Reply to Review #1

Comments:

We thank the reviewer for a thorough review and helpful comments. Please see specific responses below.

Spatial distribution of the missing source: Our results are consistent with a missing source that is located in the tropics as suggested by Warwick *et al.* [2006] and discussed in the paper. This model does not do a better job of constraining the spatial distribution of the missing source.

Seasonality of the missing source: Regarding the seasonality of the missing source, we did attempt to optimize the missing source seasonality for pre-phaseout conditions in all model runs, except case 5 (in which there was no missing source). The seasonality of the missing source for cases 7 and 8 were added to Figure 3.

In case 8, it is not possible to fully match the pre-phaseout seasonality - one must choose between the maximum, the mean or the minimum. The longer atmospheric lifetime makes it impossible to achieve the seasonal amplitude observed in the NH. This would require imposing a negative missing source at some times of the year. That would effectively shorten the atmospheric lifetime back to the original value.

Figures: The figures have been revised in accordance with the reviewer's suggestions. The revised figures are shown at the end of this document. Bar graphs have been converted to line graphs for clarity. A new figure has been inserted between the current Figure 1 and Figure 2 (see Figure 1X below) to illustrate the changes in OH. An additional panel showing seasonality of the missing source has been added to Figure 3, as mentioned above. The caption of Figure 4 has been shortened.

Tables: The third column in Table 1 has been relabeled "2007 (60% Ag)". The footnotes marked by asterisks are correct in the document as they are - which is exactly how the reviewer indicated that they should be labeled.

Other technical corrections: Page 6516, line 26 will be corrected Page 6521, line 20 will be corrected Page 6525, line 22 will be corrected



Fig. 1. The trend in biomass burning emissions of CH_3Br for the southern hemisphere (—), the northern hemisphere (—), and the globe (—). Prior to 1997 and after 2005, the biomass burning emissions are shown as the monthly averages of the 1997-2005 data excluding the highest and lowest values for a given month.



Fig. 1X. The trend in the pseudo first order loss rate constant for loss of CH_3Br to reaction with OH for the southern hemisphere (—), the northern hemisphere (—), and the globe (—). For model years 1997-2004, OH is scaled by the annual variations given by Prinn *et al* [2005]. For the remainder of the simulation, the 2004 OH scaling factor was used.



Fig. 2. The trend in agricultural emissions of CH_3Br from 1995 through 2008 for the southern hemisphere (—), the northern hemisphere (—), and the globe (—).



Fig. 3. Seasonal cycle in the missing source for the southern hemisphere (—), the northern hemisphere (—), and the globe (—) for a) scenarios 1-4, b) scenario 7 and c) scenario 8.



Fig. 4. Modeled and measured trends in atmospheric CH_3Br concentrations for 1995-2006. In all plots, the data points for Southern Hemisphere (\blacktriangle), the Northern Hemisphere (\bullet), and the globe (\blacksquare) are observations from NOAA/GMD

(<u>ftp://ftp.cmdl.noaa.gov/hats/methylhalides/ch3br/flasks/</u>). Model results are shown for the southern hemisphere (—), the northern hemisphere (—), and the globe (—) for the scenarios described in Table 2.



Fig. 5. From scenario 8, model predicted a) annual average saturation anomaly (difference from equilibrium) of CH_3Br in the ocean and b) net ocean fluxes for the southern hemisphere (—), the northern hemisphere (—), and the globe (—).