**Supplement to "Strong Sensitivity of the Isotopic Composition of Methane to the Plausible Range of Tropospheric Chlorine"**
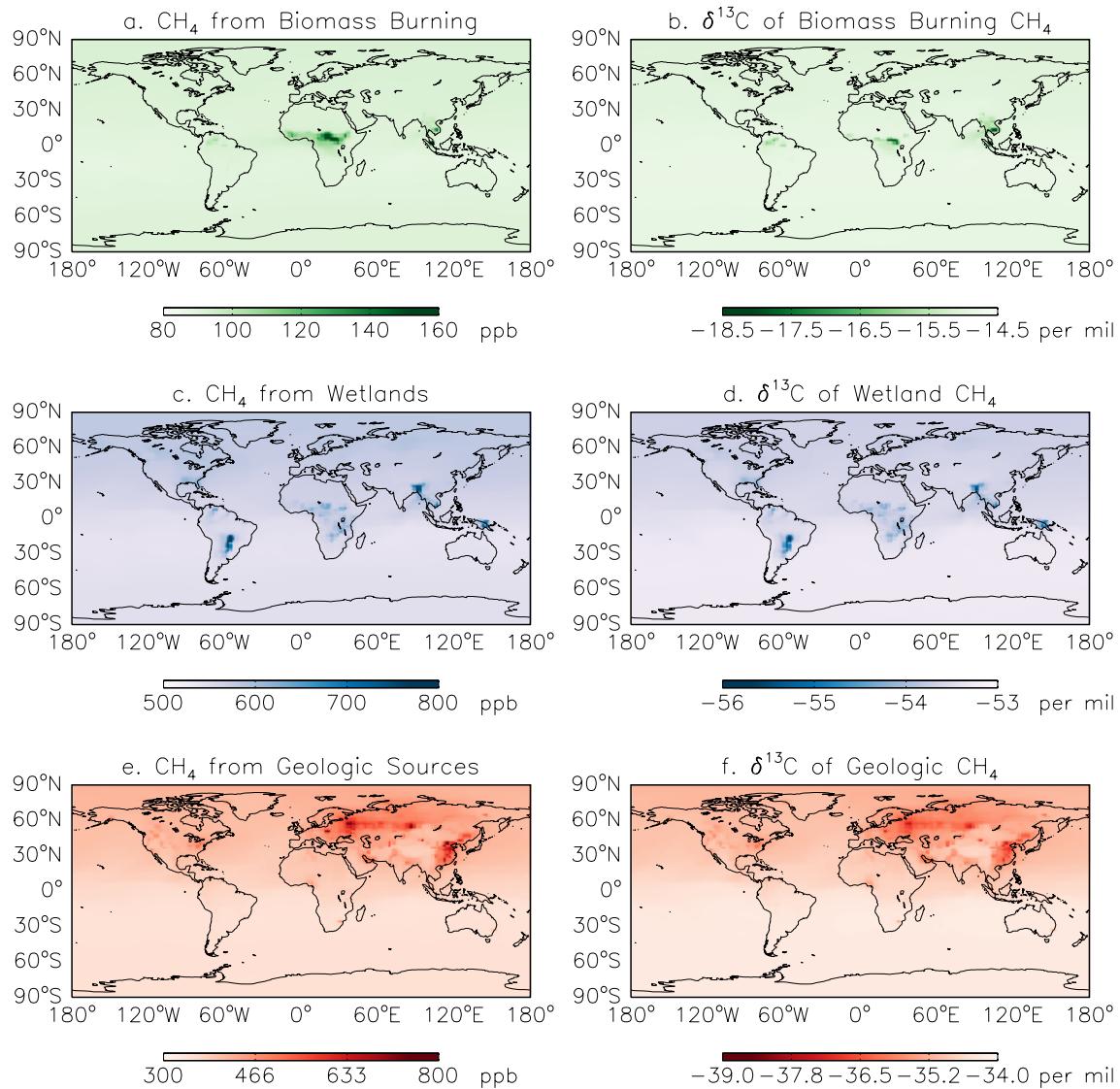
**Fig. S1:** The January 2004 surface concentration of CH₄ (left) and δ¹³C-CH₄ (right) from biomass burning (a,b), wetlands (c,d), and geologic+coal sources (e,f) from the GEOS tagged CH₄ tracers.
