

Sulfuryl Fluoride (SO₂F₂) Atmospheric Abundance and Trend from the GMD North American Tower and Aircraft Programs

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Beginning in the 1980's, sulfuryl fluoride (SO₂F₂) increasingly replaced methyl bromide (CH₃Br) as the fumigant for structures and postharvest agricultural produce, after the latter came under restrictions by the Montreal Protocol on Substances that Deplete the Ozone Layer and its subsequent amendments. Unlike CH₃Br, SO₂F₂ poses no threat to stratospheric ozone, and despite a global warming potential (GWP) of ~4780 (100-yr horizon), the current global abundance of about 2 ppt means it currently contributes negligible to global warming. The average total global lifetime of SO₂F₂ is 36 ± 11 yrs, and this is dominated by dissolution and hydrolysis in alkaline ocean waters. A previous study (Möhle et al., 2009) found that reported global industrial production of SO₂F₂ averaged ~50% higher than emission estimates derived from modeling atmospheric measurements, suggesting a missing sink that has been hypothesized as a destruction that occurs during the fumigation process. Möhle et al. (2009) estimated a 2005 emission of about 2 Gg/yr and an annual atmospheric abundance growth rate of 5 ± 1% per year. Here we present about 2 years of SO₂F₂ measurements from the GMD Global Greenhouse Gas Reference Network (GGGRN) North American Tower and Aircraft programs, and from the Halocarbons & Other Atmospheric Trace Species (HATS) global flask network.

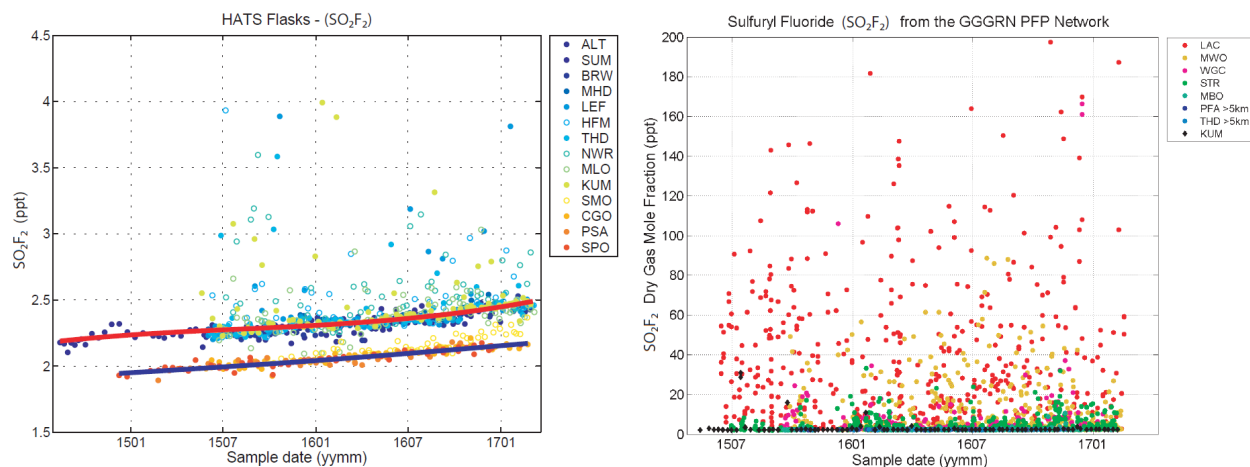


Figure 1. (Left pane) Background SO₂F₂ mole fractions from HATS remote site network. Sites with solid symbols were used to determine the hemispheric trends (red and blue lines), which are about 5% per year in accord with Möhle et al. (2009). Note the enhancements observed at sites such as THD, KUM, MLO and NWR, indicating influence from regions (California and Hawaii) where SO₂F₂ is used for fumigation. (Right pane) SO₂F₂ mole fractions observed at select North American tower and aircraft sites, with Cape Kumukahi (KUM) as background reference. The vertical axis has been limited to show 200 ppt maximum, but events with enhancement as high as 500 ppt were observed.