Atmos. Chem. Phys. Discuss., 15, C6381–C6385, 2015
www.atmos-chem-phys-discuss.net/15/C6381/2015/


Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Iodine's impact on tropospheric oxidants: a global model study in GEOS-Chem" *by* T. Sherwen et al.

**R. Sander (Referee)**

rolf.sander@mpic.de

Received and published: 31 August 2015

In a global model study with GEOS-Chem, Sherwen et al. investigate iodine's impact on tropospheric oxidants. The study is very interesting and I recommend publication in ACP after considering several changes as described below.

- Section 5.2 provides a very interesting analysis of the ozone budget. Given the title of the manuscript, it is probably the most important section of all. Unfortunately, only two model runs are compared here. Additional model runs are not mentioned until section 6. I'd like to make the following suggestions:
  - Present all model runs (including the sensitivity studies) in section 2, the



Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

model description section.

- For clarity, it may be helpful to define and use concise names instead of the somewhat lengthy phrases currently used for the sensitivity runs, e.g.:
  "no hal" → "NOHAL"
  "standard GEOS-Chem (v9-2)" → "BROMINE"
  "just iodine" → "IODINE"
  "iodine simulation" → "BR+I" or "FULLHAL"
- Add all simulations to Table A1, then move the table from the appendix into the main part.
- Add the results of NOHAL and IODINE to Table 7 and analyze their ozone budgets also in section 5.2.

- Abstract and elsewhere: "(350 $<$ hPa $<$ 900)"
  This is incorrect. You probably wanted to write "(350 hPa $< p <$ 900 hPa)"
- The term $O_X$ is used in the abstract already but not defined until section 5.2. Please define all acronyms when they are first used. Other expressions that must be defined are: $IO_X$, $CH_2IX$, PAN, PMN, PPN, and MPN.
- I think the introduction is much too long. For example, it contains repititions like

  > "The photolysis of $O_3$ produces an electronically excited oxygen atom (O(1D)), which can react with a water molecule to produce two OH radicals."

  and

  > "$O_3$ is chemically lost in the troposphere predominantly through its photolysis in the presence of water to produce OH. "

  I suggest to shorten the introduction significantly and simply refer to the review by Saiz-Lopez et al. (2012) in Chem. Rev.



ACPD
15, C6381–C6385, 2015

- It is difficult to judge the model output without knowing the model input, i.e. the distribution of the emission fields. The text only states that inorganic iodine emissions are calculated using equations from Carpenter et al. (2013). In accordance with the ACP data policy (http://www.atmospheric-chemistry-and-physics.net/about/data_policy.html), I suggest to provide the emission fields as a supplement to this article.
- Page 20973, line 22: "... approximately evenly sources..."
  Something seems wrong with this sentence.
- Page 20974, line 13: "lowest most model level"
  Change to "lowermost".
- Section 5.2: Why are the numbers in the text different from the numbers in Tab. 7? The values are 748 vs 750 for iodine and 178 vs 184 for bromine.
- Page 20977: The calculation of the diurnal change is explained in the text as well as in the caption of Fig. 14. I don't think it is necessary to duplicate this.
- It is unusual to have two separate sections called "Summary" and "Conclusions". Can they be combined?
- Being a persistent publication, I'd prefer that you cite my paper (doi: 10.5194/acp-15-4399-2015) instead of my web page (Sander, 1999). The Henry's law data in the paper and on the web are the same.
- In Table 2, you correctly list the physical Henry's law constant of HI as 25 M/atm. However, the effective solubility, taking into account almost complete dissociation of HI into $H^+$ and $I^-$, is much larger. Is this considered in the model?
- In Table 2, you give Vogt et al. (1999) as the reference for $H(INO_2) = 3.00 \times 10^{-1}$ M/atm. However, Vogt et al. (1999) assume infinity. Please check this discrepancy.



ACPD
15, C6381–C6385, 2015





- Table 3: I cannot see the reaction IO + ClO here. Is it not included in the mechanism?
- Table 4: The reaction IO + IO $\rightarrow$ I + OIO (T1) has no pressure dependence. Why is it listed as a termolecular reaction with "+$O_2$" in the equation?
- Figure 6 and 7: You show the species IONO and $IONO_2$ in the plots. They are probably the same as $INO_2$ and $INO_3$ in the text. A consistent terminology should be used.
- From the context, it becomes clear that Figures 7, 8, 9, 12, and 13 refer to the "iodine simulation". Nevertheless, I think it would be helpful to mention this explicitly in the figure captions.
- Fig. 14: The calculation of the diurnal change seems to be inconsistent. If you subtract the *maximum* ozone value, then you should also divide by the *maximum* (not the daily mean). For example, if the maximum is 100 nmol/mol, and the mean is 50 nmol/mol, then a complete (100 %) ozone destruction would result in a diurnal change value of 200 % using your formula.
- According to the IUPAC Recommendations (page 1387 of Schwartz & Warneck "Units for use in atmospheric chemistry", Pure & Appl. Chem., 67(8/9), 1377-1406, 1995, http://www.iupac.org/publications/pac/67/8/1377/pdf) the usage of "ppb" and "ppt" is discouraged for several reasons. Instead, "nmol/mol" and "pmol/mol" should be used for gas-phase mole fractions. I suggest to replace the obsolete units.
- Page 20963, lines 22: "at high IO concentrations ($>$ 2 pptv)"
  Change to: IO mixing ratios.
- Page 20977, lines 14: "BrO concentrations (0.4 pptv)"
  Change to: BrO mixing ratios.



ACPD
15, C6381–C6385, 2015

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 20957, 2015.



ACPD

15, C6381–C6385, 2015