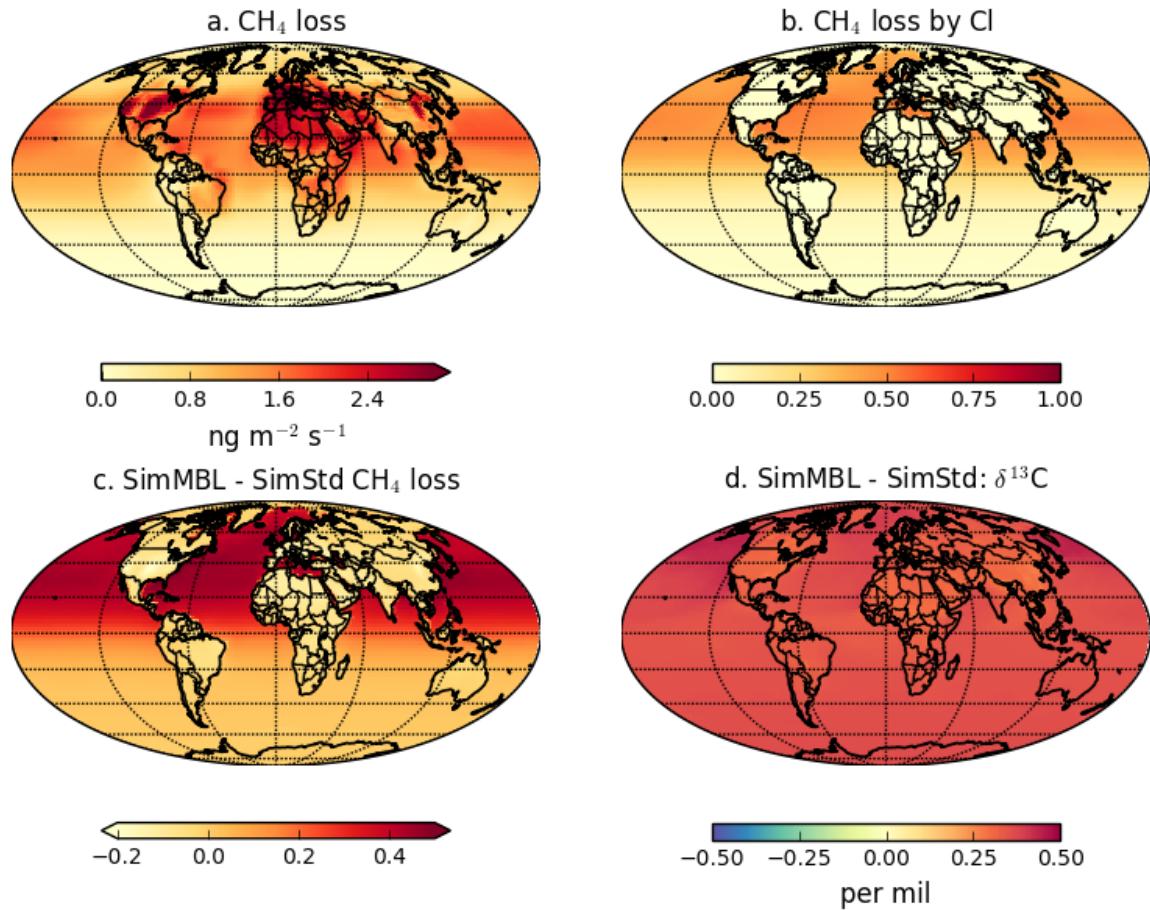
**Fig S2:** July a) CH₄ loss and b) CH₄ loss by Cl only in the SimMBL simulation, as well as the difference in c) CH₄ loss and d) $\delta^{13}$C-CH₄ between the SimMBL and SimStd simulations.
