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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 #1

Received and published: 11 April 2014

1 General comments

The manuscript addresses diurnal effects on ozone in the middle stratosphere which should not be neglected as very often the case. To be suitable for publication, the conciseness of the text has to be improved. There are a lot of details including some equations which are not important for the subject while other information is missing.

The paper would gain if also other altitude regions than 5 hPa in the stratosphere are analysed like e.g. 10 hPa with the maximum in ozone mixing ratio, or 3 hPa where the Cl catalytic cycle is most effective in longer time scale. It would be also important to

include some comparison with observations, to mention observations only in the introduction is not sufficient, especially not for a group with experience in remote sensing.

2 Specific comments

Page 5564: Connor et al. present the diurnal variation including sunrise and sunset features, not only the night/day ratio.

Page 5566: line 5: Which coupler (reference)? Alternatively skip sentence because this is not relevant for the stratosphere. At the beginning of section 2 it should be already mentioned that chemistry, radiation and dynamics are fully coupled (as stated on page 5573 which is too late). How many years are simulated in the timeslice (or perpetual 2000)?

Page 5567, top: What is the output interval? A 15 min timestep is also rather long for the chemistry at sunrise, please expand text slightly. Eq. 1 is not relevant to the subject.

Page 5569: Give reference for photochemical data (JPL?).

Page 5569 and 5570: The catalytic cycles and changes in odd oxygen are not relevant for diurnal variations at 5 hPa, this matters only higher up. Remove or add at least a sentence if no higher levels are included. Eq. 9 ignores the catalytic cycles and their rate limiting steps. The radicals and the photolysis of O_3 and NO_2 cause a diurnal variation of the partitioning between O and O_3. Please improve text here and also in section 4. Don't use 'depletion' or 'loss' if only temporary conversion to O-atoms is meant. Correct also the last paragraph on page 5563 and the second paragraph of page 5571 concerning this.

Page 5572: I don't see the reaction $NO+HO_2 \rightarrow NO_2+OH$ which is also important in the stratosphere, especially below 10 hPa.

Page 5574 and 5575: The given numbers of zenith angles are for a flat atmosphere. Please give also some information on the corrections for the spherical atmosphere in the model that should be present.

Page 5577: 5 hpa is more the middle stratosphere than the upper stratosphere.

Page 5581: Include some observations with Fig. 14, for example the nitrogen species seen by MIPAS on ENVISAT at 10 and 22 h local time.

Page 5586: Usually the paper by Bates and Nicolet in JGR 55 is cited.

Tides are mentioned several times but the effects are not quantified. Would that be possible for example by using a correlation of O_3 with N_2O?

3 Technical corrections

Page 5566, line 14: CFCs or what?

Page 5567, line 22: 'place' or 'time'?

Page 5568, line 7: is 'regional' 'longitudinal'? Line 10: definitions messed up.

Page 5571, line 24: 'than' missing.

A consistent notation for photolysis reactions should be used. Please correct R9 and R14.

Page 5577, line 19: a word or a ':' is missing. Also at other equations.

Page 5582, line 5: Typo. Line 23: At point D in the figure are *westerlies*.

Table 1: Headline and numbers do not correspond. Inverse?

Figure 3: Wrong unit at y-axis.

In Figure 5 the polar circles are at a wrong position (should be at the tangent point for solar rays), please correct this or remove the figure.

Please give a reference arrow in Figure 7, for example for 10 m/s.

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