Supplement S1: Global Box Model

To investigate the overall impact of changes in temperature, [OH] and emissions on an atmospheric gas which is removed by OH a simple global box model can be used. This model permits a first-order understanding of the factors which govern the variation in growth and the relative contribution of emissions and loss to that growth. The model integrates the global mean burden of X (Tg) based on annual mean emissions (*E*, Tg/yr) and chemical loss (*L*, Tg/yr) through the reaction X + OH → products. The modelled atmospheric burden of X ($X_{,t}$) can be integrated over a 1-year period (Δt) according to the equation:

$$\frac{1}{\Delta t}(X_{t+\Delta t} - X_t) = E - L = E - k[OH][X] \qquad (1)$$

where k (cm^3 $molecule^{-1}$ yr^{-1}) is the rate constant for the X + OH reaction (e.g. Sander et al., 2011). For CH_4 $k = 2.45\times10^{-12}exp(-1775/T)$ while for CH_3CCl_3 $k = 1.64\times10^{-12}exp(-1520/T)$.

When simulating CH_3CCl_3 we assume emissions from Montzka et al. (2011) or Rigby et al. (2013) and T=272.9 K. We then use equation (1) to derive the global mean [OH] which is consistent with the observed variations in CH_3CCl_3. The same procedure is used to derive global mean [OH] consistent with the observed CH_4 variations assuming E=553 Tg/yr.