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Global SF6 emission estimates inferred from atmospheric observations – a test case for Kyoto reporting

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Sulphur hexafluoride (SF6) is one of the strongest greenhouse gases per molecule in the atmosphere. SF6 emissions are also one of the six greenhouse gases targeted for reduction under the Kyoto Protocol. Here we present a long-term data set of globally distributed high-precision atmospheric SF6 observations which show an increase in mixing ratios from near zero in the 1970s to a global mean value of 6.3 ppt by the end of 2007. Because of its long atmospheric lifetime of around 3000 years, the accumulation of SF6 in the atmosphere is a direct measure of its global emissions: Analysis of our long-term data records implies a decrease of global SF6 sources after 1995, most likely due to emission reductions in industrialised countries. However, after 1998 the global SF6 source increases again, which is probably due to enhanced emissions from transition economies such as in China and India. Moreover, observed north-south concentration differences in SF6 suggest that emissions calculated from statistical (bottom-up) information and reported by Annex II parties to the United Nations Framework Convention on Climate Change (UNFCCC) may be too low by up to 50%. This clearly shows the importance and need for atmospheric (top-down) validation of Kyoto reporting which is only feasible with a dense world-wide observational network for greenhouse and other trace gases.

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