Atmos. Chem. Phys. Discuss., 4, S2892–S2895, 2004
www.atmos-chem-phys.org/acpd/4/S2892/
European Geosciences Union

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Pole-to-pole validation of GOME WFDOAS total ozone with groundbased data" *by* M. Weber et al.

Anonymous Referee #2

Received and published: 9 December 2004

The paper reports a systematic multi-year comparison of total ozone measured by ground-based Dobson and Brewer instruments with total ozone retrieved using the new Weighting Function Differential Optical Absorption Spectrometry algorithm from near global GOME satellite measurements. Such multi-year intercomparisons of operational data are an essential part of the world-wide effort to monitor the global ozone layer with high accuracy. "Validation" like this is necessary for referencing the various different instruments to a common standard. The authors demonstrate that the precision reached by GOME and their WFDOAS algorithm is high enough to see systematic annual variations of the ground-based data. I rate this a good paper, but would recommend several revisions which would improve the paper even more.

1. Overall recommendations:

My main concern is about the somewhat lax treatment of temperature dependence of the effective ozone absorption for the ground-based data. This leads to a small seasonal bias. According to recent work by Kerr (2002), which is not mentioned in the paper, this bias varies seasonally by less than 0.2% for Brewer data. But it may be up to 2 or 3% for Dobson data processed in the standard way, assuming a fixed temperature (and a fixed profile!). Compared to GOME WFDOAS (which accounts for the temperature dependence and to some degree for changing ozone profile) some Dobson stations seem to show a seasonal bias (Dobson low in winter), others do not. This may mean that some stations account for varying temperature (and/or changing profile shape) in their analysis. The authors should make more effort to separate Dobson and Brewer data, and to separate stations with different annual bias shape. They should contact the stations and report, what was done at the stations. By the way, Resolute is not a Dobson, but a Brewer station! I would strongly recommend that the authors clarify these issues, and treat the seasonally varying bias more rigorously, depending on the instrument and practice used at each station. What is clear is that the GOME WF-DOAS data are of high enough quality to point out such small biases in the ground-based data!

It may be a good idea to ask Jim Kerr about comments on the paper, if he is not a reviewer already!

2. Detailed recommendations:

I would suggest to change the title by omitting "Pole-to-pole" or replacing it with "Near-global". Retrieval errors increase substantially with sun-angle (c.f. Figs. 8 or 9) and the highest latitude stations used in the comparison are at 75^{o}N and 78^{o}S, quite far from

ACPD

4, S2892–S2895, 2004

the poles at 90^{o}N and 90^{o}S.

pg 6915, line 14: The neglection of ozone absorption temperature dependence (and profile shape) in the standard Dobson and Brewer processing should be mentioned here.

pg 6915, lines 19 to 26: Kerr (2002) should be mentioned.

pg 6917, lines 26, 27: The revised Brewer temperature dependence (-0.05%/10K) from Kerr (2002) should be mentioned.

pg 6918, Fig. 4: I am pretty certain that Resolute is a Brewer station, not a Dobson station. Please check and correct.

pg 6918, lines 26, 27: To me, there is a seasonal signature at every station, except maybe Singapore!

pg 6919, lines 1 to 3: I dont see any significant change in the Boulder data between 1996 and 1997. I strongly suggest to omit the entire 2 sentences.

pg 6919, line 21. A completely new train of thought is started here. I would recommend to begin a new sub-section or a new section.

pg 6920, lines 12 to 21. I am confused: GOME-Dobson should be higher in winter and lower in summer (Figs. 2 to 5). But in Fig. 6 this is not the case. Why has it disappeared? Which stations make it disappear? Why? Please explain.

Fig. 8 and discussion: It seems to me that WFDOAS is giving better agreement with the ground-stations than GDP V3 everywhere, except near the poles. There WFDOAS compares no better or even worse than GDP V3. The text should reflect this.

pg 6921 last paragraph, pg 6922 1st paragraph: This paragraph is not clear to me. What exactly did the Fairbanks campaign show? That the GOME WFDOAS - Dobson/Brewer differences are due to ozone absorption temperature dependance, profile shape, straylight not accounted for in the Dobson processing? How big is the Dob-

ACPD

4, S2892–S2895, 2004

son straylight effect? How big is the profile shape effect? The Resolute instrument is a Brewer not a Dobson (http://www.woudc.org/data/MetaQuery/metaquery_e.cfm)! Since the Brewer has smaller or no dependence on effective ozone absorption temperature, and is supposedly less affected by straylight, the 2 to 4% Bias could come from GOME WFDOAS. Was there a double monochromator Brewer in Fairbanks? It should be insensitive to (instrumental) straylight. Please think the entire issue through again and rephrase the entire paragraph (and the conclusions on page 6924, around line 10).

pg 6923, section 6: Why does Lauder not show a seasonal signature whereas Hohenpeissenberg, Comodoro Rivadavia and Syowa do? Please contact the stations and find out whether they account for the (seasonal) temperature dependent change of effective ozone absorption (and/or profile shape).

pg 6923, lines 19/20: same as above.

3. References

Kerr, J., New methodology for deriving total ozone and other atmospheric variables from Brewer spectrophotometer direct sun spectra, JGR 107, D23, doi:10.1029/2001JD001227, 2002.

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 6909, 2004.