Atmos. Chem. Phys. Discuss., 14, C964–C966, 2014
www.atmos-chem-phys-discuss.net/14/C964/2014/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Daily ozone cycle in the stratosphere: global, regional and seasonal behaviour modelled with the Whole Atmosphere Community Climate Model" *by* A. Schanz et al.

Anonymous Referee #2

Received and published: 1 April 2014

Review

Daily Ozone Cycle in the Stratosphere: Global, Regional and Seasonal Behaviour Modelled with the Whole Atmosphere Community Climate Model By A. Schanz, K. Hocke, and N. Kämpfer

General comments

This paper provides a comprehensive account of diurnal variation of ozone at 5hPa using the WACCM model. The paper is well written, very interesting and suitable for publication in the ACP. I can recommend paper for publication after I have answers

to questions concerning the method used (questions A-D below). Also discussion in Conclusions should be improved before publication

Specific comments

p. 5562, line 26: "...preserves the biosphere from...". Perhaps better to say: ...protects biosphere from...

p. 5563, line 12,...mitigation...". Probably not the correct word for this purpose?

p. 5563, lines 14-15: More recent references about observed ozone recovery from the SI2N ACP special issue.

p. 5564, line 23: Satellite orbits are not necessarily drifted away. The local equator crossing time is fixed for heliosynchronous orbits.

p. 5565, line 13: "...almost all effects...". Please, specify omitted effects.

p. 5567, lines 4 and 11: Is the time step 15 min and the output frequency one hour? Is the one hour output enough for sunrise/sunset periods?

p. 5567, Eq (3) and Eq. 84): Characterising the diurnal variation by the peak-to-valley difference is a considerable simplifying assumption. Your results seem to justify this approach, probably connected to your very smoothly varying results (see question D below). Often seeing the real variation would be a more useful result but, of course, this would require more space for results. Comments?

p. 5568, Eq. (5): in the zonal mean of X you should have latitude, not longitude as a variable.

p. 5570, lines 17- and Fig.1: The authors show in Fig.1 (and other figures following) how ozone diurnal variation can be explained by different chemical cycles. In my mind this parts necessitates more calculational details such as:

A) From WACCM you get the 4-D distribution of the gases simulated. How do you infer

the diurnal variation of a gas? Do you take a snapshot of the global simulation and use different longitudes to provide the local time variation? Or do you travel with the rotating earth and collect different local hours?

B) How do you take into account possible latitudinal variation in gas distributions?

C) The density of a given gas at a point is affected by direct transport and chemical reactions. Contributing chemical species are also subject of transport. Please explain how you separate transport and chemical effects. Also explain the method by which you separate the different chemical pathways shown e.g. in Fig.1.

D) All the curves displayed show very smooth behaviour. In my own figures I see more details. Have you done some kind of smoothing? Or is the smoothing coming from the basic method used (question A above)?

Fig. 1 and others: When you specify the latitude, please provide the limits of the latitude belt.

Conclusions: Please add discussion about dynamic effects. I am also missing discussion about what happens at other altitudes. There is a need to put results in comparison with the results in Sakazaki et al. (2013) and in Huang et al. (2010). This last reference is not mentioned at all in the references of the present article. The details are:

\bibitem[{{Huang} et∼al.(2008){Huang}, {Mayr}, {Russell}, {Mlynczak}, and {Reber}}]{HuangEtAl08}{Huang}, F.∼T., {Mayr}, H.∼G., {Russell}, J.∼M., {Mlynczak}, M.∼G., and{Reber}, C.∼A.: {Ozone diurnal variations and mean profiles in the mesosphere, lower thermosphere, and stratosphere, based on measurements from SABER on TIMED}, Journal of Geophysical Research (Space Physics), 113, 4307–+, \doi{10.1029/2007JA012739}, 2008.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 5561, 2014.