

Emissions of CF₄ (PFC-14) and C₂F₆ (PFC-116) in China Inferred from a Chinese Atmospheric Observation Network

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The perfluorocarbons (PFCs) are potent non-CO₂ Greenhouse Gases controlled by the Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC). The PFCs tetrafluoromethane (CF₄, PFC-14) and hexafluoroethane (C₂F₆, PFC-116) are the two most abundant PFCs in the atmosphere, with global warming potentials of 7,380 and 12,400 respectively over a 100-year time horizon (GWP₁₀₀), and atmospheric lifetimes of 50,000 and 10,000 years, respectively.

An atmospheric observation network consisting of nine sites located across China has made atmospheric measurements of CF₄ and C₂F₆ since 2012 and 2011 respectively. These observations provide good sensitivity to emissions in most of the important regions of China (Figure 1). Emissions of the two substances in China over the last decade (2011-2020) were derived from the observations and a top-down Bayesian inverse modelling approach. Emissions of both substances in China show a substantial increase since measurements in China began. Emissions inferred by measurements in China are larger than emissions inferred from atmospheric observations made outside China (e.g., Kim et al., 2021). The difference is likely due to substantial emissions from the western regions of China to which observations outside China (e.g., made at Gosan in South Korea) do not have sufficient sensitivity. Significant leakages of CF₄ and C₂F₆ can occur during the large volume of aluminum and magnesium production in the western regions.

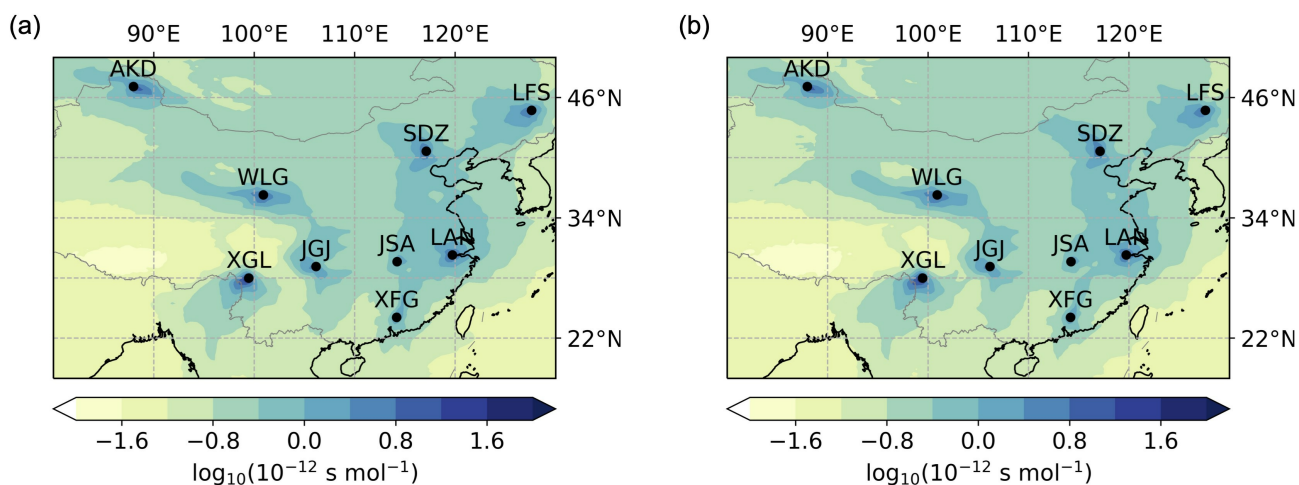


Figure 1. Locations of the measurement sites in the Chinese network. The color in the plot represents the sensitivity of all the observations to emissions in China, an average of the sensitivity in each year from all sites. Plot (a) is for CF₄ over 2012-2020 and (b) is for C₂F₆ over 2011-2020.