Revision of ACPD, Atmos. Chem. Phys. Discuss., 14, 5561-5609, 2014

Dear Dr. Jöckel, Dear Referees,

we revised the manuscript with respect to the referee comments and own ideas. The following list will give you a point by point overview on the changes we did to the manuscript.

5562/26 ***Replacement:***
We improved the text to 'protects the biosphere from'.

5563/12 ***Replacement:***
'mitigation' was replaced by 'depletion'.

5563/14-15 Update of references:
We included the studies of Kyrölä et al.(2013), Gebhardt et al.(2014) and Jonsson et al.(2009) which show trends in profiles from satellites observations.

5563/24 ***Replacement:***
Replacement of 'loss' by 'decrease'.

5564/9 Changed text:
'Connor et al.(1994) presented diurnal variation in stratospheric and mesospheric ozone from 9 months of observations of a ground-based microwave radiometer at Oroville, California.'

5564/15 Changed text:
Satellite-based observations from the Superconducting Submillimeter-Wave Limb-Emission Sounder (SMILES) (Kikuchi et al., 2013), Sounding of the Atmosphere using Broadband Emission Radiometry (SABER) (Russell et al., 1999) and Microwave Limb Sounder (MLS) (Barth et al., 1983) showed the existence of a~daily ozone cycle in the stratosphere in tropics and mid-latitudes (Huang et al., 2008; Sakazaki et al., 2013).'

5564/22 Correction:
We softened the statement to 'potentially drift away'.

5565/13 Changed text:
We changed the sentence to: 'This model includes the physical and chemical processes which are relevant for the daily ozone cycle (e.g. detailed photochemistry, transport, vertical mixing, parametrized gravity wave fluxes)'

Sect. 2/2.1 General revision:
We reordered sentences and skipped information which we consider to be unimportant. In addition we improved the description of the model and the output according to the comments of the referees. Some of the changes or specified.

5566/4 Removed text:
Skipped sentence about coupler

5566/5 ***Added sentence:***

'The model scenario fully couples chemistry, radiation and dynamics.'

5566/14 Correction:
'CFSs' is replaced by 'CFCs'.

5566/22 Changed text:
[…] released in February 2012. 'The F 2000 WACCM scenario was utilised to simulate one year starting from 1 January.' The computation capacity […]

5567/4 Changed text:
'Although it is desirable to have even shorter time steps for photochemistry during sunrise, the used computer power limits the resolution to 15 min.'

5567/11 Changed text:
improved statement by 'with an output interval of one hour'.

Eq.(1) Removed.
Eq. (1) is removed and its related text.

5567/22 Correction:
'given location'

5568/7 Correction:
'longitudinal'

Eq.(5) Correction:
In Eq.(5) phi is replaced by lambda.

5569/5 Added reference:
Reference to photochemical data of JPL was added.

5570/1 Changed text:
'The reactions involving NO, NO2, H, OH, HO2, Cl and Br are parts of catalytic ozone depletion cycles which are limited by the rates of intermediate steps (Johnson and Podolske, 1978).'

5570/4 Correction:
The '.' after Eq.(9) is removed.

5571/7 Changed text:
We changed […] 10 times than the dominant NO cycle […]' to '[…] 10 times less compared to the NO cycle [...]'

5571/11 Replacement:
Replacement of 'depletion' by 'decrease'.

5571/11 Replacement:

We replaced 'is reduced' by ' decreases'.

5571/13 Replacement:
We replaced 'is reduced' by ' decreases'.

5571/21 Replacement:
Replacement of 'depletion' by 'decrease'.

5571/24 Correction:
'than' inserted.

5572/5 Added reference:
'Satellite-based observations from SMILES (Kikuchi et al., 2013), SABER and MLS showed a morning minimum and a late afternoon maximum in the daily ozone cycle in the tropics and subtropics (Huang et al.,2008; Sakazaki et al., 2013)'

5572/18 Replacement:
We replaced 'reduces' by ' decreases'.

5572/18 Replacement:
We replaced 'rebuild' by ' rebuilt'.

5572/18 Replacement:
We replaced 'reduces' by ' decreases'.

5572/18 Removed words:
We removed 'studies with'.

R9 Replacement:
We replaced 'gamma' by 'hv'.

R14 Replacement:
We replaced 'gamma' by 'hv'.

5573/8 Removed word:
We removed 'a'.

5573/17 Replacement:
We replaced 'the depletion rate' by 'ozone decrease by'.

5574/9 Replacement:
Replacement of 'depletion' by 'decrease'.

5574/9 Replacement:
Replacement of 'time' by 'period' and 'a large value of' by 'enhanced'.

5574/5575 Bullet points:
We added a ':' at the end of the bullets.

5575/3+13 Correction:
We replaced '23.5° lat' by '23.4° lat'.

5575/20 Replacement:
We replaced 'can decrease' by 'decreases' and 'phase' by 'period'.

5577/15 Replacement:
We replaced 'In the upper stratosphere' by 'In the stratosphere at 5 hPa'.

5577/19 Correction:
We added 'by' before Eq.(10).

5578/16 Replacement:
We replaced 'reduced' by 'damped'.

5578/18 Replacement:
We replaced 'reduction of' by 'decrease in'.

5579/18 Correction:
'1 January at 00:00 LT' is replaced by '1 January at 00:00 UT'

5581/23 Added references:
We added two references for the observations of NO and NO2 by MIPA which show similar partitioning as WACCM.

5582/5 Correction:
The double 'the' was removed.

5582/23 Replacement:
We replaced 'a strong easterly winds' by 'strong westerly winds'.

5584/13 Added subordinate clause:
We added 'and from satellite-based observation of SMILES (Sakazaki et al.,2013) and TIMED/SABER (Huang et al,2008).' .

5584/7 Changed text:
We changed the text 'WACCM as well as the' to 'WACCM and the'.

5585/12 Added paragraph:
We added a paragraph which addresses different altitudes in the stratosphere than the 5 hPa pressure level:
'Our results may also help to understand the daily ozone cycle at different altitudes. For instance, in

the upper stratosphere we assume a~growing influence on ozone photochemistry from the HOx and Clx cycles. From observations it is known, that the behaviour of the daily ozone cycle is different at other altitudes (Haefele et al.,20008; Studer et al.,2013). A comprehensive understanding can be can be achieved with further analysis of chemistry-climate simulation data.'

5586/14 Changed reference:
Reference of Bates and Nicolet in JGR 55 is changed.

5578/12 Changed text:
We changed the text to '[...] agreement to observations (e.g. Huang et al, 2010; Sakazaki et al.,2012). […]'.

5578/3 Correction:
'Thus diurnal temperature variations can affect the strength of the daily ozone cycle.'

Table 1 Correction:
The headers have been inverted.

Fig. 1 Changed caption*:*
In Fig. 1 the caption was improved by 'Zonal mean ozone conversion rates [...]' .

Fig.3 Correction:
The units are corrected from 'ppm/h' to 'ppmv/h'.

Fig. 5 Correction:
Position of the polar circles are corrected.

Fig. 7a-d Added wind reference:
We added a reference arrow of 100 m/s in all four figures. In addition we improved the caption to'[…] overlaid and a reference for wind speed is given near the x-axis. […]'. In addition anchors of the arrows got the double distance.

Kind regards
Ansgar Schanz