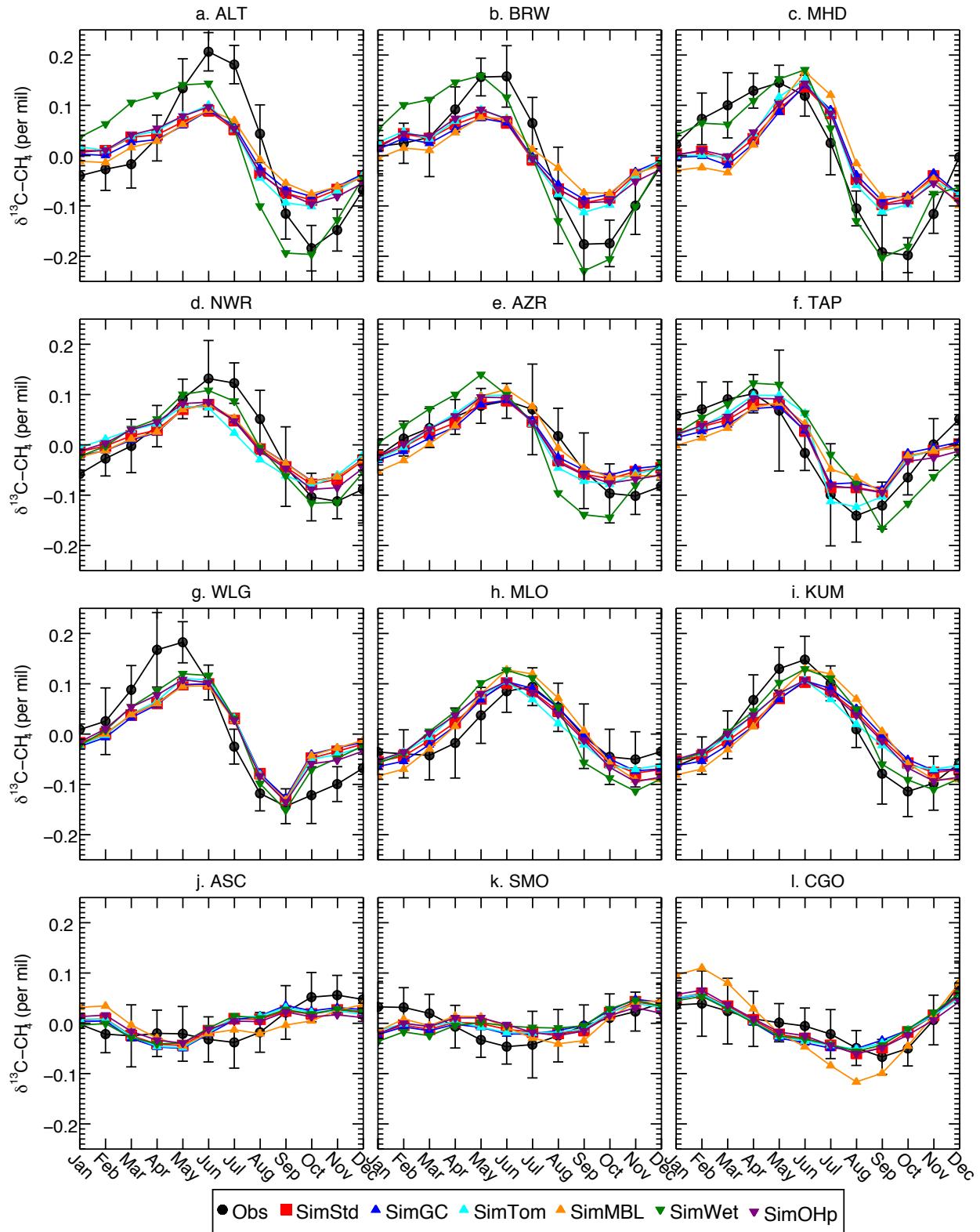
**Fig. S3:** The annual cycle of $\delta^{13}$C-CH$_4$ with the annual mean removed averaged over 2002-2004 for 12 sites. Observations (black circles) are shown with error bars representing the standard error, calculated as the maximum of the pooled standard deviation or the analytical uncertainty,

divided by the square root of the number of years of observations. The simulations are SimStd (red), SimGC (blue), SimTom (cyan), SimMBL (orange), SimWet (green), and SimOHp (purple). The latitude, longitude locations of the sites are ALT: 82.5°N, 62.5°W; BRW: 71.3°N, 156.6°W; MHD: 53.3°N, 9.9°W; NWR: 40.0°N, 105.6°W; AZR: 38.8°N, 27.4°W; TAP: 36.7°N, 126.1°E; WLG: 36.3°S, 100.9°E; MLO: 19.5°N, 155.6°W; KUM: 19.5°N, 154.8°W; ASC: 7.9°S, 14.4°W; SMO: 14.3°S, 170.6°W; CGO: 40.7°S, 144.7°E.