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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Potential impacts of CF_3I on ozone as a replacement for CF_3Br in aircraft applications" *by* Y. Li et al.

Anonymous Referee #2

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Discussing the ODP of CF3I used in aircraft fire fighting and fuel inerting is a timely subject. In think the paper should be published. I have two general issues. The first one is the presentation of the material. Judging from the title, the focus should be on the ODP calculations. Yet, this occupies only about 1/4 of the text. The discussion on iodine chemistry provided a good summary but is not well focused, and lacks the details to be scientifically useful. Second, if I understand the results correctly, much of the ozone depletion that contributes to the ODP value occurs in the troposphere. The authors failed to make this clear in the paper.

The authors need to clarify many of the results presented. For example, I assume figure 3 is from the present day atmosphere. The amount of Iy should be stated. There should be an explanation to explain how the ozone efficiency in figure 4 is defined.

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Is it based on local photochemical ozone loss per unit iodine and chlorine added, or is it the actual ozone change per unit iodine and chlorine added? I suspect it is the former. In the latter case, the authors should also specify whether the added iodine or chlorine is uniform or not. Finally, have the ozone concentration changes in Figure 6 been normalized to the same CF3I input, or are they just changes from the different model run with different amount of CF3I put in to get a 1% ozone depletion? The figure suggest to me that depositing CF3I in the tropics give a larger ODP, not because of more Iy ends up in the stratosphere, but because there is larger ozone depletion in the troposphere in the southern hemisphere.

I would like the authors to explain the following results. I expect the difference in ozone depletion between the Rupnik and the Van Horn profile is governed by where the odd iodine radicals are produced. Those produce at lower altitudes are just more prone to washout. However, I have a difficult time explaining why the emission profile makes such a big difference in the CF3I lifetime (from 0.7 days to 0.1 days). With a lifetime of a few days, the atmospheric lifetime is just the reciprocal of the local photolysis rate. I will like to see a plot of the photolysis rate as a function of latitude and altitude. I also find it surprising that the depletion from the NIST profile is larger compared to the Van Horn profile despite releasing at lower altitudes.

Specific comments:

p.5164, line 20: “CF3I has much lower impacts THAN CF3Br” and delete the last half of the sentence.

I suggest changing the subtitle for section 4 and 5. I would like to see the two section combined and labeled as ODP for CF3I in different applications.

Is the clean-air act value of 0.2 that important? How is it related to EPA ‘s value of concern of 0.05? I would suggest staying away from those discussions.

p. 5166, line 9 Delete first part of the sentence. Use of word “objectively” is awkward.

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Section 2. I am surprised to find no description of the troposphere. Again, if the ODP values are due to depletion in the troposphere, it is important to talk about dispersion of Iy in the troposphere and the ozone chemistry in the troposphere. If the ODP values are dominated by depletion in the stratosphere, it is important to talk about convection in the model.

Section 3.2 and 3.3 It would be better to move the last portion in 3.3 (assumed rates for ClO + IO and BrO + IO in Solomon et al. to the beginning of section 3.2. It is a bit tiresome to keep reading that there is incomplete understanding in iodine chemistry.

p. 5172, line 24. How tiny a fraction gets to the stratosphere? I would very much like to see a number. Again has to do with whether the ODP values are driven by depletion in the troposphere, or difference in Iy loading in the stratosphere.

Table 2. Identify rate-limiting steps by asterisks in the Table.

Figure 3: The numbers indicate that the local lifetime of ozone to iodine chemistry is a few years in the troposphere and 100 years in the lower stratosphere. I worry that in the ODP calculations, so much CF3I has to be put in to get 1% depletion that the non-linear Iodine self-reacting catalytic cycle is over emphasized. This may be an overestimate of the ODP because it is not linear.

Figure 4. What season is it?

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