Authors response to Anonymous Referee #1 comments

1. *In Section 3.2 and Fig. 4, the modelled deposition velocities are compared with the data from Helmig et al. It is not clear how they are matched in space and time. Please provide some details. What was the temporal resolution of the model output for vd that was used in the comparison with the data? Following on from the above point, if an appropriate temporal resolution (e.g. hourly) model output for vd is available, perhaps it will also be useful to plot vd vs. wind speed from the model and compare with the corresponding data plot in Helmig et al. (their Fig. 5, solid lines).*

Response: The comparison between cruise and model observations is done on a daily average for the grid box and model data from grid boxes selected based on the latitude and longitude coordinates of the ship during that 24 hr period. Due to this temporal resolution the wind speed comparison would not be appropriate.

"*The comparisons between observations and model were made using daily average values with model output selected from grid boxes the ship track passed through in that 24 hour period.***"**

2. *Table 1. 25th and 75th percentiles are given. It is not clear as to over what kind of sample size/properties (e.g. based on hourly or monthly modelled values?) these statistics are calculated?*

Response: The table description has been updated to give more information about how these statistics were calculated.

"...*The average deposition velocities, 25th and 75th percentiles were calculated from monthly average model values for grid boxes containing 100% of the land type specified unless otherwise stated.***"**

3. *Page 4, last para: I think another point of difference between the present model and that used by Luhar et al. (2018) is that the former includes halogen chemistry. Perhaps this should be mentioned.*

Response: The authors agree with the referee's comment and included the further difference between this work and that of Luhar et al. (2018) by drawing attention to the difference in chemistry schemes, specifically that GEOS-Chem includes halogen chemistry.

"*One further difference between this work and that of Luhar et al. (2018) is in the global chemistry transport model and its chemistry scheme, GEOS-Chem includes halogen chemistry which has a notable effect on tropospheric ozone (Sherwen et al., 2016b)***"**

4. *Abstract, line 13: 112 Tg yr-1. In Table 1, it is given as 122 Tg yr-1.*

Response: This was a typo and the value in the abstract has been updated. This sentence now reads "*The calculated annual deposition flux of ozone to the ocean is reduced from 222 Tg yr−1 to 122 Tg yr−1 ...*"

5. *Page 2, line 19: Generally, in addition to chemical or biological destruction, rc can also include physical loss at the surface.*

Response: The sentence has been updated as the referee suggests to correctly include the possibility of physical loss as a contributing factor to rc. The sentence now reads **"***...and the physical, chemical or biological loss of the molecule at the surface*…**"**

6. *Page 3, line 13: 'second kind order' to 'second kind with order'.*

Response: Sentence updated as per reviewers comment to now read **"***... modified Bessel functions of the second kind with order zero and one respectively*."

7. *Page 3, line 27: '3-D chemical' to '3-D global chemical'.*

Response: Sentence updated as per reviewers comments to now correctly read "... *the 3-D global chemical transport model GEOS-Chem Classic…***"**

8. *Eq. 3: The functions sinh and cosh are usually not italicised.*

Response: As per the reviewers comment the formula has been updated so that the sinh and cosh functions are no longer italicised.

$$r_c = \frac{1}{\alpha\sqrt{aD}}\left[\frac{\Psi K_1(\xi_\delta)\sinh(\lambda) + K_0(\xi_\delta)\cosh(\lambda)}{\Psi K_1(\xi_\delta)\cosh(\lambda) + K_0(\xi_\delta)\sinh(\lambda)}\right]$$

9. *Page 4, line 10: Give the unit of SST (K or deg. C) used in the parameterization equations.*

Response: Specified units of kelvin for T, with sentence now reading **"**...*sea surface temperature (K), T…***"**

10. *Page 5, line 25: I think 'table 1' should be 'table 2'.*

Response: Updated reference to correctly point to table 1

11. *Page 5, line 25 and elsewhere: Luhar et al.'s global deposition value is presented. It would be useful to also present the uncertainty they calculated, i.e. 722 ± 87.3 Tg yr-1*

Response: The uncertainty in the value of total global deposition of ozone from Luhar et al. (2018) has now been included where this figure is quoted.

12. *Page 6, line 5: 'it' to 'in'.*

Response: Corrected typo by changing 'it' to 'in' so that sentence now reads **"***These cruises were made in waters of significantly different...***"**

13. *Page 6, line 17: Put spaces around 'and' and no italics.*

Response: Corrected typo, removing 'and' from math mode such that it is now correctly spaced and no longer italicised. Sentence now reads "...,k,D and α."

14. *Page 7, lines 18-19: You could also highlight that the largest increases are in the extra tropics and they are more pronounced in the Southern Hemisphere.*

Response: Based on the referee's comment, the wording of this sentence has been changed to specifically highlight for the reader that the Southern Hemisphere extra tropics see the largest increase in surface ozone concentration. This sentence now reads

"*...most notably the extra-tropics with the Southern Hemisphere extra-tropics being the area of greatest increase. The increase in surface ozone concentration 20 becomes negligible over land.***"**

15. *Table 2: What year(s) do these values correspond to?*

Response: The table caption has been updated to specify that the values in the table are calculated from a model run of the year 2014. The caption now reads

"*Area-weighted annual average deposition velocity and deposition flux for 2014*…**"**

16. *Table 3. What year(s) do these values correspond to?*

Response: The table caption has been updated to specify that the values in the table are calculated from a model run of the year 2014. The caption now reads

"*Summary of change to atmospheric oxidative capacity for GEOS-Chem using default (constant) scheme for calculating rc and the new scheme (variable) for 2014***"**

17. *Figure 3. Please put year (2014?) in the caption. The same for Figs. 7–9.*

Response: The captions of Figures 3,7,8 and 9 have been updated to state that they are showing model data from 2014.