\( \text{CHF}_3 \) (HFC-23) Emission Trend Response to \( \text{CHCIF}_2 \) (HCFC-22) Production and Recent Emission Abatement Measures

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\( \text{CHF}_3 \) (HFC-23) is an inevitable by-product of \( \text{CHCIF}_2 \) (HCFC-22) production for use in air conditioning/refrigeration and as feedstock in fluoropolymer manufacture. \( \text{CHF}_3 \) has limited use in small emissive and non-emissive markets and thus historically this ‘waste’ gas was simply vented to the atmosphere following production at \( \text{CHCIF}_2 \) plants. Concern over its high Global Warming Potential of 14,800 (100-year horizon) has lead to international efforts to curb its emissions. We present emission and production estimates for both gases based on observations of lower-tropospheric \( \text{CHF}_3 \) and \( \text{CHCIF}_2 \) mole fractions at the Advanced Global Atmospheric Gases Experiment (AGAGE) network of five remote \textit{in situ} Gas Chromatography/Mass Selective Detector instruments and in archived air samples. We quantitatively attribute recent changes in \( \text{CHF}_3 \) production to various sources.

\textbf{Figure 1.} AGAGE \textit{in situ} atmospheric observations (2007-2009) of \( \text{CHF}_3 \) at global monitoring sites and in the Cape Grim air archive (1978-2009) show a historically accelerating growth with a marked deceleration since 2006 (left axis). Inversion using the AGAGE 2D 12-box model yields \( \text{CHF}_3 \) emission estimates (right axis). The sharp increase in \( \text{CHF}_3 \) emissions during 2004-2006 results from a dramatic increase in \( \text{CHCIF}_2 \) production in Article 5 countries (predominantly China and India). The sharp decrease in \( \text{CHF}_3 \) emissions since 2006 reflects a decrease in global \( \text{CHCIF}_2 \) production, destruction (incineration) of >6 Gg \( \text{CHF}_3 \) yr\(^{-1}\) by Article 5 countries (China, India, South Korea, Argentina and Mexico) participation in the United Nations Framework Convention on Climate Change’s Clean Development Mechanism and emission reduction efforts by non-Article 5 countries.