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## ***Interactive comment on “Atmospheric three-dimensional inverse modeling of regional industrial emissions and global oceanic uptake of carbon tetrachloride” by X. Xiao et al.***

### **Anonymous Referee #2**

Received and published: 17 September 2010

Comments: The authors have used an inverse modeling approach based on a Kalman filter to deduce industrial emissions for carbon tetrachloride and its geographic sources. The inversion uses the 3D MATCH model as the forward model and makes comparisons by ground based measurements taken at stations distributed globally. The magnitude of the global oceanic sink is also estimated.

The paper highlights that strong emissions across Asia, particularly the South and Southeast, lead to a much greater industrial source for carbon tetrachloride than had previously been suggested. As a result global carbon tetrachloride concentrations are in decline at a slower rate due to these fugitive emissions.

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General Comment: The paper is precise and the data and MATCH model appear to give good results. The manuscript only needs a few minor changes before publishing in ACP. Here are a few minor issues that I think should be addressed:

Montzka et al. 2003 has been referenced repeatedly, whilst undoubtedly a good paper you should find other literature to cite to help bolster your case.

The use of the two phrases industrial and fugitive emissions need defining as it is unclear what is exactly meant by each term. Do these phrases encompass all anthropogenic emissions? I think it is also important that you emphasise that all of the measurements taken are background concentrations, away from large anthropogenic sources.

More details about the magnitude of the J values and the constant global factors used would be helpful. How do the J values used compare with the rates in the JPL Chemical Kinetics and Photochemical Data handbook (<http://jpldataeval.jpl.nasa.gov/>)?

I think it is important to detail what the industrial sales data mentioned in the paper cover. Is there no sales data that has been published? No values for the emission based on sales are mentioned anywhere in the text to give an idea of their estimated magnitude. For example if you have emission sales for Asia it would be helpful to show the contrast between these values and the estimated fugitive emissions from the model. Can the increased emissions over South and Southeast Asia be solely attributed to fugitive emissions?

To help the reader put the papers results into context I think that it is important to compare and validate the oceanic sink estimate and the total global industrial emissions with other literature values. Is there good agreement?

Figures – It may be helpful to use different symbols and lines (i.e. dashed, dotted etc) just in case people print in black and white.

Specific Points:

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- p. 12227, line 4: Please change to CCl<sub>4</sub>.
- p. 12227, line 11: Do you need to state what the abbreviation NOAA stands for?
- p. 12227, line 23: Please reference The Montreal Protocol and Subsequent Amendments.
- p. 12228, line 8: I think it should read 'emission reductions' and 'The' Montreal Protocol (please capitalise throughout).
- p. 12228, lines 8-12: You may want to explain that due to the long lifetime of CCl<sub>4</sub> you would expect there to be little asymmetry without significant emissions or sources.
- p. 12229, line 23: It may be an idea to explain briefly what a discrete Kalman filter is and how you can use the estimates produced.
- p. 12229, line 24: Please be consistent with the use of hyphens. You have hyphenated intra-annual but not inter-annual, whereas inter-hemispheric is. Please rectify so that all references in the text to both words are all hyphenated.
- p. 12230, lines 3-8: It might be a good idea to explain what exactly you mean by high and low frequency stations – does this refer to the rates of sampling?
- p. 12230, line 4: You should state, however obvious, what the abbreviation NASA stands for.
- p. 12231, line 13: I think it would be helpful if you stated what range of pressures or altitudes these 28 layers cover.
- p. 12231, line 16 (and other places): O(1D)
- p. 12233, line 6 and 7: You may want to say/reference where you got your population statistics from, or at least state the estimates that you used. It would also be helpful to do this for the GDP data and state which year or years these GDP values are from.
- p. 12239, line 7 and 8: Gg yr<sup>-1</sup> per year – can you clarify the two different uses?

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p. 12239, line 19 and 20: I think you should have your definition of semi-hemisphere before mentioning Fig. 10 in the text.

p. 12240, line 23 and 24: I think you need to emphasise in this sentence that this is the global industrial emission of CCl<sub>4</sub>

Fig. 7. Could this be split into 7 a and b, as although colour bars are the same their value are clearly different, the captions will be easier too. Also, I think the heading for diagram one should be Industrial Emissions rather than just Industry.

Fig. 8. This is a good way to highlight changes. However, some of the text is slightly obscured and you might like to put a line from each continent to the piece of pie that represents it.

Fig 9. I think to avoid confusion it would be better to put the net loss for the CCl<sub>4</sub> budget separately.

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Interactive comment on Atmos. Chem. Phys. Discuss., 10, 12225, 2010.

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