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Atmospheric Chemistry and Physics Discussions

Interactive comment on "GOMOS ozone profile validation using ground-based and balloon sonde measurements" *by* J. A. E. van Gijsel et al.

Anonymous Referee #1

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General comments: The paper discusses about the GOMOS ozone profile validation using ground-based and balloon sonde measurements. The paper is a continuation of the work by Meijer et al. in JGR (2004). The paper is well written but it has some quite serious deficiencies. The following specific questions should be addressed before the paper can be accepted for publication.

Specific comments:

page 8519-21, Sec. 1.2: I find the list of earlier validation studies missing some essential papers:

Large satellite validation including GOMOS: Dupuy (2009) mentioned elsewhere in the paper

Envisat instrument inter-comparison: Bracher et al, Adv. Space Res. 36, 855, 2005

Comparison to balloon measurements: J-B. Renard, J. Geophys. Res.„113, A02302, 2008

Comparison to Fortuin-Kelder: Kyrölä, E., et al , J. Geophys. Res., 111, D24306, 2006

Find GOMOS validation references, for example, by http://adsabs.harvard.edu/abstract_service.html.

pages 8521-22: Sec. 2.1. Add a short description how GOMOS measurement accuracy (individual profiles) depends on star temperature and visual magnitude.

pages 8521-23, Sec 2.1-2.1.1: I am (very) surprised that there is no reference to the official ESA document about the GOMOS data quality, i.e. GOMOS disclaimer (http://envisat.esa.int/handbooks/availability/disclaimers/GOM_NL_2p_Disclaimers.pdf). I would like to think that this document is a starting point for any validation work on GOMOS! Including a co-author from the GOMOS team would also have brought some hands on knowledge on GOMOS instrument and data to the present validation work.

page 8522, line 4: Are you removing individual measurements or the whole profile when you apply 20% filter? Please, clarify.

page 8523, lines 1-5: Below 1 hPa GOMOS uses ECMWF, above 1 hPa GOMOS uses MSIS90. Please, correct the text.

page 8523, lines 6-13: The aerosol coefficients are parameters determined from data. They are also function of altitude. Please, modify the text.

p.8523, lines 9-12: Notice that second order polynomial allows a more realistic description of the aerosol effective cross section than 1/lambda law.

page 8523, lines 13-10: The large ozone profile differences (100%) coming from the changing the cross sections in Liu et al (2007) are probably peculiarity of the used nadir measurements and applied retrieval methods. In the recent GOMOS work

(see a recent work by Kyrölä presented in the WMO ACSO workshop http://igaco-o3.fmi.fi/ACSO/otm_2010.html) the differences between various cross sections lead to about 1% profile differences. Also, it is difficult to say definitely that one specific cross section is the best i.e. nearest the one used by physical processes in the atmosphere. please, comment these.

page 8524, Sec. 2.2: Could you discuss briefly how well are the validating instruments used (lidar, sonde and microwave) agreeing with each other?

page 8524, 2.2.1: Lidar data: please, discuss briefly: ozone cross sections used, typical precision/bias and vertical resolution/sampling. Mention also how lidars are validated especially above the ozone sonde range.

page 8525, lines 3-4: Why do you allow more uncertainty for lidar data than to GOMOS data?

page 8525, 2.2.2: Sonde data. please, discuss briefly: typical precision/bias and vertical resolution/sampling. Are we sure that sonde data provides the final truth about ozone profiles below 30 km?

page 8525, lines 23-26: When you average sonde data, are you using the GOMOS averaging kernel?

page 8526, 2.2.3: Microwave data. please, discuss briefly: typical precision/bias and vertical resolution/sampling. How are these measurements validated above sonde altitudes

page 8526, lines 3-4: Why do you allow more uncertainty for microwave data than to GOMOS data?

page 8527, lines 1-2: please, clarify: "... and the daylight condition have to be the same,..." Do you mean local hours must be at most TBD hours different?

page 8528, Sec. 3.1: Fig. 1. An important figure but differences are difficult to see and

the validating sets are not identical Why did you not compare the two versions directly against each other? This kind of comparison would show more clearly the differences.

pages 8528-9, Sec. 3.1: Figs. 1 and 2. The mesospheric differences may result from local hour differences between microwave instrument and GOMOS (see comment page 8527, line 1-2 above). Can you comment?

page 8529, lines 14-15: You are removing profiles exceeding 10+13 mols/cm3. Do you mean that the whole profile is ignored or only that portion exceeding the threshold? Removing big profiles creates easily bias in averages. How do you avoid this trap? Does not the error filter 20% remove already these measurements?

page 8530, Sec, 3.2.1: There is no comparison of stray light profiles?

page 8530, lines 19-20: The important spectral region for the ozone retrieval depends on altitude. At high altitudes, the retrieval is based on UV wavelengths and at low altitudes on visible wavelengths. Therefore, the accuracy of the ozone retrieval depends not only on the star magnitude but also on the shape of the stellar spectrum i.e. star effective temperature. Looking at available stellar spectra we can theoretically conclude that GOMOS faces difficulties when it is using cool and weak stars at high altitudes. And real measurements agree with theory. This aspect has been elaborated in the aforementioned JGR-paper by Kyrölä.

The comparisons in the present paper show distinctions using temperature and magnitude separately. The trouble causing stars (cool and weak) are a subset of the cool stars set but their contribution can be masked by cool and strong stars. As explained in the paper by Kyrölä the separation magnitude is about 1.9 and temperature 7000K. If this "feature" is not understood, it is easy to contaminate unnecessarily comparisons with these troublemaker stars (m>1.9 and T<7000K).

Can you comment these aspects?

All figures except 3: Please provide comments on the following questions: 1) How does

the natural variation affect the results and your conclusions? 2) Do you have a view to the large discrepancies in the mesosphere?

Technical corrections:

page 8529, line6: ...the with...

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 8515, 2010.