

Interactive comment on “Chemical transformations of Hg⁰ during Arctic mercury depletion events sampled from the NASA DC-8” by S. Y. Kim et al.

Anonymous Referee #2

Received and published: 11 June 2010

In this study the authors present aircraft observations of mercury depletion events obtained over the Arctic. The authors interpret their observations using a box model. This is an interesting paper presenting new observations.

I have a number of minor comments: 1) Table 1. It would be useful to include the location (lat/lon) and altitude of the MDEs which would be much more useful for the reader than the UTC. Some studies have suggested that high halogens occur near leads. Are there any observations available (for observers on the aircraft or from the flight cameras on-board the aircraft) that can give information on the state of the sea-ice and the potential occurrence of leads when MDEs were observed?

C3900

2) Page 10081. The authors present 14 MDE cases which all appear for be below 5 km altitude (and generally close to the surface). Did Hg⁰ levels always drop to below 50 ppqv when the aircraft flew below 5 km altitude? Or were there instances when the aircraft flew at low altitudes above sea-ice and Hg⁰ was not depleted? It would be interesting to included a discussion of these cases in order to understand the conditions conducive to AMDEs.

3) Figure 1. It is very difficult to see the red dots. I suggest that the authors modify the figure for readability.

4) Figure 2. What do the different colors of the trajectories correspond to? Please clarify in the legend.

5) page 10083. line 9. It doesn't make much sense to compare H₂O levels observed during ARCTAS to levels observed over Hawaii... It would make more sense to compare to other observations over the Arctic.

6) page 10088. Could the authors include in the base case results discussion a discussion of the key reactions and assumptions that lead to AMDEs? My understanding is that you only really need 3 things: high Br₂, light to photolyze Br₂, and then a fast reaction of Hg⁰ with Br. Is that true?

6) page 10088 and figures 4-7. It is confusing that the authors use 3 different units for Hg concentrations: ng/m³, ppq, molec/cm³. Similarly for other species they use mixing ratios in the Table but then concentrations in molec/cm³ in the figure. I suggest using mixing ratios for figures 4-7 for consistency. Also the Figures 4-7 are of very poor quality in terms of resolution and the axis can be barely seen.

7) page 10089 line 7. The authors contradict themselves. "...did no affect the time it took to reach depletion.." is followed by a statement saying that the rates did affect the time it took to reach depletion. Please clarify.

8) page 10093 line 21. Instead of citing (Selin, 2009; Sigler et al. 2009) which do

C3901

not discuss observations of Hg⁰ over the Arctic ocean, it would be more relevant to cite the study of Andersson et al. "Enhanced concentrations of dissolved gaseous mercury in the surface waters of the Arctic Ocean" Mar Chem (2008) which report high supersaturation of DGM in Arctic waters.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 10077, 2010.

C3902