, and on page

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3458 1-5 can be omitted; further paragraphs (line 6-26) are too detailed , difficult to understand and not really relevant: the reader just interested specification of time resolution and integration time of a measurement. Figure 2 can be omitted.

Remaining part of this section about the quality assurance management during GASP is described very poorly and leaves many un-answered questions on precision and accuracy. Some examples:

– How accurate is the 16% ozone destruction, is this dependent on inlet pressure ??. What type of materials were used for inner walls of inlet tubing, pump, 4-way valve, absorption cell ???.

– How often the flown photometers were re-calibrated in the laboratory against the reference Dasibi and when was the change to the JPL-ozone photometer as reference?. The 9% high bias correction: how accurate?. How large are the differences and their variability between pre-and post flight calibration???

– Are these corrections for wall losses and bias and total random error constant over entire period between 1975 and 1979 ???.

Essential for this paper is the assessment of the the quality of the GASP-ozone data in quantitative terms of precision and accuracy. A thorough and more specific uncertainty analysis and discussion is needed. GASP data set should be tested on its internal consistency by comparison ozone profiles obtained from different GASP-aircraft when matching close in time and space. Ofcourse, matching criteria must be close enough such that atmospheric variability is relatively small. Such comparison could give more quantitative insight in the reproducibility , cq. in-flight precision of the GASP data.

Section 2.1.2

P3459/21-28 and P3460/1-19 contains too many details not-relevant for this paper.

Section 2.2

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Recommendation (see also general comments): Remove part with ozone sondes

Section 2.3

P3463/10-11: MOZAIC started measurements in August 1994

First paragraph too detailed, just constraint on essential information. Referencing Marenco et al., 1998 for MOZAIC programme and Thouret et al., 1998 for O3 measurements is sufficient while flight coverage can be seen in Figure 1 b.

P3463/23-26: Manufacturer and model type of ozone analyzer??. What is the accuracy of MOZAIC-O3 measurement?. Precision and accuracy constant over entire 1994-2001 period ??

Section 2.4

Paragraph 2 and 3 concerning correlation between ozone and pv should be better removed: not convincing that observed correlation is a serious indicator for GASP data quality. P3466/3: Why not use of the potential temperature from aircraft instead of ERA-40??

Chapter 3 GASP Climatology

Section 3.1

Although, detailed presentation of zonal mean vertical ozone profiles GASP, a comparison with corresponding MOZAIC profiles as well as scientific meaning of this section is missing.

Section 3.2 and 3.3

Methodology and presentation of the GASP data and its comparison with MOZAIC data are okay, but the length is much too long and too detailed compared to the rather limited number of new scientific findings. See also my general comments.

Chapter 4

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Recommendation to remove this ozone sonde chapter (see also general comments). It is very doubtfull to validate GASP ozone data with sonde data. This chapter makes the paper unnecessarily long. A better approach would be (i) first validate and evaluate GASP data to be done in the present paper and then (ii) in a separate paper validate ozone sonde data with GASP and investigate the influence of the total ozone correction factor on the quality (accuracy) of the sonde profile.

Chapter 5 This chapter is far too long. Give a brief summary of the major findings and conlusions

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Interactive comment on Atmos. Chem. Phys. Discuss., 7, 3451, 2007.